Harris Corporation

UAS C Band Radio

Attachment to FCC Experimental License

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1. Overview

Harris Corporation is requesting an FCC Experimental License within the allocated UAS C Band (5030 – 5091 MHz) to perform testing and validation of our Command & Non-Payload Communications (CNPC) Radio System. We will install a Mobile CNPC Radio in an Unmanned Air Vehicle (UAV) and communicate to the UAV via a Fixed CNPC Base Station Mobile Station. Our experimental UAS operations will be conducted within 17km (10 miles) of the Harris Corporation Manufacturing facility located in Malabar, FL. The UAV will be operated below 400' Above Ground Level (AGL) and In Accordance With (IAW) all applicable FAA rules

2. Harris Command & Non-Payload Communications (CNPC) Radio System

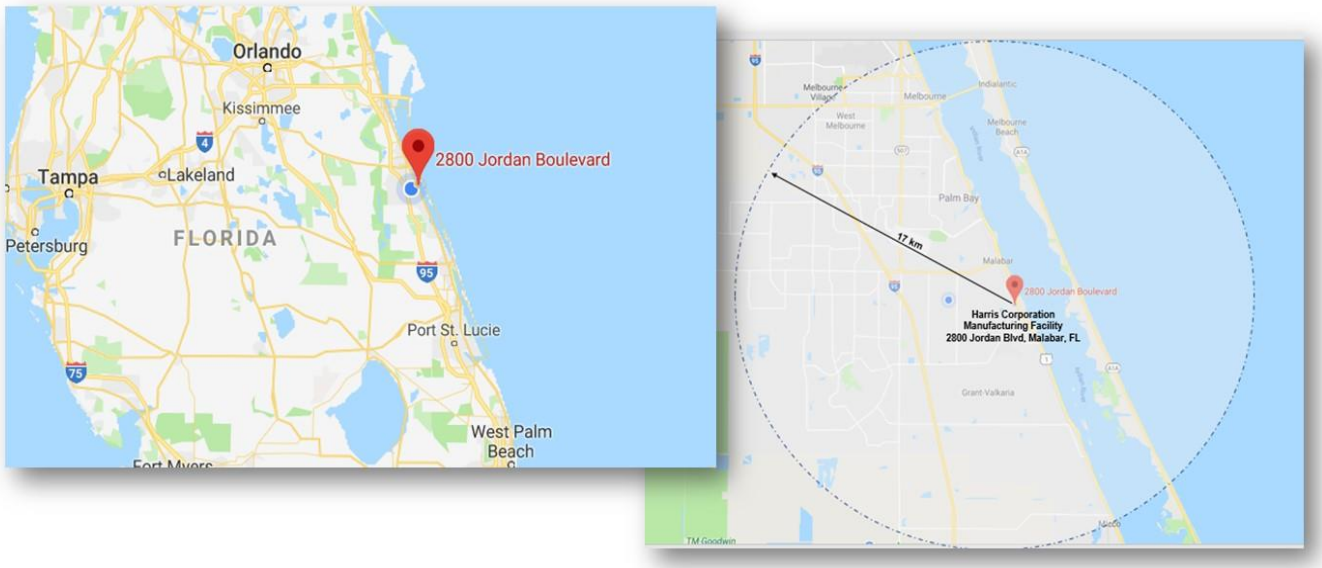
Harris Corporation is participating in several key FAA UAS initiatives, including FAA Pathfinder, FAA UAS test site projects, the RTCA Drone Advisory Committee and RTCA SC-228. We have also been an active participant in RTCA SC-228 "Minimum Performance Standards for Unmanned Aircraft Systems" and the follow-on Phase 1 Terrestrial-based CNPC Link (Command & Non-Payload Communications) committee

Based on this experience, Harris is developing initial UAS CNPC Radio and Beyond Visual Line of Sight (BVLOS) network capabilities which are at various levels of maturity given current state of the UAS standards such as RTCA DO-362 and the more recently published FAA Technical Standard Order (TSO) C213.

Our CNPC Radio systems are now at a point in development that we are ready to perform controlled RF radiation testing to verify the integrity and performance of the radio. Following the receipt of approval from the FAA we are hereby requesting an Experimental License from the FCC to further continue our testing.

3. Test Site Area (Malabar, FL)

The planned Test Site is centered on Harris Corporation's Manufacturing facility located at 2800 Jordan Blvd. Malabar, FL. This is a remote area rural area with a small General Aviation Airport (Valkaria) located about 1 1/2 miles from the Harris facility. We will closely coordinate our flight tests with Valkaria Airport Manager (Steve Borowski).



Test Site Area of Operation

4. C Band Spectrum for Unmanned Air Systems (UAS)

The FAA has designated C Band Spectrum (5030 – 5091 MHz) for use by UAS. Additionally, the FAA Spectrum Office has recommended the band be divided into 41 channels, which are allocated based on the Data Class of operation and required bandwidth.

This Experimental License application request is for a "Low, Medium and High-end" 85 kHz channel (3 Total) to support initial testing of the Harris Command and NonPayload Communication (CNPC) radio designed to support UAS Operations. Our request is to allow Manufacturing Testing of the Harris CNPC Radio for channels 3, 23 and 39 for both D1 and D2 as shown in the table below:

85 KHz Bandwidth Channels		
Channel	D1 (MHz)	D2 (MHz)
3	5041.3125	5041.3975
23	5045.6125	5045.6975
39	5049.0525	5049.1375

5. Coordination with FAA

The requested C Band allocation is within the FAA Aviation Protected Spectrum and therefore requires pre-coordination and approval from the FAA prior to applying for an Experimental License from the FCC. Correspondingly, we have been closely coordinating with the FAA Spectrum Engineering Office and the use of these (12) channels have been determined to be acceptable to the FAA.

For additional information please contact:
FAA Spectrum Office
Don Nellis
Donald.Nellis@faa.gov
(202)267.9779

Our Frequency Coordination Requests have been engineered by the FAA Spectrum Engineering Office resulting in the following (12) FAA approvals:

Chan	D1/D2	Freq	TRK #	NG #	Details
3	D1	5041.31	183072	80550	Frequency Range: 5041.27000000 to 5041.35400000 MHz, Power: 10.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Fixed
3	D1	5041.31	183071	80549	Frequency Range: 5041.27000000 to 5041.35400000 MHz, Power: 1.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Mobile
3	D2	5041.39	183076	80554	Frequency Range: 5041.35400000 to 5041.44250000 MHz, Power: 10.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Fixed
3	D2	5041.39	183075	80553	Frequency Range: 5041.35400000 to 5041.44250000 MHz, Power: 1.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Mobile
23	D1	5045.61	183078	80556	Frequency Range: 5045.57000000 to 5045.65400000 MHz, Power: 10.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Fixed
23	D1	5045.61	183077	80555	Frequency Range: 5045.57000000 to 5045.65400000 MHz, Power: 1.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Mobile
23	D2	5041.69	183081	80558	Frequency Range: 5045.65400000 to 5045.74250000 MHz, Power: 10.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Fixed
23	D2	5041.69	183080	80557	Frequency Range: 5045.65400000 to 5045.74250000 MHz, Power: 1.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Mobile
39	D1	5049.05	183083	80560	Frequency Range: 5049.01000000 to 5049.09400000 MHz, Power: 10.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Fixed
39	D1	5049.05	183082	80559	Frequency Range: 5049.01000000 to 5049.09400000 MHz, Power: 1.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Mobile
39	D2	5049.14	183087	80564	Frequency Range: 5049.09400000 to 5049.18250000 MHz, Power: 10.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Fixed
39	D2	5049.14	183086	80563	Frequency Range: 5049.09400000 to 5049.18250000 MHz, Power: 1.000000 W, Mean Peak: Peak, Tolerance: 0.01000000, Station Class: Mobile

Summary of (12) FAA C Band UAS Channel Approvals

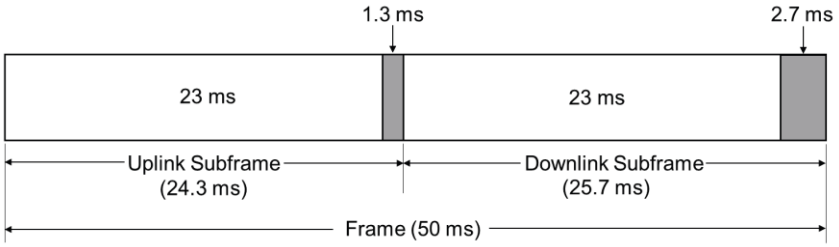
6. Modulating Signal Description

Both the fixed (Ground Base Station) and mobile (Unmanned Air Vehicle) transmitters use a GMSK (Gaussian Minimum Shift Keying) modulation scheme. Binary ones and zeroes are generated with a modulation index of 0.5 and a Bandwidth-Time (BT) product of 0.2.

6.1. RTCA TDD Format

RTCA DO-362 compliant Time Division Duplex (TDD) structure of 50 millisecond frames with 23 millisecond uplink and downlink sub-frames.

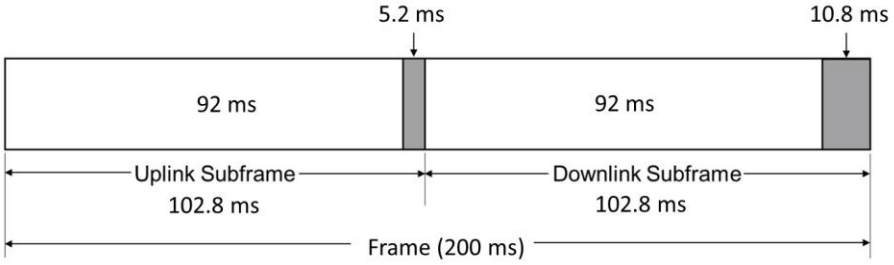
RTCA DO-362 Section 2.2.1.3 TDD Frame Structure Is shown below.



DO-362 TDD Frame Structure

6.2. Harris CNPC TDD Format

The Harris C Band CNPC Radio utilizes a very similar TDD subframe structure although currently with a 200 ms frame as shown below.

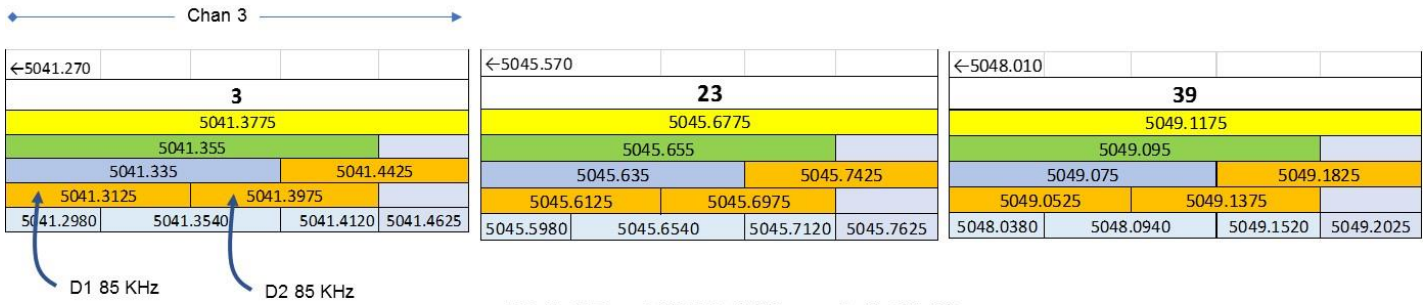


Harris CNPC TDD Frame Structure

Note: As part of our continuing development, Harris plans to modify our TDD structure to be fully compliant with the TDD (50 ms) frame structure specified in RTCA DO-362 Section 2.2.1.3.

7. UAS Requested Experimental License Channels

The FAA Spectrum Office has designated (41) channels at (5) different bandwidths (45 kHz, 85 kHz, 130 kHz, 170 kHz and 205 kHz). Harris is requesting Experimental Licenses at 85 kHz at the Low, Medium and High-end of the UAS C Band designated as channels 3, 23 and 39 as shown in the figure and chart below:



UAS C Band (85 kHz) Channels 3, 23, 39

	205 kHz	170 kHz	130 kHz	85 kHz			45 kHz			
CH	A	B	C	D1	D2	D8	E1	E2	E3	E4
1	5040.9475	5040.925	5040.905	5040.8825	5040.9675	5041.0125	5040.8680	5040.9240	5040.9820	5041.0325
2	5041.1625	5041.140	5041.120	5041.0975	5041.1825	5041.2275	5041.0830	5041.1390	5041.1970	5041.2475
3	5041.3775	5041.355	5041.335	5041.3125	5041.3975	5041.4425	5041.2980	5041.3540	5041.4120	5041.4625
4	5041.5925	5041	5041.550	5041.5275	5041.6125	5041.6575	5041.5130	5041.5690	5041.6270	5041.6775
5	5041	Channel 3 D1 & D2	041.765	5041.7425	5041.8275	5041.8725	5041.7280	5041.7840	5041.8420	5041.8925
6	5042.0		5041.980	5041.9575	5042.0425	5042.0875	5041.9430	5041.9990	5042.0570	5042.1075
7	5042.2375	5042.215	5042.195	5042.1725	5042.2575	5042.3025	5042.1580	5042.2140	5042.2720	5042.3225
8	5042.4525	5042.430	5042.410	5042.3875	5042.4725	5042.5175	5042.3730	5042.4290	5042.4870	5042.5375
9	5042.6675	5042.645	5042.625	5042.6025	5042.6875	5042.7325	5042.5880	5042.6440	5042.7020	5042.7525
10	5042.8825	5042.860	5042.840	5042.8175	5042.9025	5042.9475	5042.8030	5042.8590	5042.9170	5042.9675
11	5043.0975	5043.075	5043.055	5043.0325	5043.1175	5043.1625	5043.0180	5043.0740	5043.1320	5043.1825
12	5043.3125	5043.290	5043.270	5043.2475	5043.3325	5043.3775	5043.2330	5043.2890	5043.3470	5043.3975
13	5043.5275	5043.505	5043.485	5043.4625	5043.5475	5043.5925	5043.4480	5043.5040	5043.5620	5043.6125
14	5043.7425	5043.720	5043.700	5043.6775	5043.7625	5043.8075	5043.6630	5043.7190	5043.7770	5043.8275
15	5043.9575	5043.935	5043.915	5043.8925	5043.9775	5044.0225	5043.8780	5043.9340	5043.9920	5044.0425
16	5044.1725	5044.150	5044.130	5044.1075	5044.1925	5044.2375	5044.0930	5044.1490	5044.2070	5044.2575
17	5044.3875	5044.365	5044.345	5044.3225	5044.4075	5044.4525	5044.3080	5044.3640	5044.4220	5044.4725
18	5044.6025	5044.580	5044.560	5044.5375	5044.6225	5044.6675	5044.5230	5044.5790	5044.6370	5044.6875
19	5044.8175	5044.795	5044.775	5044.7525	5044.8375	5044.8825	5044.7380	5044.7940	5044.8520	5044.9025
20	5045.0325	5045.010	5044.990	5044.9675	5045.0525	5045.0975	5044.9530	5045.0090	5045.0670	5045.1175
21	5045.2475	5045.225	5045.205	5045.1825	5045.2675	5045.3125	5045.1680	5045.2240	5045.2820	5045.3325
22	5045.4625	5045.440	5045.420	5045.3975	5045.4825	5045.5275	5045.3830	5045.4390	5045.4970	5045.5475
23	5045.6775	5045.655	5045.635	5045.6125	5045.6975	5045.7425	5045.5980	5045.6540	5045.7120	5045.7625
24	5045.8925	5045	5045.850	5045.8275	5045.9125	5045.9575	5045.8130	5045.8690	5045.9270	5045.9775
25	504	Channel 23 D1 & D2	46.065	5046.0425	5046.1275	5046.1725	5046.0280	5046.0840	5046.1420	5046.1925
26	5046		5046.280	5046.2575	5046.3425	5046.3875	5046.2430	5046.2990	5046.3570	5046.4075
27	5046.5375	5046.515	5046.495	5046.4725	5046.5575	5046.6025	5046.4580	5046.5140	5046.5720	5046.6225
28	5046.7525	5046.730	5046.710	5046.6875	5046.7725	5046.8175	5046.6730	5046.7290	5046.7870	5046.8375
29	5046.9675	5046.945	5046.925	5046.9025	5046.9875	5047.0325	5046.8880	5046.9440	5047.0020	5047.0525
30	5047.1825	5047.160	5047.140	5047.1175	5047.2025	5047.2475	5047.1030	5047.1590	5047.2170	5047.2675
31	5047.3975	5047.375	5047.355	5047.3325	5047.4175	5047.4625	5047.3180	5047.3740	5047.4320	5047.4825
32	5047.6125	5047.590	5047.570	5047.5475	5047.6325	5047.6775	5047.5330	5047.5890	5047.6470	5047.6975
33	5047.8275	5047.805	5047.785	5047.7625	5047.8475	5047.8925	5047.7480	5047.8040	5047.8620	5047.9125
34	5048.0425	5048.020	5048.000	5047.9775	5048.0625	5048.1075	5047.9630	5048.0190	5048.0770	5048.1275
35	5048.2575	5048.235	5048.215	5048.1925	5048.2775	5048.3225	5048.1780	5048.2340	5048.2920	5048.3425
36	5048.4725	5048.450	5048.430	5048.4075	5048.4925	5048.5375	5048.3930	5048.4490	5048.5070	5048.5575
37	5048.6875	5048.665	5048.645	5048.6225	5048.7075	5048.7525	5048.6080	5048.6640	5048.7220	5048.7725
38	504	Channel 39 D1 & D2	048.860	5048.8375	5048.9225	5048.9675	5048.8230	5048.8790	5047.9370	5048.9875
39	504		049.075	5049.0525	5049.1375	5049.1825	5048.0380	5048.0940	5049.1520	5049.2025
40	5049.3325	5049.310	5049.290	5049.2675	5049.3525	5049.3975	5049.2530	5049.3090	5049.3670	5049.4175
41	5049.5475	5049.525	5049.505	5049.4825	5049.5675	5049.6125	5049.4680	5049.5240	5049.5820	5049.6325

8. FAA Approval - Aviation Protected Spectrum channels

Harris has received approval from the FAA for all (12) Aviation Protected Spectrum channels requested by Harris to support our Experimental License application with the FCC. The details of these approvals including FAA Tracking Numbers are described below:

For additional information please contact:

FAA Spectrum Office
Don Nellis
Donald.Nellis@faa.gov
(202)267.9779

8.1. FAA Approvals UAS C Band Channel 3 – D1 Base Station and Mobile

TRK 183072 (NG T180550) Summary

Attribute	Record Parameter
Serial Number	NG T180550
Frequency	M5041.3125
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0015
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 3 – D1 (Base Station)

TRK 183071 (NG T180549) Summary

Attribute	Record Parameter
Serial Number	NG T180549
Frequency	M5041.3125
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0000
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 3 – D1 (Mobile)

8.2. FAA Approvals UAS C Band Channel 3 – D2 Base Station and Mobile

TRK 183076 (NG T180554) Summary

Attribute	Record Parameter
Serial Number	NG T180554
Frequency	M5041.3975
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0015
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 3 – D2 (Base Station)

TRK 183075 (NG T180553) Summary

Attribute	Record Parameter
Serial Number	NG T180553
Frequency	M5041.3975
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0000
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 3 – D2 (Mobile)

8.3. FAA Approvals UAS C Band Channel 23 – D1 Base Station and Mobile

TRK 183078 (NG T180556) Summary

Attribute	Record Parameter
Serial Number	NG T180556
Frequency	M5045.6125
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0015
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 23 – D1 (Base)

TRK 183077 (NG T180555) Summary

Attribute	Record Parameter
Serial Number	NG T180555
Frequency	M5045.6125
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0000
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 23 – D1 (Mobile)

8.4. FAA Approvals UAS C Band Channel 23 – D2 Base Station and Mobile

TRK 183081 (NG T180558) Summary

Attribute	Record Parameter
Serial Number	NG T180558
Frequency	M5045.6975
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0015
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 23 – D2 (Base)

TRK 183080 (NG T180557) Summary

Attribute	Record Parameter
Serial Number	NG T180557
Frequency	M5045.6975
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0000
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 23 – D2 (Mobile)

8.5. FAA Approvals UAS C Band Channel 39 – D1 Base Station and Mobile

TRK 183083 (NG T180560) Summary

Attribute	Record Parameter
Serial Number	NG T180560
Frequency	M5049.0525
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0015
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 39 – D1 (Base)

TRK 183082 (NG T180559) Summary

Attribute	Record Parameter
Serial Number	NG T180559
Frequency	M5049.0525
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0000
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 39 – D1 (Mobile)

8.6. FAA Approvals UAS C Band Channel 39 – D2 Base Station and Mobile

TRK 183087 (NG T180564) Summary

Attribute	Record Parameter
Serial Number	NG T180564
Frequency	M5049.1375
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0015
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 39 – D2 (Base)

TRK 183086 (NG T180563) Summary

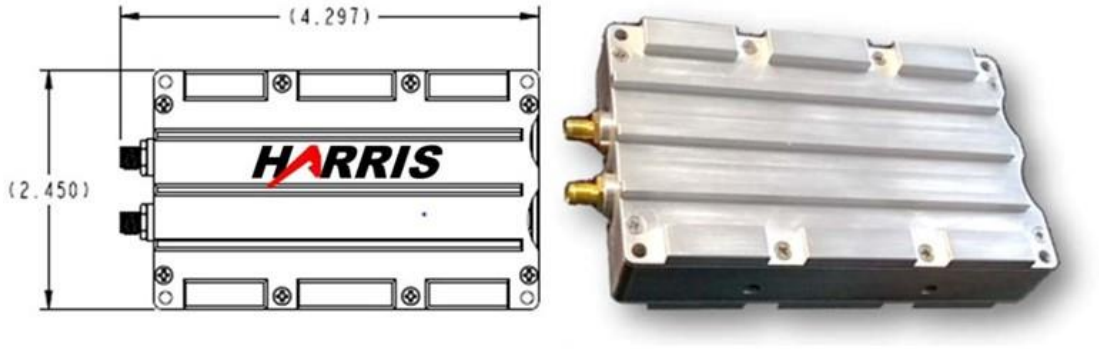
Attribute	Record Parameter
Serial Number	NG T180563
Frequency	M5049.1375
City	MALABAR
State	FL
Transmitter Radius	9
Transmitter Latitude	275853.00N
Transmitter Longitude	0803320.00W
Antenna Height	0000
Receiver Latitude	275853.00N
Receiver Longitude	0803320.00W
Service Type	
Equipment Type	C,HAC HRS102721-001
Antenna Type	DIPOLE
Flight Level	
Runway Number	

Channel 39 – D2 (Mobile)

9. Harris CNPC Airborne (Mobile) Radio

The Harris CNPC radio is a Software Defined Radio (SDR) that has been guided by the evolution of UAS Industry Standards and our participation in SC-228, RTCA MOPs and RTCA DO-362. Our CNPC Radio implementation incorporates quad core processors, the latest generation Field Programmable Gate Array (FPGA), and a state of the art programmable frequency agile transceiver. The radio is a Technology Readiness Level of 7 and sufficiently mature to support Experimental Tests and demonstrations.

The Harris CNPC radio supports the C-band spectrum approved by the FAA for UAS CNPC radio use. The radio has 2 RF SMA Connectors to support the option of 2 Spatial Diversity antennas, required to mitigate against multipath propagation losses, reducing Bit Error Rates, and improving overall link performance. The radio also includes a connector J1 main interface, providing DC Power Input, USB, Ethernet, RS-232, etc. and a J2 camera interface, providing video inputs.



Harris CNPC (Mobile) UAV Radio

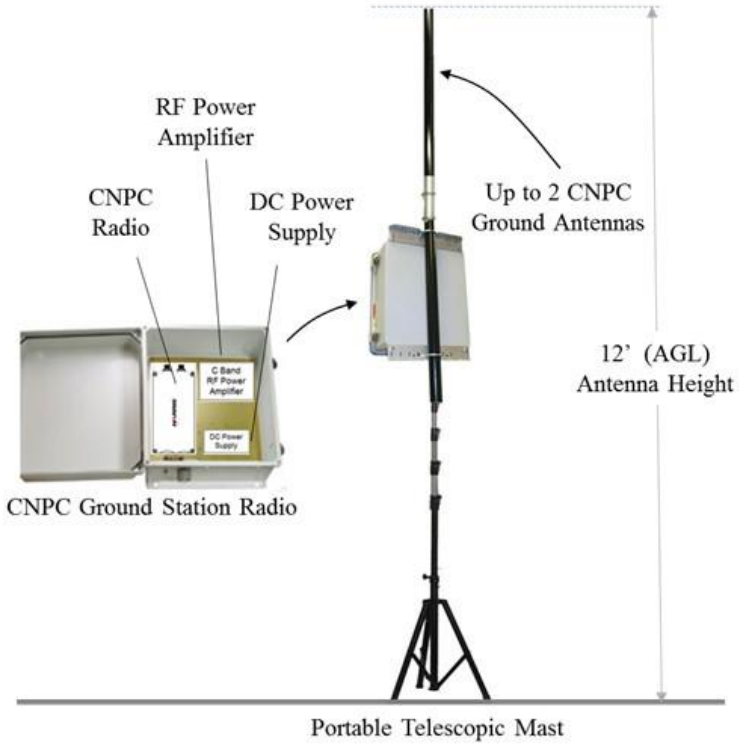
A web-based Graphical User Interface (GUI) is used to configure the radio. The radio control screen allows the operator to configure both ends of the link. A health and status monitoring feature is available via the GUI as well.

10. Harris CNPC (Fixed) Base Radio System

The Harris ground radio system includes a Harris CNPC radio, RF power amplifier (RFPA), and DC power supply. The RFPA increases the RF Power to 10 watts (40 dBm), which fulfills the need to close the CNPC Link with sufficient margin (12dB), while capable of supporting a minimum data rate of 20 kbps throughout all phases of planned UAV flight.

For the Experimental License we plan on using a COTS omnidirectional C-band antenna with a gain of 1 dBi. The CNPC ground radio system will be housed in a NEMA enclosure and mounted on a portable telescopic antenna mast that extends a minimum of 12 feet Above Ground Level (AGL). Note: Depending on area ground clutter it may be necessary to increase the height of the C Band Antenna to maintain VLOS with the HALE UAV.

The Harris CNPC Base Station will be configured as shown in the figure below:

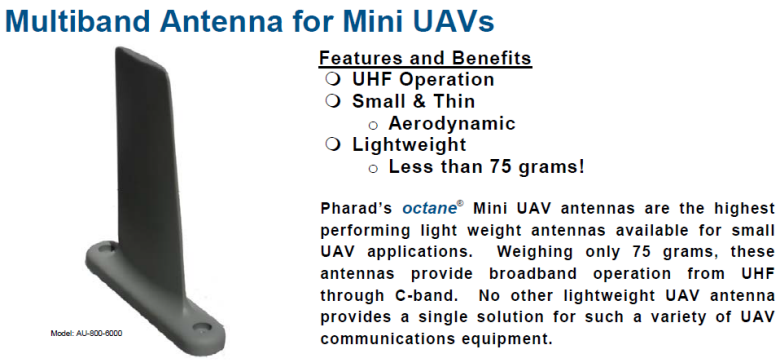


Harris CNPC Ground Station Equipment

11. Unmanned Air Vehicle (UAV) Mobile Antenna

We will evaluate several small form factor blade antennas, that are certified for aircraft use that are vertically polarized, low gain (<3 dBi), omnidirectional, with elevation patterns that are near-hemispherical in coverage such as the Octane and Taoglas mini-UAV antennas shown below:

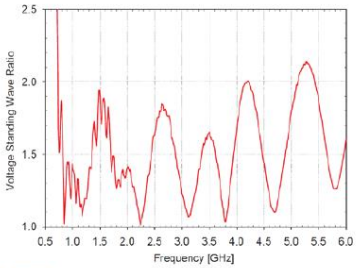
1. Octane www.octanewireless.com Model AU-800-6000 shown below:



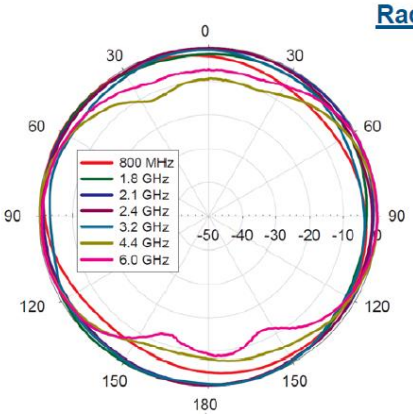
Characteristics

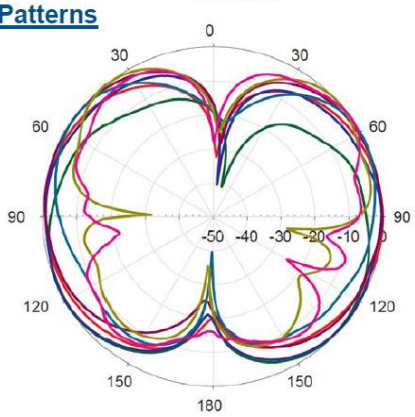
Model #	AU-800-6000
Frequency	800 – 6000 MHz
Gain	2.4 dBi @ 800 MHz 4.3 dBi @ 1500 MHz 5.0 dBi @ 6000 MHz
VSWR	< 2:1 800 – 4400 MHz < 2.2:1 4400 – 6000 MHz
Maximum Power	10 Watts
Pattern	Near omni
Polarization	Vertical
Radiator Size (H × W× L)	5.1" × 0.9"× 4.5"
Weight	75 grams
Connector Type	SMA

Typical VSWR



Radiation Patterns





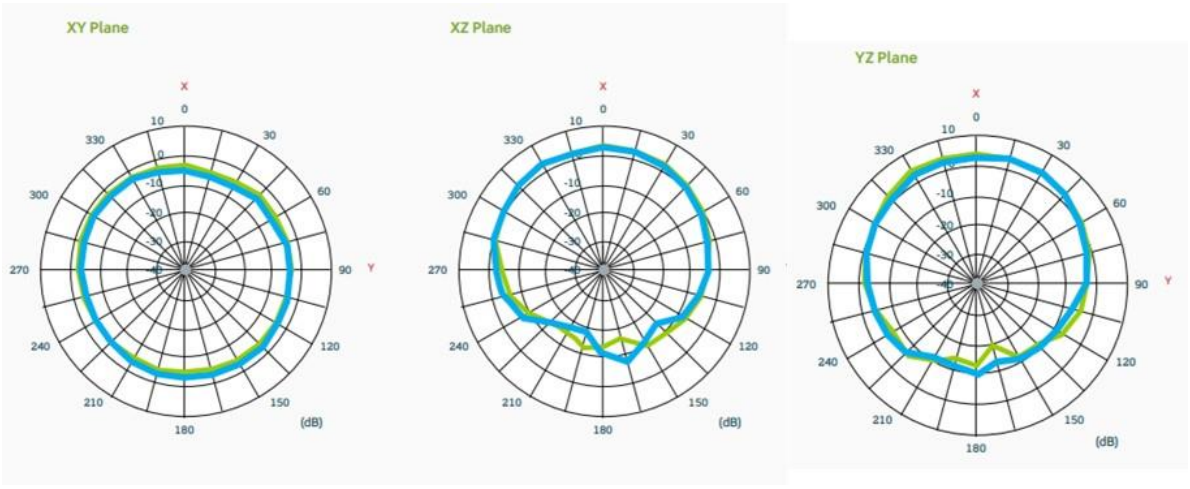
2. Taoglas WCM.10.005QQ111

- Designed for UAV / Drone Applications
- Connector Mount
- Right Hand Circularly Polarized
- IP67 Rating
- Dimensions: 30.7x34.9x17mm
- Cable: 50mm SS402 Coaxial Cable
- Connector: RP-SMA(M)

Part No: WCM.10.005QQ111

Description: Stratus 5-5.8GHz 3dBi SMA(M) Connector Mount Antenna with Semi-Rigid Flexiform 402 Cable

https://cdn.taoglas.com/datasheets/WCM.10.005QQ111.pdf



Typical UAV (Mobile Antenna)

12. CNPC (Fixed) Base Station Antenna

We will also evaluate several base station antennas, that are certified are vertically polarized, low gain (<3 dBi), omnidirectional, with elevation patterns that are near-hemispherical in coverage such as the Aruba and Southwest Antennas shown below:

12.1. Aruba Base Station Antenna

ANT-2x2-5010 is a kit of two omnidirectional antennas for use in 802.11n MIMO mesh link and client access applications. The kit contains

2 differently polarized antennas to be used as a 2x2 MIMO pair, and provides coverage in the 4.9 – 5.875 GHz frequency band.

FREQUENCY/MAX GAIN
- 4.9 – 5.875 GHz (10dBi)

POLARIZATION
- Vpol antenna: linear, vertical
- Hpol antenna: linear, horizontal

BEAMWIDTH
- E-plane: 8 degrees (Vpol antenna), 9.5 degrees (Hpol antenna)
- H-plane: 360 degrees

IMPEDANCE
- 50 ohms

MAXIMUM INPUT POWER
- 10 watts

VSWR (MINIMUM PERFORMANCE)
- 2.0:1

DIMENSIONS
- 400 x 25 x 25 (Vpol), 451 x 25 x 25 (Hpol)

WEIGHT
- 400 (Vpol), 180 (Hpol)

HOUSING
- Radome: Polycarbonate, UV, White

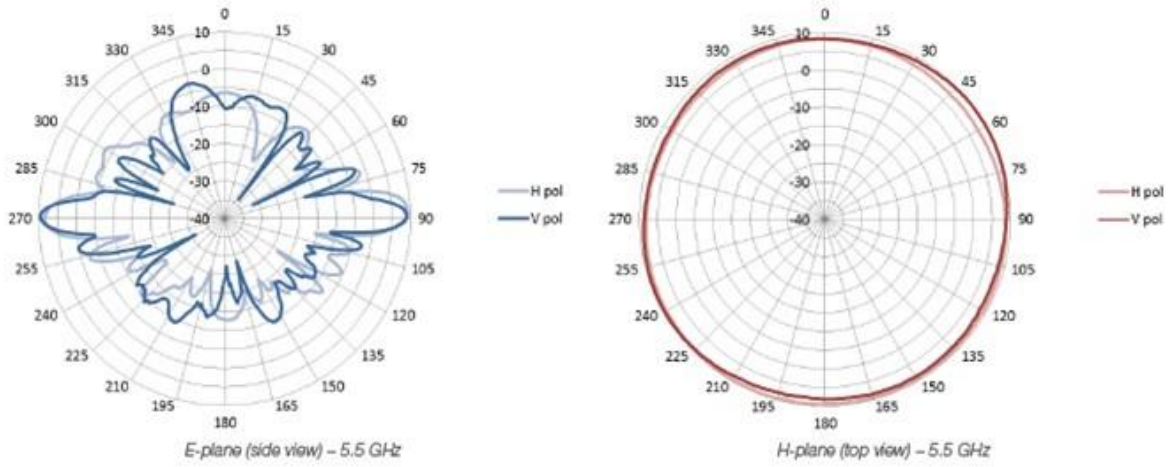
CONNECTOR
- N-type male (Note: RF cables not included)

OPERATING / STORAGE TEMP.
- -30C to +70C (operating), -40C to +85C (storage)

MOUNTING STYLE
- Direct mount on AP or pole mount

INSTALLATION HARDWARE
- Pole mount kit included.

Aruba Antenna -2x2-5010



Aruba Antenna Patterns

12.2. Southwest Antenna Part # 1032-012

Features:

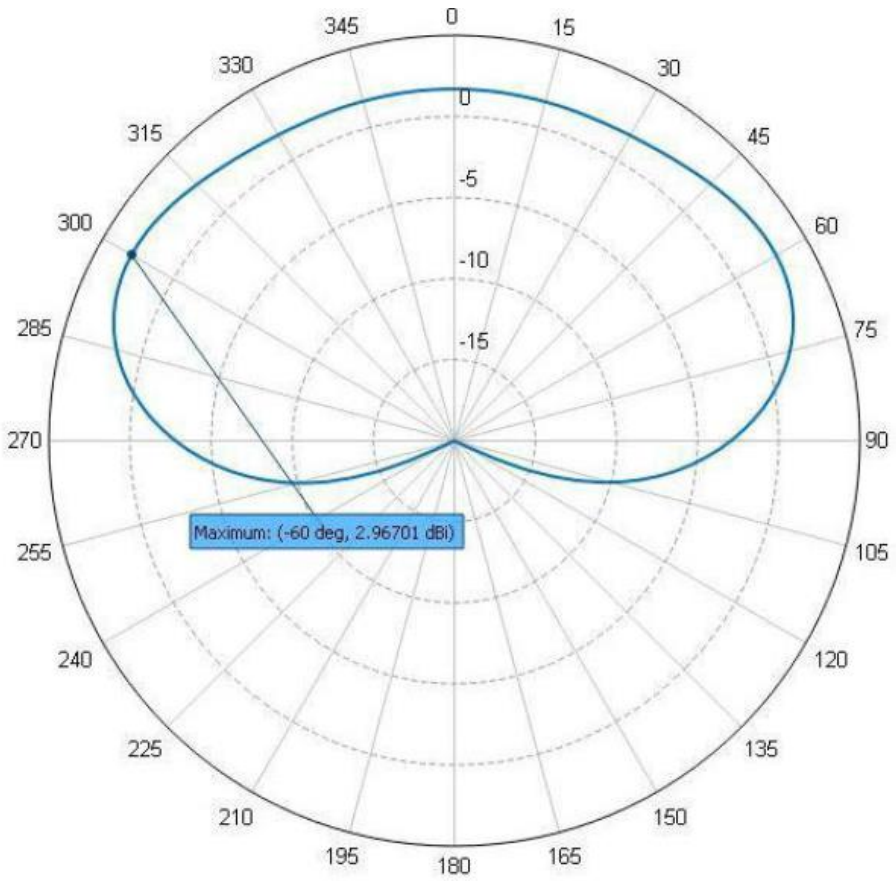
- Broad Band Coverage
- 4.7 - 5.2 GHz
- RHCP
- 3 dBic Omni Radiation Pattern
- Rugged G10 Radome, Flat Black
- Black Chrome N(m) RF Connector

Southwest Antenna
Omni Bifilar Antenna, Circularly Polarized, 4.7 - 5.2 GHz, 3 dBic

Antenna Specifications

Parameter	Value	Units	Tolerance
Antenna Pattern	Omni Antenna		
Frequency Band	C		
Impedance	50	Ohms	
Minimum Frequency	4.7 / 4,700	GHz / MHz	
Maximum Frequency	5.2 / 5,200	GHz / MHz	
Frequency Bandwidth	0.5 / 500	GHz / MHz	
Maximum VSWR	2:1	Ratio	
Gain	3.00	dBic	
Horizontal (AZ) Beamwidth	360	Degrees	
Vertical (EL) Beamwidth	158	Degrees	
Ground Plane Required	No		
Radome Material	G10 Fiberglass		

Southwest Antenna – Key Parameters



Southwest Antenna – Elevation Pattern