

RADIO REPORT FCC 47 CFR Part 15E Unlicensed National Information Infrastructure Devices in the 5 GHz Bands	
Report Reference No	G0M-1901-8021-TFC407WF-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	 DAkkS - Registration number : D-PL-12092-01-04 FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	IAV automotive Engineering Inc.
Address	15620 technology Drive 48168 Northville United States
Test Specification	According to FCC rules
Standard	47 CFR Part 15E
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	Telemetry Equipment
Model(s)	TDBOX2
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	IAV-G-00057-01-AA-V02-R01_CI01 and IAV-G-00057-01-AA-V02-R02_CI03
Software Version(s)	Frontend 0109 / Telemetrie 0211
FCC-ID	2AS2J-G00057-01
Test Result	PASSED

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
not applicable to EUT	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Test Lab Temperature	20 - 23 °C	
Test Lab Humidity	32 – 38 %	
Date of receipt of test item	2019-05-23	
Report:		
Compiled by	Florian Voigt	
Tested by (+ signature) (Responsible for Test)	Florian Voigt supervised by Wilfried Treffke	 
Approved by (+ signature) (Head of Lab)	Toralf Jahn	
Date of Issue	2019-08-05	
Total number of pages	71	
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:		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2019-08-05	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
BPSK	Binary Phase Shift Keying
EIRP	Equivalent Isotropic Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
HT	High Throughput
IEEE 802.11	MAC and PHY Layer for WiFi
OFDM	Orthogonal Frequency Division Multiplexing
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RBW	Resolution bandwidth
RMS	Root mean square
TPC	Transmit Power Control
VBW	Video bandwidth
VHT	Very High Throughput

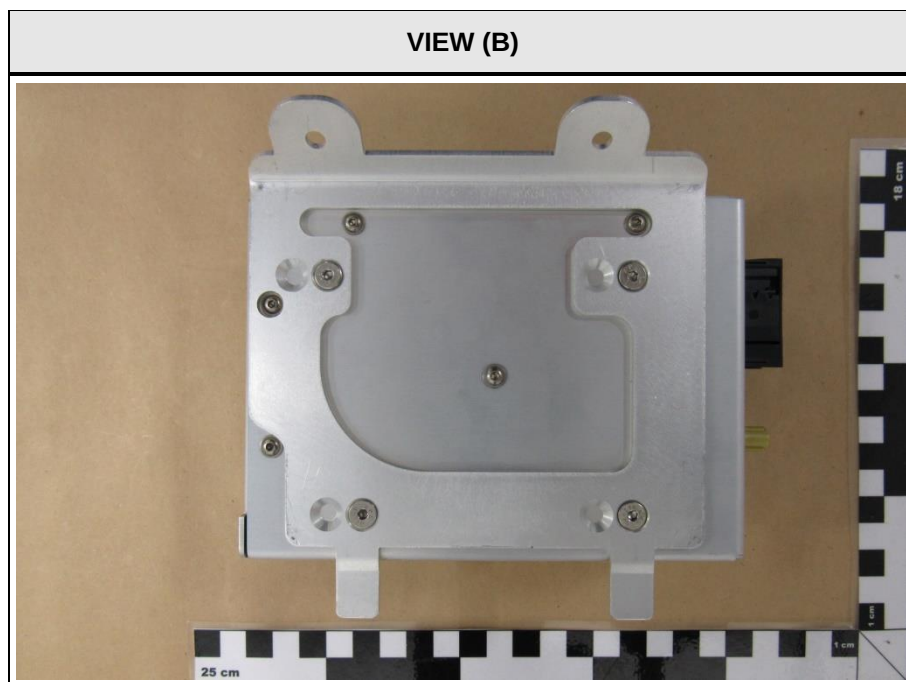
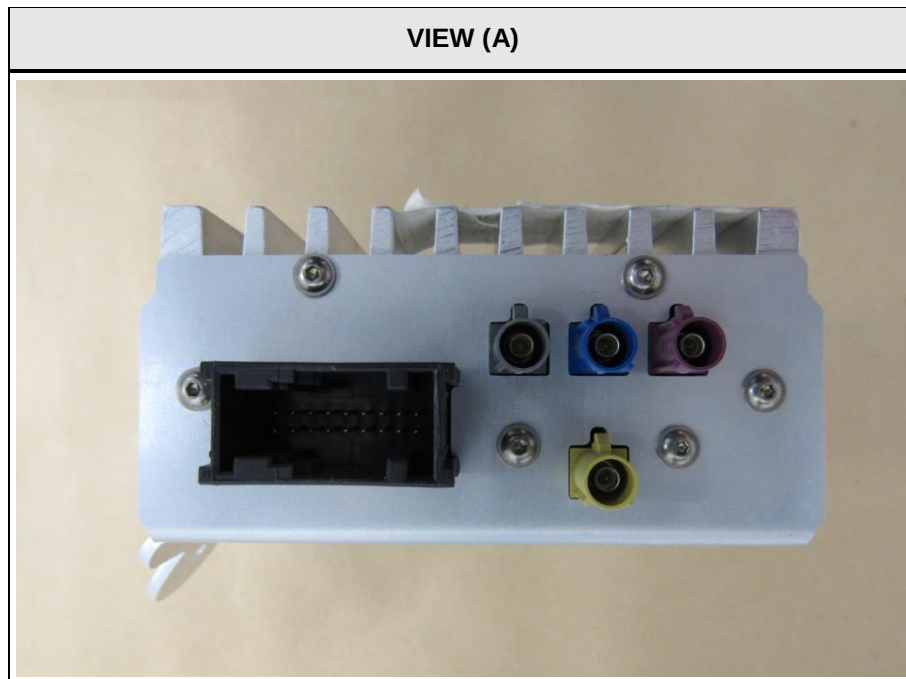
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1 Equipment (Test Item) Under Test

Description	Telemetry Equipment	
Model	TDBOX2	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	1700400005	
Hardware Version(s)	IAV-G-00057-01-AA-V02-R01_CI01 and IAV-G-00057-01-AA-V02-R02_CI03	
Software Version(s)	Frontend 0109 / Telemetrie 0211	
FCC-ID	2AS2J-G00057-01	
Equipment type	End Product	
Device type	Client	
Radio type	Transceiver	
Assigned frequency bands	5150 - 5250 MHz 5250 - 5350 MHz	
Radio technology	IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11n (HT40)	
Modulation	BPSK, QPSK, 16-QAM, 64-QAM	
Number of antenna ports	1	
Transmit power control	Yes	
Radio Module	Type	IEEE 802.11 radio module
	Model	ELLA-W161-A
	Manufacturer	uBlox
	HW Version	03
	SW Version	14.68.35.p46
	FCC-ID	PV7-WIBEAR11N-DF1
Antenna	Type	External antenna
	Model	5B4.035.510
	Manufacturer	Molex
	Gain	4.22 dBi (by measurement)
Supply Voltage	V _{NOM}	13.8 VDC (external battery)
Operating Temperature	T _{NOM}	25 °C
Battery supply	Yes	
AC/DC-Adaptor	N/A	
Manufacturer	IAV automotive Engineering Inc. 15620 technology Drive 48168 Northville United States	

1.1 Photos – Equipment External



VIEW (C)



VIEW (D)



VIEW (E)



VIEW (F)

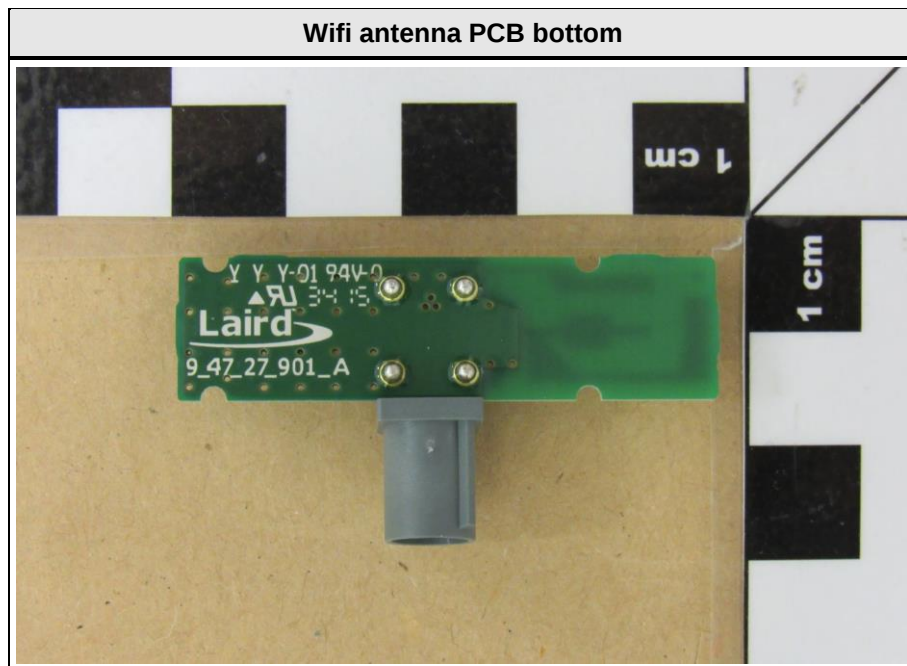
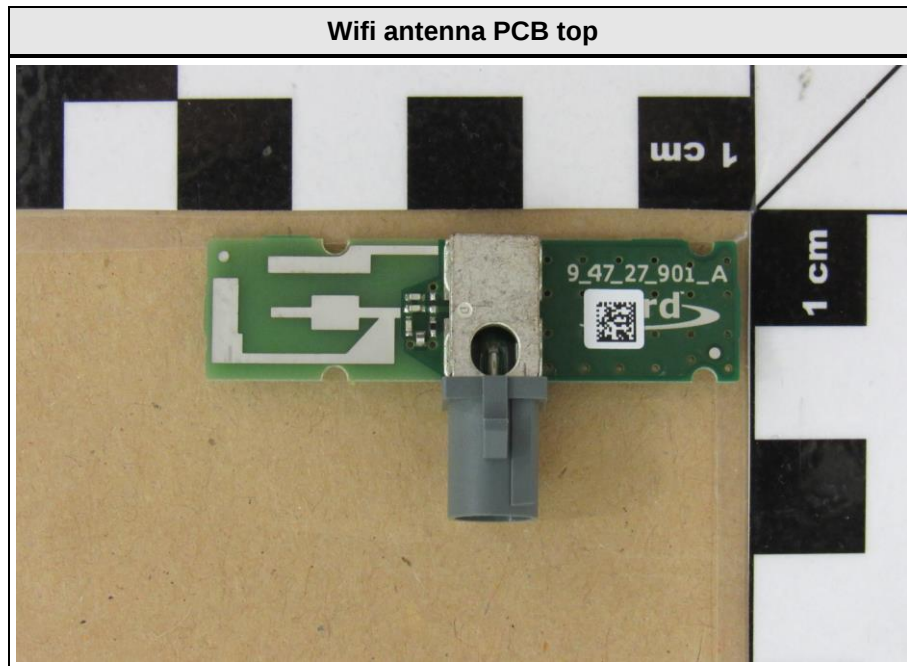


Wifi antenna top view

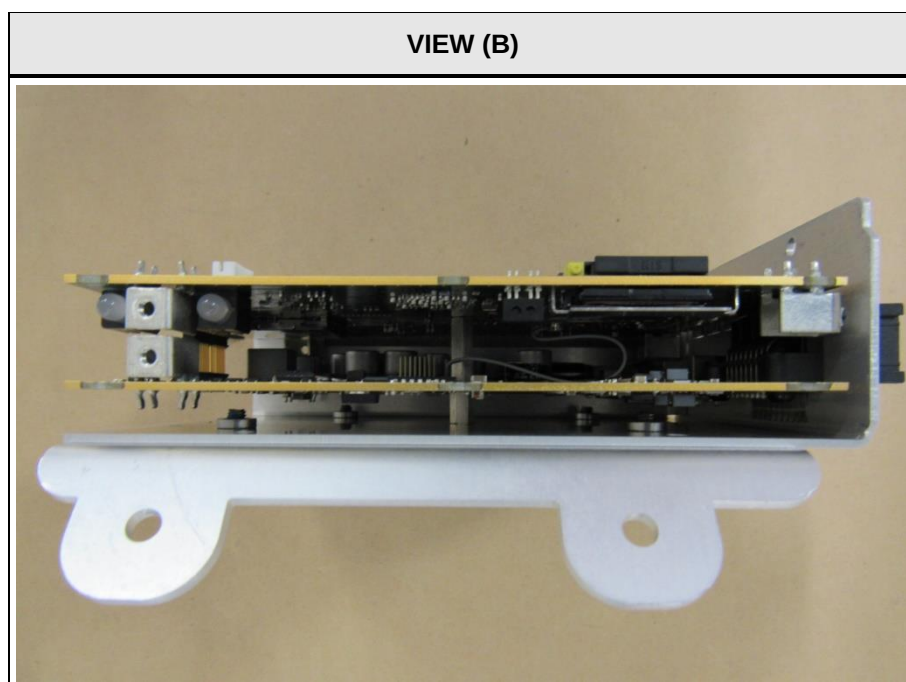
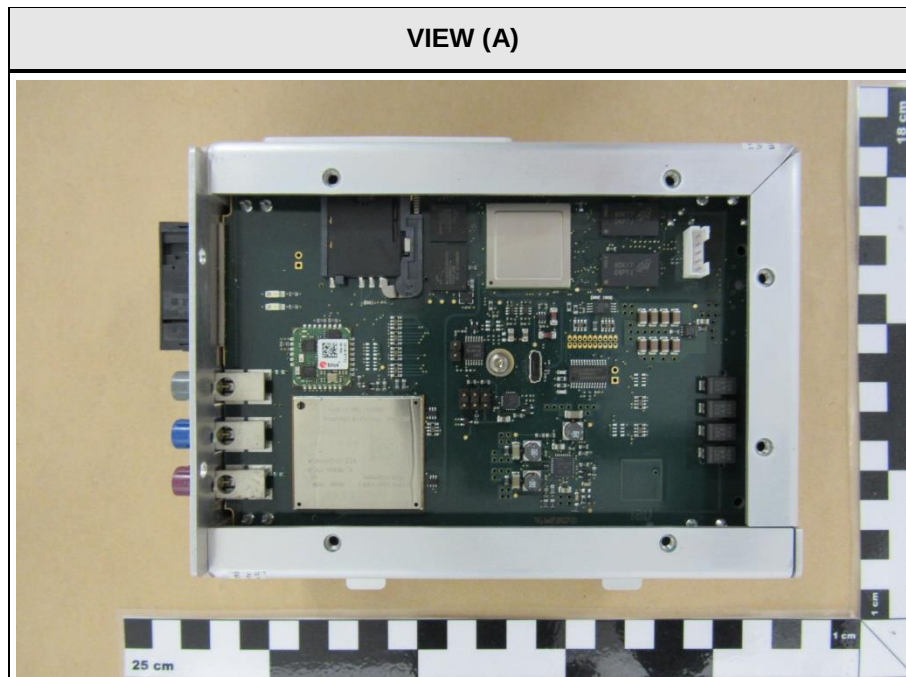


Wifi antenna side view

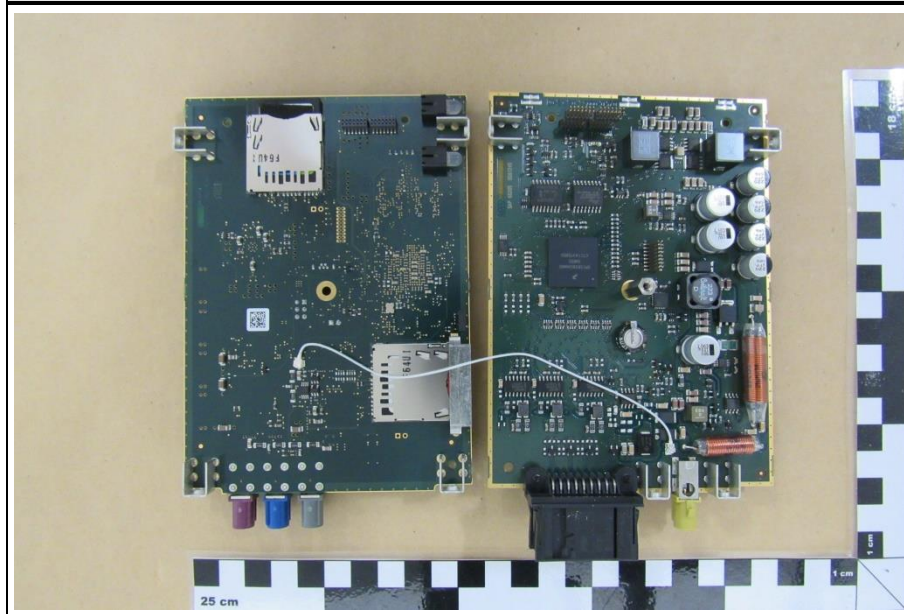




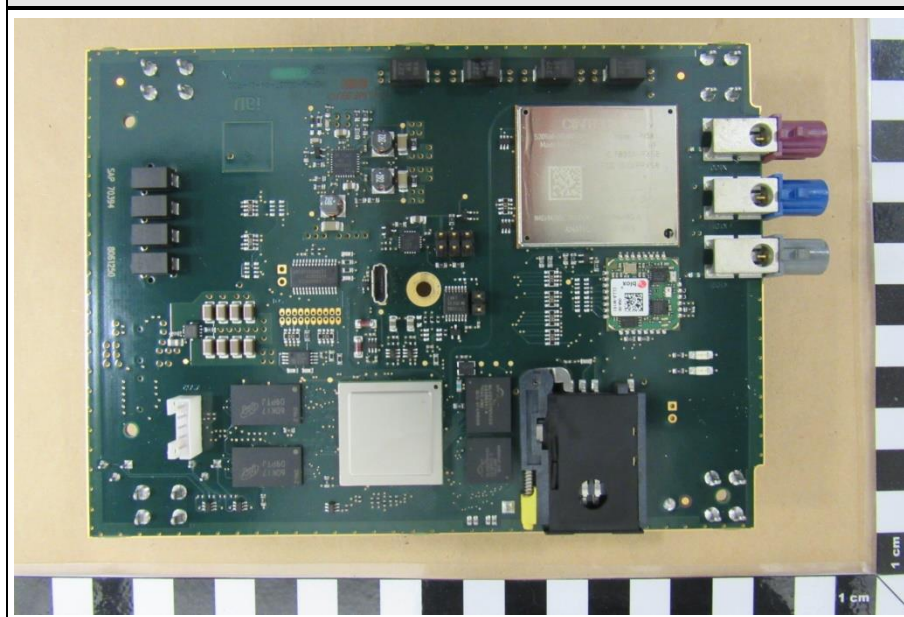
1.2 Photos – Equipment Internal



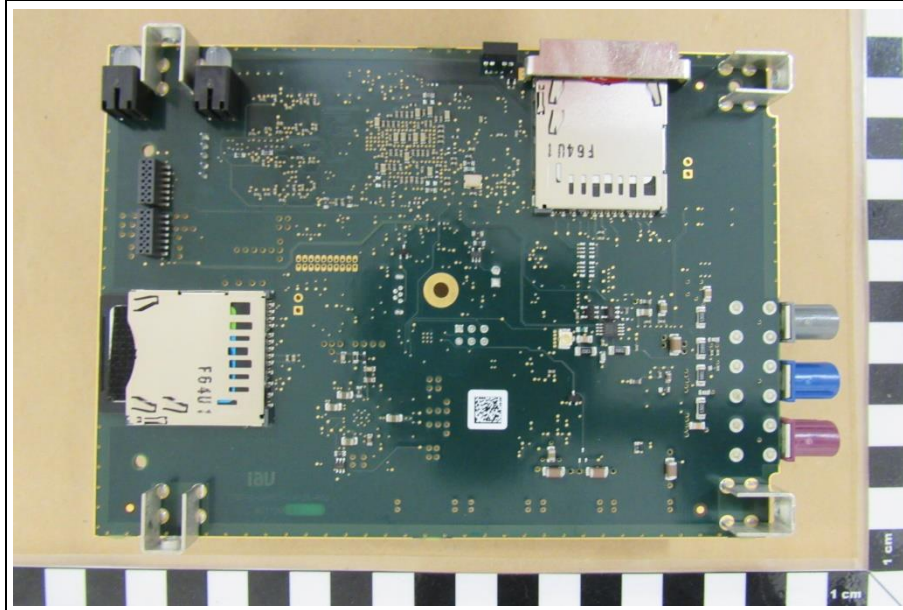
VIEW (C)



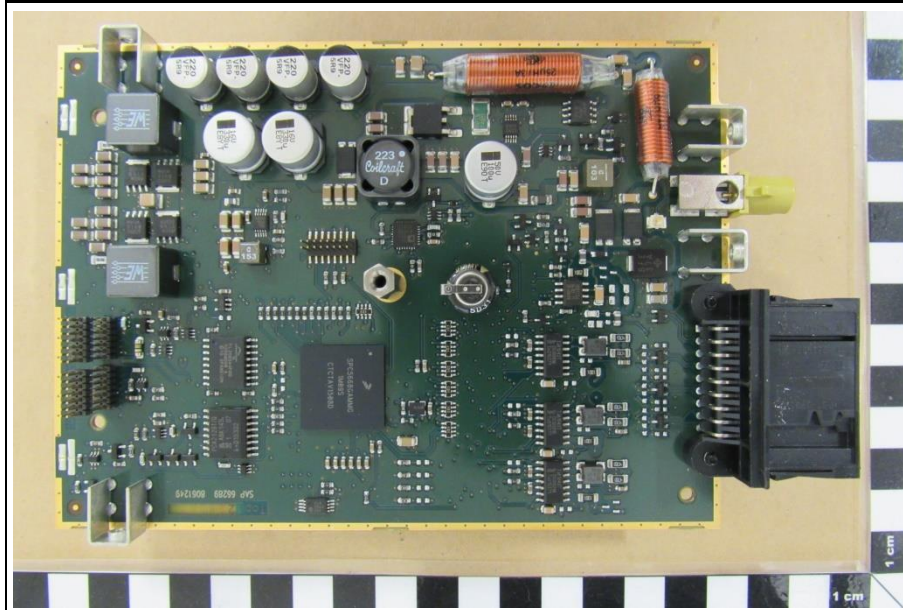
VIEW (E)



VIEW (F)



VIEW (G)



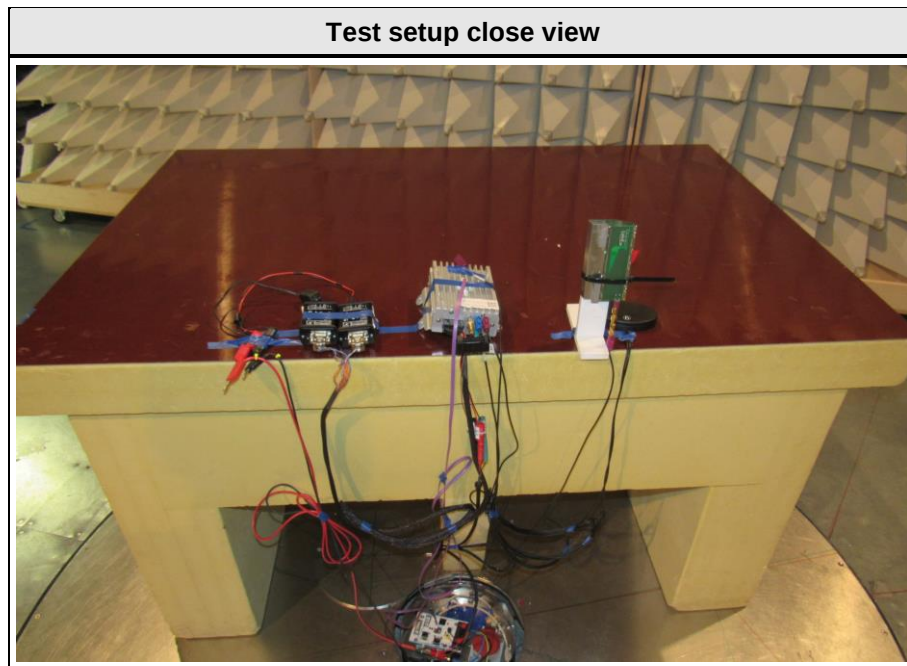
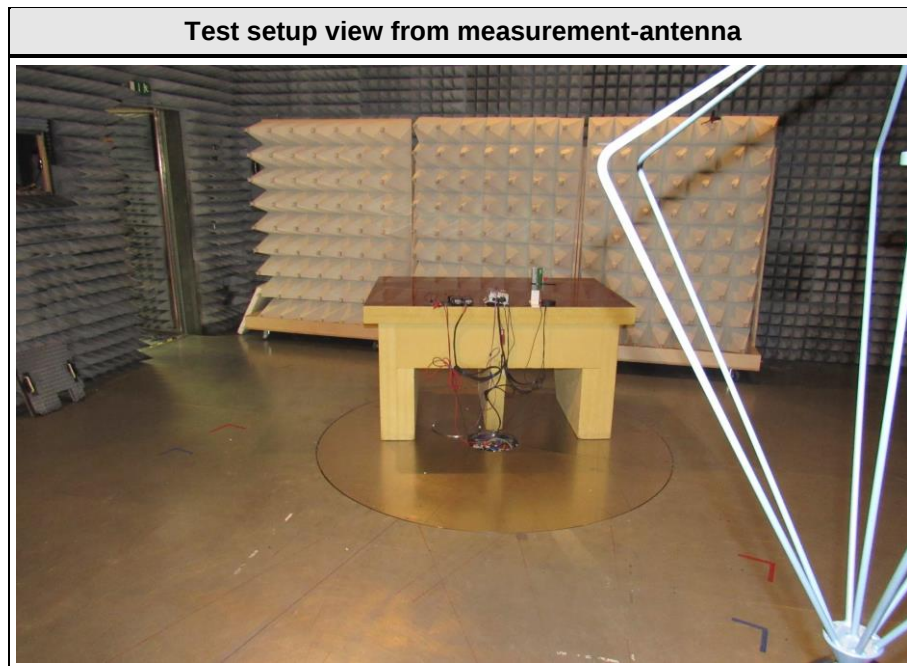
VIEW (H)



VIEW (I)



1.3 Photos – Test Setup



1.4 Support Equipment

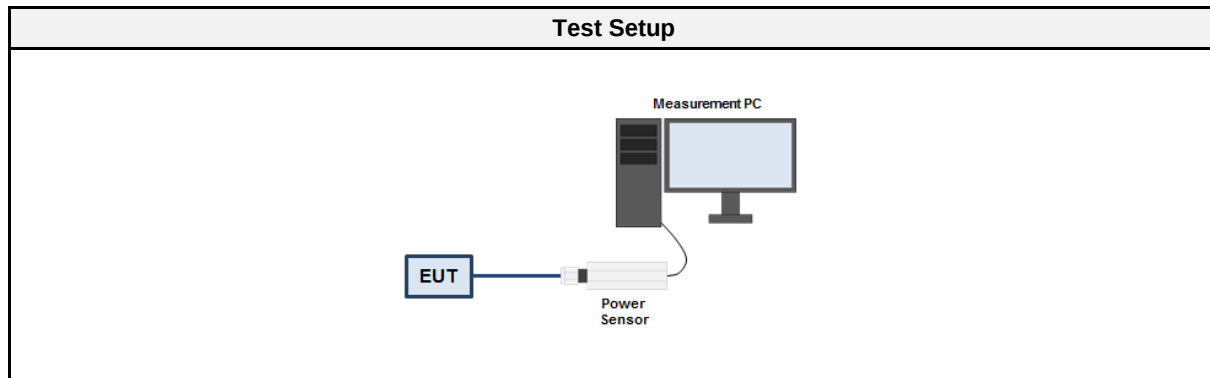
Product Type	Device	Manufacturer	Model	Comment
AE	Notebook	HP Inc. (Hewlett-Packard)	EliteBook 850	Serial No. 5CG44649ML
AE	Power Supply	HP Inc. (Hewlett-Packard)	HP part no. 744481-002 UP/N AO45R00DH	CT: WDWRR0BGC7MJ RB 0B
AE	GSM/UMTS Antenna	Laird	6 58 01	Connected but not used
AE	CAN-Bus media- converter	Peak-System	PCAN-LWL	Connected and powered but not used
AE	GPS-Antenna	Hirschmann Car Communicaion	GPS 1890 LP P/series 920 061- 305	Connected but not used
CBL	Power/CAN cable	---	1.80m	Connects EUT to power source and CAN-Bus
CBL	CAN-Powercable	---	2.0m	Powers CAN-Bus media converter
CBL	EUT-Powercable	---	1.0m	Powers EUT
CBL	Antennacable	---	2.0m	Connects GSM/UMTS antenna to EUT
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment: The Equipment Under Test used an operating system with a test firmware. The driver for IEEE 802.11 was running in a manufacturing mode.				

1.5 Test mode data rate evaluation

1.5.1 Information

Test Information	
Measurement Method	KDB 789033 E

1.5.2 Setup



1.5.3 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Power Sensor	ETS-Lindgren	7002-006	EF00934	2018-07	2019-07

1.5.4 Procedure

Test Procedure
1. EUT set to test mode on the first supported channel for each modulation and data rate 2. The conducted power is measured with a wide band power sensor 3. The power is measured for all data rates/modulations supported by the EUT 4. The data rate with the highest output power for each technology is selected for test mode

1.5.5 Results

OFDM - 5180 MHz							
Output power [dBm]							
6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
13.4	13.4	13.2	12.4	13.3	13.3	13.3	13.2

HT20 - 5180 MHz							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
13.3	13.3	13.3	13.2	13.2	13.2	13.2	13.2

HT40 - 5190 MHz							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
12.9	13.3	13.3	13.2	13.3	13.3	13.3	13.2

1.6 Test mode duty cycle evaluation

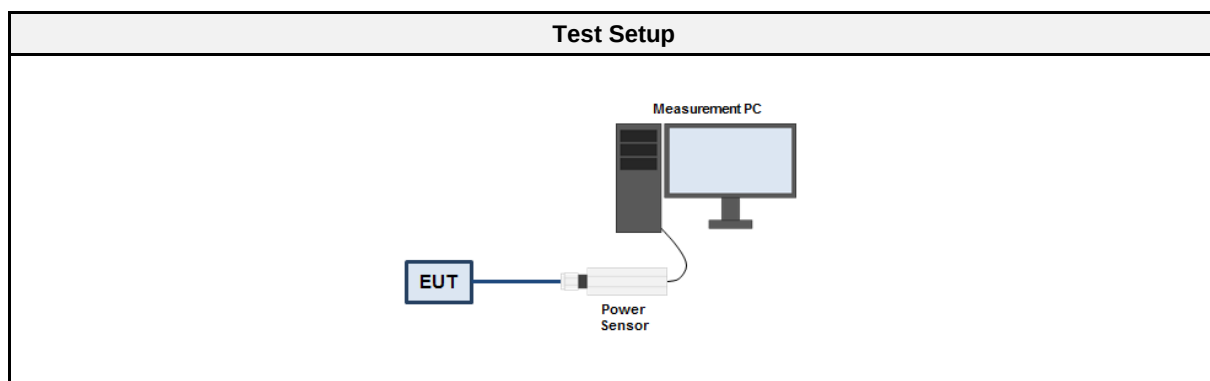
1.6.1 Information

Test Information	
Measurement Method	ANSI C63.10 12.2

1.6.2 Requirements

Requirements	
Duty cycle	Duty cycle correction
$\geq 98 \%$	No correction required
$< 98 \%$	Correction required ($10 \times \log_{10}(1/DC)$)

1.6.3 Setup



1.6.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Power Sensor	ETS-Lindgren	7002-006	EF00934	2018-07	2019-07

1.6.5 Procedure

Test Procedure
1. EUT set to test mode 2. Sweep time is set long enough to capture at least 5 bursts 3. The maximum burst duration T_{ON} is measured 4. The minimum idle duration T_{OFF} is measured 5. The duty cycle is calculated by $DC = T_{ON} / (T_{ON} + T_{OFF})$ 6. The duty cycle correction is calculated by $DC = 10 \times \log_{10}(T_{ON} / (T_{ON} + T_{OFF}))$

1.6.6 Results

Duty Cycle Results				
Mode	Channel [MHz]	Data rate	Duty Cycle	Correction Factor [dB]
OFDM (IEEE 802.11a)	5180	6 Mbps	100	N/R
HT20 (IEEE 802.11n)	5180	MCS 0	100	N/R
HT40 (IEEE 802.11n)	5190	MCS 1	100	N/R

1.7 Test Modes

Mode	Description
OFDM (IEEE 802.11a)	Mode = Transmit Modulation = BPSK Spreading = OFDM Bandwidth = 20 MHz Duty cycle = 100% Power setting = 15dBm (Software setting) Data rate = 6 Mbps
HT40 (IEEE 802.11n)	Mode = Transmit Modulation = QPSK Spreading = OFDM Bandwidth = 40 MHz Duty cycle = 100% Power setting (1 Simultaneous Tx) = 15dBm (Software setting) Data rate (1 Simultaneous Tx) = 27 Mbps MCS (1 Simultaneous Tx) = 1
Comment: The above settings were found as worst case during pre-tests.	

1.8 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Tx	36	5180
F2	Tx	48	5240
F3	Tx	64	5320
F4	Tx	36+40	5190
F5	Tx	44+48	5230
F6	Tx	60+64	5310

1.9 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 analyzer in dBμV. Any external preamplifiers used are taken into account through internal analyzer 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 analyzer. 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:

$$\text{Reading on Analyzer (dB}\mu\text{V)} + \text{A.F. (dB/m)} = \text{Net field strength (dB}\mu\text{V/m)}$$

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:

$$\text{Limit (dB}\mu\text{V/m)} = 20 \cdot \log(\mu\text{V/m})$$

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

1.10 Normative References

References	
Designator	Reference
KDB 789033	KDB 789033 D02 v02r01
ANSI C63.10	ANSI C63.10:2013

2 Result Summary

FCC 47 CFR Part 15E				
Product Standard Reference	Requirement	Reference Method	Result	Remarks
FCC 15.407(e)	6 dB bandwidth	KDB 789033 C.2	N/R	Only required in 5725-5850 MHz band.
FCC 15.407(a)(2),(a)(5),(h)(2)	26 dB bandwidth	KDB 789033 C.1	N/T	No limit. Basis for other measurements.
FCC 15.407(a)	Maximum output power	KDB 789033 E	N/T	
FCC 15.407(a)	Transmit power control	KDB 789033 E	N/R	Required in 5250-5350 and 5470-5725 MHz bands. Not required for EIRP < 500 mW.
FCC 15.407(a)	Power spectral density	KDB 789033 F	N/T	
FCC 15.407(g)	Frequency stability	ANSI C63.10 6.8	N/T	
FCC 15.207	AC power line conducted emissions	ANSI C63.10 6.2	N/R	Not powered (directly or indirectly) via AC-Mains
FCC 15.407(b)	Transmitter radiated emissions	KDB 789033 G	PASS	
FCC 15.407(a)	Radiation pattern	KDB 789033 H	N/T	5150-5250 MHz band only with EIRP > 21 dBm
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

3 Test Conditions and Results

3.1 Test Conditions and Results - Transmitter radiated emissions

3.1.1 Information

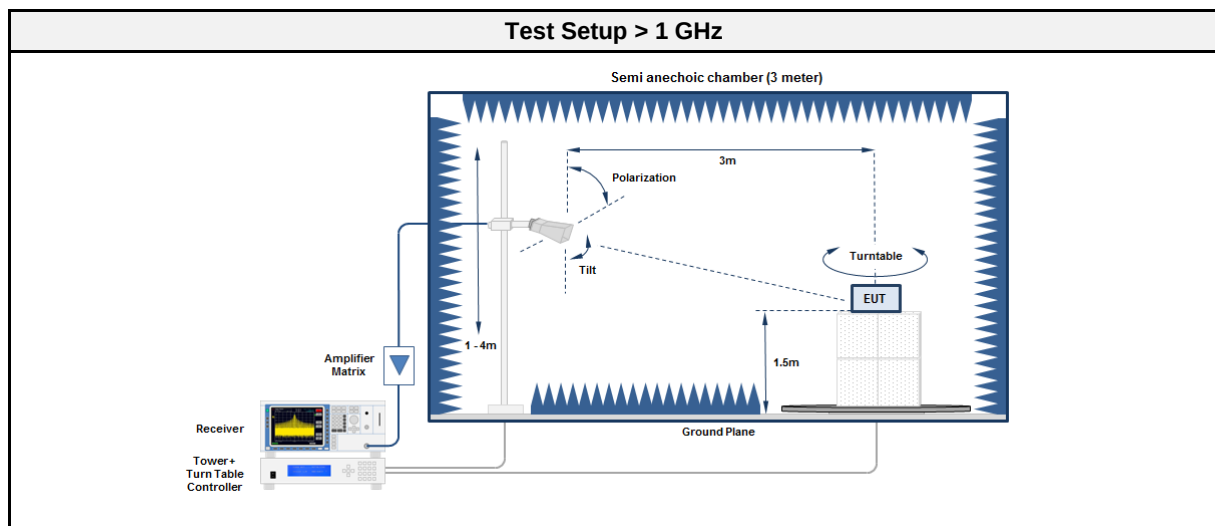
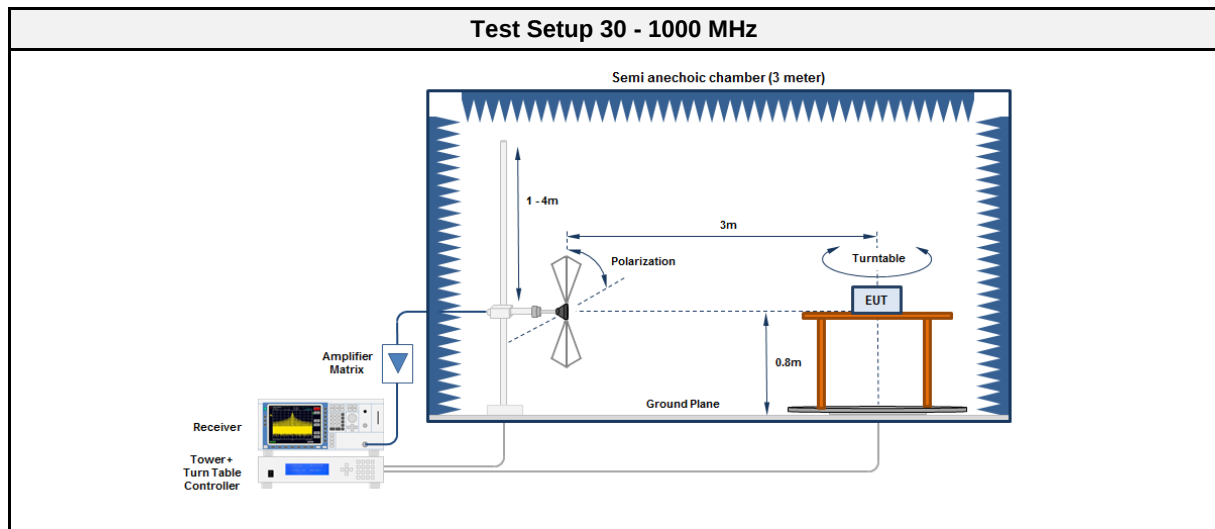
Test Information	
Reference	FCC 15.407(b)
Measurement Method	KDB 789033 G
Operator	Florian Voigt
Date	2019-06-27 - 2019-07-08

3.1.2 Limits

Limits - Restricted frequency bands and below 1 GHz			
Frequency [MHz]	Detector	Field strength [$\mu\text{V}/\text{m}$]	Measurement distance [m]
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

Limits - Outside restricted frequency bands above 1 GHz			
Frequency band [MHz]	Power limit [dBm EIRP]	Field strength limit [dB $\mu\text{V}/\text{m}$]	Measurement distance [m]
5150 - 5250	-27 dBm/MHz	68.2	3
5250 - 5350	-27 dBm/MHz	68.2	3
5470 - 5725	-27 dBm/MHz	68.2	3
5725 - 5850	-27 dBm/MHz @ ± 75 MHz from band edge	68.2	3
5725 - 5850	10 to -27 dBm/MHz @ ± 25 to ± 75 MHz from band edge	105.2 to 68.2	3
5725 - 5850	15.6 to 10 dBm/MHz @ ± 5 to ± 25 MHz from band edge	110.8 to 105.2	3
5725 - 5850	27 to 15.6 dBm/MHz @ ± 0 to ± 5 MHz from band edge	122.2 to 110.8	3

3.1.3 Setup



3.1.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2015.2.4

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2018-07	2021-07
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07
Antenna	R&S	HK 116	EF00030	2019-04	2022-04
Antenna	R&S	HL 223	EF00212	2019-05	2020-05

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2018-07	2021-07
Spectrum Analyzer	R&S	FSIQ26	EF00242	2018-07	2019-07
Spectrum analyzer	R&S	FSW43	EF00896	2018-07	2019-07
Antenna	Schwarzbeck	BBHA 9120D	EF01153	2018-09	2019-09
Horn antenna	Amplifier Research	ATH18G40 (18-40GHz)	EF01152	2018-10	2019-10
Antenna	Flann Microwave Ltd	22240-25 Amp. CBL26402075	EF00301	2016-11	2019-11

3.1.5 Procedure

Test Procedure 30 - 1000 MHz	
1.	EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground
2.	EUT set to test mode
3.	The receiver is set to peak detection with max hold
4.	The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5.	All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz	
1.	EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground
2.	EUT set to test mode
3.	The receiver is set to peak detection with max hold
4.	The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5.	All significant emissions are measured again using the corresponding final detector

3.1.6 Results

Test Results - Channel 36 / 5180 MHz - OFDM					
Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
108.0749	35.60	pk	ver	43.50	-07.96
244.8718	35.10	pk	ver	46.00	-10.92
396.1538	36.00	pk	hor	68.20	-32.22
1198	45.31	pk	ver	54.00	-08.69
1582	39.40	pk	ver	54.00	-14.60

Test Results - Channel 48 / 5240 MHz - OFDM					
Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
240.1306	39.40	pk	ver	46.00	-06.57
329.4872	34.10	pk	hor	46.00	-11.93
1192	44.03	pk	ver	54.00	-09.97
1204	41.19	pk	hor	54.00	-12.81
1576	42.52	pk	ver	54.00	-11.48

Test Results - Channel 64 / 5320 MHz - OFDM					
Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
246.1538	32.30	pk	ver	46.00	-13.73
396.1538	36.20	pk	hor	68.20	-31.96
1192	44.40	pk	ver	54.00	-09.60

Test Results - Channel 36+40 / 5190 MHz - HT40					
Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
108.4615	33.40	pk	ver	43.50	-10.12
240.1306	37.20	pk	hor	46.00	-08.80
329.4872	36.40	pk	hor	46.00	-09.65

Test Results - Channel 44+48 / 5230 MHz - HT40					
Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
108.734	34.60	pk	ver	43.50	-08.87
240.1306	35.40	pk	hor	46.00	-10.60
329.4872	35.80	pk	hor	46.00	-10.18
1192	45.51	pk	ver	54.00	-08.49
1198	44.51	pk	hor	54.00	-09.49

Test Results - Channel 60+64 / 5310 MHz - HT40					
Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
240.3953	39.20	pk	ver	46.00	-06.84
329.4872	35.80	pk	hor	46.00	-10.25
1192	46.09	pk	hor	54.00	-07.91
1996	47.73	pk	hor	68.20	-20.47
2350	42.84	pk	ver	54.00	-11.16

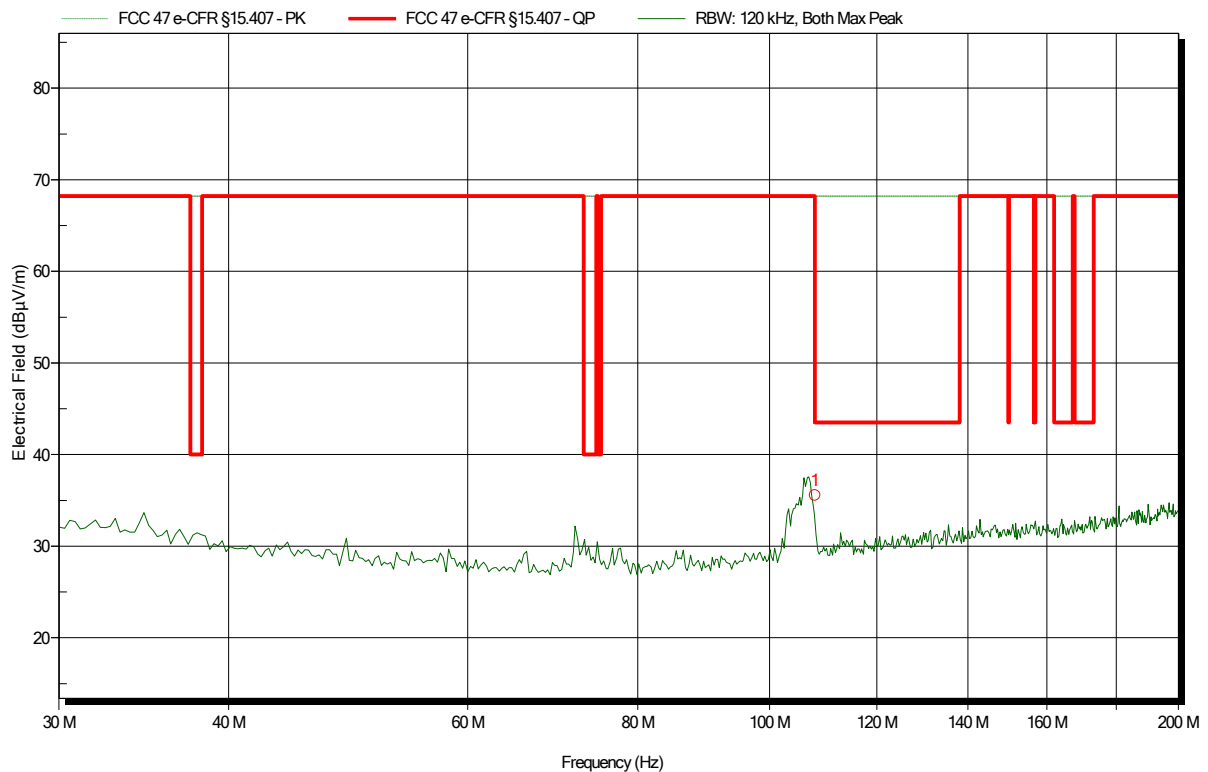
ANNEX A Transmitter spurious emissions

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Voigt
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: TX; CH36, 6MBit, OFDM
 Test Date: 2019-07-08
 Note: Antenna vertical

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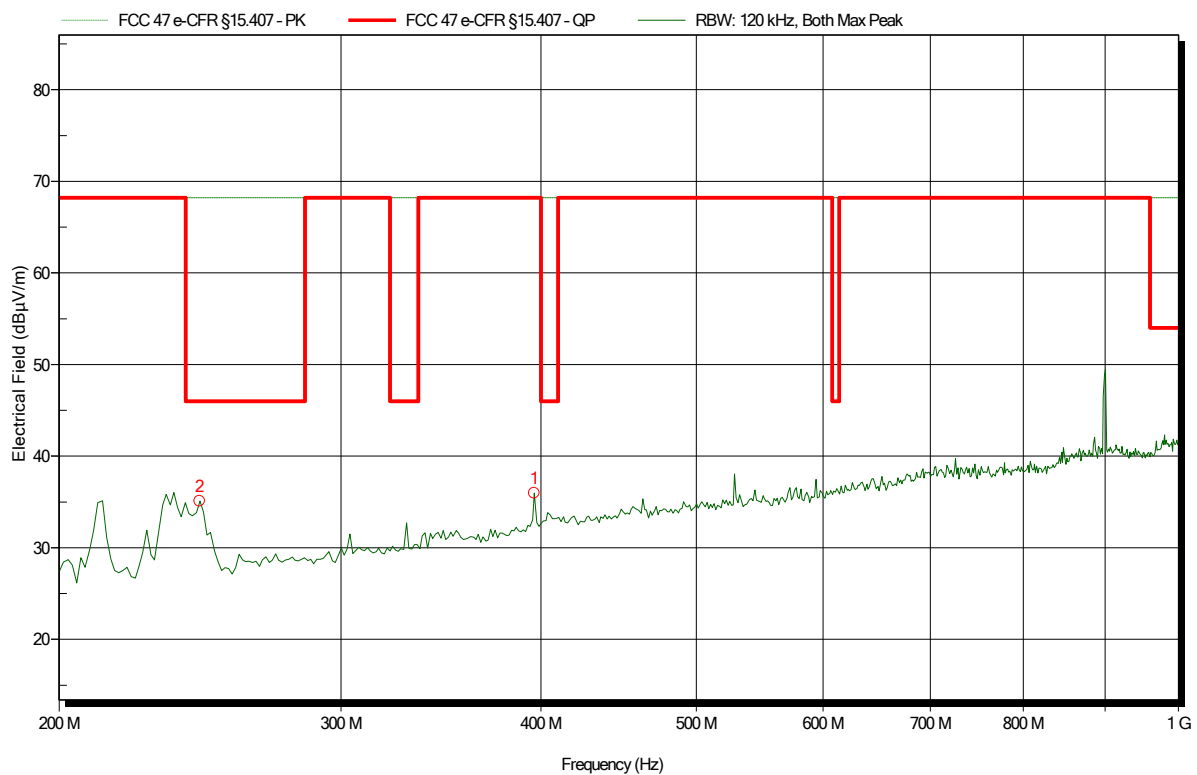
Frequency	Peak	Peak Limit	Peak Difference	Polarization	Status
108.0749 MHz	35.6 dBµV/m	43.5 dBµV/m	-7.96 dB	Vertical	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Mr. Voigt
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Rohde & Schwarz HL 223
Measurement distance: 3 m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-07-03
Note: Antenna vertical

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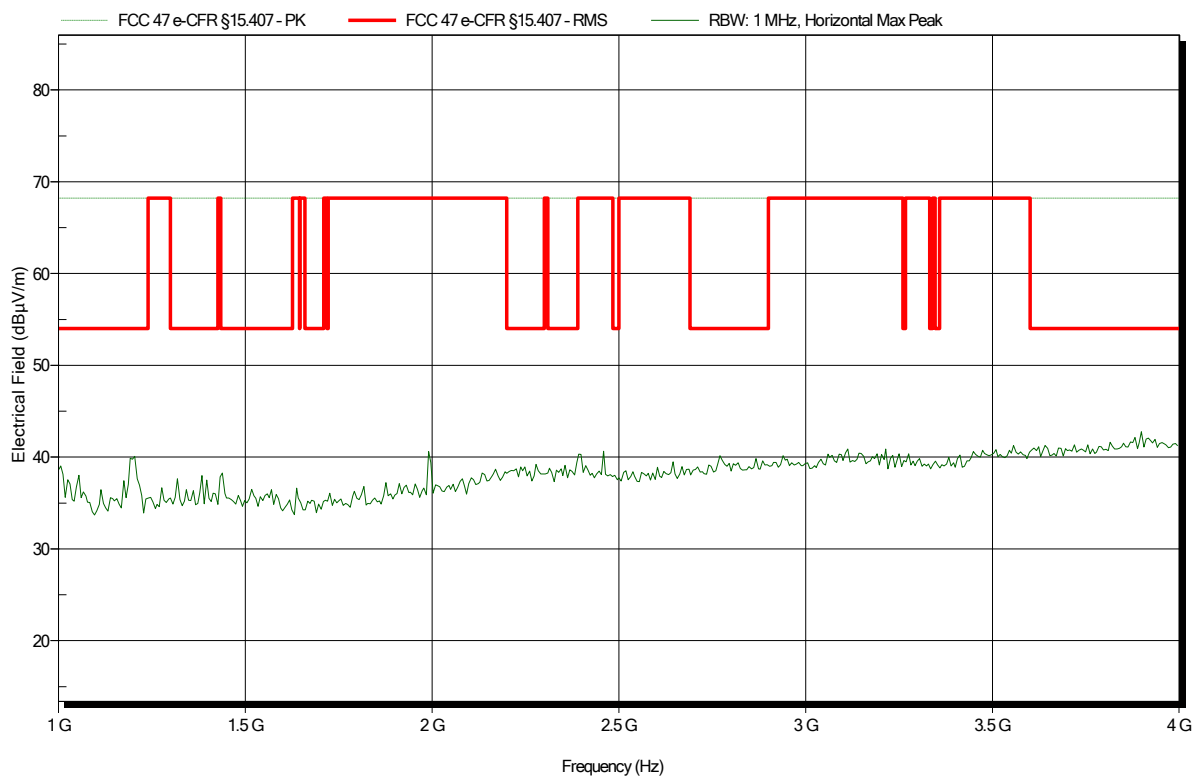


Frequency	Peak	Peak Limit	Peak Difference	Polarization	Status
244.8718 MHz	35.1 dBµV/m	46 dBµV/m	-10.92 dB	Vertical	Pass
396.1538 MHz	36 dBµV/m	68.2 dBµV/m	-32.22 dB	Horizontal	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021
 Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; CH36, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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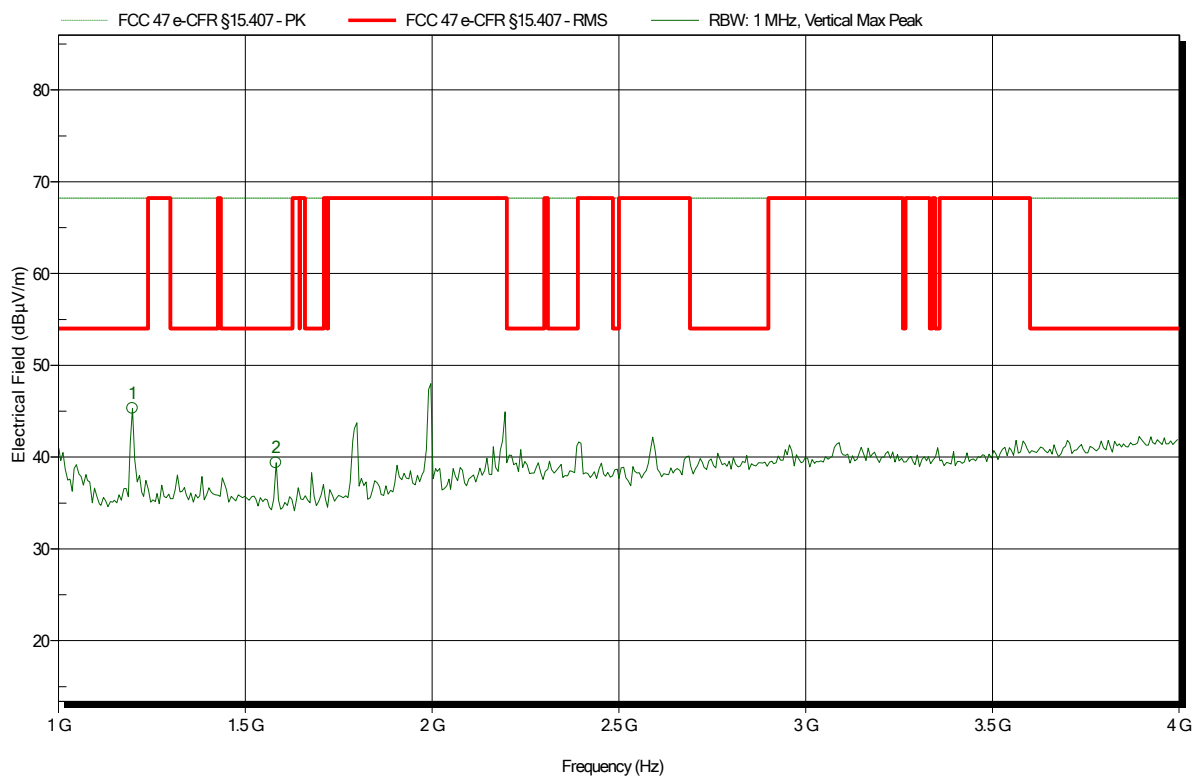


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 3 m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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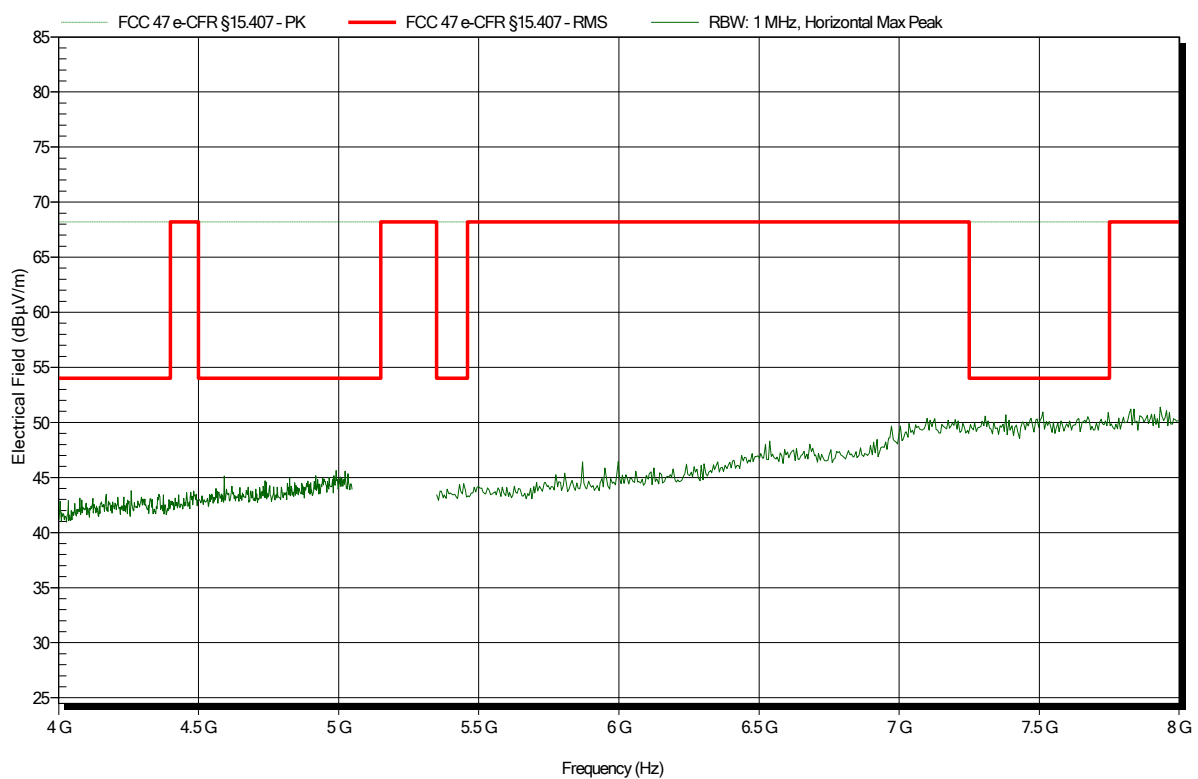
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
1.198 GHz	45.31 dBµV/m	54 dBµV/m	-8.69 dB	Pass
1.582 GHz	39.4 dBµV/m	54 dBµV/m	-14.6 dB	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Horizontal
Measurement distance: 3 m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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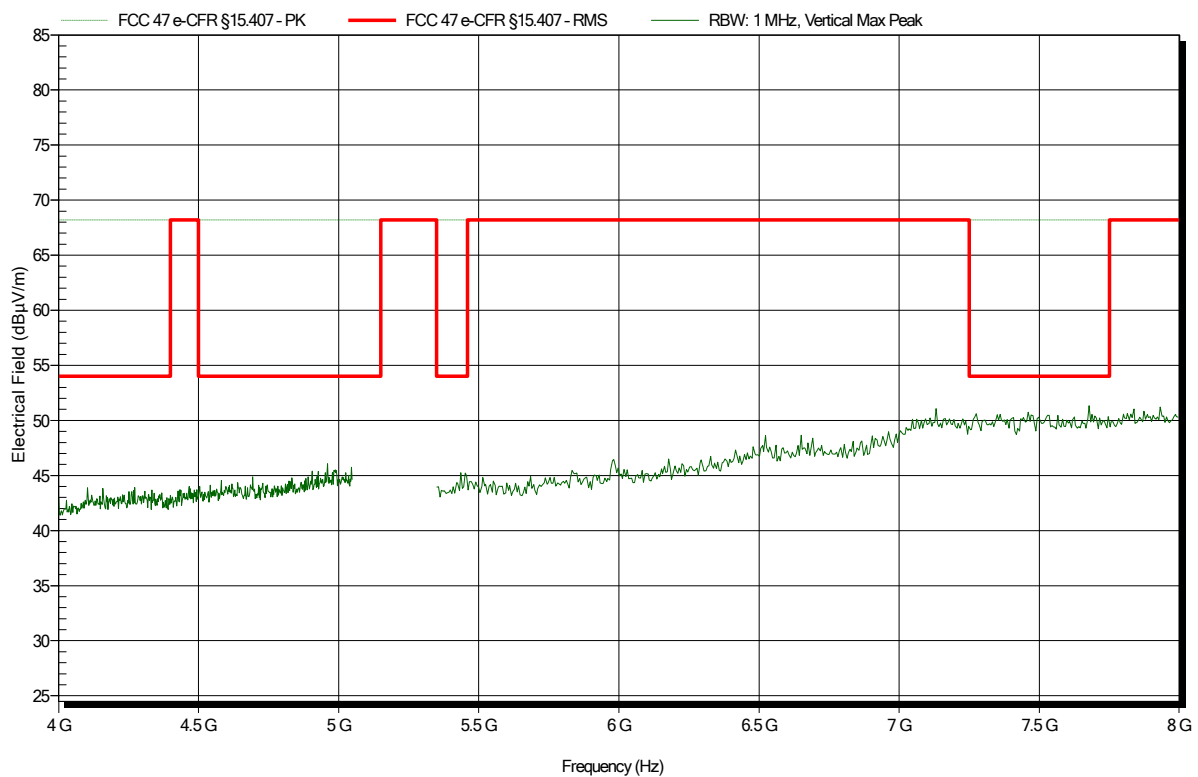


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 3 m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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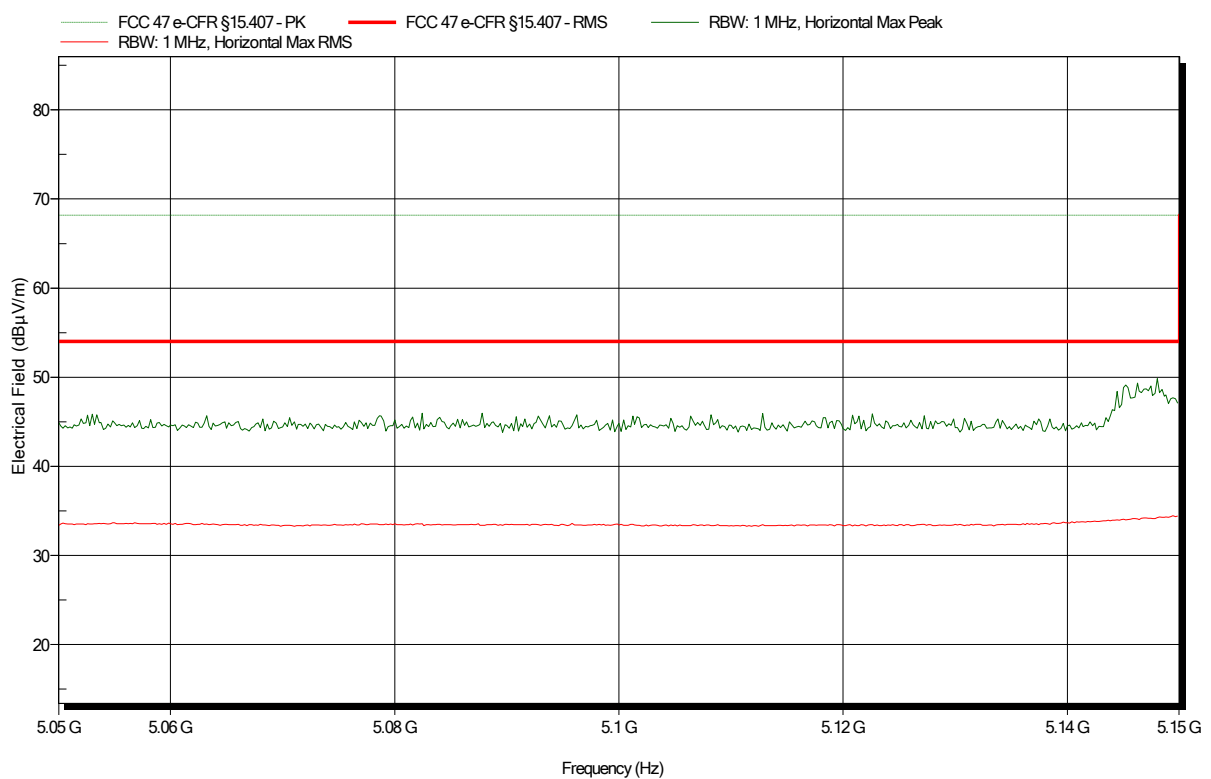


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Horizontal
Measurement distance: 3 m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical lower band-edge

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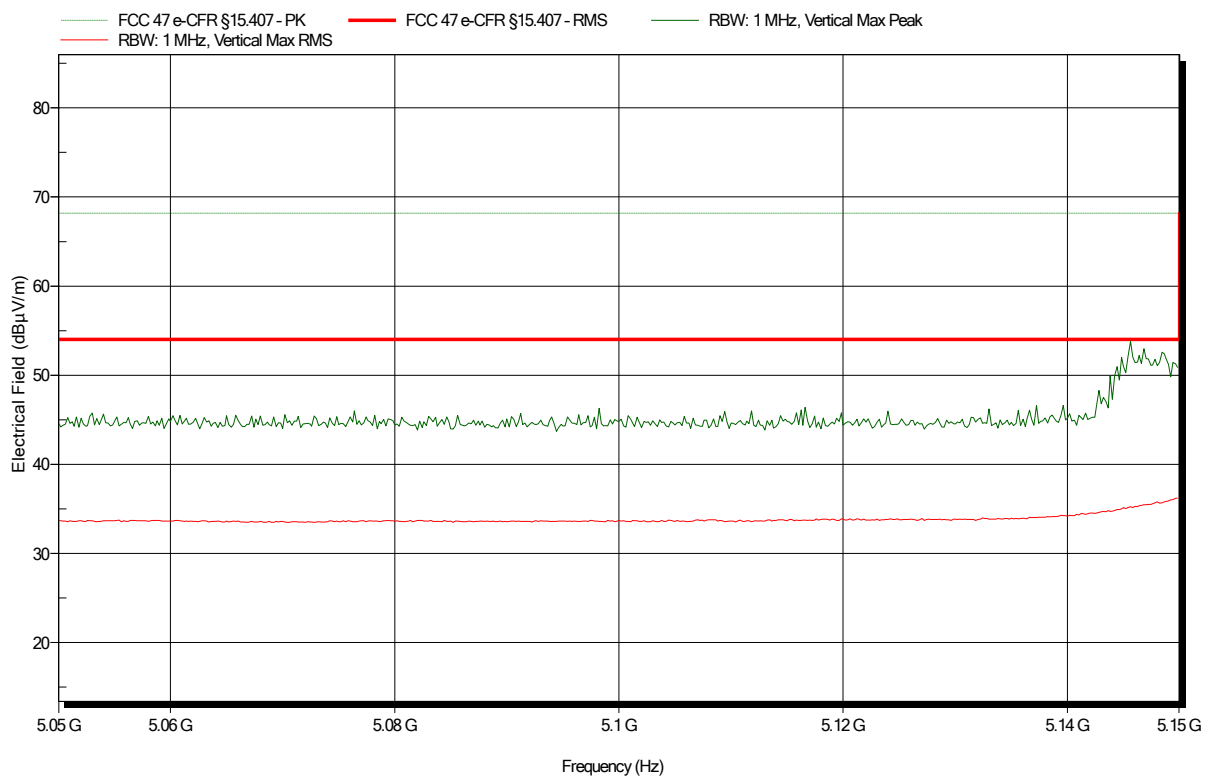


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; CH36, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical lower band-edge

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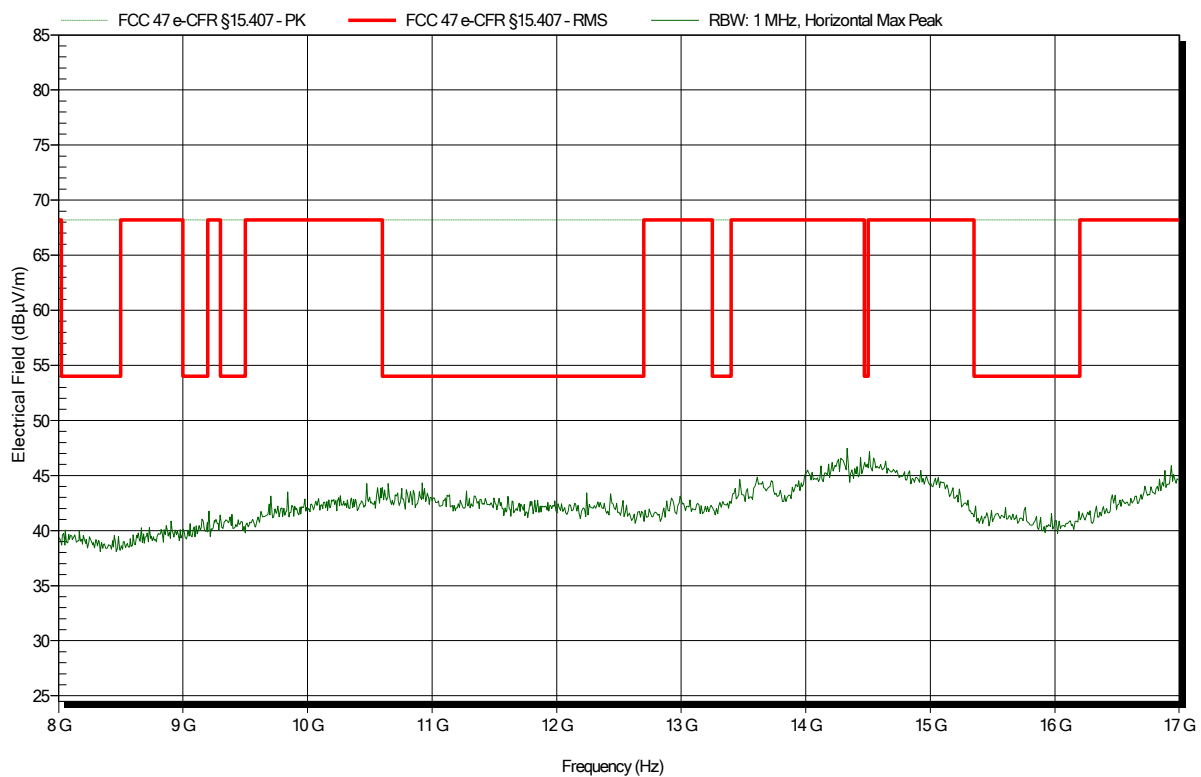


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH36, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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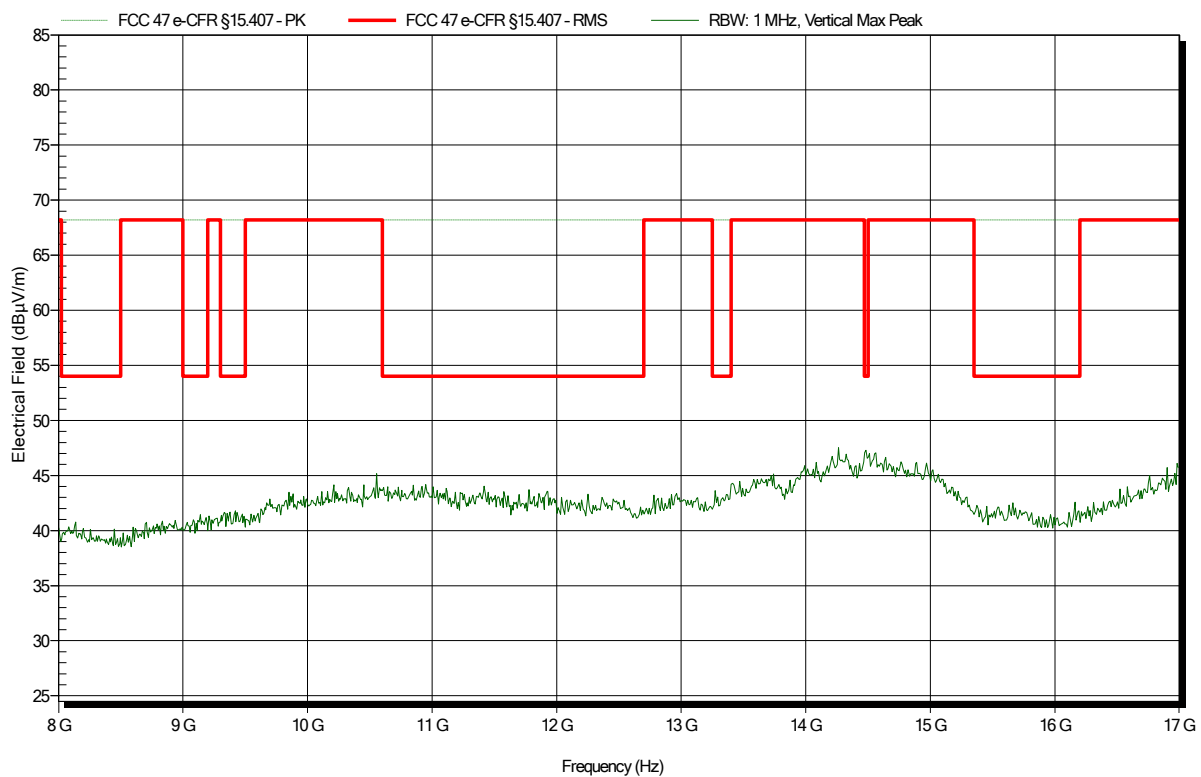


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 1 m converted to 3m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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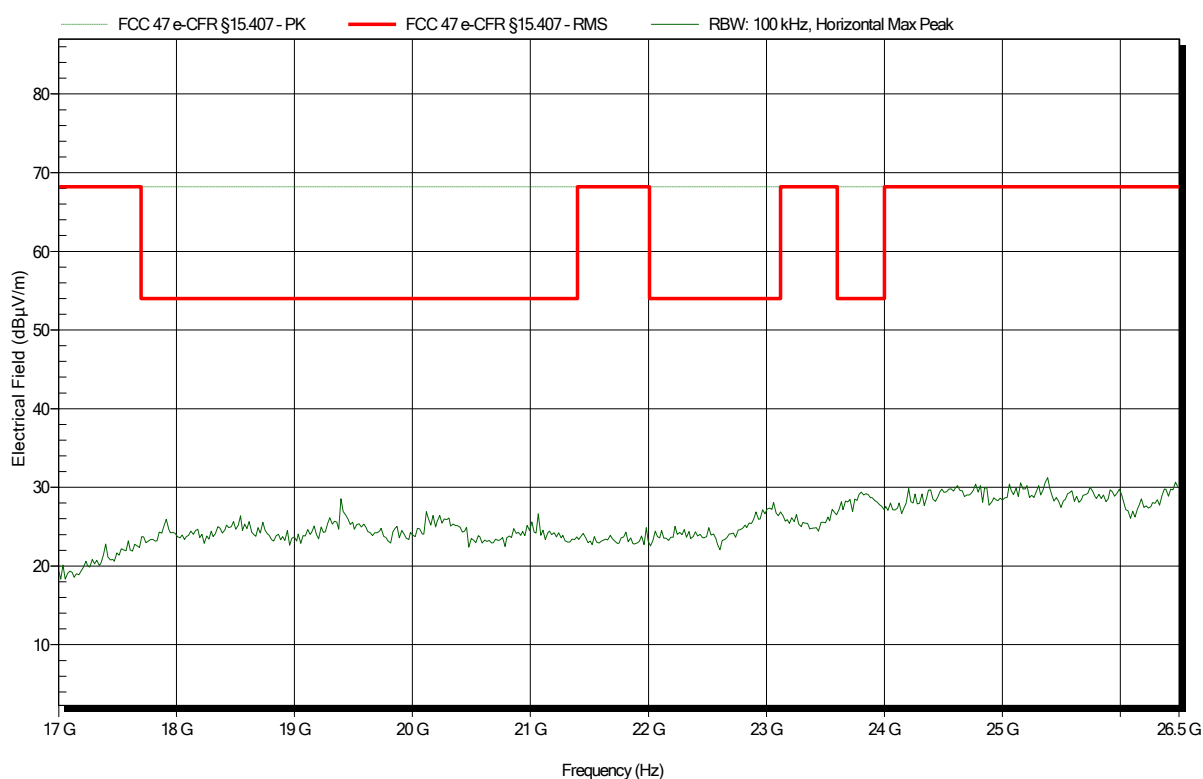


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: ATH18G40, Horizontal
Measurement distance: 1 m converted to 3m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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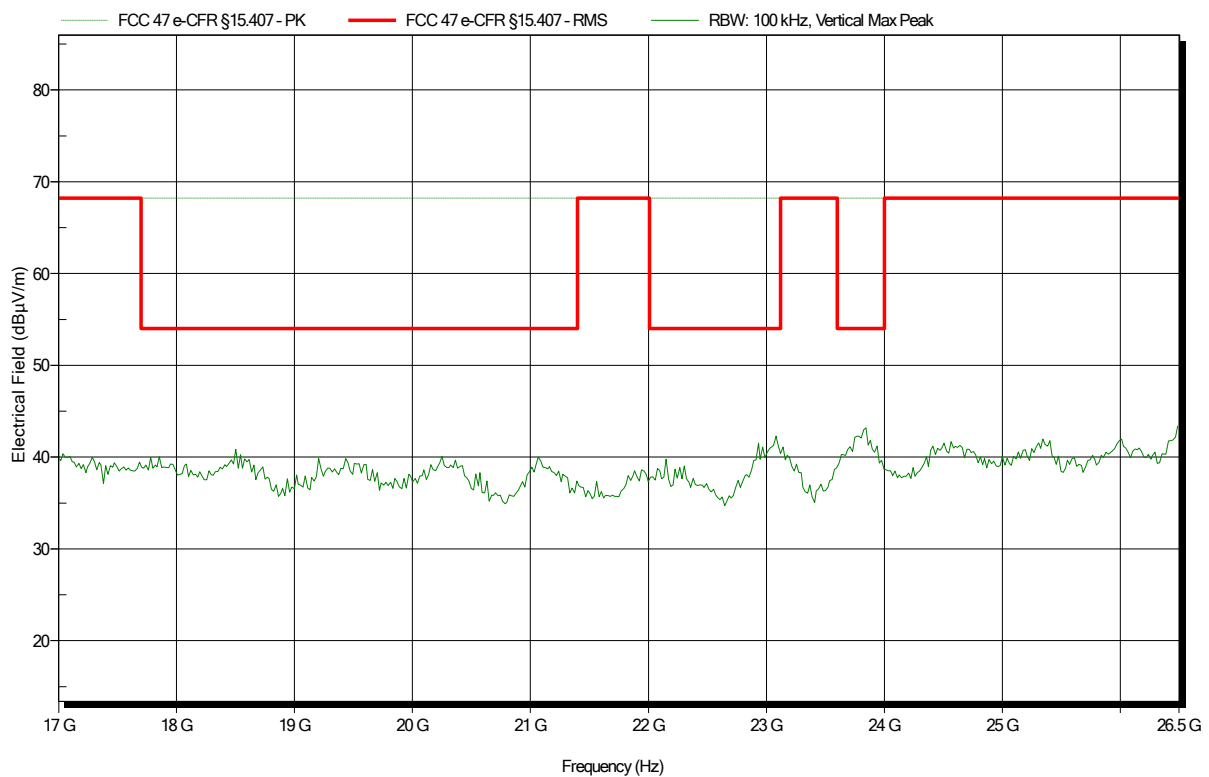


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: ATH18G40, Vertical
Measurement distance: 1 m converted to 3m
Mode: TX; CH36, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

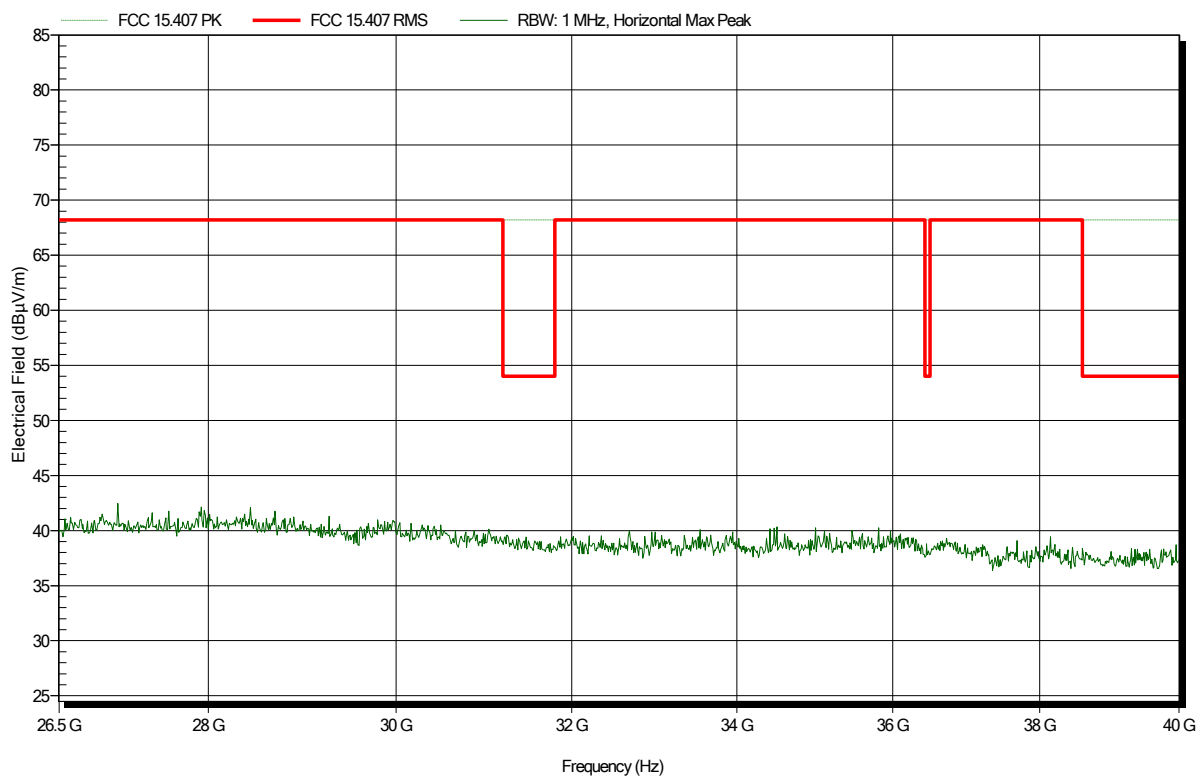
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Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021
 Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt(supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Flann Microwave Ltd 22240-25+CBL26402075, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH36, 6MBit, OFDM
 Test Date: 2019-07-01
 Note: Antenna vertical

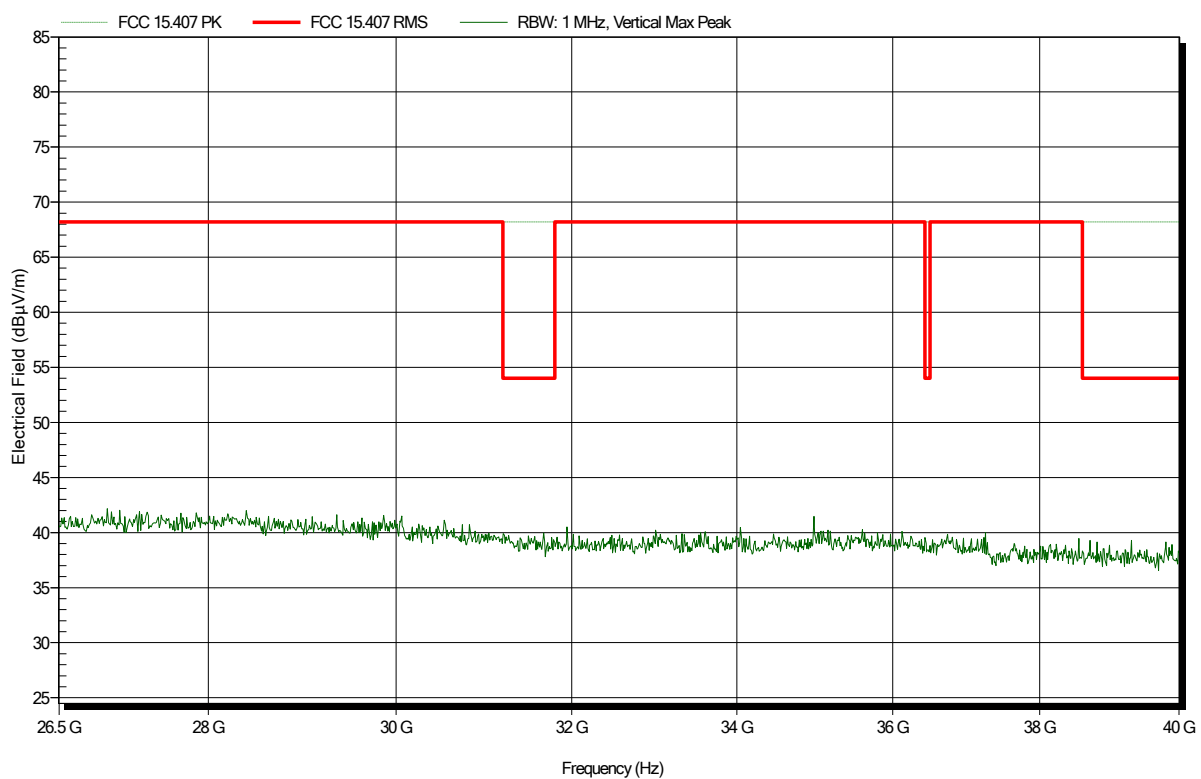
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Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021
 Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Wilfried Treffke
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Flann Microwave Ltd 22240-25+CBL26402075, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH36, 6MBit, OFDM
 Test Date: 2019-07-01
 Note: Antenna vertical

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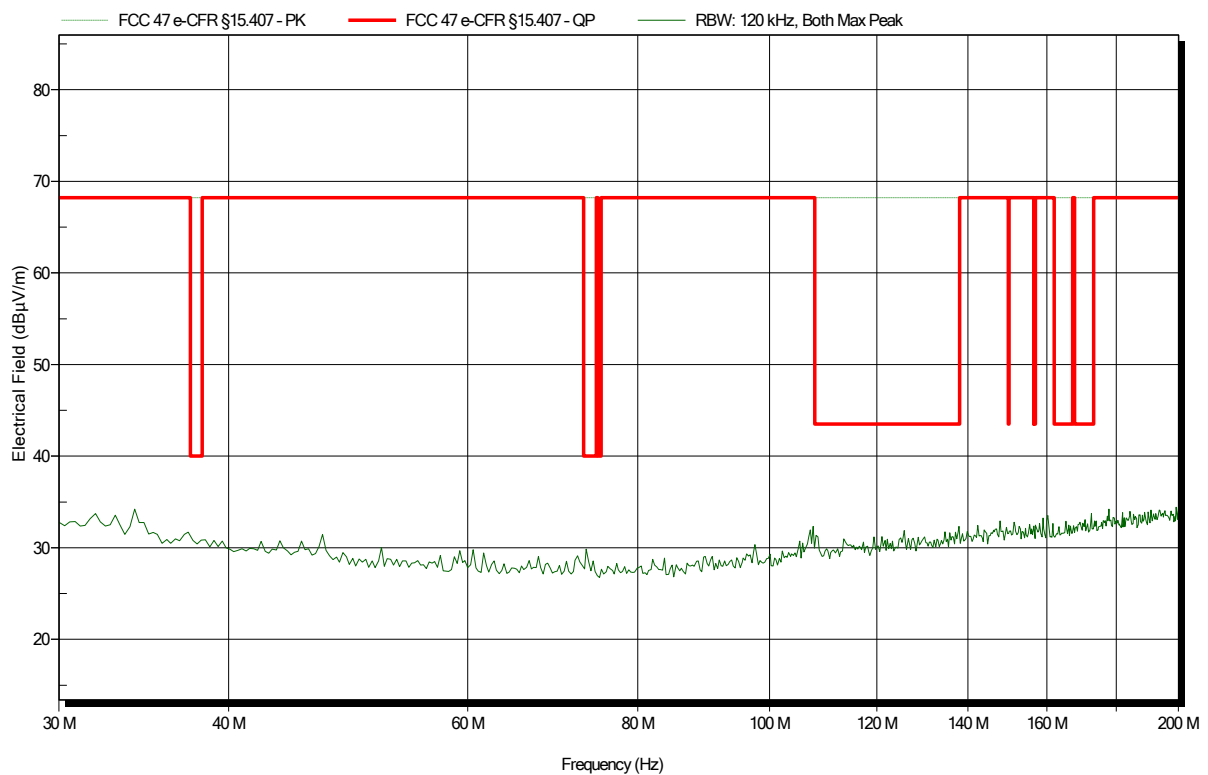


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Mr. Voigt
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Rohde & Schwarz HK 116
Measurement distance: 3 m
Mode: TX; CH48, 6MBit, OFDM
Test Date: 2019-07-08
Note: Antenna vertical

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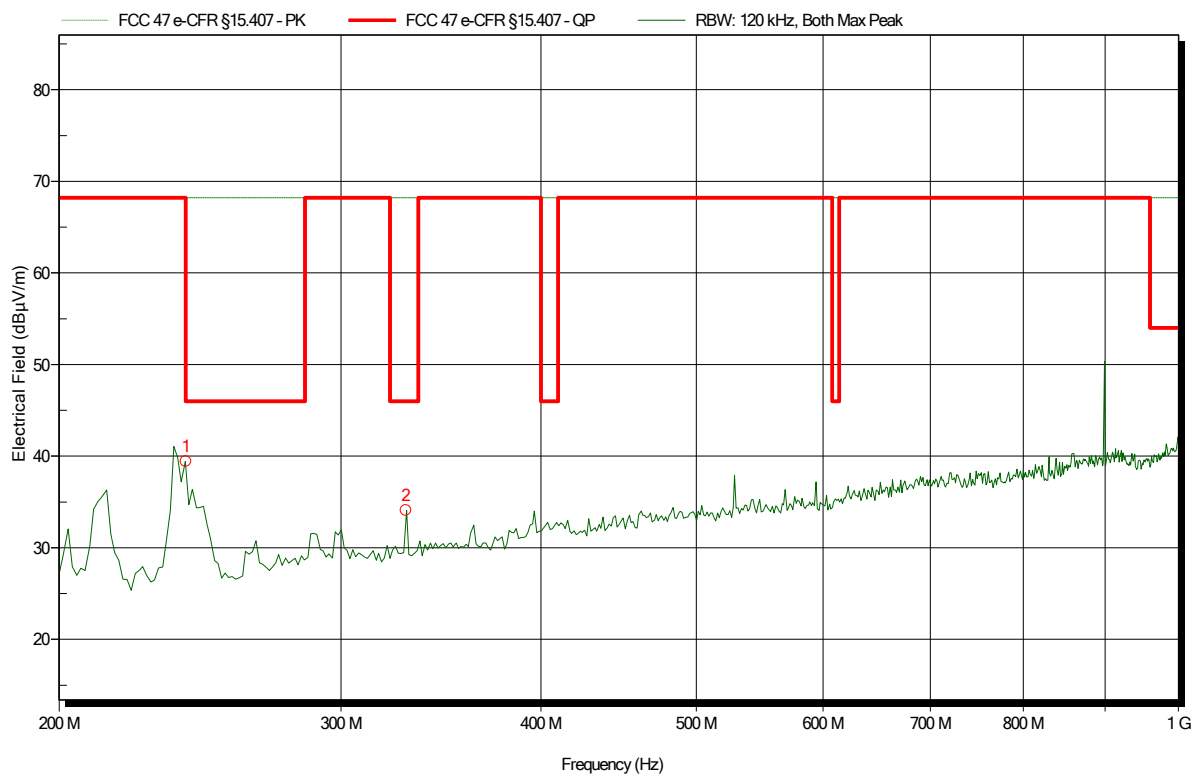


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Mr. Voigt
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Rohde & Schwarz HL 223
Measurement distance: 3 m
Mode: TX; CH48, 6MBit, OFDM
Test Date: 2019-07-03
Note: Antenna vertical

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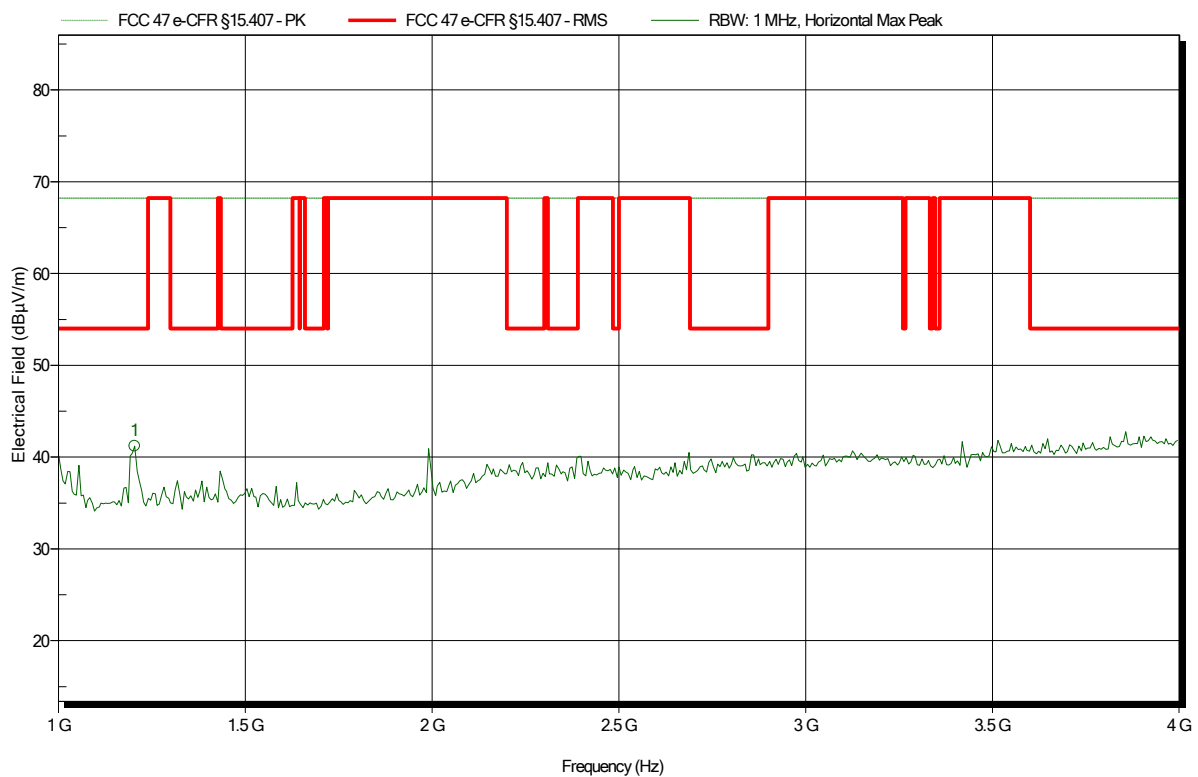
Frequency	Peak	Peak Limit	Peak Difference	Polarization	Status
240.1306 MHz	39.4 dBµV/m	46 dBµV/m	-6.57 dB	Vertical	Pass
329.4872 MHz	34.1 dBµV/m	46 dBµV/m	-11.93 dB	Horizontal	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; CH48, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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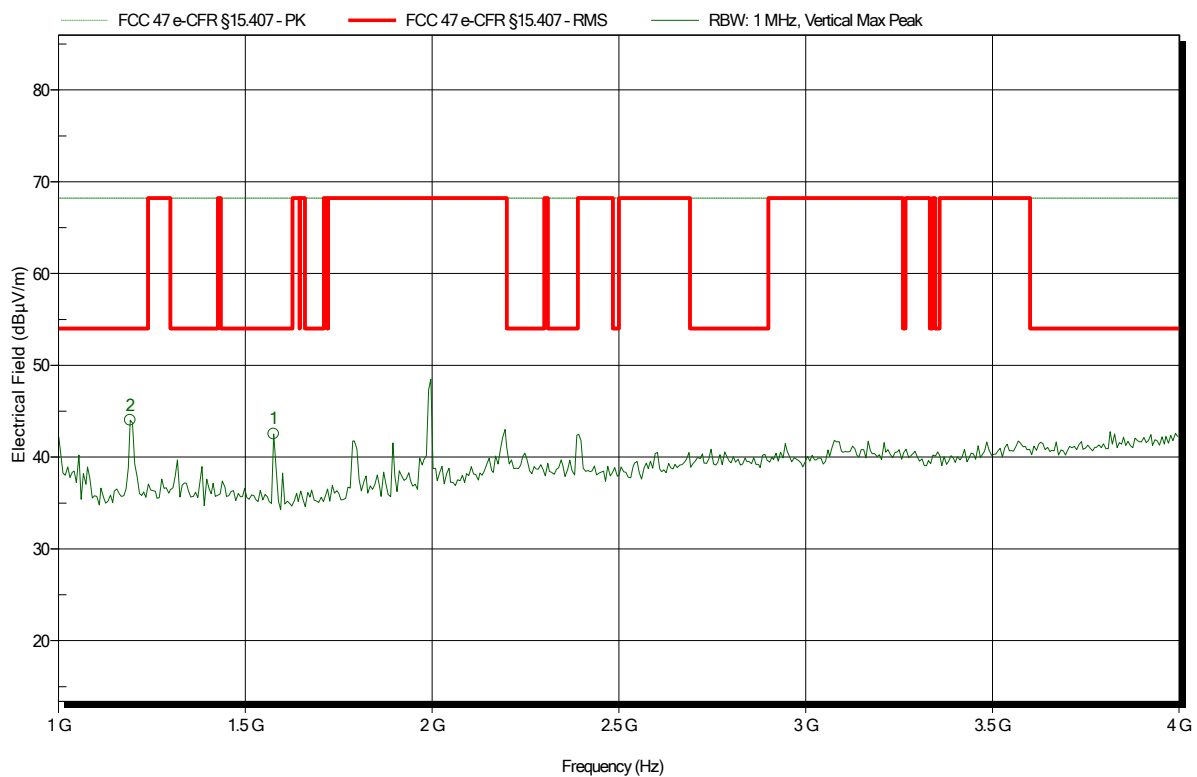
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
1.204 GHz	41.19 dBµV/m	54 dBµV/m	-12.81 dB	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 3 m
Mode: TX; CH48, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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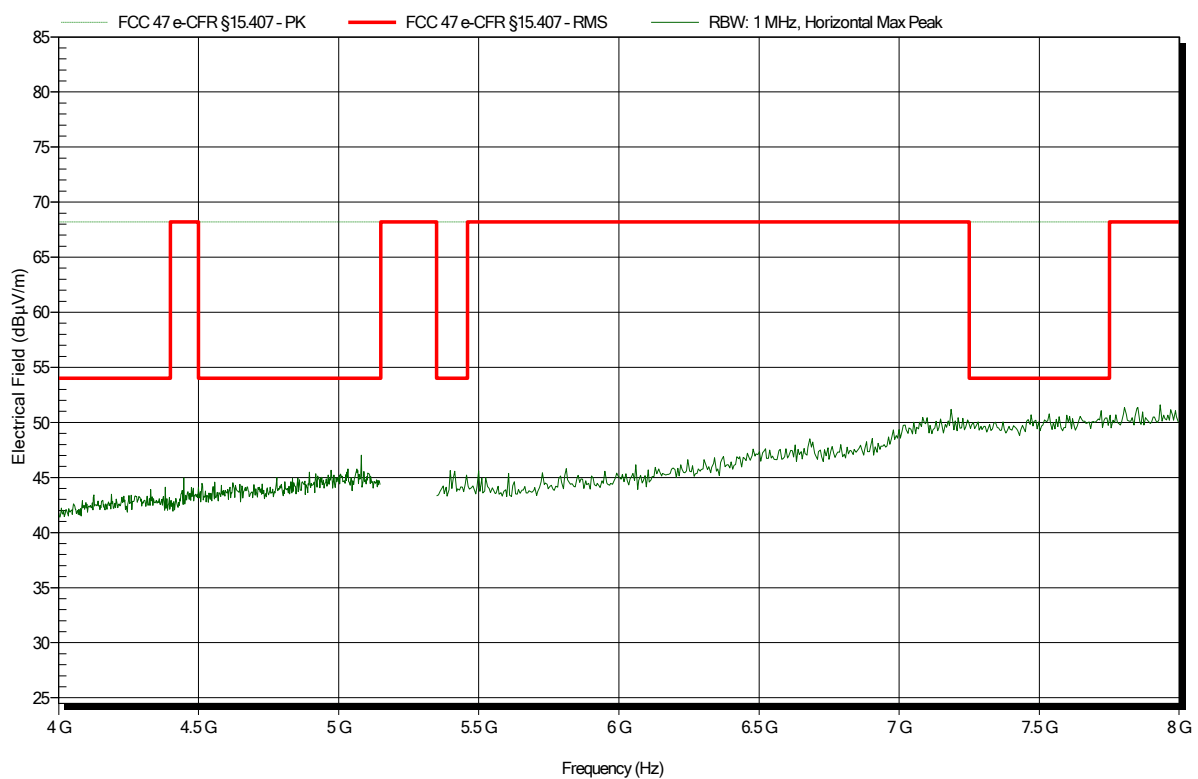
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
1.192 GHz	44.03 dBµV/m	54 dBµV/m	-9.97 dB	Pass
1.576 GHz	42.52 dBµV/m	54 dBµV/m	-11.48 dB	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 3 m
 Mode: TX; CH48, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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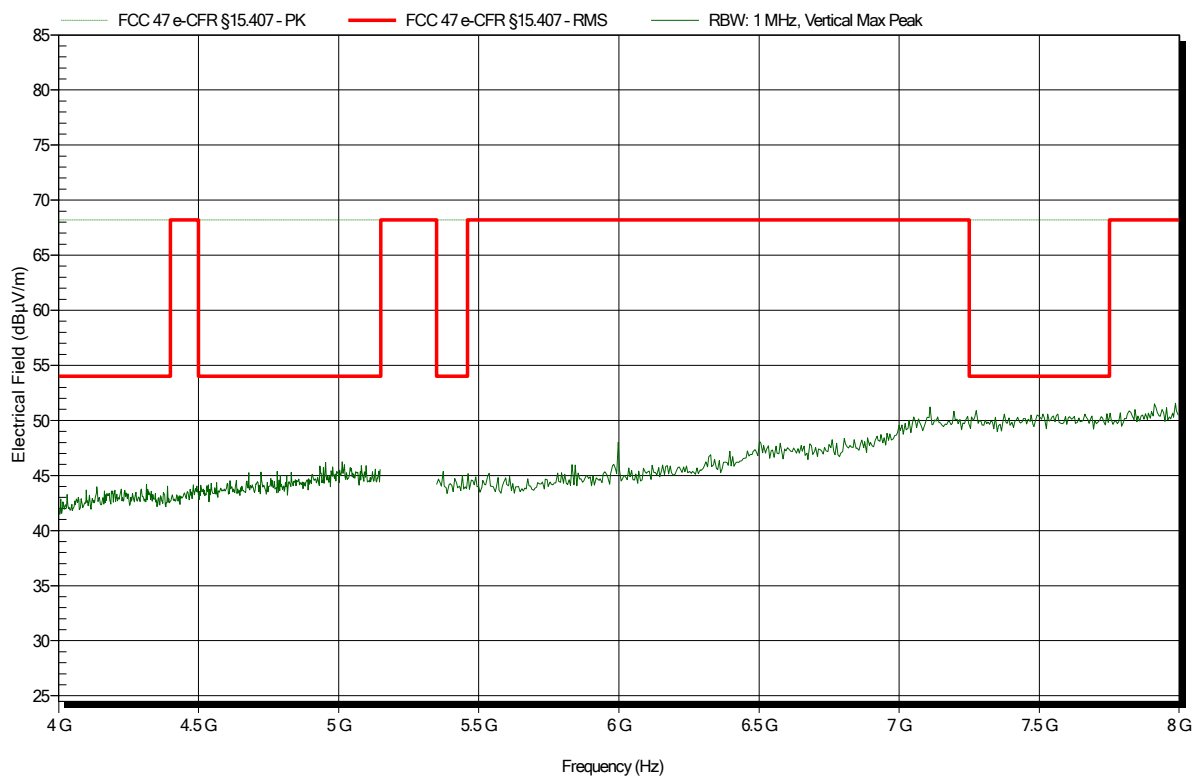


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 3 m
Mode: TX; CH48, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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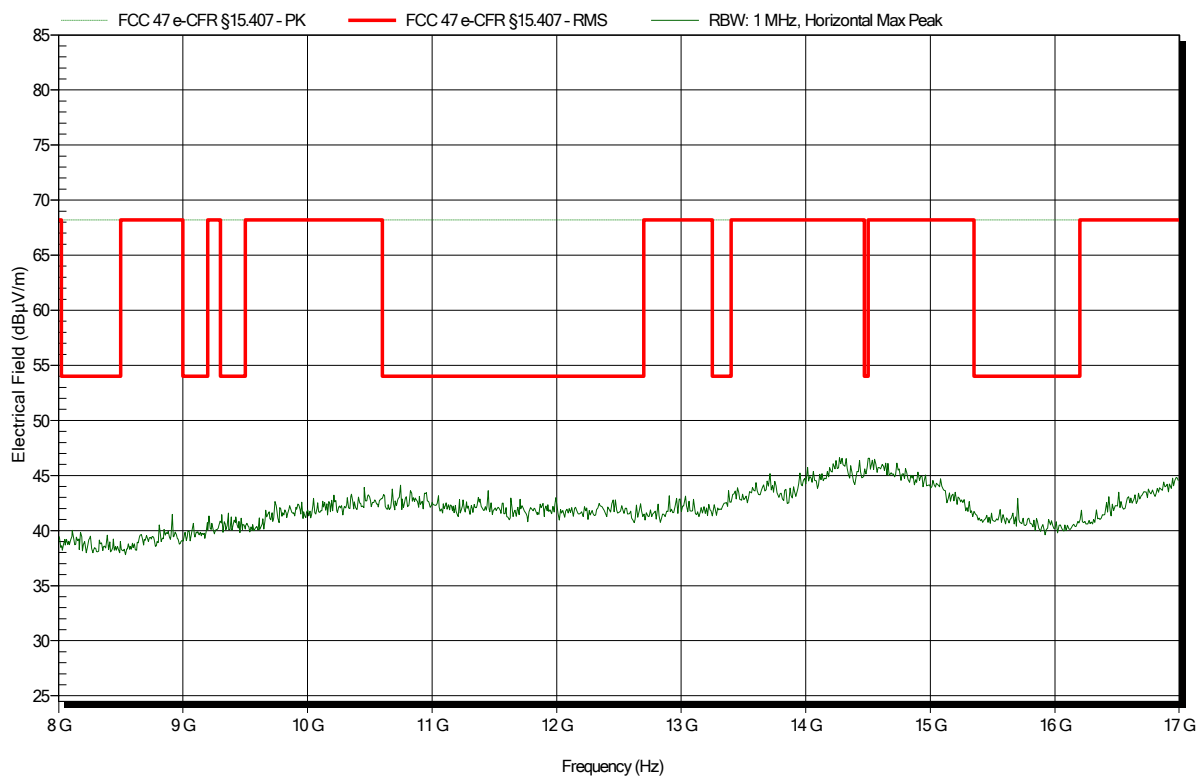


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH48, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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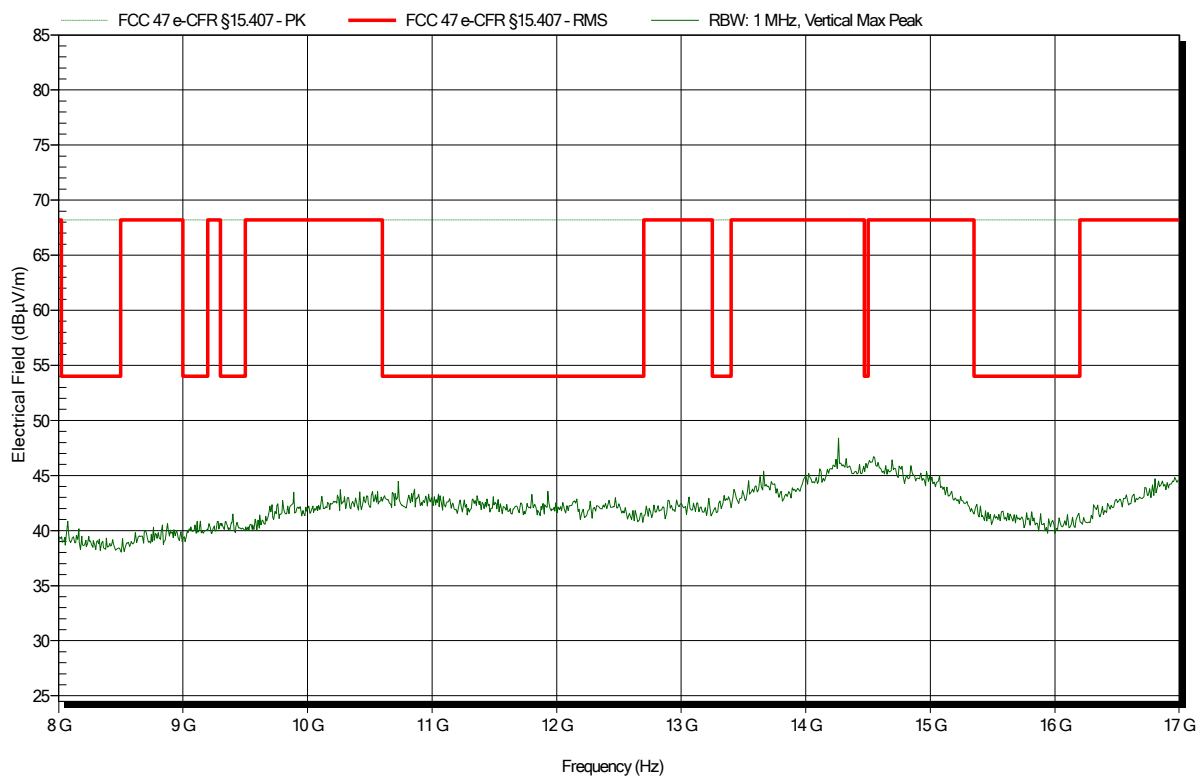


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 1 m converted to 3m
Mode: TX; CH48, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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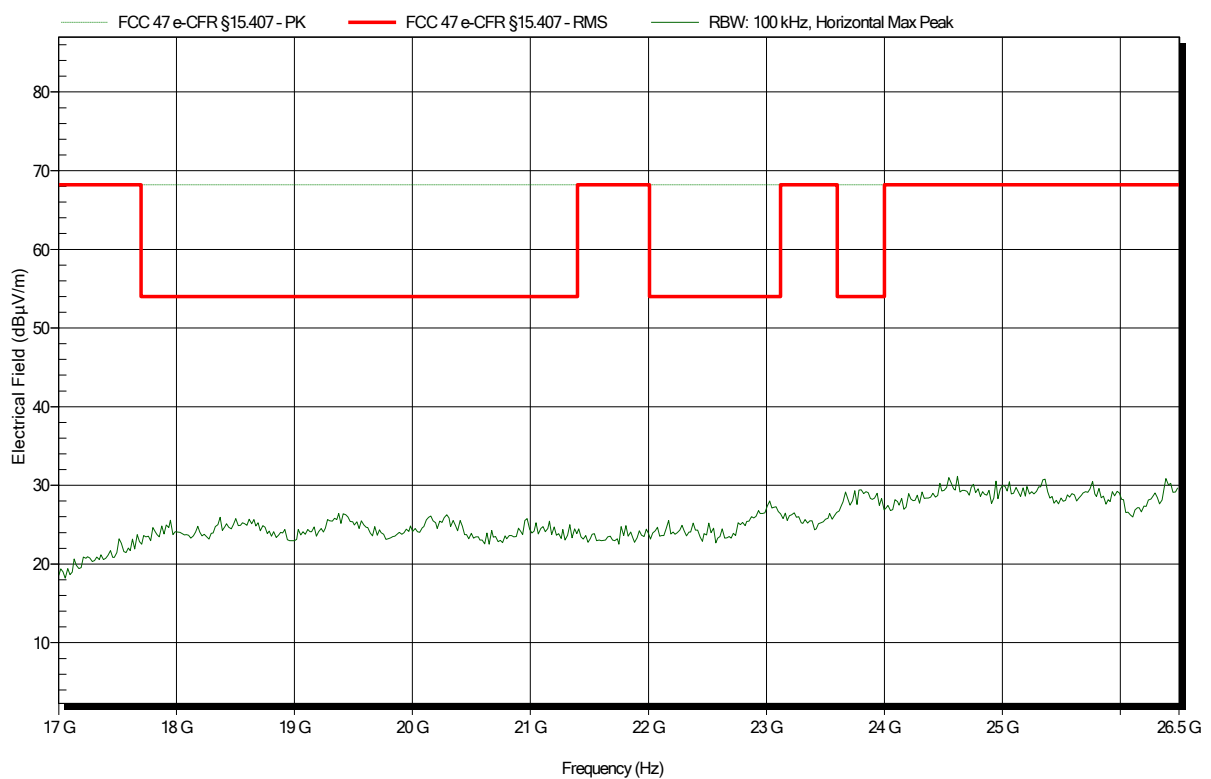


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: ATH18G40, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH48, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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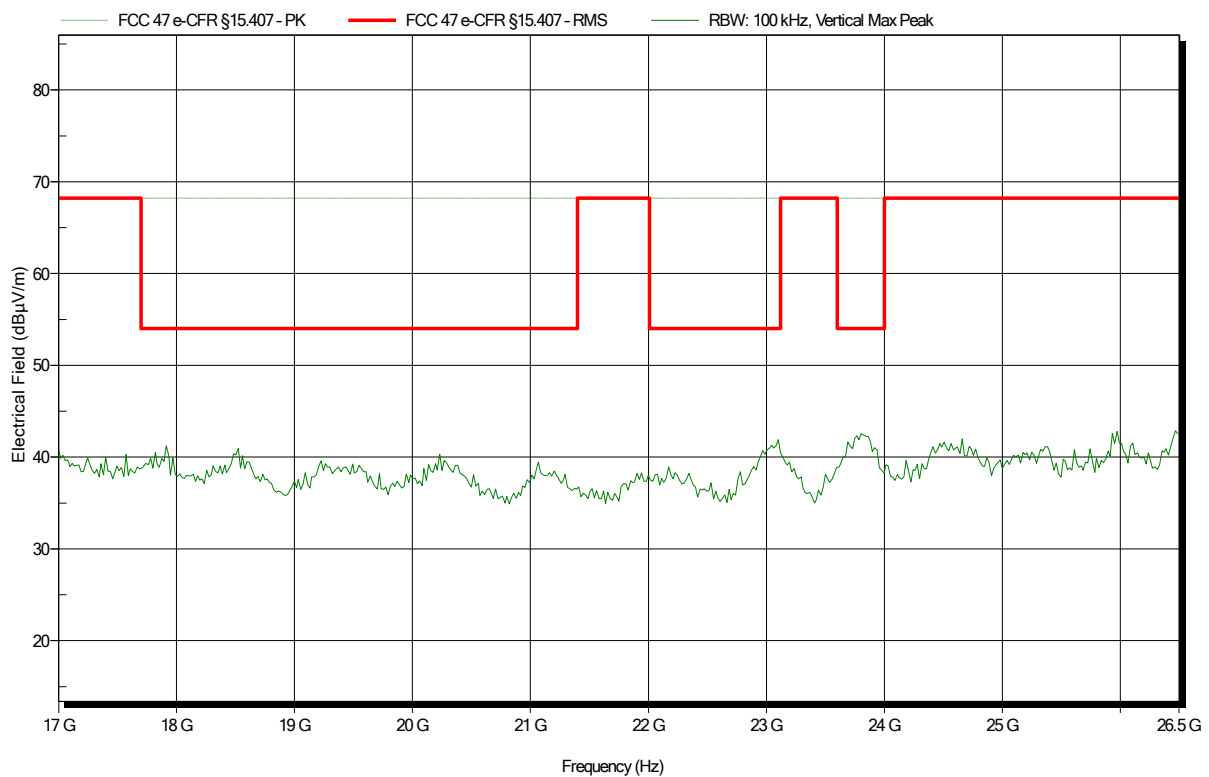


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: ATH18G40, Vertical
Measurement distance: 1 m converted to 3m
Mode: TX; CH48, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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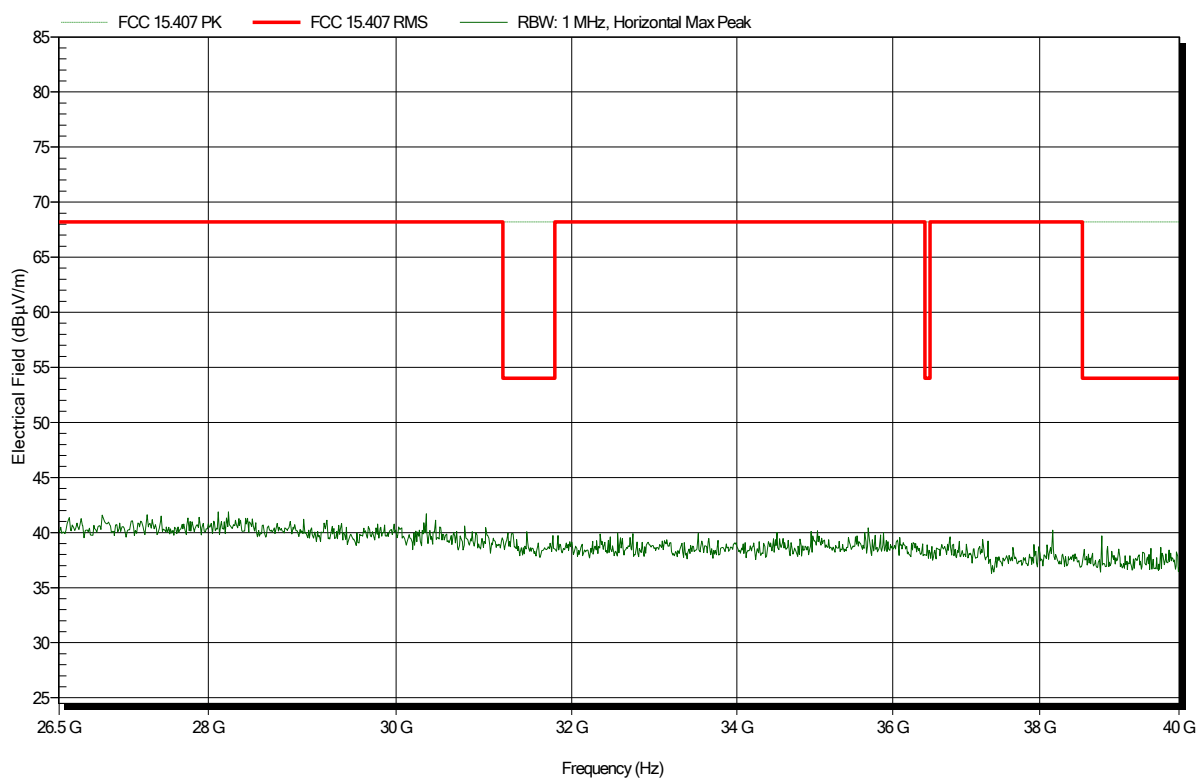


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt(supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Flann Microwave Ltd 22240-25+CBL26402075, Horizontal
Measurement distance: 1 m converted to 3m
Mode: TX; CH48, 6MBit, OFDM
Test Date: 2019-07-01
Note: Antenna vertical

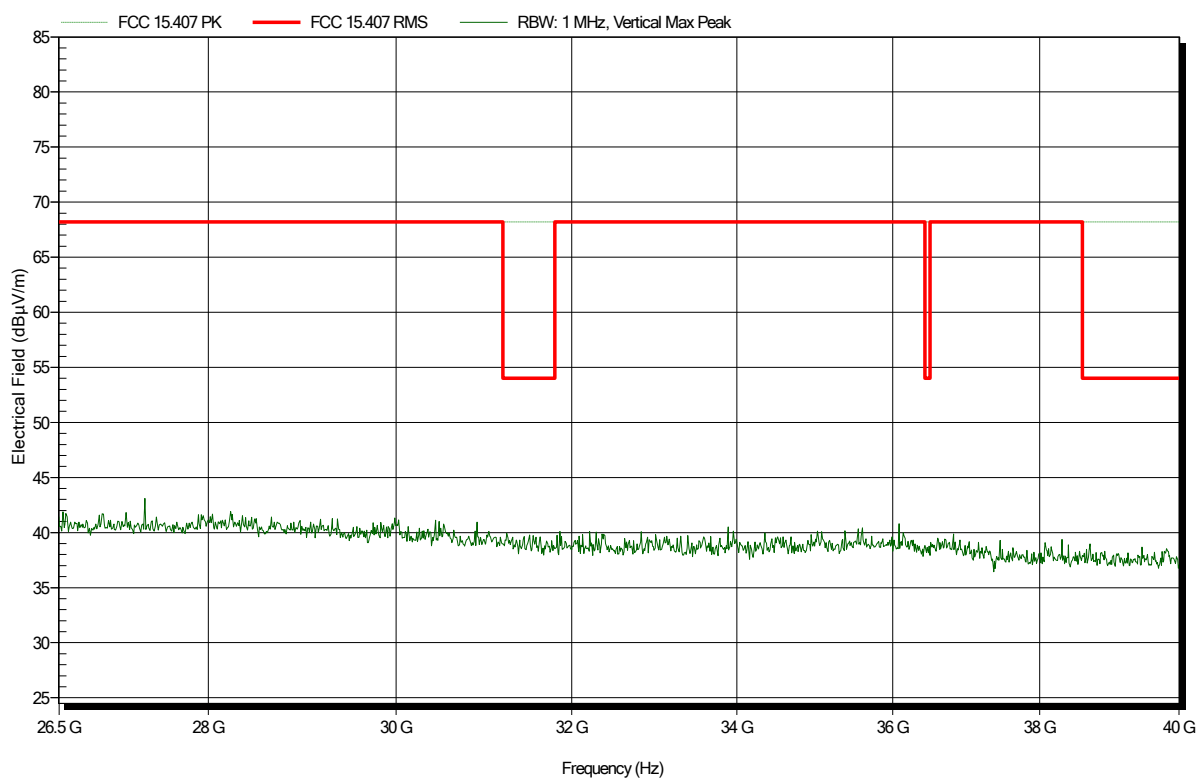
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Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021
 Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt(supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Flann Microwave Ltd 22240-25+CBL26402075, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH48, 6MBit, OFDM
 Test Date: 2019-07-01
 Note: Antenna vertical

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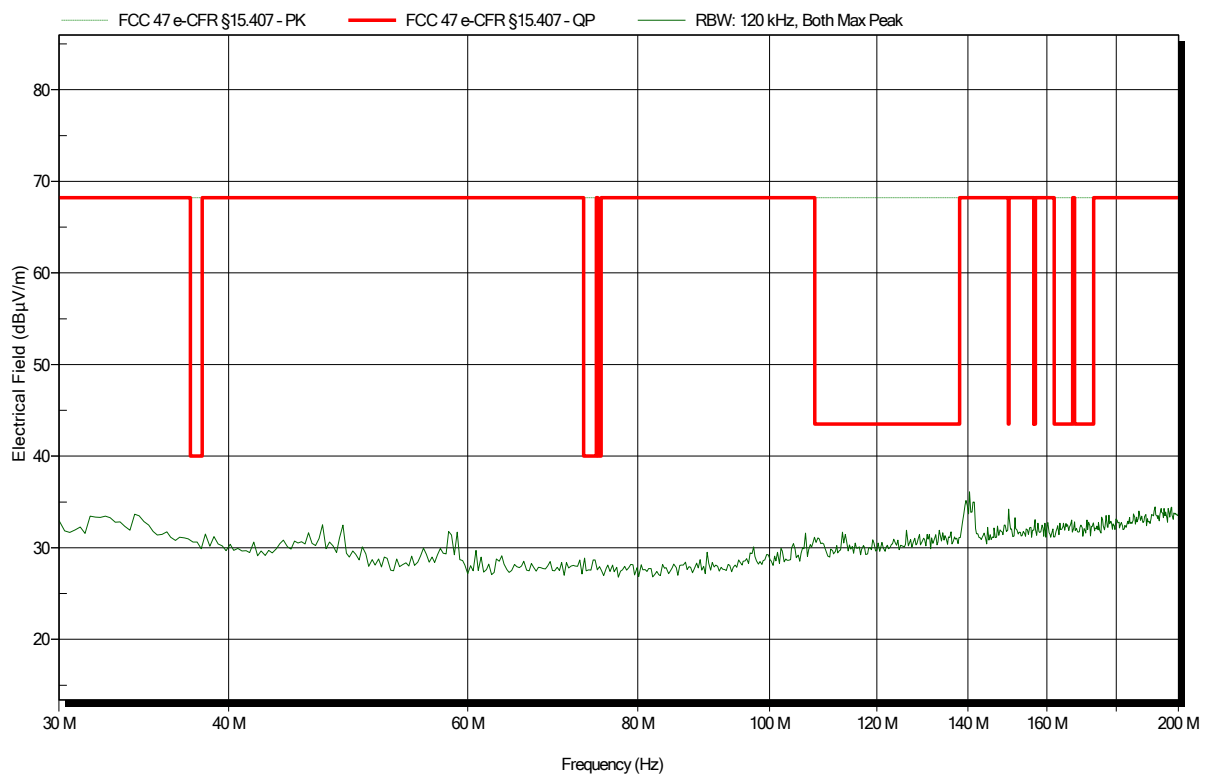


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Voigt
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: TX; CH64, 6MBit, OFDM
 Test Date: 2019-07-08
 Note: Antenna vertical

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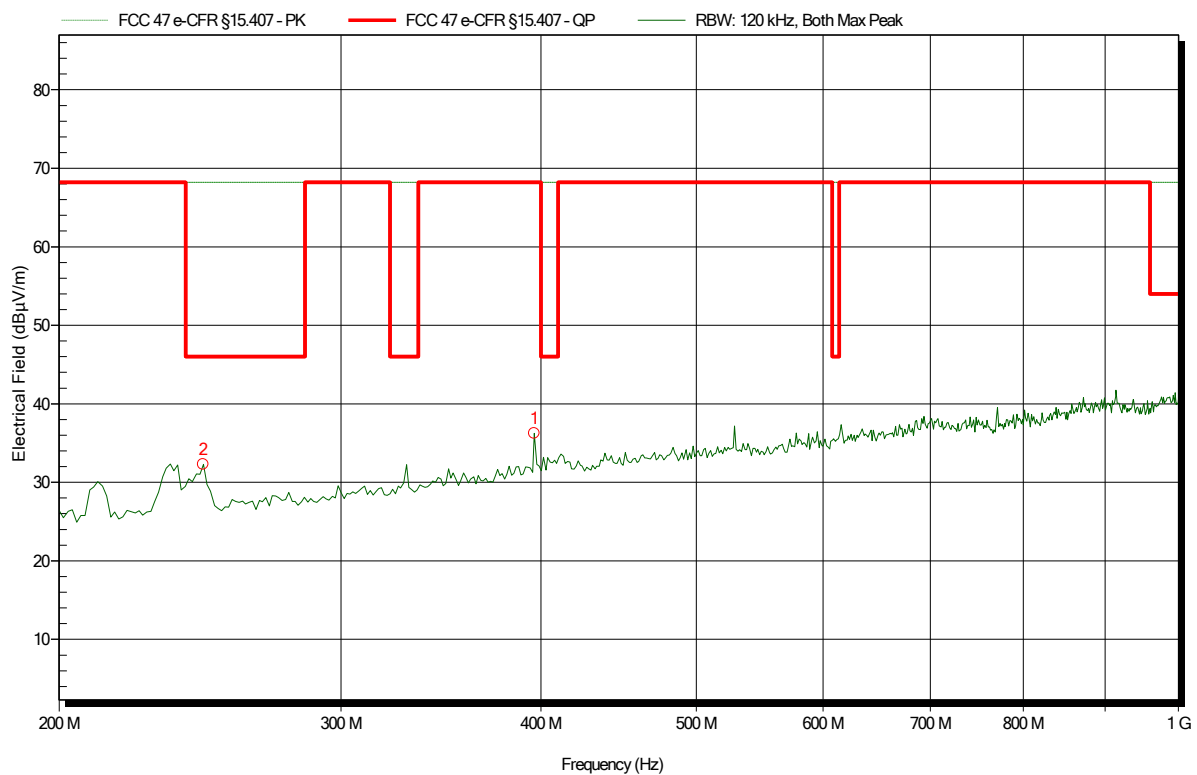


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Mr. Voigt
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Rohde & Schwarz HL 223
Measurement distance: 3 m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-07-03
Note: Antenna vertical

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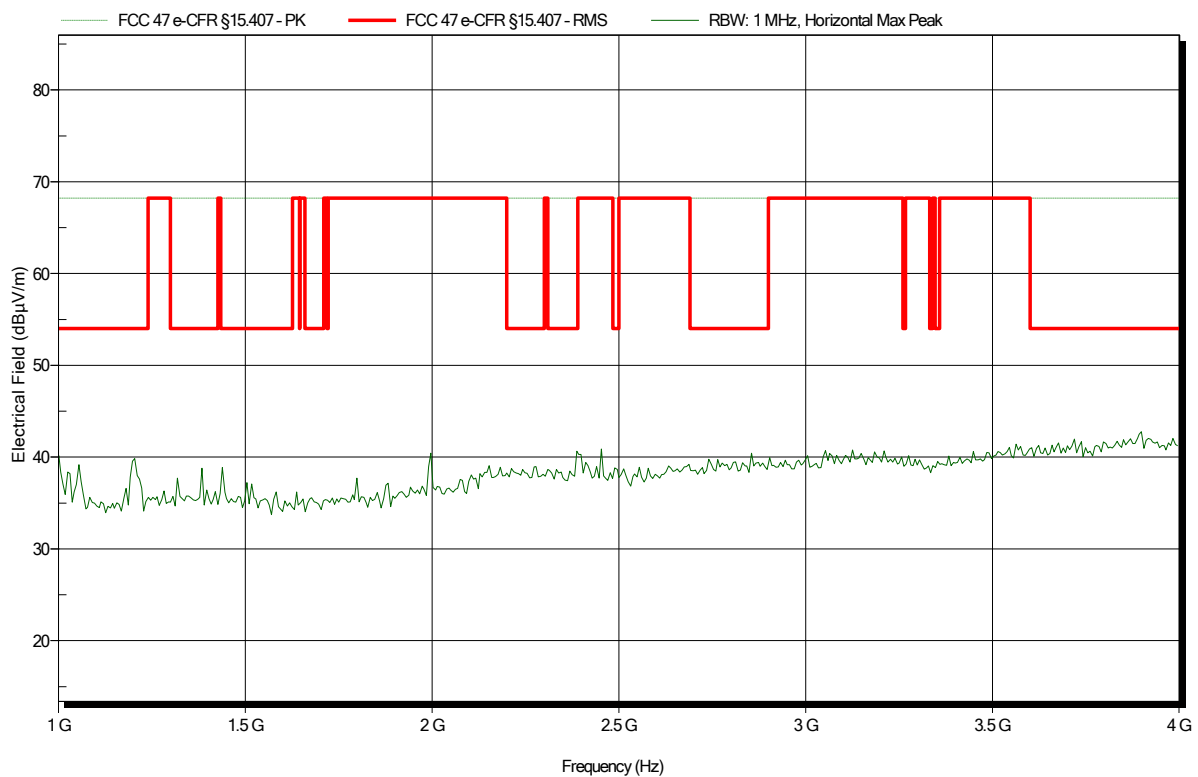
Frequency	Peak	Peak Limit	Peak Difference	Polarization	Status
246.1538 MHz	32.3 dBμV/m	46 dBμV/m	-13.73 dB	Vertical	Pass
396.1538 MHz	36.2 dBμV/m	68.2 dBμV/m	-31.96 dB	Horizontal	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Horizontal
Measurement distance: 3 m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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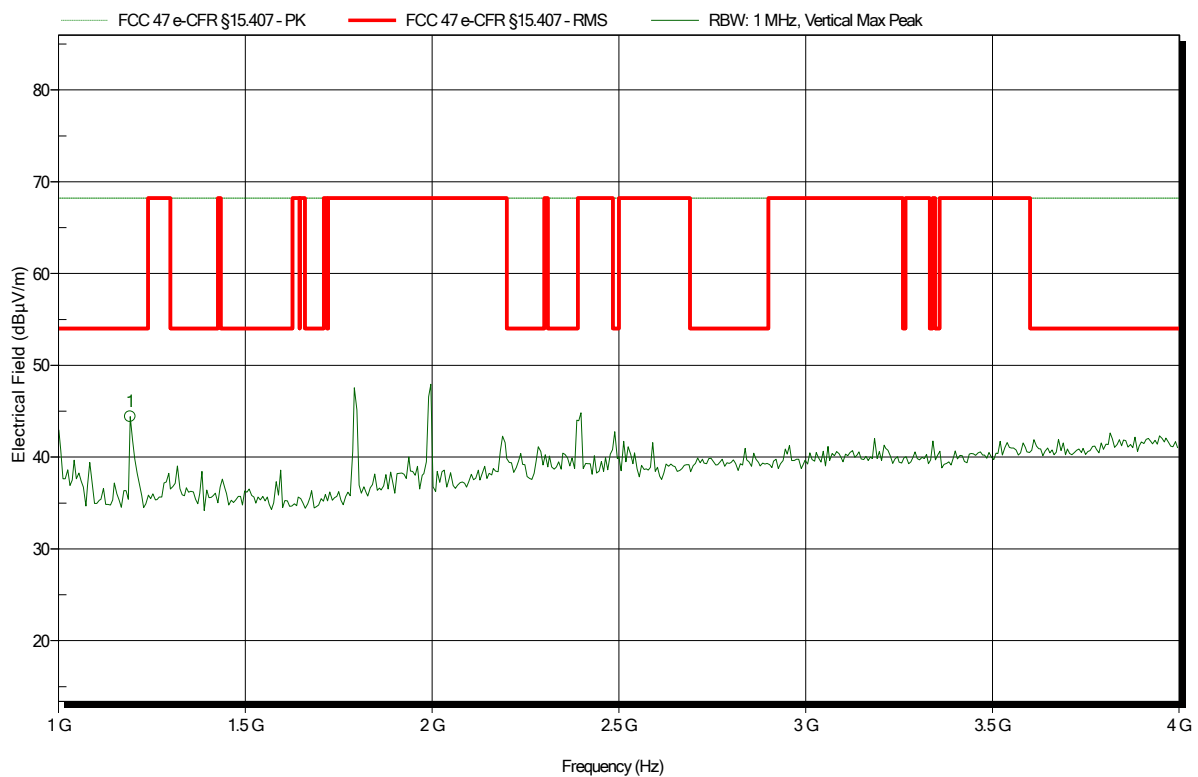


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 3 m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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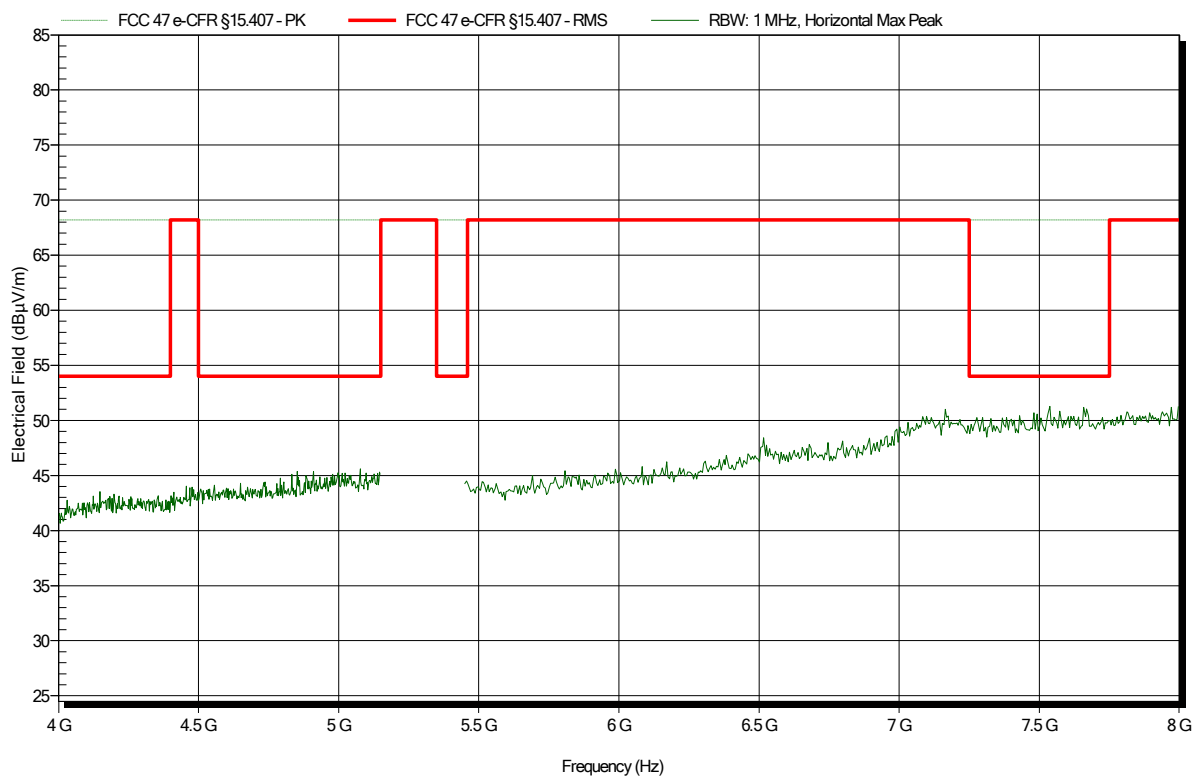
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
1.192 GHz	44.4 dBµV/m	54 dBµV/m	-9.6 dB	Pass

Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbek BBHA 9120D, Horizontal
Measurement distance: 3 m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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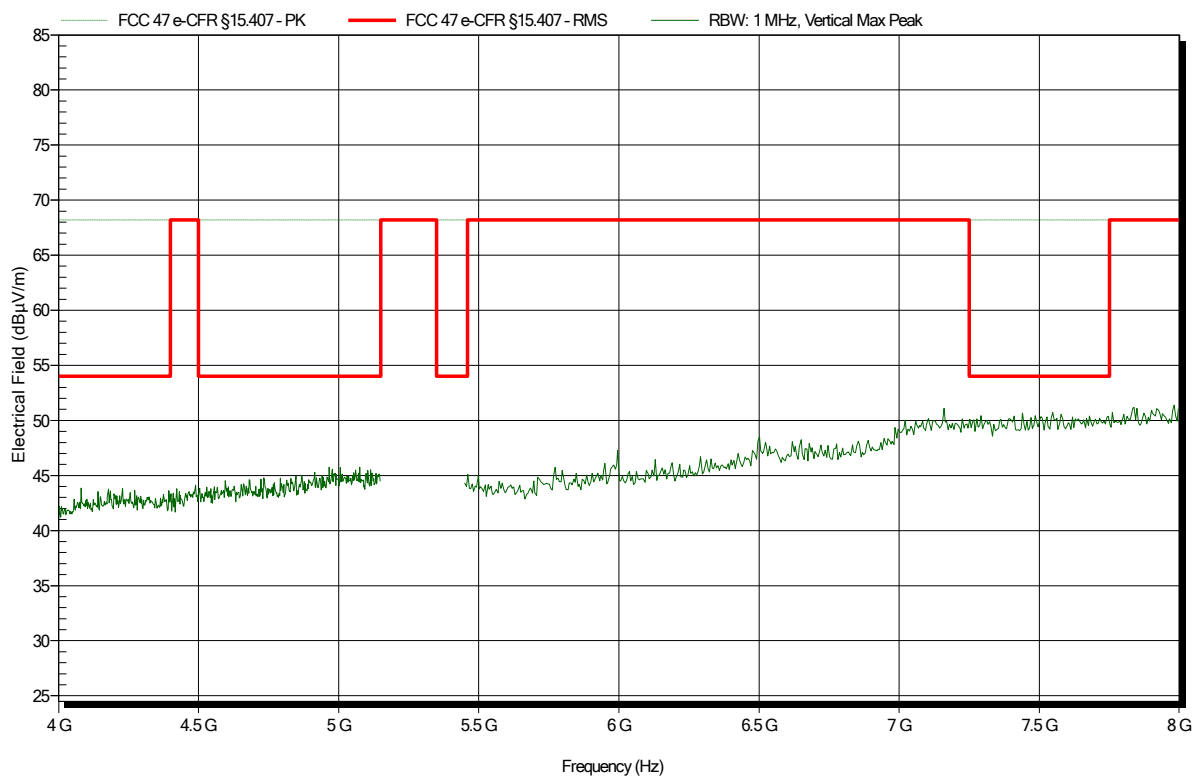


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Vertical
Measurement distance: 3 m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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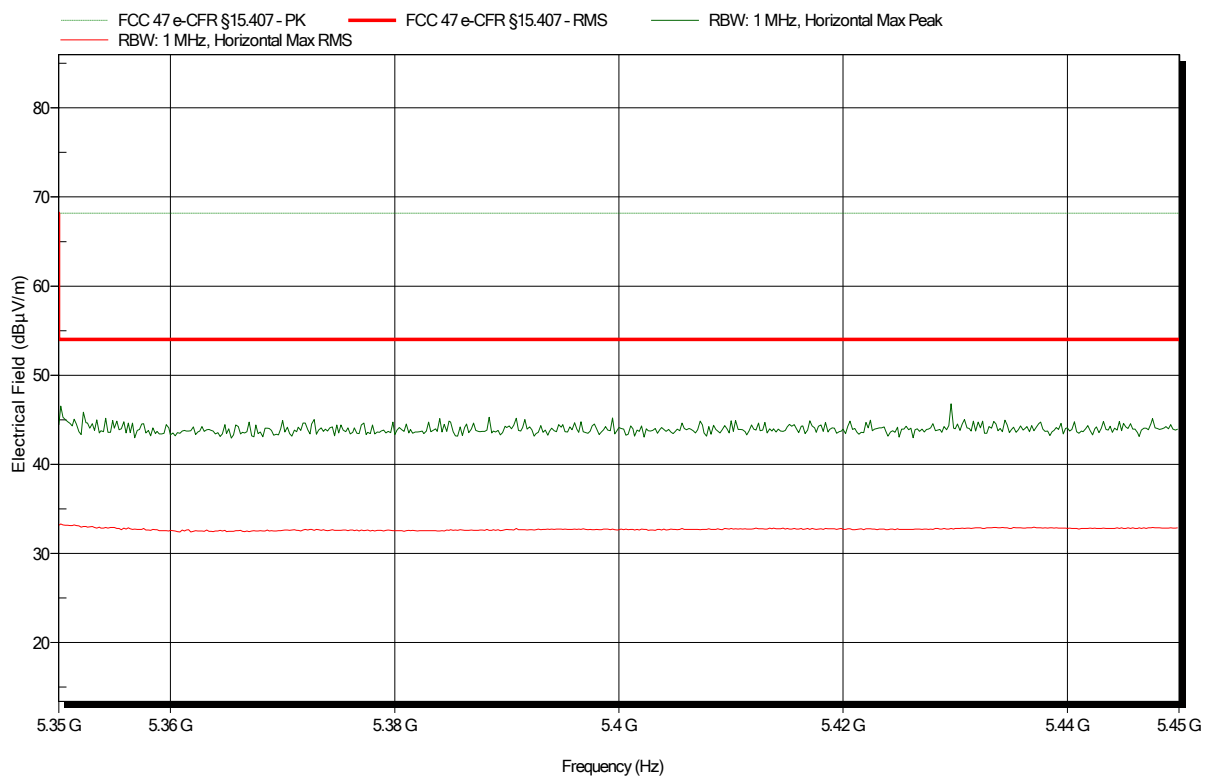


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Horizontal
Measurement distance: 3 m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical upper band-edge

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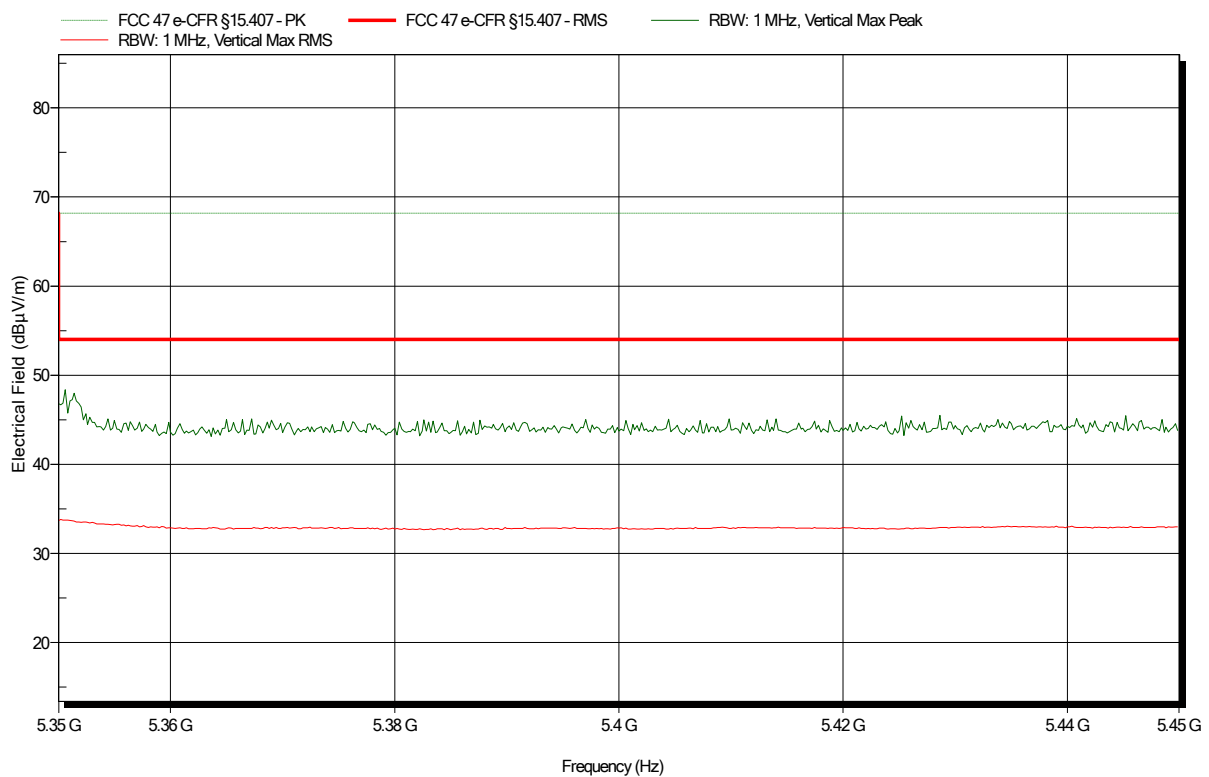


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 3 m
 Mode: TX; CH64, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna verticalupper band-edge

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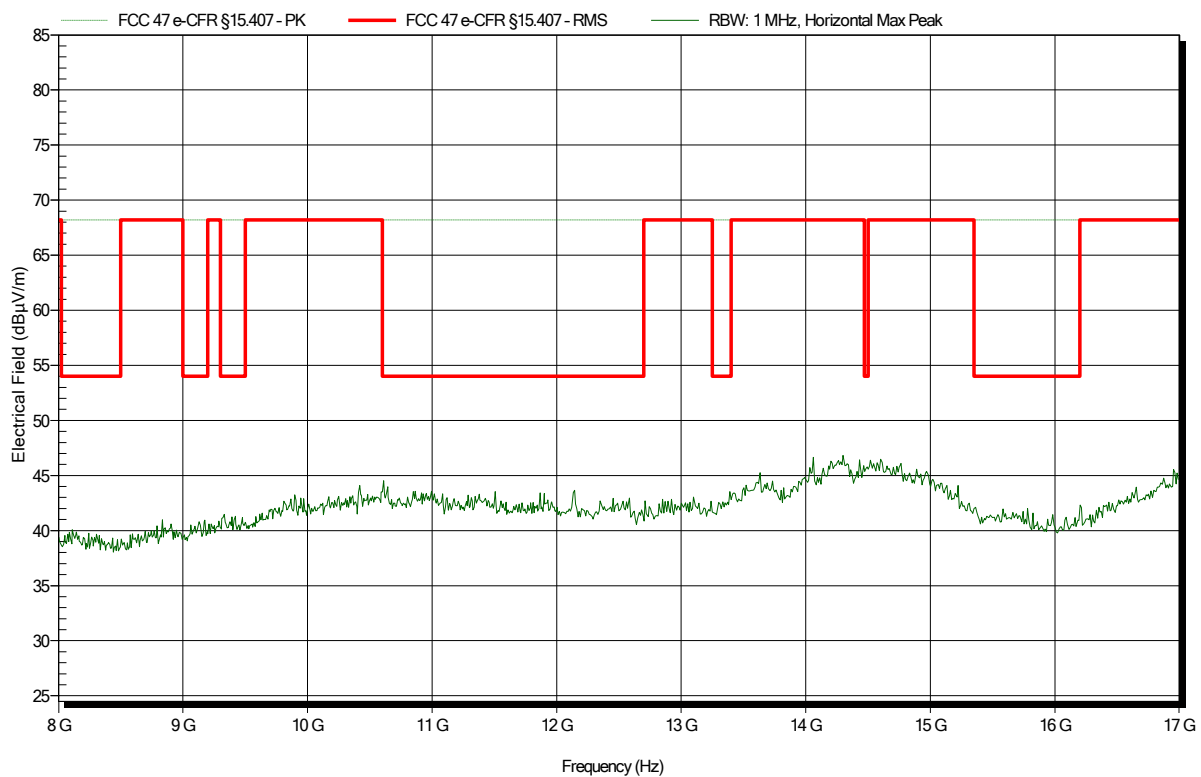


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Schwarzbeck BBHA 9120D, Horizontal
Measurement distance: 1 m converted to 3m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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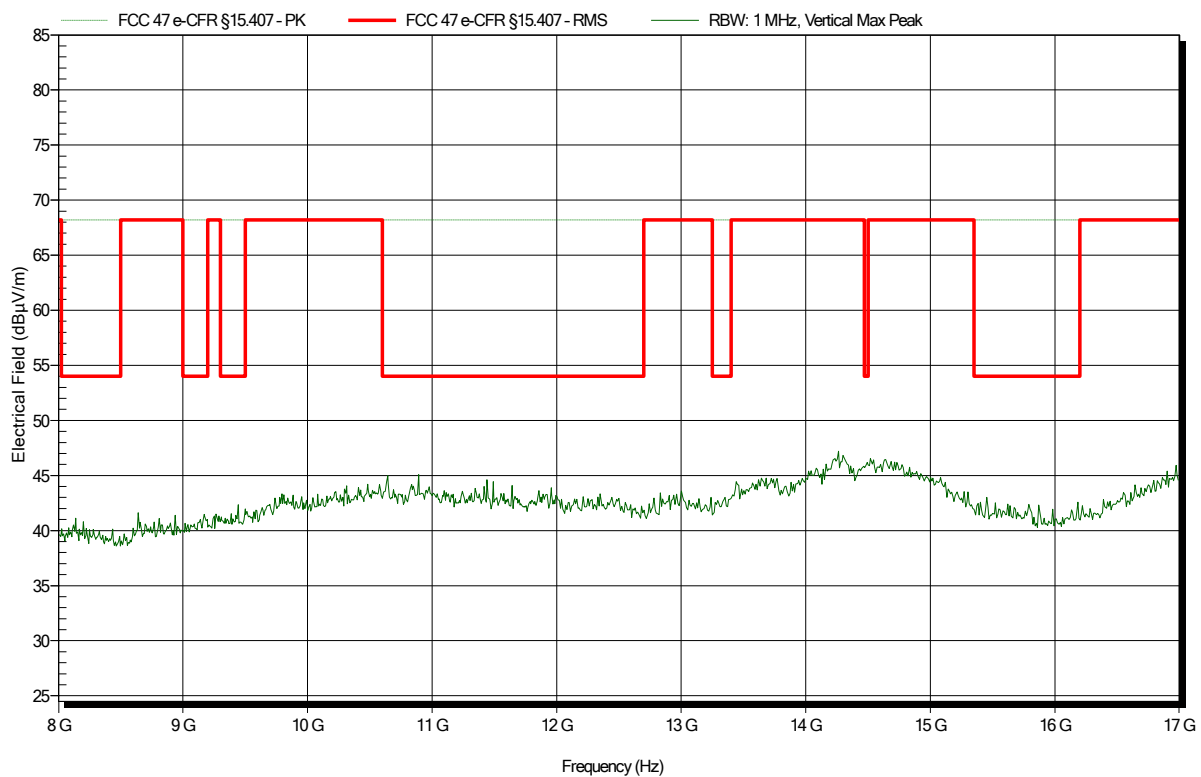


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH64, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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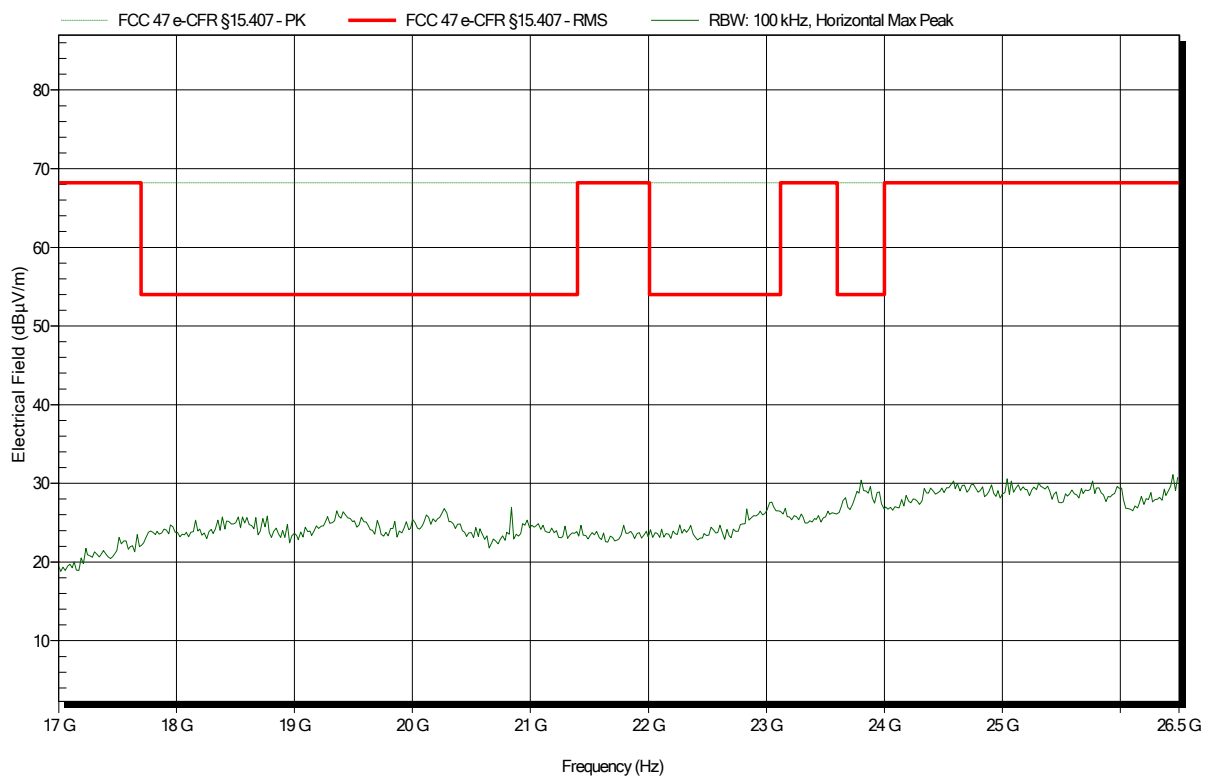


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt (supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: ATH18G40, Horizontal
Measurement distance: 1 m converted to 3m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-06-27
Note: Antenna vertical

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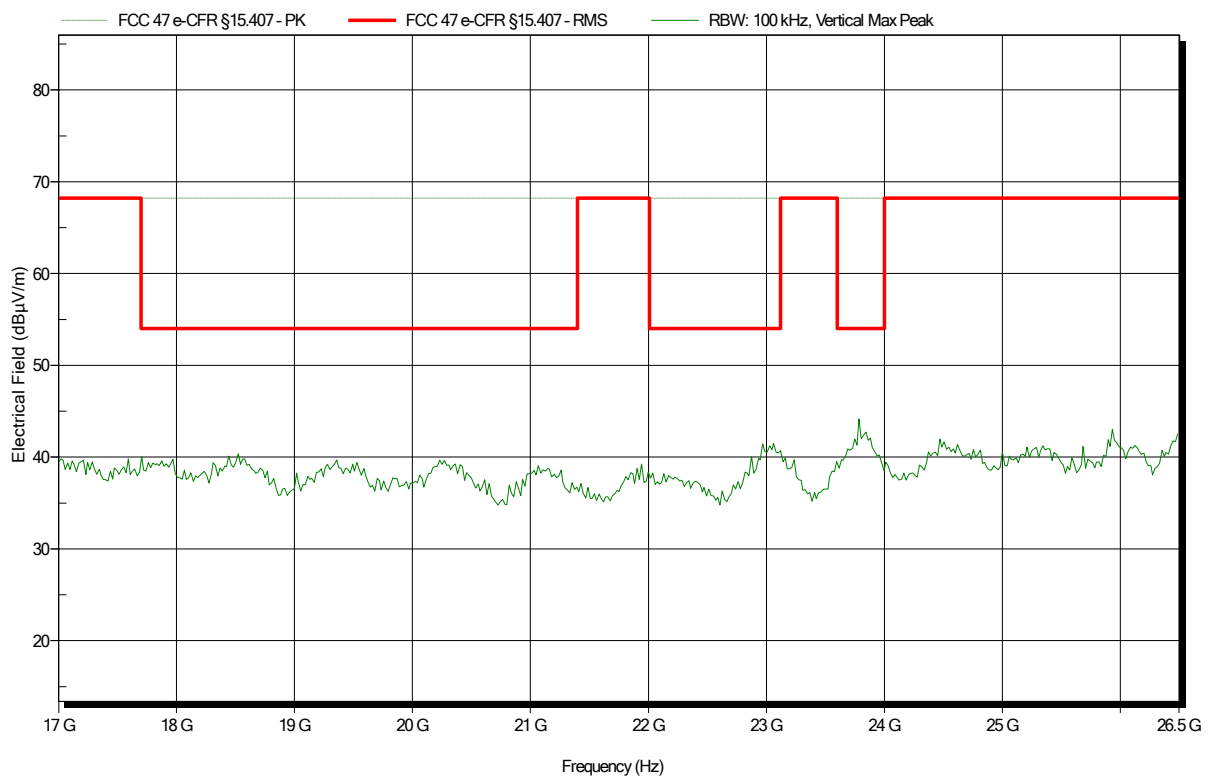


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt (supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: ATH18G40, Vertical
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH64, 6MBit, OFDM
 Test Date: 2019-06-27
 Note: Antenna vertical

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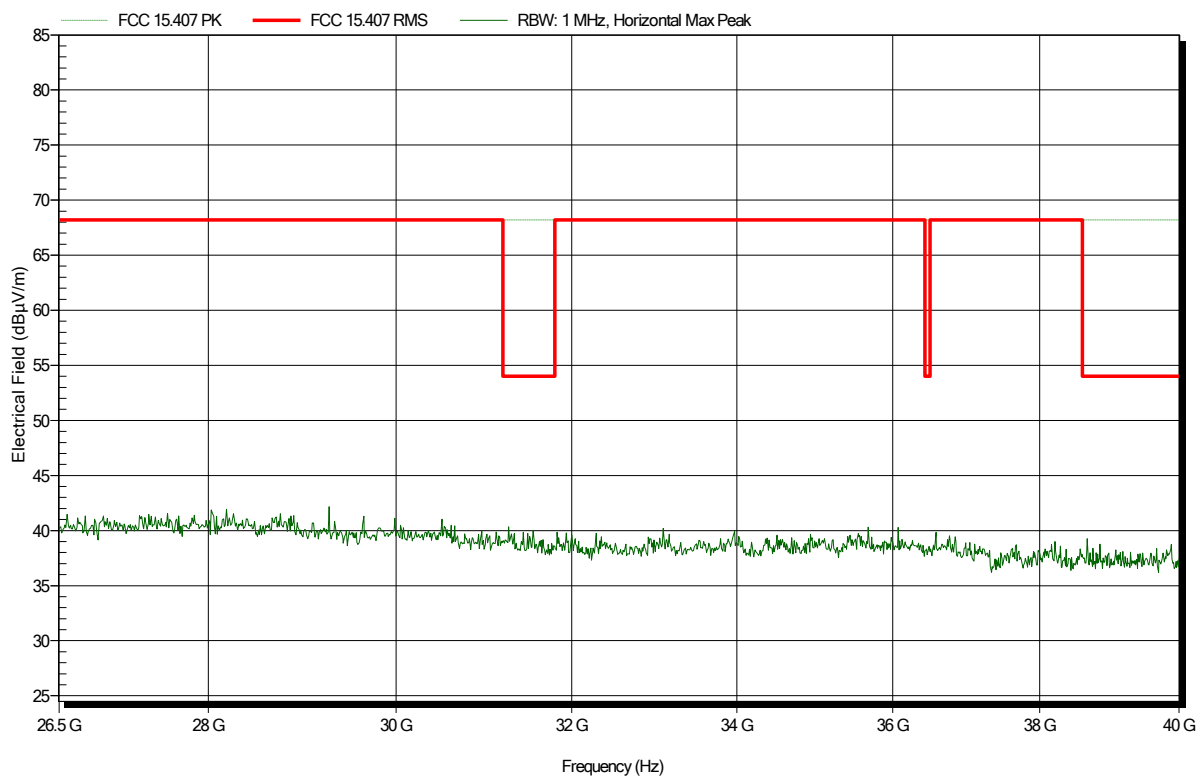


Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
 EUT Name: Telemetry Equipment
 Model: TDBOX2
 Test Site: Eurofins Product Service GmbH
 Operator: Florian Voigt(supervised)
 Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
 Antenna: Flann Microwave Ltd 22240-25+CBL26402075, Horizontal
 Measurement distance: 1 m converted to 3m
 Mode: TX; CH64, 6MBit, OFDM
 Test Date: 2019-07-01
 Note: Antenna vertical

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Spurious emissions according to FCC 15.407

Project number: G0M-1901-8021

Applicant: IAV automotive Engineering Inc.
EUT Name: Telemetry Equipment
Model: TDBOX2
Test Site: Eurofins Product Service GmbH
Operator: Florian Voigt(supervised)
Test Conditions: Tnom: 23.9°C, Vnom: 13.8VDC
Antenna: Flann Microwave Ltd 22240-25+CBL26402075, Vertical
Measurement distance: 1 m converted to 3m
Mode: TX; CH64, 6MBit, OFDM
Test Date: 2019-07-01
Note: Antenna vertical

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