

141-TRC-21-002

**SAFETY COMPLIANCE TESTING FOR FMVSS141
Minimum Sound Requirements for Hybrid and Electric Vehicles**

Tesla, Inc.
2022 Tesla Model 3
NHTSA No. C20224500

TRANSPORTATION RESEARCH CENTER INC.
10820 State Route 347
East Liberty, Ohio 43319



May 12, 2022

FINAL TEST REPORT

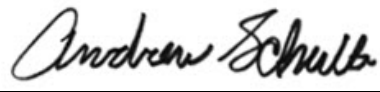
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National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
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Washington, DC 20590

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Approval Date: 5-12-2022

FINAL REPORT ACCEPTANCE BY OVSC:

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1.0 PURPOSE OF COMPLIANCE TEST

Compliance tests were conducted on a 2022 Tesla Model 3, NHTSA No. C20224500, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-141-01, dated 10/16/2020 for the determination of FMVSS 141 compliance.

The standard establishes performance requirements for pedestrian alert sounds on hybrid and electric motor vehicles to reduce the number of injuries that result from electric and hybrid vehicle crashes with pedestrians by providing a sound level and sound characteristics necessary for these vehicles to be detected and recognized by pedestrians. The standard is applicable to electric and hybrid low speed vehicles and to hybrid and electric vehicles with a gross vehicle weight rating (GVWR) of 4,536 Kg or less that are passenger cars, multi-purpose passenger vehicles, trucks, or buses.

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS

Testing was conducted at the Transportation Research Center (TRC) in accordance with NHTSA TP-141-01, dated 10/16/2020.

The vehicle was inspected to ensure it did not make any unintended sounds while stationary or in motion (e.g. squeaky brakes).

In order to condition the tires, the vehicle was subjected to three clockwise laps around a 100ft diameter circle at a speed that produced a lateral acceleration of 0.5-0.6 g, followed by three more laps in the counterclockwise direction.

The test area was set up as shown in Figure 1 below.

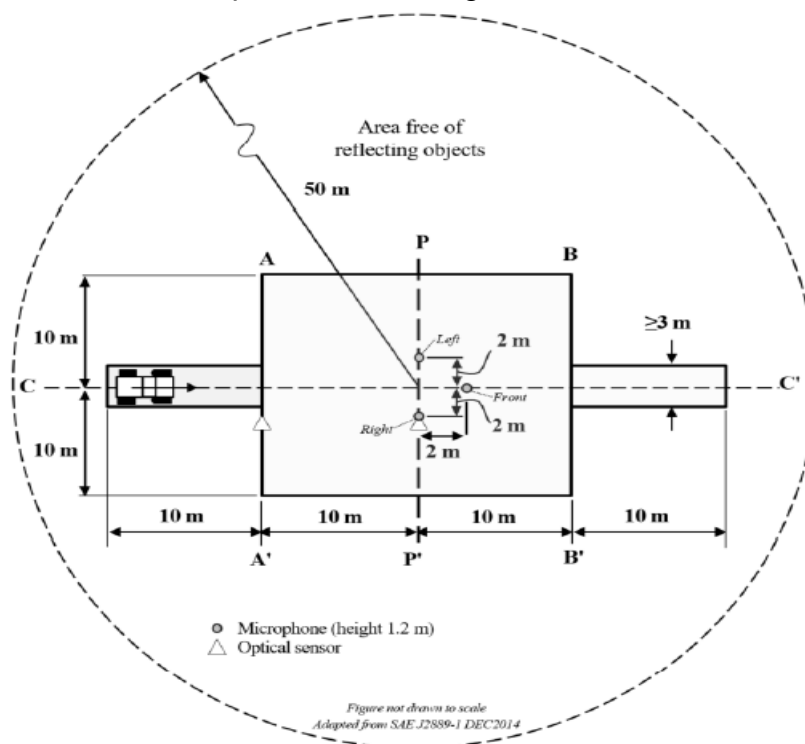


Figure 1: Test Site Dimensions

The vehicle was subjected to five test series to ensure that it would meet the specified audible alert requirements of the standard. The test series include Stationary, Reverse, 10km/h, 20km/h, and 30km/h. Ambient noise was recorded before and after each series. The series were conducted as follows:

- Stationary: The vehicle was positioned such that the front edge of the vehicle was lined up with line P-P' in Figure 1, and the vehicle centerline was lined up with line C-C'. The vehicle was facing C'. Sound measurements were taken while the vehicle was stationary, with the transmission in Drive.
- Reverse: The vehicle was positioned such that the rear edge of the vehicle was lined up with line P-P' in Figure 1, and the vehicle centerline was lined up with line C-C'. The vehicle was facing C'. Sound measurements were taken while the vehicle was stationary, with the transmission in Reverse.
- 10km/h: The vehicle was driven along line C-C' at 11km/h $\pm$ 1km/h, starting before line A-A' and ending after line B-B'. Any passes that went outside of the speed tolerance were noted and not used in the data processing. A photoelectric sensor was used to mark the moment when the front edge of the vehicle crossed line P-P'.
- 20km/h: The vehicle was driven along line C-C' at 21km/h $\pm$ 1km/h, starting before line A-A' and ending after line B-B'. Any passes that went outside of the speed tolerance were noted and not used in the data processing. A photoelectric sensor was used to mark the moment when the front edge of the vehicle crossed line P-P'.
- 30km/h: The vehicle was driven along line C-C' at 31km/h $\pm$ 1km/h, starting before line A-A' and ending after line B-B'. Any passes that went outside of the speed tolerance were noted and not used in the data processing. A photoelectric sensor was used to mark the moment when the front edge of the vehicle crossed line P-P'.

Testing was completed according to the test procedure (TP-141-01) without deviation. In certain test scenarios extra recordings were produced beyond the requirements of TP-141-01 to ensure that sufficient valid data were collected for each test scenario.

The vehicle appears to meet the performance requirements of FMVSS 141 for all sections of the test procedure that were performed. The test results are summarized on the data summary sheet in the following section.

Tesla software was updated to version v11.0 (2022.12.3.1 e12558156130) before testing. Summon, Smart Summon, and Valet modes were evaluated qualitatively by the test engineer to determine if the pedestrian alert sound was audibly different from that of normal operation in gears positions other than Park. No apparent differences were observed. Measurements for Summon, Smart Summon, and Valet modes were not recorded.

3.0 TEST DATA

DATA SHEET 1 (Sheet 1 of 2) TEST VEHICLE INSPECTION AND TEST PREPARATION

VEHICLE MAKE/MODEL/BODY STYLE: 2022 Tesla Model 3
NHTSA No.: C20224500 TEST DATE: 4/28/2022

VIN: 5YJ3E1EA7NF101759 MANUFACTURE DATE: 11/21
GVWR: 2137 KG FRONT GAWR: 1110 KG REAR GAWR: 1257 KG

SEATING POSITIONS: FRONT 2 MID 0 REAR 3

ODOMETER READING AT START OF TEST: 1599 (2573) Miles (Kilometers)

PROPULSION SYSTEM(S) & ENERGY:

☒ Electric

☐ Hybrid Electric

☐ Plug-in Hybrid Electric

☐ Other (describe): _____

Fluids checked and at proper levels?

☒ Yes

☐ No

ENGINE/MOTOR LOCATION:

☐ Front ☒ Rear ☐ Mid ☐ Other (describe): _____

TRANSMISSION TYPE:

☒ Automatic

☐ Manual

☐ Other (describe): _____

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING:

Front Axle 235/45R18
Inflation Pressure (kPa) 290

Rear Axle 235/45R18
Inflation Pressure (kPa) 290

INSTALLED TIRE SIZE(S) ON VEHICLE:

From Tire Sidewall

Front Axle

Rear Axle

Manufacturer & Tire Name Michelin Primacy mxm4

Michelin Primacy mxm4

Tire Size Designation 235/45R18

235/45R18

Are installed tire sizes same as labeled tire sizes?

☒ Yes

☐ No

If no, contact COR for further guidance.

DATA SHEET 1 (Sheet 2 of 2)
TEST VEHICLE INSPECTION AND TEST PREPARATION

VEHICLE CURB WEIGHT (Kg):

Front axle 862.6 Rear Axle 909.0
Total Vehicle 1771.6

VEHICLE TEST WEIGHT with Driver and Instrumentation (Kg):

Front axle 943.2 Rear Axle 1005.8
Total Vehicle 1949.0

Test Weight exceeds vehicle ratings (GAWRs and GVWR)?

☐ Yes ☒ No

If yes, contact COR for guidance.

TIRE CONDITIONING:

Tires are set to manufacturer recommended cold inflation pressure.

<u>Front Axle (kPa)</u>	<u>Rear Axle (kPa)</u>
Right Front <u>290</u>	Right Rear <u>290</u>
Left Front <u>290</u>	Left Rear <u>290</u>

Tires have been conditioned as required?

☒ Yes ☐ No

ASSESSMENT OF VEHICLE OPERATIONAL CONDITIONS

Do any of the gear/mode configurations substantially alter the sound emitted from the vehicle in a manner that might affect test results under a given critical operating condition?

☐ Yes ☒ No

REMARKS:

D, R, and N were quantitatively evaluated to ensure sound emitted was not observably altered for the required operating conditions. Summon, Smart Summon, and Valet mode were also qualitatively observed.

RECORDED BY: Andrew Schulte

DATE: 5/12/2022

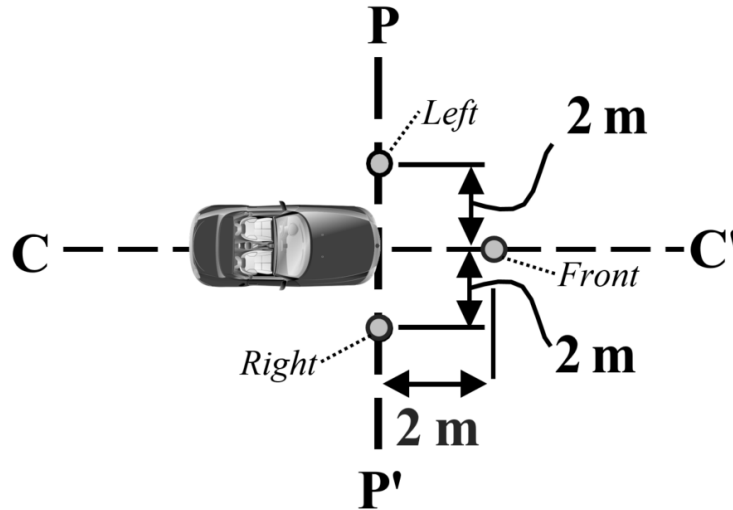
APPROVED BY: David Karls

DATE: 5/12/2022

DATA SHEET 2 (Sheet 1 of 6)

STATIONARY TEST

VEHICLE MAKE/MODEL/BODY STYLE: 2022 Tesla Model 3
 NHTSA No.: C20224500 TEST DATE: 4/28/2022



TEST CONDITIONS:

Propulsion energy sources (as applicable)

Battery level (specify units): 96% Fuel level: NA %

Measured Tire Pressures (kPa): LF 290 LR 290

RF 290 RR 290

Tires treads are free and clear of rocks and debris? ☒ Yes ☐ No

Wind Speed 1.3 m/sec < 5m/sec? ☒ Yes ☐ No

Ambient Temperature 7.8 C°, 5C° to 40C°? ☒ Yes ☐ No

Test Surface is dry and free of cracks and debris? ☒ Yes ☐ No

Test vehicle windows and doors are closed? ☒ Yes ☐ No

All electrical accessories are turned off? ☒ Yes ☐ No

Record gear position and driving mode (as applicable): D

DATA SHEET 2 (Sheet 2 of 6)
STATIONARY TEST

FIRST FOUR VALID TESTS WITHIN 2.0 dBA OVERALL SPL

Microphone Maximum SPL dbA				
	Sequence #	Left, Driver	Right, Passenger	Front, Center
Valid Test 1	1	51.7	53.4	53.2
Valid Test 2	2	51.8	53.3	53.3
Valid Test 3	3	51.8	53.2	52.8
Valid Test 4	4	52.9	54.2	54.0
Difference between max and min SPL for each microphone		1.2	1.0	1.2

Is the difference between the maximum and minimum SPL values within each microphone's set of values less than or equal to 2.0 dBA? Must be "Yes" or discuss situation with the COR before proceeding.

☒ Yes ☐ No

IDENTIFICATION OF THE QUIETEST SIDE OF TEST VEHICLE

LEFT/DRIVER SIDE

Valid Test 1 – MAX overall SPL 51.7 dB; Ambient corrected value: 51.7 dB
 Valid Test 2 – MAX overall SPL 51.8 dB; Ambient corrected value: 51.8 dB
 Valid Test 3 – MAX overall SPL 51.8 dB; Ambient corrected value: 51.8 dB
 Valid Test 4 – MAX overall SPL 52.9 dB; Ambient corrected value: 52.9 dB

Left side average overall ambient-corrected SPL = 52.1 dB

RIGHT/PASSENGER SIDE

Valid Test 1 – MAX overall SPL 53.4 dB; Ambient corrected value: 53.4 dB
 Valid Test 2 – MAX overall SPL 53.3 dB; Ambient corrected value: 53.3 dB
 Valid Test 3 – MAX overall SPL 53.2 dB; Ambient corrected value: 53.2 dB
 Valid Test 4 – MAX overall SPL 54.2 dB; Ambient corrected value: 54.2 dB

Right side average overall ambient-corrected SPL = 53.5 dB

Quietest side of vehicle (if same select side used for analysis):

☒ Left (Driver) ☐ Right (Passenger)

DATA SHEET 2 (Sheet 3 of 6)
STATIONARY TEST

**QUIETEST SIDE 1/3 OCTAVE BAND SPLs FOR FOUR VALID TEST RUNS
(AMBIENT CORRECTED)**

1/3 octave band center frequency, Hz	Valid Test 1 corrected SPL, dB	Valid Test 2 corrected SPL, dB	Valid Test 3 corrected SPL, dB	Valid Test 4 corrected SPL, dB	Average corrected SPL, dB	Minimum Required SPL	Avg ≥ Min SPL?
315	-9999	-9999	-9999	39.4	-7489.4	39.0	☐ Y ☒ N
400	31.2	33.5	28.9	42.2	34.0	39.0	☐ Y ☒ N
500	44.6	46.0	44.2	46.7	45.4	40.0	☒ Y ☐ N
630	48.2	47.4	49.1	48.1	48.2	40.0	☒ Y ☐ N
800	39.2	39.8	38.3	42.8	40.0	41.0	☐ Y ☒ N
1000	43.7	43.0	43.1	42.9	43.2	41.0	☒ Y ☐ N
1250	39.2	38.7	38.8	39.8	39.1	42.0	☐ Y ☒ N
1600	32.7	33.7	32.2	33.1	32.9	39.0	☐ Y ☒ N
2000	34.0	34.9	34.7	35.5	34.8	39.0	☐ Y ☒ N
2500	28.2	30.3	29.3	31.2	29.8	37.0	☐ Y ☒ N
3150	14.7	18.9	17.0	19.9	17.6	34.0	☐ Y ☒ N
4000	20.6	21.6	22.4	21.1	21.4	32.0	☐ Y ☒ N
5000	-9999	-9999	-9999	-9999	-9999	31.0	☐ Y ☒ N

FOUR-BAND STATIONARY COMPLIANCE

Compare the average corrected SPL values against the minimum SPL requirement for each one-third octave band. Determine if any four one-third octave bands meeting the required standard are non-adjacent to each other AND that span a range of at least nine one-third octave bands in the range of 315 Hz to 5000 Hz. Complete following table with one set of four one-third octave bands that meet these requirements.

1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

Four-band compliance result: Four non-adjacent 1/3 octave bands spanning at least nine bands meet the minimum SPLs on the quietest side of the vehicle? ☐Yes ☒No

DATA SHEET 2 (Sheet 4 of 6)

STATIONARY TEST

TWO-BAND STATIONARY COMPLIANCE

Compare the average corrected SPL values and identify which one-third octave bands meet the minimum SPL requirement. Select the band with the highest SPL of the 315 to 800 Hz bands, and select the band with the highest SPL of the 1000 to 3150 Hz bands. The selected bands must be non-adjacent AND span no fewer than three one-third octave bands in the range of 315 Hz to 3150 Hz. If the highest bands are the 800Hz and 1000Hz bands, examine the second highest band in either range may be used if it meets all other requirements. Complete following table with one set of two one-third octave bands that meet these requirements and each meets the minimum requirements.

Frequency band range, Hz	1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
315-800	630	48.2	40.0	☒ Yes ☐ No
1000-3150	1000	43.2	40.0	☒ Yes ☐ No

Calculate the Band sum of the one-third octave bands selected.

$$\text{Band Sum} = 10 \log_{10} \sum_{i=1}^2 10^{(SPL_i/10)}$$

BAND SUM = 49.4 (Must be at least 44 dBA)

Two-band compliance result: Two 1/3 octave bands spanning at least three bands meet the minimum SPLs and band sum requirements on the quietest side of the vehicle? ☒ Yes ☐ No

DATA SHEET 2 (Sheet 5 of 6)
DIRECTIVITY TEST

**FRONT MICROPHONE 1/3 OCTAVE BAND SPLs FOR FOUR VALID TEST RUNS
(AMBIENT CORRECTED)**

1/3 octave band center frequency, Hz	Valid Test 1 corrected SPL, dB	Valid Test 2 corrected SPL, dB	Valid Test 3 corrected SPL, dB	Valid Test 4 corrected SPL, dB	Average corrected SPL, dB	Minimum Required SPL	Avg ≥ Min SPL?
315	-9999	30.4	-9999	35.9	-4982.9	39.0	☐ Y ☒ N
400	31.7	34.4	29.5	41.9	34.4	39.0	☐ Y ☒ N
500	44.8	43.7	44.8	47.3	45.2	40.0	☒ Y ☐ N
630	48.4	49.0	48.3	47.7	48.3	40.0	☒ Y ☐ N
800	39.0	38.3	37.2	43.5	39.5	41.0	☐ Y ☒ N
1000	42.3	42.7	42.9	42.5	42.6	41.0	☒ Y ☐ N
1250	48.3	48.0	46.8	47.3	47.6	42.0	☒ Y ☐ N
1600	39.8	39.7	39.6	39.9	39.8	39.0	☒ Y ☐ N
2000	36.6	37.4	36.8	38.0	37.2	39.0	☐ Y ☒ N
2500	29.5	29.7	31.2	31.9	30.6	37.0	☐ Y ☒ N
3150	26.9	26.8	29.0	30.1	28.2	34.0	☐ Y ☒ N
4000	26.0	26.4	23.8	23.8	25.0	32.0	☐ Y ☒ N
5000	18.0	19.9	15.8	15.6	17.3	31.0	☐ Y ☒ N

FOUR-BAND DIRECTIVITY COMPLIANCE

Compare the average corrected SPL values against the minimum SPL requirement for each one-third octave band. Determine if any four one-third octave bands meeting the required standard are non-adjacent to each other AND that span a range of at least nine one-third octave bands in the range of 315 Hz to 5000 Hz. Complete following table with one set of four one-third octave bands that meet these requirements.

1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

Four-band compliance result: Four non-adjacent 1/3 octave bands spanning at least nine bands meet the minimum SPLs on the quietest side of the vehicle? ☐Yes ☒No

DATA SHEET 2 (Sheet 6 of 6)

DIRECTIVITY TEST

TWO-BAND DIRECTIVITY COMPLIANCE

Compare the average corrected SPL values and identify which one-third octave bands meet the minimum SPL requirement. Select the band with the highest SPL of the 315 to 800 Hz bands, and select the band with the highest SPL of the 1000 to 3150 Hz bands. The selected bands must be non-adjacent AND span no fewer than three one-third octave bands in the range of 315 Hz to 3150 Hz. If the highest bands are the 800Hz and 1000Hz bands, examine the second highest band in either range may be used if it meets all other requirements. Complete following table with one set of two one-third octave bands that meet these requirements and each meets the minimum requirements.

Frequency band range, Hz	1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
315-800	630	48.3	40.0	☒ Yes ☐ No
1000-3150	1250	47.6	40.0	☒ Yes ☐ No

Calculate the Band sum of the one-third octave bands selected.

$$\text{Band Sum} = 10 \log_{10} \sum_{i=1}^2 10^{(SPL_i/10)}$$

BAND SUM = 51.0 (Must be at least 44 dBA)

Two-band compliance result: Two 1/3 octave bands spanning at least three bands meet the minimum SPLs and band sum requirements on the quietest side of the vehicle? ☒ Yes ☐ No

REMARKS:

1/3 Octave Band SPL values of -9999 are default values used by compliance tool when a band level is flagged as not usable. Extra runs were recorded to ensure sufficient data was taken.

Overall result for STATIONARY: PASS if 1) the quietest side met *either* the four-band or two-band requirements *AND* 2) the directivity results met *either* the four-band or two-band requirements.

☒ **PASS** ☐ **FAIL**

RECORDED BY: Andrew Schulte

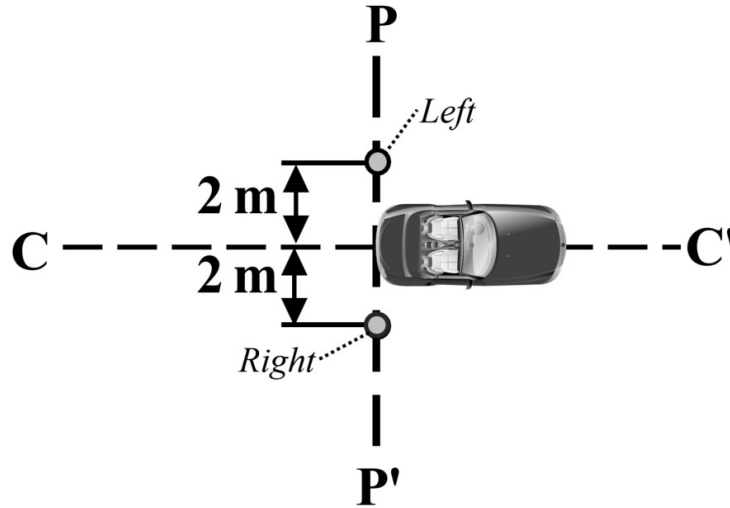
DATE: 5/12/2022

APPROVED BY: David Karls

DATE: 5/12/2022

DATA SHEET 3 (Sheet 1 of 4) REVERSE TEST

VEHICLE MAKE/MODEL/BODY STYLE: 2022 Tesla Model 3
 NHTSA No.: C20224500 TEST DATE: 4/28/2022



TEST CONDITIONS:

Propulsion energy sources (as applicable)

Battery level (specify units): 96% Fuel level: NA %

Measured Tire Pressures (kPa): LF 290 LR 290

RF 290 RR 290

Tires treads are free and clear of rocks and debris? ☒ Yes ☐ No

Wind Speed 1.8 m/sec < 5m/sec? ☒ Yes ☐ No

Ambient Temperature 8.9 C°, 5C° to 40C°? ☒ Yes ☐ No

Test Surface is dry and free of cracks and debris? ☒ Yes ☐ No

Test vehicle windows and doors are closed? ☒ Yes ☐ No

All electrical accessories are turned off? ☒ Yes ☐ No

Record gear position and driving mode (as applicable): R

DATA SHEET 3 (Sheet 2 of 4)
REVERSE TEST

FIRST FOUR VALID TESTS WITHIN 2.0 dBA OVERALL SPL

Microphone Maximum SPL dbA			
	Sequence #	Left, Driver	Right, Passenger
Valid Test 1	1	53.3	55.5
Valid Test 2	2	53.1	55.2
Valid Test 3	3	53.3	55.3
Valid Test 4	4	53.2	55.3
Difference between max and min SPL for each microphone		0.2	0.3

Is the difference between the maximum and minimum SPL values within each microphone's set of values less than or equal to 2.0 dBA? Must be "Yes" or discuss situation with the COR before proceeding.

☒ Yes ☐ No

IDENTIFICATION OF THE QUIETEST SIDE OF TEST VEHICLE

LEFT/DRIVER SIDE

Valid Test 1 – MAX overall SPL 53.3 dB; Ambient corrected value: 53.3 dB
 Valid Test 2 – MAX overall SPL 53.1 dB; Ambient corrected value: 53.1 dB
 Valid Test 3 – MAX overall SPL 53.3 dB; Ambient corrected value: 53.3 dB
 Valid Test 4 – MAX overall SPL 53.2 dB; Ambient corrected value: 53.2 dB

Left side average overall ambient-corrected SPL = 53.2 dB

RIGHT/PASSENGER SIDE

Valid Test 1 – MAX overall SPL 55.5 dB; Ambient corrected value: 55.5 dB
 Valid Test 2 – MAX overall SPL 55.2 dB; Ambient corrected value: 55.2 dB
 Valid Test 3 – MAX overall SPL 55.3 dB; Ambient corrected value: 55.3 dB
 Valid Test 4 – MAX overall SPL 55.3 dB; Ambient corrected value: 55.3 dB

Right side average overall ambient-corrected SPL = 55.3 dB

Quietest side of vehicle (if same select side used for analysis):

☒ Left (Driver) ☐ Right (Passenger)

DATA SHEET 3 (Sheet 3 of 4)
REVERSE TEST

**QUIETEST SIDE 1/3 OCTAVE BAND SPLs FOR FOUR VALID TEST RUNS
(AMBIENT CORRECTED)**

1/3 octave band center frequency, Hz	Valid Test 1 corrected SPL, dB	Valid Test 2 corrected SPL, dB	Valid Test 3 corrected SPL, dB	Valid Test 4 corrected SPL, dB	Average corrected SPL, dB	Minimum Required SPL	Avg ≥Min SPL?
315	51.0	51.1	50.9	51.4	51.1	42.0	☒ Y ☐ N
400	30.5	32.5	32.3	32.0	31.8	41.0	☐ Y ☒ N
500	30.6	-9999	36.7	-9999	-4982.7	43.0	☐ Y ☒ N
630	40.3	-9999	36.3	-9999	-4980.4	43.0	☐ Y ☒ N
800	35.7	-9999	31.3	-9999	-4982.8	44.0	☐ Y ☒ N
1000	32.9	32.6	32.6	30.1	32.1	44.0	☐ Y ☒ N
1250	47.4	47.7	47.7	47.4	47.6	45.0	☒ Y ☐ N
1600	28.9	29.1	29.3	28.7	29.0	41.0	☐ Y ☒ N
2000	15.0	14.7	-9999	15.5	-2488.5	42.0	☐ Y ☒ N
2500	-9999	-9999	-9999	-9999	-9999	40.0	☐ Y ☒ N
3150	-9999	-9999	-9999	-9999	-9999	37.0	☐ Y ☒ N
4000	-9999	-9999	-9999	-9999	-9999	35.0	☐ Y ☒ N
5000	-9999	-9999	-9999	-9999	-9999	33.0	☐ Y ☒ N

FOUR-BAND REVERSE COMPLIANCE

Compare the average corrected SPL values against the minimum SPL requirement for each one-third octave band. Determine if any four one-third octave bands meeting the required standard are non-adjacent to each other AND that span a range of at least nine one-third octave bands in the range of 315 Hz to 5000 Hz. Complete following table with one set of four one-third octave bands that meet these requirements.

1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

Four-band compliance result: Four non-adjacent 1/3 octave bands spanning at least nine bands meet the minimum SPLs on the quietest side of the vehicle? ☐Yes ☒No

DATA SHEET 3 (Sheet 4 of 4)
REVERSE TEST

TWO-BAND REVERSE COMPLIANCE

Compare the average corrected SPL values and identify which one-third octave bands meet the minimum SPL requirement. Select the band with the highest SPL of the 315 to 800 Hz bands, and select the band with the highest SPL of the 1000 to 3150 Hz bands. The selected bands must be non-adjacent AND span no fewer than three one-third octave bands in the range of 315 Hz to 3150 Hz. If the highest bands are the 800Hz and 1000Hz bands, examine the second highest band in either range may be used if it meets all other requirements. Complete following table with one set of two one-third octave bands that meet these requirements and each meets the minimum requirements.

Frequency band range, Hz	1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
315-800	315	51.1	40.0	☒ Yes ☐ No
1000-3150	1250	47.6	40.0	☒ Yes ☐ No

Calculate the Band sum of the one-third octave bands selected.

$$Band\ Sum = 10 \log_{10} \sum_{i=1}^2 10^{(SPL_i/10)}$$

BAND SUM = 52.7 (Must be at least 48 dBA)

Two-band compliance result: Two 1/3 octave bands spanning at least three bands meet the minimum SPLs and band sum requirements on the quietest side of the vehicle? ☒ Yes ☐ No

REMARKS:

1/3 Octave Band SPL values of -9999 are default values used by compliance tool when a band level is flagged as not usable. Extra runs were recorded to ensure sufficient data was taken.

Overall result for REVERSE: PASS if the quietest side met *either* the four-band or two-band requirements.

☒ **PASS** ☐ **FAIL**

RECORDED BY: Andrew Schulte

DATE: 5/12/2022

APPROVED BY: David Karls

DATE: 5/12/2022

DATA SHEET 4 (Sheet 1 of 4)
CONSTANT SPEED PASS-BY TEST (11 ± 1 km/h)

VEHICLE MAKE/MODEL/BODY STYLE: 2022 Tesla Model 3
NHTSA No.: C20224500 TEST DATE: 4/28/2022

TEST CONDITIONS:

Propulsion energy sources (as applicable)

Battery level (specify units): 99% Fuel level: NA %

Measured Tire Pressures (kPa): LF 290 LR 290

RF 290 RR 290

Tires treads are free and clear of rocks and debris? ☒ Yes ☐ No

Wind Speed 1.3 m/sec < 5m/sec? ☒ Yes ☐ No

Ambient Temperature 10.6 C°, 5C° to 40C°? ☒ Yes ☐ No

Test Surface is dry and free of cracks and debris? ☒ Yes ☐ No

Test vehicle windows and doors are closed? ☒ Yes ☐ No

All electrical accessories are turned off? ☒ Yes ☐ No

Record gear position and driving mode (as applicable): D

DATA SHEET 4 (Sheet 2 of 4)
CONSTANT SPEED PASS-BY TEST (11 ± 1 km/h)

FIRST FOUR VALID TESTS WITHIN 2.0 dBA OVERALL SPL

Microphone Maximum SPL dbA			
	Sequence #	Left, Driver	Right, Passenger
Valid Test 1	1	57.7	60.2
Valid Test 2	2	57.9	60.0
Valid Test 3	3	57.7	60.2
Valid Test 4	4	57.6	59.8
Difference between max and min SPL for each microphone		0.3	0.4

Is the difference between the maximum and minimum SPL values within each microphone's set of values less than or equal to 2.0 dBA? Must be "Yes" or discuss situation with the COR before proceeding.

☒ Yes ☐ No

IDENTIFICATION OF THE QUIETEST SIDE OF TEST VEHICLE

LEFT/DRIVER SIDE

Valid Test 1 – MAX overall SPL 57.7 dB; Ambient corrected value: 57.7 dB
 Valid Test 2 – MAX overall SPL 57.9 dB; Ambient corrected value: 57.9 dB
 Valid Test 3 – MAX overall SPL 57.7 dB; Ambient corrected value: 57.7 dB
 Valid Test 4 – MAX overall SPL 57.6 dB; Ambient corrected value: 57.6 dB

Left side average overall ambient-corrected SPL = 57.7 dB

RIGHT/PASSENGER SIDE

Valid Test 1 – MAX overall SPL 60.2 dB; Ambient corrected value: 60.2 dB
 Valid Test 2 – MAX overall SPL 60.0 dB; Ambient corrected value: 60.0 dB
 Valid Test 3 – MAX overall SPL 60.2 dB; Ambient corrected value: 60.2 dB
 Valid Test 4 – MAX overall SPL 59.8 dB; Ambient corrected value: 59.8 dB

Right side average overall ambient-corrected SPL = 60.1 dB

Quietest side of vehicle (if same select side used for analysis):

☒ Left (Driver) ☐ Right (Passenger)

DATA SHEET 4 (Sheet 3 of 4)
CONSTANT SPEED PASS-BY TEST (11 ± 1 km/h)

**QUIETEST SIDE 1/3 OCTAVE BAND SPLs FOR FOUR VALID TEST RUNS
(AMBIENT CORRECTED)**

1/3 octave band center frequency, Hz	Valid Test 1 corrected SPL, dB	Valid Test 2 corrected SPL, dB	Valid Test 3 corrected SPL, dB	Valid Test 4 corrected SPL, dB	Average corrected SPL, dB	Minimum Required SPL	Avg ≥ Min SPL?
315	36.4	35.5	35.8	36.0	35.9	45.0	☐ Y ☒ N
400	39.0	40.3	38.5	39.0	39.2	44.0	☐ Y ☒ N
500	45.3	46.2	45.0	45.1	45.4	46.0	☐ Y ☒ N
630	54.5	54.4	53.8	53.3	54.0	46.0	☒ Y ☐ N
800	45.6	45.1	45.5	44.9	45.3	47.0	☐ Y ☒ N
1000	49.1	49.8	50.0	50.5	49.9	47.0	☒ Y ☐ N
1250	48.4	48.1	49.0	49.0	48.6	48.0	☒ Y ☐ N
1600	44.6	44.5	44.0	44.7	44.5	44.0	☒ Y ☐ N
2000	46.2	46.5	46.9	46.8	46.6	45.0	☒ Y ☐ N
2500	38.2	38.2	38.6	38.3	38.3	43.0	☐ Y ☒ N
3150	33.8	33.4	33.3	33.8	33.6	40.0	☐ Y ☒ N
4000	34.6	35.3	33.4	33.3	34.2	38.0	☐ Y ☒ N
5000	34.5	33.7	32.8	32.2	33.3	36.0	☐ Y ☒ N

FOUR-BAND PASS-BY COMPLIANCE

Compare the average corrected SPL values against the minimum SPL requirement for each one-third octave band. Determine if any four one-third octave bands meeting the required standard are non-adjacent to each other AND that span a range of at least nine one-third octave bands in the range of 315 Hz to 5000 Hz. Complete following table with one set of four one-third octave bands that meet these requirements.

1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

Four-band compliance result: Four non-adjacent 1/3 octave bands spanning at least nine bands meet the minimum SPLs on the quietest side of the vehicle? ☐Yes ☒No

DATA SHEET 4 (Sheet 4 of 4)
CONSTANT SPEED PASS-BY TEST (11 ± 1 km/h)

TWO-BAND PASS-BY COMPLIANCE

Compare the average corrected SPL values and identify which one-third octave bands meet the minimum SPL requirement. Select the band with the highest SPL of the 315 to 800 Hz bands, and select the band with the highest SPL of the 1000 to 3150 Hz bands. The selected bands must be non-adjacent AND span no fewer than three one-third octave bands in the range of 315 Hz to 3150 Hz. If the highest bands are the 800Hz and 1000Hz bands, examine the second highest band in either range may be used if it meets all other requirements. Complete following table with one set of two one-third octave bands that meet these requirements and each meets the minimum requirements.

Frequency band range, Hz	1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
315-800	630	54.0	42.0	☒ Yes ☐ No
1000-3150	1000	49.9	42.0	☒ Yes ☐ No

Calculate the Band sum of the one-third octave bands selected.

$$\text{Band Sum} = 10 \log_{10} \sum_{i=1}^2 10^{(SPL_i/10)}$$

BAND SUM = 55.4 (Must be at least 51 dBA)

Two-band compliance result: Two 1/3 octave bands spanning at least three bands meet the minimum SPLs and band sum requirements on the quietest side of the vehicle? ☒ Yes ☐ No

REMARKS:

Extra runs were recorded to ensure sufficient data was taken.

Overall result for 11 ± 1 km/h PASS-BY: PASS if the quietest side met *either* the four-band or two-band requirements.

☒ **PASS** ☐ **FAIL**

RECORDED BY: Andrew Schulte

DATE: 5/12/2022

APPROVED BY: David Karls

DATE: 5/12/2022

DATA SHEET 5 (Sheet 1 of 4)
CONSTANT SPEED PASS-BY TEST (21 ± 1 km/h)

VEHICLE MAKE/MODEL/BODY STYLE: 2022 Tesla Model 3
NHTSA No.: C20224500 TEST DATE: 4/28/2022

TEST CONDITIONS:

Propulsion energy sources (as applicable)

Battery level (specify units): 99% Fuel level: NA %

Measured Tire Pressures (kPa): LF 290 LR 290

RF 290 RR 290

Tires treads are free and clear of rocks and debris? ☒ Yes ☐ No

Wind Speed 2.2 m/sec < 5m/sec? ☒ Yes ☐ No

Ambient Temperature 10.0 C°, 5C° to 40C°? ☒ Yes ☐ No

Test Surface is dry and free of cracks and debris? ☒ Yes ☐ No

Test vehicle windows and doors are closed? ☒ Yes ☐ No

All electrical accessories are turned off? ☒ Yes ☐ No

Record gear position and driving mode (as applicable): D

DATA SHEET 5 (Sheet 2 of 4)
CONSTANT SPEED PASS-BY TEST (21 ± 1 km/h)

FIRST FOUR VALID TESTS WITHIN 2.0 dBA OVERALL SPL

Microphone Maximum SPL dbA			
	Sequence #	Left, Driver	Right, Passenger
Valid Test 1	1	63.3	64.7
Valid Test 2	2	63.6	66.2
Valid Test 3	3	64.0	66.3
Valid Test 4	4	63.8	66.1
Difference between max and min SPL for each microphone		0.7	1.6

Is the difference between the maximum and minimum SPL values within each microphone's set of values less than or equal to 2.0 dBA? Must be "Yes" or discuss situation with the COR before proceeding.

☒ Yes ☐ No

IDENTIFICATION OF THE QUIETEST SIDE OF TEST VEHICLE

LEFT/DRIVER SIDE

Valid Test 1 – MAX overall SPL 63.3 dB; Ambient corrected value: 63.3 dB
 Valid Test 2 – MAX overall SPL 63.6 dB; Ambient corrected value: 63.6 dB
 Valid Test 3 – MAX overall SPL 64.0 dB; Ambient corrected value: 64.0 dB
 Valid Test 4 – MAX overall SPL 63.8 dB; Ambient corrected value: 63.8 dB

Left side average overall ambient-corrected SPL = 63.7 dB

RIGHT/PASSENGER SIDE

Valid Test 1 – MAX overall SPL 64.7 dB; Ambient corrected value: 64.7 dB
 Valid Test 2 – MAX overall SPL 66.2 dB; Ambient corrected value: 66.2 dB
 Valid Test 3 – MAX overall SPL 66.3 dB; Ambient corrected value: 66.3 dB
 Valid Test 4 – MAX overall SPL 66.1 dB; Ambient corrected value: 66.1 dB

Right side average overall ambient-corrected SPL = 65.8 dB

Quietest side of vehicle (if same select side used for analysis):

☒ Left (Driver) ☐ Right (Passenger)

DATA SHEET 5 (Sheet 3 of 4)
CONSTANT SPEED PASS-BY TEST (21 ± 1 km/h)

**QUIETEST SIDE 1/3 OCTAVE BAND SPLs FOR FOUR VALID TEST RUNS
(AMBIENT CORRECTED)**

1/3 octave band center frequency, Hz	Valid Test 1 corrected SPL, dB	Valid Test 2 corrected SPL, dB	Valid Test 3 corrected SPL, dB	Valid Test 4 corrected SPL, dB	Average corrected SPL, dB	Minimum Required SPL	Avg ≥ Min SPL?
315	38.3	39.8	39.9	40.0	39.5	52.0	☐ Y ☒ N
400	42.7	44.6	44.9	45.7	44.5	51.0	☐ Y ☒ N
500	50.0	51.6	51.3	51.3	51.1	52.0	☐ Y ☒ N
630	56.3	57.8	58.6	57.4	57.5	53.0	☒ Y ☐ N
800	53.7	54.1	55.3	55.4	54.6	53.0	☒ Y ☐ N
1000	52.5	53.8	54.7	53.9	53.7	54.0	☐ Y ☒ N
1250	54.8	55.8	56.6	56.2	55.9	54.0	☒ Y ☐ N
1600	57.1	54.6	53.7	54.9	55.1	51.0	☒ Y ☐ N
2000	55.1	54.1	53.5	55.0	54.4	51.0	☒ Y ☐ N
2500	44.9	46.9	47.1	46.7	46.4	50.0	☐ Y ☒ N
3150	39.6	40.6	40.4	40.1	40.2	47.0	☐ Y ☒ N
4000	37.2	37.8	39.5	38.8	38.3	45.0	☐ Y ☒ N
5000	33.9	34.4	35.0	34.5	34.5	43.0	☐ Y ☒ N

FOUR-BAND PASS-BY COMPLIANCE

Compare the average corrected SPL values against the minimum SPL requirement for each one-third octave band. Determine if any four one-third octave bands meeting the required standard are non-adjacent to each other AND that span a range of at least nine one-third octave bands in the range of 315 Hz to 5000 Hz. Complete following table with one set of four one-third octave bands that meet these requirements.

1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

Four-band compliance result: Four non-adjacent 1/3 octave bands spanning at least nine bands meet the minimum SPLs on the quietest side of the vehicle? ☐Yes ☒No

DATA SHEET 5 (Sheet 4 of 4)
CONSTANT SPEED PASS-BY TEST (21 ± 1 km/h)

TWO-BAND PASS-BY COMPLIANCE

Compare the average corrected SPL values and identify which one-third octave bands meet the minimum SPL requirement. Select the band with the highest SPL of the 315 to 800 Hz bands, and select the band with the highest SPL of the 1000 to 3150 Hz bands. The selected bands must be non-adjacent AND span no fewer than three one-third octave bands in the range of 315 Hz to 3150 Hz. If the highest bands are the 800Hz and 1000Hz bands, examine the second highest band in either range may be used if it meets all other requirements. Complete following table with one set of two one-third octave bands that meet these requirements and each meets the minimum requirements.

Frequency band range, Hz	1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
315-800	630	57.5	47.0	☒ Yes ☐ No
1000-3150	1250	55.9	47.0	☒ Yes ☐ No

Calculate the Band sum of the one-third octave bands selected.

$$Band\ Sum = 10 \log_{10} \sum_{i=1}^2 10^{(SPL_i/10)}$$

BAND SUM = 59.8 (Must be at least 57 dBA)

Two-band compliance result: Two 1/3 octave bands spanning at least three bands meet the minimum SPLs and band sum requirements on the quietest side of the vehicle? ☒ Yes ☐ No

REMARKS:

Extra runs were recorded to ensure sufficient data was taken.

Overall result for 21 ± 1 km/h PASS-BY: PASS if the quietest side met *either* the four-band or two-band requirements.

☒ **PASS** ☐ **FAIL**

RECORDED BY: Andrew Schulte

DATE: 5/12/2022

APPROVED BY: David Karls

DATE: 5/12/2022

DATA SHEET 6 (Sheet 1 of 4)
CONSTANT SPEED PASS-BY TEST (31 ± 1 km/h)

VEHICLE MAKE/MODEL/BODY STYLE: 2022 Tesla Model 3
NHTSA No.: C20224500 TEST DATE: 4/28/2022

TEST CONDITIONS:

Propulsion energy sources (as applicable)

Battery level (specify units): 97% Fuel level: NA %

Measured Tire Pressures (kPa): LF 290 LR 290

RF 290 RR 290

Tires treads are free and clear of rocks and debris? ☒ Yes ☐ No

Wind Speed 1.3 m/sec < 5m/sec? ☒ Yes ☐ No

Ambient Temperature 9.4 C°, 5C° to 40C°? ☒ Yes ☐ No

Test Surface is dry and free of cracks and debris? ☒ Yes ☐ No

Test vehicle windows and doors are closed? ☒ Yes ☐ No

All electrical accessories are turned off? ☒ Yes ☐ No

Record gear position and driving mode (as applicable): D

DATA SHEET 6 (Sheet 2 of 4)
CONSTANT SPEED PASS-BY TEST (31 ± 1 km/h)

FIRST FOUR VALID TESTS WITHIN 2.0 dB(A) OVERALL SPL

Microphone Maximum SPL dbA			
	Sequence #	Left, Driver	Right, Passenger
Valid Test 1	1	69.4	71.6
Valid Test 2	2	69.5	71.8
Valid Test 3	3	69.1	72.1
Valid Test 4	4	69.3	71.5
Difference between max and min SPL for each microphone		0.4	0.6

Is the difference between the maximum and minimum SPL values within each microphone's set of values less than or equal to 2.0 dBA? Must be "Yes" or discuss situation with the COR before proceeding.

☒ Yes ☐ No

IDENTIFICATION OF THE QUIETEST SIDE OF TEST VEHICLE

LEFT/DRIVER SIDE

Valid Test 1 – MAX overall SPL 69.4 dB; Ambient corrected value: 69.4 dB
Valid Test 2 – MAX overall SPL 69.5 dB; Ambient corrected value: 69.5 dB
Valid Test 3 – MAX overall SPL 69.1 dB; Ambient corrected value: 69.1 dB
Valid Test 4 – MAX overall SPL 69.3 dB; Ambient corrected value: 69.3 dB

Left side average overall ambient-corrected SPL = 69.3 dB

RIGHT/PASSENGER SIDE

Valid Test 1 – MAX overall SPL 71.6 dB; Ambient corrected value: 71.6 dB
Valid Test 2 – MAX overall SPL 71.8 dB; Ambient corrected value: 71.8 dB
Valid Test 3 – MAX overall SPL 72.1 dB; Ambient corrected value: 72.1 dB
Valid Test 4 – MAX overall SPL 71.5 dB; Ambient corrected value: 71.5 dB

Right side average overall ambient-corrected SPL = 71.8 dB

Quietest side of vehicle (if same select side used for analysis):

☒ Left (Driver) ☐ Right (Passenger)

DATA SHEET 6 (Sheet 3 of 4)
CONSTANT SPEED PASS-BY TEST (31 ± 1 km/h)

**QUIETEST SIDE 1/3 OCTAVE BAND SPLs FOR FOUR VALID TEST RUNS
(AMBIENT CORRECTED)**

1/3 octave band center frequency, Hz	Valid Test 1 corrected SPL, dB	Valid Test 2 corrected SPL, dB	Valid Test 3 corrected SPL, dB	Valid Test 4 corrected SPL, dB	Average corrected SPL, dB	Minimum Required SPL	Avg ≥ Min SPL?
315	48.8	48.6	46.3	47.8	47.9	56.0	☐ Y ☒ N
400	47.8	46.8	47.9	48.5	47.8	55.0	☐ Y ☒ N
500	51.9	51.6	52.2	52.5	52.1	57.0	☐ Y ☒ N
630	58.3	57.5	59.2	58.0	58.3	57.0	☒ Y ☐ N
800	61.6	62.0	63.1	61.5	62.1	58.0	☒ Y ☐ N
1000	57.8	57.3	57.6	56.5	57.3	58.0	☐ Y ☒ N
1250	61.8	61.2	60.0	61.3	61.1	59.0	☒ Y ☐ N
1600	63.1	64.2	61.9	63.7	63.2	55.0	☒ Y ☐ N
2000	62.8	62.9	61.8	62.3	62.5	55.0	☒ Y ☐ N
2500	54.1	54.6	54.5	54.1	54.3	54.0	☒ Y ☐ N
3150	47.9	48.2	48.6	47.7	48.1	51.0	☐ Y ☒ N
4000	46.2	46.7	45.3	46.7	46.2	49.0	☐ Y ☒ N
5000	39.7	40.4	39.4	41.1	40.2	47.0	☐ Y ☒ N

FOUR-BAND PASS-BY COMPLIANCE

Compare the average corrected SPL values against the minimum SPL requirement for each one-third octave band. Determine if any four one-third octave bands meeting the required standard are non-adjacent to each other AND that span a range of at least nine one-third octave bands in the range of 315 Hz to 5000 Hz. Complete following table with one set of four one-third octave bands that meet these requirements.

1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

Four-band compliance result: Four non-adjacent 1/3 octave bands spanning at least nine bands meet the minimum SPLs on the quietest side of the vehicle? ☐Yes ☒No

DATA SHEET 6 (Sheet 4 of 4)
CONSTANT SPEED PASS-BY TEST (31 ± 1 km/h)

TWO-BAND PASS-BY COMPLIANCE

Compare the average corrected SPL values and identify which one-third octave bands meet the minimum SPL requirement. Select the band with the highest SPL of the 315 to 800 Hz bands, and select the band with the highest SPL of the 1000 to 3150 Hz bands. The selected bands must be non-adjacent AND span no fewer than three one-third octave bands in the range of 315 Hz to 3150 Hz. If the highest bands are the 800Hz and 1000Hz bands, examine the second highest band in either range may be used if it meets all other requirements. Complete following table with one set of two one-third octave bands that meet these requirements and each meets the minimum requirements.

Frequency band range, Hz	1/3 octave band center frequency, Hz	Average corrected SPL, dB	Minimum required SPL, dB, for selected band	Meets or Exceeds Standard
315-800	800	62.1	52.0	☒ Yes ☐ No
1000-3150	1600	63.2	52.0	☒ Yes ☐ No

Calculate the Band sum of the one-third octave bands selected.

$$Band\ Sum = 10 \log_{10} \sum_{i=1}^2 10^{(SPL_i/10)}$$

BAND SUM = 65.7 (Must be at least 62 dBA)

Two-band compliance result: Two 1/3 octave bands spanning at least three bands meet the minimum SPLs and band sum requirements on the quietest side of the vehicle? ☒ Yes ☐ No

REMARKS:

Extra runs were recorded to ensure sufficient data was taken.

Overall result for 31 ± 1 km/h PASS-BY: PASS if the quietest side met *either* the four-band or two-band requirements.

☒ **PASS** ☐ **FAIL**

RECORDED BY: Andrew Schulte

DATE: 5/12/2022

APPROVED BY: David Karls

DATE: 5/12/2022

DATA SHEET 7 (Sheet 1 of 5)
RELATIVE VOLUME CHANGE REQUIREMENT

Stationary Test Data

Normalize the levels of the 13 one-third octave bands, and use these values to calculate the normalized band sum.

1/3 octave band center frequency, Hz	Average corrected SPL, dB (Data Sheet 2)		Minimum SPL, dB		Normalized Band Level, dB
315	-7489.4	-	39.0	=	-7528.4
400	34.0	-	39.0	=	-5.0
500	45.4	-	40.0	=	5.4
630	48.2	-	40.0	=	8.2
800	40.0	-	41.0	=	-1.0
1000	43.2	-	41.0	=	2.2
1250	39.1	-	42.0	=	-2.9
1600	32.9	-	39.0	=	-6.1
2000	34.8	-	39.0	=	-4.2
2500	29.8	-	37.0	=	-7.2
3150	17.6	-	34.0	=	-16.4
4000	21.4	-	32.0	=	-10.6
5000	-9999	-	31.0	=	-10030

Use the following equation to calculate the Normalized Band Sum:

$$\text{Normalized Band Sum} = 10 \times \log_{10} \left(\sum_{i=1}^{13} 10^{\frac{\text{Normalized Band Level}_i}{10}} \right)$$

Normalized Band Sum (Stationary Operating Scenario): 11.5 **dB**

DATA SHEET 7 (Sheet 2 of 5)
RELATIVE VOLUME CHANGE REQUIREMENT

11 ± 1 km/h Test Data

Normalize the levels of the 13 one-third octave bands, and use these values to calculate the normalized band sum.

1/3 octave band center frequency, Hz	Average corrected SPL, dB (Data Sheet 4)		Minimum SPL, dB		Normalized Band Level, dB
315	35.9	-	39.0	=	-3.1
400	39.2	-	39.0	=	0.2
500	45.4	-	40.0	=	5.4
630	54.0	-	40.0	=	14.0
800	45.3	-	41.0	=	4.3
1000	49.9	-	41.0	=	8.9
1250	48.6	-	42.0	=	6.6
1600	44.5	-	39.0	=	5.5
2000	46.6	-	39.0	=	7.6
2500	38.3	-	37.0	=	1.3
3150	33.6	-	34.0	=	-0.4
4000	34.2	-	32.0	=	2.2
5000	33.3	-	31.0	=	2.3

Use the following equation to calculate the Normalized Band Sum:

$$\text{Normalized Band Sum} = 10 \times \log_{10} \left(\sum_{i=1}^{13} 10^{\frac{\text{Normalized Band Level}_i}{10}} \right)$$

Normalized Band Sum (11 ± 1 km/h Operating Scenario): 17.8 **dB**

DATA SHEET 7 (Sheet 3 of 5)
RELATIVE VOLUME CHANGE REQUIREMENT

21 ± 1 km/h Test Data

Normalize the levels of the 13 one-third octave bands, and use these values to calculate the normalized band sum.

1/3 octave band center frequency, Hz	Average corrected SPL, dB (Data Sheet 5)		Minimum SPL, dB		Normalized Band Level, dB
315	39.5	-	39.0	=	0.5
400	44.5	-	39.0	=	5.5
500	51.1	-	40.0	=	11.1
630	57.5	-	40.0	=	17.5
800	54.6	-	41.0	=	13.6
1000	53.7	-	41.0	=	12.7
1250	55.9	-	42.0	=	13.9
1600	55.1	-	39.0	=	16.1
2000	54.4	-	39.0	=	15.4
2500	46.4	-	37.0	=	9.4
3150	40.2	-	34.0	=	6.2
4000	38.3	-	32.0	=	6.3
5000	34.5	-	31.0	=	3.5

Use the following equation to calculate the Normalized Band Sum:

$$\text{Normalized Band Sum} = 10 \times \log_{10} \left(\sum_{i=1}^{13} 10^{\frac{\text{Normalized Band Level}_i}{10}} \right)$$

Normalized Band Sum (21 ± 1 km/h Operating Scenario): 23.7 **dB**

DATA SHEET 7 (Sheet 4 of 5)
RELATIVE VOLUME CHANGE REQUIREMENT

31 ± 1 km/h Test Data

Normalize the levels of the 13 one-third octave bands, and use these values to calculate the normalized band sum.

1/3 octave band center frequency, Hz	Average corrected SPL, dB (Data Sheet 6)		Minimum SPL, dB		Normalized Band Level, dB
315	47.9	-	39.0	=	8.9
400	47.8	-	39.0	=	8.8
500	52.1	-	40.0	=	12.1
630	58.3	-	40.0	=	18.3
800	62.1	-	41.0	=	21.1
1000	57.3	-	41.0	=	16.3
1250	61.1	-	42.0	=	19.1
1600	63.2	-	39.0	=	24.2
2000	62.5	-	39.0	=	23.5
2500	54.3	-	37.0	=	17.3
3150	48.1	-	34.0	=	14.1
4000	46.2	-	32.0	=	14.2
5000	40.2	-	31.0	=	9.2

Use the following equation to calculate the Normalized Band Sum:

$$\text{Normalized Band Sum} = 10 \times \log_{10} \left(\sum_{i=1}^{13} 10^{\frac{\text{Normalized Band Level}_i}{10}} \right)$$

Normalized Band Sum (31 ± 1 km/h Operating Scenario): 29.8 dB

DATA SHEET 7 (Sheet 5 of 5)
RELATIVE VOLUME CHANGE REQUIREMENT

Critical Operating Speed Intervals

Between:

Stationary and 10 km/h

Normalized Band Sum 10 KM/H 17.8 dB – Normalized Band Sum Stationary 11.5 dB

= Relative Volume Change 6.3 dB

Relative Volume Change $\geq$ 3dB ? ☒ Yes ☐ No

10 km/h and 20 km/h

Normalized Band Sum 20 KM/H 23.7 dB – Normalized Band Sum 10 KM/H 17.8 dB

= Relative Volume Change 5.9 dB

Relative Volume Change $\geq$ 3dB ? ☒ Yes ☐ No

20 km/h and 30 km/h

Normalized Band Sum 30 KM/H 29.8 dB – Normalized Band Sum 20 KM/H 23.7 dB

= Relative Volume Change 6.1 dB

Relative Volume Change $\geq$ 3dB ? ☒ Yes ☐ No

REMARKS:

--

Overall result for relative volume change: PASS if the relative volume change is greater than or equal to 3dB in each of the three critical operating scenario comparisons above.

☒ **PASS** ☐ **FAIL**

RECORDED BY: Andrew Schulte

DATE: 5/12/2022

APPROVED BY: David Karls

DATE: 5/12/2022

DATA SUMMARY SHEET

VEHICLE MAKE/MODEL/BODY STYLE: 2022 Tesla Model 3

VEHICLE NHTSA NO.: C20224500 VIN: 5YJ3E1EA7NF101759

VEHICLE TYPE: Passenger Car DATE OF MANUFACTURE: 11/21

LABORATORY: Transportation Research Center, Inc.

REQUIREMENTS	PASS/FAIL
Vehicle Stationary (Data Sheet 2) Requirement for stationary AND directivity conditions; four-band OR two-band alert sounds (S5.1.1, S5.1.1.2, S5.2)	☒ PASS ☐ FAIL
Reverse (Data Sheet 3) Requirement for reverse condition; four-band OR two-band alert sounds (S5.1.2, S5.2)	☒ PASS ☐ FAIL
Constant Pass-By Speeds Greater Than 0 km/h but Less Than 20 km/h (Data Sheet 4, 11 ± 1 km/h) Requirement for constant speed pass-by conditions; four-band OR two-band alert sounds. (S5.1.3, S5.2)	☒ PASS ☐ FAIL
Constant Pass-By Speeds Greater Than or Equal to 20 km/h but Less Than 30 km/h (Data Sheet 5, 21 ± 1 km/h) Requirement for constant speed pass-by conditions; four-band OR two-band alert sounds. (S5.1.4, S5.2)	☒ PASS ☐ FAIL
Constant Pass-By Speed at 30 km/h (Data Sheet 6, 31 ± 1 km/h) Requirement for constant speed pass-by conditions; four-band OR two-band alert sounds. (S5.1.5, S5.2)	☒ PASS ☐ FAIL
Relative Volume Change (Data Sheet 7) Requirement for minimum change in volume from one critical operating condition to the next; four-band OR two-band alert sounds (S5.4, Table 7)	☒ PASS ☐ FAIL
OVERALL RESULT (PASS only if all sections above PASS)	☒ PASS ☐ FAIL

RECORDED BY: Andrew Schulte DATE: 5/12/2022

APPROVED BY: David Karls DATE: 5/12/2022

4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

Type	Output	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration
Tire Pressure Gauge	Vehicle Tire Pressure	0-150 psi	0.1 psi	±0.1% of applied pressure	Intercomp Model: 360046-150-BC	<u>0422SS08645</u>	By: <u>TRC Inc.</u> Date: <u>3-15-22</u> Due: <u>9-15-22</u>
Platform Scales	Vehicle Total, Wheel, and Axle Load	0-2500 lb per each of four pads	0.5 lb	±1.0% of applied load	Mettler Toledo Model: JXGA1000	<u>1107946</u> <u>1107948</u> <u>1107917</u> <u>1107936</u>	By: <u>Kanawha Scales</u> Date: <u>12-1-21</u> Due: <u>6-1-22</u>
Weather Station	Temperature; Relative Humidity; Barometric Pressure	-40-150°F; 1-100%; 16.00"-32.5" Hg	0.1°F; 1%; 0.01"Hg	±1°F ±2%; ±0.03"Hg	Davis Instruments Model: 6152 Vantage Pro2	<u>170215N10</u>	By: <u>Davis Inst.</u> Date: <u>10-4-2021</u> Due: <u>10-4-2022</u>
Weather Station	Wind Speed	0-200mph	0.4m/s	±1 m/s	Davis Instruments Model: 6410 Anemometer with 7905L wind cups	<u>191231N01</u>	By: <u>Davis Inst.</u> Date: <u>10-4-2021</u> Due: <u>10-4-2022</u>
GPS Speed Sensor	Vehicle Speed	0.1-1000 km/h	0.01 km/h	0.1 km/h	Racelogic Model: VBOX3i	<u>018335</u>	By: <u>Racelogic</u> Date: <u>1-3-2022</u> Due: <u>1-3-2023</u>
Digital Signal Analyzer	Record Sound Pressure	±20V	24 bits	n/a	Crystal Instruments Model: CoCo-80X	<u>4190048</u>	By: <u>Crystal Instruments</u> Date: <u>2-10-22</u> Due: <u>2-10-23</u>
Microphones	Sound Pressure (voltage)	14.6-146 dB(A)	0.01dB	n/a	GRAS Model: 146AE	<u>414812</u> <u>414808</u> <u>414807</u>	By: <u>GRAS</u> Date: <u>3-3-22</u> Due: <u>3-3-23</u>
Microphone Calibrator	Calibrated Signal	-	-	-	Brüel & Kjær Model: 4231	<u>3005037</u>	By: <u>Trescal</u> Date: <u>4-4-22</u> Due: <u>4-4-23</u>
Distance Measurement Device	Distance	0-8m	1.0mm	±0.8mm	Starrett KTX1 Tape Measure	<u>20192509</u>	By: <u>Starrett</u> Date: <u>5-6-2020</u> Due: <u>NA</u>

5.0 PHOTOGRAPHS

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022



¾ FRONT VIEW FROM LEFT SIDE OF VEHICLE

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022



¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022

MFD BY TESLA, INC.

11/21



GVWR
2137 kg (4711 lb)

WITH TIRES
235/45R18

GAWR FRT
1110 kg (2447 lb)

WITH TIRES
235/45R18

RIM
18X8.5J

COLD TIRE PRESSURE
290 kPa, 42 psi

GAWR RR
1257 kg (2771 lb)

WITH TIRES
235/45R18

RIM
18X8.5J

COLD TIRE PRESSURE
290 kPa, 42 psi

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

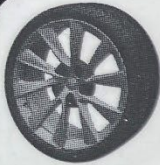
PNT: PMNG

VIN: 5YJ3E1EA7NF101759

TYPE: PASSENGER CAR

VEHICLE CERTIFICATION LABEL

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022

  **TIRE AND LOADING INFORMATION** 101759

SEATING CAPACITY – TOTAL 5 FRONT 2 REAR 3

THE COMBINED WEIGHT OF OCCUPANTS AND CARGO SHOULD NEVER EXCEED 375 kg OR 826 lb

TIRE	FRONT	REAR	SPARE
ORIGINAL TIRE SIZE	235/45R18	235/45R18	NONE
COLD TIRE PRESSURE	290 kPa, 42 psi	290 kPa, 42 psi	NONE

SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION.

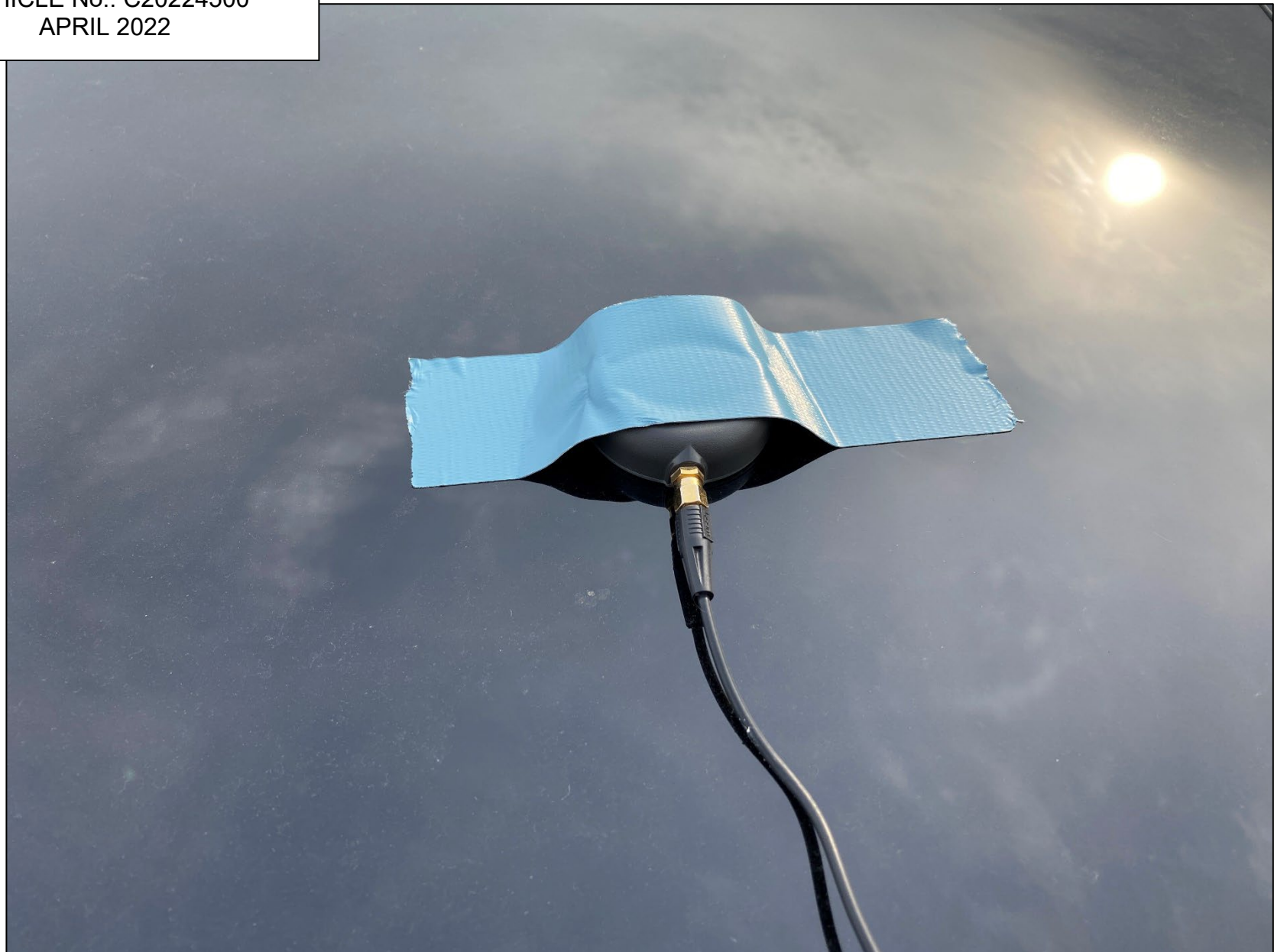
VEHICLE PLACARD

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022



INSTRUMENTATION INSIDE THE VEHICLE

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022



INSTRUMENTATION OUTSIDE THE VEHICLE

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022



MICROPHONE SETUP FOR STATIONARY TEST

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022



MICROPHONE SETUP FOR PASSBY TEST

2022 Tesla Model 3
FMVSS 141
VEHICLE No.: C20224500
APRIL 2022



MICROPHONE SETUP FOR PASSBY TEST – WIDE VIEW

6.0 APPENDIX – COMPLIANCE TOOL OUTPUT

See attachments.

Summary Output Documents

7.0 APPENDIX – OWNER’S MANUAL PAGES

Valet Mode

When Model 3 is in Valet mode, the following restrictions apply:

- Speed is limited to 70 mph (113 km/h).
- Maximum acceleration and power are limited.
- Front trunk and glovebox are locked.
- Home and Work locations are not available in the navigation system.
- Voice commands are disabled.
- Autopilot convenience features are disabled.
- The Allow Mobile Access setting cannot be changed.
- Driver Profiles are not accessible.
- The touchscreen does not display the list of keys that can access Model 3 (see [Managing Keys](#)).
- Wi-Fi and Bluetooth are disabled. When Model 3 is in Valet mode, you cannot pair new Bluetooth devices or view or delete existing paired devices. However, if a Bluetooth-paired device or a known Wi-Fi network is within range, Model 3 connects to it.

Starting Valet Mode

With Model 3 in Park, touch the driver profile icon at the top of the **Controls** screen, then touch **Valet Mode**.

The first time you enter Valet mode, the touchscreen prompts you to create a 4-digit PIN you will use to cancel Valet mode.

When Valet mode is active, the touchscreen displays the word **Valet** and the Valet mode driver profile displays on the touchscreen.

You can also use the mobile app to start and cancel Valet mode (provided Model 3 is in Park). When using the mobile app, you do not need to enter a PIN because you are already required to log into the app using your Tesla Account credentials.

Note: If the **PIN to Drive** setting is enabled (see [PIN to Drive](#)), you must enter the driving PIN before you can define or enter a Valet PIN. Once in Valet mode, Model 3 can be driven without the valet needing to enter the driving PIN.

Note: The PIN to Drive setting is not available when Valet mode is active.

← → Search

Note: If the **PIN to Drive** setting is enabled (see [PIN to Drive](#)), you must enter the driving PIN before you can define or enter a Valet PIN. Once in Valet mode, Model 3 can be driven without the valet needing to enter the driving PIN.

Note: The **PIN to Drive** setting is not available when Valet mode is active.

If you forget your valet PIN, reset it from inside Model 3 by entering your Tesla Account credentials (which also cancels Valet mode). You can also reset your PIN using the mobile app.

Canceling Valet Mode

With Model 3 in Park, touch the **Valet Mode** driver profile icon at the top of the **Controls** screen, and enter your 4-digit PIN.

When you cancel Valet mode, all settings associated with the most recently used driver profile and climate control settings are restored, and all features are available.

Note: You do not need to enter a PIN to cancel Valet mode from the mobile app.

Pedestrian Warning System

The Pedestrian Warning System causes Model 3 to emit sound when driving below 19 mph (32 km/h) or while driving in reverse. Electric vehicles operate quietly and this sound helps to alert pedestrians of your oncoming vehicle. The sound, which activates whenever Model 3 is shifted out of Park, gets louder as speed increases.

Note: The Pedestrian Warning System is not available in vehicles manufactured prior to September 1, 2019.

! Warning: If sound cannot be heard, pedestrians may not be aware of your oncoming vehicle, which may increase the likelihood of a collision resulting in serious injury or death. If the Pedestrian Warning System is not operating, immediately contact Tesla.

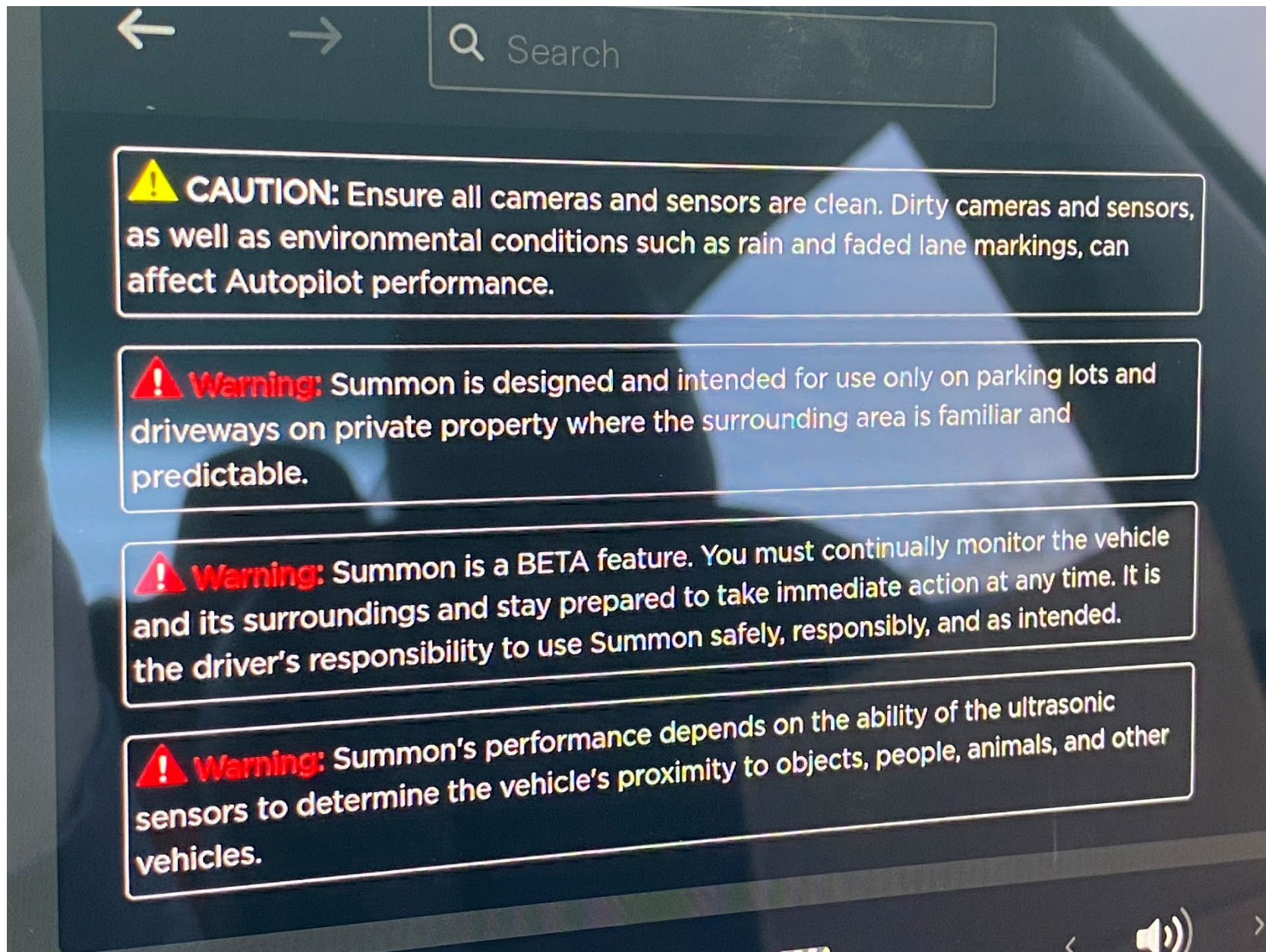
Summon

Summon allows you to automatically park and retrieve Model 3 while you are standing outside the vehicle. Summon uses data from the ultrasonic sensors to move Model 3 forward and reverse up to 39 feet (12 meters) in, or out of, a parking space.

To move Model 3 a longer distance while steering around objects, you can use Smart Summon and your mobile phone. Smart Summon allows your vehicle to find you (or you can send your vehicle to a chosen location). See [Smart Summon](#).

 **CAUTION:** Ensure all cameras and sensors are clean. Dirty cameras and sensors, as well as environmental conditions such as rain and faded lane markings, can affect Autopilot performance.

 **Warning:** Summon is designed and intended for use only on parking lots and driveways on private property where the surrounding area is familiar and predictable.



Before Using Summon

Before operating Summon, use the touchscreen to enable it and customize how you want it to work. Touch **Controls** > **Autopilot** > **Customize Summon** and adjust the following settings to suit your preferences:

- **Bumper Clearance:** Set the distance that you want Summon to stop from a detected object (for example, you may want Summon to stop within just a few inches of a garage wall). Note that this distance applies only to objects that Summon detects directly in front of Model 3 when moving forward, or directly behind Model 3 when reversing.
- **Summon Distance:** Set a maximum distance that Model 3 can travel when entering or exiting a parking space.
- **Side Clearance:** Choose an option to specify how much side clearance you want to allow. **Tight** allows Model 3 to enter and exit very narrow parking spaces.

 **Warning:** Parking in a narrow space limits the ability of the sensors to accurately detect the location of obstacles, increasing the risk of damage to Model 3 and/or surrounding objects.



Q Search

Using Summon to Park and Retrieve your Vehicle

Follow these steps to use Summon to park your Model 3:

- Align Model 3 within 39 feet (12 meters) of the parking space so Model 3 can follow a straight path into or out of the space in either Drive or Reverse.
- From outside the vehicle, initiate the parking maneuver by touching **Summon** on the mobile app, then holding down the **Forward** or **Reverse** button.

Note: If the **Require Continuous Press** setting is **No**, you do not need to hold down the button, just press and release.

Summon shifts Model 3 into Drive or Reverse (based on the direction you specified) and drives into or out of the parking space. When parking is complete, or if an obstacle is detected, Summon shifts Model 3 into Park. Summon shifts Model 3 into Park when:

- Model 3 detects an obstacle in its driving path (within the **Bumper Clearance** setting that you specified).





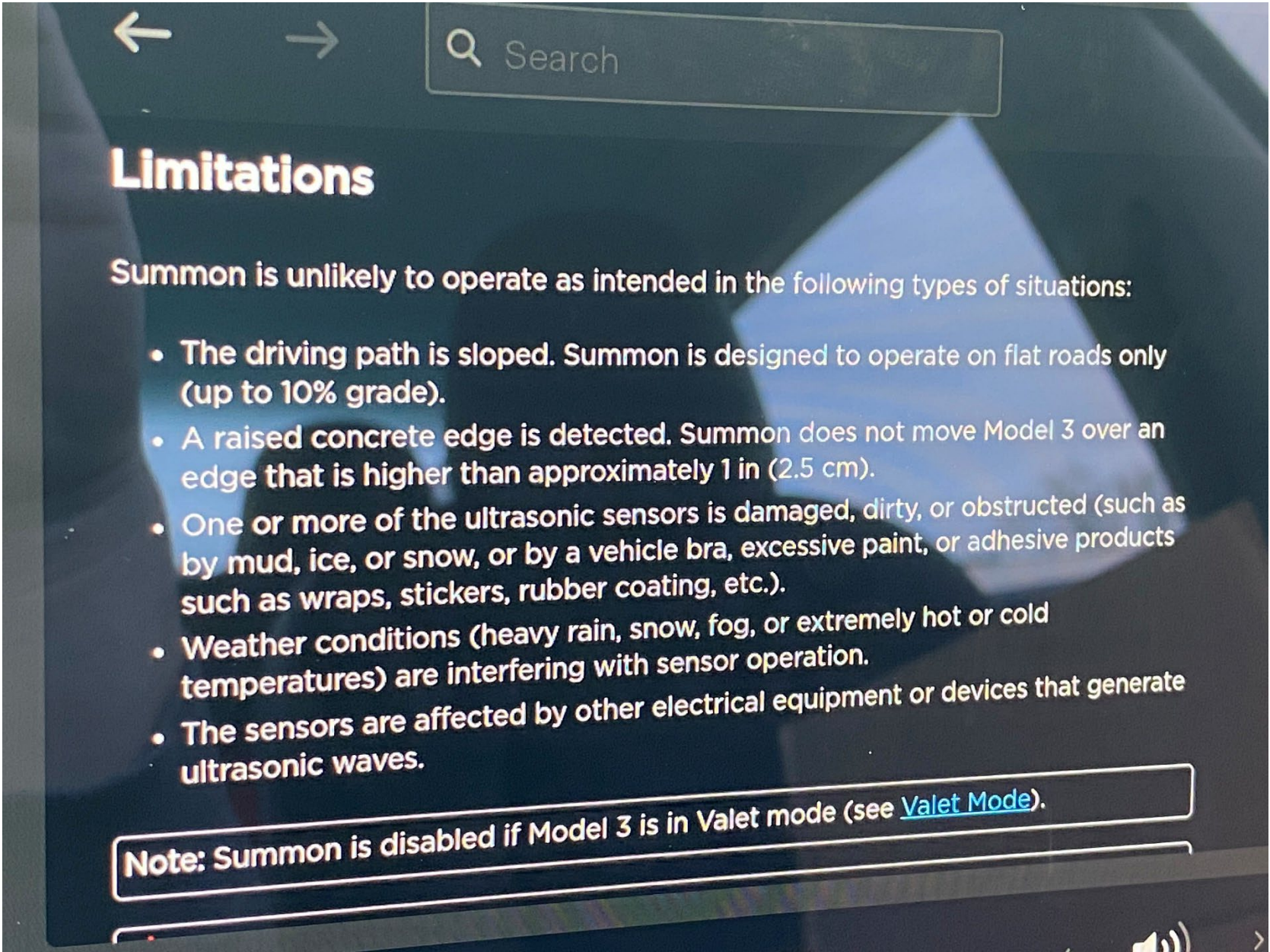
Search

Summon shifts Model 3 into Drive or Reverse (based on the direction you specified) and drives into or out of the parking space. When parking is complete, or if an obstacle is detected, Summon shifts Model 3 into Park. Summon shifts Model 3 into Park when:

- Model 3 detects an obstacle in its driving path (within the **Bumper Clearance** setting that you specified).
- Summon has moved Model 3 the maximum distance of 39 feet (12 meters).
- You release the **Forward** or **Reverse** button (when Require Continuous Press is turned on).
- You press any button to manually stop Summon.

If you used Summon to park Model 3, you can then use Summon to return Model 3 back to its original position (provided Model 3 has remained in Park), or to the maximum **Summon Distance** that you have specified (whichever comes first). Simply specify the opposite direction on the mobile app and Summon moves Model 3 along the original path, provided no obstructions have been introduced. If the ultrasonic sensors detect an obstacle, Model 3 attempts to avoid the obstacle while staying very close to its original path (Summon does not steer around obstacles).



A screenshot of a vehicle's infotainment screen. At the top, there are navigation arrows (left and right) and a search bar with a magnifying glass icon and the word "Search". Below this, the word "Limitations" is displayed in a large, bold, white font. Underneath, a paragraph states that Summon is unlikely to operate as intended in certain situations. This is followed by a bulleted list of five limitations. At the bottom, a note in a white-bordered box states that Summon is disabled if the vehicle is in Valet mode, with a link to "Valet Mode".

Limitations

Summon is unlikely to operate as intended in the following types of situations:

- The driving path is sloped. Summon is designed to operate on flat roads only (up to 10% grade).
- A raised concrete edge is detected. Summon does not move Model 3 over an edge that is higher than approximately 1 in (2.5 cm).
- One or more of the ultrasonic sensors is damaged, dirty, or obstructed (such as by mud, ice, or snow, or by a vehicle bra, excessive paint, or adhesive products such as wraps, stickers, rubber coating, etc.).
- Weather conditions (heavy rain, snow, fog, or extremely hot or cold temperatures) are interfering with sensor operation.
- The sensors are affected by other electrical equipment or devices that generate ultrasonic waves.

Note: Summon is disabled if Model 3 is in Valet mode (see [Valet Mode](#)).

Smart Summon

Smart Summon is designed to allow you to move Model 3 to your location (using your phone's GPS as a target destination) or to a location of your choice, maneuvering around and stopping for objects as necessary. Smart Summon works with the Tesla mobile app when your phone is located within approximately 213 feet (65 meters) of Model 3. Smart Summon maneuvers Model 3 out of parking spaces and around corners. This is useful for moving Model 3 out of a tight parking spot, through puddles, or helping you retrieve your car while carrying packages. You must maintain a clear line of sight between you and Model 3 and closely monitor the vehicle and its surroundings at all times.

 **CAUTION:** Ensure all cameras and sensors are clean. Dirty cameras and sensors, as well as environmental conditions such as rain and faded lane markings, can affect Autopilot performance.

 **Warning:** Smart Summon is designed and intended for use only on parking lots

! Warning: Smart Summon is designed and intended for use only on parking lots and driveways located on private property where the surrounding area is familiar and predictable. Do not use Smart Summon on public roads.

! Warning: Smart Summon must only be used on paved surfaces.

! Warning: Smart Summon is a BETA feature. You must continually monitor the vehicle and its surroundings and stay prepared to take immediate action at any time. It is the driver's responsibility to use Smart Summon safely, responsibly, and as intended.

! Warning: Smart Summon may not stop for all objects (especially very low objects such as some curbs, or very high objects such as a shelf) and may not react to all traffic. Smart Summon does not recognize the direction of traffic, does not navigate around empty parking spaces, and may not anticipate crossing traffic.

! Warning: Smart Summon's performance depends on the ultrasonic sensors, the



Search

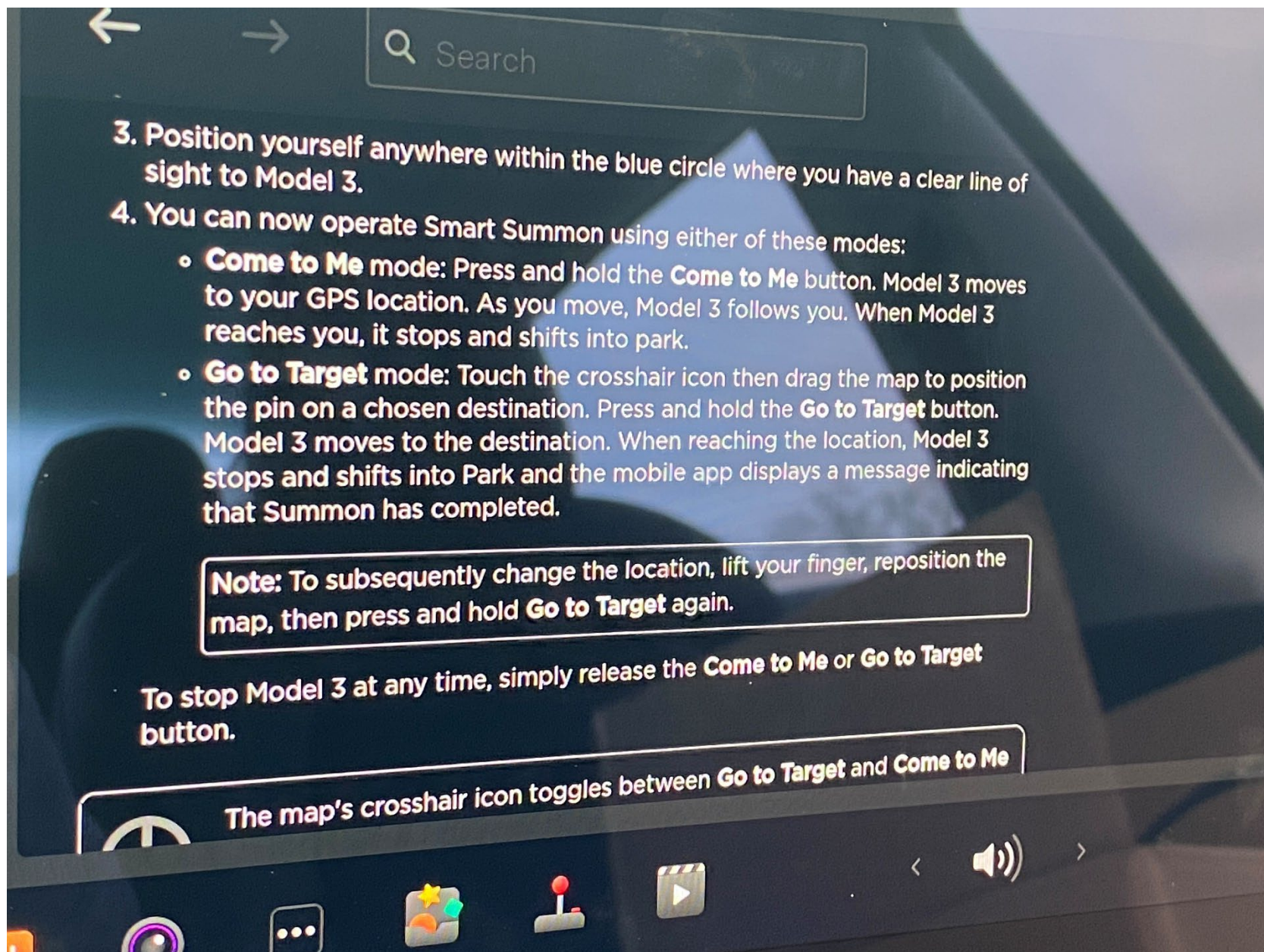
Using Smart Summon

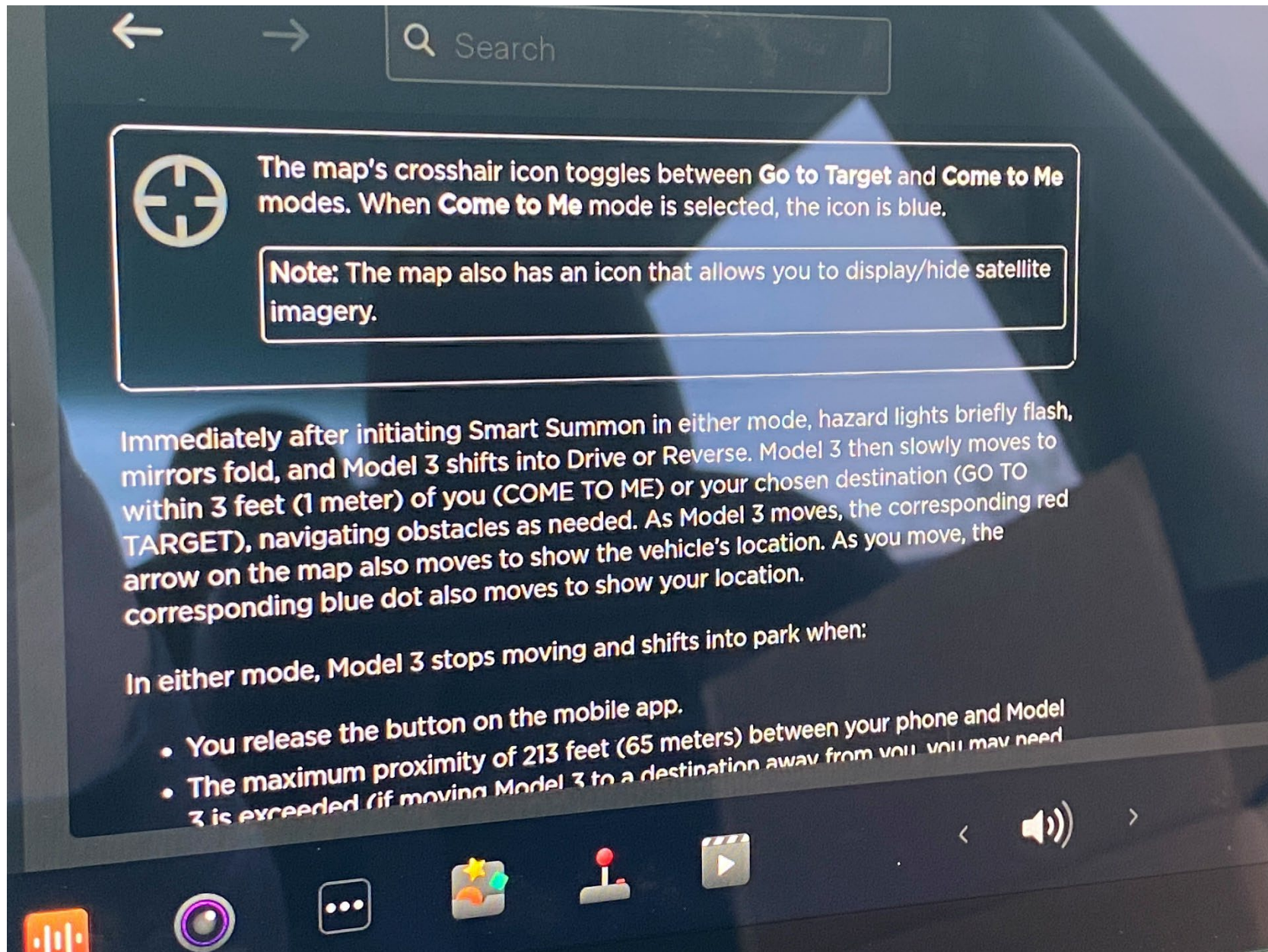
1. Open the Tesla mobile app, and press **Summon**.
2. Press the **Smart Summon** icon located in the center of the image of your Model 3.
3. It may take several seconds for Smart Summon to start up.

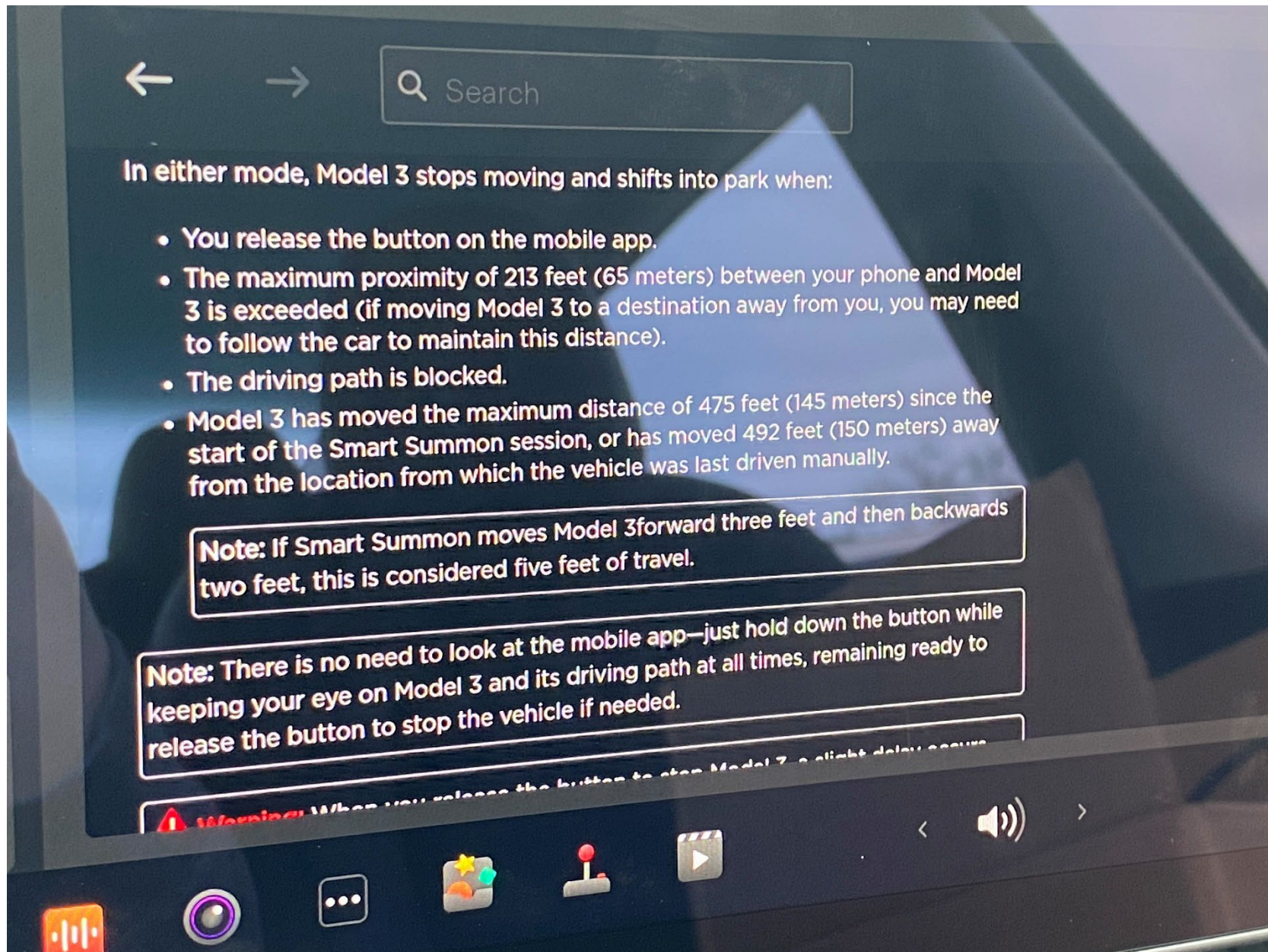
Note: You can use Standby Mode to eliminate the delay that occurs when Smart Summon is starting up (see [Standby Mode](#)).

The mobile app displays a map with a blue circle, which represents the maximum proximity of 213 feet (65 meters) that you must maintain between your phone and Model 3. The blue dot on the map represents your location, and the red arrow represents the location of Model 3.

3. Position yourself anywhere within the blue circle where you have a clear line of sight to Model 3.
4. You can now operate Smart Summon using either of these modes:
 - **Come to Me** mode: Press and hold the **Come to Me** button. Model 3 moves to your GPS location. As you move, Model 3 follows you. When Model 3









Search

⚠ Warning: When you release the button to stop Model 3, a slight delay occurs before the vehicle stops. Therefore, it is critical that you pay close attention to the vehicle's driving path at all times and proactively anticipate obstacles that the vehicle may be unable to detect.

⚠ Warning: Use extreme caution when using Smart Summon in environments where movement of obstacles can be unpredictable. For example, where people, children or animals are present.

⚠ Warning: Smart Summon may not stop for all objects (especially very low objects such as some curbs, or very high objects such as a shelf) and may not react to all oncoming or side traffic. Pay attention and be ready to stop Model 3 at all times by releasing the button on the mobile app.

Standby Mode

To keep Model 3 ready to Summon and reduce the time it takes to warm up, turn on



Limitations

Smart Summon is unlikely to operate as intended in the following types of situations:

- GPS data is unavailable due to poor cellular coverage.
- The driving path is sloped. Smart Summon is designed to operate on flat roads only (up to 10% grade).
- A raised concrete edge is detected. Depending on the height of the concrete edge, Smart Summon may not move Model 3 over it.
- One or more of the ultrasonic sensors or cameras is damaged, dirty, or obstructed (such as by mud, ice, or snow, or by a vehicle bra, excessive paint, or adhesive products such as wraps, stickers, rubber coating, etc.).
- Weather conditions (heavy rain, snow, fog, or extremely hot or cold temperatures) are interfering with sensor or camera operation.
- The sensors are affected by other electrical equipment or devices that generate ultrasonic waves.

Note: Smart Summon is disabled if Model 3 is in Valet mode (see [Valet Mode](#)).