



**Technical Report to the FCC and ISED Regarding  
Gentex Corporation - HomeLink® V**

**Model: UAHL5R  
FCC ID: NZLUAHL5R  
ISED: 4112A-UAHL5R**

**2/22/2024**

A report concerning approval for Gentex Corporation Homelink® Model UAHL5R  
Please issue grant immediately upon review.

Measurements Made by:

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Gentex Corporation

### Test Report Revision

REV Number	Date	Author	Description
1	2/14/2024	Patricia Klawitter	First Revision
2	2/22/2024	Patricia Klawitter	Added antenna gain in dBi tables

Results relate only to the items tested as received.

Compliance has been evaluated based on the Lab Manual section 7.6.2. The decision rule used regarding measurement uncertainty was to determine results solely on whether the measured values met the defined acceptance criteria without factoring in measurement uncertainty values.

## 1. General Information

### 1.1. Product Description

The Gentex Corporation HomeLink® HLV Universal Garage Door Opener is a low-power transceiver OEM device that is installed into a rearview mirror of an automobile. The installation is provided by trained technicians during the course of the manufacture of the automobile. It is powered by the 12 Volt system of the automobile.

This Universal Garage Door Opener has the capability to

1. Learn the frequency and bit code format of the user's existing garage door remote control devices and
2. Reproduce and transmit the frequency and bit code format to remotely operate the user's garage door.

The unit is designed for the periodic operation of a control signal, which typically activates a garage door opener receiver.

The unit is supplied to the automobile manufacturer without harness. For testing purposes, a typical assembly and 2-conductor cable harness were used to power the unit.

The unit is only operational when the user presses down the control button. It becomes inactive after the release of the control button.

The three-button HomeLink® unit replaces up to three hand-held transmitters. In addition to the typical operation of the garage door, the unit will learn the radio frequency codes of other transmitter types to activate entry door locks, estate gates, security systems, and home or office lighting.

The antenna system is an integral part of the unit. It cannot be altered nor replaced by the user. The service of this system is only available from the Automobile Manufacturer's Dealerships and Gentex Corporation.

### 1.2. Test Methodology

Antenna gain testing was performed according to ANSI C63.5:2017 section 6.2- Calibrations of antennas using a reference antenna.

The unit is supplied to the automobile manufacturer without harness. For testing purposes, a 2-conductor cable harness was used to interface to the unit.

### 1.3. Test Facility

The 3-meter semi-anechoic chamber where these measurements were taken is located on the grounds of Gentex Corporation's Corporate Labs, in the city of Zeeland, county of Ottawa, state of Michigan, United States of America.

Corporate Mailing/Shipping Address

Site Address

Gentex Corporation  
600 N. Centennial Street  
Zeeland, MI 49464Gentex Corporation  
380 Riley Street  
Zeeland, MI 49423

## 2. Test Configuration

Antenna Gain measurements presented in the report were made in accordance with ANSI C63.5-2017 section 6.2. The AUT was placed on a 1 x 1.5m non-metallic table elevated 150cm above the ground plane for measurements below 1GHz. Peaks were found by moving the receive antenna up and down from 1 to 4 meters and spinning AUT 360. The AUT harness was routed ~75cm straight back from the AUT and down over the edge of the test table. The test distance was 3 meters.

## 3. Antenna Gain Data

**3.1. Date(s) Tested:** 2/13/2024

**3.2. Test Method Deviations:** None

**3.3. Temperature and Humidity conditions**

	Measured Value	Unit
Temperature	21.7-22.8	°C
Humidity	39.9-42.6	%R.H.

## 3.4. Results

Worst Case Antenna Gain			
Frequency (MHz)	AUT Orientation	Antenna Gain (dBd)	Antenna Gain (dBi)
288	Side	-25.34	-23.19
310	Side	-25.48	-23.33
340	Side	-24.74	-22.59
365	Side	-24.88	-22.73
390	Side	-22.31	-20.16
430	Side	-20.99	-18.84
902	Side	-9.68	-7.53
914	Side	-10.64	-8.49
926	Side	-10.61	-8.46

### 3.5. Test Equipment Setup and Procedure

#### 3.5.1. Test Equipment Used

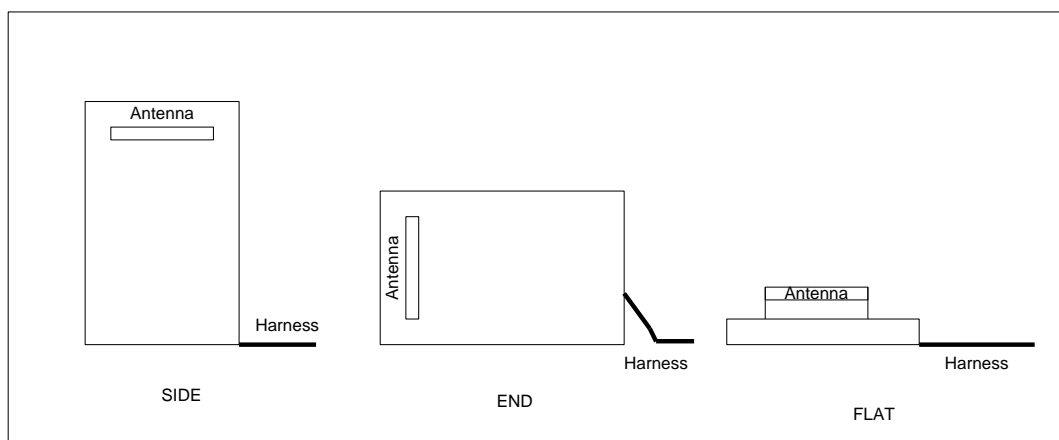
Equipment used			
ID / Serial #	Manufacturer	Description	Cal / PM Due Date
12090	Com-Power	AD-100A Dipole Antenna	5/4/2026
6595	Rohde and Schwarz	EMI Receiver	11/13/2024
CF GCL	Megaphase/Pasternack	3m Chamber Port and Cables	4/30/2024
H6192	EMCO	3148 Log Periodic RX	5/3/2024
Tower 2	ETS-Lindgren	2171B Boresight Tower	VBU
PJ2246	ETS-Lindgren	Shielded Enclosure	12/16/2024
8092	Omega	iBTHX-W Virtual	10/2/2024
Absorber 1	ETS-Lindgren	Absorbers	VBU
6539	Stanley	Tape Measure	6/16/2026
6368	Rohde and Schwarz	Signal Generator	9/16/2024
CBL 143	Megaphase	GC29-N1N1-192	4/30/2024
CBL 153	Megaphase	GC29-N1N1-360	4/30/2024

#### Spectrum Analyzer Settings:

Detector: Peak  
 Resolution Bandwidth: 120 kHz  
 Video Bandwidth 300 kHz  
 Span 1 MHz  
 Sweep Time: 25ms

For testing, the AUT was placed at the center of a non-conducting table 150cm above the ground plane pursuant to ANSI C63.5:2017 section 6.2. The AUT harness was held ~75cm straight back and away from AUT.

Equipment is placed in one of the three orthogonal orientations, End, Side, and Flat. These orientations are described below in Figure 6.2.1.



**Figure 6.2.1 EUT Orthogonal Orientations**

## 4. Formulas and Sample Calculations

### 4.1. Antenna Gain Calculation

Gain (dBd) = Reference Gain + (Measured Level - Reference Level), where Reference Gain is the gain of the reference Dipole antenna in dBd. The Measured Level is the peak value recorded with the AUT and the Reference Level is the peak value recorded with the Dipole Antenna.

Antenna Gain in dBd is converted to dBi by adding 2.15.

## Appendix A

### A. Antenna Gain Measurements

Measurements described in this section were taken according to ANSI C63.5-2017-Section 6.2 on the Gentex Corporation 3m test table.

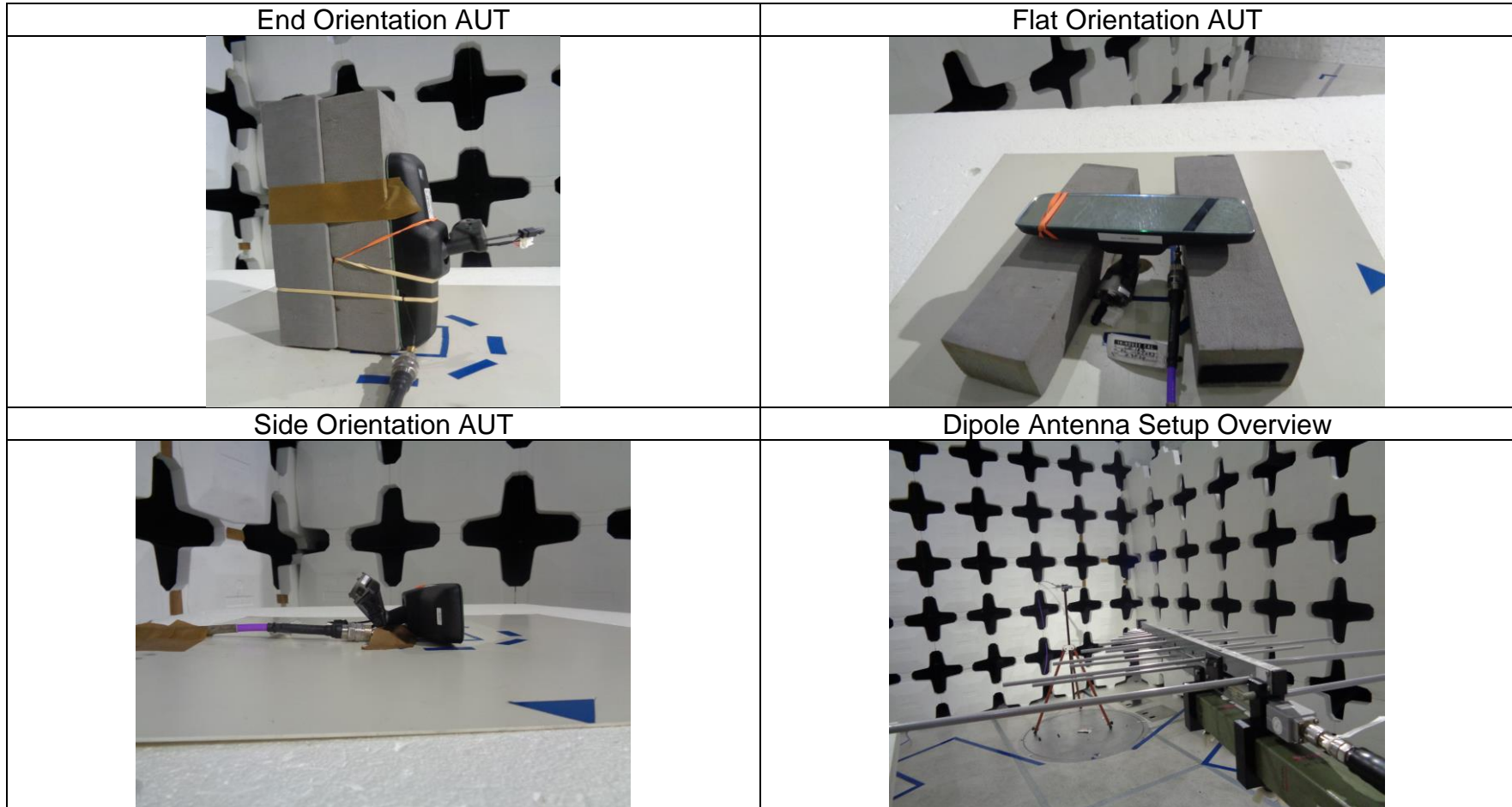
\* Measurements include Cable corrections and Antenna Factors

**Measurement Settings:**

Detector: Peak  
 Resolution Bandwidth: 120 kHz  
 Video Bandwidth 300 kHz  
 Span 1 MHz  
 Sweep Time: 25ms

Balun	Frequency (MHz)	Receive Antenna Orientation	Signal Generator Output (dBuV)	Reference Antenna Gain (dBd)	Reference Antenna Output (dBuV/m)	AUT Output (dBuV/m)			Max Output (dBuV/m)	Antenna Gain (dBd)	Antenna Gain (dBi)
						Side	End	Flat			
AD-100A (180-400MHz)	288	H	107	-4.65	97.45	76.76	73.9	73.48	76.76	-25.34	-23.19
	310	H	107	-4.65	99.7	78.87	75.36	74.26	78.87	-25.48	-23.33
	340	H	107	-4.75	99.48	79.49	74.85	78.54	79.49	-24.74	-22.59
	365	H	107	-4.85	99.43	79.4	78.61	78.06	79.4	-24.88	-22.73
	390	H	107	-4.95	99.09	81.73	75.62	81.05	81.73	-22.31	-20.16
AD-100A (400-1000MHz)	430	H	107	-5.05	98.68	82.74	77.29	81.81	82.74	-20.99	-18.84
	902	H	107	-4.85	98.84	94.01	91.42	93.64	94.01	-9.68	-7.53
	914	H	107	-4.85	98.83	93.04	92.57	92.37	93.04	-10.64	-8.49
	926	H	107	-4.85	98.89	93.13	92.34	90.65	93.13	-10.61	-8.46

### 5. Test Set Up Photos





Dipole Antenna Setup

