GENTEX CORPORATION

Technical Report to the FCC
Gentex Corporation

Model: SAHL5M
FCC ID: NZLSAHL5M
ISED: 4112A-SAHL5M

11/30/20

A report concerning approval for Gentex Corporation model SAHL5M
Please issue grant immediately upon review.

Measurements Made by:

Bolay Pannell
Digitally signed by Bolay Pannell
Date: 2020.12.01 08:24:13 -05'00'

Bolay Pannell
Senior EMC Test Engineer
Gentex Corporation

Measurements Reviewed by:

Daniel Brasier
Digitally signed by Daniel Brasier
Date: 2020.11.30 12:00:12 -05'00'

Dan Brasier
Corporate Labs Development Engineer
Gentex Corporation

Report Prepared, Approved, and Submitted by:

Brian Miller
Digitally signed by Brian Miller
Date: 2020.11.30 07:11:33 -05'00'

Brian Miller
Corporate Labs Group Leader – Wireless Regulatory
Gentex Corporation

Test Report Revision

REV Number	Date	Author	Description
1.0	11/13/20	Brian Miller	Initial Release.
2.0	11/30/20	Brian Miller	This is an amendment to the FCC Report Form for Part 15 Class B Emissions.pdf report for EMC2020-07562 dated 11/16/20. Alterations were made on 11/30/20 to correct typos on pages 3 and 5.

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 OEM device that is installed into an overhead area of the automobile or rearview mirror. 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.

The unit is designed for the periodic operation as a garage door opener.

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 to the unit.

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

1.2. Related Grants

This device will have functionality that is covered under 47 CFR Part 15.231and ISED Canada RSS-210. The device will have FCC ID # of NZLSAHL5M and ISED ID # of 4112A-SAHL5M.

1.3. Test Methodology

Radiated Emissions testing was performed according to ANSI C63.4:2014. The power source for this product is a 12V automotive vehicle battery, thus conducted emissions measurements are not required.

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.

The DUT was tested in receive mode only.

1.4. 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.

For radiated measurements above 1 GHz, RF absorbing material is placed between the antenna and EUT in accordance with ANSI C63.4:2014 Section 5.5 and chamber manufacturer's instructions.

Tabletop testing was conducted on a 3m turntable described in the site recertification report. The 3m chamber has been added to our A2LA scope of accreditation on 4/18/2019 and includes accreditation to ANSI C63.4:2014, ANSI C63.10:2013, and C63.26:2015. Our 3m chamber is registered with the ISED under Site# 4112A-2 and FCC under registration number 357351.

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1.5. Accreditation

The Gentex Corporate EMC Lab is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation (A2LA). Our laboratory scope and accreditation certificate #2529.01 are available from their web site www.a2la.org. Our scope of accreditation covers ANSI C63.4:2014, ANSI C63.10:2013, ANSI C63.26:2015 and Radiated Emissions at 3m, FCC 47 CFR Part 90, ISED RSS-137.

2. Product Labeling

2.1. Identifiers

The FCC Identifier assigned is FCC ID: NZLSAHL5M. The ISED certification number is 4112A-SAHL5M. These identifiers will be labeled on the product housing.

The label will be printed on a label, which will be placed on the exterior of the housing and permanently affixed.

Because of the small size of the device and because the installation is inside a portion of the automobile, the following statements will appear in the user's manual. Refer to attachment "Users Manual.pdf" for the entire text of the user's manual.

> "The receiver portion of the device complies with FCC rule Part 15. Operation is subject to the following two conditions:
> (1) This device may not cause harmful interference,
> (2) This device must accept any interference that may be received including interference that may cause undesired operation.
> WARNING: The transmitter has been tested and complies with FCC and ISED rules. Changes or modifications not expressly approved by the party responsible for the compliance could void the user's authority to operate the device."
>
> This equipment complies with FCC and ISED radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must be at least 20cm from the user and must not be co-located or operating in conjunction with any other antenna or transmitter.

The term "ISED:" before the certification/registration number only signifies that ISED technical specifications were met.

ISED: 4112A-SAHL5M FCC ID: NZLSAHL5M

2.2. Label Drawing and Location on Product

The label drawing is included in the "Label.pdf" attachment.

A diagram showing the location of the label on the assembly is included in the "Label Location.pdf" attachment.

3. Test Configuration

Radiated Emission measurements presented in the report were made in accordance with ANSI C63.4-2014. The EUT was placed on a 1 x 1.5m non-metallic table elevated 80cm above a conducting ground plane for all measurements. The harness was run straight down from the center of the turntable to a power supply connection sitting at the base of the table. The power supply is located beneath the floor of the chamber.

For radiated measurements above 1 GHz, RF absorbing material is placed between the antenna and EUT in accordance with ANSI C63.4:2014 Section 5.5 and chamber manufacturer's instructions.

4. Conducted Emissions Measurements

Conducted Measurements are not required for this product.

5. Radiated Emissions Data

5.1. Date(s) Tested: 11/5/20 – 11/6/20

5.2. Test Method Deviations: None.

5.3. Temperature and Humidity conditions

	Measured Value	Unit
Temperature	23.3	ºC
Humidity	38.9	%R.H.

5.4. Summary of Results

Measurement		Margin	Frequency
Worst case Digital Emission	39.45 dBuV/m	-.55dB	276.06MHz

- **Measurement Uncertainty:** The standard uncertainty of measurement has been determined in accordance with the ISO Guide to the Expression of Uncertainty in Measurements. The estimation of measurement uncertainty reported is the expanded uncertainty for a coverage factor of k=2.26 and confidence interval of approximately 95%.

  Expanded Uncertainty $U_{(k=2.26)}$ is as follows:

- Radiated Emissions – Bicon (30-250 MHz): 4.5 dB
- Radiated Emissions – LPA (250-1000 MHz): 4.2 dB
- Radiated Emissions – DRWG (1-18 GHz): 5.0 dB
- Frequency: 0.15ppm

5.5. Test Equipment Setup and Procedure

5.5.1. Test Equipment Used

Description	Model #	ID Number	Cal Due
EMCO Biconical Antenna [30-250 MHz]	3110B	H6187	7/16/21
EMCO LPA Antenna [250-1000MHz]	3148	H6192	7/16/21
Com-Power Double Ridged Waveguide [1-18GHz]	AH-118	7182	12/4/21
Rohde & Schwarz EMI Receiver	ESR26	6595	10/12/21
Cables, attenuator and port feed through	various	CF GCL	4/30/21
Miteq Preamplifier	AMF-4D-0050100-24-10P	S/N:2053240	12/31/20
3m Chamber SW	N/A	SW30	3/31/21
Miteq Preamplifier	AM-1300	1429993	12/31/20

EMI Receiver Settings Emissions:

Detector Function:	Quasi-Peak
Resolution Bandwidth:	120 kHz (below 1GHz)
	1MHz (above 1GHz)

EMI Receiver (in Spectrum Analyzer mode) Settings Occupied Bandwidth:

Detector:	Quasi-Peak
Resolution Bandwidth:	1 MHz (to determine peak level)
	10 kHz (to determine occupied bandwidth)
Video Bandwidth:	3 MHz (to determine peak level)
	30 kHz (to determine occupied bandwidth)

For the testing, the EUT was placed at the center of a non-conducting table 80cm above the ground plane pursuant to ANSI C63.4:2014 for stand-alone equipment. The 2-conductor harness was run straight down from the center of the turntable to a power supply sitting at the base of the table.

Equipment is placed in one of the three orthogonal orientations, End, Side, and Flat where applicable. The DUT was tested in in-vehicle position only similar to the flat orientation, see test setup photos for details. These orientations are described below in Figure 6.2.1.

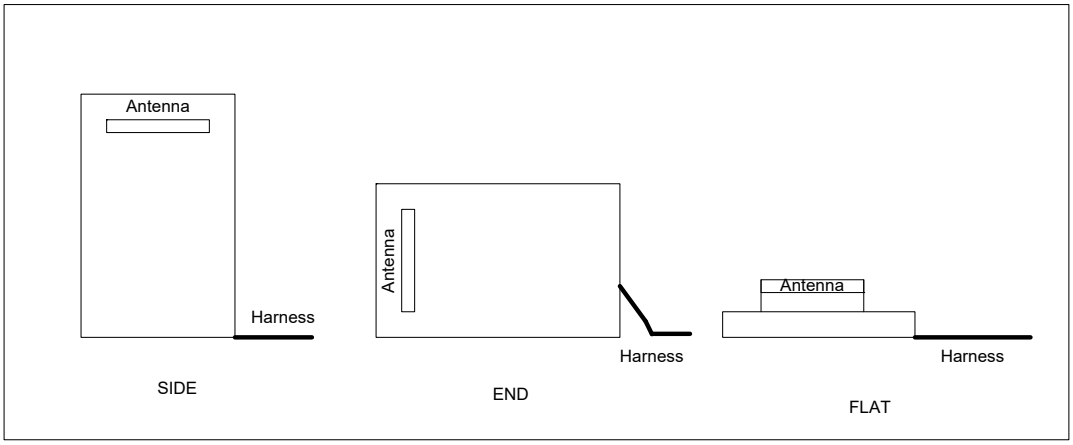


Figure 6.2.1 EUT Orthogonal Orientations

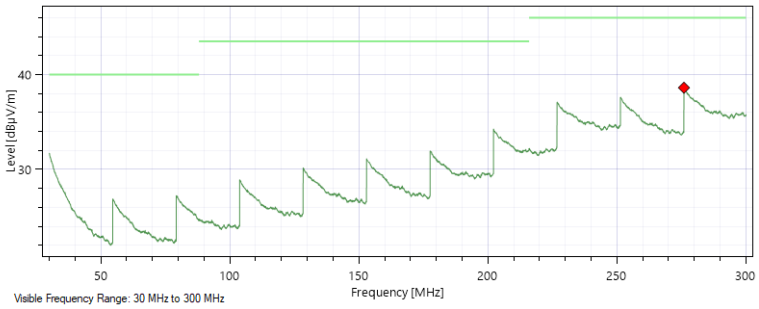
While in the prescribed orientation, the vertical antenna positioner sweeps in elevation from 1 to 4m in height until the operator finds the peak. The 3m turntable is then rotated through 360 degrees until a peak is found. The table is stopped at the peak location and the peak in elevation re-verified. Procedure is repeated for applicable orientations/measurement antenna polarizations.

6. Class B Emissions

The transmitter spurious radiation emissions were measured in a 3m semi-anechoic chamber. The design utilizes permanently attached antenna system and offers no provision antenna replacement. The DUT was placed on a turntable elevated as required above the ground plane at a distance of 3 meters from the measurement antenna. The turntable was rotated through 360 degrees to locate the position registering the maximum amplitude emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter. Raising and lowering the measurement antenna and rotating the turntable to maximize the emission. A Loop antenna was used for measuring emissions from 0.009 to 30 MHz, Biconical Antenna for 30-300 MHz, Log Antenna for 300-1000 MHz, and Double Ridge Wave Guide Horn for 1-9 GHz. Emissions were measured in dBuV/m at 3 meters.

Data was taken per 47CFR Part 2.1051 and applicable parts of 47CFR Part 15B. The DUT demonstrated compliance with the specifications of Paragraphs 47CFR 2.1051, 2.1057.

Test Mode	Detector	Frequency (MHz)		Orientation	Antenna Polarization	Peak Frequency (MHz)	Peak Emission (dBuV/m)	Limit (dBuV/m)	Margin
		Start	Stop						
RX	Quasi-Peak	30	300	End	Horizontal	276	39.17	43.5	-4.33
RX	Quasi-Peak	30	300	End	Vertical	276	39.44	40	-0.56
RX	Quasi-Peak	30	300	Flat	Horizontal	276	38.59	40	-1.41
RX	Quasi-Peak	30	300	Flat	Vertical	276.06	39.45	40	**-0.55**
RX	Quasi-Peak	30	300	Side	Horizontal	276	38.60	46	-7.40
RX	Quasi-Peak	30	300	Side	Vertical	276	39.46	46	-6.54
RX	Quasi-Peak	300	1000	End	Horizontal	750	27.70	46	-18.31
RX	Quasi-Peak	300	1000	End	Vertical	687	33.50	46	-12.51
RX	Quasi-Peak	300	1000	Flat	Horizontal	750	27.78	46	-18.23
RX	Quasi-Peak	300	1000	Flat	Vertical	688	33.82	54	-20.18
RX	Quasi-Peak	300	1000	Side	Horizontal	750	27.76	54	-26.24
RX	Quasi-Peak	300	1000	Side	Vertical	687	33.52	54	-20.48
RX	Peak	1000	5000	End	Horizontal	4784.25	53.57	74	-20.43
RX	Average	1000	5000	End	Horizontal	1600	41.02	54	-12.98
RX	Peak	1000	5000	End	Vertical	4614	53.69	74	-20.31
RX	Average	1000	5000	End	Vertical	4800	40.98	54	-13.02
RX	Peak	1000	5000	Flat	Horizontal	4675	53.76	74	-20.24
RX	Average	1000	5000	Flat	Horizontal	1600	40.87	54	-13.13
RX	Peak	1000	5000	Flat	Vertical	4551	53.63	74	-20.37
RX	Average	1000	5000	Flat	Vertical	4800	40.94	54	-13.06
RX	Peak	1000	5000	Side	Horizontal	4718	53.54	74	-20.46
RX	Average	1000	5000	Side	Horizontal	1600	41.00	54	-13.01
RX	Peak	1000	5000	Side	Vertical	4794	53.72	74	-20.28
RX	Average	1000	5000	Side	Vertical	1600	40.94	54	-13.06



Horizontal Polarization – End

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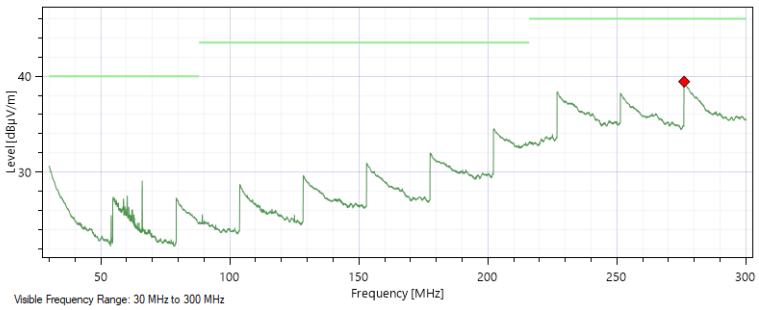
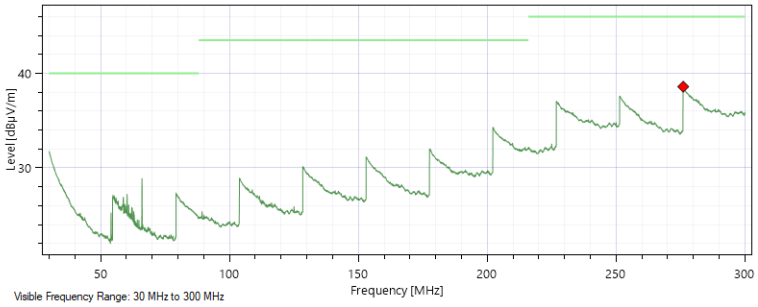
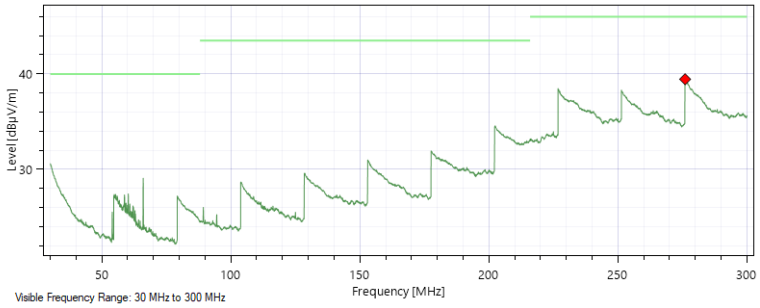


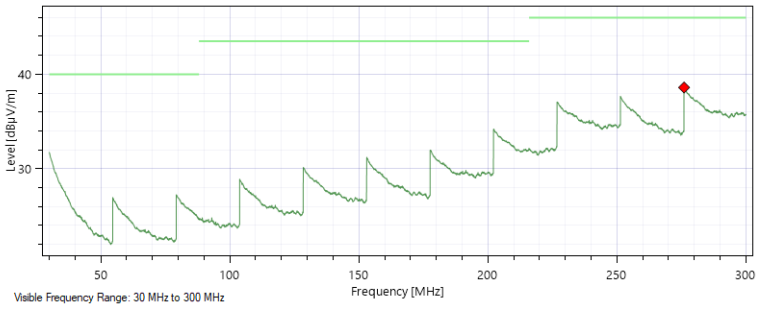
Vertical Polarization - End



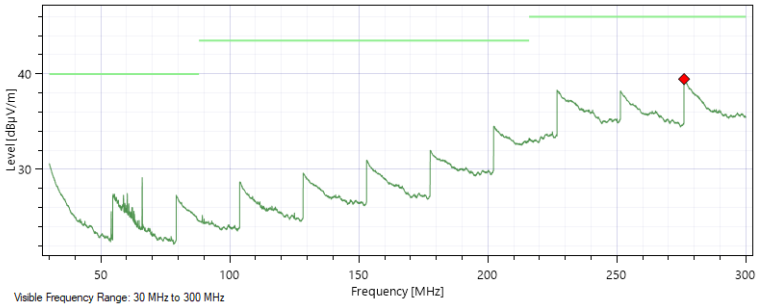
Horizontal Polarization – Flat



Vertical Polarization – Flat



Horizontal Polarization - Side



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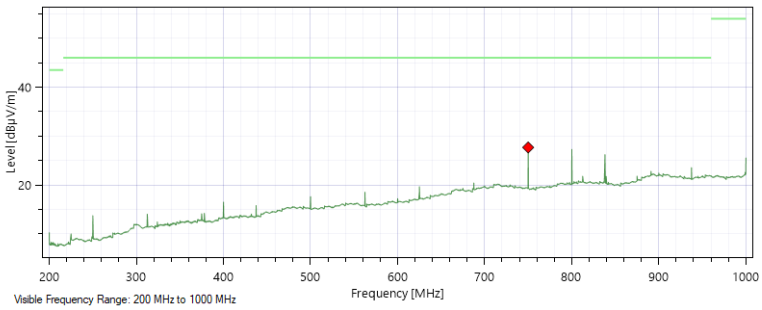
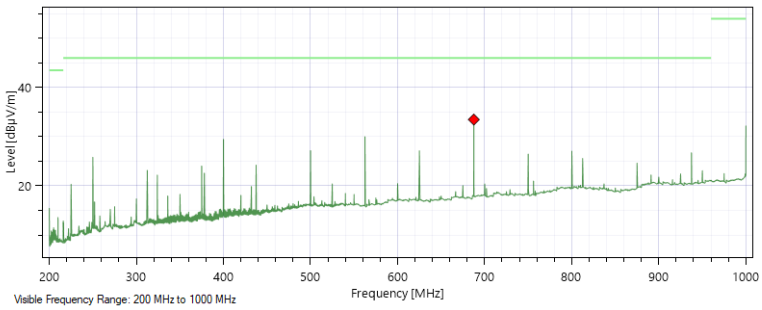


Horizontal Polarization - End



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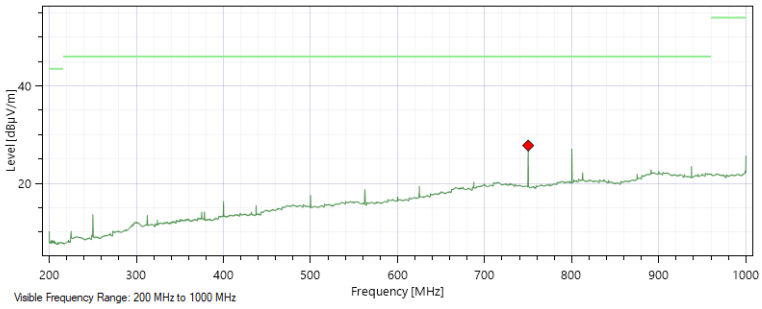

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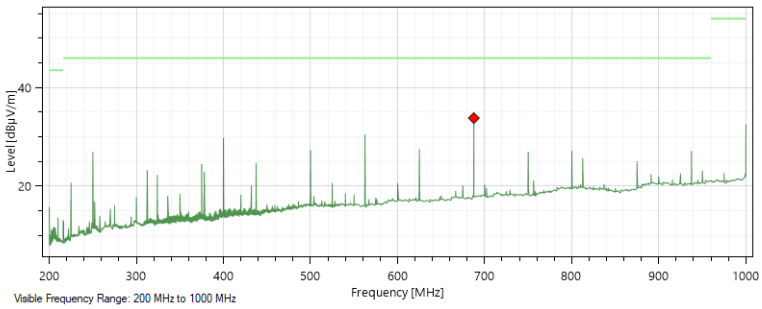

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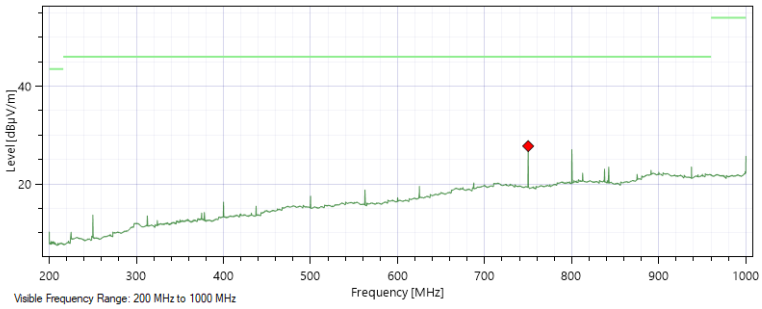

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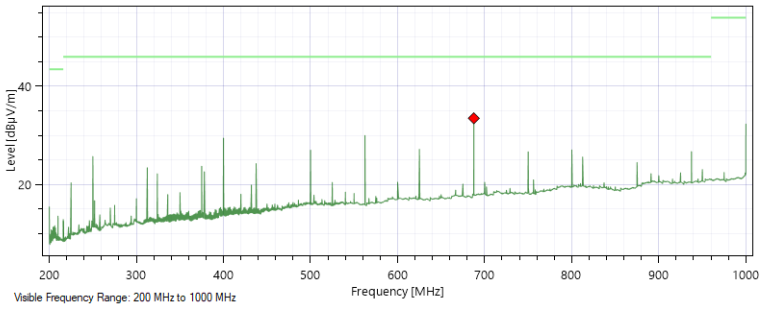
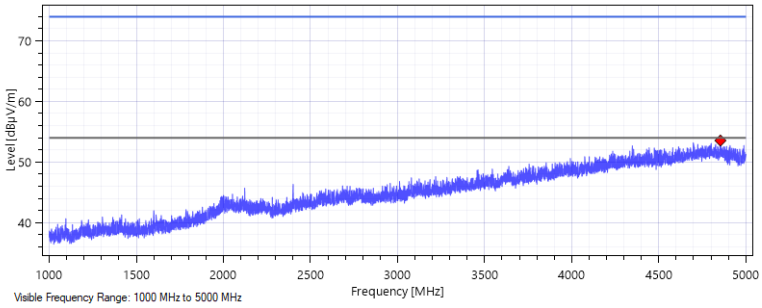


Vertical Polarization – Side



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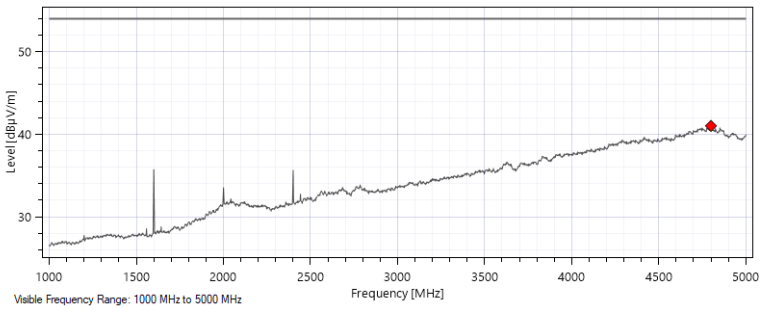

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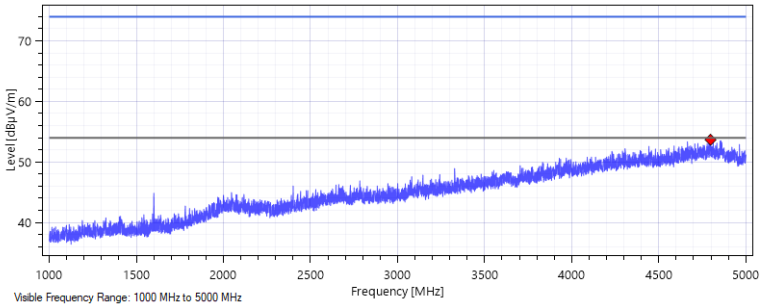

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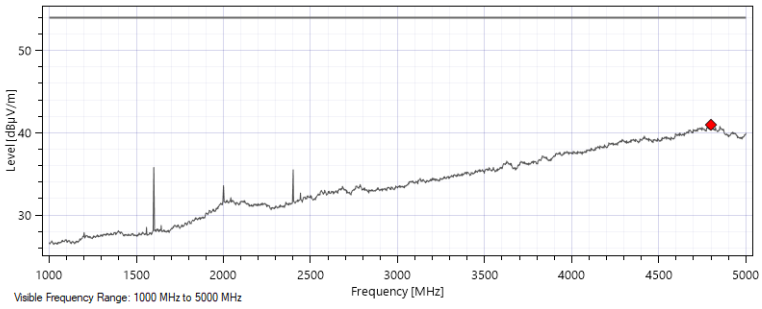

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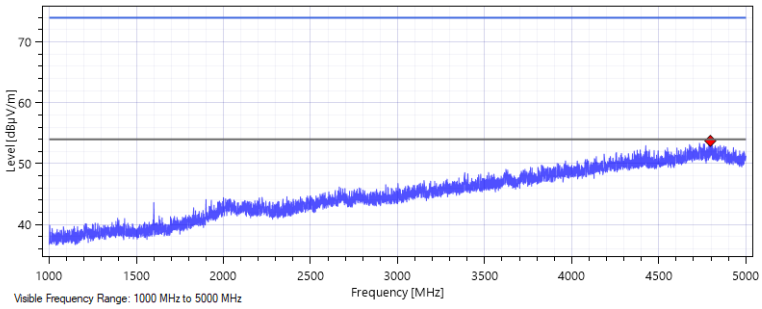

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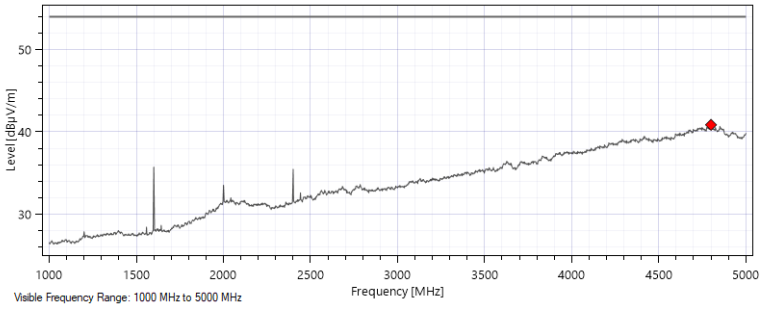

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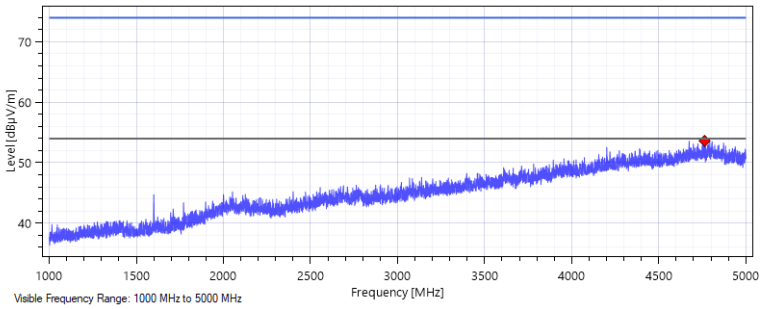

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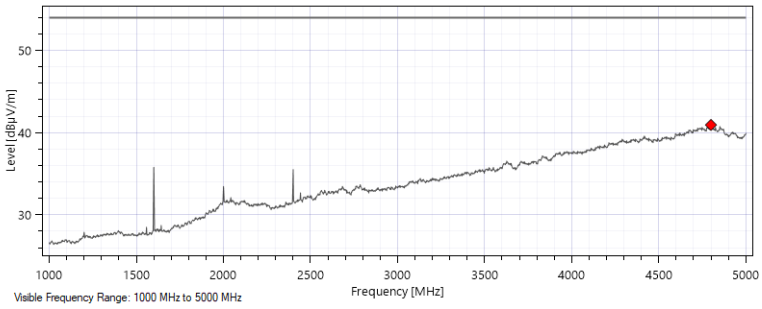

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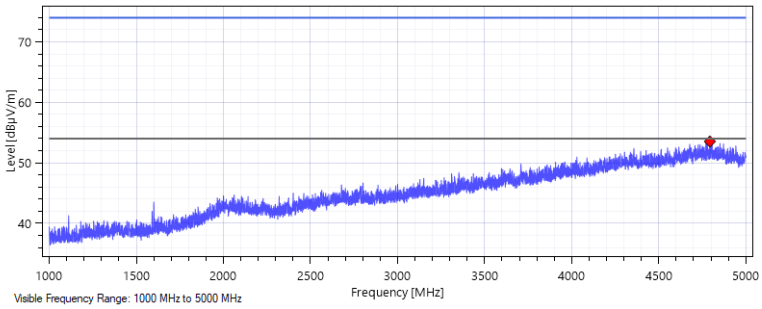

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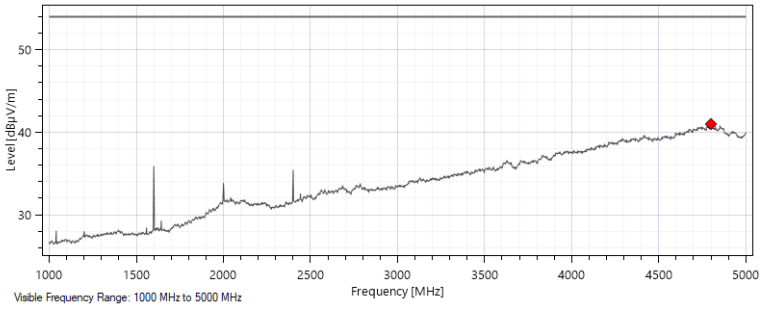

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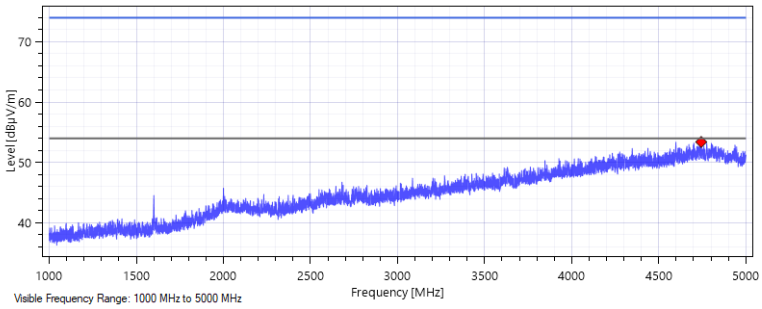

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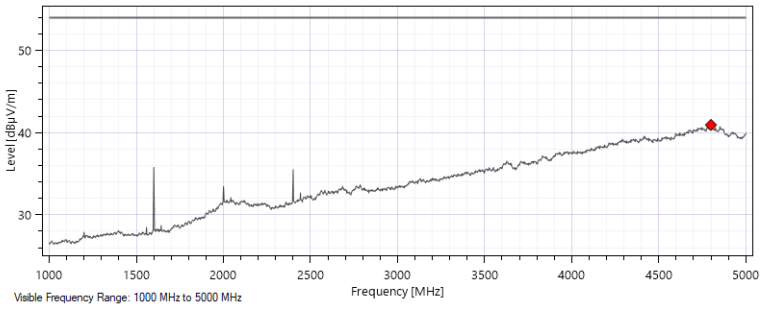

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