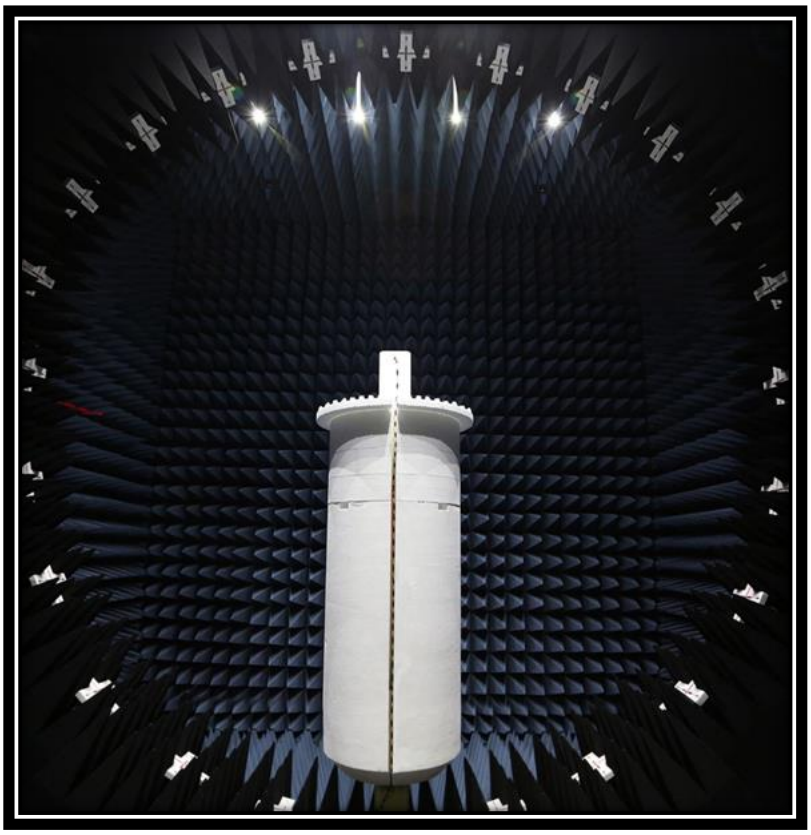
Emerson / Rosemount Inc.

RM2642

OTA Report

Report: EMPM0206.0 Rev. 01, Issue Date: August 1, 2025



Approved by:

Trevor Buls, Principal EMC Test Engineer
Signed for and on behalf of Element

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element
2023.04.17

Section	Page Number

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

FDA - Recognized by the FDA as an Accreditation Scheme for Conformity Assessment (ASCA)-accredited testing laboratory for basic safety and essential performance.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:

California Minnesota Oregon Texas Washington

FACILITIES

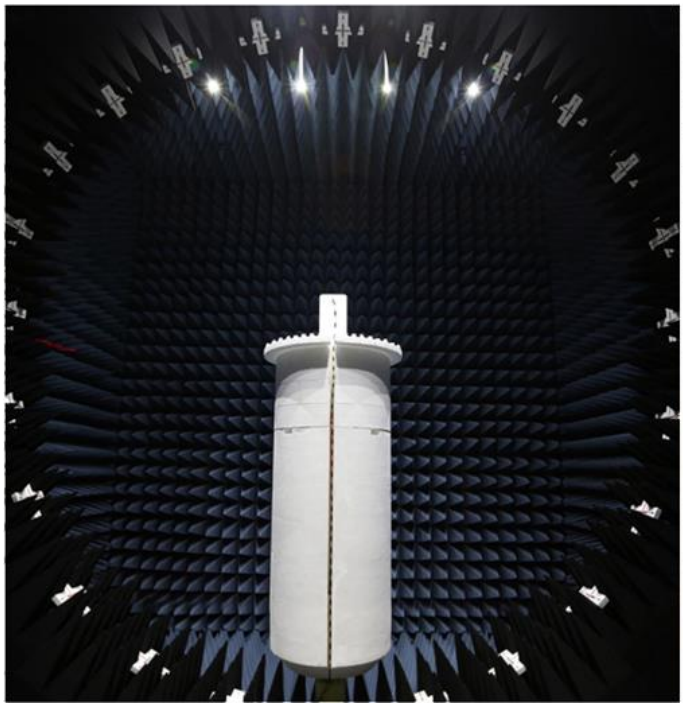
element
2025.01.03

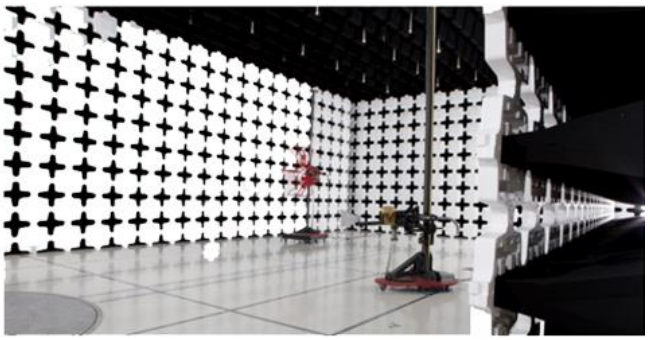
Testing was performed at the following location(s)

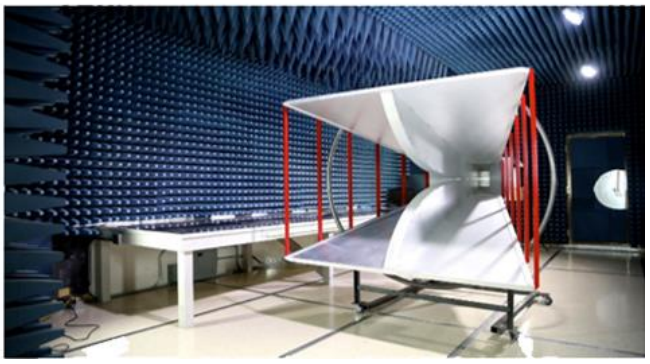
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☒	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MOC, NCC, OFCA
(7) FDA ASCA No.







PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	Emerson / Rosemount Inc.
Address:	6021 Innovation Boulevard
City, State, Zip:	Shakopee, MN 55379
Test Requested By:	Daniel Wolf
EUT:	RM2642
First Date of Test:	July 22, 2025
Last Date of Test:	July 22, 2025
Receipt Date of Samples:	July 22, 2025
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Rosemount RM2642 in host 3144S active antenna OTA test

Testing Objective:
To obtain 3D antenna pattern measurements and calculated antenna performance values (gain, efficiency, TRP, etc)

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2025-07-22	Active 3D Antenna Pattern Measurements	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

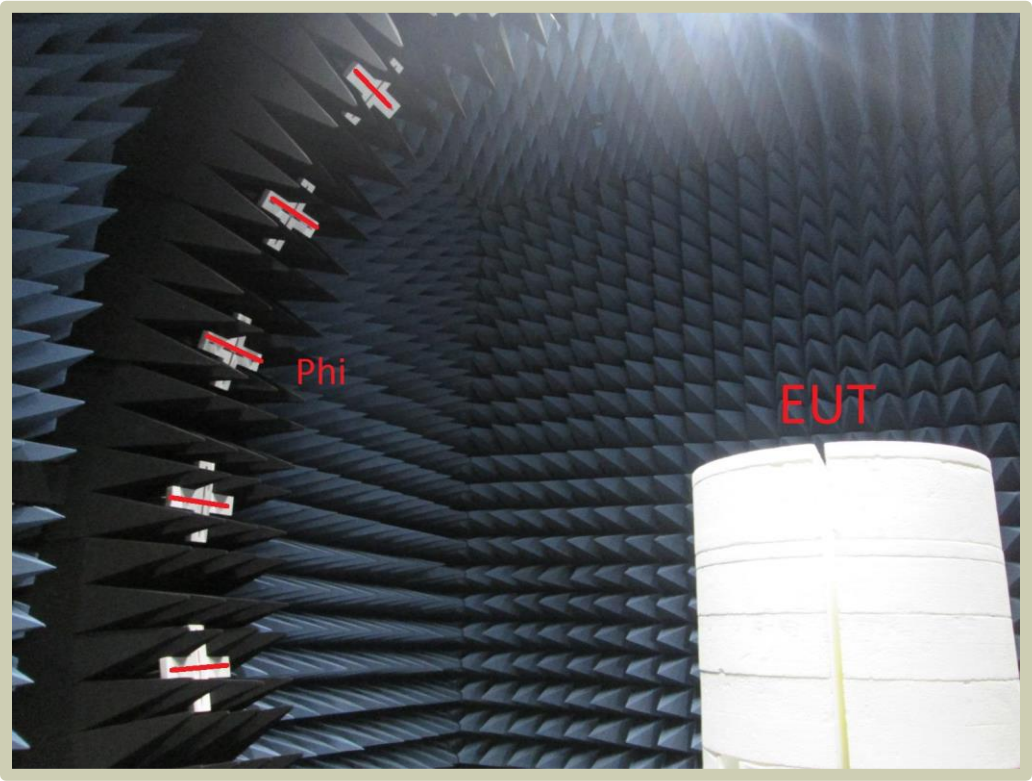
OTA MEASUREMENT SUMMARY

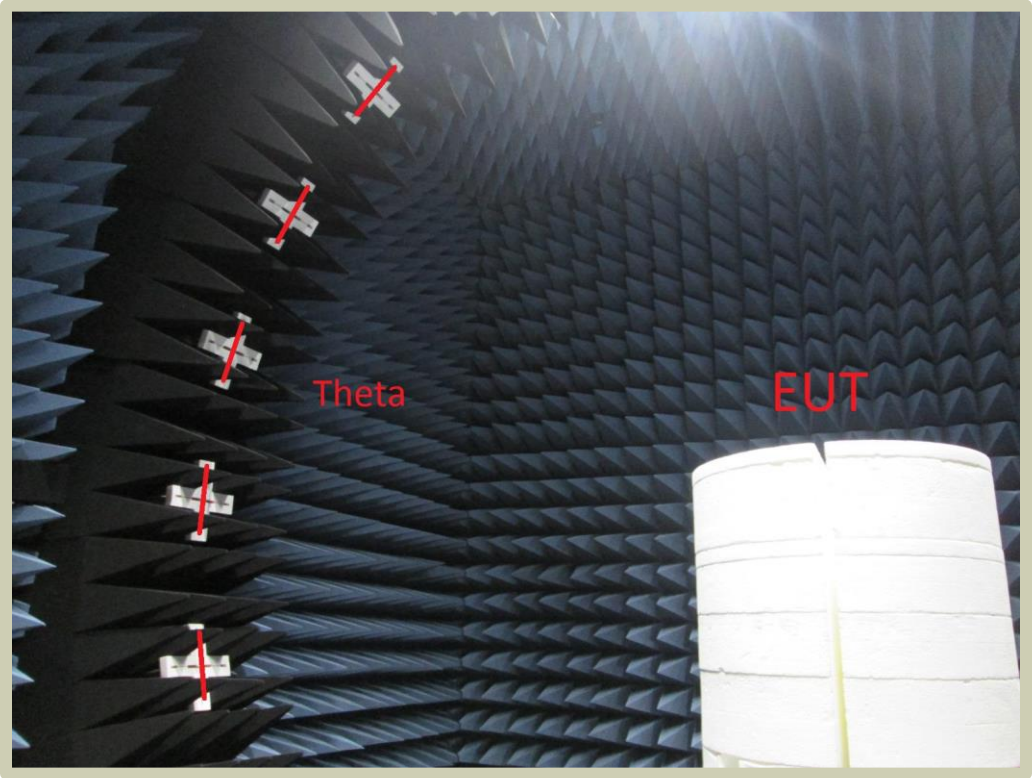
TEST DEFINITIONS

Phi Polarity	The detector antennas that are pointing in the same direction as the phi axis positioner rotates. See following page for photos.
Theta Polarity	The detector antennas that are pointing in the same direction as when the ring of detector antennas. See following page for photos.
Phi Angle	The position of the phi axis positioner, usually between 0° and 180°
Theta Angle	The position of the detector antenna, usually between -165° and 165°
Antenna Port Input Power (APIP)	The absolute power going into the antenna. This is used to calculate Efficiency and Gain.
Effective Isotropic Radiated Power (EIRP)	After combining phi and theta polarity measurements, the highest reading seen at any phi and theta angle during the measurement is the Effective Isotropic Radiated Power.
Total Radiated Power (TRP)	The sum of the power seen at all measuring antennas at all Theta and Phi angles and at both polarities. Represented in equation form by: $$TRP = \frac{1}{4\pi}\int_0^{2\pi}\int_0^{\pi}\left(EIRP_\theta(\theta,\phi) + EIRP_\phi(\theta,\phi)\right) * \sin(\theta)\, d\theta\, d\phi$$ Where θ is the theta angle of the measurement, ϕ is the phi angle of the measurement, $EIRP_\theta(\theta,\phi)$ is the reading on the theta polarity at a given theta and phi angle, and $EIRP_\phi(\theta,\phi)$is the reading on the phi polarity at a given theta and phi angle.
Minimum Effective Isotropic Sensitivity (Min. EIS)	After finding the inverse of the sum of the inverses of the phi and theta polarity measurements for each single phi and theta angle, the lowest value is the Min. EIS. EIS is represented in equation form as: $$EIS = \left(EIS_\theta(\theta_n,\phi_n)^{-1} + EIS_\phi(\theta_n,\phi_n)^{-1}\right)^{-1}$$ Where θ is the theta angle of the measurement, ϕ is the phi angle of the measurement, $EIS_\theta(\theta,\phi)$ is the reading on the theta polarity at a given theta and phi angle, and $EIS_\phi(\theta,\phi)$is the reading on the phi polarity at a given theta and phi angle. The lowest value found across all EIS values is the Minimum Effective Isotropic Sensitivity.
Total Isotropic Sensitivity (TIS)	The inverse of the sum of the inverses of all the individual EIS readings. Represented in equation form as: $$TIS = \frac{4\pi}{\int_0^{2\pi}\int_0^{\pi}\left(EIS_\theta(\theta,\phi)^{-1} + EIS_\phi(\theta,\phi)^{-1}\right) * \sin(\theta)\, d\theta\, d\phi}$$ Where θ is the theta angle of the measurement, ϕ is the phi angle of the measurement, $EIS_\theta(\theta,\phi)$ is the reading on the theta polarity at a given theta and phi angle, and $EIS_\phi(\theta,\phi)$is the reading on the phi polarity at a given theta and phi angle.
Directivity	The difference between the EIRP and the TRP or the Min. EIS and the TIS.
Efficiency	The difference between the TRP and the APIP.
Gain (also called Peak Gain)	The difference between the EIRP and the APIP.
3 dB Beamwidth	The angle between the locations of the half-power (3 dB down) points referenced against the location of the highest EIRP of the azimuth cut.

OTA MEASUREMENT SUMMARY

PHI POLARITY AND THETA POLARITY VISUALIZATION





ACTIVE 3D ANTENNA PATTERN MEASUREMENTS

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Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna - Dipole	ETS Lindgren	3126-2450	OTF2	4/18/2024	36 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	5/23/2025	12 mo
Analyzer - Network Analyzer	Agilent	E5071C	NAM	5/23/2025	36 mo

TEST DESCRIPTION

Using the modes of operation and configurations noted within this report, a radiated pattern measurement test was performed. The frequency ranges investigated (scanned), are also noted in this report.

The EUT was placed on a low dielectric constant support structure (Phi Axis Positioner) in the 3D center of the measurement zone using a laser alignment system.

The test begins with a measurement path configured (via ETS-Lindgren EMQuest Data Acquisition and Analysis Software) such that an electrical path is present from the Theta polarization element of the -165° detector antenna, to the measurement port of a spectrum analyzer. The EUT is commanded to transmit at the desired frequency and an absolute power measurement is obtained at the spectrum analyzer. The measurement path is then reconfigured (again via EMQuest) such that an electrical path is present from the Phi polarization element of the -165° detector antenna, to the measurement port of the spectrum analyzer. Another absolute power measurement is obtained at the spectrum analyzer. This process is repeated at each of the 23 detector antennas in turn. This process is repeated for every rotation of the Phi Axis Positioner up to 180° - Phi Axis Resolution. When this process is complete, EMQuest applies factors from a Range Calibration and Normalization to produce a final data set with 1D/2D/3D patterns and tabular values such as antenna efficiency, Equivalent Isotropic Radiated Power (EIRP), Total Radiated Power (TRP), etc.

A measurement uncertainty estimation has been performed for this testing. When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution. The expanded measurement uncertainty, 95% confidence level (K=2), for Maximum Gain / Efficiency for 2400-2483.5 MHz on active measurements is +/-1.08 dB. The expanded measurement uncertainty, 95% confidence level (K=2), for Maximum Gain / Efficiency for 2400-2483.5 MHz on passive measurements is +/-1.29. The calculations for estimating measurement uncertainty are available upon request.

Procedures for the Range Calibration and Normalization can be found in Element Materials Technology document: WP Antenna Pattern Measurements (3D)

ACTIVE 3D ANTENNA PATTERN MEASUREMENTS

OTA 2018.01.04

EUT:	RM2642
Serial Number:	1121
Customer:	Emerson
Attendees:	Stacy Lukas
Customer Project:	None
Tested By:	Dan Haas
Test Run Description:	Run 1, 2402

Work Order:	EMPM0206
Date:	7/22/2025
Temperature:	22.8 °C
Relative Humidity:	57.7% RH
Bar. Pressure:	1017 mbar
Job Site:	MN10

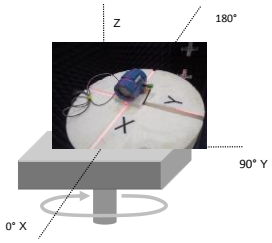
COMMENTS

APIP factor is based on output power measurement of 1.229 dBm (as shown in report EMPM0201.1) with an additional 0.51 factor provided by the manufacturer to account for cable and connector loss.

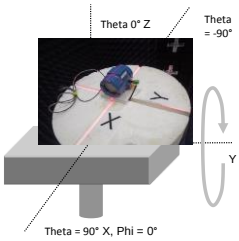
3D PATTERN DATA

Frequency (MHz)	2402
Ant. Port Input Pwr. (dBm)	1.74
Tot. Rad. Pwr. (dBm)	-6.02
Peak EIRP (dBm)	0.85
Directivity (dBi)	6.86
Efficiency (dB)	-7.76
Efficiency (%)	16.76
Gain (dBi)	-0.89
Average Gain (dB)	-7.76
E-Plane 3 dB BW (°)	74.00

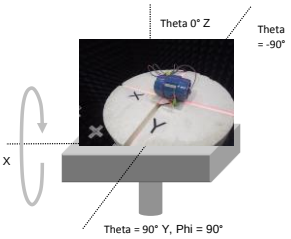
Azimuth Cut (Theta Axis = 90°)



Elevation Cut (Phi Axis = 0°)

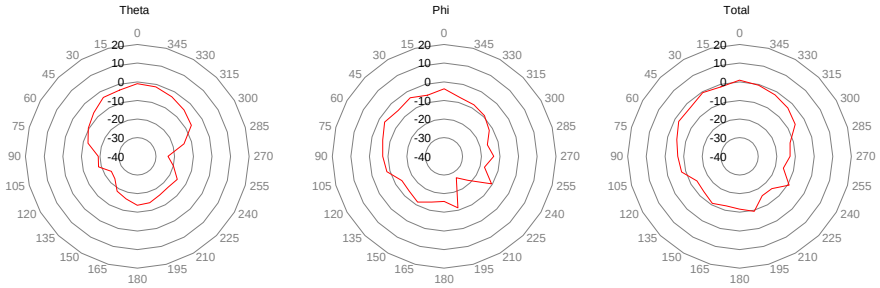


Elevation Cut (Phi Axis = 90°)

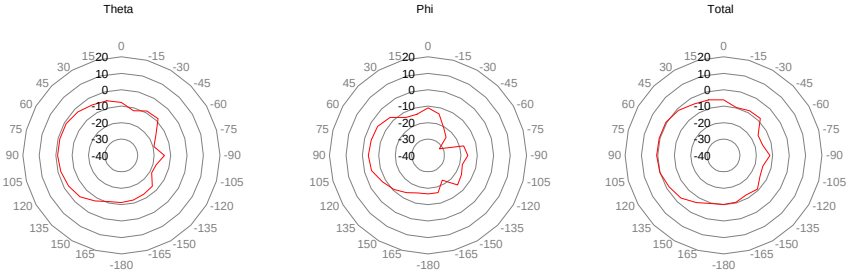


POLAR PLOTS

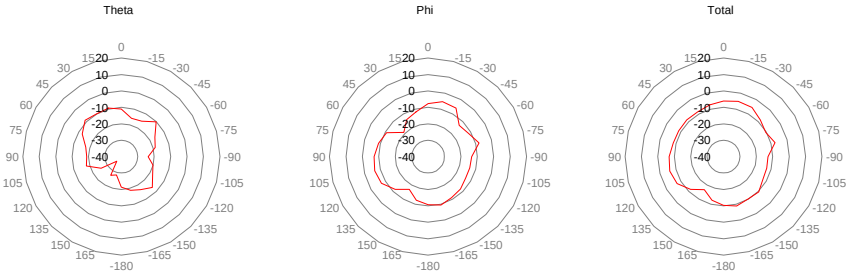
Power (dBm) — Azimuth Cut (Theta Axis = 90°)



Power (dBm) — Elevation Cut (Phi Axis = 0°)



Power (dBm) — Elevation Cut (Phi Axis = 90°)



ACTIVE 3D ANTENNA PATTERN MEASUREMENTS

OTA 2018.01.04

EUT:	RM2642
Serial Number:	1121
Customer:	Emerson
Attendees:	Stacy Lukas
Customer Project:	None
Tested By:	Dan Haas
Test Run Description:	Run 2, 2440

Work Order:	EMPM0206
Date:	7/22/2025
Temperature:	22.8 °C
Relative Humidity:	57.7% RH
Bar. Pressure:	1017 mbar
Job Site:	MN10

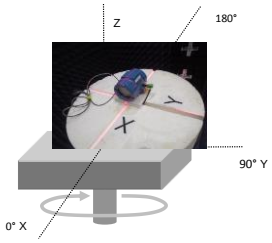
COMMENTS

APIP factor is based on output power measurement of 1.229 dBm (as shown in report EMPM0201.1) with an additional 0.51 factor provided by the manufacturer to account for cable and connector loss.

3D PATTERN DATA

Frequency (MHz)	2440
Ant. Port Input Pwr. (dBm)	1.74
Tot. Rad. Pwr. (dBm)	-5.91
Peak EIRP (dBm)	1.14
Directivity (dBi)	7.04
Efficiency (dB)	-7.65
Efficiency (%)	17.19
Gain (dBi)	-0.60
Average Gain (dB)	-7.65
E-Plane 3 dB BW (°)	80.00

Azimuth Cut (Theta Axis = 90°)



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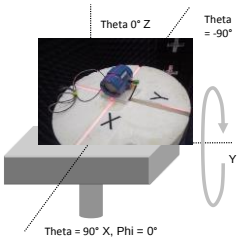
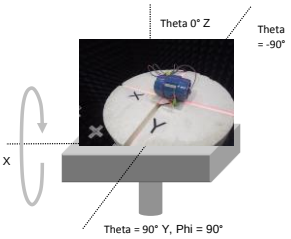
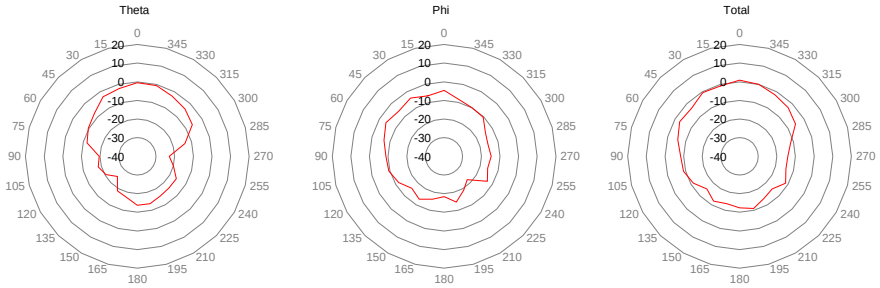


Elevation Cut (Phi Axis = 90°)

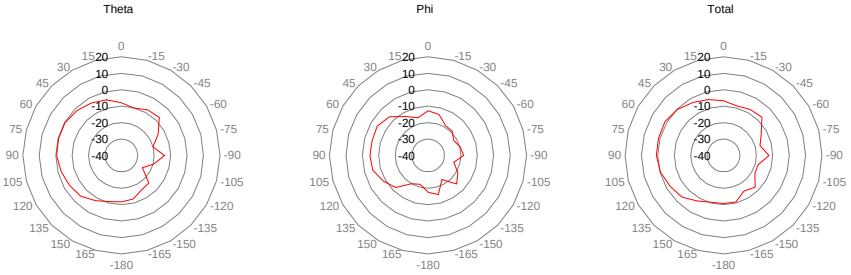


POLAR PLOTS

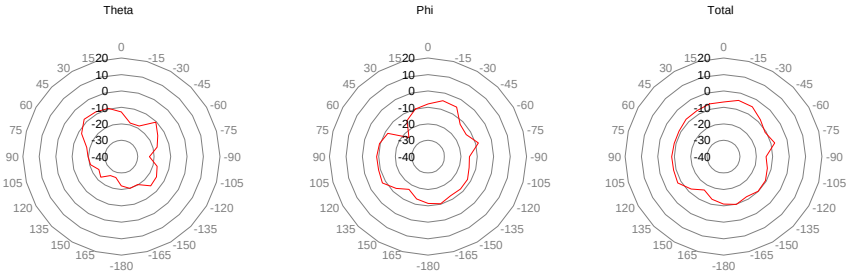
Power (dBm) — Azimuth Cut (Theta Axis = 90°)



Power (dBm) — Elevation Cut (Phi Axis = 0°)



Power (dBm) — Elevation Cut (Phi Axis = 90°)



ACTIVE 3D ANTENNA PATTERN MEASUREMENTS

OTA 2018.01.04

EUT:	RM2642
Serial Number:	1121
Customer:	Emerson
Attendees:	Stacy Lukas
Customer Project:	None
Tested By:	Dan Haas
Test Run Description:	Run 2, 2480

Work Order:	EMPM0206
Date:	7/22/2025
Temperature:	22.8 °C
Relative Humidity:	57.7% RH
Bar. Pressure:	1017 mbar
Job Site:	MN10

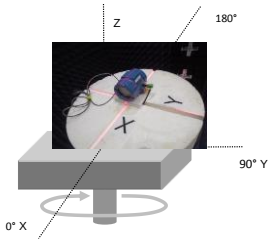
COMMENTS

APIP factor is based on output power measurement of 1.229 dBm (as shown in report EMPM0201.1) with an additional 0.51 factor provided by the manufacturer to account for cable and connector loss.

3D PATTERN DATA

Frequency (MHz)	2480
Ant. Port Input Pwr. (dBm)	1.74
Tot. Rad. Pwr. (dBm)	-6.51
Peak EIRP (dBm)	1.01
Directivity (dBi)	7.52
Efficiency (dB)	-8.25
Efficiency (%)	14.97
Gain (dBi)	-0.73
Average Gain (dB)	-8.25
E-Plane 3 dB BW (°)	75.00

Azimuth Cut (Theta Axis = 90°)



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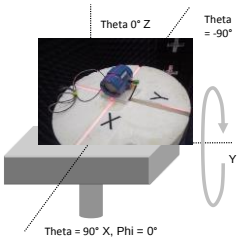

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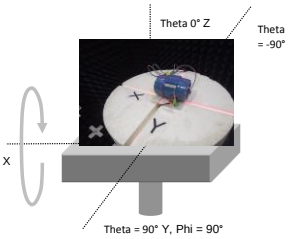
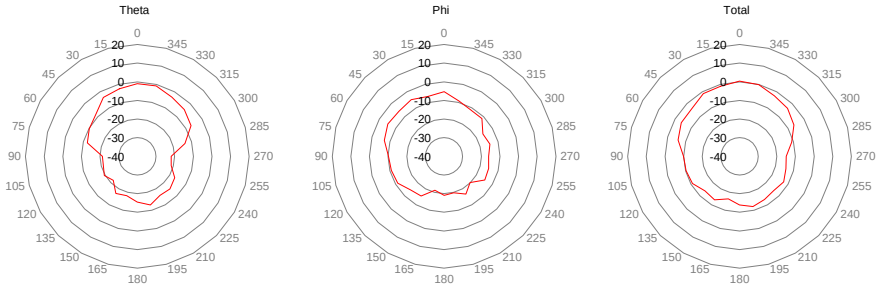


POLAR PLOTS

Power (dBm) — Azimuth Cut (Theta Axis = 90°)



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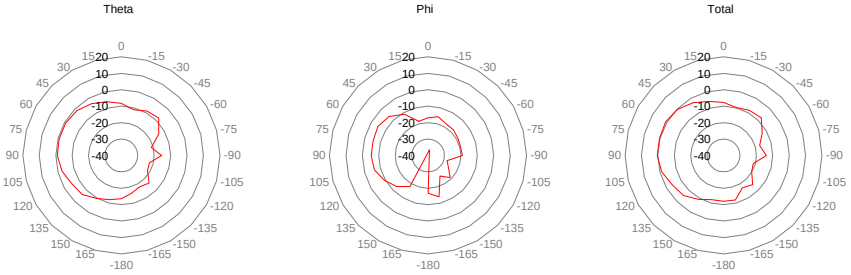
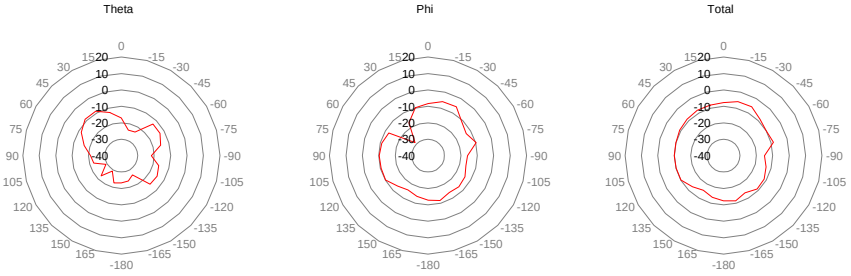
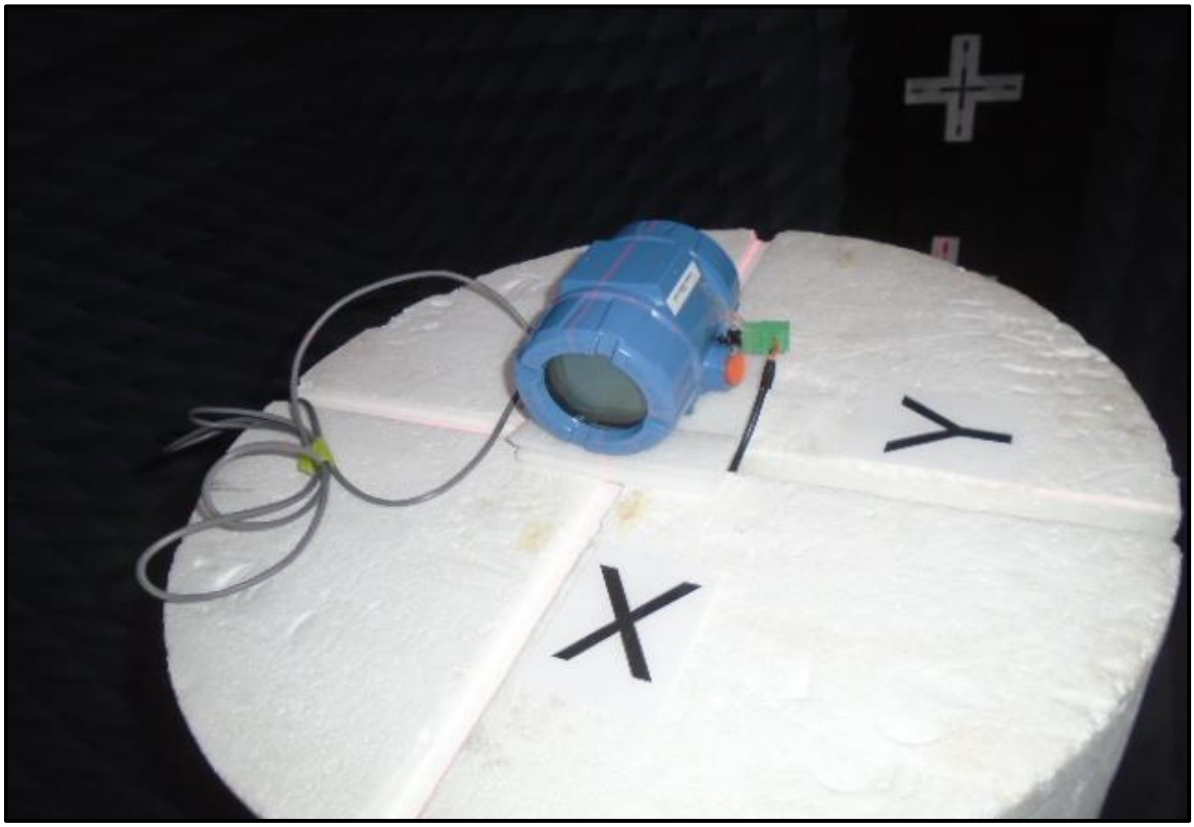


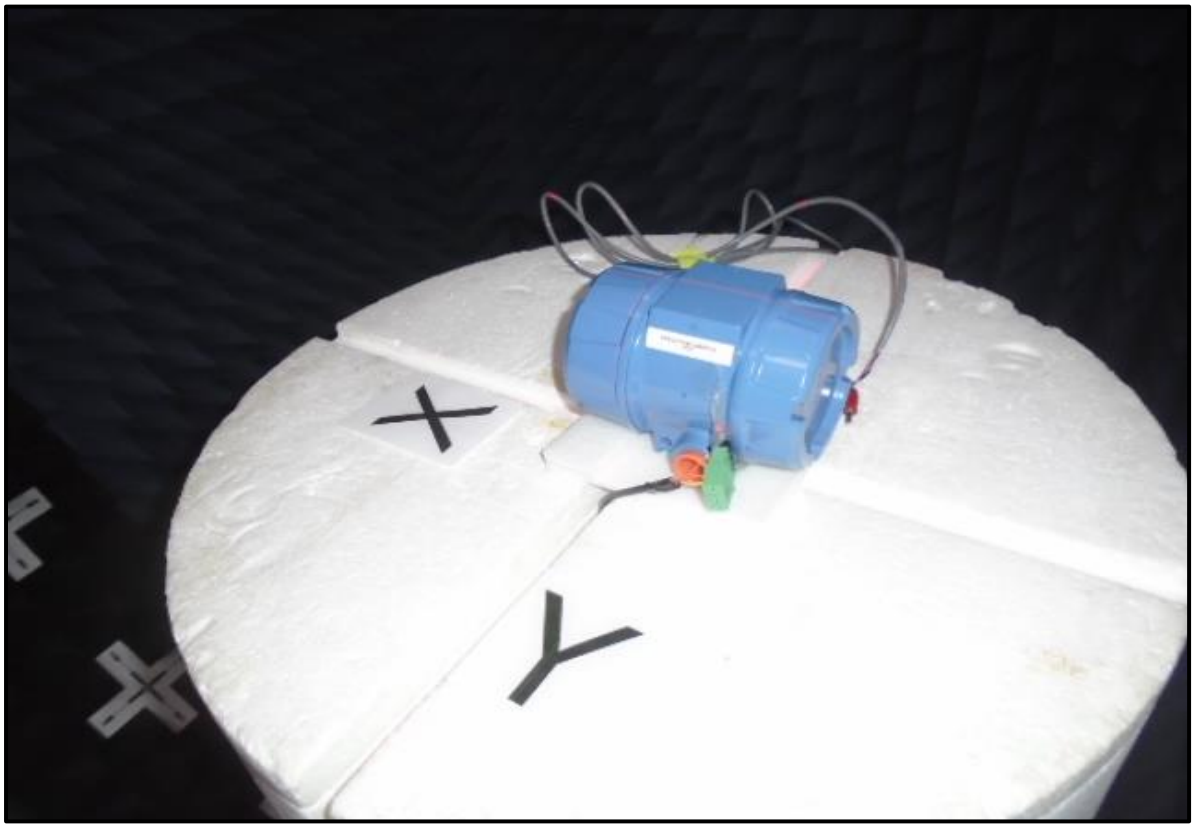
Power (dBm) — Elevation Cut (Phi Axis = 90°)



ACTIVE 3D ANTENNA PATTERN MEASUREMENTS

OTA 2018.01.04





End of Test Report