Digital Matter
Lucida (SR4L002)
BOLT

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Introduction

- ***Digital Matter*** supplied three devices and tried to find the optimal matching circuit for Lucida (SR4L002) working LTE band 2, 4, 5, 12 and 13.
- Antenova found the matching circuit for the current setup.
- The device was tested with cable.

Power cable

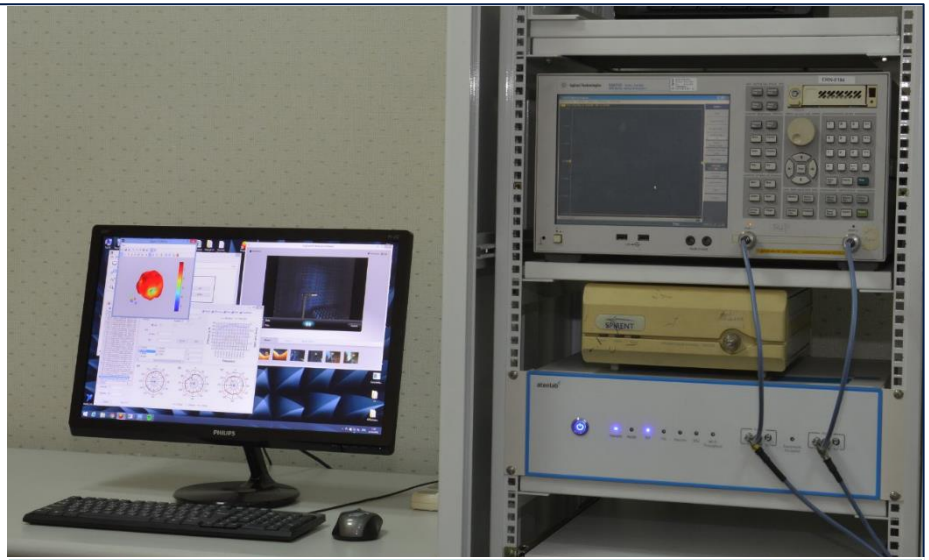
Equipment used

antenova®

Return loss/Isolation

Agilent E5071B (300KHz-8.5GHz) ENA

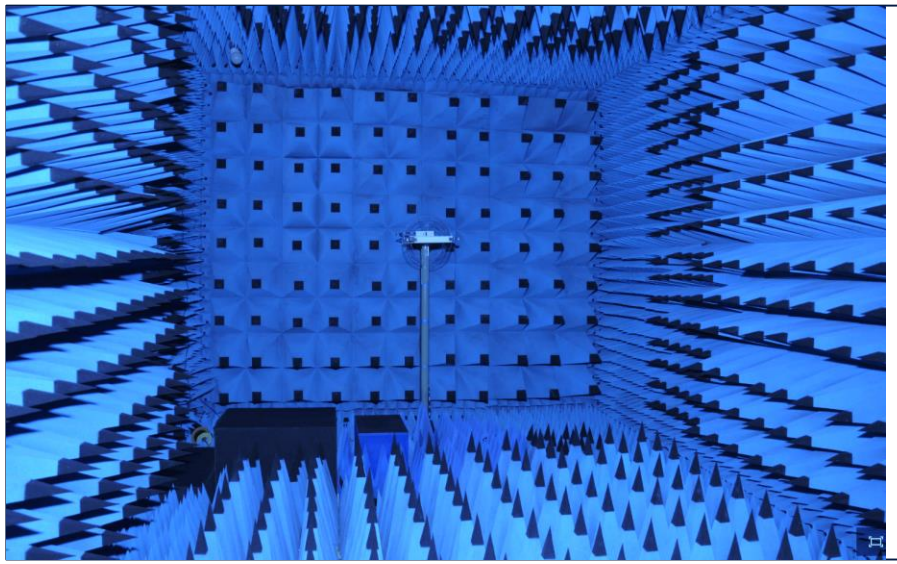
Passive Efficiency

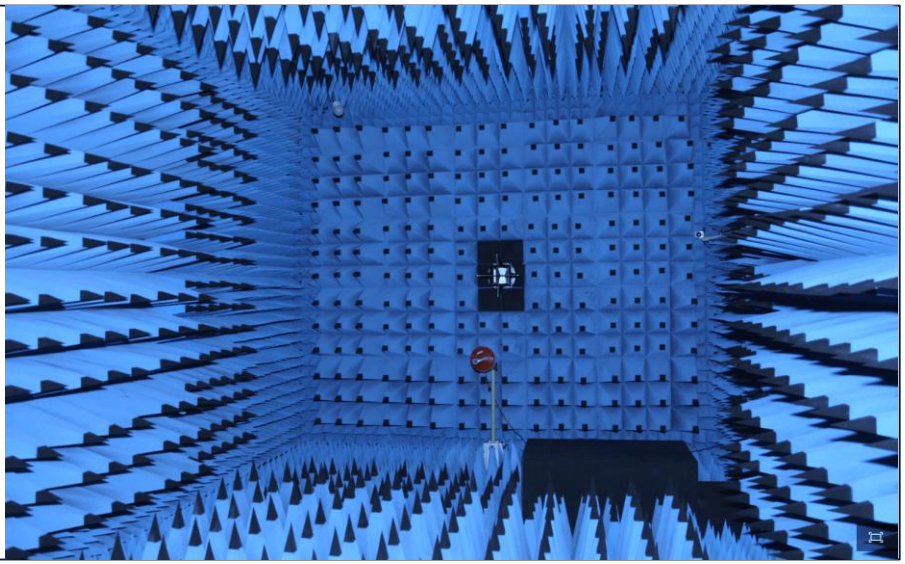


Chamber equipment Rig

Equipment used

Anechoic chamber 700MHz – 6000MHz





RF Choke

All tests using this arrangement were performed in free space. The return loss at the input of the matching circuit was measured using an Agilent ENA E5071C RF Network Analyser. For all measurements, the relevant sleeve choke was used to reduce the effect of the cable radiation.

Results Summary

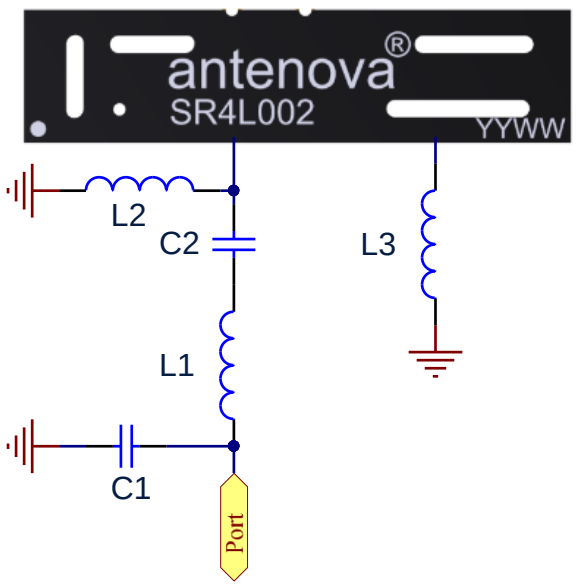
- Antenova optimised the device and provide results with the recommended matching circuit for the device.

Lucida	*698 – 894 MHz*	*1710 – 1990 MHz*	*2110 – 2155 MHz*
Return Loss	<-4.1 dB	<-7.7 dB	<-6.9 dB
Efficiency (Min)	22.13%	37.84%	29.17%
Efficiency (Avg)	27.15%	48.54%	31.39%
Gain (Peak)	0.64dBi	3.94dBi	1.63dBi
Gain (Avg)	-5.66dBi	-3.14dBi	-5.03dBi

Antenova Recommended Matching Circuit

- The recommended matching circuit was found for current setup.

Circuit diagram



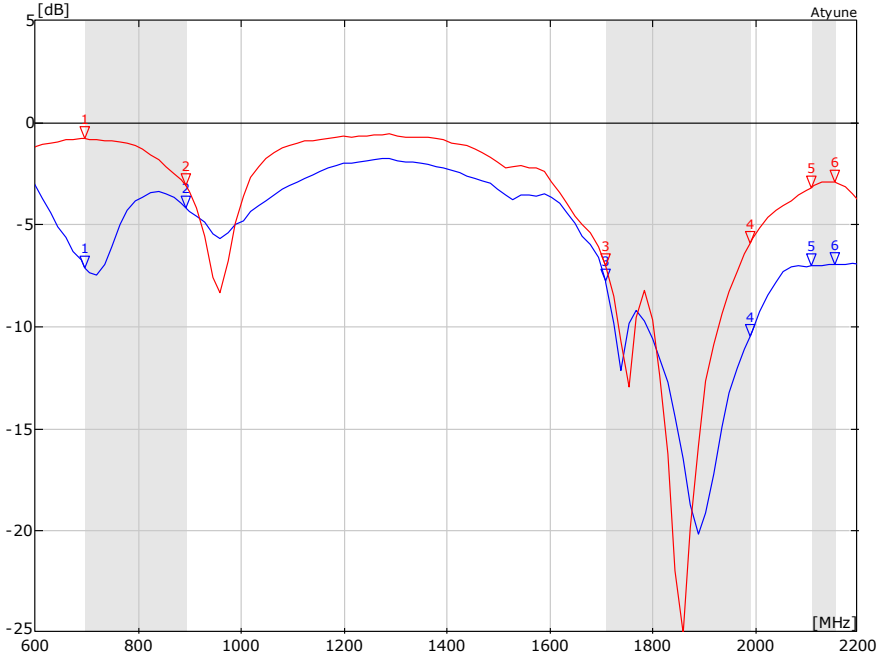
BOM (Bill of Materials)

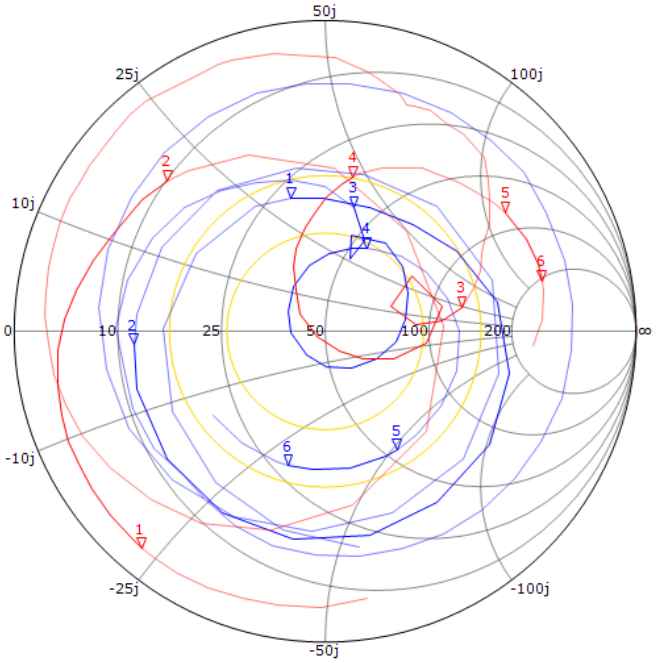
SR4L002				
Designator	***Type***	***Value***	***Manufacturer****	***Series***
C1	NA	NA	NA	NA
C2	Capacitor	3.3 pF	Murata	GJM155 series
L1	Inductor	3.3 nH	Murata	LQG15 series
L2	Inductor	15 nH	Murata	LQG15 series
L3	Inductor	15 nH	Murata	LQG15 series
**Equivalent components can be used*				

The recommended matching circuit is valid only for the hardware configuration provided. Any changes to the PCB layout, hardware or relative position of the antenna, including microphones, speakers, batteries, cases, etc, may modify the antenna impedance and it would require a different matching circuit.

Return Loss

- The Return Loss at the input of the matching circuit was measured using an Agilent E5071B RF Network Analyser.



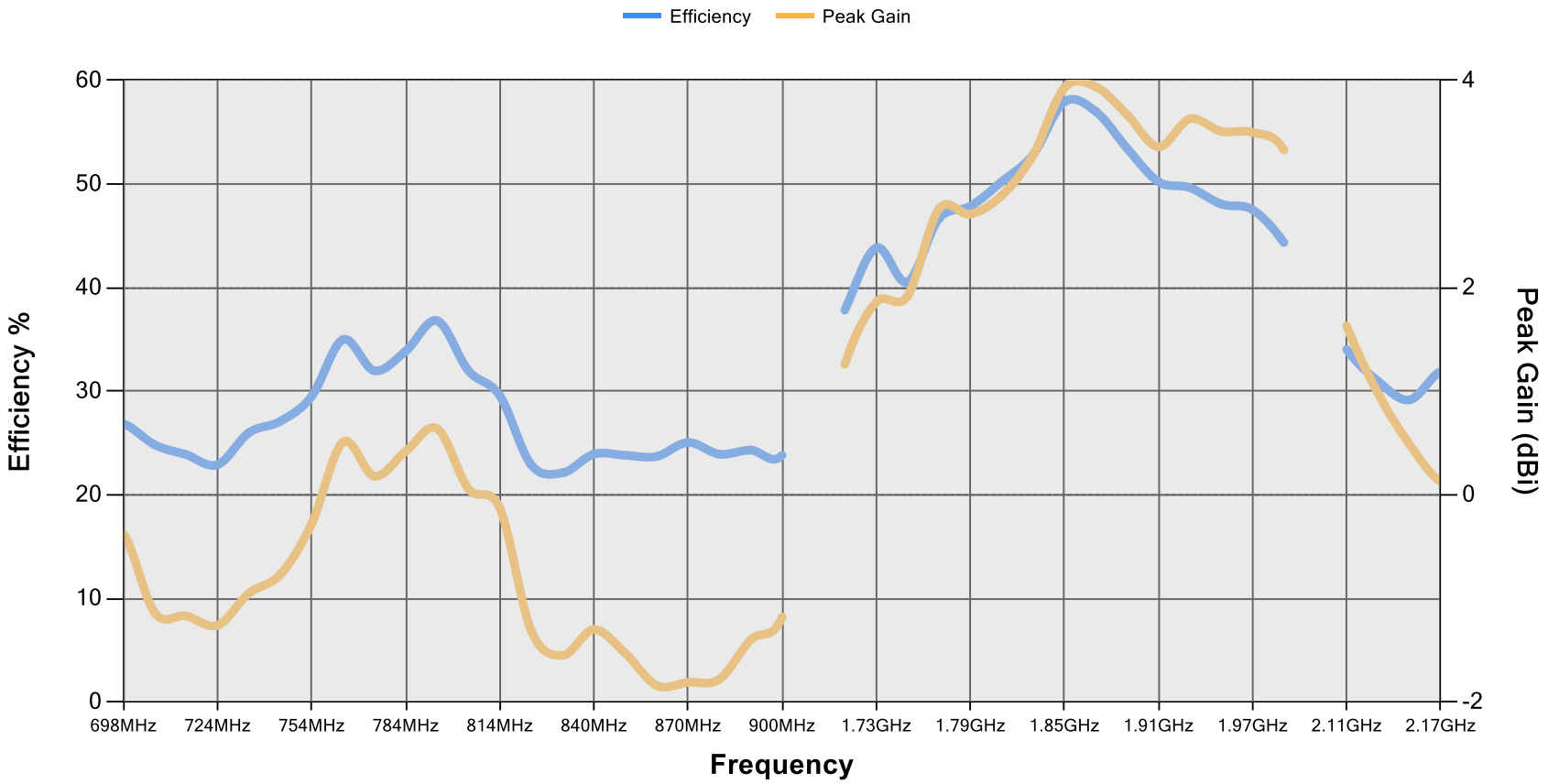


MARKERS:	MHz	dB	MHz	dB	MHz	dB
3.3nHser3.3pFser15nHshun-15nHret-wi cable .S1P - S11						
	1: 698	-7.07	3: 1710	-7.75	5: 2110	-6.98
	2: 894	-4.16	4: 1990	-10.45	6: 2155	-6.93
0ohm.S1P - S11						
	1: 698	-0.76	3: 1710	-6.96	5: 2110	-3.14
	2: 894	-3.08	4: 1990	-5.89	6: 2155	-2.88

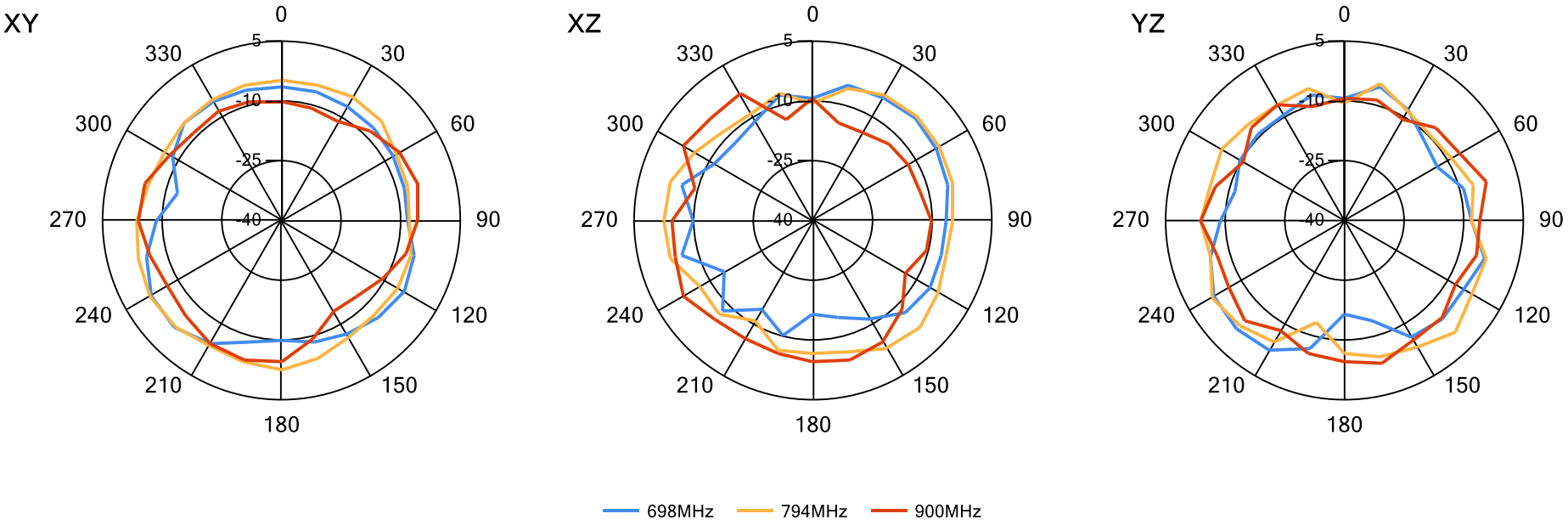
0 ohm
Matched

Passive Efficiency

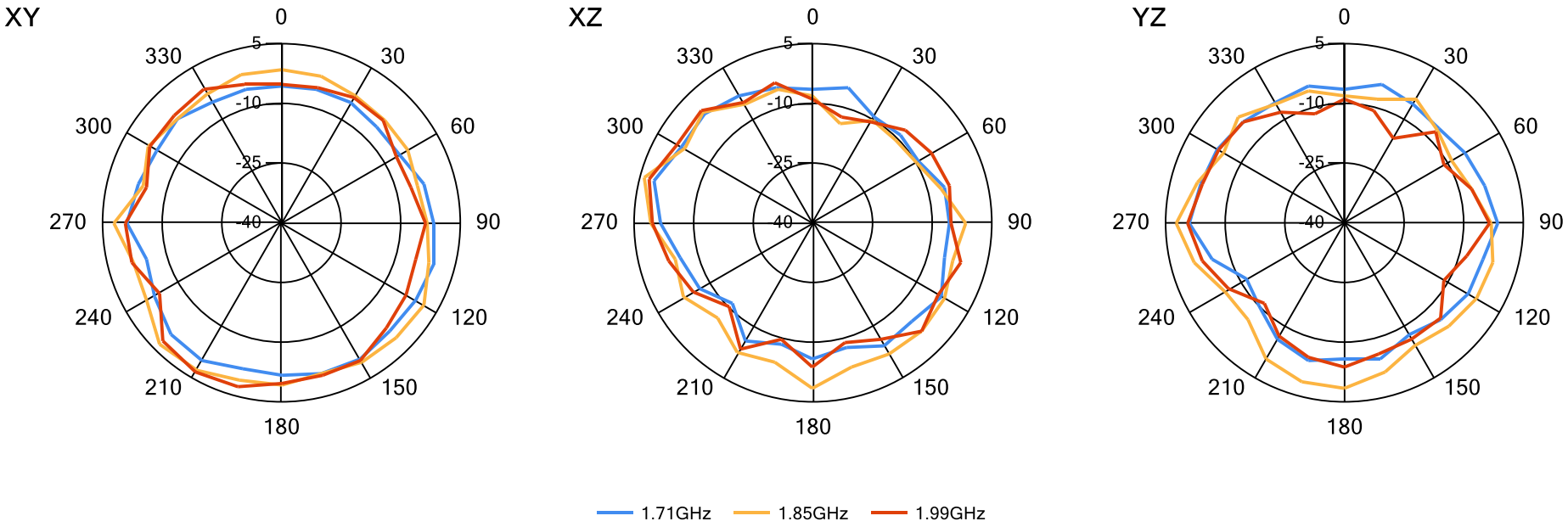
- Antenna efficiency measured in anechoic chamber.



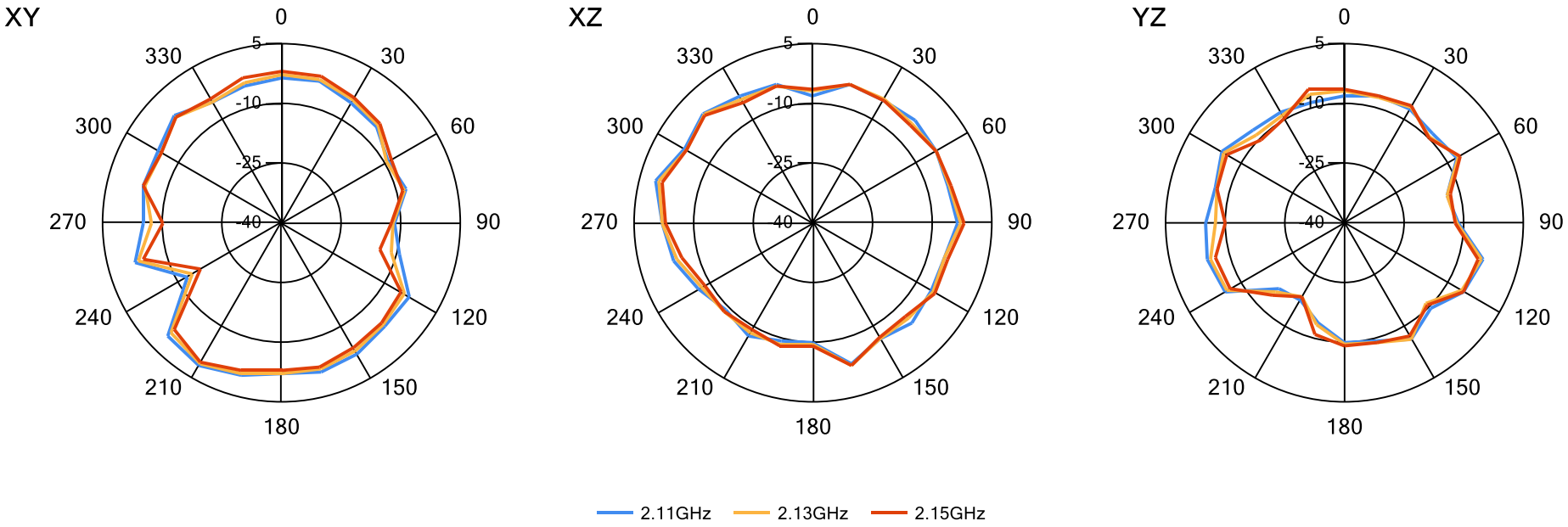
Antenna Passive Pattern



Antenna Passive Pattern



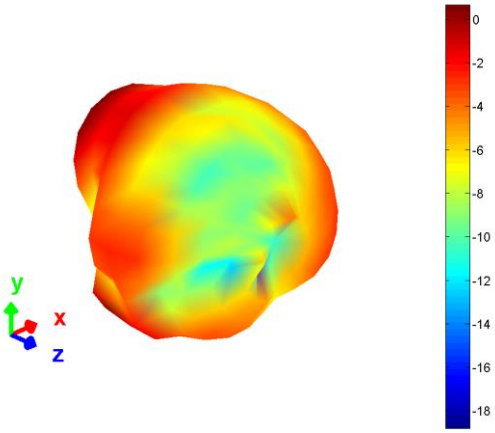
Antenna Passive Pattern



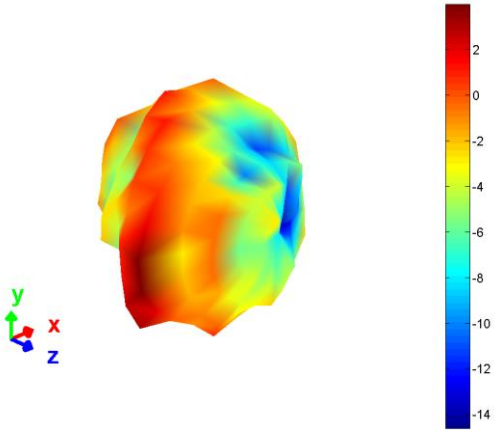
Antenna Passive Pattern 3D

Drag to rotate the pattern by using Adobe Reader.
Click to Activate

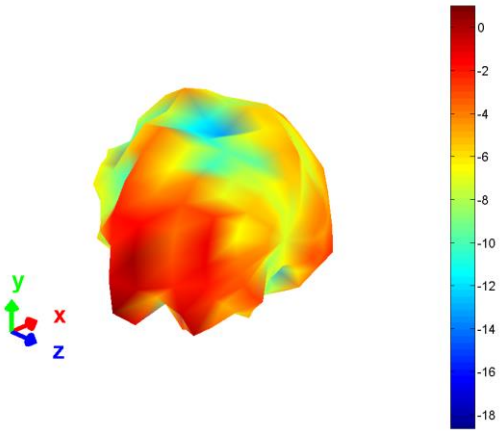
Patterns @ 794MHz



Patterns @ 1850MHz

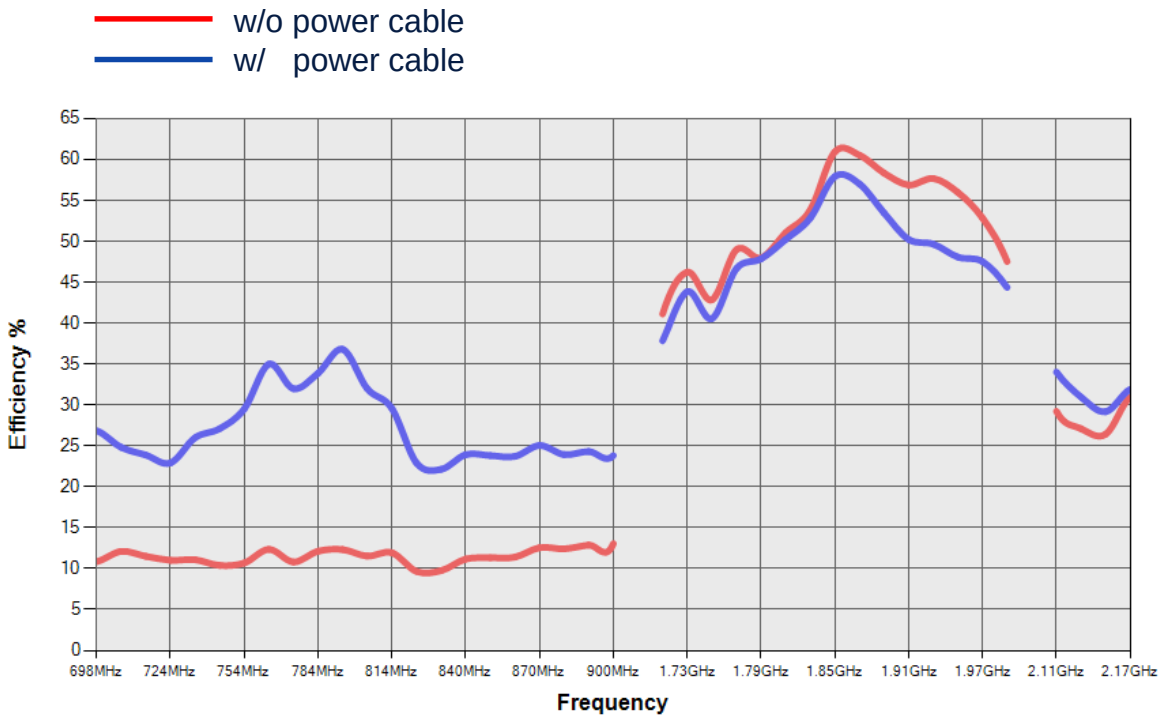


Patterns @ 2130MHz



Conclusions & Recommendations

- The antenna performance is optimal for the current device setup.
- Antenna efficiency, gain and radiation pattern were also provided in this report.
- The performance get an improved on low band after connecting with power cable. A comparison of the result was shown below.



Statement On Intellectual Property & Disclaimer

Statement on Intellectual Property

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End of Document

TRP & Efficiency

The below table shows the relationship between the passive performance Gain and TRP (Total Radiated Power). This does not represent a certainty for the active performance but is to be used as a guide only. A device may still fail certification due to device issues not related to the antenna.

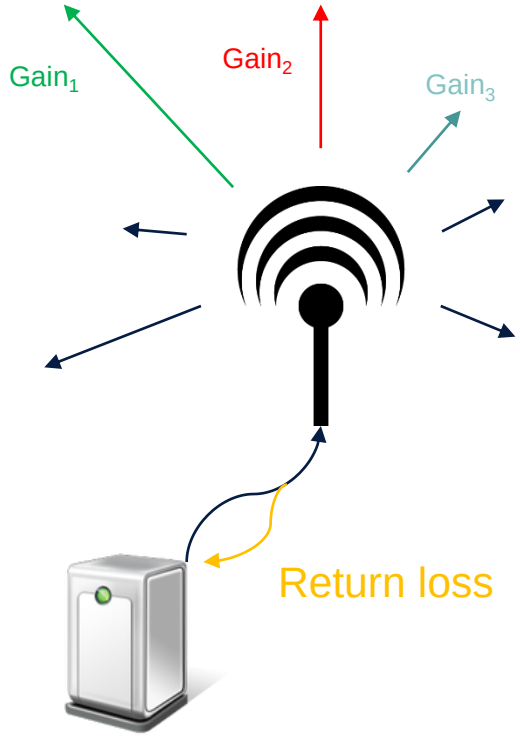
	Efficiency	Antenna Gain (Avg)	2G 850/900	2G 1800/1900	3G	LTE
*1	100%	0dB	33dBm	30dBm	24dBm	23dBm
	50%	-3dB	30dBm	27dBm	21dBm	20dBm
	30%	-5.2dB	27.8dBm	23.8dBm	18.8dBm	17.8dBm
*2	25%	-6dB	27dBm	23dBm	18dBm	17dBm
	10%	-10dB	23dBm	20dBm	14dBm	13dBm
	5%	-13dB	20dBm	17dBm	11dBm	10dBm

Please note: This is to be used as a guide and may not represent how the antenna and radio system will perform as a unit. It is recommended to measure the Total Radiated Power (TRP) for actual results.

**1: Typical minimum requirements for certification (Dependant on your required specification)*
**2: The performance could be self-defined depending on usage/application for those devices that certifications are not mandatory.*

Glossary

- **Return Loss:** It is the loss of signal power resulting from the reflection caused at a discontinuity in a transmission line.
- **Gain:** It is a figure which combines the antenna's directivity and electrical efficiency, and describes how well the antenna converts input power into radio wave headed in a specified direction and how well the antenna converts radio waves arriving from a specified direction into electrical power.
- **Efficiency:** The ratio of the total power radiated by an antenna to the net power accepted by the antenna from the connected transmitter.
- **Radiation Pattern**: A plot of the gain as a function of direction.



$$\frac{1}{return \quad loss} \propto Efficiency \propto \frac{Gain_1 + Gain_2 + Gain_3 + ... + Gain_N}{N}$$