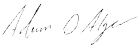
Test Report C-3600G

Equipment Under Test:	DCE045
Requirement(s):	FCC 15.203 RSS-GEN 6.8
Test Date(s):	6/5/2023-6/7/2023
Prepared for:	Stanley Black & Decker Attn: Kirwan Magdamo 701 East Joppa Road Towson, MD 21286

Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 7/18/2023

Report Reviewed by: Adam Alger, Laboratory Manager

Signature:  Date: 7/18/2023

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 7/18/2023

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Laird Connectivity Test Services in Review

The Laird Connectivity LLC laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

Certificate #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein unless otherwise noted

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Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers

Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

1 TEST REPORT SUMMARY

On **6/5/2023 to 6/7/2023** the Equipment Under Test (EUT), **DCE045**, as provided by **Stanley Black & Decker** was tested to the following requirements:

Antenna Requirements

Requirements	Description	Method	Result
FCC 15.203	Antenna Requirement	ANSI C63.10	Pass
RSS-GEN 6.8	Transmit Antenna	ANSI C63.10	Pass

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Stanley Black & Decker
Contact Person	Kirwan Magdamo
Address	701 East Joppa Road Towson, MD 21286

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	DCE045
Model Number	DCE045
Serial Number	Engineering Sample
Additional Information	FCC ID: YJ7DCE045 IC ID: 9082A-DCE045

2.2 Product Description

The DCE045 Bluetooth Audit Chip is designed for tracking and locating professional power tools, equipment, and machines using the DeWalt Tool Connect app which is capable of connecting with mobile devices that support Bluetooth Smart technology.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Programming Information

Device is powered via 3VDC coin cell battery. Device is programmed via a FTDI-USB cable, with the USB end connected to a programming laptop. Programming software used is nRF Connect for Desktop v4.0.0. Within the nRF Connect software the Direct Test Mode v.2.0.4 utility is used. Channels tested were 37 (2402 MHz), 17 (2440 MHz), and 39 (2480 MHz) with a 1M Data Rate. Transmit Power Settings used in the device are +4 dBm and -40 dBm.

2.6 Additional Information

Tested device to compare radiated field strength levels against conducted output power measurements to ascertain antenna gain. Antenna is a PCB trace antenna with dimensions shown in Section 6.

3 REFERENCES

Publication	Edition	Date	AMD 1	
ANSI C63.10	-	2015		
RSS-247	2	2017		
RSS-GEN	5	2018	2019	2021
FCC eCFR	-	2023		

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References
CISPR 16-4-1
CISPR 16-4-2
CISPR 32
ANSI C63.23
A2LA P103
A2LA P103c
ETSI TR 100-028

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

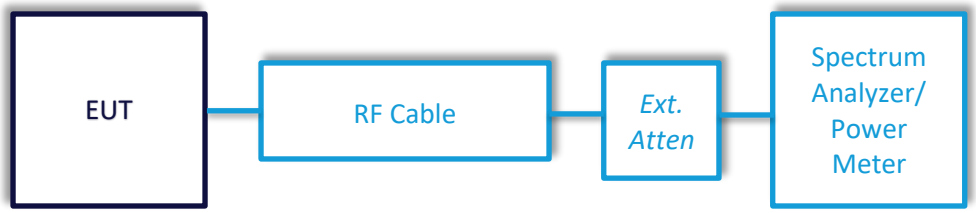
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



5.1.1 Peak Output Power

Operator	Anthony Smith	**QA**	Adam Alger
Temperature	21.1°C	**R.H. %**	45.3%
Test Date	6/7/2023	**Location**	Conducted RF Bench
Requirement	FCC: 15.247 (b)(3) IC: RSS-247 5.4 (d)	**Method**	ANSI C63.10 §11.9

Limits: 30 dBm

Test Parameters

Frequency	2402, 2440, 2480 MHz	**Setup**	Conducted
RBW	3 MHz	**VBW**	50 MHz
Detector(s)	Max Peak Hold	**Sweep Time**	Auto

EUT Parameters

Input Power	3VDC Battery	**Mode**	BLE Transmit
Frequency	2402, 2440, 2480 MHz	**Channel**	37, 17, 39
Data Rate/Modulation	BLE 1Mbps		

Instrumentation

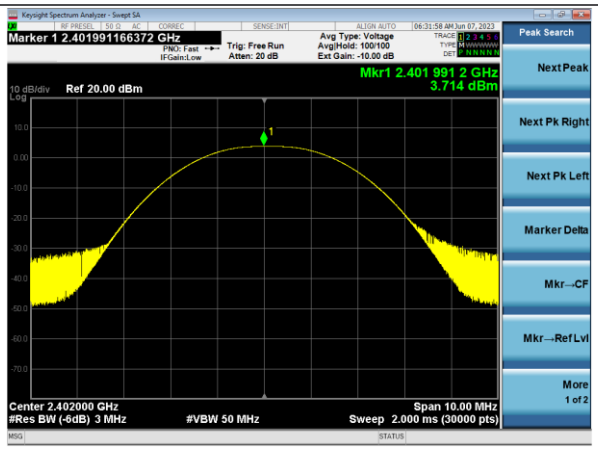
Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	3/22/2023	3/22/2024	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/11/2023	4/11/2024	Active Calibration

Data Table

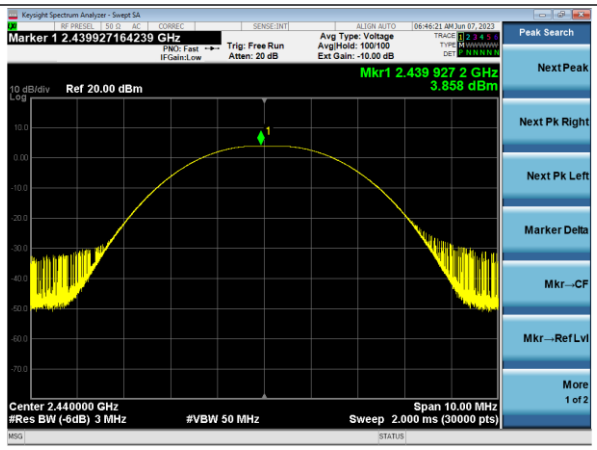
Channel	Data Rate	Transmit Power Setting	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
37	BLE 1Mbps	4	3.7	30.0	26.2
17	BLE 1Mbps	4	3.9	30.0	25.9
39	BLE 1Mbps	4	4.0	30.0	26.2

Plots

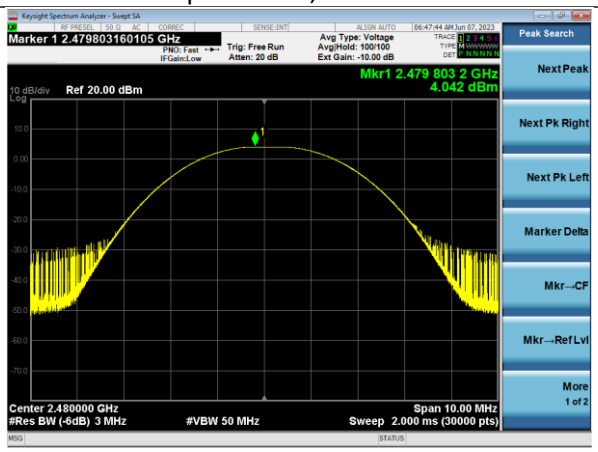
Transmit Power Setting: +4



Output Power, Channel 37



Output Power, Channel 17



Output Power, Channel 39

5.2 Radiated RF Output Power

Operator	Anthony Smith	**QA**	Jon Dilley
Temperature	24.8°C, 24.3°C	**R.H. %**	39.5%, 42.6%
Test Date	6/5/2023, 6/6/2023	**Location**	Chamber 3
Requirement	FCC 15.247	**Method**	ANSI C63.10

Test Parameters

Frequency	30 MHz-25 GHz	**Distance**	3m
Detector(s)	Peak	**Table height**	Above 1 GHz 150cm
RBW	1 MHz	**VBW**	3 MHz

EUT Parameters

Input Power	3VDC - Coin Battery	**Mode**	BLE Tx
EUT	PRBS9 Packet Length 37 1M Data Rate		

Fundamental Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	EUT Orientation	Channel
2401.7	H	150	246	90.1	Vertical	37
2401.9	V	140	76	96.6	Vertical	37
2401.8	V	110	269	94.6	Horizontal	37
2401.8	H	150	198	96.1	Horizontal	37
2401.9	H	150	66	96.7	Flat	37
2402.1	V	150	88	89.2	Flat	37
2479.6	H	150	70	97.8	Flat	39

5.3 Antenna Gain

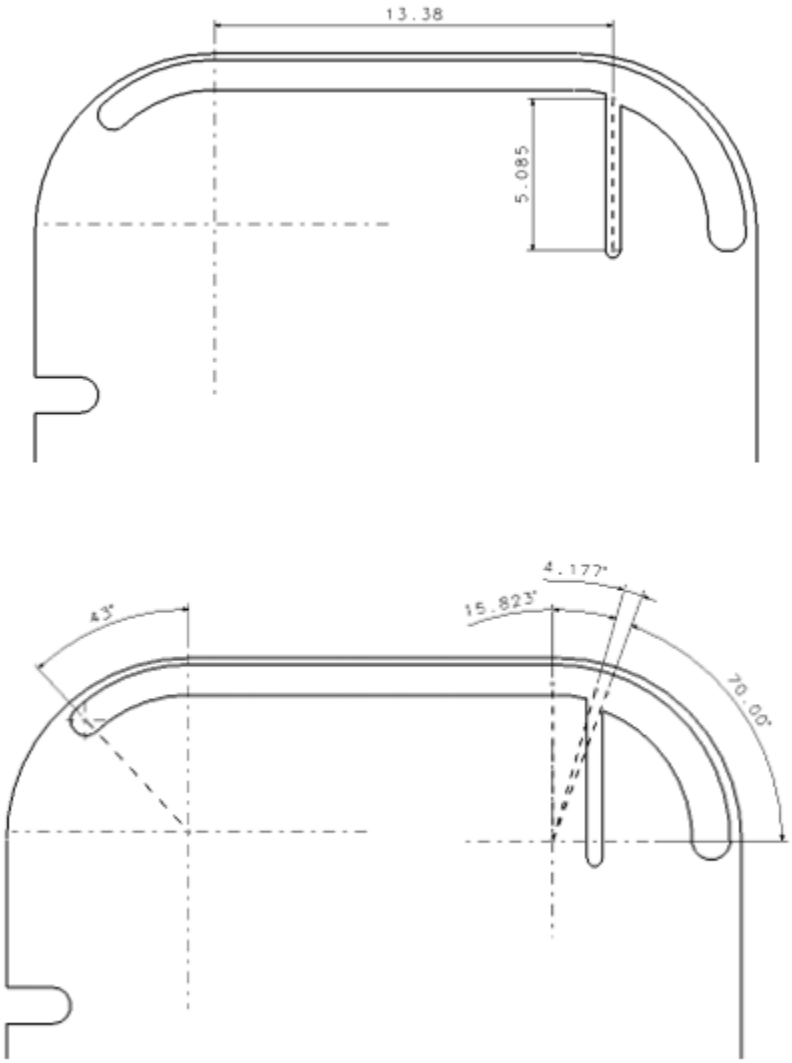
Example Calculation

Field Strength (dBµV/m) - 95.2 (Convert 3m Field Strength to dBm) – Conducted Peak Output Power (dBm) = Antenna Gain (dBi)

Data Table

Channel	Peak Reading (dBµV/m)	Conversion Factor	Peak RF Output Converted (dBm)	Conducted Peak Output Power (dBm)	Antenna Gain (dbi)
37	96.7	95.2	1.5	3.7	-2.2
39	97.8	95.2	2.6	4.0	-1.4

6 FIGURE



Unit: mm

7 REVISION HISTORY

Version	Date	Notes	Person
1	7/6/2023	Initial Draft	Anthony Smith
2	7/18/2023	Revised Draft	Anthony Smith

END OF REPORT