



# MSD40NBT Testing

Hardware Test Document  
Version 1.2

**global solutions: local support™**

Americas : +1-800-492-2320

Europe : +44-1628-858-940

Hong Kong : +852-2923-0610

**Embedded Wireless Solutions Support Center: <http://ews-support.lairdtech.com>**

[www.lairdtech.com/wireless](http://www.lairdtech.com/wireless)

## REVISION HISTORY

Revision	Date	Description	Approved By
1.0	10 Oct 2012	Initial Version	Dale Chapman
1.1	11 Oct 2013	Transitioned to Laird formatting	Sue White
1.2	12 Jan 2015	Added Rev History table	Sue White

## CONTENTS

Revision History .....	1
Contents .....	3
Hardware Tests .....	4
Receiver (Rx) Sensitivity Test .....	4
Test Equipment .....	4
Method .....	4
Rx Sensitivity Test Setup .....	4
Results .....	5
Power Consumption – Tx Current Test .....	5
Test Equipment .....	5
Method .....	5
Tx Current Test Results .....	5
Tx Power Testing .....	6
Test Equipment .....	6
Method .....	6
Results .....	6
Spectrum Mask Testing .....	7
Test Equipment .....	7
Method .....	7
Results .....	8
EVM Testing .....	9
Test Equipment .....	9
Method .....	9
Results .....	9
Frequency Error Testing .....	11
Test Equipment .....	11
Method .....	11
Results .....	11
Power Consumption – Rx Current Test .....	13
Test Equipment .....	13
Method .....	13
Results .....	13
Drop Test .....	13
Method .....	13
Results .....	14

## HARDWARE TESTS

### Receiver (Rx) Sensitivity Test

This test transmits packets to the DUT (SDC-MSD40NBT) to ensure that the DUT's receiving sensitivity meets required specifications. Because this device supports 802.11a, 802.11b, 802.11g, and 802.11n, a unique test is performed for each mode.

#### Test Equipment

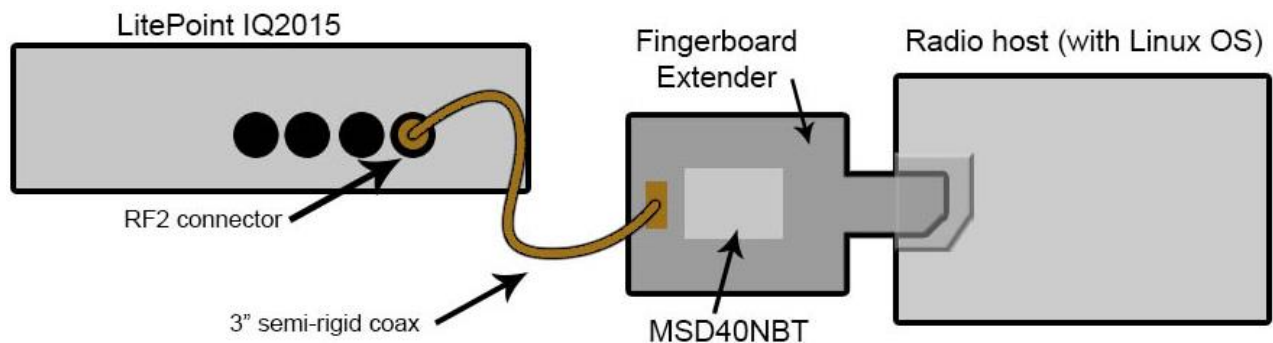
- Radio Host (with Linux OS)
- 3" semi-rigid coaxial cable
- MSD40NBT radio
- LitePoint IQ2015 VSA/VSG
- SDIO T-Board Extender

#### Method

Testing methods are as follows:

- The MSD40NBT is mounted to the SDIO T-Board extender.
- The SDIO T-Board extender is mounted to the radio host.
- The LitePoint IQ2015 is connected to the main antenna port of the MSD40NBT with the 3 inch semi-rigid coax cable.
- The Linux operating system is used on the radio host.
- The output power of the LitePoint IQ2015 is adjusted down until the packet error rate exceeds 10%.
- The Rx sensitivity number is the power required to achieve a packet error rate of < or = to 10%.

#### Rx Sensitivity Test Setup



## Results

*Table 1: 2.4 Gigahertz Band results*

Rate Type	Data Rate	Rx Sensitivity <= 10% PER		
		Channel 1	Channel 6	Channel 11
B	1	-96	-97	-97
B	11Mbps	-96	-97	-97
G	6Mbps	-91	-91	-91
G	24MBps	-91	-91	-91
G	54Mbps	-90	-90	-91
MCS0	6.5Mbps	-91	-91	-91
MCS4	39Mbps	-91	-91	-91
MCS7	65Mbps	-90	-90	-90

*Table 2: 5 Gigahertz Band results*

Rate Type	Data Rate	Rx Sensitivity <= 10%		
		Channel 36	Channel 100	Channel 161
A	6Mbps	-89	-89	-89
A	24MBps	-89	-89	-89
A	54Mbps	-88	-87	-88
MCS0	6.5Mbps	-89	-88	-88
MCS4	39Mbps	-89	-88	-88
MCS7	65Mbps	-88	-88	-88

## Power Consumption – Tx Current Test

### Test Equipment

- Yokogawa DL9140 and current probe or equivalent (oscilloscope)
- LitePoint 8.5

### Method

The Summit Regulatory Unit (software) is used to put the DUT in constant transmit mode at 100% power.

The current readings in this table are averaged over B, G, and MCS rates.

### Tx Current Test Results

802.11 Data Rates	Power Set %	Average Tx Current (mA)
B	100	314
G	100	288
A	100	281
MCS	100	277

## Tx Power Testing

### Test Equipment

- LitePoint IQ Flex.

### Method

The Summit Regulatory Unit (software) is used to put the DUT in constant transmit mode at 100% power. Transmit power is measured with the LitePoint IQ Flex.

### Results

Channel	Frequency		Data Rate	Power Set %	RMS Power, No Gap	Peak Tx Power
1	2412	B	1 Mbps	100	15.2	18.42
1	2412	B	11 Mbps	100	14.96	18.39
6	2437	B	1 Mbps	100	15.82	18.51
6	2437	B	11 Mbps	100	15.96	18.58
11	2462	B	1 Mbps	100	13.8	16.7
11	2462	B	11 Mbps	100	13.38	17.1
1	2412	G	6 Mbps	100	14	22.33
1	2412	G	24 Mbps	100	13.69	22.5
1	2412	G	54 Mbps	100	12.7	21.46
6	2437	G	6 Mbps	100	14.82	22.75
6	2437	G	24 Mbps	100	15.07	22.95
6	2437	G	54 Mbps	100	13.85	22.24
11	2462	G	6 Mbps	100	13.07	22.4
11	2462	G	24 Mbps	100	13.12	22.81
11	2462	G	54 Mbps	100	13.06	22.31
36	5180	A	6 Mbps	100	10.89	17.85
36	5180	A	24 Mbps	100	10.98	17.74
36	5180	A	54 Mbps	100	10.98	17.56
64	5320	A	6 Mbps	100	12.57	18.88
64	5320	A	24 Mbps	100	12.64	18.99
64	5320	A	54 Mbps	100	12.67	18.99
120	5600	A	6 Mbps	100	14.42	21.76
120	5600	A	24 Mbps	100	14.39	21.65
120	5600	A	54 Mbps	100	14.35	21.63
140	5700	A	6 Mbps	100	12.11	20.2
140	5700	A	24 Mbps	100	12.15	19.78
140	5700	A	54 Mbps	100	12.34	19.82
161	5805	A	6 Mbps	100	15.8	21.86
161	5805	A	24 Mbps	100	16.03	21.93
161	5805	A	54 Mbps	100	16.21	21.77

MCS Rates Channel	Frequency	MCS Rate	Data Rate	Power Set %	RMS Power, No Gap	Peak Tx Power
1	2412	MCS 0	6.5	100	12.06	N/A
1	2412	MCS 4	39	100	11.08	N/A
1	2412	MCS 7	65	100	10.7	N/A
6	2437	MCS 0	6.5	100	13.21	N/A
6	2437	MCS 4	39	100	12.42	N/A
6	2437	MCS 7	65	100	11.72	N/A
11	2462	MCS 0	6.5	100	12.92	N/A
11	2462	MCS 4	39	100	11.99	N/A
11	2462	MCS 7	65	100	11.47	N/A
36	5180	MCS 0	6.5	100	10.6	N/A
36	5180	MCS 4	39	100	9.8	N/A
36	5180	MCS 7	65	100	9.6	N/A
64	5320	MCS 0	6.5	100	12.47	N/A
64	5320	MCS 4	39	100	11.55	N/A
64	5320	MCS 7	65	100	11.24	N/A
120	5600	MCS 0	6.5	100	14.26	N/A
120	5600	MCS 4	39	100	13.87	N/A
120	5600	MCS 7	65	100	10.7	N/A
140	5700	MCS 0	6.5	100	11.9	N/A
140	5700	MCS 4	39	100	10.88	N/A
140	5700	MCS 7	65	100	8.14	N/A
161	5805	MCS 0	6.5	100	15.9	N/A
161	5805	MCS 4	39	100	15.2	N/A
161	5805	MCS 7	65	100	13.34	N/A

BT Frequency	Modulation	Average Measured Channel Power
2440	GFSK	-5 dBm
2440	Pi/4 8PSK	-5 dBm

## Spectrum Mask Testing

### Test Equipment

- LitePoint IQ Flex.

### Method

The Summit Regulatory Unit (software) is used to put the DUT in constant transmit mode at 100% power. The spectrum mask is measured with the LitePoint Flex.

## Results

Channel	Frequency		Data Rate	Power Set %	Spectrum Mask
1	2412	B	1 Mbps	100	Pass
1	2412	B	11 Mbps	100	Pass
6	2437	B	1 Mbps	100	Pass
6	2437	B	11 Mbps	100	Pass
11	2462	B	1 Mbps	100	Pass
11	2462	B	11 Mbps	100	Pass
1	2412	G	6 Mbps	100	Pass
1	2412	G	24 Mbps	100	Pass
1	2412	G	54 Mbps	100	Pass
6	2437	G	6 Mbps	100	Pass
6	2437	G	24 Mbps	100	Pass
6	2437	G	54 Mbps	100	Pass
11	2462	G	6 Mbps	100	Pass
11	2462	G	24 Mbps	100	Pass
11	2462	G	54 Mbps	100	Pass
36	5180	A	6 Mbps	100	Pass
36	5180	A	24 Mbps	100	Pass
36	5180	A	54 Mbps	100	Pass
64	5320	A	6 Mbps	100	Pass
64	5320	A	24 Mbps	100	Pass
64	5320	A	54 Mbps	100	Pass
120	5600	A	6 Mbps	100	Pass
120	5600	A	24 Mbps	100	Pass
120	5600	A	54 Mbps	100	Pass
140	5700	A	6 Mbps	100	Pass
140	5700	A	24 Mbps	100	Pass
140	5700	A	54 Mbps	100	Pass
161	5805	A	6 Mbps	100	Pass
161	5805	A	24 Mbps	100	Pass
161	5805	A	54 Mbps	100	Pass

MCS Rates Channel	Frequency	MCS Rate	Data Rate	Power Set %	Spectrum Mask
1	2412	MCS 0	6.5	100	Pass
1	2412	MCS 4	39	100	Pass
1	2412	MCS 7	65	100	Pass
6	2437	MCS 0	6.5	100	Pass
6	2437	MCS 4	39	100	Pass



MCS Rates Channel	Frequency	MCS Rate	Data Rate	Power Set %	Spectrum Mask
6	2437	MCS 7	65	100	Pass
11	2462	MCS 0	6.5	100	Pass
11	2462	MCS 4	39	100	Pass
11	2462	MCS 7	65	100	Pass
36	5180	MCS 0	6.5	100	Pass
36	5180	MCS 4	39	100	Pass
36	5180	MCS 7	65	100	Pass
64	5320	MCS 0	6.5	100	Pass
64	5320	MCS 4	39	100	Pass
64	5320	MCS 7	65	100	Pass
120	5600	MCS 0	6.5	100	Pass
120	5600	MCS 4	39	100	Pass
120	5600	MCS 7	65	100	Pass
140	5700	MCS 0	6.5	100	Pass
140	5700	MCS 4	39	100	Pass
140	5700	MCS 7	65	100	Pass
161	5805	MCS 0	6.5	100	Pass
161	5805	MCS 4	39	100	Pass
161	5805	MCS 7	65	100	Pass

## EVM Testing

### Test Equipment

The Summit Regulatory Unit (software) is used to put the DUT in constant transmit mode at 100% power.

### Method

The EVM is measured with the LitePoint Flex.

### Results

Channel	Frequency		Data Rate	Power Set %	EVM	EVM Specification	Pass/ Fail
1	2412	B	1 Mbps	100	-20.16	-9.1	Pass
1	2412	B	11 Mbps	100	-20.12	-9.1	Pass
6	2437	B	1 Mbps	100	-23.2	-9.1	Pass
6	2437	B	11 Mbps	100	-21.56	-9.1	Pass
11	2462	B	1 Mbps	100	-20.47	-9.1	Pass
11	2462	B	11 Mbps	100	-20.38	-9.1	Pass
1	2412	G	6 Mbps	100	-28.13	-5	Pass
1	2412	G	24 Mbps	100	-28.7	-16	Pass

**MSD40NBT Testing**  
Hardware Test Document

Channel	Frequency		Data Rate	Power Set %	EVM	EVM Specification	Pass/ Fail
1	2412	G	54 Mbps	100	-30.6	-25	Pass
6	2437	G	6 Mbps	100	-22.78	-5	Pass
6	2437	G	24 Mbps	100	-27.9	-16	Pass
6	2437	G	54 Mbps	100	-29.43	-25	Pass
11	2462	G	6 Mbps	100	-32.06	-5	Pass
11	2462	G	24 Mbps	100	-32.66	-16	Pass
11	2462	G	54 Mbps	100	-32.7	-25	Pass
36	5180	A	6 Mbps	100	-22.92	-5	Pass
36	5180	A	24 Mbps	100	-23.12	-16	Pass
36	5180	A	54 Mbps	100	-22.76	-25	Fail
64	5320	A	6 Mbps	100	-21.45	-5	Pass
64	5320	A	24 Mbps	100	-20.73	-16	Pass
64	5320	A	54 Mbps	100	-22.83	-25	Fail
120	5600	A	6 Mbps	100	-26.5	-5	Pass
120	5600	A	24 Mbps	100	-25.8	-16	Pass
120	5600	A	54 Mbps	100	-27.03	-25	Pass
140	5700	A	6 Mbps	100	-28.47	-5	Pass
140	5700	A	24 Mbps	100	-28.1	-16	Pass
140	5700	A	54 Mbps	100	-28.19	-25	Pass
161	5805	A	6 Mbps	100	-20.28	-5	Pass
161	5805	A	24 Mbps	100	-20	-16	Pass
161	5805	A	54 Mbps	100	-19.89	-25	Fail

MCS Rates Channel	Frequency	MCS Rate	Data Rate	Power Set %	EVM	EVM Specification	Pass/ Fail
1	2412	MCS 0	6.5	100	-30.5	-5	Pass
1	2412	MCS 4	39	100	-31	-5	Pass
1	2412	MCS 7	65	100	-31.3	-5	Pass
6	2437	MCS 0	6.5	100	-25.6	-19	Pass
6	2437	MCS 4	39	100	-31.8	-19	Pass
6	2437	MCS 7	65	100	-31.5	-28	Pass
11	2462	MCS 0	6.5	100	-32.2	-5	Pass
11	2462	MCS 4	39	100	-32.5	-19	Pass
11	2462	MCS 7	65	100	-32.5	-28	Pass
36	5180	MCS 0	6.5	100	-12.2	-5	Pass
36	5180	MCS 4	39	100	-22.38	-19	Pass
36	5180	MCS 7	65	100	-23	-28	Fail
64	5320	MCS 0	6.5	100	-21.5	-5	Pass
64	5320	MCS 4	39	100	-22.9	-19	Pass
64	5320	MCS 7	65	100	-22.3	-28	Fail

120	5600	MCS 0	6.5	100	-26.5	-5	Pass
120	5600	MCS 4	39	100	-26.29	-19	Pass
120	5600	MCS 7	65	100	-30.73	-28	Pass
140	5700	MCS 0	6.5	100	-28.9	-5	Pass
140	5600	MCS 4	39	100	-29.6	-19	Pass
140	5600	MCS 7	65	100	-31.33	-28	Pass
161	5805	MCS 0	6.5	100	-20.3	-5	Pass
161	5805	MCS 4	39	100	-20.11	-19	Pass
161	5805	MCS 7	65	100	-25.9	-28	Fail

## Frequency Error Testing

### Test Equipment

The Summit Regulatory Unit (software) is used to put the DUT in constant transmit mode at 100% power.

### Method

The frequency error is measured with the LitePoint Flex.

### Results

Channel	Frequency	Data Rate	Power Set %	Frequency Error (KHz)	Frequency Error Specifications (KHz)	Pass/Fail
1	2412 B	1 Mbps	100	-46.5	60.3	Pass
1	2412 B	11 Mbps	100	-46.88	60.3	Pass
6	2437 B	1 Mbps	100	-47.44	60.925	Pass
6	2437 B	11 Mbps	100	-47.42	60.925	Pass
11	2462 B	1 Mbps	100	-47.71	61.55	Pass
11	2462 B	11 Mbps	100	-47.49	61.55	Pass
1	2412 G	6 Mbps	100	-46.58	60.3	Pass
1	2412 G	24 Mbps	100	-46.16	60.3	Pass
1	2412 G	54 Mbps	100	-45.53	60.3	Pass
6	2437 G	6 Mbps	100	-47.04	60.925	Pass
6	2437 G	24 Mbps	100	-46.4	60.925	Pass
6	2437 G	54 Mbps	100	-45.52	60.925	Pass
11	2462 G	6 Mbps	100	-47.15	61.55	Pass
11	2462 G	24 Mbps	100	-46.91	61.55	Pass
11	2462 G	54 Mbps	100	-46.32	61.55	Pass
36	5180 A	6 Mbps	100	-33.09	129.5	Pass
36	5180 A	24 Mbps	100	-33.47	129.5	Pass
36	5180 A	54 Mbps	100	-32.85	129.5	Pass
64	5320 A	6 Mbps	100	-36.63	133	Pass
64	5320 A	24 Mbps	100	-36.04	133	Pass

**MSD40NBT Testing**  
Hardware Test Document

Channel	Frequency		Data Rate	Power Set %	Frequency Error (KHz)	Frequency Error Specifications (KHz)	Pass/Fail
64	5320	A	54 Mbps	100	-34.95	133	Pass
120	5600	A	6 Mbps	100	-37.62	140	Pass
120	5600	A	24 Mbps	100	-36.83	140	Pass
120	5600	A	54 Mbps	100	-35.35	140	Pass
140	5700	A	6 Mbps	100	-37.35	142.5	Pass
140	5700	A	24 Mbps	100	-36.81	142.5	Pass
140	5700	A	54 Mbps	100	-35.36	142.5	Pass
161	5805	A	6 Mbps	100	-39.6	145.125	Pass
161	5805	A	24 Mbps	100	-39.18	145.125	Pass
161	5805	A	54 Mbps	100	-38.46	145.125	Pass

MCS Rates Channel	Frequency	MCS Rate	Data Rate	Power Set %	Frequency Error (KHz)	Frequency Error Specifications (KHz)	Pass/Fail
1	2412	MCS 0	6.5	100	-45.51	60.3	Pass
1	2412	MCS 4	39	100	-45.22	60.3	Pass
1	2412	MCS 7	65	100	-44.78	60.3	Pass
6	2437	MCS 0	6.5	100	-46.42	60.925	Pass
6	2437	MCS 4	39	100	-45.41	60.925	Pass
6	2437	MCS 7	65	100	-44.71	60.925	Pass
11	2462	MCS 0	6.5	100	-47.15	61.55	Pass
11	2462	MCS 4	39	100	-46.67	61.55	Pass
11	2462	MCS 7	65	100	-45.91	61.55	Pass
36	5180	MCS 0	6.5	100	-35.13	129.5	Pass
36	5180	MCS 4	39	100	-34.16	129.5	Pass
36	5180	MCS 7	65	100	-32.89	129.5	Pass
64	5320	MCS 0	6.5	100	-37.18	133	Pass
64	5320	MCS 4	39	100	-36.29	133	Pass
64	5320	MCS 7	65	100	-35.02	133	Pass
120	5600	MCS 0	6.5	100	-38.17	140	Pass
120	5600	MCS 4	39	100	-37.43	140	Pass
120	5600	MCS 7	65	100	-35.55	140	Pass
140	5700	MCS 0	6.5	100	-38.33	142.5	Pass
140	5700	MCS 4	39	100	-37.08	142.5	Pass
140	5700	MCS 7	65	100	-35.15	142.5	Pass
161	5805	MCS 0	6.5	100	-39.96	145.125	Pass
161	5805	MCS 4	39	100	-39.34	145.125	Pass
161	5805	MCS 7	65	100	-37.79	145.125	Pass

## Power Consumption – Rx Current Test

### Test Equipment

- Yokogawa DL9140 oscilloscope and current probe or equivalent

### Method

The Summit Client Utility (software) is used to associate the DUT to an AP. Receive current is measured with the oscilloscope and current probe.

---

**Note:** Test cable loss entered in LitePoint 8.5 program.

---

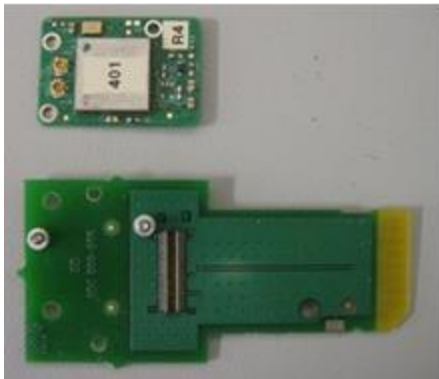
### Results

Channel	Frequency	Data Rate	Power Set %	Rx Current (mA)
1	2412	1 Mbps	100	92
6	2437	6 Mbps	100	92
11	2462	54 Mbps	100	92

## Drop Test

Prior to the drop test, the SDC-MSD40NBT (unit) was checked for operation; it both powered-up and associated to an AP.

### Method



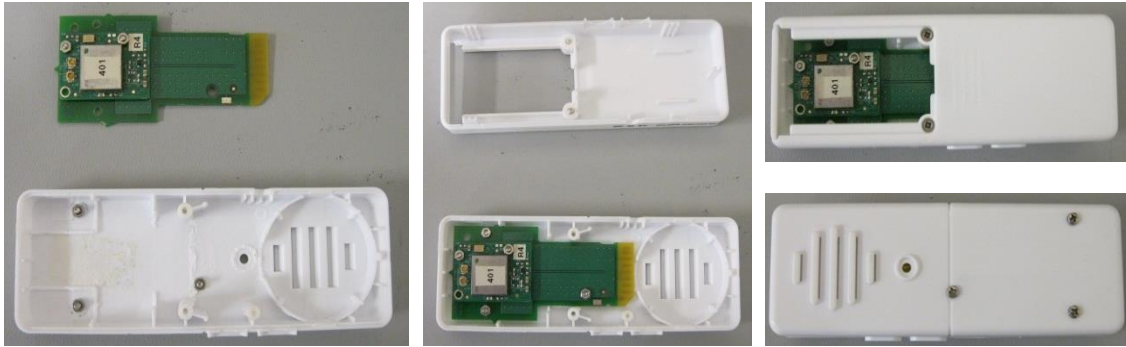
*Figure 1: MSD40NBT and SDIO extender board.*

The unit was mounted to an SDC finger board (SDIO Extender).

## MSD40NBT Testing

### Hardware Test Document

The unit was then mounted to a plastic enclosure with 1.5mm spacers, screws, and nuts without shock mounts.



*Figure 2: MSD40NBT unit and the plastic enclosure*

The plastic enclosure (with the unit mounted in it) was dropped once on each face from a height of 1.2 meters onto concrete, equaling 6 drops.

## Results

The unit was removed from its plastic enclosure and inspected visually for damage. There was no damage noted. The unit was then re-installed in the host system, enabled, and found to function in the same manner as prior to drop testing.