Application for Certification
For a Transmitter.

IOSiX LLC
1300 Tefft Ct #1
Saline, MI 48176

IOSiX OBDv5 Vehicle Data Logger

M/N: IO-2050

FCC ID: 2AICQ-2050
IC:21520-2050

REPORT # UT06125B-005

This report was prepared in accordance with the requirements of the FCC Rules and Regulations Part 2, Subpart J, 2.1033, Part 15.247, RSS-247 Issue 2, and other applicable sections of the rules as indicated herein.

Prepared By:

DNB Engineering, Inc.
1100 E Chalk Creek Road
Coalville, UT 84017

15 Nov 2021

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Paragraph numbers in this report follow the application section numbers found in the FEDERAL COMMUNICATIONS COMMISSION Rules and Regulations, Part 2, Subpart J for Certification of electronic equipment.

REVISION HISTORY				
Rev	**Pgs**	**Init**	**Description**	**Date**
001	101	LP	Original Release	12 Sep 2020
002	102	LP	Add revision history page and NVLAP disclaimers	17 Sep 2020
003	112	LP	Correct typos add additional data	28 Jun 2021
004	112	LP	Corrected Occ BW plots and add passive components to equip cal list	20 Aug 2021
005	112	LP	Re-validate and re-release test report	15 Nov 2021

General information:

Note: This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

This is a statement required by NVLAP in our ISO/IEC17025 accreditation process. What this means is the testing performed does not carry any governmental sponsorship. The efforts of the Accrediting Agency relate only to documented processes and not the actual test conduct. It in no way diminishes the validity or value of the test results. It only assigns ultimate responsibility for the result of testing to the test laboratory, not the U.S. government.

1.0 ADMINISTRATIVE DATA

1.1 Certifications and Qualifications

I certify that DNB Engineering, Inc conducted the tests performed in order to obtain the technical data presented in this application. Also, based on the results of the enclosed data, I have concluded that the equipment tested meets or exceeds the requirements of the Rules and Regulations governing this application.

1.2 Measurement Repeatability Information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2.1031 through 2.1057, Part 15. The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions. These conditions include: The same test distance, EUT Height, Measurement Site Characteristics, and the same EUT System Components. The system must have the same Interconnecting Cables arranged in identical placement to that in the test set-up, with the system and/or EUT functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of the test may result in measurement repeatability difficulties.

All changes made to the EUT during the course of testing as identified in this test report must be incorporated into the EUT or identical models to ensure compliance with the FCC regulations.

C. L. Payne III (Para. 1.1)
Facility Manager
Coalville Facility.
DNB Engineering, Inc.
Tel. (435) 336-4433
FAX (435) 336-4436

1.3 Test Equipment List

TEST EQUIPMENT LIST - CONDUCTED EMISSIONS					
Description	**Manufacturer**	**Model No.**	**Asset #**	**Serial #**	**Cal Due**
LISN	Fisher Custom Communications	FCCLISN5032401	U-286	2020	03 Feb 2021
10 dB Attenuator	Inmet	9401	U-232K	U232K	13 Jan 2021
Spectrum Analyzer	Rhode & Schwarz	FSV30	U-248	101367	17 Aug 2020
TILE Software	ETS Lindgren	3.4.11.13	U-317	8112006	07 Mar 2021
Site 1 Cable - Cond	DNB	DNB	U-400B	1.1	1 Dec 2020

TEST EQUIPMENT LIST - RADIATED EMISSIONS					
Description	**Manufacturer**	**Model No.**	**Asset #**	**Serial #**	**Cal Due**
Pre-Amplifier	Hewlett Packard	8447D	U-068	2727A06184	04 Aug 2021
Pre-Amplifier	DNB	S-21G	U-095	U-095-1	03 Feb 2021
DRG Horn Antenna	AH Systems	SAS-571	U-071	417	11 Jul 2021
Spectrum Analyzer	Rhode & Schwarz	FSV30	U-248	101367	17 Aug 2020
TILE Software	ETS- Lindgern	3.4.11.13	U-317	8112006	07 Mar 2021
Site 1 Cable - Rad	DNB	DNB	U-400B	1.2	1 Dec 2020
HF Cable	TRU Corporation	210	U-066	TRU-21B1111-080M	4 Feb 2021

TEST EQUIPMENT LIST - ANTENNA CONDUCTED					
Description	**Manufacturer**	**Model No.**	**Asset #**	**Serial #**	**Cal Due**
Spectrum Analyzer	Rhode & Schwarz	FSV30	U-248	101367	17 Aug 2020
20dB Attenuator	Inmet	64671	U-316	U-316	24 Jun 2021

1.4 Test Summary Cross Reference

Test Item	FCC Requirement	IC Requirement	Test Method	Result
Antenna Requirement	15.203/15.247	RSS-Gen 6.8	---	Pass
Conducted Emissions (General Provisions)	15.207	RSS-Gen 8.8	ANSI C63.10-2013	N/A
Radiated Emissions (General Provisions)	15.209	RSS-Gen 8.9	ANSI C63.10-2013	Pass
Output Power (FHSS)	15.247 (b,2)	RSS-247 5.4 d)	ANSI C63.10-2013 Clause 11.9.1.1	Pass
Power Spectral Densisty	15.247 (e)	RSS-247 5.2 b)	ANSI C63.10-2013 Clause 11.10.2	Pass
Band-edge RF Conducted	15.247 (d)	RSS-247 5.5	ANSI C63.10-2013 Clause 11.13.2	Pass
DTS Bandwidth	15.247 (a,2)	RSS-247 5.2 a)	ANSI C63.10-2013 Clause 11.8.1	Pass
Conducted Spurious	15.247 (d)	RSS-247 5.5	ANSI C63.10-2013 Clause 11.11.3	Pass
Radiated Spurious Emissions	15.247 (d)	RSS-247 5.5	ANSI C63.10-2013Clause 11.12.2.7	Pass
Restricted Bands	15.247 (d)	RSS-Gen 8.10	ANSI C63.10-2013 Clause 11.12.1	Pass

RSS-GEN Issue 5 Mar 2019
RSS-247 Issue 2 Feb 2017

Preliminary scans were performed to determine worst case modulation, packet length, and data rates. Only worst case data has been recorded within the body of the test report.

1.5 Measurement Uncertainty

Measurement Type	Uncertainty
AC Conducted Emissions	± 1.67 dB
OATS - Radiated Emissions - Vertical Biconical (30-300MHz)	± 4.17 dB
OATS - Radiated Emissions - Horizontal Biconical (30-300MHz)	± 4.22 dB
OATS - Radiated Emissions - Vertical Log Periodic (300-100MHz)	± 4.92 dB
OATS - Radiated Emissions - Horizontal Log Periodic (300-1000MHz)	± 4.79 dB
OATS - Radiated Emissions - Vertical DRG Horn (> 1GHz)	± 5.74 dB
OATS - Radiated Emissions - Horizontal DRG Horn (>1GHz)	± 5.80 dB
Antenna Conducted Measurements	± 1.96 dB

2.1033 (b) (1) Application for Certification

Name of Applicant:	IOSiX LLC 1300 Tefft Ct #1 Saline, MI 48176
FRN Number:	0025564303
Name of Manufacturer :	IOSiX LLC 1300 Tefft Ct #1 Saline, MI 48176
Description:	IOSiX OBDv5 Vehicle Data Logger
Model Number(s):	IO-2050
Anticipated Production Quantity:	Multiple Units
Frequency Band:	2412 - 2462 MHz
Rated Output Power: (Conducted)	802.11b 9.99 dBm (9.98 mW) 802.11g 12.64 dBm (18.37 mW) 802.11n20 12.77 dBm (18.92 mW)
Type of Signal:	Digital Transmission System (DTS)
Modulation Types:	802.11b 1M 2M 5.5M 11M 802.11g 6M 9M 12M 18M 24M 36M 48M 54M 802.11n20 MCS0 MSC1 MCS2 MCS3 MCS4 MCS5 MCS6 MCS7
Antenna Type:	Internal - Monopole - Meander
Antenna Gain:	-15.83 dBi

2.1033 (b,2) FCC Identifier

Model Number:	IO-2050
FCC ID:	2AICQ-2050
IC:	21520-2050

Label is polyester with a permanent acrylic adhesive and black resin text
Service temperature is -40 to +150C
'Extreme resistance to chemicals' - resistant to Gasoline, Grease, Oil, Bleach, Alcohol, Ammonia, Cleaning products

2.1033 (b,3)	Installation and Operating Instructions -	Supplied separately.
2.1033 (b,4)	Brief Description of Circuit Function -	Supplied separately.
2.1033 (b,5)	Block Diagram -	Supplied separately.
2.1033 (b,7)	Equipment Photographs -	Supplied separately.

2.1033 (b,6) Report of Measurements

15.203 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Pass - Antenna gain is equal to or less than -15.83dBi

Pass - Antenna is an internal meander antenna (Monopole)

15.207 Conducted Emissions - Not Applicable

Not Applicable EUT is intended to be installed in a vehicle and is connected to the vehicle battery. There is no direct or indirect connection to the AC Mains.

15.209 Radiated Emissions (General Provisions)

Test Procedure: ANSI C63.10-2013

The EUT was measured on an open area test site (OATS).

A measuring distance of at least 3 m shall be used for measurements at frequencies up to 1 GHz. For frequencies above 1 GHz, any suitable measuring distance may be used. The equipment size (excluding the antenna) shall be less than 20 % of the measuring distance.

Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site do not degrade the measurement results, in particular:

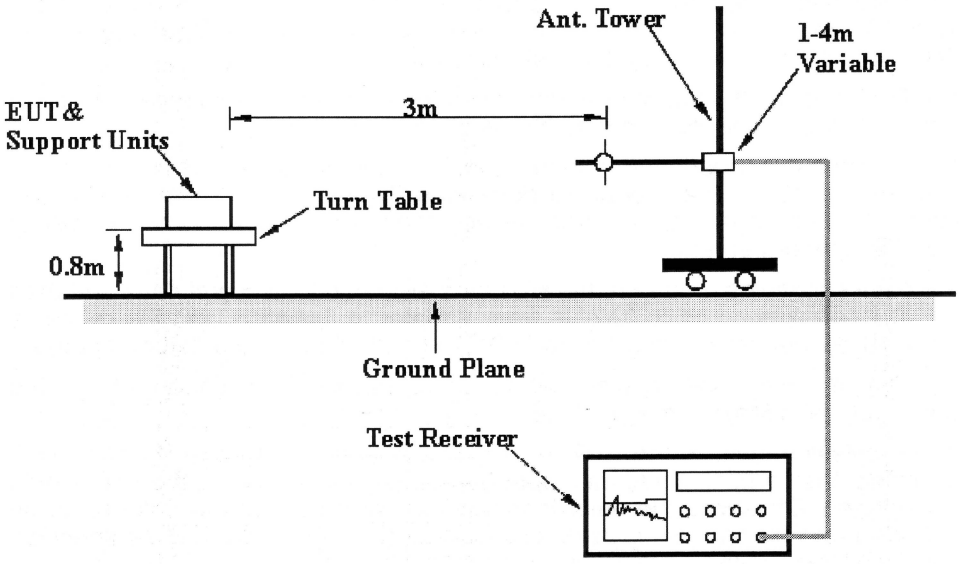
- no extraneous conducting objects having any dimension in excess of a quarter wavelength of the highest frequency tested shall be in the immediate vicinity of the site;

- all cables shall be as short as possible; as much of the cables as possible shall be on the ground plane or preferably below; and the low impedance cables shall be screened.

- EUT was positioned in three orthogonal axis - only the worst case data (X-Axis) has been recorded

The EUT shall be placed upon a non-conductive table (wooden for below 1GHz and styrene above 1GHz) 0.80 meters above the ground plane for frequencies from 30 to 1000MHz and 1.5 meters above the ground plane above 1 Ghz and shall be placed in the “worst case” transmitting mode. The EUT shall be rotated 360 degrees to find the azimuth maxima. The receive antenna shall then be raised and lowered between 1 to 4 meters to find the maximum signal emanating from the EUT. This signal strength is then recorded on the data sheets.

Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measurement Distance (meters)
.0009 - 0.490	2400/F(kHz)	$20*(Log_{10}(2400/F(kHz))$	300
0.490 - 1.705	24000/F(kHz)	$20*(Log_{10}(24000/F(kHz))$	30
1.705 - 30.0	30	29.5	30
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3


Ant. Tower
1-4m
Variable
EUT &
Support Units
3m
Turn Table
0.8m
Ground Plane
Test Receiver

1100 E Chalk Creek Road
Coalville, UT 84017
(435) 336-4433
FAX (435) 336-4436

Radiated Emissions (General)

DNB Job Number:	06125	Date: 14 Aug 2020	Specification
Customer:	IOSiX LLC		[X] 15.209
Model Number:	IO-2050		[X] ANSI C63.10-2013
Description:	IOSiX OBDv5 Vehicle Data Logger		

EUT is in conformance with FCC 15.209	X	YES		NO	Signed	*B Williams*

Radiated Emissions

FREQ (Mhz)	S/A Reading (dBuV/m	Correction Factors (dB)			dBuV/m			Positions			
		Ant	Cbl	Amp	Corr	Lim	Delta	Typ	Tbl	Pl	Hgt
30.001	27.20	20.30	0.50	26.60	21.40	40.0	-18.61	QP	282	Horz	2.65
31.849	27.97	19.23	0.57	26.60	21.17	40.0	-18.84	QP	303	Horz	2.82
36.844	36.01	16.33	0.77	26.56	26.55	40.0	-13.46	QP	108	Horz	2.77
47.894	32.47	10.25	1.15	25.38	18.48	40.0	-21.52	QP	257	Horz	2.64
49.709	40.75	10.64	1.19	26.35	26.23	40.0	-13.77	QP	120	Horz	4.00
55.280	38.00	10.86	1.15	26.50	23.51	40.0	-16.50	QP	76	Horz	3.43
79.930	34.90	10.90	1.30	26.50	20.60	40.0	-19.41	QP	270	Horz	2.45
80.093	40.53	10.90	1.30	26.50	26.23	40.0	-13.77	QP	330	Horz	2.80
88.124	46.72	10.98	1.38	26.42	32.66	43.5	-10.84	QP	294	Horz	2.49
192.568	31.45	14.43	2.29	26.07	22.09	43.5	-21.42	QP	262	Horz	2.81
195.808	31.79	14.46	2.34	26.04	22.54	43.5	-20.96	QP	268	Horz	1.73
30.001	43.58	20.30	0.50	26.60	37.78	40.0	-2.23	QP	277	Vert	1.56
31.916	44.84	19.19	0.58	26.60	38.01	40.0	-2.00	QP	181	Vert	1.48
33.179	41.18	18.46	0.63	26.60	33.66	40.0	-6.34	QP	240	Vert	3.89
35.728	39.70	16.98	0.73	26.59	30.82	40.0	-9.19	QP	304	Vert	3.40
36.888	43.49	16.30	0.78	26.56	34.01	40.0	-6.00	QP	286	Vert	2.55
79.995	42.12	10.90	1.30	26.50	27.82	40.0	-12.19	QP	207	Vert	1.84
304.546	38.22	17.21	3.31	25.83	32.92	46.0	-13.09	QP	131	Vert	1.96
935.560	26.48	28.48	6.81	27.09	34.68	46.0	-11.33	QP	128	Vert	2.23

15.247 (b,2) Output Power (DTS) ANSI C63.10-2013 Clause 11.9.1.1

11.9.1 Maximum peak conducted output power

11.9.1.1 RBW ≥ DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

Requirement: FCC Part 15.247 Clause (b,3)

15.247 Operation within the bands 2400-2483.5 MHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Limit : 1 watt or 30dBm

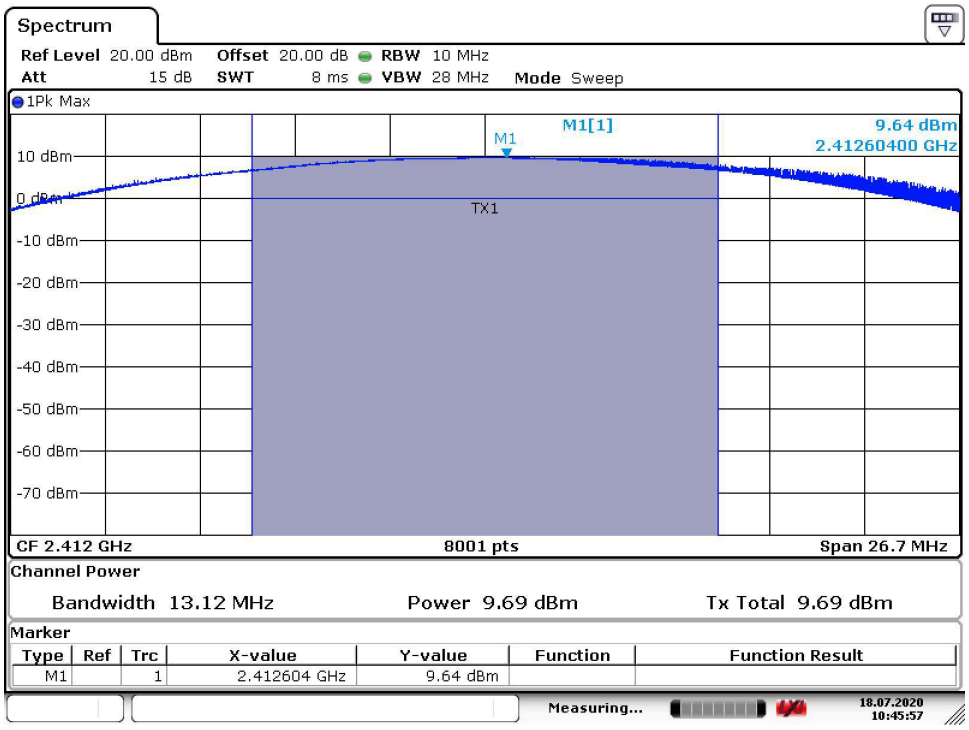
Client: IOSiX LLC | Date: 18 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm | Tech: CL Payne

Modulation: 802.11b

Low Channel: 2412 MHz | Power: 9.69 dBm | Result: Pass



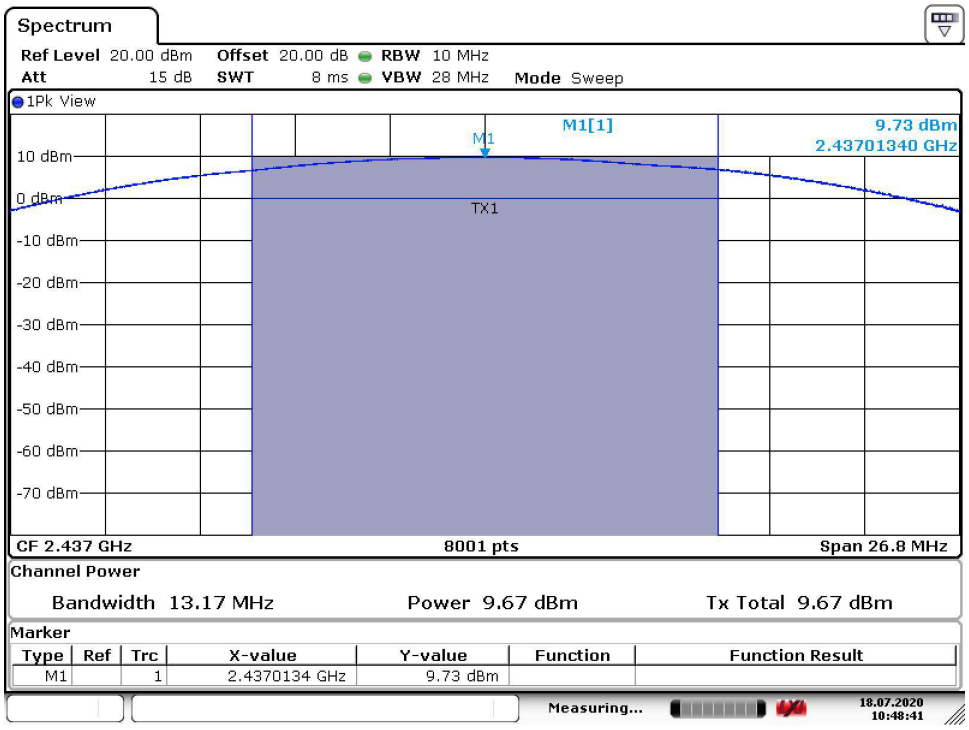
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm Tech: CL Payne

Modulation: 802.11b

Mid Channel: 2437 MHz Power: 9.67 dBm Result: Pass



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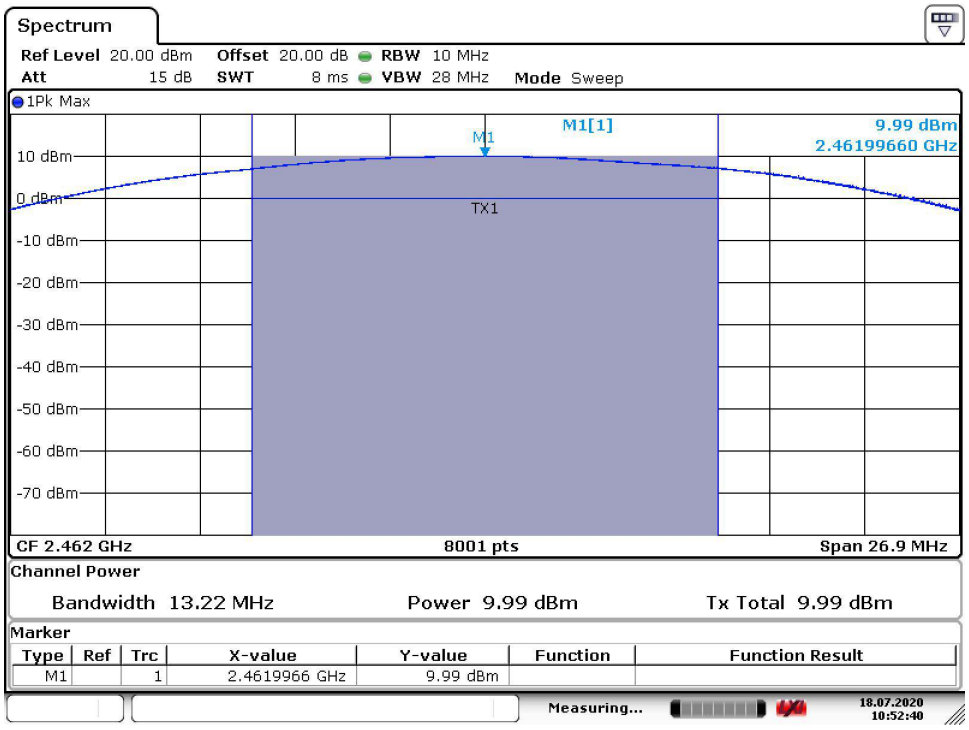
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm Tech: CL Payne

Modulation: 802.11b

High Channel: 2480 MHz Power: 9.99 dBm Result: Pass



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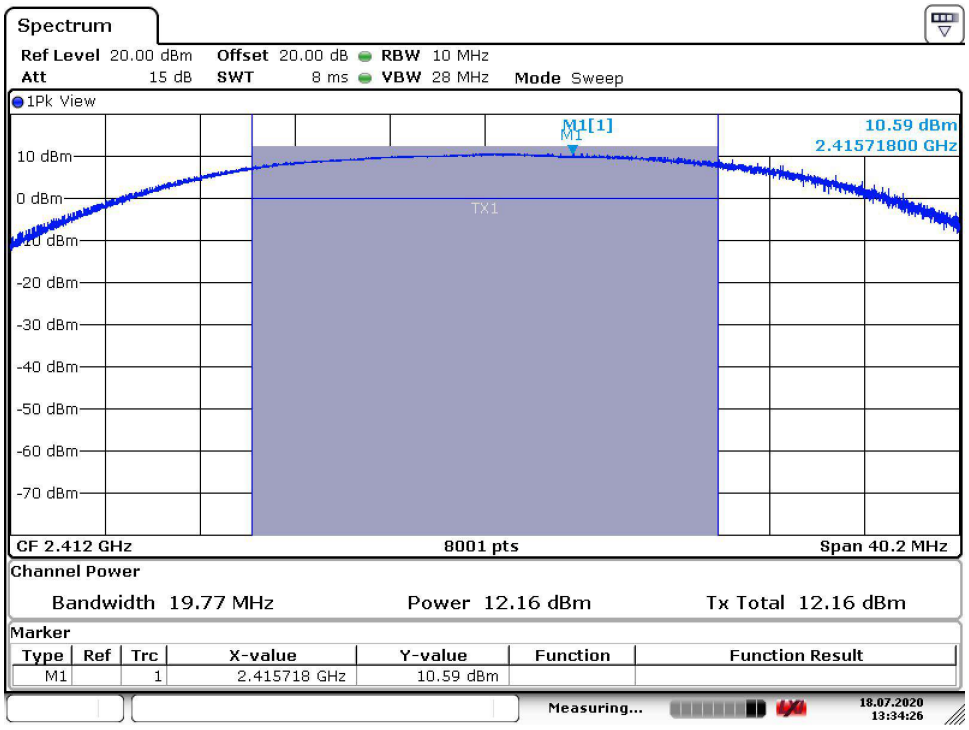
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm Tech: CL Payne

Modulation: 802.11g

Low Channel: 2412 MHz Power: 12.16 dBm Result: Pass



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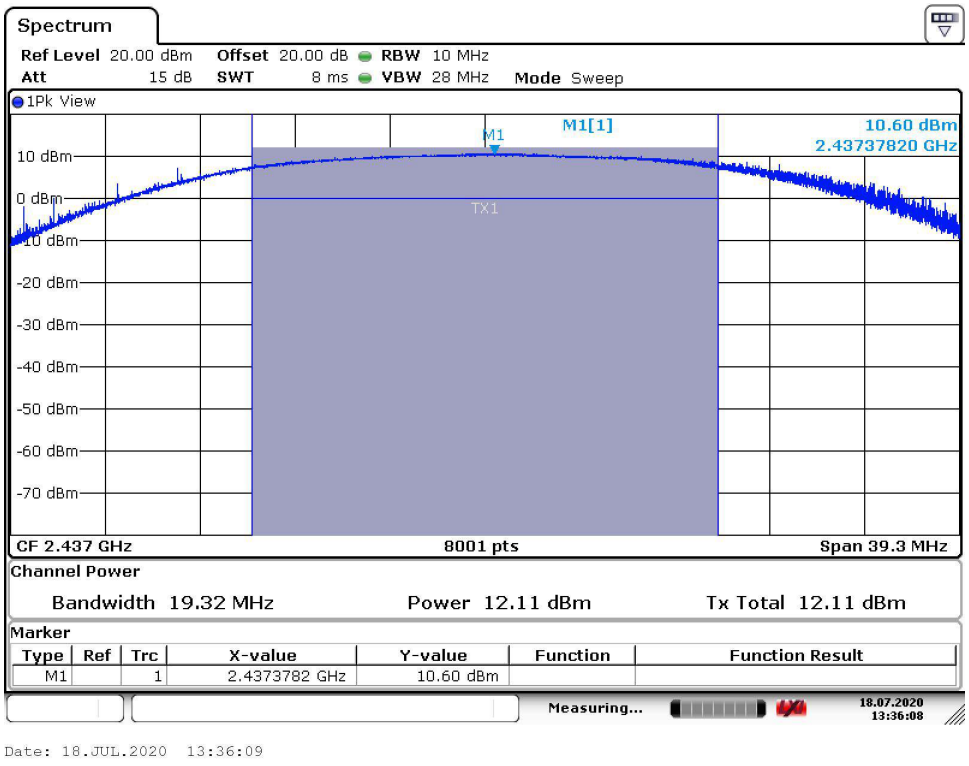
Client: IOSiX LLC | Date: 18 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm | Tech: CL Payne

Modulation: 802.11g

Mid Channel: 2437 MHz | Power: 12.11 dBm | Result: Pass



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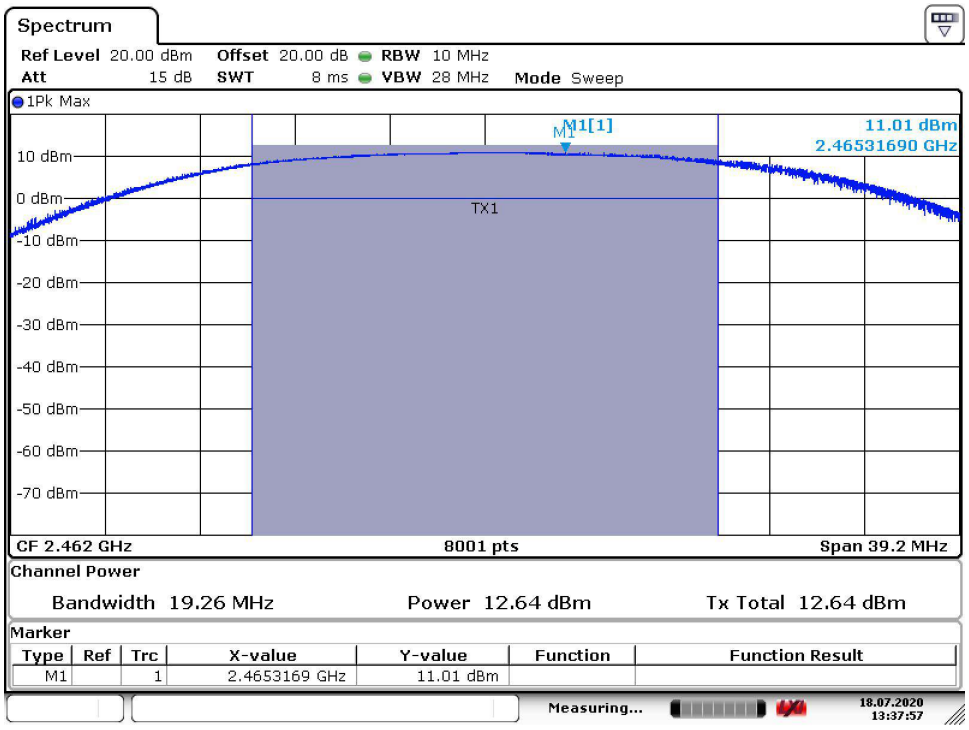
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm Tech: CL Payne

Modulation: 802.11g

High Channel: 2462 MHz Power: 12.64 dBm Result: Pass



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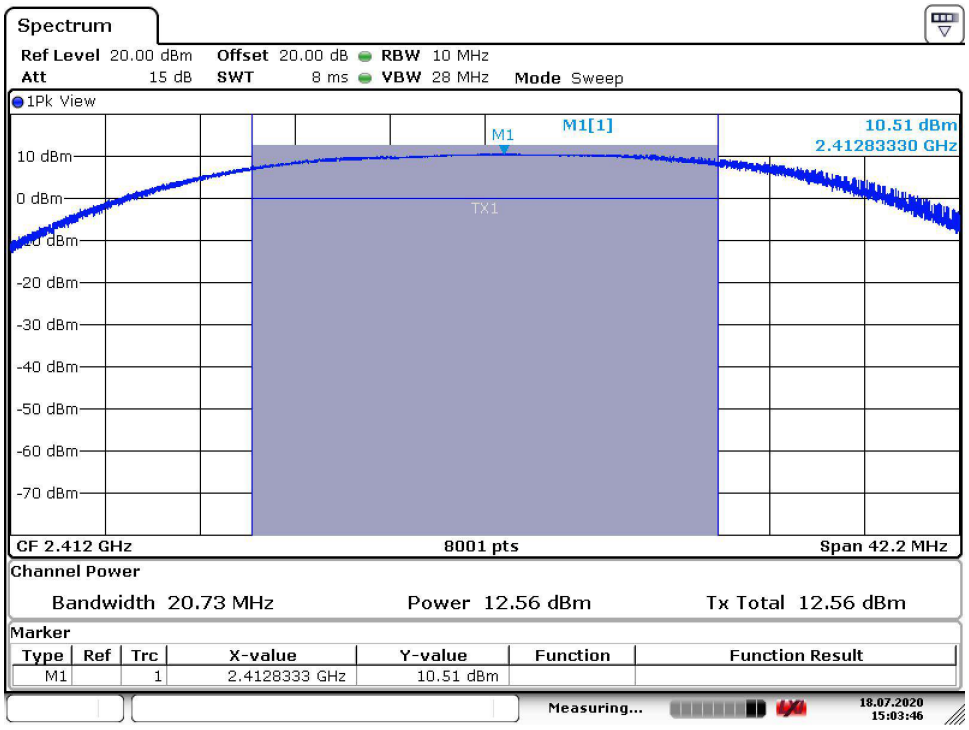
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm Tech: CL Payne

Modulation: 802.11n

Low Channel: 2412 MHz Power: 12.56 dBm Result: Pass



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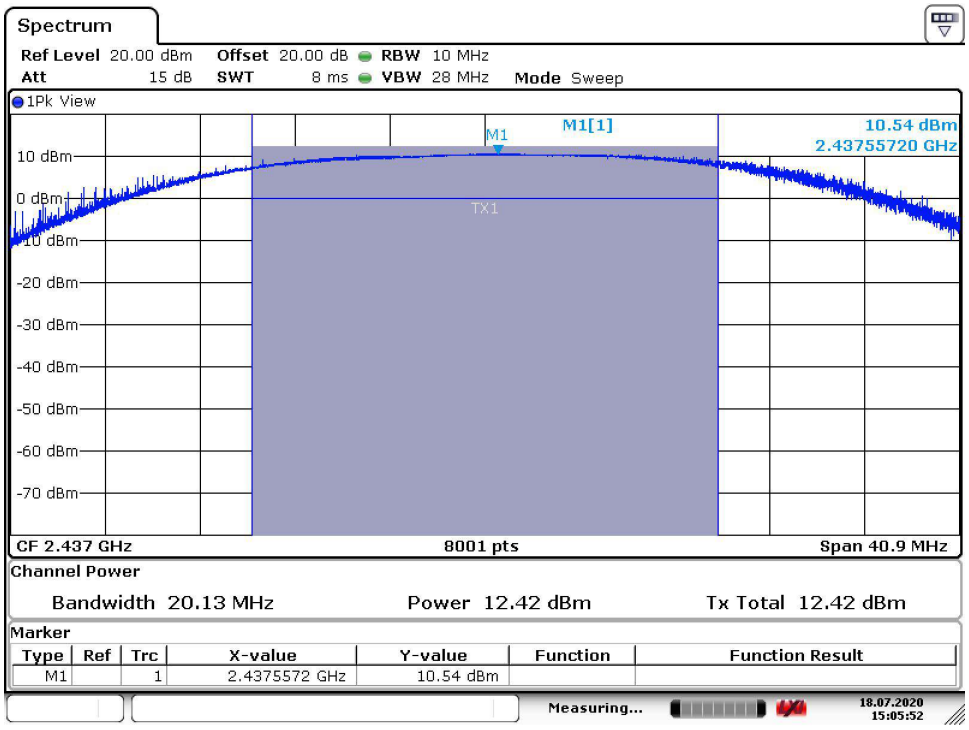
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm Tech: CL Payne

Modulation: 802.11n

Mid Channel: 2437 MHz Power: 12.42 dBm Result: Pass



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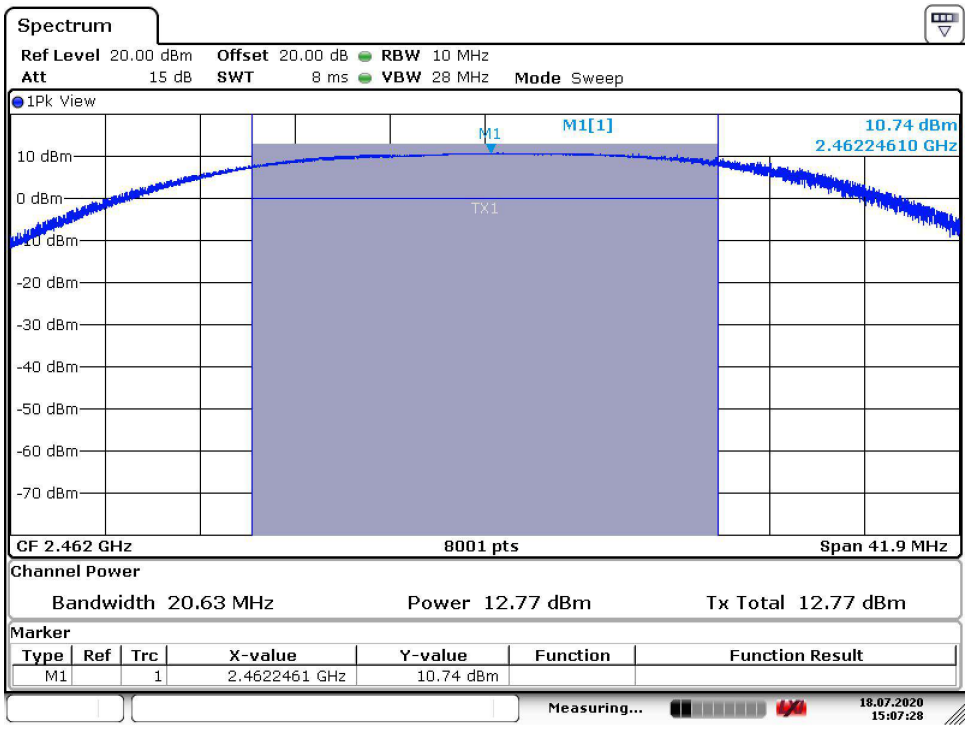
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 1 Watt or 30dBm Tech: CL Payne

Modulation: 802.11n

High Channel: 2462 MHz Power: 12.77 dBm Result: Pass



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15.247 (e) Power Spectral Density (PSD) ANSI C63.10-2013 Clause 11.10.2

Clause 11.10.2 Method PKPSD (peak PSD)

The following procedure shall be used if the maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

a) Set analyzer center frequency to DTS channel center frequency
b) Set the span to 1.5 times the DTS bandwidth
c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz
d) Set the VBW ≥ [3 x RBW]
e) Detector = peak
f) Sweep time = auto couple
g) Trace mode = max hold
h) Allow trace to fully stabilize
i) Use the peak marker function to determine the maximum amplitude level within the RBW
j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat
k) Submit plots

Requirement: FCC Part 15.247 Clause (e)

15.247 Power Spectral Density.

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

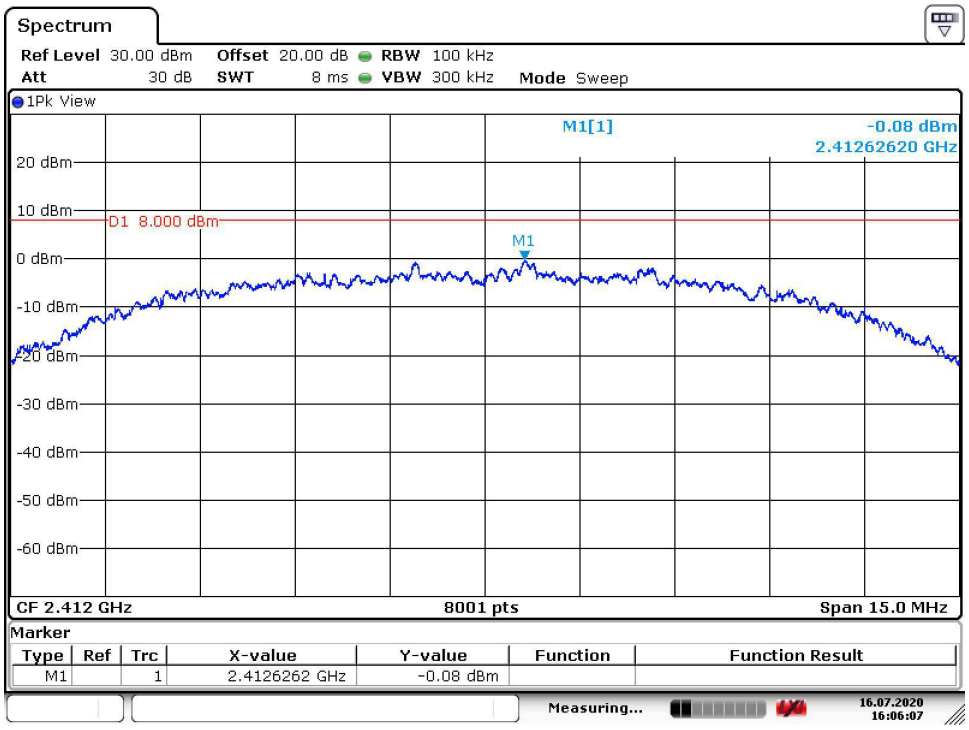
Client: IOSiX LLC | Date: 16 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement ≤ 8dBm | Tech: CL Payne

Modulation: 802.11b

Low Channel: 2412 MHz | Power: -0.08 dBm | Result: Pass



Date: 16.JUL.2020 16:06:07

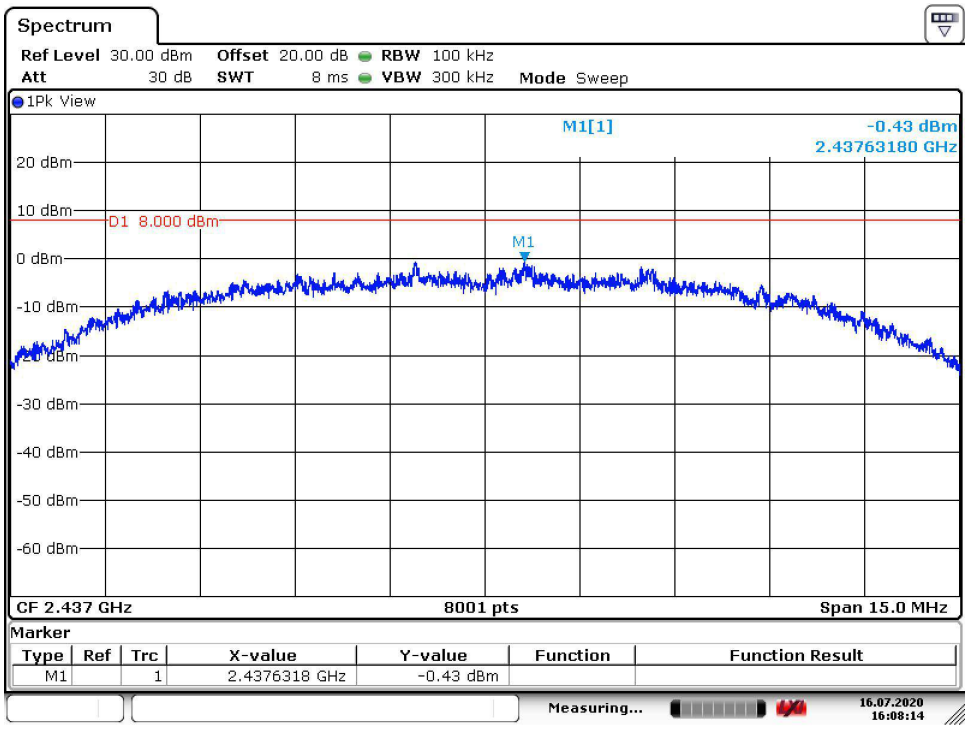
Client: IOSiX LLC | Date: 16 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement ≤ 8dBm | Tech: CL Payne

Modulation: 802.11b

Mid Channel: 2437 MHz | Power: -0.43 dBm | Result: Pass



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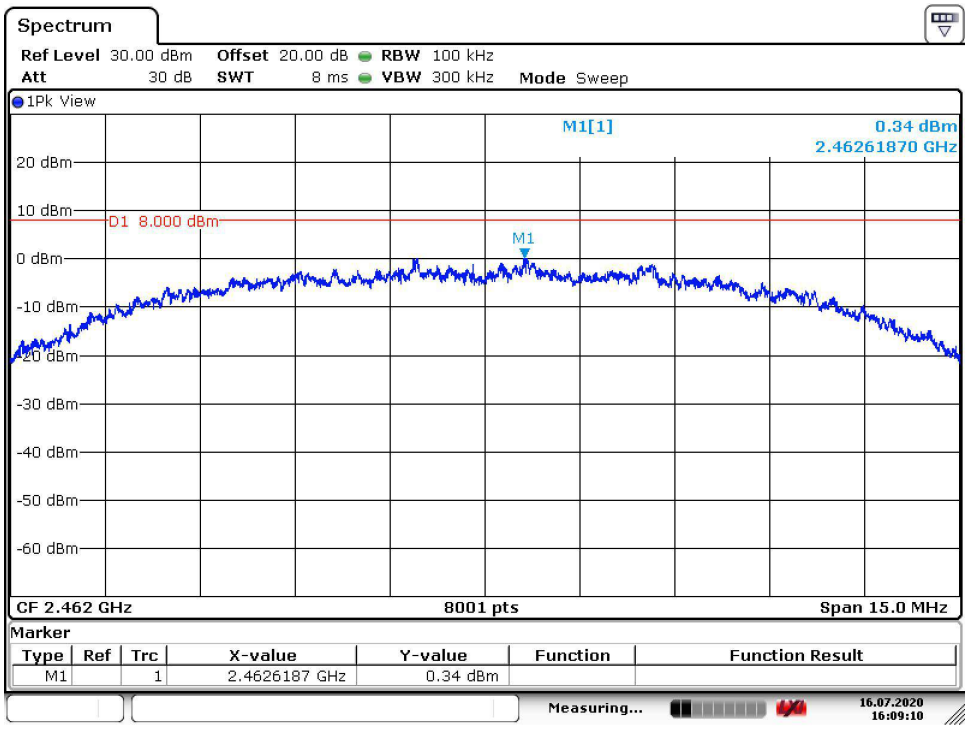
Client: IOSiX LLC | Date: 18 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement ≤ 8dBm | Tech: CL Payne

Modulation: 802.11b

High Channel: 2462 MHz | Power: 0.34 dBm | Result: Pass



Date: 16.JUL.2020 16:09:11

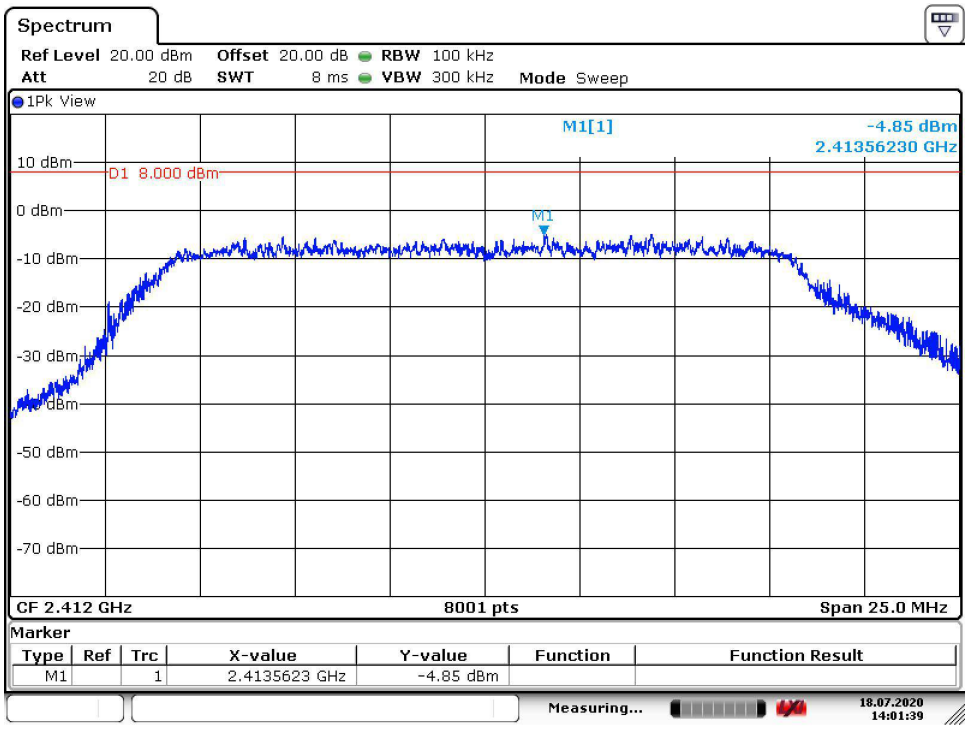
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 8dBm Tech: CL Payne

Modulation: 802.11g

Low Channel: 2412 MHz Power: -4.85 dBm Result: Pass



Date: 18.JUL.2020 14:01:40

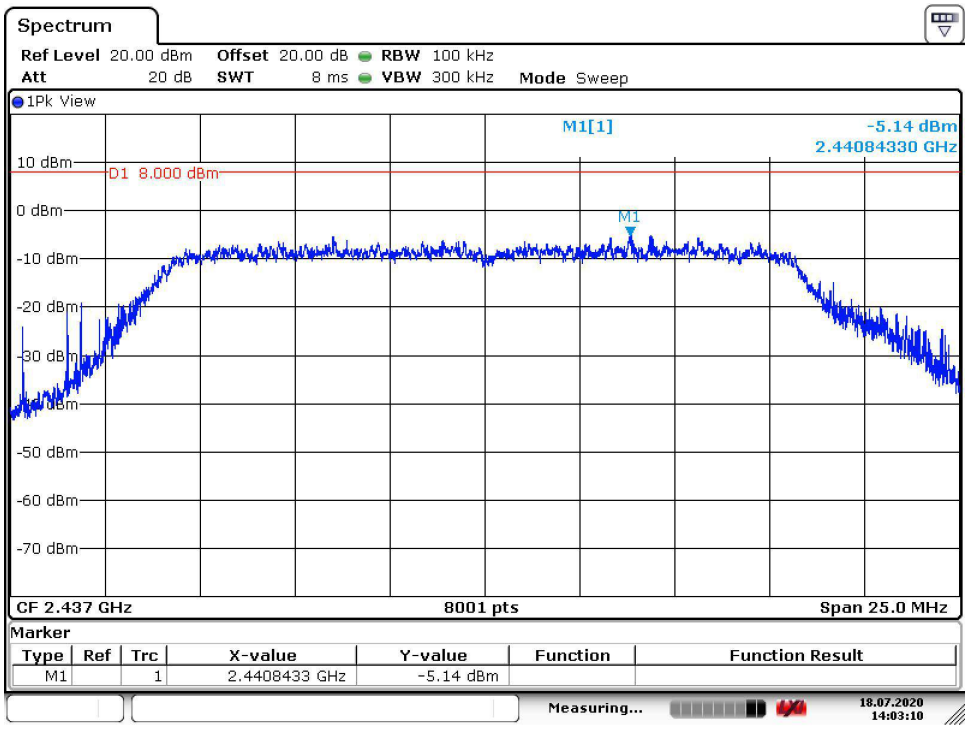
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 8dBm Tech: CL Payne

Modulation: 802.11g

Mid Channel: 2437 MHz Power: -5.14 dBm Result: Pass



Date: 18.JUL.2020 14:03:11

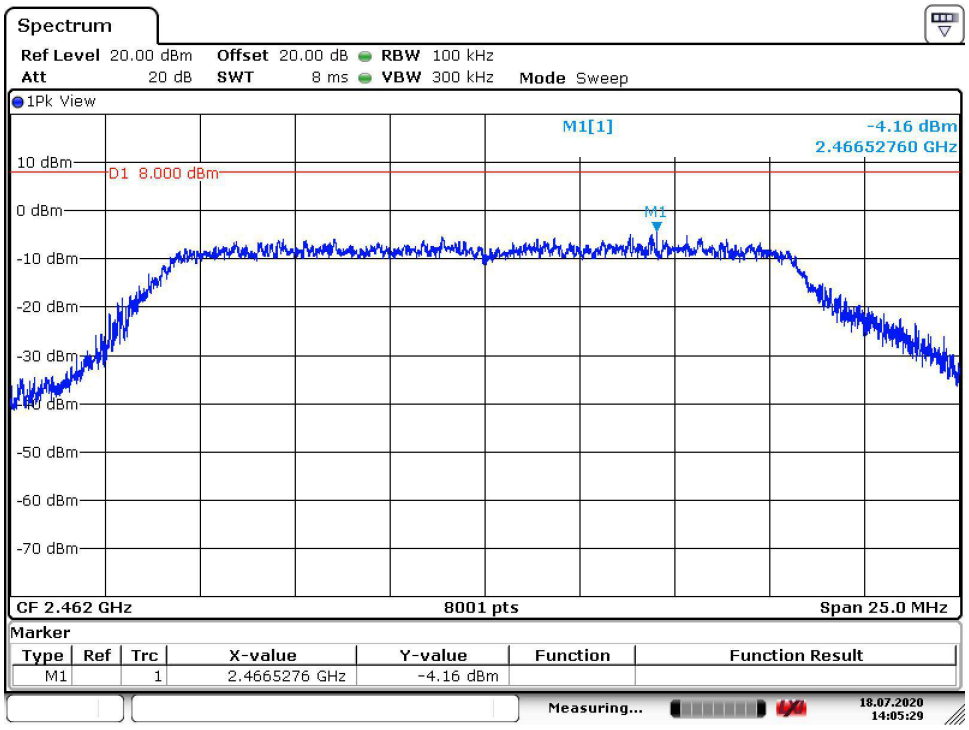
Client: IOSiX LLC | Date: 18 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement ≤ 8dBm | Tech: CL Payne

Modulation: 802.11g

High Channel: 2462 MHz | Power: -4.16 dBm | Result: Pass



Date: 18.JUL.2020 14:05:29

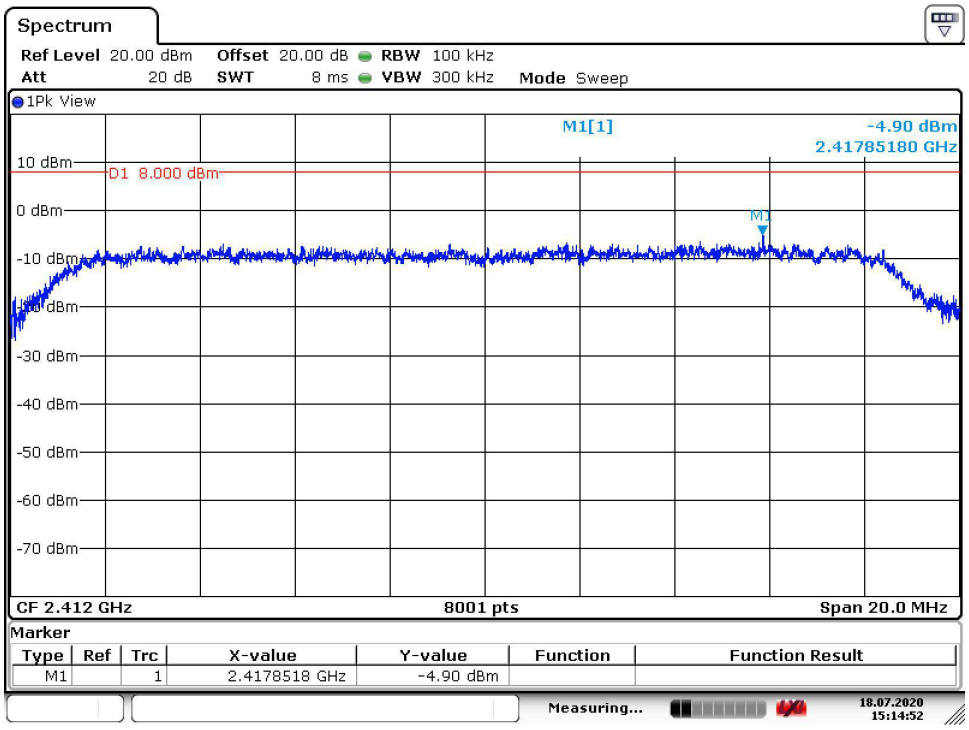
Client: IOSiX LLC | Date: 18 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement ≤ 8dBm | Tech: CL Payne

Modulation: 802.11n

Low Channel: 2412 MHz | Power: -4.90 dBm | Result: Pass



Date: 18.JUL.2020 15:14:53

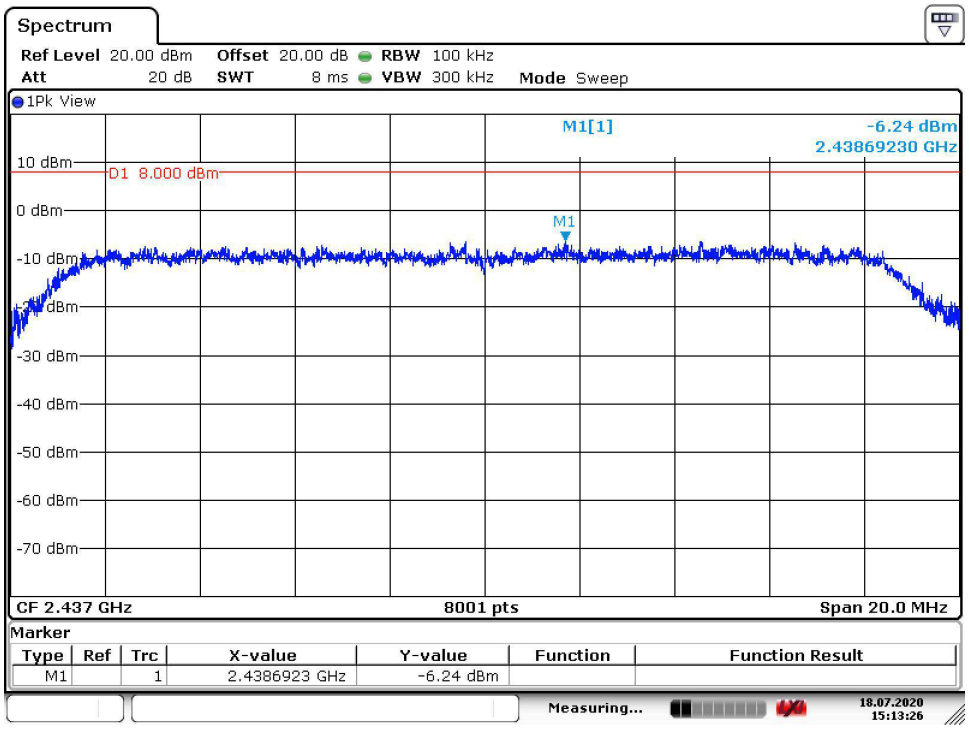
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 8dBm Tech: CL Payne

Modulation: 802.11n

Mid Channel: 2437 MHz Power: -6.24 dBm Result: Pass



Date: 18.JUL.2020 15:13:27

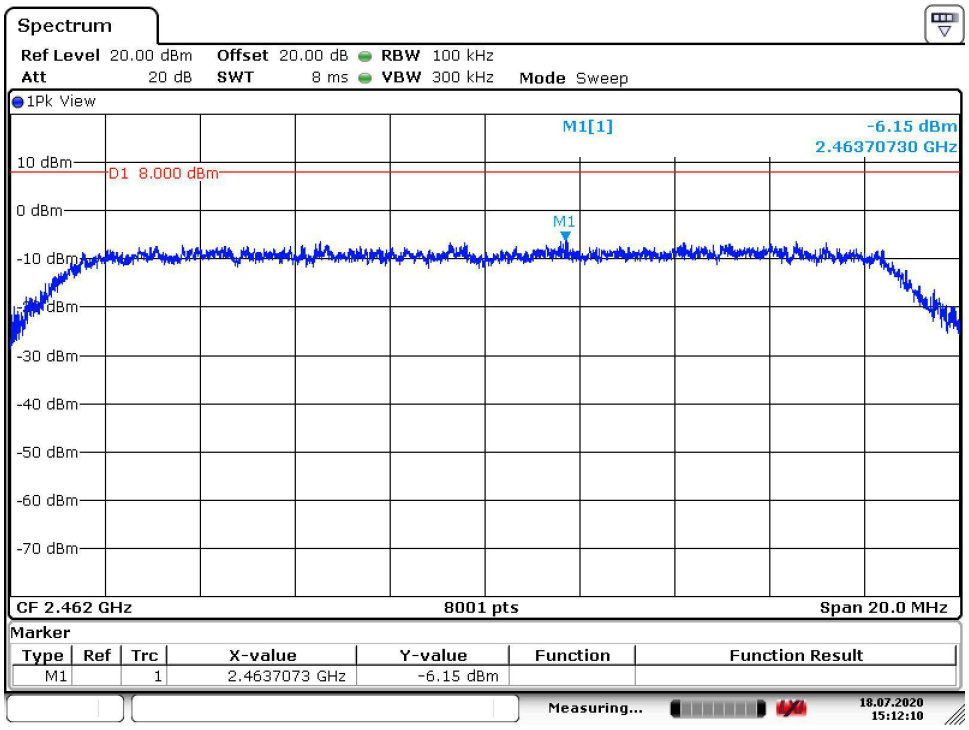
Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement ≤ 8dBm Tech: CL Payne

Modulation: 802.11n

High Channel: 2462 MHz Power: -6.15 dBm Result: Pass



Date: 18.JUL.2020 15:12:11

15.247 (d) Band-edge RF Conducted ANSI C63.10-2013 Clause 11.13.2

For band-edge measurements, use the band-edge procedure in 6.10. Band-edge measurements shall be tested both on single channels, and with the EUT hopping.

6.10 Band-edge testing

The following procedure shall be used when band-edge measurements are required.

6.10.1 Band-edge data reporting requirements

These reporting requirements are applicable to all devices for which band-edge measurements are required. On each operating frequency measured, band-edge emissions shall be reported by providing plots of the measuring instrument display. The axes, the scale units per division, and the limit shall be clearly labeled in the test report. Tabular data are not suitable for reporting band-edge emissions.

6.10.4 Authorized-band band-edge measurements (relative method)

These procedures are applicable for determining compliance at authorized-band band-edges where the requirements are expressed as a value relative to the in-band signal level.

For devices that support frequency hopping, this test sequence shall be performed twice: once with the hopping function turned OFF and then repeated with the hopping function turned ON.

a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).

b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).

c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normal mode of operation”.

d) Blank

e) Perform the test as follows:

    1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.

15.247 (d) Band-edge RF Conducted *(continued)*

2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

3) Attenuation: Auto (at least 10 dB preferred).

4) Sweep time: Coupled.

5) Resolution bandwidth: 100 kHz

6) Video bandwidth: 300 kHz

7) Detector: Peak.

8) Trace: Max hold.

f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.

g) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

h) Repeat step c) through step e) for every applicable modulation.

i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).

j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Requirement: FCC Part 15.247 Clause (d)

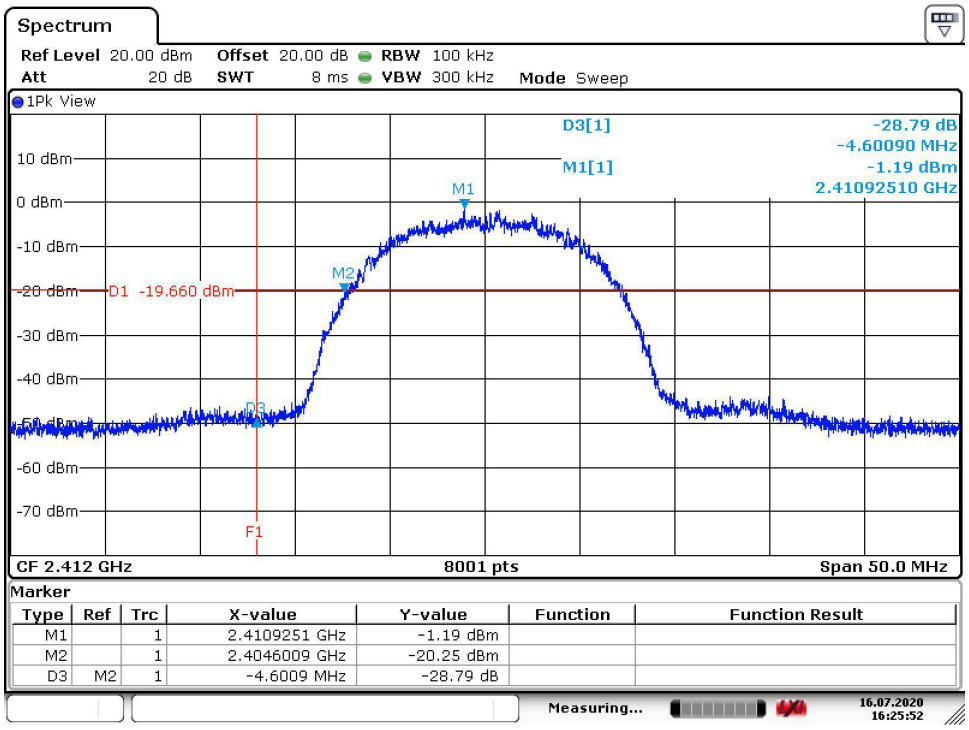
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Client: IOSiX LLC | Date: 16 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement: Band-Edge Compliance (DTS) | Tech: CL Payne

Low Channel: 2412 MHz | Modulation: 802.11b | Result: Pass



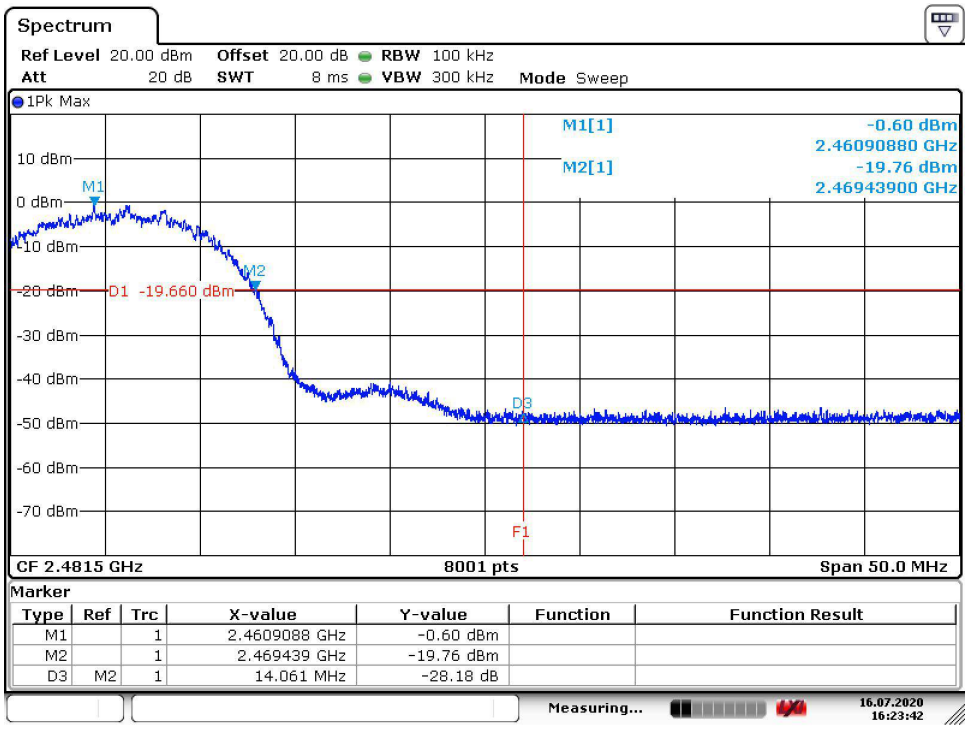
Date: 16.JUL.2020 16:25:53

Client: IOSiX LLC Date: 16 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement: Band-Edge Compliance (DTS) Tech: CL Payne

High Channel: 2462 Mhz Modulation: 802.11b Result: Pass



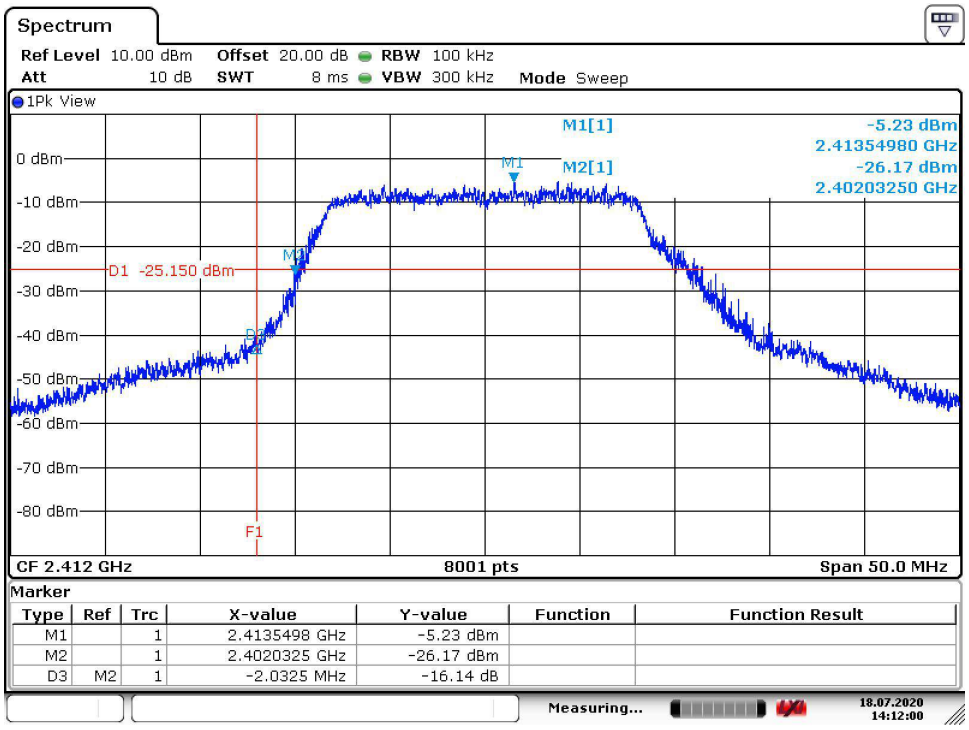
Date: 16.JUL.2020 16:23:42

Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement: Band-Edge Compliance (DTS) Tech: CL Payne

Low Channel: 2412 MHz Modulation: 802.11g Result: Pass



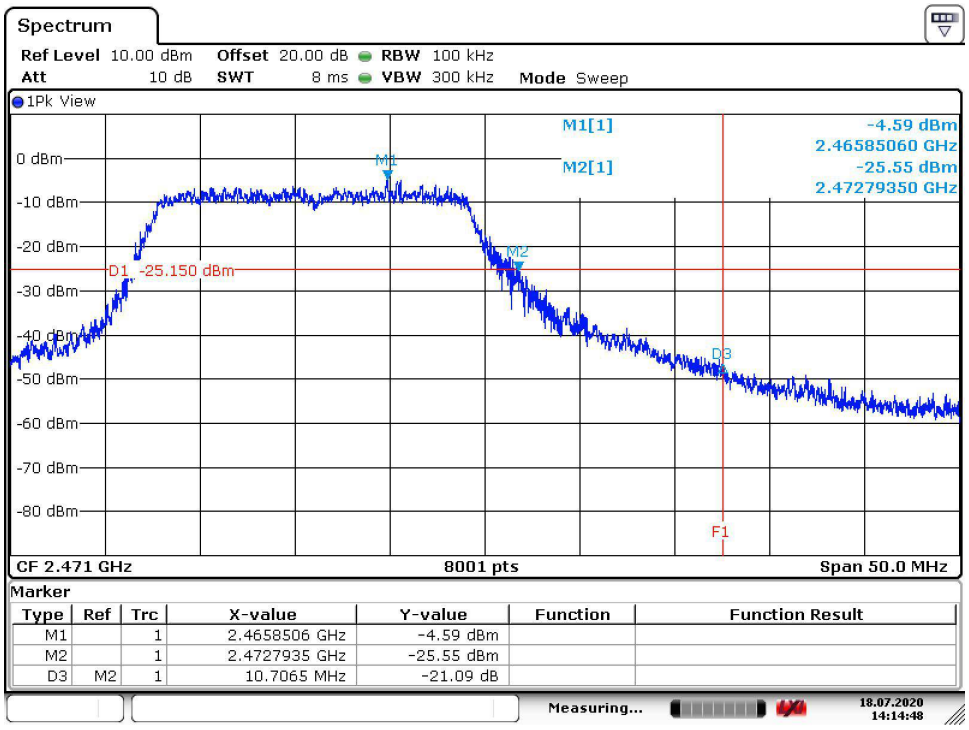
Date: 18.JUL.2020 14:12:01

Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement: Band-Edge Compliance (DTS) Tech: CL Payne

High Channel: 2462 Mhz Modulation: 802.11g Result: Pass



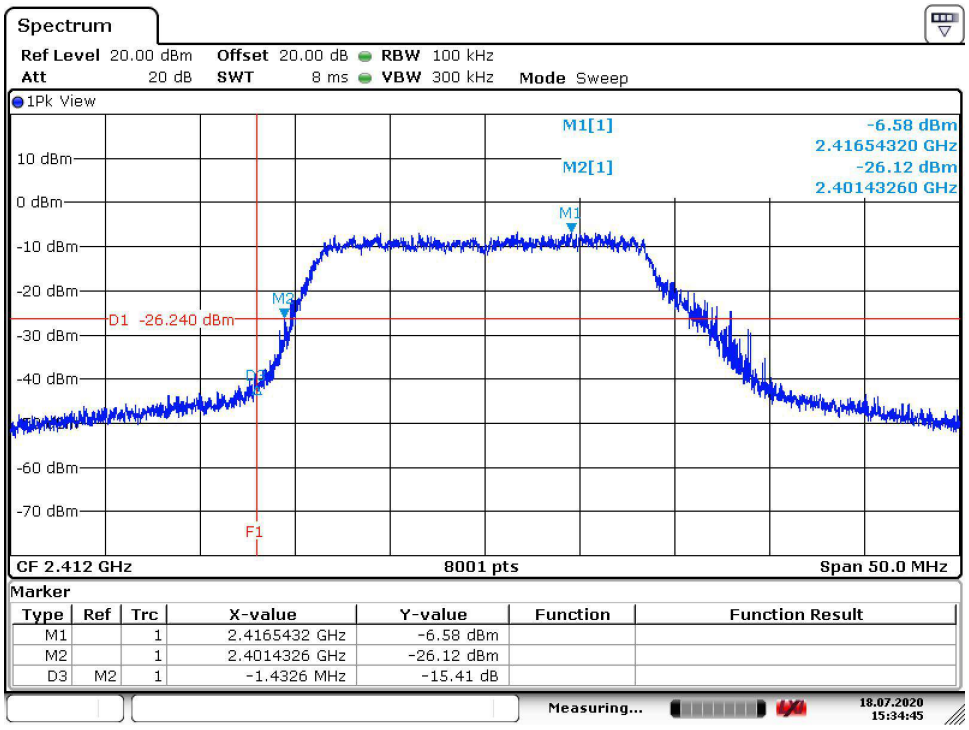
Date: 18.JUL.2020 14:14:48

Client: IOSiX LLC | Date: 18 Jul 2020 | DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger | Model No: IO-2050

Requirement: Band-Edge Compliance (DTS) | Tech: CL Payne

Low Channel: 2412 MHz | Modulation: 802.11n | Result: Pass



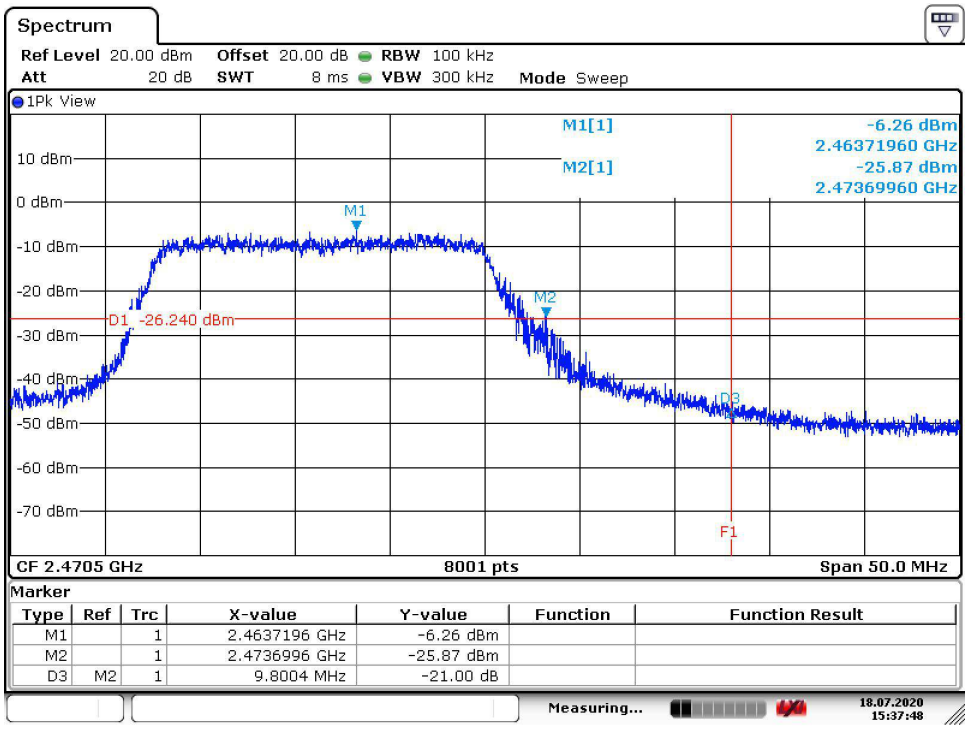
Date: 18.JUL.2020 15:34:46

Client: IOSiX LLC Date: 18 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement: Band-Edge Compliance (DTS) Tech: CL Payne

High Channel: 2462 Mhz Modulation: 802.11n Result: Pass



Date: 18.JUL.2020 15:37:49

15.247 (a,2) DTS Bandwidth ANSI C63.10-2013 Clause 11.8

DTS bandwidth measurement procedure

a) Set RBW = 100 kHz
b) Set the VBW ≥ [3 x RBW]
* per ANSI C63.10-2013 clause 6.9.2 Set the span to 2 to 5 times the OBW
c) Detector = peak
d) Trace mode = max hold
e) Sweep = auto couple
f) Allow trace to stabilize
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.
h) Submit this plot(s).

Requirement: FCC Part 15.247 Clause (a,2)

The 6 dB DTS bandwidth shall be greater than 500 kHz.

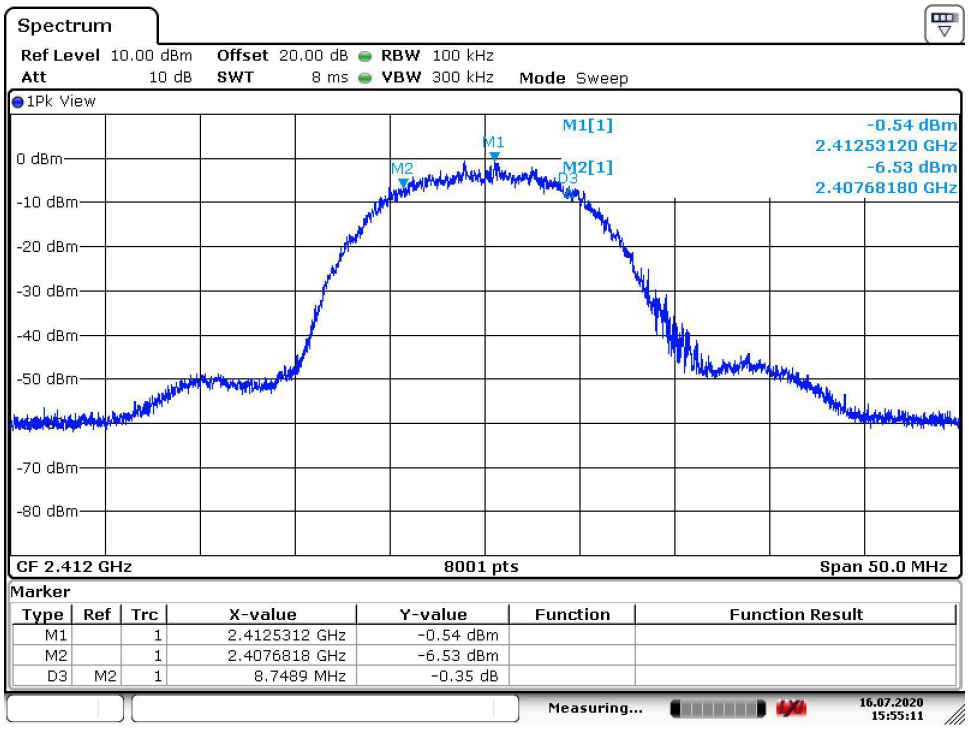
Client: IOSiX LLC Date: 16 Jul 2020 DNB Job: 06125

EUT: IOSiX OBDv5 Vehicle Data Logger Model No: IO-2050

Requirement: 6dB Bandwidth greater than 500kHz Tech: CL Payne

Modulation: 802.11b

Low Channel: 2412 6dB Bandwidth = 8.4789 MHz Result: Pass



Date: 16.JUL.2020 15:55:11