

From: Craig Mauldin

To: Behnam Ghaffari

Date: September 28, 2015

Subject: FCC File No. 0618-EX-PL-2015

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Message:

The Mobile Ad Hoc Interoperability Networking Gateway (MAINGATE)

Government Contract Number: W911NF-15-C-0016

Sub-Contract Number: CART-ARL-RSAS

MAINGATE incorporates Dynamic Spectrum Access (DSA) technology that allows the radio to access up to twelve 1.2 MHz wide radio frequencies within a defined 20 MHz band. Using spectrum access rules, the DSA enabled MAINGATE radio will safeguard against using non-approved frequencies. Where policy calls for it, DSA spectrum access rules prevent MAINGATE from using frequencies occupied by other systems. MAINGATE senses the spectrum during expected quiet intervals. During the quiet intervals, the nodes in the MAINGATE network are all in receive mode with no transmitters. The sensed spectrum is processed to measure and evaluate signal power and spectral occupancy within the assigned 20 MHz band. MAINGATE selects up to 12 available 1.2 MHz sections for use and defines the unusable and unavailable 1.2 MHz sections. Unusable and unavailable sections are excluded and substitute frequencies are provided when available.

The MAINGATE system includes a Wireless IP Network (WIPN) radio and a gateway. Other radios physically plug into the gateway via wired analog and digital interfaces. The WIPN radio connects to the gateway via a wired Ethernet interface and provides the wireless backbone network between MAINGATE equipped nodes. This application relates to the WIPN radio, which determines all of the spectrum characteristics of the MAINGATE system. This application will be used for development and operational testing.

Testing will require a 20 MHz block of frequencies assigned anywhere within the radio frequency range. Degraded operation possible with narrower frequency allocation.

MAINGATE is intended to demonstrate interim capabilities, aid system development, and enable evaluation of performance and capabilities relative to user needs.

The MAINGATE radio channel bandwidth is 1.2 MHz and is capable of simultaneous operation with up to twelve (12) sub-channels are located within a 20 MHz span. The emission designation for each sub-channel is 1M20G2D.

The MAINGATE radio supports Single-Input Single-Output (SISO) and Multiple-Input Multiple-Output (MIMO) configurations.

In SISO configuration, only one transceivers is used for transmission.

In MIMO configuration, two transceivers operate cooperatively (simultaneously) on the same carrier frequencies.

Number of Operating Units:

Up to 40 devices will be operated in a single network in development and test environments, with 1 radio in transmit mode and up to 39 radios in receive mode at any particular time within the same environment.

Maximum Bit Rate: 1.12 Mbps

Modulation Techniques and Coding:

1.12 Mbps per each 1.2 MHz sub-channel. The max bit rate supported is up to 13.4 Mbps for 12 sub-channels.

Each 1.2 MHz channel consist of 21 tones with 50 KHz tone spacing or frequency spacing. Each OFDM tone is modulated with either BPSK or QPSK modulation (depending on channels characteristics).

RF Channeling Capability:

MAINGATE radio uses up to 12 1.2 MHz OFDM channels within a 20 MHz span. Each of the 1.2 MHz channels can be tuned in 50 KHz increments. Consecutive 1.2 MHz channels require center frequency separation of at least 1.2 MHz. The 1.2 MHz channels are not required to be consecutively.

The MAINGATE radio has the capability to operate in the following bands:

- a. 174 &ndash; 216 MHz
- b. 225 &ndash; 450 MHz
- c. 470 &ndash; 698 MHz

The band (s) of operation depend (s) on the specific MAINGATE configuration. For this phase of test Raytheon is requesting frequency band(s) 470 &ndash; 608 MHz and 614 &ndash; 698 MHz.

Location:

All sites listed below are fixed, with mobile units operating with-in 100 Km radius.

Oatman

State: AZ

County: Maricopa

City: Gila Bend Mountains

Lat/Long: 33&deg; 3'4.38&quot;N 113&deg; 8'18.29&quot;W

Site Elevation: 1729 Ft, Antenna Height:

Radius of Operation: 100Km

White Tanks

State: AZ

County: Maricopa

City: Waddell

Lat/Long: 33&deg;34'32.47&quot;N 112&deg;34'41.43&quot;W

Site Elevation: 4048 Ft, Antenna Height:

Radius of Operation: 100Km

Sacaton

State: AZ

County: Pinal

City: Sacaton

Lat/Long: 33&deg; 0'8.24&quot;N 111&deg;40'26.08&quot;W

Site Elevation: 2736 Ft, Antenna Height:

Radius of Operation: 100Km

State: AZ

County: Pima

City: Kitt Peak

Lat/Long: 31&deg;57'39.44&quot;N 111&deg;35'59.06&quot;W

Site Elevation: 7707 Ft, Antenna Height:

Radius of Operation: 100Km

State: AZ

County: Pima

City: Quijotoa

Lat/Long: 32&deg; 7'59.26&quot;N 112&deg; 9'31.74&quot;W

Site Elevation: 3922 Ft, Antenna Height:

Radius of Operation: 100Km

Atascosa  
State: AZ  
County: Santa Cruz  
City: Nogales  
Lat/Long: 31&deg;25'15.80&quot;N 111&deg; 8'49.30&quot;W  
Site Elevation: 6227 Ft, Antenna Height:  
Radius of Operation: 100Km

Mule  
State: AZ  
County: Cochise  
City: Hereford  
Lat/Long: 31&deg;28'53.70&quot;N 109&deg;57'33.74&quot;W  
Site Elevation: 7152 Ft, Antenna Height:  
Radius of Operation: 100Km

Keystone  
State: AZ  
City: Pima  
Lat/Long: 31&deg;52'38.71&quot;N 111&deg;12'55.13&quot;W  
Site Elevation: 6176 Ft, Antenna Height:  
Radius of Operation: 100Km

South  
State: AZ  
City: Phoenix  
Lat/Long: 33&deg;20'4.50&quot;N 112&deg; 3'35.10&quot;W  
Site Elevation: 2564 Ft, Antenna Height:  
Radius of Operation: 100Km

Childs  
State: AZ  
City: Ajo  
Lat/Long: 32&deg;26'44.20&quot;N 112&deg;57'14.70&quot;W  
Site Elevation: 2834 Ft, Antenna Height:  
Radius of Operation: 100Km

Freeman  
State: AZ  
City: Gila Bend  
Lat/Long: 32&deg;50'37.68&quot;N 112&deg;18'22.39&quot;W  
Site Elevation: 1792 Ft, Antenna Height:  
Radius of Operation: 100Km

#### Transmitter Equipment Characteristics:

Model Number: Raytheon Maingate 902963  
Experimental: No  
Frequency Band(s): 470 &ndash; 608 MHz and 614 &ndash; 698 MHz.  
Emission Designator: 1M20G2D  
Power: 7W Mean Power

#### Antenna Characteristics:

Type: Dipole (Omni-directional center-fed dipole)  
Polarization: Vertical Linear

Frequency Range: 470 - 698 MHz  
Antenna Gain: 2 dBi  
Horizontal Beamwidth: 360&deg;  
Vertical Beamwidth: 80&deg;  
Sector Blanking: No

Stop Buzzer: Timothy Strobel 714-446-4313 or 714-330-2410  
Stop Buzzer2: Tushar Patel 714-446-4304 or 714-333-8113  
Start Date: February 1, 2015  
End Date: February 1, 2018