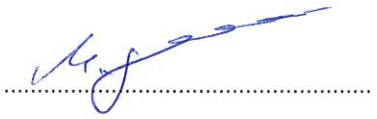
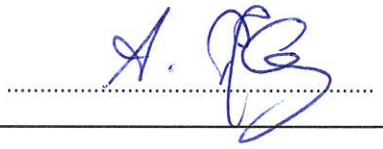
EMC TEST REPORT

FCC 47 CFR Part 15B, ISED ICES-003 Issue 7

Report Reference No	G0M-2103-9644-EF0115B-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	A2LA - Registration number: 1983.01 (ISED) ISED wireless device testing laboratory: CN 3470A FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	IAV Automotive Engineering Inc.
Address	15620 Technology Drive Michigan 48168 Northville United States
Test Specification Standard(s)	Title 47 CFR Part 15 Subpart B ISED ICES-003 Issue 7 ANSI C63.4:2014+A1:2017
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	ECU Automotive Telemetry Reader
Model(s)	TDBOX2 LTE
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	032
Software Version(s)	0305
FCC-ID	2AS2J-G00057-02
IC	24891-G0005702
Test Result	**PASSED**

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
required by standard but not appl. to test object	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Date of receipt of test item	2021-06-03	
Report:		
Compiled by	Manuel Engel	
Tested by (+ signature) (Responsible for Test)	Manuel Engel	
Approved by (+ signature) (Test Lab Engineer))	Andreas Pflug	
Date of Issue	2021-08-06	
Total number of pages	48	
General Remarks:		
The test results presented in this report relate only to the object tested. **The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.** This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		
Final label of the device was not fixed during testing.		

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
T_{NOM}	Nominal operating temperature
V_{NOM}	Nominal supply voltage

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2021-08-06	Initial Release	

REPORT INDEX

1 Equipment (Test Item) Under Test

Description	ECU Automotive Telemetry Reader	
Model	TDBOX2 LTE	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	AAB-W0228.06.2100400002	
Hardware Version(s)	032	
Software Version(s)	0305	
EUT Dimensions [cm]	11 x 16 x 5	
FCC-ID	2AS2J-G00057-02	
IC	24891-G0005702	
Class	Class B	
Equipment type	Table top	
Highest internal frequency [MHz]	2690	
Radio Module I	Type	Mobile Communication Module
	Model	EG25-G
	Manufacturer	Quectel
Radio Module II	Type	IEEE 802.11 b/g/n Module
	Model	ELLA-W131-A
	Manufacturer	u-blox
Radio Module III	Type	GNSS Module
	Model	MAX-M8Q
	Manufacturer	u-blox
Supply Voltage	V_{NOM}	13.8 VDC
AC/DC-Adaptor	None	
Manufacturer	IAV GmbH Carnotstraße 1 10587 Berlin GERMANY	

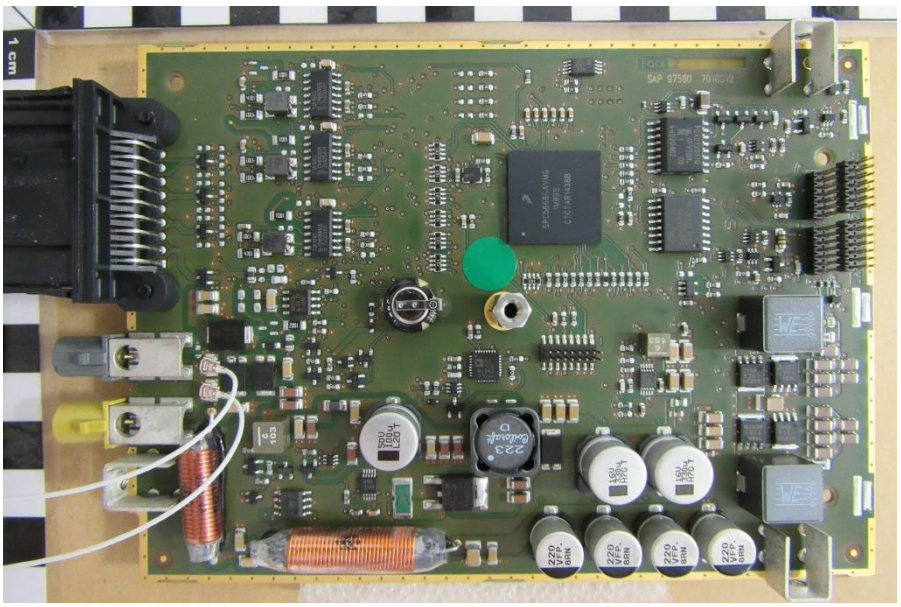
1.1 Equipment Ports

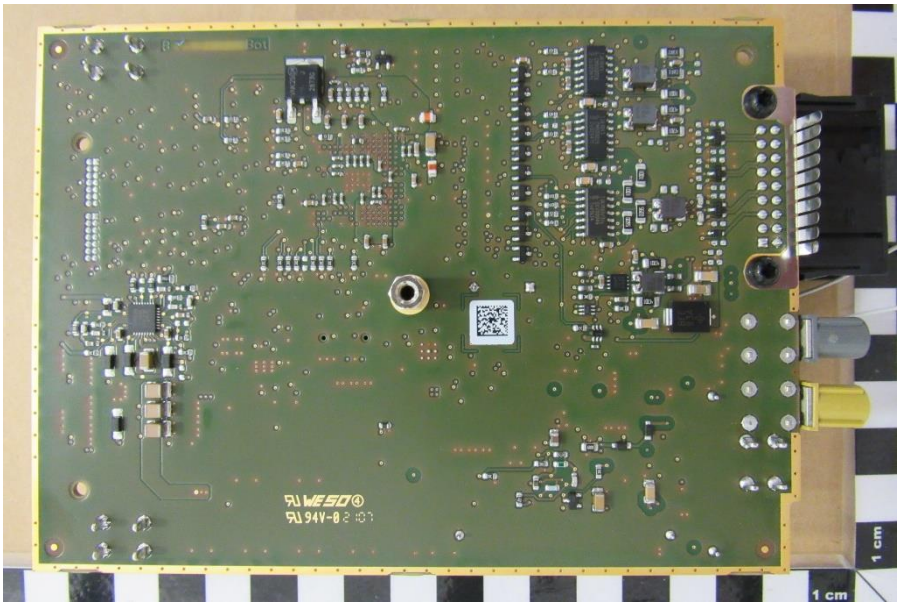
Name	Type	Attributes		Comment
CAN + Power supply	DC / IO	Count: Direction: Max. cable length [m]: Shielded: Service only:	1 In <5 No No	MQS socket for power supply and 7xCAN
Ethernet	WNP	Count: Direction: Max. cable length [m]: Shielded: Service only:	1 IO <3 Yes Yes	HSD socket for Ethernet A→B Dacar (R) 535 / 12191079 -shield connected to DUT and chamber ground plane
GNSS	IO	Count: Direction: Max. cable length [m]: Shielded: Service only:	1 IO 2.17 Yes No	Fakra antenna socket for GNSS -both side shield connected
WLAN	IO	Count: Direction: Max. cable length [m]: Shielded: Service only:	1 IO 1.84 Yes No	Fakra antenna socket for WLAN -both side shield connected
Mobile radio	IO	Count: Direction: Max. cable length [m]: Shielded: Service only:	1 IO 2.18 Yes No	Fakra antenna socket for mobile radio (Main) -both side shield connected
Mobile radio	IO	Count: Direction: Max. cable length [m]: Shielded: Service only:	1 IO 2.18 Yes No	Fakra antenna socket for mobile radio (RX-Diversity) -both side shield connected
GND	NE	Count: Direction: Max. cable length [m]: Shielded: Service only:	1 direct 0 No No	Direct to vehicle ground Connected during test direct to chamber ground plane with 1 m cable

Description:	
AC	AC mains power input/output port
DC	DC power input/output port
IO	Input/Output port
WNP	Wired network port
NE	Non-electrical port

1.2 Equipment Photos - Internal

EUT without cover


PCB 1 top


PCB 1 bottom


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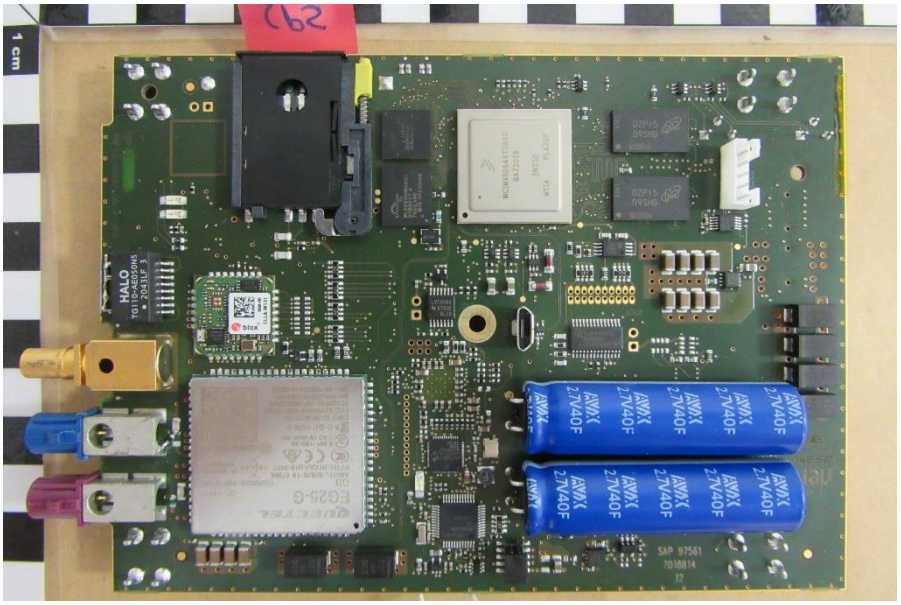

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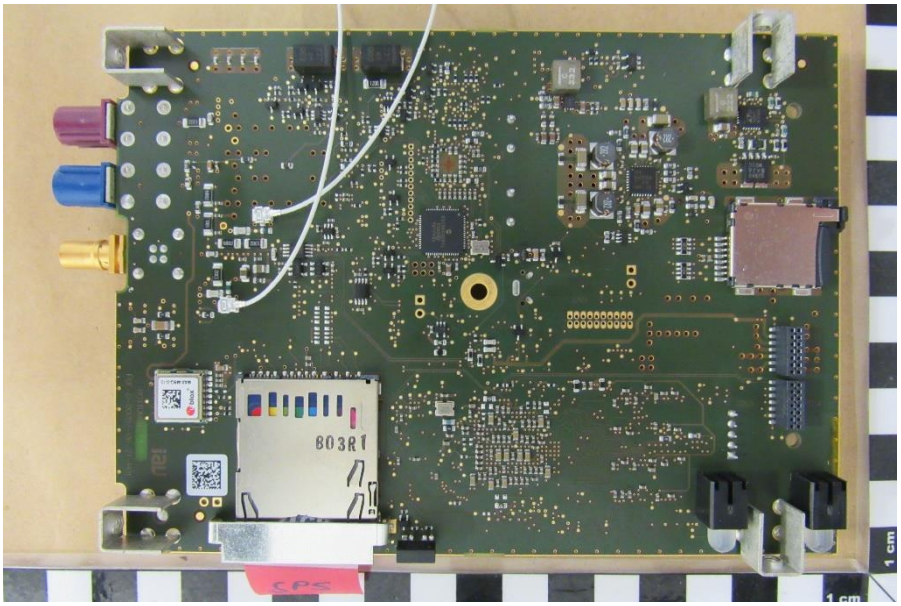
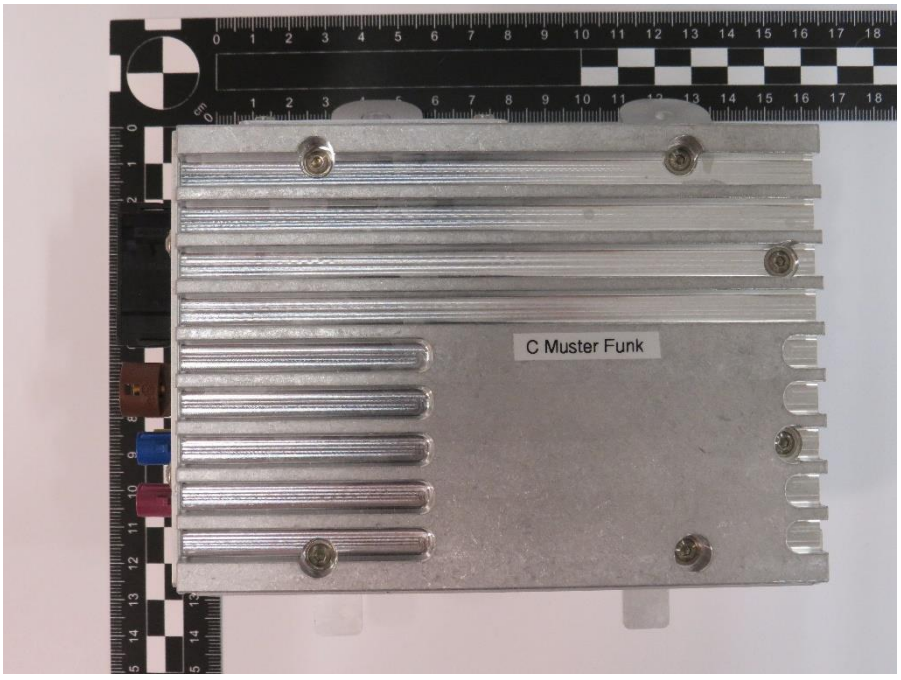
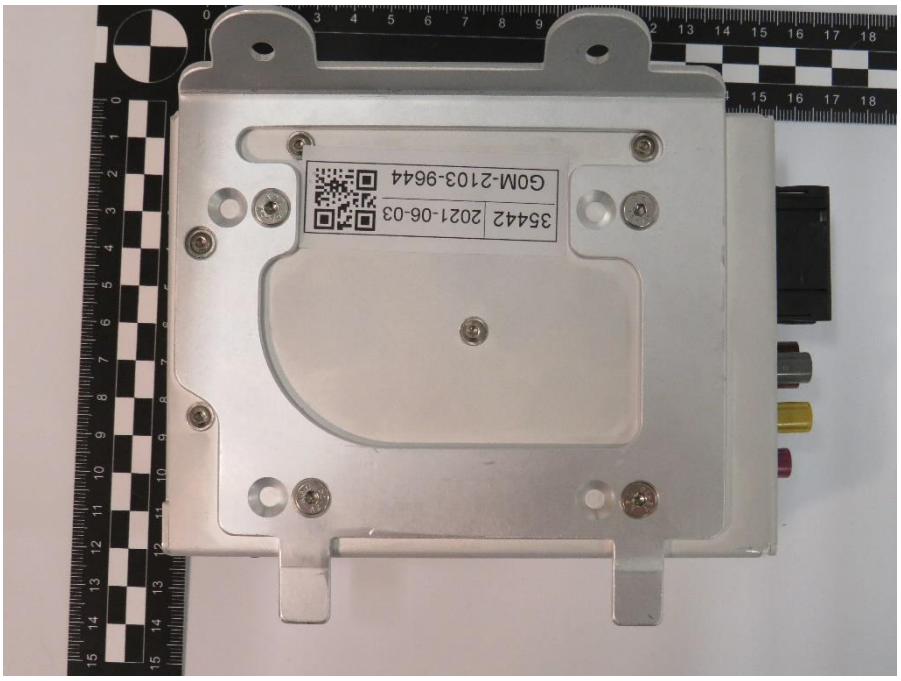
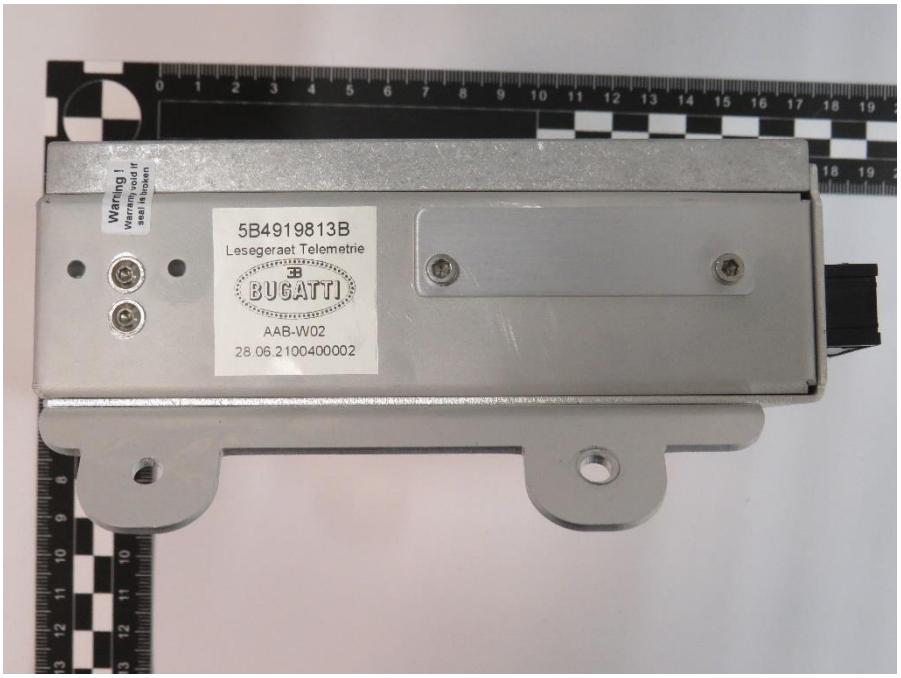


1.3 Equipment Photos - External

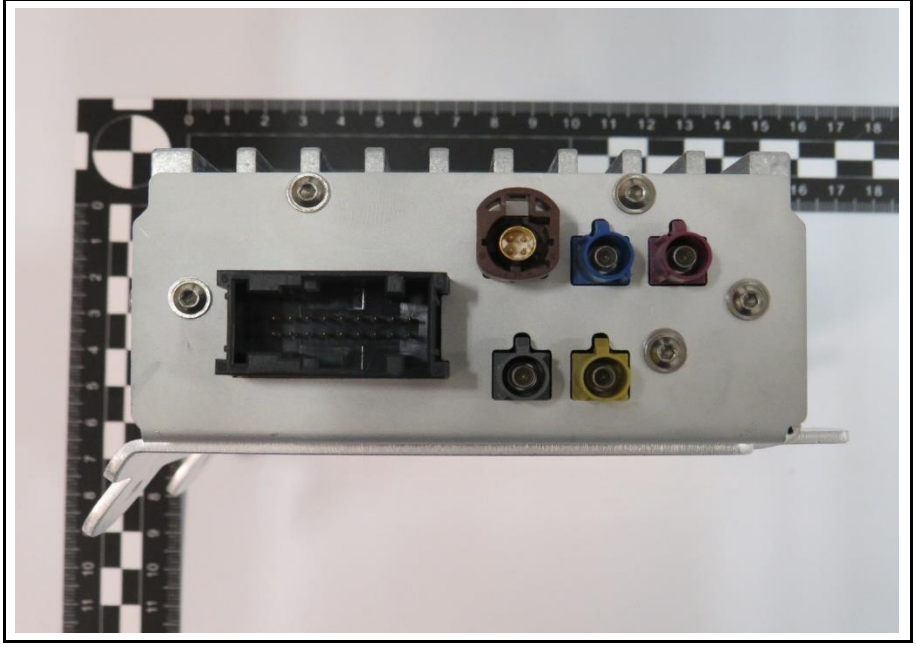
EUT top


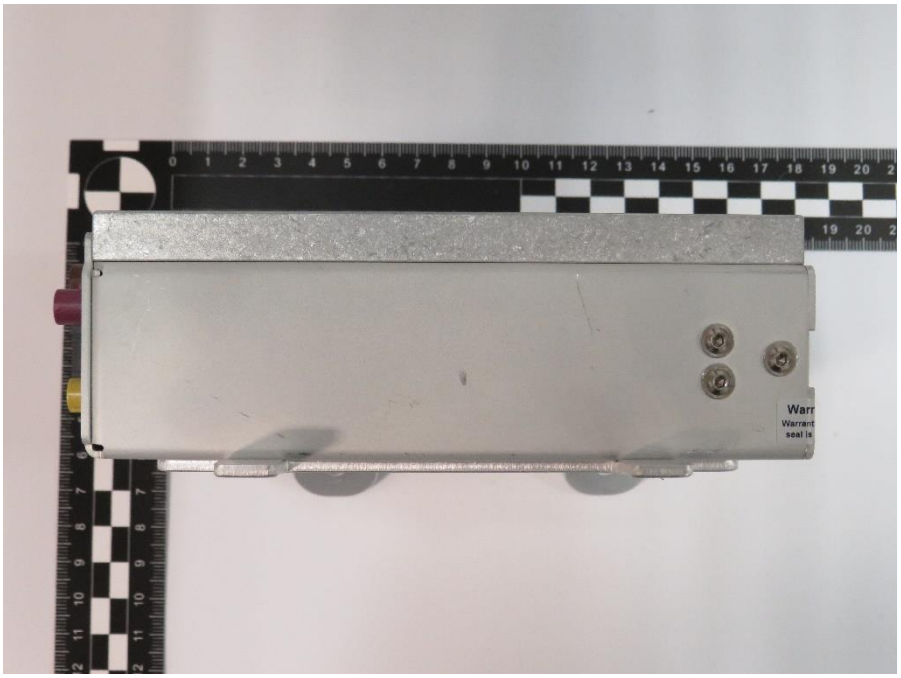
EUT bottom


EUT left

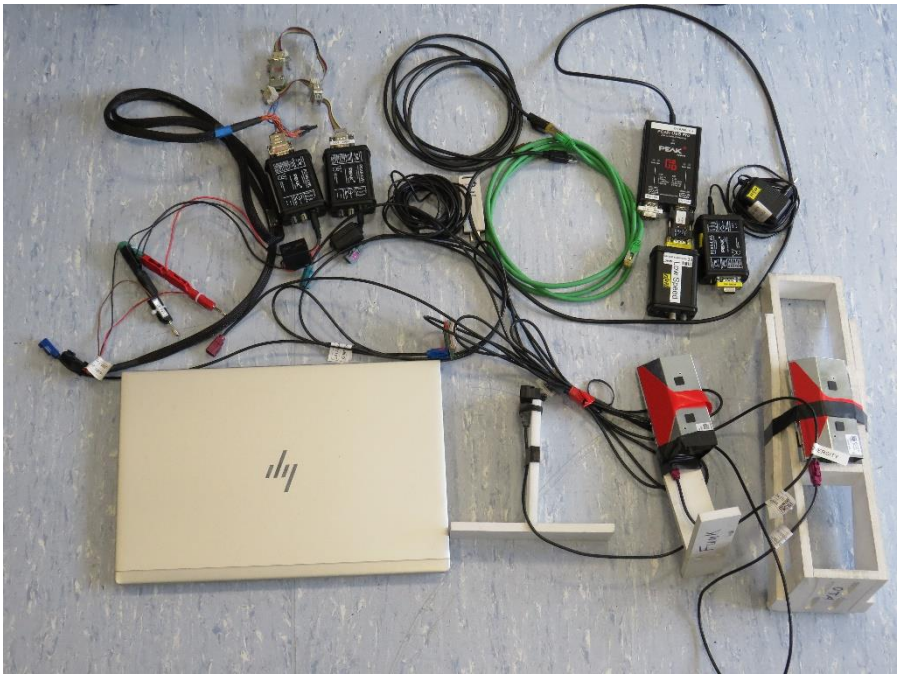


EUT front



EUT right


EUT back


Auxiliary equipment


1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Laptop	HP	Elitebook	Customer Equipment
AE	USB WLAN Adaptor	Tp link	AC600	Customer Equipment
AE	CAN LWL adaptor	PEAK Systems	PCAN-LWL	Customer Equipment
AE	CAN USB adaptor	PEAK Systems	PCAN USB Pro	Customer Equipment
AE	Antennas LTE	Bugatti: Laird: Molex:	5B4.035.500.A 6 58 01 6 58 01	Customer Equipment
AE	Antenna WLAN	Bugatti: Molex:	5B4.035.510 CMS: 9 58 02	Customer Equipment
AE	Antenna GNSS	Bugatti: Continental:	8S7.035.503.B 52510720	Customer Equipment
SIM	Radio Communication Tester	R&S	CMW 290	EF 01367
MON	Software application	-	UDP Text Logger	Customer Support Equipment
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
MON	Monitoring Equipment			
CBL	Connecting Cable			
Comment:				

1.5 Operational Modes

Mode #	Description
1	For the EMC tests a special test application is used, which continuously controls the internal and external interfaces of the EUT. Mobile communication connection to Radio Communication Tester. GSM 850; GPRS 1slots; Gamma: 3; Ch.: 188 2.4 GHz WLAN communication to laptop. GNSS receive local position.
2	For the EMC tests a special test application is used, which continuously controls the internal and external interfaces of the EUT. Mobile communication connection to Radio Communication Tester. UMTS FDD II TPC: All 1, Ch.: 9262/9662 2.4 GHz WLAN communication to laptop. GNSS receive local position.
3	For the EMC tests a special test application is used, which continuously controls the internal and external interfaces of the EUT. Mobile communication connection to Radio Communication Tester. LTE FDD 7; TPC: Max power; Ch.: 21100/3100 2.4 GHz WLAN communication to laptop. GNSS receive local position.
4	For the EMC tests a special test application is used, which continuously controls the internal and external interfaces of the EUT. Mobile communication connection to Radio Communication Tester. Evaluation of Worst case band. 2.4 GHz WLAN communication to laptop. GNSS receive local position.
Comment: Addition information about mode 4 - The RF disturbance level was investigated with a spectrum analyzer in all supported frequency bands for the regional use in north American. The final measurement was performed in the worst case band, which is not one of the bands of the other operating modes. Mobile communication module supports: GSM 1900 disable by applicant Worst Case Research: UMTS: band I, II, IV, V, VIII, LTE: band 1, 2, 3, 4, 5, 7, 8, 12, 13, 18 19, 20, 25, 26, 28	

1.6 EUT Configuration

Configuration #	Description
1	EUT powered via laboratory power supply with nominal power. EUT fully wired assembled. GNSS antenna port connected with antenna GNSS and receive local position. Both mobile communication ports connected via antenna LTE to CMW 500. Two CAN are connected during the test. One CAN highspeed connection and one CAN low speed bus connection used during test. CAN connection via optical coupler for CAN data transmission to CAN USB adaptor outside the chamber. CAN USB adaptor connected with notebook. Ethernet connection to laptop with ping. Software application on Laptop shows port status of EUT. direct to chamber ground plane with 1 m cable
Comment: -	

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyser in dBµV. Any external preamplifiers used are taken into account through internal analyser settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyser. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyser (dBµV) + A.F. (dB/m) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading	:	Net reading - FCC limit	= Margin
+21.5 dBµV + 26 dB/m	= 47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15B, ISED ICES-003 Issue 7				
Reference	**Requirement**	**Reference Method**	**Result**	**Remarks**
Emission				
FCC 15.109 ICES-003, 3.2.2	Radiated emissions	ANSI C63.4:2014 +A1:2017	PASS	-
FCC 15.107 ICES-003, 3.2.1	AC power line conducted emissions	ANSI C63.4:2014 +A1:2017	N/R	-
Comment: -				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

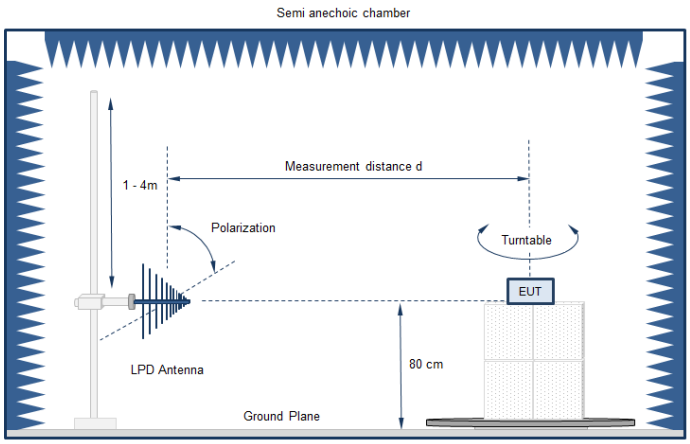
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

2.1.1 Information

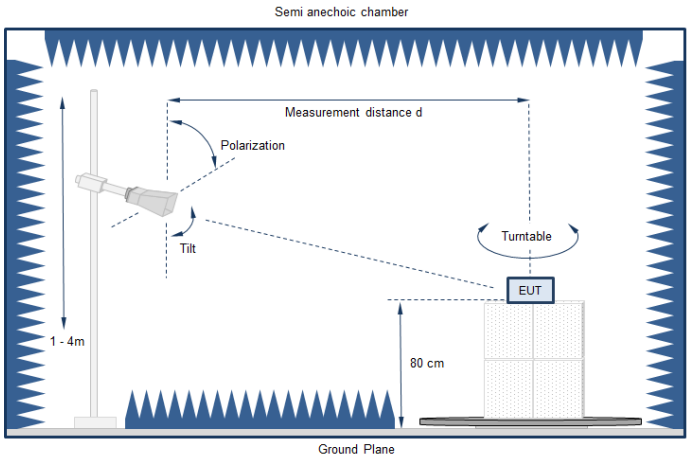
Test Information	
Reference	FCC 15.109, ICES-003, 3.2.2
Reference method	ANSI C63.4:2014+A1:2017 Section 8
Equipment class	Class B
Equipment type	Table top
Highest internal frequency [MHz]	2600
Measurement range	30 MHz to 13000 MHz
Temperature [°C]	22 - 24
Humidity [%]	46 - 52
Operator	Manuel Engel
Date	2021-07-22 and 2021-07-23

2.1.2 Setup

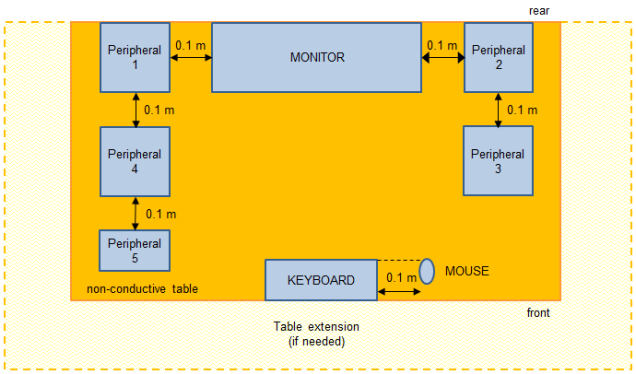
Measurement up to 1 GHz



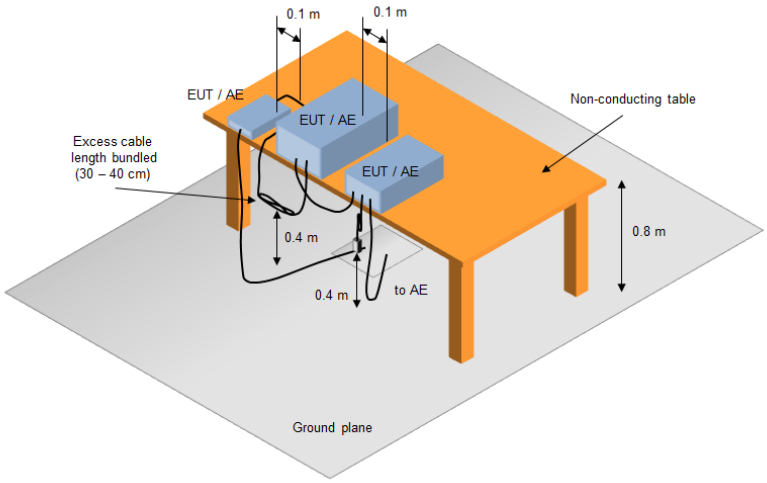
Measurement above 1 GHz



Equipment placement - Table top



Test Setup



2.1.3 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	Radimation	2020.1.8

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber	Frankonia	AC1	EF00062	2021-02	2024-02
Spectrum analyzer	Rohde & Schwarz GmbH & Co. KG	FSU43	EF01631	2020-07	2021-07
EMI Test Receiver	Rohde & Schwarz Vertriebs GmbH	ESR7	EF00943	2020-07	2021-07
Biconical Antenna	R&S	HK 116	EF00030	2021-05	2024-05
LPD Antenna	R&S	HL 223	EF00187	2019-05	2022-05
Horn Antenna	Schwarzbeck	BBHA9120D	EF00018	2019-10	2022-10
Ultra Stable Notch Filter (GSM850)	Wainwright Instruments GmbH	WRCA 947.4-0.2-2SS	EF00410	2020-06	2021-06
Climatic Sensor	Embedded Data Systems, LLC.	2800100000254 17E	EF01054	2021-03	2022-03

2.1.4 Procedure

Exploratory measurement
1. The EUT was placed on a non-conductive table at a height of 0.8m. 2. The EUT and support equipment, if needed, were set up to simulate typical usage. 3. Cables, of type and length specified by the manufacturer, were connected to at least one port of each type and were terminated by a device or simulating load of actual usage. 4. The antenna was placed at a distance of 3 or 10 m. 5. The received signal was monitored at the measurement receiver. 6. This procedure has to be performed in both antenna polarizations, horizontal and vertical. 7. The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 8.3.1

Final measurement
1. The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver. 2. A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast. 3. The EUT and cable arrangement were based on the exploratory measurement results. 4. Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded. 5. The test data of the worst-case conditions were recorded and shown on the next pages.

2.1.5 Limits

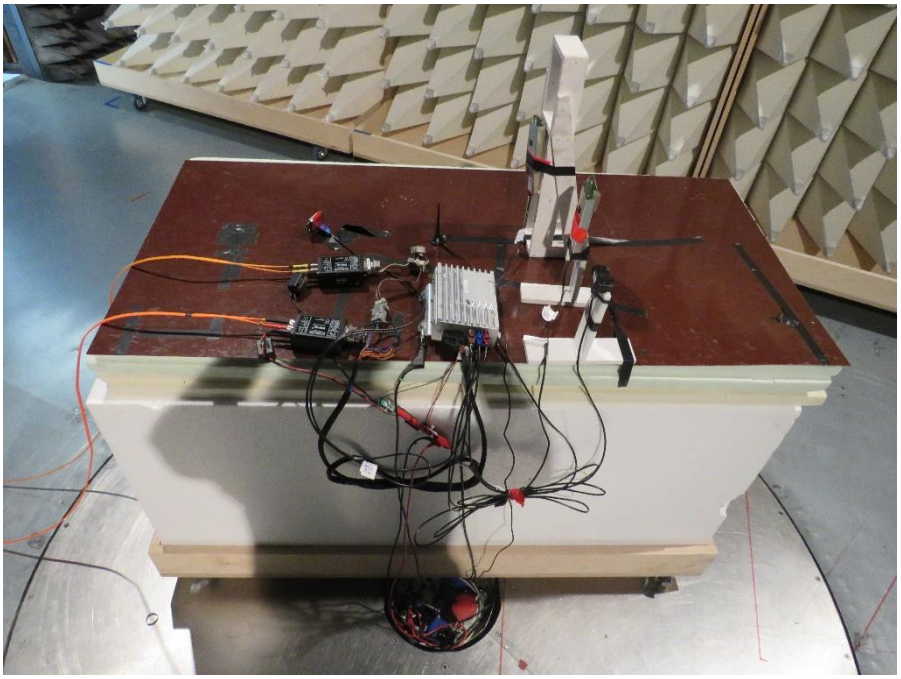
Class B @ 3 m		
Frequency [MHz]	Detector	Limit [dBµV/m]
30 - 88	Quasi-peak	40
88 - 216	Quasi-peak	43.5
216 - 960	Quasi-peak	46
960 - 1000	Quasi-peak	54
> 1000	Peak Average	74 54

2.1.6 Results

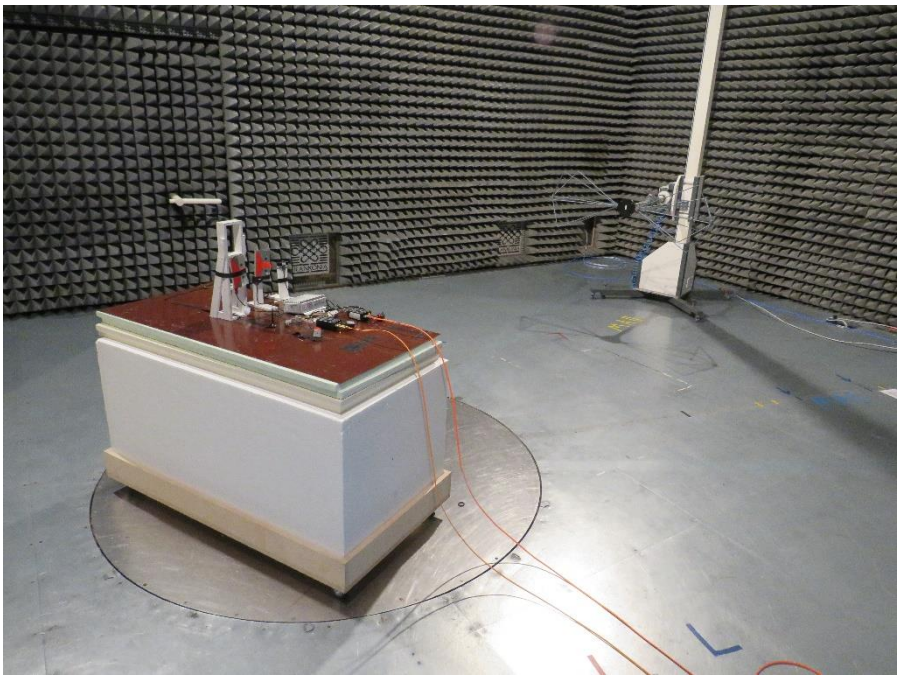
Test Results			
Operational mode	EUT Configuration	Verdict	Remark
1	1	PASS	-
2	1	PASS	-
3	1	PASS	-
4	1	PASS	-

2.1.7 Setup Photos

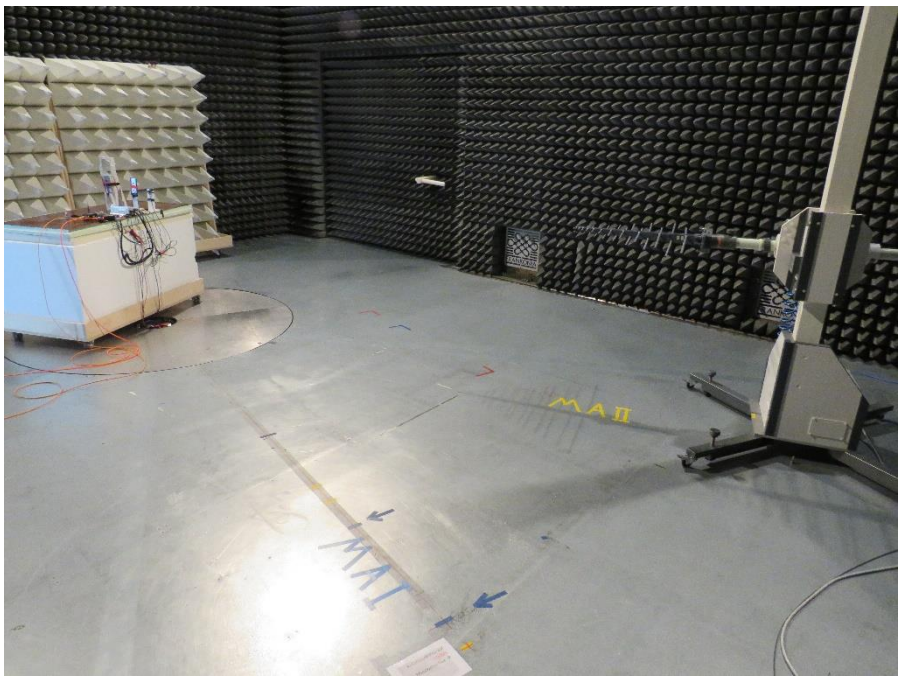
Arrangement EUT



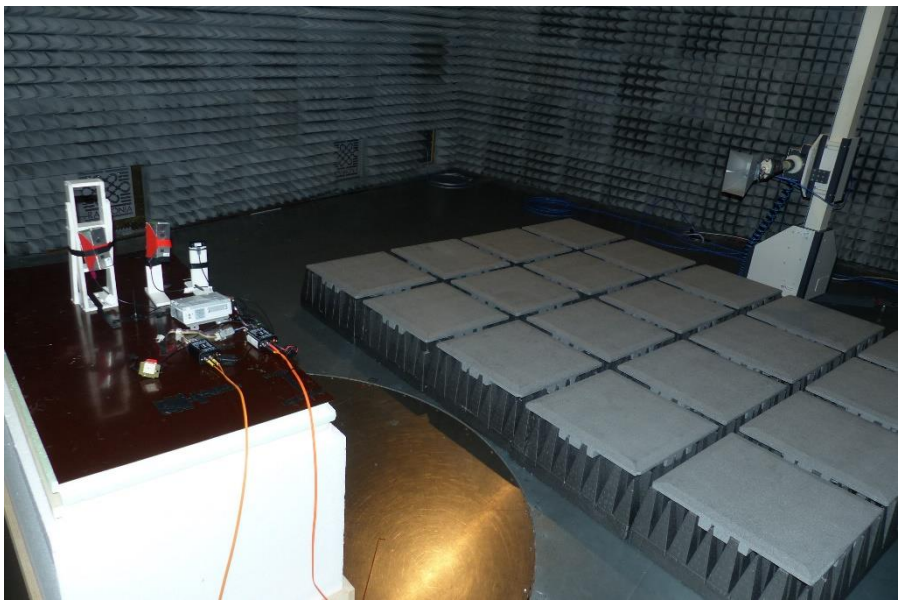
Test setup with antenna HK 116 0° Position



Test setup with antenna HL 223 0° Position



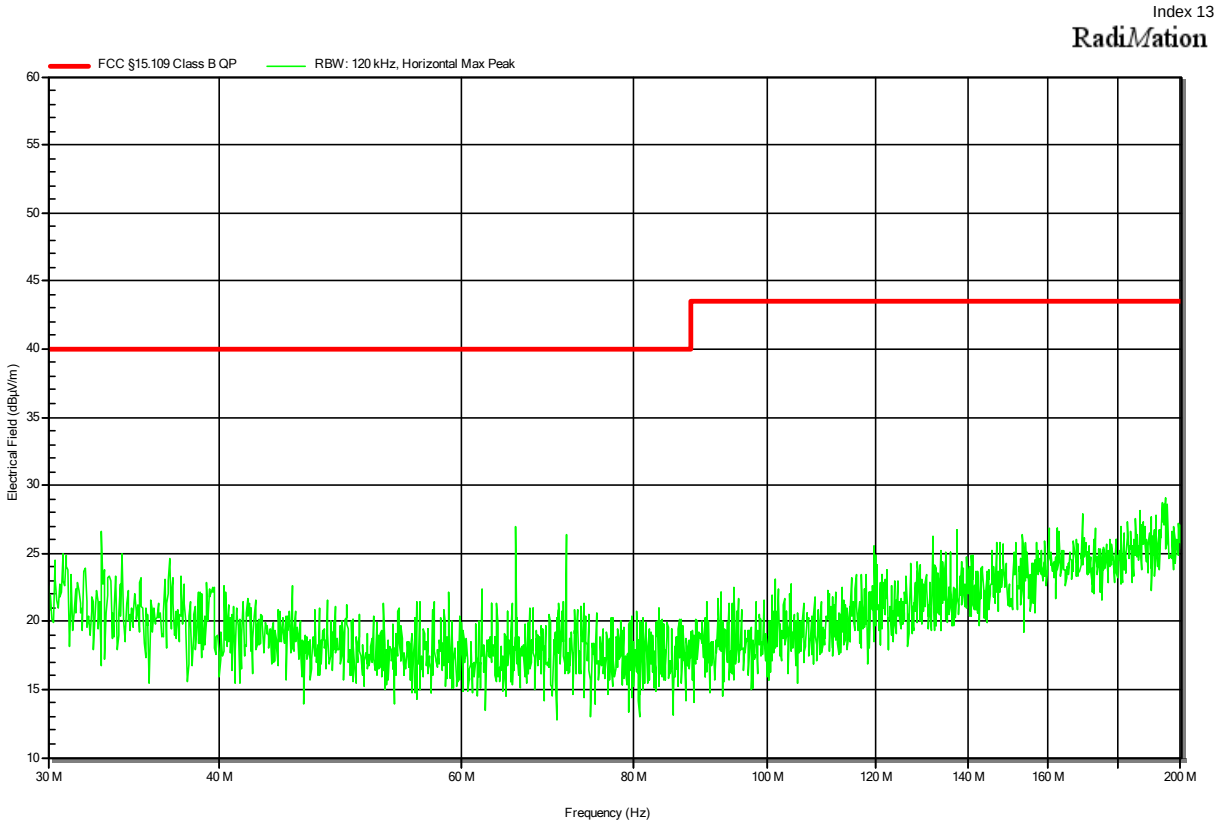
Test setup with antenna BBHA9120D 0° Position



2.1.8 Records

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	Height 1 m, angle 180°



Radiated emissions
according to FCC part 15B, ICES-003

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Test Date:	2021-07-23
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Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1

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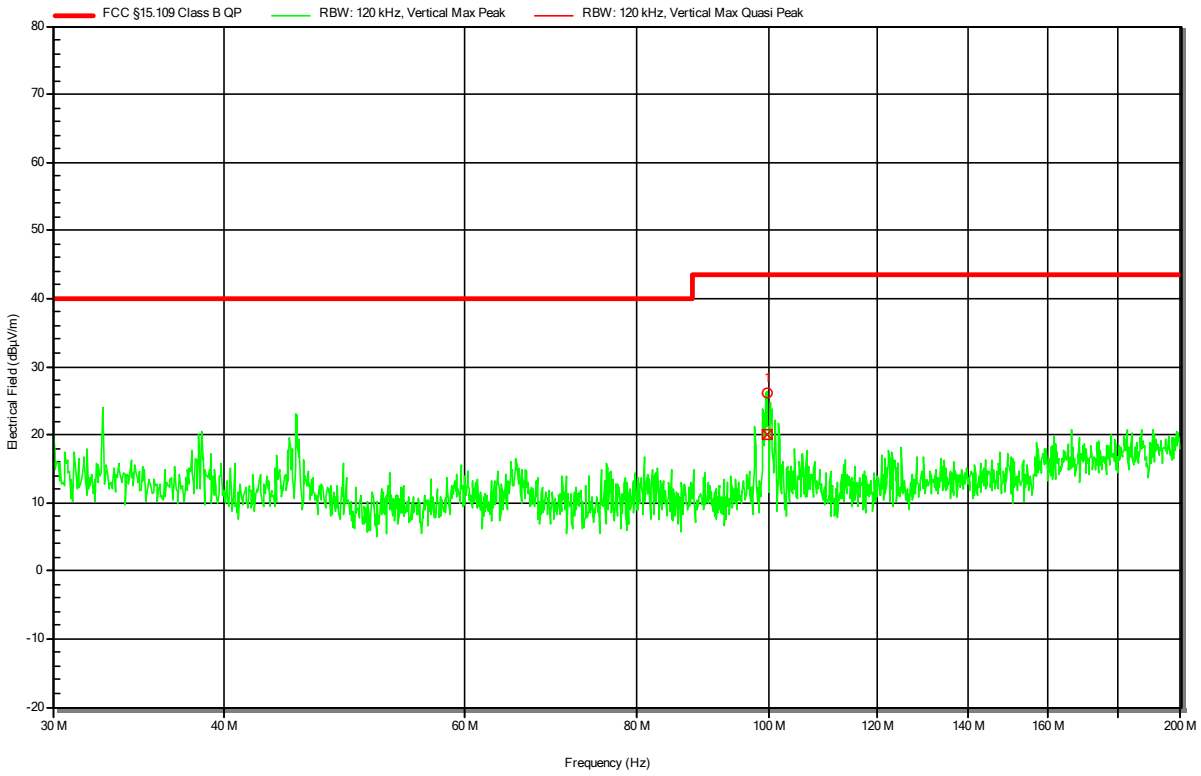
RadiMation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	99.656 MHz	19.96 dBµV/m	43.52 dBµV/m	-23.56 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

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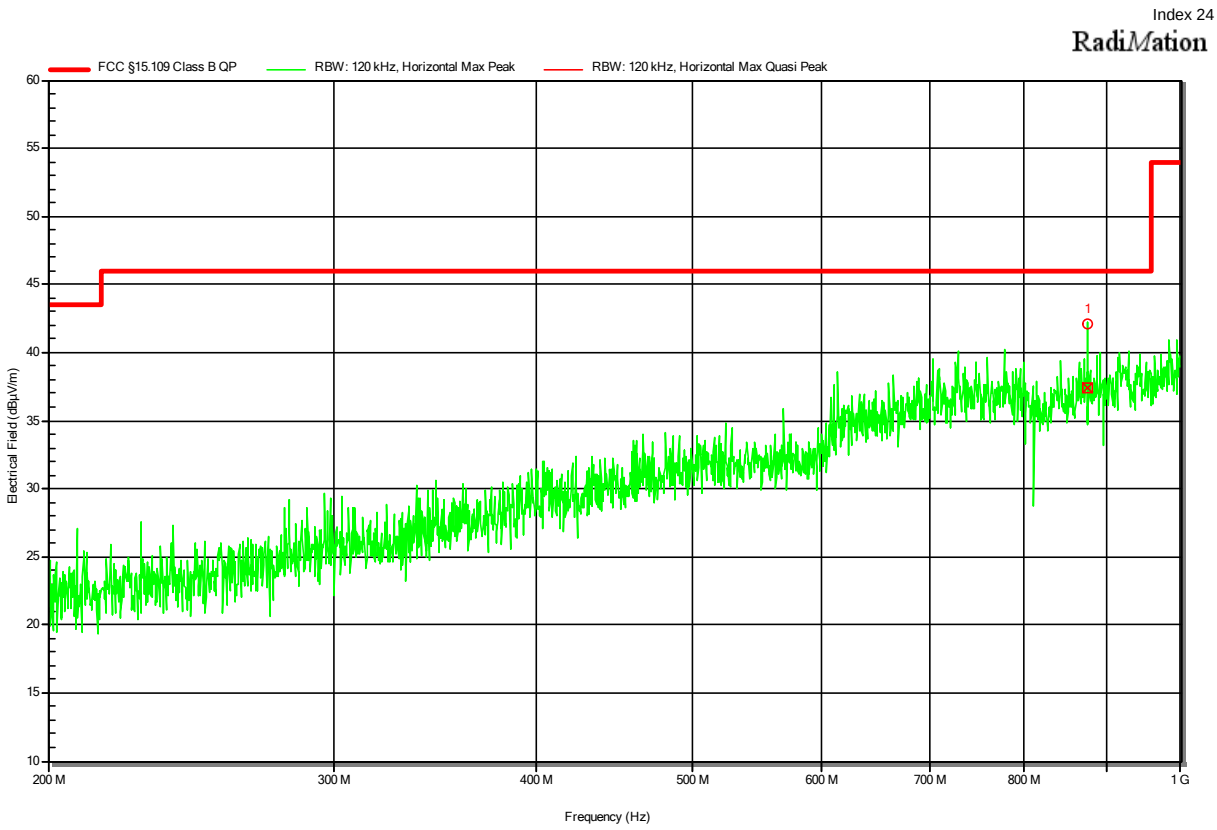
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	875.994 MHz	37.37 dBµV/m	46.02 dBµV/m	-8.65 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
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Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1

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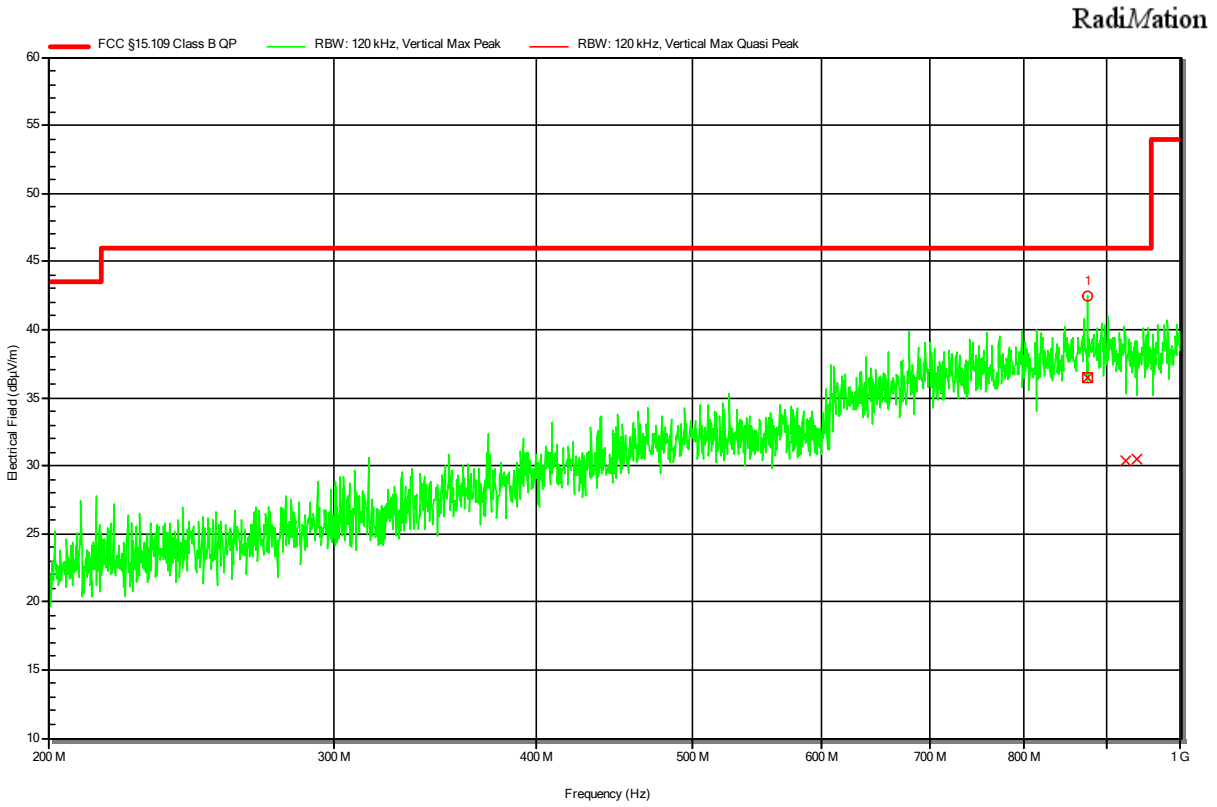
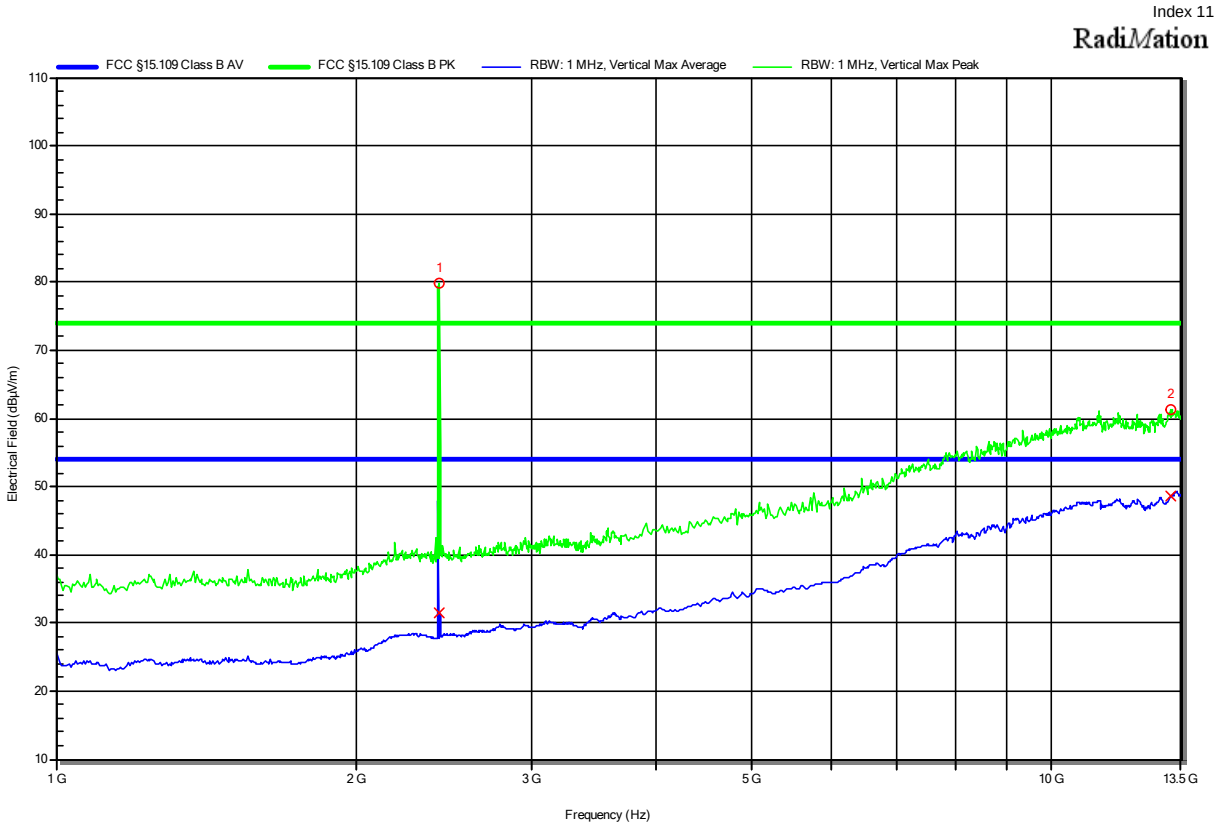


Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	875.978 MHz	36.46 dBµV/m	46.02 dBµV/m	-9.56 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1
Note 1:	

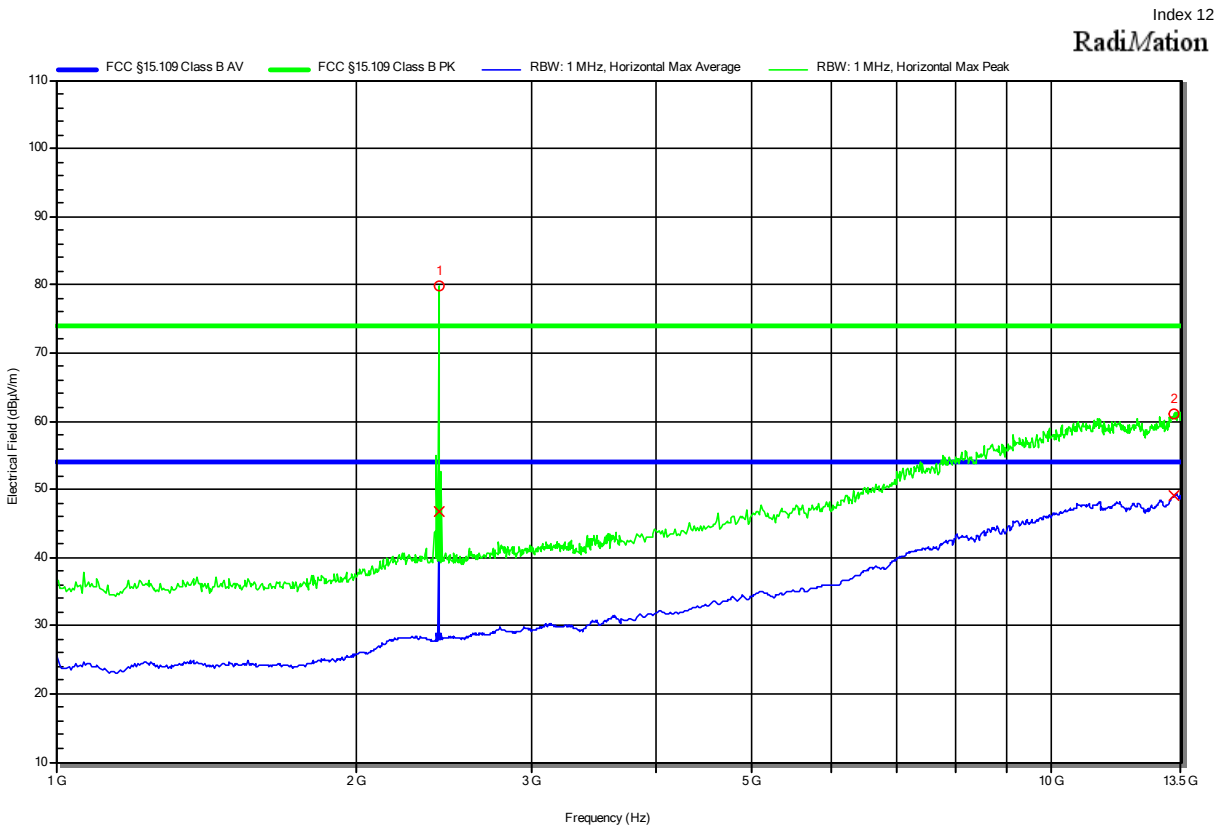


Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.428 GHz	79.74 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	13.202 GHz	61.2 dBµV/m	73.98 dBµV/m	-12.78 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	2.428 GHz	31.37 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	13.202 GHz	48.67 dBµV/m	53.98 dBµV/m	-5.31 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 1 Configuration 1



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.424 GHz	79.89 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	13.296 GHz	61.12 dBµV/m	73.98 dBµV/m	-12.86 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	2.424 GHz	46.68 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	13.296 GHz	49.14 dBµV/m	53.98 dBµV/m	-4.84 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 2 Configuration 1
Note 1:	Height 1 m, angle -180°

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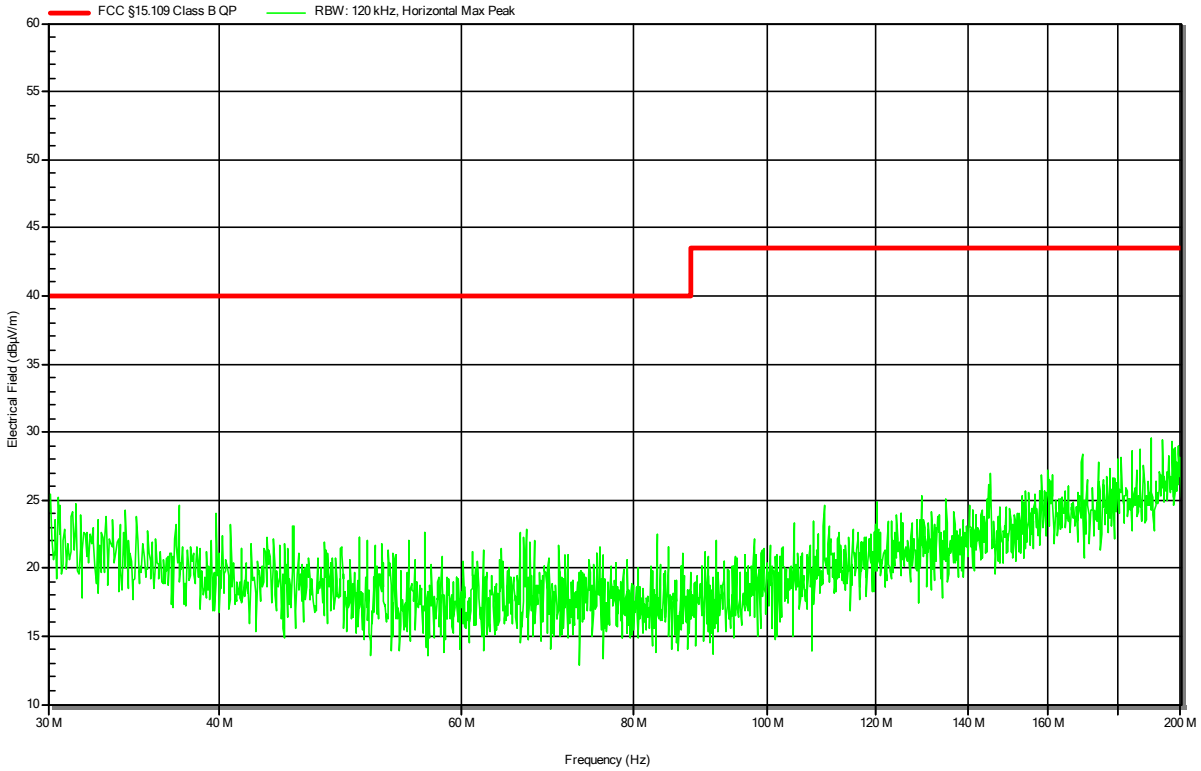

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 2 Configuration 1
Note 1:	Height 1 m, angle 0°

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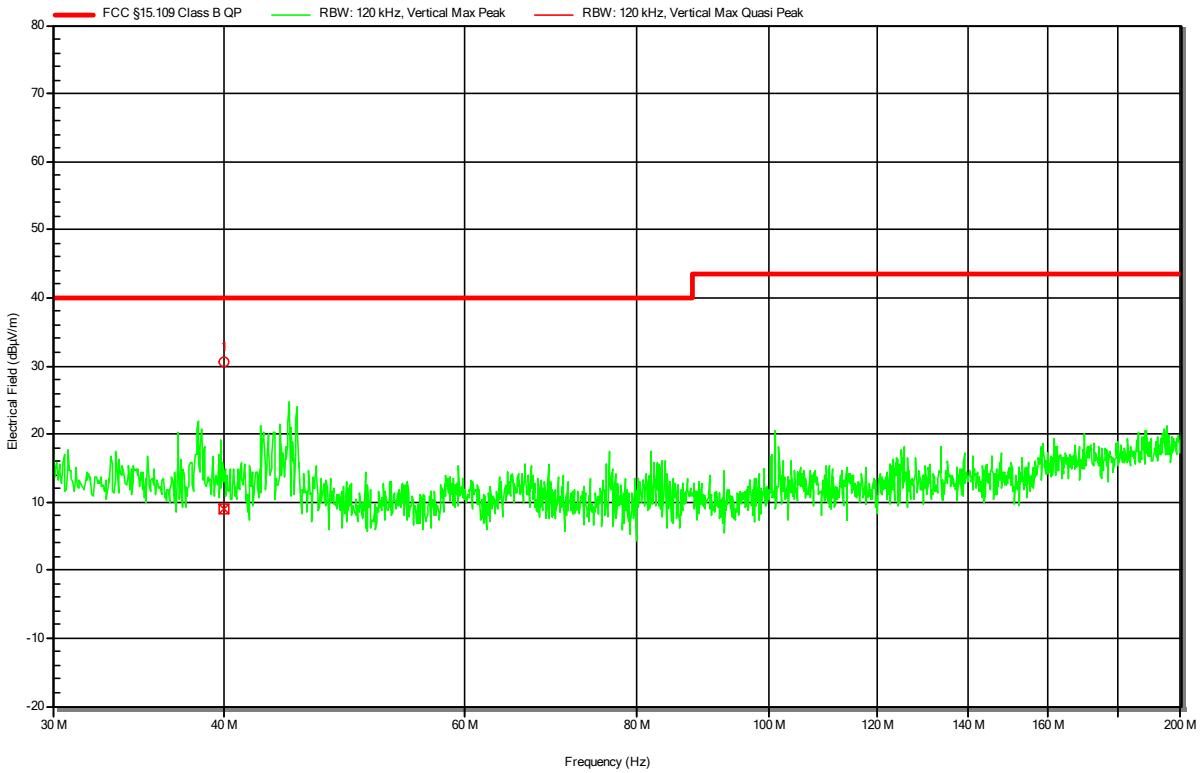
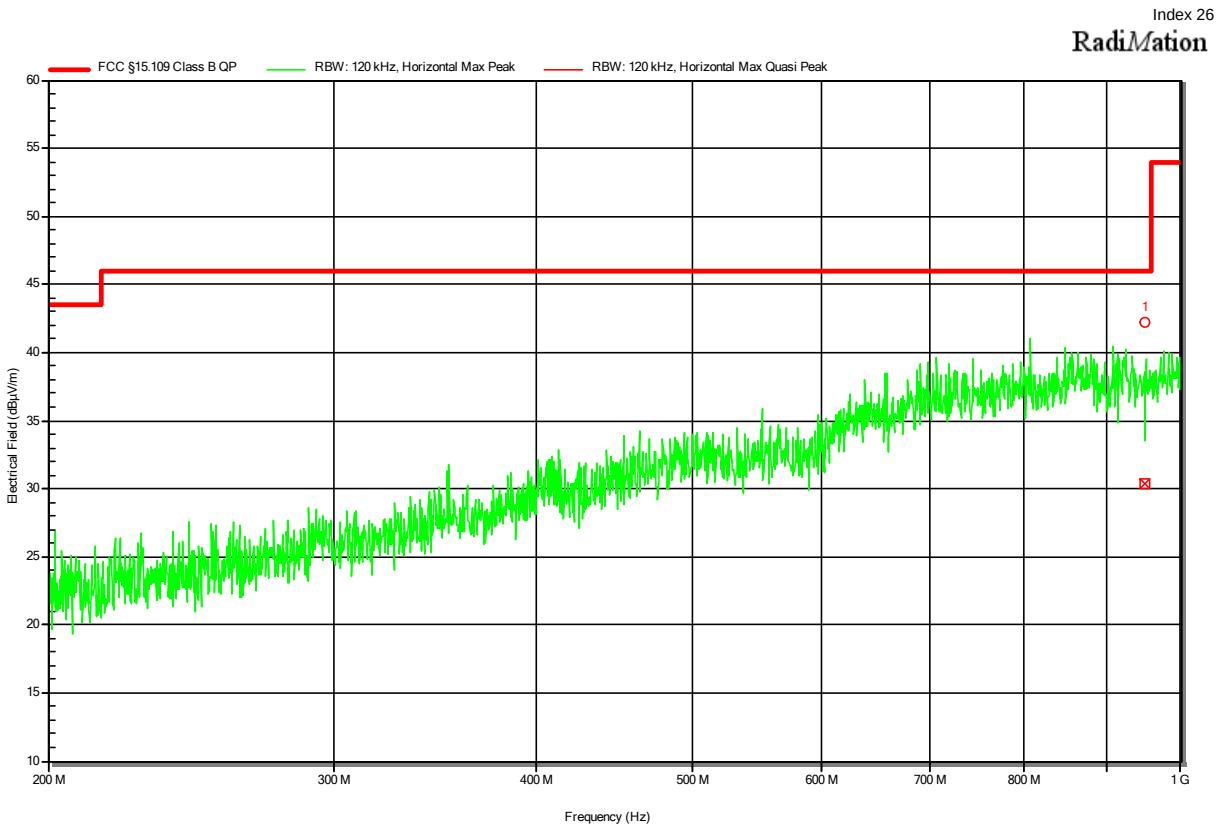
RadiMation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	39.968 MHz	9.09 dBµV/m	40 dBµV/m	-30.91 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 2 Configuration 1



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	950.706 MHz	30.32 dBµV/m	46.02 dBµV/m	-15.7 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 2 Configuration 1

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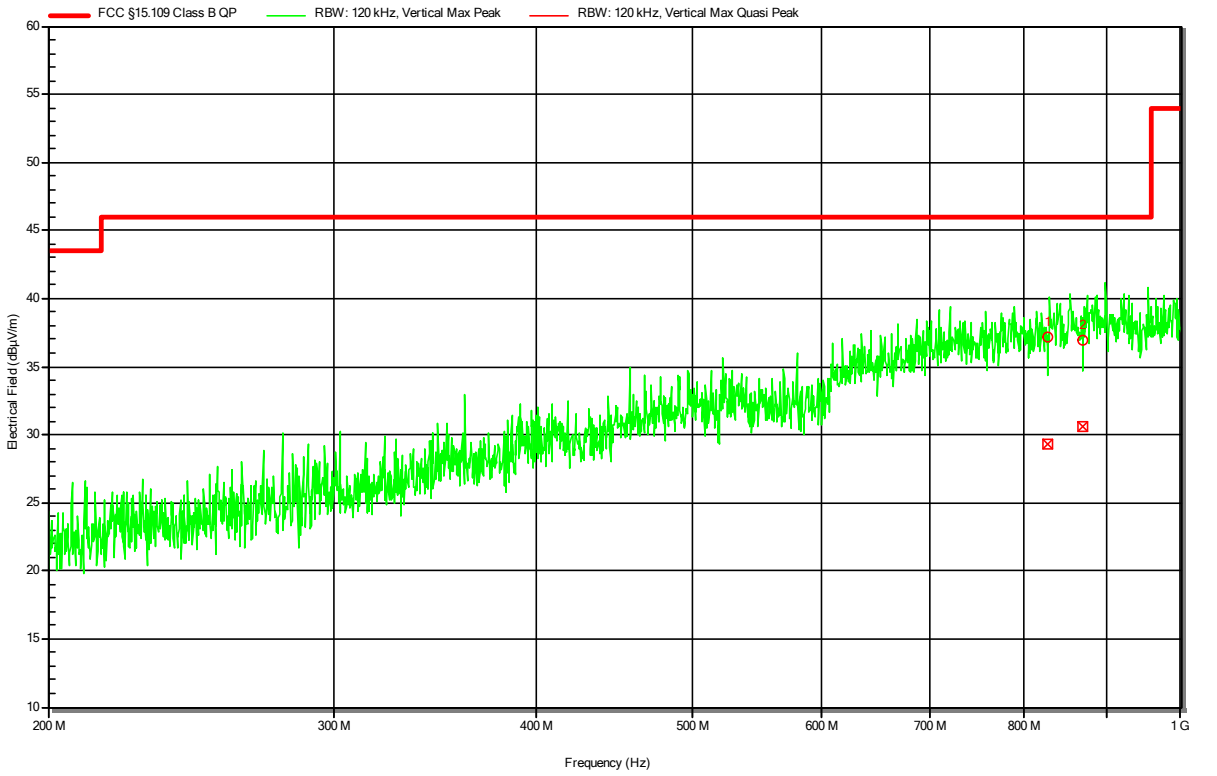
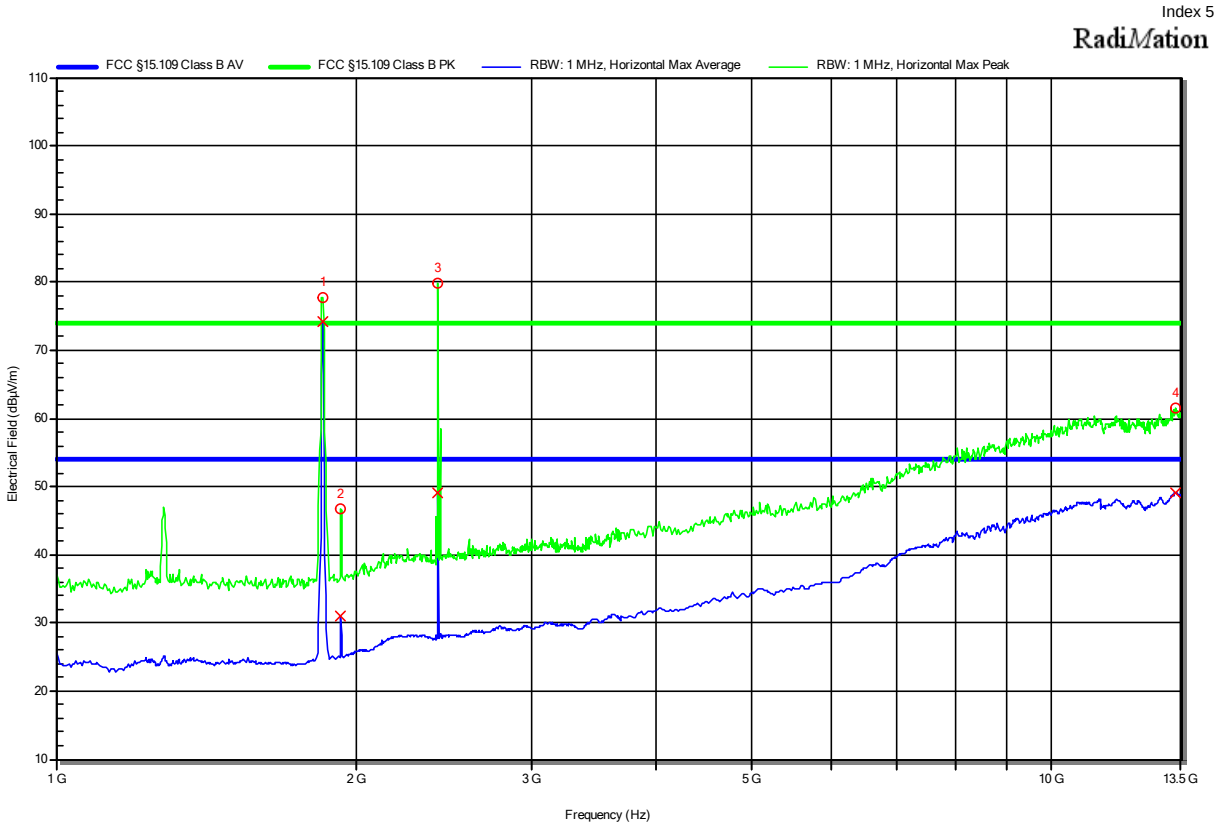


Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	827.301 MHz	29.32 dBµV/m	46.02 dBµV/m	-16.7 dB	Pass	0 degrees	1 m
2	869.901 MHz	30.57 dBµV/m	46.02 dBµV/m	-15.45 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 2 Configuration 1
Note 1:	Height 1 m, angle 0°

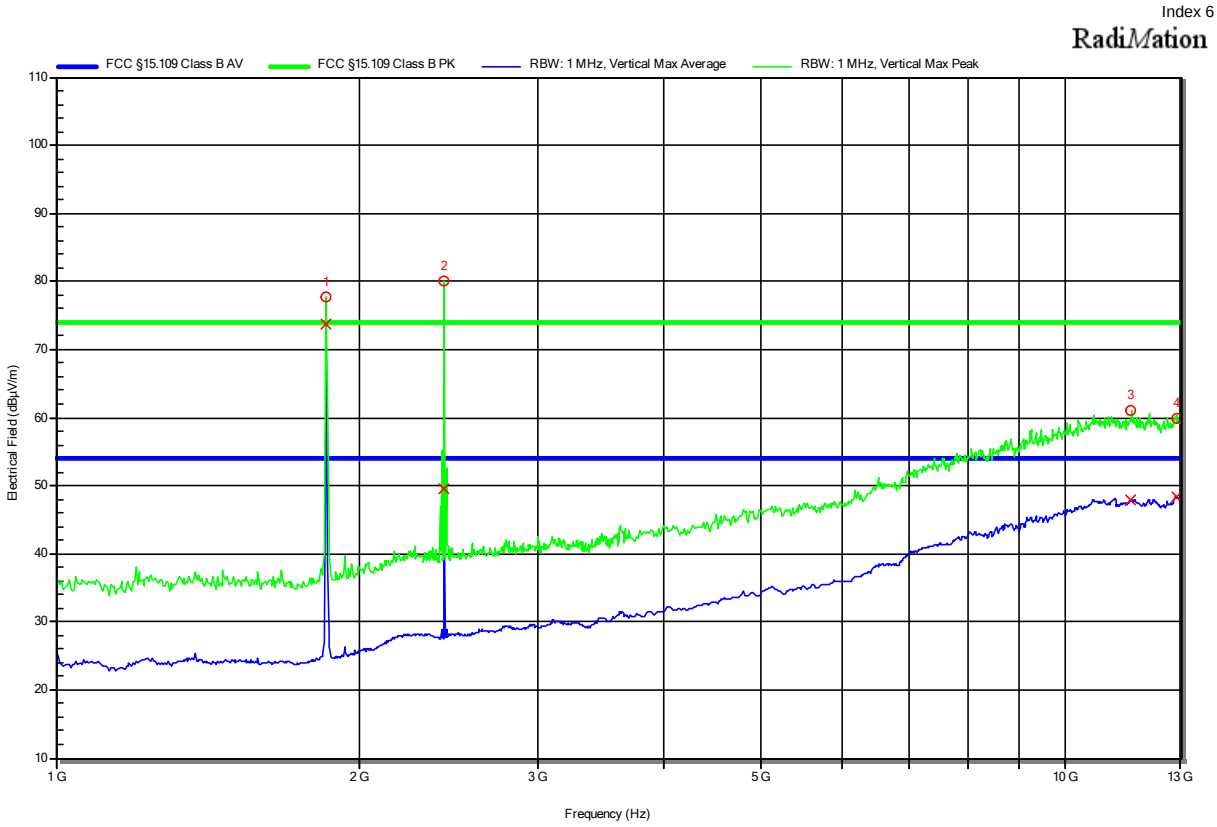


Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	1.852 GHz	77.78 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
2	1.93 GHz	46.84 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
3	2.419 GHz	79.82 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
4	13.327 GHz	61.48 dBµV/m	73.98 dBµV/m	-12.5 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.852 GHz	74.13 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
2	1.93 GHz	30.92 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
3	2.419 GHz	49.04 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
4	13.327 GHz	49.11 dBµV/m	53.98 dBµV/m	-4.87 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 2 Configuration 1

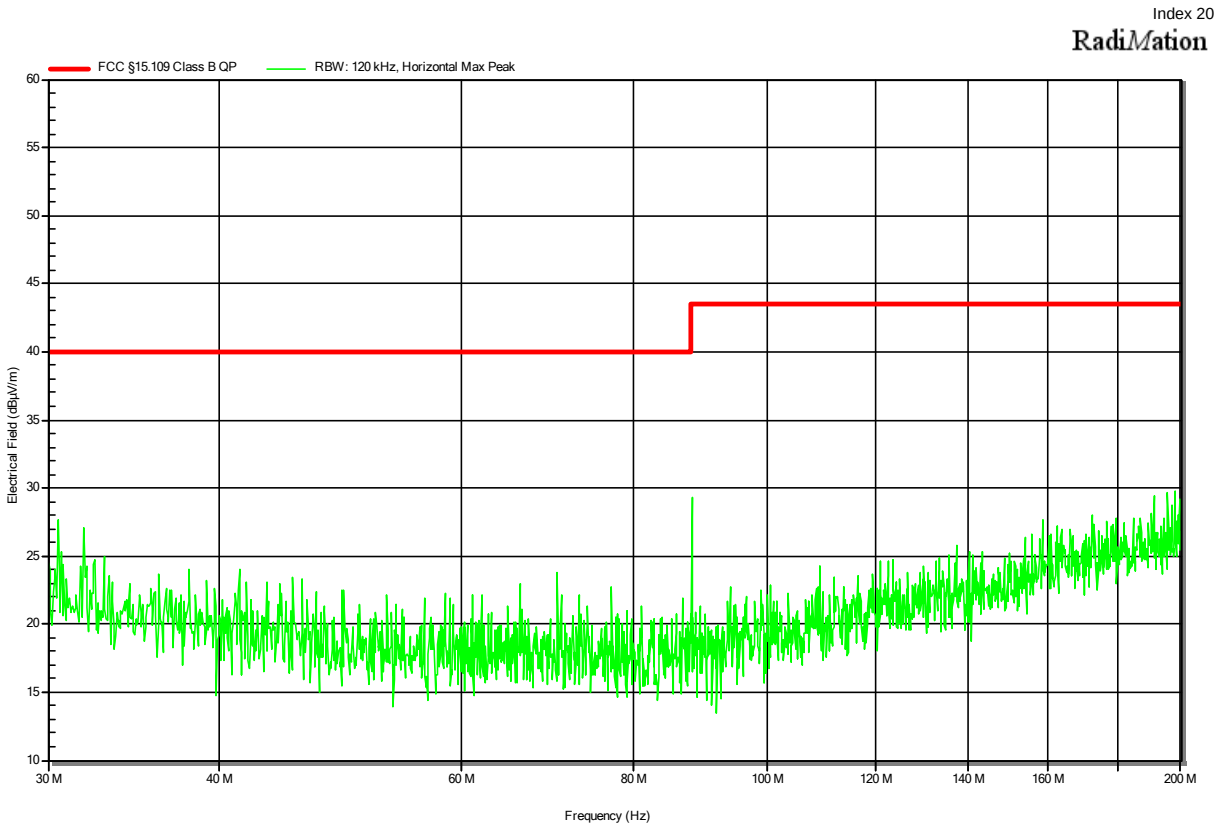


Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	1.852 GHz	77.83 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
2	2.424 GHz	79.98 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
3	11.614 GHz	61.02 dBµV/m	73.98 dBµV/m	-12.96 dB	Pass	0 degrees	1 m
4	12.881 GHz	59.92 dBµV/m	73.98 dBµV/m	-14.06 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.852 GHz	73.67 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
2	2.424 GHz	49.55 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
3	11.614 GHz	47.84 dBµV/m	53.98 dBµV/m	-6.14 dB	Pass	0 degrees	1 m
4	12.881 GHz	48.43 dBµV/m	53.98 dBµV/m	-5.55 dB	Pass	0 degrees	1 m

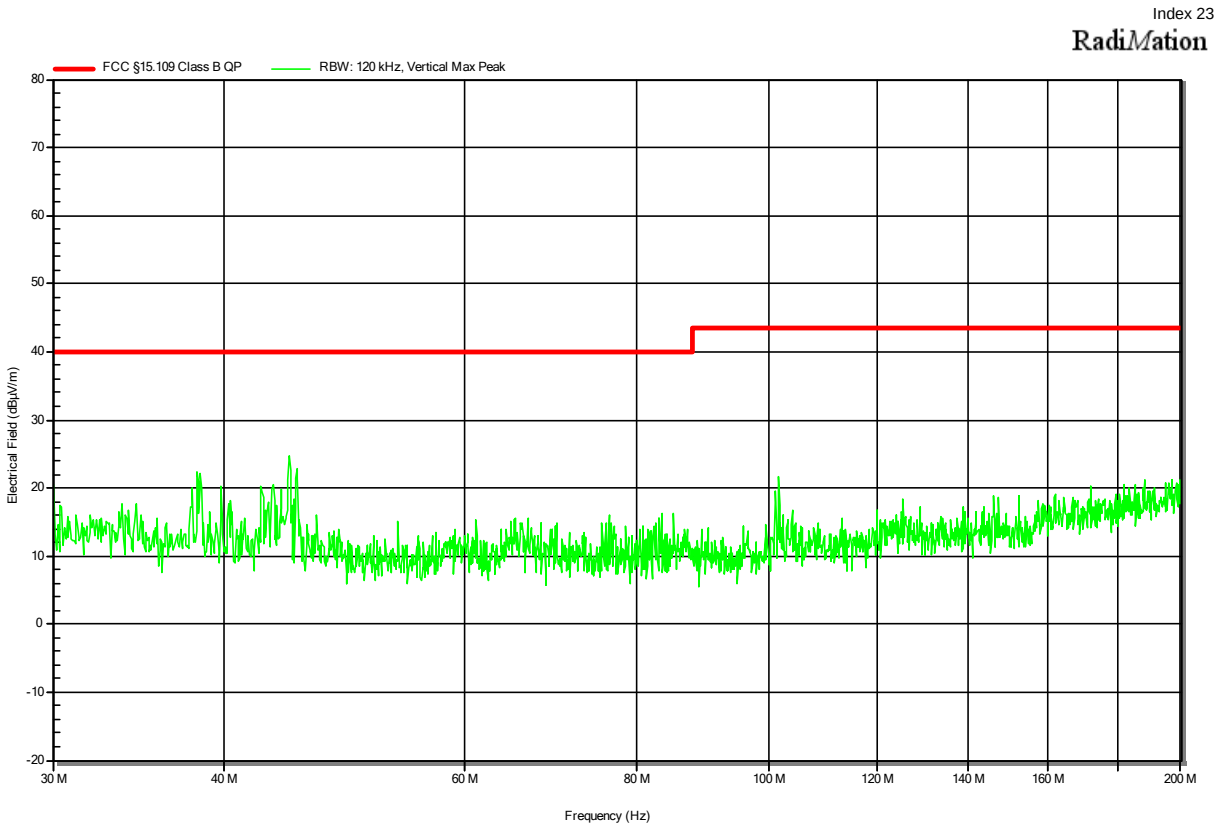
Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 3 Configuration 1
Note 1:	Height 1 m, angle 180°



Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 3 Configuration 1
Note 1:	Height 1 m, angle 0°



Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 3 Configuration 1

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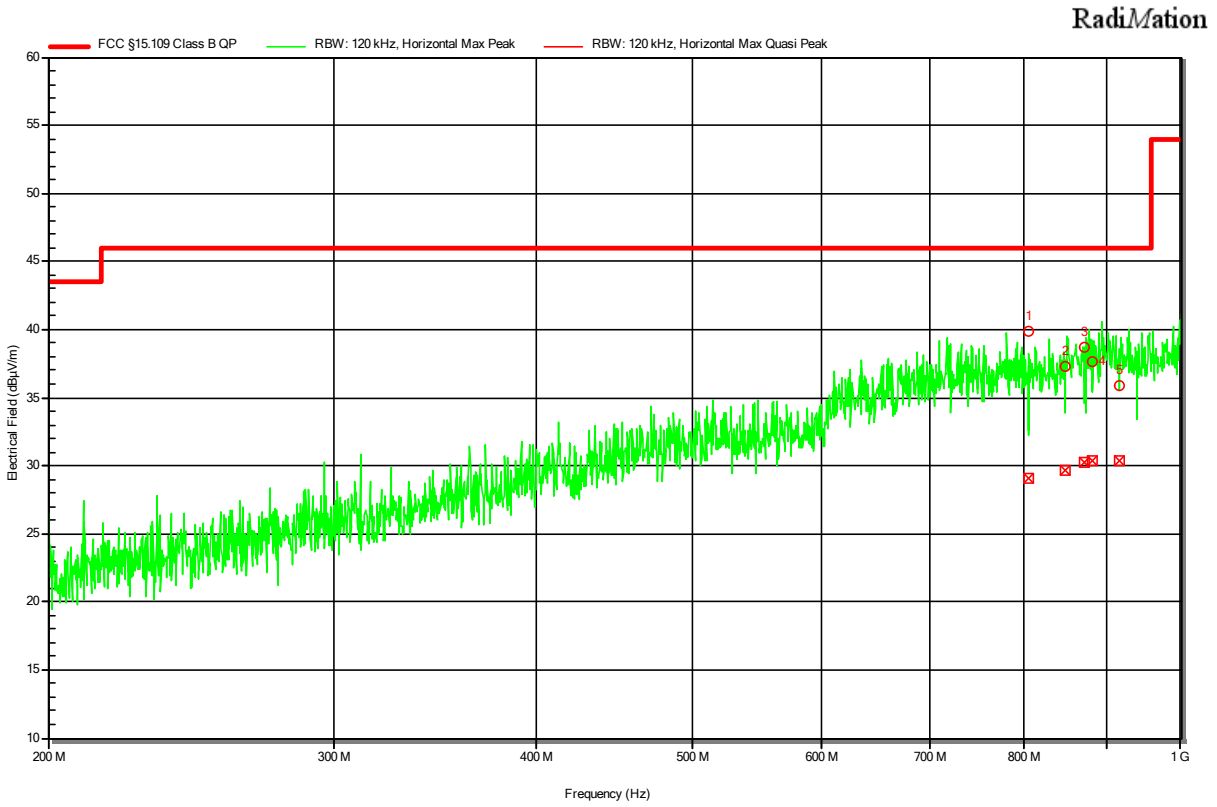

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	804.923 MHz	29.07 dBµV/m	46.02 dBµV/m	-16.95 dB	Pass	0 degrees	1 m
2	848.262 MHz	29.63 dBµV/m	46.02 dBµV/m	-16.39 dB	Pass	0 degrees	1 m
3	872.876 MHz	30.3 dBµV/m	46.02 dBµV/m	-15.72 dB	Pass	0 degrees	1 m
4	882.65 MHz	30.35 dBµV/m	46.02 dBµV/m	-15.67 dB	Pass	0 degrees	1 m
5	917.337 MHz	30.33 dBµV/m	46.02 dBµV/m	-15.69 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
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Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
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Test Date:	2021-07-23
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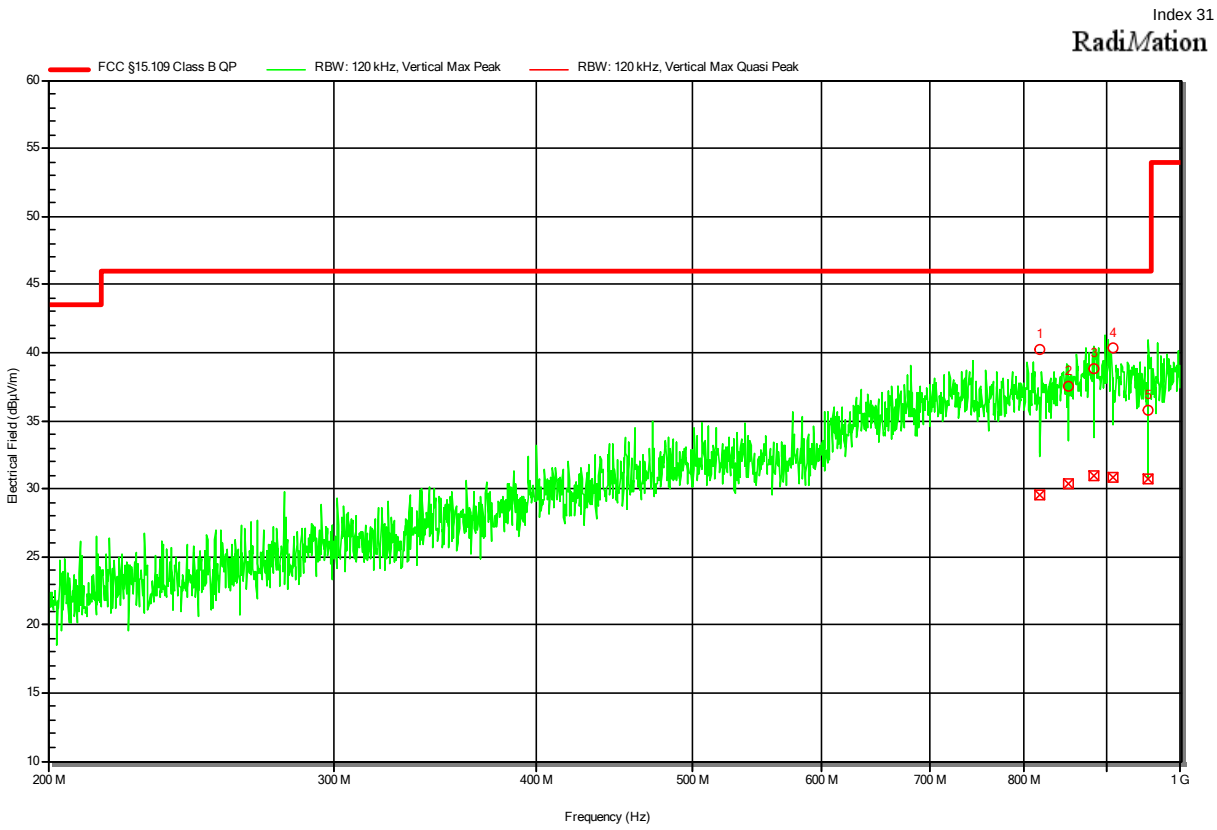
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 3 Configuration 1



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	819.153 MHz	29.54 dBµV/m	46.02 dBµV/m	-16.48 dB	Pass	0 degrees	1 m
2	853.383 MHz	30.31 dBµV/m	46.02 dBµV/m	-15.71 dB	Pass	0 degrees	1 m
3	883.416 MHz	30.98 dBµV/m	46.02 dBµV/m	-15.04 dB	Pass	0 degrees	1 m
4	908.856 MHz	30.89 dBµV/m	46.02 dBµV/m	-15.13 dB	Pass	0 degrees	1 m
5	955.029 MHz	30.67 dBµV/m	46.02 dBµV/m	-15.35 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
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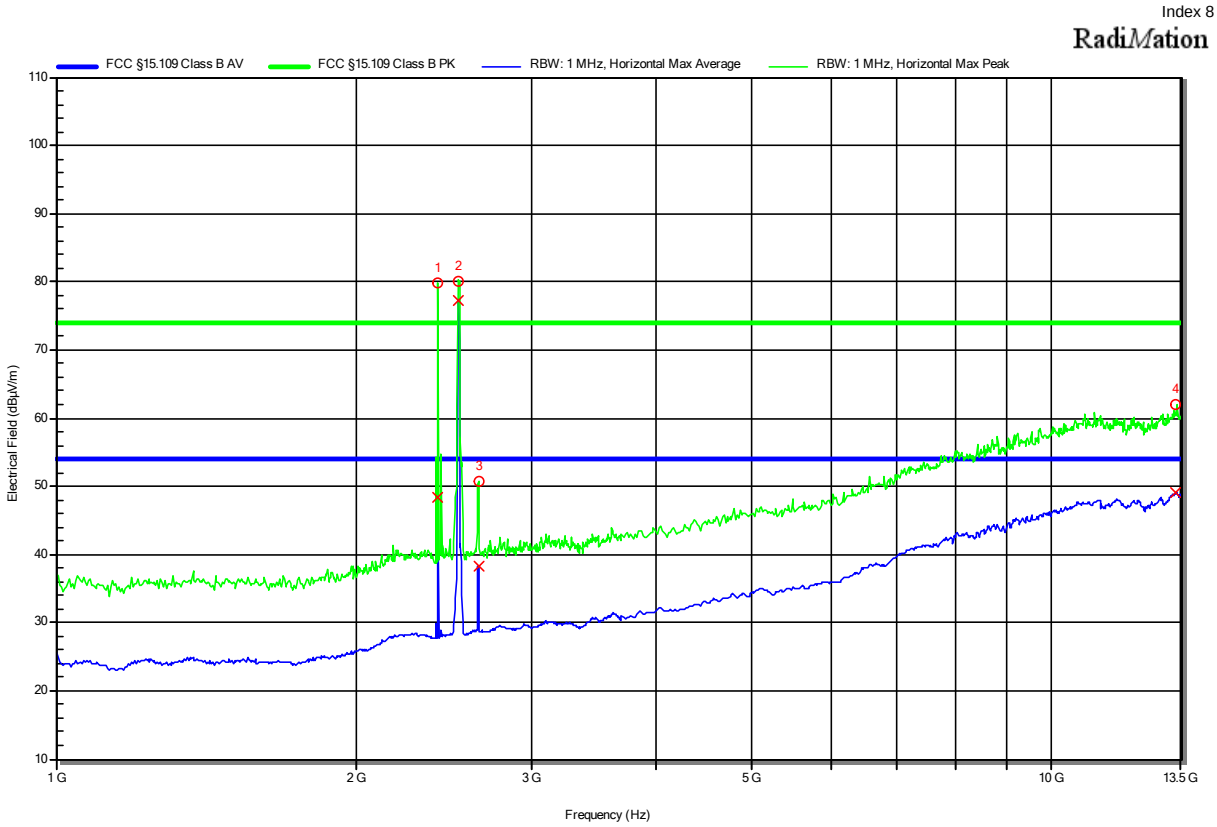
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 3 Configuration 1



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.419 GHz	79.83 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	2.536 GHz	80.1 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.657 GHz	50.84 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.343 GHz	62.03 dBµV/m	73.98 dBµV/m	-11.95 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	2.419 GHz	48.31 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	2.536 GHz	77.21 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.657 GHz	38.29 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.343 GHz	49.05 dBµV/m	53.98 dBµV/m	-4.93 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
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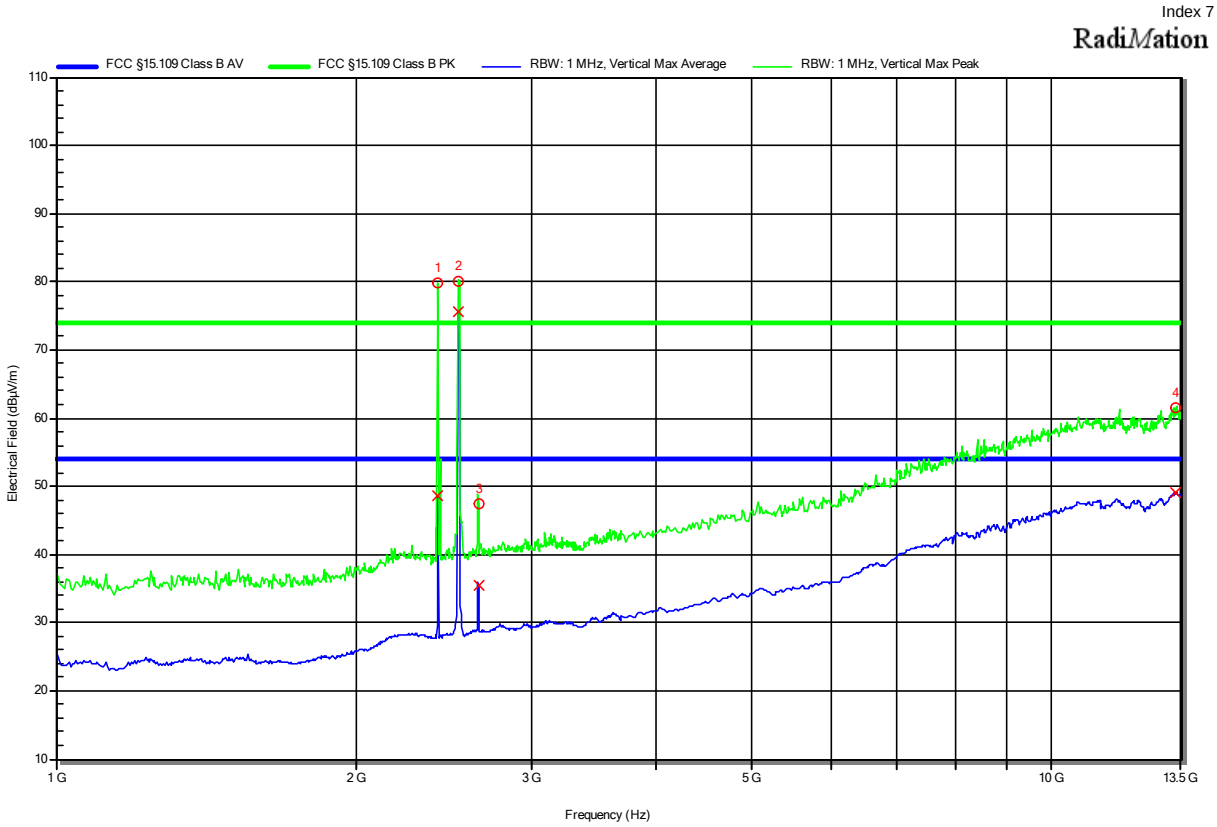
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 3 Configuration 1



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	2.419 GHz	79.81 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	2.536 GHz	80.11 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.657 GHz	47.35 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.343 GHz	61.64 dBµV/m	73.98 dBµV/m	-12.34 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	2.419 GHz	48.6 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	2.536 GHz	75.5 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.657 GHz	35.56 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.343 GHz	49.08 dBµV/m	53.98 dBµV/m	-4.9 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 4 Configuration 1
Note 1:	Height 1 m, angle 180°, LTE band 2

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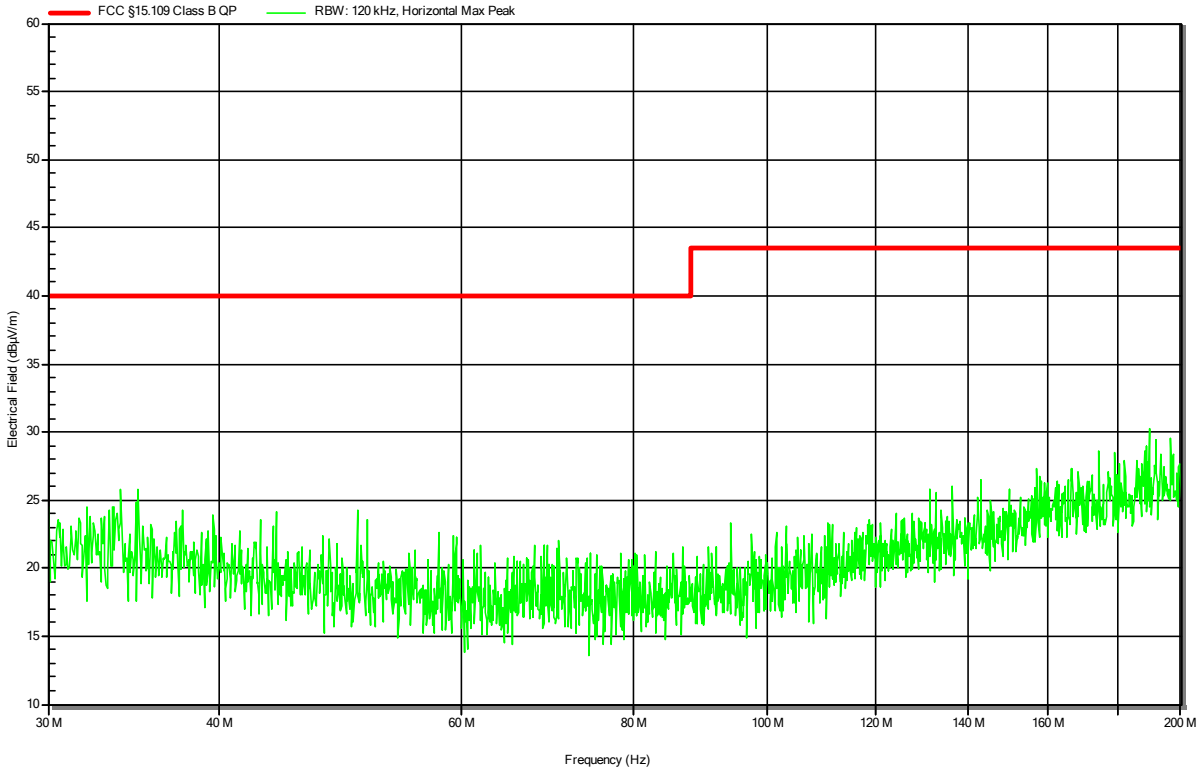
RadiMation



Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
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Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 22 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 4 Configuration 1
Note 1:	Height 1 m, angle 0°, LTE band 2

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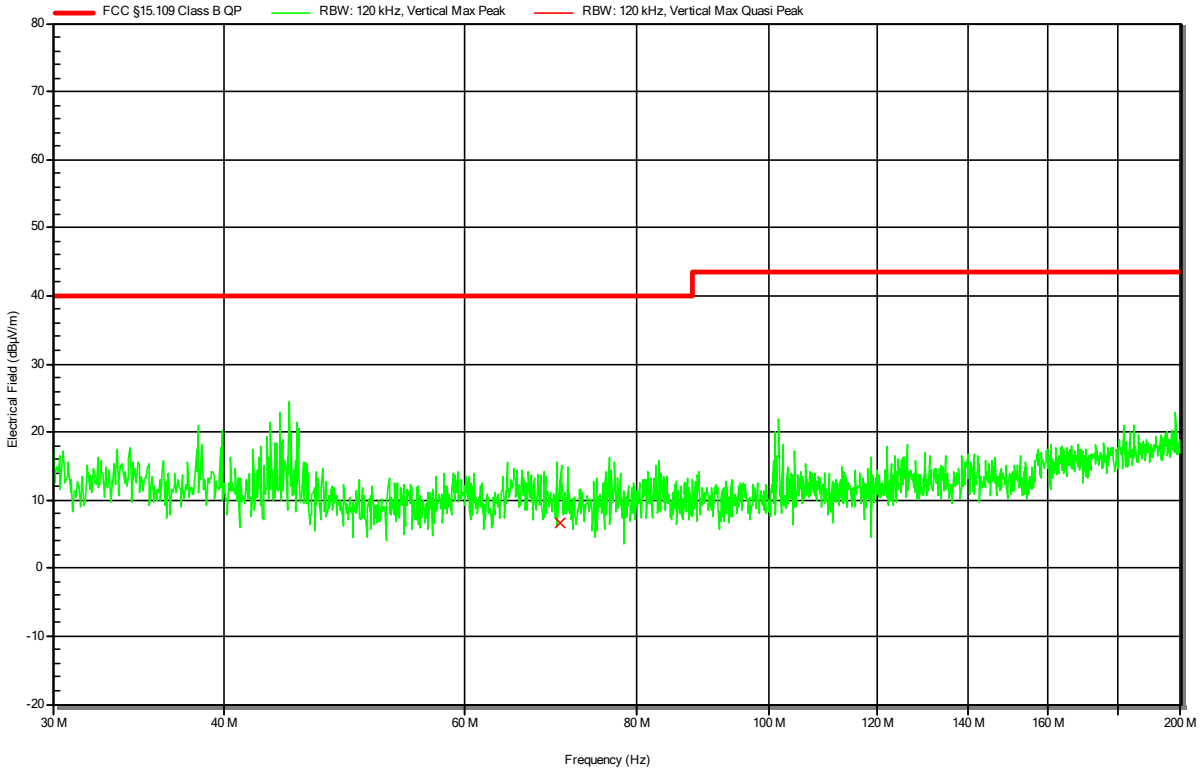
RadiMation



Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 4 Configuration 1
Note 1:	LTE band 2

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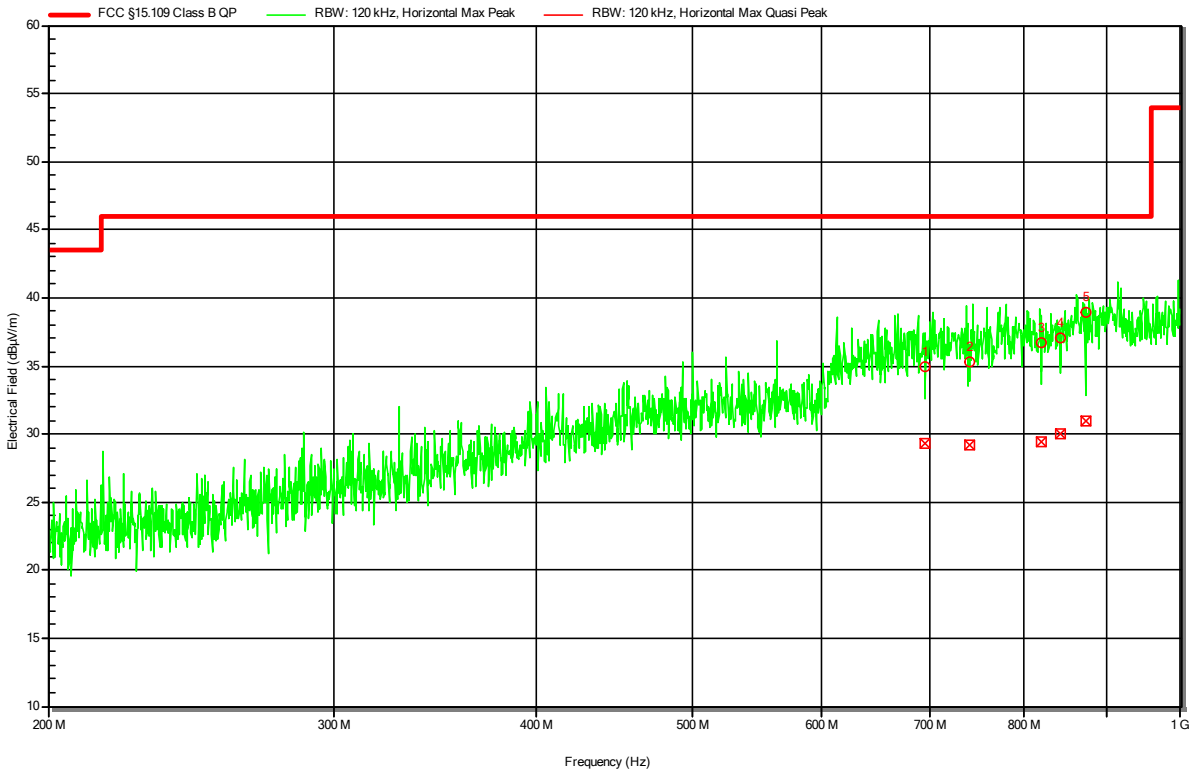
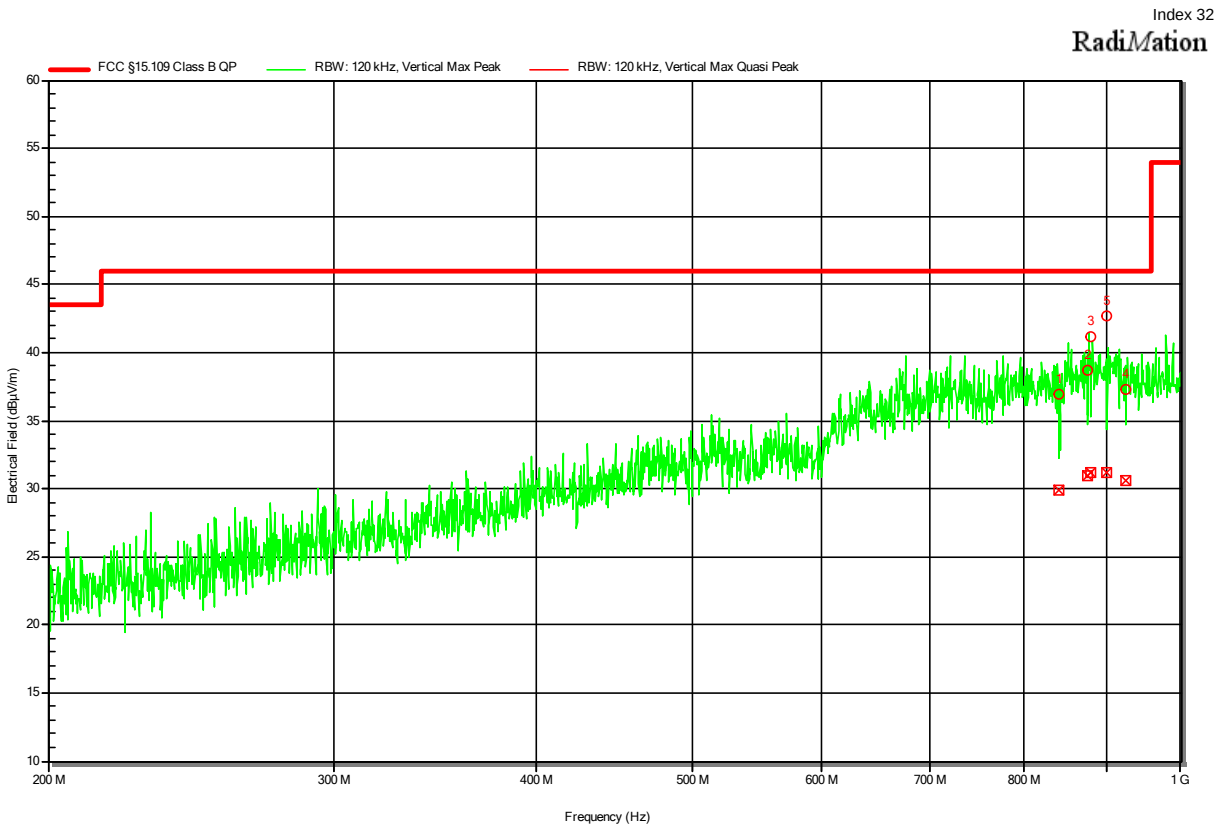
RadiMation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	695.587 MHz	29.27 dBµV/m	46.02 dBµV/m	-16.75 dB	Pass	0 degrees	1 m
2	740.108 MHz	29.15 dBµV/m	46.02 dBµV/m	-16.87 dB	Pass	0 degrees	1 m
3	820.504 MHz	29.43 dBµV/m	46.02 dBµV/m	-16.59 dB	Pass	0 degrees	1 m
4	842.306 MHz	30.06 dBµV/m	46.02 dBµV/m	-15.96 dB	Pass	0 degrees	1 m
5	873.035 MHz	30.93 dBµV/m	46.02 dBµV/m	-15.1 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

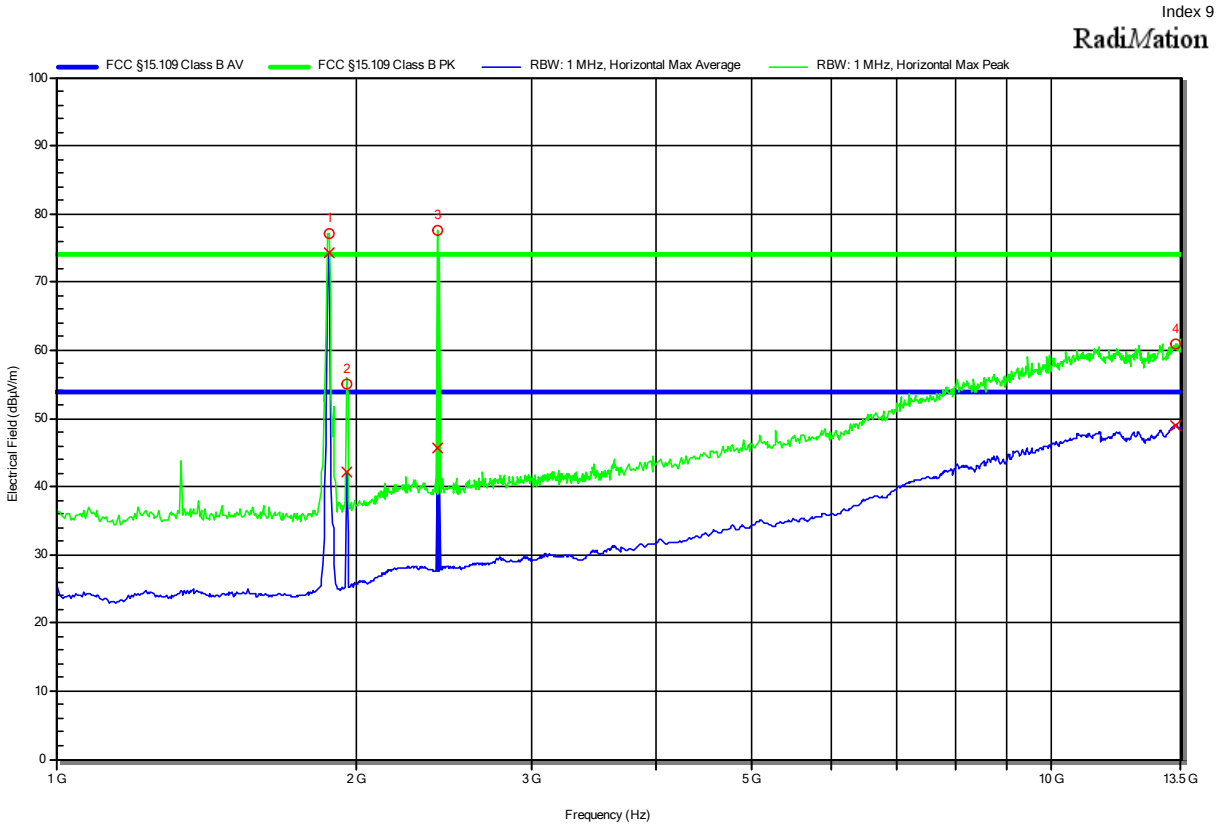
Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-23
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 4 Configuration 1



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
1	841.867 MHz	29.9 dBµV/m	46.02 dBµV/m	-16.12 dB	Pass	0 degrees	1 m
2	876.614 MHz	30.95 dBµV/m	46.02 dBµV/m	-15.07 dB	Pass	0 degrees	1 m
3	879.255 MHz	31.19 dBµV/m	46.02 dBµV/m	-14.83 dB	Pass	0 degrees	1 m
4	925.716 MHz	30.61 dBµV/m	46.02 dBµV/m	-15.41 dB	Pass	0 degrees	1 m
5	900.69 MHz	31.14 dBµV/m	46.02 dBµV/m	-14.88 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 4 Configuration 1
Note 1:	LTE band 2



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	1.878 GHz	77.07 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	1.961 GHz	55.06 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.415 GHz	77.55 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.327 GHz	60.89 dBµV/m	73.98 dBµV/m	-13.09 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.878 GHz	74.28 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	1.961 GHz	42.08 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.415 GHz	45.63 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.327 GHz	49.01 dBµV/m	53.98 dBµV/m	-4.97 dB	Pass	0 degrees	1 m

Radiated emissions
according to FCC part 15B, ICES-003

Project Number:	G0M-2103-9644
Applicant:	IAV Automotive Engineering Inc.
Model Description:	ECU Automotive Telemetry Reader
Model:	TDBOX2 LTE
Test Sample ID:	35442
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Engel
Test Date:	2021-07-22
Operating Conditions:	ambient temperature: 23 °Celsius power input: 13.8 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement Distance:	3 m
Operational Mode & EUT Configuration:	Mode 4 Configuration 1
Note 1:	LTE band 2

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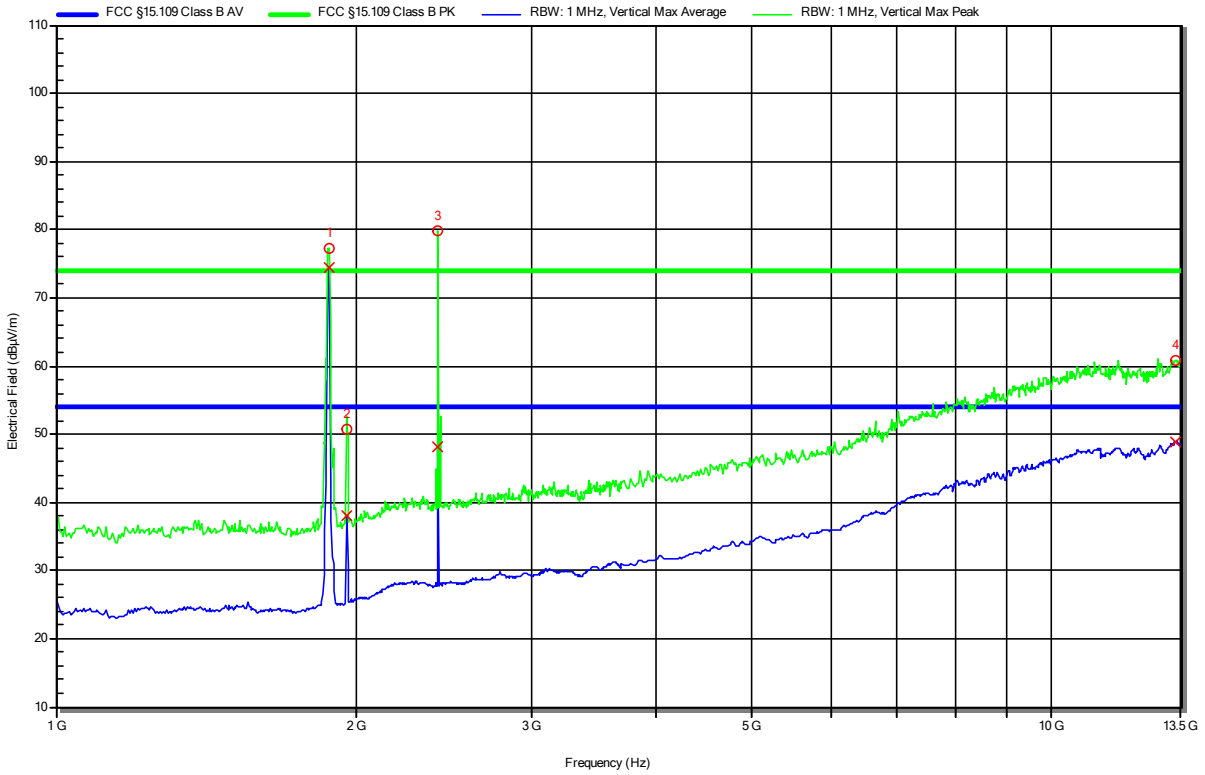
RadiMation



Peak Number	Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Angle	Height
1	1.878 GHz	77.24 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	1.961 GHz	50.73 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.419 GHz	79.85 dBµV/m	73.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.327 GHz	60.85 dBµV/m	73.98 dBµV/m	-13.13 dB	Pass	0 degrees	1 m

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height
1	1.878 GHz	74.37 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal ISM 2.4 GHz WLAN			
2	1.961 GHz	37.94 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication uplink			
3	2.419 GHz	48.07 dBµV/m	53.98 dBµV/m	Intentional radiator, carrier signal mobile communication downlink			
4	13.327 GHz	48.89 dBµV/m	53.98 dBµV/m	-5.09 dB	Pass	0 degrees	1 m

End of Report