

STA Confirmation Number: EL694551
STA File Number: 1148-EX-ST-2016
Call Sign: WI9XVT
Test Dates: Between August 2016 through December 2016
Teletronics Technology Corporation

Directional Antenna Evaluation Test

The purpose of this test is to demonstrate a new product, Beam Switching Stub Antenna, model, BSSA-4453-1 in conjunction with a current product, the nXCVR-3140 Transceiver. In this test, the BSSA antenna will be used to switch the radiation pattern to a desired direction with a goal of demonstrating increased link margin over a passive Omni-Directional Antenna used on previous tests with the nXCVR-3140.

This test will be performed on Company property and limited to the line of sight distances with in the industrial park. The test will utilize the current Antenna Tower Height at 21 Ft. The Tower Directional Antenna has a gain of 8.2 dBi with a cable loss of 15dB minimum. A vehicle will be modified to fit the Beam Switching Stub Antenna and one nXCVR-3140 Transceiver for one side of the link. The Tower side will house the second nXCVR-3140 to complete the link. Compressed video will be transmitted from one transceiver to the other and monitored for signal quality, signal strength, and accessed for multipath interference.

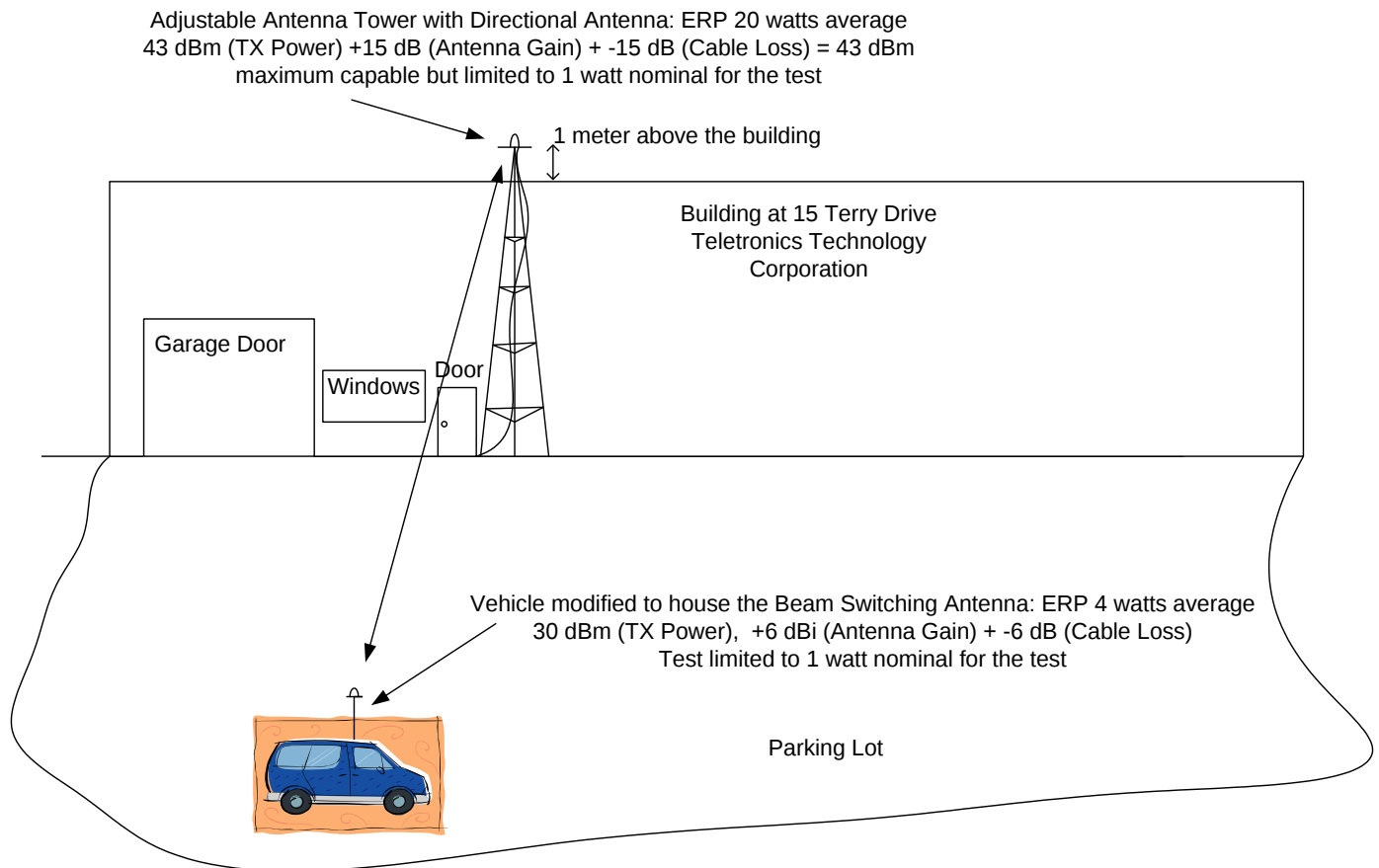


Figure 1 Test Area

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The C-Band Beam Switching Stub Antenna, BSSA-4453-1 is a transducer that transmits and receives C-Band Electro-Magnetic (EM) radiated signals between the atmospheric “free-space” and an electrical unit that generates and/or receives Radio-Frequency (RF) signals i.e., from a Teletronics Technology Corporation model nXVCR-3140A-1. The BSSA-4453-1 operational parameters are listed below:

Table 1 Bean Steering Antenna Performance

General	
Frequency Range:	4400 - 5250 MHz
Antenna Type:	4-Quadrant Switched Beam Patch Antenna
Polarization:	Vertical
Scan Type:	Periodic, based on Ground Station RSSI in Four Quadrants
Vertical Scan:	Not applicable
Horizontal Scan:	Switched Quadrants; No defined scan rate
Gain:	7.5 - 8.0 dBi; See Table 3
1st Side lobe:	-9.0 dB WRT to Beam Peak
Beamwidths:	~ 30° in Elevation, ~ 53° in Azimuth



Figure 2 BSSA Beam Steering Antenna

The Transmitting and Receiving source is the nXCVR-3140 IP transceiver, previously designed for air-to-ground and ground-to-air wireless communications using Burst SOQPSK modulation. This test will evaluate the system with in ground level multipath and the effects on

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the link margin. The modulation bandwidth will stay the same (24 MHz) and the center frequency is selectable between 4400-4940 MHz.

All tests will be performed at one freq in each band, 4920 MHz (or another frequency specified with in the programmable band) and at limited power levels.

The nXCVR-3140A-1 IP transceiver was developed under government funds as well as funding this specific test under Government contract # N00421-14-G-0009/0001.

The nXCVR-3140A-1 transceiver works as a wireless router, transparently connecting two or three radios in a point to point configuration up to 150 nautical miles in the 4400-4940 MHz frequency range. Bandwidth can be shared among the multiple users; each radio receives one or more timeslots for transmitting and receiving packets. Timeslots can be statically or dynamically allocated during network operation. The transceiver has a 100/1000BASE-T Ethernet interface for the primary routed interface and a second 100BASE-T interface that is primarily intended for diagnostics, upgrades and as an alternate management port. There are multiple serial ports for external device control, a high-speed Reduced Instruction Set Computing (RISC) processor and a power-efficient RF transmitter and receiver module.

The nXCVR-3140A-1's processor executes a real-time Linux operating system used to support the IP stack that controls the transceiver routing function.



Figure 3 nXCVR-3130 Photograph

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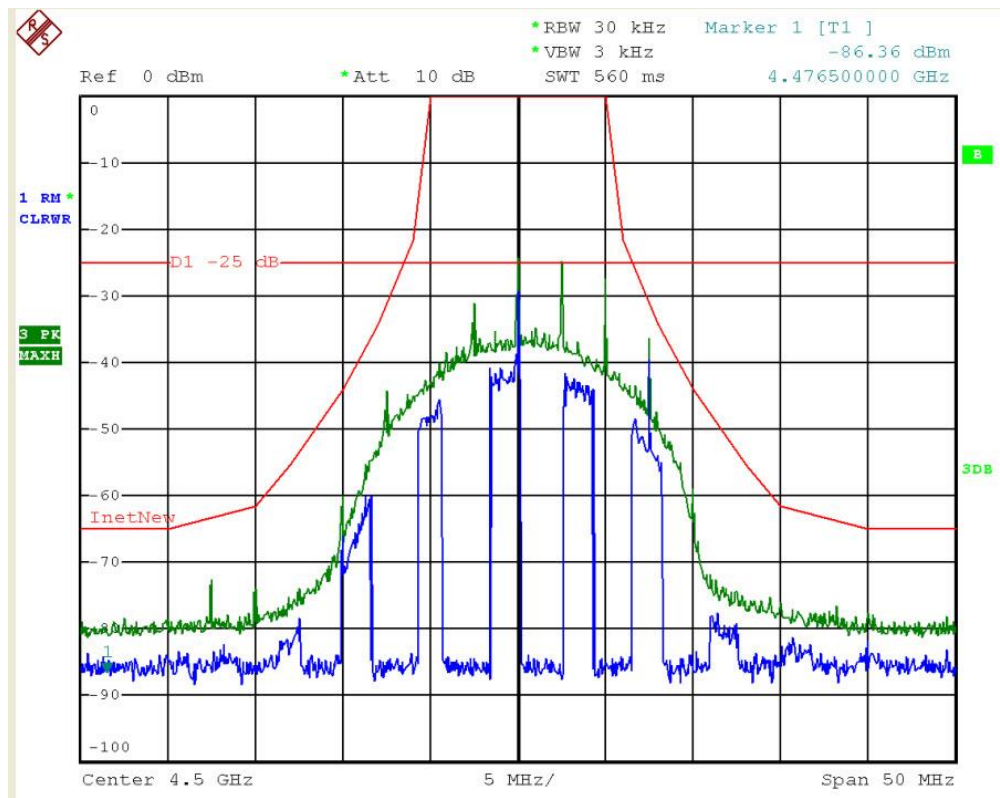


Figure 4 Transmitted Waveform

Table 2 Performance Characteristics

General	
Size	6.26" W x 6.60" D x 2.93" H (159 mm x 167.6 mm x 74.4 mm)
Weight	6.4 lbs. (2903 g)
Connectors	MDM, SMA, MS and TNC styles
Compliance	MIL-STD-461
Status information	LED1 - LED4, various port and system status indicators
General purpose output current	50 mA maximum over full temperature range
General purpose output isolation voltage	1500 Vrms
Ethernet	
Protocols	IP, TCP, UDP, SNMP
Ethernet ports	Two ports: one 100BASE-T, one 100/1000BASE-T, IPv4
Interface type	Electrical (copper wiring)

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IEEE 1588 time	Boundary clock with standards support for 1588 Version 2
Routing	Static unicast and multicast routing
Communication	Unicast, broadcast, multicast
Time reference	IEEE 1588 slave
RF Characteristics	
Transmit power	20 W typ. [Tests will be carried out at 1W (30 dBm) maximum]
Receive power	+10 dBm maximum
Receiver sensitivity	-86 dBm typical
Center frequency	Tunable from 4400-4940 MHz
Center frequency stability	±.005%
RF port impedance	50 Ohms
Electrical	
Power input	+28 ± 6 VDC
Supply current	4 Amp @ 28 V typical
Power consumption	112 W maximum typical
Grounding	Isolated power, signal and chassis grounds
Environmental	
Operating temperature	-40° C to +85° C. Note: Base plate temperature must be maintained within this specific temperature range. Do not operate the unit without a properly installed heat sink.
Storage temperature	-55° C to +100° C
Random vibration	15 grms, 20 to 2,000 Hz, 10 minutes, any axis
Acceleration	25 g indefinite duration, any axis
Shock	15g, half-sine, 11 mS, 6 shocks, any axis
Humidity	5-95% RH, non-condensing
Altitude	0 to 80,000 ft.
EMI/EMC	Per MIL-STD-461

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Table 3. Beam Switching Stub Antenna, Model BSSA-4453-1 Measured Results

Parameter	Connector	Conditions	Frequency (GHz)											
			4.4	4.5	4.6	4.7	4.8	4.92	5	5.1	5.2	5.3	5.4	5.5
Peak Gain (dBi)	J1	Elevation Cut	2.05	2.83	5.47	7.16	7.47	7.23	7.74	7.89	6.78	7.3	6.25	7.15
		Azimuth Cut	2.08	2.23	5.51	7.82	6.71	7.92	7.23	7.47	6.59	7.75	7.18	9.03
	J2	Elevation Cut	2.84	3.39	5.54	7.04	7.37	7.36	7.84	8.07	7.13	7.52	6.48	7.42
		Azimuth Cut	2.42	2.94	5.73	7.73	6.68	7.75	7.18	7.25	6.4	7.8	7.21	9.22
	J3	Elevation Cut	2.98	3.54	5.87	7.43	7.51	7.17	7.69	7.98	6.89	7.29	6.47	7.26
		Azimuth Cut	2.63	2.69	5.78	7.86	6.47	7.52	6.89	7.15	6.25	7.49	7.08	9.14
	J4	Elevation Cut	3.05	3.53	5.68	7.04	7.19	7.08	7.86	8.15	6.96	7.6	6.65	7.17
		Azimuth Cut	2.86	3.54	6.36	8.33	7.02	8.1	7.61	7.9	6.93	8.29	7.65	9.44
3-dB Beamwidth For Main Beam (Antenna Range Accuracy $\pm 3^\circ$)	J1	Elevation Cut	42	39	33	33	33	30	30	30	30	24	24	24
		Azimuth Cut	126	102	63	54	51	51	51	51	51	57	54	57
	J2	Elevation Cut	27	30	33	33	33	30	30	30	24	24	21	21
		Azimuth Cut	93	78	66	60	54	54	54	51	51	54	54	54
	J3	Elevation Cut	33	33	33	33	30	30	30	27	27	27	24	24
		Azimuth Cut	117	93	66	57	51	54	51	51	54	54	57	57
	J4	Elevation Cut	39	36	36	39	36	33	30	27	27	27	27	27
		Azimuth Cut	114	87	63	51	51	51	54	51	54	54	54	57
Cross- Polarization Isolation (dB) At Beam Peak	J1	Elevation Cut						18.17						
		Azimuth Cut						27.17						
	J2	Elevation Cut						15.95						
		Azimuth Cut						19.95						
	J3	Elevation Cut						25.62						
		Azimuth Cut						27.77						
	J4	Elevation Cut						15.75						
		Azimuth Cut						22.91						