3. Hardware Requirements

The SmartCast TV platform hardware includes a Google cast receiver client to stream content from second screens such as mobile phones, tablets and laptops. All TV related aspects of the platform shall be abstracted to a standardized API set designed to enable the television application and remain consistent across devices.

- 3.1 Bluetooth
  - 3.1.1 Bluetooth Profiles
  - 3.1.2 Bluetooth Multiple Device Support TBD until FUR8.0
    - 3.1.2.1 Bluetooth Multiple Device Hardware Requirements
  - 3.1.3 Bluetooth Minimum Range for Voice Remote
  - 3.1.4 Bluetooth Wi-Fi Combo Chip
  - 3.1.5 Bluetooth Support for Headphones, Voice Remote, Game Controller
- 3.2 TV Panel
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- 3.3 Inputs
  - 3.3.1 Composite Video Timings
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    - 3.3.3.1 P series 2560x1440 EDID timing per Port
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- 3.4 HDMI and CEC Management
  - 3.4.1 HDMI Hot Plug
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- 3.5 USB
  - 3.5.1 USB Power Delivery
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- 3.6 Codec, Containers, Formats
- 3.7 Audio Requirements
  - 3.7.1 TV Speaker Range
  - 3.7.2 Audio Codecs and Passthrough
  - 3.7.3 Audio Path
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- 3.8 Picture Quality hardware requirements
  - 3.8.1 Color Gamut
  - 3.8.2 HDMI Screen Refresh Rate
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- 3.9 Accessibility
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  - 3.9.2 Text to Speech Support
- 3.10 Power Management
  - 3.10.1 AC power boot up sequence
  - 3.10.2 Quick Start to Power On
  - 3.10.3 Power States TBD
  - 3.10.4 Wake Up Support
  - 3.10.5 ECO Mode WOW/WOL
  - 3.10.6 Power State Saved and Restored after AC Off
- 3.11 Back Panel Buttons
- 3.12 Picture-in-Picture (PIP) / Picture-by-Picture (PBP)
- 3.13 LED requirements
- 3.14 Dynamic Random-Access Memory Requirements (DRAM)
- 3.15 Flash Memory (eMMC) Requirements
  - 3.15.1 Flash Memory for Demo Mode
  - 3.15.2 Flash Memory Deletion of Demo Mode Videos
- 3.16 Performance

3.1 Bluetooth

The platform must supports Bluetooth 5.0 with dual mode topology, that is, includes simultaneous Bluetooth Classic and for the remote only, Bluetooth Low Energy (BLE) support. Bluetooth Classic is intended for higher data rate applications such as streaming audio to headsets. Blueto oth LE is a low power application at the sacrifice of data rate to support voice and App discover.

	Requirements
1	Bluetooth 5.0 required for all sku, updating software stack to Dual Port Bluetooth 5.2 in progress.
2	Dual Mode Topology (Classic and LE Concurrency) - co-exist and can concurrently occur.
3	To support pairing of BT remote, the TV is the master.
4	Maximum latency for audio delay must not exceed 200 ms (TV audio playing on Bluetooth audio device such as headphones)

3.1.1 Bluetooth Profiles

Minimum profiles required are:

	Profile	Purpose	Notes
1	Discovery		
2	Pairing		
3	Bluetooth Classic (BR/EDR)		
4	Bluetooth Classic Generic Attribute Profile (GATT) • BT remote • Headphones		
5	Bluetooth Low Energy (LE) GATT		
6	HID (Human Interface Device)	1. HID for receiving buttons from remote control. 2. Support BT game controller	Used for Gaming Controller
7	Advanced Audio Distribution Profile (A2DP) • Source • Sink	Bluetooth Audio • Required source for headphones • Source for other audio devices, e.g. sound bar, is not a requirement (but may be supported) • TV sink not currently used but required for support for streaming audio.	• TV is source for BT audio devices paired to TV. • Use case is audio from mobile client (source) streamed to TV (sink)
8	A2DP device connection management including audio switching between devices and removing devices from the paired list.	Bluetooth Audio	Support required for multiple versions Used for Headphones
9	Audio Video Remote Control Profile (AVRCP) version 1.4 with Absolute Volume control.	Bluetooth Audio	Used for Headphones Used to allow TV to accept the BT remote commands
10	HOGP - HID over GATT profile	Defines communication between a BT low energy device (e.g. watch) and host device (e.g. mobile phone)	Used for game controller
11	SCPP	Game Controller	
12	HAP - Hearing Aid profile	Hearing Aids	N/A until FUR8.0

3.1.2 Bluetooth Multiple Device Support TBD until FUR8.0

	Requirements	User Story	Details
1	Enhanced Attribute Protocol (EATT)	User expects to hear better performance with lower latency when using multiple BT devices.	Enhanced Attribute Protocol provides a way to perform concurrent/parallel transactions between a BLE client and a server and potentially reduce the latency of operations in some applications. • The Enhanced Attribute Protocol is optional per the specification • It requires encryption of the connection between the two Bluetooth Low Energy devices. This makes it inherently more secure than the original unenhanced Attribute Protocol. Support concurrent transactions between BLE devices with lower latency improvement - allowing different apps to interact with a Bluetooth Low Energy device in parallel, potentially reducing latency.

			If the L2CAP layer MTU is smaller than the Attribute layer MTU, causing the L2CAP layer to break up the PDUs coming from the (upper) Attribute layer into smaller chunks and interleave the PDU chunks coming from different applications. In this example, we have App A that is sending a PDU larger than the L2CAP MTU size, so it will be broken up into chunks of sizes up to the L2CAP MTU. This allows the PDUs from App A and App B to be interleaved instead of App B's PDU being blocked by App B's PDU.
2	Isochronous Channels (ISOC)	User wants multiple headphone listeners connected to the TV at once.	Multi-streams support for multiple, parallel connection. Specifically, data transmissions are time-sensitive and synchronized rendering of these data streams across multiple receivers. ISOC lays the foundation for the implementation of LE Audio in BLE devices Required for multiple device (headphone) support to improve performance.
3	New LE Audio Codec: LC3	User wants to hear better quality audio but preserve battery power.	• **high quality**, **low-power audio codec** called the Low Complexity Communications Coded (LC3). • LC3 provides high quality even at lower data rates than the standard SBC codec used in Bluetooth Classic implementations. • **Supports multiple, synchronized audio data streams** • Supports truly wireless earbuds (correct audio to L and R) • streaming audio streams in multiple languages.
4	LE Power Control (LEPC)	User wants to preserve battery power in the headphones.	With better power management and efficiency, the TV can increase the power for BT transmitter allowing for lower receiver power required for headphones Utilizing LEPC and keeping the RSSI within the optimal range of the receiver provides a few benefits including: • Better control over the quality of the signal. • Reducing error rates at the receiving end. • Improving coexistence with other signals in the 2.4 GHz band, including ones other than Bluetooth (such as Wi-Fi and Zigbee). Support for this feature is optional, but if the two devices support this feature, then they **must** use it for power management control.
5	Broadcast Audio Sharing	Multiple users want to listen to different language streams from the same content.	Enable one audio source to broadcast multiple audio streams to multiple audio sink devices

3.1.2.1 Bluetooth Multiple Device Hardware Requirements

	Requirements	Details
1	Supported Bluetooth devices	1. VIZIO BT remote or Voice other devices for TV navigation control, App launch, Voice search. 2. BT Headphone for private listening 3. BT Game Controller(s) for Cloud gaming
2	HW capability support (MTK and Novatek /Realtek)	1. MT7921a (dual port): 1 x BT remote + 2 BT headphones + 4 x BT game controllers 2. MT7663, 7668, 7638: 1 x BT remote + 1 BT headphone + 2 x BT game controllers 3. RTL8822CU: 1 x BT remote + 1 BT headphone + 2 x BT game controllers (TBD)

3.1.3 Bluetooth Minimum Range for Voice Remote

	Requirement	Notes
1	50 foot clear air over full frontal hemisphere.	Testing requirement applies to both Voice and keys
2	Test every 10 degrees along frontal hemisphere.	
3	Single strength must support Bluetooth remote key and voice received by TV for the entire minimum range.	1. 15 meter minimum distance BT voice remote 2. 15 meter minimum distance BT headphone

3.1.4 Bluetooth Wi-Fi Combo Chip

SOC	WiFi + BT combo Chip	Chip Support	BT
5691-H	MT7638B	11n 2*2 Dual Band	Disabled
5691-J	MT7638B	11n 2*2 Dual Band + BT 5.0/LE 2Mbps	Enabled

5691-K	MT7921A	WiFi 4 Single Band	
5695-H OLED-H 5695-J	MT7668B	11ac 2*2 Dual Band + BT 5.0/LE 2Mbps	Enabled
5583-J	MT7603	WiFi 4 Single Band	Disabled
5583-K 5583-L	MT7638B	WiFi 5 Dual Band	Enabled
5691-K, 5695s-K 5691-L, 5695s-L	• MT7921a, -K and 1st MP -L • MT7920, 2nd MP forward for -L	• WiFi 6E Tri Band • WiFi 6 Dual Band	Enabled
5586L	MT7920	Wi-Fi 6 Dual Band	Enabled
5586F	MT7663	Wi-Fi 5 Dual Band	Enabled
72690-2K	RTL8822CU	Wi-Fi 5 Dual Band	Enabled
72690-4K	RTL8852	Wi-Fi 6 Dual Band	Enabled

3.1.5 Bluetooth Support for Headphones, Voice Remote, Game Controller

If Bluetooth voice remote ships with TV then 1) BT Remote Enabled and 2) pairing screen included in OOBE.

SOC	Year	Bluetooth Antenna	BT chip	Game Controller Support	Bluetooth Headphones	Bluetooth Voice Remote shipped	Bluetooth Voice Remote not shipped	Support after launch
5691	2020 -H	no	MT7638	n/a	Not enabled	none	Not included all skus	
5691	2021 -J	yes except for 3 seasonal skus		n/a	Will enable once feature meets VQA & Product Requirements except for 3 seasonal skus	All everyday skus (no seasonal)	Seasonal SKUs no BT support: V705x-J03, V756x-J03, M70Q6x-J03 2023 seasonal (BT support in TV): V555x-J01, V505x-J09	After market BT remote supported for V555x-J01, V505x-J09
5691	2022 -K	yes	MT7921a	• Works with 1 x BT voice remote and 2 BT headphones • Total up to 4 BT game Controllers	Enabled at launch or FCS (FUR5.1, FUR5 for V505/V555 only)	All everyday skus	none 2023 seasonal: V755x-K04	
5691	2023 -L		MT7921a - first MP MT7920 - 2nd MP+	• See above • see below	All skus	All skus		
5691	2024 -8		MT7920	• Works with 1 x BT voice remote and 1 BT headphone • Total up to 2 BT game controllers	All skus	All skus		
5695	2020 -H	yes	MT7668	n/a	Will enable once feature meets VQA & Product Requirements.	none	Not included: P65Q9-H1, P75Q9-H1, P65Qx-H1, P75QX-H1, P85QX-H1	Bluetooth remote support 07/14/22
5695	2020 -H OLED	yes	MT7668	n/a	Will enable once feature meets VQA & Product Requirements.	none	Not included: OLED55-H1, OLED65-H1	Bluetooth remote support 07/14/22
5695	2021 -J	yes	MT7668	n/a	Will enable once feature meets VQA & Product Requirements.	All skus: P65Q9-J1, P75Q9-J1		
5695s	2022 -K 2024 -8 2024 -8	yes	MT7921a	above	Enabled at FCS (FUR5.1) -K All skus -L, -8	All skus		
5583	2021 -J	NO	MT7603	n/a	Not enabled	none	Not included all skus	
5583	2022 -K	yes	MT7663	• Works with 1 x BT voice remote and 1 BT headphone • Total up to 2 BT game controllers	Enabled at launch or FCS (FUR5 or FUR5.1)0 • D24fM-K01	All D skus (enabled FCS FUR5.1)		

					• D32fM-K01 • D40fM-K09 • D43fM-K04			
5583	2023 -L 2024 -8	yes	MT7663	above	All skus	All skus		
5586L	2024 -8	yes	MT7920	• Works with 1 x BT voice remote and 1 BT headphone • Total up to 2 BT game controllers	All skus	All skus		
5586F	2024 -8	yes	MT7663	above	All skus	All skus		
72690 -2K	2023 -L 2024 -8	yes	RTL8822CU	• Works with 1 x BT voice remote and 1 BT headphone • Total up to 2 BT game controllers	All skus	All skus		
72690 -4K	2024 -8	yes	RTL8852		All skus	All skus		

3.2 TV Panel

SmartCast shall support 60Hz and 120Hz panels by using different FRC, MEMC options (or none at all). The main SoC will output 2160p 60Hz to the FRC, MEMC functional block (if it is not integrated into the SoC).

	Video Output	Notes
1	3840 x 2160p 60Hz	Straight from Processor into 60Hz panel
2	3840 x 2160p 120Hz	Straight from Processor which includes MEMC, into 120Hz panel

3.2.1 OLED Panel

The OLED panel has some additional requirements compared to LCD panels as follows:

	Goal	Req.	Definition	Solution
1	Algorithm prevent Image sticking	LEA	To reduce luminance of logo which is fixed on specific area (Broadcasting logo etc.).	Follow LG spec using best solution from either LG or MTK. The setting is always on as per LG spec.
2	Algorithm prevent Image sticking	TPC	To reduce luminance of entire screen when the picture is stopped for some period of time. Begins after 1 minute of static screen.	Follow LG spec using best solution from either LG or MTK.
3	Algorithm prevent Image sticking	CPC	To reduce luminance of edge area where many types of logos are located in.	Follow LG spec using best solution from either LG or MTK.
4	Algorithm prevent Image sticking	Orbit	To make a stress of some sharp borders on the screen spread, let whole pixels on that screen move.	Pixel Shift UI setting. Default is On. Diamond pixel and size 32x16. Pixel shift timing interval is 2 minutes.
5	Algorithm prevent Image sticking	Set Algorithm	Algorithm to control luminance locally or g lobally. (News Ticker etc..) - > Benchmarking After sensing temperature of SET, if it is too high it can let TV turned off.	Follow LG spec.
6	Design prevent Image sticking	Off RS	To make it compensate not only automatically but also manually.(Factory mode or User mode etc..)	After 4 hours of cumulative usage, at power off the OLED panel automatically runs a short pixel refresh. This takes 300 seconds in background. • DC off • Immediately send CEC standby command even though TV remains powered on to perform Off-RS. Do not delay power off of CEC devices until after Off-RS • Off-RS starts and last for 5 minutes • At the conclusion of Off-RS, system goes to standby Demo Mode DC off follows same as above. Demo Mode AC off

				• AC off (no ability to perform Off-RS) • AC On • TV to DC power on with black screen (not standby) • Off-RS starts and last for 5 minutes • TV power on. In factory menu only: include a setting to start Off RS.
7	Design prevent Image sticking	JB	To make it compensate not only automatically but also manually.(Factory mode or User mode etc..)	JB is automatically run every 1500 hours at power off. Takes about an hour. As part of the process, first Off RS is run, then JB starts. A UI setting, Screen Refresher, is also available. JB can also be run from the factory menu. For retail, automatically run every 500 hours. After 600 hours a pop up "Run Screen Refresh?" with YES and DECLINE buttons displays. YES powers off automatically, runs JB and then powers TV on. If DECLINED is selected, then the pop up displays again every 24 hours until YES is selected and JB is run.
8	Design prevent Image sticking	HDR - working peaks at 800 nits.	It must be operated only when HDR source (with meta data) is input. (Not SDR source).	If HDR content detected including HDR10, Dolby Vision, HLG, then APL 10% peak brightness (800 nits).
9	Design prevent Image sticking	Smart TV UI	In order to prevent it from depleting at high luminance of specific colorful area. - When Smart TV UI is displaying, the luminance should be low at any picture modes	**If moving banner like SC screen then TPC can not apply** 1. When Smart TV UI is displaying, the luminance should be low at any picture modes 2. After 1 minute apply TPC (only works for completely static screen) 3. After 10 minutes, Black Screen (OLED turned off, TV is on). 4. After 60 more minutes powers off TV.
10	Design prevent Image sticking	No input signal	After displaying moving “No signal” logo for about 1 minute, it should be turned into Black Screen.	1. Luminance is lowered for all picture modes 2. After 1 minute black screen, OLED screen is turned off. 3. Any key press brings back picture. Second key press takes the IR action. 4. After 60 more minutes TV powers off.
11	Design prevent Image sticking	Stopped Screen aka Static screen 1. Home Screen 2. Streaming paused	After operating TPC function then OLED panel powers down but TV continues to run.	1. Luminance is lowered for all picture modes. 2. After 1 minute apply TPC. 3. After 9 more minutes (total of 10 minutes), black screen (OLED turns off, TV remains on). 4. Any key press including POWER will turn on backlight. The key is consumed. 5. After 60 more minutes, power off TV.
12	Design prevent Image sticking	User Control UI (Menu)	If the User Control UI menu displaying for some period of time without signal, it must be disappeared. (We suggest the waiting time would not be 1 min. more)	VIZIO menu must times out after 1 minute. Sidebar highlight is too bright, colors dimmed.
13	Design prevent Image sticking	PLC Curve (picture mode)	To prevent it from image sticking, SET luminance curve should be under LGD Module’s.	Follow LG spec.
14	Design prevent Image sticking	Picture Engine (Gamma/Color)	To prevent it from image sticking, SET Gamma curve should be same as LGD Module’s(2.2G).	Follow LG spec.
15	Operation	Accumulated Operating Time	The function that displays the total accumulated operating time has to be in TV SET.	Accumulated operating time must be included in factory menu. This is used for Off RS and JB.

Refer to LG Deign_Guide_v2.pdf for details. Follow LG recommendations for timer, frequency, etc.

3.3 Inputs

The platform supports the following physical inputs/ports:

	Input	Industry specification must be supported	Notes

1	Tuner	NTSC, ATSC	
2	Composite	NTSC, 480i only Limited to 2020, -H and 2021 -J skus.	No component
3	HDMI	HDMI 1.4b and 2.1a. ARC and eARC. HDCP 2.2 with HDMI bit depth of 12.	
4	HDMI 5583	D series supports FHD skus (1080P maximum resolution) and 2 HD skus (720P maximum resolution) and therefore is limited to HDMI 1.3, 1.4, 1.4a and ARC. No eARC. No HDR (4K).	
5	USB	USB 2.0 Supports: mass storage. updates, BT dongle for skus without BT support (M7, M6, V5, D)	

3.3.1 Composite Video Timings

Composite supports 480i and analog stereo.

3.3.2 HDMI Video Timings for Devices

HDMI video formats that must be supported for Consumer Electronic (CE) Devices as per EIA/CEA-861 include:

	HDMI Resolution	Resolution Name	Frame Rate	Chroma Sampling	Color Depth	5583 (6 Gbps)	5691 (18 Gbps)	5695/5695s (18 Gbps ports)	5695/5695s (48 Gbps ports)	Notes
1	1080i		60 Hz	4:4:4	8 bit	X	X	X	X	
2	720p	HD	60 Hz	4:4:4	8 bit	X	X	X	X	
3	480p		60 Hz	4:4:4	8 bit	X	X	X	X	
4	480i		60 Hz	4:4:4	8 bit	X	X	X	X	
5	1080p	FHD	24/30/60 Hz	4:4:4 4:2:2	8/10/12 bit	X	X	X	X	
6	1080p	FHD	120 Hz	4:4:4	8/10/12 bit	n/a	n/a	X	X	
7	1080p	FHD	240 Hz	4:4:4	8/10/12 bit	n/a	n/a	X*	X*	*M50QXM-K, -L 8 bit on 18 Gbps ports only
8	1440p	QHD	60 Hz	4:4:4	8/10/12 bit	n/a	X	X	X	gaming
9	1440p	QHD	120 Hz	4:4:4	8/10/12 bit	n/a	n/a	X*	X	*8 bit only gaming
10	2160p	4K UHD	24/30 Hz	4:4:4 4:2:2	8/10/12 bit	n/a	X	X	X	
11	2160p	4K UHD	60 Hz	4:2:2 4:2:0	8/10/12 bit	n/a	X	X	X	
12	2160p	4K UHD	60 Hz	4:4:4	8/10/12 bit	n/a	X*	X*	X	*8 bit only
13	2160p	4K UHD	120 Hz	4:2:0	8/10/12 bit	n/a	n/a	X*	X	*8 bit only K/L only EDID now supports
14	2160p	4K UHD	120 Hz	4:4:4 4:4:2	8/10/12 bit	n/a	n/a	n/a	X	
15	4096x2160p	4K DCI	24/30 Hz	4:4:4 4:2:2	8/10/12 bit	n/a	X	X	X	digital cinema
16	4096x2160p	4K DCI	60 Hz	4:2:2 4:2:0	8/10/12 bit	n/a	X	X	X	digital cinema
17	4096x2160p	4K DCI	60 Hz	4:4:4	8/10/12 bit	n/a	X*	X*	X	*8 bit only digital cinema
18	4096x2160p	4K DCI	120 Hz	4:2:0	8/10/12 bit	n/a	n/a	X*	X	*8 bit only K/L only digital cinema EDID now supports

19	4096x2160p	4K DCI	120 Hz	4:4:4 4:4:2	8/10/12 bit	n/a	n/a	n/a	X	digital cinema
20										

Refer to PRD for maximum pixel clock per SKU.

5695/5695s P skus ports limited to 4K@60 Hz 18 Gbps:

- 2020/21 P HDMI 1/2
- 2020/21 OLED HDMI 1/4
- 2022 -K P HDMI 1/2/4

5695/5695s P skus ports supporting 4K@60 Hz 48 Gbps:

- 2020/21 HDMI 3/4
- 2020/21 OLED HDMI 2/3
- 2022 -K P only HDMI-3
- 2022 -K OLED HDMI-2
- 2024 -8 Quantum (VQP65C-84, VQP75C-84) HDMI-3

3.3.3 PC Timings

	Features	HDMI/DVI PC TIMINGS USA	HDMI 3/4 only (2/3 For OLED)	HDMI/DVI PC TIMINGS Europe	Notes
1	Video	640x480		~~1920x1080/25Hz~~	European timings not supported
2		800X600		~~1920x1080/30Hz~~	
3		1024x768		~~1920x1080/50Hz~~	
4		1920x1080/24Hz		~~1920x1080/100Hz~~	
5		1920x1080/30Hz		~~3820x2160/50Hz~~	
6		1920x1080/60Hz		~~3820x2160/100Hz*~~	
7		1920x1080/120Hz* (HDMI2.1 only)			
8		2560x1440/60Hz**	port 1/2		
9		2560x1440/120Hz (gaming)**	X		
10		3840x2160/24Hz			
11		3840x2160/30Hz			
12		3840x2160/60Hz_4:4:4 8/10bit			
13		3840x2160/120Hz*	X		
14		4096x2160/24Hz			
15		4096x2160/30Hz			

PC Timings for HDMI and DVI are per CVT, DMT, and GTF standards and follow VESA resolution as per below.

Notes:

* Supported as per sku, e.g. currently limited to 5695

** Limitations for 2560x1440 as per tables below.

3.3.3.1 P series 2560x1440 EDID timing per Port

	HDMI Mode	HDMI Input	1440/60	1440/120
1	v2.0/2.1	18 Gbps (i.e. inputs 1 and 2)	yes	no
2	v2.0/2.1	48 Gbps (i.e. inputs 3 and 4)	no	yes
3	v1.4	18 Gbps (i.e. inputs 1 and 2)	yes	no

4	v1.4	48 Gbps (i.e. inputs 3 and 4)	yes	no

3.3.3.2 OLED 2560x1440 EDID timing per Port

	HDMI Mode	HDMI Input	1440/60	1440/120
1	v2.0/2.1	18 Gbps (i.e. inputs 1 and 4)	yes	no
2	v2.0/2.1	18 Gbps (i.e. inputs 2 and 3)	no	yes
3	v1.4	18 Gbps (i.e. inputs 1 and 4)	yes	no
4	v1.4	18 Gbps (i.e. inputs 2 and 3)	yes	no

3.3.4 HDMI Video Sub Sampling

	HDMI	24Hz	25Hx	30Hz	50Hz	60Hx	100Hz	120Hz
1	**Sub Sample**	4:2:0 4:2:2 4:4:4	4:2:0 4:2:2 4:4:4	4:2:0 4:2:2 4:4:4	4:2:0 4:2:2 4:4:4	4:2:0 4:2:2 4:4:4	4:2:0 4:2:2 4:4:4	4:2:0 4:2:2 4:4:4
2	**480i**	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	**480p**	Y	Y	Y	Y	Y	Y	Y
4	**720p**	Y	Y	Y	Y	Y	Y	Y
5	**1080i**	Y	Y	Y	Y	Y	Y	Y
6	**1080p**	Y	Y	Y	Y	Y	Y	Y
7	**2150p**	Y	Y	Y	Y	Y	Y	Y*

* 2160p 4:4:4 with 120 Hz is limited to 8 bit.

3.3.5 VIZIO Home Input

VIZIO Home is a permanent virtual input based on Chromium.

	VIZIO Home Input Requirements
1	VIZIO Home is an app launcher, not a physical input.
2	Selection of an app from VIZIO Home launches a native or HTML5 app through deep links.
3	Selection of content from a HTML5 app launches HTML/JS based video players to play content (hls.js or video.js recommended).
4	HTML and CSS resolution must support both 720p and 1080p.
5	Ambient screen - a special case partner app
6	VIZIO Home displays at power on if the last source was streaming.

3.3.6 Virtual Apps Input Source

A partner app included in the app launcher can be assigned as a virtual input. The virtual input resides in the Input selector following SmartCast TV input with the VIZIO assigned name. Examples include WatchFree and Airplay. A maximum of 5 virtual inputs supported.

3.4 HDMI and CEC Management

SmartCast TV shall rely on abstractions related to HDMI and CEC management, system settings and device info etc. SmartCast TV shall support HDMI version 1.4b, ~~2.0a,~~ 2.1a and HDCP 2.2.

D skus support only HDMI ~~1.3, 1.4,~~ 1.4b, ARC due to FHD (1080P) and HD ((720P) resolution limitations. No HDR (4K) support.

3.4.1 HDMI Hot Plug

SMARTCAST will support hot plug detection of HDMI ports.

	HDMI Hot Plug
1	Once OOBE is completed, HDMI port detection annunciates detection.
2	If CEC is enabled (default) when a device is discovered via hot plug detection, the device is renamed to the CEC name.
3	If no CEC discovery, then no action is taken.
4	When the input is selected for the first time, the TV presents a notification of the CEC discovered name or a nag to name the input.
5	TV saves dynamic EDID for HDMI connected devices between DC power cycles, then checks and updates if needed. This prevents unnecessary blanking.

3.4.2 HDMI CEC

SmartCast TV shall support the standard complement of VIZIO CEC behavior and commands supported in HDMI 1.4b. In practice cable and satellite companies do not support CEC (except for Dish Network hoppers and joeys),

	HDMI CEC requirements
1	Default CEC setting is Enabled.
2	As per HDMI version 1.4b, the maximum number of CEC devices supported shall be 14 with only 1 audio system supported.
3	Device discovery shall immediately follow OOBE for sound bars and audio systems as well as other devices.
4	A discovered device shall be included in multi-tasking and when selected, shall power on.
5	One touch play shall be supported, powering on the TV if needed and switching to the required input on the TV. If the device is connected to an audio device then switching to the required input on the audio device as well.
6	The TV shall respond to a POWER OFF command issued from a connected device and power off.
7	Virtual devices shall be discovered if connected to a mux, usually an audio device such as sound bar or audio receiver. These virtual devices are included in multi-tasking and also display with the info banner and the input selector. When selected, the device shall power on, the audio device switches to the port for the virtual device, and the TV switches to the HDMI port connected to the audio device.
8	The HDMI port with Audio Return Channel (ARC) shall pass audio from a source, such as a TV, to a CEC audio device such as a sound bar or audio receiver. This allows audio on the TV to be heard on the audio device through the HDMI cable without an audio out connection.
9	If a CEC sound bar or audio receiver is connected to any of the HDMI in ports, and TV speakers are turned off, then changes to VOLUME and MUTE from IR remote or SmartCast Mobile controls the volume level for the sound bar or audio receiver.
10	If a source is a CEC device, the IR remote or SmartCast Mobile can control the device as per the defined supported CEC commands.
11	If CEC is disabled, then CEC control and support are no longer supported. The CEC device name resets to the default HDMI port name (e.g. HDMI-1).

3.4.3 HDMI ARC

SmartCast TV shall support Audio Return Channel (ARC). ARC is supported on HDMI-1 only.

3.4.4 HDMI eARC

SmartCast TV shall support Enhanced Audio Return Channel (eARC) for object-based audio formats such as Dolby Atmos and DTS:X for some skus. eARC is supported on HDMI-1 only. eARC is included on skus as per PRD.

3.4.5 HDMI EDID

~~HDMI EDID size needs to be increased to 512 bytes to accommodate more features and data blocks. D skus remain at 256 byes.~~ To support Freesync, AMD must be included in the EDID block.

	SOC	HDMI Mode	EDID Size	HF_SCDB	HF_VSDB	1440@60Hz	1440@120Hz
1	MT5583	Auto	256B	YES			
2	MT5583	HDMI 1.4	256B				
3	MT5691	HDMI 2.1	256B		YES	YES	

4	MT5691	HDMI 1.4	256B			YES	
5	MT5695/s	HDMI 2.1	256B		YES	YES	YES
6	MT5695/s	HDMI 1.4	256B			YES	
7	MT5586L	HDMI 2.1	256B		YES	YES	
8	MT5586L	HDMI 1.4	256B			YES	
9	Novatek 2K	Auto	256B	YES			
10	Novatek 2K	HDMI 1.4	256B				
11	Novatek 4K	HDMI 2.1	256B		YES	YES	
12	Novatek 4K	HDMI 1.4	256B			YES	

3.5 USB

SmartCast platform includes 1 external fully powered USB port, with at minimum, at 2.0 but for some models, 3.0, available to the user for expansion or connection. For debugging and retail demo content FAT 32 is required. NTFS, which requires royalties, is not supported, so movies over approximately 2 hours cannot be viewed.

3.5.1 USB Power Delivery

The USB port shall support hardware and software necessary to enable the charging of high current devices via the USB port during both quick start and when power is on. Power is available to the USB port both during both quick start and when power is on. Level 1.1 charging (5 volts) required. For D/V series .9 amps, and for M/P/Oled 2 amps supported.

USB support of power continuing when TV is off as per the menu setting.

NOTE: If energy compliant (under .5 watt) with power supply drawing power, then power is also available to USB port during passive standby (Eco Mode) even though this exceeds .5 watts of power.

3.5.2 USB Retail Demo Mode Video DELETED

Deleted. Retail demo video does not play from USB. USB only uploads retail demo videos to TV.

3.5.3 USB Media Play

When a USB stick is inserted, the 10-foot media player app is launched. USB media player shall support audio, photos, and video including Dolby Vision and HDR10 content.

3.6 Codec, Containers, Formats

All codecs and containers must be dynamically determined during playback and must function across inputs including network (LAN and WAN). Required codecs and containers include Cast requirements, support for physical inputs (tuner, composite, HDMI, USB) and requirements for partner applications. The required codecs and containers are as follows:

QAM must support HEVC 2K and 4K CODECs (this supports simultaneous tuner scan of ATSC (VSB modulation) and Cable (QAM modulation) required for Demo mode).

The list of CODECs will be a living document and the SmartCast platform must have the capability to be upgraded via firmware.

	Content	Container	Extension	Codec	Notes	App Requirement
1	**Video**	**MP4** AAC (audio)	**.mp4, .m4a, .m4v**	**H.264/MPEG-4 AVC, MPEG-4 Part 2** HE-AAC (audio only) ACC-LC (audio only)	**Main and High Profile @ Level 4.1, 4.2, 5.0** **Up to 1080p60** **Advanced Simple Profile (up to 1080)**	**Google Cast** HE-AAC required for Dolby for cert.
2	Video	WebM	WebM	VP8, VP9	4Kp30 P/M series 1080p60 Series	Netflix, YouTube
3	Video	WebM	WebM	Vorbis	(Audio)	Google Cast
4	**Video**	**MKV**	**.mkv**	**H.264/MPEG-4 AVC**	**Main and High Level (up to 1080p60)** **Level 5.0**	**Prime, youTube (up to 4.2)**

5	**Video**	**MKV**	**.mkv**	**H.265/HEVC**	**4Kp60 P/M series** **1080p60 V Series**	**Google Cast, Prime**
6	**Video**	**MKV**	**.mkv**	**AC-3**	**(Audio)**	
7	**Video**	**MKV**	**.mkv**	**MP3**	**(Audio)**	**Google Cast**
8	~~**Video**~~	~~**MKV**~~	~~**.mkv**~~	~~**Opus (previously Celt)**~~	~~**(Audio common for VoIP)**~~	~~**Google Cast**~~
9	**Video**	**MKV**	**.mkv**	**VP9**	**4Kp60, level 5.1, Profile 2**	**Google Cast, Netflix, YouTube**
10	Video	AV1?		AV1	Required Youtube	YouTube, Netflix
11	**Video**	**MPEG-TS**	**.mp4, .ts**	**HEVC**	**2K and 4K**	**Netflix, Prime**
12	**Video**	**MPEG-TS**		**AC-3**	**(Audio)**	
13	Video	3GPP	.3gp, 3g2	H.264/MPEG-4 AVC	Main and High @ Level 4.1	
14	Video	OGG	.ogg	Vorbis	(Audio)	
15	**Image**		**.jpeg, .jpg**	**JPEG**		
16	**Image**		**.bmp**	**BMP**		
17	**Image**		**.png**	**PNG**		
18	**Image**		**.gif**	**GIF**		
19	Subtitles		.srt, .sub, .ssa	SRT, MicroDVD, SUB, SSA, SUB/IDX	DVD SSA=sub station alpha	DVD/Blu-Ray
20	Subtitles			TTML	Timed Text Markup Language	ATSC (tuner)
21	Subtitles		.cap, .scc	CEA-608		ATSC (tuner)
22	Subtitles			WebVTT	Web Video Text Tracks	
23	**Audio**		**.wav**	**WAV**		
24	**Audio**		**.MP3**	**.MP3**		
25	**Audio**		**.flac**	**FLAC**		
26	**Audio**			**LC3**	**high quality, low-power audio codec**	**Bluetooth 5.2**

3.7 Audio Requirements

Audio support is based on the input with audio. For composite, analog stereo is supported. Audio formats supported are as follows:

	TV speakers	Audio Type Supported	Audio Post Processing	NOTES	Kvalito Test case Ref.
1	TV speakers	PCM	Supported		Test Case ID: 55907
2	TV speakers	DD	Supported		Test Case ID: 55910
3	TV speakers	DD+	Supported		
4	TV speakers	Dolby TrueHD	Not supported	uncompressed, decode to 2.0	
5	TV speakers	Dolby TrueHD with Atmos	Not supported	uncompressed, decode to 2.0	
6	TV speakers	DD+ Atmos	No supported	uncompressed, decode to 2.0	
7	TV speakers	DTS CA (DTS Digital Surround)	Supported	decoded for TV speakers	Test Case ID: 55918
8	TV speakers	DTS-HD Master Audio (MA)	Supported	uncompressed, decode to 2.0	Test Case ID: 55921
9	TV speakers	DTS:X		uncompressed, decode to 2.0 Not supported 2020 Supported 2021 going forward for:	Test Case ID: 55924

			• 5691 • 5695/S • 5586L • 72690-4K		
10	S/PDIF	PCM	Not supported		
11	S/PDIF	DD	Not supported		
12	S/PDIF	DTS CA (DTS Digital Surround)	Not supported		Test Case ID: 60781
13	HDMI-ARC	PCM	Not supported		
14	HDMI-ARC	DD	Not supported		
15	HDMI-ARC	DD+	Not supported	Dolby TrueHD is transcoded to DD+ for HDMI-ARC out to sound bar/AVR.	Test Case ID: 56192
16	HDMI-ARC	DD+ Atmos	Not supported	Dolby TrueHD with Atmos is transcoded to DD+ Atmos for HDMI-ARC out to sound bar/AVR.	Test Case ID: 56195
17	HDMI-ARC	DTS CA (DTS Digital Surround)	Not supported	pass through audio out	Test Case ID: 56198
18	HDMI-eARC	PCM	Not supported		
19	HDMI-eARC	DD	Not supported		
20	HDMI-eARC	DD+	Not supported		
21	HDMI-eARC	Dolby TrueHD	Not supported	uncompressed	
22	HDMI-eARC	Dolby TrueHD with Atmos	Not supported	uncompressed	
23	HDMI-eARC	DD+ Atmos	Not supported		
24	HDMI-eARC	DTS Digital Surround (DS)	Not supported	pass through audio out	
25	HDMI-eARC	DTS Master Audio (MA)	Not supported	pass through audio out	
26	HDMI-eARC	DTS:X	Not supported • 5691 • 5695/S • 5586L • 72690-4K	uncompressed, NOT supported 2020 Supported 2021 going forward for:	Test Case ID: 60146

* MS12 Config Y v2.4 is required and provides transcoding support for sound bars/AVR connected via HDMI-ARC without HDMI-eARC support.

** Using DTS Virtual X instead of StudioSound for all 2020 skus and going forward including D skus.

*** DTS M6 provides decoding support for DTS-HD and DTS-MA and is supported for all skus including 2021 D skus and includes pass through. The 5583 and 72690-2K include DTS M6 but not DTS:X.

3.7.1 TV Speaker Range

1	P series 2021 -J	100Hz-16kHz, 87dB SPL
2	PQX series 2022 -K	100Hz-16kHz, **90dB SPL**

3.7.2 Audio Codecs and Passthrough

The following table identifies the audio codec supported.

	Codec	S/PDIF (optical)	ARC (eARC Off) TV speakers - Auto	ARC (eARC off) TV speakers - digital	eARC TV speakers - Auto	eARC TV speakers - digital
1	PCM	PCM	PCM	PCM	PCM	PCM

2	Dolby Digital	Dolby Digital	Dolby Digital	Dolby Digital	Dolby MAT	Dolby Digital
3	Dolby Digital+ Atmos	Dolby Digital	Dolby Digital+ Atmos	Dolby Digital+ Atmos	Dolby MAT Atmos	Dolby Digital+ Atmos
4	Dolby TrueHD Atmos	Dolby Digital	Dolby Digital+ Atmos	(n/a) *	Dolby MAT Atmos	Dolby TrueHD Atmos
5	DTS Digital Surround **	DTS	DTS	DTS	DTS	DTS
6	DTS-HD	DTS	DTS	DTS	DTS-HD	DTS-HD
7	DTS:X	DTS	DTS	DTS	DTS:X ***	DTS:X
8	AAC-LC	PCM	PCM	PCM	PCM	PCM
9	HE-AAC	PCM	PCM	PCM	PCM	PCM

3.7.3 Audio Path

The following table identifies the audio path. In the two cases with bypass, A/V sync must be maintained.

See attachment “Audio Output for Speakers and Audio Out 28052020 v4”.

3.7.4 Audio Video Sync

Audio Video Sync must be minimal to prevent lip sync issues as follows.

	Audio Video Sync	Requirements	Details
1	Normal and Low Latency modes	Following requirements apply to both normal and low latency mode even though for low latency mode the overall video and audio delays are reduced.	
2	Lip Sync Adjustment (Audio setting)	The Lip Sync Adjustment should provide a means to adjust the lag of the audio relative to the video. A positive value equates to increased audio lag. A negative value equates to reduced audio lag (AKA lead).	• Delay Adjustment range: -200 msec to 400 msec • Adjustment step size: 5 msec (120 steps) • Default: 0 msec
3	Allowed Variability Between Audio CODEC Types	Audio decode time tends to vary with audio encoding type and possibly bit rate. This variability needs to be compensated for in the firmware. Logically this compensation would be a value pulled from a LUT that operates in tandem with the Video Lip Sync compensation and the Lip Sync UI value.	• Maximum allowed difference between encoding type: 5 msec • Maximum allowed difference between bit rate: 5 msec • Maximum AV sync switching time between encoding type: 5 msec
4	Allowed Variability Between Video CODEC Types	Video decode may vary with video encoding type. This variability needs to be compensated for in the firmware. Logically this compensation would be a value pulled from a LUT that operates in tandem with the Audio Lip Sync compensation and the Lip Sync UI value.	• Maximum allowed difference: 5 msec • Maximum AV sync switching time between encoding type: 5 msec
5	Allowed Variability Between TV Speakers and Other Outputs	There must be minimum difference between audio lag on the various outputs. The outputs must be compensated so they are properly aligned. Outputs included in this requirement: • Analog • SPDIF • Bluetooth • ARC & eARC Applies also to: • Lead compensated soundbars	• The TV must contain a table of VIZIO Soundbars and their inherent latency that should be used to compensate accordingly with ARC/eARC lead so the result is neutral. • The Soundbar EDID will provide the required device identification. • Maximum allowed difference between TV speakers and any other output: 5 msec • Note: this means that there could be up to a 10 msec difference between any two non-TV speaker outputs.
6	Allowed Startup Differences Between App Audio and Video	This is the time it takes for the image and sound to sync overall (especially with a soundbar/AVR). When a user selects Netflix, for example, they should see the Netflix logo at the same time they hear the “Pah-tung!” sound that goes with it, not just the tail end of it.	• Maximum allowed difference between audio and video start: 50 msec
7	Known Limitations	1. BT headphone can’t be supported with game low latency mode. 2. Recommendation for ARC/eARC with game low latency mode is output PCM to avoid latency.	

		3. If no game low latency, follow Dolby spec, e.g. advance audio for ARC. Per Dolby spec tolerance must be frame based. Tolerance is 1 - 2 frames. 100 msec - 60 Msec. FYI 40 MSeC is about 1 frame. 4. For game with game low latency enabled and Atmos audio then audio lags. This issue is persistent in the industry. Recommendation is to connect game console audio directly to ARC/eARC audio device to receive Atmos.		

3.8 Picture Quality hardware requirements

3.8.1 Color Gamut

Color gamut defines the color space for the TV. The REC2020 percentage differs per SKU as defined in SKU PRD.

3.8.2 HDMI Screen Refresh Rate

Screen Refresh Rate for HDMI depends on the support of the panel.

	SKU	Refresh Rate	DRM	NOTES
1	2021 -J M skus	2160P@60 Hz	120	
2	2021 -J P skus	4K@120 Hz	240	
3	2022 -K M skus	4K@120 Hz	240	
4	2022 -K PQ skus	4K@120 Hz	240	
5	2022 -K M50QXM-K01 only	1080P@240 Hz		M50QXM-K01 support switching between 4K 120Hz and 1080p 240Hz. Intended for gaming.
6	2023 -L VQ6	4K1K@120 Hz	240	Spec is TBD with BOE
7	2023 -L MQX	4K1K@240Hz	480?	Spec is TBD with BOE
8	V4K	4K@60 Hz		
9	2024 VQP Quantum Pro	4K1K@240Hz		

3.8.3 Brightness NITS

Brightness NITS varies by SKU. Reference the PRD by SKU.

3.9 Accessibility

Accessibility support is required for TV with tuner and for streaming content launched from the SmartCast Home or press of a partner button including:

#	Accessibility Requirements
1	Closed Captions
2	Text-to-Speech
3	Video Description
4	Zoom Mode

3.9.1 Closed Captions for Streaming content

As mandated by the FCC, closed captions support is required for streaming video displayed on televisions.

	Closed Captions Streaming Content Requirement
1	To support closed captions for streaming video, the VIZIO platforms shall enable Timed Text decoding and presentation in accordance with the SMPTE-TT Timed Text Format (SMPTE ST 2052-1). SMPTE-TT maps to W3C TTML.
2	An API shall be implemented to allow an OTT Video Application to present a series of TTML Documents to the platform for time synchronized presentation in conjunction with the OTT video.

3	The platform shall implement TTML decode such that it is strictly time synchronized with the video stream to which the timed text corresponds. The implementation shall support any necessary translation between native stream time offset data and the time codes present in the TT stream to ensure correct synchronization between playing video and the TT stream. The implementation shall properly manage all start / stop transitions, pauses in video, seeks, buffer events, or other conditions which might perturb the coordinated and synchronized decoding of the TT and Video stream.
4	The SMPTE-TT user configurable settings shall be combined with the currently implemented OTA CC settings, overlapping common settings wherever possible. These settings shall be common across all types of closed captioning – Analog (608), Digital (709) and IPCC.
5	From SmartCast Mobile a tag of the Closed Captions on/off or a press of the CC key from a remote shall universally apply to all of the captioning formats for the SMARTCAST platform.
6	To allow OTT Video Applications to implement their own CC decoding, an API shall be implemented to allow all of the currently prevailing CC settings to be delivered (upon request) to any OTT Video Application on the platform.
7	To allow OTT Video applications to coordinate with changes in the above settings exchange, an event notification shall be implemented to trigger the application to re-read the new settings (including changes in the global enablement or disablement of TT presentation).

3.9.2 Text to Speech Support

Requirements for Text to Speech (TTS) include:

	Text-to-Speech Requirements
1	As it is royalty free and memory efficient, Cyberon TTS engine or equivalent shall be supported.
2	Text to speech applies to menu settings and text on screen for the TV and for partner applications, not for streaming video.
3	Native interfaces as well as HTML interfaces to support TTS integration shall be provided.

3.10 Power Management

SMARTCAST must support the requirements for power consumption compliant for HD/FHD and UHD. Energy star specifies power consumptions (allowances) for standby passive (Eco Mode) and standby active (Quick Start) modes with no external devices connected). Power requirements are also set to meet requirements for all states in the USA, for example California Energy Commission (CEC), as well as throughout Canada and Mexico.

3.10.1 AC power boot up sequence

The AC Power boot up sequence shall apply as follows.

	AC Power Boot Up Sequence Requirements
1	The 2020 V logo shall display during boot up if longer than 5 seconds but should not delay power up sequence (image must be in boot loader).
2	Before OOBE has been completed, applying power from AC off shall immediately power on the TV to OOBE.
3	After OOBE has been completed, TV powers up to the last source including SmartCast Home.

	Input	**Power state**	**Ac power on state**	**Time**	**Logo**	**LED Blinking**	**Notes**
1	HDMI SmartCast Tuner	AC On to Standby (Eco Mode)	Load Mboot and linux	8 seconds	Display bootloader logo until linux up	LED blinks with a 1 second period until TV is in standby, then fades to off 2 - 3 seconds.	
2	HDMI SmartCast Tuner	AC On to Standby (Quick Start)	Load Mboot and linux	10 seconds	Display bootloader logo until linux up	LED blinks at 1 hertz rate until TV is in standby, then fades to off 2 - 3 seconds.	More loaded to go to standby as QS is preloaded.
3	HDMI	Eco mode DC on	Linux load until HDMI displayed with audio	5 seconds	Logo from linux displays (looks the same as bootloader logo)	LED on until Logo display as per LED setting.	Press the Power key.
4	HDMI	Quick Start DC on	Linux load until HDMI displayed with audio	3 seconds	No logo display(delays power on)	LED on until Logo display as per LED setting.	Press the Power key.
5	SmartCast	Eco mode DC on	Linux load until SmartCast Home displayed with audio	5 seconds	Logo from linux displays (looks the same as bootloader logo)	LED on until Logo display as per LED setting.	Press the Power key.

6	SmartCast	Quick Start DC on	Linux load until SmartCast Home displayed with audio	3 seconds	No logo display(delays power on)	LED on until Logo display as per LED setting.	Press the Power key.
7	Tuner	Eco mode DC on	Linux load until Tuner displayed with channel tuned	5 seconds	Logo from linux displays (looks the same as bootloader logo)	LED on until Logo display as per LED setting.	Press the Power key.
8	Tuner	Quick Start DC on	Linux load until Tuner displayed with channel tuned	3 seconds	No logo display(delays power on)	LED on until Logo display as per LED setting.	Press the Power key.
9	HDMI SmartCast Tuner	Reboot TV to Eco mode or Quick Start	Load Mboot and linux load until input displayed with audio	16 seconds	Display bootloader logo until linux up, t**hen display the linux logo until sync.**	LED blinks with a 1 second period until TV logo displays. **Either LED is blinking or logo displays.**	• 3 seconds to tear down • 8 seconds to load Mboot • 5 seconds to power on

3.10.2 Quick Start to Power On

Wake from Quick Start to a fully functional state shall be achieved in less than TBD 200 milliseconds after the power key is press. SmartCast should be available instantly.

3.10.3 Power States TBD

The TV supports 3 power states, Active and Power Off with Eco Mode and Power Off with Quick Start.

	Power State Requirement	Source for Requirement
1	There are three power states: • Active • Power Off (Eco Mode) • Power Off (Quick Start). Power Off includes a user setting, the "Power Mode" setting, that defines the type of 'Power Off' state the TV will be in.	
2	Active power state: • TV is powered on and fully operational.	
3	Power off (called Power Mode) includes to user settings: • Eco Mode: At power down, panel is powered off and all components are off except those required to support power on using IR, WOW or WOL. TV does not power off instantly, wait TBD 30 seconds before power down so TV can be powered on again if an accidental power off. 1 minute later power on (but panel remains off) for Qterics check for update. Powers off after Qterics finds no update or after update taken. • Quick Start: At power down, TV remains powered on but panel is off and audio is off. This allows for quick power on. 1 minute later power on (but panel remains off) for Qterics check for update. Powers off after Qterics finds no update or after update taken.	
4	Eco Mode has default power consumption <= 0.5w, to meet Canada requirement. Performance for transition to power from Wake on Bluetooth or from IR is not as fast as Quick Start..	Canada energy consumption
5	Eco mode must support WOW and WOL at .5 watts and under. DELETED:Using Geolocation, if USA, the default maximum power consumption for eco mode is raised to 1 watt.	USA California Energy Commission (CEC and Oregon energy consumption
6	Quick Start <= 5 watts supports fast transition to power on when casting.	

NOTE: TVs are not energy star compliant for USA. However, energy star specifies power consumption (allowances) for standby passive and standby active with no external devices connected: for TVs, the maximum power consumption of .5 watt for eco mode.

3.10.4 Wake Up Support

Wake up is supported as follows:

	Wake Up requirements	Passive Standby (Eco Mode*)	Quick Start

1	WOL – Wake on LAN, (e.g. Ethernet “power on” command from **SmartCast Mobile**)	X	X
2	WOWL – Wake on Wi-Fi, (e.g. power on from **SmartCast Mobile**)	X	X
3	WOL with Voice Assistant (Alexa, Google Assistant) (all 2020 skus going forward excluding 5583 -J) TBD FUR8?	X	X
4	WOWL with Voice Assistant (Alexa, Google Assistant) (all 2020 skus going forward excluding 5583 -J) TBD FUR8?	X	X
5	WOBT – Wake On Bluetooth **DELETED to support Bluetooth Voice Remote**	none	none
6	Wake on Cast from SmartCast Mobileor streaming service app such as Netflix, Vudu, Pandora, etc. Airplay, any protocol		X
7	TV panel power button (GPIO into SoC)	X	X
8	SmartCast (VIA) key (power on TV then launches SmartCast TV)	X	X
9	IR partner keys (power on TV then launches partner app)	X	X
10	IR power key for TV (e.g. TV remote or cable box remote controls)	X	X
11	CEC wake up	X	X
12	Wake On AirPlay		X
13	Wake on Dial		X
14	Wake on App Launch		X
15	BT Voice Remote: Wake on Launch App		X
16	BT Voice Remote: Press power button - BT enabled but Wake on IR (point remote to TV)	X (5691 & 5695)	X

* Eco Mode must always support .5 watts for all support.

The default wake up state is the last input or as per selection in “Input at Power On”.

Quick Start provides the best casting experience. To meet power across all jurisdictions, the default is Passive Standby (Eco Mode). To encourage customer selection of Quick Start, a notification is presented on SmartCast Home.

In the event something bad happens while in power Quick Start mode, SmartCast must have provision to do a power reset without needing to unplug the power cord (Soft Power Cycle). Specifically, when TV power is on a long press of POWER button from the TV panel performs the equivalent to cycling AC.

COMMENT: For 2020 voice remotes, paired at factory and then all remote keys use BT instead of IR to communicate with TV.

3.10.5 ECO Mode WOW/WOL

When TV is in Eco Mode, the following WOW/WOL support is required.

	Eco Mode WOW/WOL	**WOW/WOL**
1	TV in Eco Mode and can support both WOW and WOL simultaneously while under 1 watt	both supported
2	TV in Eco Mode but cannot support both WOW and WOL with Eco Mode under 1 watt, then support only the last active network module (WOW or WOL) when unit was powered down.	WOW or WOL
3	TV in Eco Mode and not currently connected to WiFi or WOL then no support or WOW or WOL and this must be under .5 watt (Canada).	none

3.10.6 Power State Saved and Restored after AC Off

1	The power on state is saved and restored at AC power cycle.	Supports power on of the TV at retail that is not in demo mode.
2	TV On at AC Cycle:	1. TV was on 2. AC power off 3. AC power is restored 4. TV powers on automatically.
3	TV Off at AC Cycle	1. TV was off 2. AC power off 3. AC power is restored

		4. TV remains powered off.
4	If TV is in OOBE, at AC cycle TV always powers on automatically. This is true if TV was On or DC power Off when AC was lost.	
5	If TV is in demo mode, at AC cycle then TV always powers on automatically. This is true if TV was On or DC power Off when AC was lost.	

3.11 Back Panel Buttons

The 2020 back panel includes 4 buttons: Power On/Off, Input, Volume Up/Down. Front panel keys are executed upon key release not key press to support long key press and chorded keys (if supported). For button behavior reference the SmartCast platform settings spec, version 3 or the latest.

For all 2021 skus, the back panel includes one button: the power/input button. Not included for 2021 V5 with 4 back panel buttons.

3.12 Picture-in-Picture (PIP) / Picture-by-Picture (PBP)

The platform shall support PIP, POP, or PBP picture zoom while SmartCast Home loads. Exact location and use is TBD.

3.13 LED requirements

The LED requirements are dependent upon the state of the TV as follows:

	Condition	LED requirement
1	AC On	• Indicator LED turns Max White • LED flashes with 1 second period until standby • TV enters Standby then LED fades to Off over 2 - 3 seconds.
2	DC On	Indicator LED turns Max White
3	Splash Screen appears, Retail Demo enabled	Indicator LED fades to Off over 5 seconds
4	Splash Screen appears, Indicator setting is On	Indicator LED fades to Dim White over 5 seconds
5	Splash Screen appears, Indicator setting is Off	Indicator LED fades to Off over 5 seconds
6	DC off	Indicator LED turns Max White for 1 second, then backlight off in 0.25 seconds

Refer to LED White indicator slow standby spec version 4 for details.

3.14 Dynamic Random-Access Memory Requirements (DRAM)

2 GB DDR4 System.

- 2024 5586L

D series: 1GM System.

2022/2023/2024 P/M/VQP 5695S: 4GM (Emb. DDR4 32b 2GB + Ext. DDR4 32b 2GB)

3.15 Flash Memory (eMMC) Requirements

8 GB flash storage.

- 2024 5586L

D series: 4 GB flash storage.

2022/2023/2024 P/M/VQP 5695S: 16 GB

3.15.1 Flash Memory for Demo Mode

If OOBE is not completed (no network connection), or network is not connected in OOBE, then reserve 1 GB of flash memory for demo video. Memory requirement for demo mode no longer applies as follows:

- OOBE is completed with Wi-Fi connected
- OOBE is exited without Wi-Fi connection but network connected later using TV settings

3.15.2 Flash Memory Deletion of Demo Mode Videos

Demo mode videos deleted from flash memory after 24 hours of connecting to internet if Viewing Data accepted and DAI enabled. Required to create space to store Ads for DAI in /demo partition. Deletion after 24 hours to ensure a sku tested on the factory line does not immediately delete demo mode videos. A Reset to Factory Defaults resets the flag for Viewing Data so demo mode videos are not deleted.

3.16 Performance

	PERFORMANCE updated 240612	Test Conditions	Start Event	Stop Event	2020 spec	2022 spec	2024 Spec	Notes
2	**Power Cycle**							
3	Boot to standby (AC on -> passive standby) LED no longer blinking	AC pulled, cold boot	Insert AC power	LED blinking stop	15 seconds	15 seconds	7 seconds	infrequent
4	Eco Mode Start to VIZIO Home (full functionality)	TV off	Press Power key	SmartCast Home displays	5 seconds	3 seconds	1 second	MVV-11373, MVP5169, MVD-2596
5	Eco Mode Start to HDMI Port	TV off, HDMI device powered on	Press Power key	HDMI port source displays	5 seconds	5 seconds	1 second	MVV-11373, MVP5169, MVD-2596
6	Eco Mode Start to tuner	TV off	Press Power key	Channel tunes	5 seconds	5 seconds	3 seconds	MVV-11373, MVP5169, MVD-2596
7	Wake on IP from quick start to full functionality (SCTV Home)	TV off	Tap Power button on SC Mobile	SmartCast Home displays	2 seconds	Less 1 second	1 second	For -K wifi module remains connected at .5 watts.
8	Quick Start to VIZIO Home (full functionality)	TV off	Press Power key	SmartCast Home displays	5 seconds	1 second	1 second	MVV-11373, MVP5169, MVD-2596
9	Quick Start to HDMI Port (no slower than 3 seconds)	TV off	Press Power key	HDMI port source displays	3 seconds	3 seconds	3 seconds	MVV-11373, MVP5169, MVD-2596
10	Quick Start to tuner	TV off	Press Power key	Channel tunes	5 seconds	3 seconds	3 seconds	MVV-11373, MVP5169, MVD-2596
11	Power OFF (Eco Mode) > how long before can power on again	TV powered ON	Press Power key	Power key turns TV on	5 seconds	5 seconds	5 seconds	
12	Power OFF (Quick Start) > how long before can power on again	TV powered ON	Press Power key	Power key turns TV on			1 second	
13	**Input Switching and Rescaling**							
14	HDMI to HDMI	HDMI has video sync	Select Input from Input selector	HDMI port with sync displayed	2 seconds	1 second	1 second	3/3/22 New performance per MVV-11389
15	Native or HTML app to underlying HDMI input (BD player)	App guide & HDMI has video sync	Select Input from Input selector	HDMI port with sync displayed	500 mS	1.5 seconds	1 second	Robert's test results …
16	HDMI to VIZIO home page	HDMI has video sync	Select Input from Input selector	SmartCast Home launches		2 seconds	1 second	
17	Tuner Channel changing	channels scanned	press channel up	new channel tuned	2 seconds	1 second	1 second	
18	App HTML5 to App Native (HTML5 app to Native App (e.g. Disney+ to Netflix in memory)	1. Disney+ is source 2. Hulu is source.	Press Netflix key.	Netflix launches	1 second	1.5 seconds	1 second	Robert test partner key Hulu or Disney
19	App HTML5 to App HTML5 (visual feedback)	1. Disney+ is source 2. Hulu is source.	1. Press Hulu key 2. Press Disney+ key	1. Hulu app launches 2. Disney+ launches		1.5 seconds	1 second	
20	Exit HTML5 or native app to VIZIO Home screen	1. Netflix is source 2. Disney+ is source.	Press EXIT key	App exits, SCTV home screen display	2 seconds	2 seconds	1 second	7 seconds 5583 (out of memory)
21	Native app to native app						1 second	
22	WF+ or Antenna to VIZIO Home						1 second	

23	Channel Scan (Find Channel) WF+ Antenna menu sidebar	RF cable connected, tuner is source	Press OK	Channel scan complete	n/a	1 minute	1 minute	Robert test; 7 - 10 min. old code 3/3/22 New performance per MVV-12153
24	Channel Scan (Find More Channels)	RF cable connected, tuner is source	Press OK	Channel scan complete	n/a	7 minutes	7 minutes	Updated 2024: MTK never met 4 minutes requirement.
25	**Key response (remote or side panel)**							
26	Remote key press to visual /audible feedback Quick Settings or All Settings	SCTV displayed	Press Menu key, then down, then OK.	Sidebar displays, highlight moves, submenu displays	50 mSec	50 mSec	50 msec	sidebar navigation Test IR and BT remotes
27	Remote key press to visual /audible feedback VIZIO Home UI	SCTV displayed	Press down, then right.	Selected item changes.	300 msec	300 mSec	30 msec	Need to discuss animation flag and speed
28	Front panel button press to visual feedback				n/a	400 msec?	400 msec?	input swiching time MVD-2649
29	**Connectivity**							5581/5583
30	RJ-45 plug to connectivity. instant??	menu displayed	plug in ethernet	ethernet icon displays	2 seconds	3 seconds	3 seconds	TBD C18617299
31	Wi-Fi AP active to connectivity	Network not connected	Select network and enter password	Selected network is connected.	3 seconds	4 seconds	3 seconds	-K always connected C18617300
32	Wi-Fi time radio to scan OOBE	Pair remote completed	Network page displays	Available AP populates menu		10 seconds		TBD, Eric confirming.
33	Wi-Fi time radio to scan sidebar - when SSID are seen is sidebar	Sidebar menu open	Open Network menu	Available AP populates menu		6 seconds		C18617324
34	Bluetooth LE re-pair with Voice remote	airPOD previously paired	press MIC key, say pair headphones.	audio heard from airPOD	instant	instant		
35	Bluetooth pairing Voice remote	no headphones paired	pres MIC key say pair headphones	pairing notification displays	2 seconds	8 seconds		
36	Bluetooth pairing headphones (iPOD)	airPOD previously paired	Select pair in BT headphones	pairing notification displays	na	3 seconds		
37	**Latencies**							
38	HDMI hot plug to sync	BD player with content playing	connect HDMI port	content displays HDMI	2 seconds	5 seconds		
39	Audio & Video latency for Game mode for HDMI 60 Hz panel	Test middle of screen, game displayed	http://www.leobodnar.com/shop/index.php?main_page=product_info&products_id=317		1 frame (33 mSec)	9 msec		Per Derek/Gaming Roadmap -K
40	Audio & Video latency for Game mode for HDMI 120 Hz panel (LD)	5695s only; Test middle of screen, game displayed	http://www.leobodnar.com/shop/index.php?main_page=product_info&products_id=317		½ frame (16 mSec)	6 msec		Per Derek/Gaming Roadmap -K
41	Audio & Video latency for Game mode for HDMI 120 Hz panel (no LD)	5695s only; Test middle of screen	http://www.leobodnar.com/shop/index.php?main_page=product_info&products_id=317			5 msec		
42	Audio & Video latency for Game mode for HDMI 240 Hz panel (LD)	5695s M50QXM; Test middle of screen	http://www.leobodnar.com/shop/index.php?main_page=product_info&products_id=317			4 msec		
43	BT audio latency (headphones)	airPOD paired	add tool		200 msec	50 msec		
44	USB mount	USB stick with content	Insert USB stick.	Media player menu displays.	2 seconds	2 seconds		Media Player displays
45	**CEC**							
46	CEC response time	CEC device connected and powered on	Press down, left, up, or right	AppleTV menu navigated	200 mS	200 mS		Use AppleTV
47	CEC discovery time				5 seconds	5 seconds		

		VIZIO sound bar not previously connected	VIZIO sound bar connected to HDMI-1.	TV annunciates sound bar discovered				
48	**SmartCast TV /Application launch**							
49	SCH or WatchFree+ partner key press to on screen visual feedback (tv is on)	TV powered ON	Press partner key	SCH or WF+ displays	200 mS	1.5 seconds		Robert to test
50	Native partner key press on screen visual feedback (TV is on)	TV powered ON	Press Netflix or Prime partner key	Netflix/Prime displays		TBD		
51	HTML app partner key press to on screen visual feedback	TV on				TBD		
52	Top 5 app load time (assume xx Mbps connect rate)	app login completed				Per Agreement:		
53	Netflix	app login completed	Press Netflix key	Netflix launches.	per agreement	1 second from logo. Always Ready: (hidden) 3 seconds to launch into visible		
54	Prime Video	app login completed	Press Netflix key	Netflix launches.	higher number from Netflix /YouTube	12s with 5Mbps		
55	YouTube	app login completed	Select YouTube from SCTV.	YouTube launches	per agreement	9 sec not preloaded, 5 sec preloaded		
56	Hulu	app login completed	Press Hulu key	Hulu launches.	higher number from Netflix /YouTube	Undefined		
57	WatchFree+		Press WatchFree+ key	WatchFree+ launches.	higher number from Netflix /YouTube	3 seconds		Measure what it is today ~ 2.75 sec
58	**OOBE**							
59	OOBE completed, SC Home “Welcome to VIZIO” pop up displays	OOBE, network connected, TOS & activity data confirmed	Registration skipped.	SC Home displays with pop up “Welcome to VIZIO SmartCast”	undefined	2 seconds		
60	OOBE not started, after AC cycle and V logo, demo mode notification displays.	Reset TV to defaults to OOBE, wait for demo mode launch. Pull AC.	After AC on and V logo displays. At V logo take down start timer.	Demo mode countdown notification displays	undefined	2 seconds		

NOTES:

1. 10/27/21 Prepared by software program team (Steve, Polly, James, Robert K) based on current performance tested by Robert.
2. 4/1/22 Updated with hardware team (Nick, Eric, James, Polly)