Renesas DA14592MOD

Antenna characterization

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Revision History

Date	Rev.	Author	Description
2024-02-26	A	Pär Berglund	Released after internal review

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3 Acronyms, Abbreviations and Definitions

Table 1. Acronyms

Acronym	Description
WSI	Wireless System Integration

4 Introduction

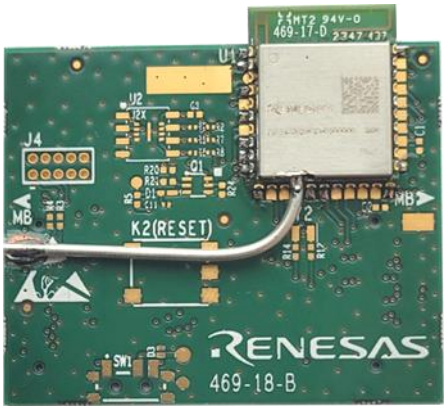
This paper presents antenna measurements for the Renesas DA14592MOD BLE module.

5 Antenna measurements

The BLE antenna performance for the Renesas DA14592MOD have been characterized in terms of Voltage Standing Wave Ratio, antenna efficiency and radiation patterns.

Antenna measurements have been done for the Renesas DA14592MOD module as stand-alone and when positioned on a reference board.

Figure 5-1 Renesas DA14592MOD module.



VSWR Renesas DA14592MOD module mounted on reference board.

5.1 Voltage Standing Wave Ratio

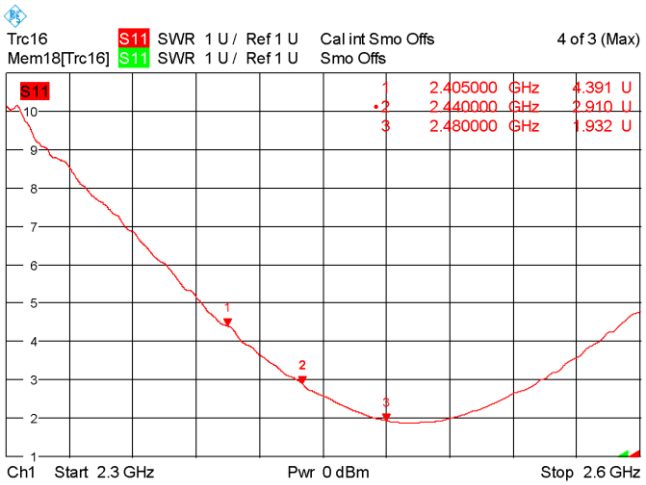


Figure 5-2 VSWR Renesas DA14592MOD module as stand-alone.

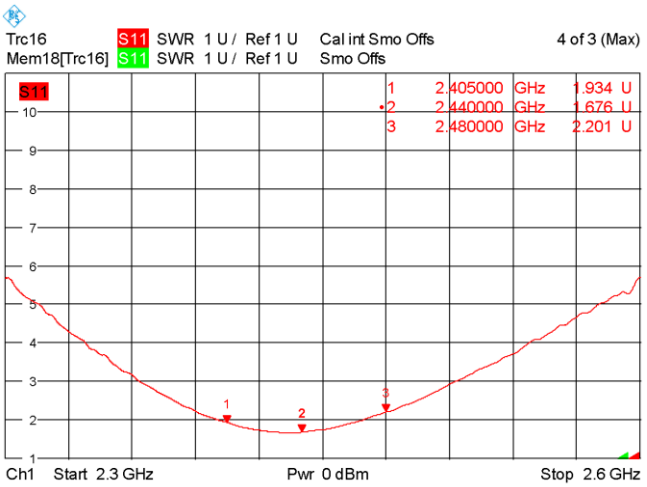


Figure 5-3 VSWR Renesas DA14592MOD module mounted on reference board.

5.2 Antenna efficiency, peak gain and 3D-radiation patterns

The antenna efficiency measurements are carried out in a Satimo SG-23 6 GHz Stargate Antenna Test Chamber. The antenna efficiency, ε_T, is the ratio of the power delivered at the 50Ω antenna interface, P_t, relative to the power radiated from the antenna, $P_{radiated}$.

$$\varepsilon_T = \frac{P_{radiated}}{P_t}$$

5.2.1 Renesas DA14592MOD module as stand-alone

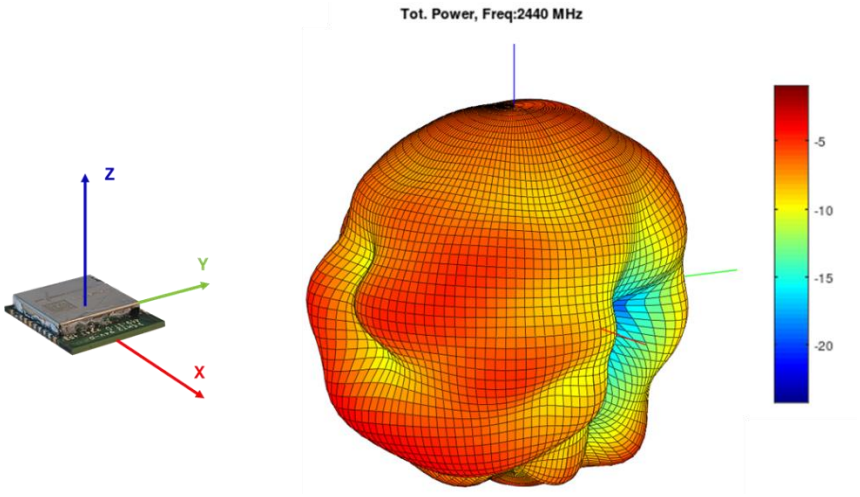


Figure 5-4 3D-radiation pattern at 2400MHz for Renesas DA14592MOD module as stand-alone.

Table 2 Antenna efficiency and peak gain for Renesas DA14592MOD module as stand-alone.

Frequency	Efficiency [dB]	Antenna peak Gain [dBi]
2400	-7,5	-2,5
2405	-7,4	-2,5
2410	-7,2	-2,4
2415	-6,9	-1,9
2420	-6,6	-1,7
2425	-6,5	-1,3
2430	-6,3	-1,2
2435	-6,2	-0,9
2440	-6,2	-0,9
2445	-6,1	-0,8
2450	-5,8	-0,6
2455	-5,7	-0,2
2460	-5,5	-0,1
2465	-5,5	0,1
2470	-5,4	0,0
2475	-5,4	0,1
2480	-5,4	0,0
2485	-5,2	0,2

5.2.2 Renesas DA14592MOD module mounted on reference board

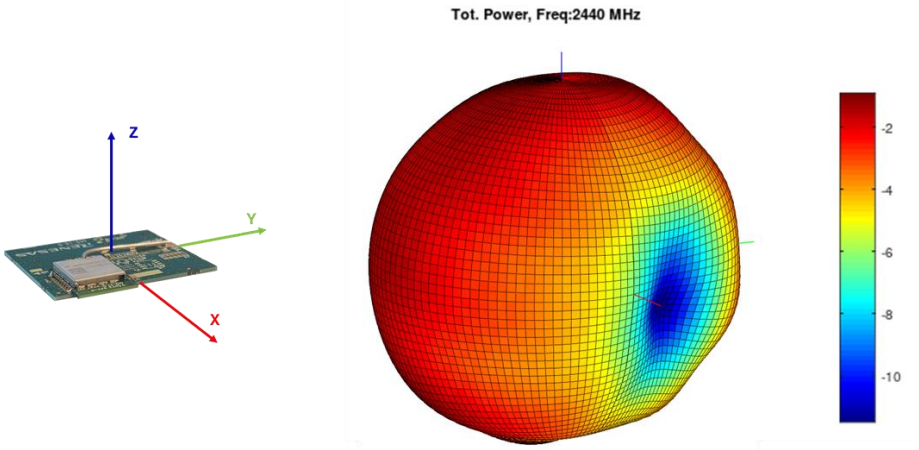


Figure 5-5 3D-radiation pattern at 2400MHz for Renesas DA14592MOD mounted on reference board.

Table 3 Antenna efficiency and peak gain for Renesas DA14592MOD module mounted on reference board.

Frequency	Efficiency [dB]	Antenna peak Gain [dBi]
2400	-3,6	-0,7
2405	-3,5	-0,5
2410	-3,4	-0,4
2415	-3,3	-0,5
2420	-3,2	-0,8
2425	-3,2	-0,8
2430	-3,1	-0,8
2435	-3,2	-0,9
2440	-3,2	-0,9
2445	-3,1	-0,8
2450	-3,1	-0,5
2455	-3,1	-0,6
2460	-3,0	-0,6
2465	-3,0	-0,6
2470	-3,1	-0,8
2475	-3,2	-0,9
2480	-3,3	-0,7
2485	-3,4	-0,7

5.3 Radiation patterns

The antenna radiation pattern measurements are carried out in a Satimo SG-23 6 GHz Stargate Antenna Test Chamber. Radiation patterns are presented for three measurement planes: XY-, XZ- and YZ-planes.

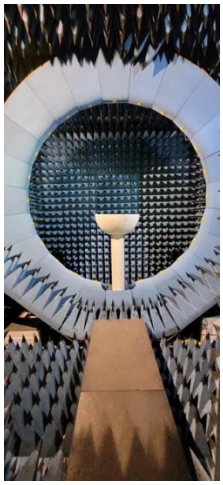


Figure 5-6 Satimo SG-23 6 GHz Stargate Antenna Test Chamber.

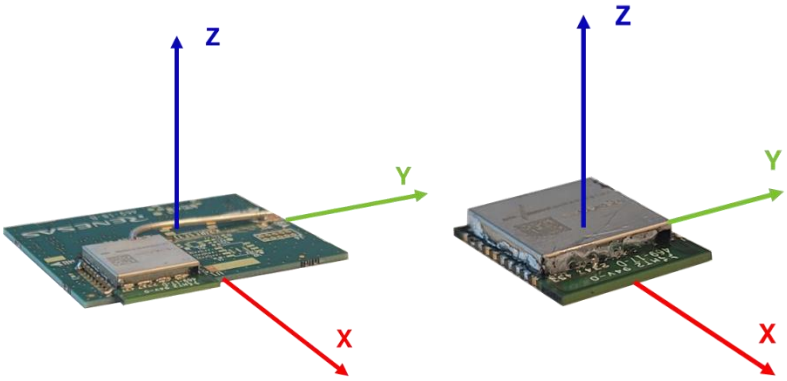


Figure 5-7 Measurement plane definition

5.3.1 Renesas DA14592MOD module as stand-alone

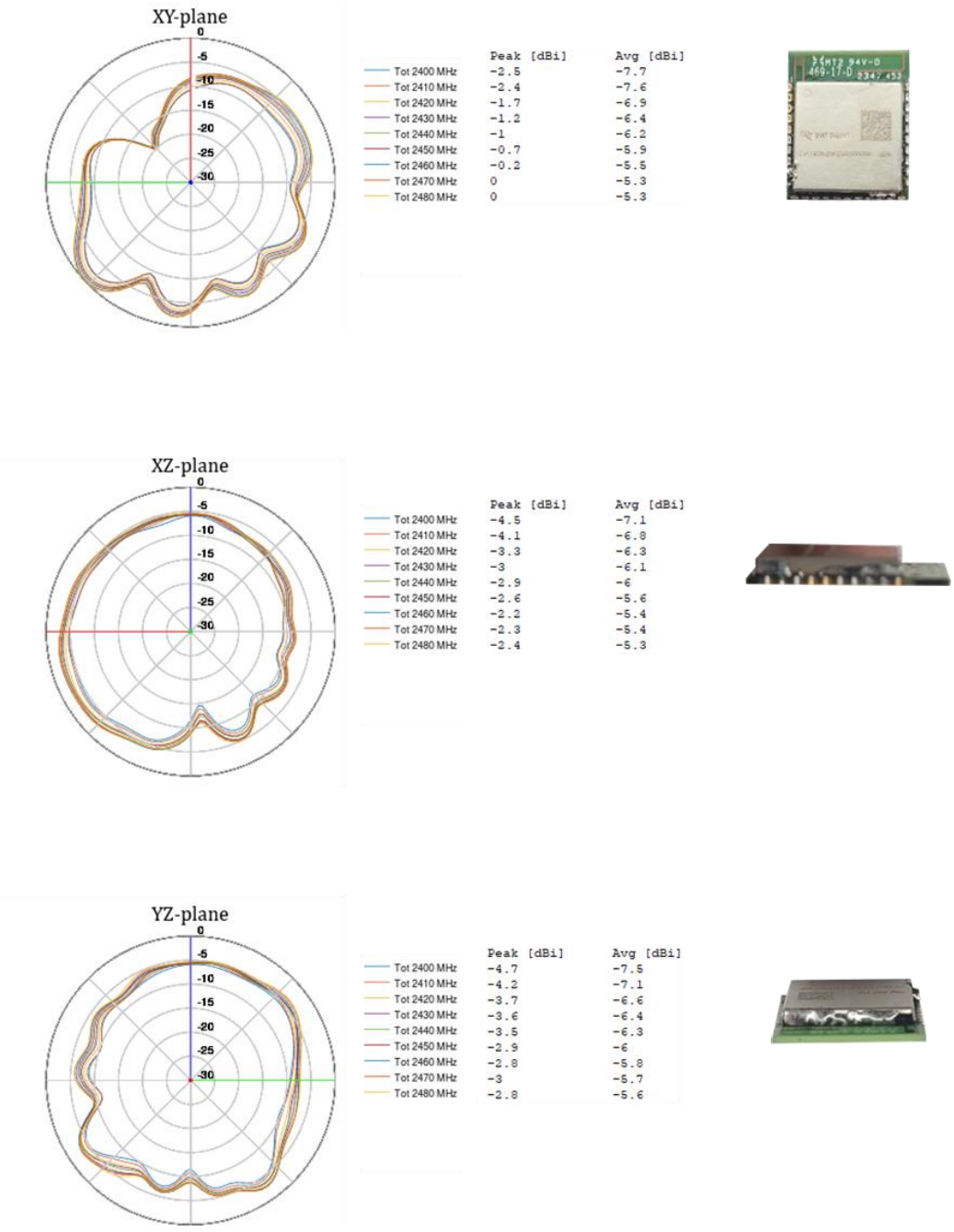


Figure 5-8 Radiation patterns Renesas DA14592MOD module as stand-alone.

5.3.2 Renesas DA14592MOD module mounted on reference board

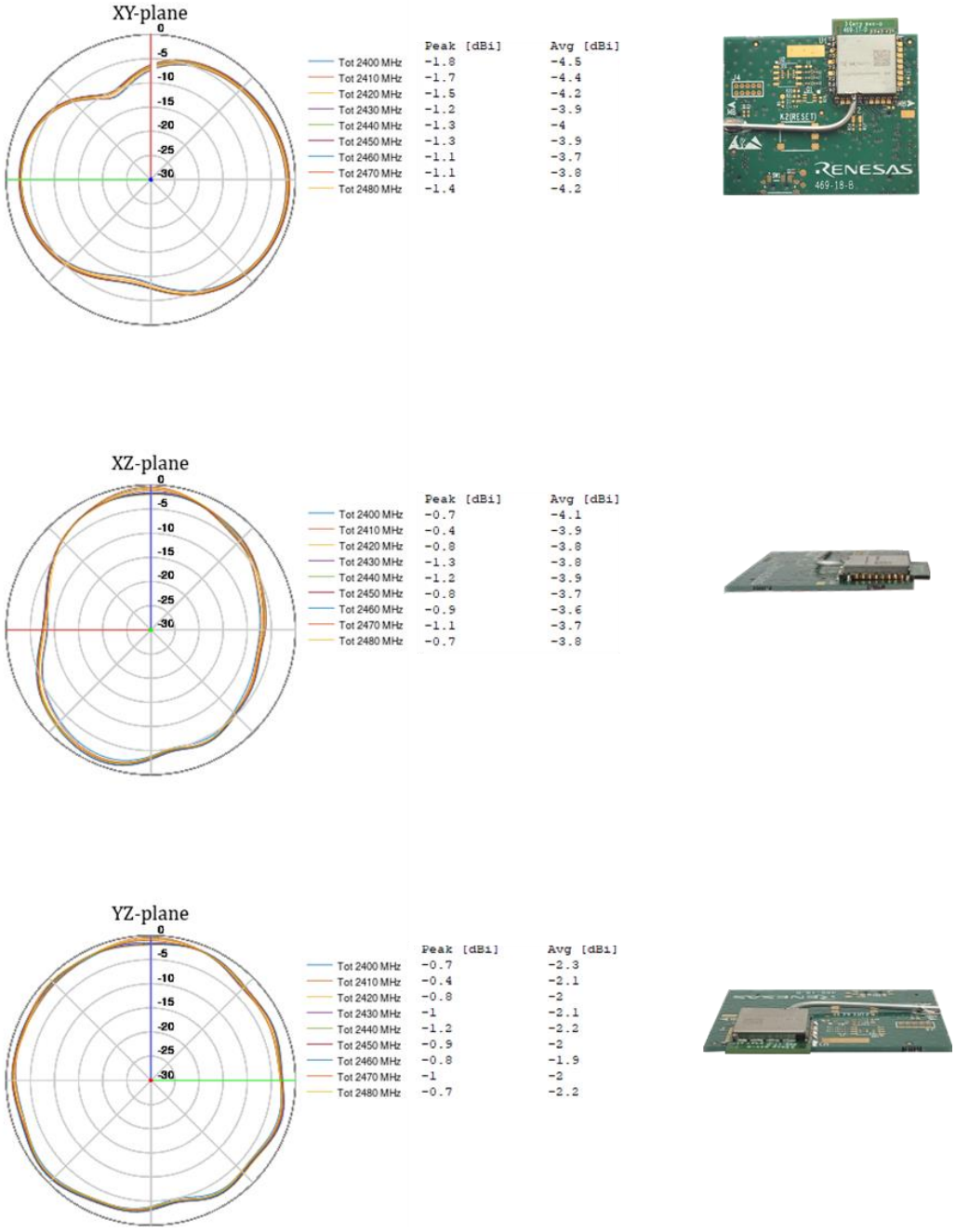


Figure 5-9 Radiation patterns Renesas DA14592MOD module mounted on reference board.

6 Summary

The BLE antenna performance for the DA14592MOD module have been characterized. The maximum antenna peak gain is measured to be:

Renesas DA14592MOD module as stand-alone:	+0.2dBi
Renesas DA14592MOD module mounted on reference board:	-0.4dBi

A. Antenna measurement system

All radiated measurements were performed using the measurement setup described in this appendix.

Table 6-1 List of equipment in antenna measurement system.

Item	Vendor	Model/Version
3D measurement chamber	Satimo	SG-23
Network Analyzer	Rohde & Schwarz	ZNB-8
Software	MVG	Wave Studio 22.5.6
Last calibration	MVG	2023-05