

COMPLIANCE TEST REPORT

ACCORDING TO SAE J1849 – FEB 2020

Emergency Vehicle Sirens

COVER PAGE

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Date: October 12, 2023

SUMMARY OF TEST RESULT

TEST DESCRIPTION		TEST RESULTS	
Test Item	Reference Standard	PASS	FAIL
Physical Inspection	/	✓	---
Entire Acoustical Test	/	✓	---
Vibration Test	J575 – APR 2021	✓	---
Corrosion Test	J575 – APR 2021	✓	---
Dust Test	J575 – APR 2021	✓	---
Moisture Test	J994 – SEP 2014	✓	---
IP 69K Test	ISO 20653:2013	✓	---
Durability Test	/	✓	---
Extreme Temp. Test	/	✓	---
EMC	J1113-21 – MAY 2013 (ISO 11452-2:2019)	✓	---

*Note: ---

NAME AND SIGNATURE : Namseon, Chun



TITLE : Test Engineer

CONTACT INFO. : +86-18667838919

DATE : October 12, 2023

2023-10-12

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Reference standard: SAE J1849 – FEB 2020
Date: October 12, 2023

TEST DETAILS

APPLICANT'S NAME : SISTEMAS Y SERVICIOS DE COMUNICACION SA DE CV
ADDRESS : AVENIDA 20 DE NOVIEMBRE # 805
COLONIA CENTRO CHIHUAHUA, CHIHUAHUA CP 31000
TELEFONO : 614-415-2525

NO. OF DEVICES TESTED : 5 Sets
RATED VOLTAGE AND WATTAGE : DC 12V, $I_{\max} = 8A$
REMARK : SAE Yelp = Yelp (*Label on the rotary switch*)
SAE Wail = Wail-1 (*Label on the rotary switch*)

PRODUCT DETAILS:

	Siren amplifier	Controller	Speaker
Type or model no.	X100A	/	XYD100
Mounting orientation	/	/	Vertical
Identification code	EVS1	/	EVS2
Rated voltage and current	DC 12V, $I_{\max} 8A$ (Input range: DC 9–16V)	/	/

TEST PLACE:

Ningbo Vehicle Testing Co., Ltd.

6F, Building D, No.1001, Tanjiang North Road, Shounan Street,
Yinzhou District, Ningbo City, Zhejiang Province, P.R.China (P.C. 315194)

Zhejiang Fangyuan Test Group Co., Ltd. (CNAS L0116)

No.300, Xiasha Road, Hangzhou Economic and Technological Development Zone,
Hangzhou, Zhejiang, China

UL-CCIC Company Limited (CNAS L2065)

No.2, Chengwan Road, Suzhou Industrial Park, Suzhou, Jiangsu, China

Wenzhou Quality and Technology Testing Research Institute (CNAS L0888)

Testing Building, National Quality Supervision and Testing Center for Footwear (Wenzhou),
1st Period of Shoe Capital, Fengmen Street, Lucheng District, Wenzhou, Zhejiang, China

TEST DATE: : December 8, 2022 – October 12, 2023

2023-10-12

SECTION 1) PHYSICAL INSPECTION

TEST COMPONENT : See page 3. Test details

VARIANT(S) : None

MARKINGS :

- CONTROLLER : N/A

- AMPLIFIER : See section 7

- SPEAKER : See section 7

2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Date: October 12, 2023

SECTION 2) ENTIRE ACOUSTICAL TEST

Temp: 21 ~ 28 °C [18°C ~ 30°C]

RH: 65 ~ 70 % [max. 80%]

Atmospheric pressure: 1030 mbar [950 ~ 1050mbar]

Test voltage: 13.60 V [13.6 V ± 0.2 V (12V system)]

SPL measurement distance: 3.00 m [3.00 m ± 0.02 m]

Microphone height from the ground: 1.20 m

	Sound Level Meter	Microphone	Calibrator	Remarks
Manufacturer	Hangzhou Aihua Intelligent Technology Co., Ltd.			
Type	AWA6290M	AWA14423	AWA6221A	
Serial no.	/	/	1001088	
Date of cal.	2021.12.09 – 2023.12.08	2021.12.09 – 2023.12.08	2022.10.31 – 2023.10.30	
Compliance standard*	ANSI S1.4 IEC 61672 Class 1	IEC 61094-4 WS2F/ WS3F	ANSI S1.40-2006 IEC 60942 Class 1	

Type of chamber: Semi-anechoic room

Size: 4.5m x 4.5m x 3.5m

Calibration standard: JJF 1147-2006 (Equivalent to ISO 3745:2003)

Cut-off frequency: 80 Hz

2023-10-12

Table B1 - SPL measurements - Siren #1

Measurement Angle (Degrees from Device Axis)	A-Weighted SPL (dB re 20 µPa) Measured with the Fast Time Setting				A-Weighted SPL (dB re 20 µPa) Measured with a Long-Term Time Setting			
	Wail		Yelp		Wail		Yelp	
	Measured	Required	Measured	Required	Measured	Required	Measured	Required
0	122.3	≥ 118	120.4	≥ 117	119.1	≥ 115	119.4	≥ 115
10	122.0	≥ 117	120.1	≥ 116	118.7	≥ 114	119.1	≥ 114
20	121.3	≥ 116	119.4	≥ 115	118.1	≥ 113	118.4	≥ 113
30	120.3	≥ 115	118.4	≥ 114	117.2	≥ 112	117.5	≥ 112
40	118.7	≥ 113	116.9	≥ 112	115.8	≥ 110	116.1	≥ 110
50	116.8	≥ 111	115.2	≥ 110	114.2	≥ 108	114.5	≥ 108
-50*	116.1	≥ 111	112.4	≥ 110	113.5	≥ 108	111.9	≥ 108
-40*	116.3	≥ 113	114.3	≥ 112	115.0	≥ 110	113.7	≥ 110
-30*	117.9	≥ 115	116.0	≥ 114	116.4	≥ 112	115.3	≥ 112
-20*	119.5	≥ 116	117.6	≥ 115	117.6	≥ 113	116.8	≥ 113
-10*	120.8	≥ 117	119.6	≥ 116	118.3	≥ 114	118.6	≥ 114

***Note:** A negative sign is used to denote angles measured with the device axis rotated clockwise from its initial zero-degrees orientation.

****SPL values that contain a five or greater in the first place to the right of the decimal shall be rounded upward.**

	Wail mode		Yelp mode	
	Measured	Required	Measured	Required
Cycling period (s)	4.740	2.0s ~ 6.0s	0.277	0.24s ~ 0.40s
Minimum fundamental frequency (Hz)*	822	≥ 500 Hz	821	≥ 500 Hz
Maximum fundamental frequency (Hz)*	1818	≤ 2000 Hz	1845	≤ 2000 Hz
DC current (amps)	7.1	N/A	7.1	N/A

Was the wail perceived as continuous in frequency with no clearly audible discrete steps between frequencies: Yes ~~No~~

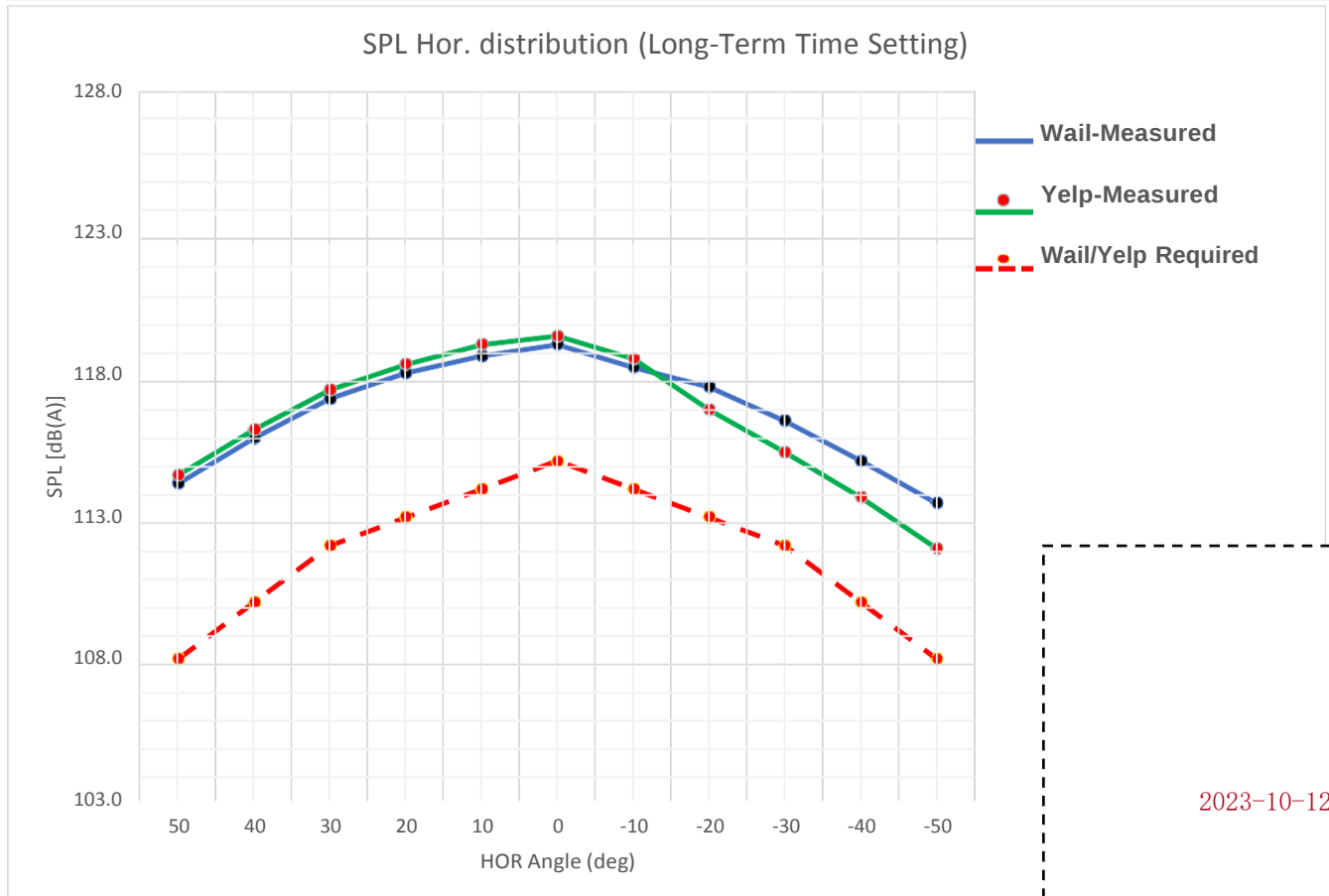
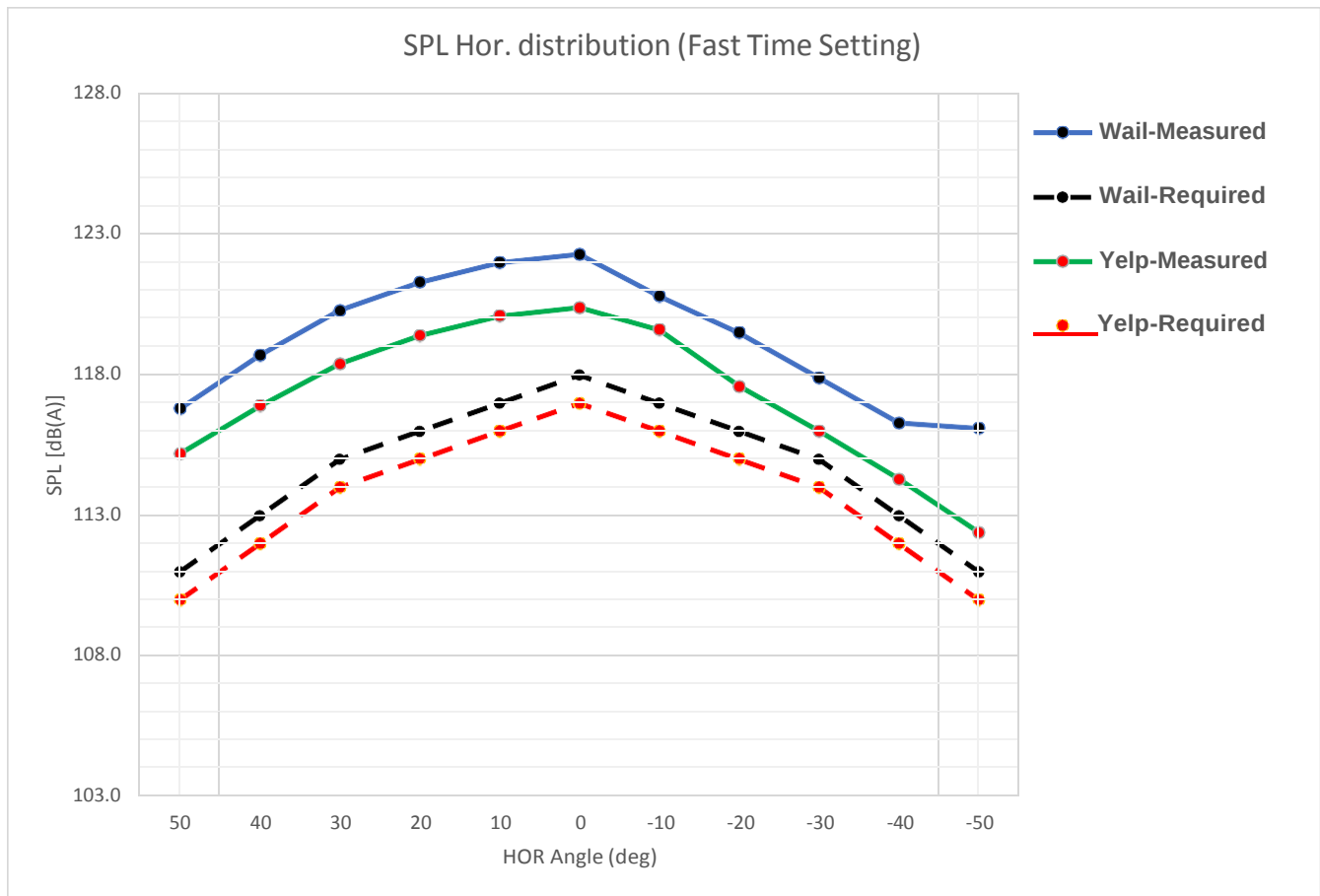
Was the yelp perceived as continuous in frequency with no clearly audible discrete steps between frequencies: Yes ~~No~~

DC current (amps) measured in the power cable (for informational purposes only, no performance requirements): see above A

*Its range shall be at least one octave, and it shall be perceived as being continuous in frequency with no clearly audible discrete steps between frequencies. (para 6.1.2.1. & 6.1.2.2.)

Remark: The siren system has been tested with 1 (one) speaker connected to the amplifier.

2023-10-12



2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Date: October 12, 2023

SECTION 3) ELECTROMAGNETIC COMPATIBILITY TEST

Table B2A - SPL measurements - Siren #2

Measurement Angle (Degrees from Device Axis)	A-Weighted SPL (dB re 20 µPa) Measured with the Fast Time Setting				A-Weighted SPL (dB re 20 µPa) Measured with a Long-Term Time Setting			
	Wail		Yelp		Wail		Yelp	
	Measured	Required	Measured	Required	Measured	Required	Measured	Required
0 (before electromagnetic compatibility tests)	123	≥ 118	120	≥ 117	119	≥ 115	119	≥ 115
0 (after electromagnetic compatibility tests)	123	≥ 120	120	≥ 117	119	≥ 116	119	≥ 116

6.1.1 SPL Requirements

When measured in accordance with 5.1, the SPL produced by Siren #1 shall meet all of the minimum requirements listed in Table 1. The SPL produced by Siren #2 through Siren #5, which are tested only at the measurement angle of 0 degrees, shall meet the corresponding SPL requirement before any other tests (e.g., vibration) are performed, **and shall not be reduced by more than 3 dB after these other tests are complete.** When comparing the measured SPL values to the SPL requirements, the measured values **shall be rounded to the nearest integer decibel value.** For the purpose of this comparison, measured SPL values that contain a five or greater in the first place to the right of the decimal shall be rounded upward.

2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Date: October 12, 2023

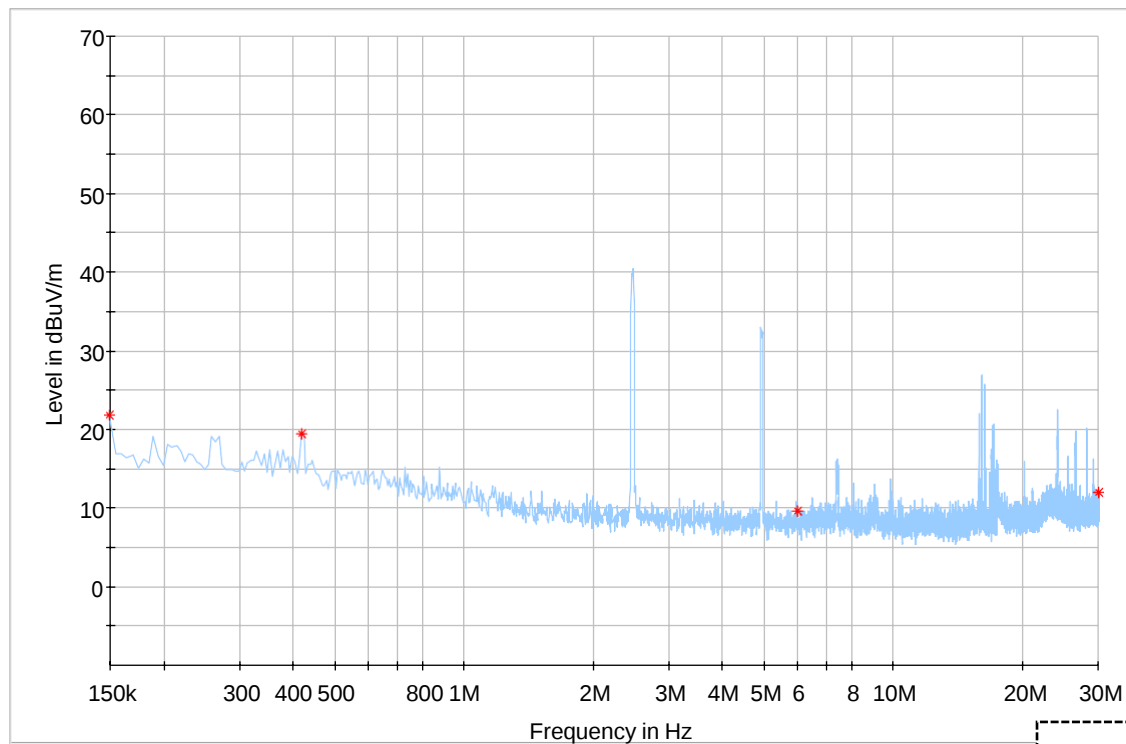
Table B2B - Radiated emissions/disturbances

Frequency Band (MHz) Wail mode CISPR25:2002	Narrowband Electric Field Level Measured with Peak Detector (dB re $\mu\text{V/m}$)	Broadband Electric Field Level Measured with Quasi-Peak Detector (dB re $\mu\text{V/m}$)	Remarks
0.15-0.3	21.87	14.53	
0.53-2.0	19.43	16.95	
5.9-6.2	9.64	4.77	
30-54	16.94	16.98	
68-108	18.50	18.40	

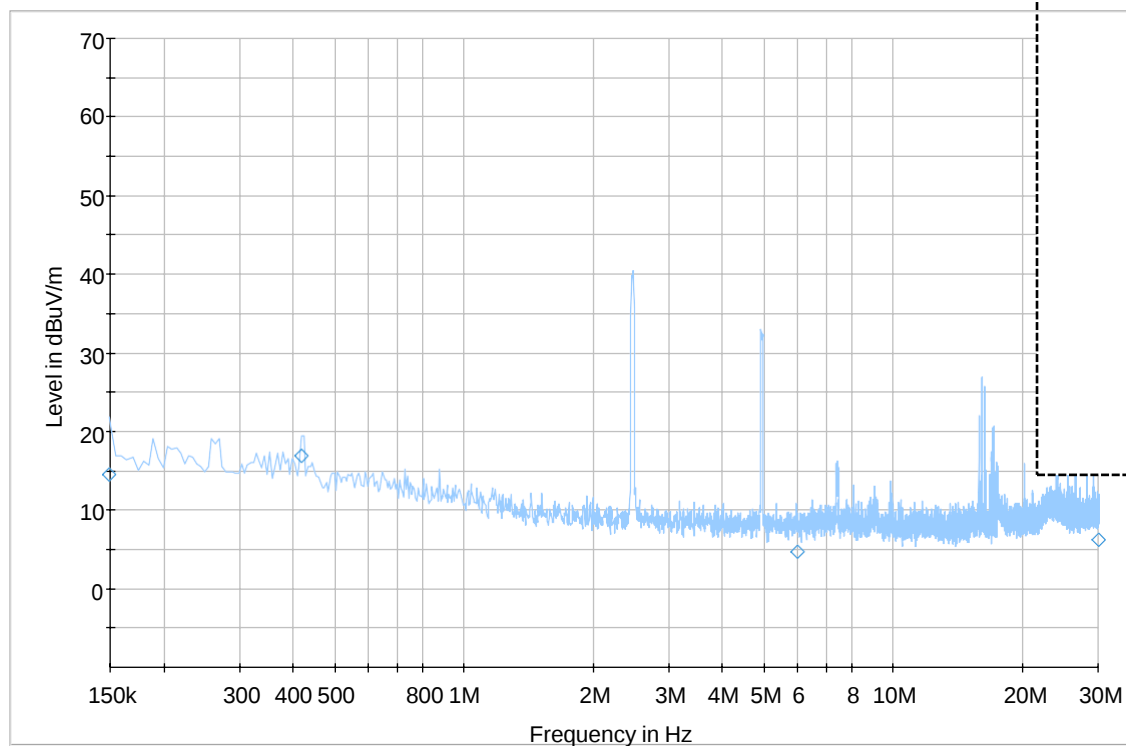
2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

RE-0.15MHz-30MHz-V-PK



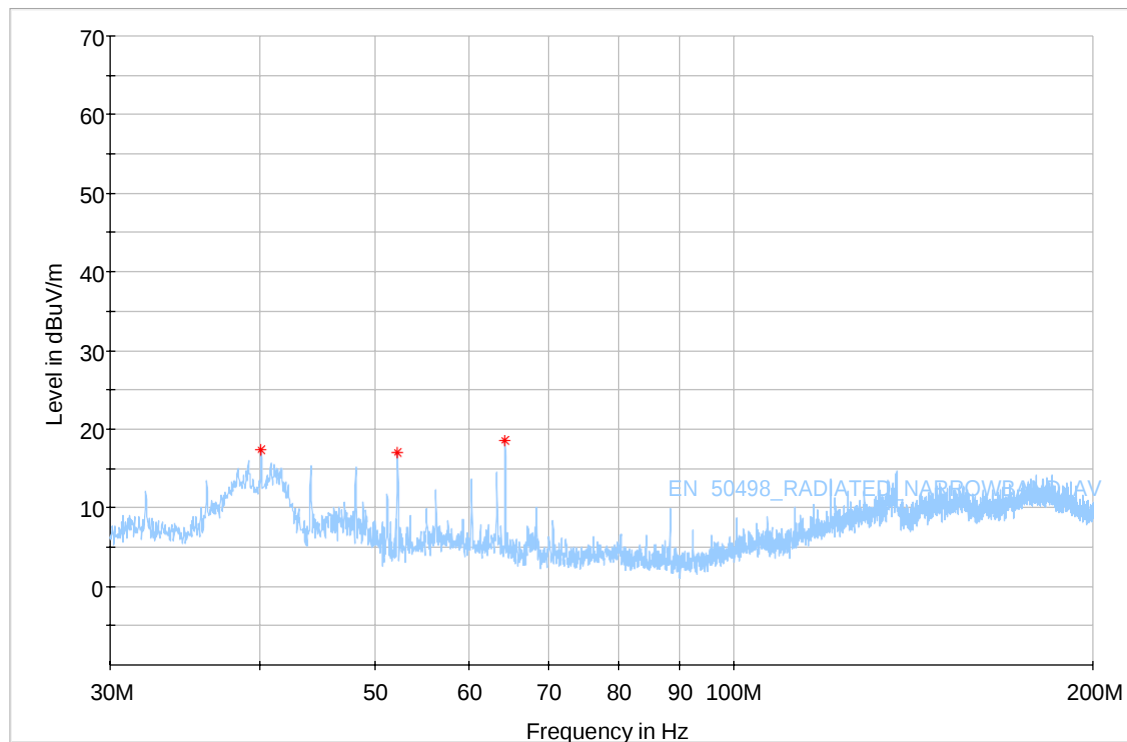
RE-0.15MHz-30MHz-V-QP



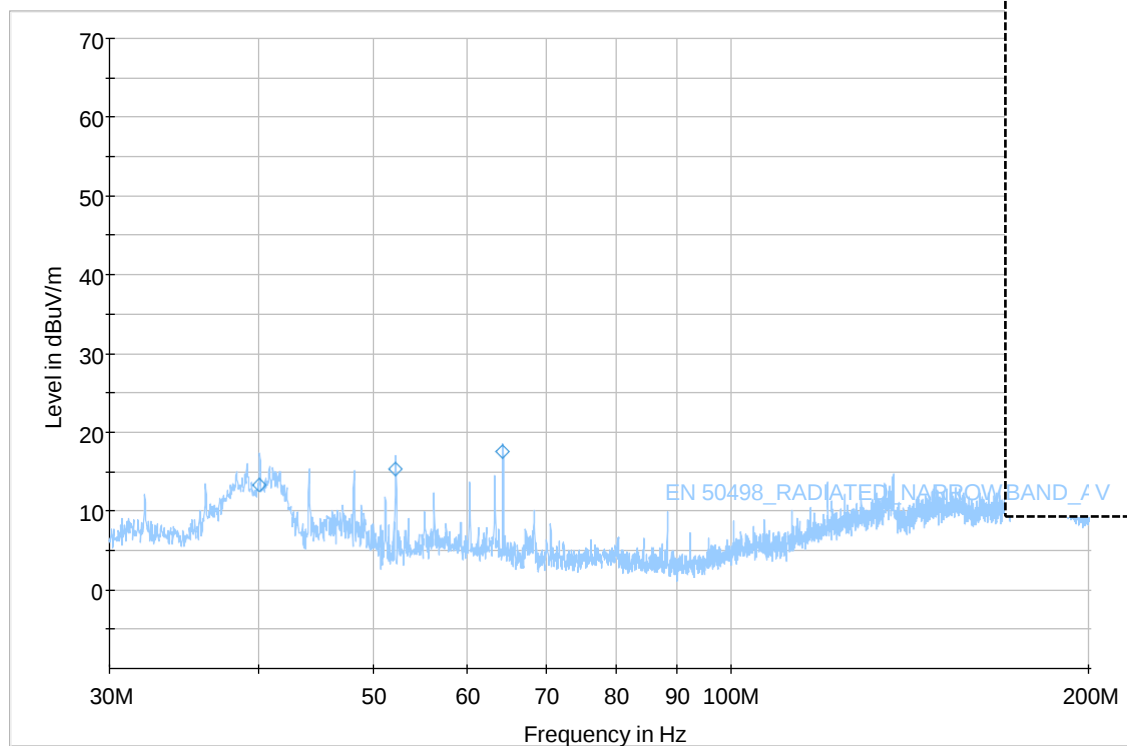
2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

RE-30MHz-108MHz-V-PK

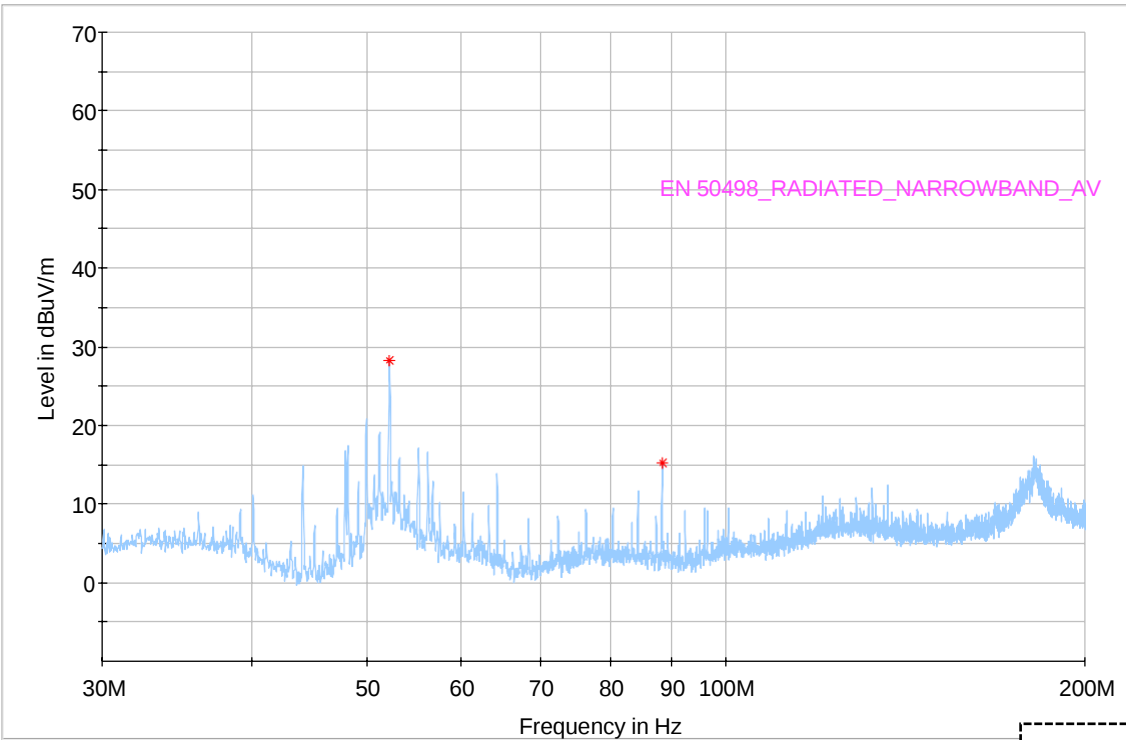


RE-30MHz-108MHz-V-QP

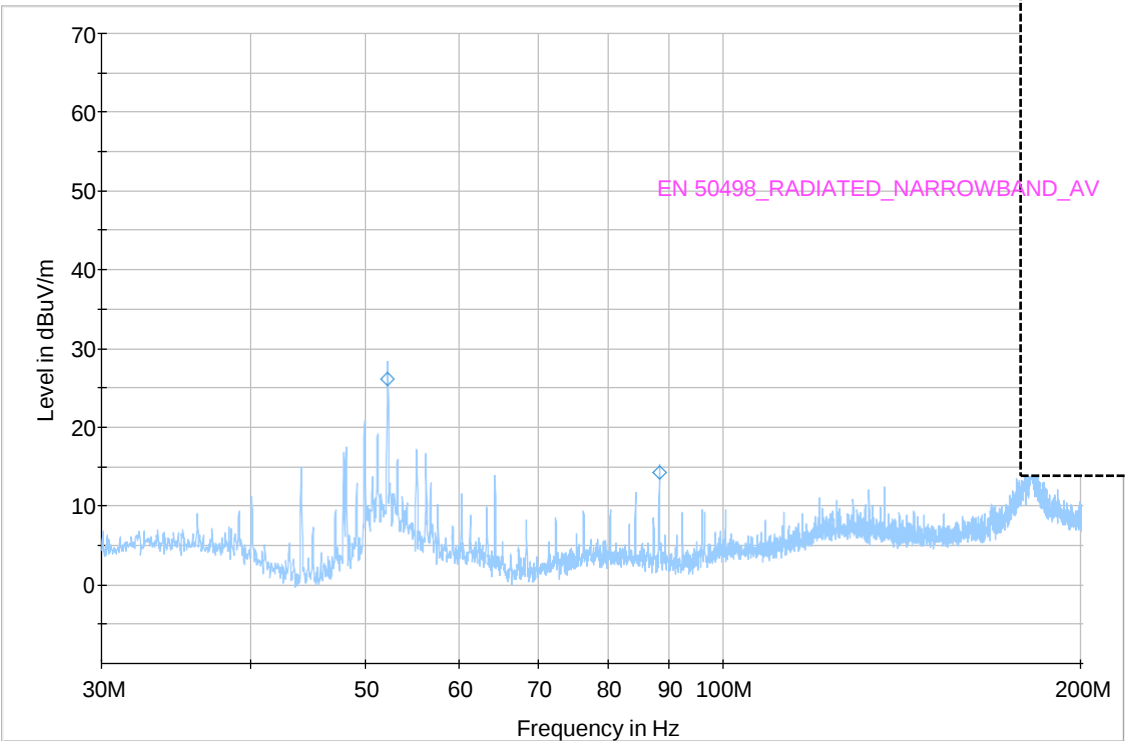


2023-10-12

RE-30MHz-108MHz-H-PK



RE-30MHz-108MHz-H-QP



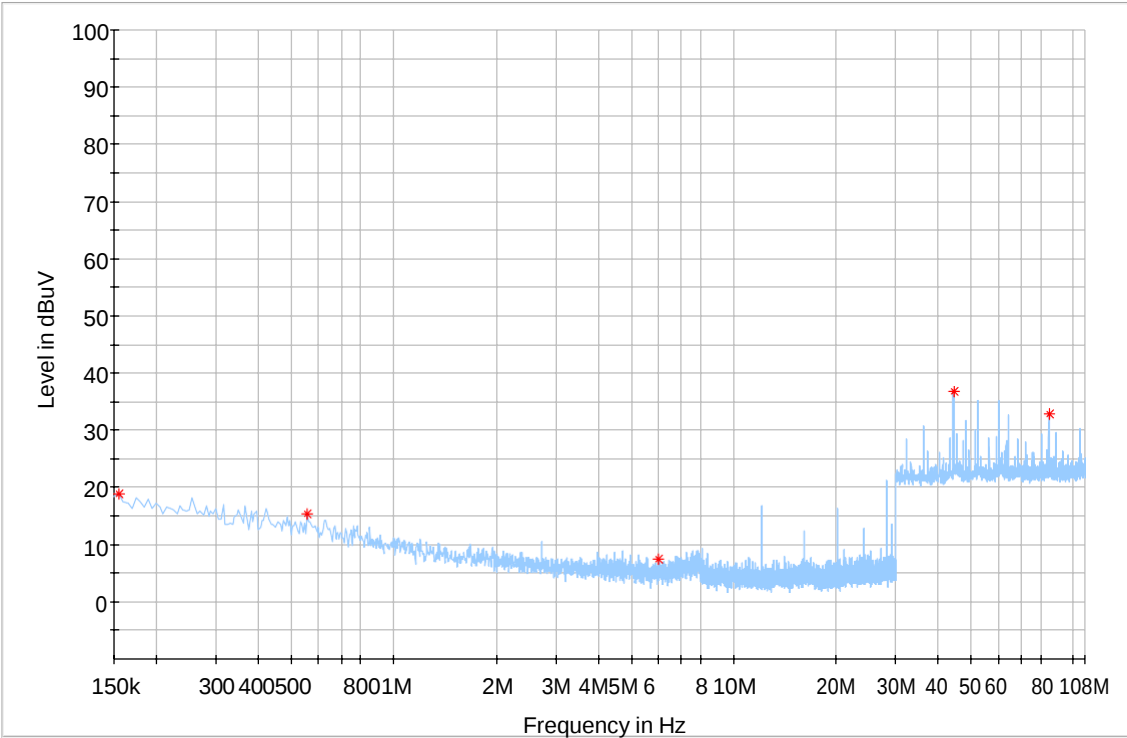
Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

Table B2C - Conducted emissions/disturbances on power input leads

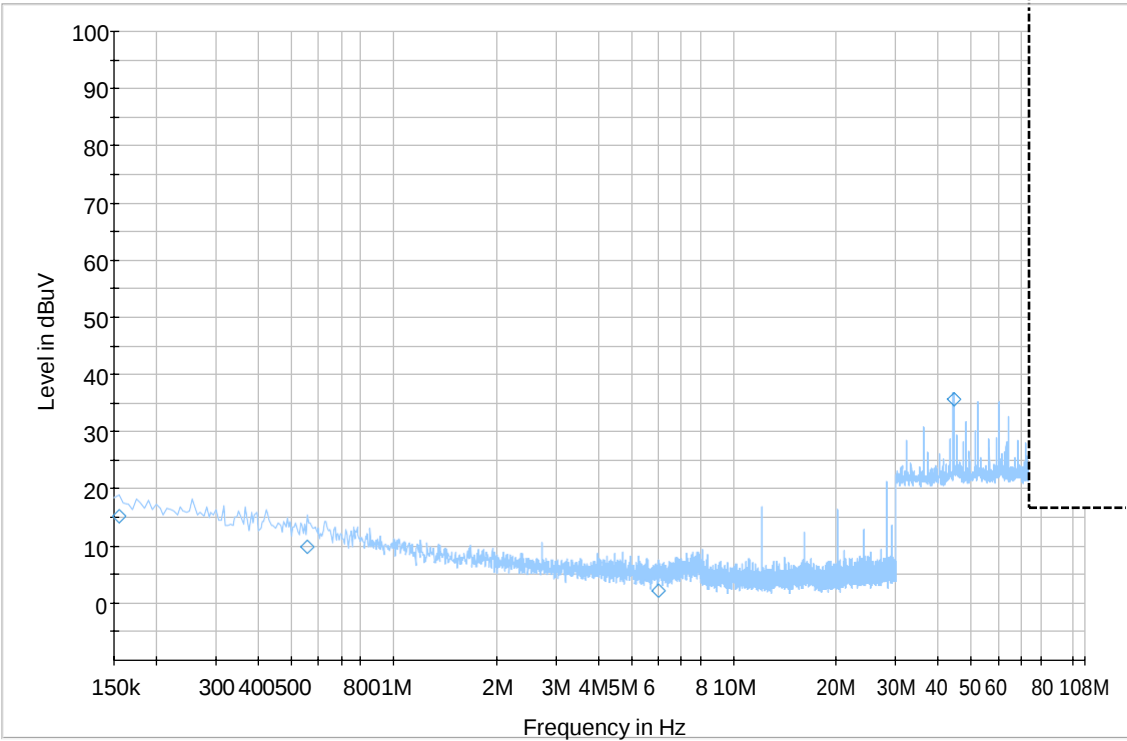
Frequency Band (MHz) Wail mode CISPR25:2002	Narrowband Electric Field Level Measured with Peak Detector on Positive Terminal (dB re $\mu\text{V/m}$)	Broadband Electric Field Level Measured with Quasi-Peak Detector on Positive Terminal (dB re $\mu\text{V/m}$)	Narrowband Electric Field Level Measured with Peak Detector on Negative Terminal (dB re $\mu\text{V/m}$)	Broadband Electric Field Level Measured with Quasi-Peak Detector on Negative Terminal (dB re $\mu\text{V/m}$)	Remarks
0.15-0.3	19.03	15.22	18.25	15.04	
0.53-2.0	15.44	9.94	16.08	12.20	
5.9-6.2	7.54	2.17	6.17	2.12	
30-54	36.71	35.64	38.71	37.35	
68-108	32.93	31.02	32.72	31.16	

2023-10-12

CE-0.15MHz-108MHz-P-PK



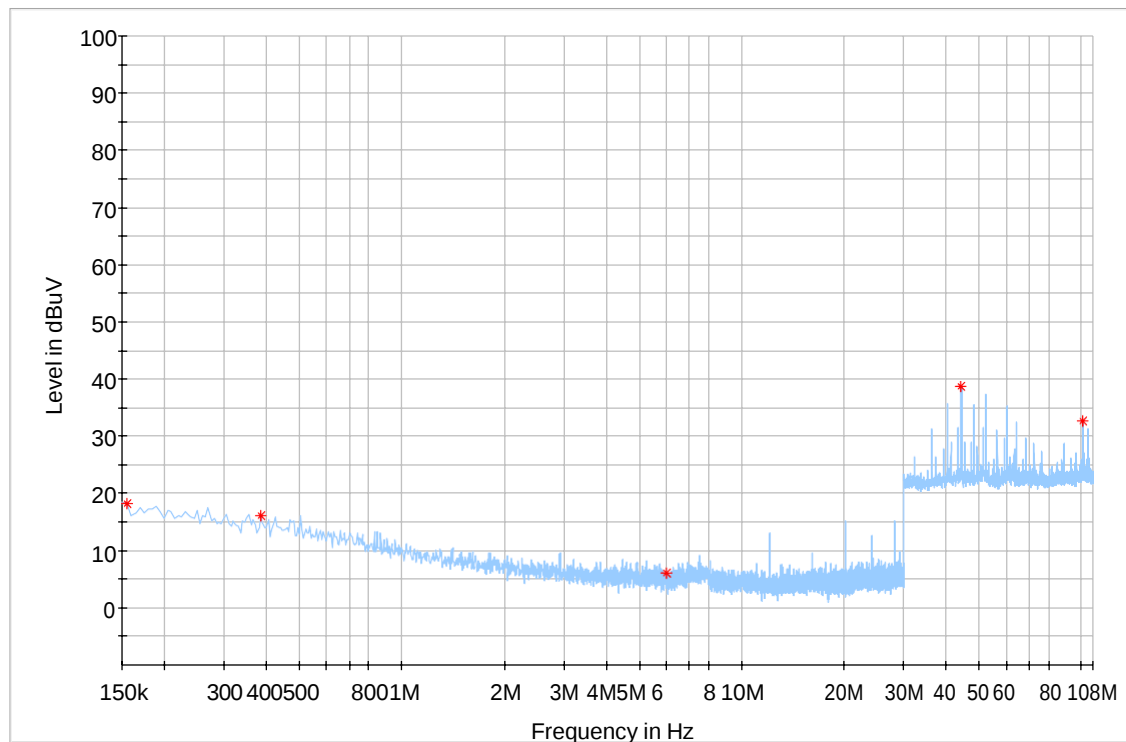
CE-0.15MHz-108MHz-P-QP



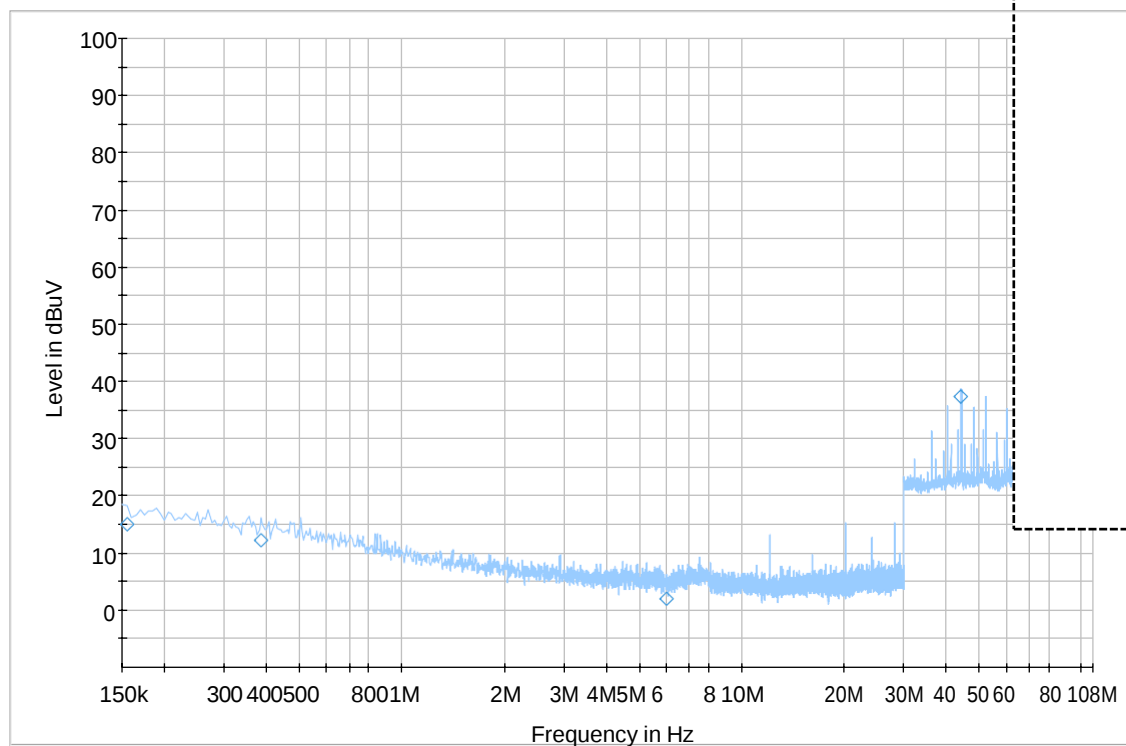
2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

CE-0.15MHz-108MHz-N-PK



CE-0.15MHz-108MHz-N-QP



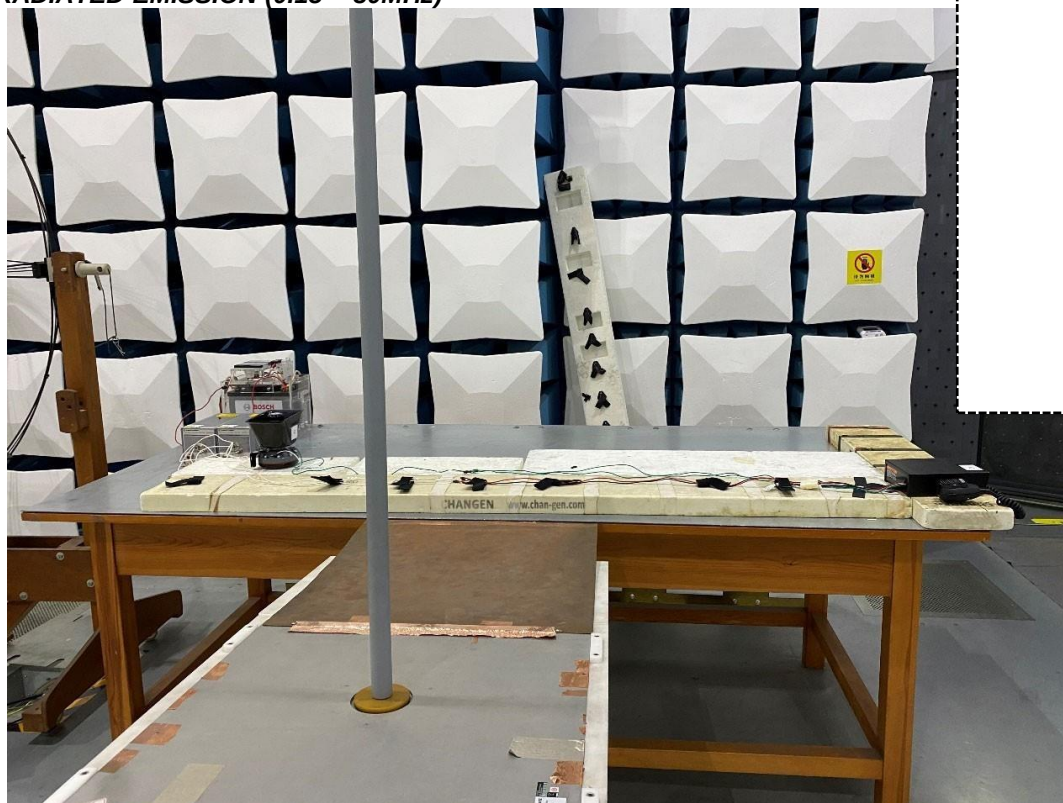
2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

CONDUCTED EMISSION



RADIATED EMISSION (0.15 – 30MHz)



2023-10-12

Subjects: Emergency Vehicle Sirens

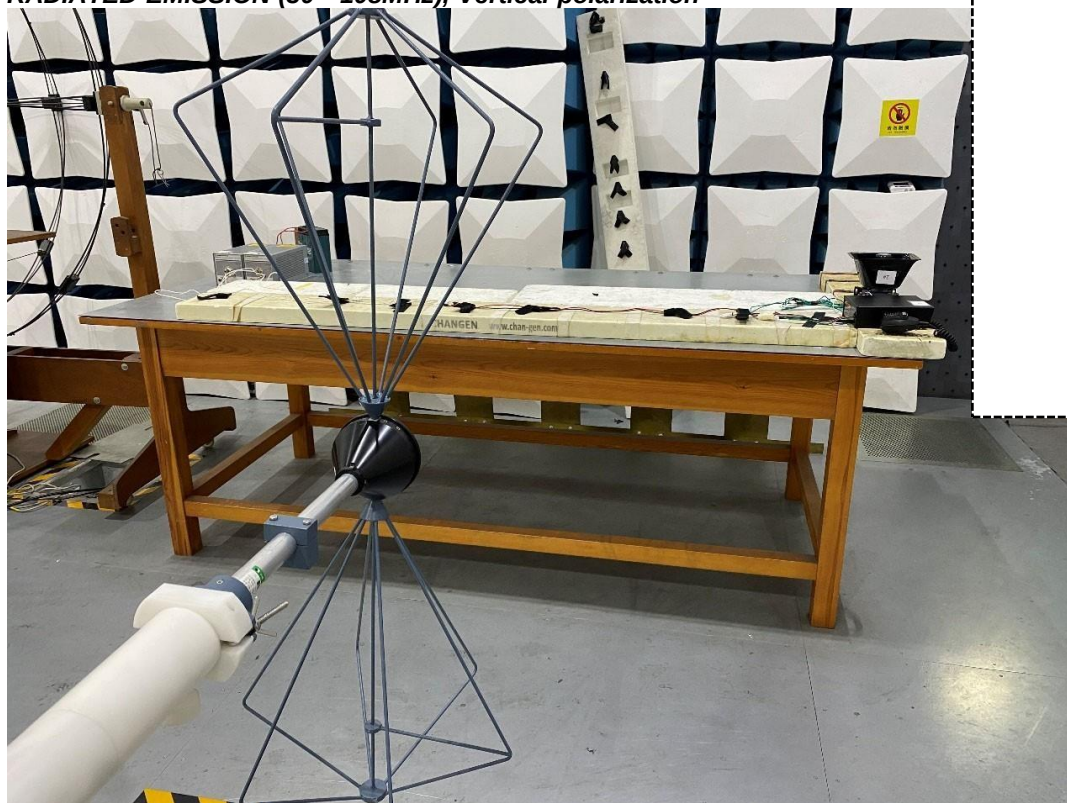
Reference standard: SAE J1849 – FEB 2020

Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

RADIATED EMISSION (30 - 108MHz), Horizontal polarization



RADIATED EMISSION (30 - 108MHz), Vertical polarization



2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

Radiated Electromagnetic Immunity Test Results

Wail mode, SAE J1113-21. Sweep the field in frequency from 26 to 1000 MHz at an amplitude of 10 V/m.

Amplitude (V/m) of the test field at which a change in the wail signal is observed: n/a

Frequency (MHz) of the test field at which a change in the wail signal is observed: n/a

Describe the change observed in the wail signal: n/a

See test details.

5.6 Radiated Electromagnetic Immunity Test

This test is required for all electronic siren amplifiers.

In the wail mode, Siren #2 shall be subjected to the radiated electromagnetic immunity test specified in SAE J1113-21.

Sweep the field in frequency from 26 to 1000 MHz at an amplitude of 10 V/m.

Continue to perform sweeps over this frequency range, but increment the field amplitude by 10 V/m each time before a new sweep is started until a change in the wail signal is observed. Record the field amplitude and frequency at which the change is observed and describe the change. A passive resistive load, which is a non-inductive resistor with a resistance within $\pm 1\%$ of the nominal impedance of the speaker used in the siren system, may be substituted for the siren loudspeaker. In this case, there shall be an alternative means to monitor the amplifier output for failure (e.g., monitor speaker or current probe).

Amplifiers that are an integral part of a speaker shall also be tested.

Test result summary:

Test sample has no degradation of its performance (Status I) during exposure to BCI with injection current 100mA within frequency band between 26MHz and 400MHz.

Scan step 5MHz at frequency band 26MHz - 200MHz, 10MHz at frequency band 200MHz – 400MHz.

Test sample has no degradation of its performance (Status I) during exposure to radiated free field immunity with field strength 50V/m rms within frequency band 400MHz - 1000MHz.

- AM(Amplitude Modulation) at frequency band 400MHz – 800MHz.
- PM(Pulse Modulation) type 1 at frequency band 800MHz – 1000MHz.

2023-10-12

2023-10-12

ISO 11452-1;2015

A.3.1 Function performance status

This element defines the expected performance objectives for the function of the device under test subjected to the test conditions. The four function performance status of the function (expected behaviour of the function observed during test) are listed below.

NOTE This element is applicable to every single individual function of a DUT and describes the operational status of the defined function during and after a test.

The minimum functional status shall be given in each test. An additional test requirement may be agreed upon between supplier and vehicle manufacturer.

— Status I

The function performs as designed during and after the test.

— Status II

The function does not perform as designed during the test but returns automatically to normal operation after the test.

— Status III

The function does not perform as designed during the test and does not return to normal operation without a simple driver/passenger intervention such as turning off/on the DUT or cycling the ignition switch after the disturbance is removed.

— Status IV

The function does not perform as designed during and after the test and cannot be returned to proper operation without more extensive intervention such as disconnecting and reconnecting the battery or power feed. The function shall not have sustained any permanent damage as a result of the testing.

	Frequency range	Antenna polarization	Field strength	BCI (at 150mm)
Test 1	26MHz to 1000MHz	Vertical	30V/m rms	60mA
Test 2	26MHz to 1000MHz	Horizontal	30V/m rms	60mA
Test 3	26MHz to 1000MHz	Vertical	50V/m rms	100mA
Test 4	26MHz to 1000MHz	Horizontal	50V/m rms	100mA

Note: Reference to UN-R10

6.8.2. ESA immunity type approval limits

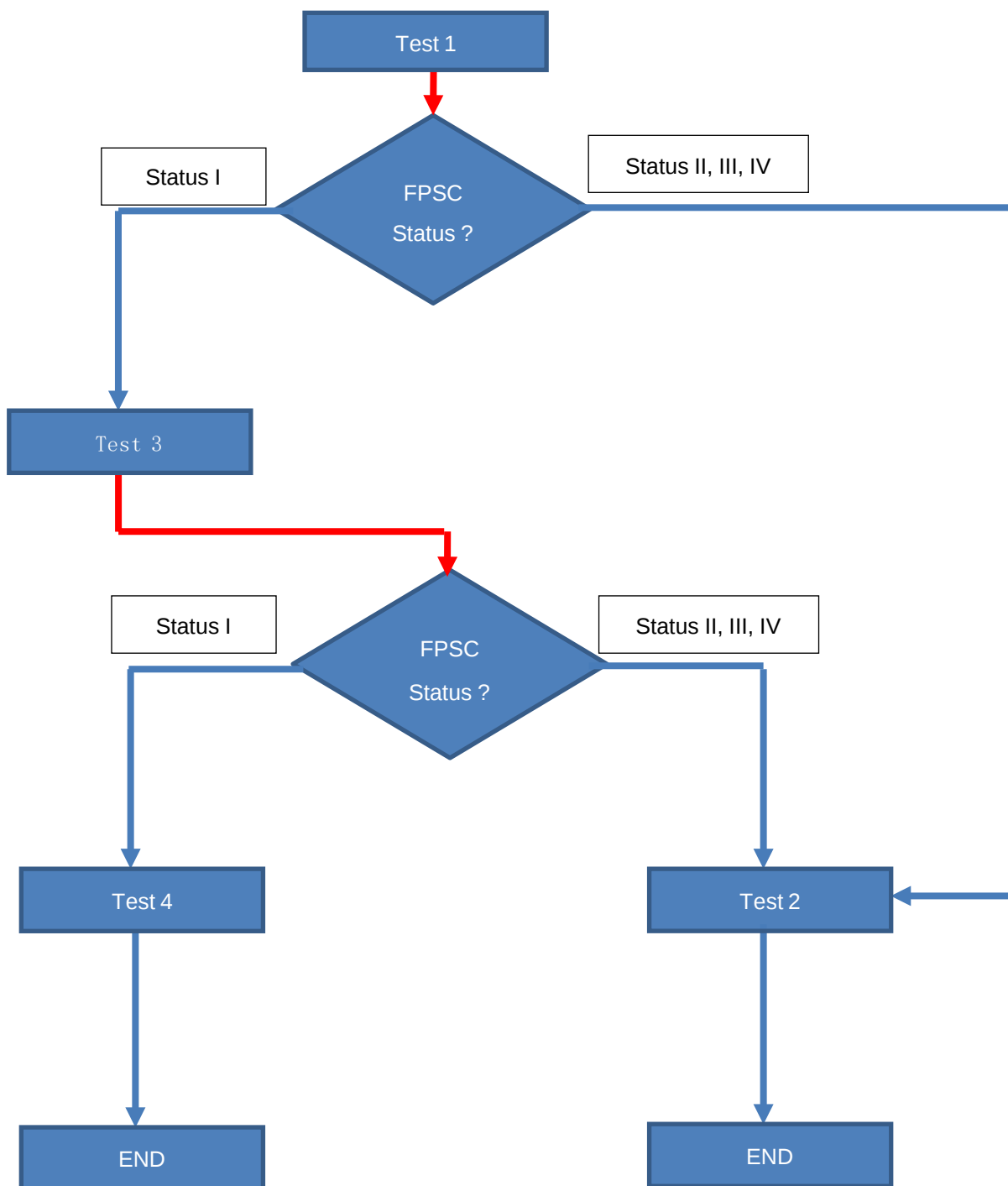
6.8.2.1. If tests are made using the methods described in Annex 9, the immunity test levels shall be 60 volts/m root-mean-square (rms) for the 150 mm stripline testing method, 15 volts/m rms for the 800 mm stripline testing method, 75 volts/m rms for the Transverse Electromagnetic Mode (TEM) cell testing method, **60 mA rms for the bulk current injection (BCI) testing method and 30 volts/m rms for the free field testing method in over 90 per cent of the 20 to 2,000 MHz frequency band**, and to a minimum of 50 volts/m rms for the 150 mm stripline testing method, 12.5 volts/m rms for the 800 mm stripline testing method, 62.5 volts/m rms, for the TEM cell testing method, 50 mA rms for the bulk current injection (BCI) testing method and 25 volts/m rms for the free field testing method over the whole 20 to 2,000 MHz frequency band.

Annex 9, para.

4.3.2. Test methodology

The test shall be performed according to ISO 11452-4 on a test bench with the following characteristics:

- BCI test method with substitution method and injection **probe positioned at 150 mm distance to the ESA**



Test Plan

~~Test 1 → Test 2 → END~~

~~Test 1 → Test 3 → Test 2 → END~~

Test 1 → Test 3 → Test 4 → END

2023-10-12



2023-10-12



2023-10-12

SECTION 4) VIBRATION, CORROSION, DUST, AND MOISTURE TEST

Table B3 - SPL measurements - Siren #3

Measurement Angle (Degrees from Device Axis)	A-Weighted SPL (dB re 20 µPa) Measured with the Fast Time Setting				A-Weighted SPL (dB re 20 µPa) Measured with a Long-Term Time Setting			
	Wail		Yelp		Wail		Yelp	
	Measured	Required	Measured	Required	Measured	Required	Measured	Required
0 (before vibration, corrosion, dust, and moisture tests)	123	≥ 118	120	≥ 117	119	≥ 115	119	≥ 115
0 (after vibration, corrosion, dust, and moisture tests)	123	≥ 120	120	≥ 117	119	≥ 116	120	≥ 116

Did the vibration test cause any cracking or rupture of parts that would affect the mounting of the siren on a vehicle?

~~Yes~~/ No

6.1.1 SPL Requirements

When measured in accordance with 5.1, the SPL produced by Siren #1 shall meet all of the minimum requirements listed in Table 1. The SPL produced by Siren #2 through Siren #5, which are tested only at the measurement angle of 0 degrees, shall meet the corresponding SPL requirement before any other tests (e.g., vibration) are performed, **and shall not be reduced by more than 3 dB after these other tests are complete.** When comparing the measured SPL values to the SPL requirements, the measured values **shall be rounded to the nearest integer decibel value.** For the purpose of this comparison, measured SPL values that contain a five or greater in the first place to the right of the decimal shall be rounded upward.

2023-10-12

SECTION 5) DURABILITY TEST

Table B4 - SPL measurements - Siren #4

Measurement Angle (Degrees from Device Axis)	A-Weighted SPL (dB re 20 µPa) Measured with the Fast Time Setting				A-Weighted SPL (dB re 20 µPa) Measured with a Long-Term Time Setting			
	Wail		Yelp		Wail		Yelp	
	Measured	Required	Measured	Required	Measured	Required	Measured	Required
0 <i>(before durability)</i>	123	≥ 118	120	≥ 117	119	≥ 115	119	≥ 115
0 <i>(after durability)</i>	122	≥ 120	120	≥ 117	119	≥ 116	119	≥ 116

6.1.1 SPL Requirements

When measured in accordance with 5.1, the SPL produced by Siren #1 shall meet all of the minimum requirements listed in Table 1. The SPL produced by Siren #2 through Siren #5, which are tested only at the measurement angle of 0 degrees, shall meet the corresponding SPL requirement before any other tests (e.g., vibration) are performed, **and shall not be reduced by more than 3 dB after these other tests are complete.** When comparing the measured SPL values to the SPL requirements, the measured values **shall be rounded to the nearest integer decibel value.** For the purpose of this comparison, measured SPL values that contain a five or greater in the first place to the right of the decimal shall be rounded upward.

2023-10-12

Subjects: Emergency Vehicle Sirens
Reference standard: SAE J1849 – FEB 2020
Report number: NBVTC-1012-2023-001FC, Date: October 12, 2023

SECTION 6) EXTREME TEMPERATURE TESTS

Table 5A - SPL measurements - Siren #5

Measurement Angle (Degrees from Device Axis)	A-Weighted SPL (dB re 20 µPa) Measured with the Fast Time Setting				A-Weighted SPL (dB re 20 µPa) Measured with the Long-Term Time Setting			
	Wail		Yelp		Wail		Yelp	
	Measured	Required	Measured	Required	Measured	Required	Measured	Required
0 (before extreme temperature tests)	123	≥ 118	120	≥ 117	119	≥ 115	119	≥ 115
0 (after extreme temperature tests)	123	≥ 120	120	≥ 117	119	≥ 116	119	≥ 116

6.1.1 SPL Requirements

When measured in accordance with 5.1, the SPL produced by Siren #1 shall meet all of the minimum requirements listed in Table 1. The SPL produced by Siren #2 through Siren #5, which are tested only at the measurement angle of 0 degrees, shall meet the corresponding SPL requirement before any other tests (e.g., vibration) are performed, **and shall not be reduced by more than 3 dB after these other tests are complete.** When comparing the measured SPL values to the SPL requirements, the measured values **shall be rounded to the nearest integer decibel value.** For the purpose of this comparison, measured SPL values that contain a five or greater in the first place to the right of the decimal shall be rounded upward.

2023-10-12

Table B5B - High temperature test data

	Measured Voltage or Frequency	
	Measured	Required
AC voltage at the speaker terminals with the siren in the yelp mode measured at ambient laboratory temperature before the temperature soak	32.15 VAC rms	/
AC voltage at the speaker terminals with the siren in the yelp mode measured at the end of the temperature soak*	32.15 VAC rms	27.33 ~ 36.97*
Minimum fundamental frequency (Hz) of the wail at the end of the temperature soak	651	≥ 500Hz
Maximum fundamental frequency (Hz) of the wail at the end of the temperature soak	1718	≤ 2000Hz

*The amplifier output voltage measured in these conditions must be within ±15% of the voltage measured at the ambient laboratory temperature.

Table B5C - Low temperature test data

	Measured Voltage or Frequency	
	Measured	Required
AC voltage at the speaker terminals with the siren in the yelp mode measured at ambient laboratory temperature before the temperature soak	32.15 VAC rms	/
AC voltage at the speaker terminals with the siren in the yelp mode measured at the end of the temperature soak*	32.15 VAC rms	27.33 ~ 36.97*
Minimum fundamental frequency (Hz) of the wail at the end of the temperature soak	653	≥ 500Hz
Maximum fundamental frequency (Hz) of the wail at the end of the temperature soak	1718	≤ 2000Hz

*The amplifier output voltage measured in these conditions must be within ±15% of the voltage measured at the ambient laboratory temperature.

2023-10-12

SECTION 7) PHOTOGRAPHS OF TEST SAMPLE



2023-10-12



2023-10-12



2023-10-12



- END OF TEST REPORT

2023-10-12

