

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Videndum Production Solutions, Inc.
Petitioner,

v.

Rotolight Limited,
Patent Owner.

Case: To Be Assigned
U.S. Patent No. 10,845,044

**DECLARATION OF WOODY SMITH
IN SUPPORT OF VIDENDUM PRODUCTION
SOLUTIONS, INC.'S PETITION
FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,845,044**

I, Woody Smith, declare:

I. INTRODUCTION

1. I have been retained by Videndum Production Solutions, Inc. (“Videndum”) to offer technical analysis and opinions relating to U.S. Patent No. 10,845,044 (the “’044 Patent”) (Ex. 1001) and certain prior art references relating to its subject matter.

2. As far as I am aware, I have no financial interest in the Petitioner, Patent Owner, the ’044 Patent, or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis at my standard consulting rate. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

3. I have been informed that the ’044 Patent was challenged by Arnold & Richter Cine Technik GmbH & Co. Betriebs KG (“ARRI”) in 2021. I have reviewed the October 15, 2021, and October 28, 2022 declarations submitted by Michael Wood in which he opined that the claims of the ’044 Patent are invalid based on Astera and Edwards. I agree with Mr. Wood’s conclusions regarding whether these claims are anticipated and/or obvious.

4. I present this Declaration in order to present my opinions on ’044 Patent and its relation to the prior art.

II. BACKGROUND AND QUALIFICATIONS

5. After receiving my B.S. in Electrical Engineering in 1975, I became involved in the lighting industry starting with regional (Texas) touring sound and lighting support. PAR cans with gels were commonplace at the time. Automated entertainment lighting was just beginning to impact touring but showed how much more was possible. That led me to design and develop a small, DMX controlled color mixing RGB light fixture. High End Systems, then the largest manufacturer of automated entertainment lighting at the time, must have like it and hired me as Director of R&D and so began 30+ years working in the areas of lighting fixture design and development, LED lighting, controls, electronics and manufacture. My work has included the design and manufacture of automated entertainment lighting fixtures including: High End Systems Studio Color & Technobeam, Hubbell Lighting Entertainment Helix range of entertainment lighting, Affineon Lighting DL, PAL, IG, and other LED lighting fixtures featuring DMX controlled dimming and color mixing, Evolucia Lighting Street Lighting fixtures, and most recently VERTAAG Lighting automated lighting, digital controls, sensors and software for Controlled Environment Agriculture. In addition to the design and development of lighting fixtures I've also provided technical support for automated lighting world-wide for major entertainment events including Singapore National Day (Singapore), Vina del Mar (Chile), China National Television, as well as numerous

concert tours including Van Halen and Britney Spears. While at High End Systems I also assisted in the drafting of patent applications from the technical side and worked with High End's patent attorney. This included the drafting of the High End Systems patent on the Studio Color design where I am listed as the primary inventor.

6. I am familiar with the lighting control systems and controls described and claimed in the '044 Patent. I have been designing lighting fixtures which utilize AMX-192 and DMX-512 ever since the inception of these standards by USITT and ANSI. Starting with my first RGB lighting fixture design I have incorporated microprocessor control of lighting functions with AMX or DMX to control lighting fixture functionality. This includes controlling numerous aspects of the lighting fixtures function from dimming (electronic as well as mechanical), strobe, color selection, color mixing, pattern selection, beam shaping, pattern rotation, beam positioning and more. These functions are typically addressed and implemented through the use of microprocessors within the fixture which translate the digital data (DMX) into a value which is then compared against a predetermined function within the lighting fixture.

7. It is also commonplace that the lighting control device (lighting console) is outfitted with extensive micro processing power and memory. While many special functions can be imbedded within the fixture software a wide range

of effects are implemented by the control console including dimming, color changing, pattern changing, strobe, positioning, flicker effects, chase, ballyhoo, waves, etc. This is only limited by the lighting designer's creativity, knowledge and expertise.

8. My CV is attached to this Declaration as Appendix B.

III. INFORMATION CONSIDERED

9. In forming my opinions as expressed in this Declaration, have reviewed the '044 Patent and its prosecution history, as well as the other materials referenced in Appendix A. I have also reviewed all of the Exhibits submitted with the Petition.

10. Counsel has informed me that I should consider these materials through the lens of one of ordinary skill in the art related to the '044 Patent at the time of the earliest purported priority date of the '044 Patent, which I understand to be April 8, 2016 (the "Priority Date"). I have done so during my review of these materials.

11. As noted above, I have reviewed the declarations submitted by Michael Wood in IPR2022-00099 and agree with the ultimate conclusion regarding anticipation and obviousness.

12. My analyses are based on my education and practical experience, as well as my inspection and study of relevant materials. In my analyses, I have

considered the materials identified in this Declaration and those listed in Appendix A. I may rely on these materials, additional materials, and this Declaration as a whole in order to respond to arguments raised by the Patent Owner. I may also consider other documents and information in further analyses, including materials that may not yet have been provided to me.

13. My review and assessment of the materials provided in this proceeding are ongoing, and I will continue to consider new materials as they are provided to me. I reserve the right to review, supplement, and amend my analyses to address any new information obtained in the course of this proceeding, on my continuing review of the materials already provided, or based on any new positions taken by Patent Owner.

IV. BACKGROUND OF THE '044 PATENT

14. Independent Claims 1, 12, and 19 of the '044 Patent recite a method, system, and computer program, respectively, for “controlling a lighting device to produce a range of different user customisable lighting effects.” Ex. 1001 at 11:43-44, 12:29-30, 12:66-13:1 (Claims 1, 12, 19).

15. The independent claims recite five basic elements: (1) receive a user input of “at least one user input simulation parameter to customise a lighting effect,” where the input simulation parameter depends on the lighting effect being simulated (Ex. 1001 at 11:46-47, 12:32-34, 13:4-5); (2) store the user input

simulation parameter in memory (*Id.* at 11:48-51, 12:35-38, 13:6-9); (3) recall the user input simulation parameter from the memory (*Id.* at 11:52-53, 12:39-41, 13:10-11); (4) calculate, using an effect simulator, a “time varying lighting value” based on the parameter (*Id.* at 11:54-56, 12:39-44, 13:12-14); and (5) output the “time varying lighting value” to a lighting device, so as to generate the user-selected lighting effect. *Id.* at 11:57-58, 12:45-47, 13:15-16. This series of functions is “standard” operating means in most “intelligent” lighting fixtures. As detailed hereafter, it is standard for a lighting fixture to receive a command from an external (or internal) user interface device, such as a lighting controller, to modify a given parameter or operation of the lighting fixture. Change of color, movement of beam, rotation of effects, all are parameters of lighting fixtures which are controlled by the user. On receiving an input from said device the lighting fixture will compare the latest data set versus current data set and calculate any necessary actions to implement same. This could include a change of color by instructing a motor within the fixture to rotate the color wheel to a new location, dimming of the light by closing a shutter slowly, strobe effect by moving the shutter open to close quickly, etc. Strobe effects, for example, may be of variable speed depending upon the value received by the lighting fixture.

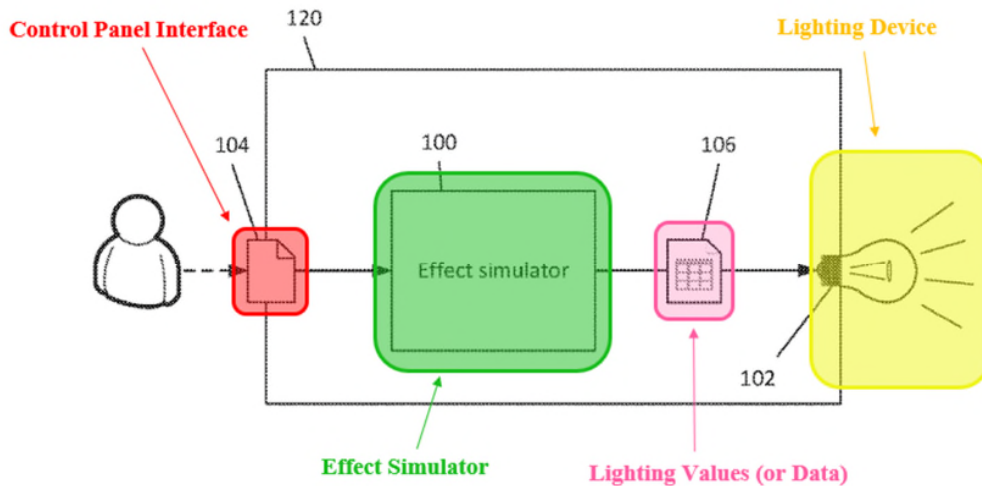


Figure 2

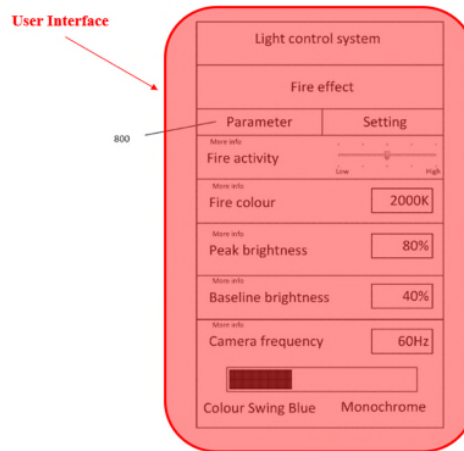


Figure 6

Id. at Figs. 2 and 6 (annotated).

16. The '044 Patent describes how users can make selections of desired lighting effects on a control panel user interface. *Id.* at 5:61-6:8, 8:5-18, Figs. 2, 6. Depending on the desired effect, a user can select and adjust “simulation parameters,” such as “brightness,” “duration,” “colour,” and “frequency,” to

customize the effect. *Id.* at 1:52-67, 6:37-7:6, 7:66-8:18, Fig. 6. The “effect simulator” uses these simulation parameters to calculate the data, or “time varying lighting values,” that characterize the lighting effect and are used to produce signals sent to the LEDs to output light, generating the desired effect. *Id.* at 5:41-54, 7:19-36, 8:5-39. Effects, with their parameters as customized by the user, may be “stored” and then “recalled” from memory after a time. *Id.* at 9:27-36. User selection of parameters such as brightness, color, duration and frequency as well as many other functions are all parameters that can be accessed and controlled in intelligent lighting fixtures.

17. I understand the '044 Patent was filed April 7, 2017 and issued November 24, 2020. Ex. 1001 at Cover Page. The '044 Patent claims priority to U.S. Provisional Application No. 62/319,809, filed April 8, 2016. *Id.* I have assumed, for purposes of this Declaration, that the '044 Patent is entitled to this Priority Date of April 8, 2016.

18. During examination, the claims of the '044 Patent were rejected for two reasons: claiming features not shown in the drawings and on non-statutory double patenting grounds in view of U.S. Patent Application No. 15/820,469 (issued as U.S. Patent No. 10,197,257). Ex. 1002 at 127-33.

19. On September 7, 2018, the Applicant submitted a new claim set and amended both the specification and figures. Ex. 1002 at 153-71.

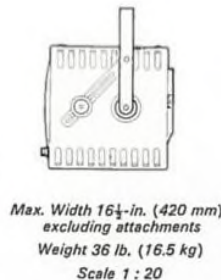
20. A subsequent Final Office Action objected to the amendments for introducing new matter and failing to satisfy the written description requirement. *Id.* at 207-18. On July 1, 2019, the Applicant withdrew the previous amendments and filed a terminal disclaimer. *Id.* at 256-69. Then, the '044 Patent was allowed. *Id.* at 305-12.

V. ENTERTAINMENT LIGHTING EFFECTS SYSTEMS

21. The '044 Patent discusses lighting effects, but this is nothing new. In fact, lighting effects for entertainment industries (e.g., film, broadcast, and TV) have a long history. Directors have long desired realistic lighting arrangements to fully engage the audience into the plot of the movie or program. Effects help complete the illusion for the viewers. Examples include the use of warm, dynamic light to represent a fire, for example.

22. An early example of a lighting device designed to produce these types of effects is shown below.

Rank Strand Effects Projectors



Max. Width 16½-in. (420 mm)
excluding attachments
Weight 36 lb. (16.5 kg)
Scale 1 : 20

Patt. 252

2000W

Pressed steel body with top access. P40s holder for 2000W Class A1/218 tubular lamp. Die-cast lens front and separate mounts for 6-in. (150-mm) dia. 3-element condenser lens system including heat filter. Runners only with clamping discs, for standard 8-in. (203-mm) back-plate optical effects attachments or 3½ × 4-in. slide carrier. Lamp tray, with 7½-in. dia. spherical reflector, adjustable from rear by lead-screw drive.

Moving Effects Attachments	AC motor-driven disc type
Thunder Clouds; ref. 653	Smoke; ref. 140
Fleecy Clouds; ref. 134	Flames; ref. 141
Storm Clouds; ref. 135	Chromosphere; ref. 667
Rain; ref. 136	Dissolving Colours; ref. 147
Snow; ref. 137	Psychodelic Mk II; ref. 723
Running Water; ref. 138	Kaleidosphere; ref. 724
2½-in. focus objective lens, slide focusing; ref. 151	
3-in. focus objective lens, slide focusing; ref. 152	
4-in. focus objective lens, slide focusing; ref. 153	

The above image is an excerpt from Strand Electric's 1971 catalogue, showcasing the Patt 252 Effects Projector. The Patt 252 was an integrated effects projector for use in theatre, film, and TV. The device operates by projecting effects from discs chosen from a long list of options. As listed in the catalogue under "Moving Effects Attachments," these options included Flames, Rain, Snow, and Running Water. A user could add atmosphere to a scene by projecting the effects onto performers or backgrounds. The effects were dynamic and moving, controlled by the rotation speed of the disc. The disc speed could be manually varied and adjusted directly from the effects projector through the small box seen under the light output lens in the above figure. This type of effects projector was in standard use throughout the 1960s and is still occasionally seen today, though later models also included remote control options.

23. This kind of unit addressed the need for continuous effects (e.g., fire and light reflected from water), but did not provide the flashes required for other types of effect simulations (e.g., lightning). Further, incandescent filament lamps were not ideal for such lightning simulations because of the time required to heat up and cool down, which may not depict the instantaneous flash of lightning.

24. Instead, many TV and film makers shifted to the xenon strobe technology, which was originally developed for photographic flash and high-power emergency lights. For example, the below pictures show an Optikinetics Super Strobe from the 1980s:





The Super Strobe could be locally operated and the flash rate was controlled by the user through a knob on the rear of the unit (see above image). The unit also had a “Remote Input” connection, allowing the strobe to be remotely operated or linked to other units. This larger banks of strobes could be synchronized to produce larger effects. I have personal experience with these types of products for entertainment applications.

25. Over time, the effects projectors and strobes improved and their functionality was integrated with the automated lighting units that were widely used from the 1990s onwards. Companies like Vari-Lite, High End Systems, Coemar, Clay-Paky and TAS, developed and manufactured sophisticated lighting

instruments capable of producing colored effects, strobing, movement, and pattern projection in a single unit. These devices were adopted throughout the entertainment lighting industry, including applications in film and TV, for the kinds of effects described above and in the '044 Patent.

26. In the mid-1980s, automated lights were remotely controlled through digital communication protocols from a central control desk capable of controlling multiple lights at once. With the 1990s came the introduction of lighting units that added local control via on-board control panels and displays. This improvement allowed for units to be used independently, without a remote controller sending commands to the units. Starting in the early 2000s, the vast majority of automated lights included this local control functionality as a standard feature. This allowed the user to locally control selections of effects and their parameters, such as strobe speed, duration of lightning flashes, and the speed of color-changing effects. In addition, the ability to control effects with a random timing element was introduced. As discussed below, this resulted in more realistic effects, especially for lightning flashes or a candle flickering.

27. One common method of remote control, which is currently widely used, is an industry standard digital communications protocol called DMX-512. This protocol allows a master controller to send individual data to several connected luminaires at once.

28. DMX-512 is a variant of industry standard RS-485 developed by the U.S. Institute for Theatre Technology (“USITT”). The DMX512 standard (512 channels of 8-bit data) was created in 1986, with subsequent revisions in 1990 leading to USITT DMX512/1990. This lighting protocol replaced AMX-192, which was developed by Strand Century in the late 1970s. AMX-192 was an analog-based protocol with severe limitations on data density, volume, and the distance to which the data could be transmitted. DMX-512 is duplex, meaning it allows a larger volume of data, and bi-directional transmission of same, to allow the transmission of data between devices. This allows data to be transmitted from a controller to any number of devices. Those devices to be addressed from 1 to 512 so (i) to know what data is relevant for that device and (ii) to communicate back to the data source or to other devices within the network.

29. These methods and effects systems remained as features within the luminaires while manufacturers began to transition from conventional light sources (e.g., incandescent or HID sources) to the more efficient and user-friendly LEDs. Although LEDs had been available prior, white LEDs for lighting were not yet possible. In 1994, Shuji Nakamura invented the ultra-bright blue LEDs that served as the foundation for today’s common commercial LEDs. Blue light can be used to “excite” light emission from phosphors that have been commercially used in fluorescent lighting for decades. In the case of fluorescents, far blue or ultra-violet

energy excites the phosphor compounds, which then release this higher energy in the form of lower-frequency light within the visible spectrum. The specific combination of phosphors controls the spectrum of emitted light at a lower frequency or wavelength, specifically selected to emit in the visible light spectrum. Similarly, blue-emitting LEDs could be used to excite phosphors that “down-convert” the high-frequency blue light to colors within the visible light spectrum.

30. In 1996, the first commercially viable white LEDs were developed and offered for sale from Nichia in Japan. While a variety of colors were possible with prior LEDs, the blue LED was particularly difficult to produce. In the early 2000s, LEDs became sufficiently bright enough to be used in film and TV. The availability of a higher power (brighter) LEDs led manufacturers to produce new luminaires that utilized LEDs and included the features of the prior models and new features made possible by LEDs. In the early 2000’s LEDs became sufficiently bright enough to be used in film and TV. The availability of higher power (brighter) LEDs led manufacturers to produce new luminaires that utilized LEDs and included the features of the prior model lighting fixtures and new features made possible by LEDs.

31. There are drawbacks of using incandescent lamps as lightning or strobe simulators due to their relatively slow on and off times. However, this does not limit lighting fixtures produced since the 1980s from creating strobing effects,

and a wide range of other special effects while using incandescent light sources or much more powerful discharge lamps. The use of mechanical shutters, mechanical dimming, etc., allowed a wide range of effects to be produced, albeit with major issues related to heating.

32. LEDs do not suffer from this issue, rather, they can be turned on and off almost instantaneously. As a result, LEDs were a clear choice for lighting effects like emergency vehicle strobes or lightning. Further, LEDs were available in multiple colors, eliminating the need for colored gels and filters. Because of these benefits, a single LED luminaire could perform many different tasks.

33. At the time of the '044 Patent, there were several available options for the generation of lighting effects in the entertainment industries. Luminaires could produce effects controlled either locally with a control panel on the luminaire, or remotely through a data connection (e.g., DMX-512 control protocol). Further, luminaires could be connected to produce coordinated or synchronized effects. Coordinated or synchronized effects can be used to produce several lightning bursts coming from different directions, or to mimic the movement of an emergency vehicle.

34. As discussed above, these coordinated effects could be controlled locally from each luminaire individually or in a master-slave relationship.¹ Multiple luminaires could also be controlled from a central lighting control system through a dedicated communication link. For each of the above control methods (local, master-slave, and remote), the ability to control the timing, speed, or rate of effects produced by any of the described control methods is a given.

35. All of these systems, techniques, and products were in common use at the time of the '044 Patent.

VI. CLAIM CONSTRUCTION AND DEFINITION OF THE POSITA

A. Claim Construction

36. It is my understanding that claims in an IPR are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.

37. I have analyzed the patentability of Claims 1-19 in the '044 Patent based on their ordinary and customary meaning, unless otherwise stated below.

B. Definition of a Person of Ordinary Skill in the Art

38. A person of ordinary skill in the art ("POSITA") in the field of the '044 Patent would have had a good working knowledge of electrical engineering

¹ In the master-slave relationship, one luminaire is designated as the master and its local control panel controls other connected luminaires.

and entertainment lighting systems, controls, and effects. The POSITA would have obtained this through an undergraduate bachelor's degree in electrical engineering, or a comparable field as well as some experience in the field (*e.g.*, in entertainment lighting systems).

39. The more education one has, the less experience needed to attain an ordinary level of skill. Similarly, more experience in the field may serve as a substitute for formal education.

VII. THE ELEMENTS IN CLAIMS 1-19 OF THE '044 PATENT ARE DISCLOSED IN THE PRIOR ART

40. I have been asked to provide an analysis as to whether the elements of Claims 1-19 of the '044 Patent (the "Challenged Claims") are disclosed in two prior art references: (a) the Astera AX10 Spotmax User Manual ("Astera Manual") (Ex. 1004) and (b) U.S. Patent No. 9,743,010 ("Edwards") (Ex. 1006).

VIII. GROUND I: ASTERA ANTICIPATES CLAIMS 1-19

A. The Astera Manual

41. The Astera Manual (Ex. 1004) is a user manual for the AX10 Spotmax (the "AX10"), which is a controllable lighting device used in the entertainment industry. *See generally*, Ex. 1004. The AX10 is used in cinematography, studio filming and photography, and entertainment lighting. I have analyzed the Astera Manual, dated May 7, 2015. I understand the Astera Manual to qualify as prior art.

42. Astera LED Technology GmbH, the manufacturer of the AX10, is a German company that has established a reputation in the entertainment lighting business as a manufacturer of LED lighting, specifically for use in film, TV, and outdoor entertainment. The Astera AX10 is waterproof and capable of being run from local battery power with wireless control. This allows for greater freedom and flexibility in use, making the Astera AX10 particularly well-suited for location shooting for in film and TV. The Astera AX10 can be used at public events, festivals, concerts, and other venues where a completely self-contained lighting unit with no cabling requirement is used.

43. After reviewing the '044 Patent's file history, I understand that the Astera Manual was not substantively considered during prosecution of the '044 Patent.

44. Astera attends industry trade shows such, showcasing products that are in widely used throughout the industry. Based on my review of the declaration provided by Simon Canins (Ex. 1005), Astera showcased its AX10 Spotmax at the Prolight and Sound Tradeshow in Frankfurt Germany around March 2014. Ex. 1005 at ¶¶ 2, 5.

45. I understand that the Astera Manual was publicly available in 2015. *Id.* at ¶¶ 4-8. I also understand that a "Quick Start Guide," which included a QR code and link for accessing the full Astera Manual, was included in the packaging

of AX10 products sold in 2015. *Id.* In addition, I understand that the Astera Manual was publicly available online, through Astera’s website since before the Priority Date. *Id.*

46. The Astera Manual includes information on the AX10 lighting system, including guidance on its operation and use. *See, e.g.*, Ex. 1004 at 7-35. The AX10, pictured below, is a controllable lighting fixture that includes an array of nine “RGBAW” (red, green, blue, amber, and white) LEDs with 135W power. *Id.* at 7.



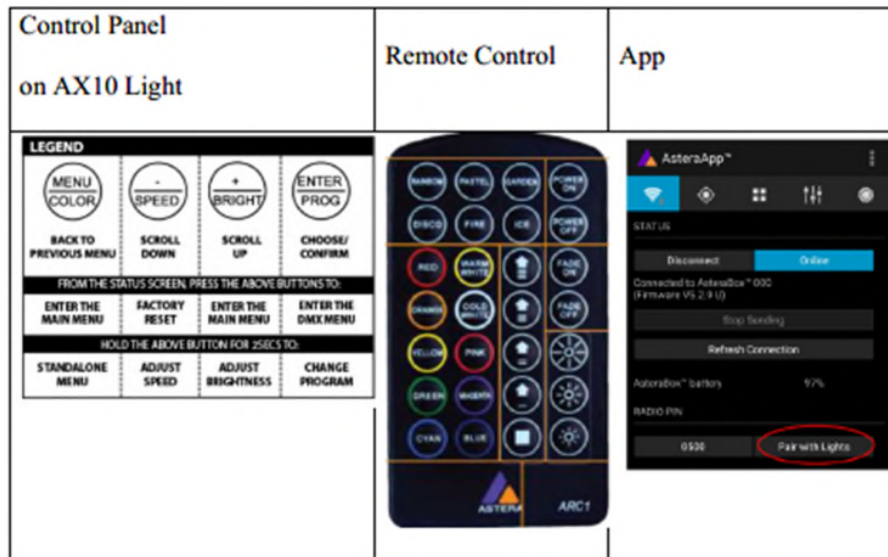
4 SPECIFICATION

LED power:	135W
Illuminants:	9 x 15W RGBAW Philips LEDs
Luminous Flux*:	3,350lm (at White 4000K)
Emitance*:	10,350lx (at 2m: White 4000K)
CRI*:	up to 92

Ex. 1004 at Cover, 7 (annotated).

47. The Astera Manual notes that the AX10’s LEDs can be controlled with different controllers. Ex. 1004 at 8-11. Specifically, the Astera Manual discloses that the AX10 “can be controlled in several ways,” including (i) an LCD

Control Panel (working with a “standalone engine”) on the AX10 (referred to throughout this Declaration as the “Control Panel”), (ii) “Aster’s ARC1 infrared remote control,” (iii) the AsteraApp (an app for mobile devices), and (vi) CRMX wireless DMX. *Id.* Exemplary images of the Control Panel, remote control, and AsteraApp are shown below:



Id. at 9, 11, 23.

48. As disclosed in the Astera Manual, the AX10 can produce customized lighting effects through the Control Panel, infrared remote, AsteraApp, or DMX control. *Id.* at 21, 23-24, 27-28, 32; *see also id.* at 17. Exemplary effects include fire with a “random” flickering; strobes of varying speeds; color chasers; color fades; spiral colors; and rainbows. *Id.* at 17, 21. Descriptions of these effects appear in the table below:

Name	Pattern
ONE COLOR STATIC	A static color is displayed on the whole virtual light.
TWO COLOR STATIC	The virtual light is split into two halves and two colors are displayed.
THREE COLOR STATIC	The virtual light is split into three parts and three colors are displayed.
FOUR COLOR STATIC	The virtual light is split into four parts and four colors are displayed.
ONE COLOR FADE	For all FADE programs, the whole color palette of four colors is used. Those colors are faded in and out one by one. Here, the whole virtual light shows the same color.
TWO COLOR FADE	The virtual light is split and shows two colors at a time.
THREE COLOR FADE	The virtual light is split and shows three colors at a time.
FOUR COLOR FADE	The virtual light is split and shows four colors at a time.
SIMPLE RUNNING	A running light; the background and the running pixels color can be set.
DOUBLE RUNNING	Two pixels are running in opposite direction.
TWO COL RUNNING	The two pixels are of different color even.
FLAG RUNNING	A three color flag is running over the background color.
DOUBLE FLAG RUNNING	Two flags are running over background in opposite direction.
SPIRAL 4 COLORS	The color is changed pixel by pixel. All four colors are used one after the other.
SPIRAL 2 COLORS	The color changes between color 1 and 2 from the outside to the inside, pixel by pixel.
RAINBOW	A rainbow effect is displayed.
FIRE	The fire effect is a random flicker between two colors, background and flickering color.

Id.

49. Further, users can customize these lighting effects with the Control Panel or AsteraApp by adjusting parameters such as speed, crossfade, stroboscope, and brightness. *Id.* at 11, 27-31. In the AsteraApp, the user can adjust these parameters using a sliding scale:

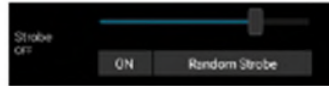
AN EFFECT CAN BE HIGHLY CUSTOMIZED:



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.



Each effect can be adjusted in brightness as well.

Id. at 27; *see also id.* at 20, 24-29.

B. The Astera Manual Discloses or Teaches Claims 1-19

a) Independent Claim 1

50. It is my opinion that, as viewed by a POSITA, the Astera Manual discloses Claim 1.

Claim 1[pre]: A method for controlling a lighting device to produce a range of different user customisable lighting effects, the method comprising:

51. The Astera Manual discloses the preamble to Claim 1.

52. The Astera Manual discloses the features and functionality of the AX10, a controllable lighting fixture that includes an array of nine RGBAW LEDs at 135W power. Ex. 1004 at 7.



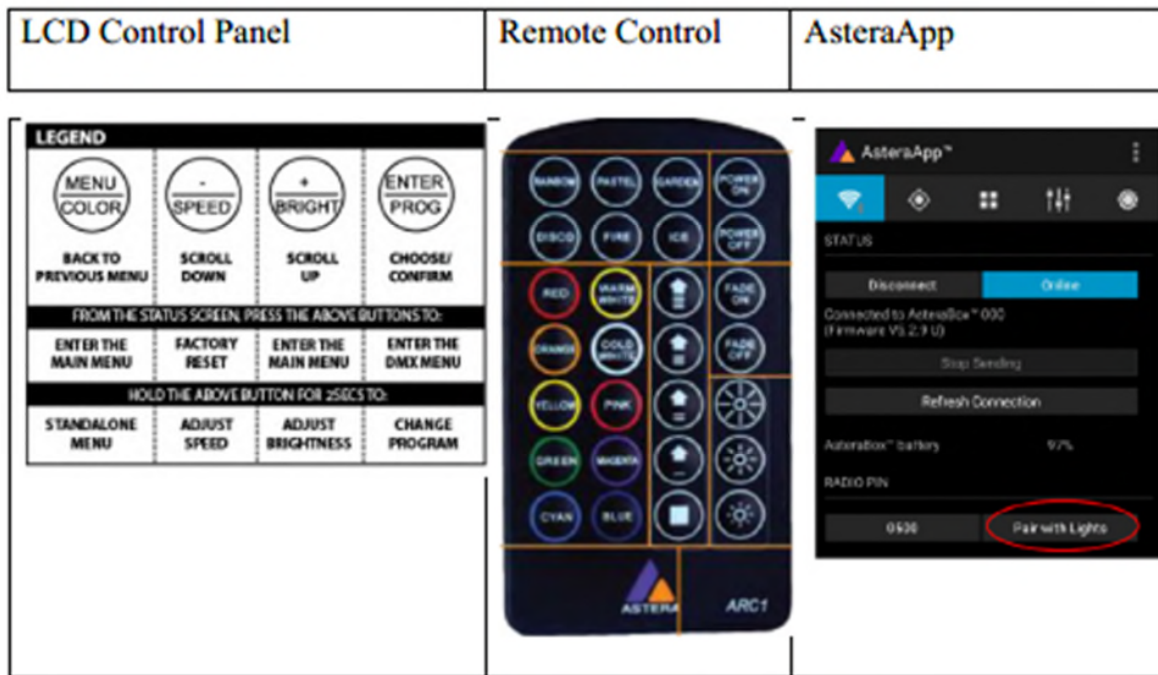
4 SPECIFICATION

LED power:	135W
Illuminants:	9 x 15W RGBAW Philips LEDs
Luminous Flux*:	3,350lm (at White 4000K)
Emitance*:	10,350lx (at 2m; White 4000K)
CRI*:	up to 92

Ex. 1004 at Cover (annotated), 7 (annotated).

53. The AX10 can be controlled by various different controllers. Ex. 1004 at 8-11 (noting the AX10 light “can be controlled in several ways”). Specifically, the AX10 light can be controlled with the Control Panel, an infrared remote control, the AsteraApp, and CRMX wireless DMX. *Id.* at 9-10.

54. Exemplary images of the Control Panel, remote control, and AsteraApp are shown below:



Id. at 9, 11, 23.

55. As disclosed in the Astera Manual, the AX10 can produce customized lighting effects. *See, e.g., id.* at 9, 23, 27. “Effect modes” offer “a comprehensive control of the built in standalone engine,” to implement “predefined programs” providing desired lighting effects. *Id.* at 21. Exemplary effects include fire, strobe, static colors, color fades, rainbow, and spiral colors. *Id.* at 17, 21. Descriptions of these effects appear in the table below:

Name	Pattern
ONE COLOR STATIC	A static color is displayed on the whole virtual light.
TWO COLOR STATIC	The virtual light is split into two halves and two colors are displayed.
THREE COLOR STATIC	The virtual light is split into three parts and three colors are displayed.
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SIMPLE RUNNING	A running light; the background and the running pixels color can be set.
DOUBLE RUNNING	Two pixels are running in opposite direction.
TWO COL RUNNING	The two pixels are of different color even.
FLAG RUNNING	A three color flag is running over the background color.
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RAINBOW	A rainbow effect is displayed.
FIRE	The fire effect is a random flicker between two colors, background and flickering color.

Id. at 21.

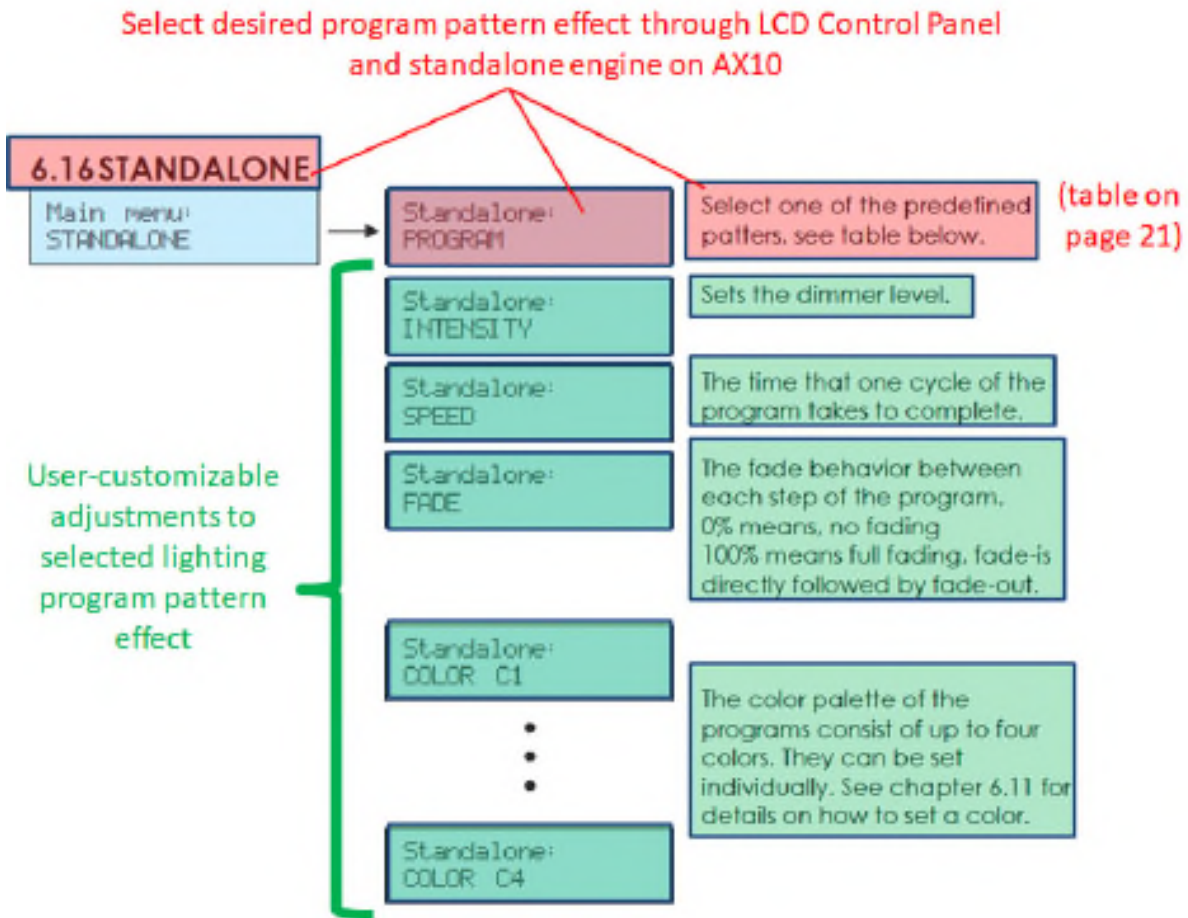
56. These lighting effects can be customized through the Control Panel or the AsteraApp. *Id.* at 8, 11, 13, 20, 24-29. The Control Panel allows a user to (i) “select” an effect; (ii) adjust the intensity, setting a dimmer level; (iii) adjust the speed, changing the time to complete one cycle of the program; (vi) adjust the fade time between the steps of the program; and (v) adjust color selections. *Id.* at 20.

6.6 CONTROL PANEL

User-customizable
adjustments to
selected lighting
program pattern
effect

LEGEND			
 BACK TO PREVIOUS MENU	 SCROLL DOWN	 SCROLL UP	 CHOOSE/ CONFIRM
FROM THE STATUS SCREEN, PRESS THE ABOVE BUTTONS TO:			
ENTER THE MAIN MENU	FACTORY RESET	ENTER THE MAIN MENU	ENTER THE DMX MENU
HOLD THE ABOVE BUTTON FOR 2SECS TO:			
STANDALONE MENU	ADJUST SPEED	ADJUST BRIGHTNESS	CHANGE PROGRAM

Select desired
program pattern



Id. at 11, 20 (annotated).

57. Users can also select and customize effects through the AsteraApp. *Id.* at 17, 21, 27-31. As illustrated in the below image, the list of effects include “running lights,” “fire effect,” “rainbow effect,” “chaser effects” and “moving chasers.” *Id.* at 27-28.

7.7 LIST OF EFFECTS

The effects' patterns are pre-defined and cannot be modified by the user. They are pre-programmed inside of each light. Still they can be parameterized. These effects are:

	Several variations of running lights are available.
	The Fire effect shows a random flickering effect. The background color and the color of the flickering effect can be adjusted.
	The rainbow effect shows a color change through all colors. Only its speed can be adjusted.
	Chaser effects provide an efficient means to create dancefloor lighting. The static chaser exchanges the color of the lights according to the tapped-in beat. The colors are randomly chosen. The effect can be adjusted to show up to 4 different colors at a time.
	The Moving Chasers overlay the static chaser by a second movement of the four displayed colors over the available positions of a Flow-Set. This gets mostly interesting of the Moving Strobe is chosen. Then, only some of the positions strobe and they are moving. So the strobe effect moves over the Flow-Set.

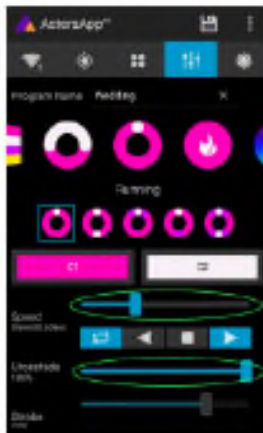
Id. at 28 (annotated).

58. Once selected, a user can “highly customize[]” the effects by adjusting parameters. *Id.* at 27. These parameters include: (i) the “speed” “to complete one cycle,” (ii) the “crossfade” of the light between steps, (iii) the “speed” of a “stroboscope effect,” (iv) the “brightness” of the effect, and (v) “color.” *Id.* at 24, 27. The user interface for parameter customization is illustrated below:

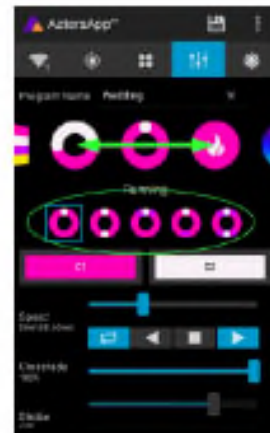
7.6 CHANGING THE EFFECT



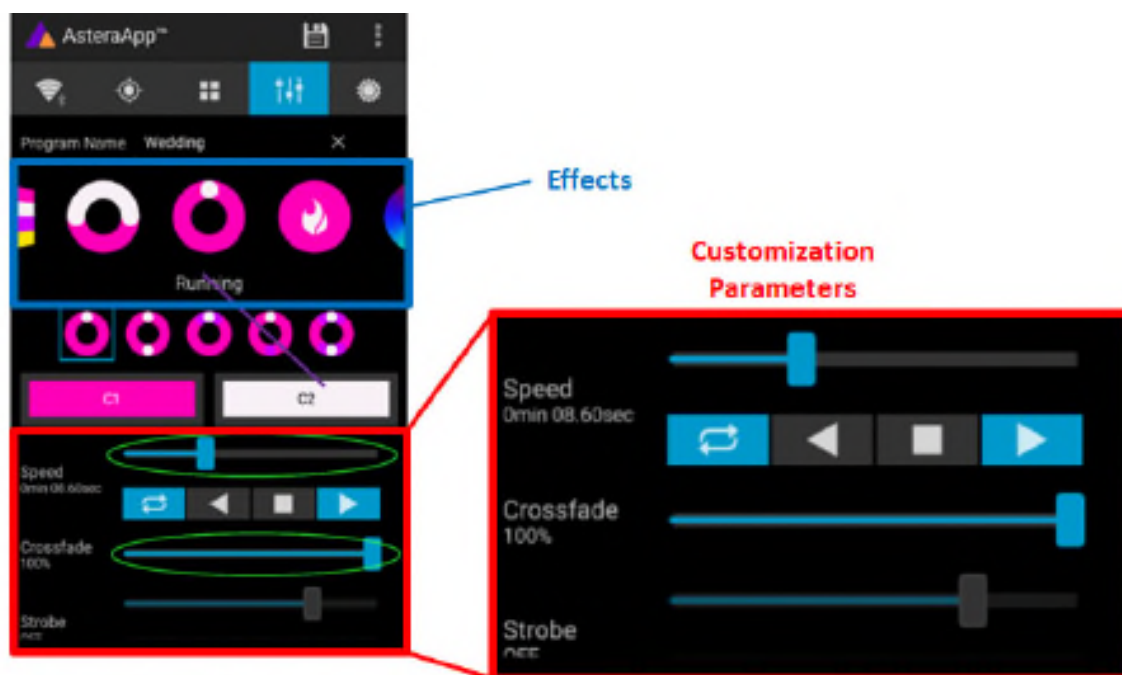
On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.



Set 'Crossfade' to 0% and 'Speed' to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.

Id. at 27 (annotated).

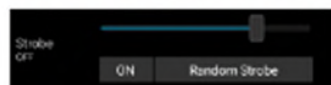
AN EFFECT CAN BE HIGHLY CUSTOMIZED:



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.



Each effect can be adjusted in brightness as well.

Id. at 27.

Claim 1[a]: *receiving user input of at least one user input simulation parameter to customise a lighting effect;*

59. The Astera Manual discloses Claim 1[a].

60. The Astera Manual discloses multiple user interfaces for the AX10, including the Control Panel, remote control, and AsteraApp. Ex. 1004 at 9.



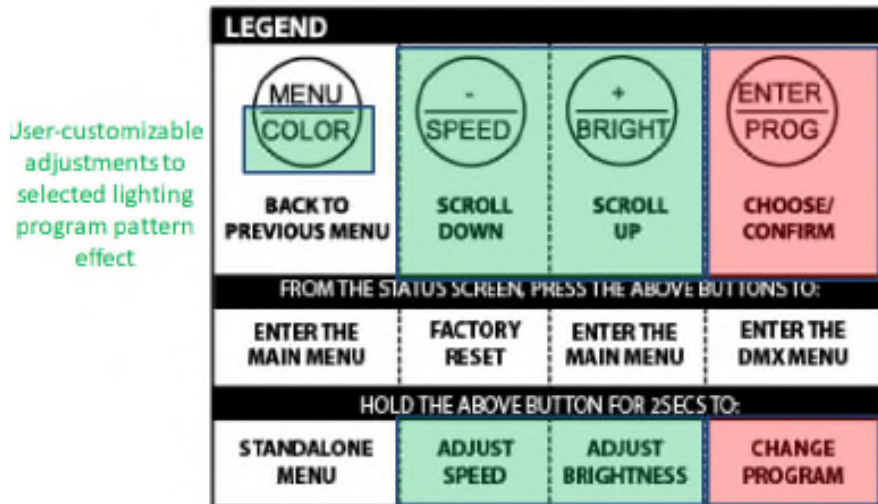
Id. at 9, 11, 23. Users can select from myriad effects and input or adjust parameters through these interfaces. *Id.* at 8, 11, 13, 20, 24-29.

61. The Astera Manual discloses a Control Panel that includes an LCD menu interface for “receiv[ing]” user selections of a lighting program or effect. *Id.* at 20-21 (listing programs and effects). Once a user selects a program or effect, the Control Panel “receives” the user selection data for the parameters. *Id.* at 11, 20.

This data includes: intensity, speed of a cycle of the program, fade time between steps of the program, and color selections. *Id.* at 20.

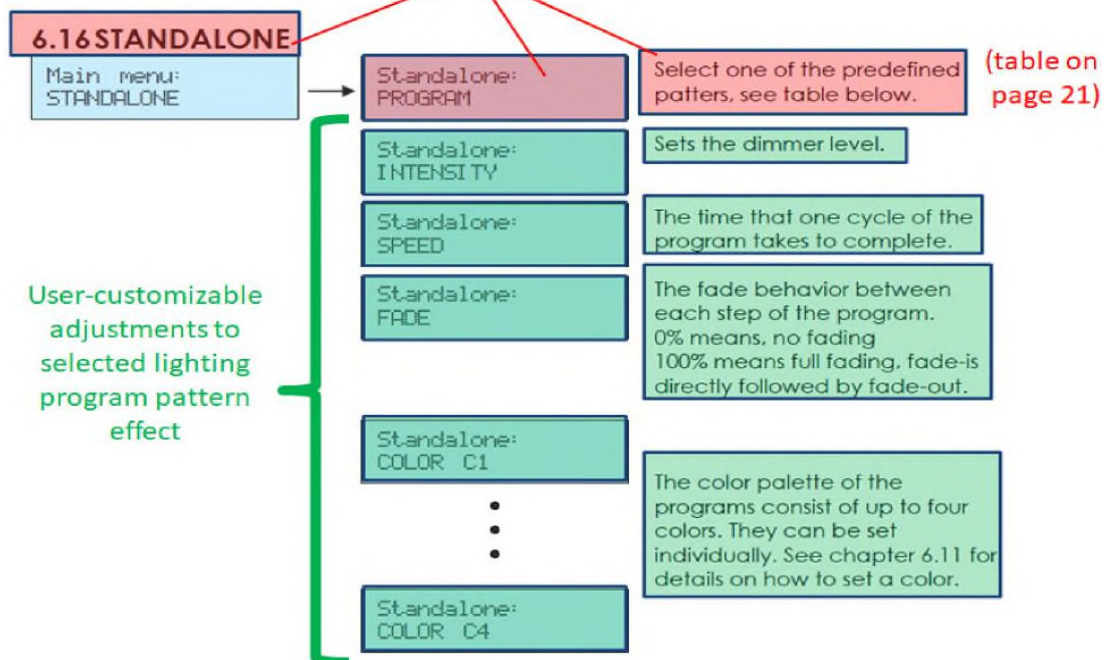
LCD Control Panel on AX10

6.6 CONTROL PANEL



Select desired program pattern effect through LCD Control Panel and standalone engine on AX10

Select desired program pattern



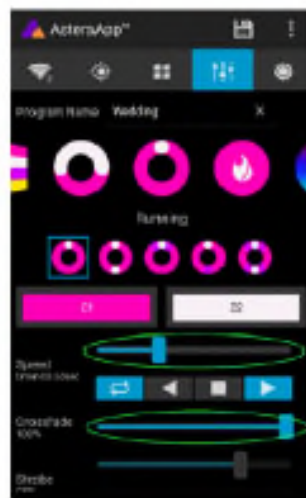
Id. at 11, 20 (annotated). The Control Panel then adjusts the desired effects accordingly based on the parameters. *See supra* ¶¶ 51-58 (Claim 1[pre]).

62. The AsteraApp allows a user to select and “highly customize[]” programs of effects (e.g., “Wedding”). *Ex. 1004* at 27. To do so, effects and programs may be selected from a main screen in the AsteraApp. *Id.* at 24-30. The user can then choose to “enter the editor” where the user is presented with options to customize the effect’s parameters. *Id.* at 27. These parameter customizations are received by AsteraApp through the user interface. *Id.* Exemplary images of the user interface appear below:

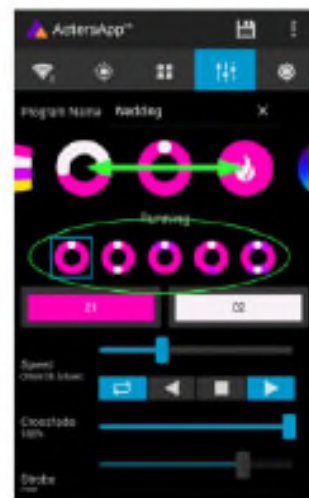
7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press “Wedding” (1), then enter the editor (2).



Set “Crossfade” to 0% and “Speed” to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

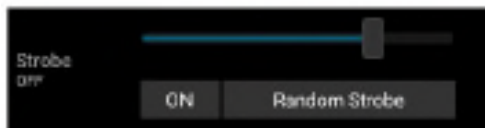
AN EFFECT CAN BE HIGHLY CUSTOMIZED:



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.



Each effect can be adjusted in brightness as well.

Id. at 27.

63. In addition, pre-defined effect patterns (e.g. “fire,” “fading colors,” and “rainbow”) may be selected in the AsteraApp. *Id.* at 28. The user can then customize the parameters of the effect and that data is received by AsteraApp. *Id.* at 27-28. For example, if a user selects the “fire” effect as part of a program, the user can customize the effect by adjusting the “background” and “flickering” colors. *Id.* In another example, if a user selects the “rainbow” effect, s/he can then adjust the “speed” at which the effect will cycle through the colors. *Id.* In addition, the Astera Manual discloses a “master brightness” control for all effects. *Id.* at 31.

This parameter allows users to adjust the brightness of any lights that would run an effect, which in turn adjusts the overall brightness of the effect. *Id.* at 31.

Claim 1[b]: storing in memory said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated;

64. The Astera Manual discloses Claim 1[b].

65. The Astera Manual teaches that the simulation parameter depends on the user-selected, pre-programmed light effect (*e.g.*, fire, rainbow, chaser), which is customized with the user's desired random strobing, speed, brightness, or color parameters. *See supra* ¶¶ 57-60 (Claim 1[a]). As discussed above, the parameters available in the menu options are based on the user-selected effect. Ex. 1004 at 20-21, 24-28. If a user selects the "rainbow" effect, the user interface will generate the "speed" parameter, which will control how quickly the lights cycle through different colors. *Id.* at 28. On the other hand, if a user selects the "fire" effect, the user interface will generate parameters to adjust the "random flicker," flickering effect colors, and set the background. *Id.*

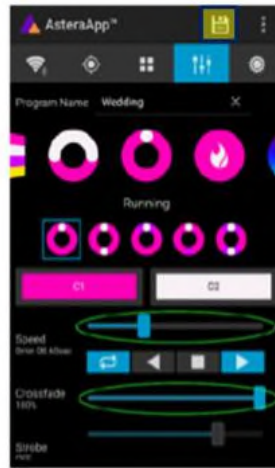
66. The Astera Manual discloses that the selected lighting effects, and user customizations thereof, may be "saved back to the main screen by pressing the save button." Ex. 1004 at 27. A user may select an effect (*e.g.*, "fire") and modify it (*e.g.*, by adjusting the "brightness" simulation parameter). *Id.*; *see also id.* at 25. Once the user has finished customizing the effect, they can "save" the effect, along

with its adjusted parameters, by choosing the disk icon in the top right-hand corner of the AsteraApp (highlighted in the below image). *Id.* at 27. This saves the user input adjusted parameters for the selected lighting effect. *Id.*²

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

After the effect is adjusted, it may be saved back to the main screen by pressing the save button.

² The Astera Manual also teaches that a user's customizations for "Anti-Flicker" are preserved when they are entered into AsteraApp. Ex. 1004 at 32. By "preserving" the Anti-Flicker adjustments, these settings are also saved and recalled when the lamps are powered back on. *Id.* at 24-32. The Anti-Flicker parameter can be adjusted for any effect. *Id.* at 32.

Id. at 27 (annotated).

67. After the effects are saved, a user can later recall and play the effect as customized. *Id.* at 10, 24, 30.

68. A POSITA would understand that the customized effects are stored to, and recalled from, a “memory.” The AsteraApp is an application operated on a mobile device. *Id.* at 27. The programming for the app, as well as the stored user adjustments and stored effects, would be contained in memory as computer-readable instructions capable of being recalled and implemented through the app. Saving within AsteraApp therefore saves to a “memory.” Saving an effect and its parameters within the main menu must save to a memory so that the saved customized effect can later be recalled and played. *Id.* at 27.

69. While using the AsteraApp in connection with an AX10 light, the adjusted effects parameters are stored to at least one memory in the AX10. Section 6.4 of the Astera Manual states that “...these effects can be created and be sent to the light by the built in UHF receiver.” *Id.* at 10. After the effects are stored in the AX10, they are stored in the built-in standalone engine, from which “the effects are just triggered and then each light replays it autonomously until it receives a new effect.” *Id.* The effects are also stored in memory within the AsteraApp. By way of explanation, if a user runs the AsteraApp offline with no AX10 connected, the

user can still modify, store, and recall the effects on the AsteraApp; therefore, they must also be stored within the AsteraApp. *Id.* at 23-34.

70. While using the AX10 in connection with the Control Panel, a POSITA would understand that any customized effects are “saved” to a memory within the AX10. Users can navigate the Control Panel interface to make Standalone mode selections of programs (*i.e.*, effects) and parameter adjustments that are received by the AX10. Ex. 1004 at 11, 14, 17, 20-21; *see also supra* ¶¶ 57-60 (Claim 1[a]). As discussed above, users can choose a program and subsequently adjust a parameter (e.g., “intensity”) for the program in order set a desired brightness for that effect. Ex. 1004 at 20. Users can then adjust the “speed” parameter, followed by the “fade” parameter of the same program. *Id.* at 11, 14, 17, 20-21. This adjusts the speed at which the effect plays on the lights and the light fades at the end of the effect (or a step in the effect). *Id.* These parameter selections must be stored in memory. Otherwise, a user would not be able to adjust a parameter and then make another selection to change a different parameter prior to finalizing the effect. A user can also edit the parameters of an effect, choose a new effect, and then return to the previous effect from which the previously adjusted parameters remain as the user last edited them. Thus, those parameters must have been stored to a memory in the AX10.

71. The Control Panel also offers users the option to “reset” the settings of the device, including “reset[ting]” the Standalone settings set for a specific user-customized effect and program. Ex. 1004 at 12, 22. The fact that the Standalone settings, which include the selected effect and any adjusted parameters (*id.* at 12 (“[r]eset all user settings to default”), 20-22) can be “reset” to default values indicates those parameters must be stored in memory on the device. The user-selected parameter settings are stored and saved until they are changed or reset. *Id.*

Claim 1[c]: recalling from said memory said at least one stored user input simulation parameter;

72. The Astera Manual discloses Claim 1[c].

73. The stored user input parameters (*see supra* ¶¶ 61-67 (Claim 1[b])) are recalled from memory prior to, and throughout, the output of desired effects from the AX10.³

³ The '044 Patent contains a single reference to storing and recalling parameters, stating “[i]t should be appreciated that due to the nature of the light 102, the effects may be customised by a user, for example, the frequency/speed, peak/minimum brightness or colour/colour temperature may be dynamically changed, and/or made to vary over time in a customised manner. ***Such user input simulation parameters may be stored in memory 220 and recalled from the memory 220 at a later time.***”

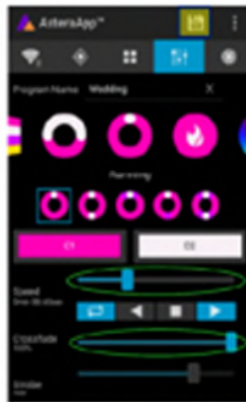
74. In AsteraApp, stored effects (with their modified parameters) can be recalled, with lighting values calculated based on the recalled effect and parameters, so the effect may be played at a later time. Ex. 1004 at 24, 27, 30. For example, customized program effects (e.g., “Wedding”) may be “saved back to the main screen,” from which they can later be recalled, played, or further adjusted. *Id.* at 27. “Wedding” would be a program comprised of multiple effects of running lights, with parameters such as color, speed, and crossfade, adjusted by the user. *Id.* As shown on the main screen of the app, other programs of effects (e.g., “fire,” “ice” or “blue pulse”) could also be selected, adjusted, and saved back to the main screen. *Id.* The saved programs of “effects” are represented by “tiles” on a main screen where they can be selected and recalled. *Id.* at 30.

The effects may be triggered on cue (for example from a director) by sending a signal over a wired remote trigger or wireless device.” Ex. 1001 at 9:27-36.

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

After the effect is adjusted, it may be saved back to the main screen by pressing the save button.

Id. at 27 (annotated).

7.9 THE MAIN SCREEN

Here each program is represented by a tile. Those tiles can be edited and freely positioned. Several pages of tiles are available.



To move or delete a tile, press the pen icon [2]. A popup will show the available actions. To add a new program tile, press the "+" icon [1].



While adding a tile, either a default "Static Red" or the currently running program can be selected. Additionally, special function tiles are available.

Id. at 30 (annotated).

75. The stored effects and adjusted parameters are saved to a memory (see *infra* Claim 1[b]). *Id.* at 27-30. When they are recalled, it is from this same memory. For example, a user can (1) edit the parameters of an effect; (2) select a new effect; and then (3) return to the previous effect, where the previously changed parameters reflect the user's last round of edits. Therefore, those parameters must have been stored to, and subsequently recalled from, a memory in the AX10 lighting device.

76. In Standalone mode implemented through the Control Panel, saved user parameter settings are recalled for the AX10 to replay and display the customized effect programs with the lights. Ex. 1004 at 10, 17, 20-21; *see also id.* at 7 (indicating the AX10 may be “operating under a previous setting.”)

Claim 1[d]: calculating, using an effect simulator, a time varying lighting value based on said recalled simulation parameter; and

77. The Astera Manual discloses Claim 1[d].

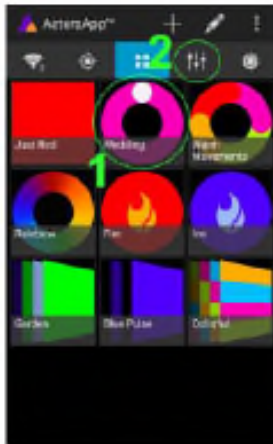
78. The '044 Patent describes an “effect simulator” as a component that “creates data 106 characterising a lighting effect.” Ex. 1001 at 7:37-42; *see also id.* at 5:46-50. It also describes the “time varying lighting value” as data or signals that contain brightness or color values, which vary over time to produce desired effects. Ex. 1001 at 8:27-39, 8:51-44. Astera includes effects simulators to calculate time-varying lighting values to generate customized effects based on user-input simulation parameters using the Control Panel and AsteraApp. Ex. 1004 at 9-11, 13, 17, 21. Similar to the '044 Patent, the Astera Manual discloses how the Control Panel and AsteraApp are used to input parameters, and the AX10 calculates values that represent the desired effects based on the parameters. This can be done using a processor. The calculated values will change depending on which recalled effects and parameters (e.g., speed and brightness) the user chooses to be played. Data characterizing the customized effect is then created from the calculated values and sent to the LEDs in order to generate the effect.

79. Users can “select” from predefined effects in the Control Panel and adjust parameters, including intensity (to set a brightness level), speed (to change the time to complete one cycle), fade time, and color. *Id.* at 20. These customized effects are stored and recalled from the AX10 light (through the Control Panel) in order for the user to make selections, adjustments, and play the desired effect. See *supra* ¶¶ 64-76 (Claims 1[b]-[c]). Using the Control Panel, the AX10 creates data that characterizes the customized effect based on the recalled effect settings. *Id.* at 23-32. *Id.* at 11-12. This data exists in the form of values and settings for the LEDs to “display these effects properly with [the] light.” *Id.* at 12, 17, 20-21. The “standalone engine” then causes the LEDs to “display static colors or replay a number of predefined effect patterns with a customizable color palette.” *Id.* at 24; see also *id.* at 10, 17. With respect to effect patterns, the values vary with time to change the output of the LEDs, which creates the effect. *Id.* The contents of the effects, including the LEDs in use and their brightness, colors, and dynamic qualities (e.g., fade-in time and strobe rate), can be saved and recalled on the AsteraApp. *Id.* at 10, 24, 30. When a user recalls a saved effect to play, the values corresponding to the effect parameters are transmitted to the light, which replays them on its effects engine using the values and times from the AsteraApp. *Id.* The effects engine, or processor, offers controls for the brightness and color of each

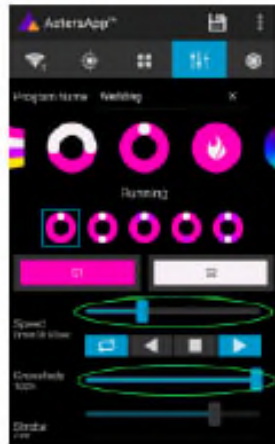
LED, from moment to moment in a time-varying manner, by using the values sent by the AsteraApp.

80. As discussed above, users can select from various effects in the Astera App. *Id.* at 27. These effects include “fire,” “chasers,” “rainbow” and “stroboscope.” Ex. 1004 at 21-24, 27-28; *see supra* ¶¶ 51-58 (Claim 1[pre]). The user can “highly customize[,]” their chosen effects by adjusting the parameters. *Id.* at 27. Available parameters include: (i) the “speed” to complete one cycle, (ii) the “crossfade” between steps, (iii) the random “stroboscope” speed, and (iv) the “brightness.” *Id.* at 27. Users can also use the “customizable color pallete,” to select and customize colors for effects. *Id.* at 10, 24. Further, certain effects (e.g., “fire”) allow a user to change the colors that make up the effect. *Id.* at 24, 28. Within the AsteraApp, users are presented with interfaces showing the selected effect. *Id.* at 23-24. The interface includes slider and button controls to adjust the speed, crossfade (from 100% for a soft fade to 0% for immediate change), stroboscope speed, random stroboscope options, and brightness (from 0% to 100%). *Id.* at 24, 27.

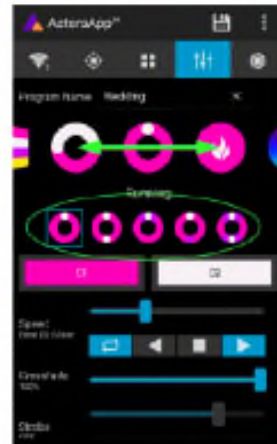
7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

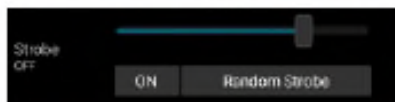
AN EFFECT CAN BE HIGHLY CUSTOMIZED:



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.



Each effect can be adjusted in brightness as well.

Id. at 27.

81. A user can save their selections and recalled the customized effect for later use. *Id.* at 27. The recalled parameters are used to calculate the time varying lighting value. Ex. 1004 at 10, 24, 30. Once a saved effect is recalled, the effects engine uses the values input in the AsteraApp, or the AsteraApp itself, calculates time-varying lighting values (e.g., brightness and color information) for these customized effects. *Id.* at 23-29. The AsteraApp is capable of “send[ing] complex effects” that can be “used to adjust the lights settings remotely” by sending controls. *Id.* at 24. The complex effects are composed of the values that represent the desired lighting and any adjustments the user made to the parameters, which are recalled with the effect as described above. When the effects are part of a show, the sent values include the timing of when each effect should be played, as well as the timing for changes within the effect itself. These changes could include timing values for implementing a “random” slow strobe, or for completing a cycle of the effect from the “speed” selection. *Id.* at 23-24, 27-28. Therefore, based on recalled user-customized parameters, “effects can be created and [can] be sent to the light by the built in UHF receiver,” where the effects are “triggered” and replayed at each light. *Id.* at 23.

Claim 1[e]: outputting to said lighting device said time varying lighting value thereby to simulate the lighting effect.

82. The Astera Manual discloses Claim 1[e].

83. The Astera Manual discloses that both the Control Panel and AsteraApp output the calculated, time-varying lighting values for the AX10 light, “display[ing] these [selected] effects properly with [its] light.” *Id.* at 21.

84. Users can select “STANDALONE” mode on the Control Panel “Main Menu” status screen. *Id.* at 11, 20, 24. The Control Panel “set[s] the parameters of the standalone engine” in the AX10 light. *Id.* at 12, 17. In “STANDALONE” operation mode, the Control Panel allows users to select a program and change the parameters (e.g., intensity, speed, fade, and color) for that particular effect. *Id.* at 20-21; *see also supra* ¶¶ 59-63 (Claim 1[a]). As a result, the Control Panel creates data characterizing the adjusted lighting effect. This appears in the form of values and settings for the LEDs (which will change over time) that set “the parameters of the standalone engine.” Ex. 1004 at 12, 17. When a user wants to play the effect, the “standalone engine” outputs the lighting values to the LEDs, causing the LEDs to “display static colors or replay a number of predefined effect patterns with a customizable color palette.” *Id.* at 24; *see also id.* at 10, 17. With respect to effect patterns, the values vary with time to change the output of the LEDs, which creates the effect.

85. The AsteraApp also allows users to select from different lighting effects (e.g., fire effect, chaser effects, or rainbow). *Id.* at 23-24. The user can then customize the effect by changing the parameters. *See supra* ¶¶ 59-63 (Claim 1[a]).

When a user wants to play an effect, the AsteraApp outputs the calculated lighting values for that effect to the AX10 lighting device. *Id.* at 24. The AsteraApp uses these customized effects to calculate time-varying lighting values, including brightness and color information, for the desired effects. *Id.* at 23-29. The Astera Manual teaches: “[w]ith the AsteraApp these effects can be created and be **sent to the light by the built in UHF receiver**,” where they are received by the standalone engine in the AX10. *Id.* at 24 (emphasis added); *see also id.* at 10, 17. The AsteraApp outputs the lighting values for a customized effect to the AX10 light. *Id.* at 23-34. When the lighting values are received by the “standalone engine,” the AX10 “replays [the effect] autonomously until a new effect is sent.” Ex. 1004 at 24.

86. The Astera Manual teaches that the contents of the effects, including the LEDs in use (and the brightness, color, and dynamic qualities like fade-in time and strobe rate), can be saved on the AsteraApp for an effect, and then later recalled and replayed. *Id.* at 27. The recalled values are sent to the AX10 light, which uses the values and times sent from AsteraApp to replay the values on its effects engine. *Id.* at 23-34. The effects engine in the light provides control signals that represent the brightness and color of each LED in the light, from moment to moment, in a time-varying manner using these parameters. The fire effect, for example, may be presented as outputs to the red and amber LEDs, varying in

intensity over time. The end result is a realistic depiction of firelight changing in intensity from moment to moment as the simulated flames move, grow, and shrink.

b) Independent Claims 12 and 19

87. A POSITA would not perceive any substantive differences of scope between independent Claim 1 and independent Claims 12 and 19. The foregoing reasoning regarding Claim 1 applies with equal force to Claims 12 and 19. A POSITA would understand the Astera Manual discloses Claims 12 and 19 for the same reasons it discloses Claim 1.

88. To illustrate the fact that Claims 1, 12, and 19 do not differ substantially in their scope, the claims are reproduced below with notable differences bolded⁴:

Claim 1	Claim 12	Claim 19
A method for controlling a lighting device to produce a range of different user customisable lighting effects, the method comprising:	A system adapted to control at least one lighting device to produce a range of different user customisable lighting effects, the system comprising:	A computer program product comprising software code for controlling a lighting device to produce a range of different user customisable lighting effects the computer program product is adapted to perform, when executed, the steps of:

⁴ The claim comparison charts throughout this Declaration apply to all grounds.

Claim 1	Claim 12	Claim 19
receiving user input of at least one user input simulation parameter to customise a lighting effect;	an input interface adapted to receive user input of at least one user input simulation parameter to customise a lighting effect;	receiving user input of at least one user input simulation parameter to customise a lighting effect;
storing in memory said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated;	a memory adapted to store said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated; and	storing in memory said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated;
recalling from said memory said at least one stored user input simulation parameter;	an effect simulator adapted to: recall from said memory said at least one stored user input simulation parameter; and	recalling from said memory said at least one stored user input simulation parameter;
calculating, using an effect simulator , a time varying lighting value based on said recalled simulation parameter; and	calculate a time varying lighting value based on said recalled simulation parameter;	calculating, using an effect simulator , a time varying lighting value based on said recalled simulation parameter; and
outputting to said lighting device said time varying lighting value thereby to simulate the lighting effect.	wherein the effect simulator is adapted to output said calculated time varying lighting value to the at least one lighting device thereby to simulate a lighting	outputting to said lighting device said time varying lighting value thereby to simulate a lighting effect.

89. Claim 1 is directed to a “method” for controlling a lighting device, while Claim 12 is directed to a “system” implementing *this same method* and

Claim 19 is directed to a “computer program” performing *this same method*. Thus, the Astera Manual discloses the limitations in Claims 12 and 19 for the same reasons discussed above with respect to Claim 1.

90. The Astera Manual discloses Claim 12. The Astera Manual teaches that the method of Claim 1 is implemented on a system that includes the AX10, as controlled by the Control Panel or through the AsteraApp. *See supra* ¶¶ 50-86 (Claim 1).

91. As discussed above with respect to Claim 1, the Astera Manual discloses that the claimed method can be performed by a “software program,” as recited in Claim 19. Ex. 1004 at 2, 23-24. The software programs disclosed by the Astera Manual are the Control Panel and AsteraApp, which are computer programs that execute functions based on software code. *Id.* at 22 (referencing firmware on the device). The AsteraApp is a mobile app, taking the form of software code downloaded and run on a user’s mobile device. The Control Panel is implemented through software-based programming within the AX10. *Id.* at 2, 12, 36. The Astera Manual indicates that the lights include “firmware version 5.2.20,” and the information menu displays “the firmware version and hardware version of the light.” Ex. 1004 at 2, 12, 22. A POSITA would know that firmware is software programmed into a read-only memory, and would thus understand that this firmware implements the programming and control of the AX10.

c) **Dependent Claim 2**

Claim 2: *The method according to claim 1 wherein said user customisable simulation parameter is stored locally.*

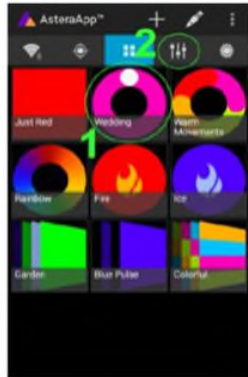
92. The Astera Manual discloses Claim 2. *See supra* ¶¶ 64-76 (Claims 1[b]-[c]).

93. The Astera Manual teaches that the user-selectable effects, and user adjustments made to those effects, can be “saved back to the main screen by pressing the save button” within the app. Ex. 1004 at 27. First, a user selects an effect (e.g., “fire” or “wedding”) and modifies it (e.g., by changing simulation parameters that adjust the effect, such as “speed,” “crossfade,” “stroboscope,” and “brightness”). *Id.* Then, the user can “save” that effect (with its adjusted parameters) by clicking the disk icon in the top right-hand corner of the AsteraApp. *Id.* at 27. The customized parameters related to the selected effect are thereby saved on a “local” memory on the device running the AsteraApp. *Id.* Once saved, the stored effects and custom effects can be recalled and played at later time. *Id.* at 10, 24, 30. Because the customized effect is “saved to the main screen,” it is available for a user to recall it from that main screen to later play the effect.

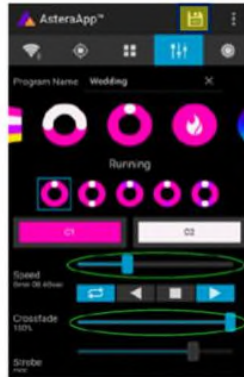
94. A POSITA would understand that the effects with user-modified parameters are stored to, and recalled from, a local “memory.” The AsteraApp is an application run on a mobile device and the programming for the app, as well as

the stored user adjustments and stored effects, would be contained in memory as computer-readable instructions that can be recalled and implemented through the AsteraApp.

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

After the effect is adjusted, it may be saved back to the main screen by pressing the save button.

Id. at 27 (annotated).

95. A POSITA would also understand that the AX10 can operate in a “standalone mode” and includes the “standalone engine.” Ex. 1004 at 10, 11. When operating in “Standalone” and controlled by the local Control Panel, where “[t]he light can no longer be controlled by any wireless signal” (*id.* at 11), the user-customized programs and parameters are saved locally within the AX10. Standalone mode would require execution of the computer-readable instructions

from a local memory in order to execute stored lighting comments and therefore implement the lighting effects.

d) Dependent Claim 3

Claim 3: The method according to claim 1, wherein the simulation parameter comprises a colour or colour temperature.

96. The Astera Manual discloses Claim 3.

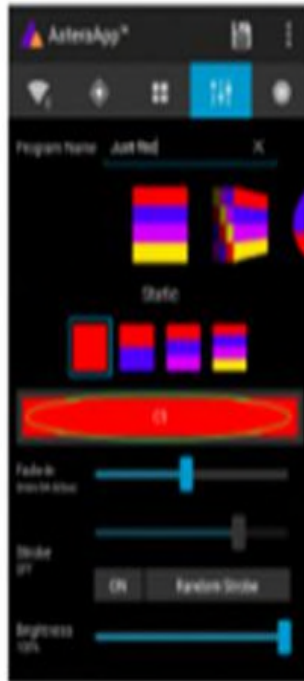
97. After a user chooses an effect in the AsteraApp, the user can customize the lighting effect to change the color or color temperature. Ex. 1004 at 20, 24, 27, 32. In “Standalone,” users can choose “color” parameters to set the “color palette” for a program. Ex. 1004 at 20, 24. Similarly, in AsteraApp, users can set color parameters for lighting effects. *Id.* at 24, 27-28.

98. The “fire” effect, for example, can be customized by modifying “the background color and the color of the flickering effect.” *Id.* at 28. These are parameters of the fire effect and the flickering is a result of the random alternation between the background and flickering colors. This modification is not limited to the “fire” effect, rather, users can set the colors for many of the lighting effects. *Id.* at 24, 27-28.

7.3 CHANGE THE COLOR



On the AsteraApp™ main screen, press "Just Red".



Once in the editor, press "C1".



Now the lights color can be changed.

Id. at 24 (annotated). Thus, users can set colors for an effect. *Id.* at 24-27.

99. A user can utilize the Astera Manual's set of predefined colors to modify the effect's "color temperature." Ex. 1004 at 14. These predefined colors options include: 2700K, 3200K, 4000K, 5500K, and 6500K. *Id.* A POSITA would recognize that these temperatures generally correspond to different colors, such as 2700K being between yellow and orange (known as tungsten light) or 6500K being approximately equal to white light (closer to daylight light). *Id.* Moreover, colors can be selected and edited to set "AsteraRGB values" for a particular "color temperature." *Id.* at 8.

e) **Dependent Claim 4**

Claim 4: The method according to claim 1, wherein the simulation parameter is related to at least one of: an effect frequency; an effect speed; a colour; a colour temperature; a trigger; a rate of increase of brightness; a rate of decrease of brightness; a rate of change of colour; a brightness; a local maximal (peak) brightness; a local minimal brightness; a brightness fluctuation period; and a colour fluctuation time period.

100. The Astera Manual discloses Claim 4.

101. The Astera Manual teaches that users can select from myriad effects using the Control Panel or the AsteraApp. Ex. 1004 at 17, 20-21, 23-24, 27-28. Users can modify the “color” of an effect, as well as select settings related to “color temperature.” See *supra* ¶¶ 96-99 (Claim 3). Users can also adjust the “intensity,” “brightness,” or “speed” parameters for each lighting effect. *Id.* at 20, 27. With respect to the “Anti-Flicker” settings, a “frequency” parameter “can be freely adjusted.” Ex. 1004 at 32. Accordingly, Astera expressly discloses parameters related to “frequency,” “brightness,” “speed,” “color,” and “color temperature.”

102. The Astera Manual also discloses that the simulation parameters for the effects are related to a rate of increase/decrease of brightness and the brightness fluctuation period. *Id.* at 20, 27. The speed at which the brightness changes or the color fluctuates during the effect is dependent upon the length of the time cycle. If an effect has several changes in color and brightness values in one cycle,

completing the cycle in a shorter time period would in turn require these changes to occur more quickly.

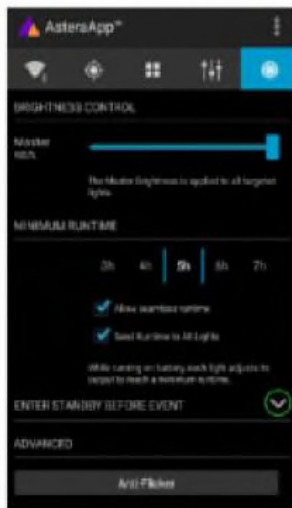
103. A user can choose an effect of a “one color fade.” *Id.* at 17. Changing the “speed” parameter of how long it will take the color to “fade in and out” relates to, among other things, the brightness fluctuation period and color fluctuation. *Id.* at 17, 20, 27-28. By altering the effect’s speed, the color will either fade in and out over a longer or shorter time period. Similarly, the fading in and out relates to the level of brightness. Thus, controlling the speed at which the lights fade also relates to the fluctuation duration of the brightness as the light fades in and out. The same is true when the fade is a “two color fade,” “three color fade,” or “four color fade.” *Id.* at 17, 20, 27-28.

104. The speed of the “stroboscope” effect can be also adjusted, thereby altering the brightness fluctuation period of the flashes. *Id.* at 27. For example, the perceived brightness fluctuation of the slow stroboscope effect would have a longer duration than that of a faster stroboscope effect. Further, the rate of color change and color fluctuation period parameters can be modified in the “chaser effect” and “rainbow effect,” which change colors and are capable of being played at various “speed[s].” *Id.* at 27-28. Changing the speed affects the rate of color change and color fluctuation period.

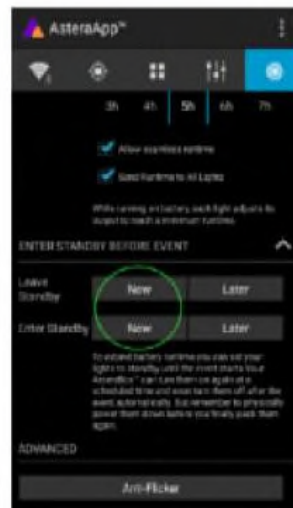
105. Users can manually choose a time delay in a “standby” mode to start the user-customized lighting effect(s). *Id.* at 34. This time delay is a trigger to start the effect, because the lights will not run the effect until the end of the delay. The “standby is intended to be used between setup and event... [A]ll lights may be switched to standby mode and woken up later when the event starts.” *Id.*

7.14 ENTER AND LEAVE STANDBY

The standby is intended to be used between setup and event (see chapter 3.2.1 **Error! Reference source not found.**). After setup is completed, all lights may be switched to standby mode and woken up later when the event starts. This ensures that no battery runtime is wasted. This can be either done manually or automated.



Press the small arrow to open the standby menu.



By pressing the “Now” buttons, standby can be switched on or off for all currently targeted lights.



Any of the “Later” buttons will require a time to be set. The standby will be scheduled to the specified time.

Ex. 1004 at 34.

106. The customization interface in the AsteraApp also includes a slider such that “[e]ach effect can be adjusted in brightness.” *Id.* at 27. The user-selected

simulation parameter can be a maximum brightness, with the slider setting possible maximum brightness as a percentage of the total possible brightness.

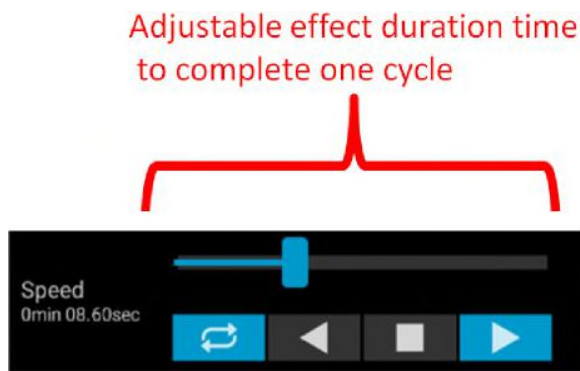


Each effect can be adjusted in brightness as well.

Id. at 27. In particular, by adjusting the percentage of the maximum brightness allowed, a user can set an upper boundary for the maximum amplitude (or brightness) of the light output for the effect. An effect run on the AX10 with a 50% brightness setting has an upper amplitude boundary that is only half of the same effect with the brightness setting at 100%.

107. Users can make similar changes to the brightness, or “intensity,” using the Control Panel. *Id.* at 20. The “intensity” option allows users to set a “dimmer level” that would represent the brightness for the lighting effect. *Id.* The Control Panel also includes a selectable button to “adjust brightness.” *Id.* at 11. It is also worth noting that, because a “background” color can be set, there is a “minimum” brightness that is at least as bright as the background color. *Id.* at 21, 27-28.

108. For each effect, a user can set boundaries for the speed and duration by setting and adjusting the “speed” of “how long it takes effect to complete one cycle,” *Id.* at 27.



The speed tells how long it will take for the effect to complete one cycle.

Id. at 27 (annotated). For example, if an effect has five steps to cycle through to complete the effect, setting the speed sets the boundaries in which the effect has to complete these five steps. In another example, for an effect having only one step, setting the speed will set the boundaries for how long the duration of that one step, (e.g. a color fade) will take to complete.

f) Dependent Claim 5

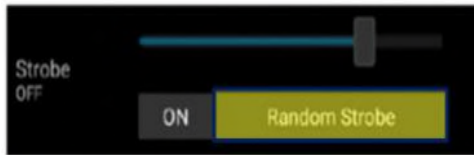
Claim 5: The method according to claim 1, wherein the lighting effect comprises a short time-period (e.g. stroboscopic) lighting effect with a user adjustable minimum pulse width.

109. The Astera Manual discloses Claim 5.

110. The Astera Manual teaches that a user can choose a “stroboscopic effect.” Ex. 1004 at 27. It further discloses the ability the ability to create a short-time alteration between pulses of lights using the color fade or “chaser” effects, which are each customizable for minimum pulse width. Ex. 1004 at 27-28.

111. The Astera Manual also discloses that the “stroboscopic effect.” an effect of flashes with a short-time period between flashes, can be “enabled and seamlessly adjusted in speed.” Ex. 1004 at 27.

AN EFFECT CAN BE HIGHLY CUSTOMIZED:



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.

Id. at 27 (annotated).

112. By enabling a user to modify the strobe speed, the Astera Manual indicates users are allowed to adjust the minimum pulse width. A slower strobe would have a longer duration, and thus a longer pulse width. On the other hand, a faster strobe speed would result in a smaller duration and pulse width. *Id.*

113. The Astera Manual teaches that “three random stroboscope options are available: slow, medium and fast.” *Id.* at 27. By choosing one of the three speeds, a user can adjust the minimum pulse width, with a random slow stroboscope effect having a greater pulse width than a random fast stroboscope effect.

114. The Astera Manual also notes that both the Control Panel and AsteraApp provide for adjustment to the “crossfade” between steps in an effect

program, as well as the “speed” of how “long it will take for the effect to complete one cycle.” *Id.* at 17, 20, 27-28.



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.

Id. at 27 (annotated).

115. Using these tools, a user can choose a simple program of, e.g., “one color fade,” and create a cycle that involves one color fading from maximum brightness to 0% brightness in one step. *Id.* at 17, 21, 27-28. The user could also create a simple “chaser effect,” alternating between two colors. *Id.* In modifying the speed to complete this cycle of fading to 0% brightness, the user will also adjust the pulse width. The longer the fade time, the longer the light pulse. The LEDs stay “on” longer and, as a result, the output light pulse is longer and it takes longer to fade down to zero light output.

116. Therefore, by creating effects with a light pulse, customizing the fade of the light, and modifying the speed of the cycle in which the light fades, the

Astera Manual teaches that a user can create short-time period lighting effects with adjustable pulse width. *Id.* at 17, 21, 27-28.

g) Dependent Claim 6

Claim 6: The method according to claim 1, wherein the user customisable simulation parameter comprises a parameter indicative of a group consisting of: a camera recording frequency; a camera shutter speed; and a camera frame rate.

117. The Astera Manual discloses Claim 6.

118. The Astera Manual teaches that users can choose an “Anti-Flicker” option to compensate for unwanted artefacts in the form of unwanted “flicker.” Ex. 1004 at 32. This unwanted flicker would otherwise be produced if the PWM refresh frequency of the light was inconsistent with the camera’s frame rate. The process involves calculating the lighting values based on user inputs that are indicative of the camera frame rate. *Id.*

119. In the master settings of the AsteraApp, a user can adjust the frequency of the pulse width modulation (PWM) refresh rate of the AX10 light, thereby avoiding any flicker that may otherwise occur. *Id.* at 32.

7.12 ANTI-FLICKER

The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the "Anti-Flicker".



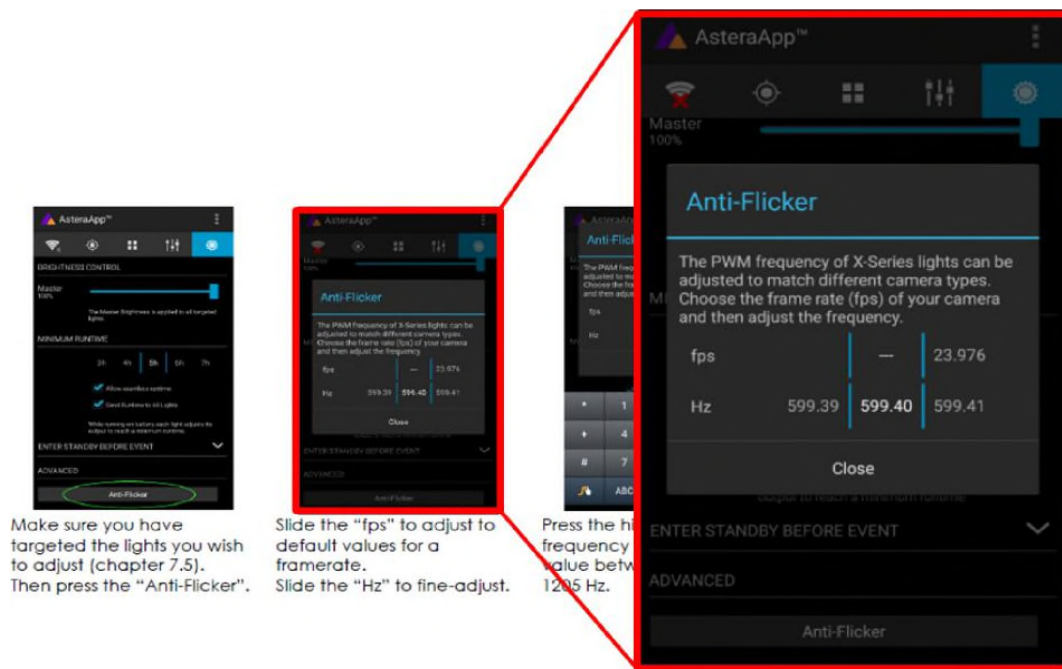
Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id. at 32.

120. The Astera Manual discloses that “[a] user first targets the lights to adjust, and then presses the ‘Anti-Flicker’ option on the user menu” of the AsteraApp. *Id.* Users can input and adjust a value for the “frame rate (fps)” of a camera in “Anti-Flicker” menu and the AsteraApp will suggest default PWM refresh values for that particular frame rate. *Id.* at 32. The Anti-Flicker menu also provides users with the choice to “slide the ‘Hz’ to fine-adjust,” which allows users to further refine the PWM refresh frequency and therefore compensate for the particular frame rate of the camera. *Id.* A user may also use the Anti-Flicker menu to compensate by pressing a “highlighted frequency to enter a custom value between 200 and 1205 Hz.” *Id.*



Id. at 32 (annotated). Within the Anti-Flicker menu, “the [PWM refresh] frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera’s frame rates.” *Id.*

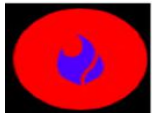
121. Thus, unwanted “flickering” artefacts caused by interaction between the frequency of the LED light output and the camera frame rate are avoided by (i) calculating a PWM frequency based on user inputs of camera frame rate, and (ii) allowing fine adjustment of the PWM frequency in view of the camera frame rate.

h) Dependent Claim 7

Claim 7: The method according to claim 1, wherein the lighting effect is designed to mimic at least one of: fire; lightning; police car light; television; a neon flickering sign; a candle; muzzle (gunshot); welding; spark/short circuit; a scan (e.g. fingerprint scanner); paparazzi flashes; fireworks; flashes (strobe); a propeller; a (nuclear) explosion; and a wormhole.

122. The Astera Manual discloses Claim 7.

123. The Astera Manual teaches that the AX10 light may be used to produce different desired lighting effects, such as a “fire” effect that mimics the “flicker” of a fire. Ex. 1004 at 28.

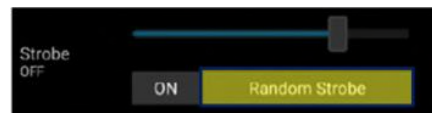


The Fire effect shows a random flickering effect. The background color and the color of the flickering effect can be adjusted.

Id. at 28; *see also id.* at 21.

124. The Astera Manual also discloses that a “stroboscope effect” may be added to any of the selected lighting special effects:

AN EFFECT CAN BE HIGHLY CUSTOMIZED:



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.

Id. at 27 (annotated); *see also id.* at 17.

125. The Astera Manual would cause a POSITA to understand that the AX10 can produce other claimed effects because is capable of generating different colors, alternating between colors, and creating strobing/flashing effects. This could be accomplished through effects such as the editable “chaser effects,” “rainbow,” spiral colors, fading colors, flow sets, and strobing. For example, a police car light consists of alternating red and blue lights. This could easily be set as running colors or a two-step color chase in the AX10. In addition, a random

sequence flash or strobe, which could be implemented with the disclosed random “stroboscope” effect, is particularly applicable for effects that request irregular timing, such as lightning, paparazzi flashes, and welding or electrical sparking effects. Too regular a timing can cause these effects to look artificial. A user can also use color to enhance the effect, such as a blue flash for an electrical spark or a yellow flash for a firework. Random flashes could also simulate a flickering neon sign, with the color of the randomly strobing light set to the user’s color of choice for the neon light. A user could also mimic candle light by using the fire effect, adjusted for brightness. The AX10 light’s ability to illuminate sequences and patterns of LEDs on a Flow-Set provides an effect where the light source is moving, which allows for fire flickering and scanning effects where the light source is continually moving.

i) Dependent Claim 8

Claim 8: The method according to claim 1, wherein the lighting value comprises brightness and/or colour data.

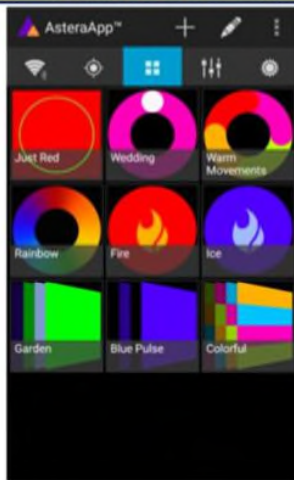
126. The Astera Manual discloses Claim 8.

127. The Astera Manual teaches that a user can choose from various lighting effects (e.g. fire, chasers, and rainbow). *See supra* ¶¶ 77-81, 129-32 (Claims 1[d], 9). The user can customize the effect by modifying the speed, crossfade, stroboscope, or brightness, resulting in lighting value data that represents the effect. *See supra* ¶¶ 51-81 (Claims 1[pre]-[d]). The AX10 system

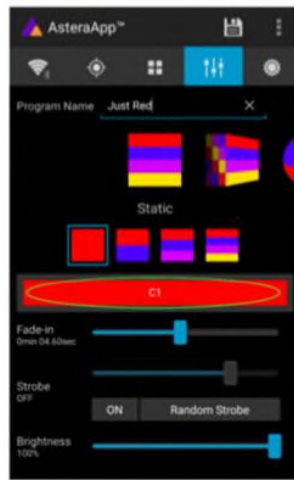
calculates time-varying lighting values based on these user-selected, customized effects, such as the brightness and color information required to run the desired effects. Ex. 1004 at 17, 20-21, 23-29, 32.

128. The “fire effect” is a random flickering between a “background color and the color of the flickering effect,” with both colors capable of modification. *Id.* Further, the Astera Manual teaches that a user can modify the brightness and color for any of the selected effects. *Id.* at 20, 24-28.

7.3 CHANGE THE COLOR



On the AsteraApp™ main screen, press “Just Red”.



Once in the editor, press “C1”.



Now the lights color can be changed.

Id. at 24 (annotated); see also *id.* (effect patterns may be “played with a customizable color palette”). When these effects are run, the brightness and color parameters are included in the lighting information that is sent to the LEDs so that they can output the desired effect.



Each effect can be adjusted in brightness as well.

Id. at 27 (annotated).

j) Dependent Claim 9

Claim 9: The method according to claim 1, further comprising converting at least one of brightness and colour data into a lighting signal and outputting the lighting signal to the lighting device.

129. The Astera Manual discloses Claim 9. *See supra* ¶¶ 82-86, 96-108, 126-128 (Claims 1[e], 3, 4, and 8).

130. The Astera Manual teaches that a user can choose from various lighting effects (e.g., fire, chasers, and rainbow). *See supra* ¶¶ 55-81 (Claims 1[pre]-[d]). A user can customize these effects by modifying the speed, crossfade, stroboscope, and brightness, which creates lighting value data that represents the effect. *See id.* Based on these user-selected, customized effects, the AX10 system calculates time-varying lighting values, such as brightness and color information, to run the desired effects. Ex. 1004 at 17, 20-21, 23-29, 32.

131. The Control Panel includes a “converter” in “Standalone” mode that converts⁵ the selected effects and parameters into values, which are then sent to the

⁵ The '044 Patent contains a very high-level describing how, before lighting data is sent to the lighting device 102 to output light simulating the effect, it may be converted by a “converter,” which converts the data into a signal suitable for the

standalone engine that outputs signals to the LEDs. *Id.* at 12, 17. The Control Panel offers “comprehensive control of the built in standalone engine,” which converts the brightness and color data into control signals that are output to the LEDs to produce the light for the desired effect. *Id.* at 17.

132. The AsteraApp also includes a “converter,” which converts the data relating to the user-selected brightness and color parameters for the lighting effects into signals to be transmitted to the AX10’s standalone engine. As discussed above with respect to Claims 1[a]-[c], a user can input the data values for color and brightness of an effect into the AsteraApp. *Id.* at 23-34. The AsteraApp converts the values into signals representing the effect that can “***be sent to the light by the built in UHF receiver,***” where they are received by the standalone engine in the AX10. *Id.* at 24 (emphasis added); *see also id.* at 10, 17. Upon receipt, the AX10 “replays [the effect] autonomously until a new effect is sent.” *Id.* at 24. That is, the effects engine or processor of the AX10 calculates the lighting values required for the desired effects, converts them into signals that can be received and implemented by the AX10. *Id.* at 23-36. Next, the AX10 sends the commands to the LED lights, which replay the desired effects based on the commands until they particular light elements being controlled. (Ex. 1001 at 8:27-39 (“lighting data converter may convert the data 106 from the lighting effect simulator 100 into a ***suitable signal*** for a particular light 102.” (emphasis added).))

receive new commands from the AsteraApp (or other control source). *Id.* at 24, 27-28, 32.

k) Dependent Claims 10, 16, and 18

Claim 10: *The method according to claim 1, wherein the controlling is for a lighting system for videography, broadcast, cinematography, studio filming and/or location filming.*

Claim 16: *The system according to claim 12, wherein the at least one lighting device comprises a lighting device for videography, broadcast, cinematography, studio filming and/or location filming.*

Claim 18: *A lighting device according to claim 17, wherein the at least one lighting device is used for videography, broadcast, cinematography, studio filming and/or location filming.*

133. The Astera Manual discloses Claims 10, 16, and 18.

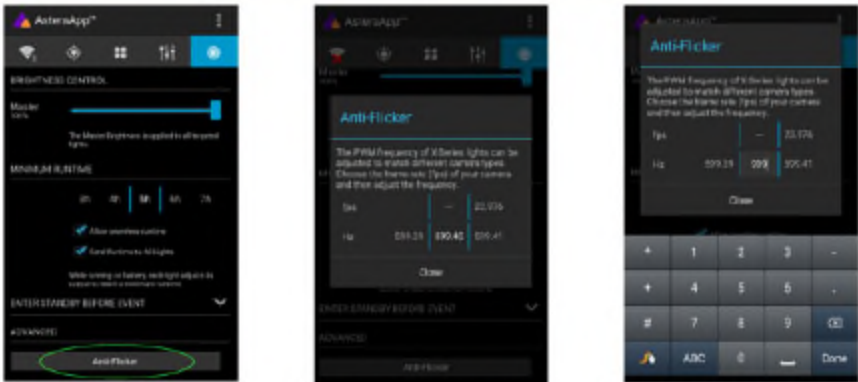
134. The Astera Manual teaches that the AX10 light is capable of producing multiple lighting effects (e.g., “fire effect,” “rainbow effect,” “stroboscope effect,” and “chase effects”). *See supra* ¶¶ 51-58 (Claim 1[pre]). These effects can be used for “videography, broadcasting, cinematography, studio filming, and location filming.”

135. Astera manufactures luminaires for the entertainment industry, with applications in film, TV, and theatre. *See, e.g., supra* ¶¶ 41-44; *see also* Ex. 1005 at ¶¶ 2-5 (noting the AX10 is one of Astera’s “production lighting products,” and that it was shown at a “Prolight and Sound Exhibition”). The AX10 was designed and sold for such uses. *See supra* ¶¶ 41-44; *see also* Ex. 1005 at ¶¶ 2-5.

136. In addition, the Astera Manual specifically teaches that the AX10 light can produce effects captured by video cameras (used in videography, broadcasting, cinematography, and studio/location filming). Ex. 1004 at 32.

137. Further, the AX10 has an “Anti-Flicker” adjustment, meaning the light settings will “fit different camera’s frame rates.” Ex. 1004 at 32.

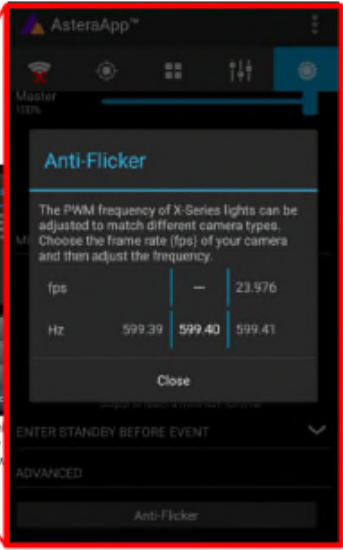
7.12 ANTI-FLICKER
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the “Anti-Flicker”.

Slide the “fps” to adjust to default values for a framerate.

Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the “Anti-Flicker”.

Slide the “fps” to adjust to default values for a framerate.

Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id. at 32 (annotated). As shown above, the Astera Manual shows a selected camera fps of “23.976” fps, which is very similar to the commonly used rate of 24 fps used in film and TV. *Id.*

138. Fitting the lights to a camera’s “frame rate” with the “Anti-Flicker” option indicates that the lighting effects are intended to be captured on video. This avoids the “flicker”—an unwanted artefact that would otherwise appear on captured video. The term “frame rate” is used in the entertainment industry to refer to the number of images captured by a video camera each second, as opposed to cameras used for still image capture, where there is no frame rate.

139. The term “flicker” is commonly used to describe the interference between a camera’s shutter or capture rate and the pulsing rate of light sources. A still camera can also suffer from these kinds of problems; however, the issue manifests itself as black or grey bars across the image instead of a “flicker.” Thus, a POSITA would understand that the Astera Manual is discuss about videography, broadcasting, cinematography, studio filming, and location filming, as opposed to still camera usage, in providing the “Anti-Flicker” option that fits the lighting settings to a camera’s frame rate.

140. A POSITA would also understand that the references to the DMX control protocol in the Astera Manual (*see, e.g.*, Ex. 1004 at 9-10) indicate the AX10 light was intended for use in TV, cinematography, and studio filming. As

discussed above, DMX is a common communication standard created by and for the entertainment lighting industry.

I) Dependent Claims 11 and 13

Claim 11: *The method according to claim 1, further comprising controlling at least one further lighting device.*

Claim 13: *The system according to claim 12, wherein the system is adapted to control at least one further lighting device.*

141. The Astera Manual discloses Claims 11 and 13.

142. The Astera Manual teaches that the AX10 light is comprised of nine “RGBAW” LEDs. Ex. 1004 at 7. The Control Panel and AsteraApp controls this plurality of LED “lighting devices” in the AX10. *See supra* ¶¶ 51-86 (Claims 1[pre]-[e]).

143. The Astera Manual also discloses that the AX10’s LED lights controlled by the AsteraApp “can be grouped into sets” so that a user-created effect “can stretch over up to 32 lights.” *Id.* at 10, 24.

6.4 CONTROL BY THE ASTERAAPP™

Your light has a built in standalone engine. It can display static colors or replay a number of predefined effect patterns with a customizable color palette.

With the AsteraApp™ these effects can be created and be sent to the light by the built in UHF receiver. The effects are just triggered and then each light replays it autonomously until it receives a new effect.

Lights can be grouped into sets. This way they can be controlled separately and also effects can stretch over up to 32 lights.

Id. at 10 (annotated). All of the lights within such a set are controlled through the AsteraApp, permitting the user to control multiple lights through the output

commands sent from the AsteraApp and received at the UHF receivers in the AX10s. *Id.* at 10, 23-24. For purposes of creating a customized light show, the Astera Manual teaches that the AsteraApp “can group several lights together, address individual lights or groups of lights, and send complex effects with a user defined color palette to all lights in range.” *Id.* at 23, 24.

7 USING THE LIGHT WITH THE ASTERAAPP™

The buttons of the AX10 only allow a basic operation of the light. To gain full control over all features, the AsteraApp™ should be used.

The AsteraApp™ is an efficient way to quickly create a customized light show. It can group several lights together, address individual lights or groups of lights, and send complex effects with a user defined color palette to all lights in range.

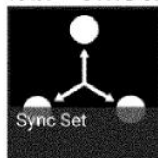
Additionally, it can be used to adjust the lights settings remotely.

The AsteraBox™ is needed to interface your Android device with the lights. It communicates to the Android device by Bluetooth and controls the lights by UHF.

Id. at 23 (annotated).

144. Lights can be grouped in a set such that all lights in the same “Sync-Set” will play the same effect simultaneously, based on control signals output from the AsteraApp:

7.4.1 SYNC SET



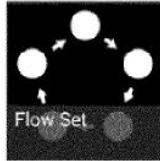
All lights that are assigned to a Sync-Set can be controlled together. They will do exactly the same.

Id. at 25.

145. Lights can also be grouped into a “Flow-Set,” in which each light can be assigned to “positions” within the Flow-Set. *Id.* at 26. The lights within a Flow-

Set will play the same lighting effect, but offset to each other, in order of their positions:

7.4.2 FLOW SET



By using a Flow-Set, lights can also be controlled together. But additionally, they are assigned to positions inside the Flow-Set and so form a virtual light with several pixels. All effects, like a running light, are stretched over this virtual light.

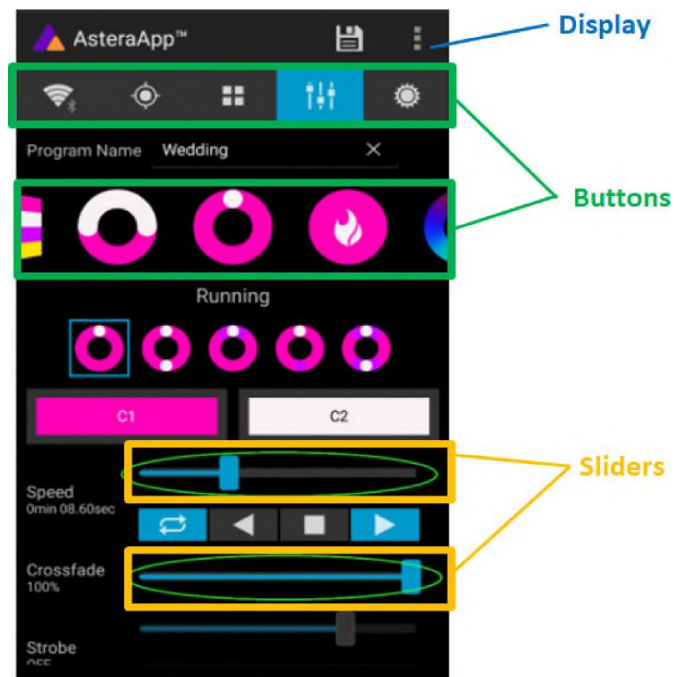
Id. at 26. “[C]ontrolling” these lights in the flow-set together is based on the control signals output from the AsteraApp that are received at each of the lights.

m) Dependent Claim 14

Claim 14: The system according to claim 12, further comprising an input interface and wherein the input interface comprises at least one of: a wireless communication interface; a dial; a slider; a display and buttons.

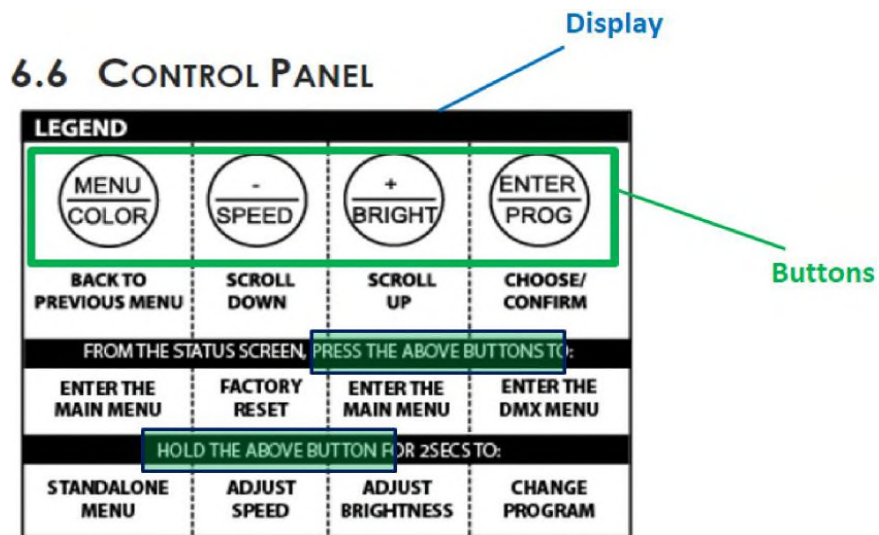
146. The Astera Manual discloses Claim 14.

147. The Astera Manual teaches that the AX10 product has different user interfaces (e.g., the Control Panel and AsteraApp) to receive user inputs. *See supra* ¶¶ 59-63 (Claim 1[a]). The AsteraApp comprises a wireless interface (Ex. 1004 at 24), in that it communicates to the AX10 lights without using hardwire. As illustrated below, the AsteraApp also comprises a display, sliders, and buttons:



Id. at 27 (annotated).

148. The Control Panel interface on the AX10 also includes a user interface containing a display and buttons:



Id. at 11 (annotated).

n) Dependent Claim 15

Claim 15: *The system according to claim 12, wherein said at least one lighting device is integrated in a combined unit.*

149. The Astera Manual discloses Claim 15.

150. The Astera Manual teaches that the AX10 includes LED lights. Ex. 1004 at 7. The Astera Manual also discloses that there are different ways to control the AX10 light, including through Control Panel user interface, memory, and standalone engine. *Id.* at 9, 20; *see also supra* ¶¶ 50-86 (Claim 1); Ex. 1004 at 9-10, 20-21 (the AX10 “has a built in standalone engine. It can display static colors or replay a number of predefined effect patterns with a customizable color palette.”); *see also id.* at 13 (allowing a user to select “standalone” mode”). A user can select programs (“change program”) for lighting effects, and adjust speed, color, and brightness of these effects through the AX10’s Control Panel, operating in standalone mode. *Id.* at 9-10, 20-21; *see also id.* at 13 (allowing users to select “standalone” mode”).

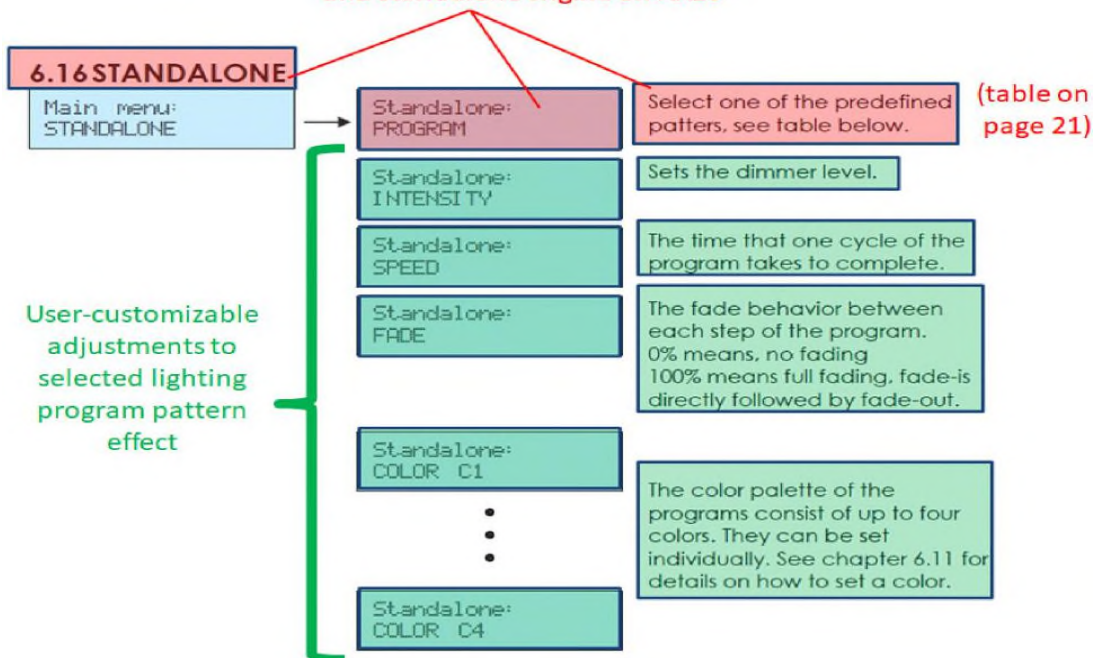
6.6 CONTROL PANEL

User-customizable adjustments to selected lighting program pattern effect

LEGEND			
			
BACK TO PREVIOUS MENU	SCROLL DOWN	SCROLL UP	CHOOSE/CONFIRM
FROM THE STATUS SCREEN, PRESS THE ABOVE BUTTONS TO:			
ENTER THE MAIN MENU	FACTORY RESET	ENTER THE MAIN MENU	ENTER THE DMX MENU
HOLD THE ABOVE BUTTON FOR 2SECS TO:			
STANDALONE MENU	ADJUST SPEED	ADJUST BRIGHTNESS	CHANGE PROGRAM

Select desired program pattern

Select desired program pattern effect through LCD Control Panel and standalone engine on AX10



Id. at 11, 20 (annotated). The AX10 LED lights, together with the Control Panel, memory (*see supra* ¶¶ 64-76 (Claims 1[b]-[c])), and standalone engine, are “integrated in a combined unit.”

151. A POSITA would have known to provide any of the AsteraApp’s interfaces or functionality, including selecting effect programs, editing parameters, and saving and recalling effects to a main screen directly on the Control Panel. A POSITA would have seen that the Control Panel and AsteraApp are two ways of controlling the same AX10 light. *Id.* at 9-10. In fact, Astera specifically teaches that a user can make many of the same selections and adjustments (e.g., selecting effects and modifying speed, intensity, and fade of those effects). *Id.* at 11, 17, 20-21, 27-28.

152. A POSITA would have also recognized that providing the AsteraApp interfaces and functionality on the Control Panel of the AX10 itself would yield certain benefits. It allowed for expanded options and functionality through controls on the AX10 itself. This functionality included saving and editing programs as icons on a main screen, or making “Anti-Flicker” adjustments. Ex. 1004 at 32. Therefore, adjusting the Control Panel to include the interfaces and functionality of the AsteraApp would have been trivial. This adjustment would have amounted to nothing more than simply adding further menu entries or including a different type of touch screen interface to make selections and save

adjustments, in the same way that the Control Panel LCD menu already allowed certain selections and adjustments. This type of modification would yield a predictable result. As only the source of the instructions (coming from the Control Panel rather than a remote AsteraApp) would change, the content and result of those instructions as implemented by the standalone engine would not. A POSITA would have been motivated to add AsteraApp functionality to the interface on the AX10 in light of the need for ease of transport and to minimize the need for additional equipment when filming. The inclusion of AsteraApp functionality would permit a user operating the device with the Control Panel, as opposed to a smartphone, to make the necessary adjustments during operation without the need for additional controllers. This would allowing a user to reliably use and adjust the AX10 light through just the device itself because she would not have to ensure she had access to multiple controllers while operating the light. In addition, adding AsteraApp features to the Control Panel would allow different users to select, modify, and operate the same light, including recalling previously edited effect programs, without requiring each separate user to first go through the process of downloading the AsteraApp and connecting the AsteraApp with the light.

o) Dependent Claim 17

Claim 17: The system according to claim 12, wherein the at least one lighting device comprises at least one light emitting diode.

153. The Astera Manual discloses Claim 14.

154. The Astera Manual teaches that the AX10 light includes one or more lighting devices made up of “9 x 15W RGBAW Philips LEDs.” Ex. 1004 at 7. Thus, each AX10 light includes nine RGBAW LEDs.

4 SPECIFICATION

LED power:	135W
Illuminants:	9 x 15W RGBAW Philips LEDs
Luminous Flux*:	3,350lm (at White 4000K)
Emittance*:	10,350lx (at 2m; White 4000K)

Id. at 7 (annotated).

IX. GROUND II: CLAIMS 1-19 WOULD HAVE BEEN OBVIOUS TO A POSITA IN VIEW OF ASTERA

155. I incorporate here by reference each of my opinions in the proceeding sections relating to Ground I, as the disclosures from the Astera Manual supporting my opinion that the Astera Manual anticipates Claims 1-19 apply equally to my opinion that Claims 1-19 would have been obvious to a POSITA in view of the Astera Manual.

156. As I explained in detail in Section VIII, it is my opinion that Astera expressly discloses, and therefore anticipates, each of Claims 1-19. The disclosures from Astera are nearly identical to, and in most instances more detailed

than, the disclosures and claims in the '044 Patent. To the extent, however, that the Board finds the Independent Claims are not disclosed by Astera, these claims, and by extension all of their dependent claims, would have been obvious to a POSITA.

157. For instance, the “calculate” limitation in Claim 1 would have been at least obvious to a POSITA. Claim 1[d] states as follows: “calculating, using an effect simulator, a time varying lighting value based on said recalled simulation parameter.” Ex. 1001 at Claim 1. The '044 Patent does not provide any details regarding *how* the “calculation” is purportedly performed by the “effect simulator.” The '044 Patent does not disclose a specific algorithm that would be contemplated by the claims, or a specific way in which a “calculation” is being performed. A POSITA would understand that the “effect simulator” takes the user input parameters and generates or creates the lighting effect by calculating (*i.e.*, taking the sum of the parameter values and averaging them to generate a lighting effect matching those numeric parameters). I agree with Dr. Bretschneider when he testified that a POSITA who knows about color sciences and color mixing and different lighting effects would understand that to produce a lighting effect a POSITA would know a calculation occurs. Ex. 1008, 149:11-153:9, 153:19-154:18, 155:4-6, 165:9-11, 176:16-19; 150:14-21, 152:10-22, 185:7-188:13 (“[W]hen you set fire temperature or the fire color to 2000 Kelvin, there *has to be*

a calculation.”) (emphasis added). A POSITA would not understand that Astera pre-stores in tables sequences of brightness and color values for *every possible combination of effects and parameters*.

158. This is not new or unique, and a POSITA would have understood that the specific data (i.e., brightness and color values or timing) for an effect is created after the user selects the effect and customizes its parameters. A POSITA would have also understood that performing a calculation to determine how the LED lights will behave to generate a lighting effect is a standard functionality performed by a computer processor in any entertainment lighting device at the time of the invention. In this context, calculating refers to the function of the microprocessor within a lighting fixture.

159. For example, DMX-512 is a stream of 8-bit resolution of data values that are transmitted from a controlling device to a given lighting fixture and accessed by said fixture through addressing of the fixture. Addressing is accomplished by setting a start value, from 1 to 512. The lighting fixture is set to receive data starting at a specific address (set by the fixture through a user interface) and accepting as many packets of data as needed to control the various functions of the fixture. Simple on/off only needs one data packet and can be linked to any of the 1-512 data channels.

160. A more complex lighting fixture might utilize 8 data packets to control multiple functions.

161. The values of these data packets are then used to “set” certain functional parameters within the lighting fixture. For example, data packet 1 may be dedicated to controlling lighting intensity. This could be used to control a mechanical dimming shutter via a stepper motor in the case of HID-based “intelligent” lighting fixtures or by utilizing Pulse Width Modulation (“PWM”) of an electronic dimming circuit for LEDs. An LED fixture such as the AX-10, which has multiple colors of LEDs, would utilize multiple data packets to control the intensity of the five colors.

162. One key element is the difference between DMX (a linear control) and the eye/photopic response to lighting (not linear). The sensitivity of the human eye allows for a wide range of sensitivity, 10 billion-fold, allowing us to see at extremely low light values (e.g., a single candle illuminating a room) to extremely high values (e.g., intense sunlight).

163. This response curve can be thought of as a logarithmic equivalent to 10X log, which requires that we utilize a non-linear curve controlling lighting intensity to better correspond to the sensitivity of human vision. This conversion from the linear values of DMX to logarithmic photopic response of human vision has to be translated.

164. Lighting fixture, like that disclosed in Astera, can use a microprocessor to take DMX values and calculate intensity of positional values (in the case of mechanical dimming) or PWM values (in the case of LED dimming) and output the same to the associated electronics. This process has been in use for decades, and a POSITA would understand that such a calculation could (and would) be performed in Astera. A lighting fixture can adapt to photopic response and generate effects. The DMX values would not need to be constantly changed to elicit a specific effect.

165. The Astera Manual discloses a “fire” effect having a “random flicker” characteristic. Ex. 1004 at 21, 28. A “random flicker” indicates that the flicker (or the alternating between background colors and flickering colors) occurs at random intervals, with each color active for a random duration. A POSITA would understand that this would result in the random generation of different visual effects for each cycle, based on a calculation that utilizes the input numerical values. If the same sequences were repeated, the light effect would not appear random. Further, the parameter adjustments would serve no purpose if no new values for an effect are created and sent to the LEDs based on said adjustments.

166. A POSITA would understand that the Astera Manual discloses that the effects do not exist until a user creates and adds/customizes each new

step/parameter for the effect. If the effect does not exist until the user creates it, it is not pre-recorded and a POSITA would understand that the effect is generated as disclosed in the '044 Patent. These lighting values would have to be created (*i.e.*, “calculated”) each time a user adjusts the parameters of an effect.

167. A POSITA would have understood that the specific data (*i.e.*, brightness and color values) for an effect (e.g., “fire,” “strobe,” and “chaser”) is created **after** the user selects the effect and customizes its parameters. A POSITA would have also known to provide any of the AsteraApp’s interfaces or functionality, including selecting effects programs, editing parameters, and saving and recalling effects to a main screen directly on the Control Panel. Thus, the Challenged Claims, including the “calculate” limitation, would have been obvious to a POSITA. Therefore, it is clear that Astera discloses the “calculating” limitation of independent Claims 1, 12, and 19. At the very least, this would have been obvious to a POSITA.

168. It would have been obvious to a POSITA to provide the AsteraApp interfaces and functionality, with the selecting effect programs, editing parameters, and saving and recalling effects to a main screen directly on the Control Panel. For instance, a POSITA would have recognized that the Control Panel and AsteraApp are two ways of controlling the same AX10 light. Ex. 1004 at 9-10. Astera says a user can make many of the same selections and

adjustments, such as selecting effects and modifying speed, intensity, and fade of those effects. *Id.* at 11, 17, 20-21, 27-28. A POSITA would have recognized that providing the AsteraApp interfaces and functionality on the Control Panel of the AX10 itself would allow for expanded options and functionality through controls on the device itself, such as allowing saving and editing programs as icons on a main screen or making “Anti-Flicker” adjustments. Modifying the Control Panel to include the interfaces and functionality of AsteraApp would have simply involved including a touch screen interface to make selections and save adjustments, in the same way the Control Panel LCD menu already allows certain selections and adjustments. This trivial modification would yield a predictable result, as only the source of the instructions (coming from the Control Panel rather than a remote AsteraApp) would change; the content and result of those instructions as implemented by the standalone engine would not. *Id.* A POSITA would have been motivated to add AsteraApp functionality to the interface on the AX10, as a POITA would want ease of transport and to minimize need for additional equipment and controllers when filming. Including AsteraApp functionality would allow a user to operate the device with the Control Panel, rather than through a smartphone, to make necessary adjustments during operation without having to use additional controllers. Adding AsteraApp features to the Control Panel would allow different users to operate the same light and make

necessary adjustments and selections, including recalling previously edited effect programs, without each separate user having to download and use AsteraApp.

X. GROUND III: EDWARDS ANTICIPATES CLAIMS 1-19

A. Edwards

169. Edwards (Ex. 1006) is directed to a system and method for producing lighting visual effects for capture with digital cameras, such as synchronizing LED light fixtures to digital camera shutters to avoid capturing unwanted artifacts. Ex. 1006 at Abstract. The system in Edwards controls the LEDs to create, for example, “simple visual effects such as a simulated camera flash, lighting pattern or gun flash.” *Id.* at Abstract.

170. Edwards was filed with the U.S. Patent Office as Application No. 15/061,893 on March 4, 2016, and issued on August 22, 2017 as U.S. Patent No. 9,743,010. Ex. 1006 at Cover Page. Edwards claims priority to Provisional Application No. 62/128,392, which was filed on March 4, 2015, as well as Provisional Application No. 62/264,673, which was filed on December 8, 2015. *Id.* at Cover Page. Therefore, I understand Edwards to qualify as prior art. I also understand that Edwards was not considered during prosecution of the '044 Patent.

171. Edwards teaches a lighting system that can be used to produce lighting effects (e.g., lightning, a camera flash, strobing, street light flicker, fire, and a candle). Ex. 1006 at 3:18-28, 11:38-12:1. The lighting system includes

“LED light fixture[s]” that output the light and lighting effects, which are captured with at least one camera and a “lighting controller.” *Id.* at 5:18-51, 6:49-62. The lighting controller “can be included inside each individual LED light fixture” or “an external third system which links all the lights together and coordinates the commands.” *Id.* at 6:57-63; *see also id.* at 7:20-8:1. A user can set up schemes by selecting and customizing parameters for these lighting effects. *Id.* at 4:18-62, 7:20-9:18. The light fixtures include “digital control and memory that allows each of them to store, recall and replay the schemes setup by the cinematographer.” *Id.* at 7:20-53. A user can use the lighting controller to adjust the settings (e.g., brightness, color, color temperature, and dimming) to fit with the user’s desired “lighting scheme” and corresponding lighting effects. *Id.* After the values are set, a “STORE” command is issued, saving the lighting schemes and corresponding values for brightness, color, color temperature, and dimming, in a memory. *Id.* When the user wants to play the lighting scheme with its effects, she issues a “RECORD” command, which “recalls” the lighting schemes and stored lighting values from the memory and converts this data into appropriate lighting signals that are sent to the LEDs to produce the desired light output. *Id.* at 72:20-8:1.

B. Edwards Discloses Claims 1-19

a) Independent Claim 1

172. It is my opinion that, as viewed by a POSITA, Edwards discloses Claim 1.

Claim 1[pre]: A method for controlling a lighting device to produce a range of different user customizable lighting effects, the method comprising:

173. Edwards discloses the preamble to Claim 1. Edwards is directed to a method and system including “one or more light emitting diode (LED) light fixtures” (or lighting devices) that are controlled to produce user customizable special effects, such as “as a simulated camera flash, lighting pattern or gun flash.” *Id.* at 3:18-28; *see also id.* at Abstract, 11:21-53 (describing how the Edwards lighting systems can produce customized lighting effects that can be “dimmed and increased in brightness real time” (e.g., lightning, camera flashes, gun shots, car lights, flashing signs, street lights, or fire, candle, or lantern light.)), 14:60-15:3. In addition, Edwards teaches how a user can set and modify “lighting schemes” that include desired lighting effects, with users able to customize the “light levels, and the color controls,” among other parameters, for the lights. *Id.* at 7:20-31; *see also id.* at 6:51-7:2, 7:32-9:6.

Claim 1[a]: receiving user input of at least one user input simulation parameter to customise a lighting effect;

174. Edwards discloses Claim 1[a]. Edwards teaches a system for creating lighting effects that receives user inputs of simulation parameters to customize the effects. Ex. 1006 at Abstract, 1:44-49, 3:18-28, 11:19-12:1. Edwards further

teaches that user input parameters (e.g., light levels, color, color temperature, and dimming) are received at a control panel on the light or a DMX⁶ board. *Id.* at 7:22-31 (“Using either the control panel on each light or using DMX commands, the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme.’ This includes the light levels, and color controls for each ‘active light’ source on the set. Some lights will support setting of color temperature as well as dimming.”); *see also id.* at 10:60-11:32 (describing a DMX control board), 15:46-16:43 (the “lighting control can be done at the fixture level or thru a centralized lighting control system”). The user inputs are received by the controllers in the lights or DMX control board, as commands to control or adjust the lights. *Id.*

175. The “lighting controller” also receives (i) “commands that control the lights” (e.g., to produce an effect) and (ii) a “sync signal,” which is related to the camera parameters it uses to coordinate initiation of outputting the effects from LEDs. Ex. 1006 at 3:13-28, 5:18-23. The lighting controller that receives these user input parameters “can be included inside each individual LED light fixture,” or it can be “an external third system which links all the lights together and

⁶ DMX is a standard communication protocol used in entertainment lighting to provide commands and data relating to lighting values and effects.

coordinates the commands.” *Id.* at 6:51-62; *see also id.* at 5:19-31, 7:20-8:1, 10:59-66, 15:46-16:36.

176. A standard DMX control board or panel allows an operator to access and modify effects and parameters of multiple connected lights, either individually or together. It then allows the operator to store and recall the lighting presets, patterns, chases, and sequences. A POSITA would understand that DMX control board or panel disclosed in Edwards would include buttons or a keypad. The buttons and/or keypad would allow an operator to, for example, choose which lights are to be controlled and make adjustments to the lighting parameters for those lights. The DMX control board or panel would further include a display to depict selections, the lighting state of the different lights being used, and user controls (e.g., sliders, faders, and knobs) to also adjust parameters of selected lights.

Claim 1[b]: storing in memory said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated;

177. Edwards discloses Claim 1[b]. Edwards teaches that the simulation parameters are used to modify effects included in “lighting schemes.” Ex. 1006 at 7:20-9:18. These parameters depend on the lighting effect or scheme that is being simulated. *See supra* ¶¶ 59-63 (Claim 1[a]); *see also, e.g.*, Ex. 1006 at 7:20-31 (“Using either the control panel on each light or using DMX commands, the

cinematographer adjusts each light until he/she has the desired settings on all lights for the 'lighting scheme'. This includes the light levels, and color controls for each 'active light' source on the set. Some lights will support setting of color temperature as well as dimming.”). The “lighting schemes” disclosed in Edwards are sets of lighting levels and values for producing the desired lighting on a filming set. A cinematographer, for example, selects the lighting effects and settings she wants to capture while filming a scene, and sets the effects and settings in different “lighting schemes.”

178. Different parameters of the lighting values are required depending on the desired lighting scheme and scenes. Each light setting parameter depends on the type of the desired lighting scheme and effect. The user adjusts the color or brightness levels to create this desired effect. For example, if the user wants to film a nighttime scene where there is a storm in the distance, the parameters allowing for low overall light levels with quick bursts or flashes light representing lighting would be required. Edwards discusses how this can be done, with parameters chosen based on the desired effect, disclosing “[l]ightning, camera flash, or [g]un [s]hot” effects where the parameters include a sequence of pulses “at different brightness levels.” Ex. 1006 at 11:39-43. If a user selects a lighting scheme that will include, for example, a fire, candle, or lantern light effect, the parameters include “subtle, randomly changing level of light.” *Id.* at 11:50-53.

When a user desires a fire effect, the parameters for different lighting levels and how quickly the lights will change between the different levels are set. Slowly-changing lighting levels may create an effect akin to a peaceful, calm flame of a candle. On the other hand, changing levels more quickly and allowing higher lighting values may represent a larger fire similar to the light that would come from a burning house.

179. Edwards also teaches that the setting of the color temperature parameters depends on the desired effect to be simulated. *Id.* at 6:63-7:2. Lighting “setup can be changed in color temperature such that one scheme is harsher cool white is used for the purpose of having a more aggressive a darker feeling. The next scheme can be a warm light scheme with completely different feeling.” *Id.* at 6:63-7:2.

180. Once the user inputs the parameters to set up the lights with the settings for the desired schemes, Edwards teaches that a “STORE” command may be issued so “[m]ultiple schemes can be stored, preferably digitally, each featuring different light levels, color controls and other settings per active LED light....Each light would have **memory storage** for all digital settings corresponding to each scheme.” *Id.* at 7:20-40 (emphasis added). As part of these schemes, camera settings, including “gamma, ISO, color settings, shutter speed, resolutions, etc.... could be stored and recalled for use in each scheme.” *Id.* at 7:45-53; *see also id.* at

5:48-52, 6:35-39 (noting that lighting settings can be downloaded to memory inside each light), 6:51-62 (“multiple lights are networked together with **digital control and memory that allows each of them to store, recall and replay the schemes setup by the cinematographer.**” (emphasis added), 8:62-66 (indicating there is a memory setting provided for pulse width parameter inputs).

181. In Edwards, users input simulation parameter settings to customize lighting effects used in lighting schemes. These settings (*e.g.*, color, color temperature, light level, dimming, camera settings) are then saved to a memory in, at least, each light.

Claim 1[c]: recalling from said memory said at least one stored user input simulation parameter;

182. Edwards discloses Claim 1[c]. Edwards teaches that user input simulation parameter settings are stored in memory. *See supra* ¶¶ 177-81 (Claim 1[b]). Edwards also teaches that these stored lighting parameter settings are later “recalled” from memory, which allows the selected lighting effects and schemes to be replayed. Ex. 1006 at 6:51-62 (“multiple lights are networked together with digital control and **memory** that allows each of them to **store, recall and replay the schemes setup by the cinematographer.**”) (emphasis added). A user selects the “STORE” command to save all of the desired lighting values for a lighting scheme (*e.g.*, brightness, color, color temperature, and dimming) and any relevant camera settings to a memory. *Id.* at 7:32-55. Afterwards, a “RECORD” command can be

issued, recalling the lighting values for the scheme such that the LEDs output the desired lighting for capturing with the cameras. *Id.* at 7:20-65 (noting that after the values for the light parameter and camera settings that make up each lighting scheme are stored in the memory by the STORE command, the controllers for the lights will then “**recall the stored values** for each of these schemes” following a “RECORD” command.) (emphasis added). Thus, it is clear that when these values are “recalled” they are “recalled” from that same memory they were stored in.

Claim 1[d]: calculating, using an effect simulator, a time varying lighting value based on said recalled simulation parameter; and

183. Edwards discloses Claim 1[d]. Edwards teaches a “lighting controller” that receives (i) “commands that control the lights” (e.g., to produce an effect) and (ii) a “sync signal” that controls when the lights should turn on/off in coordination with the opening/closing of the shutter of a camera capturing the lighting effects. *Id.* at 5:18-23. The lighting controller “can be included inside each individual LED light fixture.” *Id.* at 6:56-63. Alternatively, it can be “an external third system which links all the lights together and coordinates the commands.” *Id.* at 6:57-62; *see also id.* at 5:19-31, 7:20-8:1, 10:59-66, 15:46-16:36.

184. The stored lighting schemes values that will create lighting effects are saved to memories in the lighting devices via the “STORE” command. *Id.* at 7:20-53. Thereafter, when “RECORD” command is issued, the lighting controllers

“recall the stored values” for the desired lighting schemes from memory and “replay them in order, sequentially in sync with [a] sync signal.” *Id.* at 7:54-8:1. If a user selects stored schemes “1, 3, 5, for example,” the “lights would prepare to replay scheme 1, then 3 then 5 in sequence throughout the filming.” *Id.* When replaying chosen schemes, the lighting controllers perform as follows: (i) recall the parameters for the chosen schemes and (ii) **calculate** the necessary lighting commands sent to the LED lights so that the lights create the proper lighting for each scheme. *Id.* The saved and recalled lighting values are used to **calculate** command signals that represent the light levels, brightness, color, color temperature, and dimming of the lights over the course of a lighting scheme. *Id.* at 7:20-30. The lighting commands sent by the lighting controllers are time-varying lighting values that reflect the “different light levels, color controls and other settings per active LED light” for each scheme. *Id.* at 7:20-65.

Claim 1[e]: outputting to said lighting device said time varying lighting value thereby to simulate the lighting effect.

185. Edwards discloses Claim 1[e]. Edwards teaches that the lighting controller’s command are output to the LED lights, creating effects such as “a simulated camera flash, lighting pattern or gun flash.” *Id.* at 3:18-28; *see also id.* at Abstract, 5:24-29, 11:33-53 (describing how the lighting controller can output commands comprising time-varying lighting values to produce lighting effects, (e.g., lightning, camera flashes, gun shots, car lights, flashing signs, street lights,

fire, candle, or lantern light)). In order for the camera flash, gun flash, lighting, fire, street lights effects to be produced such that they can be captured during filming, the LEDs must receive signals corresponding to the various lighting levels set for the course of each scheme. Therefore, the saved and recalled time-varying lighting values must be output to the LEDs. This will allow the LEDs to turn on/off at the correct times and at the desired brightness, dimming, color, and color temperature to generate the effects for the scheme.

186. Edwards also discloses that in using “synchronized lighting[,] the controller may in addition read a system time stamp and play a lighting ‘scrip’ or series of commands. This allows special effects and lighting timing to be replayed perfectly, synchronized across different takes.” *Id.* at 5:38-42. The lighting controller outputs a series of commands comprising time-varying lighting values to the LEDs in order to implement the desired lighting schemes and special effects. *See supra* ¶¶ 174-84 (Claims 1[a]-[d]).

187. Edwards teaches that

“[a]ll lights would wait for the rising edge of the sync signal to trigger turning on each scheme frame. At the falling edge the lights would all turn off. At the next rising edge all lights would turn on the next sequential scheme. Each active light in the network or [] system will therefore recall the stored values for each of these schemes and replay them in order, sequentially in sync with the sync signal. When filming starts the sync signal will initialize the record sequence and all

lighting will continue to sequentially replay each scheme until the sync signal stops, indicating the filming has stopped.”

Id. at 7:54-8:1; *see also id.* at 16:13-36.

b) Independent Claims 12 and 19

188. A POSITA would not perceive any substantive differences of scope between independent Claim 1 and independent Claims 12 and 19. The foregoing reasoning regarding Claim 1 applies with equal force to Claims 12 and 19. A POSITA would understand that Edwards discloses Claims 12 and 19 for the same reasons it discloses Claim 1.

189. To illustrate the fact that Claims 1, 12, and 19 do not differ substantially in their scope, the claims are reproduced below with notable differences bolded⁷:

Claim 1	Claim 12	Claim 19
A method for controlling a lighting device to produce a range of different user customisable lighting effects, the method comprising:	A system adapted to control at least one lighting device to produce a range of different user customisable lighting effects, the system comprising:	A computer program product comprising software code for controlling a lighting device to produce a range of different user customisable lighting effects the computer program product is adapted to perform, when executed, the steps of:

⁷ The claim comparison charts throughout this Declaration apply to all grounds.

Claim 1	Claim 12	Claim 19
receiving user input of at least one user input simulation parameter to customise a lighting effect;	an input interface adapted to receive user input of at least one user input simulation parameter to customise a lighting effect;	receiving user input of at least one user input simulation parameter to customise a lighting effect;
storing in memory said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated;	a memory adapted to store said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated; and	storing in memory said at least one user input simulation parameter, said at least one user input simulation parameter depending on the lighting effect being simulated;
recalling from said memory said at least one stored user input simulation parameter;	an effect simulator adapted to: recall from said memory said at least one stored user input simulation parameter; and	recalling from said memory said at least one stored user input simulation parameter;
calculating, using an effect simulator , a time varying lighting value based on said recalled simulation parameter; and	calculate a time varying lighting value based on said recalled simulation parameter;	calculating, using an effect simulator , a time varying lighting value based on said recalled simulation parameter; and
outputting to said lighting device said time varying lighting value thereby to simulate the lighting effect.	Wherein the effect simulator is adapted to output said calculated time varying lighting value to the at least one lighting device thereby to simulate a lighting effect.	Outputting to said lighting device said time varying lighting value thereby to simulate a lighting effect.

190. Claim 1 is directed to a “method” for controlling a lighting device, while Claim 12 is directed to a “system” implementing *this same method* and Claim 19 is directed to a “computer program” performing *this same method*. Thus, Edwards discloses the limitations in Claims 12 and 19 for the same reasons discussed above with respect to Claim 1.

191. Edwards discloses Claim 12. Edwards teaches that the method of Claim 1 is implemented on a system that includes LED lighting fixtures as controlled by a control panel, a controller on the LED fixture itself, or through a DMX control board. *See supra* ¶¶ 172-87 (Claim 1).

192. Edwards makes clear that a controller in the lighting system implements a software program to execute the necessary steps, from receiving user input for desired lighting effects and modified parameters to the LEDs outputting light corresponding to those selected effects and parameters. *See* Claim 19. Edwards discloses that the method “comprises programming the intensity value of each of the light fixtures prior to the changing step,” and that “there is preferably a memory that stores all DMX commands to be executed and an input synchronization signal with the lighting controller that synchronizes all lighting transitions with the camera frame capture.” *Id.* at 1:52-54, 5:48-52. Edwards also discloses:

[f]or film and studio applications...multiple lights are networked together with digital control and memory that allows each of them to store, recall and replay the schemes setup by the cinematographer. . . . The multi-scheme control systems can be included inside each individual LED light fixture or they can be networked to an external third system which links all the lights together and coordinates the commands. The control system for each light preferably includes support of multiple commands to control each light and schemes.

Id. at 6:51-62. The system in Edwards uses a “software program” to perform the claimed method. *Id.* at 7:20-31, 10:59-11:36. Commands (*e.g.*, for a lighting effect) are programmed into memory, then a program on the lighting controller executes those commands and replays the effect in a controlled fashion to capture desired lighting schemes. A POSITA would know that the industry standard method for controlling LED lighting through DMX or RDM, as disclosed by Edwards, is through software-controlled systems within the luminaire.

c) Dependent Claim 2

Claim 2: *The method according to claim 1 wherein said user customisable simulation parameter is stored locally.*

193. Edwards discloses Claim 2. *See supra* ¶¶ 177-82 (Claims 1[b], [c]). Edwards teaches that a user can choose and set different lighting settings and schemes (*e.g.*, for creating a customizable lighting effect) that are saved to memories in all lights on the network. Ex. 1006 at 6:51-55, 7:20-50. Edwards discloses a light scheme in which “multiple lights are networked together with

digital control and memory that allows each of them to store, recall and replay the schemes setup by the cinematographer.” Ex. 1006 at 6:51-55. Further, Edwards discloses that “[m]ultiple schemes can be stored, preferably digitally, each featuring different light levels, color controls and other settings per active LED light.” Ex. 1006 at 7:20-53. As part of these schemes, Edwards teaches that camera settings, such as “gamma, ISO, color settings, shutter speed, resolutions, etc., ... could be stored and recalled for use in each scheme.” *Id.* at 7:45-53. Each scheme’s stored settings, including the parameters for the camera sync signal and camera settings, are recalled and replayed or used by the lights at a later time. *Id.* at 6:51-55, 7:45-50. Edwards also teaches that each “light would have memory storage for all digital settings corresponding to each scheme.” *Id.* Therefore, with each light possessing a “memory storage,” the parameters for the lighting effect included in the stored digital settings are stored in the local memory for each light, and can be recalled from these same local memories.

d) Dependent Claim 3

Claim 3: The method according to claim 1, wherein the simulation parameter comprises a colour or colour temperature.

194. Edwards discloses Claim 3. Edwards teaches that “[u]sing either the control panel on each light or using DMX commands, the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’

source on the set. Some lights will support setting of color temperature as well as dimming.” Ex. 1006 at 7:22-3; *see also id.* at 6:63-7:1 (“[l]ighting setup can be changed in color temperature”).

e) Dependent Claim 4

Claim 4: The method according to claim 1, wherein the simulation parameter is related to at least one of: an effect frequency; an effect speed; a colour; a colour temperature; a trigger; a rate of increase of brightness; a rate of decrease of brightness; a rate of change of colour; a brightness; a local maximal (peak) brightness; a local minimal brightness; a brightness fluctuation period; and a colour fluctuation time period.

195. Edwards discloses Claim 4. Edwards discloses a lighting system that can be used to create to lighting effects (e.g., lightning, a camera flash, strobing, street light flicker, fire, and a candle). Ex. 1006 at 3:18-28, 11:38-12:1. These exemplary lighting effects incorporate user-input simulation parameters related to, among other things, color, color temperature, trigger (synchronization signal), brightness, and local maximal/minimal brightness. *Id.* at 7:20-31. Edwards discloses that

[u]sing either the control panel on each light or using DMX commands, the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’ source on the set. Some lights will support setting of color temperature as well as dimming. Other lights may support full color (like RGB). The most

critical and common setting is dimming which controls the percentage of light coming out of the fixture.

Id. at 7:20-31. In order to trigger the lighting effects, a synchronization signal is used such that, when a user executes a “RECORD” command, the lights wait for a rising edge of the synchronization signal to trigger turning on. *Id.* at 5:22-44 (a “sync signal...is preferably fed into the lighting controller that synchronizes lighting commands....Instead of changing the lights asynchronously, the controller preferably holds the commands until the next vertical frame sync pulse.”; *see also id.* at 7:32-8:1.

196. Edwards discloses that the lighting system can create lighting effects (e.g., lightning, camera flash, strobing, street light flicker, fire, and a candle). Ex. 1006 at 3:18-28, 11:38-12:1. For example, a “[l]ightning, camera flash or Gun Shot” can be imitated by use of a “single frame strobe or a strobe lasting for multiple frames” along with “different brightness levels.” *Id.* at 11:39-43; *see also id.* at 3:21-25. Edwards also teaches that a “[n]ight” scene (e.g., a “car driving by, flashing sign in window, [or] street light flicker”) can be created by “controlling on or more lights [to give] the effect of light moving or changing intensity or distance.” *Id.* at 11:44-49. In addition, Edwards discloses that a “[f]ire, candle, [or] lantern light” can be simulated through a “subtle, randomly changing level of light.” *Id.* at 11:50-53.

197. These example effects include, among other things, parameters related to color, trigger, a rate of increase/decrease of brightness, a brightness, a local maximum/minimum brightness, and a brightness fluctuation period. Ex. 1006 at 7:54-9:6, 7:20-31, 5:31-40, 11:19-53. For instance, the “[f]ire, candle and lantern light” effect includes parameters for creating “a subtle, randomly changing level of light.” Ex. 1006 at 11:50-53. The subtle, randomly changing level of light requires parameters related to brightness for both the fire and the color of the fire or flame. This effect would also require parameters related to local maximum/minimum brightness because the brightness of the randomly changing levels of light would need to change between a maximum and minimum value in order to imitate the changes in the fire’s flames. Parameters related to the rate of increase/decrease of brightness and change of color would also be required. These parameters would be tied to the time associated with the random changes between different random light levels. If the rate of increase/decrease of brightness and color fluctuations was fixed, then the changing level of light would not be considered random. Thus, to create a randomly changing level of light, parameters must be included to randomly change the increase/decrease in brightness and change of color. Parameters related to brightness/color fluctuation periods would set the time associated with the random changes to the levels of the light during the effect.

f) Dependent Claim 5

Claim 5: *The method according to claim 1, wherein the lighting effect comprises a short time-period (e.g. stroboscopic) lighting effect with a user adjustable minimum pulse width.*

198. Edwards discloses Claim 5. Edwards describes preprogrammed lighting effects, such as short time-period lighting effects (e.g. “lightning, camera flash or Gun Shot”) that can include “a single frame strobe or a strobe lasting for multiple frames.” Ex. 1006 at 11:39-43. A “frame” is a short period of time, (e.g., 1/30th of a second). A “strobe,” also known as stroboscope or stroboscopic, is an effect having a series of flashes. Edwards describes short time-period stroboscopic effects as having a customizable minimum pulse width (the duration the pulse lasts). *Id.* at 8:62-9:6. The user can select a pulse width of a “single frame” or “multiple frames.” *Id.* at 3:23-28, 8:5-10, 11:37-43. A camera flash could be a single frame flash, because they are usually of very short duration. *Id.* at 3:23-28, 8:5-10, 11:37-43. On the other hand, a lightning flash could be a much longer flash that lasts for multiple frames; however, a strobe flash lasting for multiple frames would still only occur for a fraction of a second, and would therefore be considered a short time-period effect.

199. Edwards discloses a “Pulse Width” mode that allows users to modify “pulse width” settings and therefore providing the “advantage that it can be used for strobing action capture.” Ex. 1006 at 8:62-9:6. Edwards teaches that with such

an effect, “the light only stay[s] on for the length of the pulse width setting.” *Id.* (“Pulse Width: In this mode a scheme memory setting is provided to the active lighting for ‘pulse width’. In this mode the light only stay[s] on for the length of the pulse width setting. This would likely be a rising or falling edge trigger that fires once per frame. This method has the added advantage that it can be used for strobing action capture and also can be used to reduce the total exposure time.”).

g) Dependent Claim 6

Claim 6: The method according to claim 1, wherein the user customisable simulation parameter comprises a parameter indicative of a group consisting of: a camera recording frequency; a camera shutter speed; and a camera frame rate.

200. Edwards discloses Claim 6. Edwards discloses permitting users to input parameters indicative of, among other things, camera shutter speed and frame rate, in the form of camera settings and a camera synchronization signal. Ex. 1006 at Abstract, 1:44-49, 3:18-28, 7:45-50, 11:19-12:1. Edwards teaches that the lighting controller, based on a user feeding the camera sync signal to the controller, “preferably holds the commands until the next vertical frame sync pulse,” so the “lighting transitions for each frame are preferably timed to occur during the closed shutter period prior to the frame being captured by the camera. In this way lighting is stable throughout the frame and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.* at 5:18-31. Parameters of, for example, camera shutter speed and frame rate, are accounted for in activating the

LEDs by (i) providing an input to synchronize LED lighting changes to the times at which the camera shutter is closed (with the lights being “on” at the desired level when the shutter is open), and (ii) making all LED lighting transitions between captured camera frames. *See, e.g., supra/infra* at ¶¶ 169, 201, 204-205.

201. Edwards also teaches that the “synchronization of changes in lighting to the camera shutter for videos and motion pictures...enables all lighting transitions to be done between frames making the resulting frame image capture clean and free from artifacts that occur when lighting changes occur in the middle of a frame.” *Id.* at 1:25-30. In addition, Edwards discloses that “the active lighting is synchronized to the camera shutter, so a special effect such as a gun shot flash can be synchronized with the exact time pulse when the camera shutter is open. This ensures the lighting event is captured cleanly on camera in that specific frame.” *Id.* at 4:47-54; *see also id.* at 3:18-28, 7:54-8:1, 11:33-12:1, 14:60-66, 15:46-17:10.

202. Edwards discloses that camera settings, including shutter speed, can be stored as part of the commands sent to lighting devices, and can later be recalled when implementing a lighting scheme. *Id.* at 7:33-8:1 (stating that camera settings, including “gamma, ISO, color settings, shutter speed, resolutions, etc....could be stored and recalled for use in each scheme.”); *see also id.* at 5:13-16:5.

203. Edwards describes specific examples of how the lights can be controlled to avoid “the lighting chang[ing] mid frame [that] can cause artifacts and ruin the lighting setup.” *Id.* at 8:37-40. Edwards discloses that this can be accomplished through a “combination” of the following:

1. Sync signal: A smart sync signal can turn on the lighting scheme with a rising edge and turn it off with a falling edge. This is preferably carefully timed with frame capture on the camera to make sure the lighting and frame capture are cleanly synchronized.
2. Shutter angle: Motion picture cameras were developed for film that was advanced between each frame. Shutter angle refers to the amount of time used by the camera to advance the film between frame captures. The original camera angle was 180 degrees which equals 50% shutter closed and 50% shutter open. The shutter angle creates a cinematic “look” and is critical to making films that look like “movies”. Digital cameras have preserved this concept of shutter angle. There is a “shutter off” time in between each frame capture. This shutter off time needs to be indicated as part of the sync signal. In this solution the SYNC signal triggers the onset of the “shutter off time”. This gives the lighting time to change schemes before the frame capture occurs.
3. Pulse Width: In this mode a scheme memory setting is provided to the active lighting for “pulse

width”. In this mode the light only stay on for the length of the pulse width setting. This would likely be a rising or falling edge trigger that fires once per frame. This method has the added advantage that it can be used for strobing action capture and also can be used to reduce the total exposure time. This is an alternate way of dimming—using frame sync’d pulse width verses reduced light levels for the full frame. A 50% pulse width time duration is equal to a 50% reduction in light level for 100% of the frame.

Id. at 8:40-9:6.

204. The sync signal based on the camera frame rate can be used in many different ways:

- (1) The sync signal can be used so that all lighting schemes are turned on with a rising edge and turned off with a trailing edge, meaning the lights are all “on” during the time the frame is captured. This synchronizes the time the lights are on with the capture of the frame, and as a result, no lighting changes are made during the frame capture that would otherwise cause unwanted artefacts.
- (2) The sync signal can be related to the camera shutter angle. In this example, the sync signal provides information regarding the “shutter off” time where no frame is being captured. Edwards discloses that the

lighting changes are made during this “shutter off” time when no frame is being captured.

- (3) Edwards specifies that a pulse width, or duration that the lights are “on,” can be triggered by a rising or falling edge of a sync signal, providing the desired amount of light during the frame capture.

205. The parameters of, for example, camera shutter speed and frame rate are accounted for in activating the LEDs by (i) synchronizing the lighting changes to the times when the camera shutter is open and closed and (ii) making all transitions between captured camera frames as described above. In order for the system in Edwards to be able to only make lighting transitions during the period when the system's shutter is closed, the system uses the shutter speed and frame rate of the camera. The shutter speed and frame rate define the period at which the shutter is closed, and thus also define the period when lighting transitions should take place. The amount of time that the shutter is closed before it opens is defined by the shutter speed and frame rate. If the shutter opens and closes very quickly, many frames will be captured during a given time period, and the shutter closed times would be reduced. On the other hand, if the shutter speed and frame rate are slower, the shutter may remain closed for a longer time period between frame captures. By ensuring that lighting transitions only take place when the shutter is closed, there can be no image capture of the lighting transition itself. This ensures

that there can also be no capture of the associated rolling shutter artefacts that would otherwise occur if lighting changes occurred mid-frame while the camera shutter was open and a frame was being exposed and captured.

h) Dependent Claim 7

Claim 7: The method according to claim 1, wherein the lighting effect is designed to mimic at least one of: fire; lightning; police car light; television; a neon flickering sign; a candle; muzzle (gunshot); welding; spark/short circuit; a scan (e.g. fingerprint scanner); paparazzi flashes; fireworks; flashes (strobe); a propeller; a (nuclear) explosion; and a wormhole.

206. Edwards discloses Claim 7. Edwards teaches that by adjusting for various levels of brightness, colors, or intensity, or distance for the light, a number of user-customizable lighting effects can be imitated (e.g. fire, lightning, flickering sign, muzzle (gunshot) flash, paparazzi flashes, and strobe flashes). *Id.* at 7:20-30; *see also id.* at 11:33-53. Edwards discloses that a “[l]ightning, camera flash or Gun Shot” can be imitated via a “single frame strobe or a strobe lasting for multiple frames” along with “different brightness levels.” *Id.* at 11:39-43; *see also id.* at 3:21-25. In addition, Edwards discloses that a “[n]ight” scene (e.g., a “car driving by, flashing sign in window, [or] street light flicker”) can be created by “controlling one or more lights [to give] the effect of light moving or changing intensity or distance.” *Id.* at 11:44-49. Edwards also teaches that a “[f]ire, candle, [or] lantern light” can be mimicked through a “subtle, randomly changing level of light.” *Id.* at 11:50-53.

207. The lighting system in Edwards provides cinematographers the ability to modify “each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’ source on the set.” *Id.* at 7:20-30; *see also id.* at 11:33-53. Thus, a POSITA would understand that a cinematographer using the lighting system disclosed by Edwards could produce other claimed effects. For instance, by controlling one or more lights for the “[n]ight” scenes, a user could also create a scan effect. *Id.* at 11:44-12:5. Further, a user could create lighting that simulates a fireworks display by adjusting the brightness, color, and distance.

i) Dependent Claim 8

Claim 8: *The method according to claim 1, wherein the lighting value comprises brightness and/or colour data.*

208. Edwards discloses Claim 8. Edwards teaches the calculating and outputting of commands including lighting values to LEDs representing lighting schemes and effects based on user parameters. *See supra* ¶¶ 183-87, 211-16 (Claims 1[d]-[e], 9). These lighting values represent the user-modified lighting effects and schemes, such as brightness and color data, because the inputs comprise settings for brightness and color values. Ex. 1006 at 7:20-36, 1:44-2:2, 6:63-7:2, 11:19-32.

209. Edwards discloses that:

[u]sing either the control panel on each light or using DMX commands, the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’ source on the set. Some lights will support setting of color temperature as well as dimming. Other lights may support full color (like RGB). The most critical and common setting is dimming which controls the percentage of light coming out of the fixture.

Id. at 7:20-36 (emphasis added); *see also id.* at 1:44-2:2, 6:63-7:2, 11:1932.

210. These light settings, which include brightness and color information, are then “stored.” *Id.* at 7:3-8:10. Upon issuance of a “RECORD” command, the lighting controllers disclosed in Edwards “recall the stored values” for the desired lighting schemes from memory. *Id.* at 7:3-8:10. Next, the lighting controllers “replay them in order, sequentially in sync with [a] sync signal. When filming starts the sync signal will initialize the record sequence and all lighting will continue to sequentially replay each scheme until the sync signal stops, indicating the filming has stopped.” *Id.* at 7:32-8:1; *see also id.* at 5:18-52. When the lighting controller “replays” the stored and recalled lighting schemes, it sends the lighting values that include the brightness and color data and represent the customized schemes. *Id.* at *Id.* at 7:3-8:10, Fig. 2.

j) **Dependent Claim 9**

Claim 9: *The method according to claim 1, further comprising converting at least one of brightness and colour data into a lighting signal and outputting the lighting signal to the lighting device.*

211. Edwards discloses Claim 9. Edwards discloses that:

[u]sing either the control panel on each light or using DMX commands, the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’ source on the set. Some lights will support setting of color temperature as well as dimming. Other lights may support full color (like RGB). The most critical and common setting is dimming which controls the percentage of light coming out of the fixture.

Ex. 1006 at 7:20-36; *see also id.* at 1:44-2:2, 6:63-7:2, 11:19-32. Therefore, the light settings in Edwards include both brightness and color information.

212. These light settings, including brightness and color information, are “stored,” and can be recalled and played on the lights in sync with the camera synchronization signal. *Id.* at 7:31-8:1. The lighting controller holds commands to control the lights “until the next vertical frame sync pulse,” so that any “lighting transitions” or time-varying changes in the lighting values for each frame are specifically timed to “occur during the closed shutter period prior to the frame being captured by the camera.” *Id.* at 5:24-29.

213. The lighting controller includes a converter that “converts” the lighting commands into “digital controls” for the LEDs. *Id.* at Fig. 1, 6:21-62. The lighting controller “holds” these digital controls before sending the information to the LEDs based on the sync signal. *Id.* at 5:18-52, 6:31-62, 7:32-42.

214. Edwards discloses the use of existing protocols and hardware to control lighting. Ex. 1006 at 4:6-10. In addition, Edwards discloses using this hardware to store sets of luminaire settings using the DMX protocol. Ex. 1006 at 7:32-42. It is inherent in this existing hardware that the stored settings are converted to the DMX signals for output to the luminaires. For example, a lighting control desk may slowly fade from 50% to 100% intensity over ten seconds. The control desk would calculate the required level every few milliseconds during the ten second and convert the desired value to an appropriate DMX control signal to be sent to the luminaire.

215. Edwards discloses a network that sends commands to digital LED lights using DMX or RDM. *Id.* at 4:32-39. DMX is an entertainment industry standard protocol for controlling lighting, including brightness and color. “DMX or RDM networks are a preferred standard for film and studio systems.” *Id.* at 4:35-36. Edwards also teaches that the system may play lighting scrips in order to control the lighting: “Using synchronized lighting the controller may in addition

read a system time stamp and play a lighting ‘scrip’ or series of commands.” *Id.* at 5:38-40 (The term “scrip” means a script or sequence of lighting commands.).

216. LEDs are used in the Edwards lighting system “because they can be changed using digital controls in nanoseconds, far higher than the frame rate of video capture.” *Id.* at 6:49-51. The digital controls provided to the LEDs result from a converter that converts the commands to digital control signals. *Id.* at 6:49-51. In the Edwards lighting system, “multiple lights are networked together with digital control and memory that allows each of them to store, recall and replay the schemes setup by the cinematographer....The multi-scheme control systems can be included inside each individual LED light fixture or they can be networked to an external third system which links all the lights together and coordinates the commands. The control system for each light preferably includes support of multiple commands to control each light and schemes.” *Id.* at 6:51-62. These commands provided to the LED light fixtures, or generated by controllers inside LED light fixtures, are then converted to the “digital controls” that are provided to the LEDs. *Id.* at 6:49-51, Fig. 1.

k) Dependent Claims 10, 16, and 18

Claim 10: *The method according to claim 1, wherein the controlling is for a lighting system for videography, broadcast, cinematography, studio filming and/or location filming.*

Claim 16: *The system according to claim 12, wherein the at least one lighting device comprises a lighting device for videography, broadcast, cinematography, studio filming and/or location filming.*

Claim 18: *A lighting device according to claim 17, wherein the at least one lighting device is used for videography, broadcast, cinematography, studio filming and/or location filming.*

217. Edwards discloses Claims 10, 16, and 18. Edwards discloses that “[t]he present invention is related to synchronization of changes in lighting to the camera shutter for videos and motion pictures.” Ex. 1006 at 1:25-27. Further, Edwards teaches that “[u]sing either the control panel on each light or using DMX commands, the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’ source on the set.” *Id.* at 7:22-27; *see also id.* at 1:44-49, 2:66-3:19, 6:51-55. This Edwards disclosure of using a camera for videos or motion pictures, along with references to a cinematographer, indicates that the lighting system can be used for videography, broadcast, cinematography, studio filming, and/or location filming.

l) Dependent Claims 11 and 13

Claim 11: *The method according to claim 1, further comprising controlling at least one further lighting device.*

Claim 13: *The system according to claim 12, wherein the system is adapted to control at least one further lighting device.*

218. Edwards discloses Claims 11 and 13. Edwards discloses that the the lighting system's controller is meant to control multiple lights that are networked together. *Id.* at 1:44-49, 6:51-62. Edwards teaches that "[t]he present invention is a method for making a digital video, the method comprising synchronizing one or more light emitting diode (LED) light fixtures to the shutters of one or more digital cameras, and changing an intensity of the one or more lights while the shutter on each of the one or more cameras is closed." *Id.* at 1:44-49. Edwards also discloses that:

For film and studio applications in this invention[,] multiple lights are networked together with digital control and memory that allows each of them to store, recall and replay the schemes setup by the cinematographer. LED lights will preferably be exclusively used as the active lights under a network controlled system. The multi-scheme control systems can be included inside each individual LED light fixture or they can be networked to an external third system which links all the lights together and coordinates the commands.

Id. at 6:51-62. Therefore, the controller external to the light fixtures controls the plurality of light fixtures. This network controller provides the time-varying

lighting values to each of the lighting fixtures so that they implement the desired lighting schemes and effects.

m) Dependent Claim 14

Claim 14: The system according to claim 12, further comprising an input interface and wherein the input interface comprises at least one of: a wireless communication interface; a dial; a slider; a display and buttons.

219. Edwards discloses Claim 14. Edwards discloses that the claimed controller “can be included inside each individual LED light fixture,” or can be “an external third system which links all the lights together and coordinates the commands.” *Id.* at 6:57-62; *see also id.* at 5:19-31, 7:20-8:1, 10:59-66, 15:46-16:36.

220. Edwards also discloses that a user can setup desired lighting schemes using a “control panel on each light.” *Id.* at 7:20-31. A POSITA would understand that the control panel would include, at a minimum, buttons, dials or sliders to allow the user to make selections. A POSITA would further understand the control panel to include a display for the user to make the modifications and set the desired effects. A display would be required for a user to see the effects and adjustments, both those disclosed by Edwards and those that he might want to make. The types of inputs claimed (*e.g.*, buttons, dials, and sliders) were and are common and expected ways that effects and adjustments are chosen and created on a lighting

device. These would also be necessary in conjunction with a display or the user would be unable to make selections.

221. With respect to using a controller that is external from the light fixture, Edwards teaches that a user can set up schemes and adjust the lights using a standard DMX board. Ex. 1006 at 7:22-27 (“Using the control panel on each light or using DMX commands, the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’ source on the set.”); *see also id.* at 4:23-27, 11:21-30, 13:65-14:5, 14:36-41, 16:36-40.

222. Edwards teaches that “[t]he industry standard for adjusting lights is DMX control boards. The present invention can utilize DMX addressing and command standards to support VALT. A standard DMX control board can be used to control the individual lights and setup for each VALT track in the same way it is used today.” Ex. 1006 at 16:36-40. Edwards further discloses that a “VALT DMX console or control panel may be structured to comprise push button VALT commands, and organize lighting controls by VALT track.” *Id.* at 17:66-18:2.

223. A standard DMX control board or panel allows an operator to access and customize effects and parameters of multiple connected lights, individually or together, and store and recall lighting presets, patterns, chases, and sequences. A POSITA would understand that a DMX control board or panel, as disclosed in

Edwards, would include buttons or a keypad. The buttons and keypad allow an operator to choose the lights to be controlled and adjust the lighting parameters for those lights. In addition, the DMX control board or panel would include a display to show selections and the lighting state of the lights being used, as well as user controls (e.g., sliders, faders, and knobs) to further adjust parameters of selected lights.

n) Dependent Claim 15

Claim 15: *The system according to claim 12, wherein said at least one lighting device is integrated in a combined unit.*

224. Edwards discloses Claim 15. Edwards discloses that its “lighting controller” can be “included inside each individual LED light fixture.” *Id.* at 5:22-23, 6:57-62. Edwards discusses that “[t]he control system for each light preferably includes support of multiple commands to control each light and schemes.” *Id.* Further, Edwards teaches that “[u]sing the control panel on each light..., the cinematographer adjusts each light until he/she has the desired settings on all lights for the ‘lighting scheme’. This includes the light levels, and color controls for each ‘active light’ source on the set.” *Id.* at 7:22-27. These disclosures (the inclusion of the lighting controller inside each LED fixture and the user’s ability to use a “control panel” on the light) make it clear that the controller, which includes the effect simulator, *see supra* ¶¶ 183-92 (Claims 1[d]-[e], 12)), memory in the

lighting fixture (*see supra* ¶¶ 177-82 (Claims 1[b]-[c]), and LED lights can be integrated in a combined unit.

o) Dependent Claim 17

Claim 17: *The system according to claim 12, wherein the at least one lighting device comprises at least one light emitting diode.*

225. Edwards discloses Claim 17. Edwards teaches that the lighting devices in the lighting system include LEDs. Ex. 1006 at Abstract; *see also id.* at 1:44-49, 2:66-3:19, 4:32-35, 6:49-56. Edwards discloses a lighting system “comprising synchronizing one or more light emitting diode (LED) light fixtures to the shutters of one or more digital cameras.” Ex. 1006 at 1:44-49. In addition, Edwards discloses that “[a]ll ‘active lights’ on the set preferably comprise digital LED lights that are networked together and support the command structure for multi-scheme lighting.” *Id.* at 4:32-35; *see also id.* at 6:55-56 (“LED lights will preferably be exclusively used as the active lights under a network controlled system”).

XI. GROUND IV: CLAIMS 1-19 WOULD HAVE BEEN OBVIOUS TO A POSITA IN VIEW OF EDWARDS

226. I incorporate here by reference each of my opinions in the proceeding sections relating to Ground III, as the disclosures from the Edwards supporting my opinion that Edwards anticipates Claims 1-19 apply equally to my opinion that Claims 1-19 would have been obvious to a POSITA in view of Edwards.

227. As I explained in detail in Section X, it is my opinion that Edwards expressly discloses, and therefore anticipates, each of Claims 1-19. The disclosures from Edwards are nearly identical to, and in most instances more detailed than, the disclosures and claims in the '044 Patent. To the extent, however, the Board finds that the Independent Claims are not disclosed by Edwards, the Independent Claims, and all of their dependent claims, would have been obvious to a POSITA.

228. For instance, the “calculate” limitation in Claim 1 would have been at least obvious to a POSITA. Claim 1[d] states as follows: “calculating, using an effect simulator, a time varying lighting value based on said recalled simulation parameter.” Ex. 1001 at Claim 1. The ’044 Patent does not provide any details regarding **how** the “calculation” is purportedly performed by the “effect simulator.” The ’044 Patent does not disclose a specific algorithm that would be contemplated by the claims, or a specific way in which a “calculation” is being performed. A POSITA would understand that the “effect simulator” takes the user input parameters and generates or creates the lighting effect by calculating (*i.e.*, taking the sum of the parameter values and averaging them to generate a lighting effect matching those numeric parameters). I agree with Dr. Bretschneider when he testified that a POSITA who knows about color sciences and color mixing and different lighting effects would understand that to produce a lighting effect a POSITA would know a calculation occurs. Dr. Bretschneider Depo., 149:11-153:9, 153:19-154:18, 155:4-6, 165:9-11, 176:16-19; 150:14-21, 152:10-22, 185:7-188:13 (“[W]hen you set fire temperature or the fire color to 2000 Kelvin, there *has to be a calculation.*”) (emphasis added).

229. This is not new or unique, and a POSITA would have understood that the specific data (i.e., brightness and color values or timing) for an effect is created after the user selects the effect and customizes its parameters. A POSITA would have also understood that performing a calculation to determine how the LED lights will behave to generate a lighting effect is a standard functionality performed by a computer processor in any entertainment lighting device at the time of the invention. In this context, calculating refers to the function of the microprocessor within a lighting fixture.

230. Edwards discloses a DMX and RDM Real Time Control processor that, according to Edwards, allows for dynamic changing of lighting effects: “DMX and RDM are widely accepted standards in film and studio lighting that allow for dynamic changing of the lighting on set.” Ex. 1006 at 10:59-11:32. For example, DMX-512 is a stream of 8-bit resolution of data values that are transmitted from a controlling device to a given lighting fixture and accessed by said fixture through addressing of the fixture. Addressing is accomplished by setting a start value, from 1 to 512. The lighting fixture is set to receive data starting at a specific address (set by the fixture through a user interface) and accepting as many packets of data as needed to control the various functions of the fixture. Simple on/off only needs one data packet and can be linked to any of the 1-512 data channels.

231. A more complex lighting fixture might utilize 8 data packets to control multiple functions.

232. The values of these data packets are then used to “set” certain functional parameters within the lighting fixture. For example, data packet 1 may be dedicated to controlling lighting intensity. This could be used to control a mechanical dimming shutter via a stepper motor in the case of HID-based “intelligent” lighting fixtures or by utilizing Pulse Width Modulation (“PWM”) of an electronic dimming circuit for LEDs. An LED fixture such as the AX-10, which has multiple colors of LEDs, would utilize multiple data packets to control the intensity of the five colors.

233. One key element is the difference between DMX (a linear control) and the eye/photopic response to lighting (not linear). The sensitivity of the human eye allows for a wide range of sensitivity, 10 billion-fold, allowing us to see at extremely low light values (e.g., a single candle illuminating a room) to extremely high values (e.g., intense sunlight).

234. This response curve can be thought of as a logarithmic equivalent to 10X log, which requires that we utilize a non-linear curve controlling lighting intensity to better correspond to the sensitivity of human vision. This conversion from the linear values of DMX to logarithmic photopic response of human vision has to be translated.

235. Lighting fixture, like that disclosed in Edwards, can use a microprocessor to take DMX values and calculate intensity of positional values (in the case of mechanical dimming) or PWM values (in the case of LED dimming) and output the same to the associated electronics. This process has been in use for decades, and a POSITA would understand that such a calculation could (and would) be performed in Edwards.

236. A lighting fixture can adapt to photopic response and generate effects. The DMX values would not need to be constantly changed to elicit a specific effect.

237. Edwards discloses a “[f]ire, candle and lantern light” effect and “lightning” effect with random changing light levels. Ex. 1006 at 11:33-53. A POSITA would understand that this would result in the random generation of different visual effects for each cycle, based on a calculation that utilizes the input numerical values. If the same sequences were repeated, the light effect would not appear random. Further, the parameter adjustments would serve no purpose if no new values for an effect are created and sent to the LEDs based on said adjustments.

238. A POSITA would understand that Edwards discloses that the effects do not exist until a user creates and adds/customizes each new step/parameter for the effect. If the effect does not exist until the user creates it, it is not pre-recorded

and a POSITA would understand that the effect is generated as disclosed in the '044 Patent. These lighting values would have to be created (*i.e.*, “calculated”) each time a user adjusts the parameters of an effect.

239. A POSITA would have understood that the specific data (*i.e.*, brightness and color values) for an effect (e.g., “fire,” “strobe,” and “chaser”) is created ***after*** the user selects the effect and customizes its parameters. Thus, the Challenged Claims, including the “calculate” limitation, would have been obvious to a POSITA. Therefore, it is clear that Edwards discloses the “calculating” limitation of independent Claims 1, 12, and 19. At the very least, this would have been obvious to a POSITA.

240. Additionally, if the Board finds that Claim 14 is not disclosed in Edwards, it would have been obvious to a POSITA. Edwards discloses that a user can setup desired lighting schemes using a “control panel on each light.” Ex. 1006 at 7:20-31. A POSITA would understand such a control panel to include buttons, dials, or sliders for a user to make selections, as well as a display for the user to make the adjustments and set the desired effects. If these types of input methods were not included, the user would be unable to make selections. A POSITA would understand that Edwards’ use of DMX controls would utilize a well-known and standard DMX control board or panel to allow users to access and adjust effects and parameters of multiple lights, individually or together, and store and recall

lighting presets, patterns, chases, and sequences. A POSITA would understand that a DMX control board or panel, as in Edwards, would have buttons or a keypad (to select the lights to be controlled), a display (to show selections and lighting state), and user controls such as sliders, faders, and knobs (to adjust parameters of selected lights).

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and, further, that these statements were made with the knowledge that willful false statements and the like are punishable by fine, imprisonment, or both, under Section 1001 of Title 18 of the U.S. Code.



Woody Smith
Dated: July 15, 2023

APPENDIX A

Materials Considered

Exhibit No.	Description
1001	U.S. Patent No. 10,845,044 to Gammons <i>et al</i>
1002	File History for U.S. Patent No. 10,845,044
1004	Astera AX10 Spotmax User Manual (“Astera”)
1005	Declaration of Simon Canins (“Canins Decl.”)
1006	U.S. Patent No. 9,743,010 to Edwards (“Edwards”)
1007	Institution Decision in IPR2022-00099 challenging the ’044 Patent
1008	Transcript of August 17/18 Deposition of Dr. Bretschneider
1009	Patent Owner’s First Amended Complaint Against Petitioner
1010	Gottuso January 14, 2023 Email to the Board
1011	Board’s Dismissal of IPR2022-00099

Appendix B

W O O D Y S M I T H
P R O F E S S I O N A L E X P E R I E N C E

Summary:

Twenty-five years' experience in automated system design for industrial, commercial and arena lighting, processing equipment and automation for vertical farming applications. Product development from concept, market research, design and development through production and release to market. Managed teams of 40+ engineers with budgets > \$2.5 million. CEO, COO, CTO, VP Engineering, Director R&D, Lean/Six-Sigma, International Sales and Technical Support, Hydroponics, Aeroponics, Automation, Vertical Farming, Renewable Energy

Digital Lighting, Engineering & Design, LLC

January 2015 – Present

Designed automated horticultural growing system (CEA: Controlled Environment Agriculture) for vertical farming applications including software, digital control, sensors, solar, wind and geothermal energy and advanced digitally controlled LED lighting technology. Specific emphasis on resource conservation, specific lighting spectrum to achieve highest photosynthetic efficiency, utilization of UV-LED to enhance Vitamin D levels in mushrooms and means and methods of determining nutritional value of produce. Developed significant technology implementing automation and AI in these applications.

Evolucia Lighting, Sarasota, FL

CTO, January 2012 – April 2014

Provided design, engineering, and manufacturing support for all Evolucia and Affineon LED products. Expanded LED streetlight offering while improving design for manufacturing. Engineering lead with Asian manufacturing partner.

Affineon Digital Lighting, Coral Springs, FL

CEO, August 2005 – January 2012

Founded Affineon in 2005 to integrate emerging LED technology into commercial, industrial, theatrical and house of worship applications. Designed over 20 products focusing on high power applications for LED. Worked with Disney, US Army, Sloan-Kettering, Osram, Siemens, etc. Acquired by Evolucia in 2012.

Coemar, Spa, Castel Goffredo, MN, Italy

DIRECTOR, INTERNATIONAL SALES, TECHNICAL SUPPORT *March 2003 to August, 2005*

Provided worldwide sales and technical support on concert lighting products utilized for theatrical, concert, TV/film and entertainment applications. Worked with Genesis, Van Halen, Singapore National Day, etc. Travel included Italy, Germany, US, Australia, China, Hong Kong, Korea, Singapore, and Japan.

Hubbell Entertainment Division, Hubbell Inc. Sunrise, Florida
V.P. ENGINEERING, DIRECTOR *August, 1999 to January, 2003*

Developed a new line of automated lighting fixtures for entertainment, commercial and architectural markets. These products utilized modular production techniques to produce 64 variants from 12 main component sub-assemblies. ISO-9000.

Martin Professional, Aarhus, Denmark

CHIEF OPERATING OFFICER *September, 1995 to August, 1998*

COO of US division of Martin Professional A/S of Denmark the world's leading manufacturer of automated lighting fixtures for entertainment applications with >\$100 million in annual sales. Handled Operations, QC, major account sales, and technical support.

High End Systems, Lightwave Research, Austin, TX

DIRECTOR, RESEARCH & DEVELOPMENT *March, 1992 to September, 1995*

Designed Studio Color and Technobeam automated lighting fixtures. Managed R&D team of 40+ engineers and support staff with oversight of budgets >\$2.5M. Product sales > \$30 million.

E D U C A T I O N / C E R T I F I C A T I O N

EDUCATION:

Trinity University, San Antonio, Texas, B.S., Electrical Engineering

CERTIFICATIONS:

Pro/Engineer Basic, Advanced, Detail, Sheet metal, and Surface Training
3D Systems SLA Rapid Prototype Basic and Advanced Training
LEAN and Six Sigma Master Black Belt
AGI Lighting Design

PATENTS:

US 5,515,254 Automated Color Mixing Wash Luminaire
US 5,580,164 Power Lens for an Automated Luminaire
US D 446,204 Portion of an Audio Amplifier
US D 489,145 Light Fixture
US D 492,436 Light Fixture
US D 496,744 Light Fixture

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