



**Engineering Test Report No. 2301308-01 Rev. A**

Report Date	February 22, 2024
Manufacturer Name	Appareo Systems
Manufacturer Address	1830 NDSU Research Circle Fargo, ND 58102
Product Name Model No.	Telematic Control Unit TCU-GLOBAL,V1
Date Received	October 19, 2023
Test Dates	October 24 – November 13, 2023
Specifications	ETSI EN 300 328 ETSI EN 300 440 ETSI EN 301 893 ETSI EN 301 908 ETSI EN 303 413 ETSI EG 203 367 v1.1.1
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515
Signature	
Tested by	Tylar Jozefczyk
Signature	
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894
PO Number	49850

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## 1. Report Revision History

Revision	Date	Description
–	27 FEB 2024	Initial Release of Engineering Test Report No. 2301308-01
A	5 MAR 2024 by TMJ	<ul style="list-style-type: none"><li>- Throughout report: Added Rev A to the Test Report Number in the header.</li><li>- Throughout report: Updated product name from “Telematic Control Unit TCU-Global” to “Telematic Control Unit”.</li><li>- Throughout report: Updated model number from “TCU-GLOBAL, V1” to “TCU-GLOBAL,V1”.</li><li>- Section 19, Page 10: Added to the Notes line: “Pages 23 – 30: the plots have the incorrect module number noted in the Notes line. The module is EG21G CAT1.”</li><li>- Section 19, Pages 17, 18, and 21: Corrected specification line to “ETSI EN 301 908”.</li></ul>

## 2. Introduction

This document presents the results of limited spurious emissions measurements performed on a Telematic Control Unit (hereinafter referred to as the Equipment Under Test (EUT)). The EUT is a composite system comprised of the following radio modules:

- Quectel LTE CAT1 EG21-G cellular module
- Quectel FC20 Wi-Fi and Bluetooth module

The intent of these measurements is to ensure continuing compliance of the composite system against article 3.2 of the RED.

The EUT was identified as follows:

EUT Identification	
Description	Telematic Control Unit
Model/Part No.	TCU-GLOBAL,V1
Serial No.	SN633
Size of EUT	30.97 mm x 112.42mm x 108.33mm
Firmware/Software Version	0.7.3
Highest Internal Frequency	5GHz

The EUT listed above was used throughout the test series.

## 3. Power Input

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

## 4. Grounding

The EUT was not grounded.

## 5. Support Equipment

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

Description	Model #	S/N
Comprion UT3 2FF Adapter	1110 0007	---
Lenovo Laptop	ThinkPad	---
GridConnect CAN-USB Converter	GC-CAN-USB-COM-FD-ISO	---

## 6. Interconnect Leads

The following interconnect cables were submitted with the test item:

Item	Description
USB	Connects laptop to EUT
D-sub9	Connects EUT to CAN-USB converter.

## 7. Modifications Made to EUT

No modifications were made to the EUT during the testing.

## 8. Modes of Operation

The EUT was configured to transmit at the following settings:

Mode	Description
Wi-Fi	- 2412MHz - 5180MHz
Bluetooth	- 2402MHz
Cell	- LTE: Bands 3 and 12 - WDCMA: Bands 1 and 8 - GSM500
GNSS Rx	- 1575.42MHz
Multi-Tx	EUT set up in either Combination 1 or 2. (See below.)

The EUT was configured to transmit in the following combinations:

Combination	Description
1	- LTE CAT1 – 1732.5MHz - 802.11n20 – 2412MHz - BLE – 2440MHz
2	- WDCMA – 1922.6MHz - 802.11n20 – 2412MHz - BLE – 2440MHz

## 9. Test Specifications

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

Reference Number	Title of Standard	Year	Amend./ Ver.	Listed in Official Journal
ETSI EN 300 328	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonized Standard for access to radio spectrum	2019	V2.2.2	Yes
ETSI EN 300 440	Short Range Devices (SRD); Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonized Standard for access to radio spectrum	2018	V2.2.1	Yes
ETSI EN 301 893	5 GHz RLAN; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU	2017	V2.1.1	Yes
ETSI EN 301 908-1	IMT cellular networks; Harmonized Standard for access to radio spectrum; Part 1: Introduction and common requirements Release 15	2021	V15.1.1	Yes
ETSI EN 301 908-1	IMT cellular networks; Harmonized Standard for access to radio spectrum; Part 1: Introduction and common requirements; Release 15	2023	V15.2.1	No
ETSI EN 301 908-2	IMT cellular networks; Harmonized Standard for access to radio spectrum; Part 2: CDMA Direct Spread (UTRA FDD) User Equipment (UE)	2020	V13.1.1	Yes
ETSI EN 303 413	Satellite Earth Stations and Systems (SES); Global Navigation Satellite System (GNSS) receivers; Radio equipment operating in the 1 164 MHz to 1 300 MHz and 1 559 MHz to 1 610 MHz frequency bands; Harmonized Standard for access to radio spectrum	2021	V1.2.1	Yes

## 10. Test Plan

No test plan was provided. Instructions were provided by personnel from Appareo Systems and used in conjunction with the specifications listed in Section 9 of this document.

### 11. Deviations, Additions, or Exclusions from the Test Specifications

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

### 12. Laboratory Conditions

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

Ambient Parameters	Value
Temperature	22.3°C
Relative Humidity	24%
Atmospheric Pressure	1027.5mb

### 13. Summary

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

Test Description	Test Method	Result
Composite System Unwanted Emissions in the Spurious Domain	ETSI EN 300 328	Conforms
	ETSI EN 300 440	
	ETSI EN 301 893	
	ETSI EN 301 908	
	ETSI EN 303 413	

### 14. 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 $\mu$ V/m term to  $\mu$ V/m, the dB $\mu$ V/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in  $\mu$ V/m terms.

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

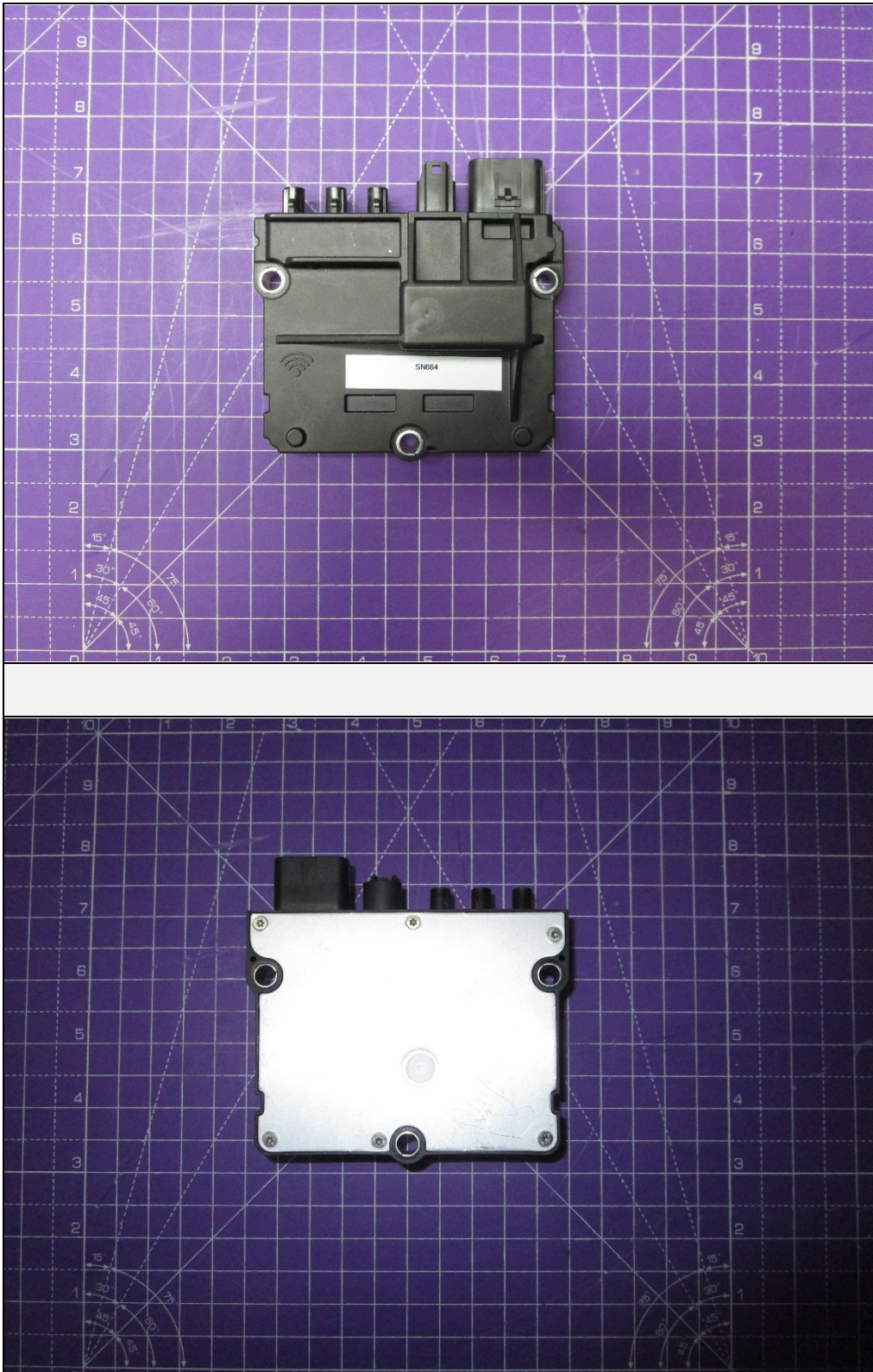
### 15. Statement of Conformity

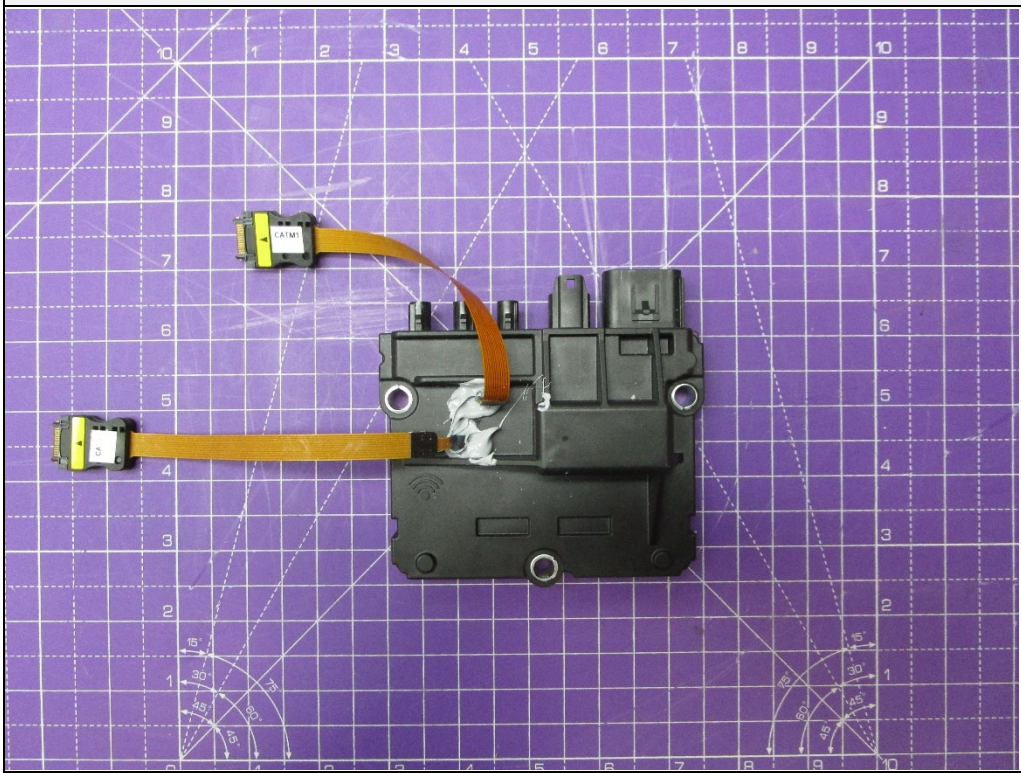
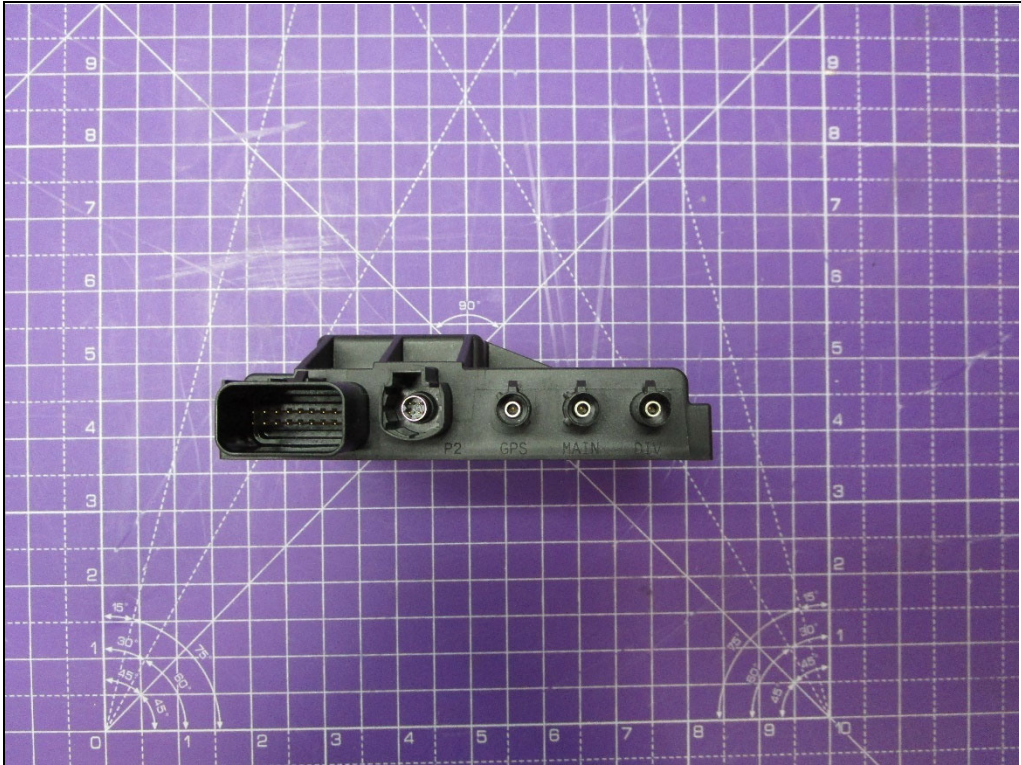
The Appareo Systems Telematic Control Unit (Model No. TCU-GLOBAL,V1, Serial No. SN633) did fully conform to the selected requirements of the ETSI EN 300 328, EN 300 440, EN 301 893, EN 301 908, EN 303 413 specifications.

### 16. 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 test specifications listed in Section 9 of this document. The data presented in this test report pertains to the EUT 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.

### 17. Photographs of EUT







## 18. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	3/10/2023	3/10/2024
CDZ4	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	5/17/2023	5/17/2024
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	10/26/2022	10/26/2024
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	6/13/2022	6/13/2024
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	5/26/2022	5/26/2024
R21F	3M ANECHOIC CHAMBER NSA	EMC TEST SYSTEMS	3M ANECHOIC		30MHZ-18GHZ	3/1/2023	3/1/2024
RAT1	SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSP	100340	9KHz-3GHz	10/27/2023	10/27/2024
RBF2	WIDEBAND RADIO COMM. TESTER	ROHDE & SCHWARZ	CMW500	121396	---	2/28/2023	2/28/2024
SES0	24VDC POWER SUPPLY	P-TRANS	FS-32024-1M	001	18-27VDC	NOTE 1	
SMA36	POWER SUPPLY	VOLTEQ	HY3020EX	190106015	30V/20A	NOTE 1	
XON1	MICROBOX BATTERY	EMC TOOLS	8.4V/2500MAH	3500527	---	CNR	
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	9/14/2023	9/14/2025
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	9/14/2023	9/14/2025

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.

19. Composite System Unwanted Emissions in the Spurious Domain

EUT Information	
Manufacturer	Appareo Systems
Product	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Mode	Wi-Fi, Bluetooth, Cell, GNSS Rx

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Test Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	R21F
Type of Antenna Used	Above 1GHz: Double-ridged waveguide (or equivalent)
Notes	The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.  Pages 23 – 30: the plots have the incorrect module number noted in the Notes line. The module is EG21G CAT1.

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
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2

ETSI EN 300 328 Requirements		
The transmitter unwanted emissions in the spurious domain shall not exceed the following values:		
Frequency Range	Maximum Power, E.R.P. (≤ 1GHz) E.I.R.P. (>1GHz)	Bandwidth
30MHz to 47MHz	-36 dBm	100kHz
47MHz to 74MHz	-54 dBm	100kHz
74MHz to 87.5MHz	-36 dBm	100kHz
87.5MHz to 118MHz	-54 dBm	100kHz
118MHz to 174MHz	-36 dBm	100kHz
174MHz to 230MHz	-54 dBm	100kHz
230MHz to 470MHz	-36 dBm	100kHz
470MHz to 862MHz	-54 dBm	100kHz
862MHz to 1GHz	-36 dBm	100kHz
1GHz to 12.75GHz	-30 dBm	1MHz

For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are E.R.P. for emissions up to 1GHz and as E.I.R.P. for emissions above 1GHz.

ETSI EN 300 440 Requirements

The transmitter unwanted emissions in the spurious domain shall not exceed the following values:

Frequency Ranges	47MHz to 74MHz 87.5MHz to 108MHz 174MHz to 230MHz 470MHz to 862MHz	Other frequencies ≤ 1000MHz	Frequencies > 1000MHz
State			
Operating	4nW	250nW	1μW
Standby	2nW	2nW	20nW

ETSI EN 301 893 Requirements

The transmitter unwanted emissions in the spurious domain shall not exceed the following values:

Frequency Range	Maximum Power	Bandwidth
30MHz to 47MHz	-36 dBm	100kHz
47MHz to 74MHz	-54 dBm	100kHz
74MHz to 87.5MHz	-36 dBm	100kHz
87.5MHz to 118MHz	-54 dBm	100kHz
118MHz to 174MHz	-36 dBm	100kHz
174MHz to 230MHz	-54 dBm	100kHz
230MHz to 470MHz	-36 dBm	100kHz
470MHz to 862MHz	-54 dBm	1MHz
862MHz to 1GHz	-36 dBm	1MHz
1GHz to 5.5GHz	-30 dBm	1MHz
5.35GHz to 5.47GHz	-30 dBm	1MHz
5.725GHz to 26GHz	-30 dBm	1MHz

ETSI EN 301 908-1 Requirements

The transmitter unwanted emissions in the spurious domain shall not exceed the following values:

Frequency	Minimum Requirement (E.R.P)/reference bandwidth idle mode	Minimum Requirement (E.R.P)/reference bandwidth traffic mode	Applicability
$30\text{MHz} \leq f < 1000\text{MHz}$	-57dBm/100kHz	-36dBm/100kHz	All
$1\text{GHz} \leq f < 12.75\text{GHz}$	-47dBm/1MHz	-30dBm/1MHz	All
$12.75\text{GHz} \leq f < 5^{\text{th}}$ harmonic of the upper frequency edge of the Upline operating band in GHz	-47dBm/1MHz	-30dBm/1MHz	All <sup>3</sup>
$12.75\text{GHz} < f < 26\text{GHz}$	-47dBm/1MHz	-30dBm/1MHz	All <sup>4</sup>

Note 1:  $f_c$  is the UE transmit center frequency.

Note 2: This frequency range is not in the spurious domain, no requirement is then defined for this frequency range.

Note 3: Applies for Band where the upper frequency edge of the Uplink Band is > 2.69GHz.

Note 4: Applies for Band where the upper frequency edge of the Uplink Band is > 5.2GHz.

ETSI EN 301 908-2 Requirements

The transmitter unwanted emissions in the spurious domain shall not exceed the following values in the tables below:

Frequency Bandwidth	Measurement Bandwidth	Minimum Requirement
$9\text{kHz} \leq f < 150\text{kHz}$	1kHz	-36dBm
$150\text{kHz} \leq f < 30\text{MHz}$	10kHz	-36dBm
$30\text{MHz} \leq f < 1000\text{MHz}$	100kHz	-36dBm
$1\text{GHz} \leq f < 12.75\text{GHz}$	1MHz	-30dBm
$12.75\text{GHz} \leq f < 5^{\text{th}}$ harmonic of the upper frequency edge of the Upline operating band in GHz	1MHz	-30dBm <sup>(note)</sup>

Note: Applies only for Band XXII.

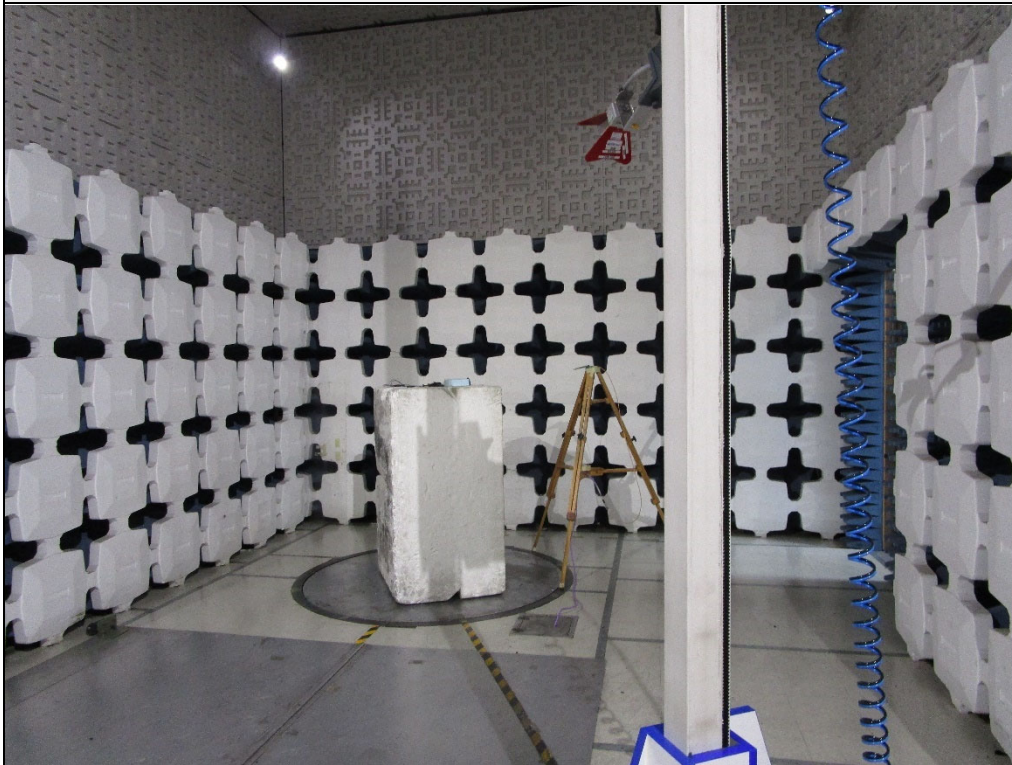
Operating Band	Frequency Bandwidth	Measurement Bandwidth	Minimum Requirement
I	$462.5\text{MHz} \leq f \leq 467.5\text{MHz}$	1MHz	-50dBm
	$791\text{MHz} \leq f \leq 821\text{MHz}$	3.84MHz	-60dBm
	$921\text{MHz} \leq f \leq 925\text{MHz}$	100kHz	-60dBm (Note 1)
	$925\text{MHz} \leq f \leq 935\text{MHz}$	100kHz	-67dBm (Note 1)
	$935\text{MHz} \leq f \leq 960\text{MHz}$	100kHz	-79dBm (Note 1)
		3.84MHz	-60dBm
	$1805\text{MHz} \leq f \leq 1880\text{MHz}$	100kHz	-71dBm (Note 1)
		3.84MHz	-60dBm
	$2010\text{MHz} \leq f \leq 2025\text{MHz}$	3.84MHz	-60dBm
	$2110\text{MHz} \leq f \leq 2170\text{MHz}$	3.84MHz	-60dBm
$2300\text{MHz} \leq f \leq 2400\text{MHz}$	3.84MHz	-60dBm	
$2585\text{MHz} \leq f \leq 2640\text{MHz}$	3.84MHz	-60dBm	
VIII	$791\text{MHz} \leq f \leq 821\text{MHz}$	3.84MHz	-60dBm
	$925\text{MHz} \leq f \leq 935\text{MHz}$	100kHz	-67dBm (Note 1)
		3.84MHz	-60dBm
	$935\text{MHz} \leq f \leq 960\text{MHz}$	100kHz	-79dBm (Note 1)
		3.84MHz	-60dBm
	$1805\text{MHz} \leq f \leq 1830\text{MHz}$	100kHz	-71dBm (Notes 1 & 2)
		3.84MHz	-60dBm (Note 2)
	$1830\text{MHz} \leq f \leq 1880\text{MHz}$	100kHz	-71dBm (Note 1)
		3.84MHz	-60dBm
	$1830\text{MHz} \leq f \leq 1880\text{MHz}$	100kHz	-60dBm
		3.84MHz	-60dBm
	$1880\text{MHz} \leq f \leq 1920\text{MHz}$	3.84MHz	-60dBm
	$2010\text{MHz} \leq f \leq 2025\text{MHz}$	3.84MHz	-60dBm
$2110\text{MHz} \leq f \leq 2170\text{MHz}$	3.84MHz	-60dBm	
$2300\text{MHz} \leq f \leq 2400\text{MHz}$	3.84MHz	-60dBm	
$2585\text{MHz} \leq f \leq 2640\text{MHz}$	3.84MHz	-60dBm	
$2640\text{MHz} \leq f \leq 2690\text{MHz}$	3.84MHz	-60dBm (Note 2)	

NOTE 1: The transmitter additional spurious emission measurements are made on frequencies which are integer multiples of 200kHz. As exceptions, up to five measurements with a level up to the applicable requirements are permitted for each UARFCN used in the measurement.

NOTE 2: The transmitter additional spurious emission measurements are made on frequencies which are integer multiples of 200kHz. As exceptions, measurements with a level up to the applicable requirements are permitted for each UARFCN used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> harmonic spurious emissions.



Test Setup for Radiated Spurious Emissions – Above 1GHz Horizontal Antenna Polarization



Test Setup for Radiated Spurious Emissions – Above 1GHz Vertical Antenna Polarization

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 300 328
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Wi-Fi
Frequency Tested	2412MHz
Test Performed By	Tylar Jozefczyk
Notes	

Freq. (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
4824.00	H	49.36	Ambient	-67.00	8.04	3.88	-62.83	-30.00	-32.83
4824.00	V	48.45	Ambient	-67.20	8.04	3.88	-63.03	-30.00	-33.03
7236.00	H	47.94	Ambient	-70.10	9.66	4.90	-65.34	-30.00	-35.34
7236.00	V	47.21	Ambient	-71.08	9.66	4.90	-66.32	-30.00	-36.32
9648.00	H	48.35	Ambient	-68.00	10.75	5.46	-62.71	-30.00	-32.71
9648.00	V	48.49	Ambient	-68.00	10.75	5.46	-62.71	-30.00	-32.71
12060.00	H	48.25	Ambient	-68.00	10.70	6.40	-63.70	-30.00	-33.70
12060.00	V	47.90	Ambient	-67.80	10.70	6.40	-63.50	-30.00	-33.50

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 301 893
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Wi-Fi
Frequency Tested	5180MHz
Test Performed By	Tylar Jozefczyk
Notes	

Freq. (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
10360.00	H	42.89	Ambient	-75.00	10.55	5.76	-70.20	-30.00	-40.20
10360.00	V	42.20	Ambient	-75.00	10.55	5.76	-70.20	-30.00	-40.20
15540.00	H	42.54	Ambient	-74.20	10.99	7.20	-70.41	-30.00	-40.41
15540.00	V	42.04	Ambient	-74.40	10.99	7.20	-70.61	-30.00	-40.61

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 300 328
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Bluetooth
Frequency Tested	2402MHz
Test Performed By	Tylar Jozefczyk
Notes	

Freq. (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
4804.00	H	47.42	Ambient	-67.50	7.92	3.87	-63.45	-30.00	-33.45
4804.00	V	48.04	Ambient	-66.90	7.92	3.87	-62.85	-30.00	-32.85
7206.00	H	47.32	Ambient	-67.64	9.62	4.89	-62.91	-30.00	-32.91
7206.00	V	47.14	Ambient	-67.62	9.62	4.89	-62.89	-30.00	-32.89
9608.00	H	47.20	Ambient	-67.80	10.68	5.45	-62.57	-30.00	-32.57
9608.00	V	47.32	Ambient	-67.72	10.68	5.45	-62.49	-30.00	-32.49
12010.00	H	47.14	Ambient	-67.30	10.72	6.40	-62.98	-30.00	-32.98
12010.00	V	47.13	Ambient	-67.42	10.72	6.40	-63.10	-30.00	-33.10



DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 300 908
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Cell – LTE Band 12
Frequency Tested	707.5MHz
Test Performed By	Tylar Jozefczyk
Notes	

Freq. (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
1415.00	H	29.12		-32.15	3.84	2.08	-30.39	-30.00	-0.39
1415.00	V	26.96		-33.59	3.84	2.08	-31.83	-30.00	-1.83
2122.50	H	51.49	Ambient	-51.09	5.66	2.55	-47.98	-30.00	-17.98
2122.50	V	52.23	Ambient	-49.26	5.66	2.55	-46.15	-30.00	-16.15
2830.00	H	51.96	Ambient	-48.85	6.40	3.01	-45.47	-30.00	-15.47
2830.00	V	51.68	Ambient	-48.85	6.40	3.01	-45.46	-30.00	-15.46
3537.50	H	50.42	Ambient	-49.79	8.01	3.38	-45.16	-30.00	-15.16
3537.50	V	50.21	Ambient	-49.47	8.01	3.38	-44.83	-30.00	-14.83

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 300 908
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Cell – LTE Band 3
Frequency Tested	1747.5MHz
Test Performed By	Tylar Jozefczyk
Notes	

Freq. (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
3495.00	H	19.15	Ambient	-43.56	7.26	3.36	-39.65	-30.00	-9.65
3495.00	V	21.06	Ambient	-44.02	7.26	3.36	-40.11	-30.00	-10.11
5242.50	H	52.20		-49.53	7.50	4.04	-46.07	-30.00	-16.07
5242.50	V	51.68		-46.11	7.50	4.04	-42.65	-30.00	-12.65
6990.00	H	49.20	Ambient	-52.23	9.66	4.80	-47.37	-30.00	-17.37
6990.00	V	49.38	Ambient	-52.49	9.66	4.80	-47.63	-30.00	-17.63
8737.50	H	48.86	Ambient	-52.69	10.57	5.20	-47.32	-30.00	-17.32
8737.50	V	48.68	Ambient	-51.16	10.57	5.20	-45.79	-30.00	-15.79

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 301 893
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Cell – WDCMA Band 8
Frequency Tested	882.4MHz
Test Performed By	Tylar Jozefczyk
Notes	

Freq. (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
1764.80	H	20.48		-44.76	6.17	2.32	-40.90	-30.00	-10.90
1764.80	V	20.50		-42.89	6.17	2.32	-39.03	-30.00	-9.03
2647.20	H	54.82		-46.26	5.51	2.91	-43.65	-30.00	-13.65
2647.20	V	57.07		-43.86	5.51	2.91	-41.25	-30.00	-11.25
3529.60	H	51.47		-48.74	7.99	3.37	-44.12	-30.00	-14.12
3529.60	V	52.82		-46.90	7.99	3.37	-42.28	-30.00	-12.28
4412.00	H	52.75		-45.90	9.19	3.73	-40.44	-30.00	-10.44
4412.00	V	55.85		-42.84	9.19	3.73	-37.39	-30.00	-7.39
5294.40	H	47.50	Ambient	-49.74	9.94	4.07	-43.87	-30.00	-13.87
5294.40	V	48.05	Ambient	-49.19	9.94	4.07	-43.32	-30.00	-13.32
6176.80	H	47.54	Ambient	-48.83	10.57	4.43	-42.69	-30.00	-12.69
6176.80	V	47.75	Ambient	-49.27	10.57	4.43	-43.13	-30.00	-13.13

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 301 893
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Cell – WDCMA Band 1
Frequency Tested	1747.5MHz
Test Performed By	Tylar Jozefczyk
Notes	

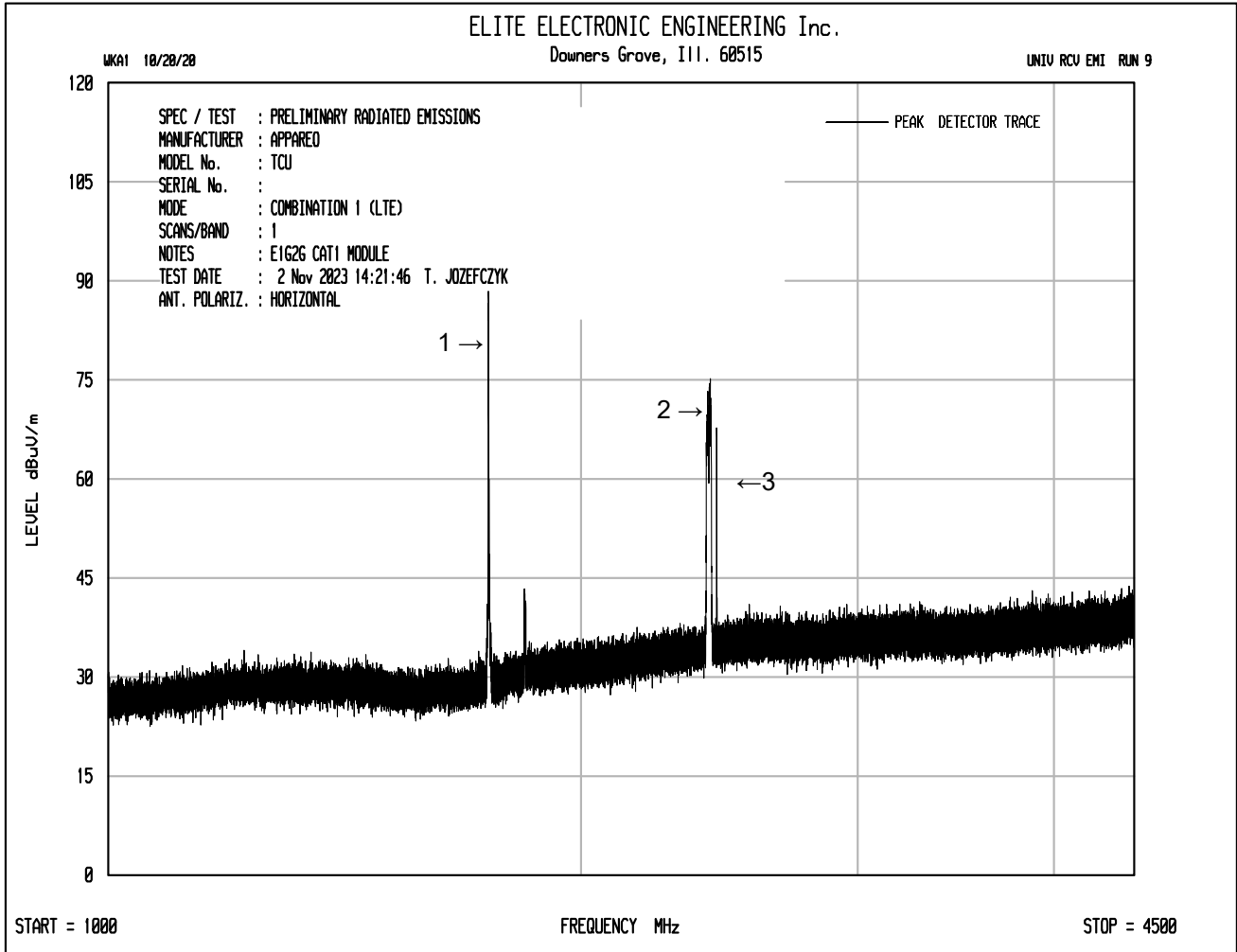
Freq. (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
3845.20	H	24.12	Ambient	-35.10	7.65	3.51	-30.96	-30.00	-0.96
3845.20	V	21.88	Ambient	-39.50	7.65	3.51	-35.36	-30.00	-5.36
5767.80	H	60.90		-39.17	7.88	4.26	-35.55	-30.00	-5.55
5767.80	V	66.31		-40.00	7.88	4.26	-36.38	-30.00	-6.38
7690.40	H	50.64		-49.07	9.80	5.08	-44.35	-30.00	-14.35
7690.40	V	51.62		-47.29	9.80	5.08	-42.57	-30.00	-12.57
9613.00	H	48.49		-56.58	10.69	5.45	-51.34	-30.00	-21.34
9613.00	V	50.55		-49.16	10.69	5.45	-43.92	-30.00	-13.92
11535.60	H	45.56	Ambient	-67.84	10.87	6.23	-63.20	-30.00	-33.20
11535.60	V	46.11	Ambient	-66.96	10.87	6.23	-62.32	-30.00	-32.32
13458.20	H	46.58	Ambient	-66.75	11.15	6.59	-62.19	-30.00	-32.19
13458.20	V	46.88	Ambient	-66.92	11.15	6.59	-62.36	-30.00	-32.36

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 301 908
Test	Transmitter Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	Cell – GSM850
Frequency Tested	836.6MHz
Test Performed By	Tylar Jozefczyk
Notes	

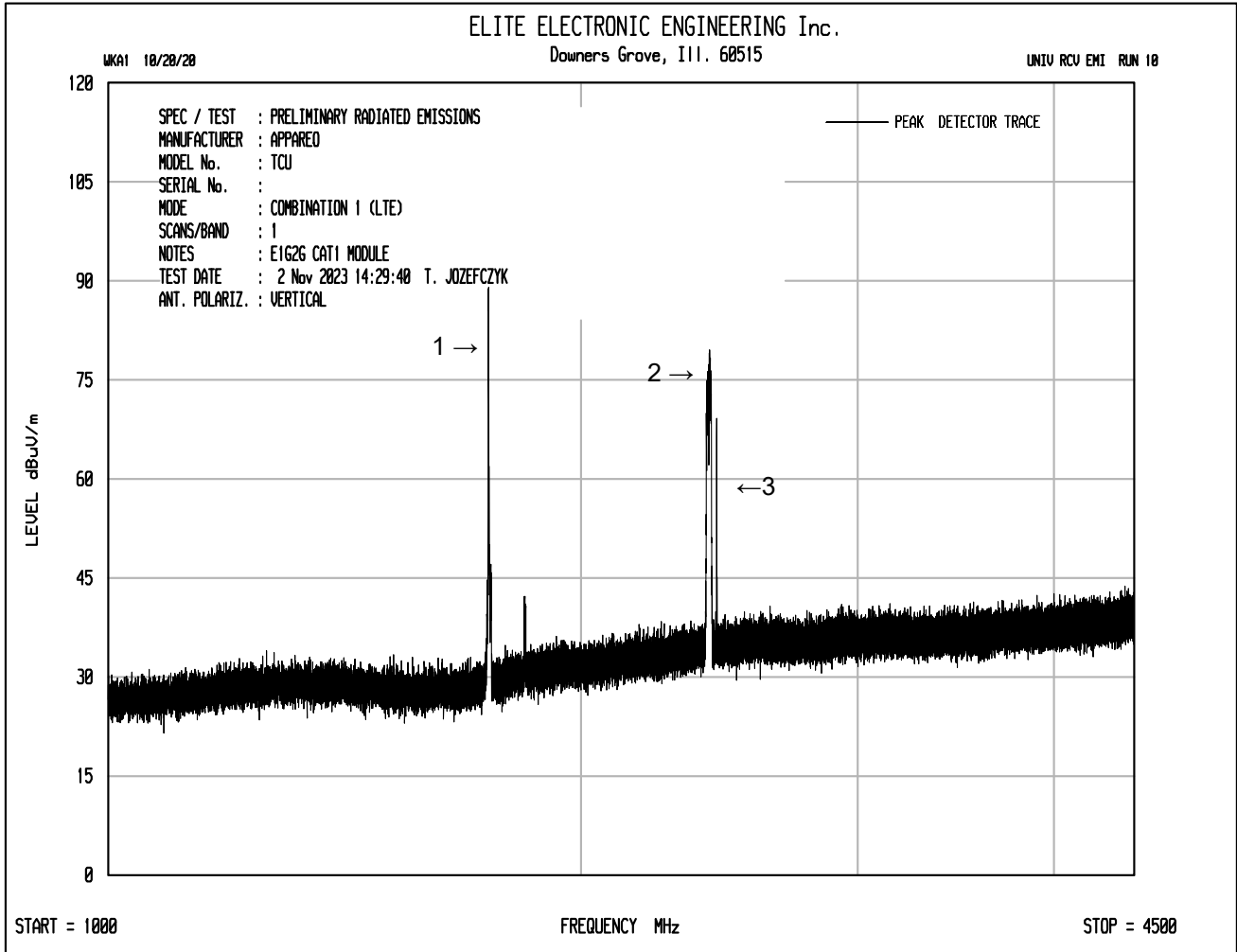
Freq. (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
1673.20	H	26.31	Ambient	-36.68	4.88	2.26	-34.06	-30.00	-4.06
1673.20	V	26.08	Ambient	-36.79	4.88	2.26	-34.17	-30.00	-4.17
2509.80	H	51.77	Ambient	-49.65	5.16	2.82	-47.31	-30.00	-17.31
2509.80	V	51.54	Ambient	-49.69	5.16	2.82	-47.35	-30.00	-17.35
3346.40	H	51.87	Ambient	-48.28	7.65	3.29	-43.92	-30.00	-13.92
3346.40	V	51.30	Ambient	-48.99	7.65	3.29	-44.63	-30.00	-14.63
4183.00	H	49.40	Ambient	-49.63	9.05	3.65	-44.23	-30.00	-14.23
4183.00	V	49.24	Ambient	-49.70	9.05	3.65	-44.30	-30.00	-14.30
5019.60	H	49.06	Ambient	-48.46	9.85	3.94	-42.56	-30.00	-12.56
5019.60	V	49.01	Ambient	-48.24	9.85	3.94	-42.33	-30.00	-12.33

DATA PAGE	
Manufacturer	Appareo Systems
EUT	Telematic Control Unit
Model No.	TCU-GLOBAL,V1
Serial No.	SN633
Specification	ETSI EN 303 413
Test	Receiver Unwanted Emissions in the Spurious Domain – Intermodulation Products
Mode	GNSS Rx
Frequency Tested	1575.42MHz
Test Performed By	Tylar Jozefczyk
Notes	

Freq. (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	RMS EIRP (dBm)	Limit (dBm)	Margin (dB)
3150.84	H	37.54	Ambient	-62.68	7.14	3.19	-58.73	-47.00	-11.73
3150.84	V	37.68	Ambient	-62.26	7.14	3.19	-58.31	-47.00	-11.31
4726.26	H	34.81	Ambient	-63.30	8.94	3.84	-58.20	-47.00	-11.20
4726.26	V	33.90	Ambient	-64.04	8.94	3.84	-58.94	-47.00	-11.94
6301.68	H	34.82	Ambient	-61.14	10.71	4.49	-54.92	-47.00	-7.92
6301.68	V	35.17	Ambient	-61.77	10.71	4.49	-55.55	-47.00	-8.55
7877.10	H	35.01	Ambient	-61.99	12.41	5.15	-54.74	-47.00	-7.74
7877.10	V	34.77	Ambient	-62.43	12.41	5.15	-55.18	-47.00	-8.18
9452.52	H	35.09	Ambient	-59.07	13.23	5.39	-51.23	-47.00	-4.23
9452.52	V	35.78	Ambient	-58.31	13.23	5.39	-50.47	-47.00	-3.47

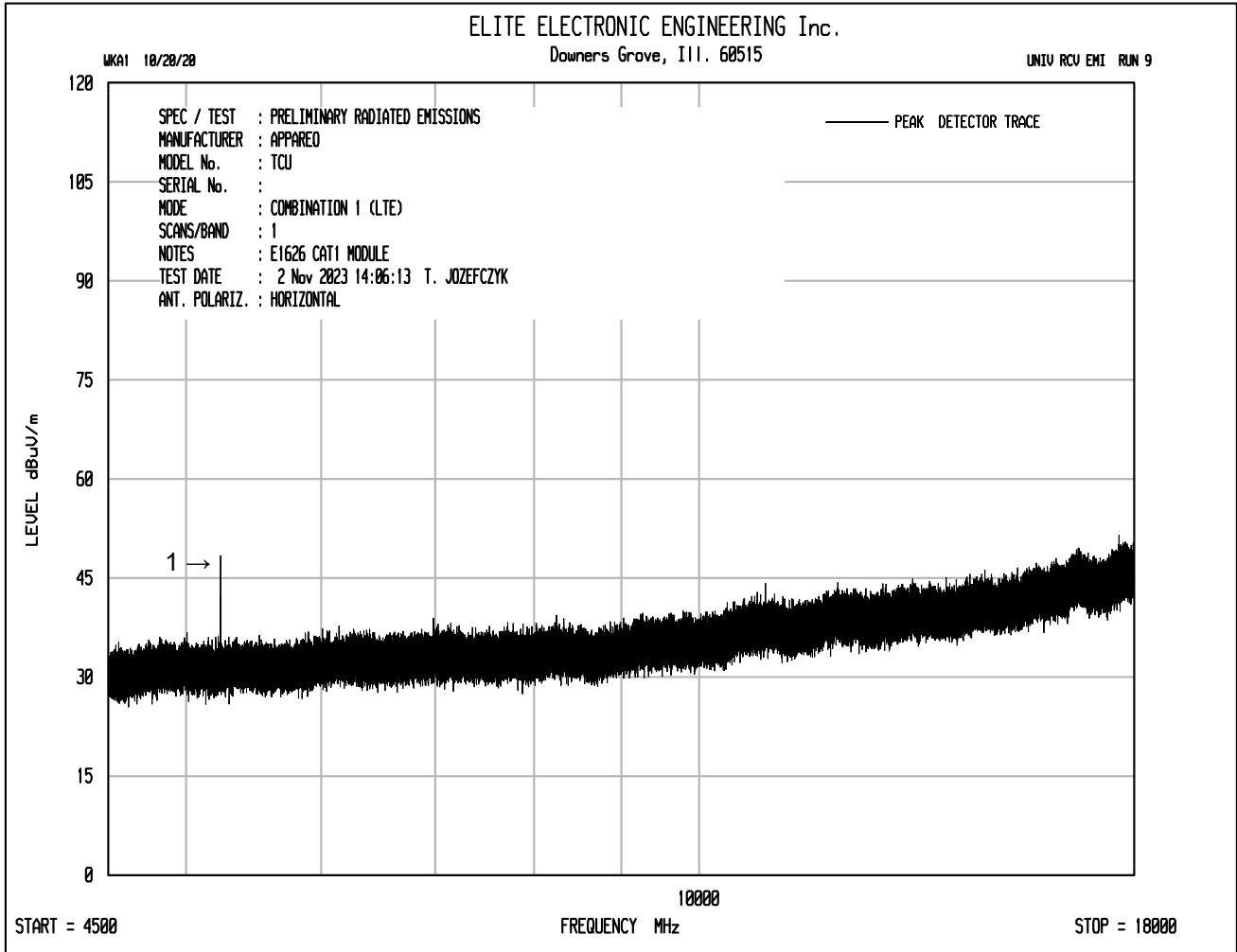


Note	Description
1	Plot shows emissions at LTE Band 3.
2	Plot shows emissions at Bluetooth frequency 2402MHz.
3	Plot shows emissions at Wi-Fi frequency 2412MHz.

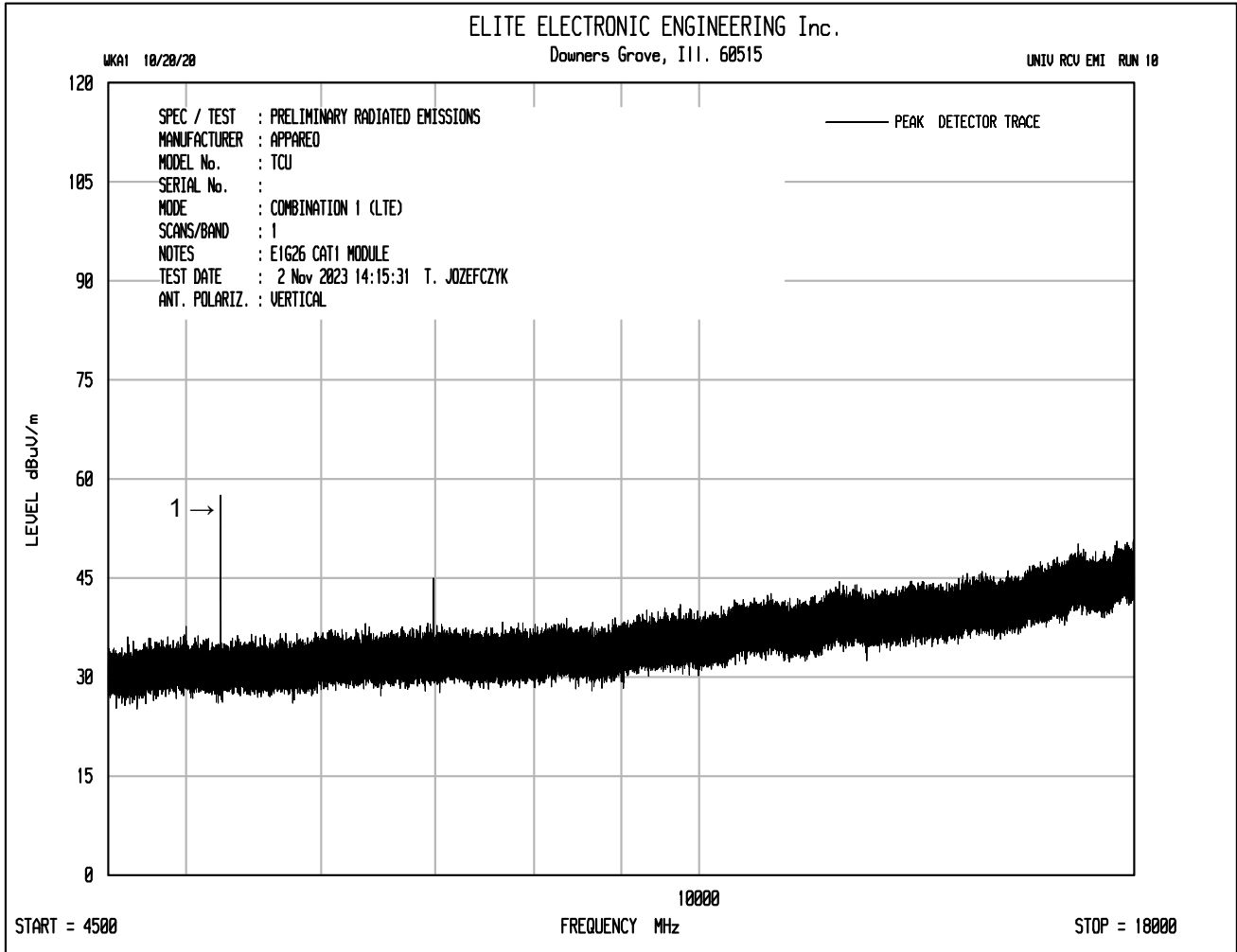


Note	Description
1	Plot shows emissions at LTE Band 3.
2	Plot shows emissions at Bluetooth frequency 2402MHz.
3	Plot shows emissions at Wi-Fi frequency 2412MHz.

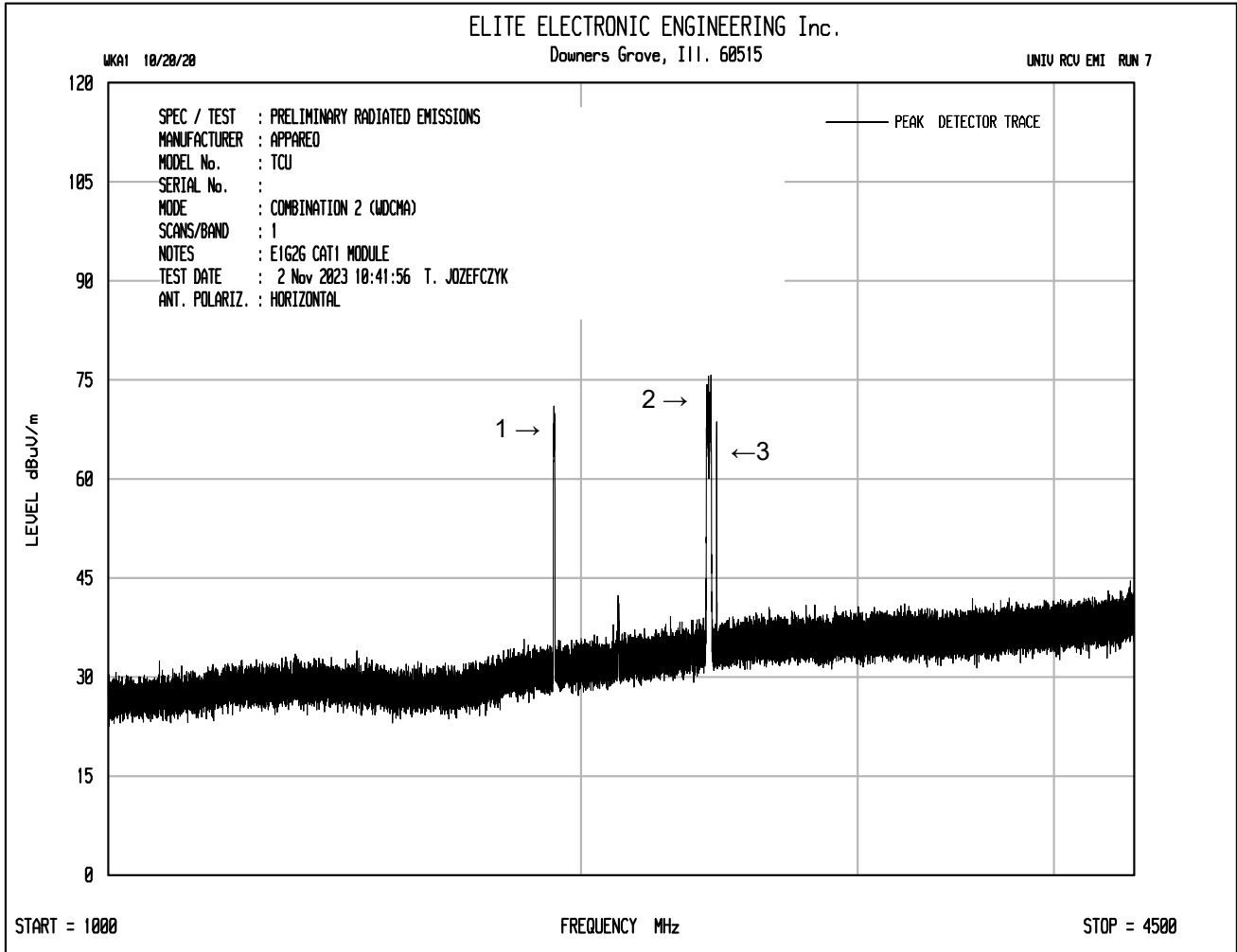




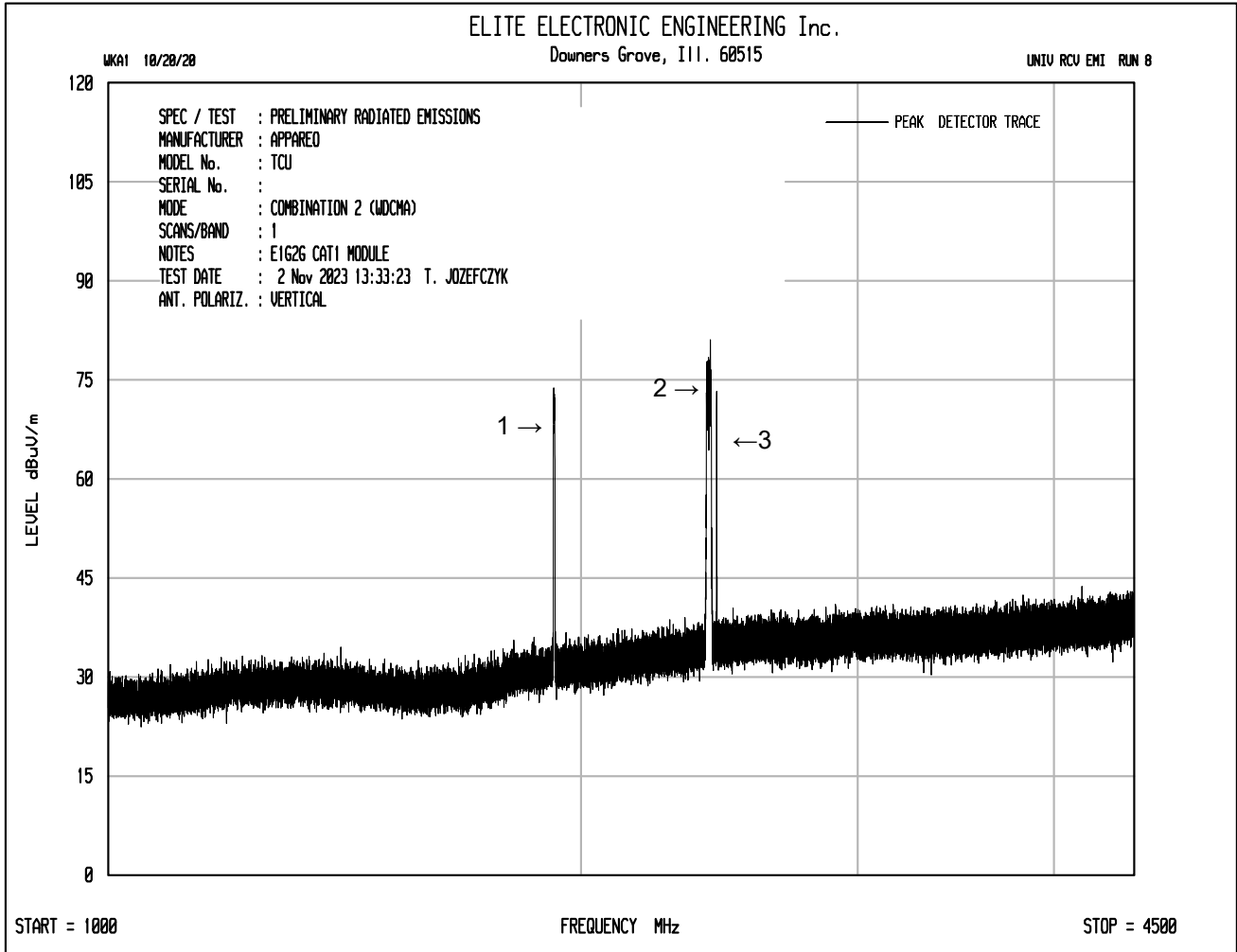
Note	Description
1	Plot shows the 3 <sup>rd</sup> harmonic of LTE Band 3 (5242.5MHz).



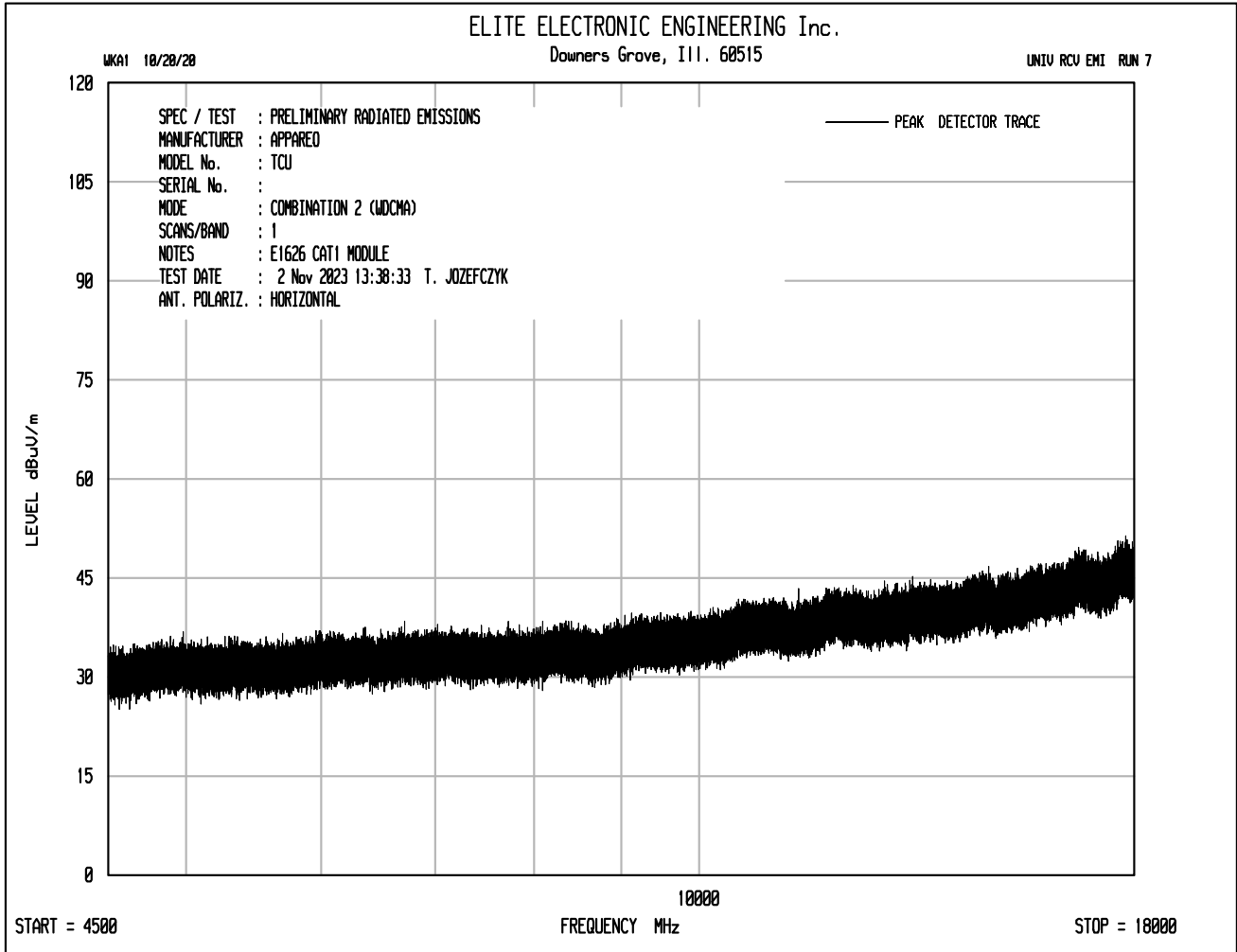
Note	Description
1	Plot shows the 3 <sup>rd</sup> harmonic of LTE Band 3 (5242.5MHz).

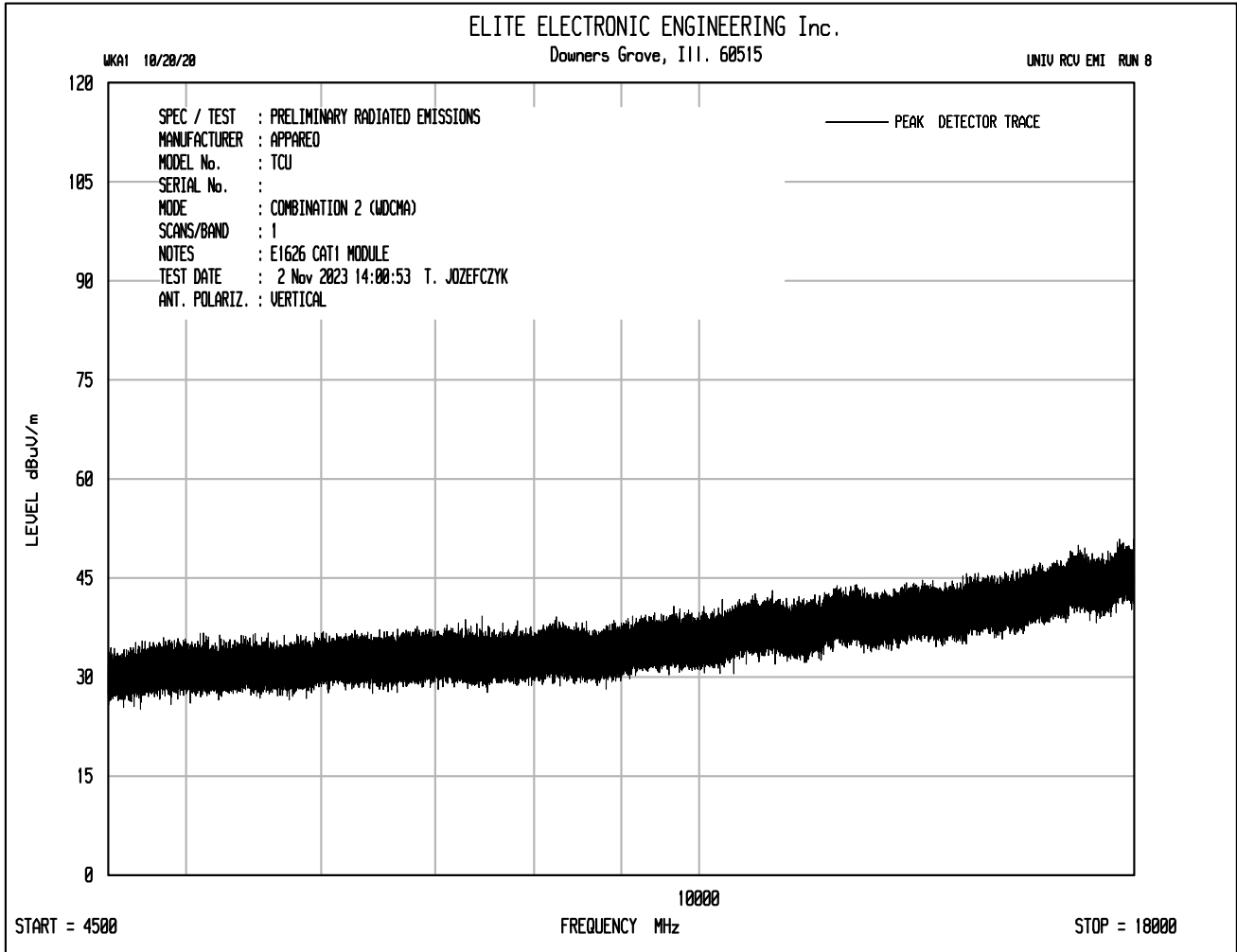


Note	Description
1	Plot shows emissions at WDCMA Band 1.
2	Plot shows emissions at Bluetooth frequency 2402MHz.
3	Plot shows emissions at Wi-Fi frequency 2412MHz.



Note	Description
1	Plot shows emissions at WDCMA Band 1.
2	Plot shows emissions at Bluetooth frequency 2402MHz.
3	Plot shows emissions at Wi-Fi frequency 2412MHz.





20. Scope of Accreditation



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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ELECTRICAL

Valid To: June 30, 2025

Certificate Number: 1786.01

In recognition of the successful completion of the A2LA Accreditation Program evaluation process, accreditation is granted to this laboratory to perform the following automotive electromagnetic compatibility and other electrical tests:

**Test Technology:**

**Test Method(s)¹:**

*Transient Immunity  
 (Max Voltage 60V/Max current 100A)*

ISO 7637-2 (including emissions); ISO 7637-3;  
 ISO 16750-2:2012, Sections 4.6.3 and 4.6.4;  
 CS-11979, Section 6.4; CS.00054, Section 5.9;  
 EMC-CS-2009.1 (CI220); FMC1278 (CI220, CI221, CI222);  
 GMW 3097, Section 3.5; SAE J1113-11; SAE J1113-12;  
 ECE Regulation 10.06 Annex 10

*Electrostatic Discharge (ESD)  
 (Up to +/-25kV)*

ISO 10605 (2001, 2008);  
 CS-11979 Section 7.0; CS.00054, Section 5.10;  
 EMC-CS-2009.1 (CI 280); FMC1278 (CI280); SAE J1113-13;  
 GMW 3097 Section 3.6

*Conducted Emissions*

CISPR 25 (2002, 2008), Sections 6.2 and 6.3;  
 CISPR 25 (2016), Sections 6.3 and 6.4;  
 CS-11979, Section 5.1; CS.00054, Sections 5.6.1 and 5.6.2;  
 GMW 3097, Section 3.3.2;  
 EMC-CS-2009.1 (CE 420); FMC1278 (CE420, CE421,  
 CE 430, CE440)



**Test Technology:**

**Test Method(s)¹:**

*Radiated Emissions Anechoic  
(Up to 6GHz)*

CISPR 25 (2002, 2008), Section 6.4;  
CISPR 25 (2016), Section 6.5;  
CS-11979, Section 5.3; CS.00054, Section 5.6.3;  
GMW 3097, Section 3.3.1;  
EMC-CS-2009.1 (RE 310); FMC1278 (RE310, RE320);

*Vehicle Radiated Emissions*

CISPR 12; CISPR 36; ICES-002;  
ECE Regulation 10.06 Annex 5

*Bulk Current Injection (BCI)  
(1 to 400MHz 500mA)*

ISO 11452-4; CS-11979, Section 6.1; CS.00054, Section 5.8.1;  
GMW 3097, Section 3.4.1; SAE J1113-4;  
EMC-CS-2009.1 (RI112); FMC1278 (RI112);  
ECE Regulation 10.06 Annex 9

*Radiated Immunity Anechoic  
(Up to 6GHz and 200V/m)  
(Including Radar Pulse 600V/m)*

ISO 11452-2;  
CS-11979, Section 6.2; CS.00054, Section 5.8.2;  
GMW 3097, Section 3.4.2;  
EMC-CS-2009.1 (RI114); FMC1278 (RI114); SAE J1113-21;  
ECE Regulation 10.06 Annex 9

*Radiated Immunity Magnetic Field*

ISO 11452-8; FMC 1278 (RI140)

*Radiated Immunity Reverb  
(360MHz to 6GHz and 100V/m)*

ISO/IEC 61000-4-21; GMW 3097, Section 3.4.3;  
EMC-CS-2009.1 (RI114); FMC1278 (RI114);  
ISO 11452-11

*Radiated Immunity  
(Portable Transmitters)  
(Up to 6GHz and 20W)*

ISO 11452-9;  
EMC-CS-2009.1 (RI115); FMC1278 (RI115);  
GMW 3097, Sec 3.4.4

*Vehicle Radiated Immunity (ALSE)*

ISO 11451-2; ECE Regulation 10.06 Annex 6

*Vehicle Product Specific EMC  
Standards*

EN 14982; EN ISO 13309; ISO 13766; EN 50498;  
EC Regulation No. 2015/208; EN 55012

*Electrical Loads*

ISO 16750-2

*Stripline*

ISO 11452-5

*Transverse Electromagnetic (TEM)  
Cell*

ISO 11452-3



**Test Technology:**

**Test Method(s)¹:**

**Emissions**

Radiated and Conducted  
(3m Semi-anechoic chamber,  
up to 40 GHz)

47 CFR, FCC Part 15 B (using ANSI C63.4:2014);  
47 CFR, FCC Part 18 (using FCC MP-5:1986);  
ICES-001; ICES-003; ICES-005;  
IEC/CISPR 11, Ed. 4.1 (2004-06); AS/NZS CISPR 11 (2004);  
IEC/CISPR 11 Ed 5 (2009-05) + A1 (2010);  
KN 11 (2008-5) with RRL Notice No. 2008-3 (May 20, 2008);  
CISPR 11; EN 55011; KS C 9811; CNS 13803 (1997, 2003);  
CISPR 14-1; EN 55014-1; AS/NZS CISPR 14.1;  
CISPR 16-2-1 (2008); CISPR 16-2-1; KS C 9814-1; KN 14-1;  
IEC/CISPR 22 (1997);  
EN 55022 (1998) + A1(2000);  
EN 55022 (1998) + A1(2000) + A2(2003); EN 55022 (2006);  
IEC/CISPR 22 (2008-09); AS/NZS CISPR 22 (2004);  
AS/NZS CISPR 22, 3rd Edition (2006); KN 22 (up to 6 GHz);  
CNS 13438 (up to 6 GHz); VCCI V-3 (up to 6 GHz);  
CISPR 32; EN 55032; KS C 9832; KN 32;  
ECE Regulation 10.06 Annex 7 (Broadband);  
ECE Regulation 10.06 Annex 8 (Narrowband);  
ECE Regulation 10.06 Annex 14 (Conducted)

Cellular Radiated Spurious Emissions

ETSI TS 151 010-1 GSM; 3GPP TS 51.010-1, Sec 12;  
ETSI TS 134 124 UMTS; 3GPP TS 34.124;  
ETSI TS 136 124 LTE; E-UTRA; 3GPP TS 36.124

Current Harmonics

IEC 61000-3-2; IEC 61000-3-12;  
EN 61000-3-2; KN 61000-3-2;  
KS C 9610-3-2; ECE Regulation 10.06 Annex 11

Flicker and Fluctuations

IEC 61000-3-3; IEC 61000-3-11;  
EN 61000-3-3; KN 61000-3-3;  
KS C 9610-3-3; ECE Regulation 10.06 Annex 12

**Immunity**

Electrostatic Discharge

IEC 61000-4-2, Ed. 1.2 (2001);  
IEC 61000-4-2 (1995) + A1(1998) + A2(2000);  
EN 61000-4-2 (1995); EN 61000-4-2 (2009-05);  
KN 61000-4-2 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
IEC 61000-4-2; EN 61000-4-2; KN 61000-4-2;  
KS C 9610-4-2; IEEE C37.90.3 2001

Radiated Immunity

IEC 61000-4-3 (1995) + A1(1998) + A2(2000);  
IEC 61000-4-3, Ed. 3.0 (2006-02);  
IEC 61000-4-3, Ed. 3.2 (2010);  
KN 61000-4-3 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
IEC 61000-4-3; EN 61000-4-3; KN 61000-4-3;  
KS C 9610-4-3; IEEE C37.90.2 2004

**Test Technology:**

**Test Method(s)<sup>1</sup>:**

**Immunity (cont'd)**

Electrical Fast Transient/Burst

IEC 61000-4-4, Ed. 2.0 (2004-07);  
 IEC 61000-4-4, Ed. 2.1 (2011);  
 IEC 61000-4-4 (1995) + A1(2000) + A2(2001);  
 KN 61000-4-4 (2008-5);  
 RRL Notice No. 2008-5 (May 20, 2008);  
 IEC 61000-4-4; EN 61000-4-4; KN 61000-4-4;  
 KS C 9610-4-4; ECE Regulation 10.06 Annex 15

Surge

IEC 61000-4-5 (1995) + A1(2000);  
 IEC 61000-4-5, Ed 1.1 (2005-11);  
 EN 61000-4-5 (1995) + A1(2001);  
 KN 61000-4-5 (2008-5);  
 RRL Notice No. 2008-4 (May 20, 2008);  
 IEC 61000-4-5; EN 61000-4-5; KN 61000-4-5;  
 KS C 9610-4-5;  
 IEEE C37.90.1 2012; IEEE STD C62.41.2 2002;  
 ECE Regulation 10.06 Annex 16

Conducted Immunity

IEC 61000-4-6 (1996) + A1(2000);  
 IEC 61000-4-6, Ed 2.0 (2006-05);  
 IEC 61000-4-6 Ed. 3.0 (2008);  
 KN 61000-4-6 (2008-5);  
 RRL Notice No. 2008-4 (May 20, 2008);  
 EN 61000-4-6 (1996) + A1(2001); IEC 61000-4-6;  
 EN 61000-4-6; KN 61000-4-6; KS C 9610-4-6

Power Frequency Magnetic Field  
 Immunity (*Down to 3 A/m*)

IEC 61000-4-8 (1993) + A1(2000); IEC 61000-4-8 (2009);  
 EN 61000-4-8 (1994) + A1(2000);  
 KN 61000-4-8 (2008-5);  
 RRL Notice No. 2008-4 (May 20, 2008);  
 IEC 61000-4-8; EN 61000-4-8; KN 61000-4-8; KS C 9610-4-8

Voltage Dips, Short Interrupts, and Line  
 Voltage Variations

IEC 61000-4-11, Ed. 2 (2004-03);  
 KN 61000-4-11 (2008-5);  
 RRL Notice No. 2008-4 (May 20, 2008);  
 IEC 61000-4-11; EN 61000-4-11; KN 61000-4-11;  
 KS C 9610-4-11

Ring Wave

IEC 61000-4-12, Ed. 2 (2006-09);  
 EN 61000-4-12:2006;  
 IEC 61000-4-12; EN 61000-4-12; KN 61000-4-12;  
 IEEE STD C62.41.2 2002



**Test Technology:**

**Test Method(s):**

Generic and Product Specific EMC Standards

IEC/EN 61000-6-1; AS/NZS 61000-6-1; KN 61000-6-1; KS C 9610-6-1; IEC/EN 61000-6-2; AS/NZS 61000-6-2; KN 61000-6-2; KS C 9610-6-2; IEC/EN 61000-6-3; AS/NZS 61000-6-3; KN 61000-6-3; KS C 9610-6-3; IEC/EN 61000-6-4; AS/NZS 61000-6-4; KN 61000-6-4; KS C 9610-6-4; EN 50130-4; EN 61326-1; EN 50121-3-2; EN 12895; EN 50270; EN 50491-1; EN 50491-2; EN 50491-3; EN 55015; EN 60730-1; EN 60945; IEC 60533; EN 61326-2-6; EN 61800-3; IEC/CISPR 14-2; EN 55014-2; AS/NZS CISPR 14.2; KN 14-2; KS C 9814-2; IEC/CISPR 24; AS/NZS CISPR 24; EN 55024; KN 24; IEC/CISPR 35; AS/NZS CISPR 35; EN 55035; KN 35; KS C 9835; IEC 60601-1-2; JIS T0601-1-2

*TxRx EMC Requirements*

EN 301 489-1; EN 301 489-3; EN 301 489-9; EN 301 489-17; EN 301 489-19; EN 301 489-20

*European Radio Test Standards*

ETSI EN 300 086-1; ETSI EN 300 086-2; ETSI EN 300 113-1; ETSI EN 300 113-2; ETSI EN 300 220-1; ETSI EN 300 220-2; ETSI EN 300 220-3-1; ETSI EN 300 220-3-2; ETSI EN 300 330-1; ETSI EN 300 330-2; ETSI EN 300 440-1; ETSI EN 300 440-2; ETSI EN 300 422-1; ETSI EN 300 422-2; ETSI EN 300 328; ETSI EN 301 893; ETSI EN 301 511; ETSI EN 301 908-1; ETSI EN 908-2; ETSI EN 908-13; ETSI EN 303 413; ETSI EN 302 502; EN 303 340; EN 303 345-2; EN 303 345-3; EN 303 345-4

*Canadian Radio Tests*

RSS-102 measurement (RF Exposure Evaluation); RSS-102 measurement (Nerve Stimulation); SPR-002; RSS-111; RSS-112; RSS-117; RSS-119; RSS-123; RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133; RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141; RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192; RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210; RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222; RSS-236; RSS-238; RSS-243; RSS-244; RSS-247; RSS-248; RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-GEN

*Mexico Radio Tests*

IFT-008-2015; NOM-208-SCFI-2016

*Japan Radio Tests*

Radio Law No. 131, Ordinance of MPT No. 37, 1981, MIC Notification No. 88:2004, Table No. 22-11; ARIB STD-T66, Regulation 18

*Taiwan Radio Tests*

LP-0002 (July 15, 2020)

<b><u>Test Technology:</u></b>	<b><u>Test Method(s):</u></b>
<i>Australia/New Zealand Radio Tests</i>	AS/NZS 4268; Radiocommunications (Short Range Devices) Standard (2014)
<i>Hong Kong Radio Tests</i>	HKCA 1039 Issue 6; HKCA 1042; HKCA 1033 Issue 7; HKCA 1061; HKCA 1008; HKCA 1043; HKCA 1057; HKCA 1073
<i>Korean Radio Test Standards</i>	KN 301 489-1; KN 301 489-3; KN 301 489-9; KN 301 489-17; KN 301 489-52; KS X 3124; KS X 3125; KS X 3130; KS X 3126; KS X 3129
<i>Vietnam Radio Test Standards</i>	QCVN 47:2015/BTTTT; QCVN 54:2020/BTTTT; QCVN 55:2011/BTTTT; QCVN 65:2013/BTTTT; QCVN 73:2013/BTTTT; QCVN 74:2020/BTTTT; QCVN 112:2017/BTTTT; QCVN 117:2020/BTTTT
<i>Vietnam EMC Test Standards</i>	QCVN 18:2014/BTTTT; QCVN 86:2019/BTTTT; QCVN 96:2015/BTTTT; QCVN 118:2018/BTTTT
<i>Unlicensed Radio Frequency Devices (3 Meter Semi-Anechoic Room)</i>	47 CFR FCC Part 15C, 15D, 15E, 15F, 15G, 15H (using ANSI C63.10:2013, ANSI C63.17:2013 and FCC KDB 905462 D02 (v02))
<i>Licensed Radio Service Equipment</i>	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101 (using ANSI/TIA-603-E, TIA-102.CAAA-E, ANSI C63.26:2015)
<i>OIA (Over the Air) Performance</i> GSM, GPRS, EGPRS UMTS (W-CDMA) LTE including CAT M1 A-GPS for UMTS/GSM LTS A-GPS, A-GLONASS, SIB8/SIB16 Large Device/Laptop/Tablet Testing Integrated Device Testing WiFi 802.11 a/b/g/n/a	CTIA Test Plan for Wireless Device Over-the-Air Performance (Method for Measurement for Radiated Power and Receiver Performance) V3.8.2; CTIA Test Plan for RF Performance Evaluation of WiFi Mobile Converged Devices V2.1.0

**Test Technology:**

**Test Method(s)<sup>1</sup>:**

***Electrical Measurements and Simulation***

**AC Voltage / Current**

(1mV to 5kV) 60 Hz  
(0.1V to 250V) up to 500 MHz  
(1µA to 150A) 60 Hz

FAA AC 150/5345-10H;  
FAA AC 150/5345-43J;  
FAA AC 150/5345-44K;  
FAA AC 150/5345-46E;  
FAA AC 150/5345-47C;  
FAA EB 67D

**DC Voltage / Current**

(1mV to 15 kV) / (1µA to 10A)

**Power Factor / Efficiency / Crest Factor**

(Power to 30kW)

**Resistance**

(1mΩ to 4000MΩ)

**Surge**

(Up to 10 kV / 5 kA) (Combination Wave and Ring Wave)

**On the following products and materials:**

Telecommunications Terminal Equipment (TTE), Radio Equipment, Network Equipment, Information Technology Equipment (ITE), Automotive Electronic Equipment, Automotive Hybrid Electronic Devices, Maritime Navigation and Radio Communication Equipment and Systems, Vehicles, Boats and Internal Combustion Engine Driven Devices, Automotive, Aviation, and General Lighting Products, Medical Electrical Equipment, Motors, Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment, Household Appliances, Electric Tools, Low-voltage Switchgear and Control gear, Programmable Controllers, Electrical Equipment for Measurement, Control and Laboratory Use, Base Materials, Power and Data Transmission Cables and Connectors

<sup>1</sup> When the date, edition, version, etc. is not identified in the scope of accreditation, laboratories may use the version that immediately precedes the current version for a period of one year from the date of publication of the standard measurement method, per part C., Section 1 of A2LA R101 - General Requirements - Accreditation of ISO-IEC 17025 Laboratories.

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1<sup>2</sup>

<b>Rule Subpart/Technology</b>	<b>Test Method</b>	<b>Maximum Frequency (MHz)</b>
<b><u>Unintentional Radiators</u></b> Part 15B	ANSI C63.4:2014	40000
<b><u>Industrial, Scientific, and Medical Equipment</u></b> Part 18	FCC MP-5 (February 1986)	40000
<b><u>Intentional Radiators</u></b> Part 15C	ANSI C63.10:2013	40000



Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1<sup>2</sup>

<b>Rule Subpart/Technology</b>	<b>Test Method</b>	<b>Maximum Frequency (MHz)</b>
<u>Unlicensed Personal Communication Systems Devices</u> Part 15D	ANSI C63.17:2013	40000
<u>U-NII without DFS Intentional Radiators</u> Part 15E	ANSI C63.10:2013	40000
<u>U-NII with DFS Intentional Radiators</u> Part 15E	FCC KDB 905462 D02 (v02)	40000
<u>UWB Intentional Radiators</u> Part 15F	ANSI C63.10:2013	40000
<u>BPL Intentional Radiators</u> Part 15G	ANSI C63.10:2013	40000
<u>White Space Device Intentional Radiators</u> Part 15H	ANSI C63.10:2013	40000
<u>Commercial Mobile Services (FCC Licensed Radio Service Equipment)</u> Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>General Mobile Radio Services (FCC Licensed Radio Service Equipment)</u> Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97, and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment)</u> Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Maritime and Aviation Radio Services</u> Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	40000
<u>Microwave and Millimeter Bands Radio Services</u> Parts 25, 30, 74, 90 (above 3 GHz), 97 (above 3 GHz), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000

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Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1<sup>2</sup>

<b>Rule Subpart/Technology</b>	<b>Test Method</b>	<b>Maximum Frequency (MHz)</b>
<u>Broadcast Radio Services</u> Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Signal Boosters</u> Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters) Section 90.219	ANSI C63.26:2015	40000

<sup>2</sup> Accreditation does not imply acceptance to the FCC equipment authorization program. Please see the FCC website (<https://apps.fcc.gov/oetcf/eas/>) for a listing of FCC approved laboratories.





## Accredited Laboratory

A2LA has accredited

### ELITE ELECTRONIC ENGINEERING INC.

Downers Grove, IL

for technical competence in the field of

### Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 15<sup>th</sup> day of August 2023.



Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 1786.01  
Valid to June 30, 2025

*For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.*