Appendix B: Noise Study

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NOISE STUDY

Interstate 55

Route PP to County Road 311

Prepared for:

MoDOT PROJECT NO. J010956

November 2014

Prepared by:

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1.0 EXECUTIVE SUMMARY

The Interstate 55 corridor currently has two interchanges in the Scott City, MO area. The Routes K-M-61 interchange is currently used at its full capacity. As development increases at the Route AB interchange, increased traffic congestion issues are expected there as well. After a comprehensive review of six alternative solutions at three locations, the preferred alternative was determined to be the addition of an interchange at Interstate 55 and Route PP. This new interchange will provide traffic congestion relief to both the current Scott City interchanges, as well as increase access to the interstate for the Kelso, MO area.

Because of the addition of a new interchange, this project qualifies as a Type I Project and therefore requires a noise analysis for potential abatement measures. One receiver in the project area was found to be impacted in the design year (2031) by the FHWA Noise Abatement Criteria. After analyzing potential abatement measures, <u>none were found to be both feasible and reasonable per FHWA and MoDOT policies</u>. Table 1.1 shows details on the abatement option considered.

1.1 DEFINITION OF TERMS

<u>Benefited Impacted Receiver</u>: An impacted receptor or group of impacted receptors that receives at least a 7 dBA reduction in noise levels after the addition of noise abatement measure(s)

<u>Benefited Non-Impacted Receiver</u>: A receptor or group of receptors that is not impacted but does receive at least a 7 dBA reduction in noise levels after the addition of noise abatement measure(s)

<u>Benefited Receptor</u>: A receptor that receives at least a 7 dBA reduction in noise levels after the addition of noise abatement measure(s)

Impacted Receiver: A receptor or group of receptors that has an L_{eq} at the loudest traffic noise hour approaching (within 1 dB) or exceeding the Noise Abatement Criteria Table, or exceeds existing noise levels by 15 dBA

Impacted Receptor: Any receptor that has an L_{eq} at the loudest traffic noise hour approaching (within 1 dB) or exceeding the Noise Abatement Criteria Table, or exceeds existing noise levels by 15 dBA

L_{eq} (h): Sound energy in decibels averaged over an equivalent hour long period

Noise Sensitive Area (NSA): An area with receptors classified under Activity Categories A-E in the FHWA Noise Abatement Criteria Table that is considered for noise abatement

Non-Impacted Receiver: A receptor or group of receptors that does not have an L_{eq} at the loudest traffic noise hour approaching (within 1 dB) or exceeding the Noise Abatement Criteria Table, and does not exceed existing noise levels by 15 dBA

Receiver: A noise modeling site that may represent one or more receptors

Receptor: A dwelling unit or equivalent dwelling unit (such as a playground)

Table 1-1 Executive Summary Table																
NSA	Number of Impacted Receptors by Activity Category					Consideration of Noise Abatement Warranted?	Barrier Option	Number of first-row, impacted receptors	Number of first-row impacted receivers with 5 dBA insertion loss	67% of first-row impacted receivers with 5 dBA insertion loss?	Abatement Feasible?	Details of Feasible Barriers Evaluated for Reasonableness			Less than 1300 ft^2 per benefited receptor?	Abatement Reasonable?
	B	C	D	E	Total							Benefited Receptors	Square Feet	Square Feet/ Benefited Receptor		
2	1				1	Yes	A	1	1	✓	✓	0	43,855	-	×	×

2.0 PROJECT BACKGROUND

The project extends along Interstate 55 from Route PP to Country Road 311 in Scott City, MO and Kelso, MO, as seen in Figure 2.1 below.

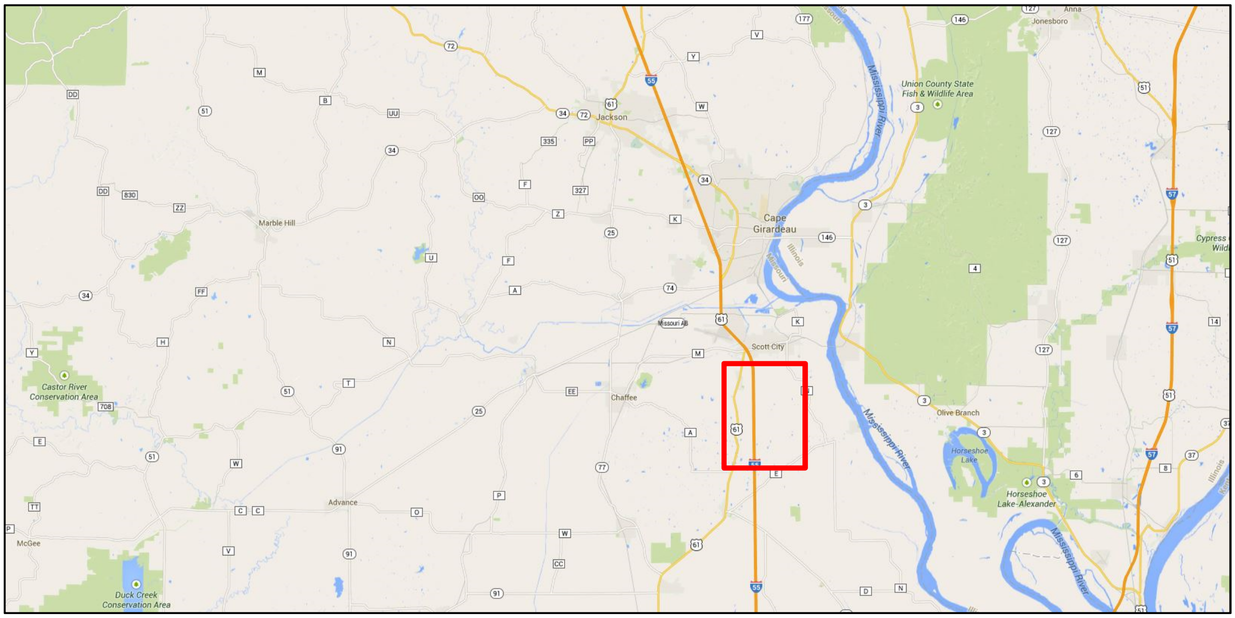


Figure 2.1 Location Map

Interstate 55 has two interchanges in Scott City, MO, located at Route AB and at Route 61/Route M/Route K. The Route AB interchange currently has congestion issues, and as the industrial park continues to develop, traffic problems are expected to get worse. Estimates show that two of the ramps will operate at a Level of Service "F" by 2031. As this interchange becomes overcrowded, traffic is expected to spill over to the Route 61/Route M/Route K interchange.

The proposed location for the new interchange is at Route PP, about 2.25 miles south of the Route AB interchange, at Kelso, MO. The existing bridge at Route PP will be replaced to build a full diamond interchange with single lane ramps. This new access point will allow northbound Route 61 traffic to enter I-55 before the Route 61/Route M/Route K interchange. The improved access for Kelso will reduce the number of vehicles entering the existing interchange in Scott City and ease some of the congestion. Both cities will benefit from the additional access.

The construction of a new interchange qualifies this project as a Type I noise abatement project; therefore, a noise analysis is required in accordance with 23 CFR 772, MoDOT Noise Policy EPG 127.13, and all Federal Highway Administration (FHWA) noise standards.

3.0 NOISE ENVIRONMENT

The project area consists of a few residential areas as well as a few industrial areas. To be considered for noise abatement, a receiver must be categorized under FHWA Noise Abatement Criteria (NAC) activity categories A-E, shown in Table 3-1. Building reduction factors are used when evaluating interior noise impacts for category D, shown in Table 3-2. Equivalent receptor numbers for categories C, D, and E are counted as feet of frontage divided by the average of the single family residential frontages in the project area.

Table 3-1 FHWA Noise Abatement Criteria (Hourly A-Weighted Sound Level - Decibels)			
Activity Category	**Activity Criteria $L_{eq}(h)$***	**Evaluation Location**	**Activity Descriptions**
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	Exterior	Residential.
C	67	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	----		Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical) and warehousing.
G	----		Undeveloped lands that are not permitted.

*"Approaching NAC" is defined by MoDOT as being 1 dBA less than the NAC for Activity Categories A-E

Table 3-2 Building Noise Reduction Factors		
Building Type	Window Condtion	Noise Reduction Due to the Exterior of the Structure
All	Open	10 dB
Light Frame	Ordinary Sash	20 dB
	Storm Windows	25 dB
Masonry	Single Glazed	25 dB
	Double Glazed	35 dB

The project area was divided into 4 separate noise sensitive areas (NSA) qualifying for noise abatement consideration, as shown on Exhibit 1. Only receivers within 500' of the project were included, as sufficient evidence indicates TNM is not reliable beyond this distance. The following is a list of the activity categories in each NSA that were analyzed.

NSA 1:

- 12 residential receptors (category B)

NSA 2:

- 6 residential receptors (category B)

NSA 3:

- 6 residential receptors (category B)
- 1 pre-school playground (category C)

NSA 4:

- 12 residential receptors (category B)

4.0 ANALYSIS METHODOLOGY

Extech HD600 Datalogging Sound Level Meters were used and calibrated before each noise measurement, completed on September 23rd & 24th, 2014 and October 24th, 2014. Readings were taken at various locations along the corridor (see Exhibit 2) in 30 minute intervals while traffic was counted and categorized into the five standard vehicle types. See Table 4-1 for traffic counts.

Table 4-1												
Validation Measurement Traffic Counts												
Receivers	Date	Time Period	Hourly Traffic Based on Concurrent Traffic Counts (1)									
			Southbound I-55 (2)					Northbound I-55 (2)				
			Autos	MT	HT	Bus	MC	Autos	MT	HT	Bus	MC
1.1/2.1	9/23/2014	10:50-11:20 AM	446	36	146	0	0	406	32	196	0	0
1.2/2.2	9/23/2014	6:00-6:30 PM	520	14	102	0	2	382	12	96	0	0
Receivers	Date	Time Period	Hourly Traffic Based on Concurrent Traffic Counts (1)									
			Southbound US 61					Northbound US 61				
			Autos	MT	HT	Bus	MC	Autos	MT	HT	Bus	MC
3.1/4.1/5.1	9/23/2014	12:00-12:30 PM	174	4	2	0	0	98	8	2	0	0
3.2/4.2/5.2	9/24/2014	7:20-7:50 AM	106	8	0	0	0	182	6	8	0	0
NOTES:												
MT = Medium Trucks				HT = Heavy Trucks				MC = Motorcycles				
FHWA TNM = Federal Highway Administration Traffic Noise Model												
(1) Hourly volumes derived by extrapolation of counts taken during 30-minute period to a one-hour value												
(2) Sum of volume from both lanes. Individual lanes counted in field and modeled as such in TNM.												

Next, the FHWA Traffic Noise Model, TNM 2.5, was used to model all relevant roadways, receivers, barriers, building rows, terrain lines, and ground zones in the project area for the existing condition (see included CD for all TNM files and input data)

The field measurements and their corresponding traffic counts validated the model by ensuring less than a 3 dBA difference (plus or minus) between the measured L_{eq} and the modeled L_{eq} (h) at each location, as shown in Table 4-2.

Table 4-2							
Measurement and Validation Data							
Receiver	Short-Term Measurements					FHWA TNM L_{eq} (h) Noise Levels dBA	Measured Minus Modeled Noise Levels dB
	Date	Time Period	Measured Noise Levels (dBA)				
			L_{eq}	L_{max}	L_{min}		
1.1	9/23/2014	10:45-11:15 AM	57.2	83.3	49.9	59.7	-2.5
2.1	9/23/2014	10:45-11:15 AM	66.5	84.3	49.3	68.4	-1.9
1.2	9/23/2014	6:00-6:30 PM	58.4	82.7	52.5	58.3	0.1
2.2	9/23/2014	6:00-6:30 PM	69.2	84.7	57.5	66.5	2.7
3.1	9/23/2014	5:10-5:40 PM	49.8	76.3	40.3	52.4	-2.6
4.1	9/23/2014	5:10-5:40 PM	50.7	70.6	43.3	52.6	-1.9
5.1	9/23/2014	5:10-5:40 PM	51.5	71.2	44.0	54.0	-2.5
3.2	9/24/2014	7:20-7:50 AM	53.2	80.4	45.4	53.0	0.2
4.2	9/24/2014	7:20-7:50 AM	54.8	68.2	49.0	53.1	1.7
5.2	9/24/2014	7:20-7:50 AM	57.3	74.0	50.3	54.5	2.8
NOTES:							
L_{eq} = Equivalent Noise Level			L_{min} = Minimum Noise Level			L_{max} = Maximum Noise Level	
L_{eq} (h) = Hourly L_{eq}			dB = Decibel			dBA = A-weighted Sound	

After validating the model, existing noise levels at each receiver near a road with high volumes were calculated. Single receptors were placed at an outdoor area of frequent use for locations being considered for noise abatement.

For areas not currently near a high volume roadway, ambient measurements were taken for a 30-minute period (Field Measurements 6-13). The average noise level of the ambient measurement at each location was used as the existing noise level.

Using the TNM 2.5 software, the highway with the new interchange and outer roads was modeled using the construction plans for the proposed highway. The previously modeled receivers, barriers, building rows, and ground zones were included while making any necessary adjustments for the future roads. Future (2031) traffic volume projections and heavy vehicle percentages were used with the development of the future conditions model.

When traffic noise impacts were identified in the future conditions model, noise abatement was evaluated for feasibility and reasonableness. To be considered impacted, a receptor must have an L_{eq} at the loudest traffic noise hour approaching (within 1 dBA) or exceeding the NAC for the corresponding land use category, or exceeding existing noise levels by 15 dBA.

For noise abatement to be feasible, MoDOT requires at least a 5 dBA insertion loss for a minimum of 67% of front-row, impacted receptors. Feasibility also refers to the engineering limitations, including the physical constraints and other constructability constraint limits such as maintenance, drainage, safety, etc.

If a noise barrier is considered feasible, it is checked for three mandatory reasonableness factors, all of which must be met. First, noise abatement measures cannot exceed 1300 ft^2 of sound wall per benefited receptor. A benefited receptor is defined as a receptor that receives at least a 7 dBA reduction in noise level after the implementation of noise abatement measures. Second, noise abatement must provide a 7 dBA reduction for a minimum of 67% of front-row benefited receptors. And third, viewpoints of owners and residents of the benefited receptors will be acquired in the form of a survey. Non-owner residents shall receive 25 percent of their respective vote. Owners shall receive 75 percent of their respective vote. Over 50 percent of the aggregate response must be in favor of abatement.

5.0 NOISE IMPACTS/ABATEMENT CONSIDERATIONS

37 receptors were evaluated for noise impacts along the corridor. Of those, only one receptor (130 N State HWY PP) was found to be impacted by NAC criteria. None were impacted by a substantial increase. See Table 5-1 below for complete receiver data.

Barrier Option A (NSA 2) is a two-barrier system extending along the shoulder of northbound I-55 and the I-55 on ramp. Even with almost 2200' of wall at 20' high, the receptor only receives a 6.8 dBA reduction. <u>Therefore, the wall is not reasonable</u>. Barrier Option A can be seen on Exhibit 2.

Table 5-1
Receiver Data

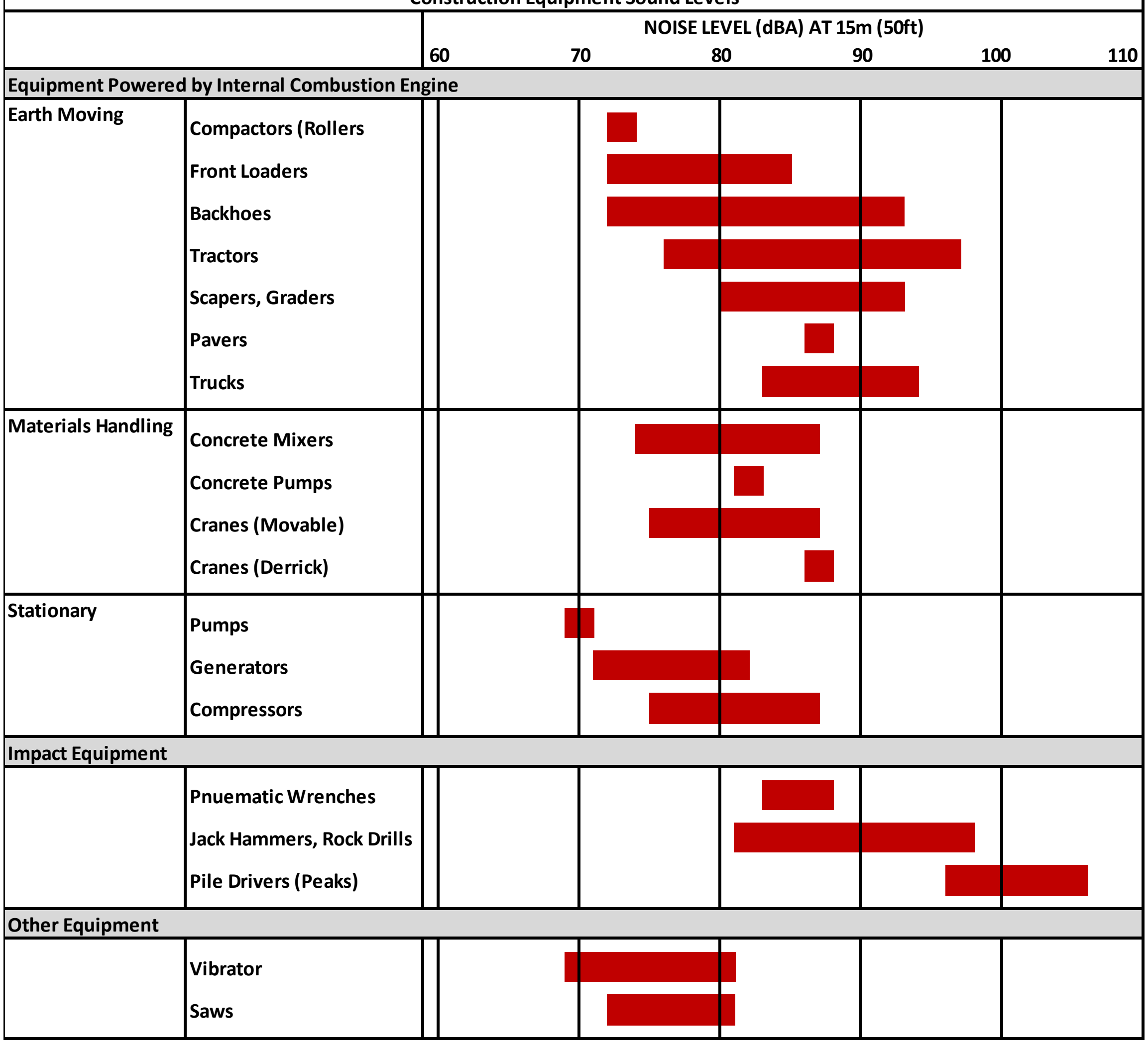
	Receiver	X	Y	Z	Dwelling Units	Existing Level (dBA)	Future Level (dBA)	Increase (dBA)	Impact Crit.	Category
NSA 1	330 Arlington Dr	1,097,478.20	494,163.25	388	1	46.0	50.8	4.8	66	B
NSA 1	338 Arlington Dr	1,097,576.14	494,132.98	385.7	1	46.0	51.4	5.4	66	B
NSA 1	340 Arlington Dr	1,097,787.15	494,027.81	381.4	1	46.0	53.4	7.4	66	B
NSA 1	321 Arlington Dr	1,097,321.85	494,106.75	380.9	1	46.0	51.7	5.7	66	B
NSA 1	325 Arlington Dr	1,097,396.92	494,061.22	380.6	1	46.0	52.4	6.4	66	B
NSA 1	335 Arlington Dr	1,097,470.63	494,017.06	380.9	1	46.0	53.3	7.3	66	B
NSA 1	406 Messmer St	1,096,461.95	494,197.52	399.3	1	54.3	55.5	1.2	66	B
NSA 1	414 Messmer St	1,096,423.73	494,105.10	396.1	1	54.4	57.1	2.7	66	B
NSA 1	422 Messmer St	1,096,387.10	494,043.75	395.3	1	55.4	59.6	4.2	66	B
NSA 1	430 Messmer St	1,096,268.46	493,833.29	390.9	1	56.7	61.9	5.2	66	B
NSA 1	440 Messmer St	1,096,237.82	493,747.89	392	1	57.1	58.5	1.4	66	B
NSA 1	450 Messmer St	1,096,193.51	493,666.47	392	1	57.8	57.6	-0.2	66	B
NSA 2	370 Route PP	1,100,002.17	493,665.33	378.1	1	64.7	62.6	-2.1	66	B
NSA 2	130 N State HWY PP	1,100,726.09	493,689.36	381.2	1	69.3	71.2	1.9	66	B
NSA 2	423 N State HWY PP	1,101,028.61	496,310.29	380.5	1	58.8	60.2	1.4	66	B
NSA 2	247 Route PP	1,099,521.70	494,668.08	374.1	1	63.0	57.5	-5.5	66	B
NSA 2	279 Route PP	1,099,871.60	494,521.84	380	1	64.6	61.6	-3.0	66	B
NSA 2	300 Route PP	1,099,989.87	494,219.35	375.8	1	66.9	63.3	-3.6	66	B
NSA 3	926 County HWY 311	1,102,009.54	499,153.21	372.5	1	50.0	54.1	4.1	66	B
NSA 3	976 County HWY 311	1,102,154.46	499,696.97	374.7	1	50.0	53.1	3.1	66	B
NSA 3	Kiddie Kountry	1,102,009.87	500,942.36	413.5	1	55.0	57.6	2.6	66	C
NSA 3	9 County HWY 312	1,101,941.01	501,463.57	420.9	1	55.0	63.4	8.4	66	B
NSA 3	54 County HWY 312	1,102,410.77	501,439.55	410.5	1	55.0	48.3	-6.7	66	B
NSA 3	1205 County HWY 311	1,101,592.87	501,800.91	394.4	1	55.0	53.7	-1.3	66	B
NSA 3	951 Rose Con Rd	1,101,946.88	502,038.75	381.5	1	55.0	54.3	-0.7	66	B
NSA 4	2121 Fornfelt	1,101,779.43	503,530.19	360	1	51.0	60.7	9.7	66	B
NSA 4	2107 Fornfelt	1,101,986.81	503,608.21	360.4	1	51.0	50.9	-0.1	66	B
NSA 4	2121 Fornfelt	1,102,081.38	503,622.32	360.2	1	51.0	49	-2.0	66	B
NSA 4	2023 Fornfelt	1,102,145.26	503,629.79	360	1	51.0	48.1	-2.9	66	B
NSA 4	2021 Fornfelt	1,102,193.37	503,641.41	360	1	51.0	47.5	-3.5	66	B
NSA 4	2114 Fornfelt	1101869.017	503668.8013	360.7	1	51.0	54.7	3.7	66	B
NSA 4	2018 Fornfelt	1102191.713	503721.9229	360.6	1	51.0	47.7	-3.3	66	B
NSA 4	2120 Fornfelt	1101757.028	503693.702	360.2	1	51.0	63.1	12.1	66	B
NSA 4	2113 Mary St	1101821.733	503832.3162	360	1	55.0	56.8	1.8	66	B
NSA 4	2107 Mary St	1101933.722	503918.6388	360	1	55.0	52.6	-2.4	66	B
NSA 4	2103 Mary St	1102036.587	503963.4601	360.1	1	55.0	50.4	-4.6	66	B
NSA 4	2015 Mary St	1102165.167	503988.3609	360.1	1	55.0	48.8	-6.2	66	B

6.0 CONSTRUCTION NOISE

Per 23 CFR 772.19, the temporary increase in noise levels due to construction was considered. These noise impacts will take place in the immediate vicinity of the construction activities and generally be limited to working hours. The figure below shows some typical operating noise levels at a distance of 50 feet. MoDOT construction specifications require all construction equipment to be in good working order. Mufflers are required to help reduce and address construction noise impacts. Interference with speech communication for those passing by, working, or living near the construction sites is to be expected. However, because of the distance of the construction areas to the NSAs and the hours of equipment use, noise impacts due to construction are expected to be minor and to occur infrequently.

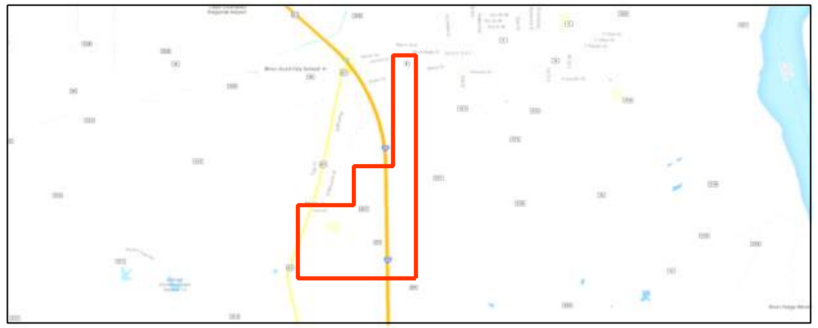
Figure 6.1

Construction Equipment Sound Levels



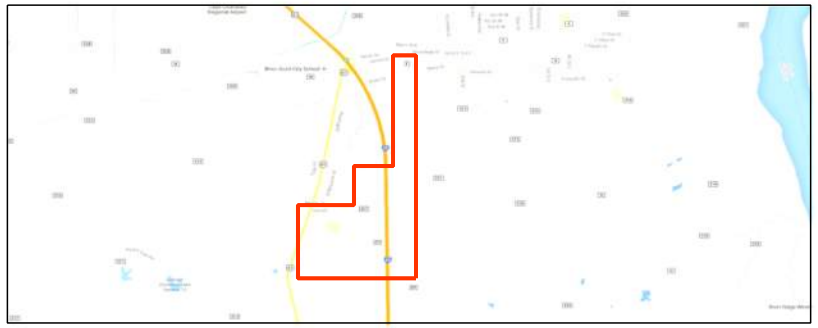
*SOURCE: U.S. Report to the President and Congress on Noise, February, 1972

Exhibit 1 - Noise Sensitive Areas
I-55 & Route PP Traffic Noise Study



Not To Scale

Exhibit 2 - Receiver/Noise Barrier Locations
I-55 & Route PP Traffic Noise Study



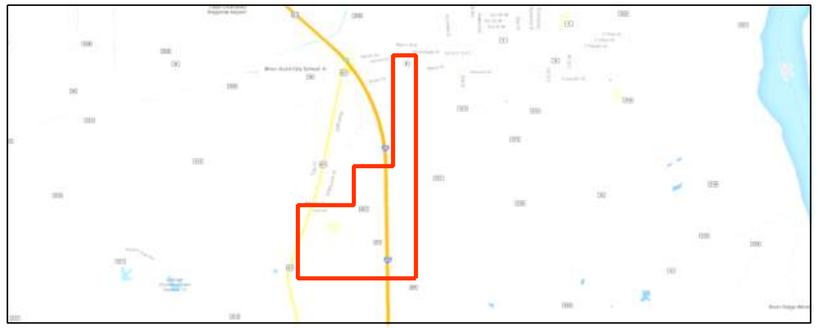
Not To Scale

NOTE: Noise Levels Based
On 2031 Traffic Projections

Legend

- Non-Impacted Receiver
- Impacted Receiver
- Sound Wall Analyzed (Does NOT Qualify)
- 1 Field Measurement Location

Exhibit 3 - Noise Level Contours
I-55 & Route PP Traffic Noise Study

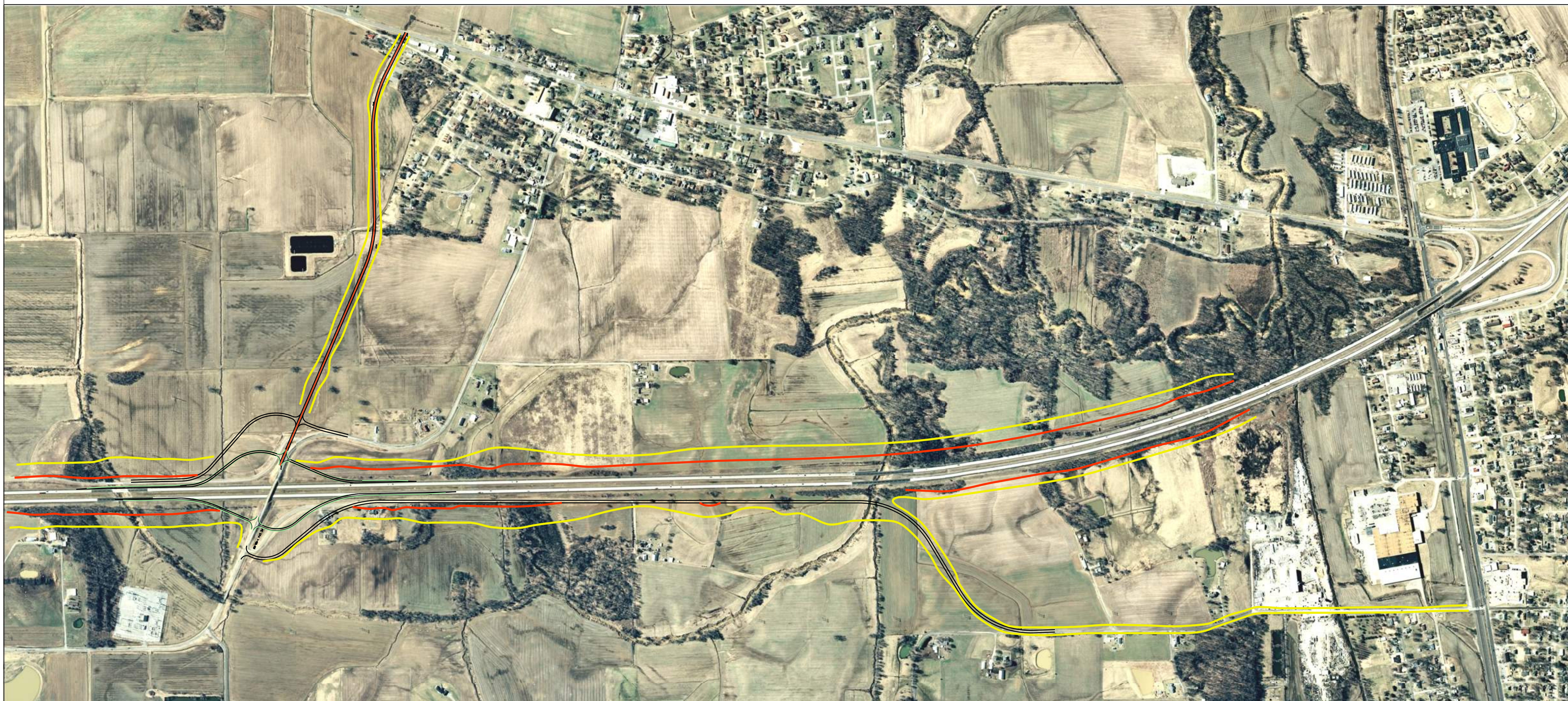


Legend

- 71 $L_{eq}(h)$ dBA Contour
- 66 $L_{eq}(h)$ dBA Contour

Not To Scale

NOTE: Noise Levels Based
On 2031 Traffic Projections



APPENDIX – MEASUREMENT DATA

- Table A-1: Field Measurement Summary
- Field Measurement Graphs

Table A-1

Field Measurement Summary

1.1	September 23, 2014	2.1	September 23, 2014	1.2	September 23, 2014	2.2	September 23, 2014
Maximum Value =	83.3 dBA	Maximum Value =	84.3 dBA	Maximum Value =	82.7 dBA	Maximum Value =	84.7 dBA
Minimum Value =	49.9 dBA	Minimum Value =	49.3 dBA	Minimum Value =	52.5 dBA	Minimum Value =	57.5 dBA
Median Value =	56.2 dBA	Median Value =	66.7 dBA	Median Value =	57.1 dBA	Median Value =	69.3 dBA
L10 =	62.0 dBA	L10 =	73.9 dBA	L10 =	63.5 dBA	L10 =	74.5 dBA
Average Value (L_{eq})=	57.2 dBA	Average Value (L_{eq})=	66.5 dBA	Average Value (L_{eq})=	58.4 dBA	Average Value (L_{eq})=	69.2 dBA
TNM Modeled (L_{eq}) =	**59.7** dBA	TNM Modeled (L_{eq}) =	**68.4** dBA	TNM Modeled (L_{eq}) =	**58.3** dBA	TNM Modeled (L_{eq}) =	**66.5** dBA
Difference =	-2.5 dBA	Difference =	-1.9 dBA	Difference =	0.1 dBA	Difference =	2.7 dBA

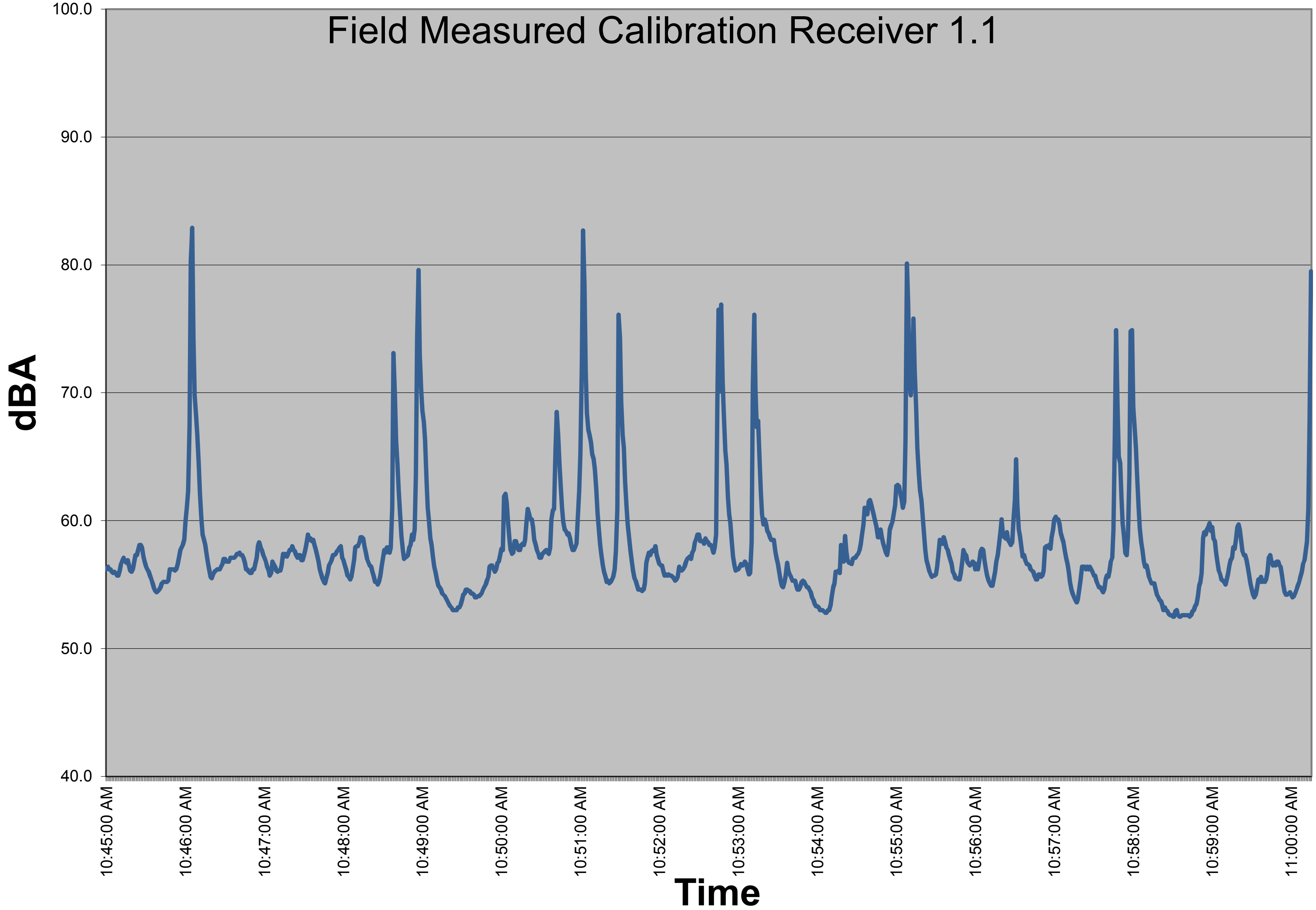
3.1	September 23, 2014	4.1	September 23, 2014	5.1	September 23, 2014
Maximum Value =	76.3 dBA	Maximum Value =	70.6 dBA	Maximum Value =	71.2 dBA
Minimum Value =	40.3 dBA	Minimum Value =	43.3 dBA	Minimum Value =	44.0 dBA
Median Value =	49.0 dBA	Median Value =	49.9 dBA	Median Value =	49.5 dBA
L10 =	57.3 dBA	L10 =	56.2 dBA	L10 =	59.7 dBA
Average Value (L_{eq})=	49.8 dBA	Average Value (L_{eq})=	50.7 dBA	Average Value (L_{eq})=	51.5 dBA
TNM Modeled (L_{eq}) =	**52.4** dBA	TNM Modeled (L_{eq}) =	**52.6** dBA	TNM Modeled (L_{eq}) =	**54.0** dBA
Difference =	-2.6 dBA	Difference =	-1.9 dBA	Difference =	-2.5 dBA

3.2	September 24, 2014	4.2	September 24, 2014	5.2	September 24, 2014
Maximum Value =	80.4 dBA	Maximum Value =	68.2 dBA	Maximum Value =	74.0 dBA
Minimum Value =	45.4 dBA	Minimum Value =	49.0 dBA	Minimum Value =	50.3 dBA
Median Value =	52.3 dBA	Median Value =	54.3 dBA	Median Value =	56.9 dBA
L10 =	58.6 dBA	L10 =	58.4 dBA	L10 =	61.8 dBA
Average Value (L_{eq})=	53.2 dBA	Average Value (L_{eq})=	54.8 dBA	Average Value (L_{eq})=	57.3 dBA
TNM Modeled (L_{eq}) =	**53.0** dBA	TNM Modeled (L_{eq}) =	**53.1** dBA	TNM Modeled (L_{eq}) =	**54.5** dBA
Difference =	0.2 dBA	Difference =	1.7 dBA	Difference =	2.8 dBA

6	September 23, 2014	7	September 23, 2014	8	September 23, 2014	9	September 23, 2014
Maximum Value =	67.1 dBA	Maximum Value =	54.6 dBA	Maximum Value =	57.1 dBA	Maximum Value =	56.9 dBA
Minimum Value =	44.2 dBA	Minimum Value =	42.0 dBA	Minimum Value =	42.7 dBA	Minimum Value =	41.5 dBA
Median Value =	50.6 dBA	Median Value =	45.6 dBA	Median Value =	45.8 dBA	Median Value =	44.8 dBA
L10 =	52.4 dBA	L10 =	48.7 dBA	L10 =	51.5 dBA	L10 =	47.4 dBA
Average Value (L_{eq})=	50.6 dBA	Average Value (L_{eq})=	45.9 dBA	Average Value (L_{eq})=	46.8 dBA	Average Value (L_{eq})=	45.1 dBA

10	October 24, 2014	11	October 24, 2014	12	October 24, 2014	13	October 24, 2014
Maximum Value =	80.2 dBA	Maximum Value =	80.0 dBA	Maximum Value =	82.7 dBA	Maximum Value =	92.1 dBA
Minimum Value =	49.9 dBA	Minimum Value =	49.7 dBA	Minimum Value =	45.6 dBA	Minimum Value =	50.3 dBA
Median Value =	54.8 dBA	Median Value =	56.4 dBA	Median Value =	49.3 dBA	Median Value =	53.0 dBA
L10 =	57.6 dBA	L10 =	70.2 dBA	L10 =	58.0 dBA	L10 =	65.9 dBA
Average Value (L_{eq})=	55.2 dBA	Average Value (L_{eq})=	58.7 dBA	Average Value (L_{eq})=	51.2 dBA	Average Value (L_{eq})=	55.6 dBA

GBA architects engineers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dBA
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60.0
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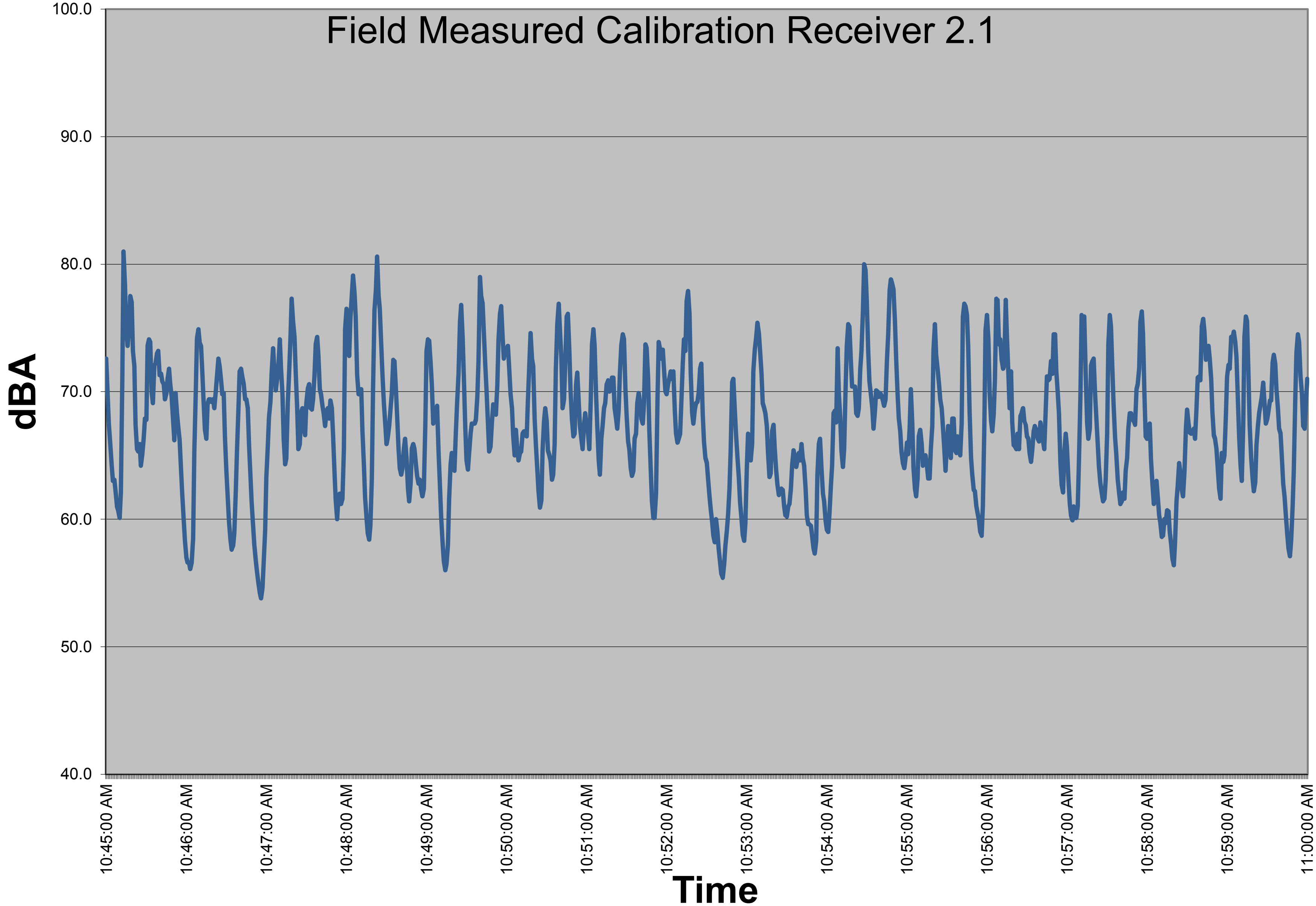
Time



Field Measured Calibration Receiver 2.1
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60.0
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40.0
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10:46:00 AM
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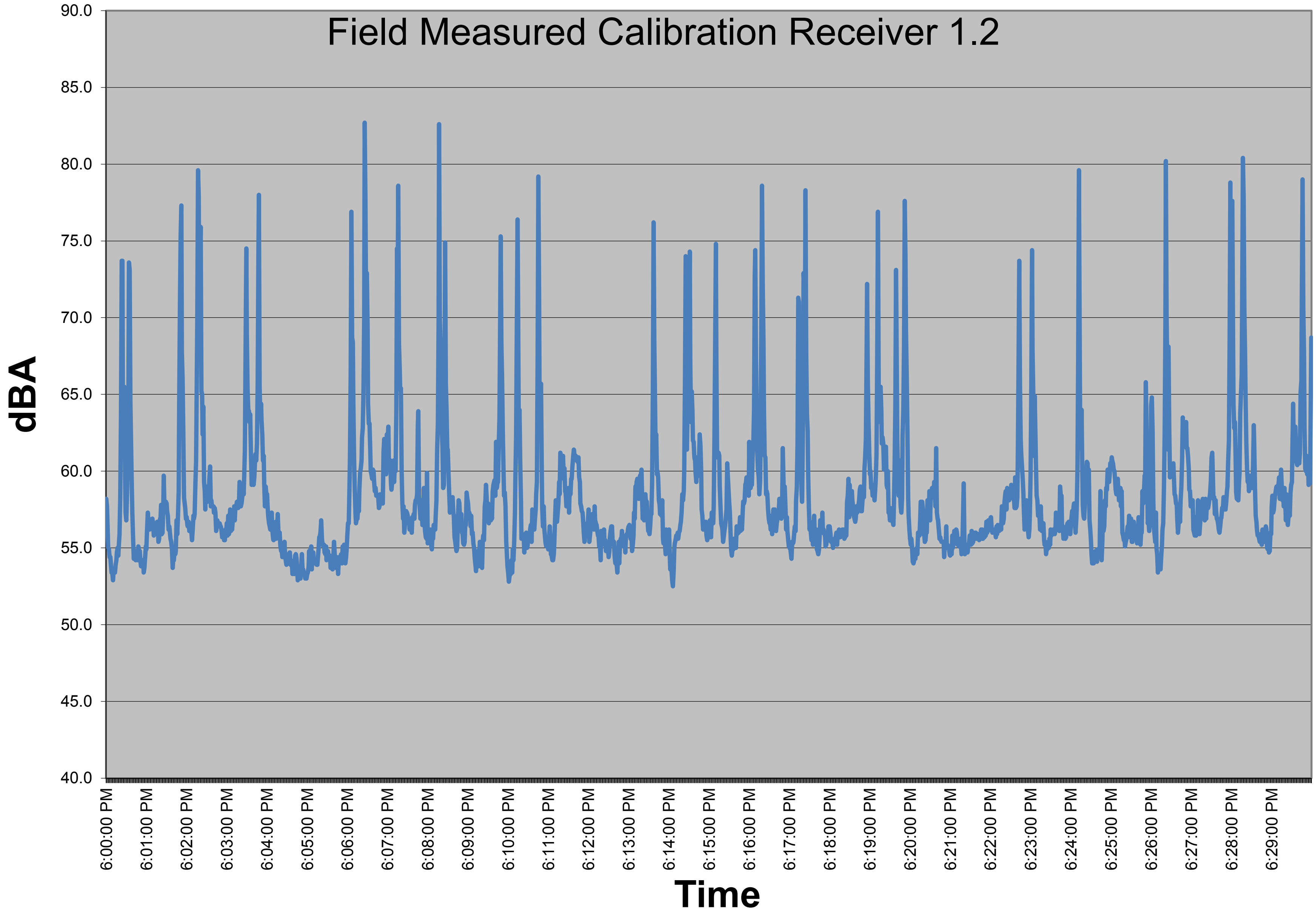
Time


Field Measured Calibration Receiver 1.2
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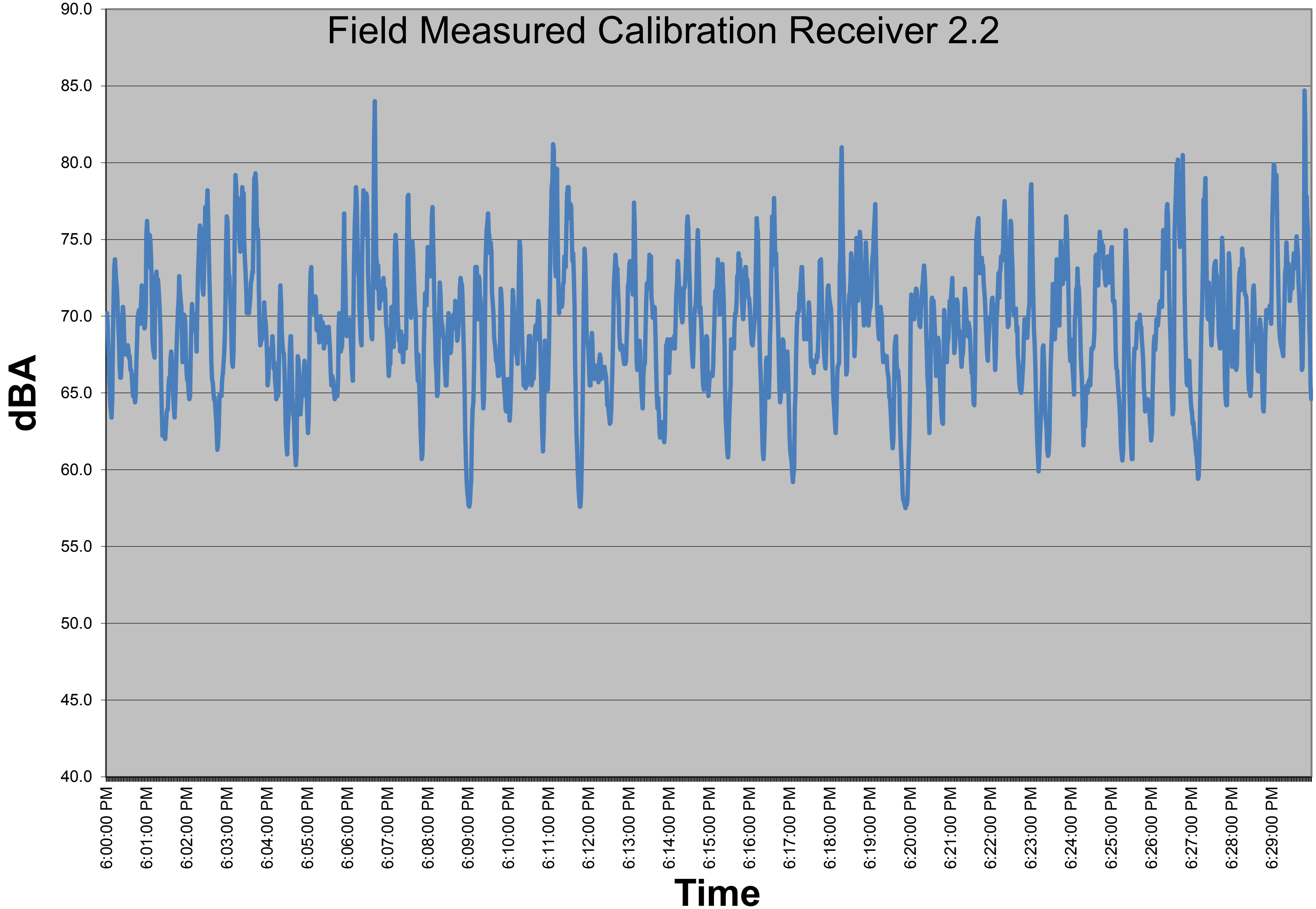
Time


Field Measured Calibration Receiver 2.2
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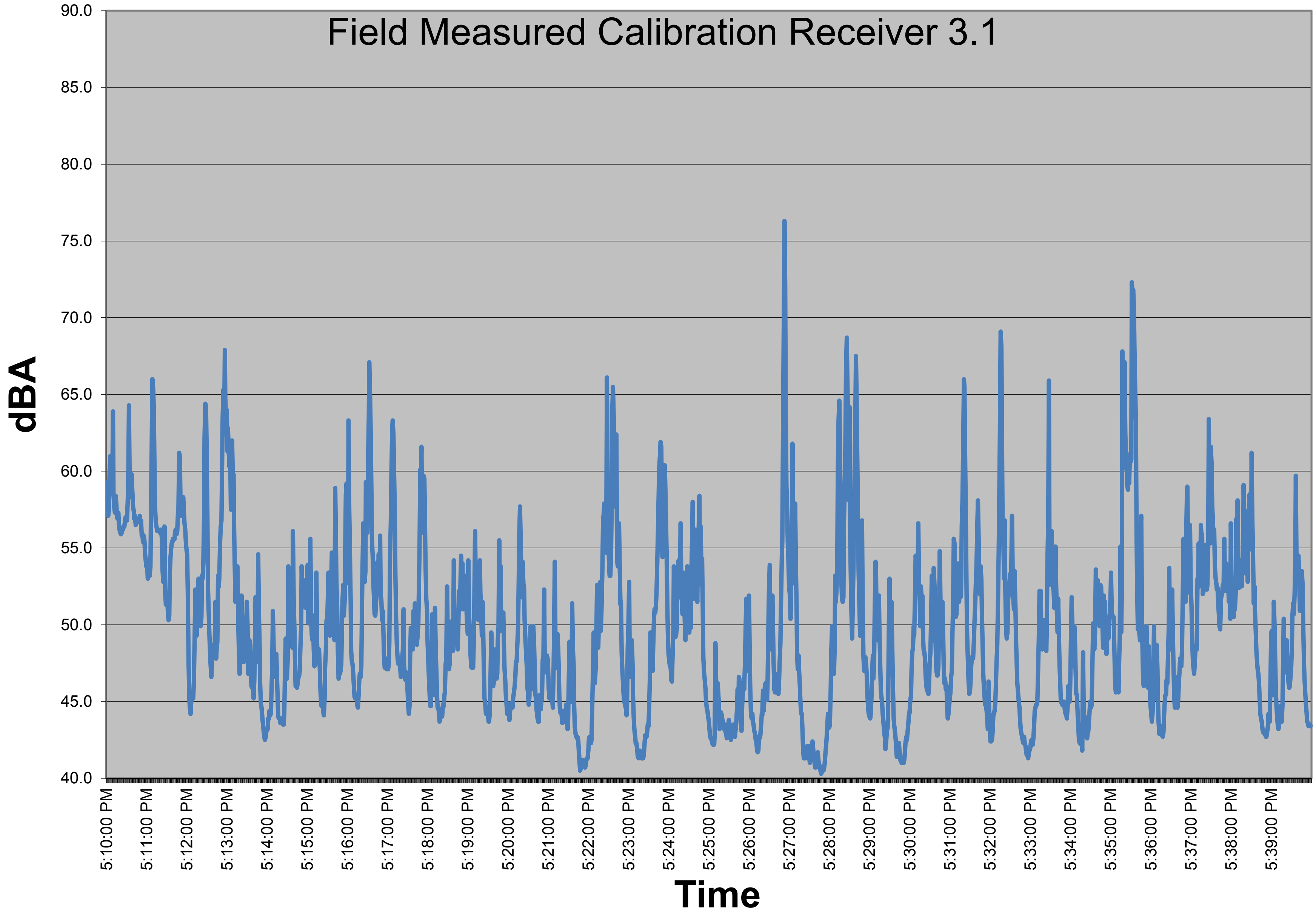
Time



Field Measured Calibration Receiver 3.1
dBA
Time
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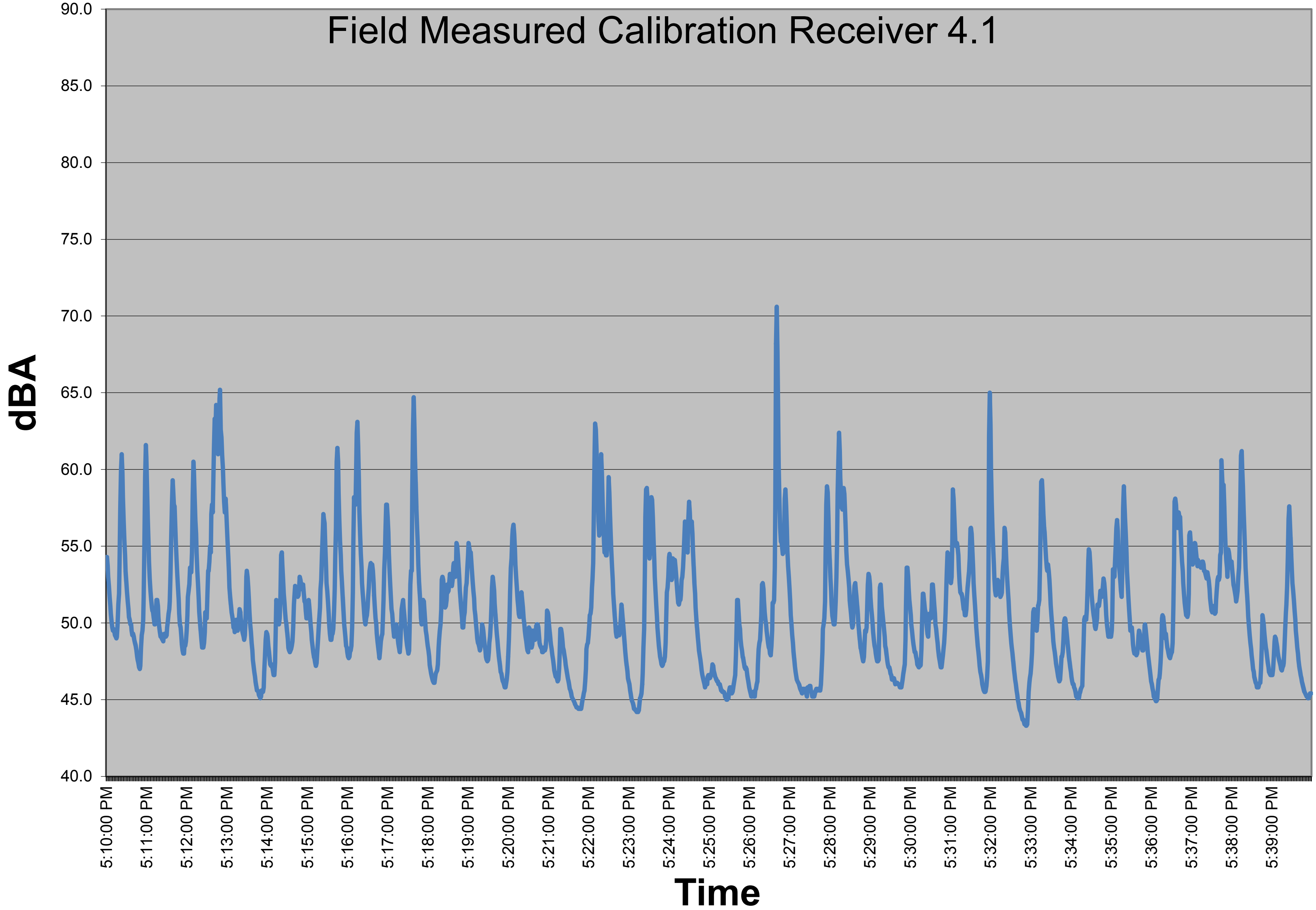
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dBA
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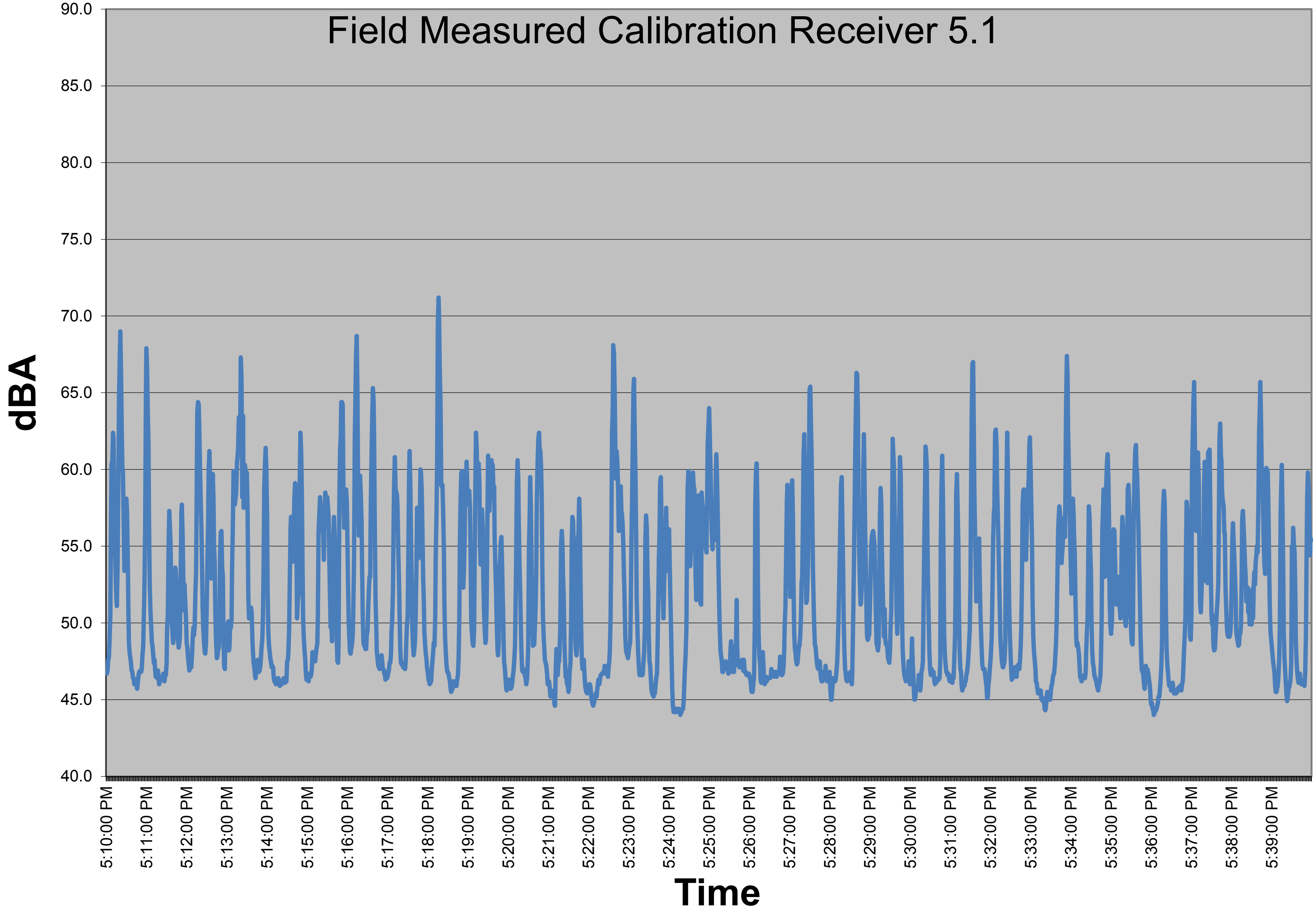
Time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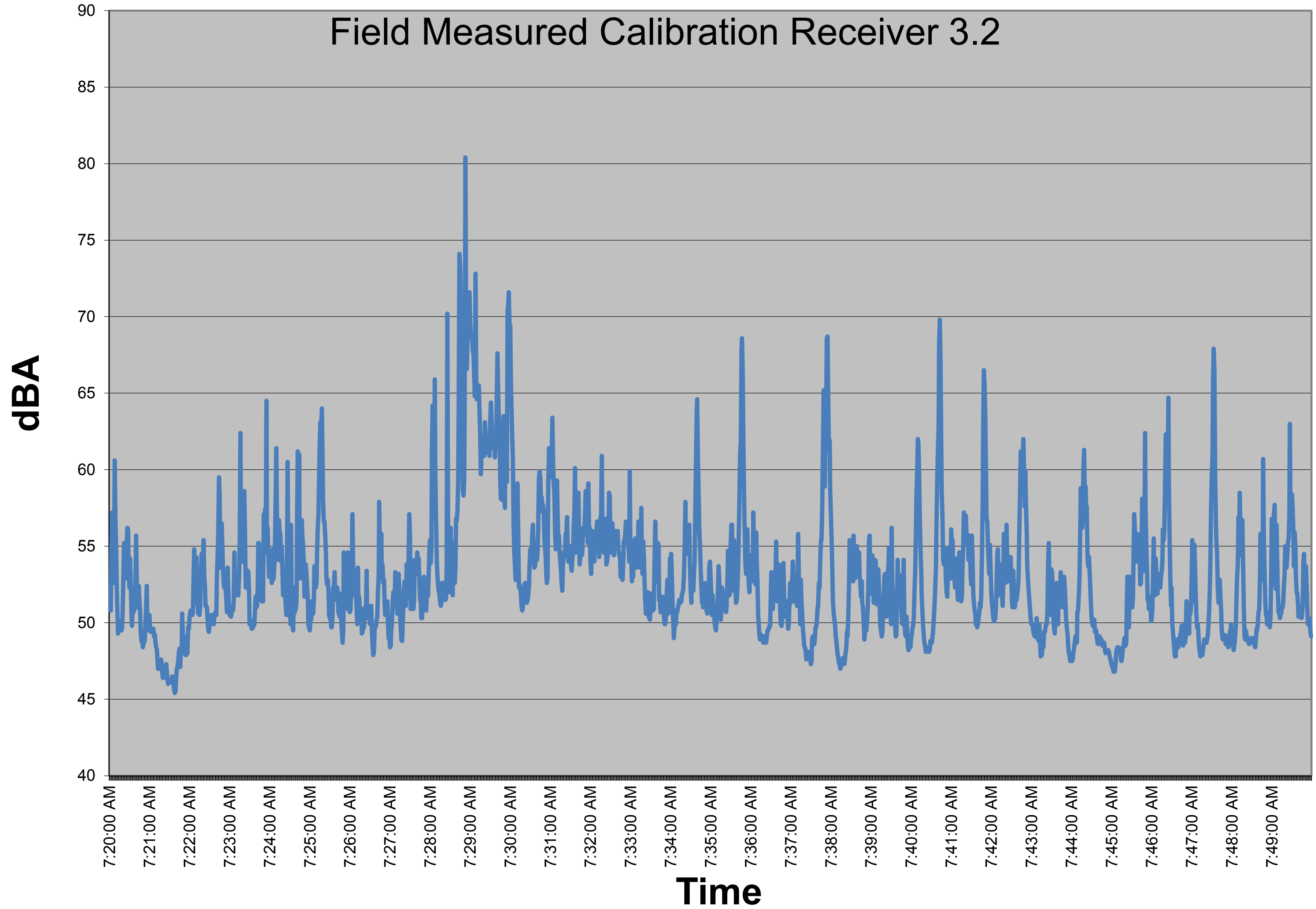
Time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dBA
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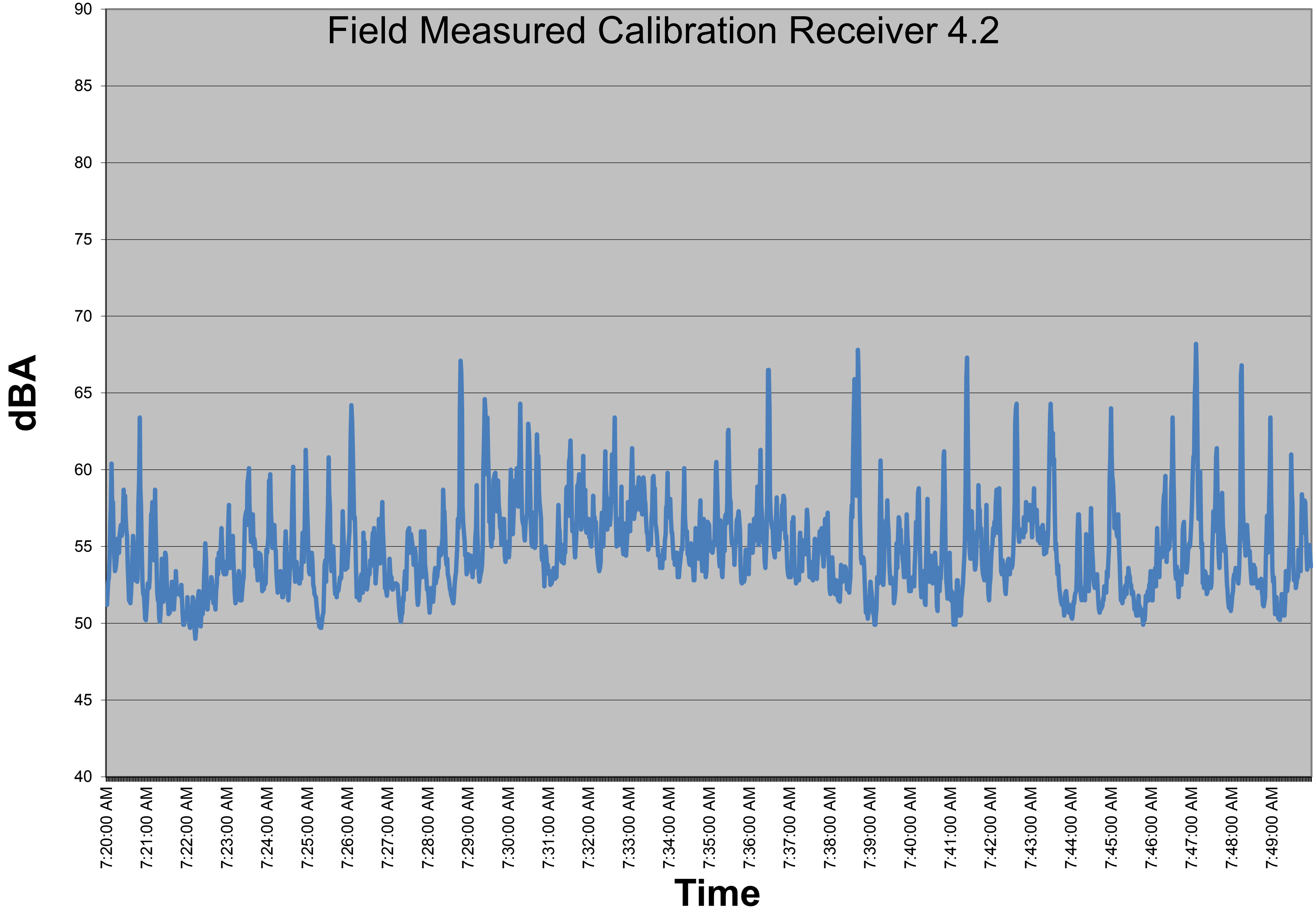
Time



Field Measured Calibration Receiver 4.2
dBA
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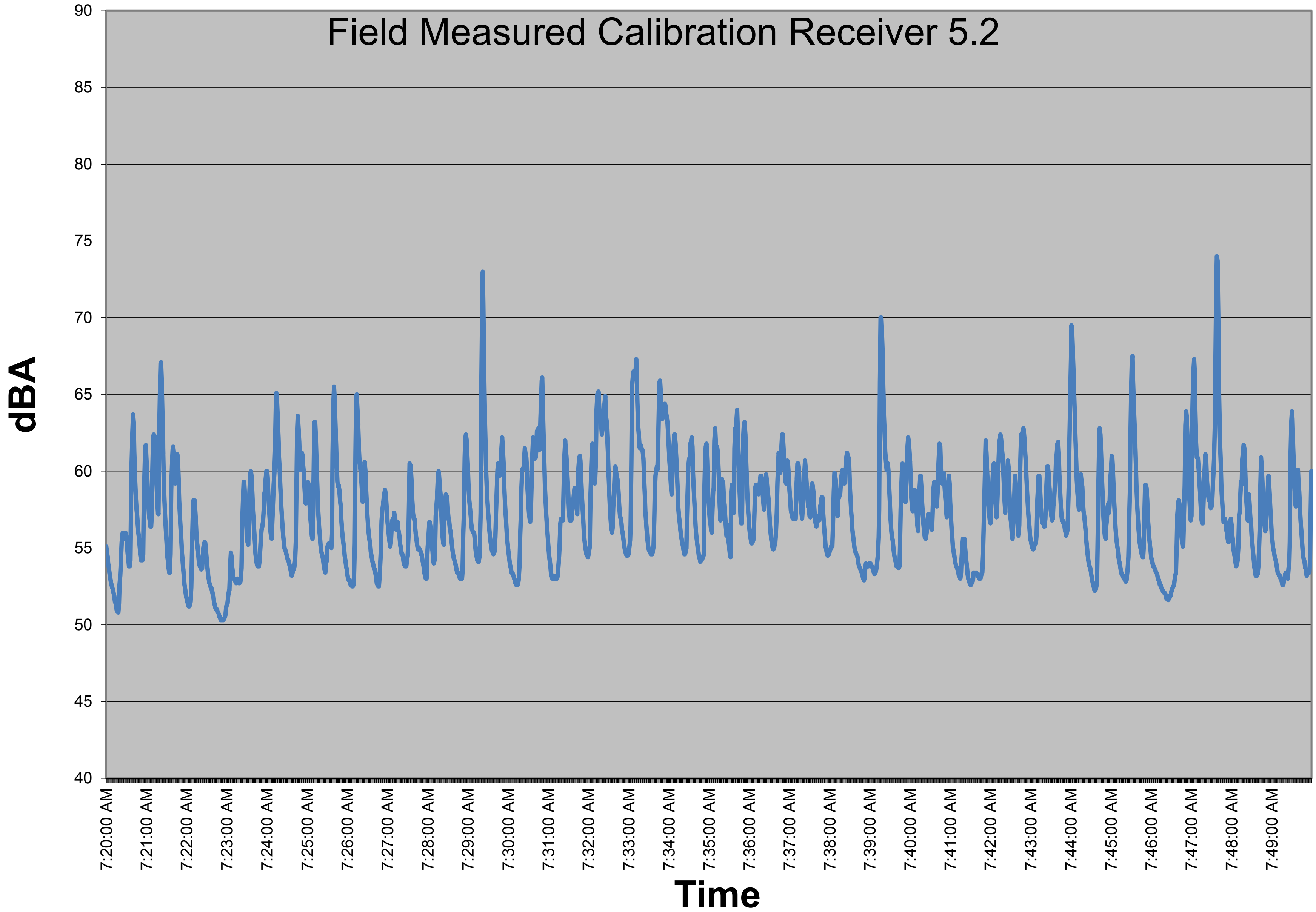
Time



Field Measured Calibration Receiver 5.2
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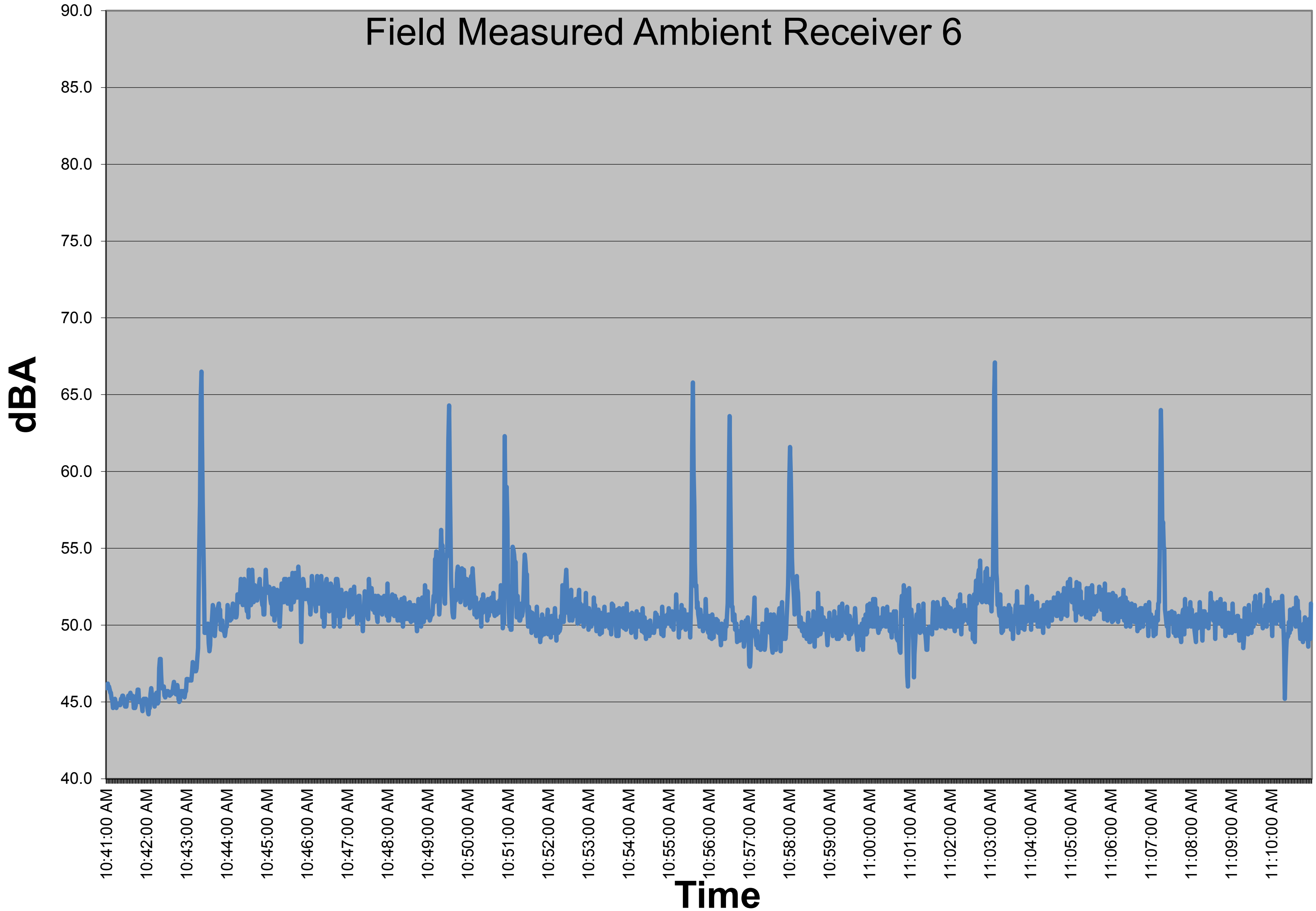
Time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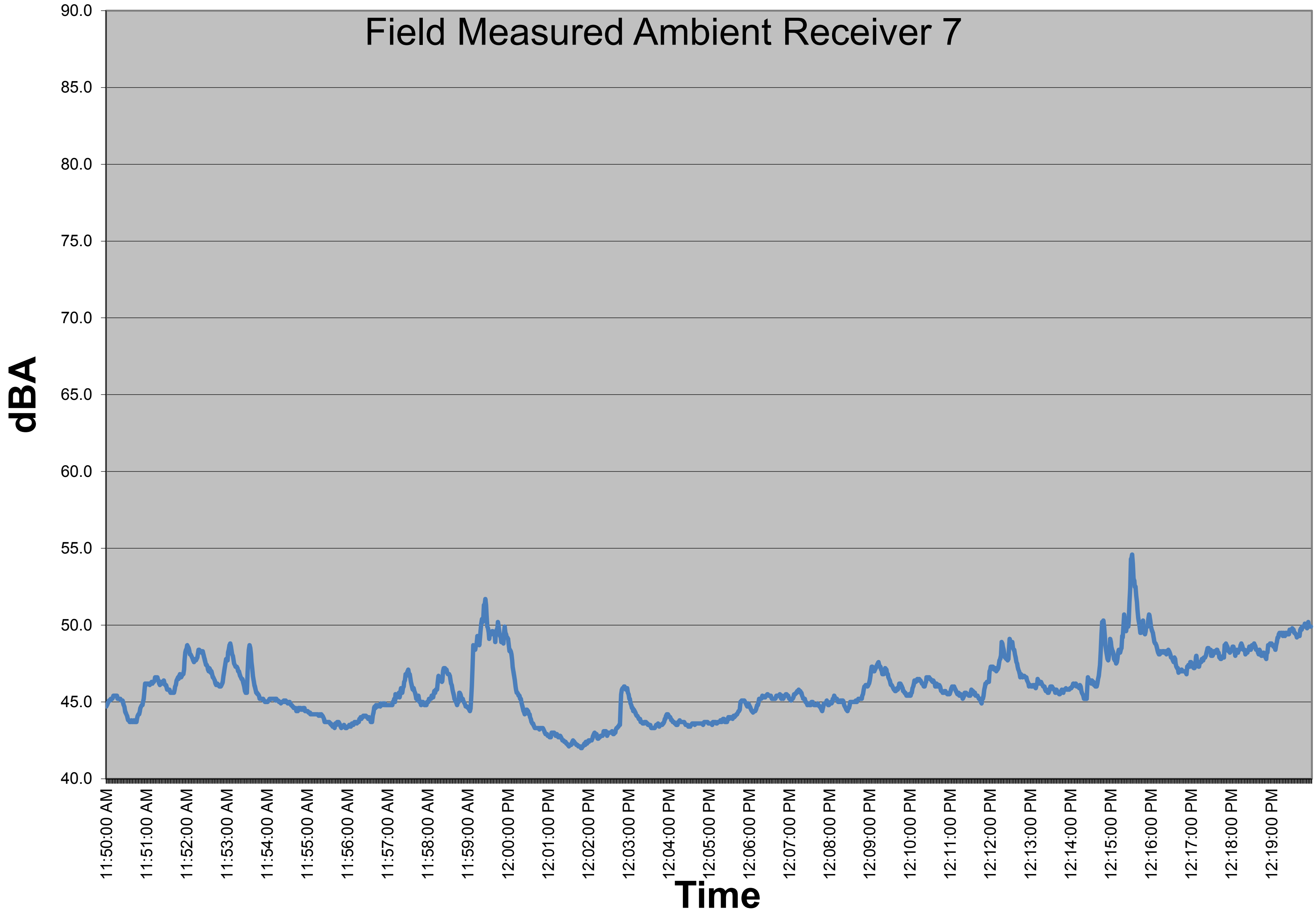
Time



Field Measured Ambient Receiver 7
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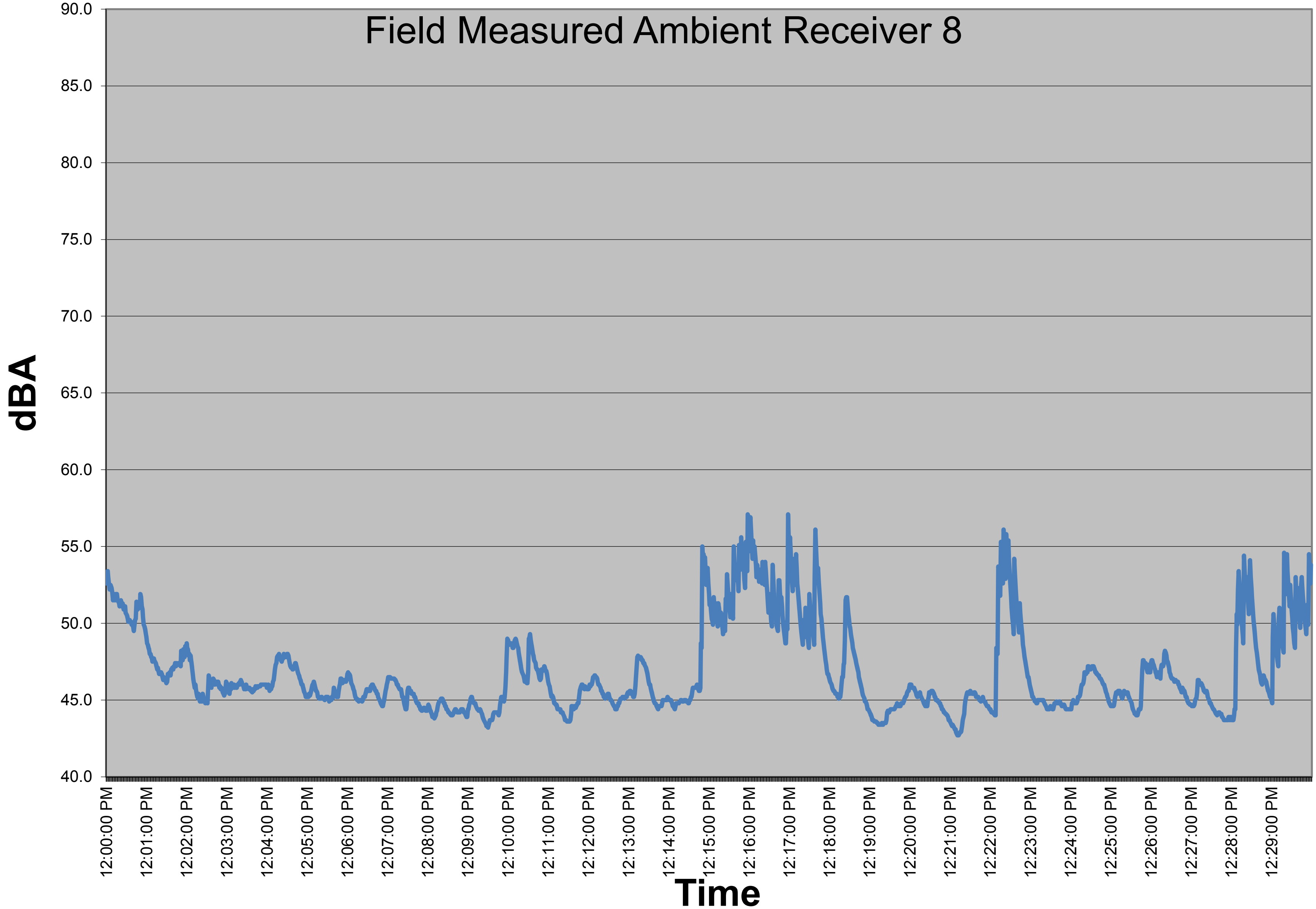
Time



Field Measured Ambient Receiver 8
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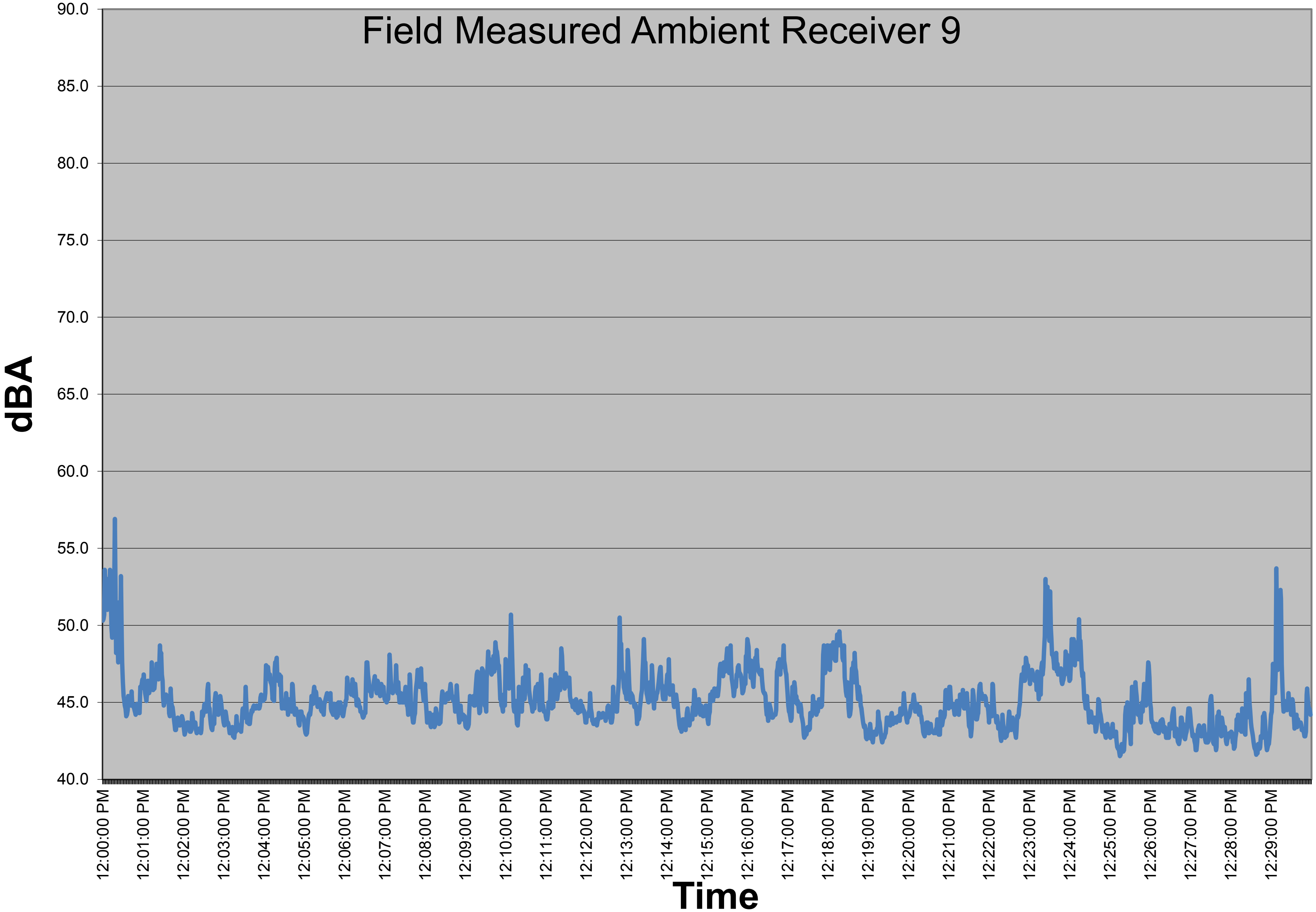
Time



Field Measured Ambient Receiver 9
dBA
Time
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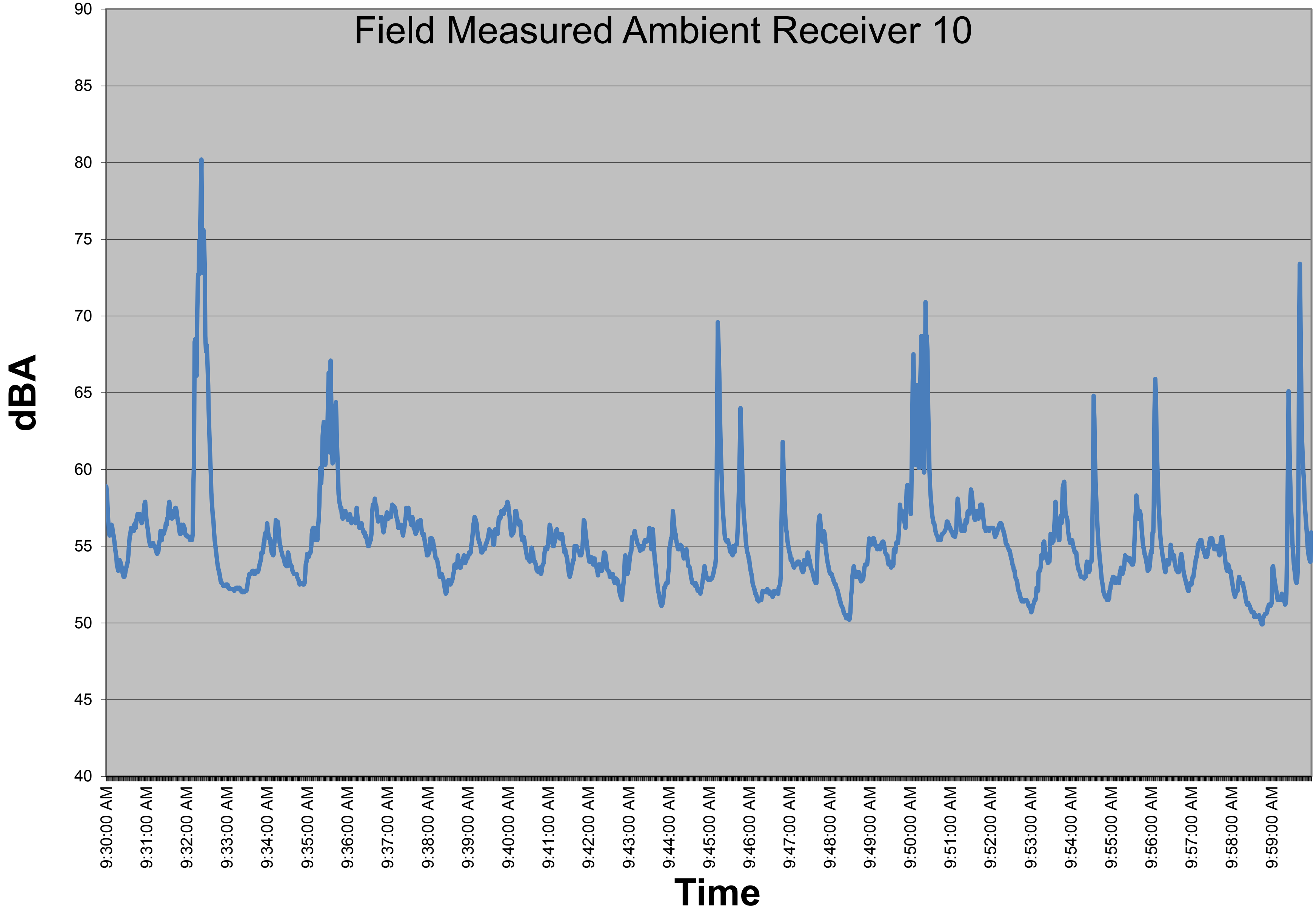

Field Measured Ambient Receiver 10
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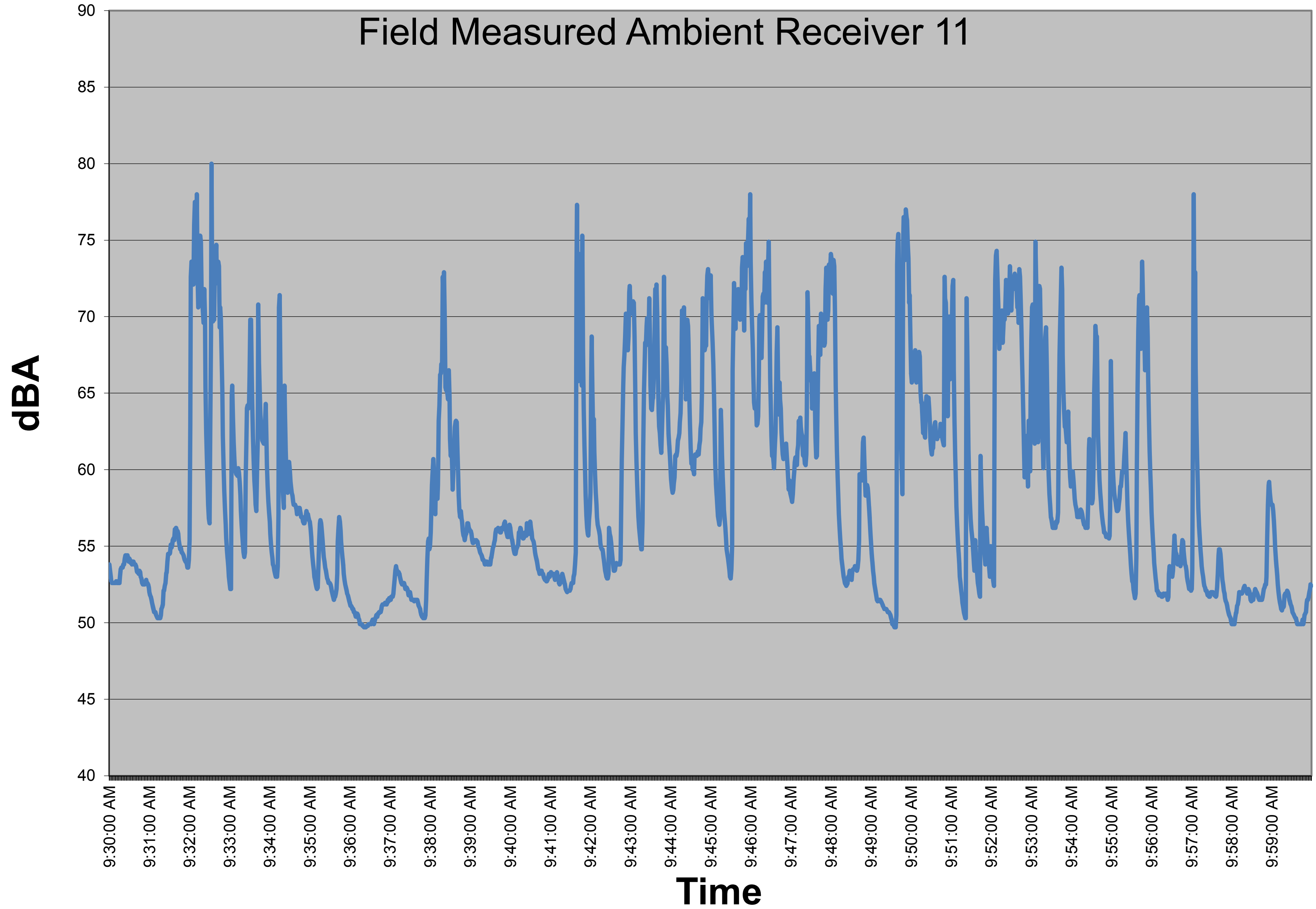
Time



Field Measured Ambient Receiver 11
dBA
Time
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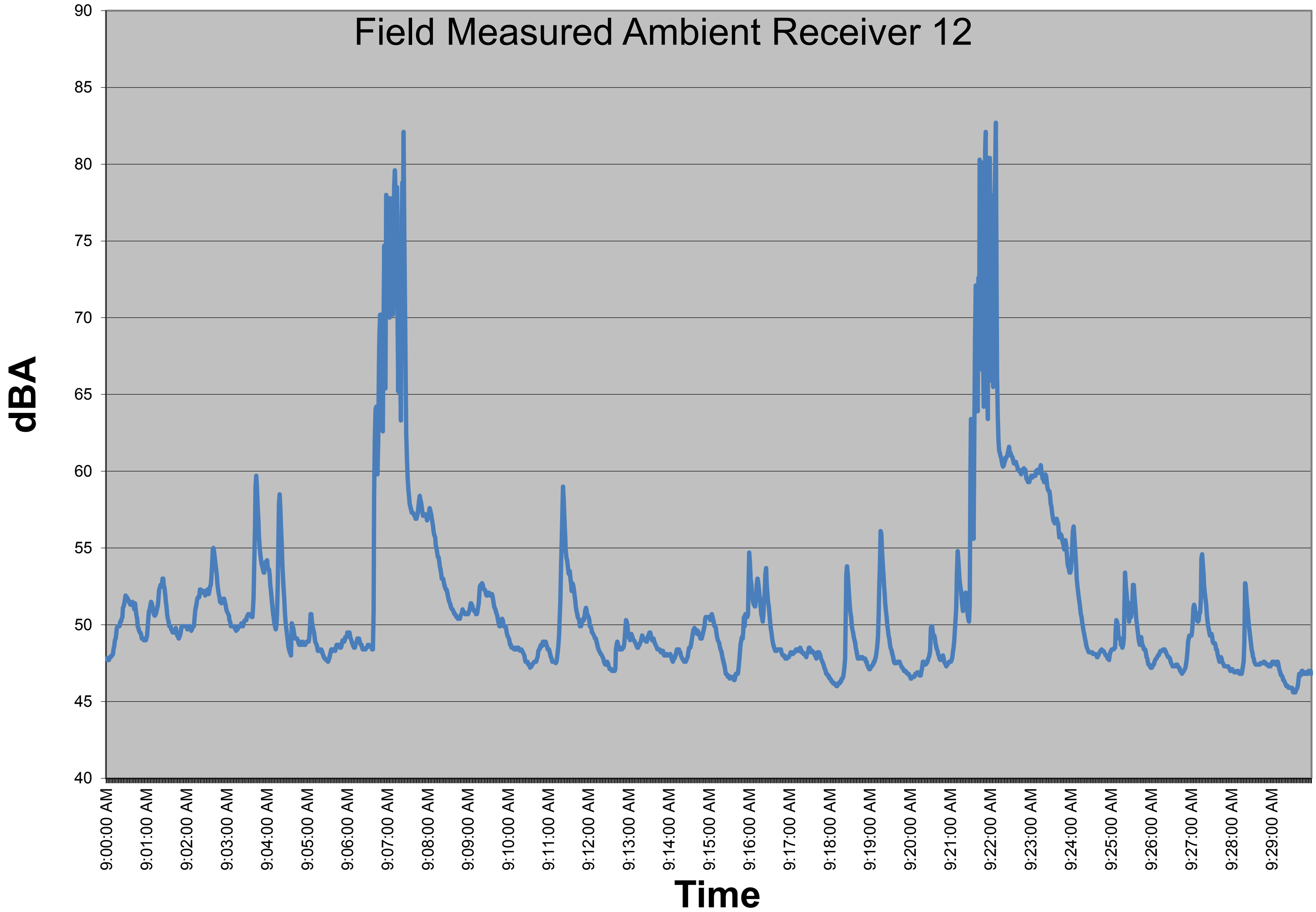
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dBA
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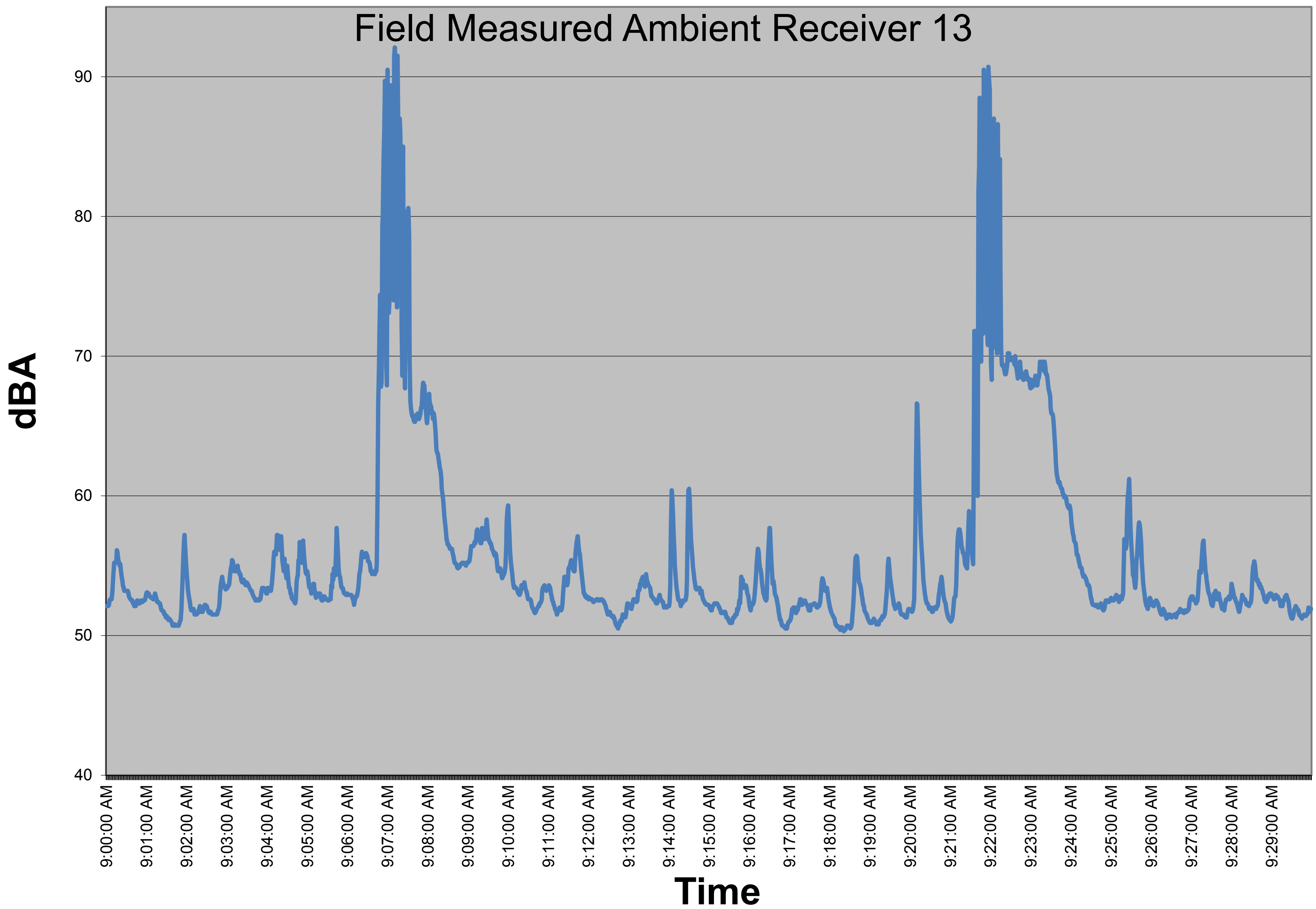
Time


Field Measured Ambient Receiver 13
dBA
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Time