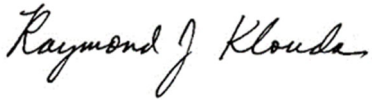




Engineering Test Report No. 2600005-05

Report Date	September 30, 2026	
Manufacturer Name	Caterpillar Inc	
Manufacturer Address	100 NE Adams St Peoria, IL 61629	
Model No. Part No.	5G Telematics Radio – PL645 661-9822 & 661-9821	
Date Received	July 14, 2026	
Test Dates	July 14, 2026 – August 22, 2026	
Specifications	FCC "Code of Federal Regulations" Title 47 Part 2, Subpart J FCC "Code of Federal Regulations" Title 47 Part 22, Subpart H FCC "Code of Federal Regulations" Title 47 Part 24, Subpart E FCC "Code of Federal Regulations" Title 47 Part 27, Subpart C Radio Standards Specifications RSS-GEN Radio Standards Specifications RSS-132 Radio Standards Specifications RSS-133 Radio Standards Specifications RSS-139	
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515	FCC Reg. Number: 269750 IC Reg. Number: 2987A CAB Identifier: US0107
Signature	 	
Tested by	Javier Cardenas	Tylar Jozefczyk
Signature		
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	SBJA83479	

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Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications. The data presented in this test report pertains to the EUT on the test dates specified. Any electrical or mechanical modifications made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification. This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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1. Report Revision History

Revision	Date	Description
–	30 SEP 2026	Initial Release of Engineering Test Report No. 2600005-05

2. Introduction

2.1. Scope of Tests

This document presents the results of a series of RF emissions tests that were performed on the Caterpillar Inc 5G Telematics Radio to determine compliance with the radiated emission requirements with new antennae options (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was manufactured and submitted for testing by Caterpillar Inc located in Peoria, IL.

2.2. Purpose

The test series was performed to determine if the EUT meets the output power and RF radiated emission requirements of the FCC "Code of Federal Regulations" Title 47 Part 2 Subpart J, Part 22 Subpart H, Part 24 Subpart E, and Part 27 Subpart C.

The test series was also performed to determine if the EUT meets the output power and RF radiated emission requirements of the Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-Gen, RSS-132, RSS-133 and RSS-139.

Testing was performed in accordance with ANSI C63.26-2015.

2.3. Identification of the EUT

The EUTs were identified as follows and used throughout the test series:

EUT Identification	
EUT #1	
Equipment Under Test Description	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Software/Firmware Version	Linux Version: v6.17.4-10-g85617921cf35 OS Release: Buildroot 2025.08.1 (pkg83003) NAD Project Rev.: WCM598EGLBTR02A08M8G_OCPU_F02_02.001
Band of Operation	GSM850, GSM1900, WCDMA B2/B4/B5
Antenna Type	Metal Stamp PIFA
EUT #2	
Equipment Under Test Description	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Software/Firmware Version	Linux Version: v6.17.4-10-g85617921cf35 OS Release: Buildroot 2025.08.1 (pkg83003) NAD Project Rev.: WCM598EGLBTR02A08M8G_OCPU_F02_02.001
Band of Operation	GSM850, GSM1900, WCDMA B2/B4/B5
Antenna Type	Chip

3. Antenna Gain

The EUT antenna gains were supplied by Caterpillar Inc personnel:

Frequency Range (MHz)	Peak Gain (dBi)	
	Internal Antenna	External Antenna
617 - 698	0.8	1.6
698 - 716	-1.4	1.7
716 - 793	1.2	1.5
793 - 817	1.2	1.8
817 - 894	1.5	3.4
894 - 960	0.8	3.9
1520 - 1660	1.4	5.4
1710 - 1785	0.9	5.1
1785 - 1880	1.3	4.8
1880 - 1995	1.5	4.8
1995 - 2025	1.1	3.7
2025 - 2110	1.0	5.1
2110 - 2300	1.2	5.3
2300 - 2412	2.5	5.4
2500 - 2600	3.5	4.8
2600 - 2700	2.9	4.7
2700 – 2800	---	5.5
2800 – 3000	---	4.6
3000 – 3300	---	4.8
3300 - 4200	4.4 (Main), 3.8 (Diversity)	5.5
4200 - 5000	3.3 (Main), 3.3 (Diversity)	5.5

4. Power Input

The EUT was powered by 12VDC from a twisted pair, 1 meter, harness.

5. Grounding

The EUT was not connected to ground.

6. Support Equipment

The EUT was submitted for testing along with the following support equipment:

Description	Model #	S/N
Support EUT	PL645	260619016002008D

7. Interconnect Leads

The following interconnect cables were submitted with the EUT:

Item	Description
RS485	Connected EUT and Support EUT to Support Laptop

8. Modifications Made to the EUT

No modifications were made to the EUT during the testing.

9. Modes of Operation

The EUTs were programmed to transmit in the following modes:

Mode	Description
WCDMA Band 2	- Channel 9262 - Channel 9400 - Channel 9538
WCDMA Band 4	- Channel 1312 - Channel 1413 - Channel 1513
WCDMA Band 5	- Channel 4132 - Channel 4182 - Channel 4233
GSM850	- Channel 128 - Channel 190 - Channel 251
GSM1900	- Channel 512 - Channel 661 - Channel 810

10. Test Specifications

The tests were performed to selected portions of, and in accordance with, the test specifications.

- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter A, Part 2, Subpart J – "Equipment Authorization Procedures"
- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter B, Part 22, Subpart H – "Cellular Radiotelephone Service"
- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter B, Part 24, Subpart E
- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter B, Part 27, Subpart C
- Radio Standards Specifications RSS-GEN, Issue 6 (July 30, 2026) – "General Requirements for Compliance of Radio Apparatus"
- Radio Standards Specifications RSS-132 Issue 4 (January 31, 2023) – "Cellular Systems Operating in the Bands 824-849 MHz and 869-894 MHz"
- Radio Standards Specifications RSS-133 Issue 7 (July 24, 2024) – "Personal Communications Service Equipment Operating in the Bands 1850-1915 MHz and 1930-1995 MHz"
- Radio Standards Specifications RSS-139 Issue 4, Amendment 1 (October 2022) – "Advanced Wireless Services Equipment Operating in the Bands 1710-1780 MHz and 2110-2200 MHz"
- IEEE ANSI C63.26-2015 – "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services"

11. Test Plan

No test plan was provided. Instructions were provided by personnel from Caterpillar Inc and used in conjunction with the specifications noted in Section 9.

12. Deviation, Additions to, or Exclusions from Test Specifications

There were no deviations, additions to, or exclusions from the test specifications during this test series.

13. Laboratory Conditions

The ambient parameters of the laboratory during testing were as follows:

Ambient Parameters	Value
Temperature	24.5°C
Relative Humidity	40%
Atmospheric Pressure	1017mb

14. Summary

The following EMC tests were performed, and the results are shown below:

Test Description	Requirements	Test Method	Result
Maximum Peak Conducted Output Power	FCC Part 2, 22, 24, 27 ISED RSS-132, RSS-133, RSS-139	ANSI C63.26-2015	Conforms
Effective Isotropic Radiated Power (EIRP)			Conforms
Transmitter Radiated Emissions			Conforms

15. Sample Calculations

For Radiated Emissions:

The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external preamplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

$$\text{Formula 1: FS (dB}\mu\text{V/m)} = \text{MTR (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)} + (-\text{PA (dB)}) + \text{DC (dB)}$$

To convert the Field Strength dB μ V/m term to μ V/m, the dB μ V/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in μ V/m terms.

$$\text{Formula 2: FS (}\mu\text{V/m)} = \text{AntiLog}[(\text{FS (dB}\mu\text{V/m)})/20]$$

For Effective Isotropic Radiated Power::

The resultant effective radiated power is a summation of the matched signal (dBm), equivalent antenna gain (dB) and the cable loss factor (dB).

$$\text{EIRP (dBm)} = \text{Matched Signal (dBm)} + \text{Antenna Gain (dB)} - \text{Cable Loss (dB)}$$

Alternatively, the effective radiated power can be calculated by summing the measured conducted output power (dBm) and antenna gain (dB)

$$\text{EIRP (dBm)} = \text{Conducted Output Power (dBm)} + \text{Antenna Gain (dB)}$$

16. Statement of Conformity

The Caterpillar Inc 5G Telematics Radio (Model No. PL645, Serial No. 260623016003008D (External Antenna)) did fully conform to the selected requirements of FCC Parts 2, 22, 24 & 27 and ISED RSS-132, RSS-133, & RSS-139.

Additionally, the Caterpillar Inc (Model No. PL645, Serial No. 260619016008008D (Internal Antenna)) did fully conform to the selected requirements of FCC Parts 2, 22, 24 & 27 and ISED RSS-132, RSS-133, & RSS-139.

17. Certification

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the FCC Parts 2, 22, 24 & 27 and ISSED RSS-132, RSS-133, & RSS-139 test specifications. The data presented in this test report pertains to the EUT as received by the customer on the test date specified. Any electrical or mechanical modifications made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

18. Photographs of EUT





19. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW10	Preamplifier	Planar	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1-18GHz	3/18/2026	3/18/2027
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-2000MHz	6/21/2024	8/23/2026
NWQ1	Double Ridged Waveguide (3M)	ETS-Lindgren	3117	66655	1-18GHz	7/13/2026	7/13/2028
NWV0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3119	164466	400MHZ-6GHZ	NOTE 1	
R29F	3M ANECHOIC CHAMBER NSA	EMC TEST SYSTEMS	3M ANECHOIC		30MHZ-18GHZ	6/1/2025	6/1/2027
RBG3	EMI Analyzer	Rohde & Schwarz	ESW44	101592	2HZ-44GHZ	4/10/2026	4/10/2027
SMA57	POWER SUPPLY	VOLTEQ	HY3030EX	220401514	30V/30A	NOTE 1	
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	9/16/2025	9/16/2027
XPQ6	FILTER	K&L MICROWAVE	11SH10-9000/U2000-O/O	2	5000-5800 MHZ	9/16/2025	9/16/2027

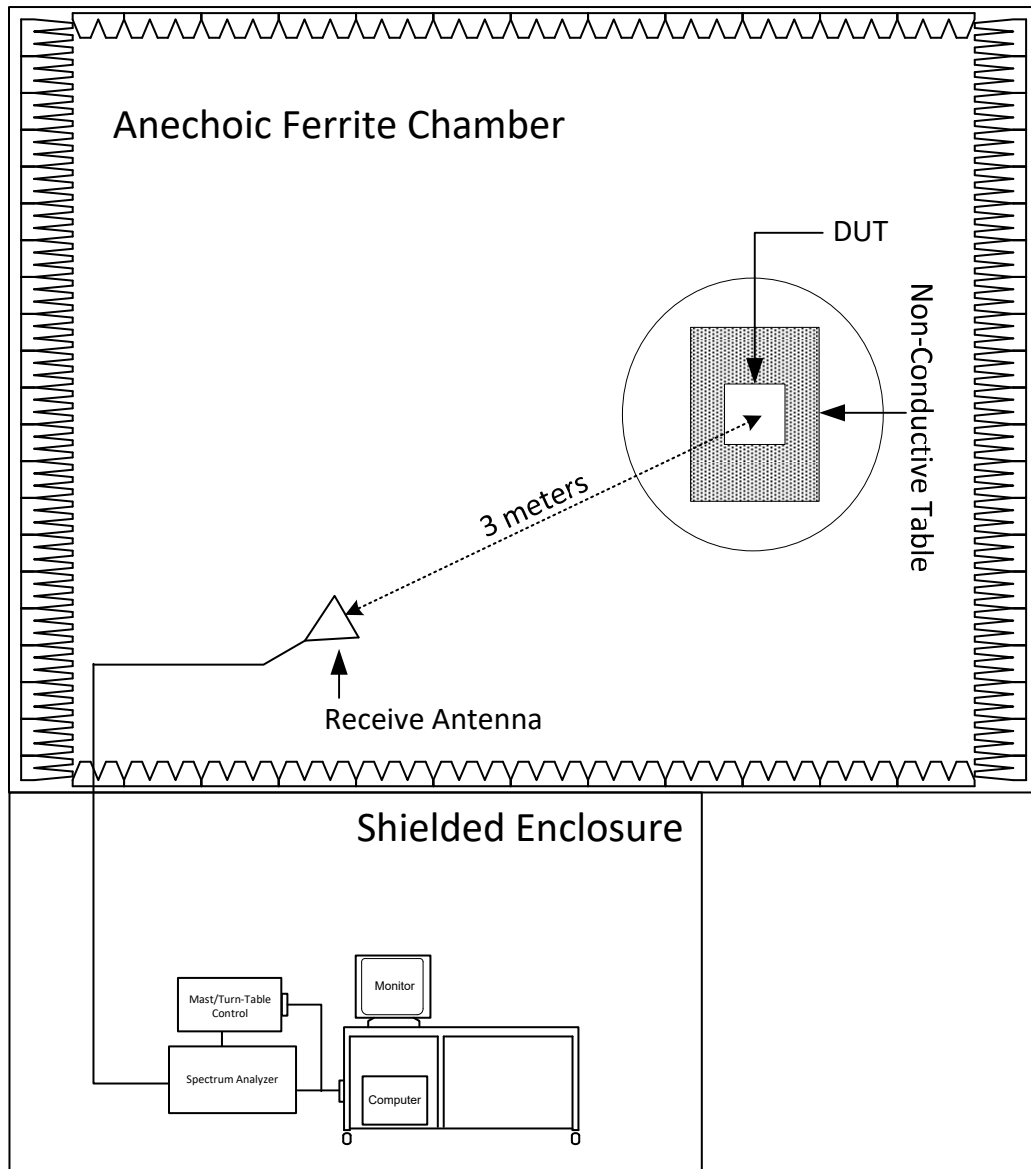
N/A: Not Applicable

I/O: Initial Only

CNR: Calibration Not Required

NOTE 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

20. Block Diagram of Test Setup



Radiated Measurements Test Setup

21. Maximum Peak Conducted Output Power

EUT Information	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822, 661-9821
Serial No.	260623016003008D (External Antenna), 260619016008008D (Internal Antenna)
Mode	WCDMA Band 2, WCDMA Band 4, WCDMA Band 5, GSM1900, GSM850

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Port Conducted
Type of Test Site	Elite Test Bench
Test Site Used	N/A
Type of Antennas Used	N/A
Notes	None

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
RF Output Power, Conducted	± 0.349 dB
Temperature	$\pm 0.165^{\circ}\text{C}$
Humidity	$\pm 1.7\%$ RH
DC and Low Frequency Voltages	± 0.115 Volts

Procedure
EUT was set to connect with a CMW500 base station simulator. The path loss was compensated for, and the output power reading was measured and recorded from the CMW500.

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA
Result	Output Power = 0.176W (22.46dBm)
Notes	None

Band	Network	Subset	Frequency (MHz)	Channel	Conducted Power (dBm)
Band II	RMC	12.2kbps RMC	1852.4	9262	22.04
			1880	9400	21.75
			1907.6	9538	21.46
Band IV	RMC	12.2kbps RMC	1935.2	9676	21.17
			1962.8	9814	20.88
			1990.4	9952	20.59
Band V	RMC	12.2kbps RMC	2018	10090	20.30
			2045.6	10228	20.01
			2073.2	10366	19.72

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Mode	WCDMA
Result	Output Power = 0.176W (22.46dBm)
Notes	None

Band	Network	Subset	Frequency (MHz)	Channel	Conducted Power (dBm)
Band II	RMC	12.2kbps RMC	1852.4	9262	22.04
			1880	9400	21.75
			1907.6	9538	21.46
Band IV	RMC	12.2kbps RMC	1935.2	9676	21.17
			1962.8	9814	20.88
			1990.4	9952	20.59
Band V	RMC	12.2kbps RMC	2018	10090	20.30
			2045.6	10228	20.01
			2073.2	10366	19.72

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	GSM
Result	Output Power = 2.099W (33.27dBm)
Notes	None

Band	Network	Subset	Frequency (MHz)	Channel	Conducted Power (dBm)
GSM850	GPRS	1 Tx Slot	824.2	128	22.63
			836.6	190	33.22
			848.8	251	33.27
GSM1900	GPRS	1 Tx Slot	1850.2	512	29.57
			1880	661	29.30
			1909.8	810	30.49

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Mode	GSM
Result	Output Power = 2.099W (33.22dBm)
Notes	None

Band	Network	Subset	Frequency (MHz)	Channel	Conducted Power (dBm)
GSM850	GPRS	1 Tx Slot	824.2	128	22.63
			836.6	190	33.22
			848.8	251	33.27
GSM1900	GPRS	1 Tx Slot	1850.2	512	29.57
			1880	661	29.30
			1909.8	810	30.49

22. Effective Isotropic Radiated Power (EIRP)

EUT Information	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822, 661-9821
Serial No.	260623016003008D (External Antenna), 260619016008008D (Internal Antenna)
Mode	WCDMA Band 2, WCDMA Band 4, WCDMA Band 5, GSM850, GSM1900

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	R29F
Antenna Types Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Notes	None

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1

Mode	Description
WCDMA Band 2	- Channel 9262 - Channel 9400 - Channel 9538
WCDMA Band 4	- Channel 1312 - Channel 1413 - Channel 1513
WCDMA Band 5	- Channel 4132 - Channel 4182 - Channel 4233
GSM850	- Channel 128 - Channel 190 - Channel 251
GSM1900	- Channel 512 - Channel 661 - Channel 810

Requirements – FCCFCC §22.913(a)(5)

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

FCC §24.232(c)

Mobile and portable stations are limited to 2W EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

FCC §27.50(d)(4)

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Requirements – ISSEDRSS-132 Section 5.4

The equivalent radiated power (ERP) shall not exceed 7W for mobile equipment and 3W for portable equipment.

RSS-133 Section 5.5

For subscriber equipment, the EIRP is limited to 2W/channel bandwidth.

RSS-139 Section 5.5

The maximum output power of subscriber equipment in the Band 1710 – 1780MHz is 30dBm EIRP/channel bandwidth.

Procedure

The EUT was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle, and high channels.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a double ridged waveguide antenna was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss and antenna gain as required. The peak power output was calculated for the frequencies.

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 2
Result	Max EIRP = 0.186W (22.70dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
1852.40	H	89.50	23.03	1.58	2.96	21.64
	V	82.38	18.65	1.58	2.96	17.26
1880.00	H	81.99	15.89	1.38	2.98	14.29
	V	86.60	23.17	1.38	2.98	21.56
1907.60	H	90.26	24.53	1.17	3.00	22.70
	V	85.98	22.84	1.17	3.00	21.00

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 4
Result	Max EIRP = 0.41W (26.16dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
1712.40	H	90.77	22.47	2.36	2.86	21.97
	V	85.82	20.38	2.36	2.86	19.88
1732.60	H	94.98	26.94	2.10	2.87	26.16
	V	85.10	19.93	2.10	2.87	19.15
1752.60	H	84.44	16.65	1.87	2.89	15.63
	V	86.50	21.59	1.87	2.89	20.57

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 5
Result	Max EIRP = 0.3W (24.78dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
826.40	H	95.36	25.17	0.00	1.95	23.22
	V	88.66	20.62	0.00	1.95	18.67
836.60	H	95.31	25.20	0.00	1.96	23.24
	V	90.28	22.65	0.00	1.96	20.69
846.60	H	96.78	26.75	0.00	1.97	24.78
	V	93.95	26.72	0.00	1.97	24.74

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	GSM850
Result	Max EIRP = 0.48W (26.83dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
824.20	H	92.03	21.80	0.00	1.95	19.85
	V	88.22	20.12	0.00	1.95	18.17
836.60	H	93.30	23.19	0.00	1.96	21.23
	V	94.65	27.02	0.00	1.96	25.06
848.80	H	96.84	26.83	0.00	1.98	24.85
	V	88.60	21.45	0.00	1.98	19.48

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	GSM1900
Result	Max EIRP = 0.32W (25.07dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
1851.00	H	92.94	26.45	1.59	2.96	25.07
	V	88.62	24.88	1.59	2.96	23.50
1880.00	H	84.24	18.14	1.38	2.98	16.54
	V	87.06	23.63	1.38	2.98	22.02
1909.80	H	88.03	22.33	1.15	3.00	20.47
	V	88.23	25.11	1.15	3.00	23.26

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Mode	WCDMA Band 2
Result	Max EIRP = 0.159W (22.03dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
1852.40	H	86.26	19.79	1.58	2.96	18.40
	V	87.09	23.36	1.58	2.96	21.97
1880.00	H	87.97	21.87	1.38	2.98	20.27
	V	87.07	23.64	1.38	2.98	22.03
1907.60	H	86.59	20.86	1.17	3.00	19.03
	V	85.08	21.94	1.17	3.00	20.10

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Mode	WCDMA Band 4
Result	Max EIRP = 0.12W (20.86dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
1712.40	H	87.59	19.29	2.36	2.86	18.79
	V	86.45	21.01	2.36	2.86	20.51
1732.60	H	88.87	20.83	2.10	2.87	20.05
	V	86.81	21.64	2.10	2.87	20.86
1752.60	H	87.45	19.66	1.87	2.89	18.64
	V	84.99	20.08	1.87	2.89	19.06

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Mode	WCDMA Band 5
Result	Max EIRP = 0.21W (23.23dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
826.40	H	90.53	20.34	0.00	1.95	18.39
	V	92.81	24.77	0.00	1.95	22.82
836.60	H	91.12	21.01	0.00	1.96	19.05
	V	92.82	25.19	0.00	1.96	23.23
846.60	H	90.94	20.91	0.00	1.97	18.94
	V	91.93	24.70	0.00	1.97	22.72

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Mode	GSM850
Result	Max EIRP = 0.41W (26.17dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
824.20	H	95.79	25.56	0.00	1.95	23.61
	V	95.02	26.92	0.00	1.95	24.97
836.60	H	95.07	24.96	0.00	1.96	23.00
	V	95.76	28.13	0.00	1.96	26.17
848.80	H	95.89	25.88	0.00	1.98	23.90
	V	95.23	28.08	0.00	1.98	26.11

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9821
Serial No.	260619016008008D (Internal Antenna)
Mode	GSM1900
Result	Max EIRP = 0.469W (26.72dBm)
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)
1850.20	H	90.60	24.10	1.59	2.96	22.73
	V	91.84	28.09	1.59	2.96	26.72
1880.00	H	91.74	25.64	1.38	2.98	24.04
	V	87.65	24.22	1.38	2.98	22.61
1909.80	H	91.60	25.90	1.15	3.00	24.04
	V	89.44	26.32	1.15	3.00	24.47

EIRP (dBm) = Sig Gen Reading (dBm) + Ant Gain (dB) + Cable Loss (dB)

23. Transmitter Radiated Emissions

EUT Information	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822, 661-9821
Serial No.	260623016003008D (External Antenna), 260619016008008D (Internal Antenna)
Modes	WCDMA Band 2, WCDMA Band 4, WCDMA Band 5, GSM850, GSM1900

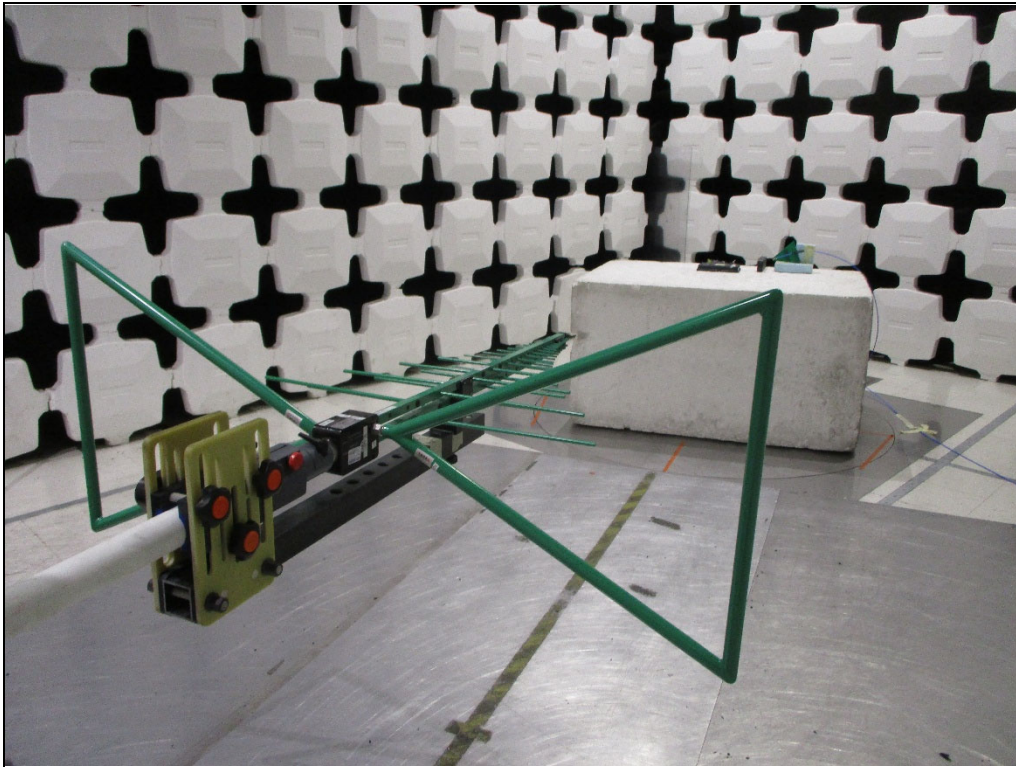
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	R29F
Antenna Types Used	Below 1GHz: Bilog (or equivalent) 1 – 18GHz: Double-ridged waveguide (or equivalent) Above 18GHz: Horn (or equivalent)
Notes	None

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3

Mode	Description
WCDMA Band 2	- Channel 9262 - Channel 9400 - Channel 9538
WCDMA Band 4	- Channel 1312 - Channel 1413 - Channel 1513
WCDMA Band 5	- Channel 4132 - Channel 4182 - Channel 4233
GSM850	- Channel 128 - Channel 190 - Channel 251
GSM1900	- Channel 512 - Channel 661 - Channel 810

Procedure

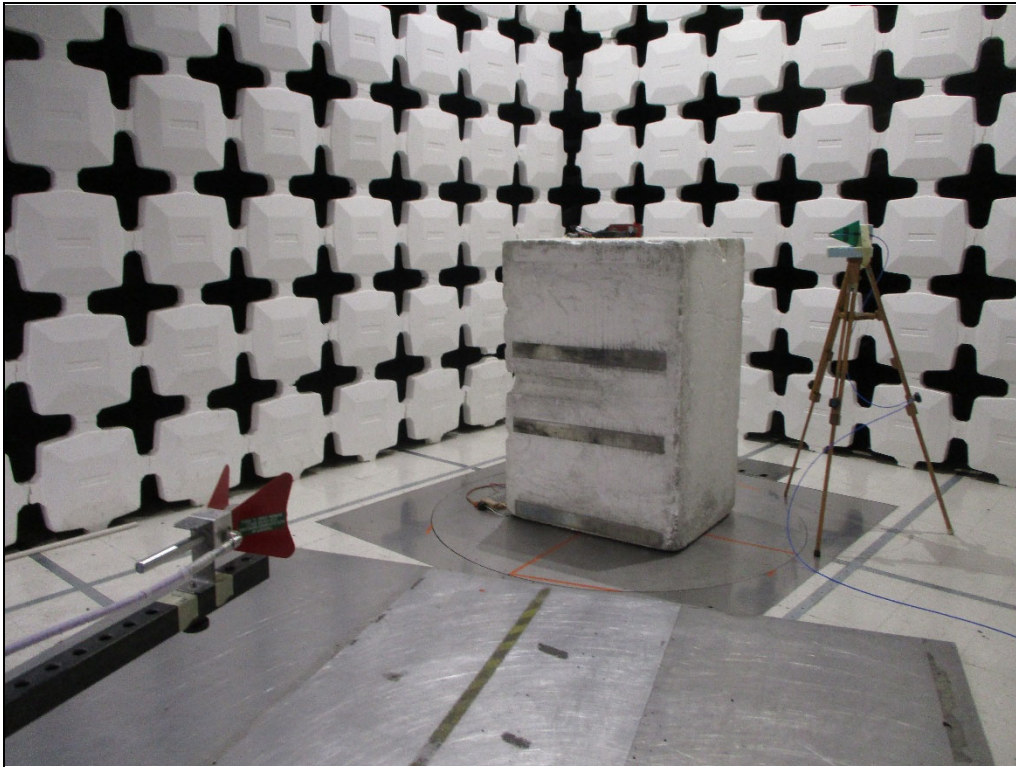
The EUT was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle, and high channels.



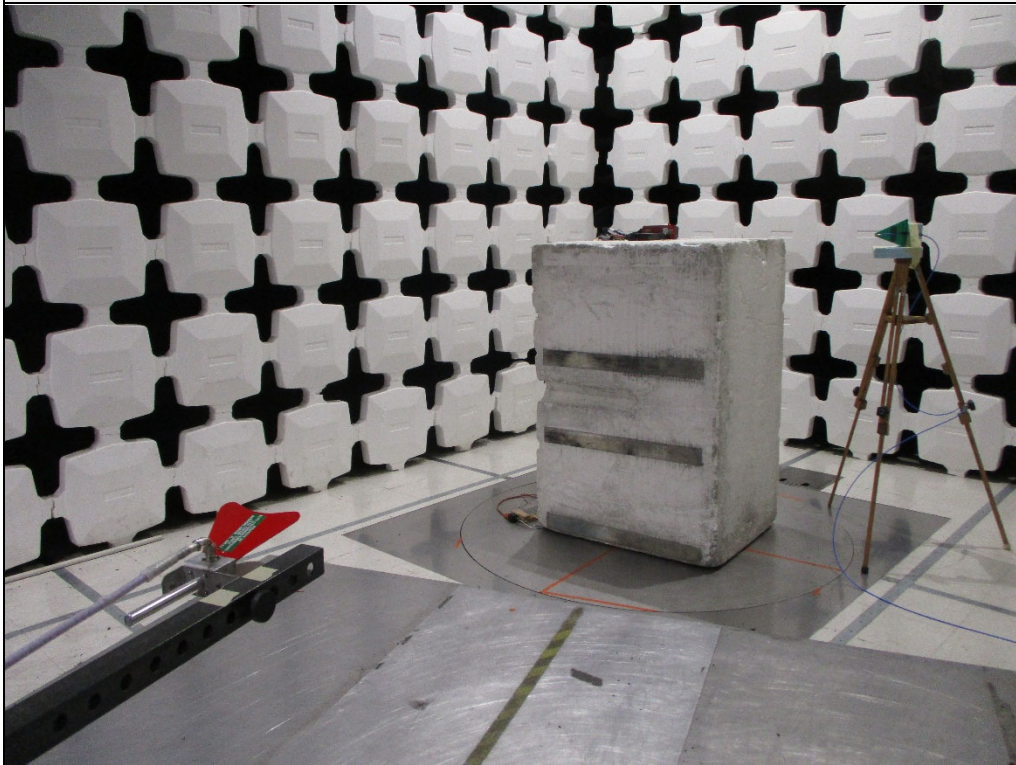
Test Setup for Radiated Spurious Emissions: 30MHz to 1GHz, Horizontal Polarization



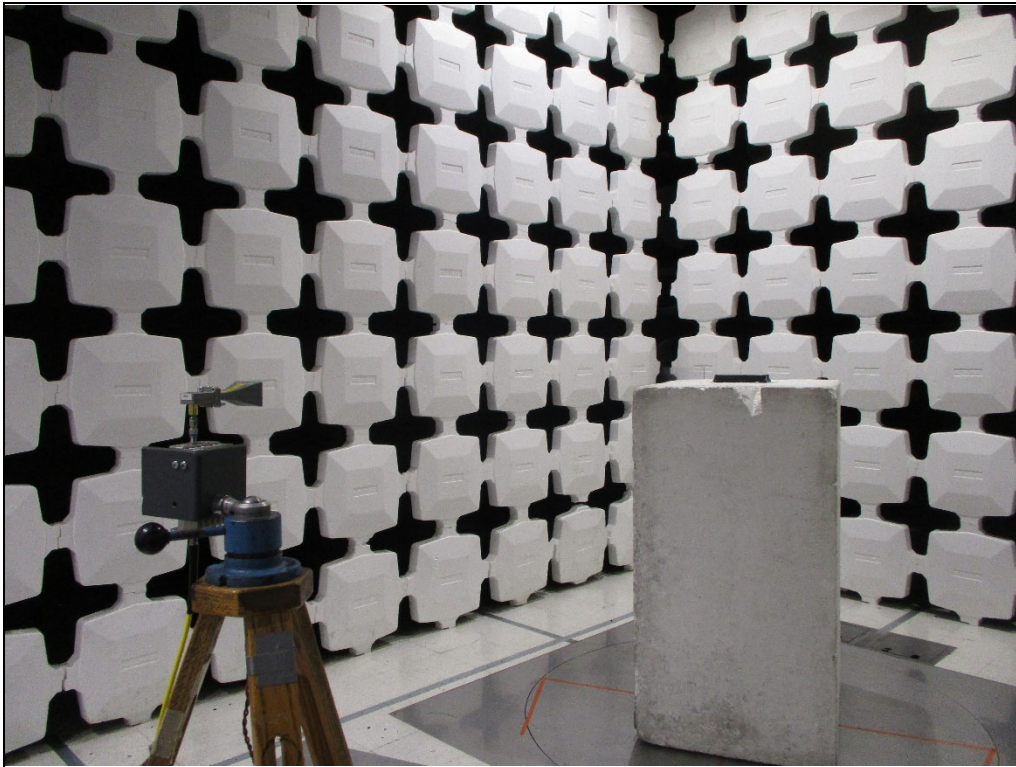
Test Setup for Radiated Spurious Emissions: 30MHz to 1GHz, Vertical Polarization



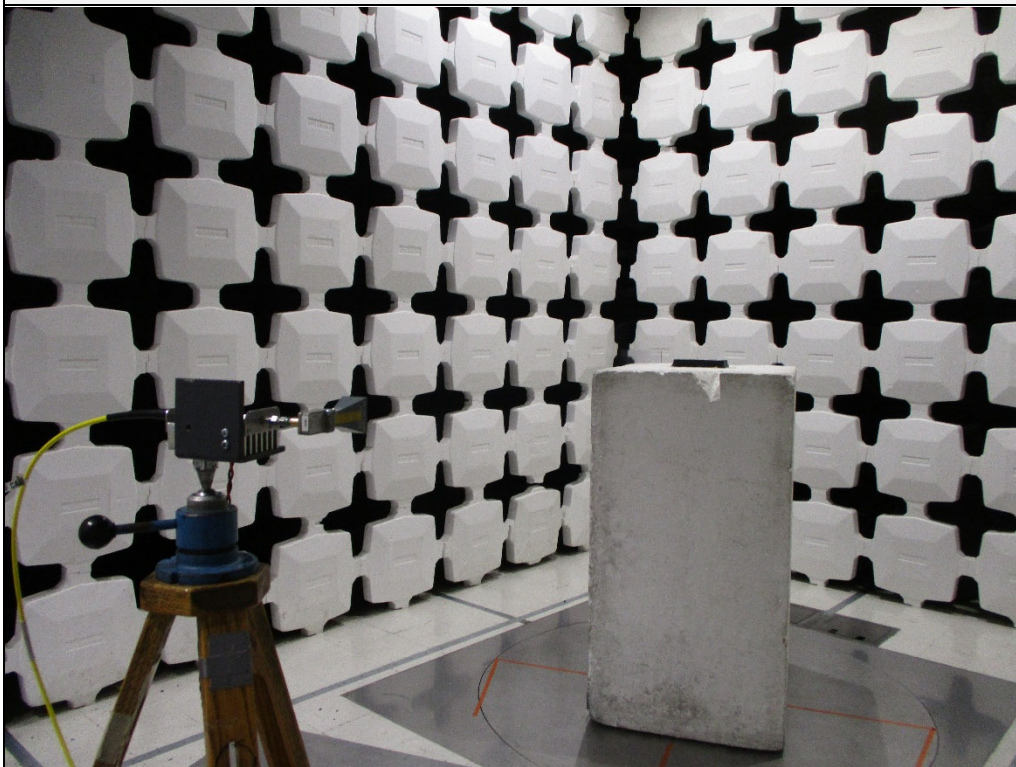
Test Setup for Radiated Spurious Emissions: 1GHz to 18GHz, Horizontal Polarization



Test Setup for Radiated Spurious Emissions: 1GHz to 18GHz, Vertical Polarization

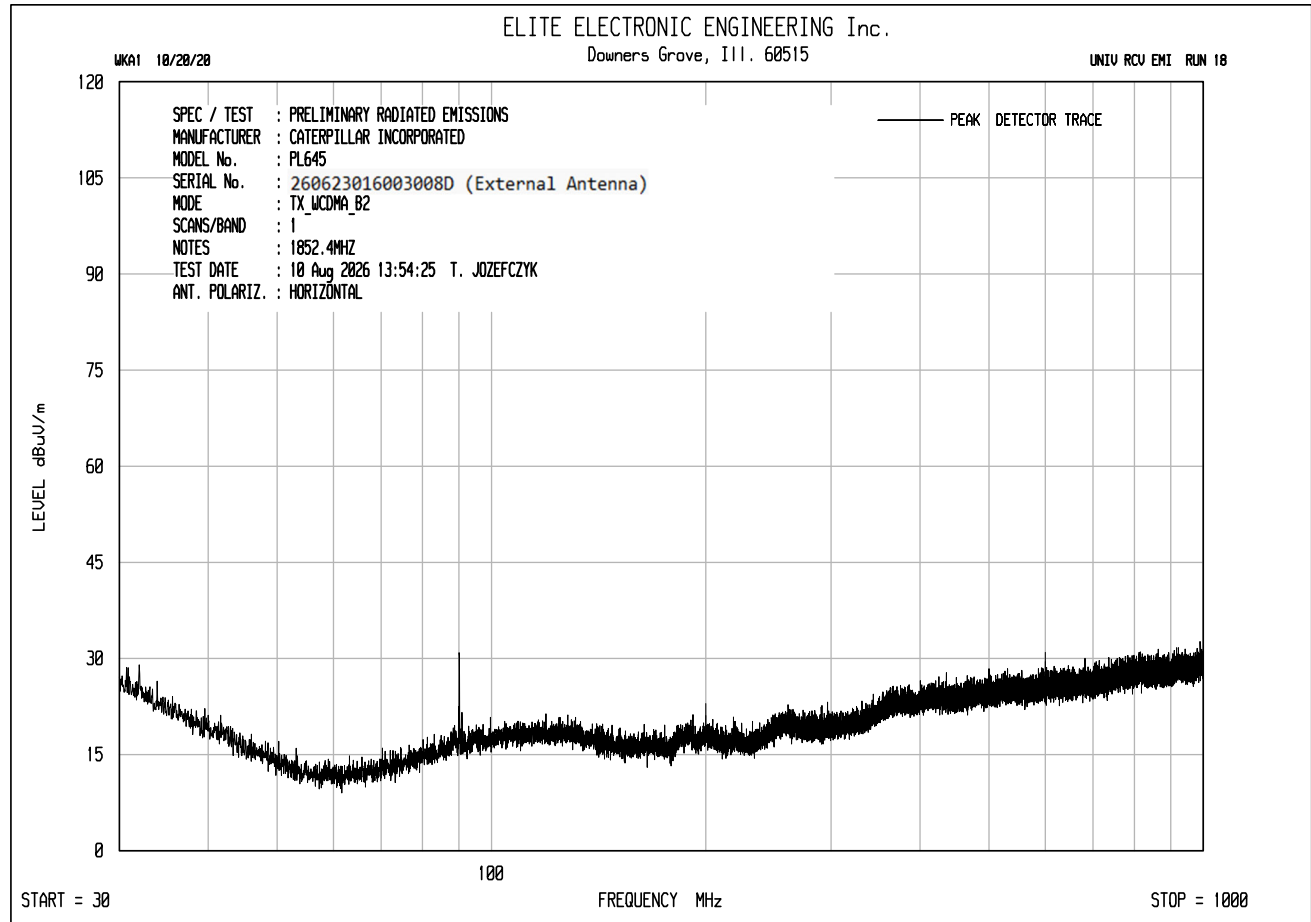


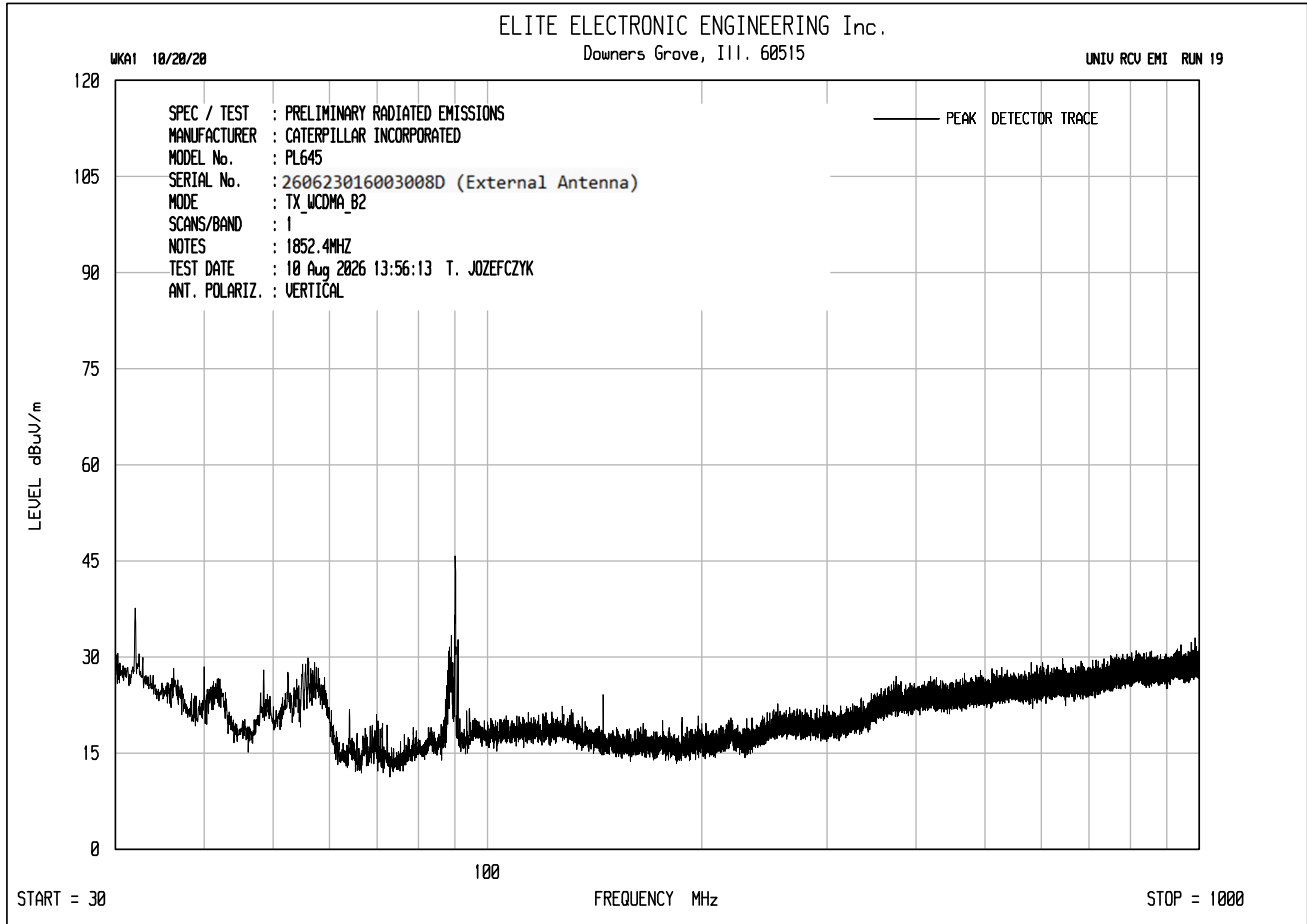
Test Setup for Radiated Spurious Emissions: 18GHz to 26.5GHz, Horizontal Polarization

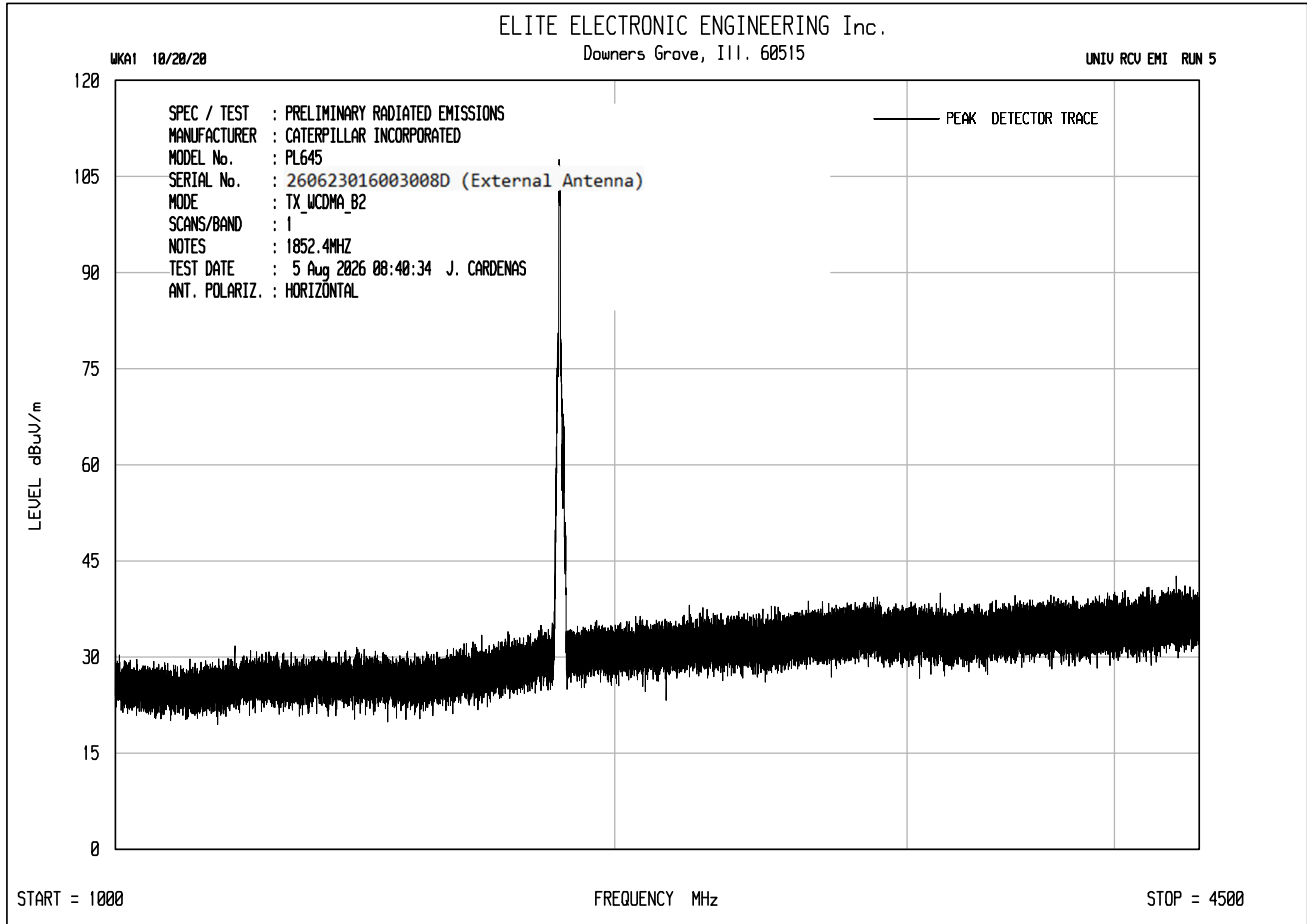


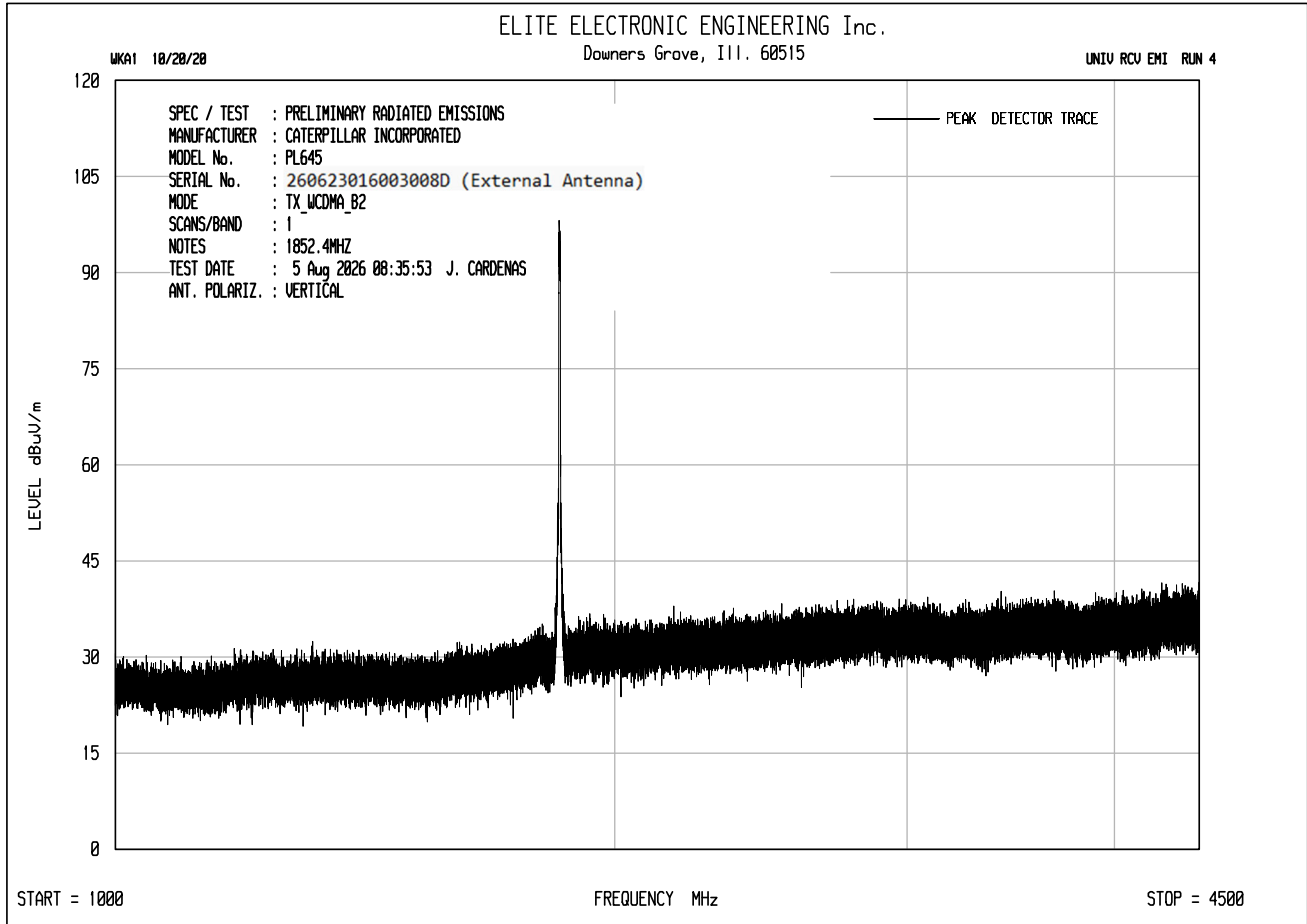
Test Setup for Radiated Spurious Emissions: 18GHz to 26.5GHz, Vertical Polarization

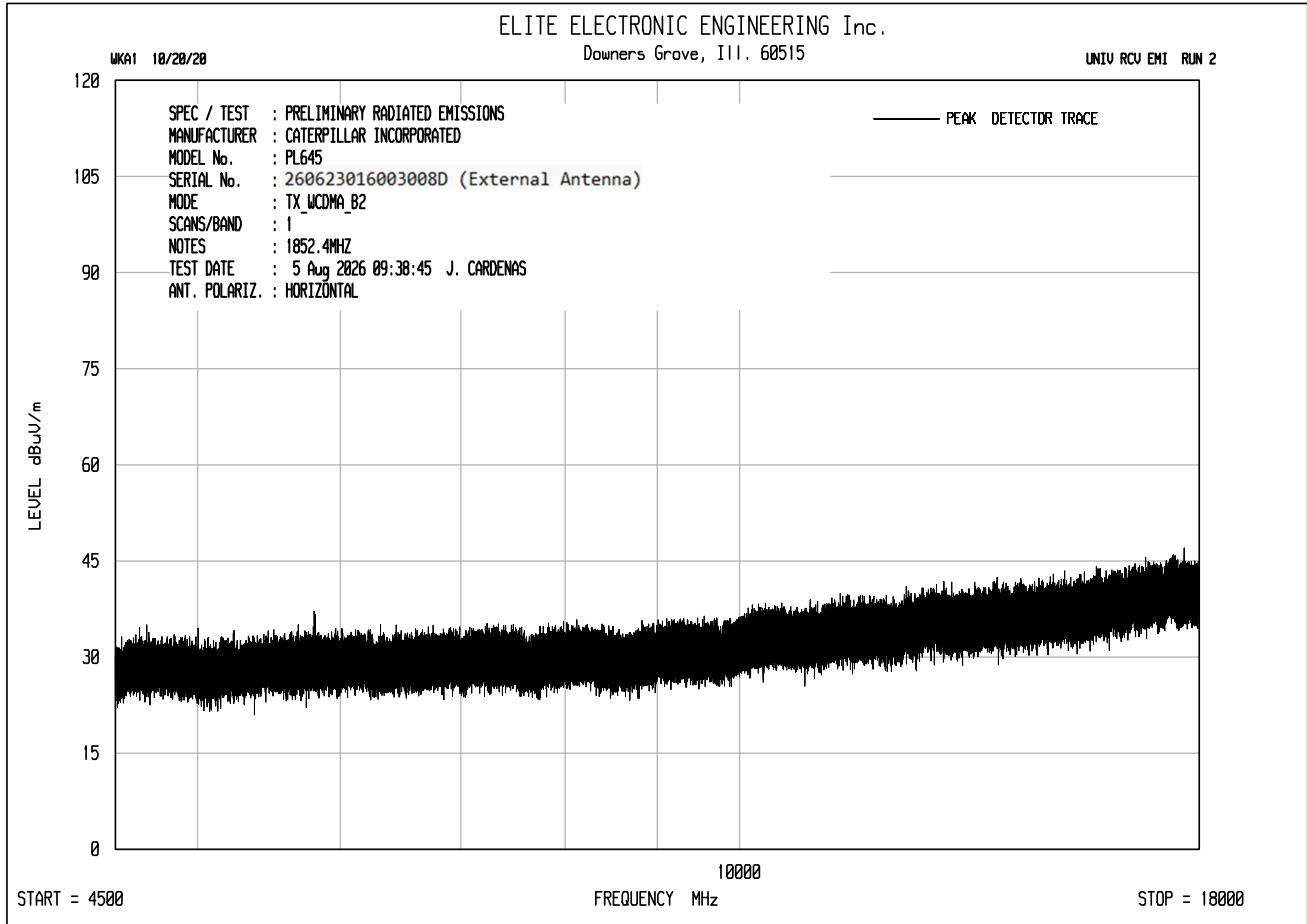
Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 2
Frequency Tested	1852.4MHz
Notes	None

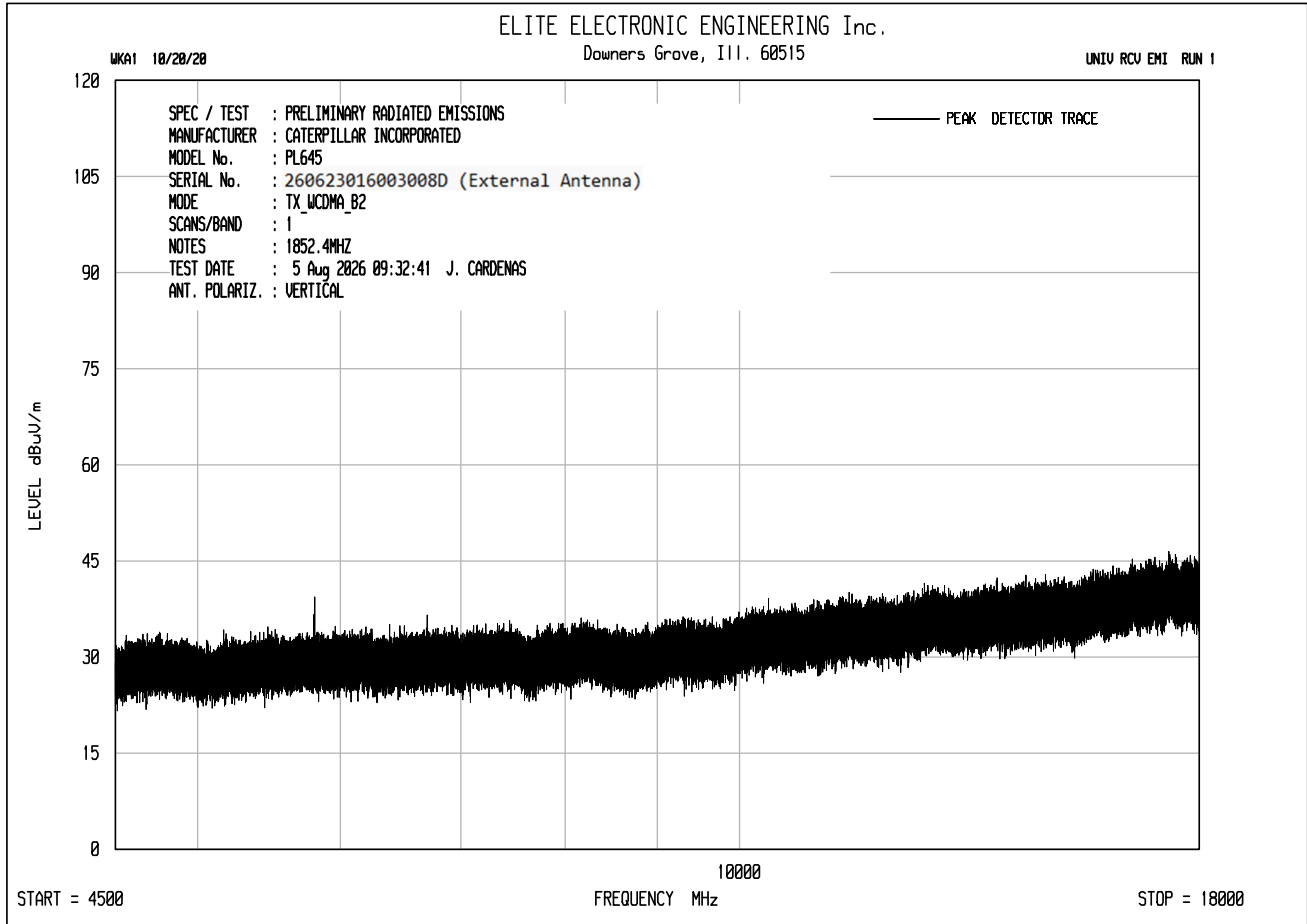


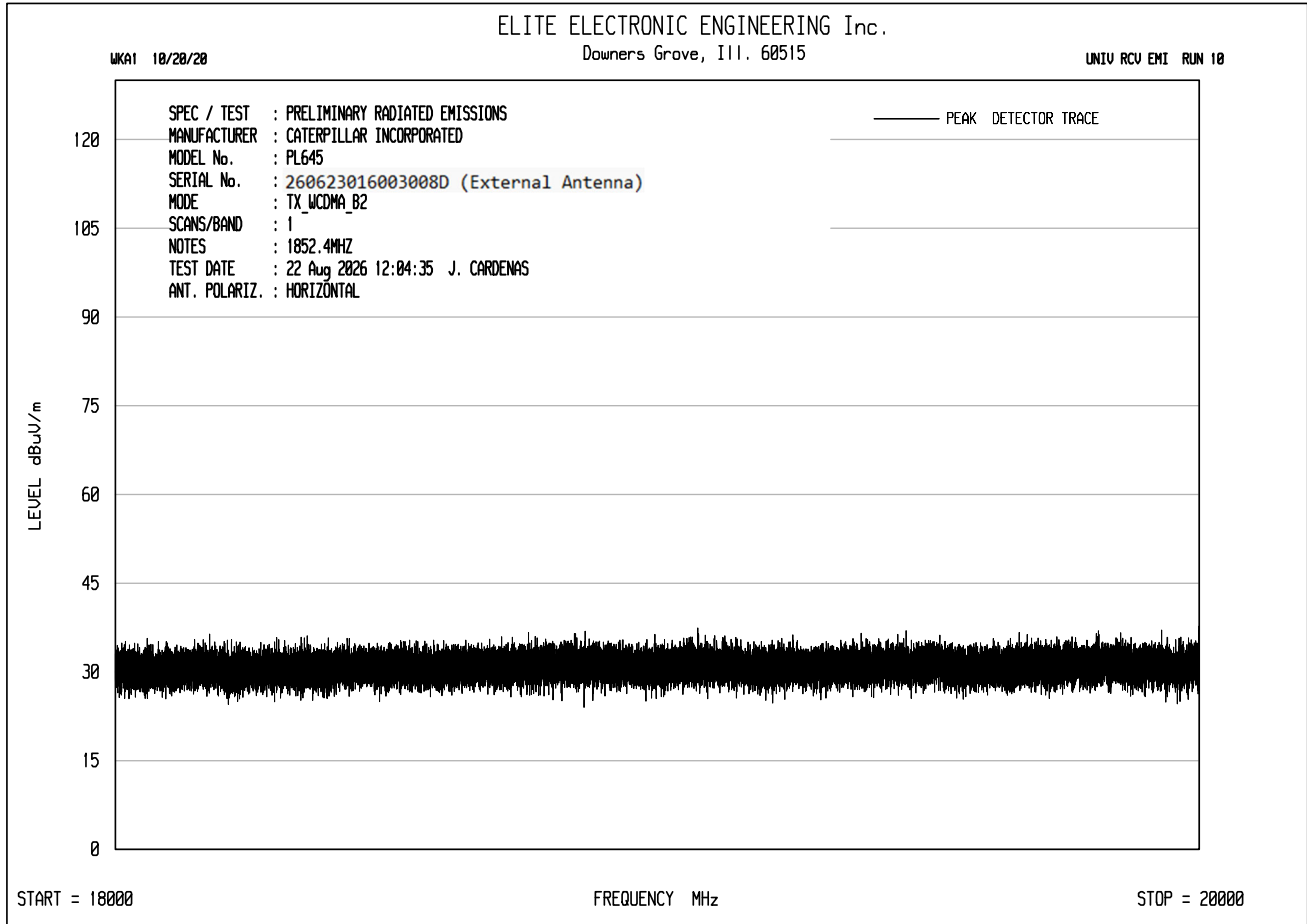


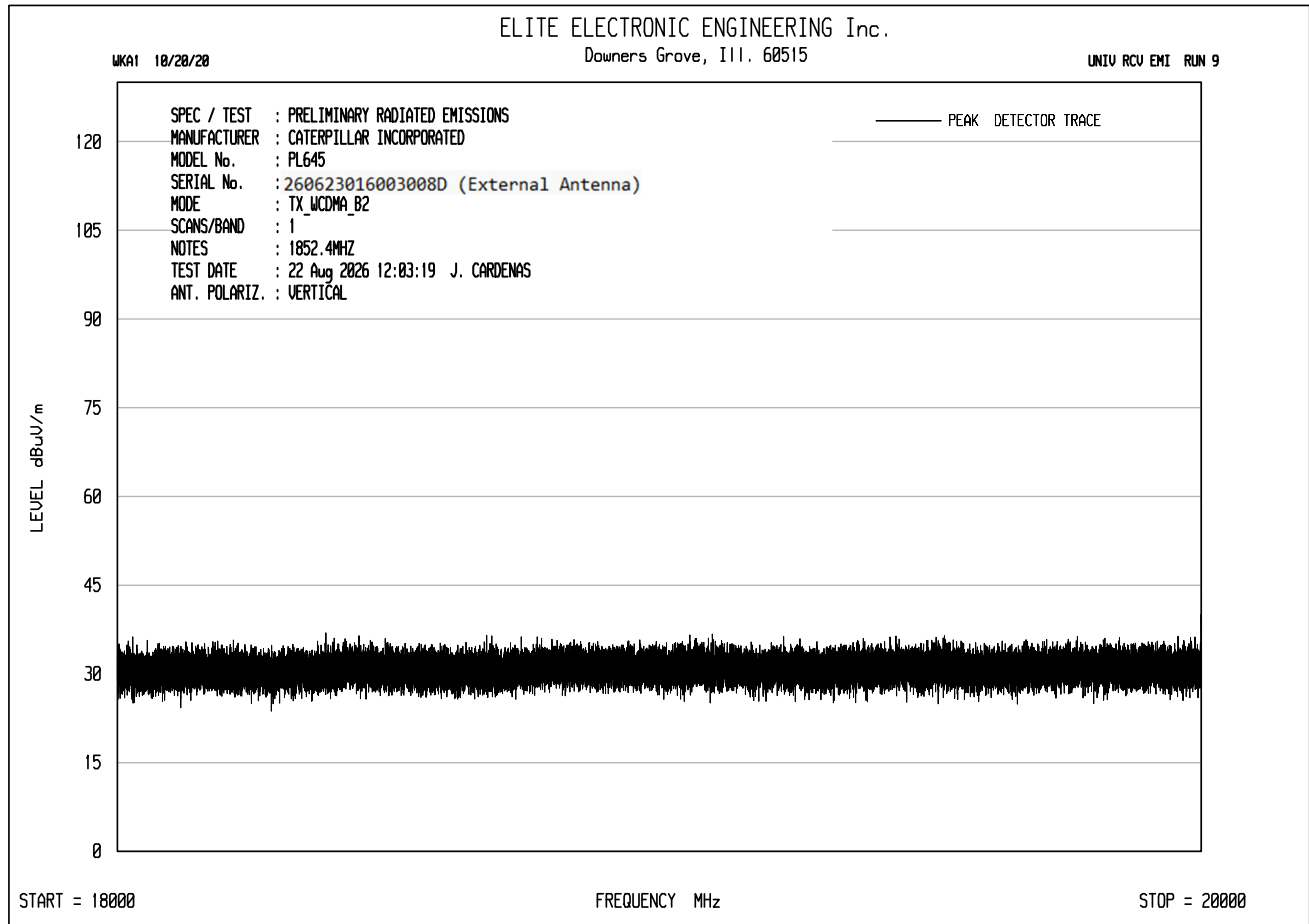






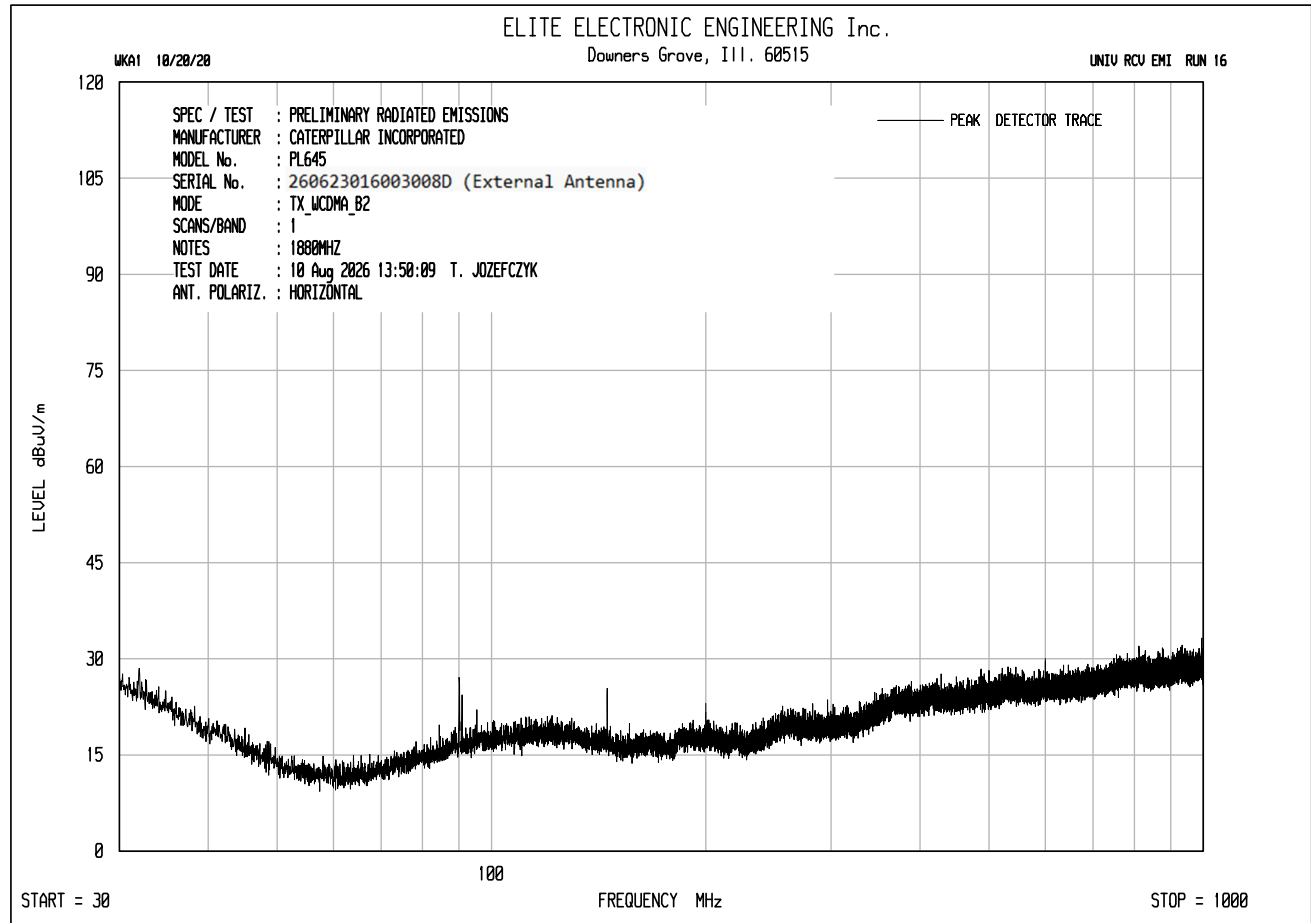


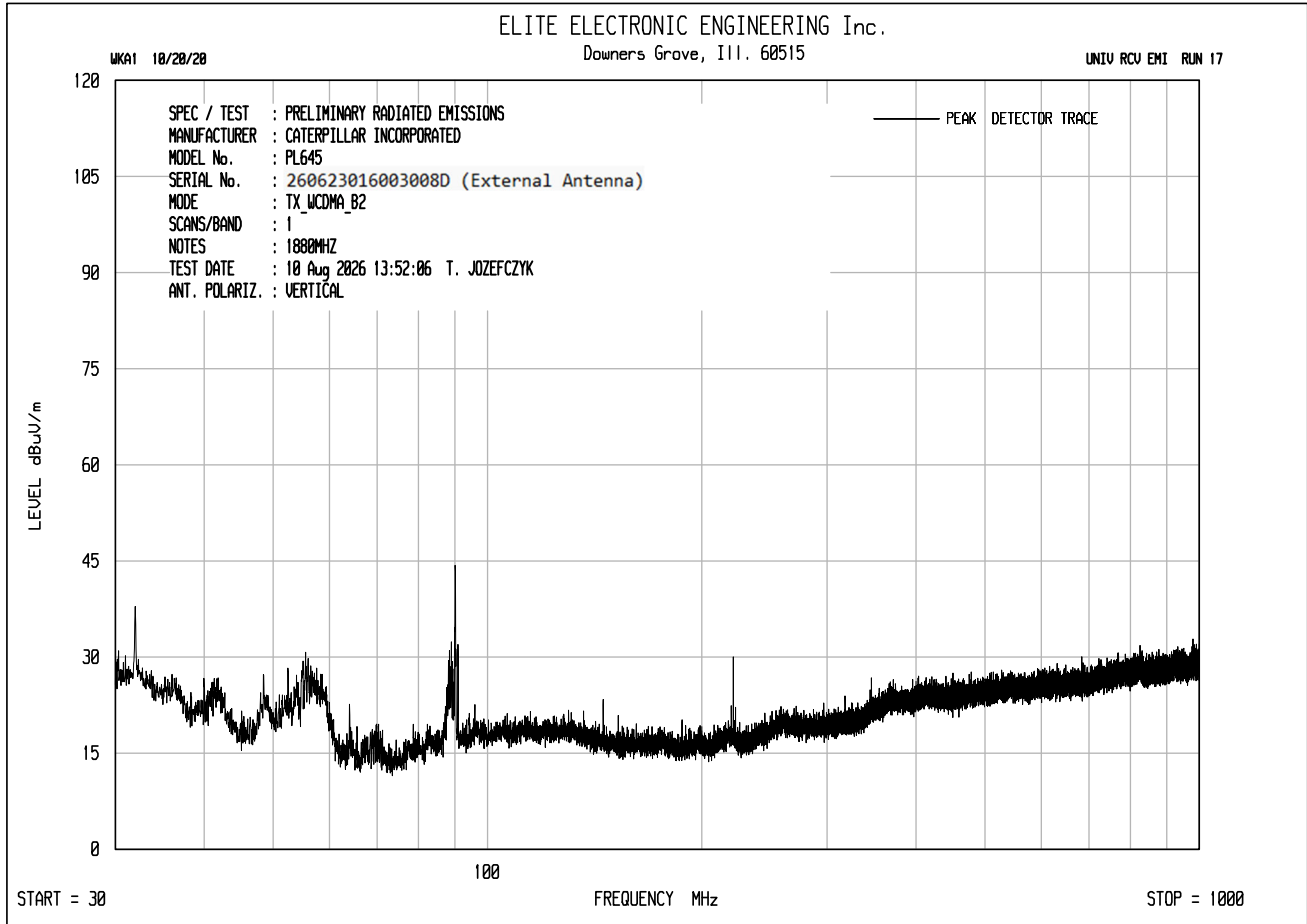


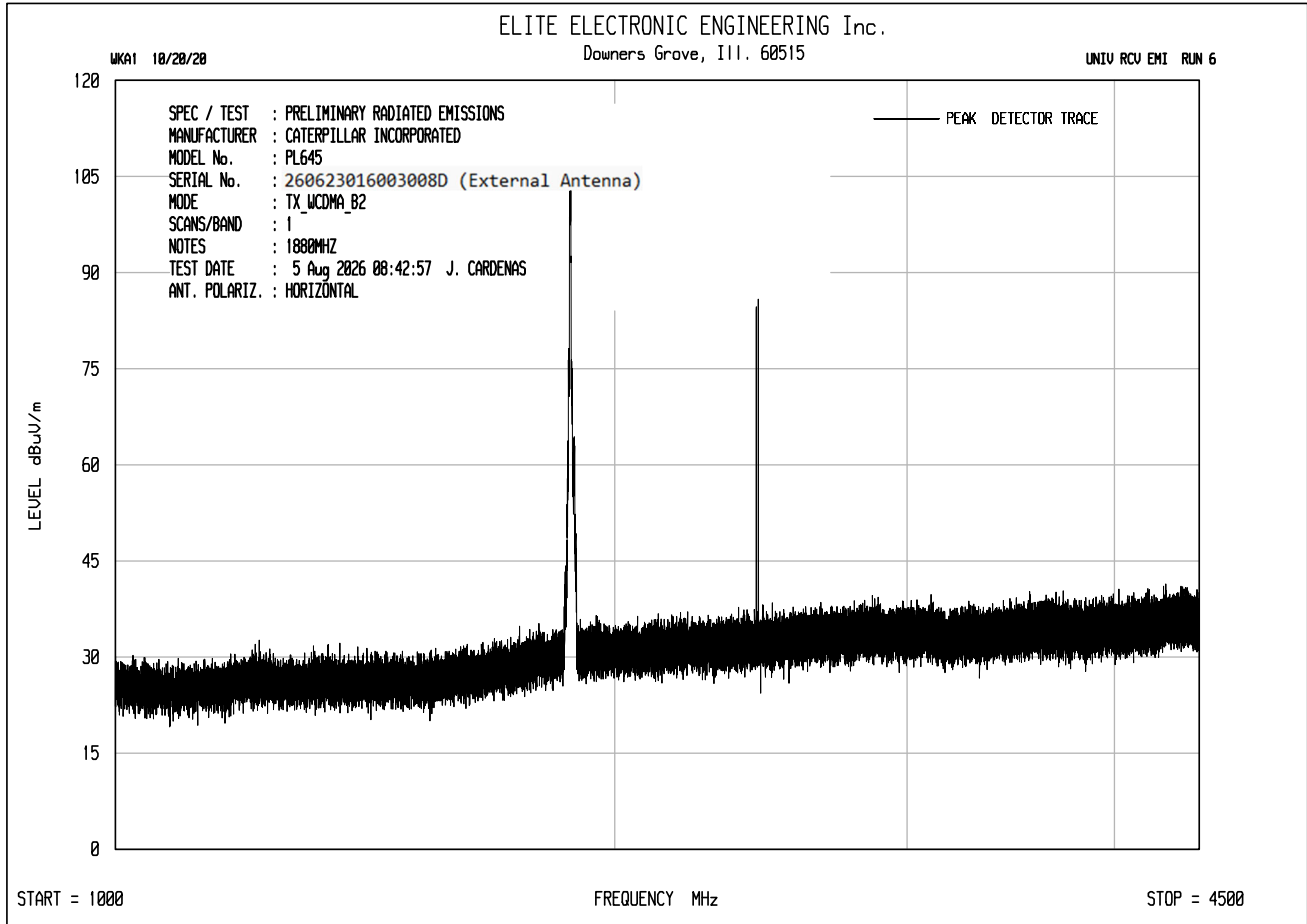


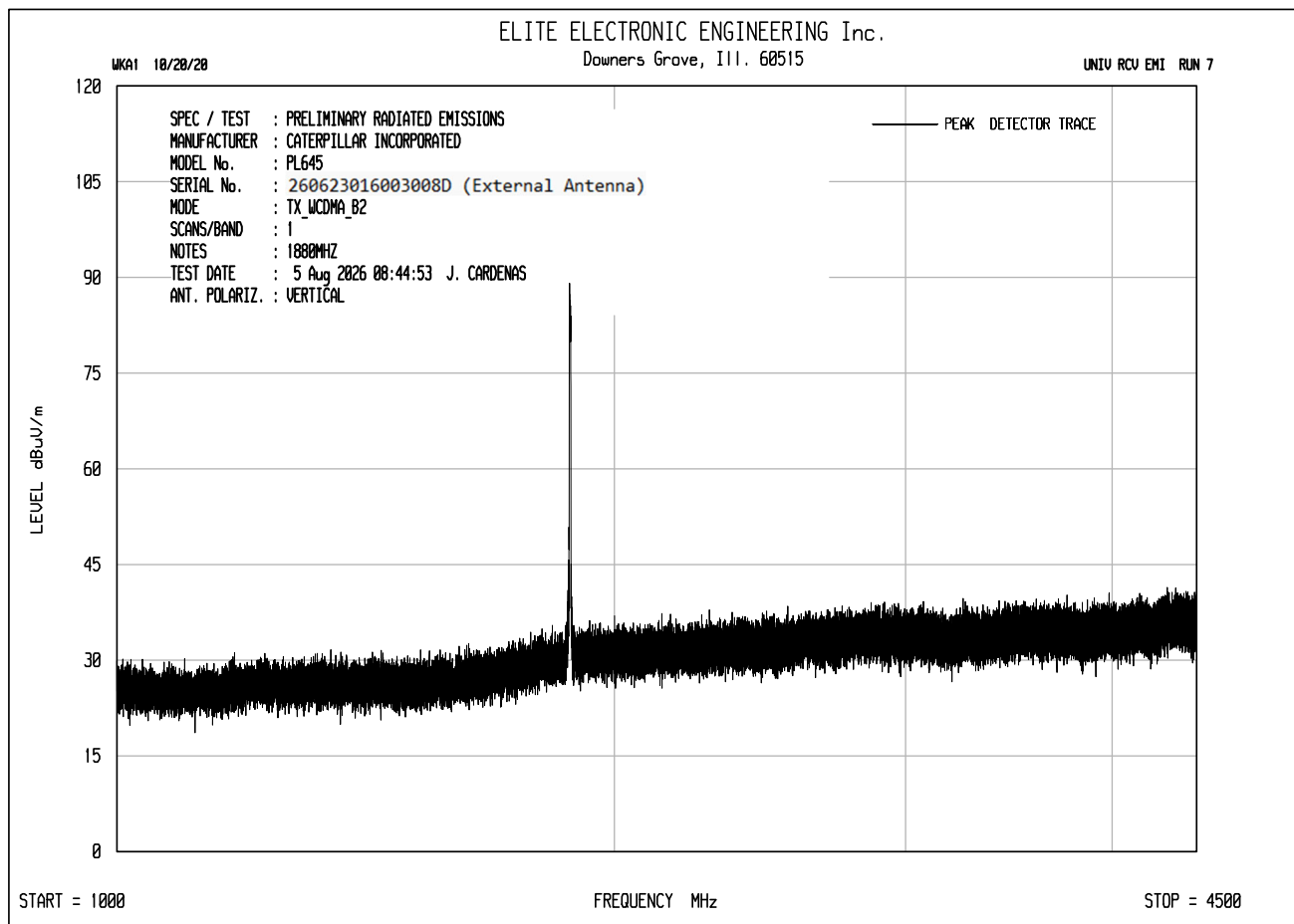
Freq. MHz	Ant Pol	Meter Reading (dBμV)	Ambient	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
3704.80	H	27.84	Ambient	-35.34	5.04	4.31	-34.62	56.66	35.04
3704.80	V	27.08	Ambient	-34.95	5.04	4.31	-34.23	56.27	35.04
5557.20	H	49.61	Ambient	-49.93	6.10	5.22	-49.04	71.08	35.04
5557.20	V	48.80	Ambient	-50.91	6.10	5.22	-50.03	72.07	35.04

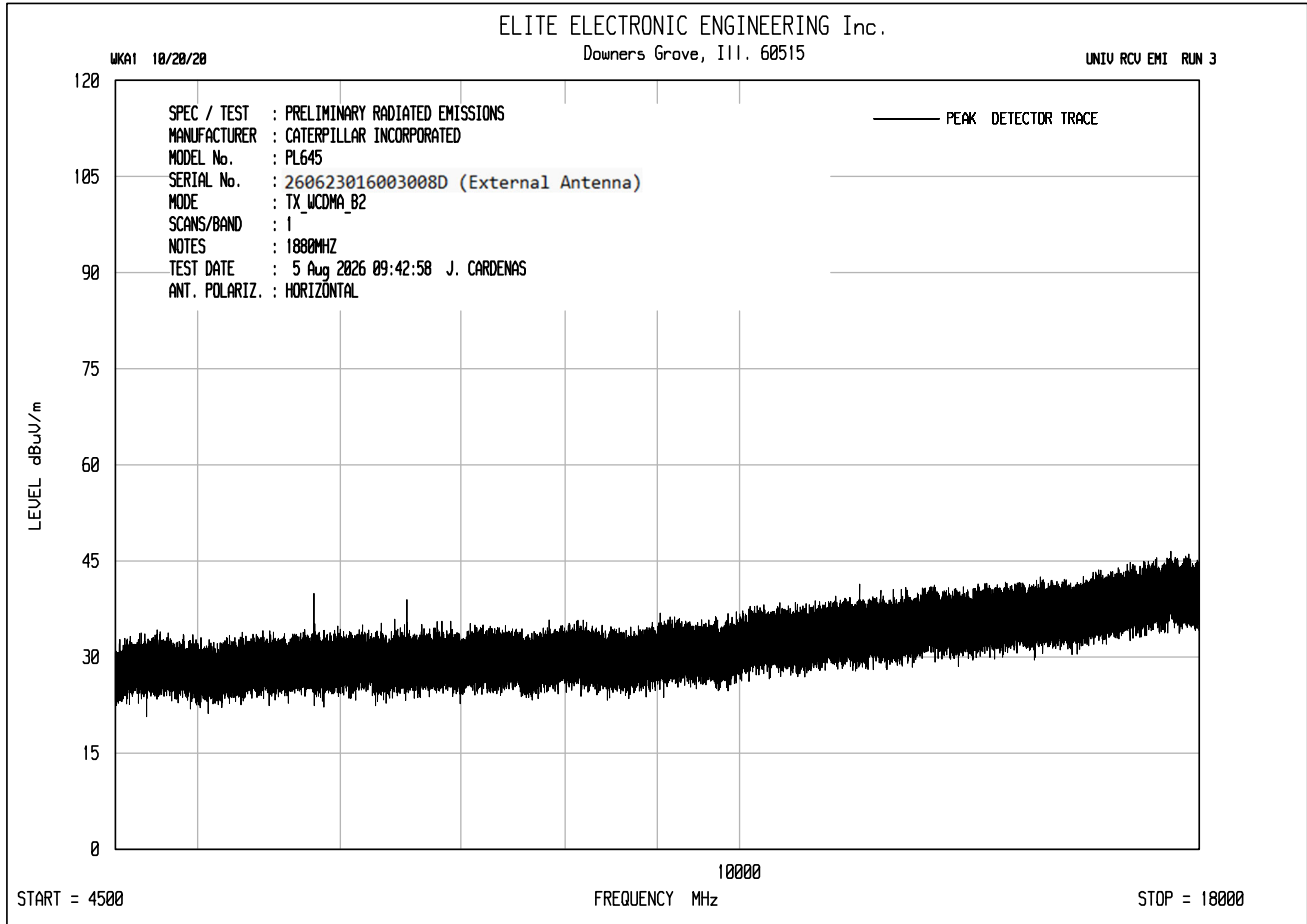
Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 2
Frequency Tested	1880MHz
Notes	None

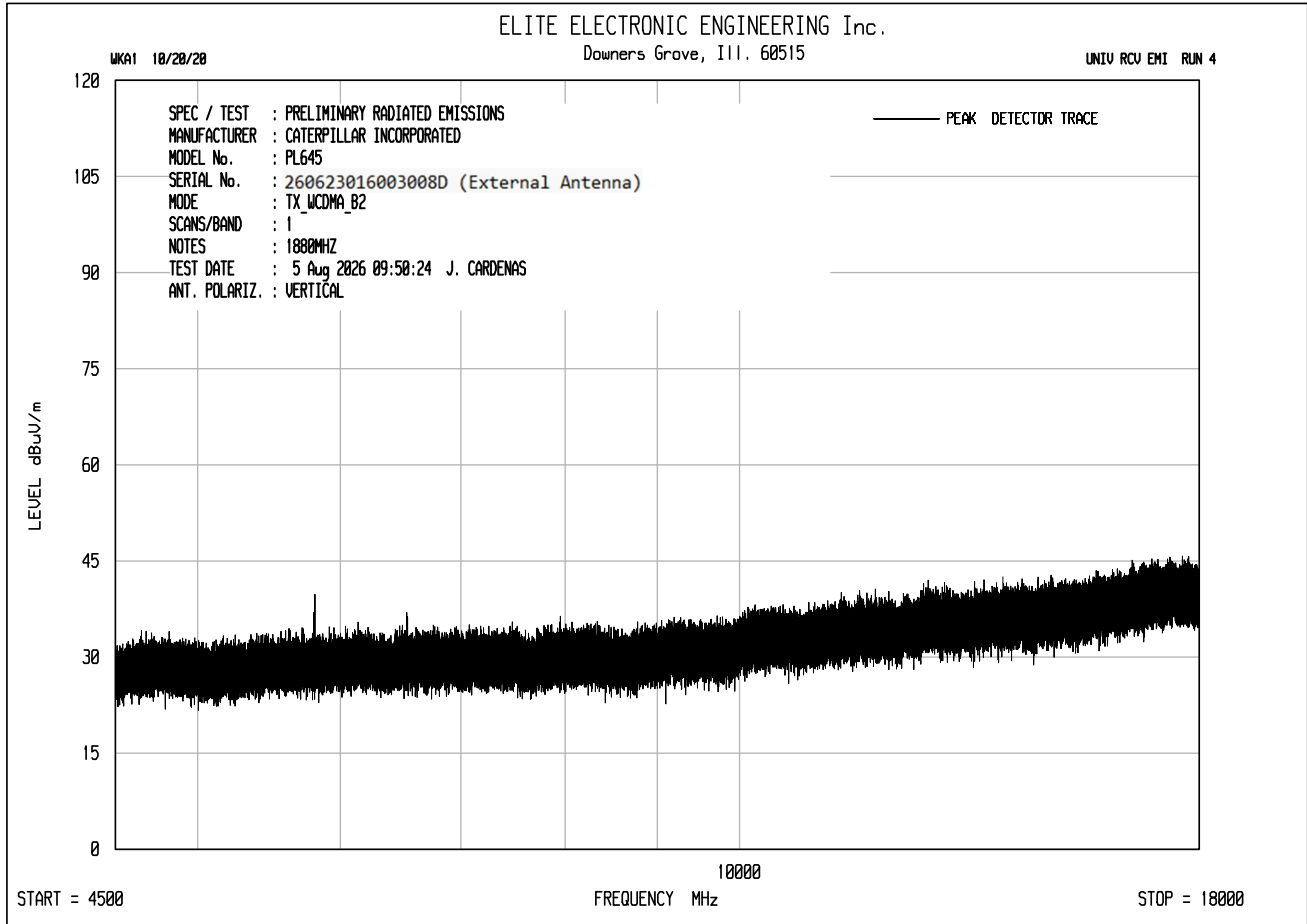


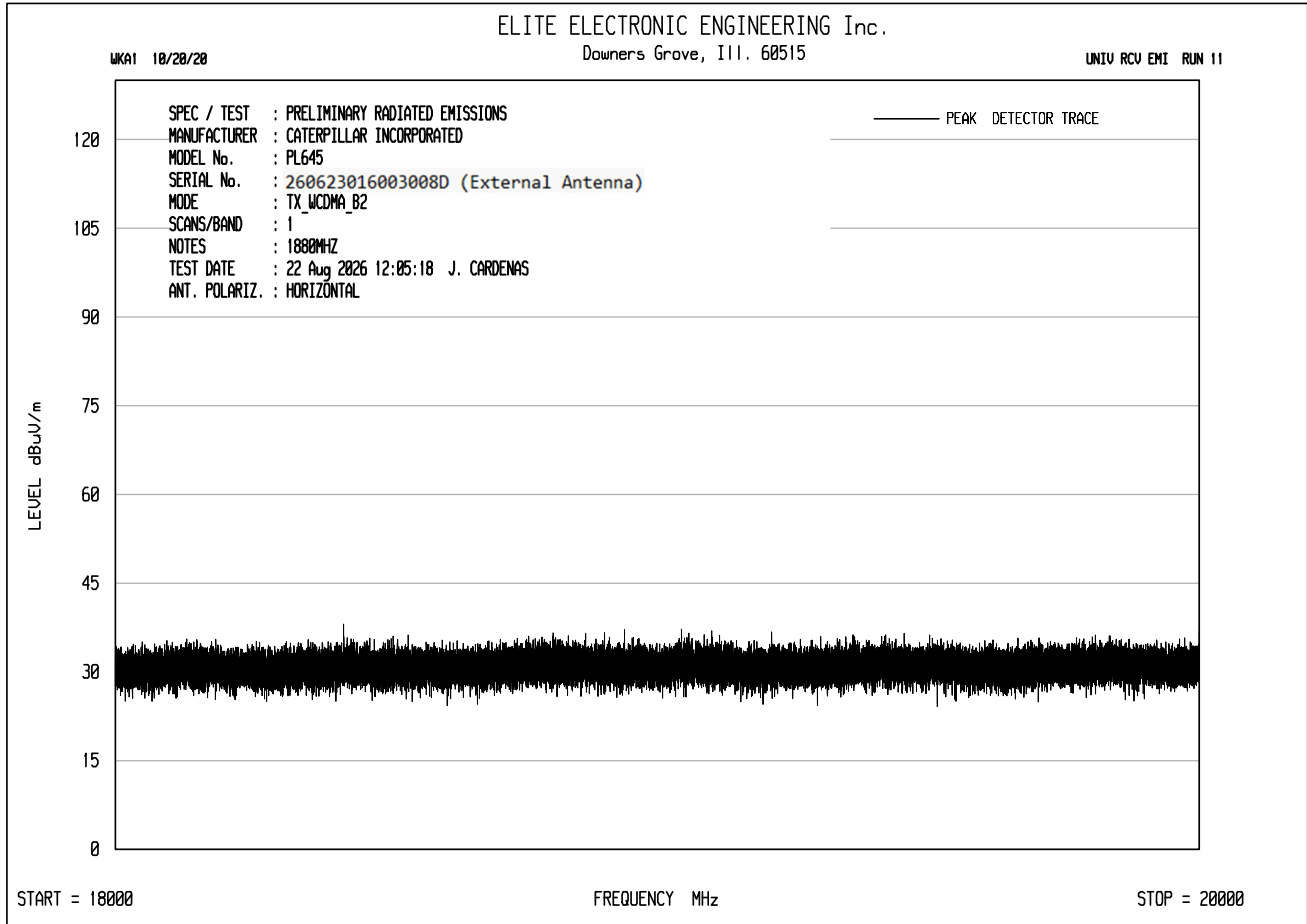


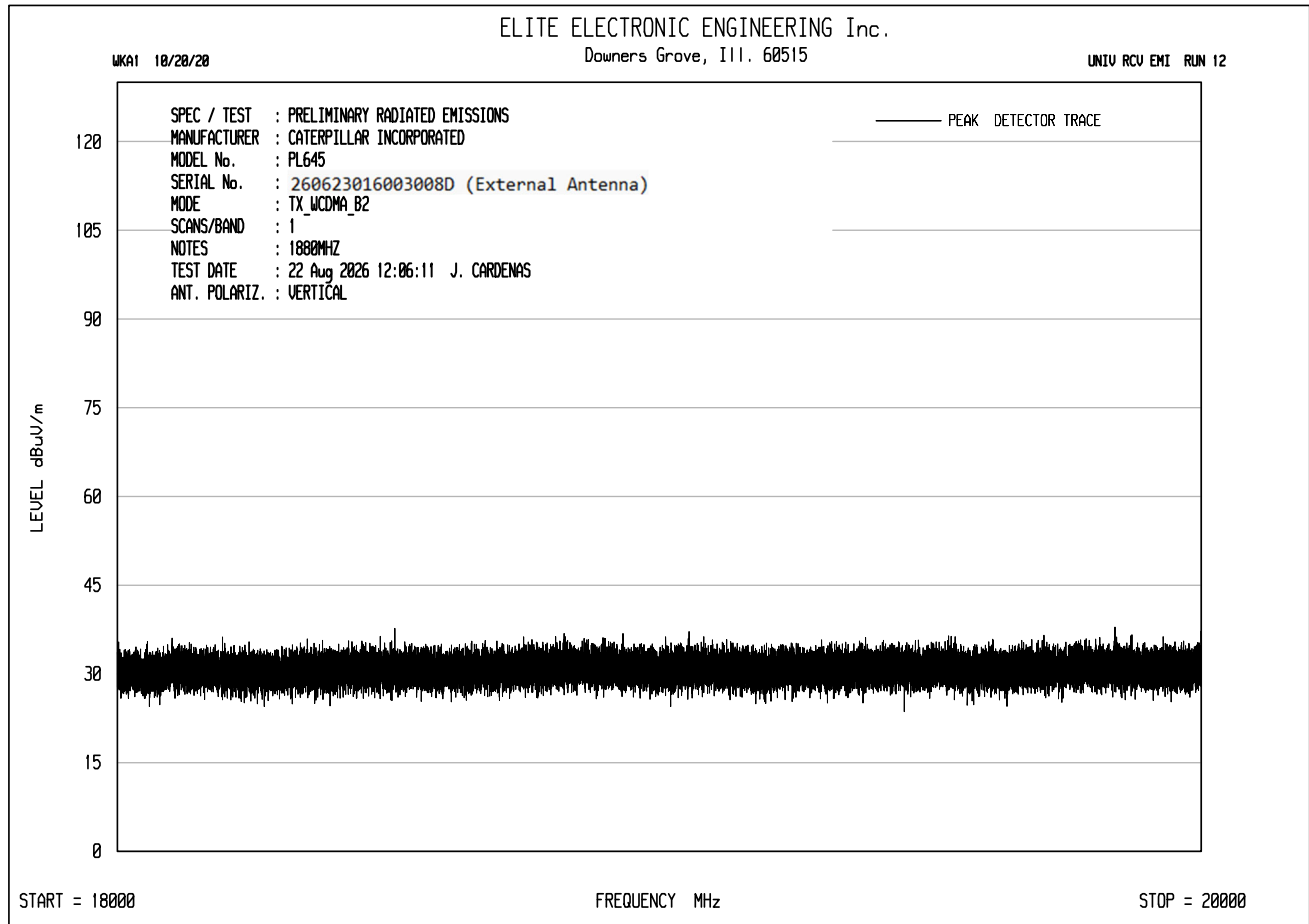






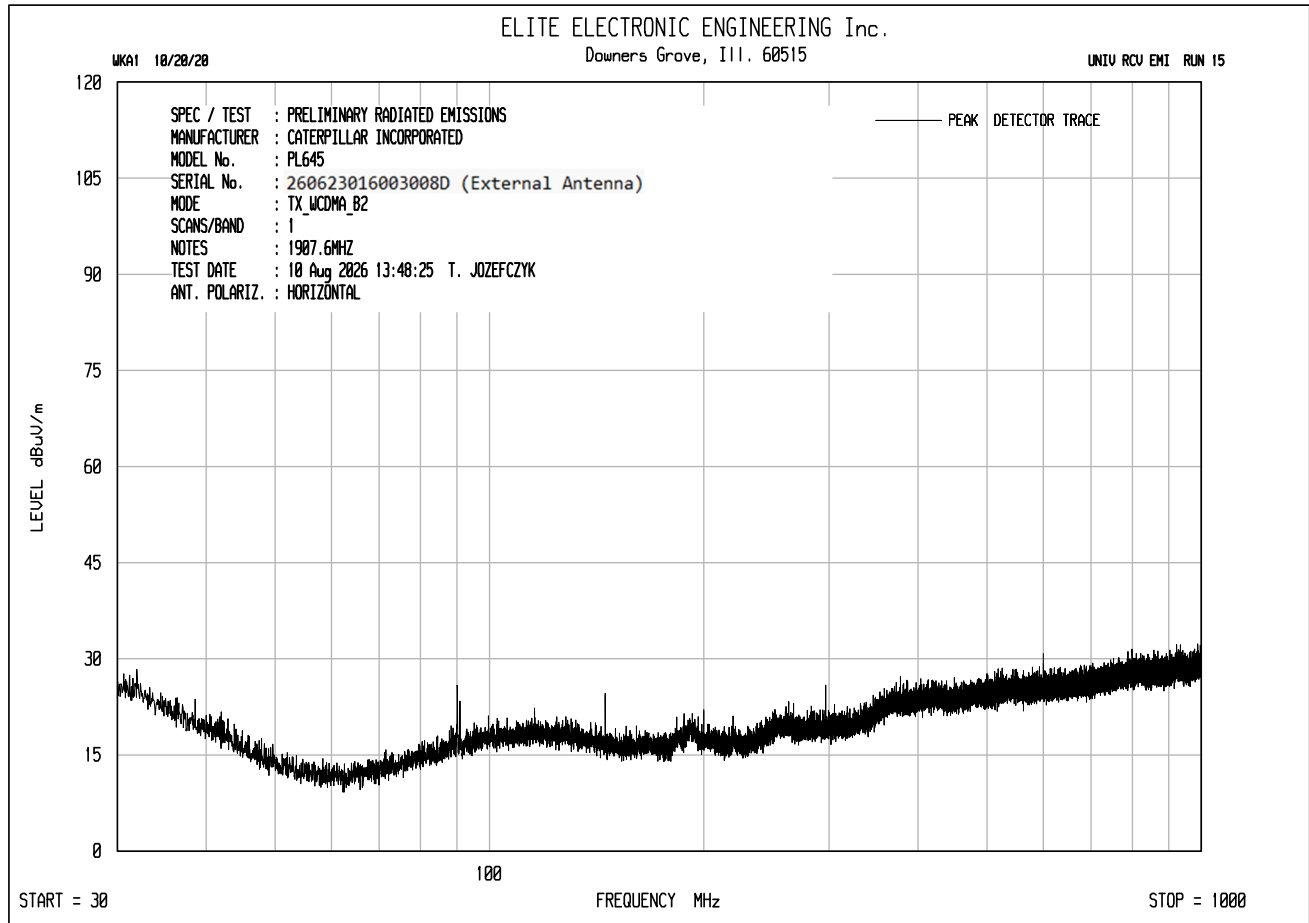


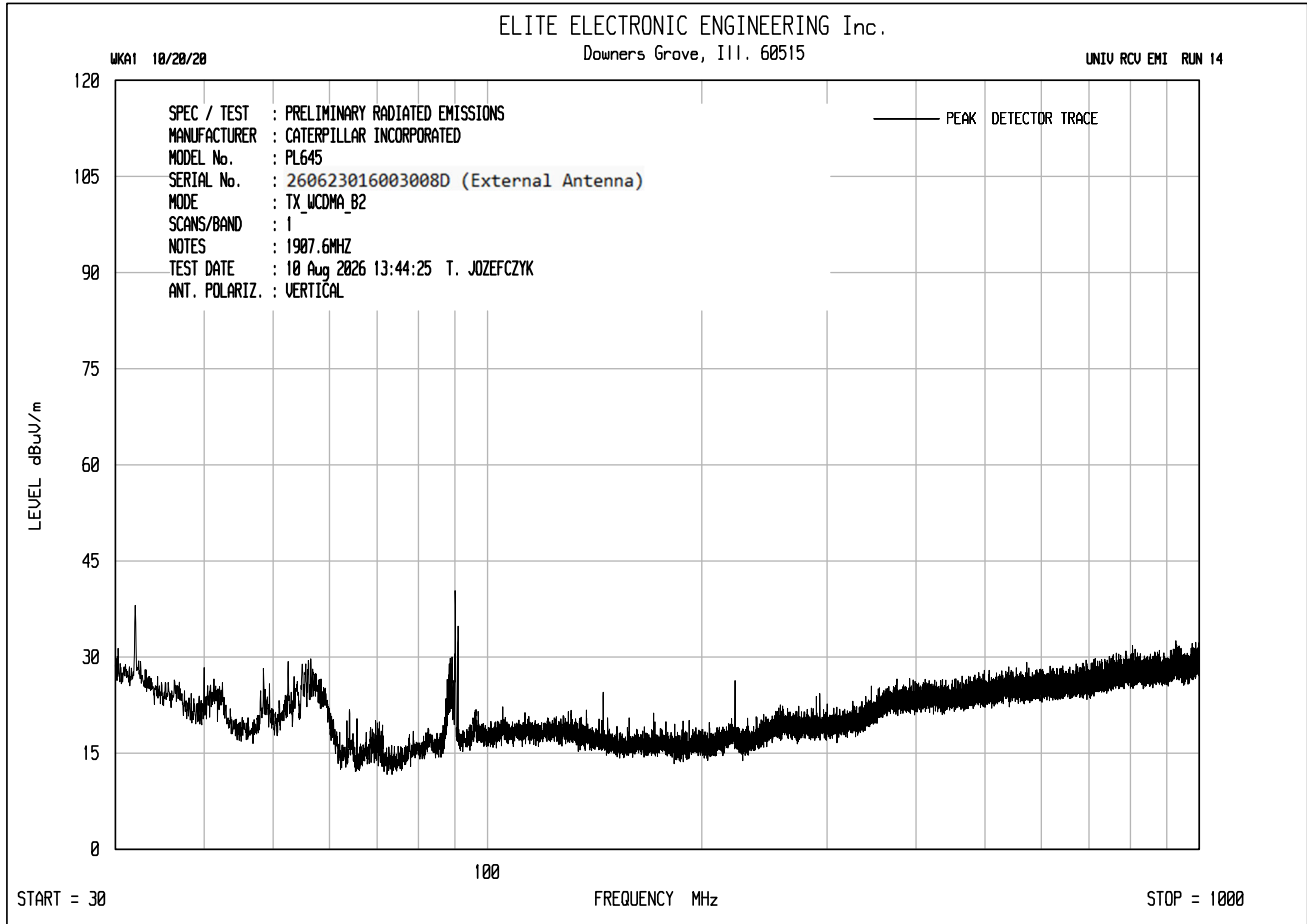


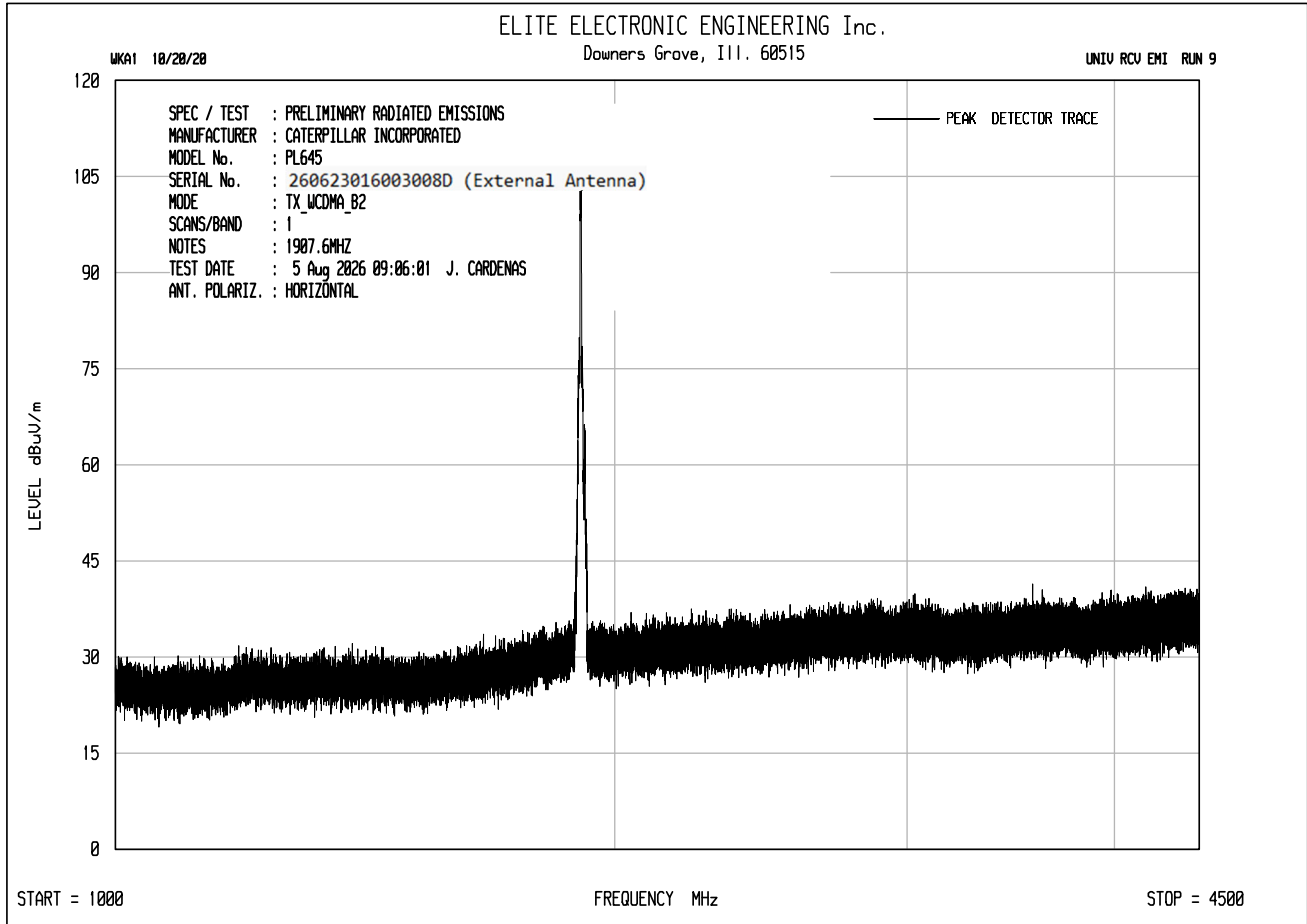


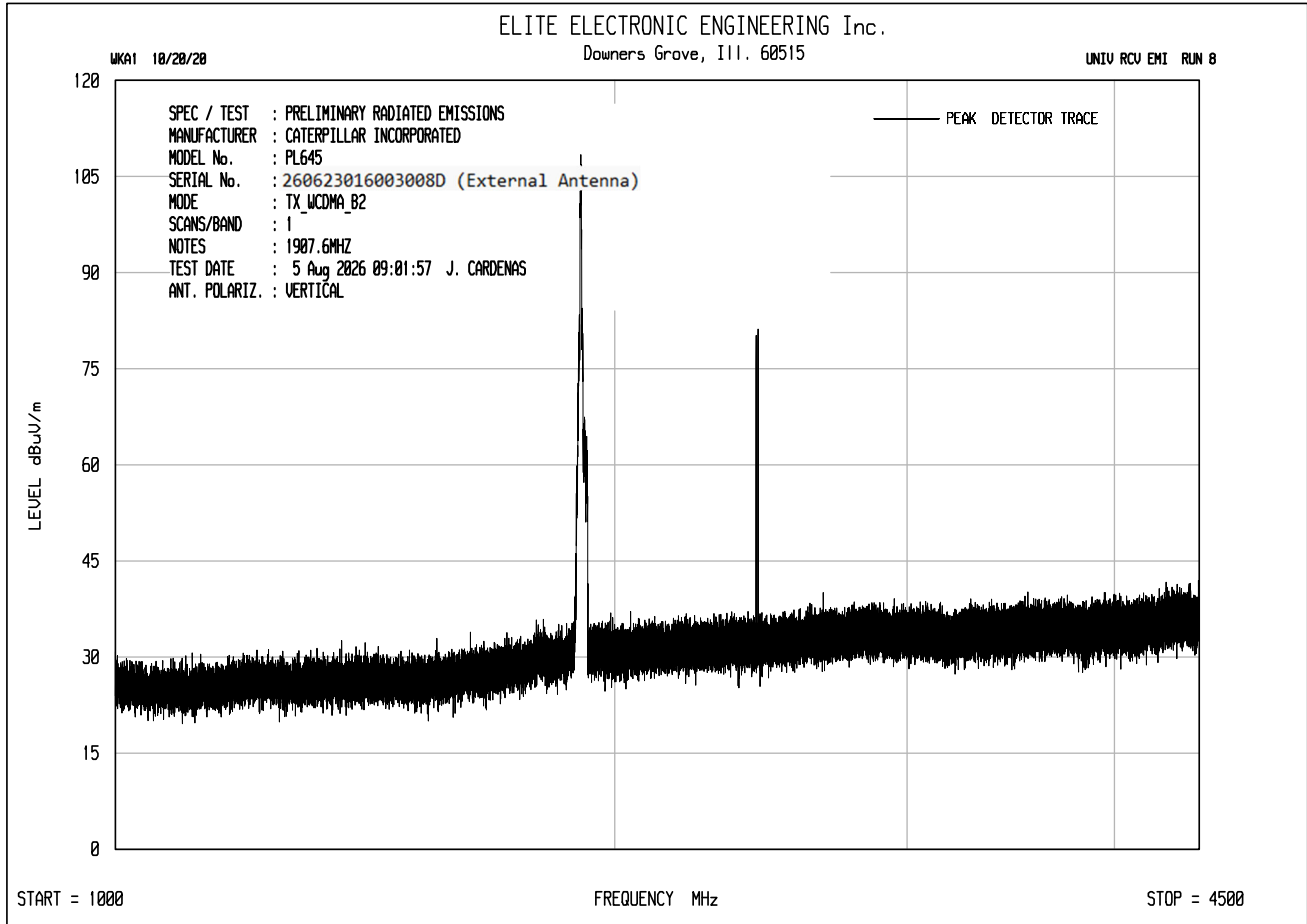
Freq. MHz	Ant Pol	Meter Reading (dBμV)	Ambient	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
3760.00	H	26.10	Ambient	-36.92	5.07	4.34	-36.19	58.23	35.04
3760.00	V	26.51	Ambient	-35.33	5.07	4.34	-34.60	56.64	35.04
5640.00	H	49.06	Ambient	-50.03	5.66	5.26	-49.62	71.66	35.04
5640.00	V	48.25	Ambient	-50.98	5.66	5.26	-50.58	72.62	35.04

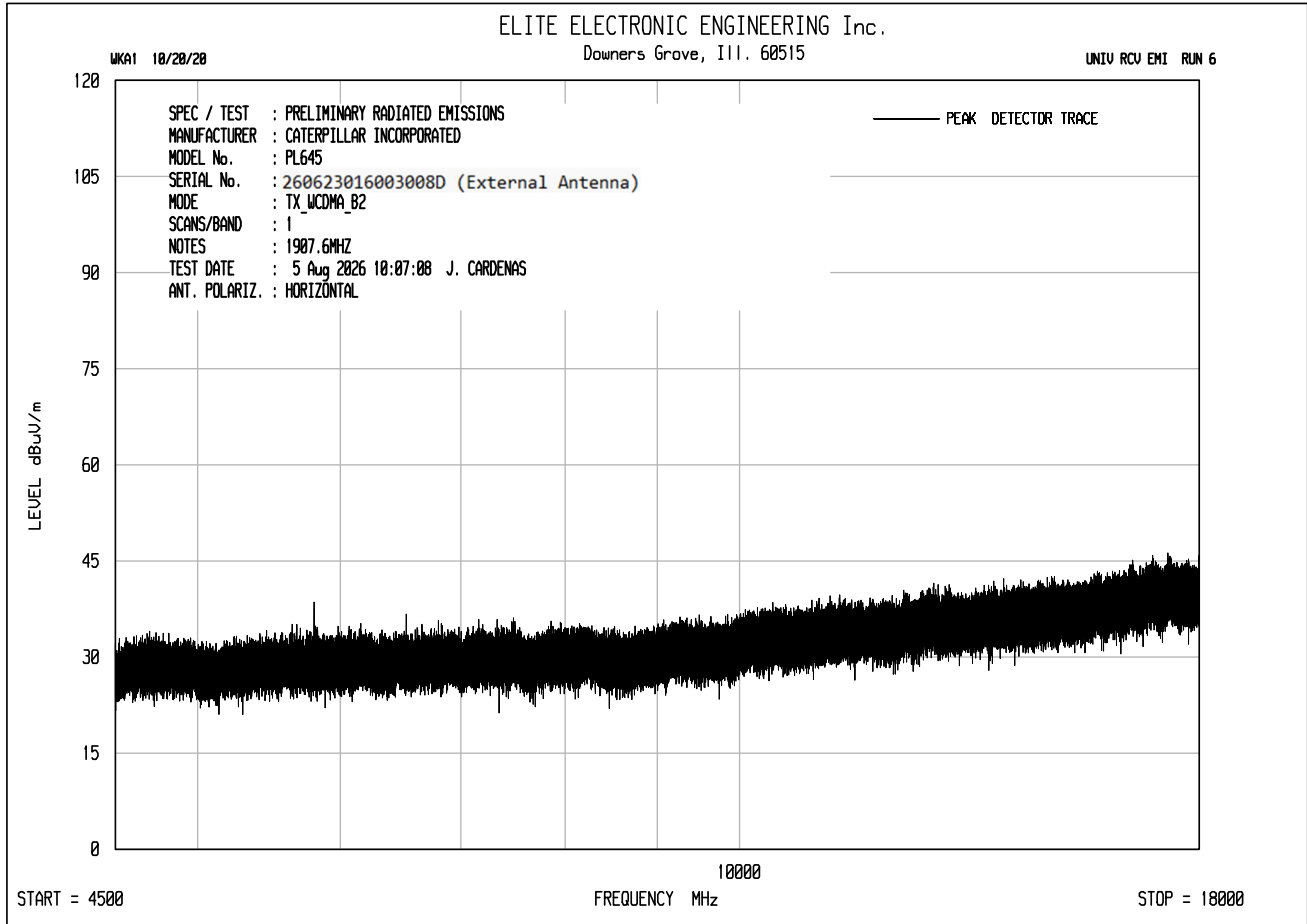
Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 2
Frequency Tested	1907.6MHz
Notes	None

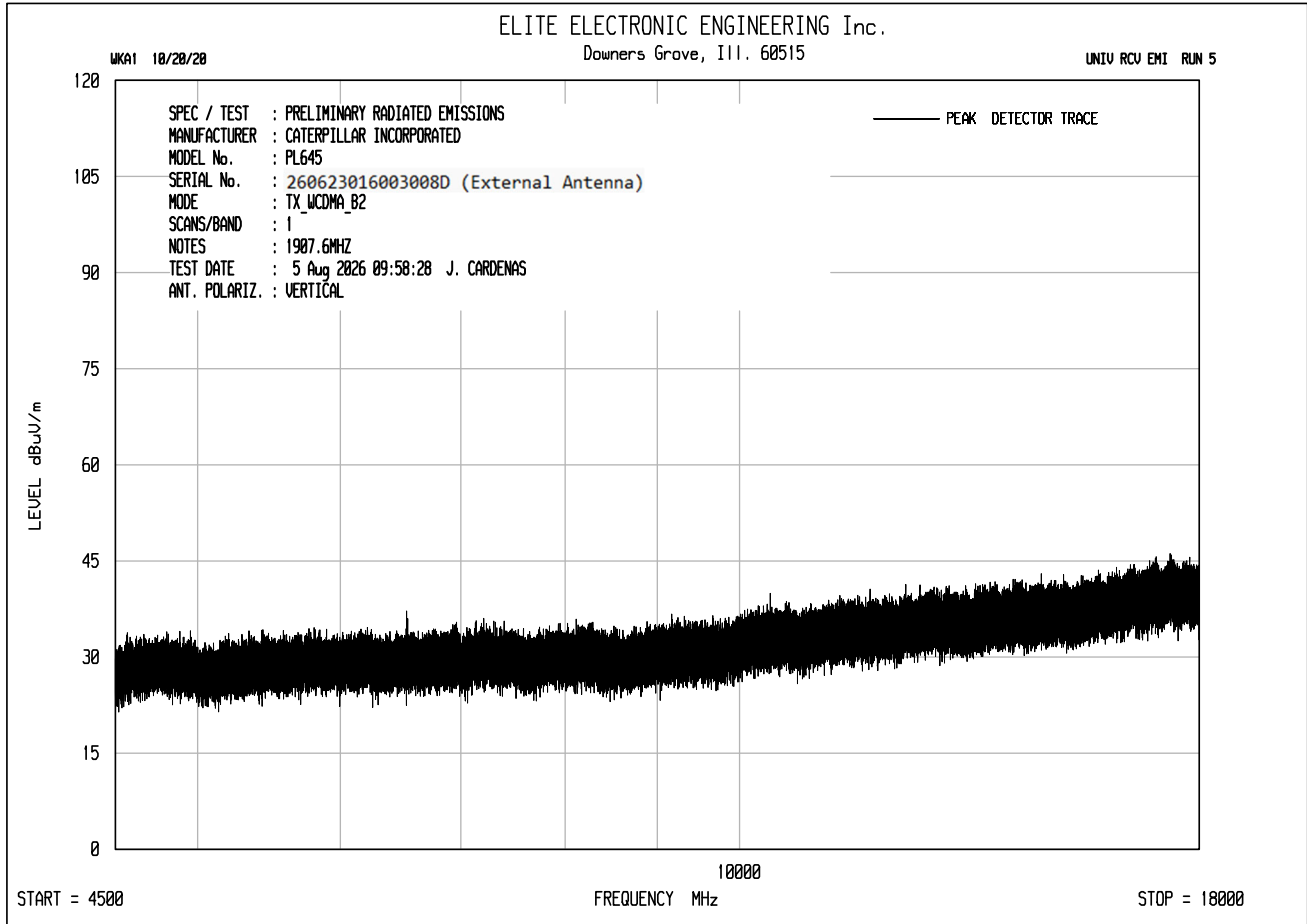


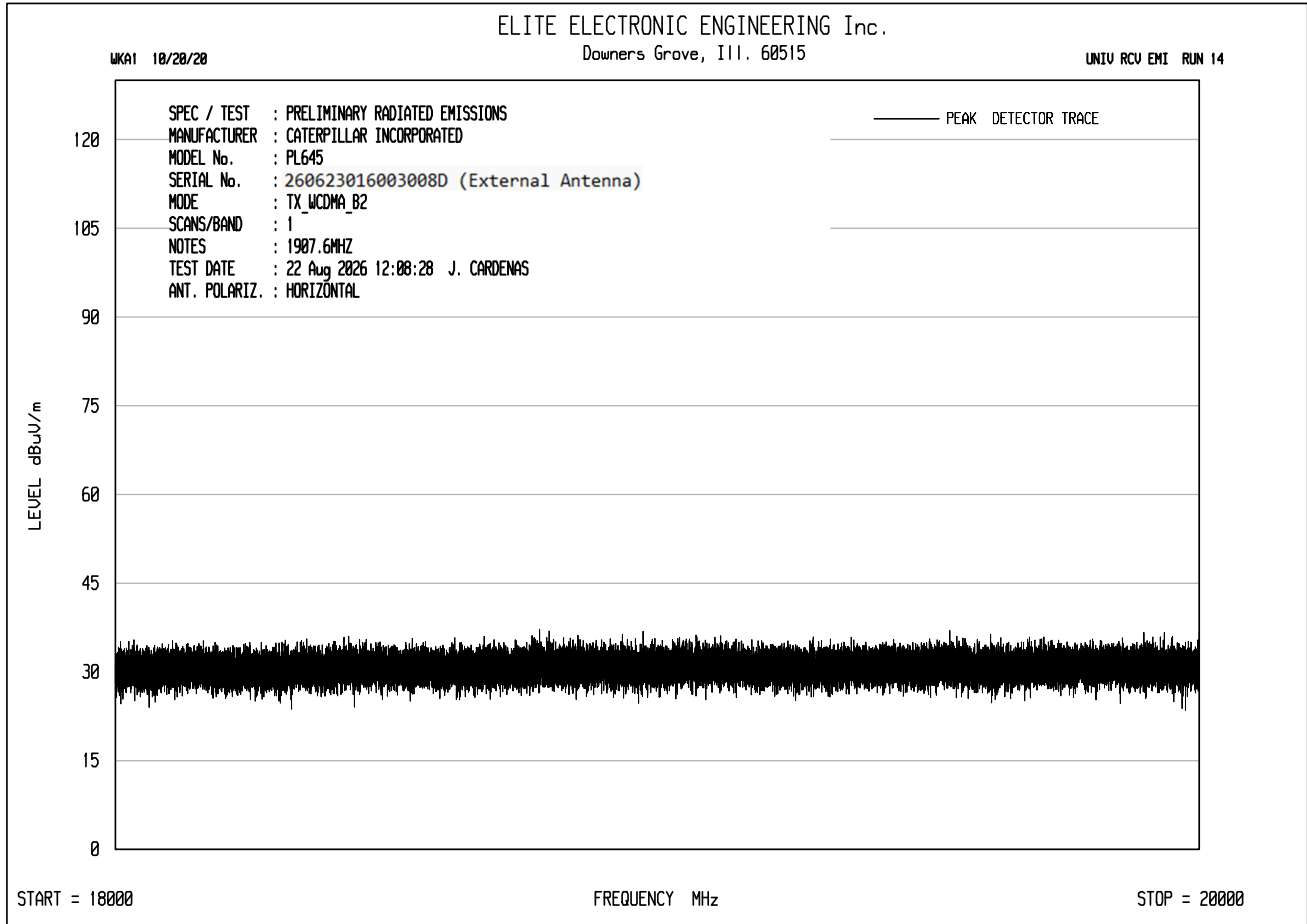


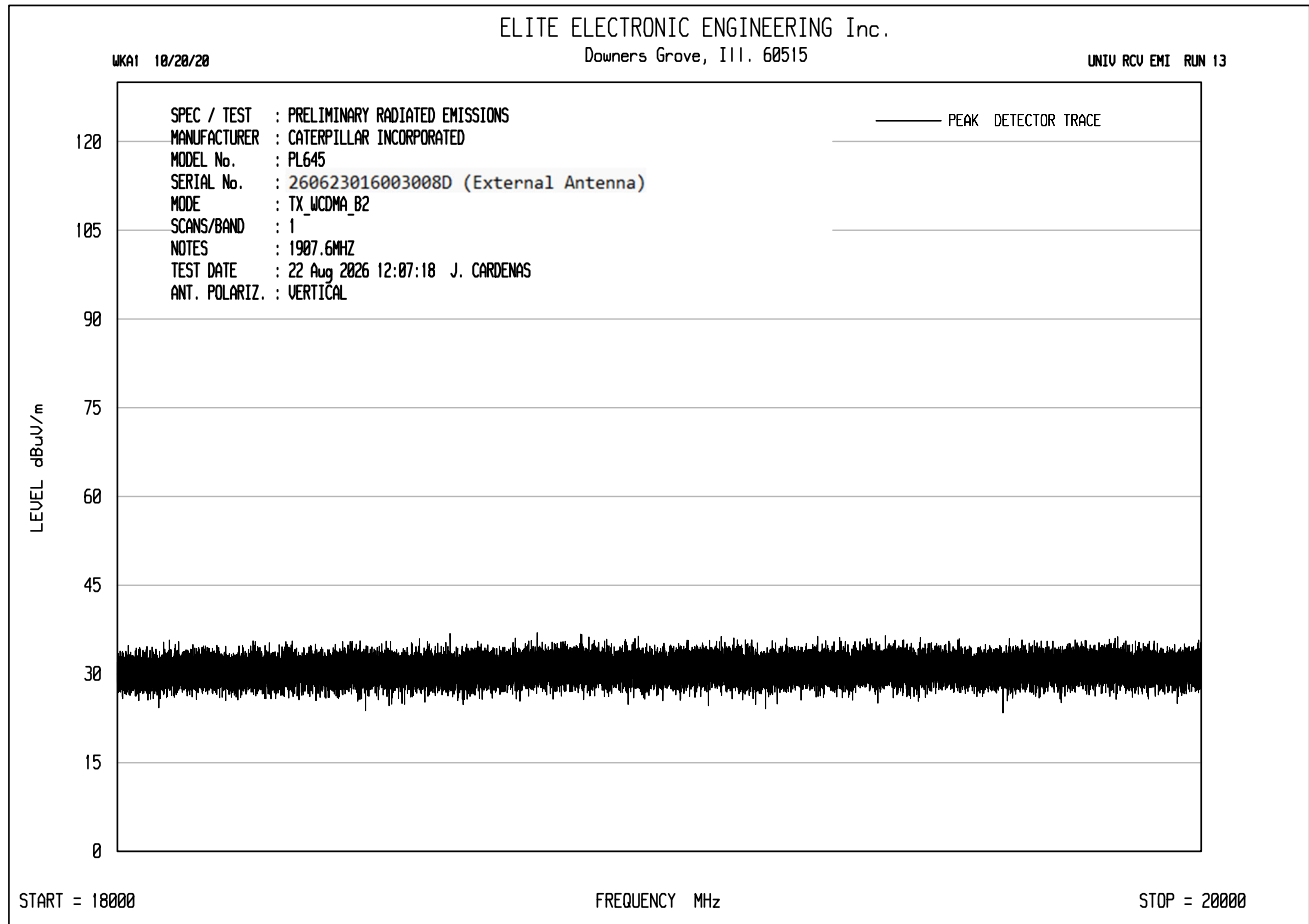






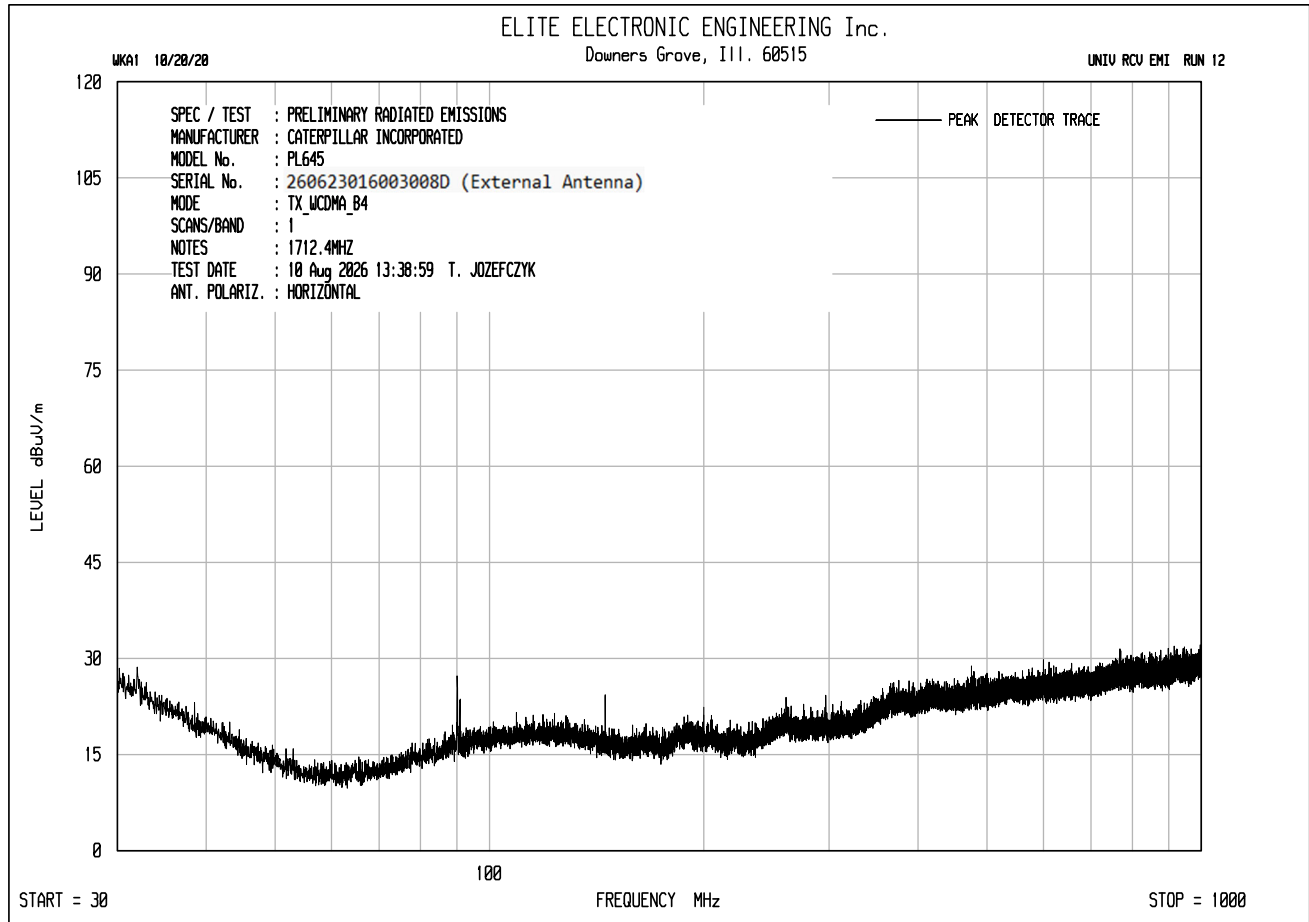


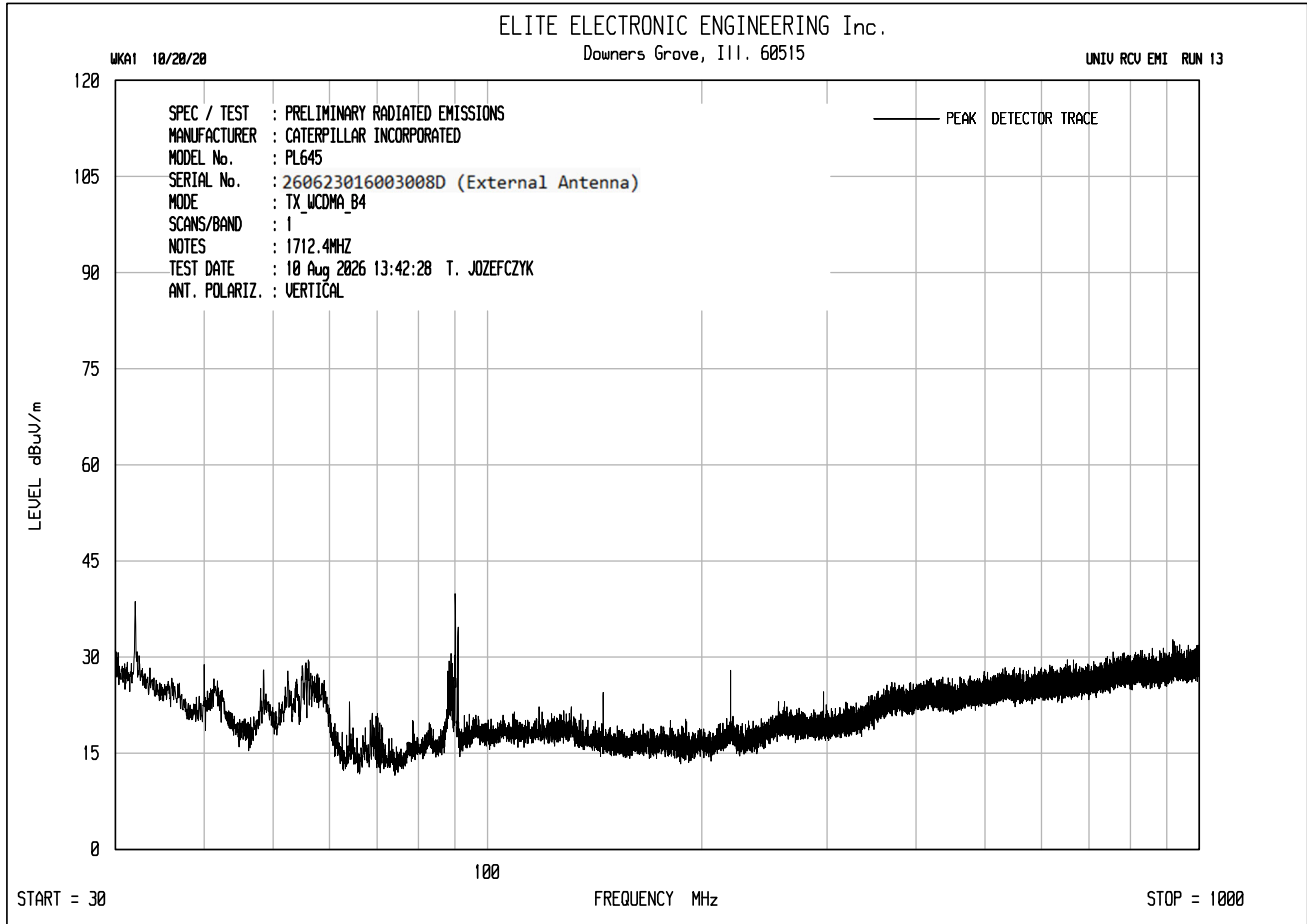


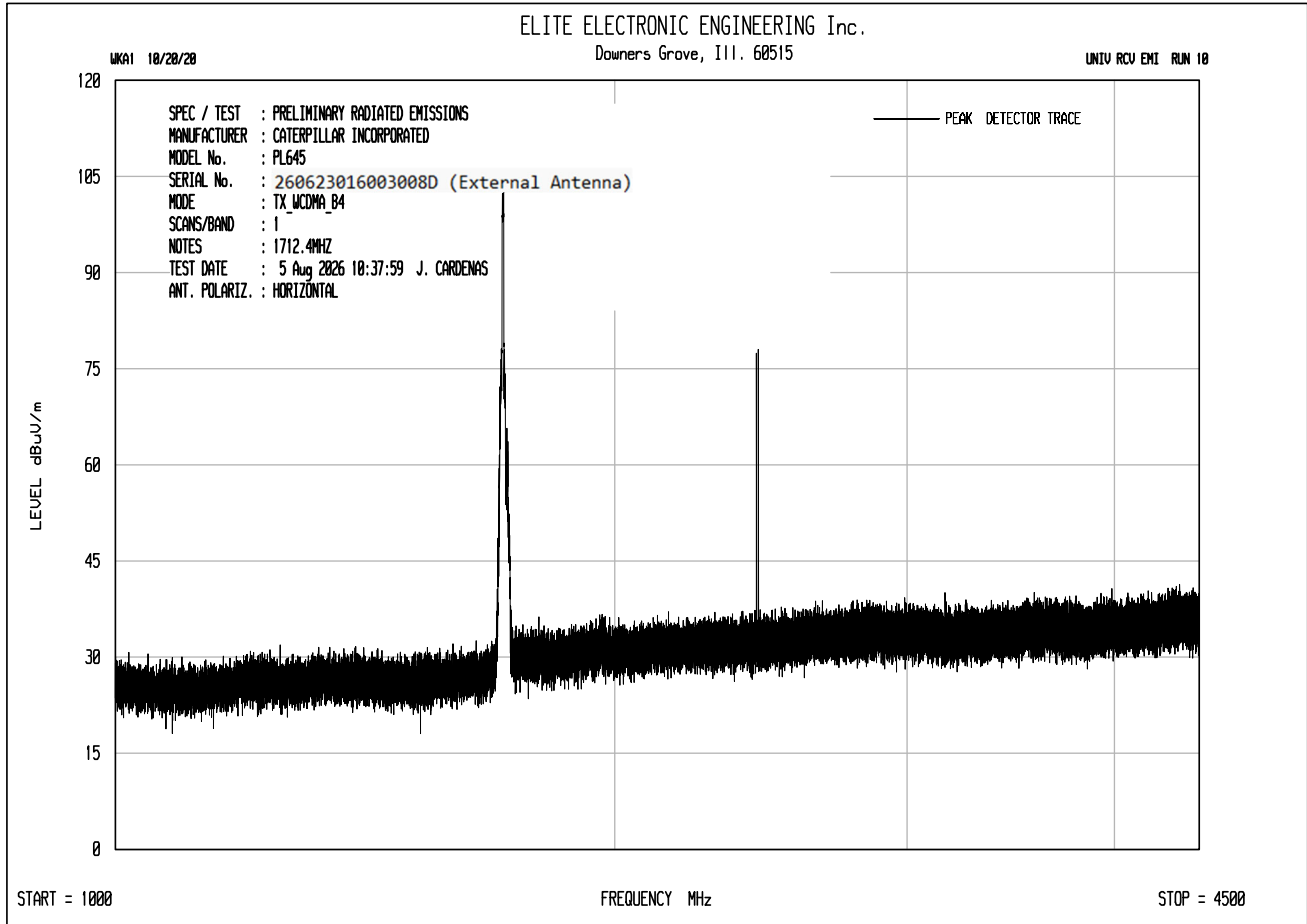


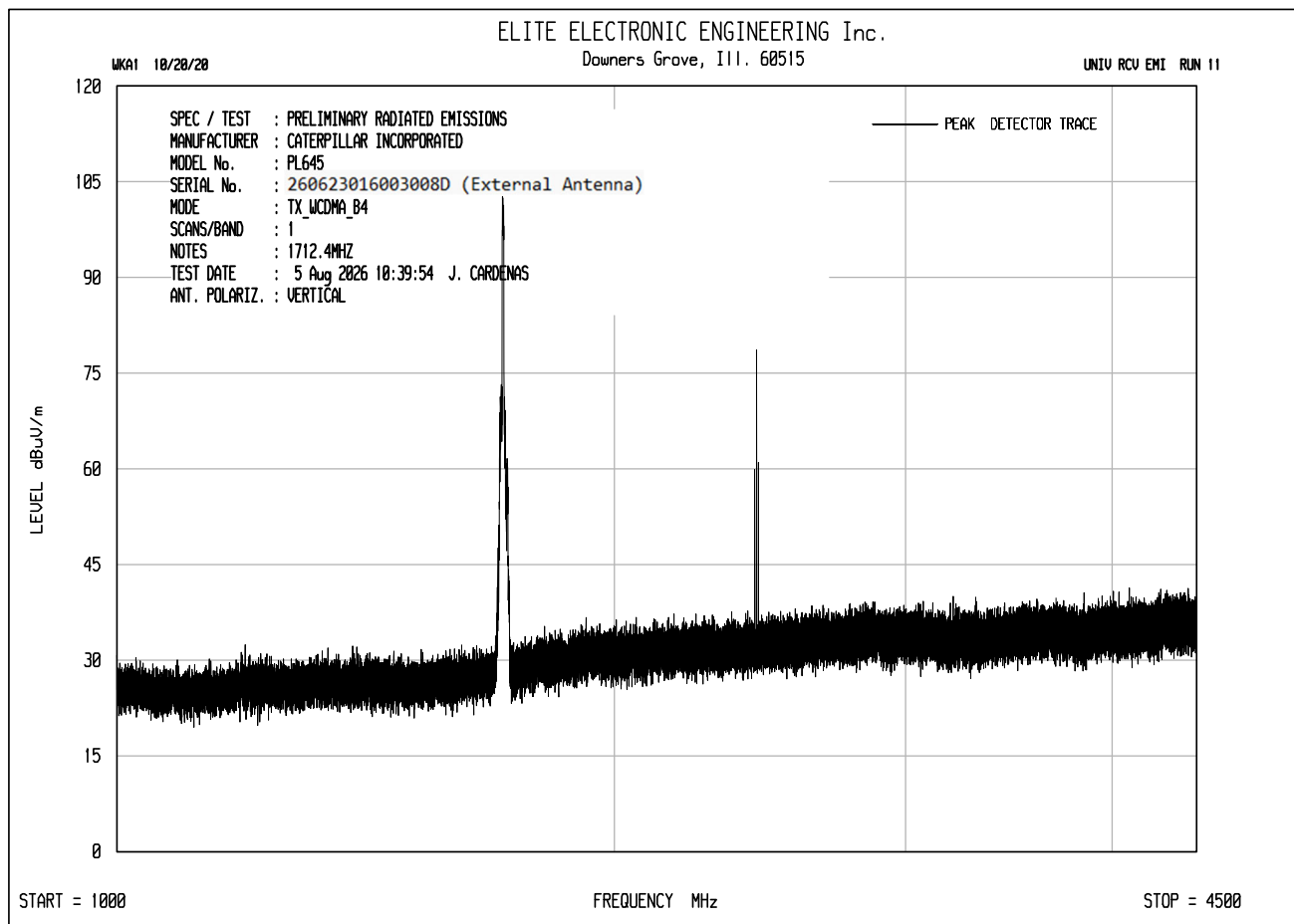
Freq. MHz	Ant Pol	Meter Reading (dBμV)	Ambient	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
3815.20	H	26.59	Ambient	-36.32	4.92	4.37	-35.77	57.81	35.04
3815.20	V	26.00	Ambient	-35.74	4.92	4.37	-35.19	57.23	35.04
5722.80	H	49.27	Ambient	-49.37	5.50	5.30	-49.17	71.21	35.04
5722.80	V	48.78	Ambient	-49.97	5.50	5.30	-49.77	71.81	35.04

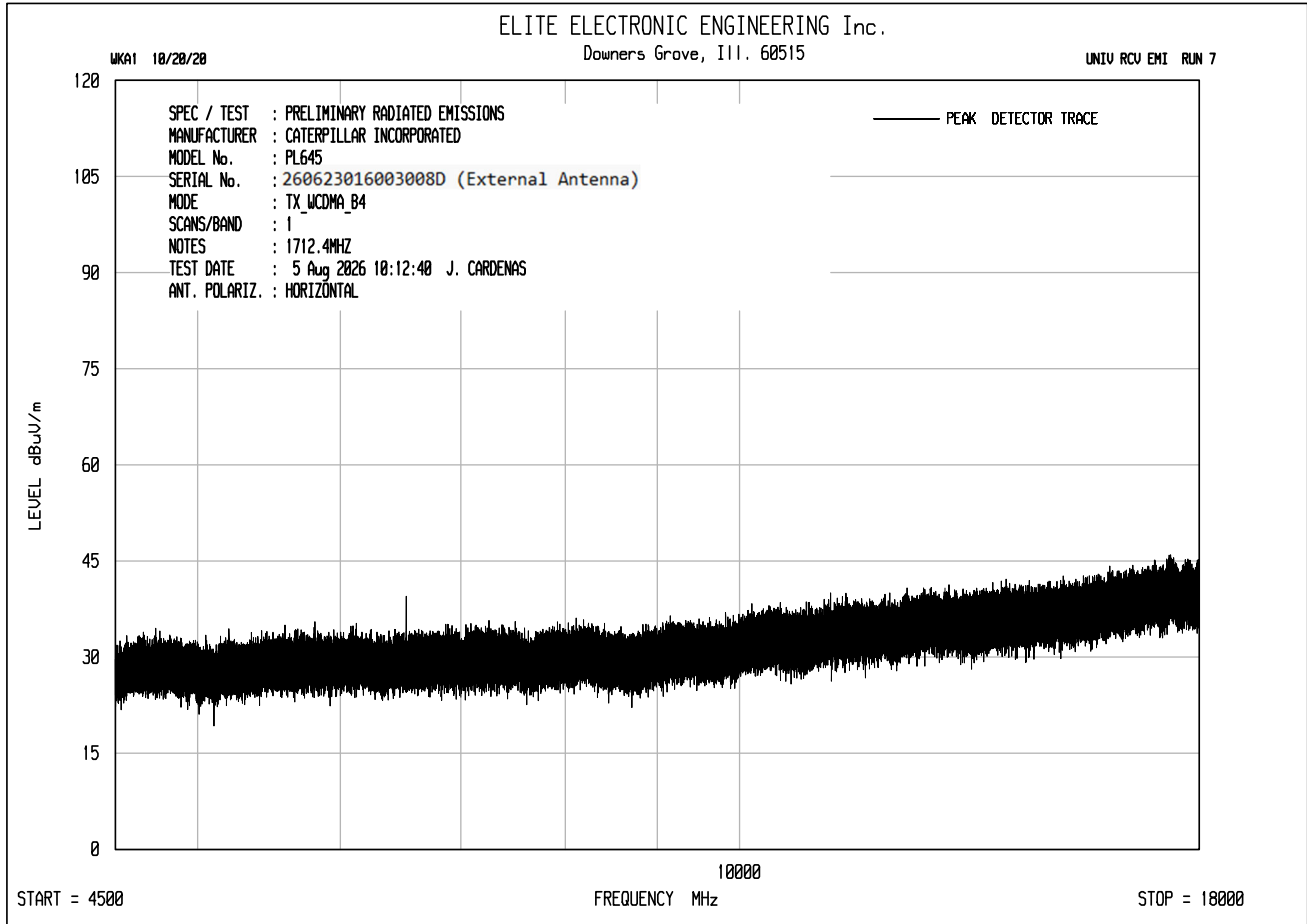
Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 4
Frequency Tested	1712.4MHz
Notes	None

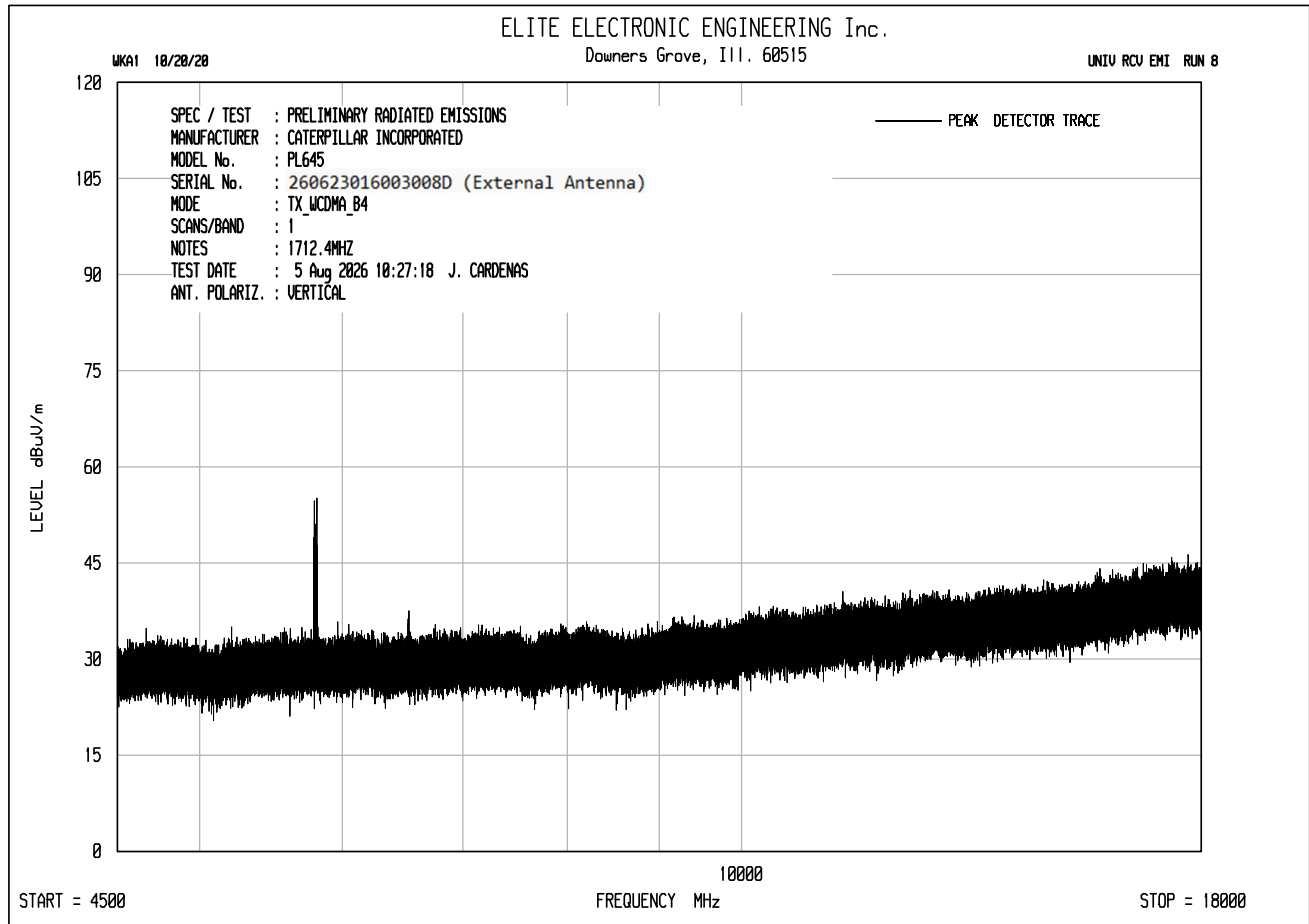






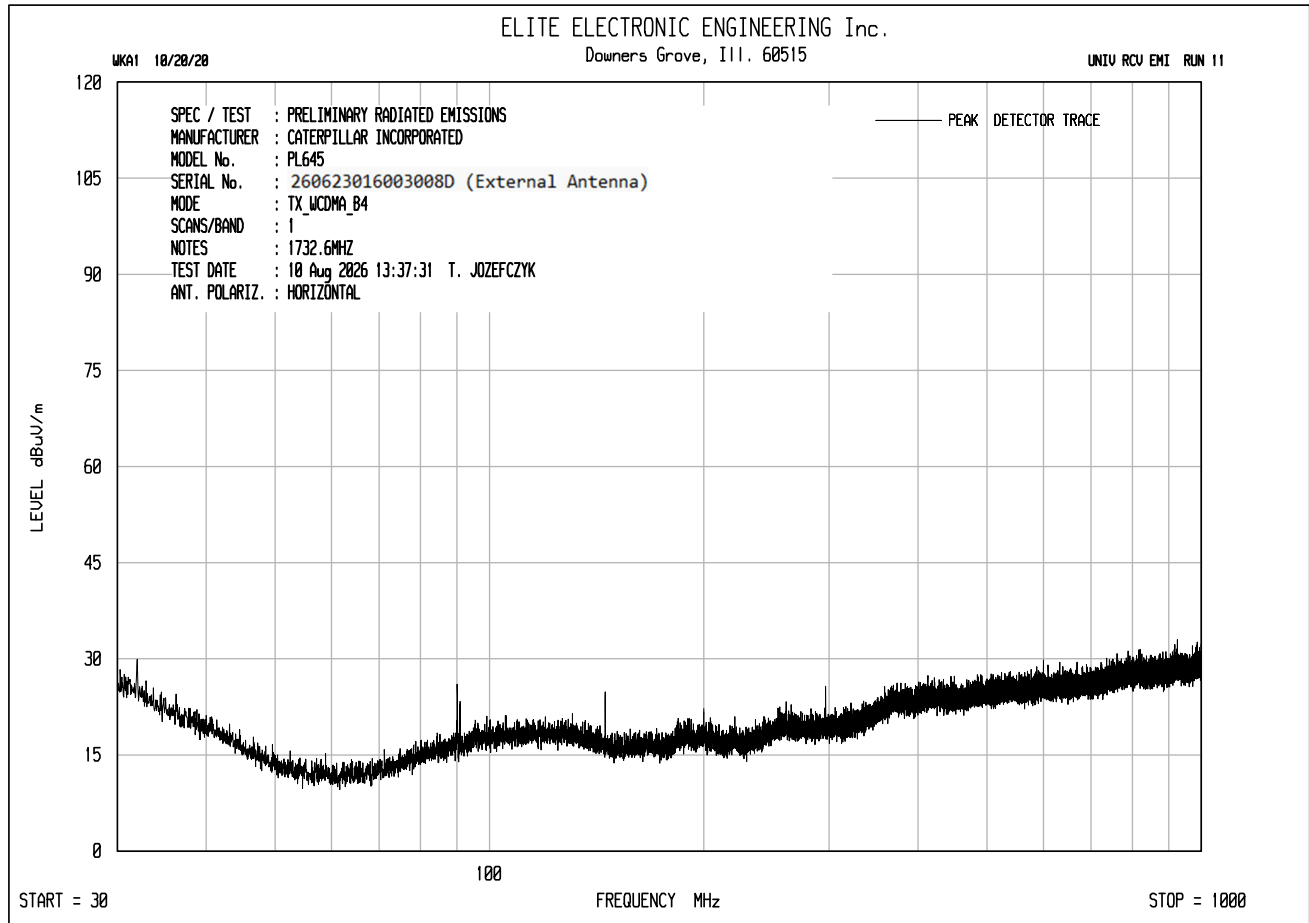


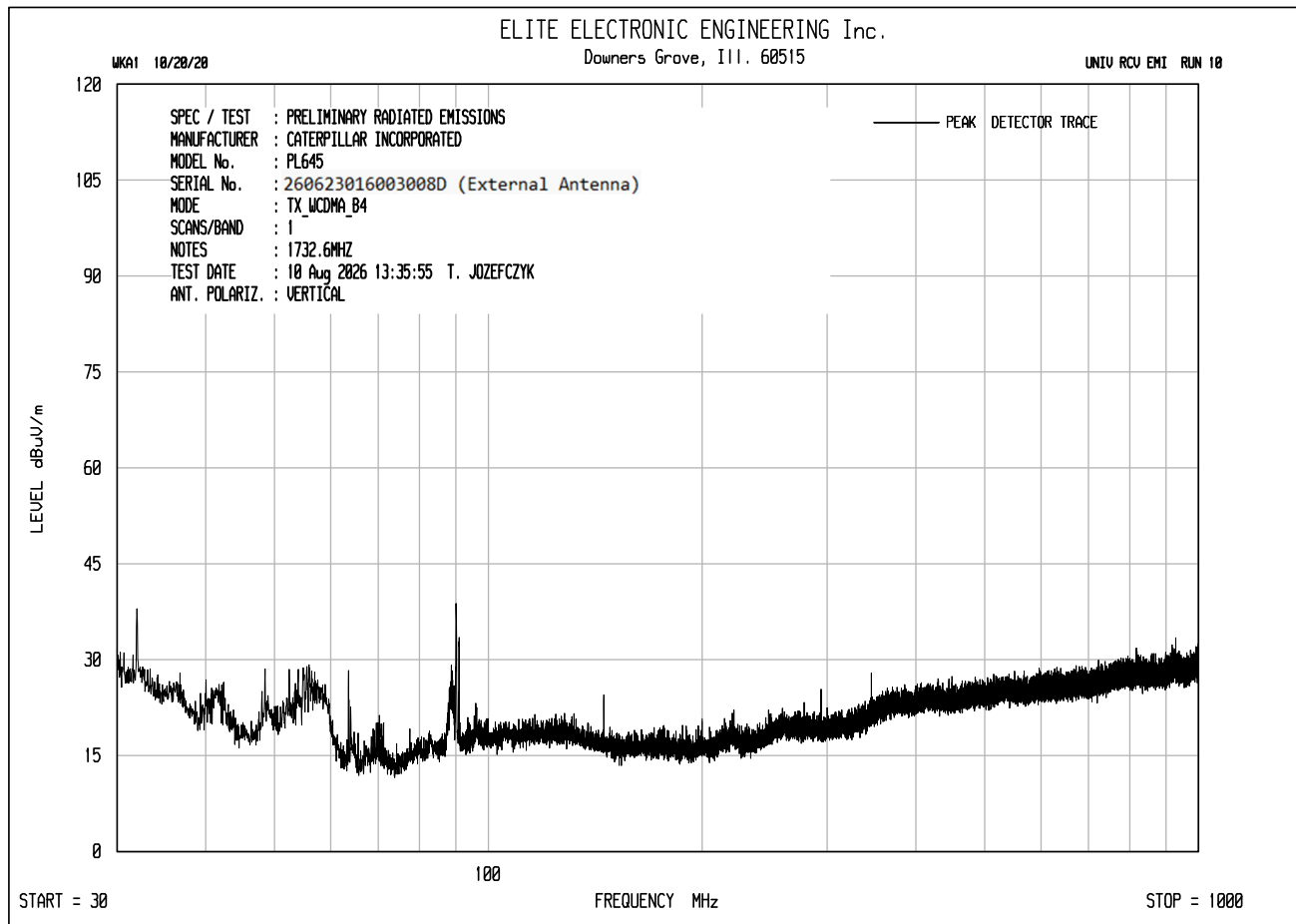


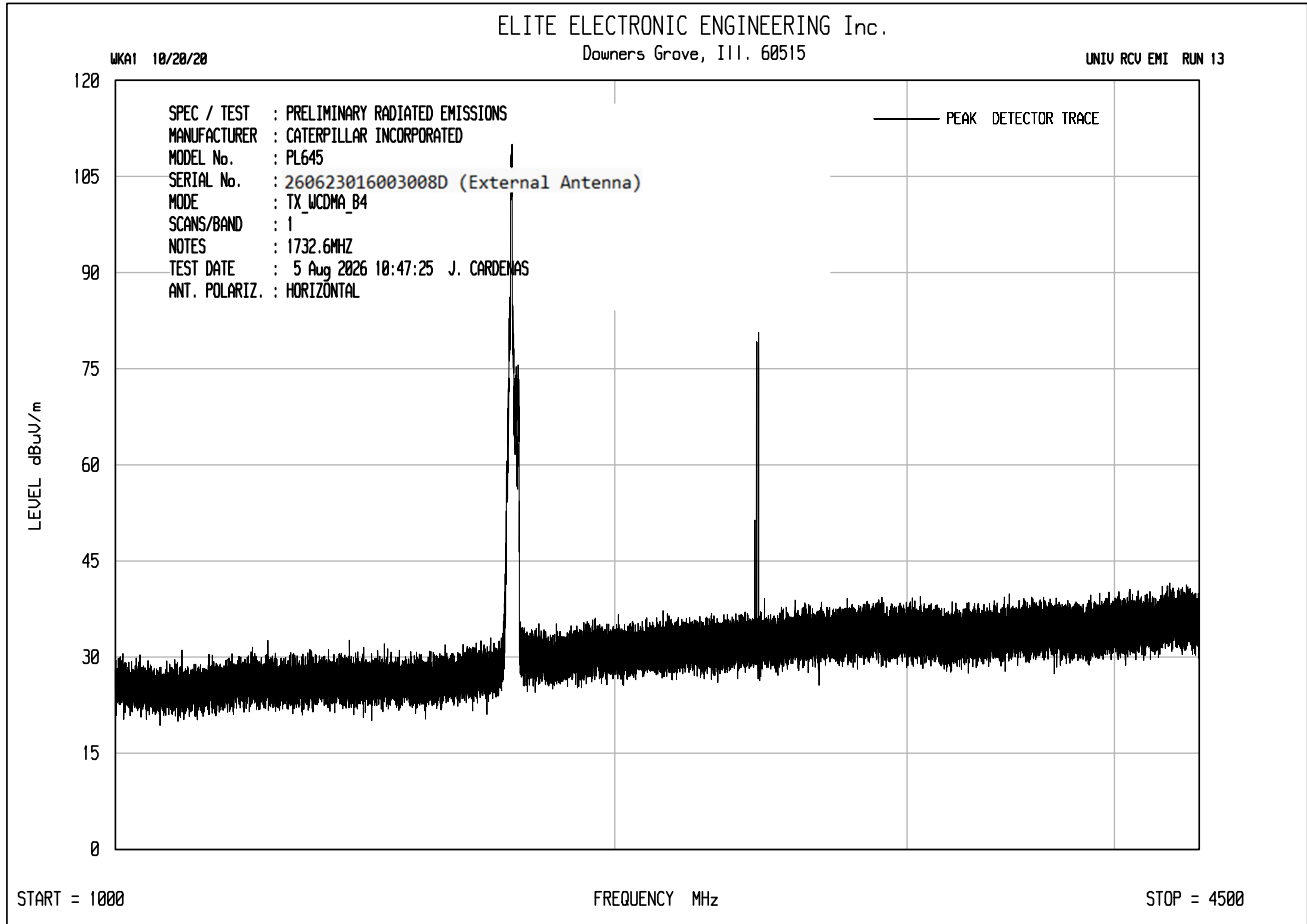


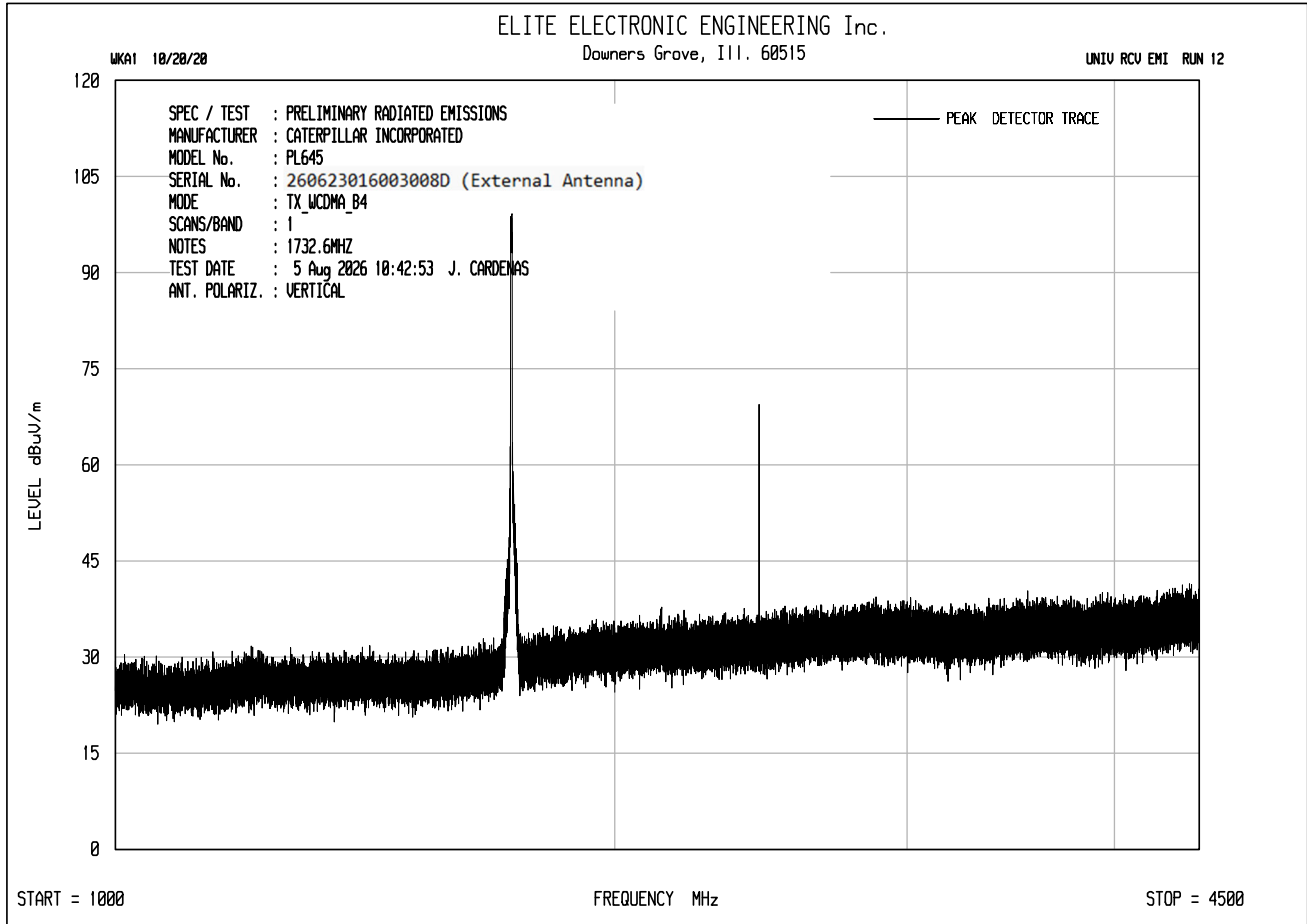
Freq. MHz	Ant Pol	Meter Reading (dBμV)	Ambient	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
3424.80	H	25.74	Ambient	-39.42	5.01	4.15	-38.57	60.76	35.19
3424.80	V	26.80	Ambient	-36.47	5.01	4.15	-35.62	57.81	35.19
5137.20	H	48.41	Ambient	-50.57	5.07	5.00	-50.49	72.68	35.19
5137.20	V	48.12	Ambient	-50.48	5.07	5.00	-50.40	72.59	35.19

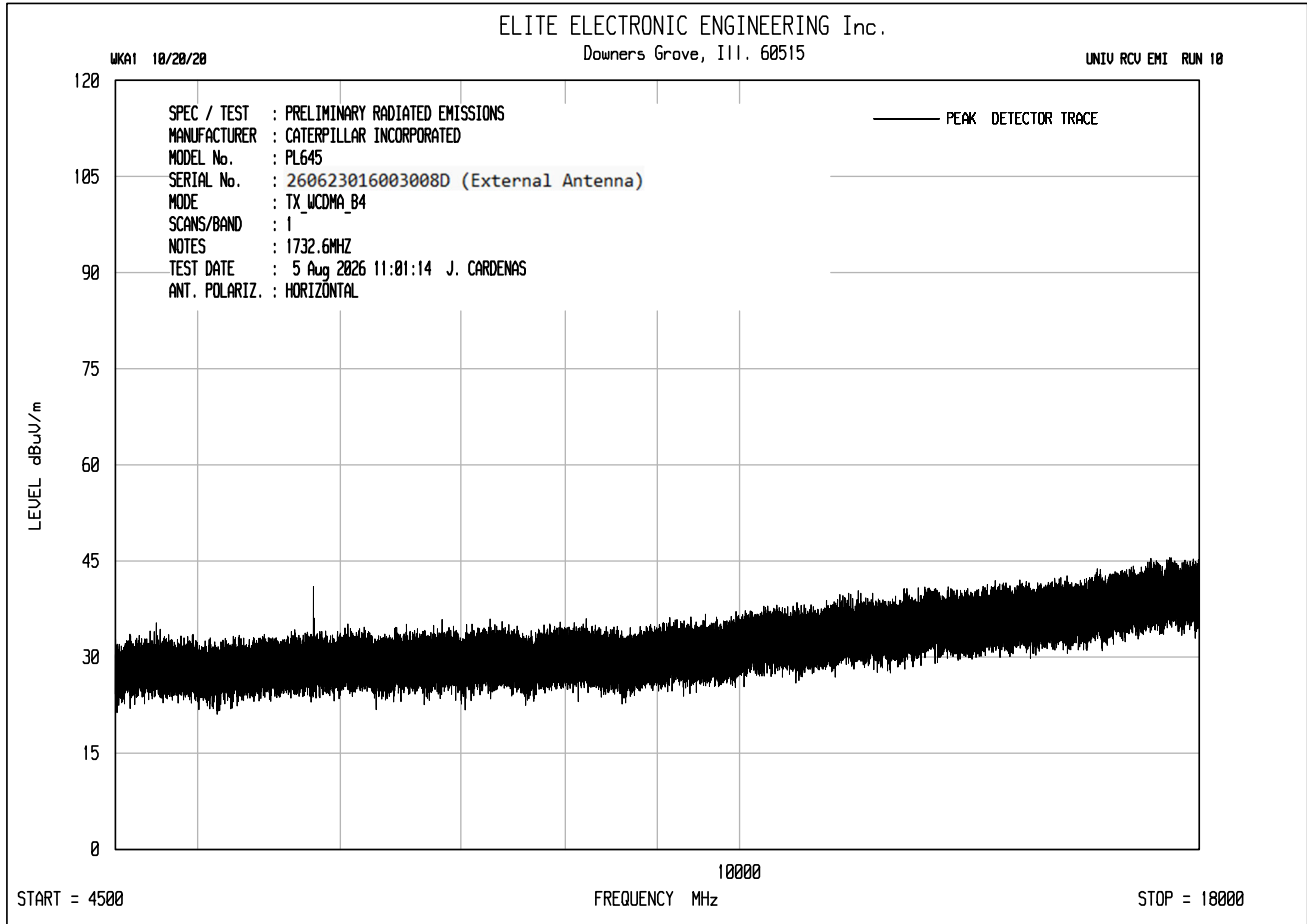
Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 4
Frequency Tested	1732.6MHz
Notes	None

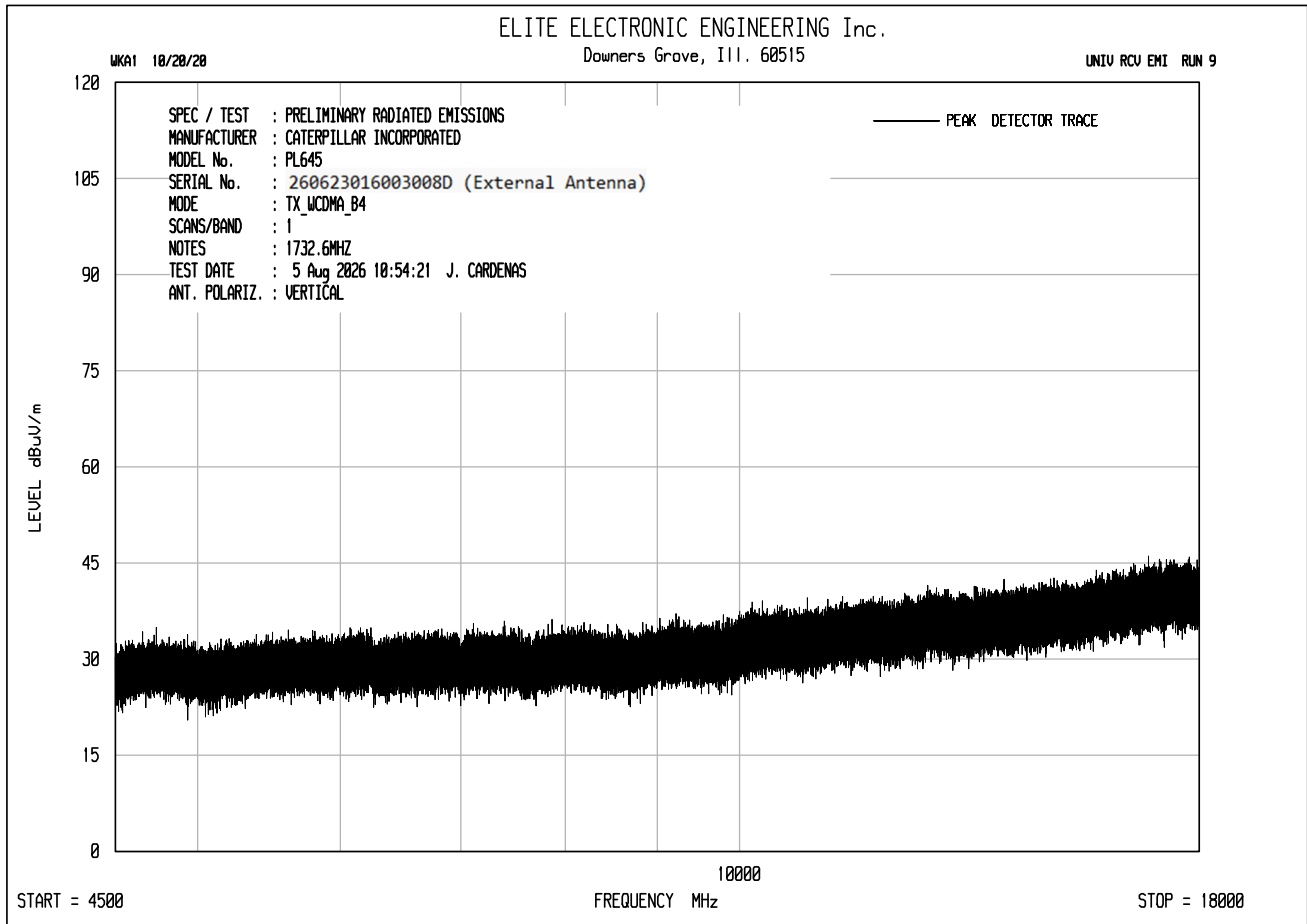






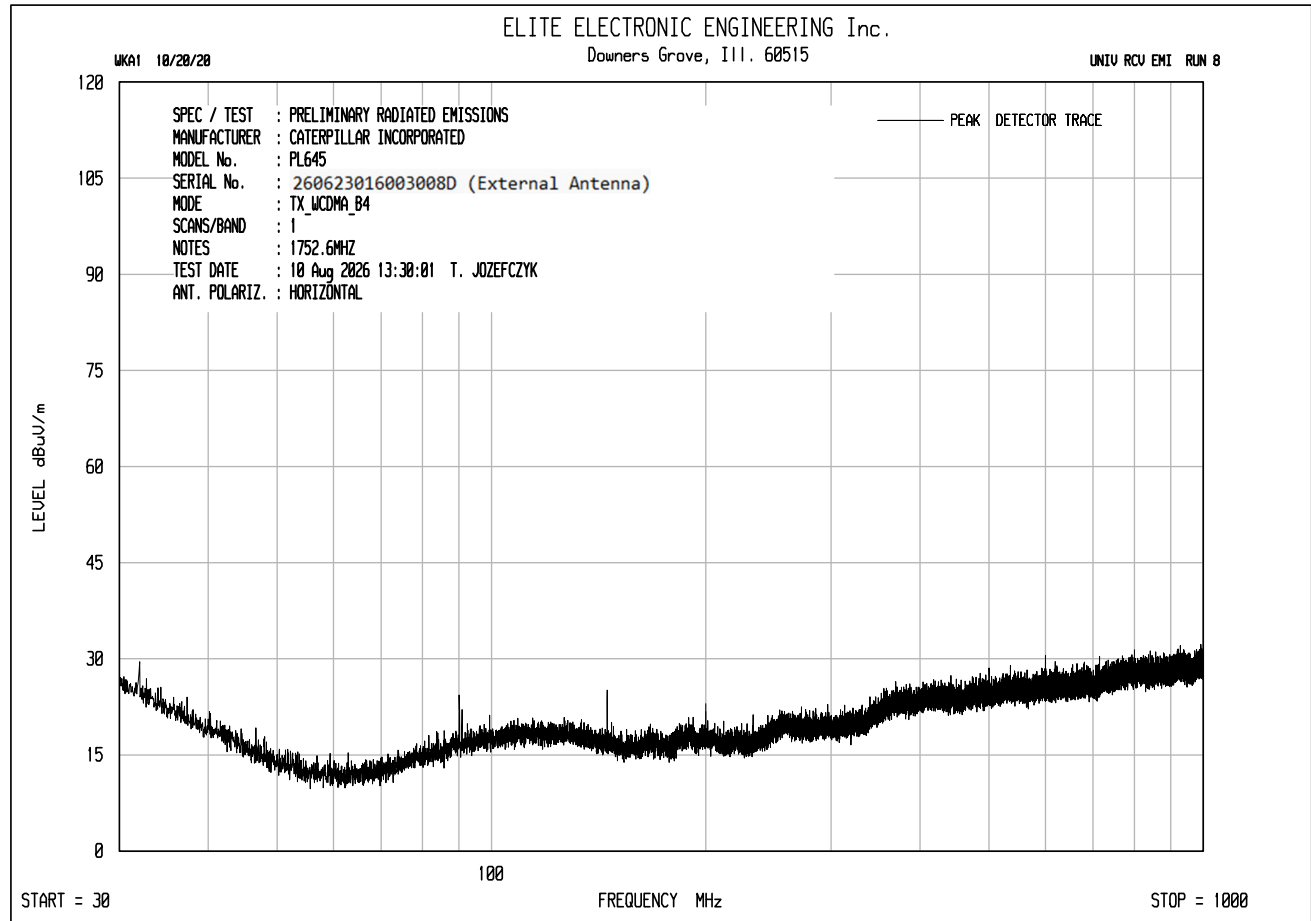


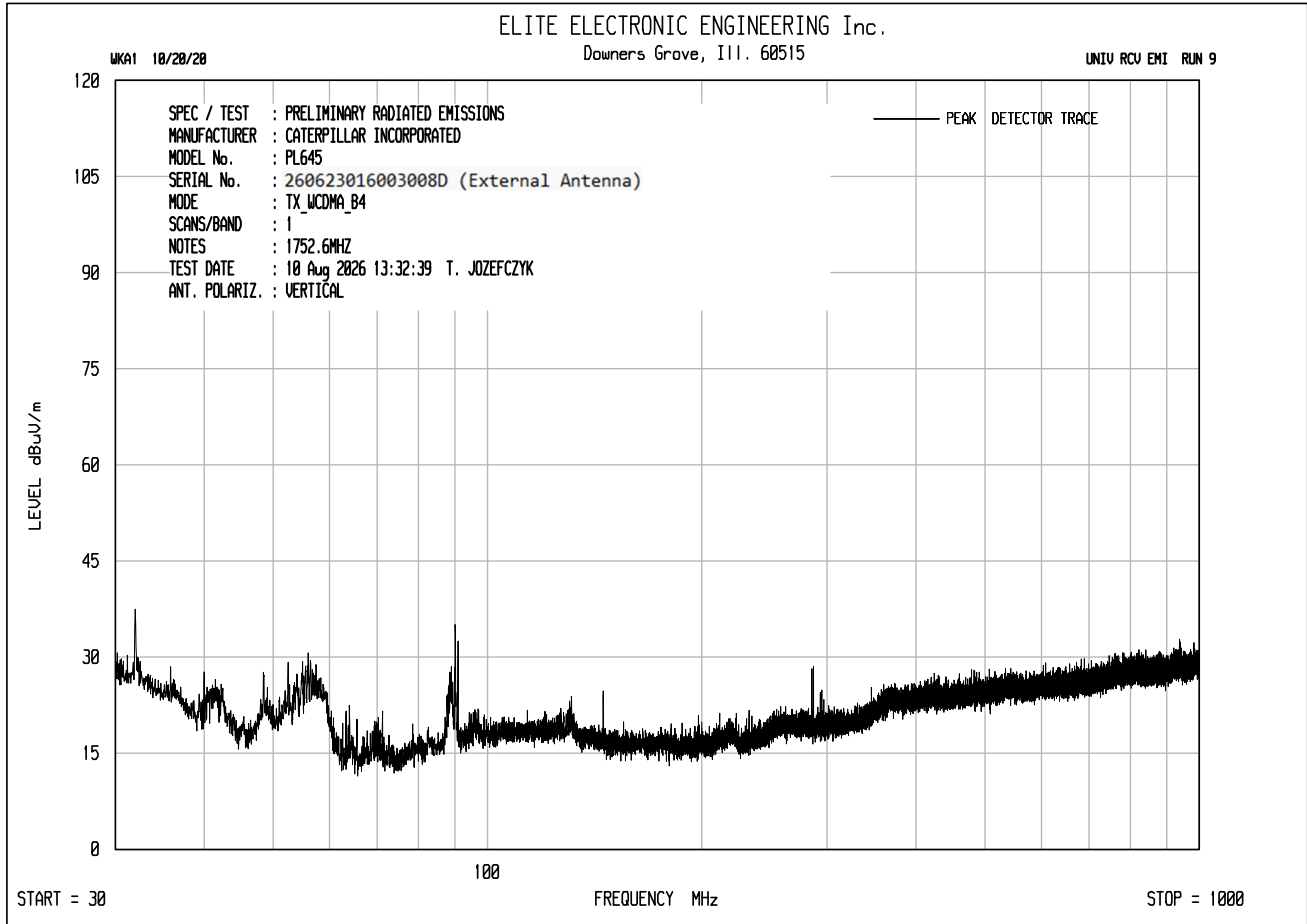


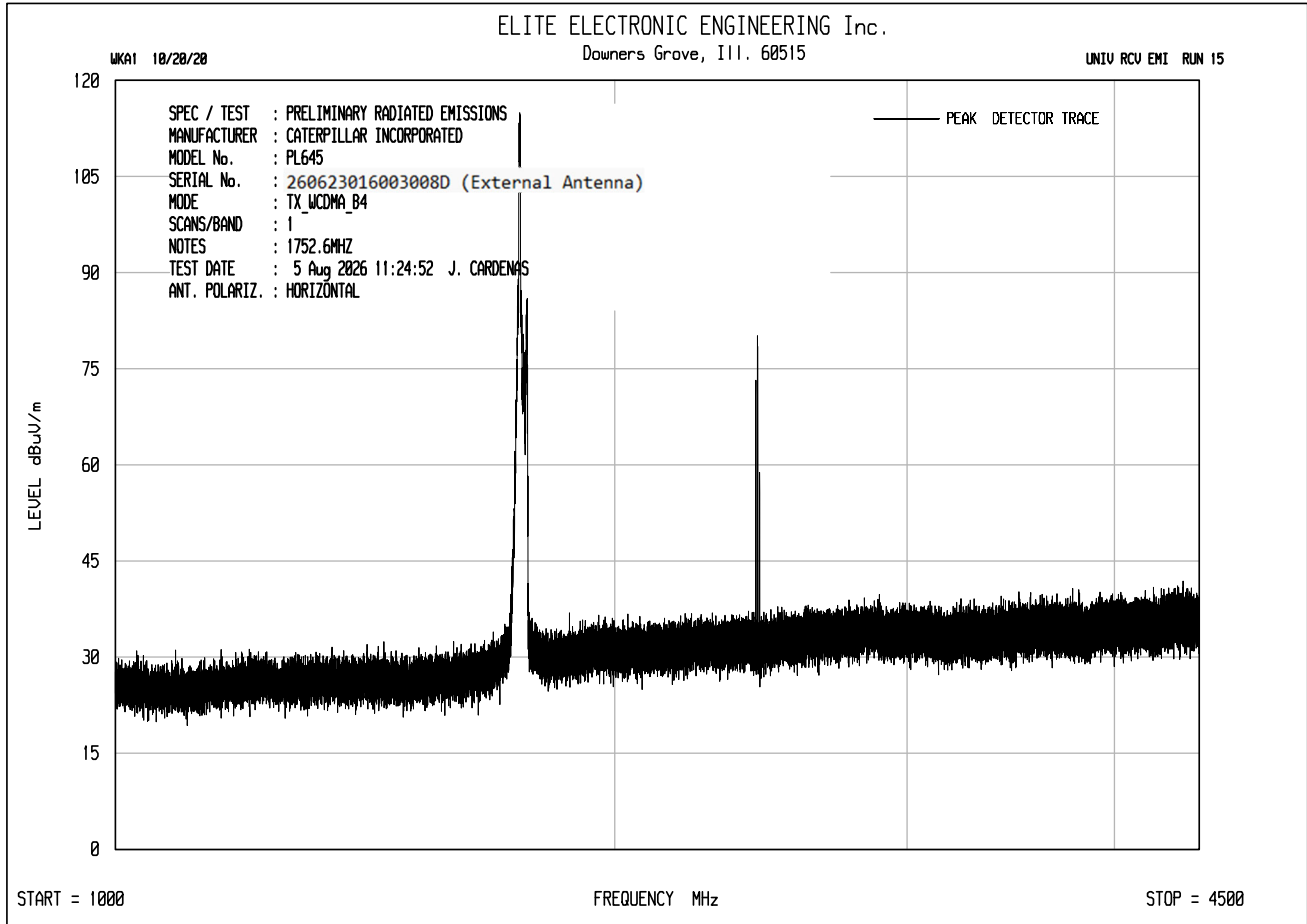


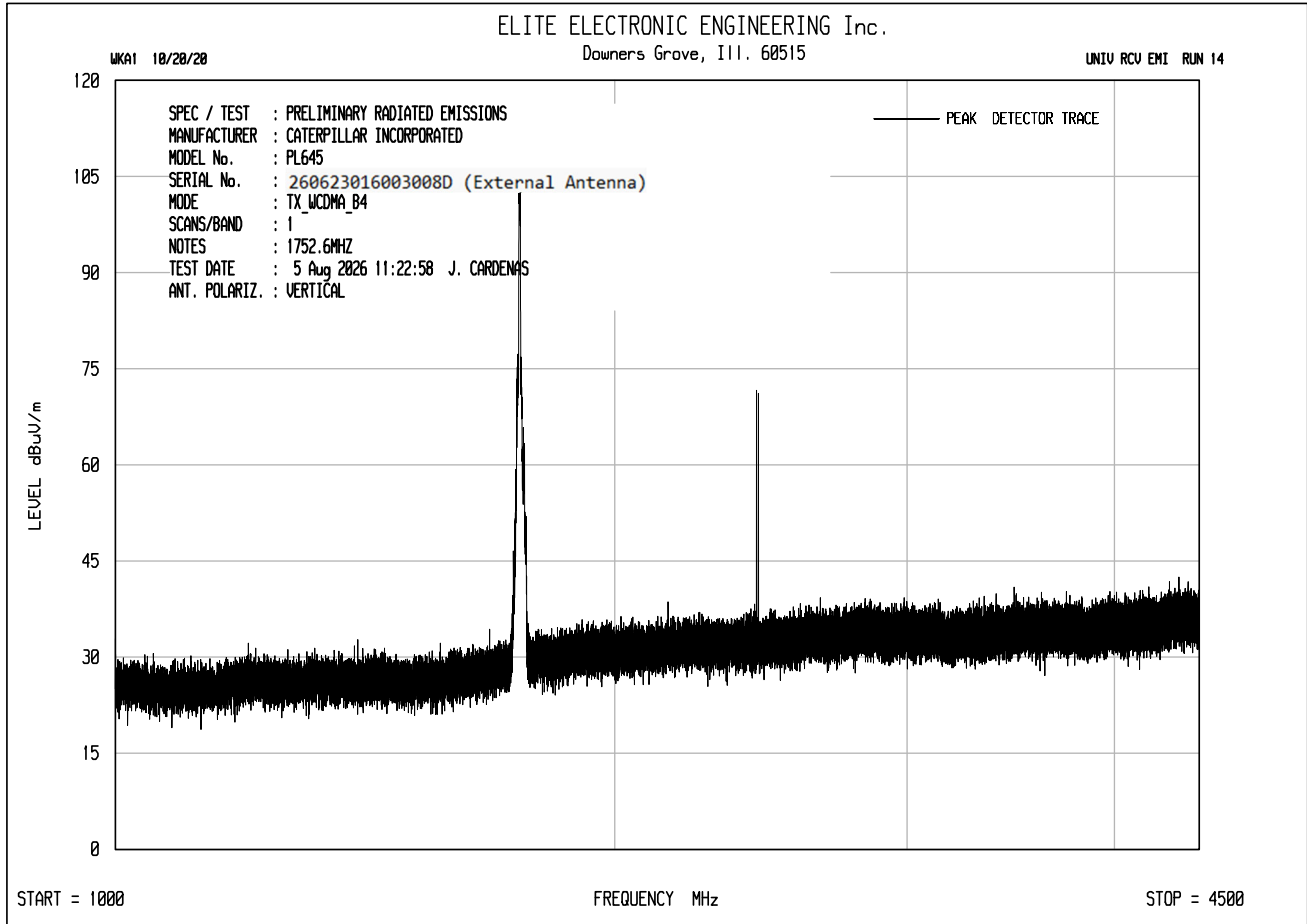
Freq. MHz	Ant Pol	Meter Reading (dBμV)	Ambient	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
3465.20	H	26.46	Ambient	-38.31	4.84	4.18	-37.65	59.84	35.19
3465.20	V	26.42	Ambient	-36.65	4.84	4.18	-35.98	58.17	35.19
5197.80	H	46.18	Ambient	-52.33	4.99	5.03	-52.37	74.56	35.19
5197.80	V	48.59	Ambient	-50.07	4.99	5.03	-50.11	72.30	35.19

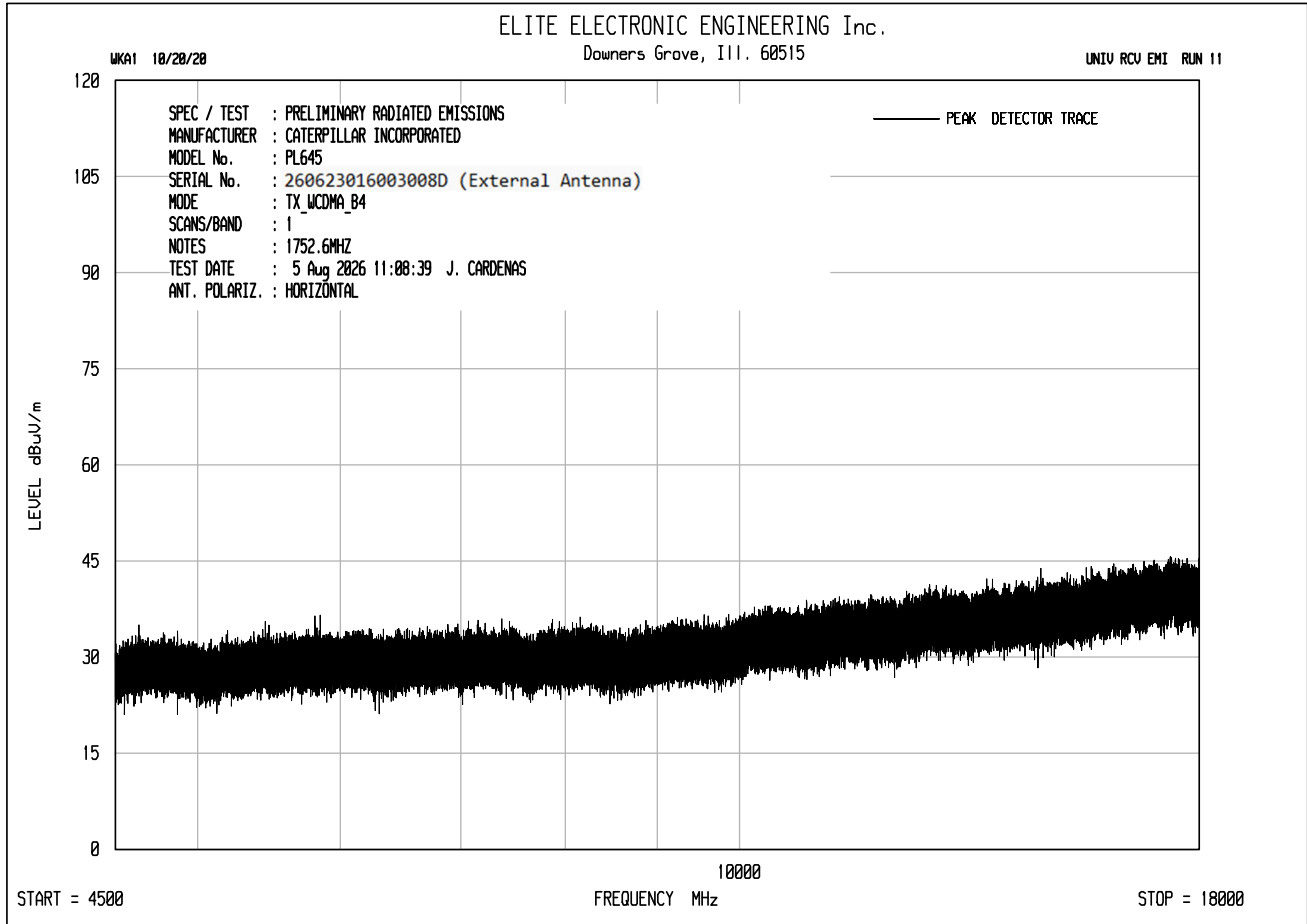
Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 4
Frequency Tested	1752.6MHz
Notes	None

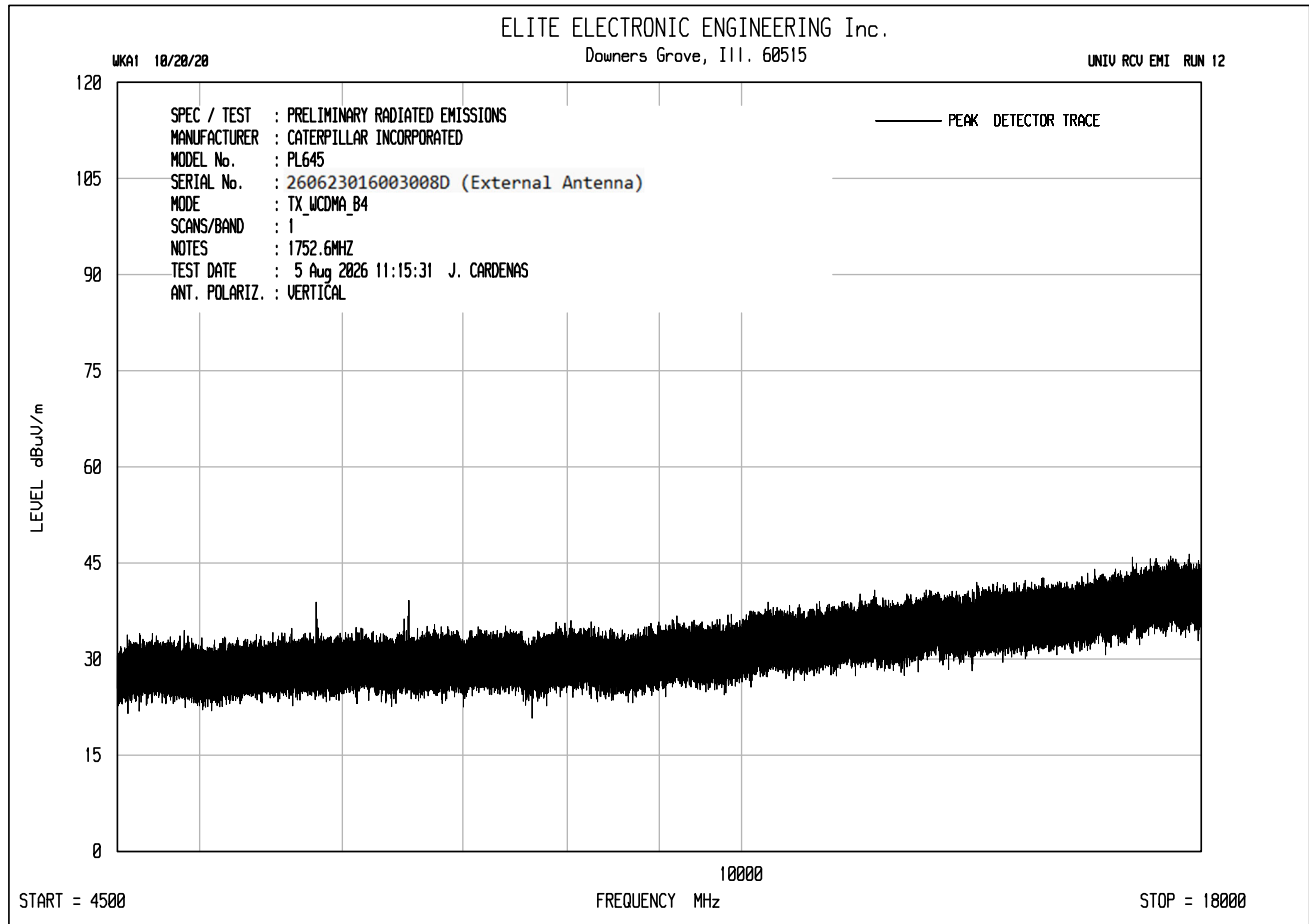












Freq. MHz	Ant Pol	Meter Reading (dBμV)	Ambient	Calculated Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
3505.20	H	26.04	Ambient	-38.35	4.84	4.20	-37.70	59.89	35.19
3505.20	V	25.51	Ambient	-37.36	4.84	4.20	-36.71	58.90	35.19
5257.80	H	48.44	Ambient	-49.73	5.01	5.06	-49.77	71.96	35.19
5257.80	V	48.64	Ambient	-50.11	5.01	5.06	-50.16	72.35	35.19

Test Details	
Manufacturer	Caterpillar Inc
Equipment Under Test	5G Telematics Radio
Model No.	PL645
Part No.	661-9822
Serial No.	260623016003008D (External Antenna)
Mode	WCDMA Band 5
Frequency Tested	826.4MHz
Notes	None

