RRA-EMIESS23E443DAV-07Av0

Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5
RSS 247 – Issue 3

Equipment under test:

DAVEY TRONIC 5 BLASTHUB

FCC ID: *2AUQC-DT5GBH*
IC NUMBER: *25586-DT5GBH*

Company:

DAVEY BICKFORD

Distribution: Mrs STOJANOVIC **(Company:** DAVEY BICKFORD**)**

Number of pages: 13 with 1 appendixes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function / Visa
0	16-Jul-24	Creation	M. DUMESNIL, Radio Laboratory Manager

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Information in italics are declared by the manufacturer/customer and are under his responsibility

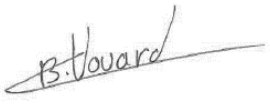
S51 RTY 000 INT 00015 [03]

DESIGNATION OF PRODUCT:	***DAVEY TRONIC 5 BLASTHUB***
Serial number (S/N):	*9235*
Reference / model (P/N):	*BH*
Firmware version:	*0x17 (LoRa Module)*
MANUFACTURER:	*DAVEY BICKFORD*

COMPANY SUBMITTING THE PRODUCT:

Company:	DAVEY BICKFORD
Address:	LE MOULIN GASPARD CHEMIN DE LA PYROTECHNIE 89550 HERY FRANCE
Responsible:	Mrs STOJANOVIC
DATE OF TEST:	18-Apr-24
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677 ISED Accredited under CANADA-EU MRA Designation Number: FR0001 Industry Canada Registration Number: 4452A
TESTED BY:	B. VOVARD
WRITTEN BY:	B. VOVARD

VISA:



CONTENTS

REVISIONS HISTORY

Revision	Date	Modified pages	Modifications
0	**24-Apr-24**	/	Creation

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: ***DAVEY TRONIC 5 BLASTHUB***, in accordance with normative reference.

The equipment under test integrates:

- 2x LoRa 2.4 GHz transceiver radio module not already certified,
- WiFi 5 GHz transceiver radio module already certified (FCC ID: T7V-9026 / IC: 216Q-9026),
- 13.56MHz RFID Tag,
- GNSS module operational in the band 1559MHz – 1610MHz

This report is a justification statement for antenna as stated in 'Timco' newsletter for Part 15 applications with equipment classes DTS, DSS, NII, 6ID, etc. which require the antenna gain for compliance with EIRP limits.

This report concerns only antenna gain calculation of LoRa 2.4 GHz Radio parts.

Measurements are done separately on two 2.4 GHz LoRa Module, named "LoRa 2A" and "LoRa 2B".

The host device of certified module(s) shall be properly labeled to identify the module(s) within.

2. PRODUCT DESCRIPTION

Category of equipment (ISED):	I
Class:	A
Utilization:	Industrial
Antenna type and gain:	Integrated antenna Gain at 2414.8 MHz for LoRa 2A=> +10.15 dBi Gain at 2436.4 MHz for LoRa 2A => +10.83 dBi Gain at 2473.2 MHz for LoRa 2A => +9.58 dBi Gain at 2414.8 MHz for LoRa 2B => +9.43 dBi Gain at 2436.4 MHz for LoRa 2B => +9.76 dBi Gain at 2473.2 MHz for LoRa 2B => +9.88 dBi
Operating frequency band:	From 2400 MHz to 2483.5 MHz
Operating frequency range:	From 2414.8 MHz to 2473.2 MHz
Number of channels:	17

Frequencies tested:	2414.8 MHz, 2436.4 MHz and 2473.2 MHz
Channel spacing:	0.8 to 8 MHz
Modulation:	LoRa
Power soft adjusted to	13 (LoRa 2A & LoRa 2B)
Power source:	Internal rechargeable Li-Ion battery 7.27 Vdc 7000mAh Input used for measurements by adapter 12 Vdc on 120 Vac 60 Hz

The radio is operational during charge mode.

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2023)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for ComplianceTesting of Unlicensed Wireless Devices.
558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
RSS-247	Issue 3, August 2023 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

4. TEST METHODOLOGY

Justification statement:
For antenna as stated in '**Timco**' newsletter for Part 15 applications with equipment classes DTS, which require the antenna gain for compliance with EIRP limits.

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators
Paragraph 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

Radio performance tests procedures given in RSS-247:
Paragraph 5 - Standard specifications for frequency hopping systems and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
0	BAT-EMC V3.18.0.26	Software	/	/	/
4088	R&S FSP40	Spectrum Analyzer	13/05/2022	2	12/05/2024
7279	SUCOFLEX SF104 N 1.5m	Cable	20/05/2022	2	19/05/2024
8508	California instruments 1251RP	Power source	(1)	(1)	(1)
8548	Midwest Microwave 10dB	Attenuator	08/02/2023	3	07/02/2026
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
12911	Huber + Suhner N-2m	cable	20/05/2022	2	19/05/2024
14736	MATURO	Turntable and mat controller MCU	/	/	/
14903	Fluke 177	Multimeter	22/12/2023	2	21/12/2025
18413	MecHANC - N - 5m	Cable	25/03/24	2	25/03/2026

(1) The equipment is not verified; instead, the output voltage is checked before each measurement with the calibrated multimeter.

6. TESTS RESULTS SUMMARY

6.1 CFR 47 part 15requirements

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(b) Maximum peak output power	X				Note 1
	(c) Operation with directional antenna gains > 6 dBi	X				

NAp: Not Applicable NAs: Not Asked

Note 1: First, a measurement was performed using the radiated method and the results found in radio test report referenced **RRA-EMIESS23E443DAV-05Av0**, then a conducted measurement was performed with the same sample replacing the integral antenna by a UFL connector.

Gain antenna is calculated by subtracting conducted power measurement from radiated power measurement.

6.2 RSS-247 requirements

Test Procedure RSS-247	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
Paragraph 5	Standard specifications for frequency hopping system and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
5.4	Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) requirements	X				Note 1

NAp: Not Applicable NAs: Not Asked

Note 1: First, a measurement was performed using the radiated method and the results found in radio test report referenced **RRA-EMIESS23E443DAV-05Av0**, then a conducted measurement was performed with the same sample replacing the integral antenna by a UFL connector.

Gain antenna is calculated by subtracting conducted power measurement from radiated power measurement.

7. MEASUREMENT UNCERTAINTY

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%.

Parameter	Emitech Uncertainty
RF power, conducted	± 0.8dB
Radiated emission valid to 26 GHz 9kHz – 30MHz 30MHz – 1GHz 1GHz – 18GHz 18GHz – 40GHz	 ± 2.7 dB ± 5.0 dB ± 5.3 dB ± 6.1 dB
AC Power Lines conducted emissions	± 3.4 dB
Temperature	± 1 °C
Humidity	± 5 %

8. ANTENNA GAIN CALCULATION – LoRa RADIO PART

Temperature (°C) : 22 **Humidity (%HR):** 39 **Date :** December 19, 2023
Technician : S. LOUIS

Standard: FCC Part 15
RSS-247

Test procedure:
For FCC Part 15: paragraph 15.247 (b)
For RSS-247: paragraph 5.4

Radiated Method Measurement: (Refer **RRA-EMIESS23E443DAV-05Av0**)
RBW≥DTS bandwidth method of paragraph 11.9.1.1 of ANSI C63.10

First an exploratory radiated measurement was performed.

During this phase the product is oriented in this normal positions.

Then the final measurement is realized with the product on the most critical orientation.

The system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

Distance of antenna: 3 meters (in anechoic room)

Antenna height: 1.5 meter (in anechoic room)

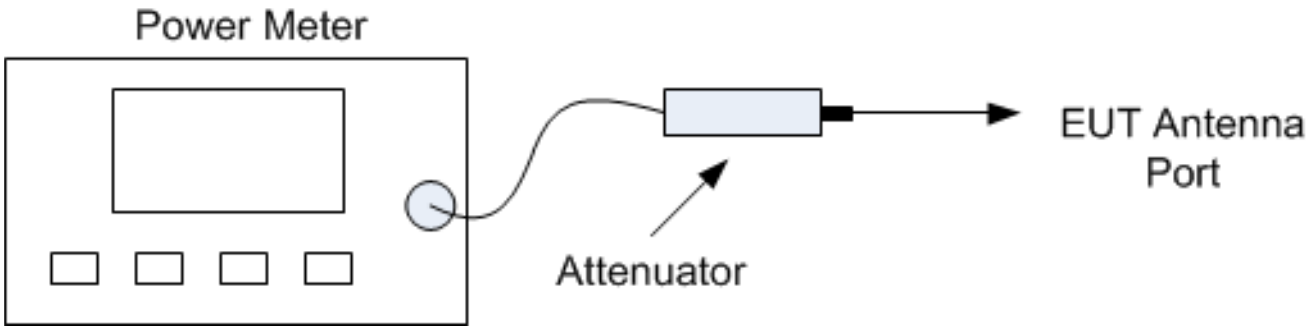
Antenna polarization: vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized with an analyser and peak detector. The resolution bandwidth is adjusted at 10 MHz and video bandwidth at 10 MHz. (11.9.1.1 of ANSI C63.10)

Finally the radiated electro-magnetic field is converted in dBm with the following formula:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna with a Gain (unit in dBi) different following the frequencies used.

Conducted Method Measurement:
RBW≥DTS bandwidth method of paragraph 11.9.1.1 of ANSI C63.10

Conducted test



The measure is realized in conducted mode.

The power meter is replaced with an spectrum analyser and peak detector. The resolution bandwidth is adjusted at 10 MHz and video bandwidth at 10 MHz. (11.9.1.1 of ANSI C63.10).

Equipment under test operating condition:

The equipment is blocked in continuous modulated transmission mode by an internal data signal at the highest power level at which the transmitter is intended to operate.

P Software adjusted to +13dBm

Power source: 120 Vac 60 Hz by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results for LoRa 2A:

Sample N° 1 Low Channel (F = 2414.8 MHz)

	Radiated Output power measured at 3 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 120 Vac	110	14.74	4.59	10.15

Polarization of test antenna: Vertical (height: 100 cm)
Position of equipment: Position 1 - (azimuth: 130 degrees)

(1) Conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Sample N° 1 Central Channel (F = 2436.4 MHz)

	Radiated Output power measured at 3 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 120 Vac	111	15.74	4.91	10.83

Polarization of test antenna: Vertical (height: 100 cm)
Position of equipment: Position 1 - (azimuth: 130 degrees)

(1) Conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Sample N° 1 High Channel (F = 2473.2 MHz)

	Radiated Output power measured at 3 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 120 Vac	111.5	16.24	6.66	9.58

Polarization of test antenna: Vertical (height: 100 cm)
Position of equipment: Position 1 - (azimuth: 130 degrees)

(1) Conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Results for LoRa 2B:

Sample N° 1 Low Channel (F = 2414.8 MHz)

	Radiated Output power measured at 3 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 120 Vac	111.3	16.04	6.61	9.43

Polarization of test antenna: Vertical (height: 100 cm)
Position of equipment: Position 1 - (azimuth: 130 degrees)

(2) Conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Sample N° 1 Central Channel (F = 2436.4 MHz)

	Radiated Output power measured at 3 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 120 Vac	111.2	15.94	6.18	9.76

Polarization of test antenna: Vertical (height: 100 cm)
Position of equipment: Position 1 - (azimuth: 130 degrees)

(2) Conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Sample N° 1 High Channel (F = 2473.2 MHz)

	Radiated Output power measured at 3 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 120 Vac	109.5	14.24	4.36	9.88

Polarization of test antenna: Vertical (height: 100 cm)
Position of equipment: Position 1 - (azimuth: 130 degrees)

(2) Conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

□□□ End of report, 1 appendix to be forwarded □□□

APPENDIX 1: Test equipment list

Antenna Gain Calculation

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	MecHANC	18413
Attenuator 10dB	Midwest Microwave	8548
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000