Antenna matching and measurement report

Projet : ZED-US

XXI-Lab		**Le client**	
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			Historique
Date	**Version**	**Référence**	**Motifs**
20/11/2020	1.0	Exp-NETATMO_Match_ZED-US_20-11-2020	Création

Sommaire

1 Introduction

1.1 Type of service :

Tuning of antenna matching circuit at 2.4GHz (Ref XXI-Lab: Ant_dev)

1.2 Purpose of the study

Search for the optimal matching network for the ZED-US product antenna - Zigbee - at 2.4GHz.

1.3 Tools used

- Network analyser
- Anechoic chamber

1.4 Input data

One product in permanent transmission mode (Zigbee)

Two product without firmware for conducted tests

1.5 Delivery

This study report

2 Wifi Antenna Performances

2.1 Antenna Matching

With the antenna matching circuit used by default the tuning is not good but can be considered as acceptable.

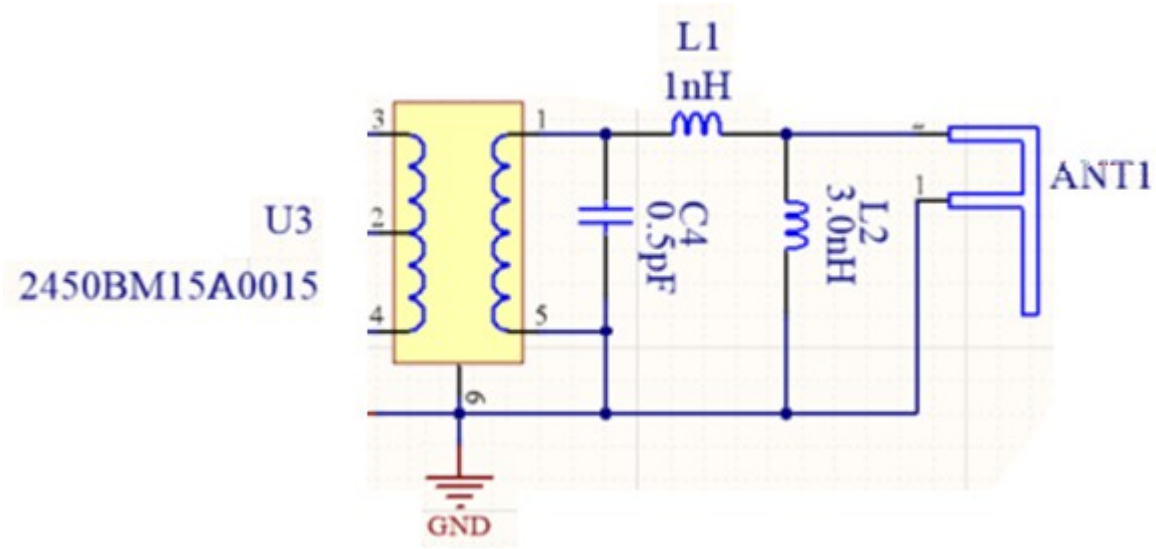

figure 1. antenna matching circuit ''Ant-3.0nH shunt-1nH serie- 0.5pF shunt'' used by default

figure 2. Adaptation of the antenna with the matching used as default : 'Ant-3.0nH shunt-1nH serie- 0.5pF shunt''

A new matching circuit has been designed to improve the antenna tuning. This circuit is the following:

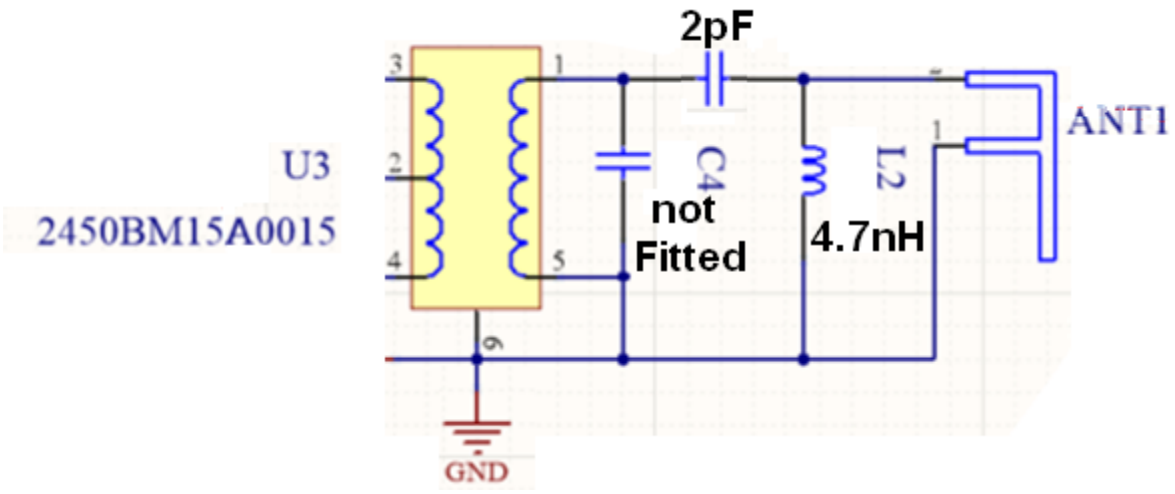

figure 3. antenna matching circuit proposed: ''Ant-4.7nH shunt - 2pf serie''

With this circuit the antenna matching is good. It is the following:

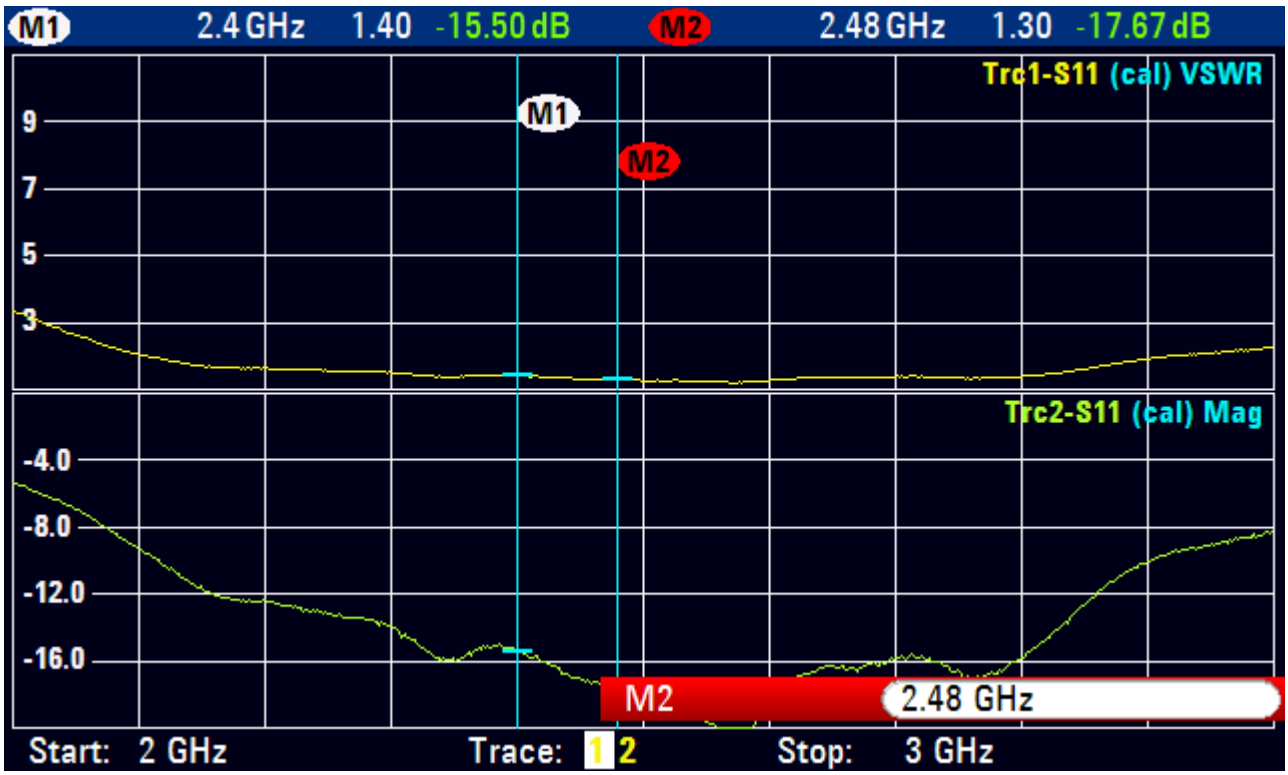

figure 4. Adaptation of the antenna with the matching proposed : ''Ant-1pf serie-1pF shunt''

Among the different matching circuit studied, this matching circuit allows the better radiated performances

2.2 Radiated measurements

The measurements were carried out for the E1, E2 and H planes at 2405, 2442 & 2480MHz frequency in vertical and horizontal polarization with a step of 1 °. From these results the total polarization was calculated.

Measurements have been done using the modem of the product tuned at maximum power for two different product configurations: product with matching circuit used by default – ''Ant-3.0nH shunt-1nH serie- 0.5pF shunt'' and the proposed matching circuit – ''Ant-4.7nH shunt - 2pf serie''

The H, E1 & E2 planes are displayed below :

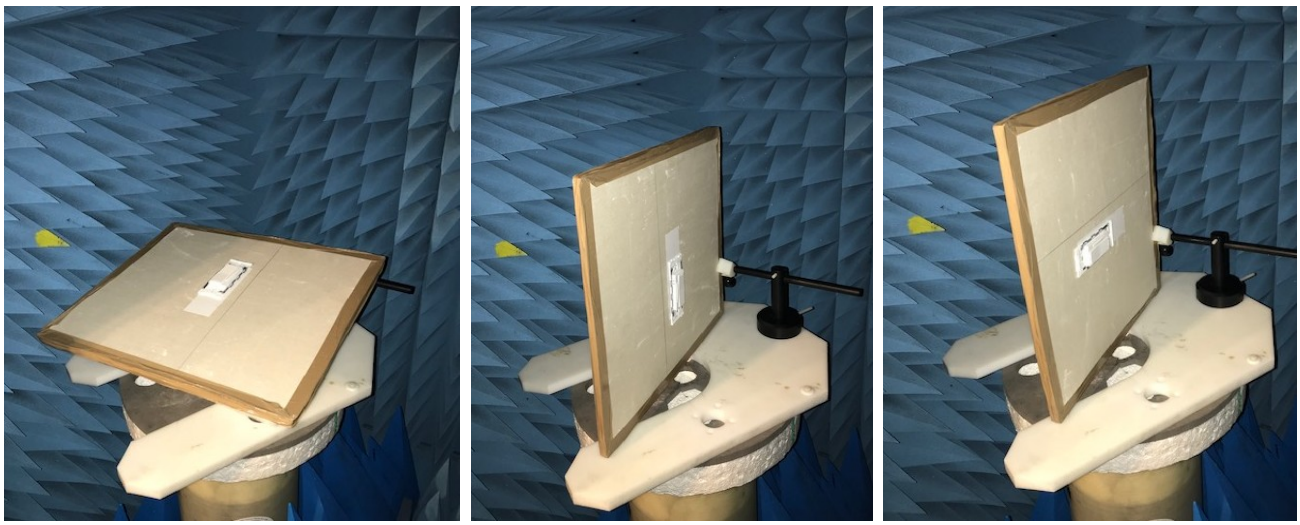

figure 5. Photo of the H, E1 & E2 plane

Results are compiled in the table below:

Radiated Power (dBm) / Frequency / plane	2405MHz			2440MHz			2480MHz		
	H	E1	E2	H	E1	E2	H	E1	E2
Default matching network ''Ant-3.0nH shu-1nH ser- 0.5pF shu''	-4.35	+3.15	+8.27	-3.50	+3.56	+8.67	-3.24	+3.67	+8.22
Proposed matching network ''Ant-4.7nH shunt - 2pf serie''	-2.25	+5.43	+10.39	-1.80	+5.3	+10.56	-1.46	+5.66	+10.34

tableau 1. Maximum radiated power for the default and proposed matching network

The proposed matching network allow to gain about 2dB whatever the zigbee frequcency.

Taken into account a power measured at +6.3dBm at the antenna port, then the antenna gain is about +4dBi, what is very good for such a product.

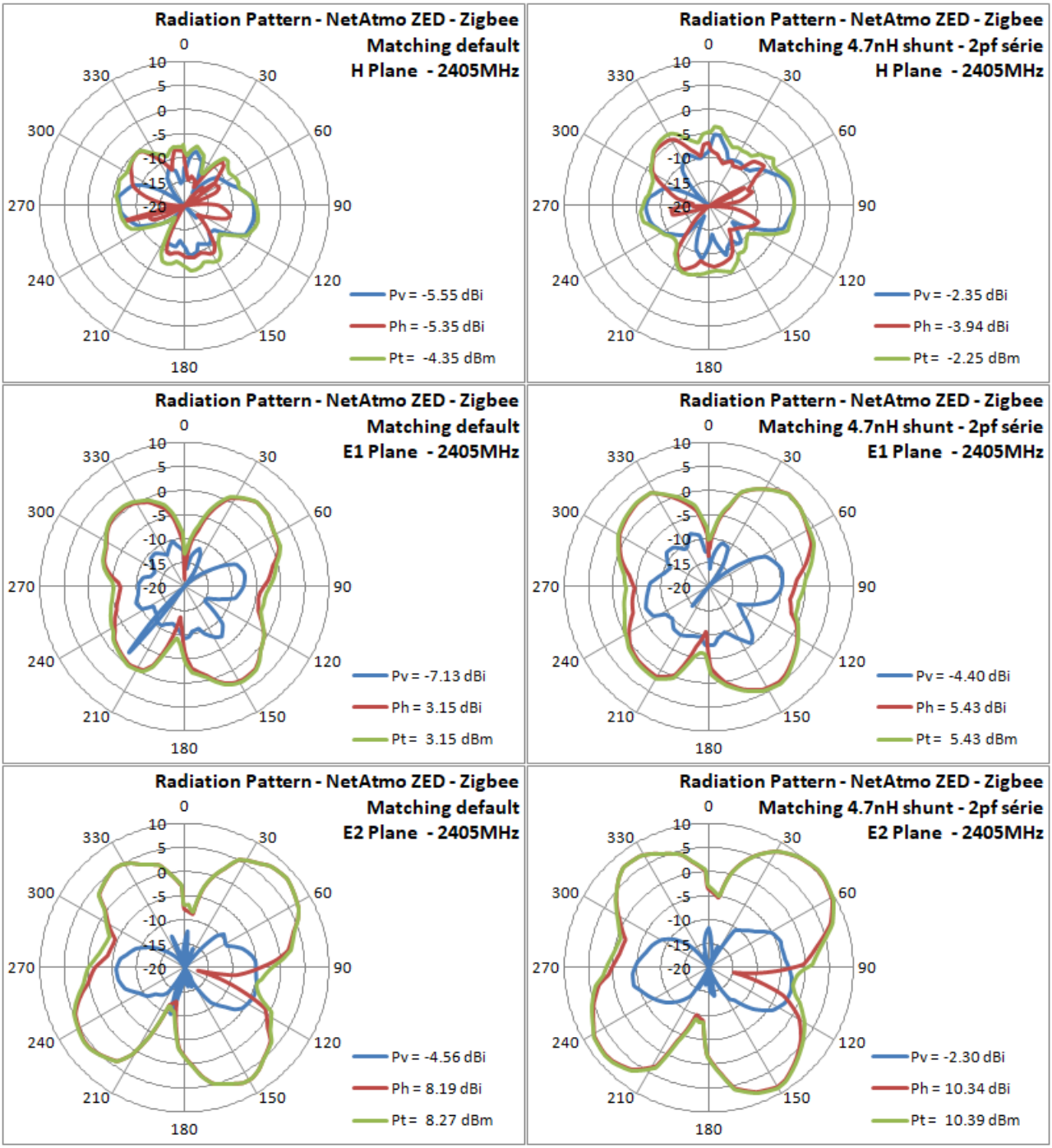

figure 6. From left to right, from top to bottom, Radiation pattern for product with default matching and proposed matching for H, E1 and E2 planes for the 2405MHz frequency

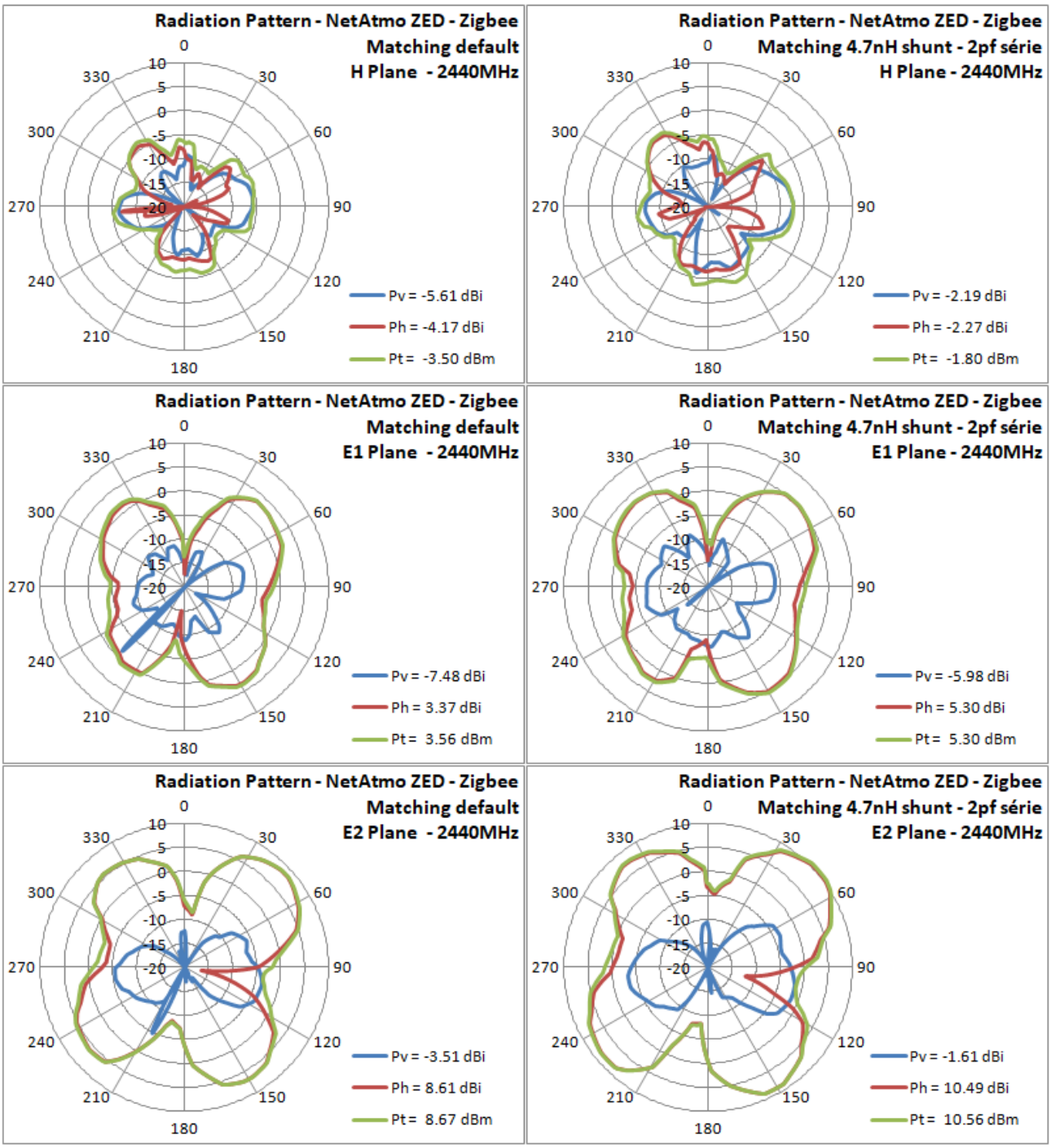

figure 7. From left to right, from top to bottom, Radiation pattern for product with default matching and proposed matching for H, E1 and E2 planes for the 2440MHz frequency

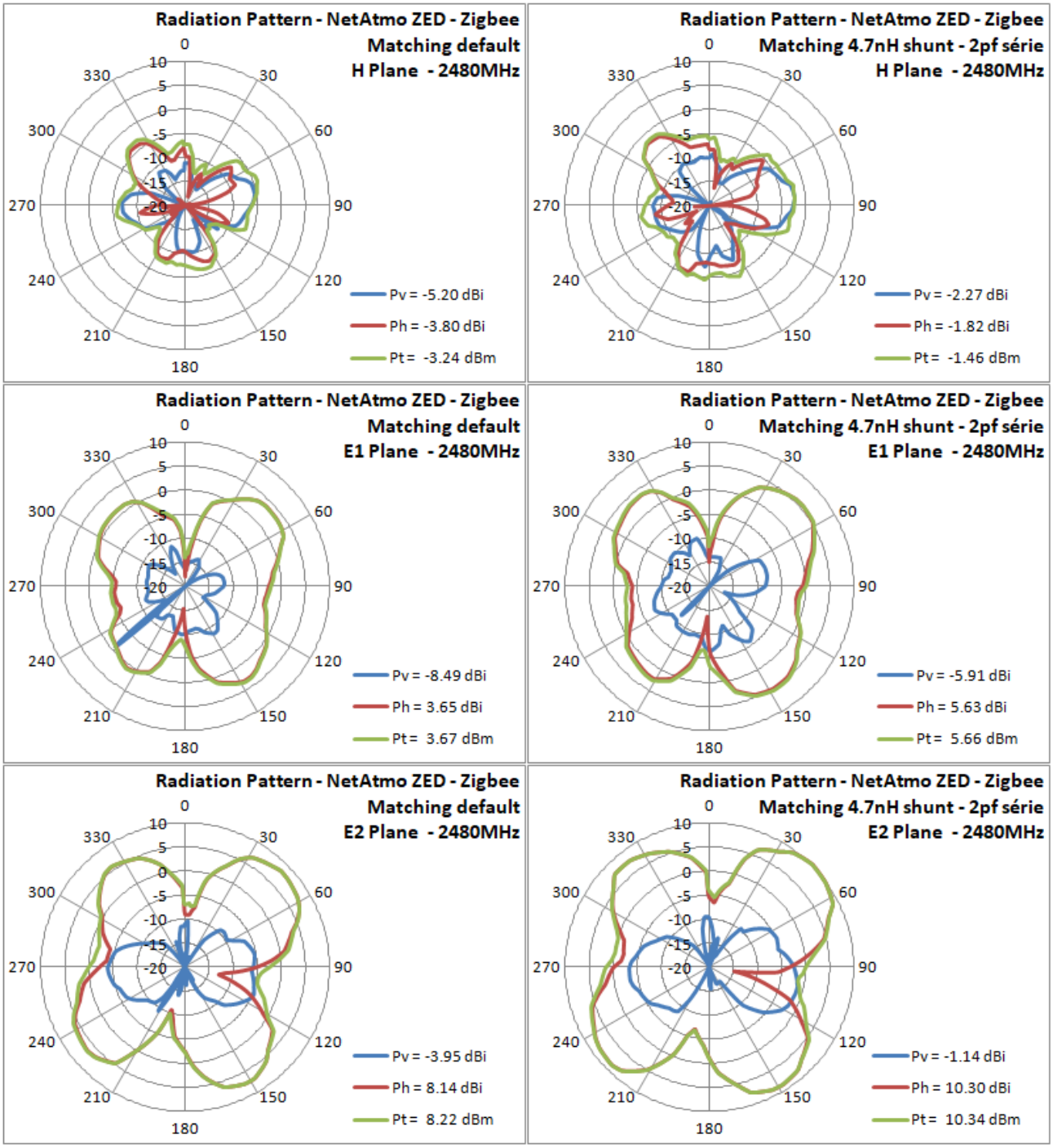

figure 8. From left to right, from top to bottom, Radiation pattern for product with default matching and proposed matching for H, E1 and E2 planes for the 2480MHz frequency

3 Conclusion

Zigbee antenna is not well matched with matching network used by default.

Different matching network have been designed and measured. Among those different circuits, the best has been proposed. It allows improving the radiated performances about 2dB whatever the Zigbee frequency. Taken into account a power measured at +6.3dBm at the antenna port, then the antenna gain is about +4dBi, what is very good for such a product.