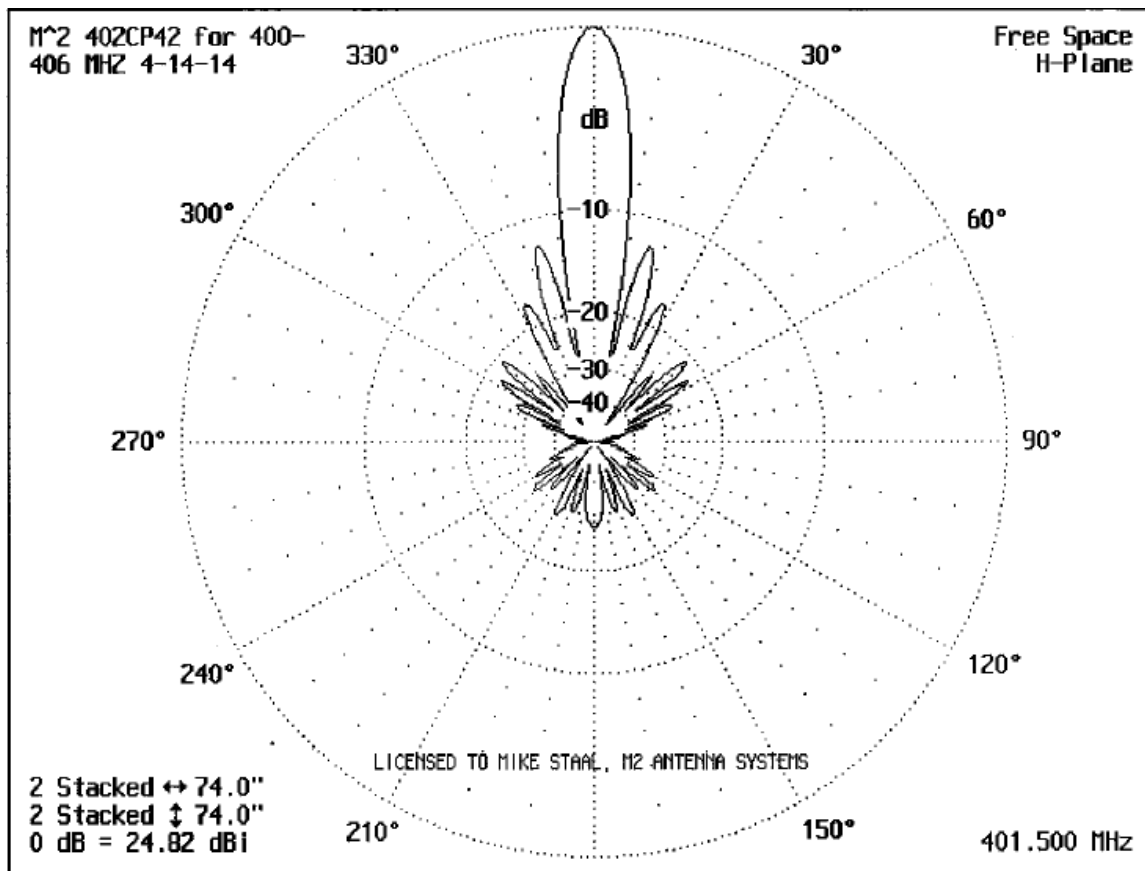


ATTACHMENT A: CORVUS-BC-1 & -BC2 UHF Telemetry System Summary

System RF Characteristics:

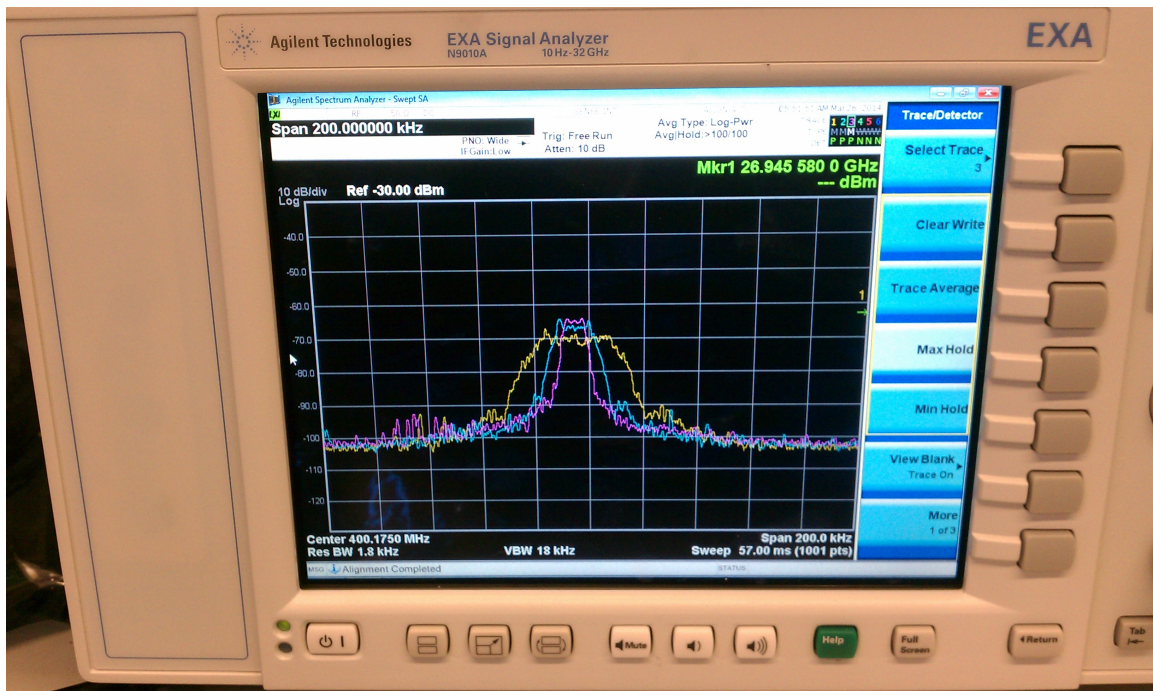
- 1) Telemetry Link Satellite Polarization: Linear Polarization
- 2) Telemetry G.S. Downlink Antenna Type: 4 X 18.7 dBi gain Yagis (21 elements per plane X 2 planes)
- 3) Telemetry Antenna Boresight Gain at 400.175 MHz: +23.5.0 dBiC
- 4) Telemetry Link Maximum Downlink EIRP: +4.3 dBW
- 5) TLM Link Maximum Downlink PFD (at NADIR Location): -168.1 dBW/m²/Hz
- 6) TLM Link Antenna Patterns: *See Figures 6-A, 6-B and 6-C below.*
- 7) G. S. Antenna Beamwidth: 10 degrees (see azimuth plot)



8) Emission -3 dB BW: 40 kHz

9) Emission Designator: 40M0F1D (GFSK @ 38.4 kbps)

10) Emission Spectrum Characteristics: The same transceiver is used on the spacecraft as in the ground station. The two transceivers communicate with each other in 1/2-duplex mode. We use three different data rates. The purple trace is 9600 bps, the blue trace is 19,200 bps and the yellow trace is 38,400 bps. We will be predominantly using the 38,400 bps as our standard data rate in the future. [BTW, Ignore the green marker data at the top of the screen. That should have been turned off]. The key point here is that the FIR filters of the transceiver have the same sort of roll-off characteristic on TX and RX at both frequencies and we do not see any spurs generated from our equipment adding to this. Here is the downlink spectrum from one of these radios. The Corvus-BC-1 and -BC-2 emissions at 400.175 MHz looks the same as this emission taken from another identical transmitter from the same lot and the same as the two Perseus-M satellites, in orbit, which were operated under a different Part 5 license.



Using our Part 5 license, we will be send telemetry from Corvus-BC-1 and -BC-2 spacecraft every day and you can feel free to monitor these emissions if you like. We can supply TLEs or pass data if you wish to perform a test with us.

11) Typical Link Budget for Corvus-BC-1 and -BC-2 at G.S. 5° Elevation Angle:

Corvus-BC and HD Link Budget B-TC-1		
Downlink Telemetry Budget:		
Parameter:	Value:	Units:
<i>Spacecraft:</i>		
Spacecraft Transmitter Power Output:	2.0	watts
In dBW:	3.0	dBW
In dBm:	33.0	dBm
Spacecraft Transmission Line Losses:	-0.3	dB
S/C Connector, Filter or In-Line Switch Losses:	-0.2	dB
Spacecraft Antenna Gain:	0.0	dBiL
Spacecraft EIRP:	2.6	dBW
<i>Downlink Path:</i>		
Spacecraft Antenna Pointing Loss:	-1.0	dB
Antenna Polarization Loss:	-5.0	dB
Path Loss:	-152.5	dB
Atmospheric Loss:	-2.1	dB
Ionospheric Loss:	-0.4	dB
Rain Loss:	0.0	dB
Isotropic Signal Level at Ground Station:	-158.4	dBW
<i>Ground Station:</i>		
<i>----- Eb/No Method -----</i>		
Ground Station Antenna Pointing Loss:	-0.4	dB
Ground Station Radome Loss:	0.0	dB
Ground Station Antenna Gain:	23.5	dBiC
Ground Station Transmission Line Losses:	-1.0	dB
Ground Station LNA Noise Temperature:	100	K
Ground Station Transmission Line Temp.:	290	K
Ground Station Sky Temperature:	275	K
G.S. Transmission Line Coefficient:	0.794	
Ground Station Effective Noise Temperature:	378	K
Ground Station Figure of Merit (G/T):	-3.3	dB/K
G.S. Signal-to-Noise Power Density (C/No):	66.5	dBHz
System Desired Data Rate:	38400	bps
In dBHz:	45.8	dBHz
Telemetry System Eb/No:	20.7	dB
Telemetry System Required Bit Error Rate:	1.00E-05	
Telemetry System Required Eb/No:	14.8	dB
System Link Margin:	5.9	dB

Figure 6-A:

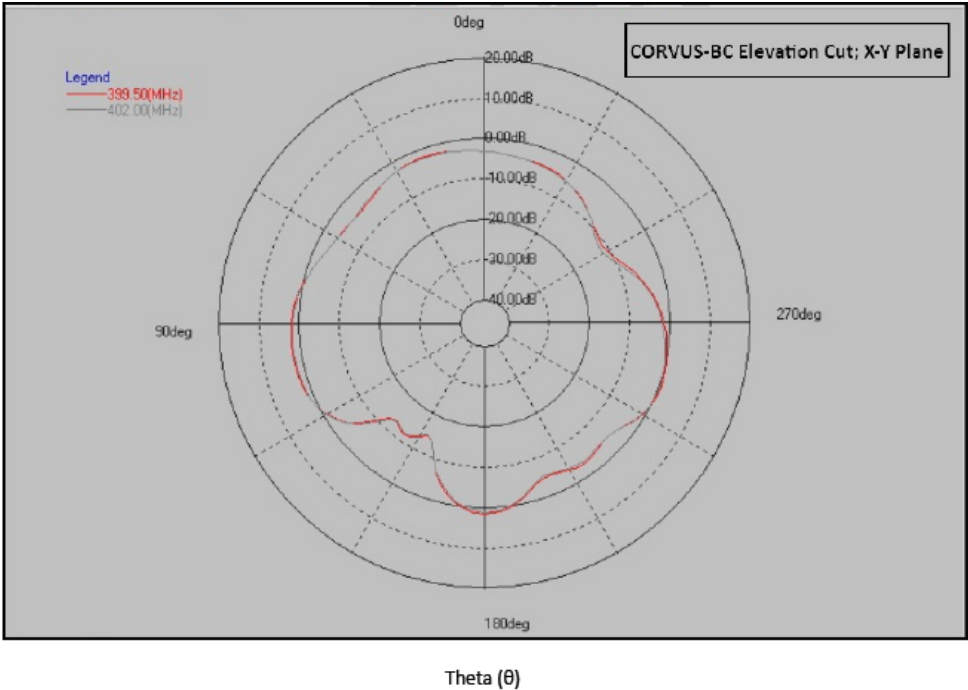


Figure 6-B:

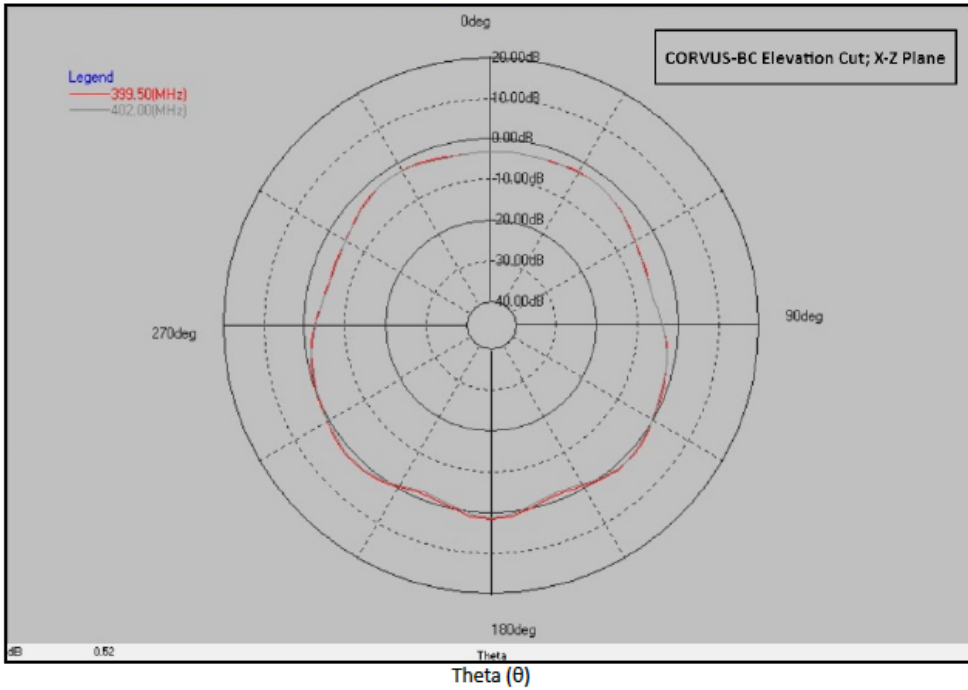


Figure 6-C:

