



# NATIONAL RADIO ASTRONOMY OBSERVATORY

POST OFFICE BOX 2  
GREEN BANK, WV 24944-0002  
NRQZ OFFICE TELEPHONE (304) 456-2107  
HTTP://WWW.GB.NRAO.EDU/

FAX (304) 456-2276  
NRQZ@NRAO.EDU

December 22, 2017  
Page 1 of 2  
NRQZ ID: 11183\_14NOV2017

FCC Regulatory Group  
Wavestream Corporation  
545 W. Terrace Drive  
San Dimas, CA 91773

|                                |  |
|--------------------------------|--|
| Application Reason/Purpose     | Prior coordination notification  |
| File Number                    | Shall be provided by applicant   |
| Applicant Name                 | Addressee  |
| Call Sign                      | Various  |
| Site Name or Loc               | Hot Springs, VA 38 01 59.7N, 79 46 46.5W* <i>(Special Conditions)</i><br>Monterey, VA 38 25 41.1N, 79 35 46.8W |
| System Configuration           | See attached "Site Specific Data"<br>See attached "Final Engineering" for Hot Springs                          |
| Previous NRAO Coordination No. | NRQZ ID None Listed  |
| Current NRAO Coordination No.  | NRQZ ID 11183_14NOV2017  |

Dear Applicant:

The National Radio Quiet Zone (NRQZ) has evaluated these facilities to determine the interference impact on our highly sensitive radio astronomy operations.

### **Special Condition: Hot Springs, VA**

The National Radio Astronomy Observatory (NRAO), Green Bank, WV, objects unless the Applicant's license is restricted to an Effective Radiated Power (ERP) of 7532 Watts per 308 kHz unit bandwidth at Azimuth 353.2 degrees True.

To meet this Special Condition, the Applicant shall:

1. Use the final engineering submitted by Gary Edwards, Comsearch, indicating that all facilities meet the ERP restriction.
2. Arrange for a site inspection to verify the implementation of this Special Condition.
3. Post a copy of this document and associated attachments at the Transmit facility.

### **Regulatory**

The NRQZ Office requests that:

1. The FCC places the Special Condition on the Station License.
2. This Letter of Concurrence be attached to the FCC application.
3. The applicant provides the NRQZ Office with notice of its official filing with the FCC per section 47CFR1.924 (a) (2).

Reference Copy / Approved with Special Conditions



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The National Radio Astronomy Observatory (NRAO) site located at Green Bank, Pocahontas County, WV, has no objection to this frequency assignment provided the special conditions are met.

The Sugar Grove Research Station, the former Naval Radio Research Observatory (NRRO), located at Sugar Grove, Pendleton County, WV has no objections to this frequency assignment.

This letter constitutes coordination of assignment in the National Radio Quiet Zone as required by the FCC Rules and Regulations 47CFR1.924.

If I may be of assistance, please feel free to contact me.

Sincerest regards,

Paulette W. Woody  
NRQZ Office Administrator  
PWW:pww

cc: Gary Edwards, Comsearch

file: 11183.docx

Attachments: Final Engineering

This concurrence remains valid provided the data contained within is consistent with the applicant's filing at the Commission. Any discrepancy in system parameters, such as geographical coordinates (Latitude, Longitude, AMSL), antenna height above ground level (AGL), antenna gains or directivity (orientation), channel (operating frequency or frequency bands), emission type, and power requires re-coordination. If the Commission has questions regarding the validity of this or any concurrence, please direct inquiries to [nrqz@nrao.edu](mailto:nrqz@nrao.edu) or 304-456-2107.

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| NRQZ ID           | Max TX Pwr (W) | Max Gain (dBi) | Antenna Model           | Calculated Max ERPd per TX (W) prior to system loss | Lat N NAD83 | Lon W NAD83 | MSL (m) | AGL (m) | Freq Low (MHz) | Freq High (MHz) | Bandwidth BW (MHz) | AZ ° True                            | Mechanical-DT | Electrical-DT |
|-------------------|----------------|----------------|-------------------------|---|-------------|-------------|---------|---------|----------------|-----------------|--------------------|--------------------------------------|---------------|---------------|
| 11183 Hot Springs | 4              | 43.3           | Skyware Global Type 123 | 52126.7   | 38 01 59.7  | 79 46 46.5  | 1032.23 | 2.74    | 14000          | 14500           | 0.308              | 149.7 to 252.7 degrees, EL 41.3-12.3 | 0             | 0             |
| 11183 Monterey    | 4              | 43.3           | Skyware Global Type 123 | 52126.7   | 38 25 41.1  | 79 35 46.8  | 1117.81 | 2.74    | 14000          | 14500           | 0.308              | 150.2 to 252.7 degrees, EL 12.0-41.0 | 0             | 0             |

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NRQZ# 11183 Hot Springs 12/18/2017 DATE  
<http://www.ngdc.noaa.gov/geomag-web/#declination> Magnetic Declination Correction 8.95 ° West  
8° 57' W ± 0° 21' changing by 0° 2' W per year

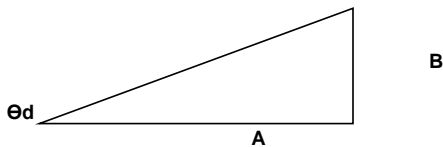
Location: Hot Springs, VA Latitude: 38 01 59.7 (ddmmss.s)  
 298 Woodside Lane Longitude: 79 46 46.5 (ddmmss.s)  
Hot Springs, VA Ground Elev.: 1032.23 Meters 3386.5 Ft  
 Antenna Ht.: 2.74 Meters 9.0 Ft  
 Frequency: 14000 - 14500 MHz

NRAO AERP (watts) 7532 watts at 353.2 ° True (Φd)  
 Bandwidth 308 kHz watts at 353.2 ° True  
 Diffraction 353.2 ° True

| Sector Name or Indicator                            | 1                     |                       |
|---|-----------------------|-----------------------|
|   | Skyware Global        | Skyware Global        |
| a. Antenna Type                                     | <u>41.15</u> dBd      | <u>41.15</u> dBd      |
| b. Maximum Antenna Gain                             | <u>41.15</u> dBd      | <u>41.15</u> dBd      |
| c. Antenna Azimuth (° True or "omni")               | <u>149.7</u> °T to    | <u>252.7</u> °T to    |
| Antenna Azimuth (Mag)                               | <u>158.7</u> °Mag     | <u>261.7</u> °Mag     |
| d. Az to GBT on Antenna Pattern                     | <u>203.5</u> °        | <u>100.5</u> °        |
| e. Antenna Gain to GBT (b -   f  )                  | <u>-7.91</u> dB       | <u>-10.00</u> dB      |
| f. Antenna Gain to GBT Below Maximum                | <u>-49.06</u> dB      | <u>-51.15</u> dB      |
| g. Mechanical Downtilt (Φbt)                        | <u>12.3 - 41.3</u> °  | <u>12.3 - 41.3</u> °  |
| h. Loss to GBT Due to Mechanical Downtilt           | <u>        </u> dB    | <u>        </u> dB    |
| i. Transmitter Output Power                         | <u>4</u> watts        | <u>4</u> watts        |
| j. System Losses: Combiner/Duplexer                 | <u>        </u> dB    | <u>        </u> dB    |
| Lightning Arrestor                                  | <u>        </u> dB    | <u>        </u> dB    |
| Main Line   | <u>        </u> dB    | <u>        </u> dB    |
| RF Filter   | <u>        </u> dB    | <u>        </u> dB    |
| Misc. connectors, etc.                              | <u>        </u> dB    | <u>        </u> dB    |
| j. System Loss                                      | <u>0.00</u> dB        | <u>0.00</u> dB        |
| k. Power to Antenna (ix j)                          | <u>4.00</u> watts     | <u>4.00</u> watts     |
| l. Main Beam Power (k x b)                          | <u>52126.67</u> watts | <u>52126.67</u> watts |
| m. ERPd to GBT (l x (f + h)) or (l x (e - (h + j))) | <u>0.65</u> watts     | <u>0.40</u> watts     |

Power at output of duplexer 4.00  
4.00

**AZ bearing range 149.7° - 252.7° True**



Enter 1st Obstacle Information provided by NRQZ office

|                                  |                                      |                     |
|----------------------------------|--------------------------------------|---------------------|
| <u>24.2</u> km to 1st Obstacle   | Θd = Angle to 1st Obstacle           | <u>79396</u>        |
| <u>3395.57</u> TX AMSL (ft)      | A = Distance to 1st Obstacle in Feet | <u>-734.1791339</u> |
| <u>4129.75</u> AMSL 1st Obstacle | B = Ant Ht AMSL minus Ht of 1st Obs  |                     |
|                                  | Θd = arctan(B/A) =                   | <u>-0.53</u> °      |

A -Θd value indicates that the first obstacle is above the horizon  
 A +Θd value indicaes that the first obstacle is below the horizon

Effective mechanical downtilt adjustment:  
 Effective Elevation = Θd - Θbt cos(Φd - Φbt) =  
 Effective Elevation Adjustment =

Definitions:  
 Φd = Azimuth to GBT  
 Φbt = Azimuth of mechanical beam tilt (verticle)  
 Θd = Elevation to 1st obstacle (negative above horizon)  
 Θbt = Elevation of antenna mechanical beam tilt (neg. above horizon)

Note: No adjustments for electrical beam tilt are required because the pattern data already accounts for this

Effective azimuth on horizontal pattern = Φd - Antenna Azimuth (True) {If AZ<0, then add 360}  
 Effective elevation on vertical pattern = Θd - Θbt cos(Φd - Φbt) {IF ELEV<0, then add 360}

Antenna Gain = HPAT(Eff AZ) + VPAT(Eff ELEV) + Max Gain