**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

M-RED INC.,	§ § §	Case No.
Plaintiff,	§ §	**JURY TRIAL DEMANDED**
v.	§ §	
	§	
MITSUBISHI ELECTRIC	§	
CORPORATION,	§ §	
	§	
Defendant.	§	

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff M-Red Inc. ("M-Red" or "Plaintiff") for its Complaint against Mitsubishi Electric

Corporation ("MELCO") alleges as follows:

THE PARTIES

1.   M-Red is a corporation organized and existing under the laws of the State of Texas,

with its principal place of business located at 100 W. Houston Street, Marshall, Texas 75670.

2.   Upon information and belief, MELCO is a corporation organized and existing

under the laws of Japan, with a principal place of business located at Tokyo Building, 2-7-3,

Marunouchi, Chiyoda-ku, Tokyo, Japan 100-8310. MELCO may be served pursuant to the

provisions of the Hague Convention. MELCO may also be served with process by serving the

Texas Secretary of State at 1019 Brazos Street, Austin, Texas 78701 as its agent for service because

it engages in business in Texas but has not designated or maintained a resident agent for service

of process in Texas as required by statute.

3.   MELCO is a leading manufacturer and seller of automobiles and automotive

electronics in the United States. Upon information and belief, MELCO does business in Texas

and in the Eastern District of Texas directly and through intermediaries.

JURISDICTION AND VENUE

4.   This is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. §§ 1, *et seq.* This Court has jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338(a).

5.   This Court has personal jurisdiction over MELCO. MELCO regularly conducts business and has committed acts of patent infringement and/or has induced acts of patent infringement by others in this Judicial District and/or has contributed to patent infringement by others in this Judicial District, the State of Texas, and elsewhere in the United States.

6.   MELCO is subject to this Court's jurisdiction pursuant to due process and/or the Texas Long Arm Statute due at least to its substantial business in this State and Judicial District, including (a) at least part of its past infringing activities, (b) regularly doing or soliciting business in Texas, and/or (c) engaging in persistent conduct and/or deriving substantial revenue from goods and services provided to customers in Texas.

7.   For example, MELCO has (i) done and continues to do business in Texas; (ii) MELCO has committed and continues to commit acts of patent infringement in the State of Texas, including making, using, offering to sell, and/or selling accused products in Texas, and/or importing Accused Products into Texas, including by Internet sales and sales via retail and wholesale stores, inducing others to commit acts of patent infringement in Texas, and/or committing a least a portion of any other infringements alleged herein; and (iii) MELCO regularly places its products within the stream of commerce—directly, through subsidiaries, or through third parties—with the expectation and knowledge that such products, such as consoles and accessories, will be shipped to, sold, or used in Texas and elsewhere in the United States. Accordingly, MELCO has established minimum contacts within Texas and purposefully availed itself of the

benefits of Texas, and the exercise of personal jurisdiction over MELCO would not offend traditional notions of fair play and substantial justice.

8.   MELCO purposefully directs and controls the sale of the Accused Products into established United States distribution channels, including sales to nationwide retailers and for sale in Texas. MELCO further places the Accused Products into international supply chains, knowing that the Accused Products will be sold in the United States, including Texas.

9.   On information and belief, MELCO derived substantial revenues from such infringing acts, including from its sales of infringing devices in the United States.

10.   On information and belief, MELCO has, and continues to, sold and offered to sell Accused Products, such as automotive head units, to U.S. customers, both directly and through intermediaries. On information and belief MELCO delivers the Accused Products to U.S. Customers in the United States.

11.   In addition, on information and belief, MELCO knowingly contributed to or induced infringement by others within this District, including end users, by advertising, marketing, offering for sale, and selling such devices to distributers, resellers, partners, and/or end users in this Judicial District, and by providing instructions, user manuals, advertising, and/or marketing materials which facilitated, directed, or encouraged the use of their infringing functionality.

12.   Venue is proper in this Judicial District pursuant to 28 U.S.C. § 1391 because, among other things, MELCO does not reside in the United States, and thus may be sued in any judicial district pursuant to 28 U.S.C. § 1391(c)(3).

PATENTS-IN-SUIT

13.   On February 8, 2005, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 6,853,259 (the "'259 Patent") entitled "Ring oscillator dynamic

adjustments for auto calibration." A true and correct copy of the '259 Patent is attached hereto as Exhibit A.

14.   On June 27, 2006, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,068,557 (the "'557 Patent") entitled "Ring oscillator dynamic adjustments for auto calibration." A true and correct copy of the '557 Patent is attached hereto as Exhibit B.

15.   On April 24, 2007, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,209,401 (the "'401 Patent") entitled "Ring oscillator dynamic adjustments for auto calibration." A true and correct copy of the '401 Patent is attached hereto as Exhibit C.

16.   On January 23, 2001, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 6,177,843 (the "'843 Patent") entitled "Oscillator circuit controlled by programmable logic." A true and correct copy of the '843 Patent is attached hereto as Exhibit D.

17.   On September 30, 2003, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 6,628,171 (the "'171 Patent") entitled "Method, architecture and circuit for controlling and/or operating an oscillator." A true and correct copy of the '171 Patent is attached hereto as Exhibit E.
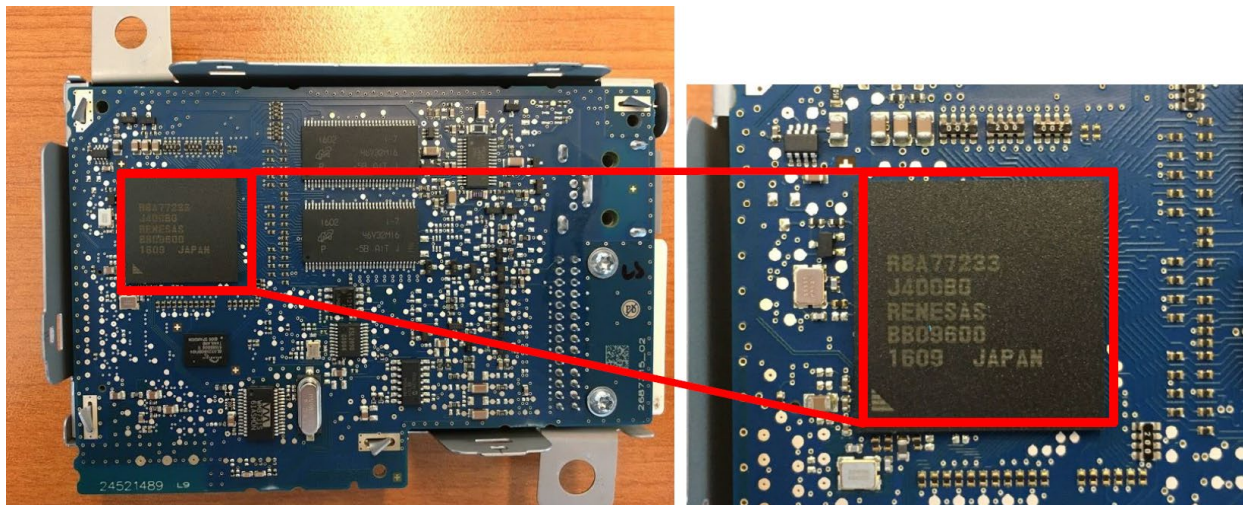
18.   The '259, '557, and '401 Patents (the "Norman Patents") generally describe integrated circuits comprising voltage and temperate sensors which output a voltage and temperate and store the output in memory. The technology was developed by Robert D. Norman and Dominik J. Schmidt. The Norman Patents also describe methods for dynamically adjusting clock frequency based on voltage and temperature values. In some embodiments of the inventions, temperature sensors dynamically monitor environmental parameters and store these parameters on a memory. These techniques are incorporated into integrated circuits ("ICs") and software utilized

in MELCO Accused Products.   For example, this functionality is included and utilized in Qualcomm System-on-a-Chips ("SoCs") used in MELCO Accused Products, such as the Snapdragon 820Am included in the MELCO FlexConnect infotainment system.[1] For example, this functionality is included and utilized in Renesas SoCs used in MELCO Accused Products, such as the Renesas R8A77233 included in the MELCO MDGMY10 Bluetooth Hands Free Module, and the Renesas R8A77760DBGV included in the MELCO NR-207 head unit.   On information and belief MELCO Accused Products, such as automobiles and infotainment systems, further comprise Nvidia, Broadcom, and Amlogic SoCs that include and utilize this functionality.

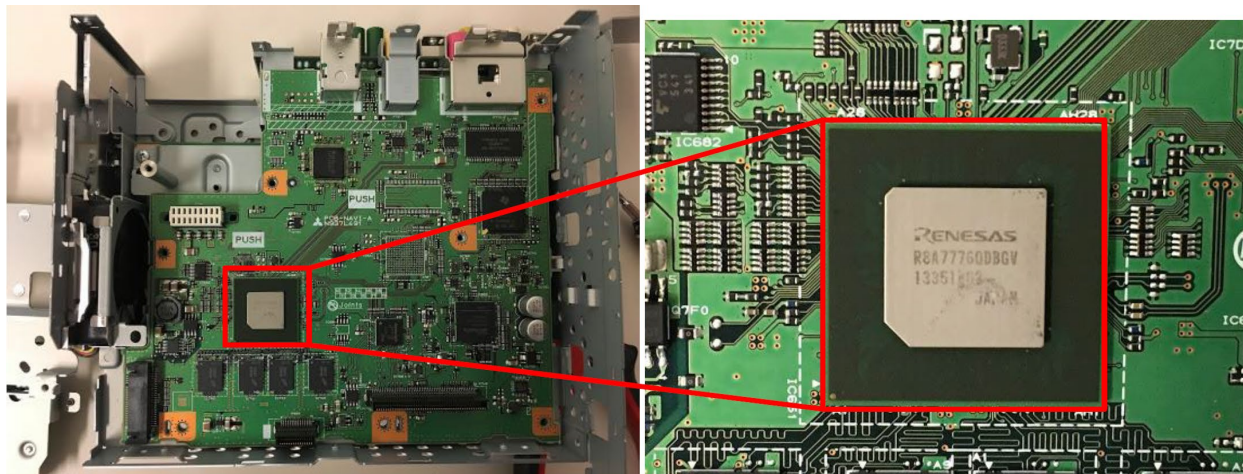*External view of a MELCO MDGMY10 Bluetooth Modul*

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[1] https://www.businesswire.com/news/home/20170103005847/en/Mitsubishi-Electric-Creates-Infotainment-Platform-with-LTE-Advanced-Connectivity-and-Driver-Assistance-Capabilities

Internal view of a MELCO MDGMY10 Bluetooth Module

External view of a MELCO NR-207 Head Unit

Internal view of a MELCO NR-207 Head Unit

19.   For example, on information and belief, MELCO makes, uses, sells, offers for sale, and imports products with Qualcomm SoCs, including the Snapdragon line of SoCs, and associated software, which can perform Dynamic Clock and Voltage Scaling ("DCVS").[2] According to Qualcomm, DCVS "is a technique used to adjust the frequency and voltage of the power equation to deliver the needed performance at the ideal power level." Additionally, the "CPU cores of Snapdragon processors lie on separate voltage and frequency planes. This allows each CPU core to hit independent frequencies and voltages, delivering scalable performance and power levels."[3] On information and belief, Qualcomm SoCs include a Thermal Engine that works with frequency and voltage scaling to "cap the maximum operating frequency of the CPU."[4] Qualcomm SoCs are incorporated into MELCO Accused Products, such as the FlexConnect infotainment system Smartphone. Qualcomm SoCs further calibrate the frequency of a processor, such as to adjust for

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[2] DCVS may alternately be referred to as Dynamic Frequency and Voltage Scaling ("DVFS")
[3] Power vs. Performance Management of the CPU, Qualcomm, (retrieved April 29, 2019), https://www.qualcomm.com/news/onq/2013/10/25/power-vs-performance-management-cpu
[4] Qualcomm Snapdragon 410E Processor APQ8016E System Power Overview, Qualcomm (retrieved April 29, 2019), https://developer.qualcomm.com/qfile/35136/lm80-p0436-73_a_qualcomm_snapdragon_410e_processor_apq8016e_system_power_overview.pdf&usg=AOvVaw2fQ9dLyNcd-8h3Rd_-vbbM

frequency drift due to temperature and voltage variations.[5] On information and belief, a processor writes adjustment values to a RAM and/or register file, the output of which is applied to an oscillator to maintain an operating point.[6]

20.   For example, on information and belief, MELCO makes, uses, sells, offers for sale, and imports products with Nvidia SoCs, including the Tegra line of SoCs, and associated software, which adjust a clock frequency based on variations in voltage and temperature. For example, Nvidia SoCs enable "GPU DVFS [] using the devfreq framework."[7] Upon information and belief, Nvidia SoCs further adjust for frequency drift by adjusting clock speeds based on variations in temperature and voltage.[8] According to NVIDIA, the DVFS "algorithm has very fine control over the frequency levels . . . ."[9] Additionally, "[d]uring period of low GPU utilization, GPU clocks and voltage can be dropped to lower levels to greatly reduce idle power consumption. When an incoming task is detected, the frequency and voltage levels are immediately increased to the appropriate operating values to ensure higher performance. The DVFS software intelligently raises the voltage and frequency only up to a level that is required to deliver the performance demanded by the application. . ."[10] On information and belief, Nvidia SoCs further calibrate clock speeds to compensate for frequency drift due to variations in temperature and voltage.

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[5] *See* https://developer.qualcomm.com/qfile/35466/lm80-p2751-5_c.pdf at 10
[6] *See id.* at 21.
[7]https://docs.nvidia.com/jetson/l4t/index.html#page/Tegra%20Linux%20Driver%20Package%20Development%20Guide/introduction.html; *see also* https://docs.nvidia.com/jetson/l4t/index.html#page/Tegra%20Linux%20Driver%20Package%20Development%20Guide/power_management_nano.html#
[8] *See* https://www.nvidia.com/en-us/geforce/forums/gaming-pcs/8/116552/ram-bandwidth-200-bclk-i3-MELCO-p7h55/
[9] https://www.nvidia.com/docs/IO/116757/Tegra_4_GPU_Whitepaper_FINALv2.pdf
[10] *Id.*
Power vs. Performance Management of the CPU, Qualcomm, (retrieved April 29, 2019), https://www.qualcomm.com/news/onq/2013/10/25/power-vs-performance-management-cpu

21.   For example, on information and belief, MELCO makes, uses, sells, offers for sale, and imports products with Amlogic SoCs, including the S905 line of SoCs, and associated hardware which adjust a clock frequency based on variations in voltage and temperature. For example, Amlogic SoCs calibrate clock speeds, such as to adjust for frequency drift due to temperature and voltage variations. On information and belief, a processor writes adjustment values to a RAM and/or register file, the output of which is applied to an oscillator to maintain an operating point. For example, the Amlogic S905 maintains a frequency tolerance of ±50 ppm at -20-85 °C by compensating for temperature and voltage swings (*e.g.*, VSWING values). For example, the Amlogic S905 further implements DVFS to set and maintain optimal operating frequencies, including to compensate for temperature and voltage variations.

4.6 Recommended Oscillator Electrical Characteristics

requires the 24MHz oscillator for generating the main clock source.

Symbol	Description	Min.	Typ.	Max.	Unit	Notes
F_o	Nominal Frequency		24		MHz	
$\Delta f/f_o$	Frequency Tolerance	-30		30	ppm	At 25 °C
		-50		50	ppm	At -20~85 °C

Power Management
- Multiple internal power domains controlled by software
- Multiple sleep modes for CPU, system, DRAM, etc.
- Multiple internal PLLs for DVFS operation
- Multi-voltage I/O design for 1.8V and 3.3V
- Power management auxiliary processor in a dedicated always-on (AO) power domain that can communicate with an external PMIC

Excerpts from Amlogic S905D Datasheet

22.   For example, on information and belief, MELCO makes, uses, sells, offers to sell, and imports products with Broadcom SoCs, such as Wireless LAN/Bluetooth Combo chips and

embedded processors, which adjust a clock frequency based on variations in voltage and temperature.   For example, Broadcom SoCs include "Adaptive Voltage Scaling" ("AVS") functionality which "also supports [dynamic frequency scaling] and DVFS mode."[11] Broadcom's AVS functionality adjusts a clock frequency based on at least variations in temperature and voltage.[12]   For example, Broadcom SoCs further include both hardware and software based "frequency drift compensation" which calibrates frequency based on variations in temperature and voltage.[13]   Broadcom SoCs further include an "advanced WLAN power management unit sequencer. The PMU sequencer provides significant power savings by putting the BCM43569 into various power management states appropriate to the current environment and activities that are being performed. The power management unit enables and disables internal regulators, switches, and other blocks based on a computation of the required resources and a table that describes the relationship between resources and the time needed to enable and disable them. Power up sequences are fully programmable. Configurable, free-running counters (running at 32.768 kHz LPO clock) in the PMU sequencer are used to turn on/turn off individual regulators and power switches. Clock speeds are dynamically changed (or gated altogether) for the current mode."[14] On information and belief, at least all 43xxx and 47xxx series Broadcom chips include and utilize WLAN power management units substantially similar to that of the BCM43569.

23.   For example, on information and belief, MELCO makes, uses sells, offers to sell, and imports products with Renesas SoCs which adjust a clock frequency based on variations in voltage and temperature. For example, Renesas R-Car-H3 SoCs include and utilize DVFS and

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[11] https://github.com/torvalds/linux/blob/master/drivers/cpufreq/brcmstb-avs-cpufreq.c
[12] *Id.*
[13] https://docs.broadcom.com/doc/12398471 at 2; *see also*
https://docs.broadcom.com/doc/1211168567832 at 8.
[14] https://www.cypress.com/file/310246/download at 20

Adaptive Voltage Scaling ("AVS") to set and maintain optimal operating frequencies, including to compensate for temperature and voltage variations. For example, on information and belief, Renesas R-Car-H3 SoCs calibrate clock speeds, such as to adjust for frequency drift due to temperature and voltage variations. On information and belief, a processor writes adjustment values to a RAM and/or register file, the output of which is applied to an oscillator to maintain an operating point.

R-Car Series, 3rd Generation   1.   Overview

1.2.7   Graphics Units

Item	Description
3D Graphics Engine (3DGE)	R-Car H3 ver3.0 • Imagination Technologies PowerVR Series6XT GX6650 • Max. Freq. 600 MHz • Drastically performance improvements for sophisticated graphics and GPU computer • Reducing power consumption even further through advanced power saving mechanisms • Lowest memory bandwidth in the industry with compression technologies • Ultra HD deep color GPU Support APIs: OpenGL ES 3.1, (OpenCL 1.2 EP) • 7.2Gpix/s 300Mpoly/s 288GFLOPS R-Car M3 ver1.0/ver3.0 • Imagination Technologies PowerVR Series 6XT GX6250 • Max. Freq. 700 MHz with DVFS control • Drastically performance improvements for sophisticated graphics and GPU computer • Reducing power consumption even further through advanced power saving mechanisms • Lowest memory bandwidth in the industry with compression technologies • Ultra HD deep color GPU Support APIs: OpenGL ES 3.1, (OpenCL 1.2 EP) • 2.8Gpix/s 350Mpoly/s 112GFLOPS

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(3)   Synchronization with the Grandmaster Clock

In situations requiring physical synchronization of the local clock with the Grandmaster clock, the fractional nanoseconds value (the 20 lower-order bits of the gPTP timer) is used to make the adjustment. Specifically, the increment value is finely adjusted to correct for deviations of the clock frequency from that of the Grandmaster clock.

Use the timer offset value (in the gPTP timer offset registers, GTOi.TOV) to correct for offsets from the theoretical value (at start-up, etc.). The sum of the timer value and the offset register is the "corrected timer" value.

Note that for the nanoseconds part of the Offset register GTOi.TOV[31:0] should be below 10^9.

The following equation gives a method of calculating the increment (GTI.TIV) from the frequency of the gPTP clock and its deviation from that of the Grandmaster clock. Variable d is the deviation (d = 10^{-6} for 1 ppm).

$$GTI.TIV = round\left(\frac{2^{20}\ GHz}{f_{GPTP}} \times (1 + d)\right)$$

After adjusting for the current deviation of clock frequency, reset the gPTP timer increment register (GTI.TIV).

After calculating the new offset value, reset the gPTP timer offset register (GTOi.TOV).

Table 54.1   Pin Configuration

Signal Name	Signal Conforming to PCI Standard	I/O	Description	Third Generation R-Car Series Products	
				R-Car H3 ver3.0	R-Car M3 ver1.0/ver3.0
PCIE*n*_CLK_P PCIE*n*_CLK_M (*n* = 0, 1)	REFCLK+ REFCLK-	Input	Reference clock inputs to the PLL incorporated in the PCIE Controller module (differential inputs). 100-MHz clock should be applied.	√	√
PCIE*n*_TX*m*_P PCIE*n*_TX*m*_M (*n* = 0, 1 ; *m* = blank)	PETp0 PETn0	Output	Transmit data pins used by a physical module, where 2.5- or 5.0-GHz signals are propagated. (Differential output)	√	√
PCIE*n*_RX*m*_P PCIE*n*_RX*m*_M (*n* = 0, 1 ; *m* = blank)	PERp0 PERn0	Input	Receive data pins used by a physical module, where 2.5- or 5.0-GHz signals are propagated. (Differential input)	√	√
PCIE*n*_RESREF (*n* = 0, 1)	—	InOut	Reference Resistor Connection Attach a 200-Ω ±1% ±100 ppm/°C precision resistor-to-ground on the board.	√	√

Excerpt from Renesas R-Car H3 / M3 User's Manual: Hardware

24.   The '843 and '171 Patents (the "Chou Patents") generally describe methods and apparatuses to present an output signal having a frequency from an oscillator, including and/or utilizing (i) a reference signal, (ii) a control signal and (iii) the output signal. The technology was developed by Richard Chou, Pidugu L. Narayana, and Paul H. Scott. In some embodiments of the

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invention, a logic circuit may be configured to present the control signal in response to (i) the

output signal and (ii) the reference signal. For example, the logic circuit may disable the oscillator

when the output signal oscillates outside a predetermined range. In some embodiments of the

invention, the oscillator may be implemented as a phase-locked loop (PLL) with reference signal

or as a voltage-controlled oscillator (VCO). The signal may prevent the VCO from "running"

away by maintaining the frequency of the oscillation of the signal VCO_OUT within a number of

predefined criteria that may avoid the runaway condition. These techniques are incorporated into

integrated circuits ("ICs") and software utilized in MELCO Accused Products. For example, this

functionality is included and utilized in Qualcomm System-on-a-Chips ("SoCs") used in MELCO

Accused Products, such as the Snapdragon 820Am included in the MELCO FlexConnect

infotainment system.[15] For example, this functionality is included and utilized in Renesas SoCs

used in MELCO Accused Products, such as the Renesas R8A77233 included in the MELCO

MDGMY10 Bluetooth Hands Free Module, and the Renesas R8A77760DBGV included in the

MELCO NR-207 head unit. On information and belief MELCO Accused Products, such as

automobiles and infotainment systems, further comprise Nvidia, Broadcom, and Amlogic SoCs

that include and utilize this functionality.

      25.   For example, on information and belief, MELCO makes, uses, sells, offers for sale,

and imports products using Qualcomm, Broadcom, Amlogic, Renesas, and Nvidia SoCs with

"watchdog" functionality that infringes the Chou Patents. For example, the MELCO Accused

Products use Linux-based SoCs that implement watchdog functionality through hardware (*e.g.,* a

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[15] https://www.businesswire.com/news/home/20170103005847/en/Mitsubishi-Electric-Creates-Infotainment-Platform-with-LTE-Advanced-Connectivity-and-Driver-Assistance-Capabilities *See also* https://www.qualcomm.com/news/releases/2019/01/07/qualcomm-announces-multi-tiered-3rd-generation-snapdragon-automotive

hardware circuit corresponding with a device node in a /dev/watchdog directory), and software (*e.g.,* a kernel timer in a /dev/watchdog directory and/or other platform-specific implementations).[16]

26.   For example, the PLLs and Clocks of Qualcomm Snapdragon SoCs include watchdog timers, and further include configurable Watchdog timer disable inputs.[17]   Qualcomm SoCs implement watchdog functionality through hardware and software to disable oscillators, such as a CPU oscillator in a runaway state:

2.4 watchdogWorking diagram

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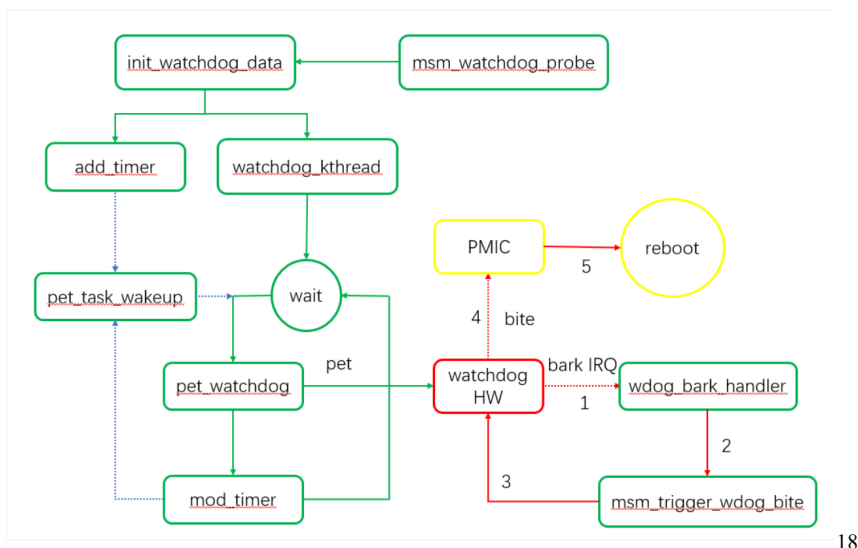
27.   For example, Nvidia SoCs include watchdog functionality that "when turned on, has a timer that starts decrementing . . . When the timeout condition occurs, the WDT1 hardware

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[16] https://www.programmersought.com/article/16015070422/;
https://www.programmersought.com/article/96024752062/#:~:text=Watchdog%20is%20mainly%20used%20in,CPU%20runaway%2C%20etc.);
https://www.programmersought.com/article/42626850394/
[17] Ex. F at 25, 66.
18
https://www.programmersought.com/article/96024752062/#:~:text=Watchdog%20is%20mainly%20used%20in,CPU%20runaway%2C%20etc.)

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sends a reset signal to the CPU that causes it to reset."[19]   The reset signal comprises a control

signal in response to an output signal (*e.g.,* an oscillation frequency) and a reference signal (*e.g.* a

reference clock frequency):

Watchdog Timer Controller Settings

These settings specify watchdog timer controller register values. These values will be configured by MB1.

Field	Description	Configuration Example
bpmp_wdtcr	Contains the bpmp processer watchdog timer register value	wdt.bpmp_wdtcr = 0x710640; configures for 100sec
Sce_wdtcr	Contains the SCE processer watchdog timer register value	wdt.sce_wdtcr = 0x707103;
aon_wdtcr	Contains aon's watchdog timer register value	wdt.aon_wdtcr = 0x700000;
rtc2_ao_wdtcr	Contains rtc2_ao watchdog timer register value	wdt.rtc2_ao_wdtcr = 0x700000;
top_wdt0_wdtcr	Contains top_wdt0 watchdog timer register value	wdt.top_wdt0_wdtcr = 0x715016;
top_wdt1_wdtcr	Contains top_wdt1 watchdog timer register value	wdt.top_wdt1_wdtcr = 0x710640;
top_wdt2_wdtcr	Contains top_wdt2 watchdog timer register value	wdt.top_wdt2_wdtcr = 0x707103;

[20]

28.   For example, upon information and belief, the Broadcom 43xxx series WiFi SoCs

include and utilize at least an external reference clock and a low power oscillator to implement

watchdog functionality, such as by comparing an output signal to a reference clock, and activing

a control signal when certain parameters are violated. [21]   For example, similar Broadcom chips

used in Android devices further implement watchdog functionality as described above.[22]

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[19]

https://docs.nvidia.com/drive/active/5.1.0.2L/nvvib_docs/index.html#page/DRIVE_OS_Linux_S
DK_Development_Guide/Interfaces/WDT.html

[20]

https://docs.nvidia.com/jetson/l4t/index.html#page/Tegra%20Linux%20Driver%20Package%20
Development%20Guide/mb1_platform_config_tx2.html

[21] *See e.g.* https://www.cypress.com/file/310246/download at 23-25.

[22] https://android.googlesource.com/kernel/bcm/+/android-wear-
5.0.2_r0.5/drivers/watchdog/Kconfig

29.   For example, on information and belief, Amlogic SoCs, such as the Amlogic S905, include watchdog software and hardware to reset or disable a clock that fails to reset the watchdog timer, such as during oscillator runaway:

6.11.3 Watchdog Timer

There are also two watchdog timers, one in AO and the other in EE domain, illustrated as following:
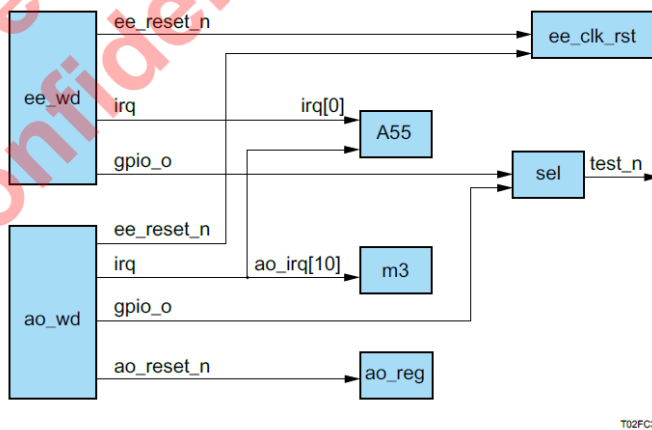
Figure 6-28 EE domain Watchdog Timer Degisn
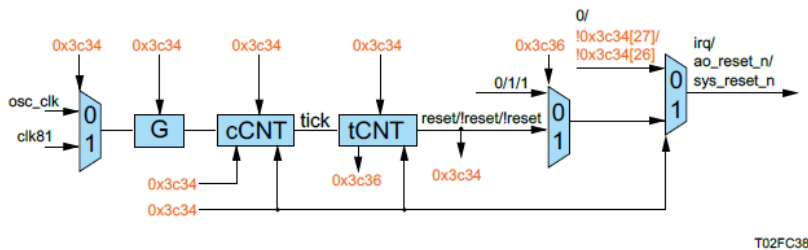
Excerpts from Amlogic S905D Datasheet

30.   For example, Renesas SoCs, such as the R-Car H3, include watchdog hardware and software to reset or disable a clock that fails to reset the watchdog timer, such as during oscillator runaway. For example, the R-Car H3 includes a reference clock (*e.g.* RCLK) watchdog which can disable and/or reset a clock when the watchdog overflows (*e.g.* during oscillator runaway).

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77. RCLK Watchdog Timer (RWDT)

R-Car H3 ver3.0

R-Car M3 ver1.0   R-Car M3 ver3.0

77.1   Overview

This LSI includes the RCLK watchdog timer (RWDT).

This LSI can be reset by the overflow of the counter when the value of the counter has not been updated because of a system runaway.

The RWDT is a single-channel timer that uses the RCLK as an input and can be used as a watchdog timer. RCLK is a clock, which is generated by the clock pulse generator (CPG).

Frequency of RCLK:

— R-Car H3 ver3.0: Select from 32.89 kHz and 32.55 kHz
— R-Car M3 ver1.0/ver3.0: Select from 32.89 kHz and 32.55 kHz

77.1.1   Features

• One channel is provided.
• Can be used as a watchdog timer. Reset is generated when the counter overflows.
• A counter input clock can be chosen from:
  Clocks (RCLK/1 to RCLK/ $(128 \times 60 \times 30)$) that are obtained by dividing the RCLK.

77.1.2   Block Diagram

Figure 77.1 shows block diagrams of the RWDT.
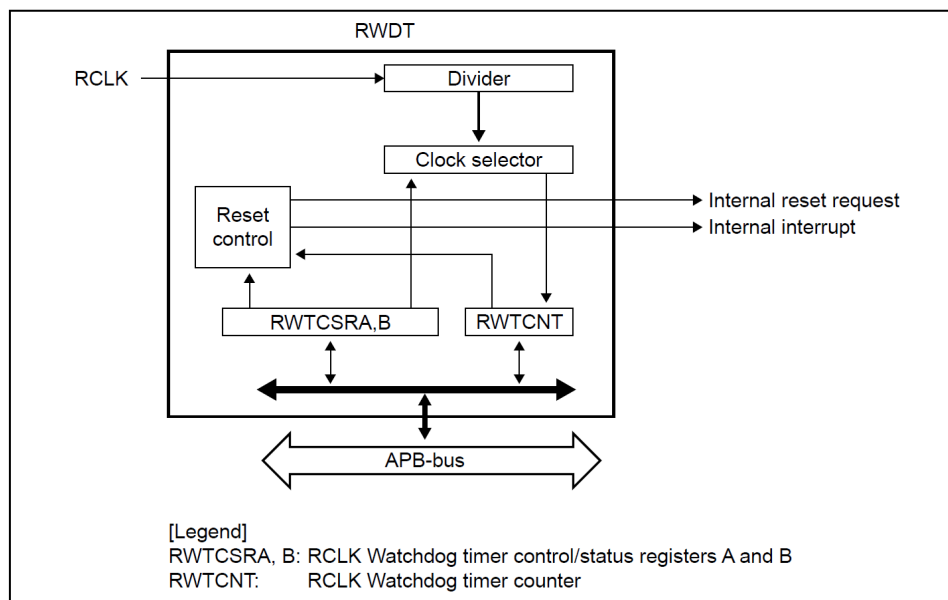

Figure 77.1   Block Diagram of RWDT

Excerpt from Renesas R-Car H3 / M3 User's Manual: Hardware

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31.   MELCO has infringed and is continuing to infringe the '259, '557, '401, '843, and '171 Patents (the "Asserted Patents") by making, using, selling, offering to sell, and/or importing, and by actively inducing others to make, use, sell, offer to sell, and/or importing, products that utilize semiconductors including, but not limited to, Qualcomm, Broadcom, Amlogic, and Nvidia ICs (the "Accused Products"). The Accused Products infringe the Norman and Chou Patents at least because they include ICs such as all versions, generations, and models of Snapdragon series chips (*e.g.,* MSM7xxx, MSM8xxx, SDM6xx, SDM8xx, APQ8xxx), Qualcomm series mobile platform chips (*e.g.,* QSC4xx, QSC6xxx), Qualcomm/Atheros wireless/Bluetooth series chips (*e.g.,* QCA4xxx, QCA6xxx, QCA9xxx, WCN3xxx, IPQ8xxx, CSR1xxx, QCC5xxx, QCC3xxx), and Qualcomm Smart Audio series chips (*e.g.,* QSC2xx, QSC4xx) Smart Audio ("Exemplary Qualcomm SoCs"), Broadcom SoCs such as, but not limited to, all versions, generations and models of BCM Bluetooth SoCs (*e.g.,* BCM20xx), BCM GNSS/GPS SoCs (*e.g.,* BCM477x, BCM477xx), BCM Wireless LAN/Bluetooth Combo chips (*e.g.,* BCM43xxx, BCM43xx), BCM embedded processors (*e.g.,* BCM11xx, BCM11xxx), Broadcom Communications Processors (*e.g.,* BCM587xx, BCM58xx, BCM5301x, XLPxxx), Broadcom Knowledge-Based Processors (*e.g.,* BCM15K, NL/NLAxxxx/xxxxx), Broadcom Multicore Processors (*e.g.,* XLSxxx), Broadcom Ethernet Network Adapters, Stingray SmartNIC Adapters and IC ("Exemplary Broadcom SoCs"); all NVIDIA SoCs such as, but not limited to, all versions, generations, and models of Tegra series chips (*e.g.,* Tegra APX, Tegra 6xx, Tegra 2, Tegra 3, Tegra 4, Tegra K1, Tegra X1) ("Exemplary Nvidia SoCs"), and all Amlogic SoCs such as, but not limited to, all versions, generations, and models of the AML8726, M8, T8, T9, S8, and S9 families ("Exemplary Amlogic SoCs"), and all Renesas SoCs such as, but not limited to, all versions, generations and models of R-Car, RH850, RA, R8, RZ, RL78, RX, RH8509, and Synergy branded MCUs ("Exemplary Renesas SoCs").

32.   M-Red has at all times complied with the marking provisions of 35 U.S.C. § 287 with respect to the Patents-in-Suit. On information and belief, prior assignees and licensees have also complied with the marking provisions of 35 U.S.C. § 287.

COUNT I
(Infringement of the '259 Patent)

33.   Paragraphs 1 through 31 are incorporated by reference as if fully set forth herein.

34.   M-Red has not licensed or otherwise authorized MELCO to make, use, offer for sale, sell, or import any products that embody the inventions of the '259 Patent.

35.   MELCO has and continues to directly infringe the '259 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '259 Patent. Upon information and belief, MELCO Accused Products include Qualcomm SoCs, such as the MELCO FlexConnect infotainment system incorporating a Qualcomm SoC such as the Exemplary Qualcomm SoCs.

36.   For example, MELCO has and continues to directly infringe at least claim 1 of the '259 Patent by making, using, offering to sell, selling, and/or importing into the United States products that include an apparatus to compensate for voltage and temperature variations on an integrated circuit, such as, for example, the thermal controller components and associated software utilized with the Accused Products such as MELCO Accused Products that incorporate Exemplary Qualcomm SoCs. The Exemplary Qualcomm SoCs, such as the SoCs utilized in the MELCO FlexConnect infotainment system includes a voltage sensor. The Exemplary Qualcomm SoCs each operate at different voltages and frequencies and dynamically adjust these voltages and frequencies based on outputs from sensors.

37.   MELCO has and continues to directly infringe at least claim 1 of the '259 Patent by making, using, offering to sell, selling, and/or importing into the United States products that include an apparatus to compensate for voltage and temperature variations on an integrated circuit, comprising: a voltage sensor having a digital voltage output; a temperature sensor having a digital temperature output; a register coupled to the voltage sensor and the temperature sensor, the register adapted to concatenate the digital voltage output and the temperature output into an address output; and a memory device having an address input coupled to the address output of the register, the memory device being adapted to store one or more corrective vectors.

38.   On information and belief, the MELCO Accused Products include SoCs that include a voltage sensor having a voltage output, and a temperature sensor having a temperature output. For example, on information and belief, the Qualcomm SoC used in the MELCO FlexConnect infotainment system includes a voltage sensor. For example, the Exemplary Qualcomm SoCs, each include one or more temperature and voltage sensors that provide outputs stored in one or more registers.

39.   On information and belief, the Qualcomm SoCs used in the MELCO FlexConnect infotainment system include a register coupled to the voltage sensor and the temperature sensor, the register adapted to concatenate the voltage output and the temperature output into an address output. On information and belief, the Qualcomm SoC used in the MELCO FlexConnect infotainment system includes one or more registers including registers that store voltage and temperature information related to the performance of the temperature sensors, the thermal controller, and the voltage states of the SoC and its cores. For example, upon information and belief, the one or more registers of the Exemplary Qualcomm SoCs are adapted to combine the

digital voltage and temperature in order to determine whether to alter the performance of the processor.

40.   On information and belief, the Qualcomm SoCs used in the MELCO FlexConnect infotainment system include a memory device having an address input coupled to the address output of the register, the memory device being adapted to store one or more corrective vectors. On information and belief, the Qualcomm SoC used in the MELCO FlexConnect infotainment system includes RAM, cache memory, and buffer memory to store corrective vectors, such as commands to increase or decrease the frequency and/or voltage of the SoC via, such as by implementing dynamic voltage and frequency scaling (DVFS), and/or by compensating for clock drift. For example, the Exemplary Qualcomm SoCs each includes a "dynamic GPU clock and voltage scaling"[23] functionality that is used to "lower or raise the voltage when performance changes are made to the core."[24]

41.   Upon information and belief, and as discussed above, MELCO Accused Products including the Exemplary Broadcom SoCs, Exemplary Amlogic SoCs, Exemplary Renesas SoCs, and Exemplary Nvidia SoCs practice the claimed limitations of the '259 Patent in a substantially similar manner to MELCO Accused Products including the Exemplary Qualcomm SoCs.

42.   MELCO has and continues to indirectly infringe one or more claims of the '259 Patent by knowingly and intentionally inducing others, including MELCO customers and end users of the MELCO Accused Products and products that include the Accused Products, to directly

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[23] https://www.qualcomm.com/media/documents/files/qualcomm-snapdragon-400-product-brief.pdf

[24] Qualcomm Snapdragon 410E Processor APQ8016E System Power Overview, Qualcomm (retrieved April 29, 2019), https://developer.qualcomm.com/qfile/35136/lm80-p0436-73_a_qualcomm_snapdragon_410e_processor_apq8016e_system_power_overview.pdf&usg=AOvVaw2fQ9dLyNcd-8h3Rd_-vbbM

infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the MELCO FlexConnect infotainment system incorporating a Qualcomm SoC such as the Exemplary Qualcomm SoCs.

43.   MELCO, with knowledge that these products, or the use thereof, infringes the '259 Patent at least as of the date of this Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '259 Patent by providing these products to customers and ultimately to end users for use in an infringing manner in the United States including, but not limited to, end users of products that incorporate MELCO Accused Products.

44.   MELCO induced infringement by others, including end users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end users, infringe the '259 Patent, but while remaining willfully blind to the infringement.

45.   M-Red has suffered damages as a result of MELCO's direct and indirect infringement of the '259 Patent in an amount to be proved at trial.

46.   M-Red has suffered, and will continue to suffer, irreparable harm as a result of MELCO's infringement of the '259 Patent, for which there is no adequate remedy at law, unless MELCO's infringement is enjoined by this Court.

COUNT II
(Infringement of the '557 Patent)

47.   Paragraphs 1 through 31 are incorporated by reference as if fully set forth herein.

48.   M-Red has not licensed or otherwise authorized MELCO to make, use, offer for sale, sell, or import any products that embody the inventions of the '557 Patent.

49.   MELCO has and continues to directly infringe the '557 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '557 Patent. Upon information and belief, these products include MELCO SoCs and products that incorporate MELCO SoCs, including at least the Exemplary MELCO SoCs, which are sold in the United States and incorporated by others into products sold in the United States. Upon information and belief, these products further include MELCO Accused Products incorporating Qualcomm SoCs, including at least the MELCO FlexConnect infotainment system incorporating a Qualcomm SoC such as the Exemplary Qualcomm SoCs.

50.   For example, MELCO has and continues to directly infringe at least claim 1 of the '557 Patent by making, using, offering to sell, selling, and/or importing into the United States products that include an integrated circuit comprising a voltage sensor having a voltage input; a temperature sensor having a temperature input; and a memory capable of receiving an input address based upon the voltage output and the temperature output, the memory configured to store compensation data. On information and belief, such integrated circuits include, by way of example, the Accused Products that include thermal controller components and associated software such as the Exemplary MELCO SoCs, products that incorporate the Exemplary MELCO SoCs, and MELCO Accused Products that incorporate Exemplary Qualcomm SoCs. For example, the Accused Products operate at different voltages and frequencies and dynamically adjust these voltages and frequencies based on outputs from sensors. On information and belief, such integrated circuits include, by way of example, Qualcomm SoCs included in MELCO Accused Products such as the MELCO FlexConnect infotainment system that include thermal controller

components and associated software, such as the Exemplary Qualcomm SoCs. For example, Qualcomm SoCs operate at different voltages and frequencies and dynamically adjust these voltages and frequencies based on outputs from sensors.

51.   On information and belief, the MELCO Accused Products include a voltage sensor having a voltage output, and a temperature sensor having a temperature output. For example, on information and belief, the Qualcomm SoCs used in MELCO Accused Products such as the Exemplary Qualcomm SoCs utilized in the MELCO FlexConnect infotainment system, include one or more temperature and voltage sensors that provide outputs.

52.   On information and belief, the MELCO Accused Products further include storage capable of receiving an input address based upon the voltage output and the temperature output, the memory configured to store compensation data. For example, on information and belief, the Qualcomm SoCs used in MELCO Accused Products, such as the Exemplary Qualcomm SoCs utilized in the MELCO FlexConnect infotainment system, include RAM, cache memory, and buffer memory capable of receiving an input address based upon the voltage output and temperature output, and are configured to store compensation data, such as commands to increase or decrease the frequency and/or voltage of the SoCs. For example, the Qualcomm SoCs incorporated in the Accused Products each include "Thermal Engine" functionality that works with frequency and voltage scaling to "cap the maximum operating frequency of the CPU."[25]

53.   Upon information and belief, and as discussed above, MELCO Accused Products including the Exemplary Broadcom SoCs, Exemplary Amlogic SoCs, Exemplary Renesas SoCs,

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[25] Qualcomm Snapdragon 410E Processor APQ8016E System Power Overview, Qualcomm (retrieved April 29, 2019), https://developer.qualcomm.com/qfile/35136/lm80-p0436-73_a_qualcomm_snapdragon_410e_processor_apq8016e_system_power_overview.pdf&usg=A OvVaw2fQ9dLyNcd-8h3Rd_-vbbM

and Exemplary Nvidia SoCs practice the claimed limitations of the '557 Patent in a substantially similar manner to MELCO Accused Products including the Exemplary Qualcomm SoCs.

54.   MELCO has and continues to indirectly infringe one or more claims of the '557 Patent by knowingly and intentionally inducing others, including MELCO customers and end users of the Accused Products and products that include the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling, and/or importing into the United States products that include infringing technology, such as the MELCO FlexConnect infotainment system incorporating a Qualcomm SoC such as the Exemplary Qualcomm SoCs.

55.   MELCO, with knowledge that these products, or the use thereof, infringe the '557 Patent at least as of the date of this Complaint, knowingly and intentionally induced, and continues to knowingly and intentionally induce, direct infringement of the '557 Patent by providing these products to customers and ultimately to end users for use in an infringing manner in the United States including, but not limited to, end users of products that incorporate MELCO Accused Products.

56.   MELCO induced infringement by others, including end users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end users, infringe the '557 Patent, but while remaining willfully blind to the infringement.

57.   M-Red has suffered damages as a result of MELCO's direct and indirect infringement of the '557 Patent in an amount to be proved at trial.

58.   M-Red has suffered, and will continue to suffer, irreparable harm as a result of MELCO's infringement of the '557 Patent, for which there is no adequate remedy at law, unless MELCO's infringement is enjoined by this Court.

<div align="center">

COUNT III
(Infringement of the '401 Patent)

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59.   Paragraphs 1 through 31 are incorporated by reference as if fully set forth herein.

60.   M-Red has not licensed or otherwise authorized MELCO to make, use, offer for sale, sell, or import any products that embody the inventions of the '401 Patent.

61.   MELCO has and continues to directly infringe the '401 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '401 Patent. Upon information and belief, these products include MELCO SoCs and products that incorporate MELCO SoCs, including at least the Exemplary MELCO SoCs, which are sold in the United States and incorporated by others into products sold in the United States. Upon information and belief, these products further include MELCO Accused Products incorporating Qualcomm SoCs, including at least the MELCO FlexConnect infotainment system incorporating a Qualcomm SoC such as the Exemplary Qualcomm SoCs.

62.   For example, MELCO has and continues to directly infringe at least claim 1 of the '401 Patent by making, using, offering to sell, selling, and/or importing into the United States products that include an integrated circuit comprising: a voltage sensor having a voltage output; a temperature sensor having a temperature output; an analog-to-digital converter ("ADC") coupled to the voltage sensor and the temperature sensor, the ADC to convert the voltage output and the temperature output to digital values; and a storage coupled to receive an input address based upon

at least one of the voltage output and temperature output, the storage configured to store compensation data, for example, the thermal controller components and associated software utilized with the MELCO Accused Products, such as the Exemplary MELCO SoCs, products that incorporate the Exemplary MELCO SoCs, and MELCO Accused Products that incorporate Exemplary Qualcomm SoCs. For example, on information and belief, the Exemplary Qualcomm SoCs each includes a voltage sensor having a digital voltage output. For example, the Exemplary Qualcomm SoCs incorporated in MELCO Accused Products operate at different voltages and frequencies and dynamically adjust these voltages and frequencies based on outputs from sensors.

63.   On information and belief, the Qualcomm SoCs used in the MELCO FlexConnect infotainment system include a voltage sensor having a voltage output, and a temperature sensor having a temperature output. For example, on information and belief, Qualcomm SoCs such as the Exemplary Qualcomm SoCs, incorporated in the MELCO FlexConnect infotainment system, include one or more temperature and voltage sensors that provide outputs.

64.   On information and belief, the Qualcomm SoCs used in the MELCO FlexConnect infotainment system include an analog-to-digital converter coupled to the voltage sensor and the temperature sensor, the ADC to convert the voltage output and the temperature output to digital values. For example, on information and belief, Qualcomm SoCs such as the Exemplary Qualcomm SoCs, incorporated in the MELCO FlexConnect infotainment system, include sensors which output analog signals which are converted to digital signals prior to storage.

65.   On information and belief, the Qualcomm SoCs incorporated in the MELCO FlexConnect infotainment system further include a storage capable of receiving an input address based upon the voltage output and the temperature output, the memory configured to store compensation data. For example, on information and belief, Qualcomm SoCs such as the

Exemplary Qualcomm SoCs, incorporated in the MELCO FlexConnect infotainment system, include ram, cache memory, and buffer memory capable of receiving an input address based upon the voltage output and temperature output, and are configured to store compensation data, such as commands to increase or decrease the frequency and/or voltage of the SoC. For example, the Qualcomm SoCs incorporated in MELCO Accused Products each include "Thermal Engine" functionality that works with frequency and voltage scaling to "cap the maximum operating frequency of the CPU."[26]

66.   Upon information and belief, and as discussed above, MELCO Accused Products including the Exemplary Broadcom SoCs, Exemplary Amlogic SoCs, Exemplary Renesas SoCs, and Exemplary Nvidia SoCs practice the claimed limitations of the '401 Patent in a substantially similar manner to MELCO Accused Products including the Exemplary Qualcomm SoCs.

67.   MELCO has and continues to indirectly infringe one or more claims of the '401 Patent by knowingly and intentionally inducing others, including MELCO customers and end users of the MELCO Accused Products and products that include the Accused Products, to directly infringe, either literally or under the doctrine of equivalents, by making, using, offering to sell, selling and/or importing into the United States products that include infringing technology, such as the MELCO FlexConnect infotainment system incorporating a Qualcomm SoC such as the Exemplary Qualcomm SoCs.

68.   MELCO, with knowledge that these products, or the use thereof, infringes the '401 Patent at least as of the date of this Complaint, knowingly and intentionally induced, and continues

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[26] Qualcomm Snapdragon 410E Processor APQ8016E System Power Overview, Qualcomm (retrieved April 29, 2019), https://developer.qualcomm.com/qfile/35136/lm80-p0436-73_a_qualcomm_snapdragon_410e_processor_apq8016e_system_power_overview.pdf&usg=AOvVaw2fQ9dLyNcd-8h3Rd_-vbbM

to knowingly and intentionally induce, direct infringement of the '401 Patent by providing these products to customers and ultimately to end users for use in an infringing manner in the United States including, but not limited to, end users of products that incorporate MELCO Accused Products.

69.   MELCO induced infringement by others, including end users, with the intent to cause infringing acts by others or, in the alternative, with the belief that there was a high probability that others, including end users, infringe the '401 Patent, but while remaining willfully blind to the infringement.

70.   M-Red has suffered damages as a result of MELCO's direct and indirect infringement of the '401 Patent in an amount to be proved at trial.

71.   M-Red has suffered, and will continue to suffer, irreparable harm as a result of MELCO's infringement of the '401 Patent, for which there is no adequate remedy at law, unless MELCO's infringement is enjoined by this Court.

COUNT IV
(Infringement of the '843 Patent)

72.   Paragraphs 1 through 31 are incorporated by reference as if fully set forth herein.

73.   M-Red has not licensed or otherwise authorized MELCO to make, use, offer for sale, sell, or import any products that embody the inventions of the '843 Patent.

74.   MELCO has and continues to directly infringe the '843 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '843 Patent. Upon information and belief, these products include at least the MELCO Accused Products incorporating Qualcomm, Nvidia, and/or

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Broadcom SoCs, such as at least the MELCO FlexConnect infotainment system incorporating the Exemplary Qualcomm SoCs.

75.   For example, MELCO has and continues to directly infringe at least claim 1 of the '843 Patent by making, using, offering to sell, selling, and/or importing into the United States products that include an apparatus comprising: an oscillator circuit configured to present an output signal having a frequency in response to (i) a reference signal, (ii) a control signal and (iii) said output signal; and a logic circuit configured to present said control signal to a phase frequency detector in response to (i) said output signal and (ii) said reference signal.

76.   For example, the MELCO Accused Products comprise an oscillator circuit configured to present an output signal having a frequency, such as a processor, a clock, and/or a phase-locked loop of an SoC.

77.   For example, the Accused Products output a frequency, such as from a processor, a clock, and/or a phase-locked loop of an SoC based on a reference signal (*e.g.,* a reference clock), a control signal (*e.g.,* a watchdog signal), and said output signal.

78.   For example, the Accused Products further comprise a logic circuit, such as a logic circuit of a phase locked loop, configured to present a watchdog signal to a phase frequency detector in response to an output signal and reference signal, such as when a difference between the output signal and reference signal exceeds a parameter.

79.   Upon information and belief, and as discussed above, MELCO Accused Products including the Exemplary Broadcom SoCs, Exemplary Amlogic SoCs, Exemplary Renesas SoCs, and Exemplary Nvidia SoCs practice the claimed limitations of the '843 Patent in a substantially similar manner to MELCO Accused Products including the Exemplary Qualcomm SoCs.

80.   M-Red has suffered damages as a result of MELCO's direct infringement of the '843 Patent in an amount to be proved at trial.

COUNT V
(Infringement of the '171 Patent)

81.   Paragraphs 1 through 31 are incorporated by reference as if fully set forth herein.

82.   M-Red has not licensed or otherwise authorized MELCO to make, use, offer for sale, sell, or import any products that embody the inventions of the '171 Patent.

83.   MELCO has and continues to directly infringe the '171 Patent, either literally or under the doctrine of equivalents, without authority and in violation of 35 U.S.C. § 271, by making, using, offering to sell, selling, and/or importing into the United States products that satisfy each and every limitation of one or more claims of the '171 Patent. Upon information and belief, these products include at least the MELCO Accused Products incorporating Qualcomm, Nvidia, and/or Broadcom SoCs, such as at least the MELCO FlexConnect infotainment system incorporating the Exemplary Qualcomm SoCs.

84.   For example, MELCO has and continues to directly infringe at least claim 1 of the '171 Patent by making, using, offering to sell, selling, and/or importing into the United States products that include a circuit comprising: an oscillator circuit having (i) first, second and third input terminals and (ii) an output terminal coupled to the second input terminal; and a logic circuit configured to present a control signal to a phase frequency detector, the logic circuit having (i) input terminals coupled to the first and second input terminals of said oscillator circuit, respectively, (ii) a counter circuit coupled to the first and second input terminals of said oscillator circuit input terminals, and (iii) a first decoder circuit coupled to the counter circuit through a first plurality of terminals and having a first output terminal coupled to the third input terminal of said oscillator circuit.

85.   For example, upon information and belief, the MELCO Accused Products comprise an SoC with a processor, PLL, and/or clock that comprises a first, second, and third input terminal, such as input terminals of a phase frequency detector, logic trap, and/or a divider.

86.   For example, upon information and belief, the Accused Products comprise an SoC with an output terminal coupled to the first and second input terminals, such as a frequency output (*e.g.* VCO_OUT), coupled to a plurality of divider and/or phase frequency detector inputs.

87.   For example, upon information and belief, the Accused Products comprise an SoC with a logic circuit (*e.g.* a watchdog circuit) configured to present a control signal (*e.g.* a reset signal) to a phase frequency detector. Upon information and belief, the watchdog circuit has input terminals coupled to the first and second input terminals of the oscillator circuit (*e.g.* clock, PLL, and/or processor), such as the divider and phase frequency detector circuits of the oscillator circuit.

88.   For example, upon information and belief, the watchdog circuit of the MELCO Accused Products further comprises a counter coupled to the first and second input terminals of the oscillator circuit, and a decoder circuit coupled to the counter circuit having a first output terminal coupled to the third input terminal of said oscillator circuit.

89.   For example, the Accused Products comprise an oscillator circuit configured to present an output signal having a frequency, such as a processor, a clock, and/or a phase-locked loop of an SoC.

90.   For example, the Accused Products output a frequency, such as from a processor, a clock, and/or a phase-locked loop of an SoC based on a reference signal (*e.g.*, a reference clock), a control signal (*e.g.,* a watchdog signal), and said output signal.

91.   For example, The Accused Products further comprise a logic circuit, such as a logic circuit of a phase locked loop, configured to present a watchdog signal to a phase frequency

detector in response to an output signal and reference signal, such as when a difference between the output signal and reference signal exceeds a parameter.

92.   Upon information and belief, and as discussed above, MELCO Accused Products including the Exemplary Broadcom SoCs, Exemplary Amlogic SoCs, Exemplary Renesas SoCs, and Exemplary Nvidia SoCs practice the claimed limitations of the '171 Patent in a substantially similar manner to MELCO Accused Products including the Exemplary Qualcomm SoCs.

93.   M-Red has suffered damages as a result of MELCO's direct infringement of the '171 Patent in an amount to be proved at trial.

DEMAND FOR JURY TRIAL

Plaintiff hereby demands a jury for all issues so triable.

PRAYER FOR RELIEF

WHEREFORE, M-Red prays for relief against MELCO as follows:

a.   Entry of judgment declaring that MELCO has directly and/or indirectly infringed one or more claims of each Asserted Patent;

b.   Entry of judgment declaring that MELCO's infringement of the Asserted Patents is willful;

c.   An order awarding damages sufficient to compensate M-Red for MELCO's infringement of the Patents-in-Suit, but in no event less than a reasonable royalty, including supplemental damages post-verdict, together with pre-judgment and post-judgment interest and costs;

d.   Enhanced damages pursuant to 35 U.S.C. § 284;

e.   Entry of judgment declaring that this case is exceptional and awarding M-Red its costs and reasonable attorney fees under 35 U.S.C. § 285;

f.   An accounting for acts of infringement;

g.   Such other equitable relief which may be requested and to which the Plaintiff is

entitled; and

h.   Such other and further relief as the Court deems just and proper.

Dated: March 5, 2021   Respectfully submitted,

                                      /s/ Alfred R. Fabricant
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                                      ATTORNEYS FOR PLAINTIFF
                                       M-RED INC.

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