

# Impacts of New Technologies at the Gray Hill Tower on VLA Operations

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## Abstract

NRAO was informed of a technology upgrade to a cell tower located near the East arm of the VLA in mid-May 2025. NRAO quickly raised concerns about the impact of this upgrade (that would include technologies transmitting above 1 GHz for the first time, including both LTE and 5G bands). The technology upgrade was carried out and activated on January 25, 2026. This memo describes the interactions between NRAO and the Cell Provider related to the Gray Hill tower, the experiments that were carried out in order to evaluate the impact of these technologies on normal VLA operations, and the actions taken by NRAO and the Cell Provider to mitigate these impacts. As of April 24th, 2026, the Cell Provider has deactivated the two sectors that faced telescopes in the VLA, and impacts from this tower’s upgrade have been minimized.

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## 1 Background Summary

NRAO received a written frequency notification on May 13th, 2025 through the Bureau of Land Management Socorro Field office. The notice stated that American Tower Corporation has filed an application as facility manager to modify equipment on behalf of the Cell Provider at the site Magdalena, NM (ATC Site : 89018 / Communication Site : NMNM009760 at Latitude 34.037991470 deg., Longitude: -107.446288120 deg.). This notification included a technology upgrade from previous operations at 622-642 and 728-734 MHz to the Gray Hill Tower, located near the East arm of the Jansky Very Large Array (VLA) in Fall 2025. In initial meetings, NRAO raised concerns about the impact of this upgrade (that would include technologies transmitting above 1 GHz for the first time, including both LTE and 5G bands). A full copy of the notification is attached to the appendix of this memo. The technology upgrade was carried out and activated on January 25, 2026. This memo describes the interactions between NRAO and the Cell Provider related to the Gray Hill tower, the experiments that were carried out in order to evaluate the impact of these technologies on normal VLA operations, and the actions taken by NRAO and the Cell Provider to mitigate these impacts. As of April 24th, 2026, the Cell Provider has deactivated the two sectors that faced telescopes in the VLA, and impacts from this tower's upgrade have been minimized.

### 1.1 Cell towers near the VLA

The cellular coverage framework around the VLA is not new, and is certainly not provider exclusive. There are numerous towers from all major providers situated along US-60, specifically on mountain tops just outside of Magdalena, Datil, and Pie Town (see Fig. 1). Throughout the region, there are other notable towers such as the tower on the Alamo Navajo Indian Reservation and Fox Mountain.

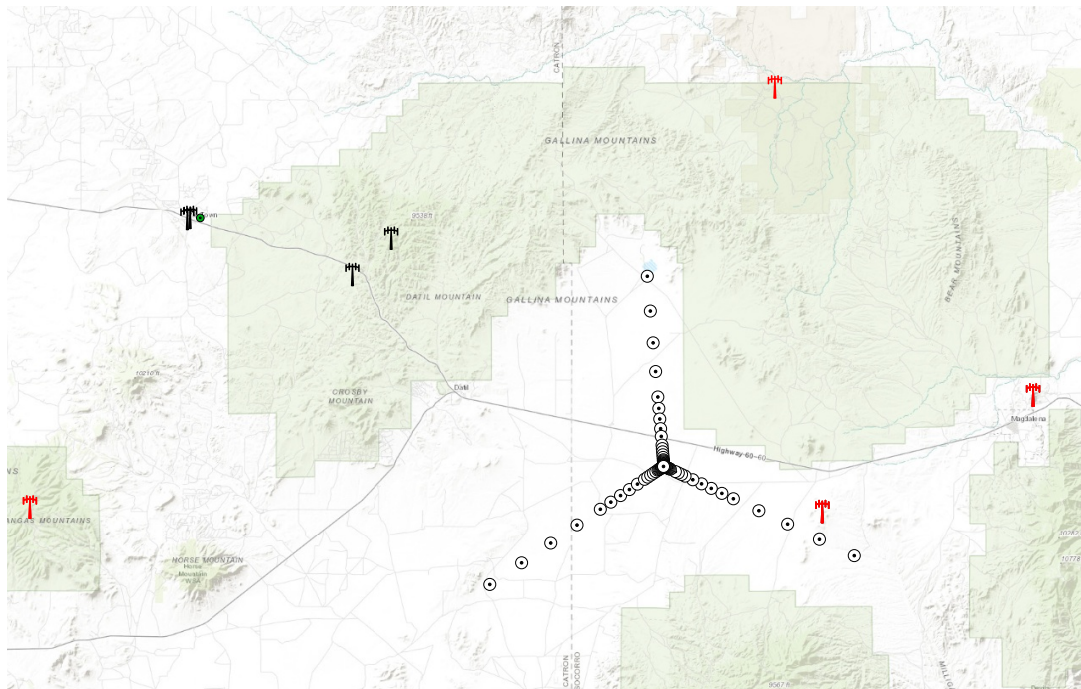


Figure 1: Locations of major communication towers surrounding the VLA. The white circle-dots denote locations of VLA antenna pads where antennas could be placed depending on desired configuration. The green circle-dot indicates the location of the VLBA Pie Town antenna. The Gray Hill tower is slightly North of the end of the second to last antenna pad of the East arm of the VLA.

However, the frequency in use, the radio frequency (RF) propagation effects, and the tower deployment all play a crucial role in the impact to VLA operations. Lower cellular frequencies have been at the forefront of network coverage in rural America over the past decade due to their ability to cover larger areas based on RF propagation characteristics. The frequency range of this low-band network does not directly overlap with VLA receivers, and therefore creates an RF environment of coexistence.

But technological advancements of consumer devices in the past decade have driven the desire for greater network speeds. This has resulted in cellular providers exploring the roll-out of higher frequency bands throughout rural America. Before the planned Gray Hill tower upgrade, none of the surrounding towers that had undergone technology upgrades had the combination of location or technical deployment that resulted in any disruption to VLA operations from their primary downlink transmission.

## 1.2 NRQZ versus NMRCZ

The National Radio Quiet Zone (NRQZ) was established by the Federal Communications Commission (FCC) in Docket No. 11745 (November 19, 1958) and by the Interdepartment Radio Advisory Committee (IRAC) in Document 3867/2 (March 26, 1958) to minimize possible harmful interference to the National Radio Astronomy Observatory (NRAO) in Green Bank, WV. NRQZ coordination is required for all new or modified, permanent, fixed, licensed transmitters inside the NRQZ, as specified for federal transmitters by NTIA Manual Section 8.3.9 and for non-federal transmitters by the FCC in 47 CFR § 1.924. This enables the Green Bank Observatory (GBO) to operate in an RF-quiet environment, and often results in terrestrial cellular providers applying power mitigation measures toward GBO. The New Mexico Radio Coordination Zone (NMRCZ) consists of the region in the Plains of San Agustin, New Mexico around the Karl G. Jansky Very Large Array (VLA) and the Very Long Baseline Array (VLBA) Pie Town site. Although not a formally defined and protected zone like the NRQZ, it was created by the NRAO to establish awareness and criteria for coordination and operation that can provide RFI protection for the VLA and VLBA. The NMRCZ is applicable to terrestrial, airborne, and satellite-based RF emitters, where NRAO greatly appreciates voluntary coordination for all transmitting radio frequency sources.

## 2 Summary of NRAO SMD Modeling and Coordination with the Cell Provider

NRAO SMD modeled the expected impact soon after receiving the initial notification of the Cell Provider's Gray Hill tower upgrade, with the intent to reduce the risk of VLA receiver signal compression in the 27 active antennas in each configuration, while not significantly impacting the planned service from the Gray Hill tower. The Cell Provider provided NRAO with all the necessary technical parameters not included in the initial notice to ensure that a full risk evaluation could be completed. The antenna sector azimuths and antenna pattern are shown in Figure 2, illustrating the cellular tower sectors expected to be problematic to VLA operations while in A configuration. The VLA-A configuration was chosen because it presents an immediate worst-case scenario for single VLA antennas due to the proximity of the Gray Hill tower to the east arm. Sectors are referred to in this memo as Alpha (orange), Beta (green) and Gamma (purple).

Signal compression limits for a VLA receiver were researched by NRAO SMD and used as the received-power threshold in the initial impact analysis. Signal compression is known to occur when a received signal exceeds the headroom of a component in the receiver cascade. From a 12 K cold-sky cascade spreadsheet created for the EVLA S-band receiver around 2015, the SMA-SMA ambient adapter before the ambient amplifier in the cascade presents the least amount of headroom, resulting in VLA receiver signal compression when the received signal reaches  $-3.8$  dBm or greater. NRAO notes, however, that this threshold has not been extensively validated in practice and should be treated with caution until tests yield complete results. Additionally, real-world effects such as reflections and unknown receiver sidelobe levels can alter the received signal relative to theoretical values.

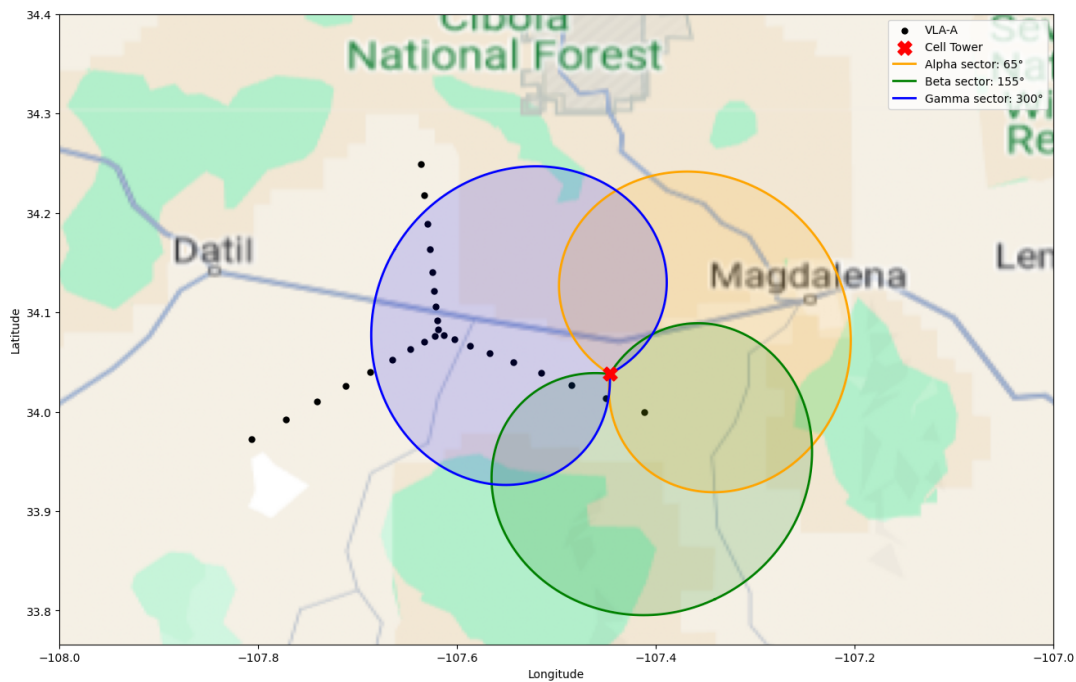


Figure 2: Gray Hill tower's planned AWS F block deployment of [65, 155, 300]° sectors with the 3GPP / ITU standard antenna, overlaid with the VLA in A configuration. Antenna pattern coverage size not to scale. Sectors are referred to in this memo as Alpha (orange), Beta (green) and Gamma (purple).

In evaluating the effective radiated power (ERP) in each direction from the planned cell-tower upgrades using the technical parameters provided by the Cell Provider, several items were identified after NRAO performed an RF propagation study to each receiver in VLA A configuration:

1. VLA pad E64, the worst-case scenario, resulted in a received power 9.6 dB above the theoretical signal-compression limit for a VLA receiver.
2. The signal at the VLA center is not the worst-case scenario for compression, but it contains the greatest density of antennas and includes the shortest baselines. The core will always be within the tower's gamma-sector main beam, increasing the impact to VLA operations.
3. All VLA pads are line of sight, increasing unknown risks not defined by the theoretical analysis.

As a result, NRAO proposed several recommendations to the Cell Provider prior to deployment of the upgraded technology:

1. Do not bring PCS and AWS upgrades to the Gray Hill tower.
2. Reduce transmitter power significantly for the beta and gamma sectors, or add electrical downtilt or uptilt to those sectors, to bring received power levels below the expected signal-compression limit.
3. Regardless of whether preliminary mitigation steps are taken, coordinate the testing and activation of the upgraded technologies and continue working with NRAO SMD to mitigate any issues observed with the VLA in these bands.

Through continued discussions, the Cell Provider expressed concerns about being unable to serve the region with PCS and AWS bands at both customer and regulatory levels, and planned to proceed with

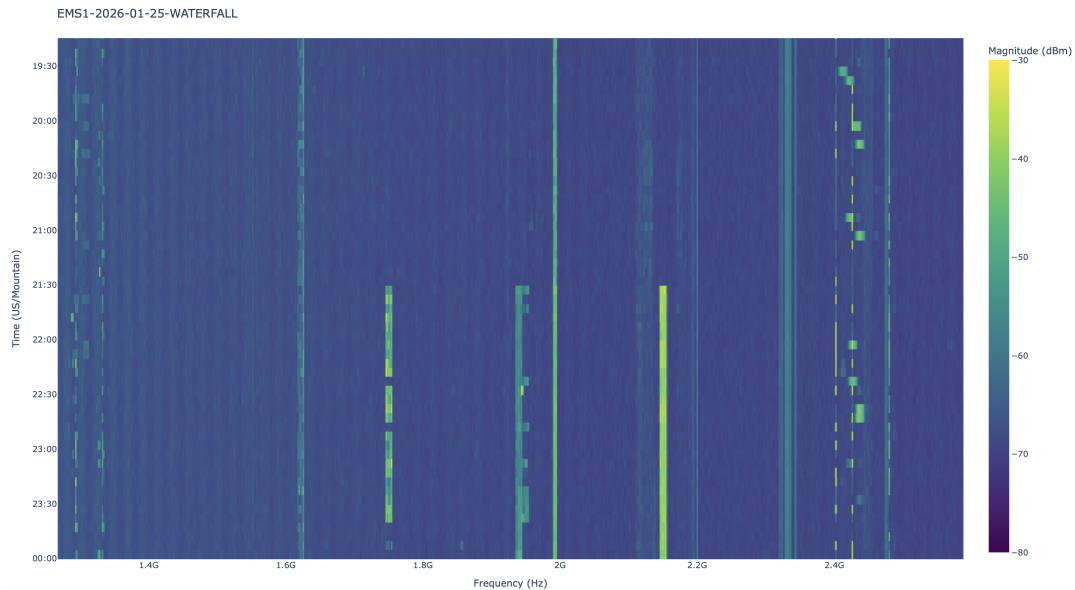


Figure 3: Waterfall plot generated from data taken by a spectrum monitoring device (ESM-1) located near the center of the VLA. Frequency bands associated with the tower’s technology upgrade can be seen as becoming occupied (“turning on”) around 21:30 MT.

the original deployment. However, based on NRAO’s recommendations, a test agreement was formed between the Cell Provider and NRAO stating that a coordinated test would be performed as the new upgrades were brought on air. The Cell Provider also expressed interest in continuing to work with NRAO should any problems with the planned deployment arise.

## 2.1 Technology Activation - January 25, 2026

On January 25th at 21:30 MT, the activation of the new technology on the tower was detected by a spectrum monitoring device, referred to as the ESM-1 (see Fig. 3), located near the center of the VLA, as well as afterward communicated to NRAO by the Cell Provider. The signals were in the expected bands and seemed to remain constantly active. The technology activation was also immediately apparent in VLA data as the tower was activated during an observation of NRAO’s VLA Sky Survey (VLASS; see Fig. 4), an all-sky survey taken in S-band. The VLA at that time was in the BnA configuration, where the North arm had antennas in a fully extended configuration, while the East and West arms were in a shorter configuration, putting the outermost antenna at larger distance from the Gray Hill tower than when antennas are placed near the closest pads in the most extended configuration.

In an attempt to better understand the technology upgrades’ impact on the VLA we collected flux density measurements from several VLASS observations. The value in using VLASS data was due to the high observing cadence, the reuse of common calibrator sources between the observations, and ease of access to flux density results via the weblogs generated by the VLA Calibration Pipeline (see Fig 5). Given the clear degradation in data quality but still unknown size of impact of the issue, the NRAO decided to suspend all regular S-band observing starting on February 23, 2026. In order to fully characterize the tower’s impacts on the VLA, NRAO reached out to the Cell Provider’s staff who graciously agreed to participate in coordinated testing.

Initial evaluation also included L-band observations (1.0–2.0 GHz), where new transmissions appeared as expected. However, it was determined that while this causes a slight reduction in usable bandwidth, the observed signal levels were more tolerable as compared to VLA’s S-band receiver (2.0-4.0 GHz). Thus follow-up tests focused on S-band mitigation. Spectrum monitoring following the activation also

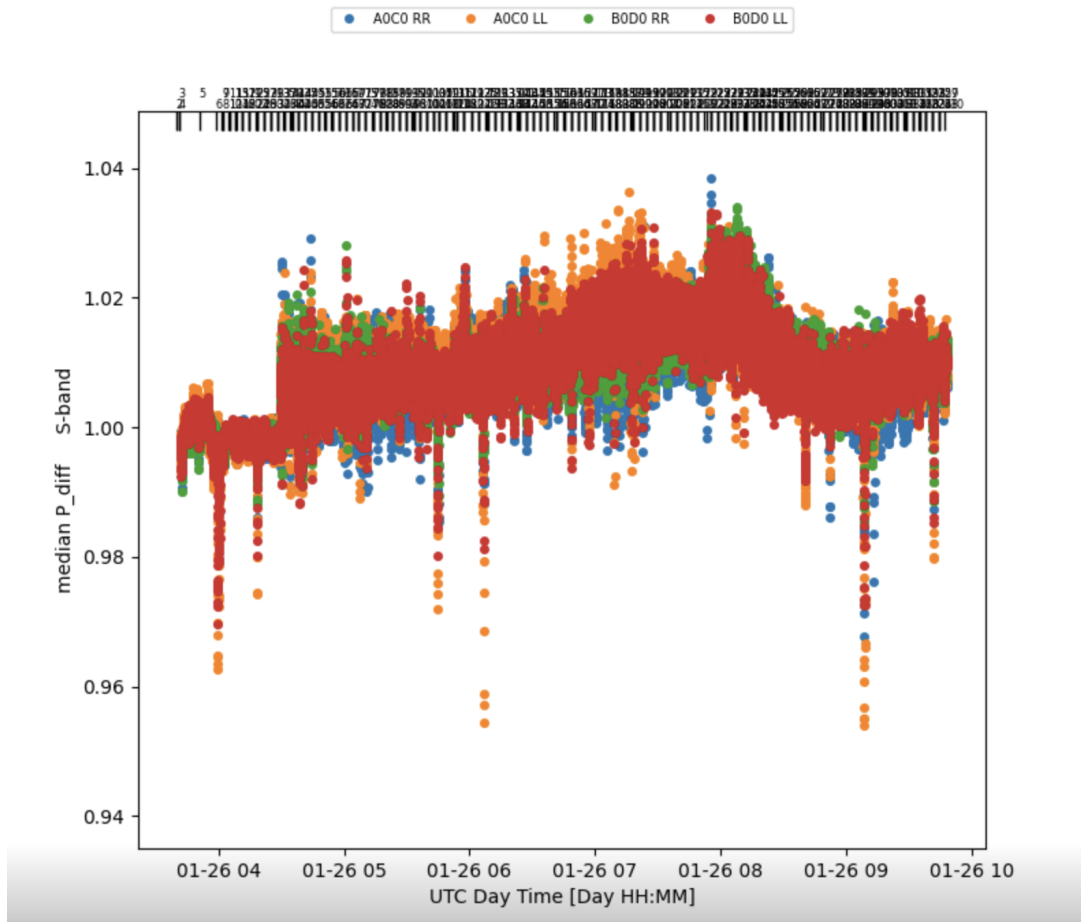


Figure 4: Plot of median Pdiff vs time for the VLASS observation which was running on the VLA as the tower's new technology upgrade came online. Pdiff, or power difference, is used as a diagnostic for antenna health where a calibrated noise signal is injected into the signal path at 10 Hz intervals. The general Pdiff level and noise can be seen to change at the time of the tower's activation. Note: unlike the ESM-1 from Figure 3, the VLA records data in UT. The conversion between UT and MT is -6 hours.

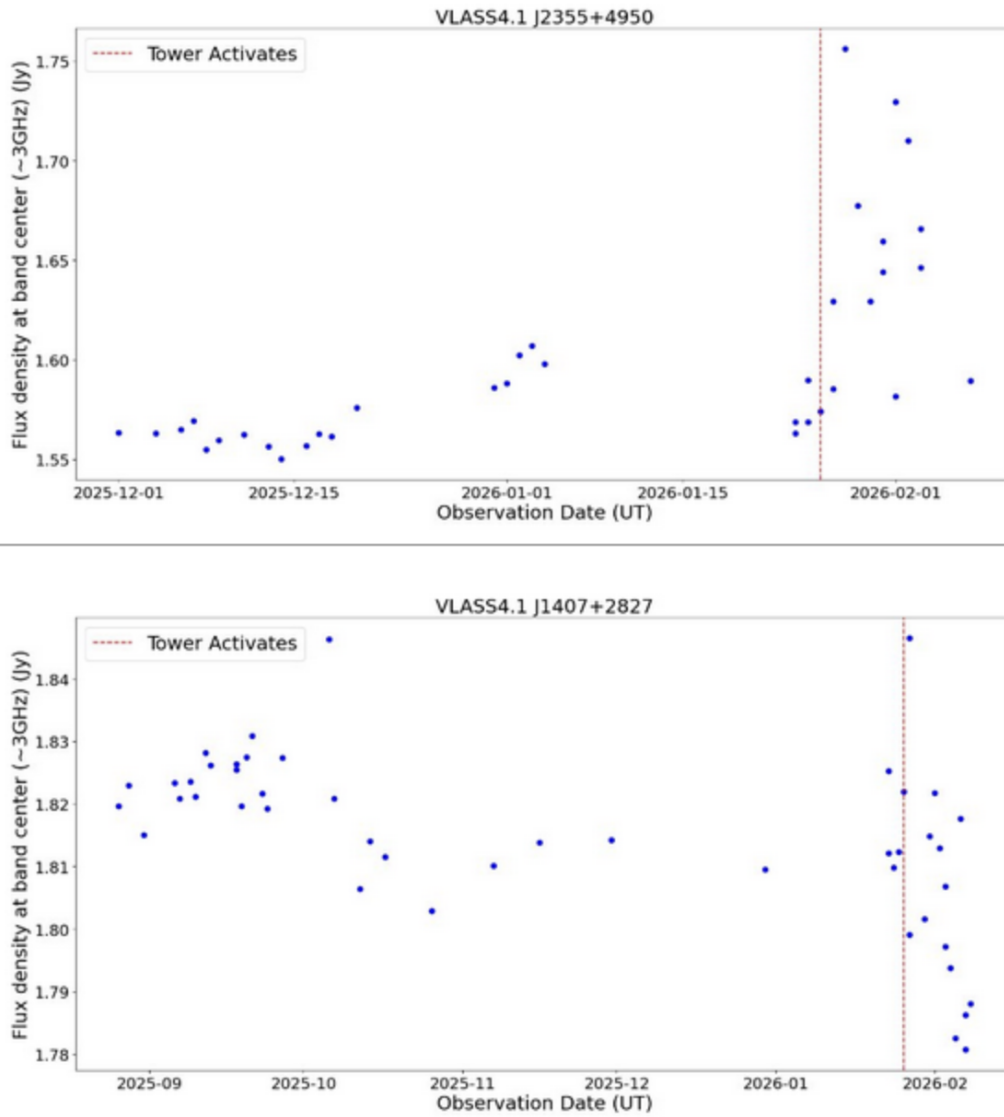


Figure 5: Flux density values vs observing date of two calibrators used by VLASS observations. The dashed red line indicates the time of the technology upgrades activation. Flux density uncertainty is relatively low with slow variation in time before the activation date and is clearly increased after activation.

noted increased traffic from mobile phones communicating with the new base station frequencies, with increased occupancy during regular working hours at the VLA. Given the absence of a formal mobile phone use policy at the VLA, due to previous non-interference nature in the primary transmission bands, this will likely have to be revisited internally going forward.

## 3 Test 1 - March 13, 2026

### 3.1 Methodology

The first coordinated test involved mimicking a typical science observation by observing one of the VLA's known flux density scale calibrators, 3C48, and a nearby weaker source, J0122+2502. These sources were observed during the day when they were in the direction of the tower (East). The correlator was set up to use the default S-band tuning ( $2 \times 1$  GHz wide basebands with  $16 \times 128$  MHz wide spectral windows) with the addition of a single 64 MHz wide high resolution ( $896 \times 71.43$  kHz wide channels) spectral window directly centered on the 2150 MHz signal.

The first test focused on observing the tower while it cycled between using a single sector of the three available (see Fig. 2). Additionally the test day concluded with the Cell Provider operating the Beta sector at a lower power level, a possible coordination option that was explored more in the second test. The full test schedule can be found below together with the corresponding NRAO archive file id, with each item having running through the observation sequence described above.

- All Sectors On (TRFI0007\_sb50461980\_1\_1.61112.65637070602)
- All Sectors Off (TRFI0007\_sb50461980\_1\_1\_000.61112.66701936343)
- Alpha (TRFI0007\_sb50461980\_1\_1\_001.61112.67668421296)
- Beta (TRFI0007\_sb50461980\_1\_1\_002.61112.68663841435)
- Gamma (TRFI0007\_sb50461980\_1\_1\_003.61112.6962457176)
- Beta Low Power Mode (TRFI0007\_sb50461980\_1\_1\_004.61112.7086319213)

### 3.2 Results

To compare the tests in a standard way each observation was run through the VLA's Calibration and Imaging Pipeline, which includes self-calibration on the target source, J0122+2502 in this case. Running each observation through the pipeline also allowed us to mimic the results a typical VLA user might be left with as this output (a calibrated measurement set and images) is more or less the current VLA standard data product.

As shown in Figure 6, there is a clear difference in the amount of power received at the VLA site from each of the different sectors. These ESM-1 results (independent from VLA data) agree well with what we expected based on the Alpha, Beta, and Gamma sector pointings shown in Figure 2. These results also agree with the VLA spectra taken live during the observations shown in Figure 7. Of particular note is that, based on these two Figures, the Alpha Only observation is largely the same as the All Sectors Off observation.

An interesting detail of the signal is noted in Figure 8. The signal is much brighter than the background noise level and seems to be well contained within its allocated bounds (2145-2155 MHz). It also seems to contain a very bright narrow band feature at the upper end of its allocation. From discussions with the Cell Provider after the test day we were informed this is referred to as a "NarrowBand Internet of Things" (NB-IoT), a type of signal present in certain types of cellular technology.

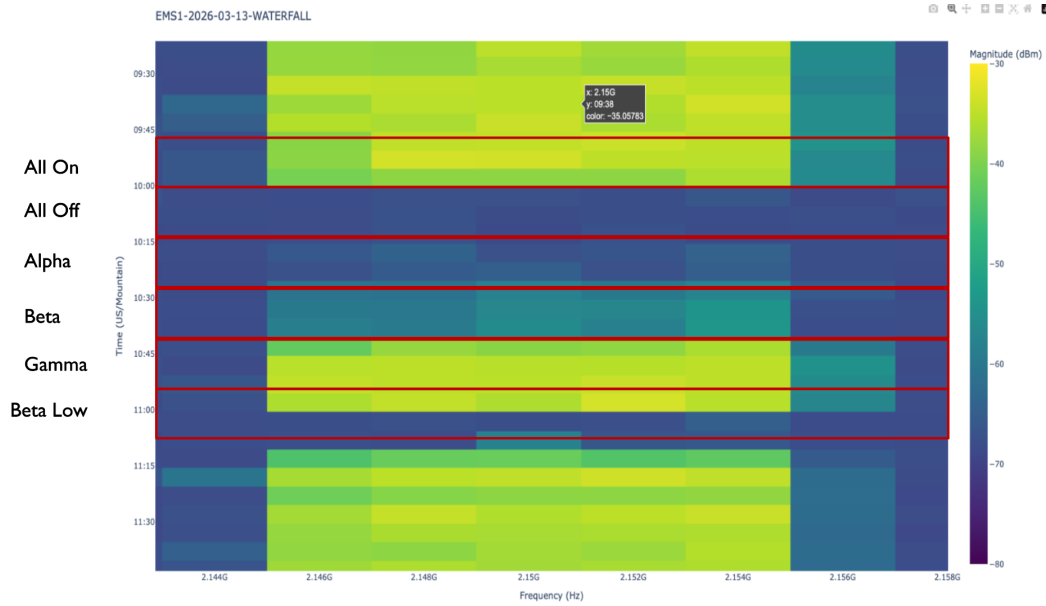


Figure 6: Waterfall plot of data taken with the ESM-1 during the first day of testing. The individual tests have been outlined in red.

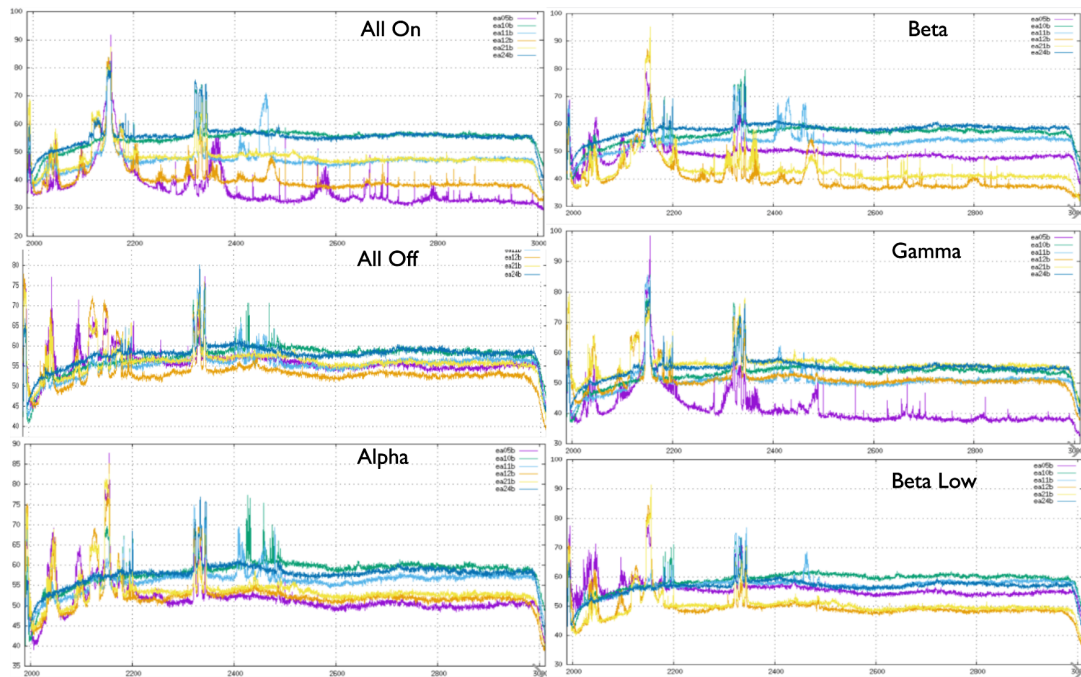


Figure 7: Spectra data taken during each of the observations from Test 1. Note the effects on the upper part of the baseband in the All On, Beta, and Gamma observations. Also of note is the average level differences between the antennas that are not present in the All Off state. Antennas EA05, EA12, EA21 being the three closest to the tower at the end of east arm, and antennas EA10, EA24, and EA11 being located at the ends of the north arm, west arm, and center of the array respectively.

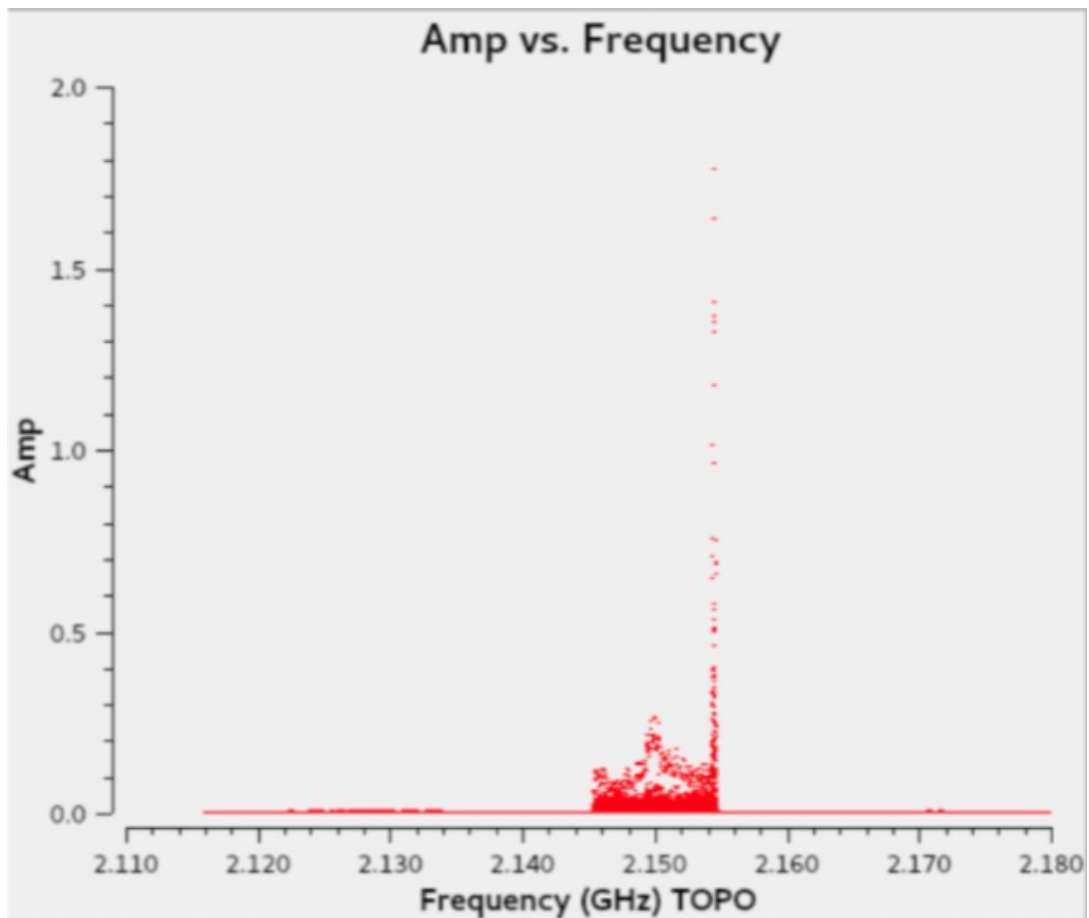


Figure 8: VLA data of the 2150 MHz signal taken from the high frequency resolution spectral window. The narrow feature at the top end of the band is a known signal type (NB-IoT).

The raw data and pipeline results were inspected and both showed signs of gain compression, particularly the lower frequency baseband and on the few antennas closest to the tower. Again, unsurprisingly, this effect seemed to be most prevalent when all sectors were in simultaneous use and in the Gamma sector.

Images of the target source, J0122+2502, were made using the full continuum band for each observation and are presented in Figure 9. CASA was used to fit the source's main component and extract the measured flux density. All flux densities agreed with each other to within a few percent ( $<4\%$ ), which we took as a sign that major compression effects, such as apparent reductions in flux density, were being handled by the standard continuum calibration provided by the pipeline.

The major differences in results between the observations were in the RMS noise levels of the images. The RMS noise level of the All Sectors On state, Gamma sector, and, surprisingly, Beta Low Power mode were all noticeably higher than the others. The Beta Low Power mode data was inspected and it was later discovered that the "low power" state was not in use for about half of the observation, which can be seen in the ESM-1 results at Figure 6. There were also strong, short lived signals that seemed to appear when the "low power" mode was first activated and then again at the end of the test when it was deactivated. Given this, the Beta Low Power mode image RMS is likely artificially high. A chart of RMS noise level, measured via the pixels outside of the clean mask, is presented in Figure 10.

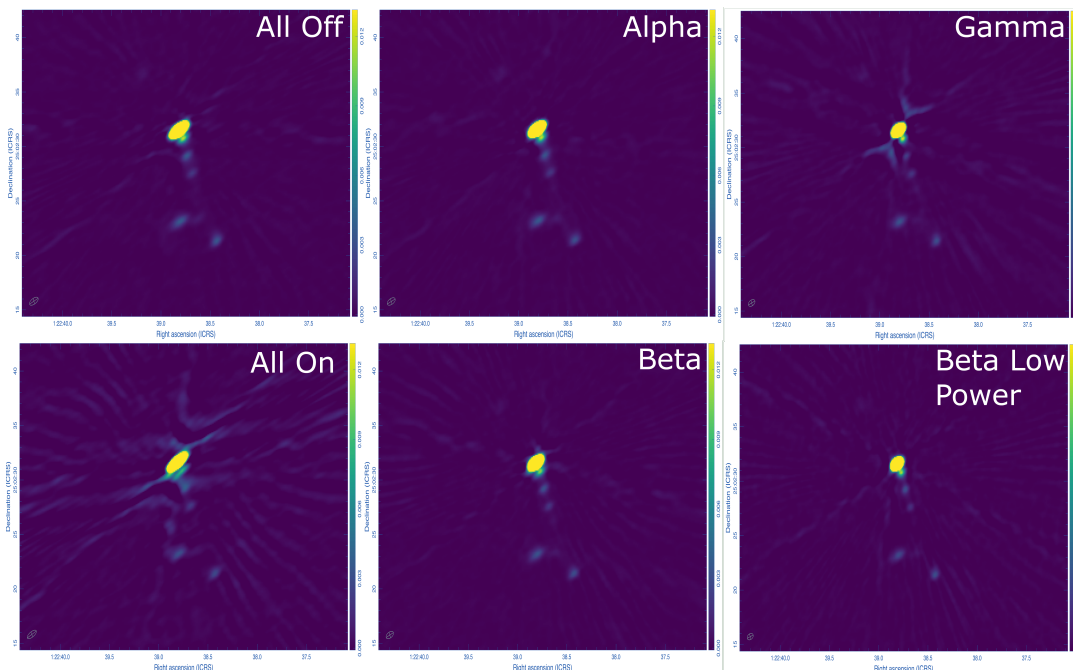


Figure 9: Images of each observation from Test 1 generated from the VLA Calibration and Imaging Pipeline, which includes self-calibration. All images are matched to the same color scale. The full images are much much larger than shown here and have been significantly zoomed to show the source.

## 4 Test 2 - April 9, 2026

### 4.1 Methodology

After the results of Test 1 were presented to the Cell Provider it was decided that a second round of testing should be performed to rule out the possibility of a "Gamma Low Power mode" being useful, as the Gamma sector had clearly the largest impact. The second round of testing used the same overall

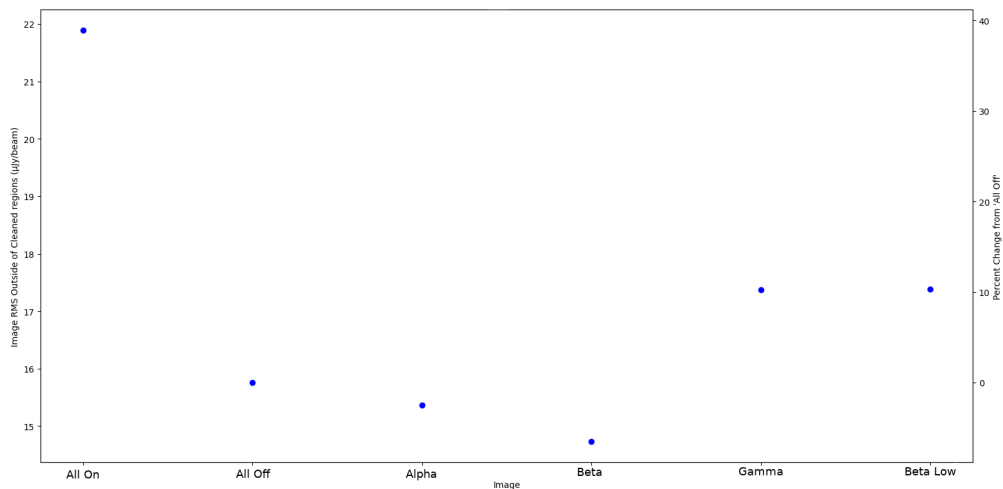


Figure 10: RMS vs Image from the first test day. RMS was taken by using all pixels that resided outside of the clean mask generated via CASA's auto-masking in the pipeline.

observation strategy and setup as the first. The only differences were on the Cell Provider's side, which focused on sending the Gamma sector different levels of power. The full schedule can be found below and unless otherwise stated, the absence of a sector indicates it was operational and at full power. Unfortunately, there was not enough time to perform another observation where all sectors were again turned off.

- Gamma 100% Power, NBloT signal off (TRFI0007\_sb50461980\_1\_1.61139.628318206014)
- Gamma 50% Power (TRFI0007\_sb50461980\_1\_1\_000.61139.637982824075)
- Gamma 4% Power (TRFI0007\_sb50461980\_1\_1\_001.61139.64805258102)
- Gamma Off (TRFI0007\_sb50461980\_1\_1\_002.61139.65719636574)
- Gamma and Beta Off (TRFI0007\_sb50461980\_1\_1\_003.61139.66703462963)
- All Sectors On (TRFI0007\_sb50461980\_1\_1\_004.61139.67716224537)

## 4.2 Results

The data were again processed through the VLA Calibration and Imaging Pipeline and a similar analysis to Test 1 was performed. The ESM-1 was again utilized as an independent measurement of the RFI and a waterfall plot of the full test day is provided in Figure 11. From this plot, we can see that, from the ESM-1's perspective, there is no real difference between the Gamma sector operating at 100% power and 50% power. There is a noticeable reduction in strength when the Gamma sector is operating at 4% power, however, discussions with the Cell Provider's engineers revealed that this level of power (3 Watts) is only enough to power the equipment and not enough for the Gamma sector to meaningfully provide coverage to its pointing direction. The Gamma Off observation shows signal levels similar to the Gamma 4% Power observation and, unsurprisingly, seems quite similar to Test 1's Beta Only observation. Similarly, the Gamma and Beta Off observation is largely the same as Test 1's Alpha Only observation. Similar results are also present in the spectra provided in Figure 12. It is also evident comparing spectra between Gamma Off and Gamma + Beta Off that apparent inter-modulation products around 2.45 GHz disappeared.

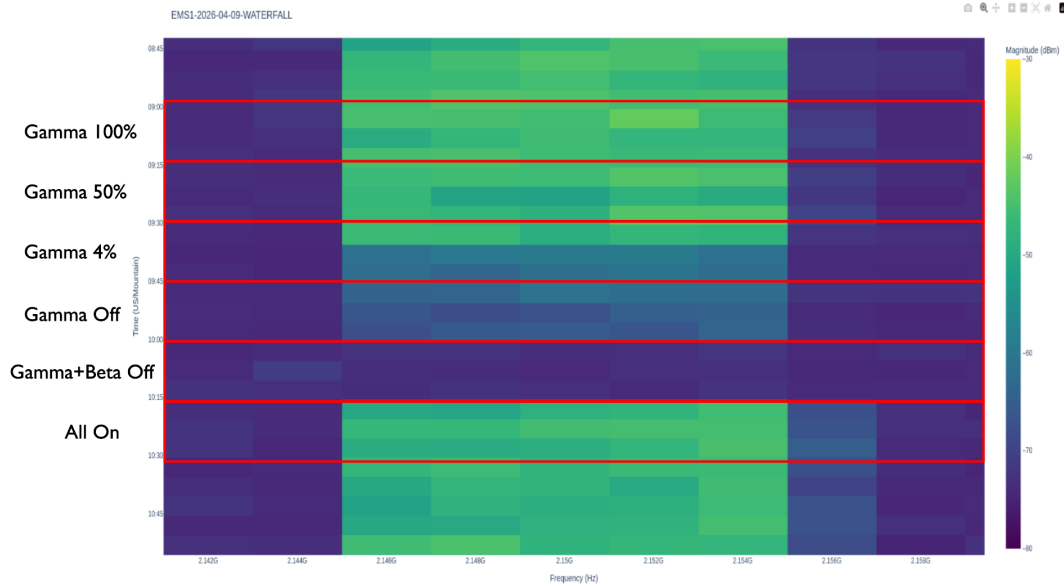


Figure 11: Waterfall plot of data taken with the ESM-1 during the second day of testing. The individual tests have been outlined in red.

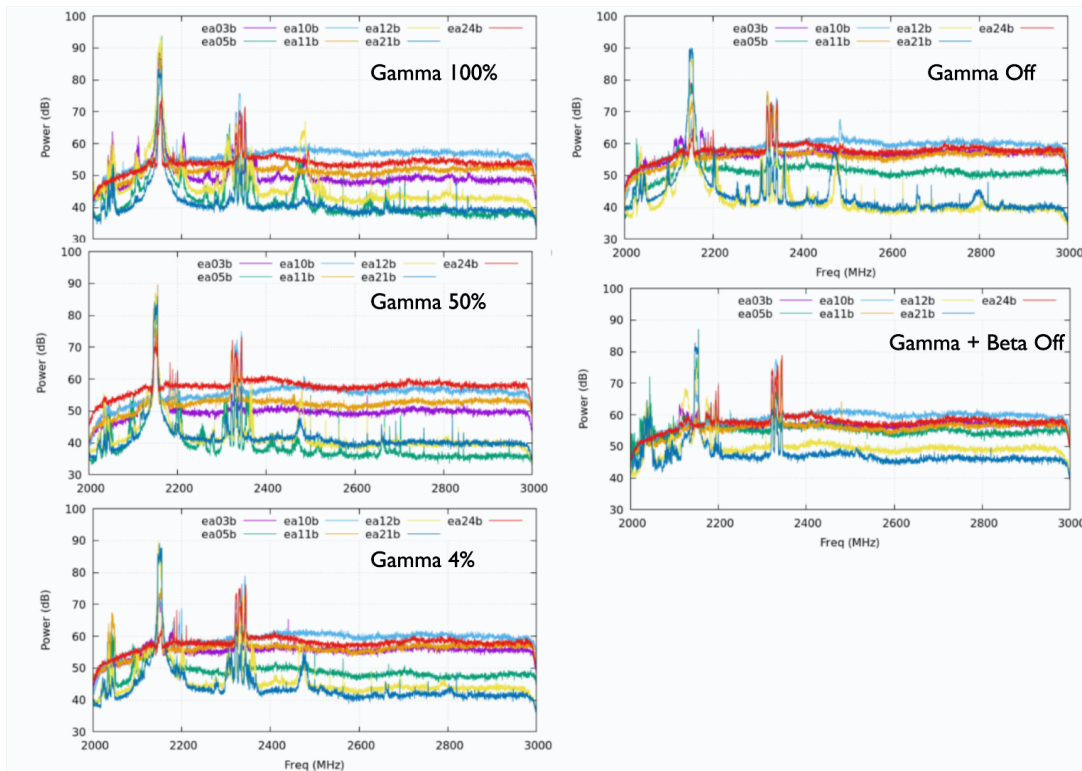


Figure 12: Spectra data taken during each of the observations, other than the All Sectors On state, from Test 2. Antennas EA05, EA12, EA21 being the three closest to the tower at the end of east arm, antennas EA10 and EA24 at the ends of the north and west arms respectively, and finally EA11 and EA03 being located near the center of the array.

Images of the target source were again made using the full continuum band for each observation and are presented here in Figure 13. A similar analysis was performed on these images and again it was found that the flux densities of the source's main component between all images agreed to within a few percent.

Much like before, the major differences in the results were found to be in the measured RMS noise levels, Figure 14. Interestingly there were major differences between the Gamma 100% Power observation and the All Sectors On observation. These tests should have effectively been the same with the only difference being the use of the NBloT signal. Upon inspection it was noticed that the pipeline had treated these two observations very differently. The pipeline was somehow able to perform a deep self-calibration on the Gamma 100% Power observation but was completely unable to perform self-calibration on the All Sectors On observation. Discussions with pipeline developers seemed to suggest that the algorithms being used to determine whether or not the pipeline should combine frequencies in an attempt to increase the signal to noise ratio of the data such that it can perform self-calibration were being thrown off by these data. Our practical interpretation of this result is that it is uncertain whether or not the current software pipeline can reasonably handle data taken when the tower is fully powering the Gamma sector.

Another interesting detail when examining the RMS levels was that the Gamma Off observation showed a much higher RMS noise level than expected. This level was expected to be similar to the Beta Only level from Test 1, but was instead nearly the same level as the All Sectors On observation. The data was again inspected and it was shown that two of our observations from Test 2, Gamma Off and All Sectors On, seemed to contain strange dropouts that were not present in Test 1. These dropouts are shown in Figure 15. It is unclear to us what caused these dropouts to occur, or why the pipeline was unable to identify them, but we note two general points of interest. One, the lower amplitude is consistent with what we would expect a serious case of gain compression to appear as. Two, there appears to be a brightening at 1990-1995 MHz that is time coincident with the dropouts. We are aware the tower is able to operate in this frequency range but as several companies make use of that band we are unable to say whether or not the source of that interference was due to the tower or not.

## 5 Overall Test Conclusions

Due to the issues listed at the end of Section 4.2, it was decided the final comparison would be from a mix of the two test days. Figures 16 and 17 show the final summarized results. There is a clear difference between the VLA's data quality with the new technology fully powered on (e.g. all three sectors) - with most issues being related to the Gamma sector - and with only the Alpha sector on (i.e. Gamma and Beta off). Additionally, there does not seem to be a meaningful degradation in data quality when only the Alpha sector is active and operating at 100% power.

## 6 Impacts on VLA S-Band Operations

While NRAO and the Cell Provider were working on a solution to these compression issues, a new reduced bandwidth instrument configuration was made available to VLA observers that moved baseband frequencies away from the lower part of the S-band receiver. The center frequencies were set to 2.88400 and 3.88400 GHz that resulted in sky frequency ranges of 2.372 - 3.396 and 3.372 - 4.396 GHz. This setup avoided the lower 400 MHz of the 2 GHz wide S-band receiver of the VLA. but also reduced observing bandwidth and increased required observing time. A comparison between the previous and shifted alternative baseband setups are shown in Fig. 18. While this change provided limited benefit to the antennas closest to the transmitting tower due to front-end compression and introduction of inter-modulation products, antennas at larger distances from the tower (that only suffered from mild to moderate digital signal compression) or higher attenuation settings allowed some usable data collection

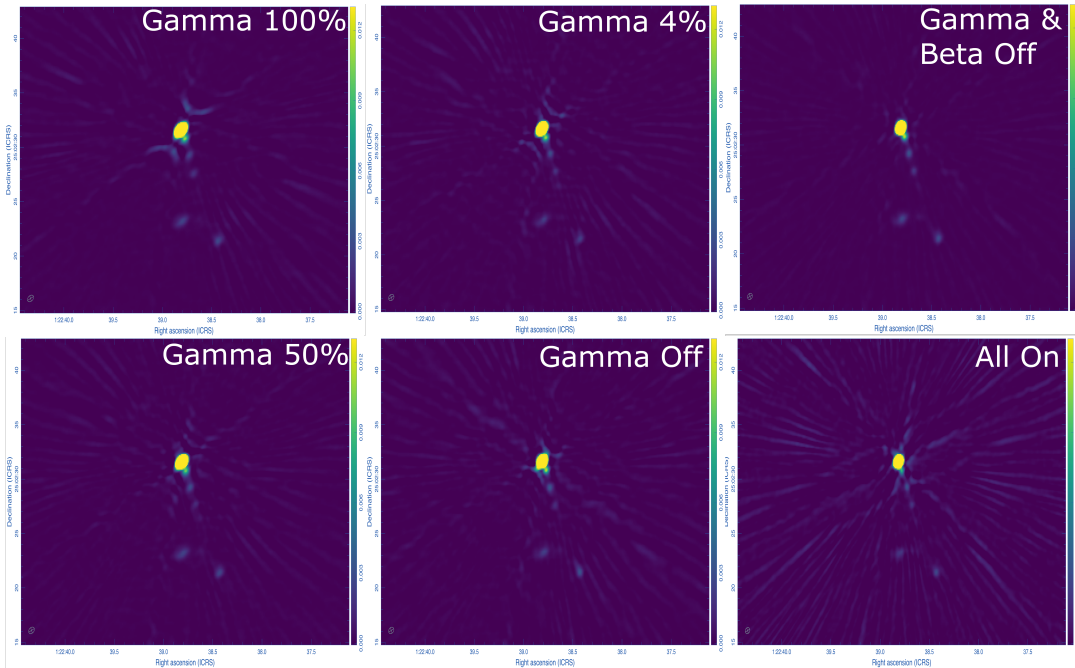


Figure 13: Images of each observation from Test 2 generated from the VLA Calibration and Imaging Pipeline, which includes self-calibration. All images are matched to the same color scale as Figure 9. The full images are much much larger than shown here and have been significantly zoomed to show the source.

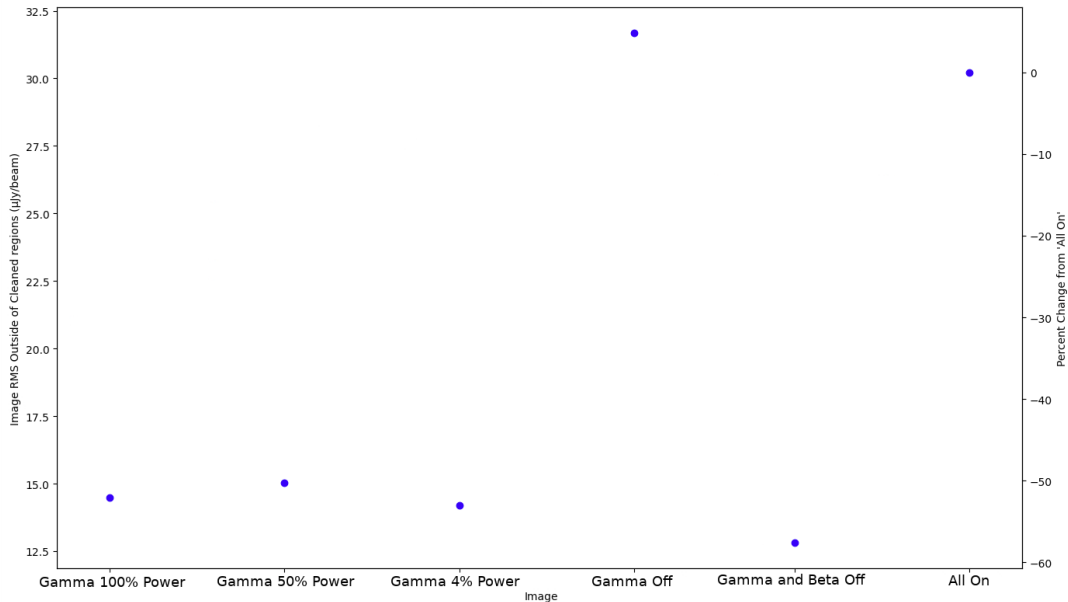


Figure 14: RMS vs Image from the second test day. RMS was taken by using all pixels that reside outside of the clean mask generated via CASA’s auto-masking in the pipeline.

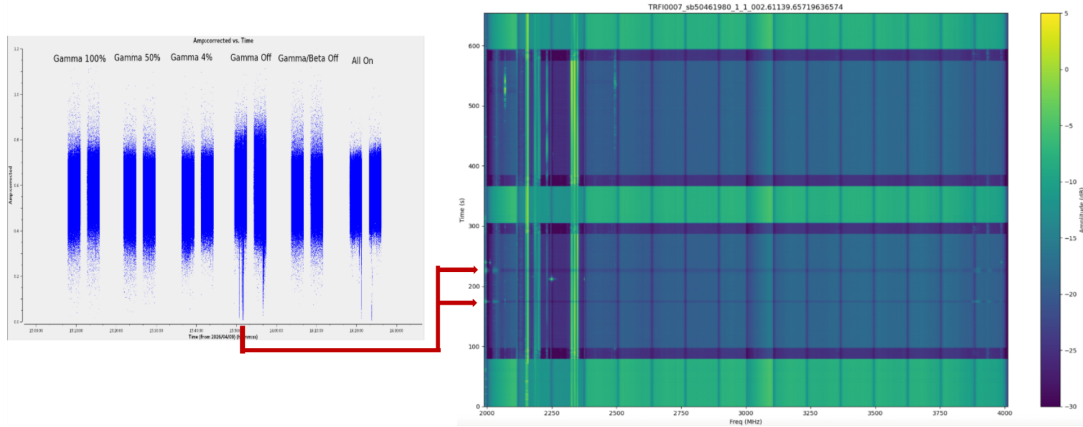


Figure 15: Left, Calibrated Amplitude vs Time for Test 2. Right, waterfall plot of the Gamma Off observation averaged across all antennas. Two of the dropouts seen in the left plot are mapped to the right via the red arrows.

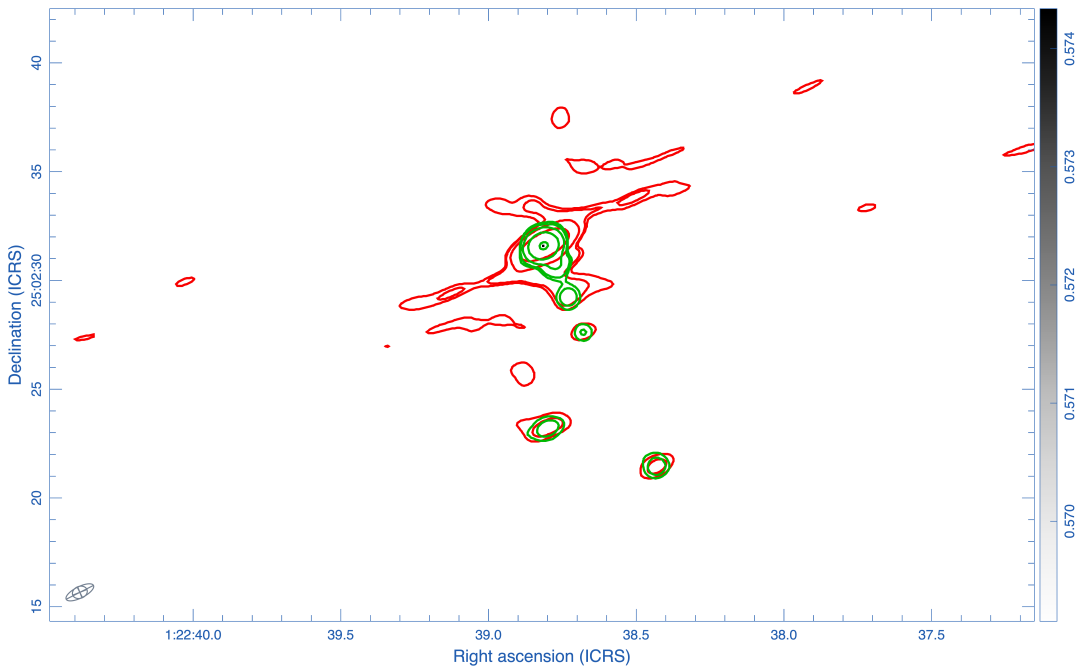


Figure 16: Stacked image showing contours from Test 1's All Sectors On observation (red) and contours from Test 2's Gamma and Beta Off observation (green). Both sets of contours are made starting at each image's  $5\sigma$  level.

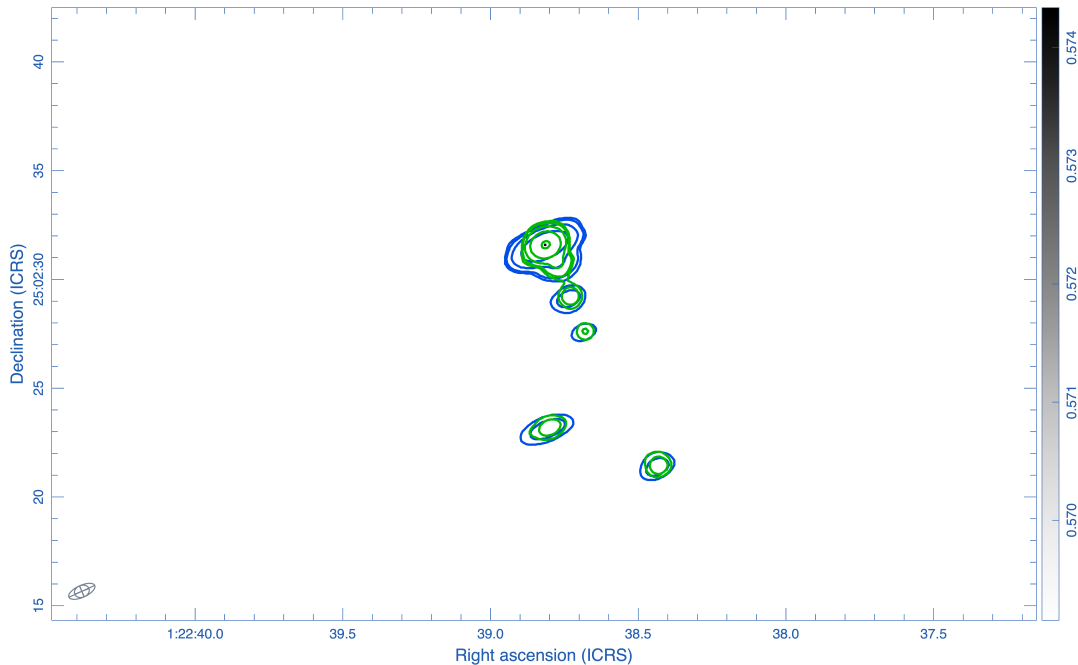


Figure 17: Stacked image showing contours from Test 1's All Sectors Off observation (blue) and contours from Test 2's Gamma and Beta Off observation (green). Both sets of contours are made starting at each image's  $5\sigma$  level.

from a large subset of the array antennas. Given that S-band VLA observations could not be halted any longer due to scheduling pressure, regular S-band observations were resumed on March 23rd, 2026 with the original or the altered setup depending on observers preference.

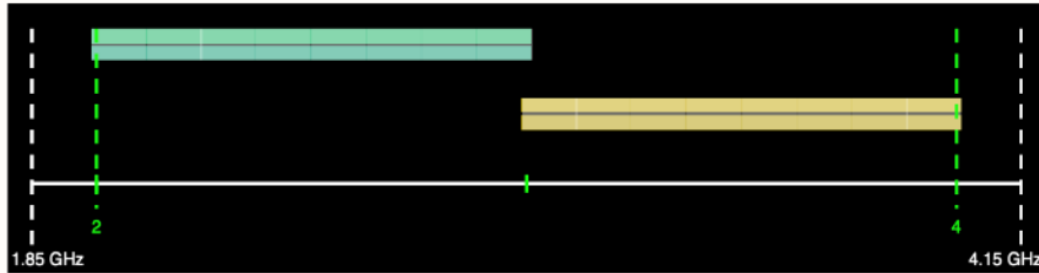
## 7 Request to the Cell Provider and Resolution

After the April 9 Test, and based on the cooperative work described above, NRAO made the following request to the Cell Provider: (1) that the Gray Hill tower only operate the F-block frequency in the Alpha sector, (2) that other AWS (H/I block) frequencies not be activated at this location, since those transmitters would have the same impacts, only at other frequencies in S-band (2-4 GHz), and (3) that once the VLA was moved into the D-configuration (smallest), that NRAO perform another cooperative test to gauge impacts on our shortest-baseline configuration.

The Cell Provider took this request, and on April 24th, 2026 at 10 am shut-off transmissions in the AWS F-block for the Beta and Gamma sectors, while continuing the broadcast in the Alpha sector, as seen in Fig. 19. As of May 6, 2026, the VLA has resumed normal base bands for S-band observations. NRAO appreciates the rapid and collaborative effort on the part of our Cell Provider colleagues.

As can be seen in Fig. 19 the emissions of the 2.1 GHz transmissions are only weakly visible with the spectrum monitor at the center of the VLA. As seen from Fig. 2 the antenna pattern coverage of the Alpha sector still intersects with the outermost two antenna pads on the East arm. These antennas will remain somewhat impacted by transmissions in their lower baseband based on preliminary evaluation. Further investigation is needed to evaluate the magnitude of this remaining impact on the 2-3 GHz part of the spectrum when in A configuration, while the 3-4 GHz part of the spectrum appears uncompromised and fully usable using the standard S-band configuration.

**NRAO Defaults » S16f3B » Receiver Band: S**



**NRAO Defaults » S14f2Ashiftalt » Receiver Band: S**

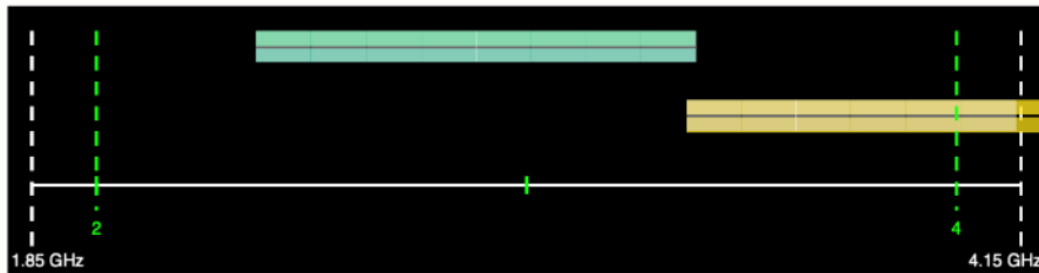


Figure 18: Visualization of the two 1 GHz wide baseband tunings in sky frequency for S-band. Top shows the default setup (S16f3B), bottom shows the modified setup moving the lower baseband away from the tower transmissions (S14f2Ashiftalt).

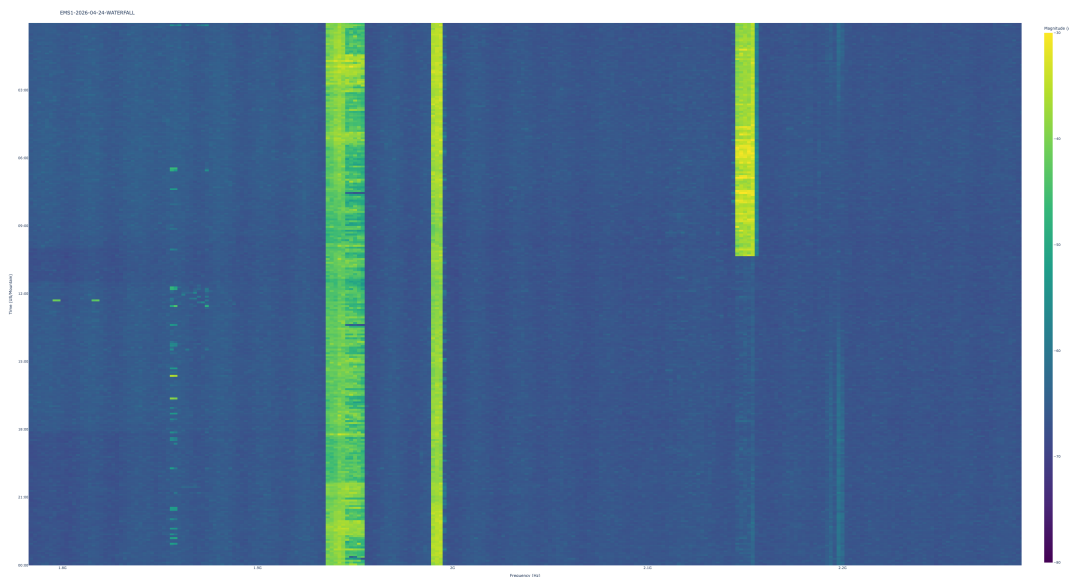


Figure 19: Waterfall plot of the VLA omni-directional spectrum monitoring system on April 24th, 2026, showing the time when transmissions in the Beta and Gamma sectors ceased.



## 8 Acknowledgments

The National Radio Astronomy Observatory (NRAO) and the Green Bank Observatory (GBO) are facilities of the National Science Foundation (NSF) operated under cooperative agreement by Associated Universities, Inc (AUI).

### A Frequency Notification (05/13/2025)

Below attached is a copy of the original frequency notification NRAO received on May 13th, 2025.

## FREQUENCY NOTIFICATION

Notice is hereby given that:

American Tower Corporation, 10 Presidential Way, Woburn, MA 01801

has filed an application as a facility manager to modify equipment on behalf of [REDACTED] MAGDALENA NM /  
ATC Site #: 89018 / Communication Site #: NMNM009760

Latitude: 34.03799147000000  
Longitude: -107.44628812000000

As a facility owner/manager, the user will lease tower and building space to tenants and customers.

Technical data concerning this proposed installation is enclosed with this notice.

Comments which pertain to the technical electronic aspects of the proposal should be made directly to the FCC or IRAC. In such an event, the comments should make reference to the applicant's FCC/IRAC file number and city of broadcast. Comments should be sent to:

The Secretary  
Federal Communication Commission  
1919 M Street, N.W.  
Washington, DC 20554

OR

Executive Secretary  
IRAC  
Office of Telecommunication  
U.S. Dept. of Commerce  
1325 G Street, N.W.  
Washington, DC 20005



All comments should be specific and as detailed as possible and should present suggestions to remedy anticipated conflicts. A copy should also be sent to the BLM at the address below.

Users within the area affected may file comments concerning the proposed use within thirty (30) days of the date of receipt of this notice with:

*Carol Harris, Realty Specialist*  
*Bureau of Land Management*  
*Socorro Field Office*  
*901 S. Highway 85*  
*Socorro, NM 87801*  
*575-838-1298*

**Anastasia Giagkas**  
*Account Specialist, Real Estate Transactions*  
**American Tower Corporation**  
10 Presidential Way  
Woburn, MA 01801  
[anastasia.giagkas@americantower.com](mailto:anastasia.giagkas@americantower.com)  
+1 (781) 926-4522

**UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
COMMUNICATION SITE TECHNICAL DATA REPORT**

1. Name and address of applicant 	2. Right of way Near FR 549, 12.5 miles W SW of Magdalena	3. State NM	4. County Socorro
	5. Resource Area Socorro Field Office	6. District Albuquerque	7. Elevation 7,678'
8. Legal description and site name 			
9. Latitude and longitude Lat: 34.03799 / Long: -107.44628			
Case file number:			

10. Type of applicant

- |   |  |
|---|--|
| a. <input type="checkbox"/> Individual              | d. <input type="checkbox"/> State            |
| b. <input type="checkbox"/> Corporation*            | e. <input type="checkbox"/> Local government |
| c. <input type="checkbox"/> Partnership/Association | f. <input type="checkbox"/> Federal          |

11. Name, address, and telephone number of emergency contact person(s)



Communication Site telephone number 

12. Power source

- |                          |                         |                          |
|--------------------------|-------------------------|--------------------------|
| a. _____ commercial      | c. _____ Wind w/Battery | e. _____ Other (explain) |
| b. _____ solar w/battery | d. _____ Battery only   |                          |
- Stand by power \_\_\_\_\_ Type

13. Type of operational control planned:

- |                        |                             |
|------------------------|-----------------------------|
| a. _____ Local control | c. _____ Automatic Repeater |
| b. _____ Wire Control  | d. _____ Radio link Remote  |

14. Repeater tone protected: \_\_\_\_\_ Yes  No

15. Antenna Mounting Structure:

- |  |   |
|--|---|
| _____ Wooden                                   | <input checked="" type="checkbox"/> Steel Tower |
| Height above ground <u>301</u>                 | <input type="checkbox"/> Treated                |
| Dia of pole or Tower _____                     | Number Planned _____                            |
| Distance from Bldg _____                       | Model No. _____                                 |
| Space for other Users <input type="checkbox"/> | Number Planned _____                            |

Please provide a copy of the site construction plan showing a landscape view and aerial view

TRANSMITTER EQUIPMENT TECHNICAL INFORMATION

16. Transmitter: Mfg. Ericsson Model No. [Redacted]
Type Accepted No. Serial No.
Age Years New Model No.

17. Transmitter Isolators or Circulators used:

Mfg Model No.
Age Years New Serial No.
Number ISO used: Total isolation achieved db.

18. Antenna and Cable System used:

Antenna Mfg. RFS Cable Mfg.
Type Passive Cable Dia.
Model APXVLL19P\_43-C-A20 / APXVAARR24\_43-U-NA20 Cable length inside Bldg. Ft
Cable length outside Bldg. Ft
Gain 18.7 db Age Years New Cable fittings type N UHF BNC
Direction 65 Degrees Cable Type
Height(AGL) Top 265 Ft Bottom Ft.
Polarization Horizontal +/-45 Vertical Circular
Number of Fitting adapters used in transmitter systems 4

19. Emission:

Call sign Listed in 25 Emission Type OFDM
True Power 120 Watts Emission Bandwidth Watts
ERP 4111.49 Watts

20. Frequencies in Mhz, Ghz, Khz

I understand that the transmitter will not be placed in service until it is properly licensed by the FCC [Redacted] INITIAL

RECEIVER EQUIPMENT TECHNICAL INFORMATION

21. Receiver

Mfg. Ericsson Model No. [Redacted]
Type Accepted No. Serial No.
Age Years New Model No.

22. Multi-coupler

Mfg. Model No.

Duplexer \_\_\_\_\_

Cavity \_\_\_\_\_ Age \_\_\_\_\_

New  Model Year \_\_\_\_\_

Rack Mount?  Yes  No

Free Standing  Yes  No

Serial No. \_\_\_\_\_

Number of Rx's on system \_\_\_\_\_

Cabinet mount?  Yes  No

Type of fittings used  N  UHP  BNC

23. Antenna and cable system Used for receiver

Same  Yes  No, if so please describe.

Antenna Mfg. \_\_\_\_\_

Cable Mfg. \_\_\_\_\_

Type \_\_\_\_\_

Cable Dia. \_\_\_\_\_

Model \_\_\_\_\_

Cable length inside Bldg. \_\_\_\_\_ Ft

Cable length outside Bldg. \_\_\_\_\_ Ft

Gain \_\_\_\_\_ db Age \_\_\_\_\_ Years  New

Cable fittings type N  UHF  BNC

Direction \_\_\_\_\_ Degrees

Cable Type \_\_\_\_\_

Height (AGL) Top \_\_\_\_\_ Ft

Bottom \_\_\_\_\_ Ft.

Polarization Horizontal \_\_\_\_\_ Vertical \_\_\_\_\_ Circular \_\_\_\_\_

Number of Fitting adapters used in transmitter systems \_\_\_\_\_

24. Frequencies Mhz, Ghz, Khz

[Redacted]

25. Other related data:

[Redacted]

I HEREBY CERTIFY, that I am of legal age and authorized to do business in the state and that I have personally examined the information contained in the application and believe the information submitted is correct to the best of my knowledge.

[Redacted]

04/14/2025

Signature of applicant

Date

Title 18, U.S.C. Section 1001, makes it a crime for any person to knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements, or representations as to any matter within its jurisdiction.