FOD Finder™
XFV2 Radar
Users Manual
12/08/2020

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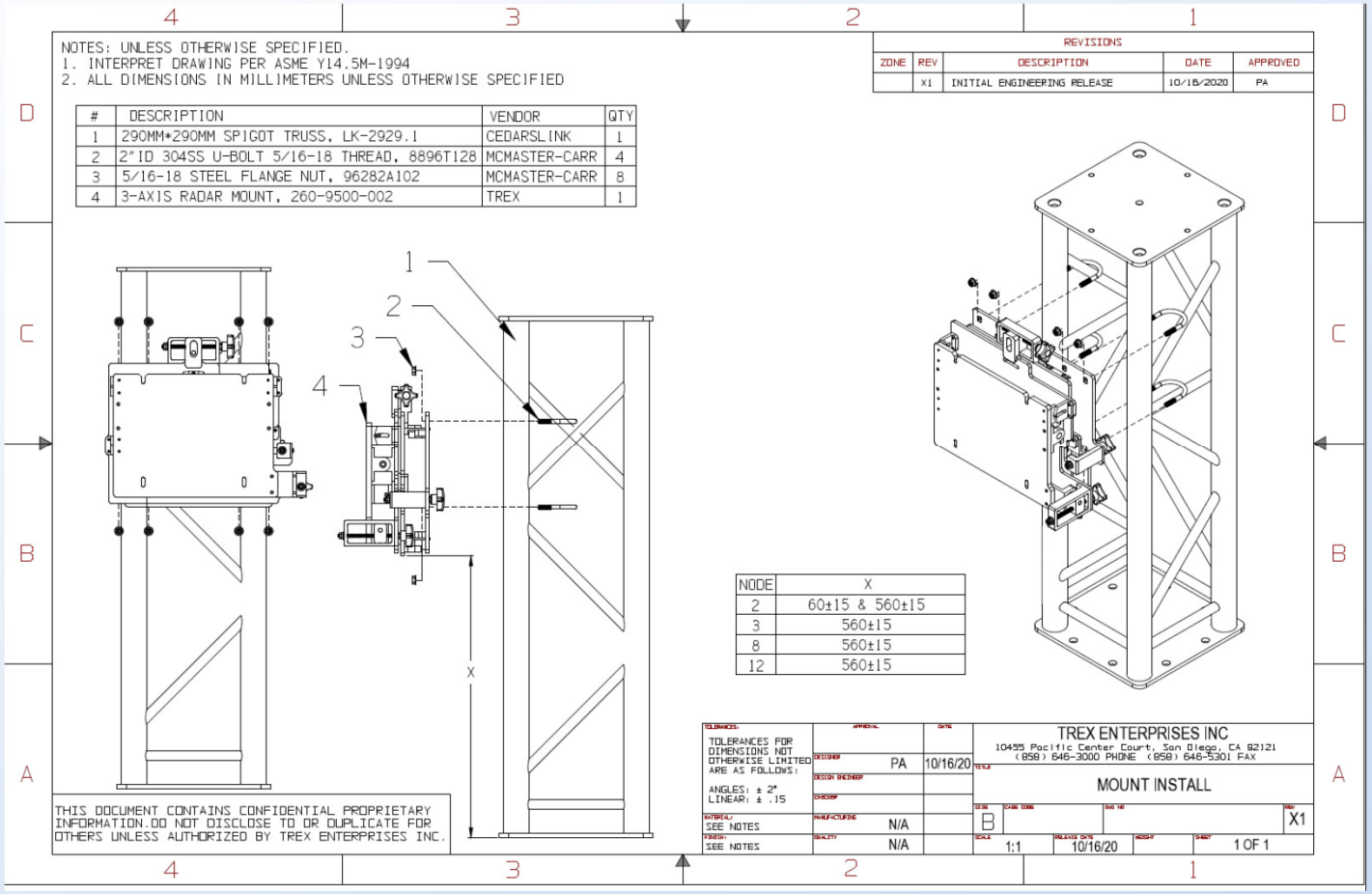
Fixed Platform (Tower) Installation

Radar mount assembly with azimuth/elevation pointing adjustment, attached to a tower using U-bolt hardware



NOTES: UNLESS OTHERWISE SPECIFIED.
1. INTERPRET DRAWING PER ASME Y14.5M-1994
2. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

#	DESCRIPTION	VENDOR	QTY
1	290MM*290MM SPIGOT TRUSS, LK-2929.1	CEDARSLINK	1
2	2"ID 304SS U-BOLT 5/16-18 THREAD, 8896T128	MCMASTER-CARR	4
3	5/16-18 STEEL FLANGE NUT, 96282A102	MCMASTER-CARR	8
4	3-AXIS RADAR MOUNT, 260-9500-002	TREX	1

ZONE	REV	DESCRIPTION	DATE	APPROVED
	X1	INITIAL ENGINEERING RELEASE	10/16/2020	PA

NODE	X
2	60±15 & 560±15
3	560±15
8	560±15
12	560±15

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TOLERANCES FOR DIMENSIONS NOT OTHERWISE LIMITED ARE AS FOLLOWS:
ANGLES: ± 2°
LINEAR: ± .15
MATERIAL: SEE NOTES
FINISH: SEE NOTES

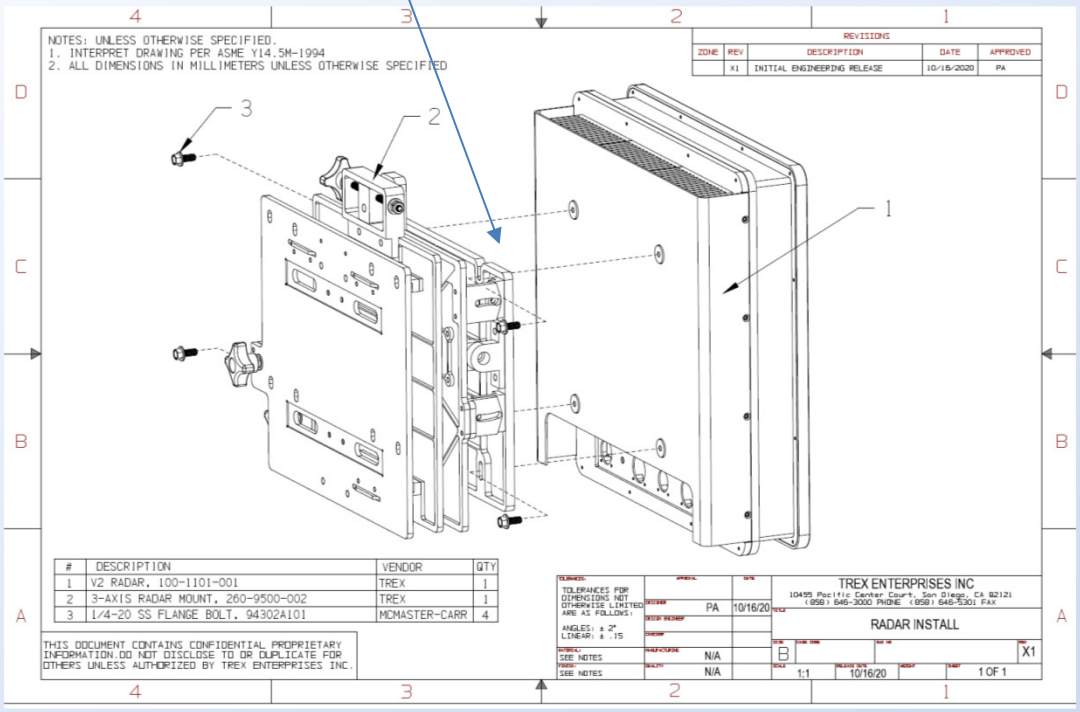
DESIGNER PA 10/16/20
DESIGN ENGINEER
CHECKER
MANUFACTURING N/A
QUALITY N/A

TREX ENTERPRISES INC
10455 Pacific Center Court, San Diego, CA 92121
(858) 646-3000 PHONE (858) 646-5301 FAX

TITLE: MOUNT INSTALL
SIZE B
REV X1
SCALE 1:1
RELEASE DATE 10/16/20
SHEET 1 OF 1

Fixed Platform (Tower) Installation, cont.

Radar mounted directly to fixed az/el positioner



Mobile Platform Installation

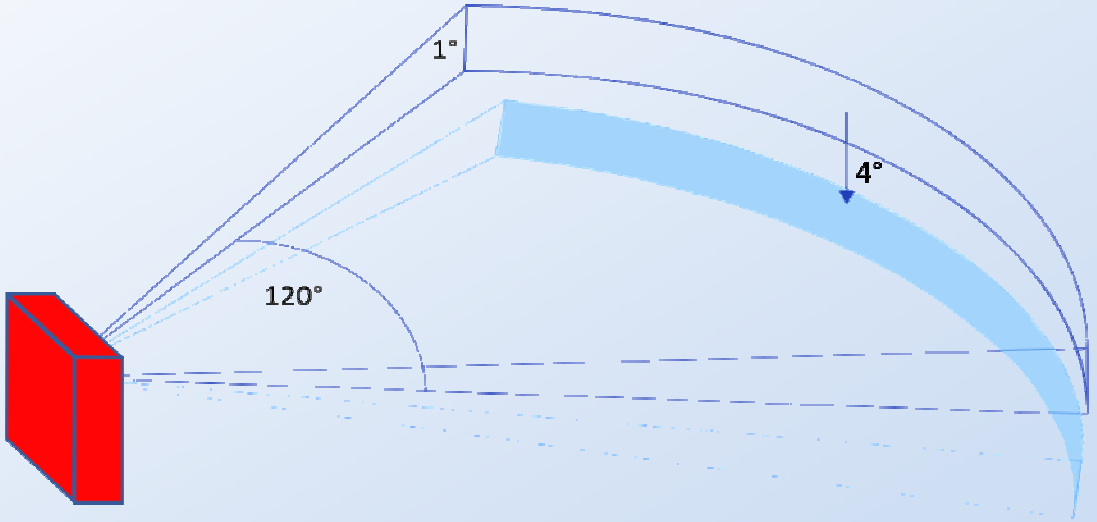
Radar is integrated with light bar, mounts to vehicular roof rack

Radar DC Power and Data Connections

- DC power provided through a 5-pin Amphenol connector P/N PT06A-14-3P(SR)
  - Radar powered by +24VDC at approximately 3A
- Data transmitted through standard Cat-5 cable, interfaced with Amphenol connector and shield P/N RJFTV6MG
- A clip-on one-turn inductor, Fair-Rite P/N 0443167251, is integrated with each cable to reduce the radiated emissions below FCC limit specifications

Radar Beam Orientation

The radar beam is concentrated by a microstrip patch-array antenna, onto a sector of 120 degrees in azimuth by 1 degree in elevation. This fan beam scans with RF frequency over 4 degrees of elevation during every chirp. The radar is mounted to align the area of surveillance with this window.



FCC info and Caution to the user

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note that changes or modifications to the Radar unit not expressly approved by Trex Aviation Systems could void the user's authority to operate the equipment.

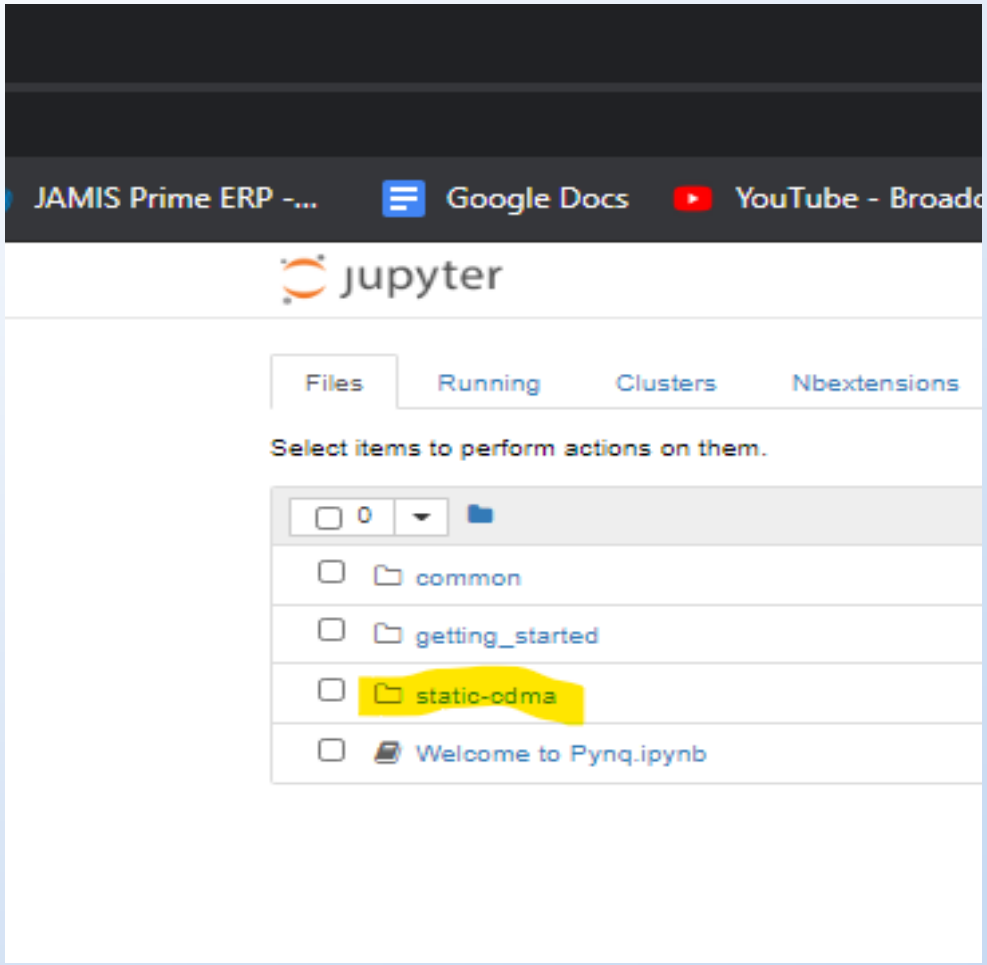
System Power-Up

The FOD Finder XFV2 radar system power is delivered from a power box at the base of the tower, or on a service platform within 10m of the radar unit. The power box includes a circuit breaker switch that controls AC power. AC power activates an AC-to-DC power supply that provides 24VDC to the unit.

When the AC circuit breaker is turned on, the radar unit starts a 3-minute boot-up, initialization and calibration sequence. After this time interval the unit begins transmitting RF power and processing the radar returns.

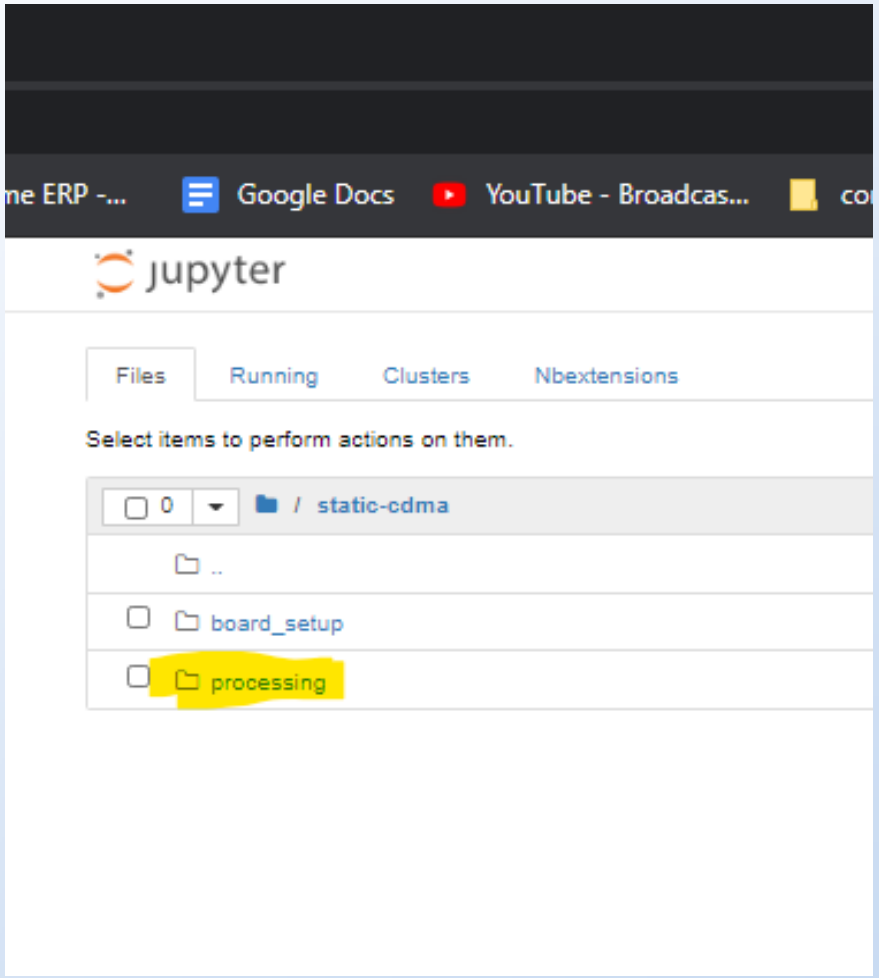
Startup Instructions: Run-Time Software

Open the Program Folder "Static-CDMA" as shown to the right



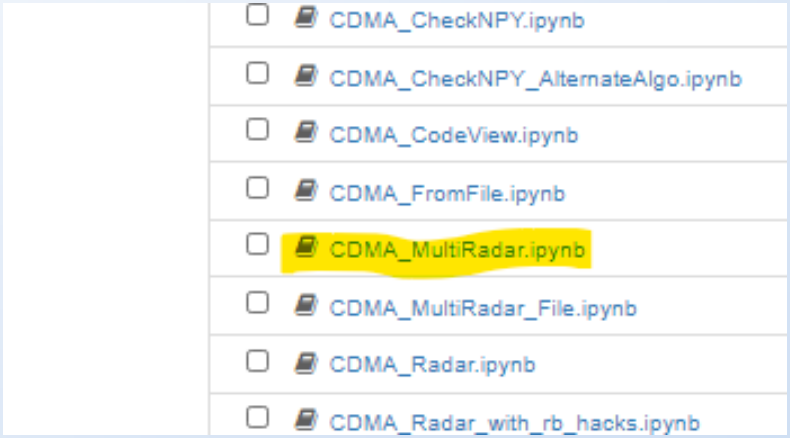
Startup Instructions: Run-Time Software (cont.)

Double-click on the "Processing" tab as shown to the right



Startup Instructions: Run-Time Software (cont.)

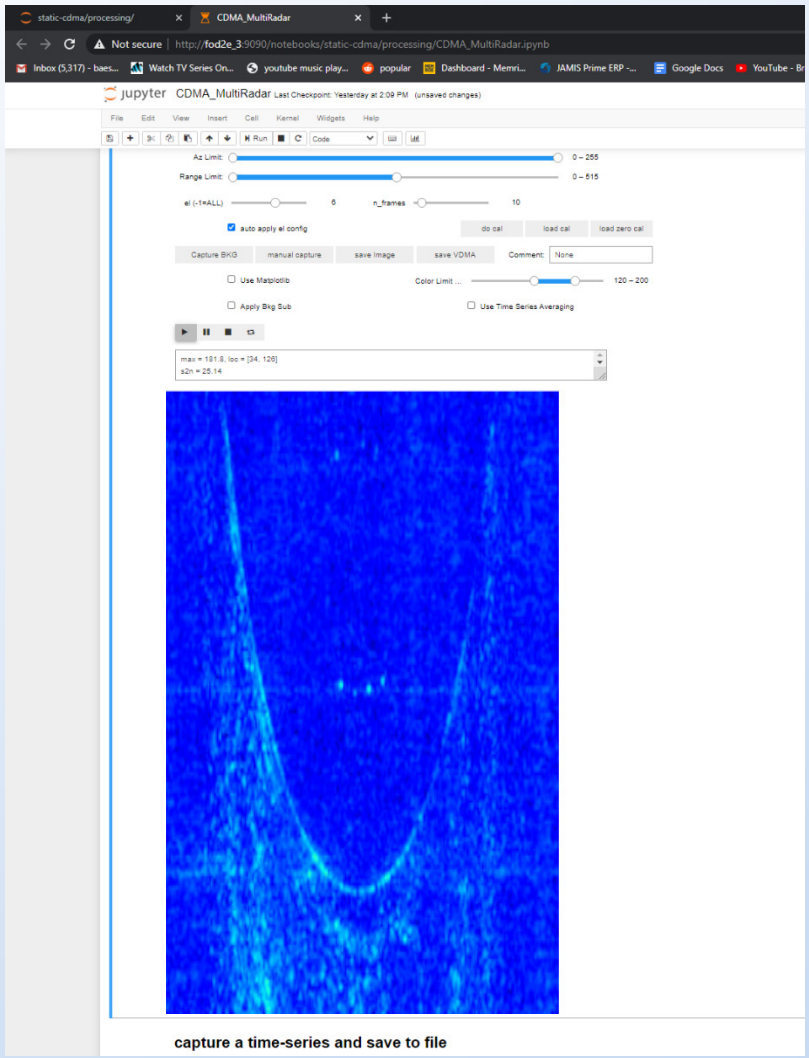
Open the “CDMA_Multi Radar” script:



Startup Instructions: Run-Time Software (cont.)

The radar begins transmitting, and return data are displayed in a blue box of varying color, indicating magnitude of signal.

Slider bars above the return image can be adjusted via the computer mouse, to alter the display or select system operating parameters.



FOD Finder Radar Calibration and Verification

The FOD Finder XF radar requires an initial calibration to operate at optimum performance. The calibration procedure measures the relative response, in phase and amplitude, of all transmit and receive channel combinations in use by the radar. This calibration data is collected by acquiring radar data from a single, strong return source placed in the radar far-field, such as a corner cube, and is measured at twelve different frequencies across the radar band. The calibration data is then stored on the internal radar processor and applied to all radar signals during operation to produce a high-gain beam shape. Importantly, this calibration is applied at the data processing level and does not require any adjustment of the radar system hardware. Data for a new calibration can be generated by observing radar returns from a known target and a new calibration can be applied simply by re-writing the calibration file on the radar.

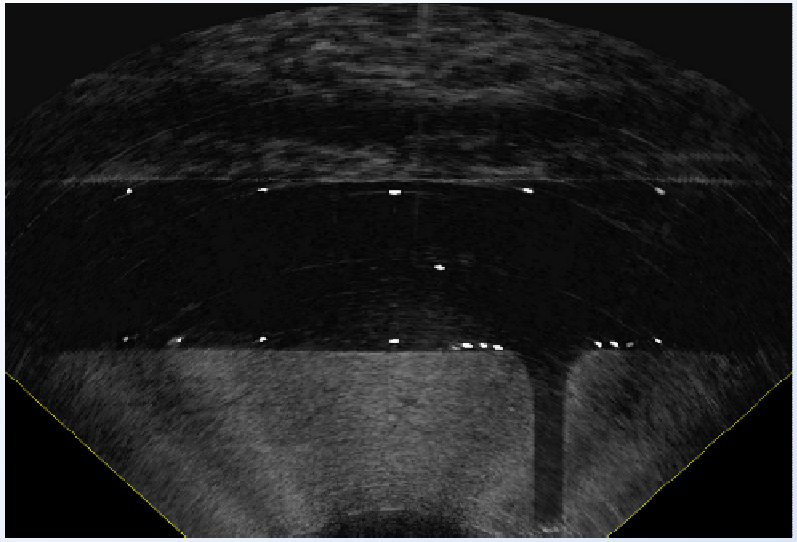
The FOD Finder radar is fully calibrated at the factory and then an additional calibration is performed on site at the time of installation. Calibration is verified by measuring the return signal from a radar target with a known radar cross-section. The system continues to automatically update its phase calibration during its operation based on the data returns from fixed objects within the radar field-of-view, comparing the returns from those objects at the time of installation to the returns from those objects at the present time. No input is required by the operator for the calibration update to occur.

FOD Finder Radar Calibration and Verification (cont.)

The radar calibration is a function of the relative electrical line lengths of traces within the radar and the impedance of the radar MMW circuits. If no physical changes are made to the radar, these values do not change appreciably. There may be small changes in the system parameters over time due to changes in temperature or aging of components. Automatic updates to the calibration files, based on the returns of known objects in the field-of-view (such as runway landing lights), are incorporated to correct for these small changes over time.

Calibration of the radar is verified by monitoring returns from fixed objects within the radar field-of-view and comparing the current phase and amplitude of returns to those measured when the radar was first installed. This requires no user action, assuming said data is exportable to Trex Aviation for analysis. As part of a standard system performance verification, current radar returns and calibration data are exported to Trex Aviation and the validity of the updated calibration file is confirmed. A visual image of a runway with side marking lights and a runway centerline light is shown on the next page. While this is a visually reconstructed image, the data used are those needed to verify the system calibration. Phase and amplitude returns from selected point targets, such as the landing lights (which appear as white dots in the image), are used for calibration verification.

FOD Finder Radar Calibration and Verification (cont.)



This reconstructed radar image of a runway relies on data processed using the calibration file; data from bright point targets are used to verify that the calibration is current.

As part of system self-monitoring and self-calibration, the radar verifies the accuracy of its own calibration by logging data from fixed point objects within the radar field-of-view and comparing return levels to those measured at system installation. If it detects that these returns have fallen below a threshold level, even after an attempted self-calibration effort, the radar will alert the operator with an error message and request that the data be exported to Trex Aviation for external re-calibration.

RF Safety

The FOD Finder™ XFV2 radar transmits RF power at 78-81 GHz out of a radome making up the front face of the radar enclosure. The MMW energy travels thru the white face plastic, where it diverges at an angle of approximately 120 degrees in azimuth and 1 degree in elevation. Over a sweep period of approximately 50ms, this fan beam is swept over a range of 4 degrees in elevation.

The FCC Maximum Permissible Exposures (MPE) for this operating frequency are a power density of 5mW/cm^2 averaged for a time duration of 6 minutes max for and operator and 1mW/cm^2 averaged for a time of 30 minutes max for the general public.

When working with this product powered up, the operator should not stand in front of the unit, any closer than 20 cm from the radome where the radar beam is emitted. When the unit is installed where the General Public may be exposed to the radar beam we suggest the general Public should be kept away at a distance greater then 3 meters from the front of the radar where the beam is emitted. At this distance, the exposure level is .005 mW/cm^2, or 0.5% of the MPE threshold.

System Warranty and Troubleshooting

The FOD Finder XFV2 radar system is delivered with a one-year warranty from the date of installation.

If issues arise during system operation the first step is to power down the system and restart after 30 seconds. If performance issues persist, a screen shot of the user display should be taken and sent to the system installer.

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