

2.4 GHz Antenna

- HLCD33-Z-SC-BS-1C-DEAC-WP-OTA-3.0 antenna
- 2.4 GHz

1 Introduction

This document describes a antenna that can be used with all 2.4 GHz transceivers and transmitters.



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2 Abbreviations

VSWR	Voltage Standing Wave
SMA	SubMiniature version A
ISM	Industrial, Scientific, Medical
EIRP	Equivalent Isotropically Radiated Power

3 Description of the Antenna

3.1 Implementation of the Antenna

3.1.1 Figure 1

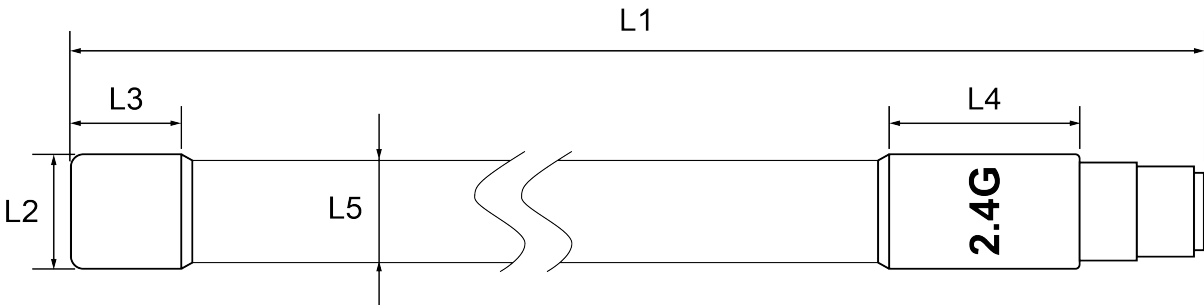


Figure 1. Dimensions

3.1.2 Table 1 Dimensions

L1	150±3 mm
L2	Ø23 mm
L3	10 mm
L4	14 mm
L5	Ø16 mm

Table 1. Dimensions

3.1.2 Table 2 Main technical specifications

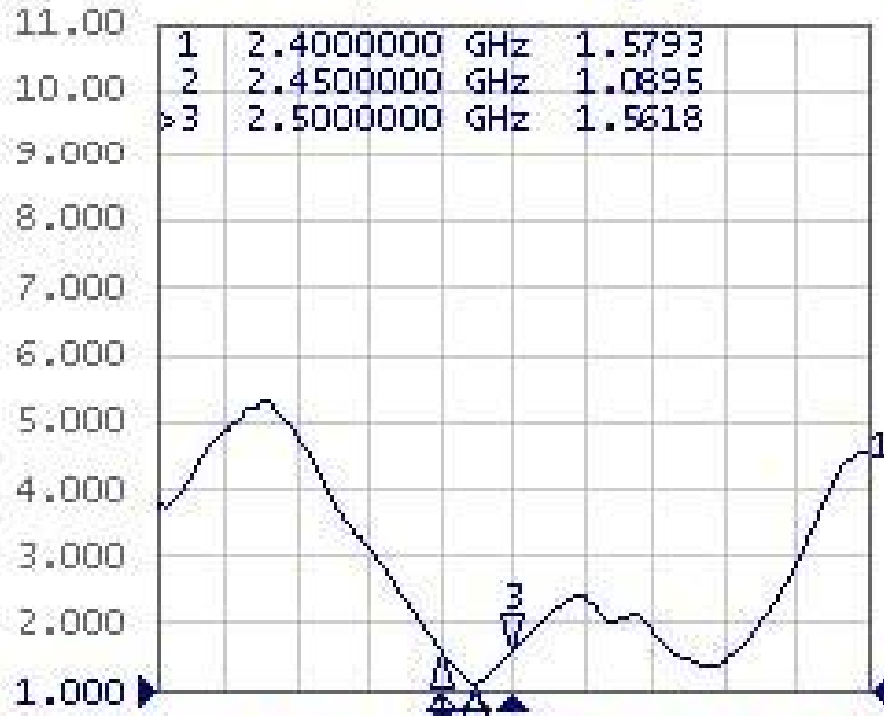
Main technical specifications	
Frequency Range	2.4~2.5GHz
Impedance(Ω)	50
VSWR	≤2.0
Admitted Power	50W
Polarization	Linear,Vertical
Radiation	Omni-directional
ConnectorType	SMA
Physical Properties	
Antenna cable	
Operating Temp	-55℃~+200℃
Storage Temp	-55℃~+200℃

4 .Results

4.1 SWR and Smith Graph and Radiation Pattern

(1)SWR

Tr1 S11 SWR 1.000/ Ref 1.000 [F1]



(2)Smith Graph

Tr2 S11 Smith (R+jX) Scale 1.000U [F1]

1	2.4000000	GHz	48.848 Ω	22.753 Ω
2	2.4500000	GHz	48.084 Ω	3.7408 Ω
3	2.5000000	GHz	33.841 Ω	3.9888 Ω

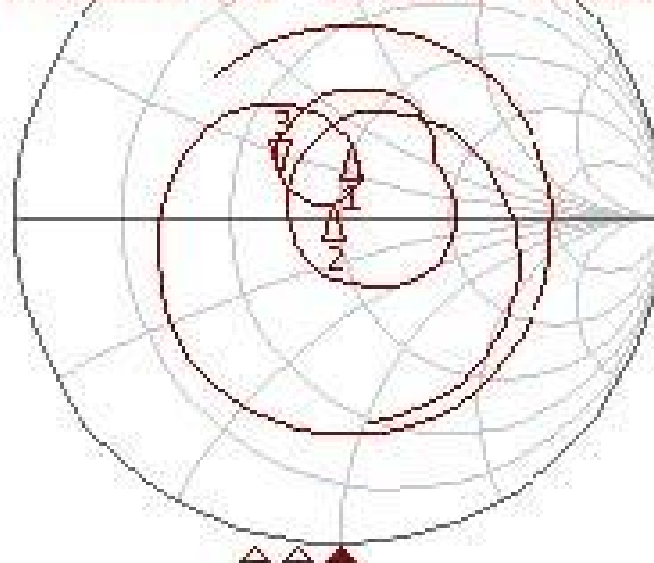


Figure 2. Radiation Pattern 1

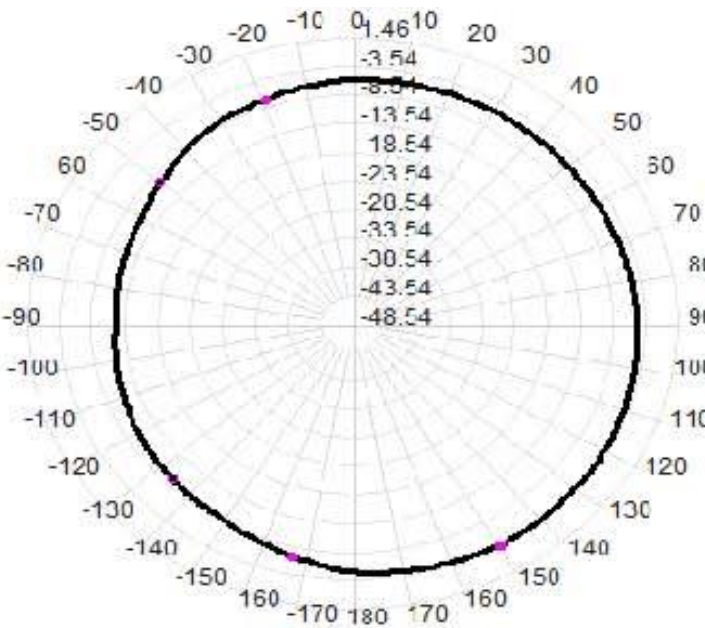
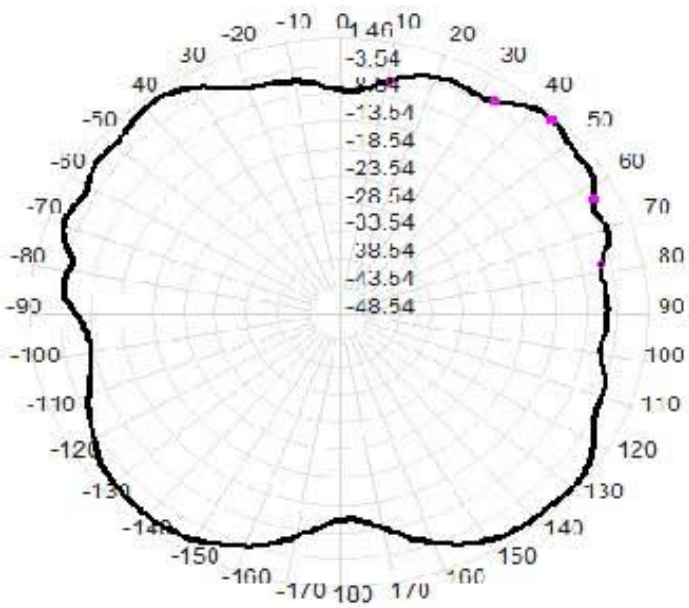
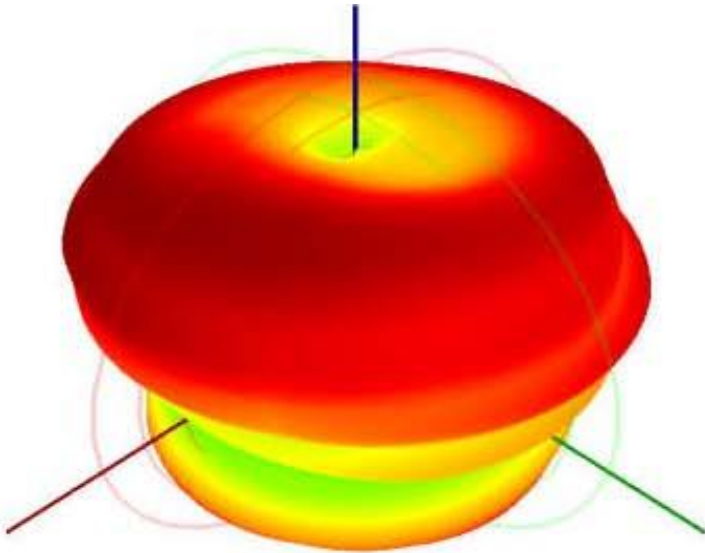


Figure 3 Radiation Pattern 2

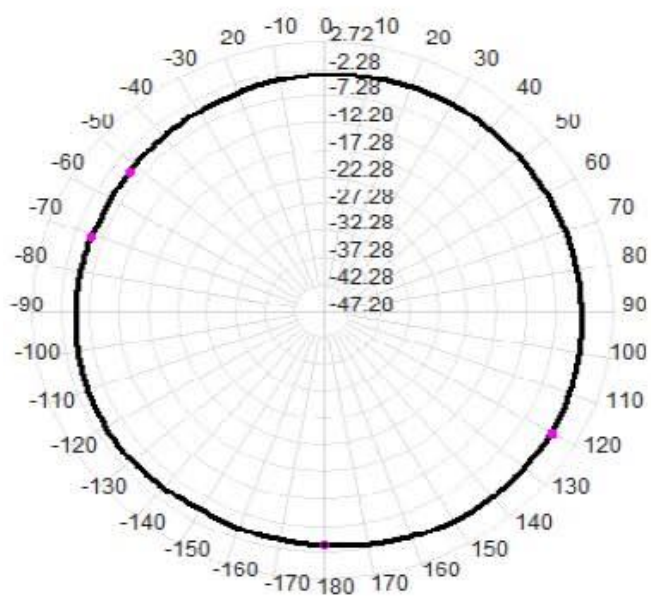
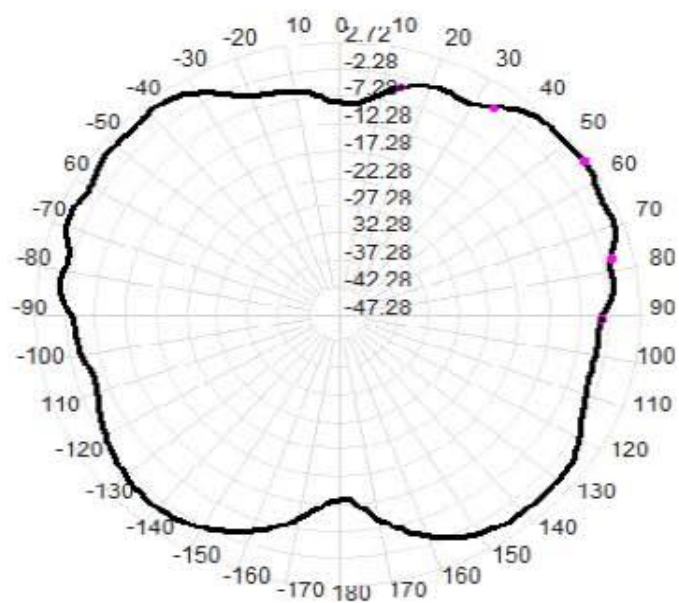
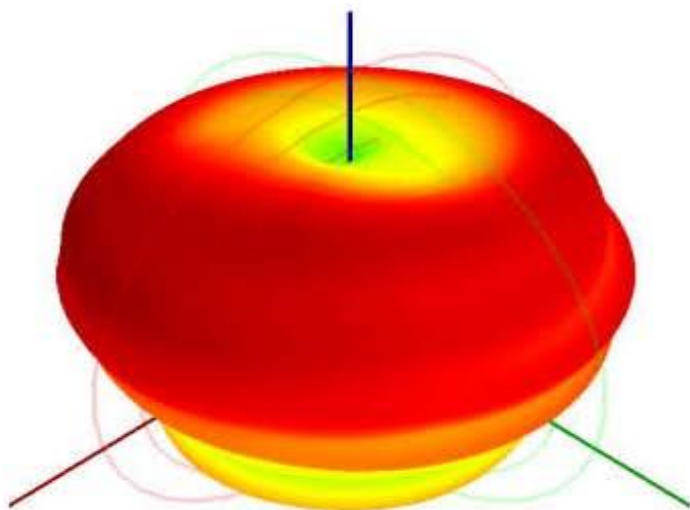
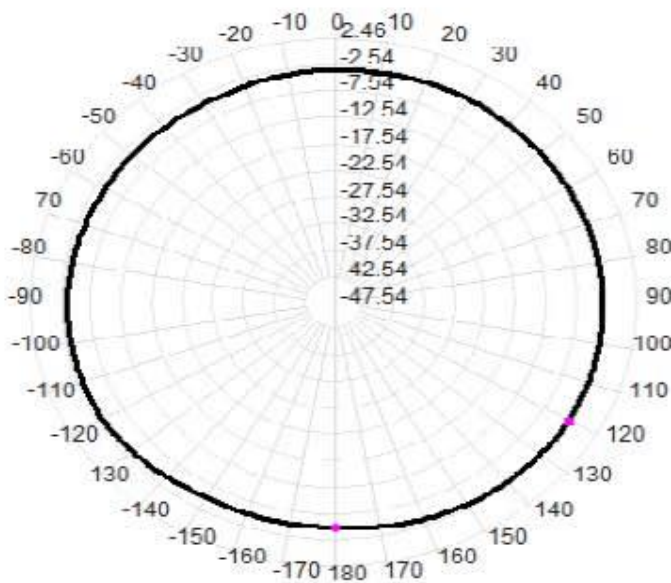
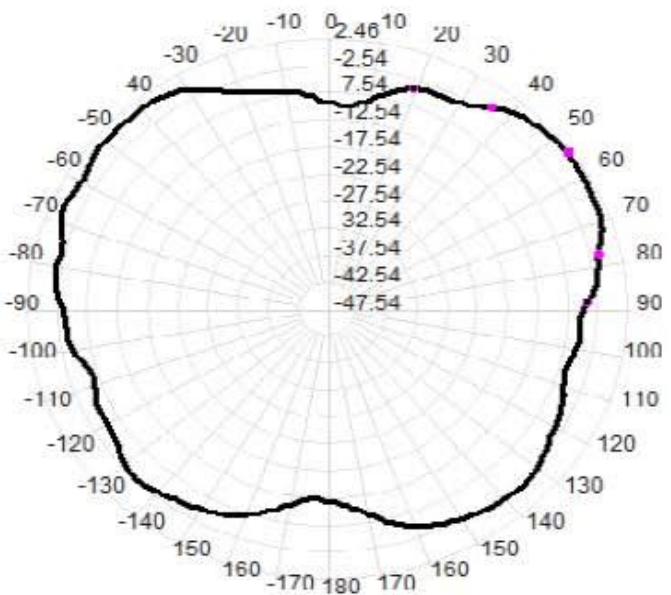
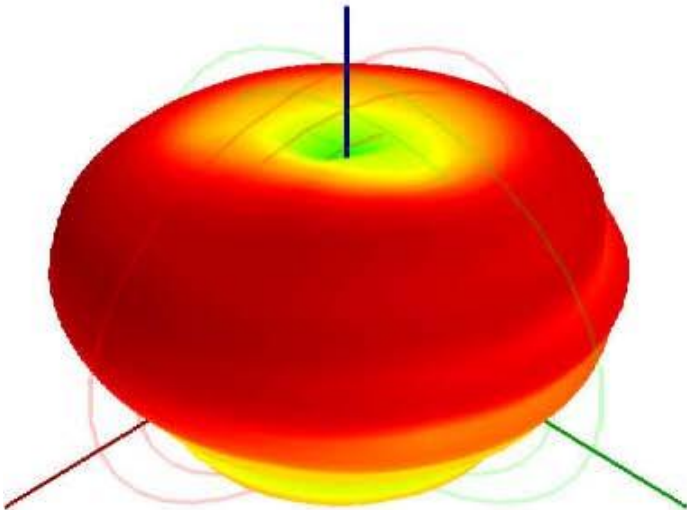


Figure 4. Radiation Pattern 3



4.2 Reflection

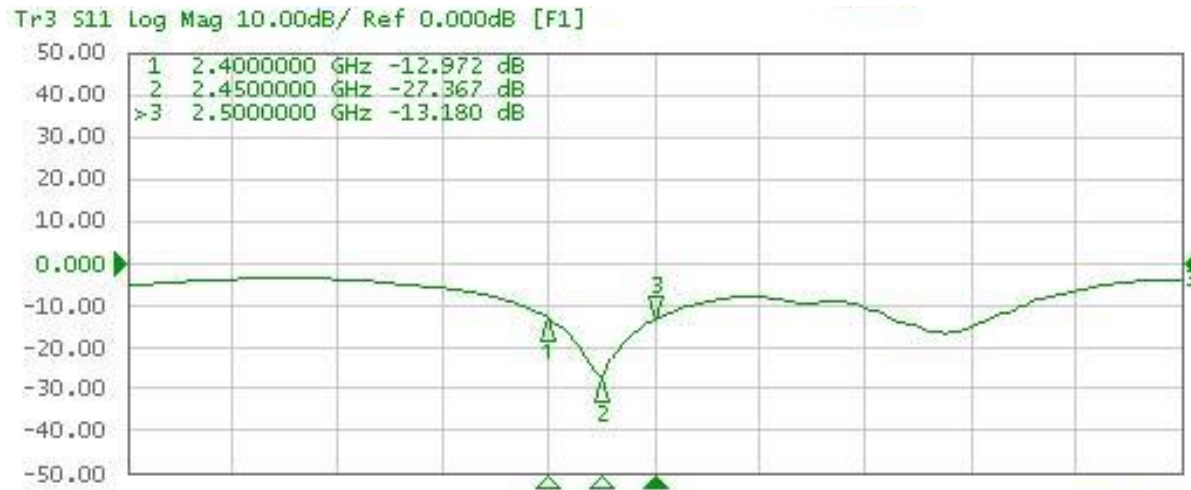


Figure 5. Measured Reflection of the Antenna

Figure 9 show that the antenna ensures less than 10 % reflection of the available power for a bandwidth of more than 100 MHz. A large bandwidth makes the antenna less sensitive to detuning due to plastic encapsulation or other objects in the vicinity of the antenna.

5 Conclusion

The antenna presented in this document performs well for all frequencies in the 2.4 GHz ISM band. These properties will ensure stable performance regardless of operating frequency and positioning of the antenna. Table 3 lists the most important properties for the antenna.

Frequency ID	1	2	3	4	5	6	7	8	9	10	11
Frequency (MHz)	2400.0	2410.0	2420.0	2430.0	2440.0	2450.0	2460.0	2470.0	2480.0	2490.0	2500.0
Point Values											
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	-1.12	-1.14	-0.98	-0.75	-0.69	-0.59	-0.47	-0.36	-0.19	-0.18	-0.21
Peak EIRP (dBm)	3.60	3.49	3.58	3.77	3.79	3.86	3.96	4.04	4.26	4.32	4.33
Directivity (dBi)	4.72	4.63	4.56	4.52	4.48	4.45	4.42	4.41	4.46	4.51	4.54
Efficiency (dB)	-1.12	-1.14	-0.98	-0.75	-0.69	-0.59	-0.47	-0.36	-0.19	-0.18	-0.21
Efficiency (%)	77.30	77.00	79.80	84.20	85.30	87.40	89.80	91.90	95.70	95.90	95.30
Gain (dBi)	3.60	3.49	3.58	3.77	3.79	3.86	3.96	4.04	4.26	4.32	4.33
NHPRP $\pm$ Pi/ 4 (dBm)	-2.93	-2.96	-2.82	-2.62	-2.61	-2.55	-2.47	-2.40	-2.26	-2.27	-2.32
NHPRP $\pm$ Pi/ 6 (dBm)	-5.68	-5.71	-5.58	-5.41	-5.43	-5.46	-5.45	-5.43	-5.31	-5.33	-5.38
NHPRP $\pm$ Pi/ 8 (dBm)	-8.35	-8.35	-8.23	-8.09	-8.18	-8.34	-8.49	-8.58	-8.50	-8.50	-8.54
Upper Hem. PRP (dBm)	-2.08	-2.21	-2.17	-2.04	-2.04	-1.95	-1.85	-1.79	-1.66	-1.63	-1.60
Lower Hem. PRP (dBm)	-8.16	-7.75	-7.18	-6.63	-6.43	-6.29	-6.11	-5.89	-5.63	-5.66	-5.83
Upper Hem. PRP (%)	61.97	60.17	60.61	62.48	62.58	63.85	65.33	66.16	68.29	68.67	69.17
Lower Hem. PRP (%)	15.29	16.80	19.15	21.73	22.74	23.51	24.47	25.78	27.37	27.18	26.15

Table 3 important properties