Kyushu Institute of Technology

Department of Applied Science for Integrated System Engineering

BIRDS-2 CUBESAT PROJECT

EM-2 UHF & VHF Antenna Gain Test Report_Version 2

Laboratory of Spacecraft Environment Interaction Engineering

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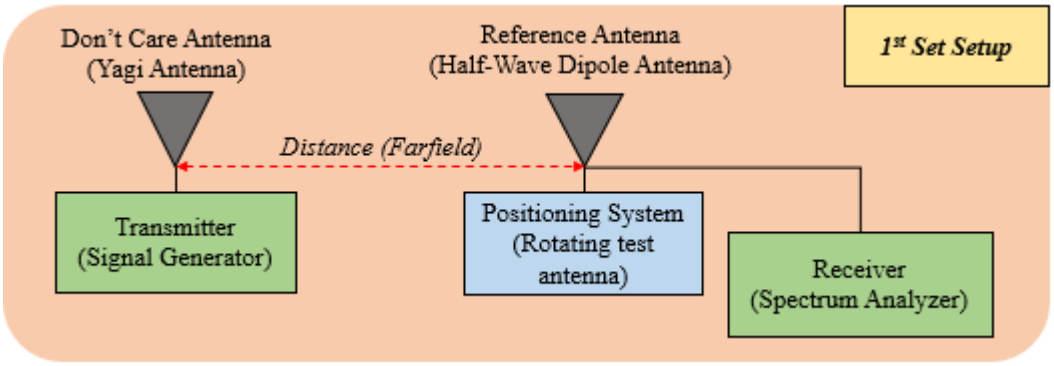
1. Antenna Radiation Pattern Measurement Set Up

The test setup for antenna radiation pattern can be categorized in two sets of setups:

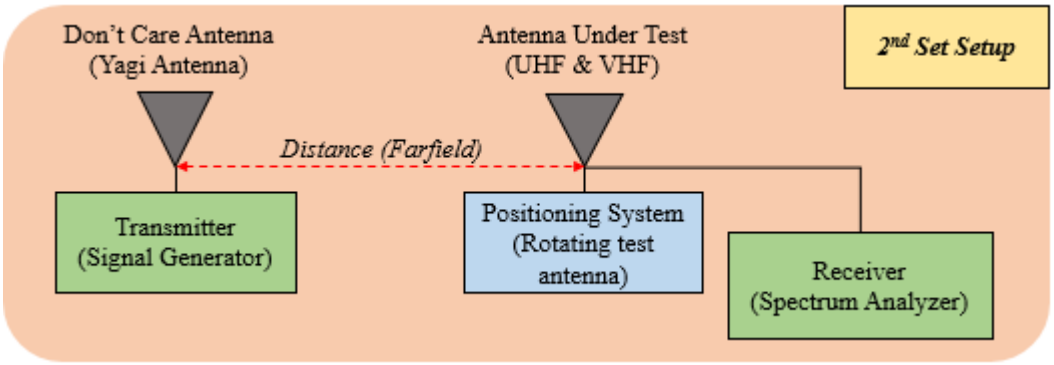
1st set test:

'Don't Care' Antenna (Yagi Diamond A1430S7 Antenna) and Reference Antenna (Half-Wave Dipole Antenna (SCHWARZBECK UHAP/VHAP)) →reference power



2nd set test:

'Don't Care' Antenna (Yagi Diamond A1430S7 Antenna) and Antenna Under Test (UHF/VHF monopole antennae)



2. Antenna Radiation Pattern Result

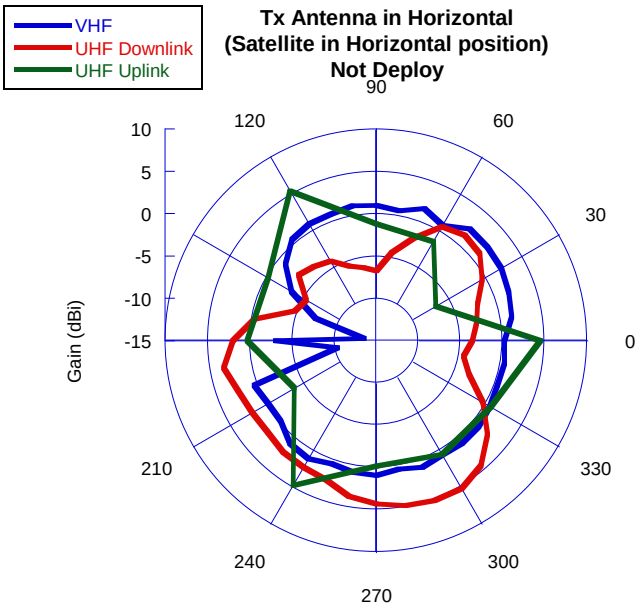
<u>In case of Both UHF & VHF antenna are not deploy (+Y facing Tx)</u>

1. Satellite in Horizontal Position

a. VHF Monopole Antenna (145.825 MHz)

b. UHF Downlink Monopole Antenna (437.375 MHz)

c. UHF Uplink Monopole Antenna (435.313 MHz)

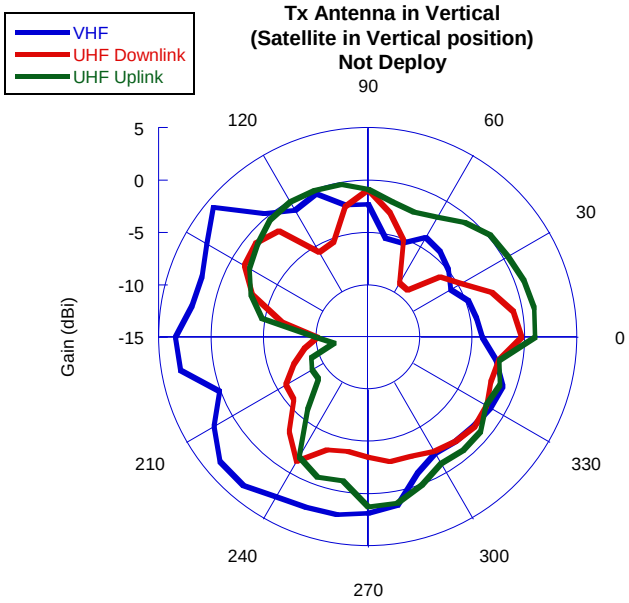


2. Satellite in Vertical Position

a. VHF Monopole Antenna (145.825 MHz)

b. UHF Downlink Monopole Antenna (437.375 MHz)

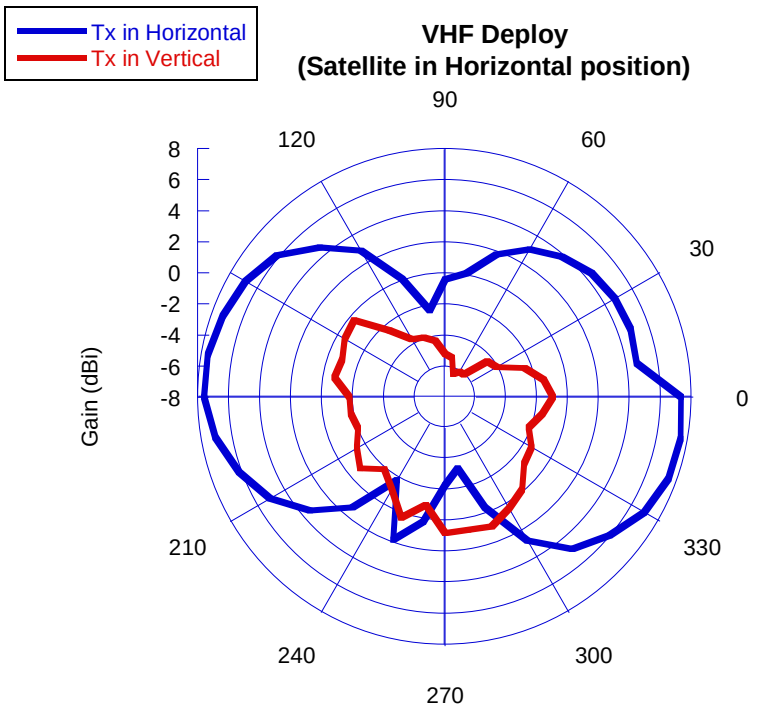
c. UHF Uplink Monopole Antenna (435.313 MHz)



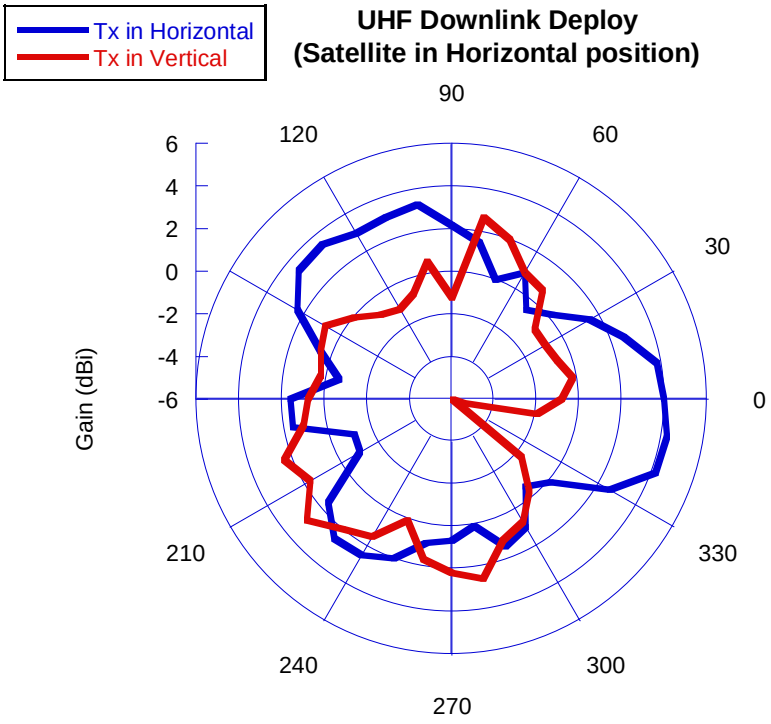
In case of Both UHF & VHF antenna are deploy

1. Satellite in Horizontal Position (+Y is facing Tx)

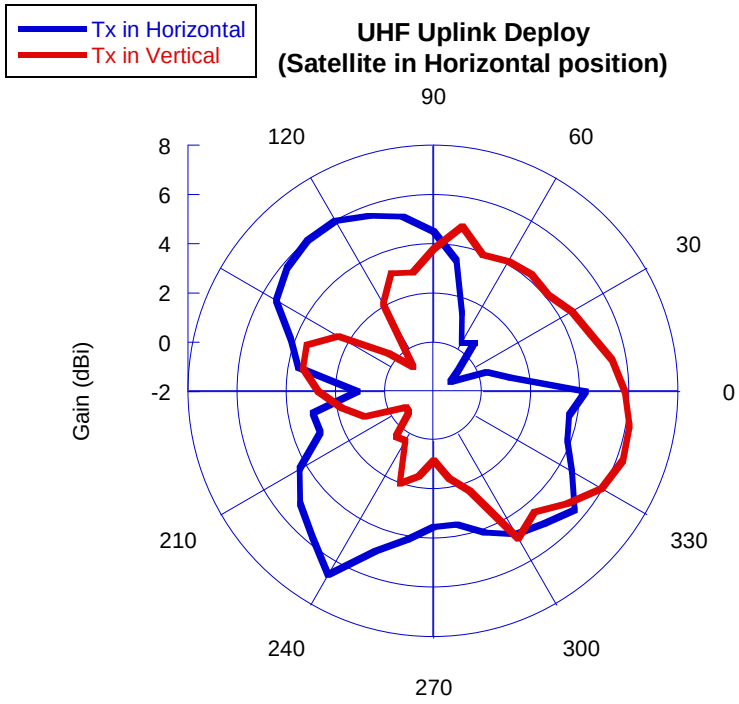
a. VHF Monopole Antenna (145.825 MHz)



b. UHF Downlink Monopole Antenna (437.375 MHz)



c. UHF Uplink Monopole Antenna (435.313 MHz)

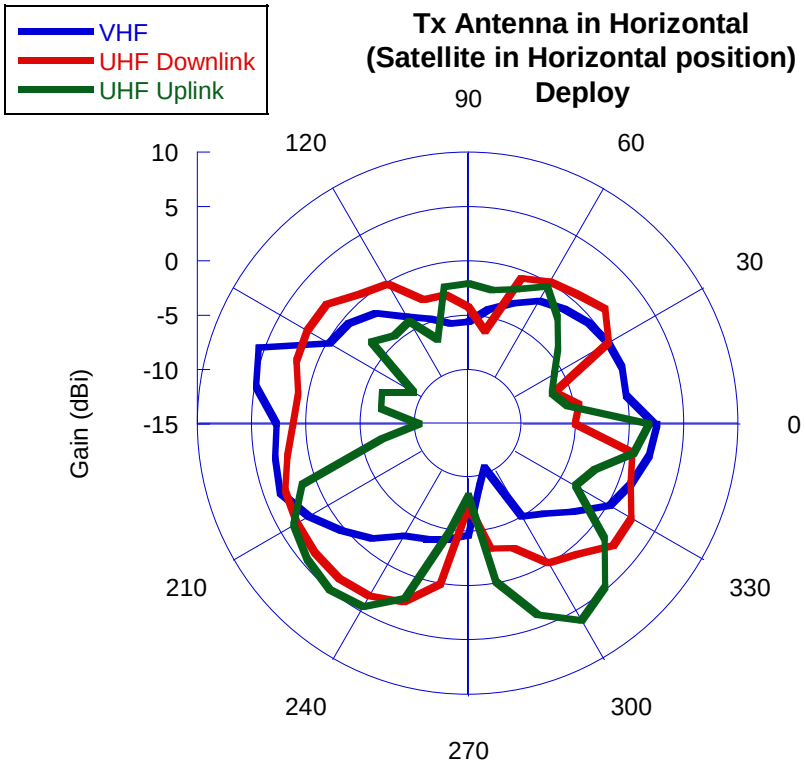


2. Satellite in Horizontal Position (+Y is facing Upward)

   a. VHF Monopole Antenna (145.825 MHz)

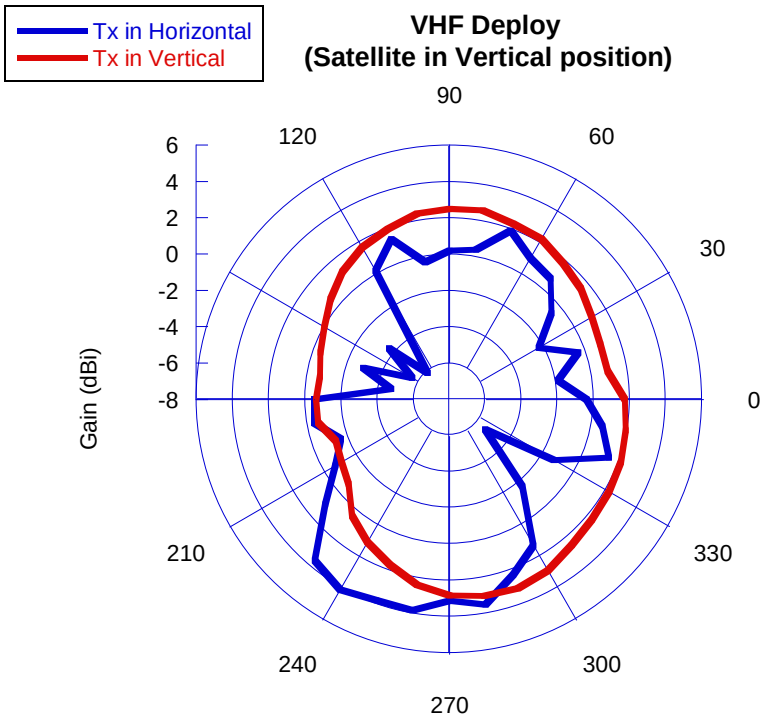
   b. UHF Downlink Monopole Antenna (437.375 MHz)

   c. UHF Uplink Monopole Antenna (435.313 MHz)

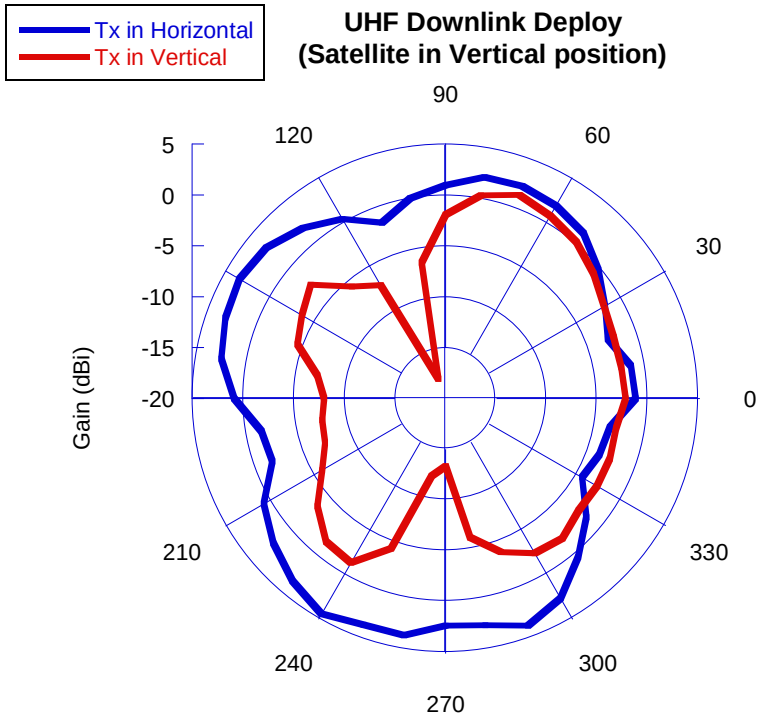


3. Satellite in Vertical Position (+Y facing Tx)

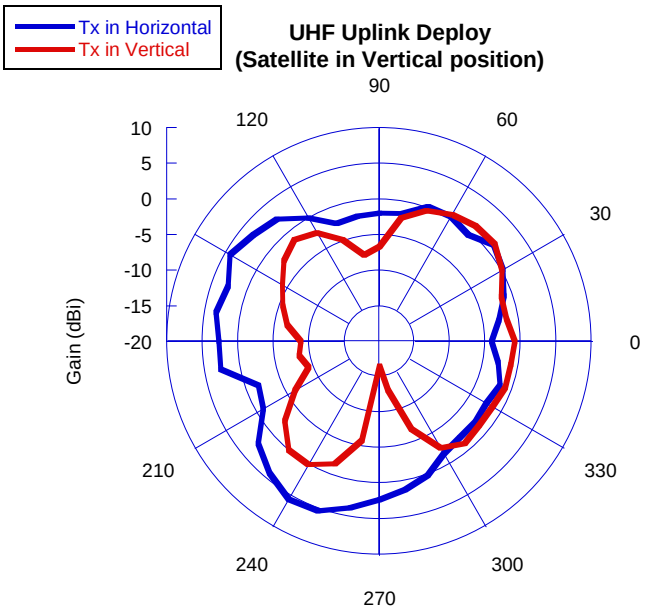
   a. VHF Monopole Antenna (145.825 MHz)



   b. UHF Downlink Monopole Antenna (437.375 MHz)



c. UHF Uplink Monopole Antenna (435.313 MHz)



The 3 antennae comparation method will follow the procedure below:

1. Use the Yagi Diamond A1430S7 as TX and the Half-Wave Dipole Antenna (SCHWARZBECK UHAP/VHAP) as RX, then measure the received power in Spectrum Analyzer (Reference RX Power [Ref_Power]).
2. Now, change the Half-Wave Dipole Antenna (SCHWARZBECK UHAP/VHAP) for the Antenna Under Test at the same distance at the last testing, then measure the received power in Spectrum Analyzer (Antenna Under Test RX Power [Ant_test_Power]).
3. Finally, the calculation of the Antenna Under Test gain is the following:

Antenna under test Gain (dBi) = Reference Antenna Gain (dBi) + [Ant_Test_Power (dB) – Ref_Power (dB)]

Type of Antenna	Condition of Antenna	Frequency (MHz)	Received Power from Reference Antenna (dBm)	Max Received Power from Antenna Under Test (dBm)	Reference Antenna Gain (dBi)	AUT Gain (dBi)
UHF Downlink	Deploy	437.375	-24.9	-22.6	2.15	4.45
	Not Deploy			-21.9		5.15
UHF Uplink	Deploy	435.313	-25.64	-21.2	2.15	6.59
	Not Deploy			-22.4		5.39
VHF	Deploy	145.825	-14.02	-8.6	2.15	7.57
	Not Deploy			-11.9		4.27