

Title: WLAN P1518 C5 10k Data Sheet

Ref.: ST.175, MP.315

WLAN P1518 C5 10k Data Sheet

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N° Rev.	Description
1	Simplified table in Sec. 3.3.2. Added maximum e minimum radiation level and direction in Appendix A.

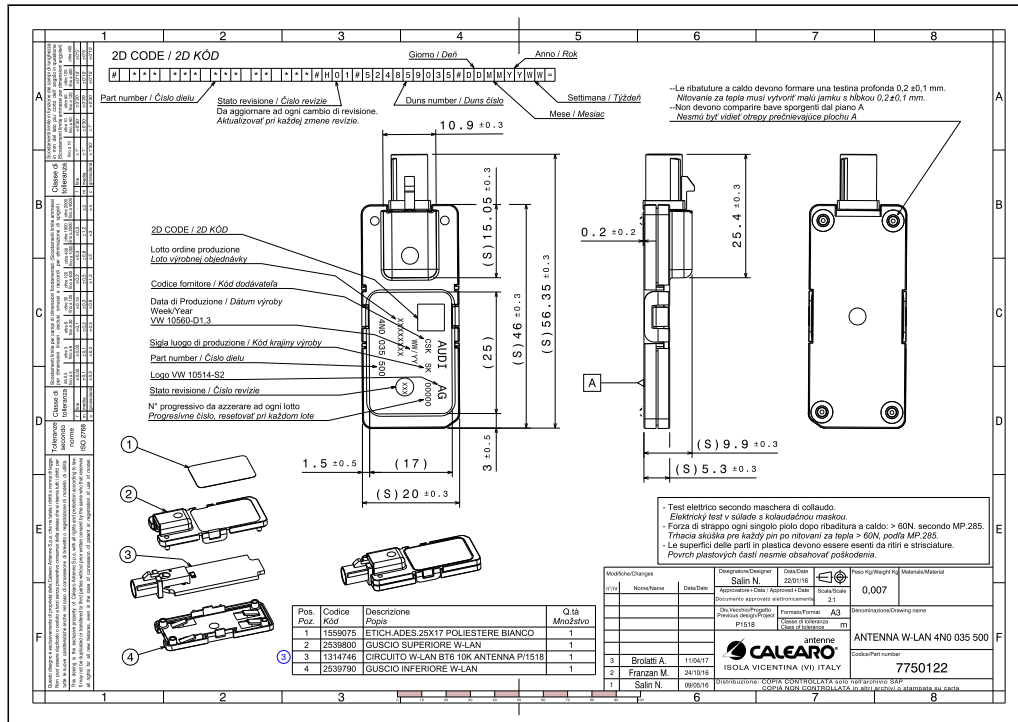
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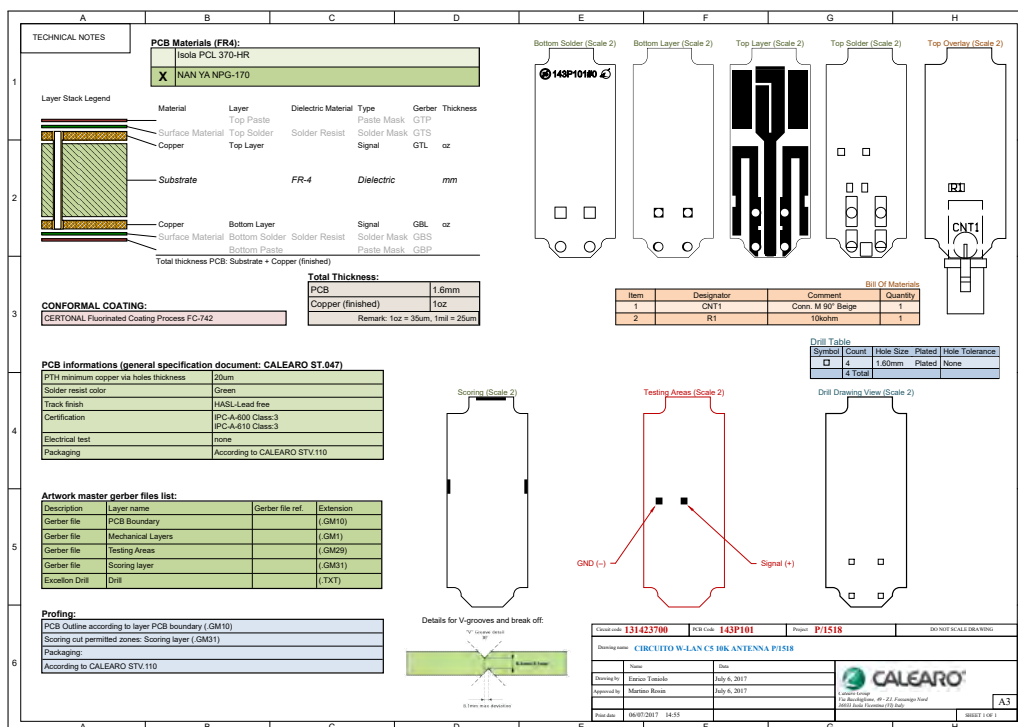
1 D.U.T.

C5

ANTENNA W-LAN 4N0 035 500 AU-VW-LAMB
DRW 7750122



CIRCUITO W-LAN C5 10K ANTENNA P/1518
DIS 131423700



Analyzed Sample: EB159 (Cia-Nanya NPG-170) 131423700

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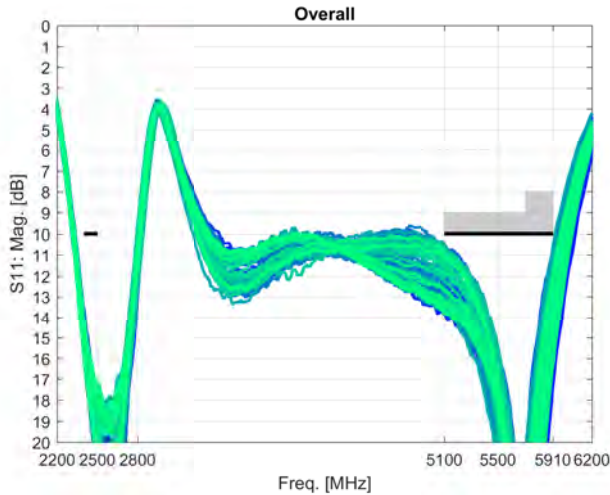
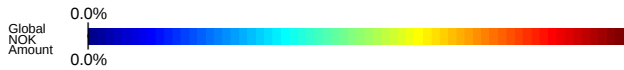
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2 Return Loss

The Return Loss has been measured with the setup described according to the Calearo Test Method 'MP.315'. The characterization of about 90 C5 samples has been carried out with two different types of sma-fakra adapter:

Pomona SMB Model 72979

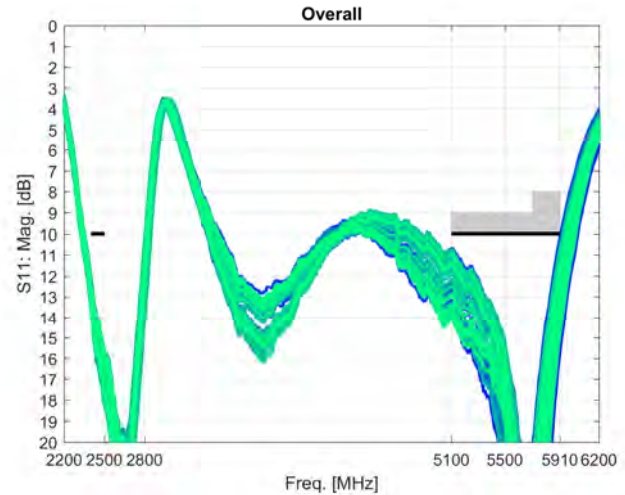
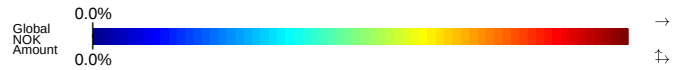
Total Samples = 89 | OK = 89 (100%) | NOK = 0 (0%)



(Return Loss) = 16.6 dB, (Return Power) = 2.64% and Δ (Return Power) = 3.10 dB
Overall evaluation for Freq. [MHz], f: (f>=2400 & f<=2500) | (f>=5100 & f<=5910)

Rosenberger Fakra 03 K 159-S20 S3

Total Samples = 88 | OK = 88 (100%) | NOK = 0 (0%)



(Return Loss) = 16.5 dB, (Return Power) = 2.71% and Δ (Return Power) = 3.24 dB
Overall evaluation for Freq. [MHz], f: (f>=2400 & f<=2500) | (f>=5100 & f<=5910)

Conclusion

The tested samples result 100 % OK: Return Loss $\geq$ 10 dB between 2400–2500 and 5100–5910 MHz.

Further details can be found in I170824tone1 of 10th August, 2017 and I170721tone1 of 21st July, 2017.



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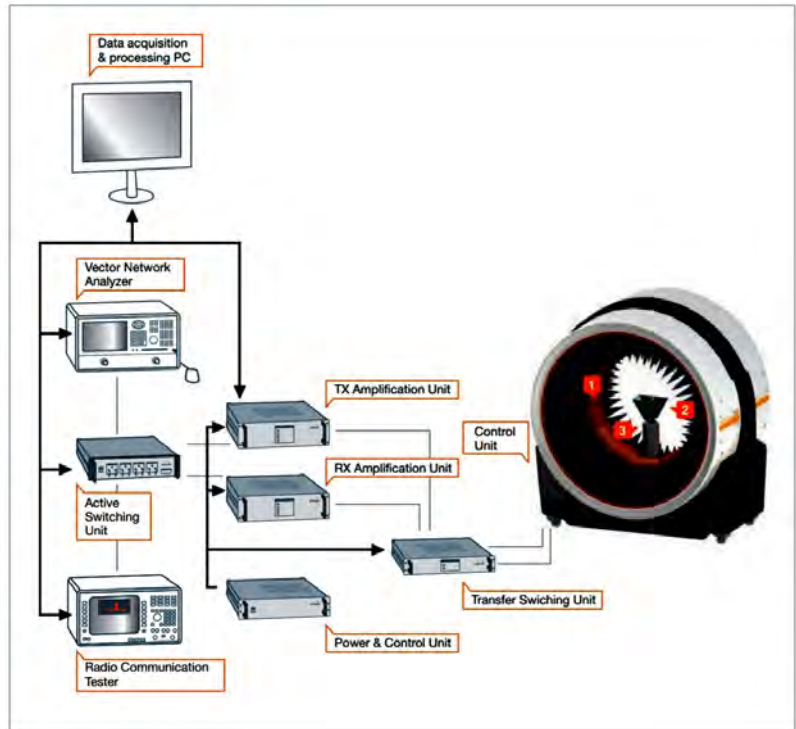
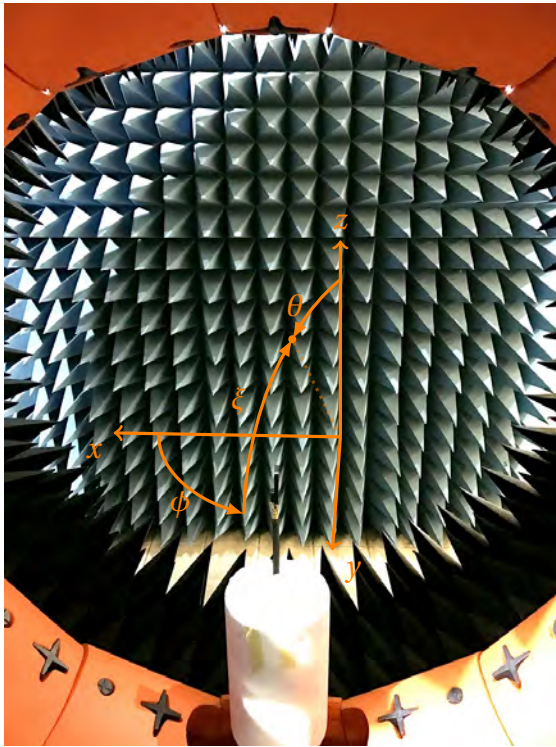
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3 Radiation Pattern

3.1 Setup

The radiation pattern of the sample 'EB159' has been measured using the following setup:

StarLab / Microwave Vision Italy s.r.l. - 00040 Pomezia (RM)



Frequencies = 2350, 2360, 2370, 2380, 2390, 2400, 2410, 2420, 2430, 2440, 2450, 2460, 2470, 2480, 2490, 2500, 2510, 2520, 2530, 2540, 2550, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 5910, 6000 MHz.

⚠ A wideband (2200–6000 MHz) reference monocone 'SMC2200' on 1 mt diameter Ground Plane has been used as reference antenna, instead of many monopoles covering the whole bands. See also http://www.mvg-world.com/system/files/datasheet_antenna_2016_hd_monocones.pdf

More information, about this setup, could be found in 'I160419tone1 §5.3.4' or <http://www.mvg-world.com/products/fieldproductfamily/antenna-measurement-2/starlab>.

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3.2 Definitions

POLAR PATTERN

$G(\phi, \theta, f)$ is the measured (realized) gain magnitude of the A.U.T. expressed in dBi (referred to the isotropic antenna).

The total gain is the sum of the
Vertical and Horizontal polarized component:
 $10^{G_{\text{Total}}/10} = 10^{G_{\text{Vpol}}/10} + 10^{G_{\text{Hpol}}/10}$

LINEAR AVERAGE GAIN

$$\text{AVG}(f) = 20 \log_{10} \text{mean}_{\forall \phi, \theta \in [\theta_1, \theta_2]} 10^{G/20}$$

Global MIN-MAX

$$\text{Min}(f) = 20 \log_{10} \min_{\forall \theta, \phi} 10^{G/20}, \quad \text{Max}(f) = 20 \log_{10} \max_{\forall \theta, \phi} 10^{G/20}$$

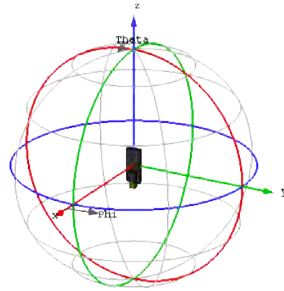
Globally:
 $\text{Min} = \min_f \text{Min}(f), \quad \text{Max} = \max_f \text{Max}(f)$

TOTAL EFFICIENCY

$$\epsilon = \frac{1}{4\pi} \int_0^{2\pi} \int_0^\pi 10^{G_{\text{Total}}(\theta, \phi)/10} \sin \theta \, d\theta \, d\phi$$

REFERENCE FRAME

(standalone)



Elevation $\xi = 90^\circ - \theta$.

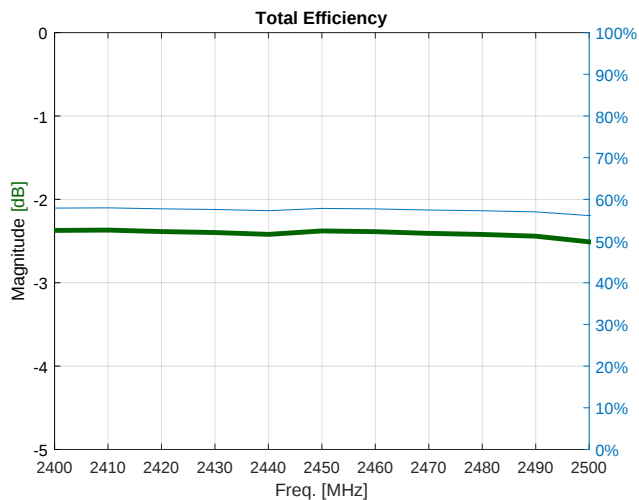
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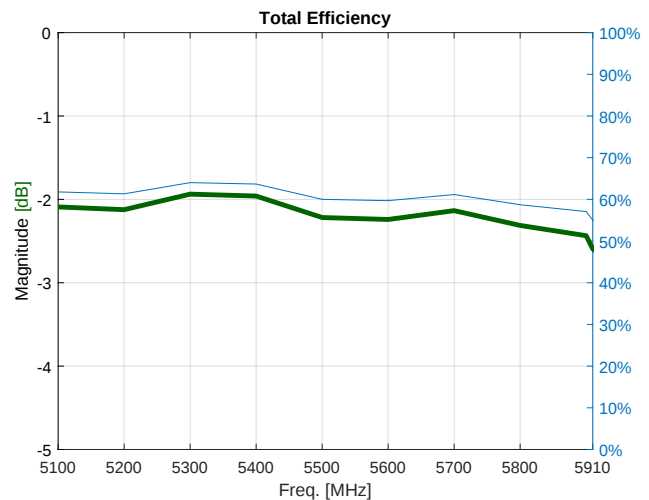
3.3 Results

3.3.1 Total Efficiency

Lower Band



Upper Band



Freq. (MHz)	Total Efficiency (dB)	%
2400	-2.37	57.91
2410	-2.37	57.96
2420	-2.39	57.72
2430	-2.40	57.57
2440	-2.42	57.28
2450	-2.38	57.83
2460	-2.39	57.71
2470	-2.41	57.44
2480	-2.42	57.27
2490	-2.44	57.00
2500	-2.51	56.11

Statistics on the whole band:

min	-2.51	56.11
mean	-2.41	57.44
max	-2.37	57.96
std	0.04	0.53

Freq. (MHz)	Total Efficiency (dB)	%
5100	-2.09	61.79
5200	-2.12	61.33
5300	-1.94	64.01
5400	-1.96	63.67
5500	-2.22	60.01
5600	-2.24	59.69
5700	-2.14	61.16
5800	-2.31	58.71
5900	-2.44	57.07
5910	-2.59	55.03

Statistics on the whole band:

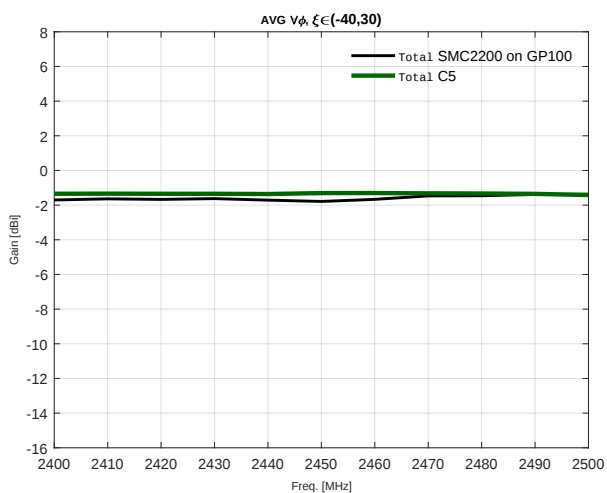
min	-2.59	55.03
mean	-2.20	60.25
max	-1.94	64.01
std	0.20	2.80

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3.3.2 Linear Average Gain for $-40^\circ \leq \xi \leq 30^\circ$

Lower Band

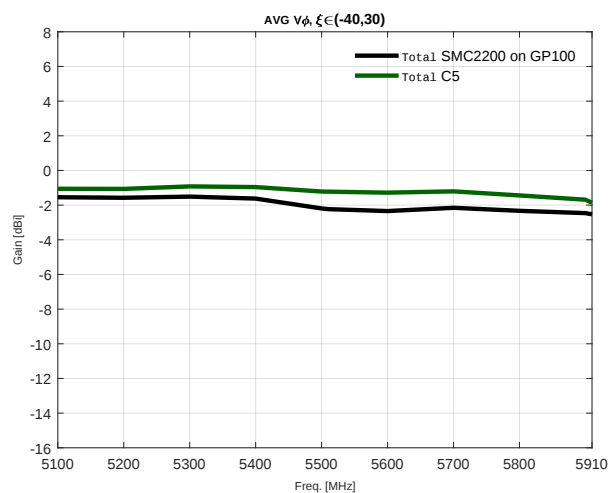


Freq. (MHz)	AVG (dBi)
2400	-1.36
2410	-1.36
2420	-1.37
2430	-1.37
2440	-1.38
2450	-1.33
2460	-1.33
2470	-1.35
2480	-1.36
2490	-1.38
2500	-1.45

Statistics on the whole band:

min	-1.45
mean	-1.37
max	-1.33
std	0.03

Upper Band



Freq. (MHz)	AVG (dBi)
5100	-1.14
5200	-1.17
5300	-1.05
5400	-1.11
5500	-1.40
5600	-1.49
5700	-1.41
5800	-1.64
5900	-1.96
5910	-2.15

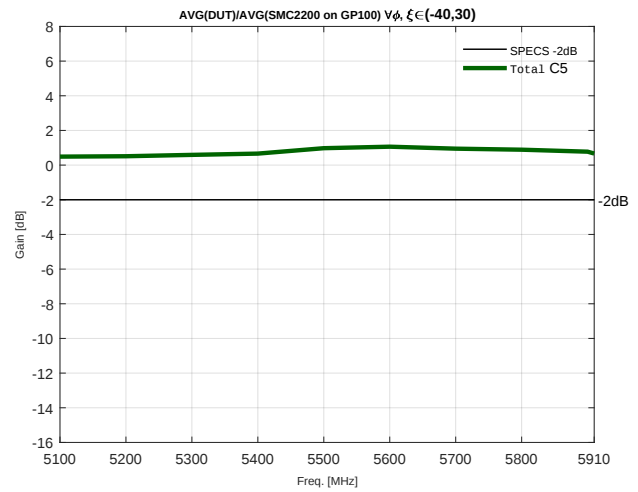
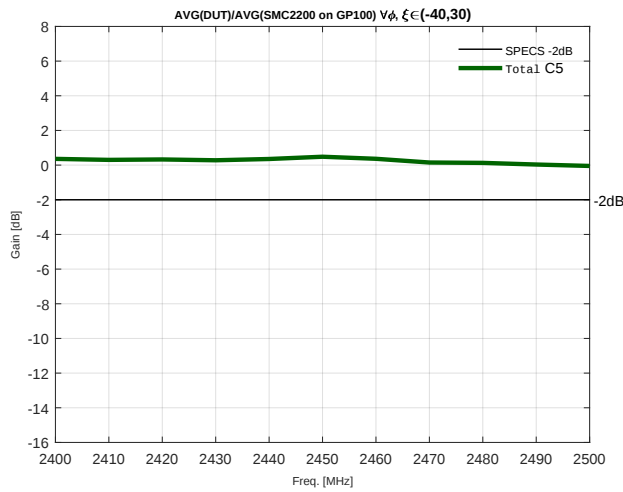
Statistics on the whole band:

min	-2.15
mean	-1.45
max	-1.05
std	0.37

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3.3.2.1 Comparison with Limits



Conclusion

As results from the comparison with the limits, the antenna radiation performances are compliant with specification limit of -2 dB from the reference monocone (ST.175): the minimum distance
min Δ AVG = -0.05 dB > -2 dB as shown in the table below:

Freq. (MHz)	Δ AVG (dB)
2400	0.36
2410	0.30
2420	0.33
2430	0.28
2440	0.35
2450	0.48
2460	0.36
2470	0.15
2480	0.13
2490	0.03
2500	-0.05

Statistics on the whole band:

min	-0.05
mean	0.25
max	0.48
std	0.16

Freq. (MHz)	Δ AVG (dB)
5100	0.49
5200	0.51
5300	0.59
5400	0.66
5500	0.98
5600	1.06
5700	0.95
5800	0.89
5900	0.77
5910	0.67

Statistics on the whole band:

min	0.49
mean	0.76
max	1.06
std	0.20

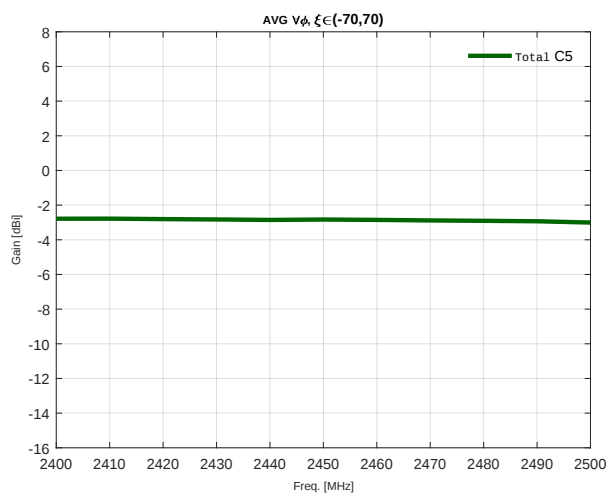
In Sec.3.3.3, the antenna mean performances on extended elevation (ξ) ranges will be represented, while the whole 3D polar pattern is shown for few frequencies in Sec.3.4.

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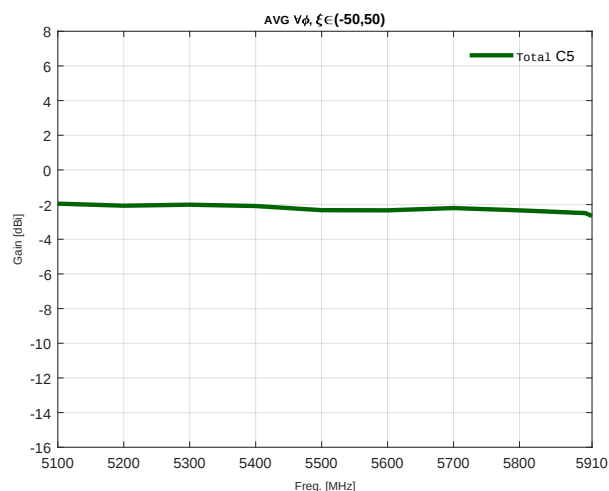
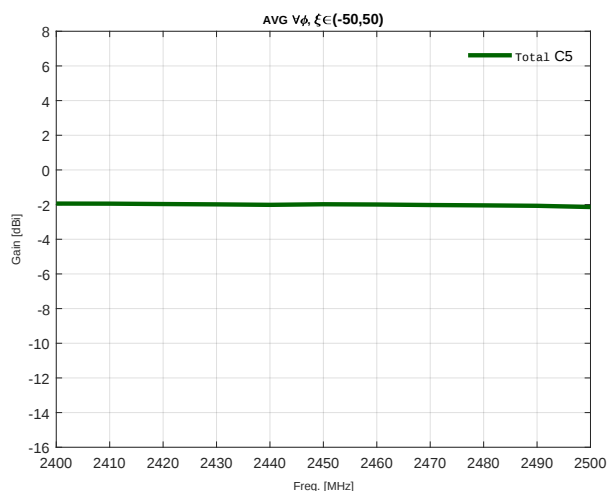
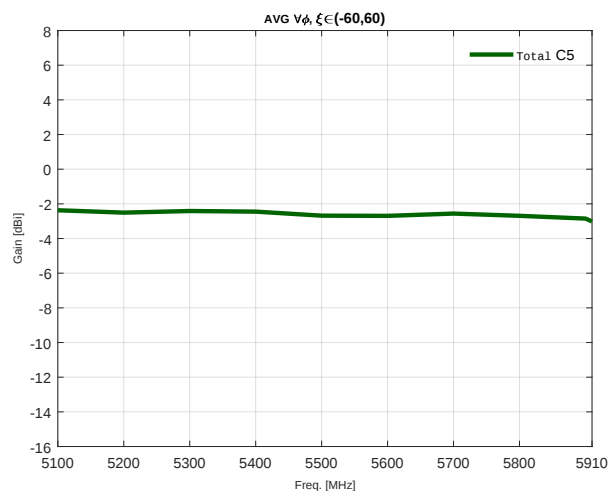
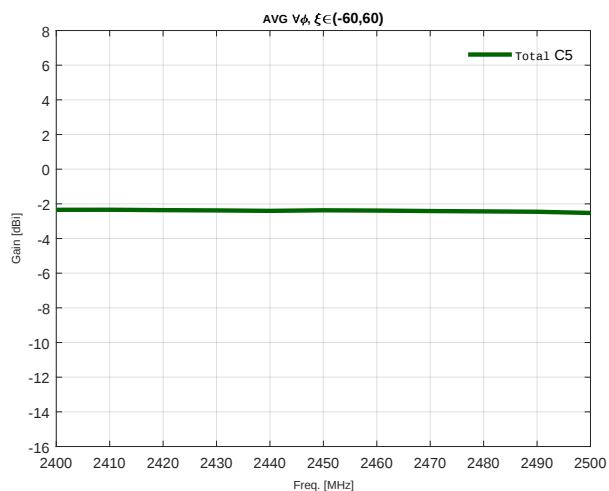
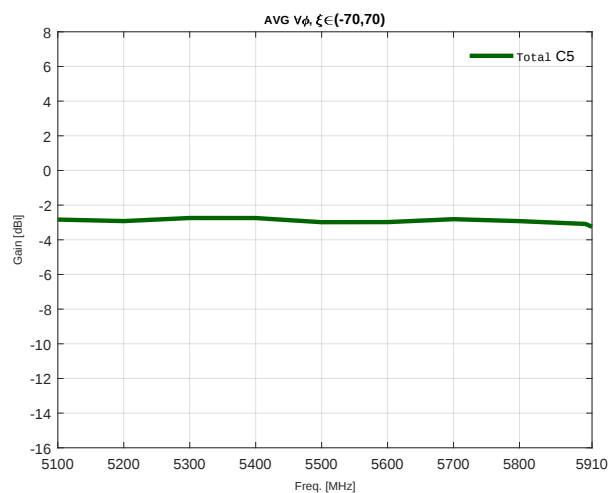
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3.3.3 Linear Average Gain for $|\xi| \leq 70, 60, 50^\circ$

Lower Band



Upper Band



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3.4 3D Polar Pattern

NORMALIZED TO MAX

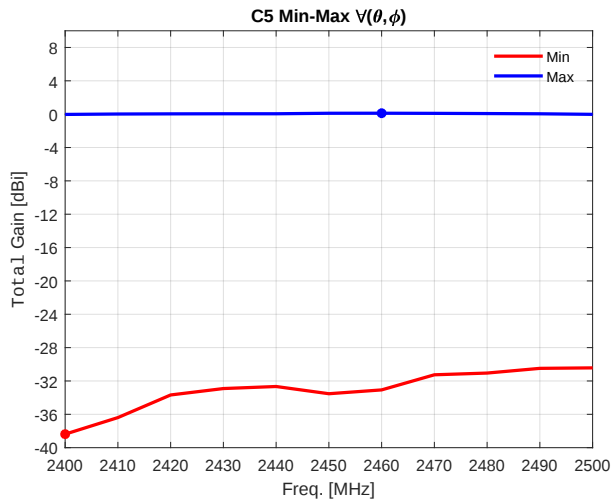
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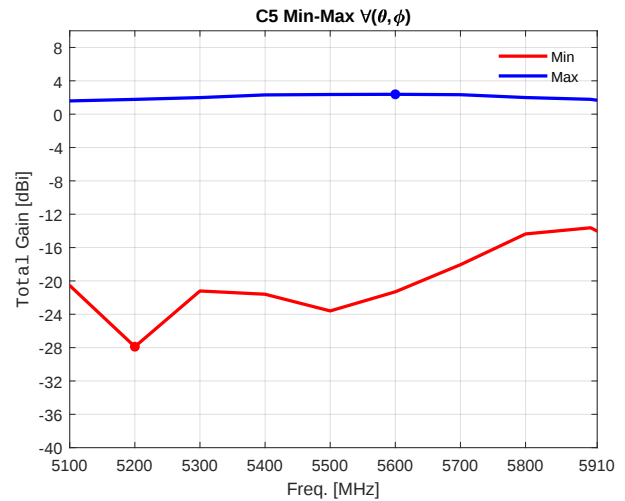
Appendix

A Global Min and Max values and directions

Lower Band



Upper Band



Freq. (MHz)	Min (dBi)	θ_{Min} (deg)	ϕ_{Min} (deg)	Max (dBi)	θ_{Max} (deg)	ϕ_{Max} (deg)
2400	-38.38	178	299	-0.03	93	11
2410	-36.39	178	299	0.02	93	12
2420	-33.68	178	298	0.04	93	12
2430	-32.91	177	294	0.05	93	11
2440	-32.66	177	293	0.05	93	11
2450	-33.53	177	291	0.11	93	10
2460	-33.07	177	291	0.11	93	9
2470	-31.26	177	293	0.10	93	7
2480	-31.05	178	293	0.07	93	7
2490	-30.49	177	293	0.04	93	6
2500	-30.43	178	293	-0.02	94	7

Freq. (MHz)	Min (dBi)	θ_{Min} (deg)	ϕ_{Min} (deg)	Max (dBi)	θ_{Max} (deg)	ϕ_{Max} (deg)
5100	-20.55	174	43	1.59	82	168
5200	-27.89	174	44	1.77	84	167
5300	-21.21	174	52	1.99	86	167
5400	-21.60	48	311	2.31	89	166
5500	-23.60	50	313	2.36	89	166
5600	-21.30	52	313	2.38	88	166
5700	-18.06	52	321	2.33	87	167
5800	-14.37	50	330	1.99	84	168
5900	-13.63	7	320	1.78	85	243
5910	-14.03	7	321	1.67	84	242

Globally:

Freq. (MHz)	Min (dBi)	θ_{Min} (deg)	ϕ_{Min} (deg)	Max (dBi)	θ_{Max} (deg)	ϕ_{Max} (deg)
2400	-38.38	178	299			
2460				0.11	93	9

Globally:

Freq. (MHz)	Min (dBi)	θ_{Min} (deg)	ϕ_{Min} (deg)	Max (dBi)	θ_{Max} (deg)	ϕ_{Max} (deg)
5200	-27.89	174	44			
5600				2.38	88	166

⚠ The Global Min and Max refer to the antenna placed in free-space as indicated in Sec. 3.2.