ORIGINAL

CLARITY MEDIA SYSTEMS. LLC
A subsidiary of Flying J Inc.

PROGRESS REPORT
TO THE
FEDERAL COMMUNICATIONS COMMISSION

EXPERIMENTAL RADIO SERVICE LICENSE
CALL SIGN: WE2XNE
FILE NO. 0692-EX-PL-2007

July 31, 2008

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1. OVERVIEW AND EXECUTIVE SUMMARY:

In the Experimental Radio Service license that the Federal Communications Commission ("FCC" or "Commission") issued to Clarity Media Systems, LLC ("Clarity") on April 24,2008 (Call Sign WE2XNE, File No. 0692-EX-PL-2007)("Experimental License"), Clarity was directed, inter alia, to file a progress report "detailing how it met its interference limitations when the system initially became operational (e.g., successful coordination with [the Society of Broadcast Engineers]), any reported interference caused by the system, and the means of remediation of such interference." Clarity Experimental License at 4 (Special Condition No. 6). This Report is prepared and submitted in fulfillment of this condition.

A. Clarity Objectives

Clarity completed principal operations under the Experimental License during the first two weeks of June 2008. As laid out in the underlying application for the Experimental License, the Clarity program had the following objectives:

1. Ascertain the minimum signal level at the fence line (–150 meters to –300 meters from the Clarity transmitting antenna, depending on the Flying J Travel Plaza) at which Clarity can provide its required signal quality to parked tractor trailers without suffering the negative effects of multipath distortions.

2. Take enough signal strength measurements from a Clarity transmitting antenna operating at the minimum signal level (determined per No. 1 above) at the Flying J Travel Plaza fence line (FL) to enable an accurate conclusion about the overall signal strength pattern to be drawn, and to determine whether Clarity's transmission system meets the minimum desired-to-undesired (D/U) signal ratio of 8 dB for the digital ENG equipment that is now transitioning to the 2025-2110 MHz band.

Clarity used its authorized experimental operations to gather comprehensive, accurate, and meaningful measured data at two Flying J Travel Plazas – one in Winslow, Arizona and the other in North Salt Lake, Utah – that together are representative of the approximately 250 Flying J Travel Plazas around the country where Clarity seeks to deploy its system.

B. Establishment of -72 dBm/Channel as Clarity's Reauired Signal Level at the Fence Line

Pursuant to the first objective, Clarity used its experimental operations to establish that -72 dBm per channel is the minimum signal strength it requires at the fence line of the truck parking areas where the Clarity receivers will be located in order to meet its modest coverage and signal quality objectives. Whether the fence line is 150 meters from the transmitting antenna (as it is at the smallest Flying J Travel Plazas) or approximately 300 meters (as it is at the travel plazas with the largest truck parking areas), the Clarity transmission system would be optimized during installation through a combination of transmitting antenna height above ground, electrical and mechanical beam downtilt, and ERP/transmitter power output ("TPO") per channel to produce, at the far side of the truck parking area, a -72 dBm per channel signal in the principal azimuth of the directional 120° half-power beamwidth of the sector antenna. This signal strength level corresponds, as a general matter, to a TPO per channel of between 1 and 5 milliWatts (or, alternatively, an ERP per channel of between 10 and 50 milliWatts).

A signal strength level of -72 dBm per channel at the fence line means that the received signal level ("RSL") at specified distances ***beyond*** the fence line will be constant across the Flying J system – regardless of how far the fence line is from the transmitting antenna. As a result, measurements of RSL at various distances from a Clarity transmitting antenna that is optimized for coverage of the largest of the Flying J Travel Plazas (i.e., the transmission system is set up to produce a -72 dBm per channel signal at 300 meters away), along eight azimuths spaced every 45" around the compass, produce an RSL grid that represents the operational worst case for assessing the potential for harmful interference from Clarity operations anywhere in the nation. To the extent that there are smaller plazas that bring the grid points in by as much as 150 meters,' or there are terrain and/or man-made obstacles that block reception of the signal out to the grid points, these features will only serve to reduce any potential for harmful interference that may otherwise have been found.

C. Winslow and North Salt Lake RSL Measurements

In its experimental operations at Winslow on June 3 and 4,2008, Clarity's technical team made RSL measurements at 45" azimuths at intervals of 300m, 600m, 1200m, and 2400m from a transmitting antenna that was installed less than 10 meters above ground and optimized for a -72 dBm per channel signal strength 300 meters from the transmitting antenna. TPO per channel at Winslow was 5 mW, and ERP per channel was 50 mW. Through these measurements, Clarity developed a comprehensive data record of the energy produced by the Clarity directional transmitting antenna at distances of up to 2400 meters (or 1.5 miles) from the same transmission system Clarity seeks to deploy at Flying J Travel Plazas around the country. Clarity also took RSL measurements at as many of the radial points and distances as it could access during experimental operations at North Salt Lake on June 8 and 9,2008. In the North Salt Lake case, the transmission system was optimized for a -72 dBm/channel signal strength 150 meters from the

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[1] **In this regard, an RSL measurement taken at 2400 meters from a Clarity transmitting antenna that is optimized to produce a -72 dBm per channel signal at 300 meters would be the same value as an RSL measurement taken at 1200 meters from an identically-oriented Clarity transmitting antenna that is optimized to produce a -72 dBm per channel signal at 150 meters.**

transmitting antenna. TPO per channel at North Salt Lake was 1 mW, and ERP per channel was 11 mW.

The data generated by Clarity during these experimental operations are notable in several respects:

- First, the RSL measurements at Winslow – where the transmission system was optimized to cover a parking lot that extended as much as 300 meters from the transmitting antenna – represented the highest RSLs that would be experienced at any Flying J Travel Plaza in the country.

- Second, the data generated at the two test sites are universally applicable through the Flying J system unless there are terrain factors or other obstructions that will block reception of the signal at certain distances.

- Third, the data reveal that in nearly all cases, the measured RSLs were the same as or lower than the RSLs that Clarity's technical team anticipated or predicted based on the transmitter proof of performance it conducted.

- Fourth, the data confirmed that Clarity's decision to use directional transmitting antennas will decrease the RSL by 8 dB at +/- 90° from the principal azimuth of the transmitting antenna, and by at least 20 dB at 180° off the principal azimuth, regardless of the distance at which the measurement was taken.

D. Non-Participation bv Broadcasters was No Obstacle to Generation of a Comprehensive Data Set for Assessing; Clarity's Potential Impact on Co-Frequency ENG Systems

Clarity coordinated the testing program at both the Arizona and Utah locations in advance of the test dates with the Society of Broadcast Engineers ("SBE") and potentially affected Local Television Transmission Service licensees, as required by Special Condition Nos. 4 and 3 on its license for Call Sign WE2XNE. Although the SBE and other broadcaster associations and parties with prior interest in the related Media Bureau proceeding regarding Clarity's proposed system were invited to attend either or both sites, there was no attendance or participation by broadcast-industry representatives in the June 2008 experimental operations.

Clarity emphasizes that the non-participation by broadcasters in the experimental operations did not prevent Clarity from gathering the data it required to achieve the second testing objective set out above. As Clarity explains in this Report, it conducted tests in a laboratory setting with a Clarity transmitting antenna in the 2025-2109 MHz band and a co-frequency, digital ENG link, where the ENG receiver was pointed directly at an ENG transmission source that was set up right next to the Clarity transmitting antenna. The ENG link was operated successfully when the desired-to-undesired ("D/U") ratio of the ENG signal to the Clarity signal was maintained at 8 dB or more. The ENG link reached an entirely satisfactory channel-state information ("CSI") level when the D/U ratio of the ENG signal to the Clarity signal was established at 12 dB (providing 4 dB of link margin). When the D/U ratio was reduced to 3 dB for one of the tested conditions, the ENG link failed to reach satisfactory CSI. These tests confirm the

specifications provided by digital ENG equipment manufacturers that the minimum D/U ratio for this equipment is 8 dB, and that as long as a 12 dB D/U ratio is maintained in the presence of a Clarity signal, Clarity will not cause harmful interference to ENG operations.

Clarity was also able to take direct line-of-sight RSL measurements of a Clarity transmitting antenna operating at the maximum power levels (50 mW ERP per channel, 5 mW TPO per channel) that will be required at any Flying J Travel Plaza nationwide from at or near two separate fixed ENG receive sites. For each of these particular measurements, Clarity temporarily increased the ERP per channel of the North Salt Lake transmission system from 11 mW to 50 mW (TPO per channel thus was increased from 1 mW to 5 mW), and reoriented the directional antenna so that the principal azimuth included the ENG fixed receive sites to which the particular measurement corresponded. In the first case, an RSL measurement was taken from the roof of a building in downtown Salt Lake City on which a fixed ENG receive site is located, and in the second case, an RSL measurement was taken from near a fixed ENG receive site on a mountaintop northwest of downtown Salt Lake City. In the first case, Clarity's testing team was granted access to the rooftop ENG site for measurements; in the second case, the ENG site was inaccessible to unauthorized personnel, so Clarity picked a location that is on the same azimuth as and at a comparable elevation to the ENG site, but that was closer to the transmitting antenna than the ENG receiver. The RSL at the building rooftop (the Key Bank Tower, f/k/a the Beneficial Life Tower, which is 8.37 kilometers from the transmitting antenna) was -108 dBm/channel. At the mountain measurement site, which is located just 2.3 kilometers from the Clarity transmitting antenna but at a higher elevation, the measured RSL was -101.7 dBm/channel. For comparison purposes, Clarity later reoriented its directional transmitting antenna on its proper bearing for coverage of the parking area of the North Salt Lake Flying J Travel Plaza, and reset the TPO per channel to 1 mW (the level needed to provide a -72 dBm/channel signal at the fence line). It then measured the RSL at an additional mountainside site, this one located 5.95 km from the Clarity transmitting antenna. In this case, which is the true operational scenario for that facility, Clarity measured the RSL to be less than -110 dBm (i.e., at least 18 dB below manufacturers' published specifications for minimum receiver threshold sensitivity of -92 dBm/channel for COFDM).

E. Results

The Clarity laboratory tests and RSL measurements confirm in every respect Clarity's oft-stated expectation that the extremely low power transmission systems Clarity seeks to deploy at Flying J Travel Plazas to bring television service to the cabs of resting long-haul truck drivers is effectively incapable of causing harmful interference to digital ENG links. The D/U threshold for digital ENG receive systems is, as the manufacturers of the equipment have informed Clarity, 8 dB. With a generous addition of 4 dB of link margin on top of margin built into the manufacturers' numbers, the D/U objective Clarity strove for is 12 dB. Clarity's tests confirm:

1. There is simply no way that a Clarity transmission system serving a travel plaza truck parking area that extends no more than 300 meters beyond the transmitting antenna can cause the D/U ratio at fixed ENG receive site to drop below 12 dB. Geographic separation between Flying J Travel Plazas and the elevated, wide-coverage-area fixed ENG receive sites alone will provide the desired protection.

2. For portable ENG receive equipment that may be operated by a news crew at or near a Flying J Travel Plaza, there is a statistically small possibility that the alignment situation between the Clarity transmitting antenna, the ENG transmitting antenna, and an ENG receiver could cause the D/U ratio for the ENG receiver to drop below the 12 dB target in particular locations. The possibility of harmful interference is so low as to be insignificant.

a. The geographic area within which there is even the potential for a harmfully interfering alignment with a Clarity transmitting antenna is a tiny fraction (much less than 0.01% in the worst case) of the coverage area of a major-market broadcast station.

b. Mobile ENG receive equipment is rare, and is expected not to account for more than a tiny percentage of overall ENG operation in the 2025-2110 MHz band for the foreseeable future.

c. In the highly unlikely event of a potentially harmful interfering alignment, there may be terrain, foliage, or structural obstructions that prevent the ENG receiver from having line-of-sight visibility to the Clarity transmitting antenna. Without line of sight, harmful interference to the ENG link is impossible.

d. Even if, against all odds, a potentially harmfully interfering alignment were to occur near a Flying J Travel Plaza, the situation would be readily alleviated by the broadcast crew in any of several non-burdensome ways – e.g., by using the technical tools that all crews have to select a polarization that is not affected by the Clarity transmission (something that would be done as a matter of course by the technician in setting up the link), or changing the direction of the ENG transmission path so that it is not directly aligned with the Clarity transmission path. Together, these two simple measures – each of which requires no action by a broadcast crew that the crew does not take today in the absence of Clarity operations – will restore more than enough link margin to the ENG path to ensure that the D/U ratio remains considerably above 12 dB.

* * *

In the Sections that follow, Clarity will describe the field and laboratory tests that were conducted pursuant to or in furtherance of its Experimental License under Call Sign WE2XNE; provide details as to equipment used and results obtained; and discuss the implications of the tests and results on the ability of Clarity to successfully deploy its proposed system on a secondary basis at Flying J Travel Plaza locations around the country.

2. DESCRIPTION OF FIELD AND RELATED LABORATORY/BENCH TESTS:

A. Coordination with TTS Licensees and Society of d Engineers

In satisfaction both of its pledge to cooperate with incumbent users of the 2025-2109 MHz band and its obligations under the Experimental License to coordinate testing with the SBE, Clarity sent a letter of invitation to the planned Winslow and North Salt Lake tests to the Executive Director of the SBE and other broadcasting representatives that had participated in the Media Bureau proceeding on Clarity's applications for CARS licenses. A copy of this letter is included as Attachment 1 to this Report. Following the letter, Clarity representatives made a number of follow-up contacts – including one that postponed the planned dates of the tests to the first two weeks in June. Regrettably, none of the contacted broadcast representatives chose to cooperate or even respond to Clarity's coordination effort. Clarity received no reports of harmful interference to ENG operations from its June 2008 transmissions from the two sites.

In satisfaction of Condition No. 3 on its Experimental License for Call Sign WE2XNE, Clarity also searched the Commission's databases for the identity of licensees of LTTS systems in frequency bands and geographic areas that overlapped with the Winslow and/or North Salt Lake operations. It identified just over two dozen entities that hold relevant LTTS authorizations, and sent letters to each licensee describing the date and type of the operations Clarity intended to perform at each site, and urging the licensee to contact Clarity to coordinate any potentially affected operations. A copy of the template of the letter sent to the identified LTTS licensees is included as Attachment 2 to this Report. No LTTS licensees indicated any concern in response to Clarity's coordination letter, and Clarity received no reports of harmful interference to LTTS operations from its June 2008 transmissions from the two sites

B. Transmitter Proof of Performance

Before Clarity conducted RSL measurements at either Winslow or North Salt Lake, it conducted a series of proof of performance power measurements from the transmitter. Attachment 3 to this Report contains the report of this measurement, from the Test Engineer at Loma Scientific International – the company that developed Clarity's transmitter. The report confirms that all transmitter power output ("TPO") per channel measurements accurately conform to industry practice of using professional test equipment calibrated with calibration traceable to the National Institute of Standards & Technology (formerly the National Bureau of Standards).

C. Measurements at Winslow and North Salt Lake

1. Establishment of Minimum Required Signal Strength:

The first purpose of the field tests was to confirm the minimum signal strength level that Clarity would need to produce at the outer reaches of truck parking areas of Flying J Travel Plazas to be served by the Clarity system in order to satisfy Clarity's quality of service objectives. The longest transmitting antenna-to-fence-line distance in the Flying J system is about 300 meters, and

the shortest distance from transmitting antenna to the fence line in the system is just under 150 meters. Through a series of measurements conducted at various traffic levels on the Winslow Flying J Travel Plaza, Clarity was able to establish that a signal strength level of -72 dBm per channel at the fence line would enable its service quality objectives to be met. The -72 dBm/channel level is the level that Clarity requires in the principal azimuth at the fence line. With Clarity's directional antenna, the signal level at any given distance in meters drops off the farther away from the principal azimuth one moves at that distance. At the off-principal azimuth (i.e., the azimuth 180° away from the principal azimuth), the signal strength level at the fence-line distance (300 meters in the case of Winslow) would be -92 dBm/channel – fully 20 dB below the signal strength at the same distance on the principal azimuth. Clarity has committed in the Media Bureau proceeding on Clarity's CARS license applications not to use anything more than the minimum required signal strength in the provision of its service.

To produce a -72 dBm per channel signal at a fence line 300 meters away, the Clarity transmission system would have to operate with a TPO per channel of approximately 5 mW (ERP per channel of 50 mW), driving a transmiting antenna that is up to 10 meters above the ground. To produce the same -72 dBm per channel signal at a fence line that is only 150 meters away, the Clarity transmission system would have to operate with a TPO per channel of just over 1 mW (ERP per channel of –11 mW), driving a transmitting antenna that is up to 10 meters above the ground. There would be a greater degree of mechanical and electrical beam downtilt in the 150 meter case than in the 300 meter case, in order to concentrate the peak of the radiated signal on an area in the middle of the parking lot.

2. Identification of Predicted Receive Signal Levels in dBm/Channel:

Using the -72 dBm per channel signal strength figure at the fence line, and taking into account the characteristics of the Clarity directional antenna, Clarity was able to predict the received signal levels ("RSL") on any azimuth at 300m, 600m, 1200m, and 2400m from the transmitting antenna. In a nutshell, the RSL level should drop by approximately 6 dB on any azimuth each time the distance from the transmitting antenna doubles. Thus, if the RSL at 300 meters is -72 dBm/channel on the principal azimuth, the RSL at 600 meters on the same azimuth should be -78 dBm/channel; the RSL at 1200 meters should be -84 dBm/channel, and the RSL at 2400 meters should be -90 dBm/channel.

Figure 1 below shows the predicted RSL levels for Winslow, and Figure 2 below shows the predicted RSL levels for North Salt Lake.

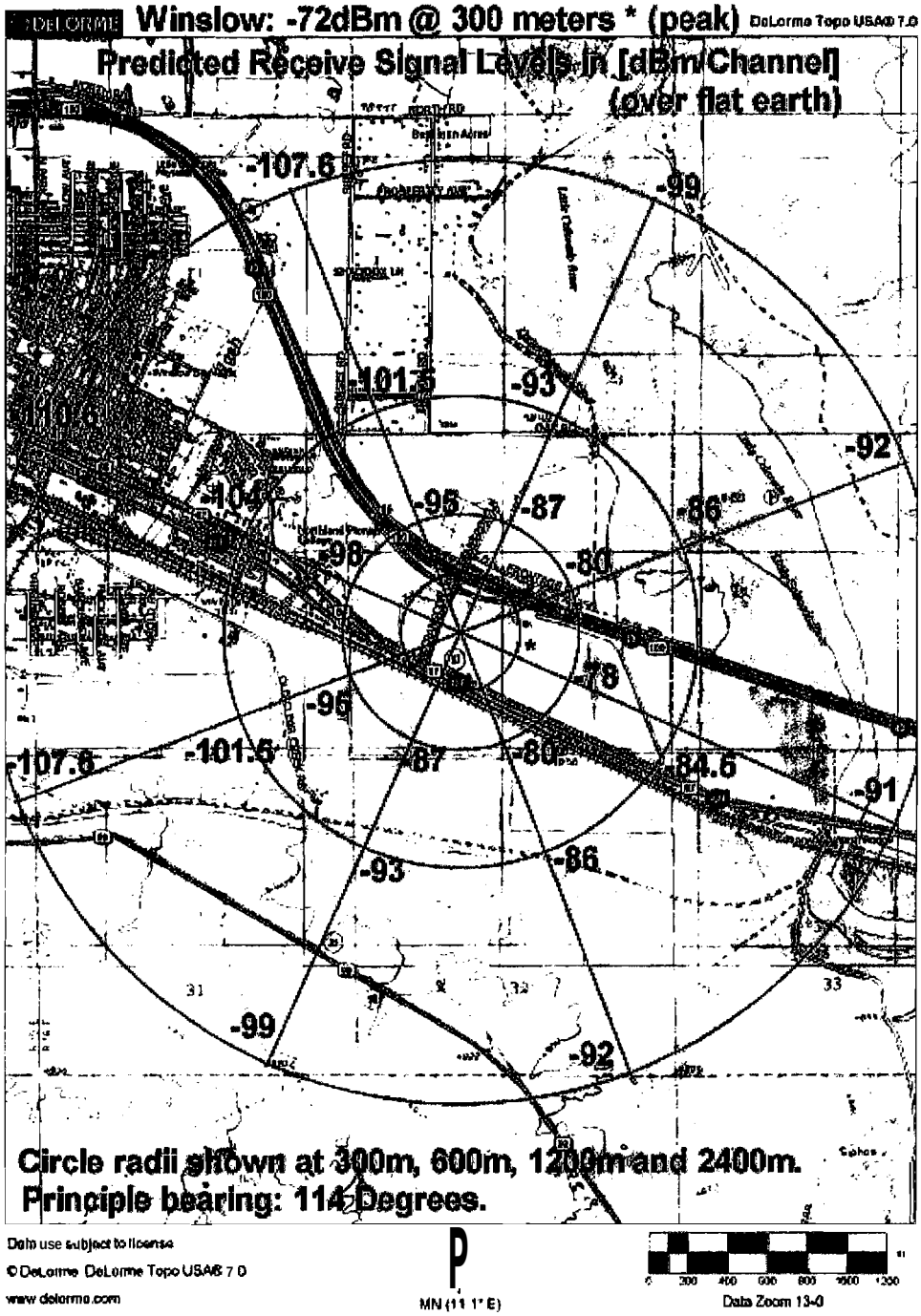


Figure 1: Predicted RSL Values for Winslow, AZ

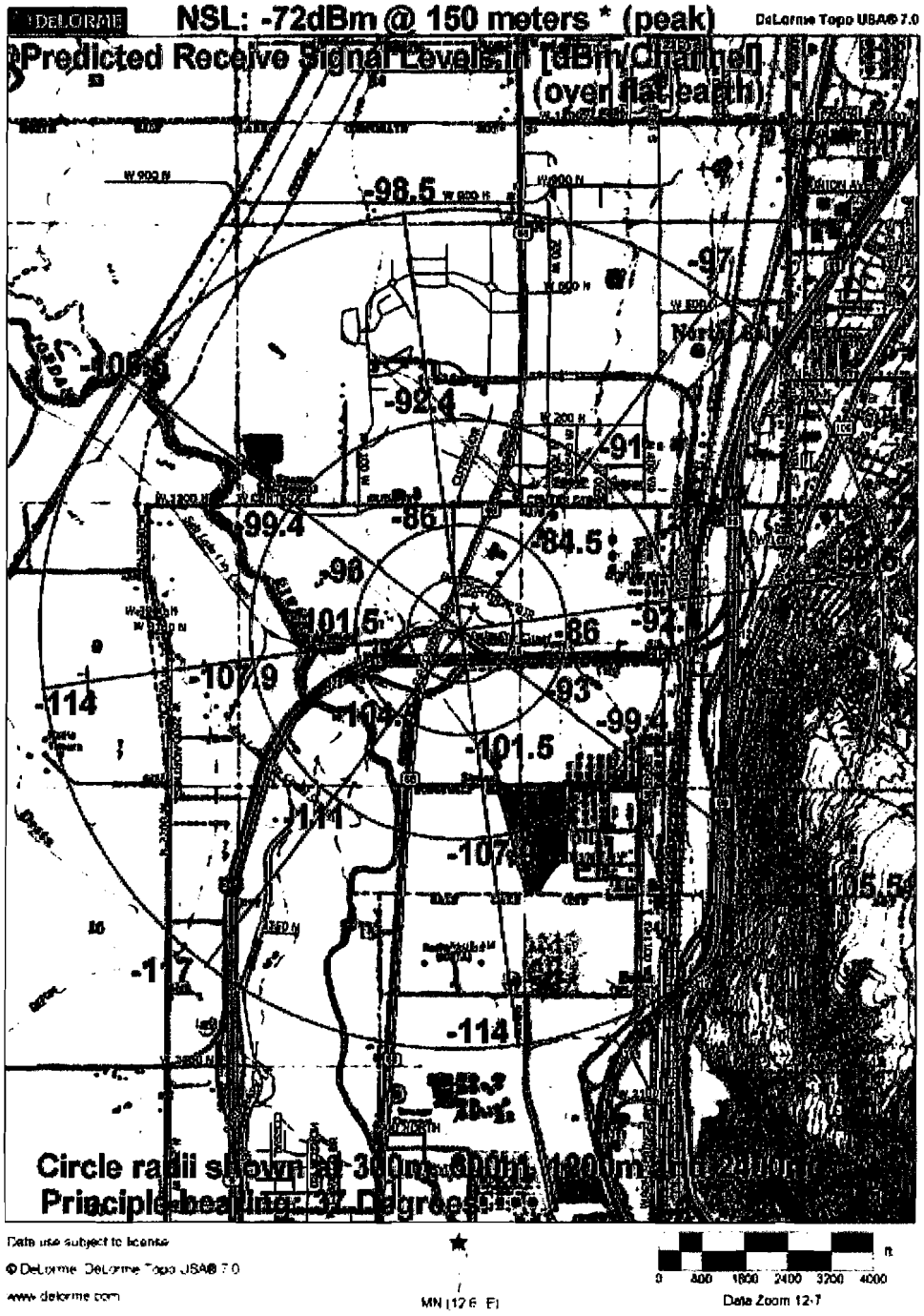


Figure 2: Theoretical RSL Values for North Salt Lake, UT

Clarity provides these figures to show, based on the transmitter proof of performance, what the expected RSLs were at the two sites, and to illustrate the mitigative impact on some azimuths of using a directional antenna. The anticipated effect can be seen very clearly in Figure 1, where the RSLs at 600m, 1200, and 2400m toward and in the town of Winslow, which happens to be in the off-principal direction of the transmitting antenna, were anticipated to be 20 dB below the RSLs at the same distances in the principal direction of the transmitting antenna.

The two figures also illustrate the anticipated difference in RSL from a Clarity transmitting antenna that produces a -72 dBm per channel signal at 300 meters versus a Clarity transmitting antenna that produces a -72 dBm per channel signal at 150 meters. For North Salt Lake, the 20 dB reduction at 2400 meters from the principal bearing (-97 dBm/channel) to the off-principal bearing (-117 dBm/channel) correlated with the principal-to-off-principal reduction in Winslow. However, the North Salt Lake RSL at 2400 meters, on all azimuths, was predicted to be about 6 dB lower than the RSL in Winslow at the corresponding azimuths and distances. In other words, the RSLs at the smallest Flying J Travel Plazas (the 150 meter case) are predicted to be 6 dB lower at any given distance/azimuth combination than the RSLs at the largest Flying J Travel Plazas (the 300 meter case).

3. Description of RSL Measurements and Presentation of Measured RSL Data:

RSL measurements were taken in Winslow, Arizona on June 3 and 4, 2008, and in North Salt Lake, Utah on June 9 and 10, 2008. The operational equipment was comprised of the following components:

1. Transmitter, Loma Scientific International Model No. LSI-67DTL
2. Transmodulator, Televes Model No. 5023
3. Transmission Line, Andrew Model No. LDF5-50
4. Transmit Antenna, Loma Scientific International Model No. LSI-2100
5. Receive Antenna (various gain, 9-11 dBi), Loma Scientific International custom models[2]
6. Block Down Converter, Loma Scientific International custom models
7. Digital Set-Top Box, EchoStar Model No. 351

At each of the test locations, the transmitting antenna was mounted on the roof of a building in the Flying J Travel Plaza from which a good view of the truck parking area could be had. In neither case was the transmitting antenna located more than 10 meters above ground – in fact, the transmitting antenna height above ground was 9.8 meters at Winslow and 9.9 meters at North Salt Lake. The transmitting antenna incorporated 4 degrees of electrical beam downtilt, and additional mechanical beam downtilt was incorporated in order to concentrate the peak of the antenna pattern toward the midpoint of the parking area (or at 150 meters in the case of Winslow). In both cases, the 120" horizontal beamwidth of the directional antenna pattern allowed acceptable signal coverage of the parking area. This combination of relatively low antenna height above ground and electrical beam downtilt was designed to limit the interference potential from the transmitting antenna while permitting Clarity to meet its objective of providing a digital television signal of sufficient quality to truck-borne receivers at the edges of the Flying J parking areas. As will be discussed below, the system proved to work just as designed.

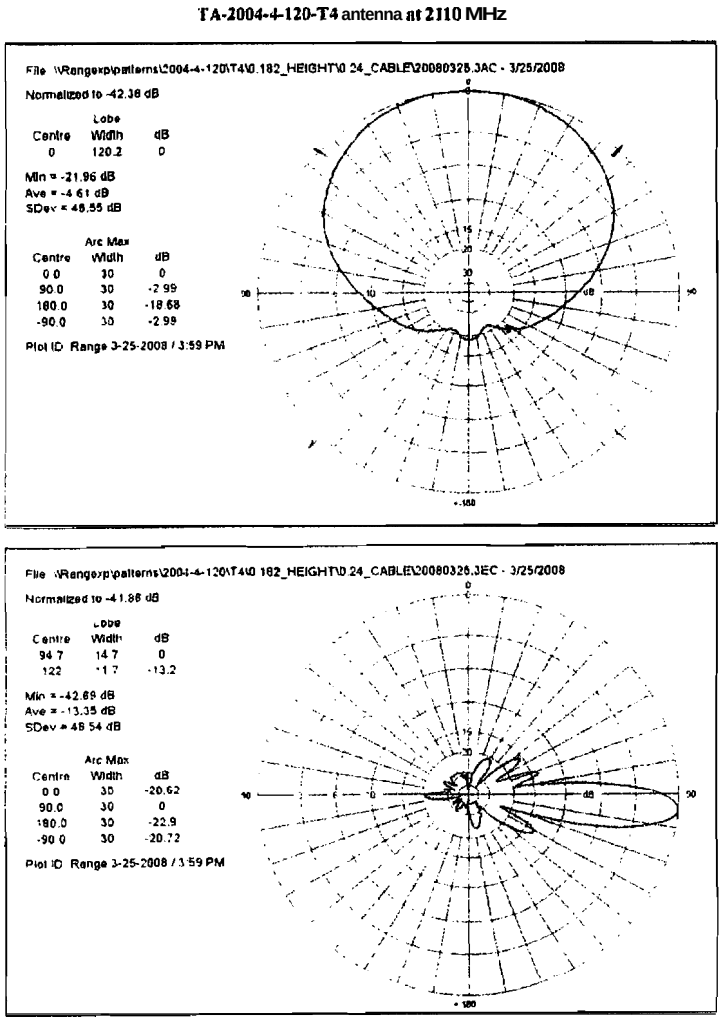
[2] During testing, prototypes of the receive antenna that will be provided for operational use of the Clarity system were evaluated by Clarity in cooperation with the antenna manufacturers. These evaluations confirmed that either of the two potential receive antenna models would operate effectively at the required signal strength of -72 dBm/channel.

The equipment Clarity used to take its measurements is listed on the first page of Attachment **3.**

Attachment 4 to this Report contains the block diagrams and descriptions of the equipment used during the testing at Winslow and North Salt Lake.

a. RSL Measurements Out to 1.5 miles (2400 meters) from Transmitting Antenna:

The Clarity transmitting antenna is a 120 degree sectorized antenna with vertical polarization. The front-to-back ratio is at least 20 dB (as reflected in the predicted levels in Figures 1 and 2 above). Figures **3** and 4 below show the horizontal and vertical gain patterns of the Clarity transmit antenna.



Figures 3 and 4: Antenna Pattern of Clarity Transmit Antenna

At Winslow, Clarity set the directional transmitting antenna on the roof of the plaza's restaurant, and focused the principal azimuth of the coverage pattern to the southeast to cover the truck parking area. As can be seen in Figure 5, which shows an example overlay of the horizontal antenna gain on a grid of geographical coordinates for Winslow, this means that the principal bearing of the antenna pattern is pointed at 114°.[3]

To generate a -72 dBm per channel RSL at 300 meters over the parking area, Clarity set the ERP at 50 mW/channel. This translates to a TPO of about 5 mW/channel – or 10% of the maximum TPO/channel that was authorized in the WE2XNE license. Because there are no Flying J Travel Plazas at which the target tractor-trailers would be parked more than 300 meters from the transmitting antenna, the scenario tested in Winslow represents a system-wide maximum case in terms of the potential for interference from a Clarity transmitting antenna.

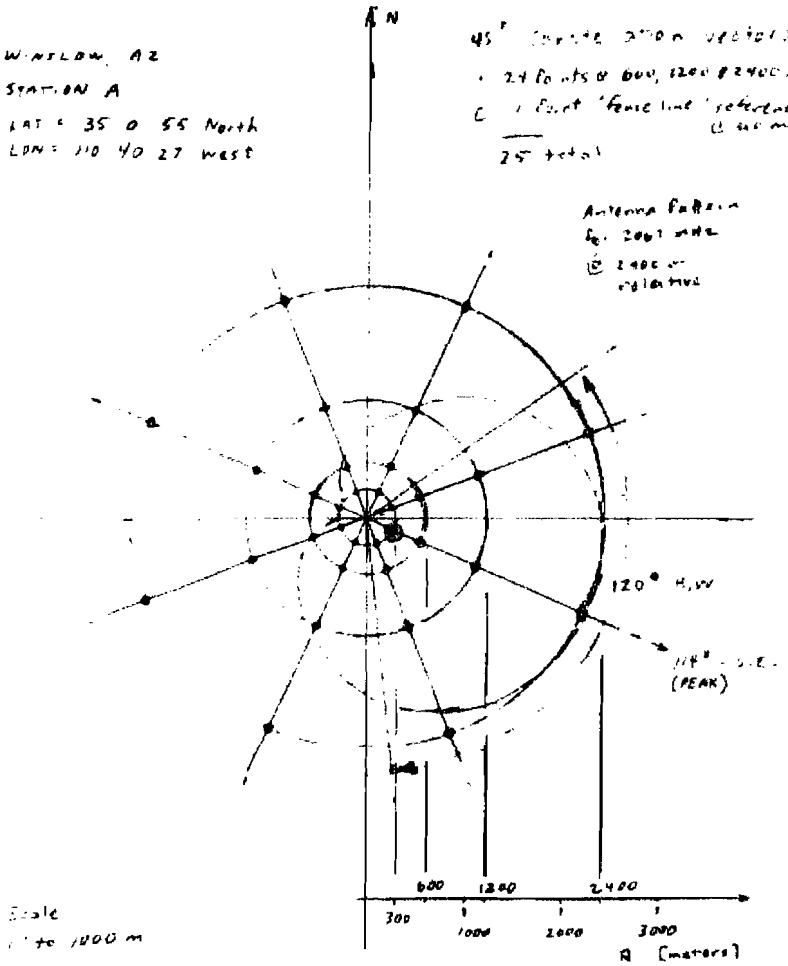


Figure 5: Overlay of Horizontal Antenna Gain on Geographical Grid

[3] Figure 5 shows the overlay of the antenna pattern on a geographic grid from Winslow for the sole purpose of illustrating the shape of the directional antenna pattern. The antenna pattern is not to scale, as it is without regard to the power that is driven through the transmitting antenna.

Attachment 5 to the Report contains photographs of the transmitter, roof-mounted transmitting antenna and test receivers employed for the RSL measurements in Winslow.

Figure 6 below shows a spectrum analyzer printout of the RSL at the fence line (approximately 300 meters from the transmitting antenna). The value is set at -72 dBm/channel.

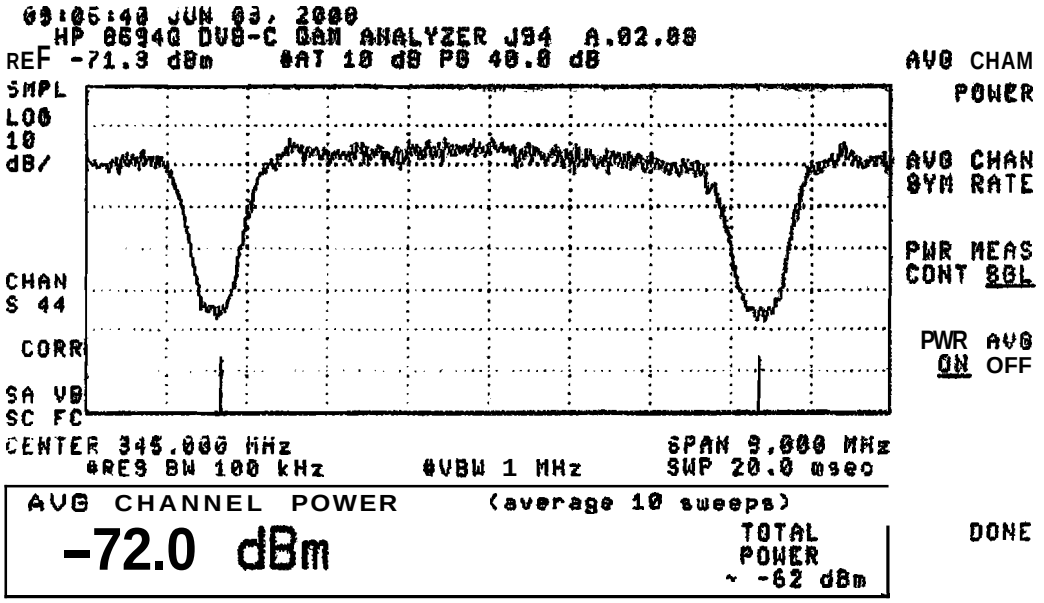


Figure 6: Spectrum Analyzer Printout of Clarity Transmitting Antenna (at 300m, Principal Azimuth)

Even in a relatively-flat, lightly-populated area such as Winslow, it turned out to be impossible for Clarity to gain access to all 32 points it required to take RSL measurements at the 300m, 600m, 1200m and 2400m points on 45° azimuths. Some measurement points were terrain blocked by nearby Interstate 40 or scrub trees, some points were on gated private property and inaccessible to the public, and some points were blocked by the buildings of Winslow. Actual measurements from all of the grid points that were both accessible and had clear line of sight to the transmitting antenna are shown in Figure 7.

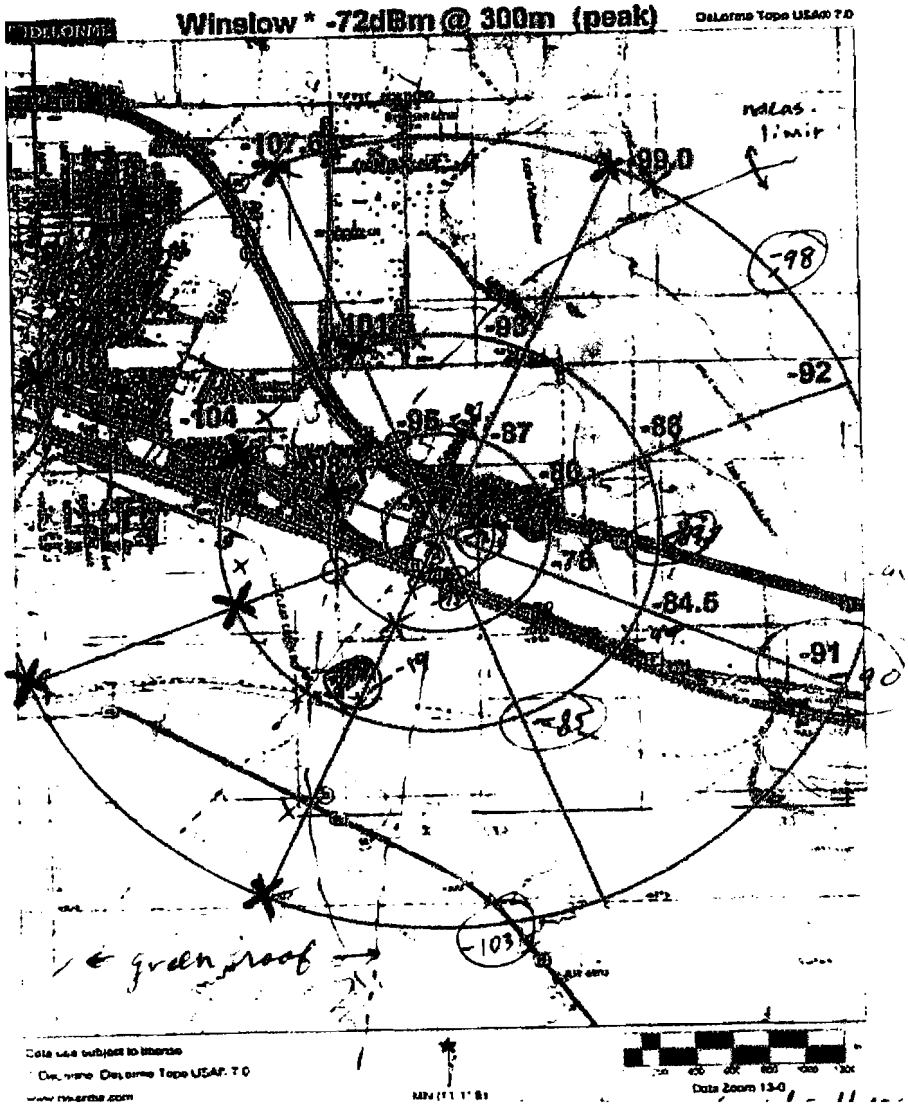


Figure 7: Winslow Grid Point Measurements

Clarity was surprised to find that it could gain access to only about 60% of the grid locations it intended to measure in Winslow. While this confirmed Clarity's general expectation that many sites from which there would even be a potential for harmful interference from a Clarity transmission system were terrain-blocked or otherwise shielded or inaccessible, it meant that Clarity would have to devise another mechanism for generating the comprehensive RSL measurements it had set out to take.

To develop a comprehensive set of RSL measurements at all 32 of the grid points, and to establish a representative worst-case depiction of the RSL environment on all 8 azimuths out to 2400 meters (1.5 miles) from a directional Clarity transmitting antenna set to the maximum level that would be required in operation, Clarity conducted a series of "periscope" measurements. For these tests, Clarity identified spots at 300m, 600m, 1200m and 2400m from the transmitting antenna that had clear line of sight. At each location (which were on various azimuths), Clarity set

the bearing of the location to the transmitting antenna as the principal azimuth and a technician stationed on the roof of the building where the transmit antenna was mounted physically rotated the antenna mast until the antenna was pointed directly at the measurement location (a condition that was readily observable on the spectrum analyzer to which the receive antenna was connected). Once the RSL level on the principal azimuth was recorded, the technician would rotate the transmit antenna by 45°, and a new measurement was taken. This was repeated until all 8 azimuthal measurements were taken at each of the four measurement distances. The result is a comprehensive grid of RSL measurements of Clarity's transmitting antenna operating at maximum power.

The results of the RSL measurements taken in the Clarity periscope tests are produced in Table 1. The measurements made are referenced to receive antenna input. The values shown in black at each distance are the predicted values shown on the grid plot in Figure 1 above. The values shown in red at each distance and on each azimuth are the measured RSL values. The calculated values are based on free space path loss; the measurements were all made with the same calibrated downconverter.

Table 1: Received Signal Level (RSL) Testing - Average Digital Power per Channel in dBm from a Clarity Transmitting Antenna Operating at 5 mW/channel TPO (ERP of 50 mW/channel)

Ref. to Peak Azimuth (Degrees)	Distance from Clarity Transmit Antenna 300m	600m	1200m	2400m
0	-72 -73.5	-78 -78.3	-84.5 -86.5	-91 -95
45	-74 -74.4	-80 -79.2	-86 -87.4	-92 -95.9
90	-81 -81	-87 -86	-93 -93.2	-99 -101.2
135	-89 -91.8	-95 -93	-101.5 -102	-107.6 -108
180	-92 -93.5	-98 -98	-104 -104	-110.6 -109.5(*)
225	-89 -91.8	-95 -96	-101.5 -102.3	-107.6 -107.7
270	-81 -80.8	-87 -86.8	-93 -93.7	-99 -102.9
315	-74 -72.2	-80 -79.9	-86 -87.8	-92 **-96.5**

(*) Measured RSL was at or below minimum test receiver sensitivity (the receiver's noise floor is -110 dBm/channel)

In nearly all of the measurements, the RSL was below the predicted level – in some cases by more than 4 dB. In no case where the measured RSL was at or above the minimum test receiver sensitivity was the recorded value more than a dB or so higher than predicted. Still, there was impressive correlation between the predicted values and the RSLs.

For each measurement point, Clarity made a spectrum analyzer printout of the result. Figure 6 above is the printout of the measurement taken on the principal azimuth at a distance of 300 meters. Figure 8 below is the diametrically opposite printout – the measurement taken on the 180° off-principal azimuth at a distance of 2400 meters.

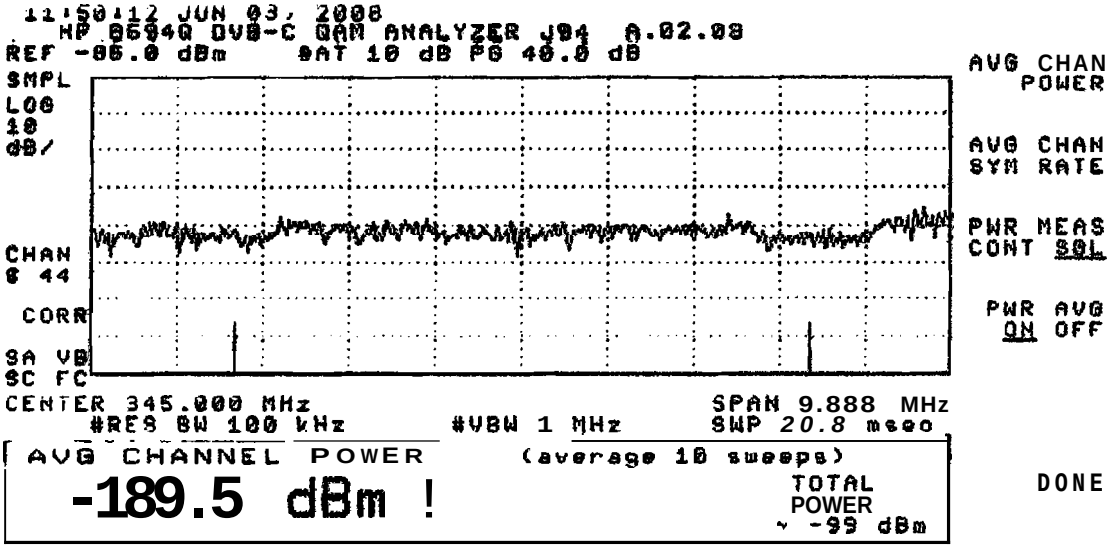


Figure 8: Spectrum Analyzer Printout of Clarity Transmitting Antenna at 2400m. Off-Principal

In the North Salt Lake, Utah tests on June 9 and 10, Clarity mounted the directional transmitting antenna on the roof of the plaza's truck wash, focused the principal azimuth to the northeast (which is generally away from Salt Lake City, which lies about five miles to the south southeast) to cover the truck parking area. To generate a -72 dBm RSL/channel at 150 meters over the plaza's truck parking area, Clarity set the ERP at 11 mW/channel. This translates to a TPO of about 1 mW/channel – or just 2% of the maximum output powerlchannel that was authorized in the WE2XNE license. The principal bearing of the pattern for the transmitting antenna was on the 37" azimuth.

Attachment 6 to the Report contains photographs of the transmitter, roof-mounted transmitting antenna and test receivers employed for the RSL measurements in North Salt Lake.

Figure 9 below shows a spectrum analyzer printout of the RSL at the fence line (approximately 150 meters from the transmitting antenna) on the 37" azimuth. The RSL value recorded is just about -72 dBm/channel.

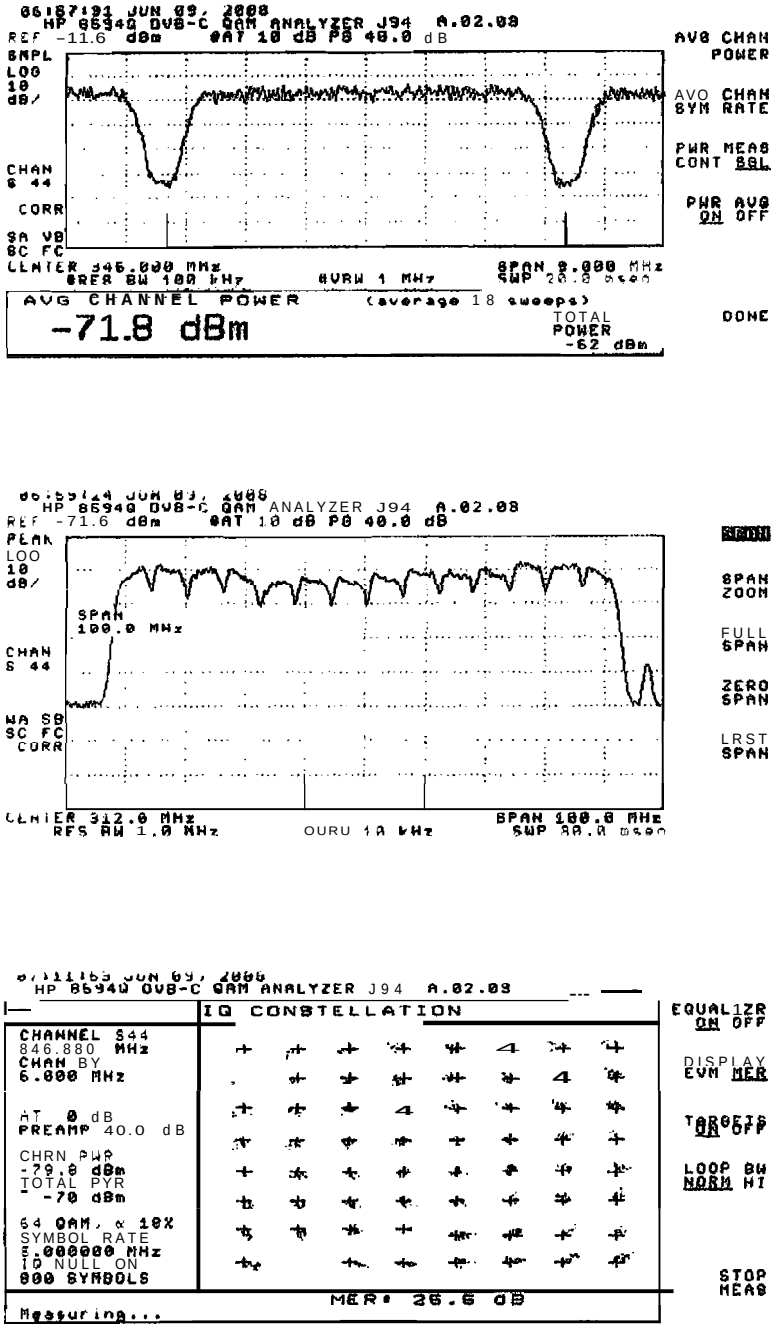


Figure 9: Spectrum Analyzer Printout of Clarity Transmitting Antenna at 150m, Principal Azimuth

In North Salt Lake, which is a significantly more industrial area than Winslow and has the Wasatch Mountains close by, it was even more difficult for Clarity to gain access to all 32 points it needed to take RSL measurements at the 300m, 600m, 1200m and 2400m points on 45° azimuths. Indeed, less than half of the points were usable or accessible to Clarity's team. Actual measurements from grid points that were both accessible and had clear line of sight to the transmitting antenna are shown in Figure 10.

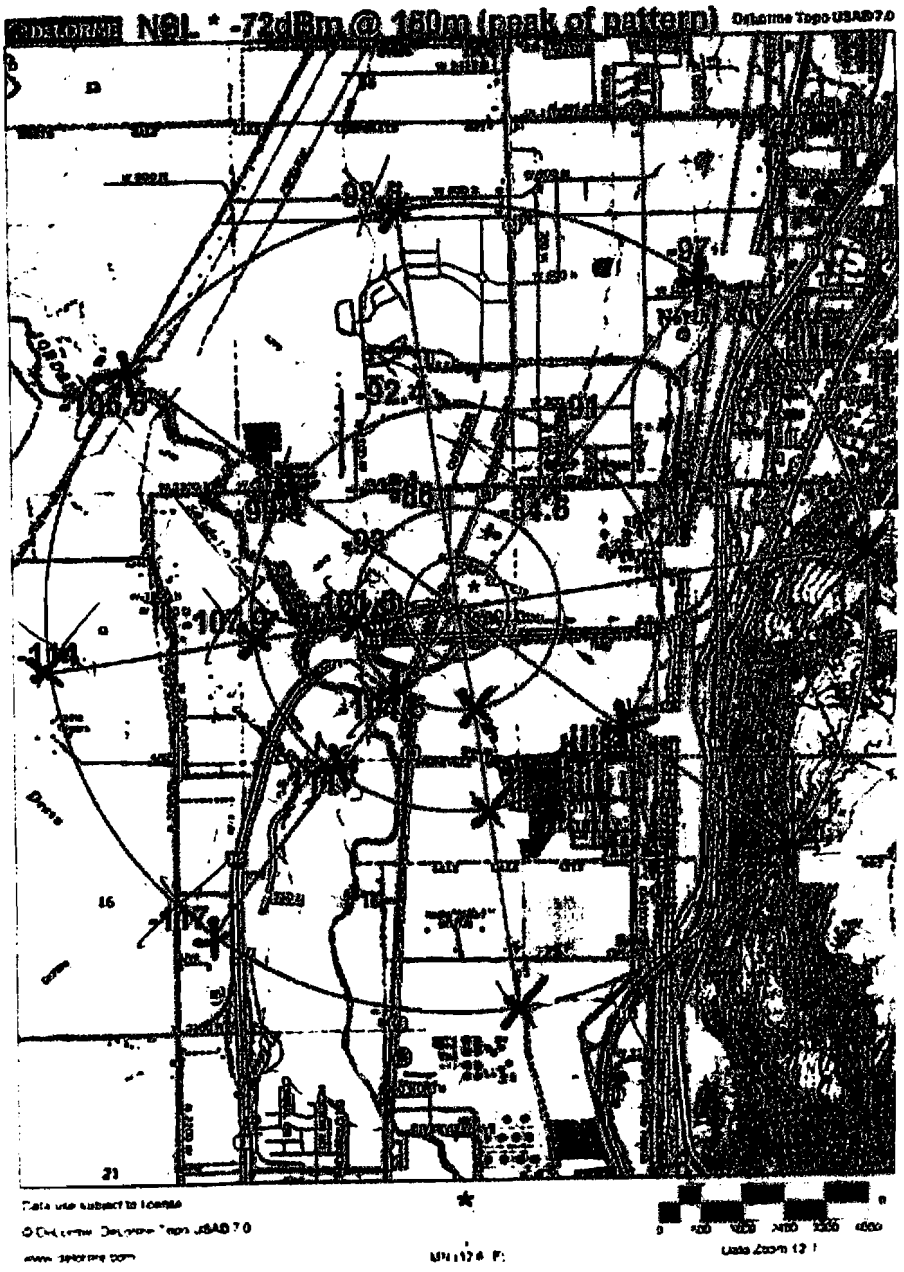


Figure 10: North Salt Lake Grid Point Measurements

Clarity even had difficulty finding points from which it could take "periscope" measurements at 300m, 600m, 1200m, and 2400m using the 1 mW TPO per channel level that the small size of the North Salt Lake Flying J Travel Plaza indicated. As shown below, Clarity took periscope RSL measurements at distances of 250m, 716m, and 2100m from the North Salt Lake transmitting antenna. These measurements were done in the same manner as was described above for the periscope tests in Winslow.

The results of the RSL measurements taken in the Clarity periscope tests from North Salt Lake are produced in Table 2. The measurements made are referenced to receive antenna input. The values shown in black at each distance are the predicted values shown on the grid plot in Figure 1 above, extrapolated for the different distances at which the RSL measurements were taken. The values shown in red at each distance and on each azimuth are the measured RSL values. The calculated values are based on free space path loss; the measurements were made with the same calibrated receive antenna downconverter that was used the week before in Winslow.

Table 2: Received Signal Level (RSL) Testing - Average Digital Power per Channel in dBm from a Clarity Transmitting Antenna Operating at 1 mW/channel TPO (ERP of 11 mW/channel)

Ref. to Peak Azimuth (Degrees)	Distance from Clarity Transmit Antenna		
	250m	716m	2100m
0	-77 -80	-86 -89.3	-95.8 -96.5
45	-78.5 -79.6	-87.7 -89.7	-97.3 -98
90	-85 -86.5	-94.7 -99.2	-104.3 -103
135	-93.5 -93.4	-103.2 -107	-112.8 -108(*)
180	-96.5 -95	-105.2 -107	-115.8 -110(*)
225	-93.5 -96.3	-103.2 -102	-112.8 -108(*)
270	-85 -85.8	-94.7 -93	-104.3 -103
315	-78.5 -80	-87.7 -90	-97.3 -98

(*) Measured RSL was at or below minimum test receiver sensitivity (the receiver's noise floor is -110 dBm/channel)

In nearly all of the measurements, the RSL was below the predicted level – in some cases by more than 4 dB. In no case where the measured RSL was at or above the minimum test receiver sensitivity was the recorded value more than a dB or so higher than predicted. There was strong correlation between the predicted values and the RSLs.

b. Specialized RSL Measurements at Altitude and at ENG Receive Sites:

In both Winslow and North Salt Lake, Clarity used the opportunity of the tests to conduct some specialized measurements. In Winslow, Clarity was able to use an elevator truck located on the principal bearing with line of sight at a distance of 858 meters to take RSL measurements at various heights from 4 meters to 30 meters above ground. The average RSL measured at elevation was -81 dBm. Extrapolating from the theoretical predictions in Figure 1, the predicted value at

858 meters away from the transmitting antenna on the principal bearing is -81.5 dBm. The measurements showed that signal strength diminishes with increases in elevation of up to 30 meters at moderate distances.

In North Salt Lake, Clarity was aware of several locations with line of sight access to the authorized transmitter site that are used by broadcasters for central fixed ENG receive sites. As shown in Figure 11 below, one of these locations is on the top of the Key Bank Tower (formerly the Beneficial Life Tower) in downtown Salt Lake City – 8.37 kilometers from Clarity's North Salt Lake transmitting antenna.[4] Clarity was eager to conduct an RSL measurement from the rooftop of the Key Bank Tower because the prospect of harmful interference from a Clarity transmitting antenna operating from the North Salt Lake Flying J Travel Plaza had been asserted repeatedly – both specifically and as representative of harmful interference situations system-wide – by certain parties to the Media Bureau proceedings on Clarity's CARS applications.

[4] **The coordinates of the Key Bank Tower rooftop are** 40° 46' 06" N, 111° 53' 21.2" W.

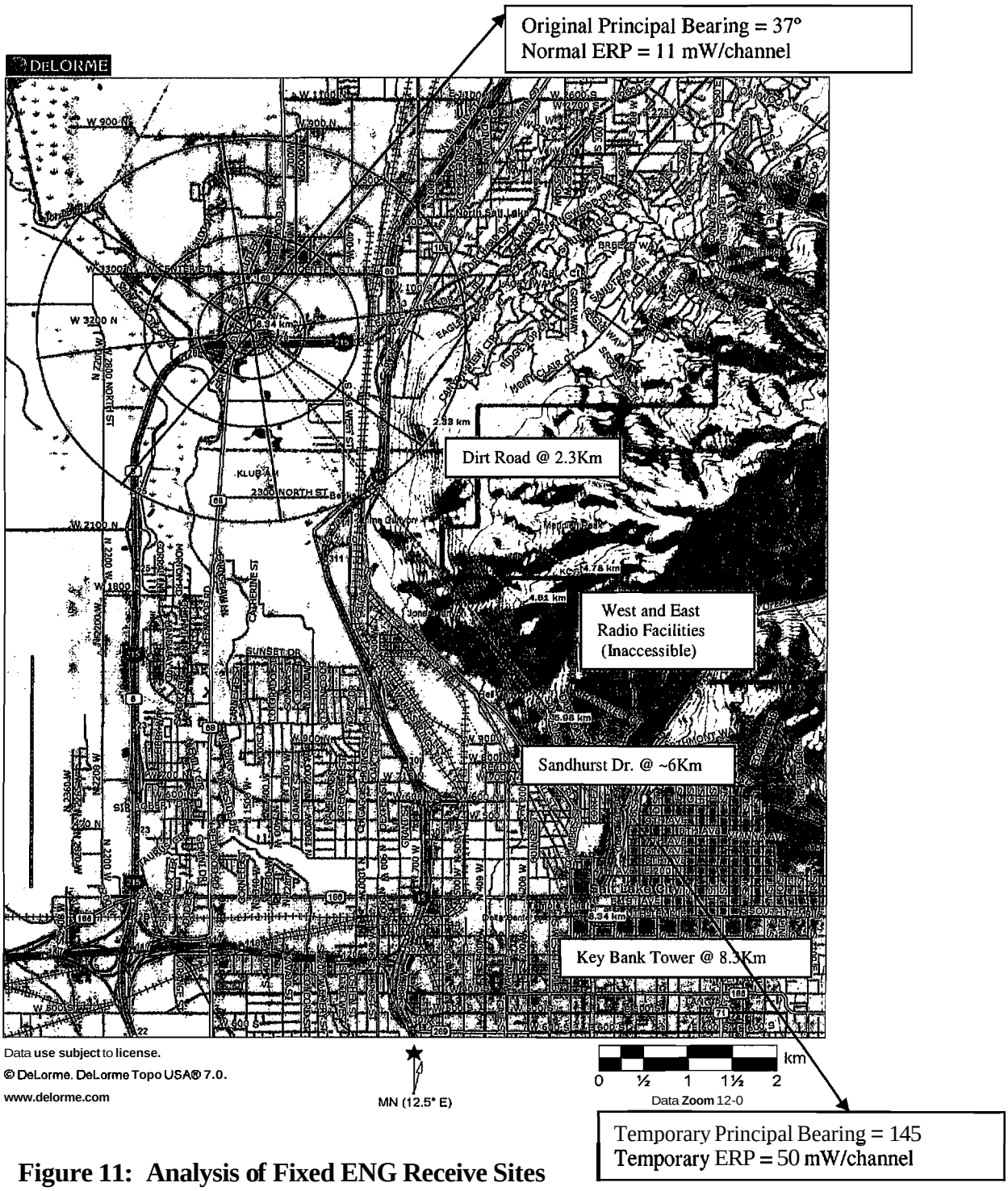


Figure 11: Analysis of Fixed ENG Receive Sites

On the testing days in North Salt Lake, Clarity arranged with the property manager of the Key Bank Tower to gain access to the building's roof for RSL measurements. Because the principal azimuth of the North Salt Lake transmitting antenna as installed for the tests described above was set on a bearing of 37" (i.e., more than 100" away from downtown Salt Lake City), and because the power required to cover the local Flying J Travel Plaza truck parking lot was low, the receiver Clarity used for the testing program would not be able accurately to measure the transmitting antenna's signal from the Key Bank Tower.[5] To conduct the RSL measurement, Clarity temporarily reoriented the Clarity transmitting antenna so that the principal azimuth was temporarily relocated to a bearing of 145° – i.e., pointed toward the Key Bank Tower – and increased the ERP per channel from 11 mW to the 50 mW system-wide maximum (i.e., TPO was upped from 1 mW to 5 mW). The measured RSL from the rooftop of the Key Bank Tower at a distance of 8.37 km was -108 dBm/channel (which is right at the minimum threshold sensitivity level for the Clarity receive equipment).[6] For comparison, with the original transmitting antenna orientation and ERP/TPO per channel levels, Clarity's North Salt Lake transmission systemer would have produced an RSL at the Key Bank Tower rooftop of -124 to -125 dBm/channel.

Clarity conducted a second RSL measurement from a mountainside site with line of sight to the Flying J Travel Plaza in North Salt Lake at a distance of 2.3 kilometers. This site is at a comparable elevation to – but is some 2.5 kilometers closer to the Clarity transmitting antenna than – a mountaintop fixed ENG receive site that proved to be inaccessible to Clarity's measuring equipment.[7] Clarity took this measurement while the transmitting antenna's principal azimuth was temporarily oriented on a bearing of 145" (as opposed to the original 37" bearing), and while the power was temporarily increased to the system-wide maximum ERP/channel of 50 mW (up from the nominal 11 mW ERP/channel for North Salt Lake) (i.e., TPO per channel was upped from 1 mW to 5 mW). The measured RSL at the site was -101.7 dBm/channel. Figure 12 below contains a printout of the spectrum analyzer reading Clarity took from this location. For comparison, with the normal transmitting antenna orientation at 37° and the ERP per channel set to the 11 mW/channel level needed to produce a -72 dBm/channel signal at 150 meters, Clarity's North Salt Lake transmission system would have produced an RSL at the same site of -116 dBm/channel.

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[5] The receiver's noise floor is -110 dBm per channel. As shown in Figure 2 above, the predicted RSL at 2400 meters on the azimuth toward Salt Lake City (i.e., the azimuth to the SSE) is already below -110 dBm/channel.

[6] The predicted RSL at 8400 meters from a 50 mW/channel ERP transmitting antenna on the azimuth tested is between -107 dBm/channel and -108 dBm/channel (based on a 6 dB rate of decay for every doubling of the distance from the transmitter). The fact that the measured RSL at 8400 meters and at a substantially higher elevation (some 160 feet above the ground) was already down to -108 dBm/channel indicates the effectiveness of the mechanical and electrical beam downtilt measures Clarity uses in its transmitter installations.

[7] The coordinates of this site are 40° 47' 28" N, 111° 53' 39" W. This site is the "dirt road" site marked on Figure 11 above.

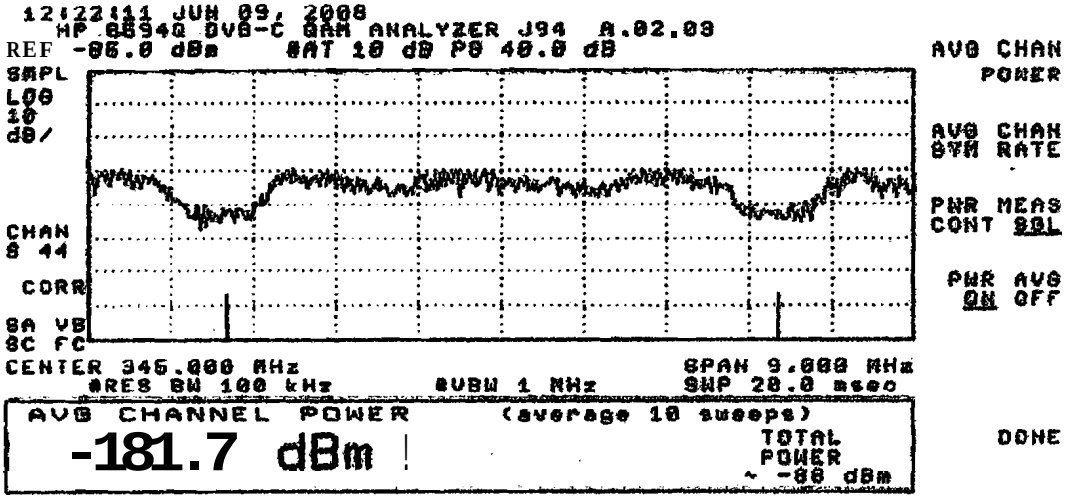

Figure 12: Spectrum Analyzer Printout from Site Near Radio Broadcast Towers

Finally, to corroborate the theoretical/predicted results of RSL measurements taken from or near fixed ENG sites, Clarity took an RSL measurement from an elevated, mountainside location 5.95 km (with line of sight) from the Clarity transmitting antenna while on its original bearing (37") and operating at 11 mW/channel ERP (or 1 mW/channel TPO).[8] The RSL at this location was below -110 dBm/channel – i.e., below the minimum receiver sensitivity).

3. CONFIRMATION OF 8 dB AS THE MINIMUM REQUIRED DESIRED-TO-UNDESIRED ("D/U") RATIO FOR 2.1 GHz BAND DIGITAL ENG RECEIVE EQUIPMENT.

Clarity was aware from the outset of this round of tests and measurements that the gathering of even a comprehensive set of RSL measurement data would not, by itself, confirm Clarity's longstanding assertion that its tiny travel-plaza television transmission system had virtually no potential to cause interference to any co-frequency ENG operations. The RSL levels, low as they are now confirmed to be, do not indicate by themselves whether the broadcasters' ENG equipment would maintain minimum required desired-to-undesired ("D/U") ratios in the presence of the Clarity signals.

It was Clarity's intention, as desired by the Commission, to conduct empirical tests using actual 2.1 GHz ENG equipment operating in the presence of actual Clarity transmissions. Clarity wanted to determine the extent, if any, to which its transmissions would harmfully interfere with co-frequency ENG reception. Although it seems intuitive that broadcasters would want to know this information first-hand as well, the complete paucity of constructive participation by

[8] The coordinates of the second site are 40" 49' 28" N, 111° 54' 37" W. This site is the "Sandhurst Drive" site marked on Figure 11 above.

broadcasters in connection with anything Clarity has tried to do over the last two and one-half years to assuage broadcaster concerns led Clarity to develop a contingency plan for gathering data that establishes the D N ratio for 2.1 GHz band ENG receivers.

Although the broadcast community ignored Clarity's invitations and attempts to coordinate operations and assessment techniques, Clarity was nevertheless able to identify and confirm the minimum D N ratio for COFDM ENG equipment in the 2.1 GHz band. The level, as Clarity had previously been informed by equipment manufacturers, is 8 dB. The 8 dB level is relative to a minimum receiver threshold sensitivity level in the ENG receive equipment of -92 dBm/channel.[9] These data points allow an assessment to be made of the potential for Clarity's transmissions – at the RSL levels it has systematically recorded at various distances beyond the fence line of a Flying J Travel Plaza truck parking area – to cause harmful interference to ENG equipment.

A. Overview of D/U Interference Testing

To establish the D N level, Clarity's technical team devised and carried out a laboratory test that involved setting up a 2.1 GHz-band ENG link (comprised of a transmitter and a receiver). This link, over which a television signal was transmitted, established the "desired" component of the D N ratio. The technical team then introduced co-channel interference from a Clarity transmitter that was broadcasting an AV signal fed from a DVD player. By systematically adjusting the Clarity signal to correspond with differing D/U ratios as compared to the ENG signal, Clarity was able to establish that an 8 dB D N ratio for the ENG link was marginally acceptable. A 3 dB D N ratio was clearly unacceptable, as the ENG picture on the MPEG decoder locked or froze. A 12 dB D N ratio was clearly acceptable, as there was no picture locking or freezing observed.

The first step in the assessment involved setting up an ENG link. Figure 13 below shows the transmission equipment. The transmission parameters for the link are shown in Table 3 below. Figure 14 shows a spectrum analyzer print-out of the transmitter output.

[9] Attachment 7 to this Report contains a data fact sheet from RF Central, a manufacturer of ENG equipment for the 2 GHz band. The data sheet identifies the minimum receiver threshold sensitivity level of RF Central's unit as – 92 dBm/channel.

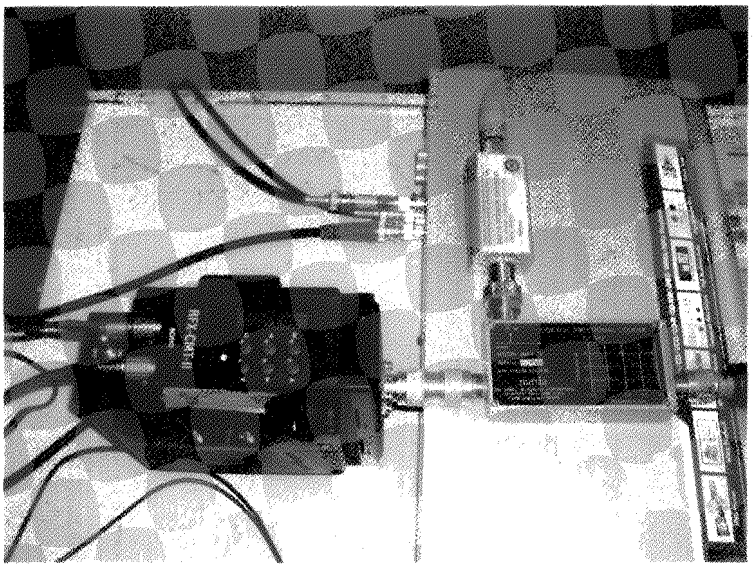

Figure 13: ENG Transmitter, Test Coupler, and Power Sensor

Table **3: DVB-T ENG/BAS Radio Link Parameters**

Parameter	**Value**
Power	
ERP (a)	0 dBm (-20 dBi)
ERP (b)	-10 dBm (-30 dBi)
ERP (c)	-20 dBm (-40 dBi)
Frequency	2067.5 MHz ENG Ch. A4r
Bandwidth	8 MHz
Modulation	COFDM, 2K Carriers – QPSK
FEC	3/4
Guard Interval	1/8
Bit Rate	8.29 Mbps (MPEG 2 MP/ML VIDEO COMPRESSION)

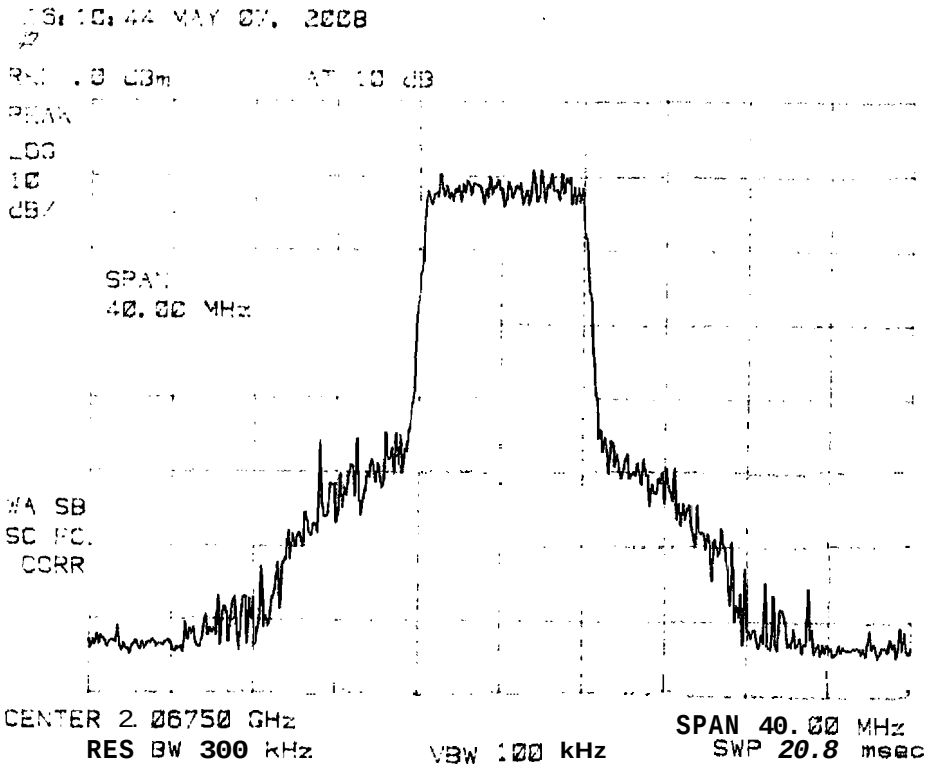

Figure 14: Spectrum Analyzer Plot of Transmitter Output (-20 dB)

For the ENG receiver, the technical team used a 10 dB rectangular horn. A low noise block downconverter is located in the same reference plan as the receive antenna for measuring D/U ratios. The receiver is preset to the same frequency as the transmitter. The front panel of the receiver displays input power and COFDM Channel-State Information ("CSI").[10] Figure 15 shows the ENG receiver set up.

[10] CSI is not the same as Bit Error Rate (BER), but it does convey interference information based on selective COFDM (pilot) carriers. CSI is useful as a metric for link reliability. For example: the baseline CSI is 5% for no interference, whereas severe interference from noise or poor D/U (co-channel) would read about 30% CSI. A 12% CSI is more than adequate for a good quality link.

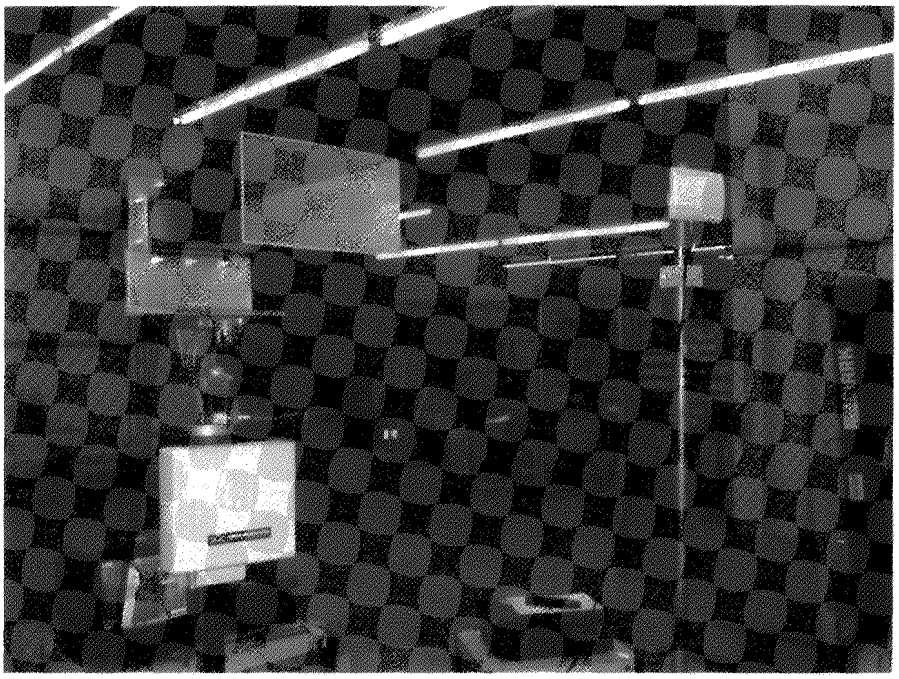

Figure 15: ENG Receiver Set Up

For the three ERP settings listed above, the receiver input levels are -50, -60 and -70 dBm, respectively. Therefore the simulated RSLs into the receive antenna are -60, -70 and -80 dBm, respectively. Figure 16 below shows a spectrum analyzer sweep with these RSLs (the diamond marker is set at -60 dBm). The sweep was made with only the ENG signal present; the simulated Clarity signal had nor been introduced.

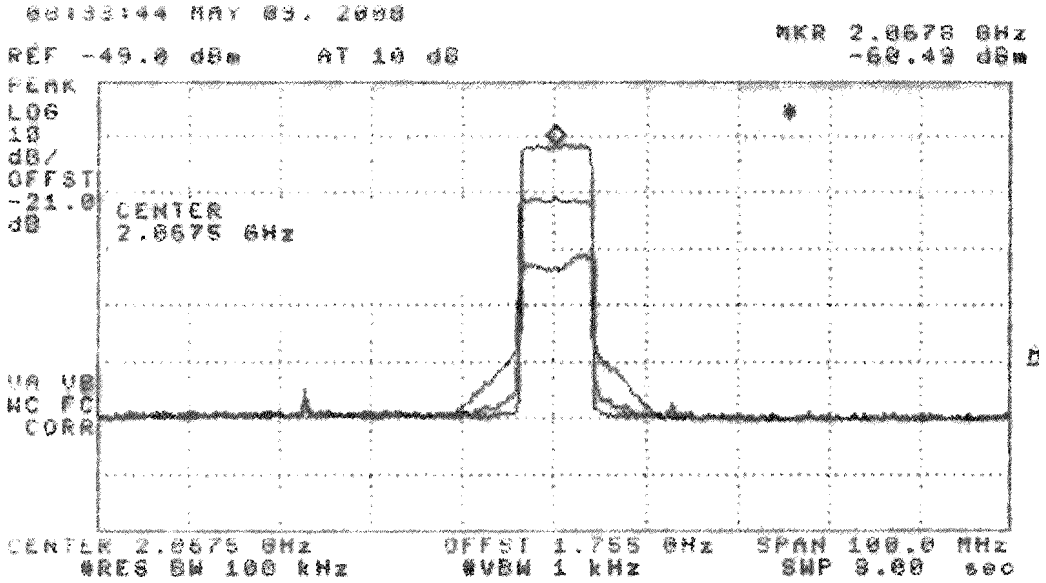

Figure 16: Spectrum Analyzer Sweep of ENG RSLs

Figure 17 below is a photograph of the portable ENG receiver the technical team used in the laboratory test

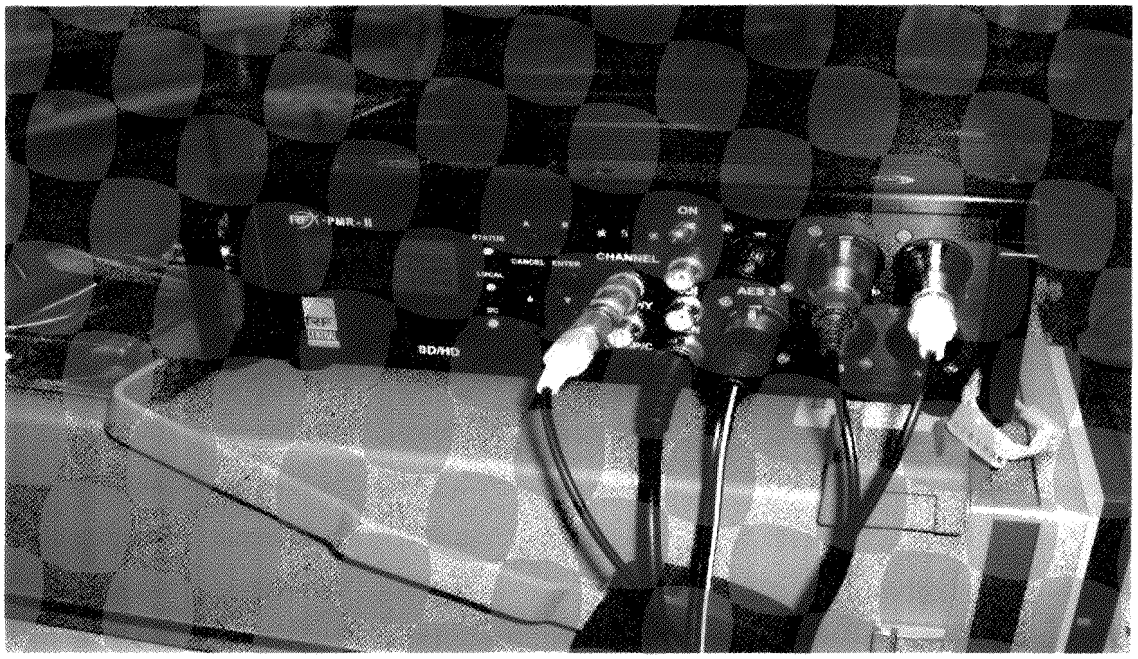

Figure 17: ENG Receiver

Into this ENG link, co-channel interference from a Clarity transmitter is introduced. After turning on the Loma Scientific International Model LSI-67DTL transmitter, the technical team made the measurements provided in Table 4 below. The interfering ERP is -24 dBm/channel out of a 10 dB rectangular horn. The path distance from both the ENG and Clarity transmitters to the ENG receiver was approximately 25 feet.

Table 4: Results **of Introduction of Clarity Signal Into ENG Link**

D/U	CSI	Picture
3 dB	99%	locked
8 dB	30%	ok or locking (marginal)
12 dB	18%	ok
18 dB	12%	ok

Note: Picture "locked" or "locking" refers to the freeze frame output of the MPEG decoder

B. Conclusion

CSI monitoring is a convenient and effective way to judge the quality of a COFDM communications link. Corrections can always be made to improve CSI.

Completely reliable ENG links are readily achieved with a D/U of only 12 dB, and the testing confirms that 8 dB is the minimum D/U required for digital ENG links in the 2.1 GHz band. With these results, and the RSL measurements that were taken in Winslow and North Salt Lake from operational Clarity transmission systems, an accurate and comprehensive assessment may now be made of the potential for interference. In all cases, this assessment is able to rely on empirical data – rendering any reliance on tools that merely predict the likelihood of interference unnecessary.

4. ANALYSIS OF RESULTS

A. Overview

Clarity's experimental operations under its Experimental Radio Service License Call Sign WE2XNE proved several essential points that support Clarity's quest to use an ultra low-power, short-range television transmission system to bring a first local television service to unserved professional long-haul truck drivers who do their layovers each day at a Flying J Travel Plaza:

- Clarity's service can satisfy Clarity's signal quality objectives if the signal strength its transmission system produces at the fence line of the truck parking area is -72 dBm/channel on the principal bearing of the transmitting antenna.

- System wide, Clarity requires no more than 50 mW/channel ERP (i.e., about 5 mW/channel transmitter power output) to produce a signal strength level of -72 dBm/channel at 300 meters on the principal bearing of the directional transmitting antenna Clarity will use for its service. Many Flying J Travel Plaza truck parking areas have fence lines that are substantially closer to the transmitting antenna location than 300 meters, and the ERP and TPO per channel of the Clarity transmitting antenna at these locations will be substantially lower than 50 mW/channel and 5 mW/channel, respectively.

- The front-to-back ratio of Clarity's directional antenna is 20 dB (meaning that Clarity produces 20 dB lower signals in the 180° off-principal direction than it does on the principal bearing), and signal strength is 8 dB lower at +/- 90° off principal bearing.

- The Received Signal Level ("RSL") from a Clarity transmitting antenna decays to background noise levels very quickly beyond the fence line.

- The minimum D/U ratio for 2.1 GHz band digital ENG equipment is 8 dB. Protecting ENG equipment to a 12 dB D/U (with a CSI figure of 18%) will provide sufficient margin.