Choose Scandinavian trust

2D Antenna Peak Gain TEST REPORT

Report ID:
REP086129

Project number:
PRJ0076203

Type of assessment:
2D Antenna Pattern

Type of radio equipment:
2.4-2.5GHz Edge Inverted L

Applicant:
Cooper Industries (Electrical) Inc.

Description of product:
2.4-2.5GHz Edge Inverted L

Model(s)/HVIN(s):
ACAB-2683-07 inside R260 Rev 7

Specifications:

- 2D Antenna Peak Gain

Date of issue: April 22, 2025

Kevin Rose, EMC/RF Specialist
Tested by

Signature

Lab locations

Company name	Nemko Canada Inc.
Facilities	**Ottawa site:** 303 River Road, Ottawa, ON, Canada, K1V 1H2 Tel: +1 613 737 9680, Fax: +1 613 737 9691 **Montréal site:** 292 Labrosse Avenue, Pointe-Claire, QC, Canada, H9R 5L8 Tel: +1 514 694 2684, Fax: +1 514 694 3528 **Cambridge site:** 1-130 Saltsman Drive, Cambridge, ON, Canada, N3E 0B2 Tel: +1 519 650 4811
Test site registration number:	– CA2040 (Ottawa) – CA2041 (Montreal) – CA0101 (Cambridge)
Website	www.nemko.com

Limits of responsibility

Note that this report's results relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of this report.
This test report has been completed following the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

None	2D antenna pattern and peak gain

1.2 Exclusions

None.

1.3 Test report revision history

Table 1.3-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
REP0086129	April 22, 2025	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

None

2.3 Model variant declaration

There were no model variants declared by the applicant.

2.4 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Equipment (antenna) under test (EUT) details

3.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

3.2 Applicant/Manufacturer

Applicant name	Cooper Industries (Electrical) Inc.
Applicant address	74-1833 Coast Meridian Rd., Port Coquitlam, BC, Canada, V3C 6G5

3.3 Antenna information

Product name	2.4-2.5GHz Edge Inverted L
Model	ACAB-2683-07 inside R260 Rev 7
Variant(s)	ACAB-2683-07 inside R260 Rev 13
Manufacturer	Pulse

3.4 EUT setup details

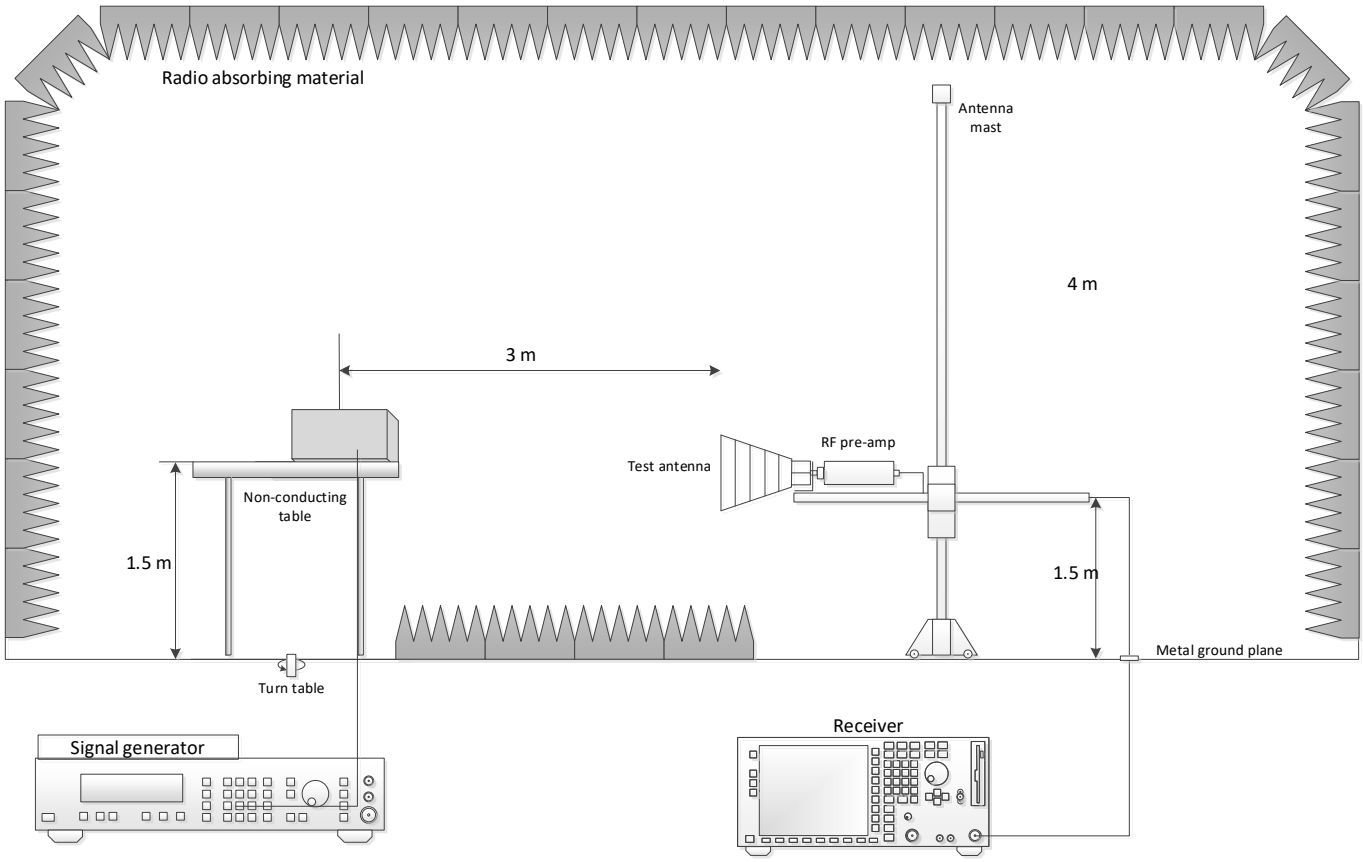


Figure 3.4-1: Test setup diagram

Section 4 Test conditions

4.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

4.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 5 Testing data

5.1 2D antenna pattern and peak gain

5.1.1 References and limits

- FCC 47 CFR Part 15, Subpart B: §15.203

5.1.2 Test summary

Test date	March 8, 2025
Tested by	Kevin Rose
Test location	Montreal

5.1.3 Notes

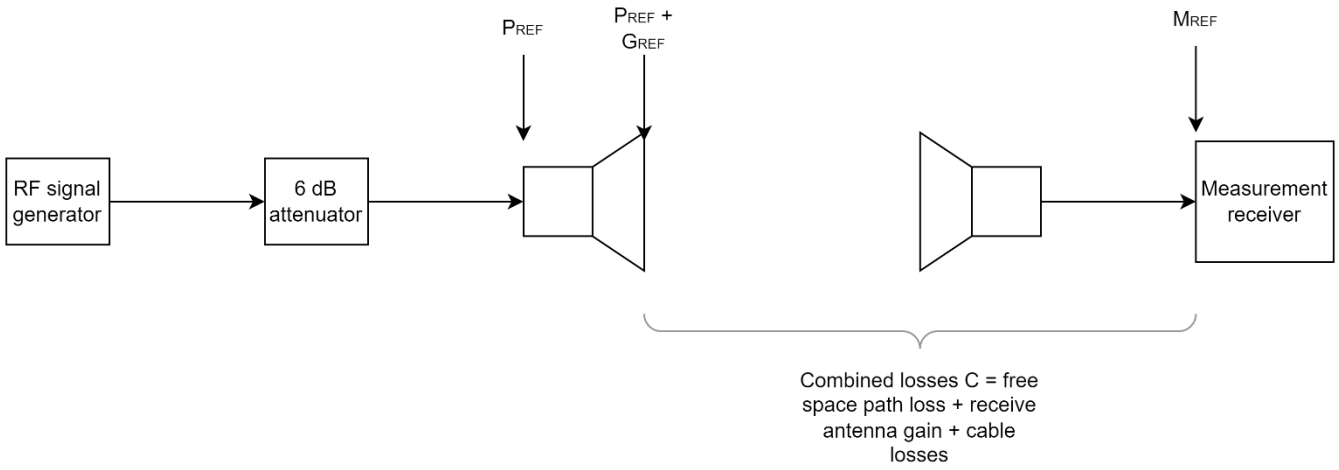
None

5.1.4 Setup details

Measurements were performed in a 3m semi-anechoic chamber and consisted of 2 steps.

Step 1: Reference Measurement:

A reference antenna is connected to an RF signal generator via a ferrite-loaded cable and 6 dB attenuator. The reference antenna is then placed at the center of the anechoic chamber turntable at a height of approximately 1.5 m. The RF signal generator is then configured to generate a 0 dBm unmodulated signal at the frequency(-ies) under test. The polarization of the receive antenna is adjusted to match the polarization of the transmit antenna and the turntable angle and receive antenna height are adjusted to maximize the received signal level at the measurement receiver.

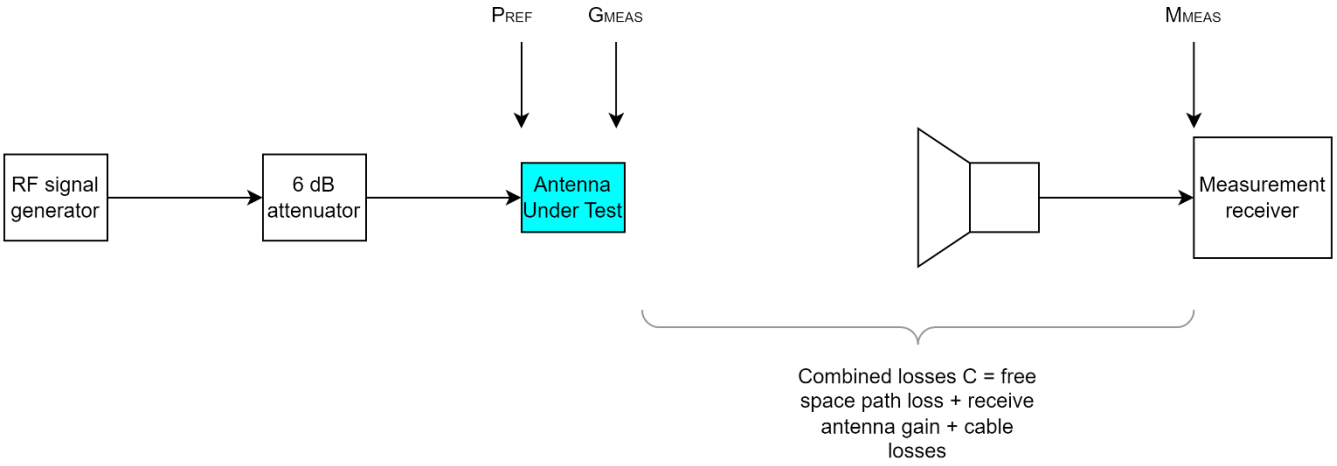


The signal level at the measurement receiver, M_{REF}, is recorded for each of the frequencies under test. Given that the transmit antenna is calibrated with a known gain G_{REF}, the following expression holds true:

$$M_{REF} = P_{REF} + G_{REF} + C \qquad \text{Equation [1]}$$

Step 2: Antenna Under Test Measurement

For this step, the reference antenna is replaced with the antenna under test. Again, the RF signal generator is set to 0 dBm output at the frequency(-ies) under test. The received signal level at the measurement receiver is recorded as the antenna under test is rotated 360 degrees in 5 degree steps. The receive antenna is then changed to the opposite polarization and the received signal level at the measurement receiver is recorded again as the turntable is rotated 360 degrees in 5 degree steps.



The peak received signal level at the measurement receiver is identified and noted as M_{MEAS}.

As before, the following holds true:

$$M_{MEAS} = P_{REF} + G_{MEAS} + C \qquad \text{Equation [2]}$$

G_{MEAS} is the peak gain of the antenna under test and is the value of interest.

Re-arranging Equation [2] in terms of G_{MEAS} gives:

$$G_{MEAS} = M_{MEAS} - P_{REF} - C \qquad \text{Equation [3]}$$

And re-arranging Equation [1] in terms of P_{REF} gives:

$$P_{REF} = M_{REF} - G_{REF} - C \qquad \text{Equation [4]}$$

Substituting P_{REF} in Equation [3] with Equation [4] gives:

$$G_{MEAS} = M_{MEAS} - (M_{REF} - G_{REF} - C) - C$$
$$G_{MEAS} = M_{MEAS} - M_{REF} + G_{REF} + C - C$$

$$\boldsymbol{G_{MEAS} = M_{MEAS} - M_{REF} + G_{REF}} \qquad \textbf{Equation [5]}$$

Where:

G_{MEAS} = peak gain of antenna under test in dBi
M_{MEAS} = measured received signal level with antenna under test
M_{REF} = measured received signa level with calibrated reference antenna
G_{REF} = gain of reference antenna in dBi

Table 5.1-1: *2D antenna pattern and peak gain equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber (Emissions)	TDK	SAC-3	FA002532e	1 year	March 8, 2025
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	June 6, 2025
Horn antenna (1–18 GHz)	EMCO	3115	FA001451	1 year	June 6, 2025
50 Ω coax cable	Huber + Suhner	None	FA003438	1 year	May 11, 2025
RF Cable Assembly	Huber + Suhner	2M-750-195A-750	FA002554	1 year	May 11, 2025
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	January 27, 2026
Signal generator	Rohde & Schwarz	SMB100B	FA003063	1 year	May 7, 2025

Notes: N/A – not applicable
NCR – no calibration required
VOU – verify on use

Table 5.1-2: *2D antenna pattern and peak gain test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.60.15

Notes: None

5.1.5 Test data

Table 5.1-3: *2D antenna pattern and peak gain results*

Frequency (MHz)	Peak Gain (dBi)
2400-2483.5	5.4

Sample calculation:
Frequency: 2400-2483.5 MHz
M_{MEAS}: 5.4
M_{REF}: 0
G_{REF}: 5.4

G_{MEAS} = M_{MEAS} – M_{REF} - G_{REF}
= (xx) – (xx) – (xx)
= xx dBi

End of test report