

Test Report # TR 317254

Equipment Under Test: Bluetooth Tool Module

Test Date(s): 4/2/17, 4/17/17, 7/19/17 – 7/20/17, & 7/26/17

Prepared for: Stanley Black & Decker
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Report Issued by: Coty Hammerer, EMC Engineer I

Signature: *Coty Hammerer*

Date: 9/01/17

Report Reviewed by: Ryan Urness, Director of Test Services

Signature: *[Signature]*

Date: 09/01/17

Report Constructed by: Coty Hammerer, EMC Engineer I

Signature: *Coty Hammerer*

Date: 8/24/17

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CONTENTS

Contents.....	2
Laird Technologies Test Services in Review	3
1 Test Report Summary	4
2 Client Information.....	5
2.1 Equipment Under Test (EUT) Information	5
2.2 Product Description	5
2.3 Modifications Incorporated for Compliance.....	5
2.4 Deviations and Exclusions from Test Specifications	5
2.5 Additional Information.....	6
3 References	7
4 Uncertainty Summary	8
5 Test Data	9
5.1 Antenna Port Conducted Emissions.....	9
5.2 Radiated Emissions	26
6 Revision History	32

Laird Technologies Test Services in Review

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



A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

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



Federal Communications Commission (FCC) – USA

Accredited recognition of two 3 meter Semi-Anechoic Chambers

Accredited Test Firm Registration Number: 953492



**Government
of Canada**

Innovation, Science and Economic Development Canada

ISED Site listing of two 3 meter Semi-Anechoic Chambers based on RSS-GEN – Issue 4

File Number: IC 3088A-2

File Number: IC 3088A-3

Company: Stanley Black & Decker	Page 3 of 32	Name: Bluetooth Tool Module
Report: 317254		Model: N471440(02)
Job: C-2778		Serial: Engineering Sample

1 TEST REPORT SUMMARY

Between 4/2/17, 4/17/17, 7/19/17-7/20/17, & 7/26/17 the Equipment Under Test (EUT), Bluetooth Tool Module, as provided by Stanley Black & Decker was tested to the following requirements:

Requirement	Description	Specification	Method	Result
FCC: 15.247 (a)(2) IC: RSS-247 5.2 (1)	Digital Modulation System 6 dB bandwidth	500 kHz	ANSI C63.10	Pass
FCC: 2.1049 IC: RSS-GEN 6.6	Occupied Bandwidth	Reported	ANSI C63.10	-
FCC: 15.247 (b)(3) IC: RSS-247 5.4 (4)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Pass
FCC: 15.247 (e) IC: RSS-247 5.2 (2)	Digital Modulation System Power Spectral Density	8 dBm / 3 kHz	ANSI C63.10	Pass
FCC: 15.247 (d) IC: RSS-247 5.5	RF Spurious Emissions at the Transmitter Antenna Terminal	30 dBc	ANSI C63.10	Pass
FCC: 15.247 (d) IC: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Pass
FCC: 2.1055 (d) IC: RSS-GEN 6.11	Frequency Stability	Reported	ANSI C63.10	Pass
FCC: 15.207 IC: RSS-GEN 8.8	AC Power Line Conducted Emissions	0.150-30 MHz	ANSI C63.10	N/A

Notice:

The results relate only to the item tested and described in this report. Any modifications made to the equipment under test after the specified test date(s) may invalidate the data herein.

If the resulting measurement margin is seen to be within the uncertainty value, as listed in this report, the possibility exists that this unit may not meet the required limit specification if subsequently tested.

2 CLIENT INFORMATION

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

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Bluetooth Tool Module
Model Number	N471440(02)
Serial Number	Engineering Sample
Host (Impact Drill Model) Model Numbers	DCF896 & DCF896H

2.2 Product Description

The Bluetooth Tool Module permits a User to connect their DEWALT power tool to their mobile device giving them the ability to:

- Provide tool tracking & inventory management
- Provide security by enabling/disabling the tool or sending alerts when tool is out of range
- Customize tool performance
- Provide diagnostic and technical information to the User

The DEWALT Bluetooth Tool Module was tested in the following tools:

- DCF896 – Impact Driver

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 Additional Information

The EUT was powered via a 20 VDC benchtop supply for Conducted Radio measurements while for Radiated Measurements a 20VDC rechargeable battery was attached the tool. The radio module was programmed at 2402, 2440 and 2480 MHz (low, middle and high channels, respectively) with an Android device using the Nordic Semiconductor nRF Connect Version 4.10 application. For radiated measurements the EUT was tested in 3 orientations.

Note: Stanley Black & Decker states that the Host (Impact Drill) sample tested for Radiated measurements was the DCF896 model which is identical to the DCF896H model, except for some mechanical configuration of the impactor drive. Therefore, both host model numbers are being listed within this report, with the specific model tested highlighted herein.

Company: Stanley Black & Decker	Page 6 of 32	Name: Bluetooth Tool Module
Report: 317254		Model: N471440(02)
Job: C-2778		Serial: Engineering Sample

3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15.247	-	2017
RSS-247	2	2017
CFR 47 Part 15.209	-	2017
CFR 47 Part 15.207	-	2017
ICES-003	6	2017
ANSI C63.10	-	2013

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	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty \pm
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

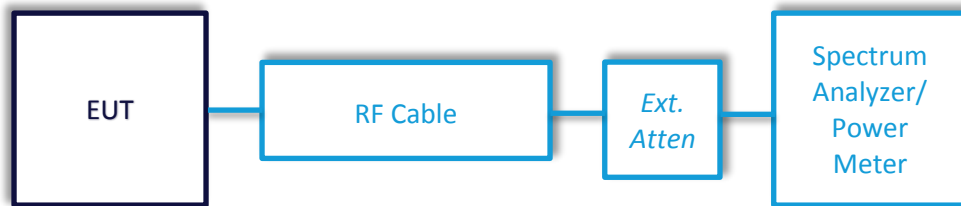
Parameter	ETSI U.C. \pm	U.C. \pm
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	<p>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.</p> <p>The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.</p>
Example Calculations	<p>Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm)</p> <p>Margin (dB) = Limit (dBm) – Corrected Reading (dBm)</p>

Block Diagram



Instrumentation



Date : 23-Mar-2017 Test : Antenna Port Conducted Emissions Job # : C-2696
 PE : Michael Hintzke Customer : Stanley Black & Decker Quote # : 317078

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960173	Cable - low loss 1m	A.H. Systems, Inc.	SAC-26G-1	388	5/16/2016	5/16/2017	Active Verification

5.1.1 Duty Cycle

Operator	Michael Hintzke
QA	Aidi Zainal
Test Date	4/2/17
Location	Conducted Radio Bench Area
Temp. / R.H.	70°F / 33%
Method	ANSI C63.10-2013 section 11.6

Test Parameters

Frequency	2402 MHz, 2440 MHz, 2480 MHz
Bandwidth Measurement Settings	<ul style="list-style-type: none"> • 8 MHz RBW / 50 MHz VBW • Peak Detector
EUT Power Input	20 VDC
Duty Cycle Calculation	Duty Cycle = (Transmit On Time) / (Transmit On Time + Transmit Off Time)

Table – Duty Cycle

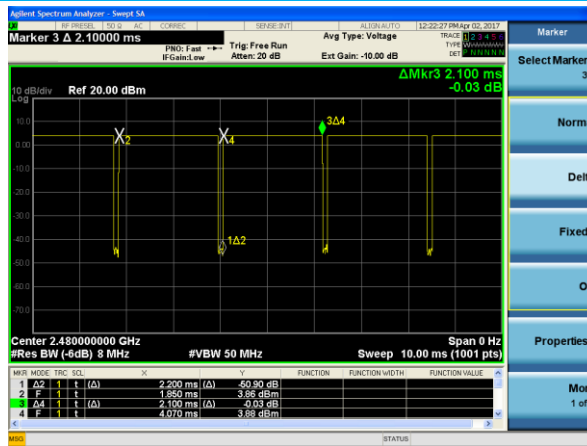
Mode	Channel	On-time (ms)	Total Time (ms)	Duty	*Duty Cycle Correction (dB)
BLE	low	2.100	2.200	0.95	0.20
BLE	mid	2.100	2.210	0.95	0.22
BLE	high	2.100	2.200	0.95	0.20

Plots – Duty Cycle



Low Channel

Middle Channel



High Channel

5.1.2 DTS & Occupied Bandwidth Measurements

Operator	Michael Hintzke
QA	Aidi Zainal
Test Date	4/2/17
Location	Conducted Radio Bench Area
Temp. / R.H.	70°F / 33%
Requirement	CFR 47 Part 15.247(a)(2) RSS-247 section 5.2 a)
Method	FCC KDB 558074 D01 Meas Guidance v04 section 6.0

Limits:

Requirement	Limit
6 dB Bandwidth	≥ 500 kHz

Test Parameters

Frequency	2402 MHz, 2440 MHz, 2480 MHz
Bandwidth Measurement Settings	<ul style="list-style-type: none"> • DTS BW: 100 kHz RBW / 300 kHz VBW • 99% OBW: RBW = 1% - 5% of OBW; VBW ≥ 3*RBW • Peak Detector
EUT Power Input	20 VDC

Table – Bandwidth Measurements

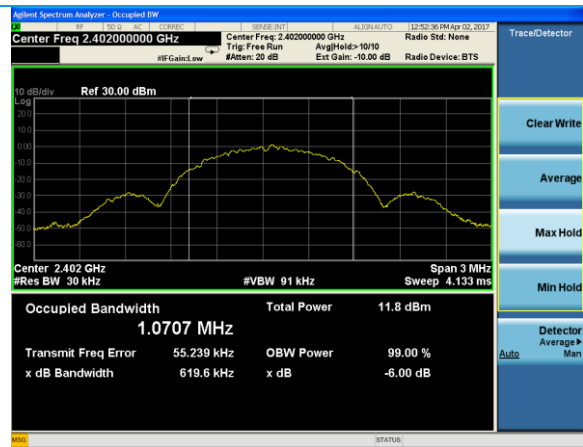
Channel Frequency (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth minimum limit (MHz)	99% OBW (MHz)
2402	0.721	0.500	101.071
2440	0.716	0.500	1.065
2480	0.719	0.500	1.060

Plots

Low Channel



DTS Bandwidth



99% OBW

Mid Channel

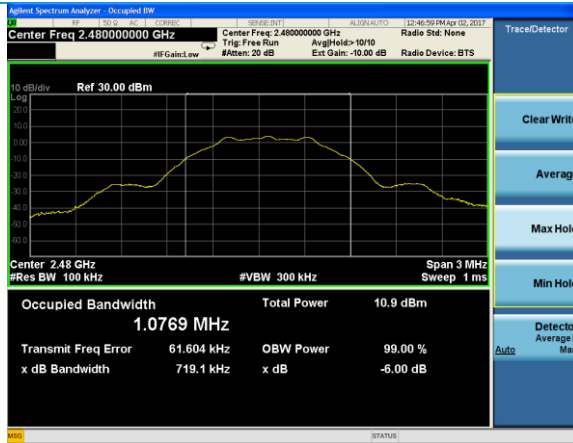


DTS Bandwidth

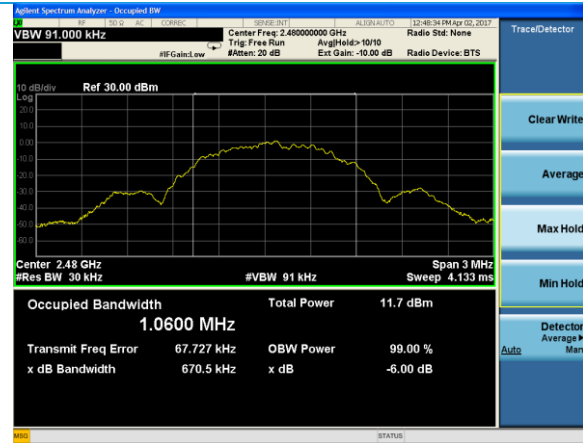


99% OBW

High Channel



DTS Bandwidth



99% OBW

5.1.3 Maximum Conducted (Average) Output Power

Operator	Michael Hintzke
QA	Aidi Zainal
Test Date	4/17/17
Location	Conducted Radio Bench Area
Temp. / R.H.	70°F / 33%
Requirement	CFR 47 Part 15.247 (b)(3) RSS-247 section 5.4 d)
Method	FCC KDB 558074 D01 Meas Guidance v04 section 9.2.2.4
Example Calculation	$P_{(W)} = 10^{(P_{(dBm)}/10)}$

Limits:

Requirement	Limit
Maximum Conducted Output Power	1 Watt

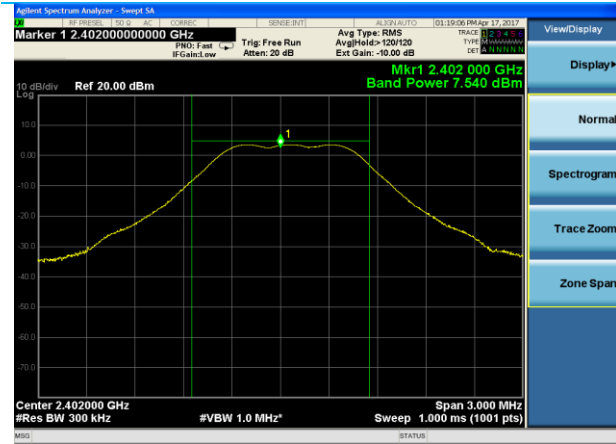
Test Parameters

Frequency	2402 MHz, 2440 MHz, 2480 MHz
Maximum Conducted Output Power Measurement Settings	<ul style="list-style-type: none"> • 300 kHz RBW / 1 MHz VBW • RMS Detector
EUT Power Input	20 VDC

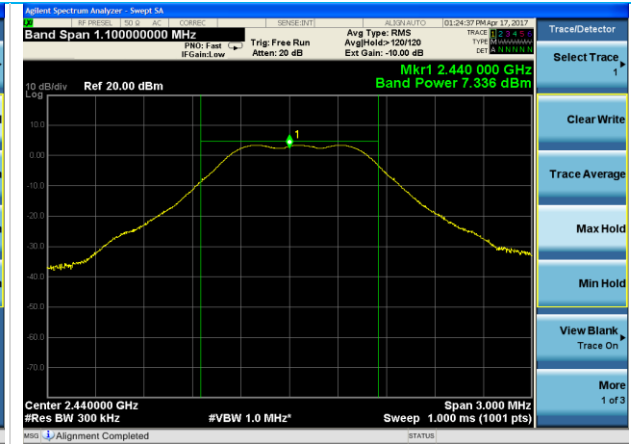
Table – Maximum Conducted (Average) Output Power Measurements

Channel Frequency (MHz)	Max Conducted (Average) Output Power (dBm)	Power Limit (dBm)	Margin (MHz)
2402	7.740	30	22.260
2440	7.556	30	22.444
2480	7.4510	30	22.549

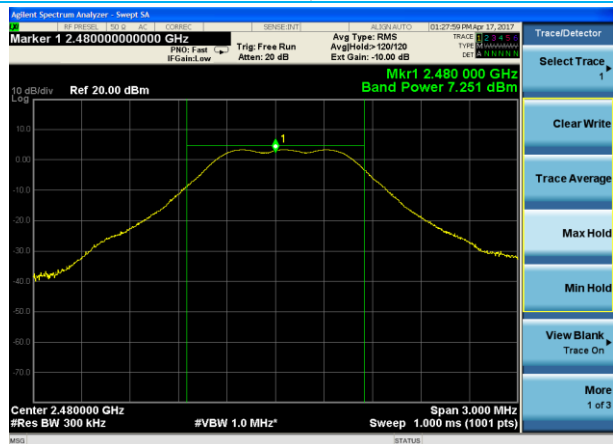
Plots – Maximum Conducted (Average) Output Power



Low Channel



Middle Channel



High Channel

5.1.4 Power Spectral Density

Operator	Michael Hintzke
QA	Aidi Zainal
Test Date	4/17/17
Location	Conducted Radio Bench Area
Temp. / R.H.	70°F / 33%
Requirement	CFR 47 Part 15.247 (e) RSS-247 section 5.2 b)
Method	FCC KDB 558074 D01 Meas Guidance v04 section 10.5

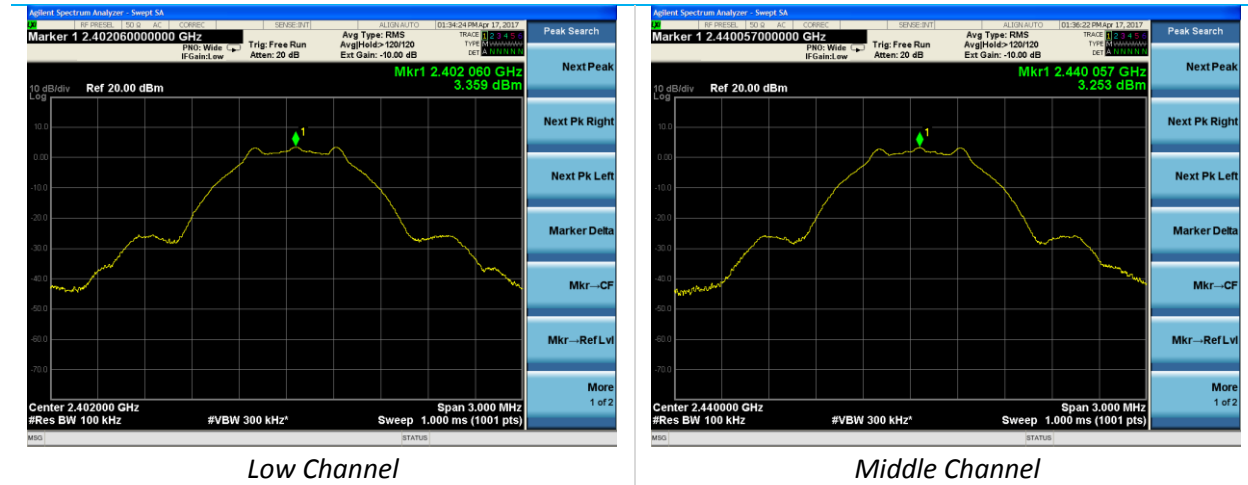
Limits:

Requirement	Limit
Power Spectral Density	8 dBm

Table – Power Spectral Density

Channel Frequency (MHz)	Average PSD in 100 kHz BW (dBm)	PSD in 3 kHz Limit (dBm)	PSD Margin (dBm)
2402	3.559	8	4.441
2440	3.473	8	4.527
2480	3.428	8	4.572

Plots – Power Spectral Density



5.1.5 100 kHz Bandwidth Spurious Emissions

Operator	Michael Hintzke
QA	Aidi Zainal
Test Date	4/2/17
Location	Conducted Radio Bench Area
Temp. / R.H.	70°F / 33%
Requirement	CFR 47 Part 15.247 (d) RSS-247 section 5.5,
Method	FCC KDB 558074 D01 Meas Guidance v04 section 6.0

Limits:

Requirement	Limit
100 kHz Bandwidth Spurious Emissions	30 dBc

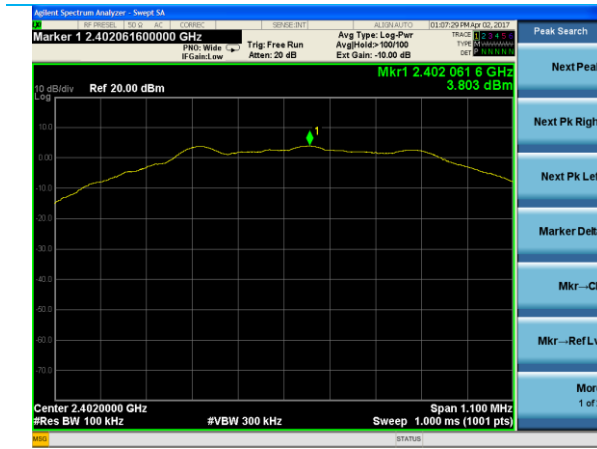
Test Parameters

Frequency	30 MHz – 25000 MHz
Bandwidth Measurement Settings	<ul style="list-style-type: none"> • 100 kHz RBW / 300 kHz VBW • Peak Detector
EUT Power Input	20 VDC

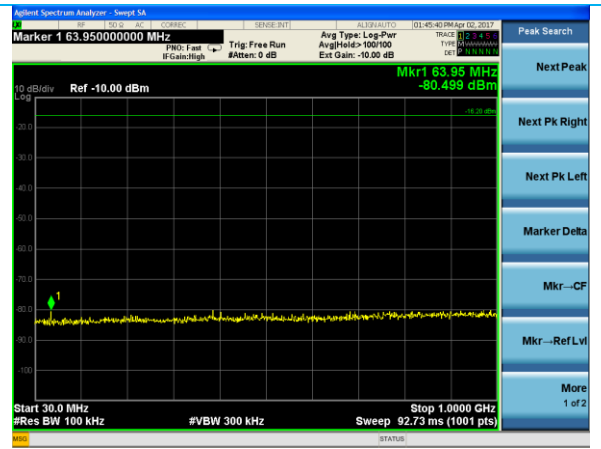
Table – 100 kHz Bandwidth Emissions

Channel Frequency (MHz)	Spurious Emission Frequency (MHz)	Spurious Emissions Level (dBm)	100 kHz Reference (dBm)	30 dBc Limit (dBm)	Margin (dB)
2402	63.95	-80.499	3.803	-26.197	54.302
2402	4807	-55.036	3.803	-26.197	28.839
2402	12010	-68.059	3.803	-26.197	41.862
2440	942.77	-79.749	3.766	-26.234	53.515
2440	2566	-56.984	3.766	-26.234	30.750
2440	12205	-67.022	3.766	-26.234	40.788
2480	900.09	-79.911	3.699	-26.301	53.610
2480	2611	-56.910	3.699	-26.301	30.609
2480	12400	-67.290	3.699	-26.301	40.989

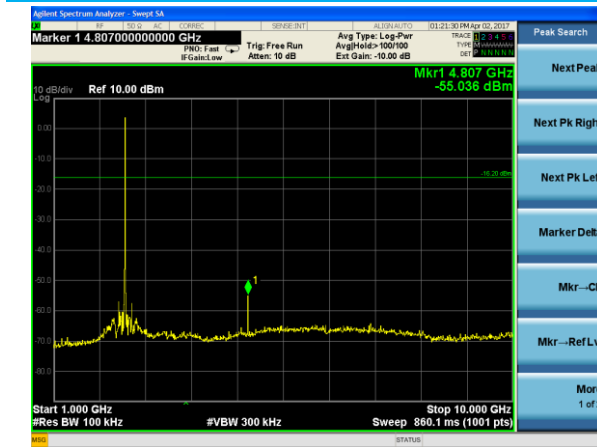
Plots –100 kHz Bandwidth Spurious Emissions



Fundamental



30 MHz – 1000 MHz

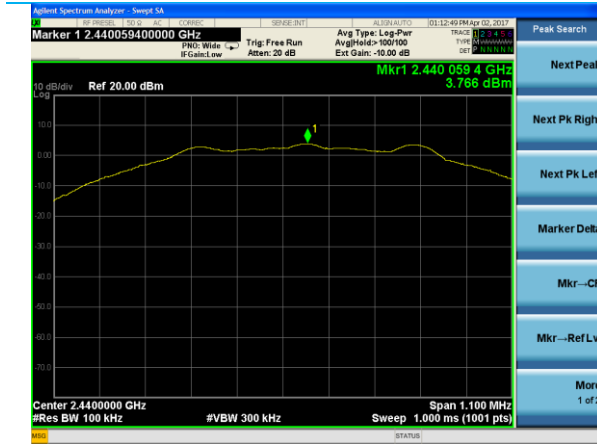


1 GHz – 10 GHz

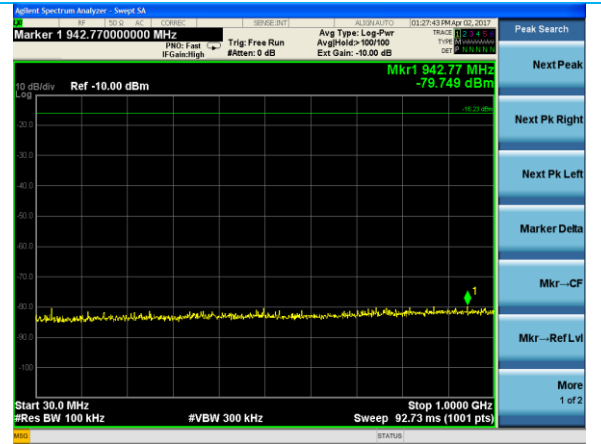


10 GHz – 25 GHz

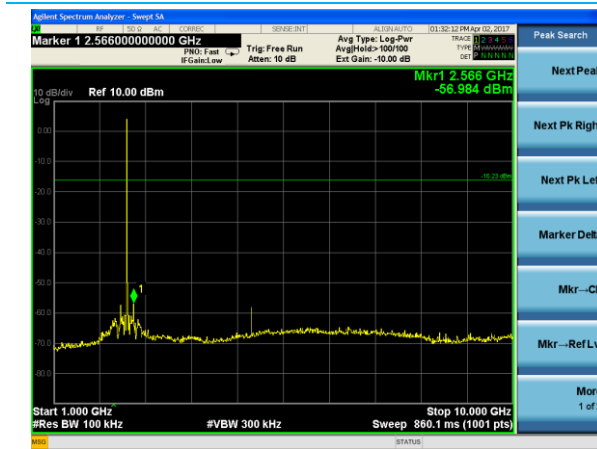
Low Channel



Fundamental



30 MHz – 1000 MHz



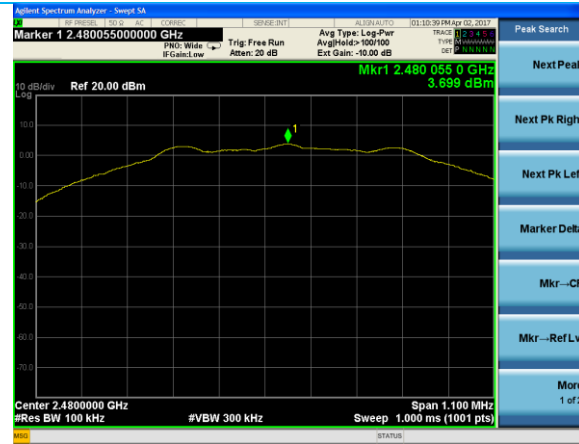
1 GHz – 10 GHz



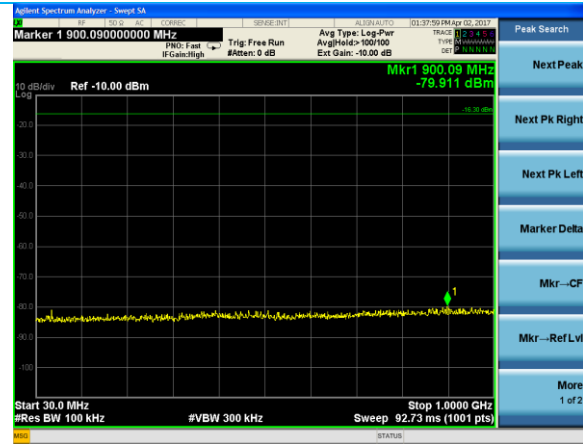
10 GHz – 25 GHz

Middle Channel

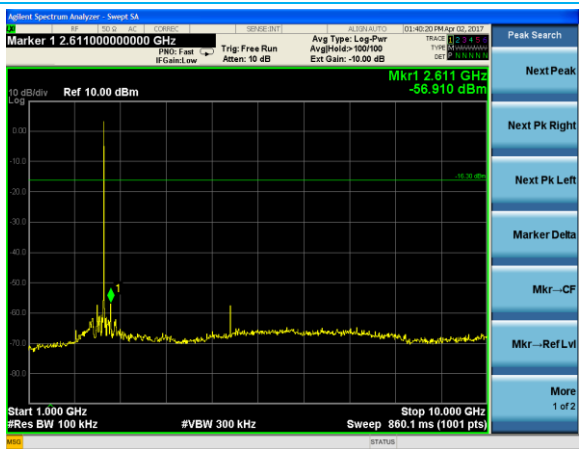
Company: Stanley Black & Decker	Page 21 of 32	Name: Bluetooth Tool Module
Report: 317254		Model: N471440(02)
Job: C-2778		Serial: Engineering Sample



Fundamental



30 MHz – 1000 MHz



GHz – 10 GHz



10 GHz – 25 GHz

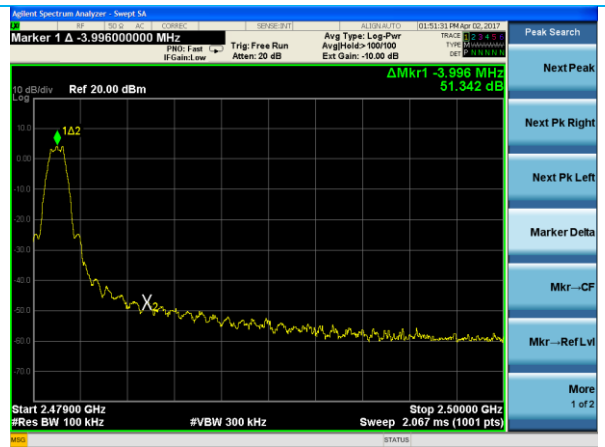
High Channel

Company: Stanley Black & Decker	Page 22 of 32	Name: Bluetooth Tool Module
Report: 317254		Model: N471440(02)
Job: C-2778		Serial: Engineering Sample

Plots –Band-Edges in 100 kHz Bandwidth



Lower Bandedge



Upper Bandedge

5.1.6 Frequency Stability

Operator	Michael Hintzke
QA	Aidi Zainal
Test Date	4/2/17
Location	Conducted Radio Bench Area
Temp. / R.H.	70°F / 33%
Requirement	CFR 47 Part 2.1055 (d)(1) RSS-Gen section 6.11

Test Parameters

Frequency	2402 MHz, 2440 MHz 2480 MHz
Bandwidth Measurement Settings	<ul style="list-style-type: none"> • 100 kHz RBW / 300 kHz VBW • Peak Detector
EUT Power Input	20 VDC

Table – Frequency Stability

Supply Voltage (VDC)	Channel Frequency (Hz)	Measured Frequency (Hz)	Deviation (Hz)
20	2402000000	2402056111	56111
22	2402000000	2402056856	56856
18	2402000000	2402056796	56796

Low Channel

Supply Voltage (VDC)	Channel Frequency (Hz)	Measured Frequency (Hz)	Deviation (Hz)
20	2440000000	2440056936	56936
22	2440000000	2440056690	56690
18	2440000000	2440056561	56561

Middle Channel

Supply Voltage (VDC)	Channel Frequency (Hz)	Measured Frequency (Hz)	Deviation (Hz)
20	2480000000	2480057901	57901
22	2480000000	2480057938	57938
18.0	2480000000	2480057665	57665

High Channel

5.2 Radiated Emissions

<p>Description of Measurement</p>	<p>The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna.</p> <p>The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values.</p> <p>The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.</p>
<p>Example Calculations</p>	<p>Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m)</p> <p>Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m)</p> <p>Example at 4000 MHz: Reading = 40 dBμV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBμV/m Average Limit = 20 log (500) = 54 dBμV/m Margin = 54 dBμV/m - 50.8 dBμV/m = 3.2 dB</p>

Block Diagram



5.2.1 Radiated Emissions

Operator	Coty Hammerer & Shane Dock
QA	Aidi Zainal
Test Date	7/19/16 – 7/20/17, & 7/26/17
Location	5m Chamber & 3m Chamber
Temp. / R.H.	71°F / 50%
Requirement	CFR 47 Part 15 209 CFR 47 Part 15.205 RSS-Gen section 6.13
Method	ANSI C63.10

Limits:

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
>960	500	3

Test Parameters

Frequency	30 MHz – 25000 MHz
Distance	3 meters
RBW Settings	≤1 GHz: 120 kHz >1 GHz: 1 MHz
VBW Settings	≤1 GHz: 1.2 MHz >1 GHz: 3 MHz (Peak); 510 Hz (Average)
Notes	Radiated emissions were measured with the standalone DC tool containing the BLE module. The module is located within in the drill. Host Products: DCF896 & DCF896H Rechargeable 20VDC batteries were used to power the tool.
Notes	Average measurements were performed with a 510 Hz VBW determined by the following equation [1/ (minimum transmitter on time)] as specified in ANSI C63.10 section 4.1.4.2.3 f).

Instrumentation



Smart Technology. Delivered.

Date: 19-Jul-2017 Test: Radiated Measurements Job #: C-2778
 PE: Coty Hammerer Customer: SBD Quote #: 317254

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	7/22/2016	8/26/2017	Active Calibration
2	AA 960171	Cable - low loss 6m	A.H. Systems, Inc.	SAC-26G-6	386	3/3/2016	10/2/2017	Active Verification
3	EE 960087	Spectrum Analyzer	Agilent	N9010A	MY53400296	12/22/2016	12/22/2017	Active Calibration
4	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	10/13/2016	10/13/2017	Active Calibration
5	AA 960176	Cable - low loss 6m	A.H. Systems, Inc.	SAC-26G-6	395	5/19/2017	5/19/2018	Active Verification
6	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2017	5/12/2018	Active Calibration
7	EE 960159	Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	462101702	4/12/2017	4/12/2018	Active Calibration
8	AA 960153	High Pass Filter 2.4 GHz	KWM	HPF-L-14186	7272-04	5/2/2017	5/2/2018	Active Calibration
9	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	4/17/2017	4/17/2018	Active Calibration
10	AA 960174	Small Horn Antenna	ETS Lindgren	3116C-PA	00206880	5/1/2017	5/1/2018	Active Calibration

5.2.1.1 Bluetooth Tool Module with Hosts DCF896 & DCF896H Impact Drill

Tables

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT Orientation	Notes
198.00	1.00	0.00	24.57	43.5	18.93	Horizontal	Vertical	1
184.50	1.00	0.00	24.55	43.5	18.95	Vertical	Vertical	1
993.95	1.00	0.00	28.95	54.00	25.05	Vertical	Vertical	1

Note 1: System noise floor measurement

Peak Frequency (MHz)	Peak Measurement (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Average Frequency (MHz)	Average Measurement (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
2326.00	56.80	74.00	17.21	2389.28	43.81	54.00	10.20
2483.75	57.79	74.00	16.21	2485.03	44.51	54.00	9.49

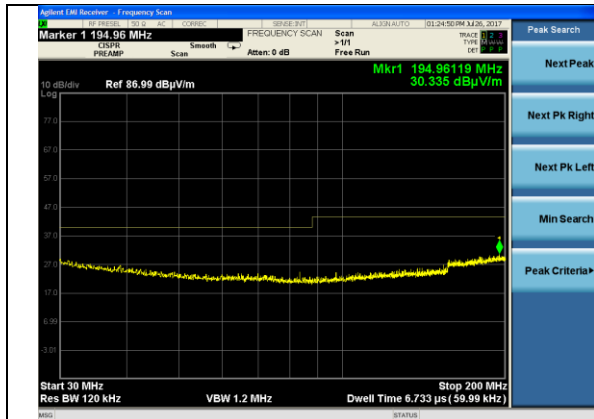
15.205 Restricted Band Emissions – Band Edges

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Avg Margin (dB)	Antenna Polarity	EUT Orientation
4804.00	1.43	323.00	52.12	47.08	54.00	6.92	Horizontal	Vertical
4804.00	1.00	173.30	50.57	44.60	54.00	9.40	Vertical	Vertical
4804.00	1.09	184.50	48.47	43.12	54.00	10.88	Horizontal	Side
4804.00	1.63	213.25	48.58	43.15	54.00	10.85	Vertical	Side
4804.00	1.08	0.00	48.41	42.59	54.00	11.42	Horizontal	Flat
4804.00	1.41	2.50	49.12	43.36	54.00	10.64	Vertical	Flat
4880.00	1.51	328.00	51.56	46.55	54.00	7.45	Horizontal	Vertical
4960.00	1.57	225.00	52.190	47.016	54.00	6.98	Horizontal	Vertical
7320.00	1.22	226.00	57.87	51.55	54.00	2.45	Vertical	Vertical
7440.00	1.97	205.75	58.69	52.92	54.00	1.08	Horizontal	Flat

15.205 Restricted Band Emissions – Transmitter Harmonics

Company: Stanley Black & Decker	Page 29 of 32	Name: Bluetooth Tool Module
Report: 317254		Model: N471440(02)
Job: C-2778		Serial: Engineering Sample

Plots- Worst Case



Horizontal, 30-200 MHz



Vertical, 30-200 MHz



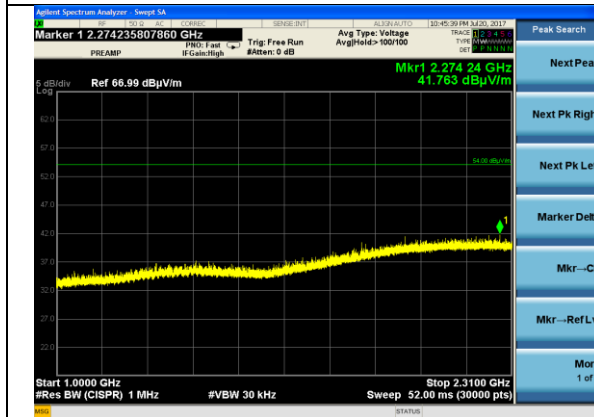
Horizontal, 200-1000 MHz



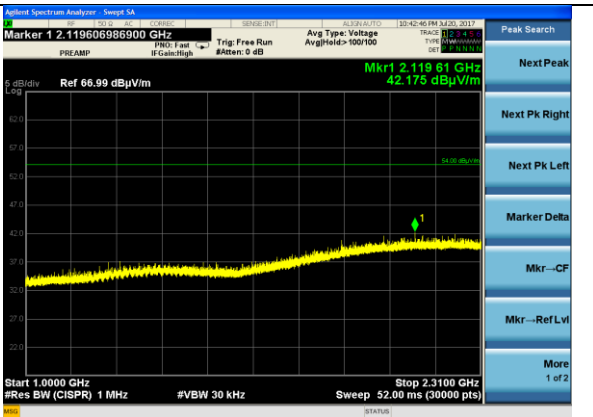
Vertical, 200-1000 MHz

Note: Emission at 832.25 MHz was not a function of the EUT. This was verified by removing the EUT from the Semi-Anechoic Chamber and witnessing the same frequency/magnitude emission.

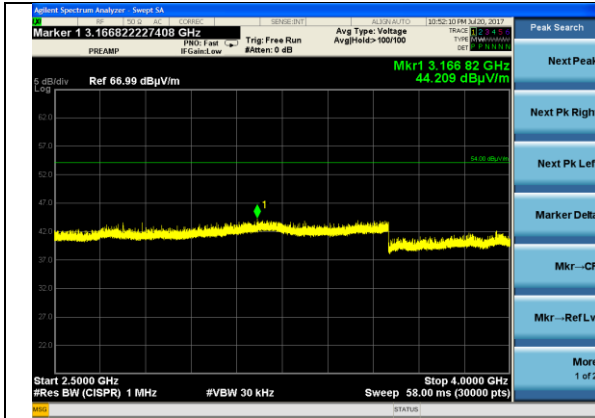
Note: Emission at 832.25 MHz was not a function of the EUT. This was verified by removing the EUT from the Semi-Anechoic Chamber and witnessing the same frequency/magnitude emission.



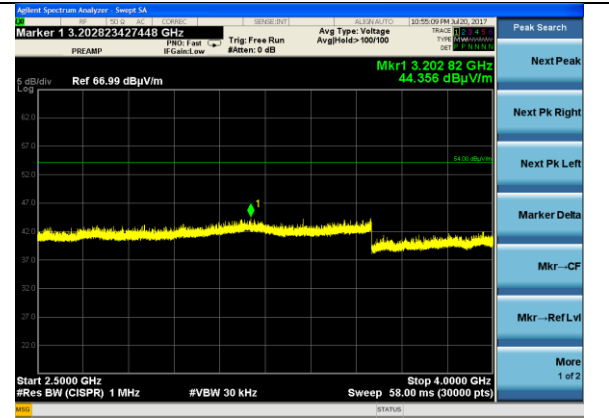
Horizontal, 1-2.31 GHz, Reduced VBW



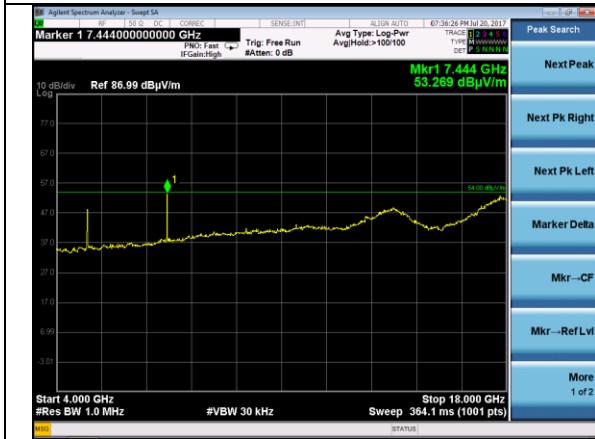
Vertical, 1-2.31 GHz, Reduced VBW



Horizontal, 2.5-4 GHz, Reduced VBW



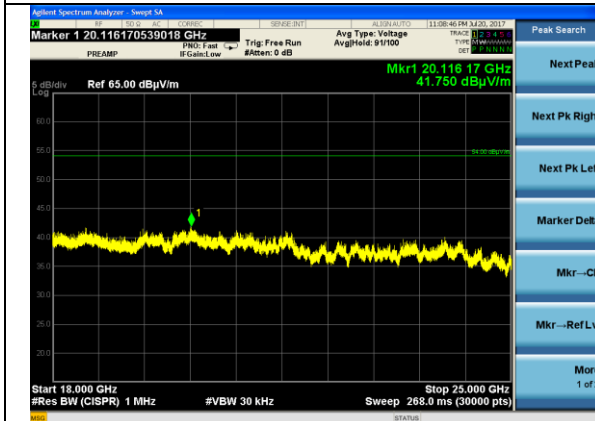
Horizontal, 2.5-4 GHz, Reduced VBW



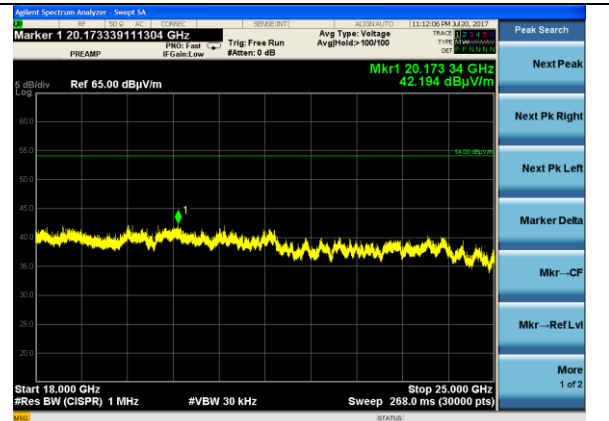
Horizontal, 4-18 GHz, Reduced VBW



Vertical, 4-18 GHz, Reduced VBW



Horizontal, 18-25 GHz, Reduced VBW



Vertical, 18-25 GHz, Reduced VBW

6 REVISION HISTORY

Version	Date	Notes	Person
0	8/31/17	Initial Draft	Coty Hammerer
1	9/1/17	Adjustment To Host/Model Info	Coty Hammerer

END OF REPORT