A Textron Company

November 25, 2019

Federal Communications Commission
445 12th Street SW
Washington, DC 20554
(316) 821-9516

Title: STA License Request for Data Link Testing at Bell Textron Arlington, Texas

Application File Number: **1933-EX-ST-2019**
Confirmation Number: **EL212404**

Dear FCC,

This request is intended to cover an increase in the output power to 84.15W for the Air-Directional emission found in column "**Lossy ERP w/ SL (W)"** in Table 2 of this document.

Specifically, the lossy ERP (Effective Radiated Power) with system losses for the Air-Directional emission to be increased from 54.34W to 85W (84.15W).

This new update will be used in conjunction with the currently issued FCC experimental STA license under call sign WP9XLY (File Number: 1933-EX-ST-2019).

The rest of the document provides details regarding the testing and is an update to what was submitted in the application under call sign WP9XLY.

Stop Buzzer Contact
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Kind Regards,

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This request for Special temporary Authority (STA) is submitted pursuant to 47 CFR 5.61 to request authorization to perform performance evaluation testing of an L3-Harris data link system. The proposed operation is planned for 10 flights between December 2019 and May 2020. Note: requested period is for 6 months to allow for schedule changes should they arise. STA is required because the data link system transmits in a frequency band (Ku) and at radio frequency power levels that require FCC licensing.

PURPOSE:

Data link performance testing: The purpose of this testing is to evaluate the performance of a full-duplex L3-Harris data link system at range and configured as designed between an airborne platform and ground based platform. The airborne system will be installed on Bell Textron's V-280 tiltrotor aircraft and will consist of two antennas, one directional steerable in a 2-axis configuration pointing back to the ground station and the second being an omni directional antenna. The system is intended to transmit on either the directional or the omni but not both antennas simultaneously. The ground station will be setup at Bell Textron's Flight Research Center in Arlington, Texas located next to the Arlington Municipal Airport. The ground station will consist of two antennas, one directional steerable in a 2-axis configuration pointing to the airborne system and the second being an omni directional antenna. The system is intended to transmit on either the directional or the omni but not both antennas simultaneously.

This testing is only to evaluate the performance of the L3-Harris data link system in this configuration and will NOT be used for remote piloting. The V-280 aircraft will always be human piloted.

OPERATIONS:

- Testing will be limited to daylight hours and clear weather days.
- Maximum altitude of V-280 will be limited to 3000 meters above mean sea-level.
- Plan for 10 flights between November 2019 and April 2020.
- Plan for a four-week ground test period in advance of the flight testing. The system will be transmitting during the ground test events at the Bell Arlington, TX facility.
- Requested STA is for 6 months to accommodate any follow-on testing or setup delays.
- The purpose of the test is the evaluate the performance of the datalink system. The information transmitted in not classified or sensitive and will consist of video and data.
- Airborne hardware will be installed on the Bell V-280 aircraft.
- Ground based hardware will be installed at the Bell Flight Research Center in Arlington, Texas.
- The data link system will NOT be used for remote piloting. This is a test of the data link system performance only and the V-280 aircraft will always be human piloted.

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EQUIPMENT:

Table 1 lists all relevant test equipment.

Table 1: Test Equipment

Location	Manufacturer	Model Number	Function	No. of Units
V-280	L3Harris	6009100001	Modem	1
V-280	L3Harris	1000441393	Amplifier	1
V-280	L3Harris	60030090-007	Directional Antenna	1
V-280	L3Harris	1000389012	Omni Directional Antenna	1
Ground	L3Harris	6009100001	Modem	1
Ground	L3Harris	1000440631	Amplifier	1
Ground	L3Harris	60072537-001	Directional Antenna	1
Ground	L3Harris	60051685-001	Omni Directional Antenna	1

TRANSMITTED FREQUENCIES:

The following emission designators are intended for use on V-280's CDL test:

- BR-.02 Clear, 800KG1D, at both 14.4 – 14.83 and 15.15 – 15.35 GHz
- BR-.04 Clear, 1M60G1D, at 15.15 – 15.35 GHz
- BR-10.71, 21M4G1D, at 14.4 – 14.83 GHz
- BR-21.42, 42M8G1D, at 14.4 – 14.83 GHz

The link direction is "down" for 14.4 – 14.83 GHz and the link direction is "up" for 15.15 – 15.35 GHz. Bell Textron is requesting two separate frequencies, one in the uplink band (15.15 – 15.35 GHz) and the other in the downlink band (14.4 – 14.83 GHz) determined by the FCC. Frequencies should accommodate the necessary band edge separation for the largest emission designators of 21.42MHz in the downlink band and 1.6MHz in the uplink band. Bell Textron's proposed frequencies are as follows:

- Proposed downlink frequency is **14.500 GHz** (emission designator 42M8G1D)
- Proposed uplink frequency is **15.200 GHz** (emission designator 1M60G1D)

TEST LOCATION:

Testing will be conducted within a radius of 56 km centered at WGS 84 coordinates of Latitude 32° 10' 33.5" N and Longitude 097° 05' 01.7" W at a flight elevation not to exceed 3000 m MSL. Figure 1 below shows a map view of the test location highlighted in a red circle. The ground station transceiver is located at WGS 84 coordinates of Latitude 32° 40' 2.7" N and Longitude 097° 5' 55.47" W at an elevation of 205 m MSL.

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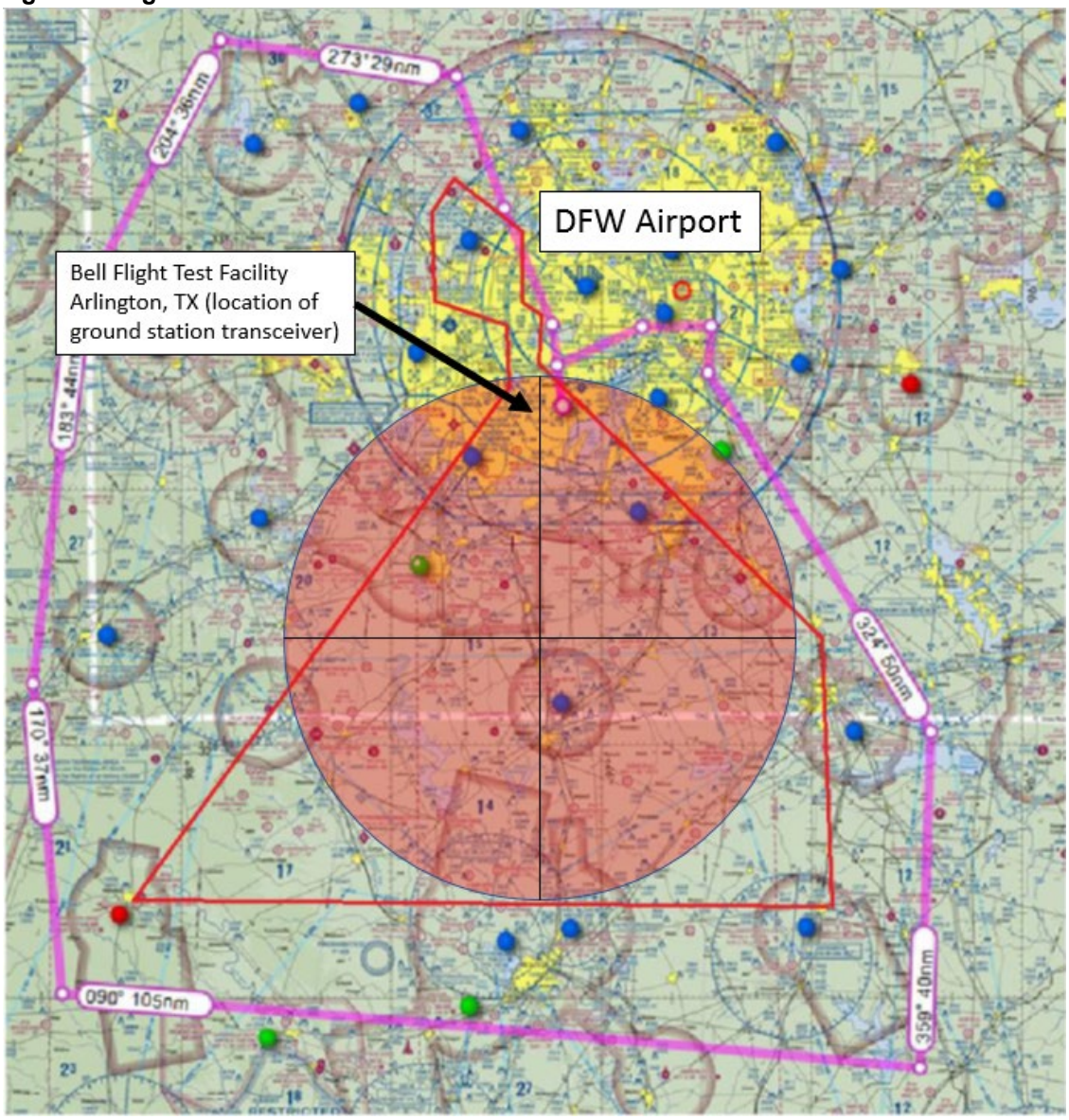
Figure 1: Flight Test Location



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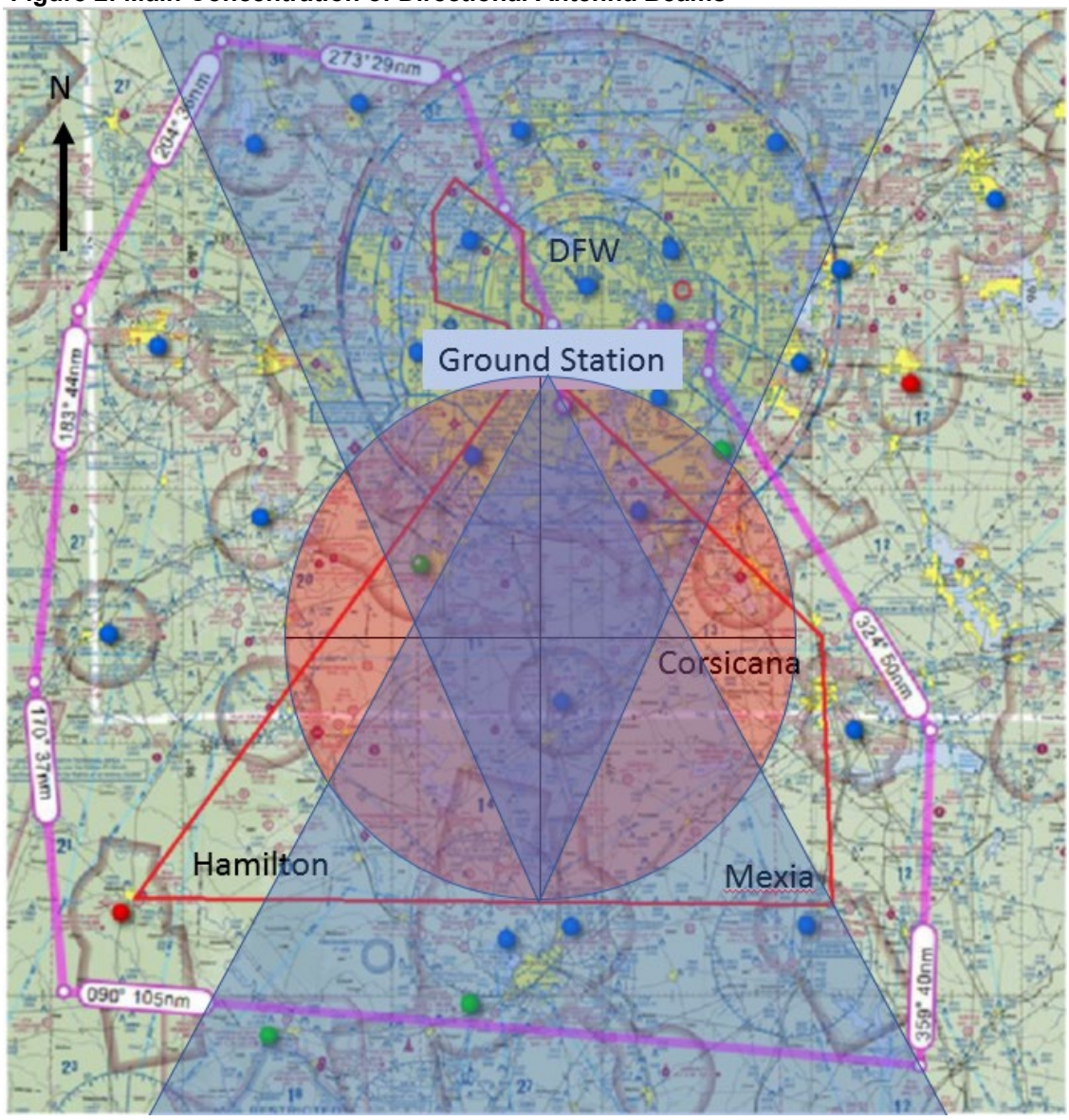
TEST LOCATION:

Figure 2 illustrates the main concentration of directional antennas beams represented by blue shaded triangles. Since the ground station is located north of the airborne station flight operations area and assuming the directional antennas are always pointing at each other, the main beams are in the north-south and south-north orientation.

Figure 2: Main Concentration of Directional Antenna Beams



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TEST CONFIGURATION:

Figure 3 illustrates the concept of the four-antenna data link architecture. Both the airborne and ground based systems have one directional and one omni directional antenna each. There is a switch in the ground station system to switch between the omni directional antenna and the directional antenna. Although the transmission will be either one or the other, there is the instance when both could be transmitting for an instance during the switching process. The same thing applies to the airborne system.

Figure 3: Ground Station and Airborne Antenna Architecture Concept

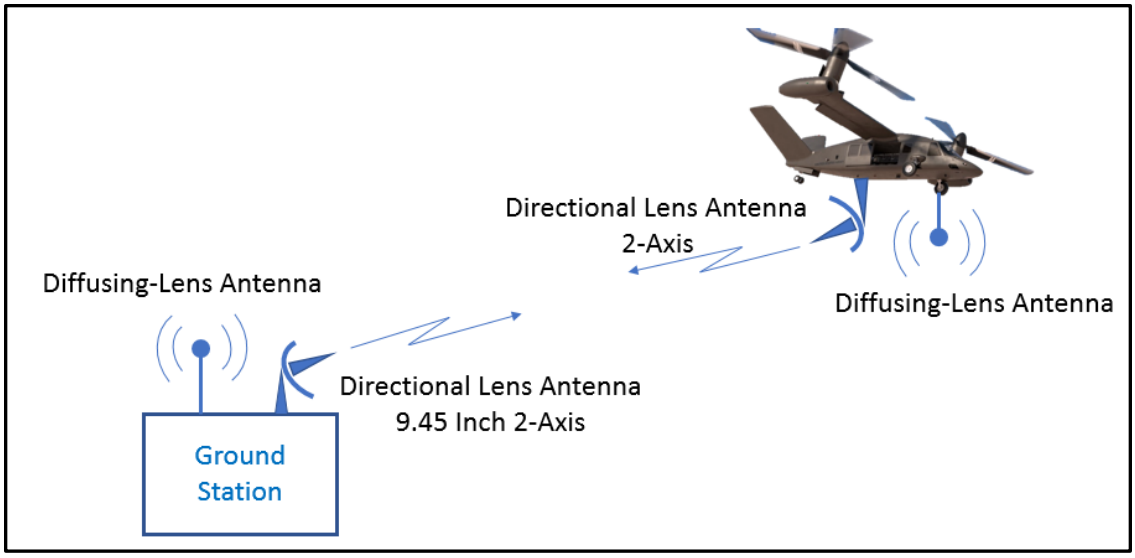

Figure 4 illustrates the ground station configuration.

Figure 4: Ground Station Configuration

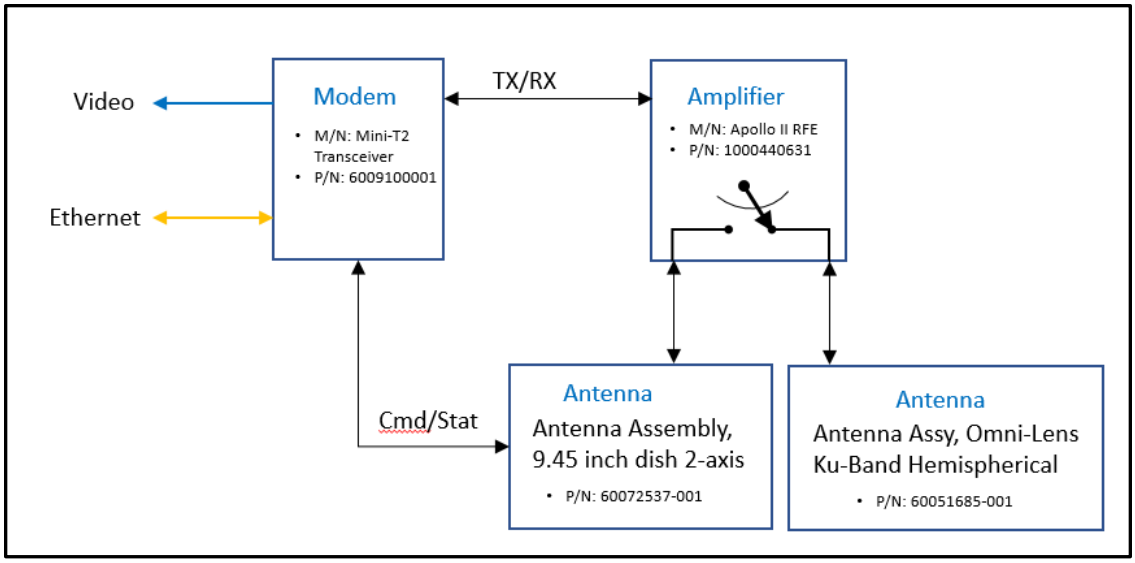

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Figure 5 illustrates the airborne configuration.

Figure 5: Airborne Station Configuration

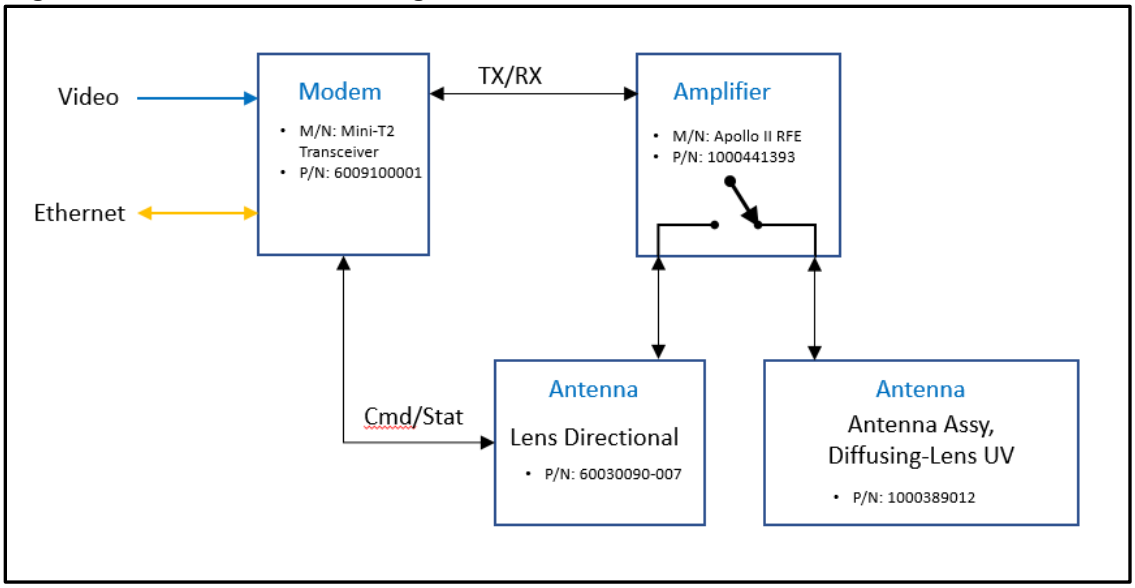
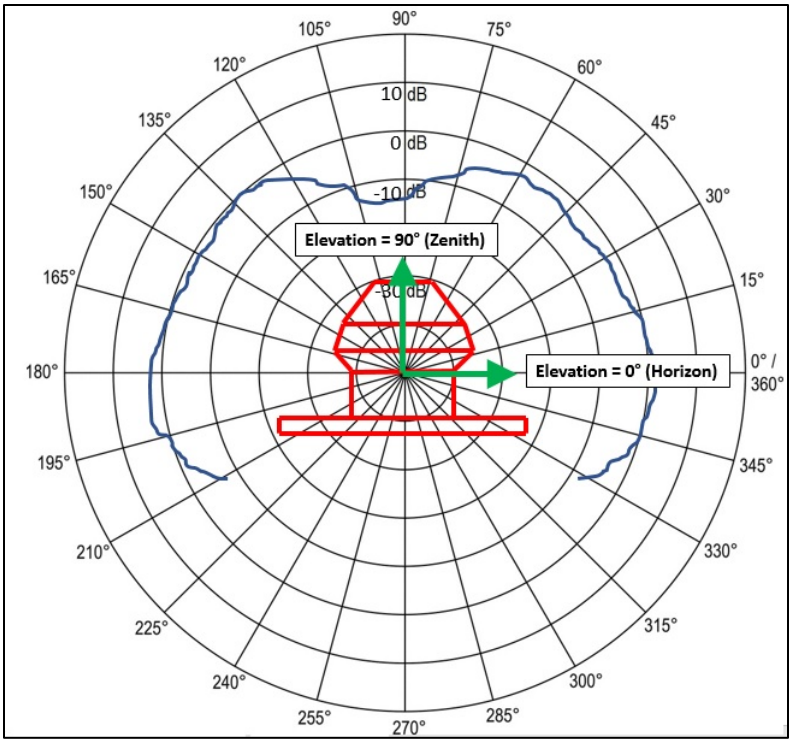


Figure 6 illustrates the general elevation radiation pattern for both the airborne and ground Diffusing Lens antennas. Radio frequency gain in the designated bands is about unity at beam peaks.

Figure 6: Airborne & Ground Diffusing-Lens Antenna Radiation Pattern (General)



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POWER CALCULATIONS:

$P_{(W)} = 1W \cdot 10^{(P_{(dBm)}/10)} / 1000$

ERP (W) = $P_{(W)} \cdot \log^{-1}(\text{Ant Gain (dBi-2.15)}/10)$

SL = System Loss due to radio frequency attenuation for the installation

Table 2 includes ERP calculations for a lossless and lossy system based on available data

Table 2: Effective Radiated Power (ERP) Values for The Air and Ground Configurations

Path	RFE TX Pwr (dBm)	RFE TX Pwr $P_{(W)}$	Antenna Gain (dBi)	Lossless ERP (W)	Lossy ERP w/o SL (W)	Lossy ERP w/ SL (W)	3dB Beam width (deg)
Air-Omni	38	6.31	0	3.85	0.49	0.25	Omni
Air-Directional	38	6.31	19.5	342.77	167.88	**84.14**	12
Ground-Omni	38	6.31	2	6.10	5.31	2.66	Omni
Ground-Directional	38	6.31	26	1531.09	1335.52	668.34	6

Table 3 contains cabling and system loss information for reference.

Path	SL: Non-Cable System Loss (dB)	Cable Length (ft)	Cable Loss (dB)	TX Pwr at Antenna w/o SL (dBm)	TX Pwr at Antenna w/o SL $P_{(W)}$	TX Pwr at Antenna w/ SL (dBm)	TX Pwr at Antenna w/ SL $P_{(W)}$
Air-Omni	3	42.83	8.95	29.05	0.8	26.05	0.4
Air-Directional	3	13.48	3.10	34.9	3.09	31.9	1.55
Ground-Omni	3	3	0.6	37.4	5.50	34.4	2.75
Ground-Directional	3	3	0.6	37.4	5.50	34.4	2.75

Table 3: System Loss Definitions

Frequency Accuracy

- The Mini-T2 CMA frequency accuracy for Std-CDL waveforms shall be + 5 kHz for Ku-band for data rates < 2.0M.
- The Mini-T2 CMA frequency accuracy for Std-CDL waveforms shall be + 55 kHz for Ku-band for data rates >2.0M.

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