



Nox S2

Antenna characterization

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Revision History

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1 Introduction

This paper presents antenna measurements for the Nox S2 BLE antenna.

2 Antenna measurements

The Nox S2 BLE antenna is verified in terms of *Voltage Standing Wave Ratio (VSWR)*, *antenna efficiency* and *radiation patterns*.

2.1 Voltage Standing Wave Ratio

Voltage Standing Wave Ratio (VSWR) is a measure of how well an antenna is impedance matched to the system impedance. A VSWR of one means a perfect match where all the available power is delivered to the antenna and an infinite VSWR means a short or an open circuit where all the energy is reflected.

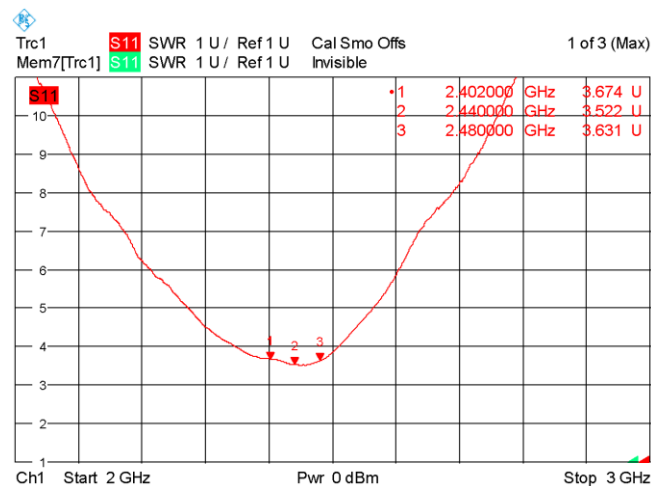


Figure 2-1 VSWR Nox S2.

2.2 Antenna efficiency

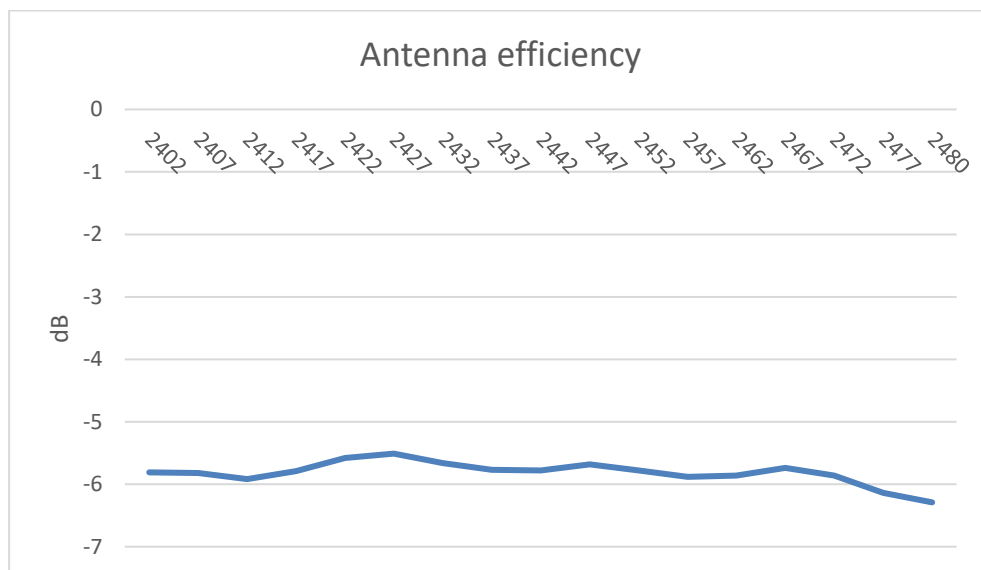
The antenna efficiency measurements are carried out in a Satimo SG-23 6 GHz Stargate Antenna Test Chamber. The antenna efficiency, ϵ_T , is the ratio of the power delivered at the 50Ω antenna interface, P_t , relative to the power radiated from the antenna, $P_{radiated}$.

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

The antenna system efficiency can be expressed in dB or %, where 100% corresponds to 0dB.

Table 1 Antenna efficiency for the Nox S2 BLE antenna.

Frequency [MHz]	Efficiency	
	[%]	[dB]
2402	26	-5.81
2407	26	-5.82
2412	26	-5.92
2417	26	-5.79
2422	28	-5.58
2427	28	-5.51
2432	27	-5.66
2437	26	-5.77
2442	26	-5.78
2447	27	-5.68
2452	26	-5.78
2457	26	-5.88
2462	26	-5.86
2467	27	-5.74
2472	26	-5.86
2477	24	-6.14
2480	23	-6.29



2.3 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 as well as a 3D pattern visualising the radiation pattern around the DUT.

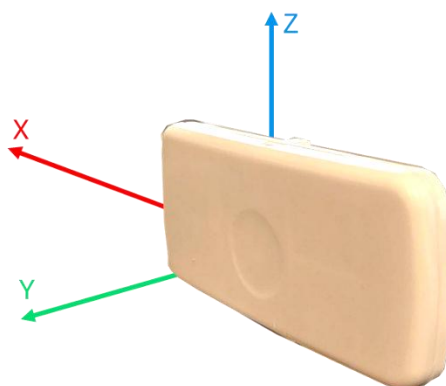


Figure 2-2 Measurement plane definitions.

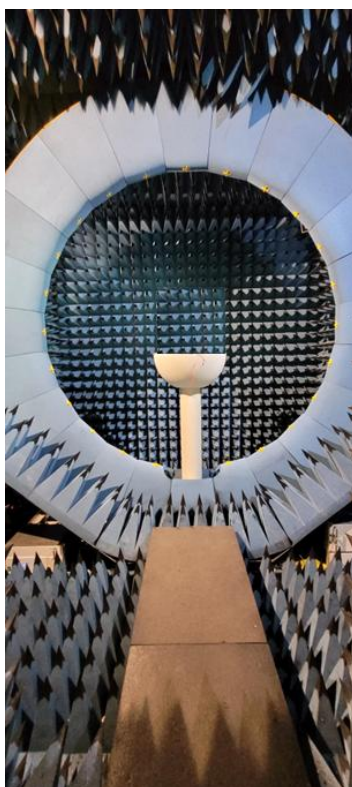


Figure 2-3 Satimo SG-23 6 GHz Stargate Antenna Test Chamber.

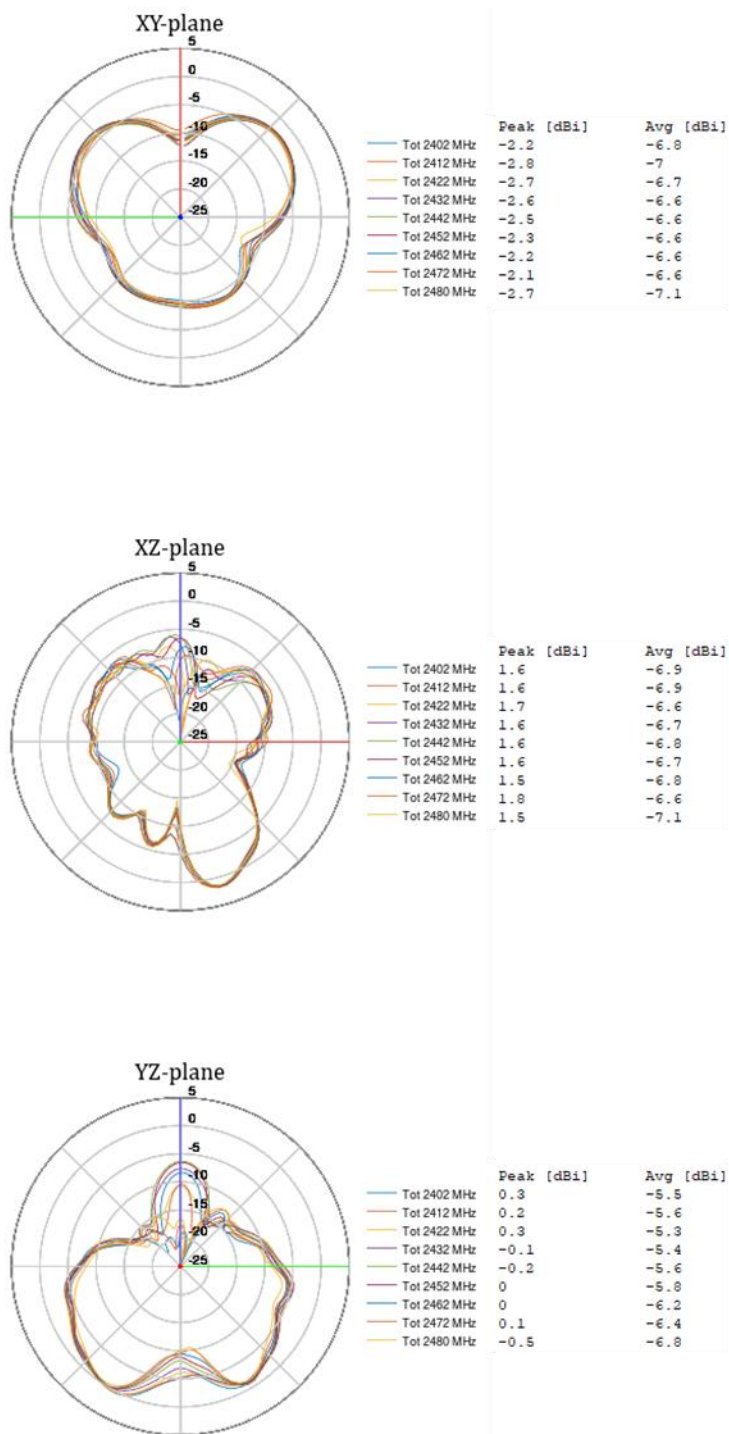


Figure 2-4 2D radiation patterns for the Nox S2.

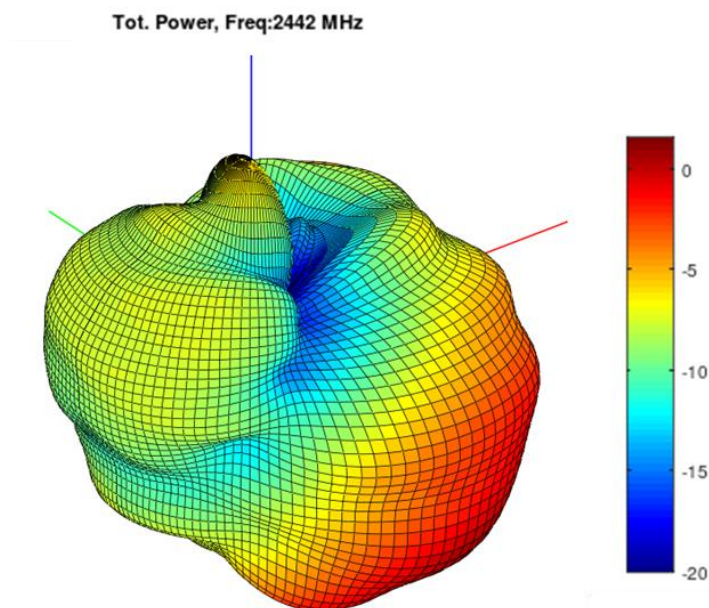


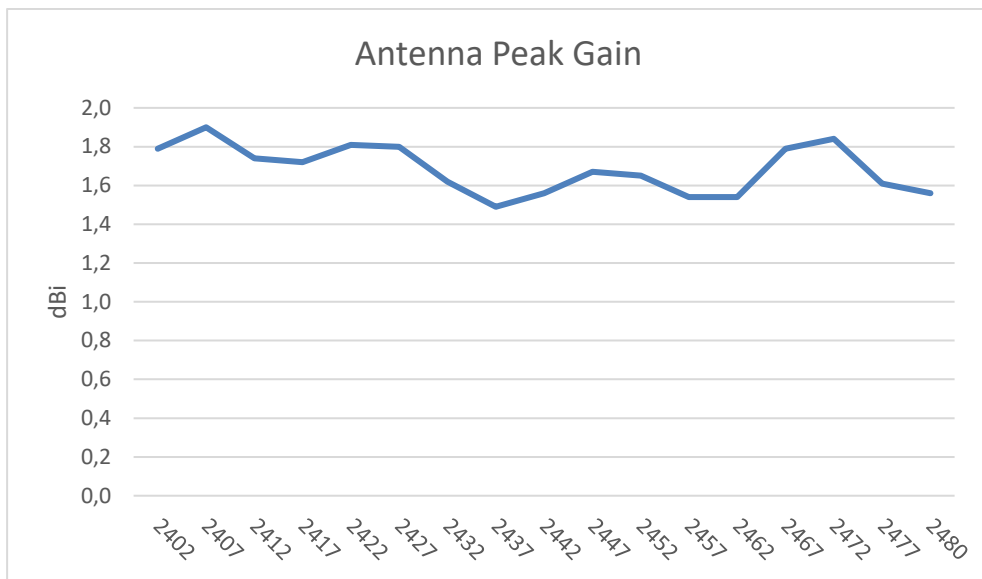
Figure 2-5 3D radiation pattern @2442MHz for the Nox S2. Maximum antenna peak gain is found to be in a cut that is not covered by the three planes XY, XZ and YZ.

2.4 Antenna peak gain

The antenna peak gain is summarized in Table 2.

Table 2 Antenna peak gain for the Nox S2 BLE antenna.

Frequency [MHz]	Antenna Peak Gain [dBi]
2402	1.8
2407	1.9
2412	1.7
2417	1.7
2422	1.8
2427	1.8
2432	1.6
2437	1.5
2442	1.6
2447	1.7
2452	1.7
2457	1.5
2462	1.5
2467	1.8
2472	1.8
2477	1.6
2480	1.6





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3 Summary

The BLE antenna performance for the Nox S2 has been characterized.

Maximum antenna peak gain is measured to be: 1.9dBi



A. Antenna measurement system

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

Table 3-1 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	2025-07