

Test Report # 316392 A

Equipment Under Test: Cor 7C

Test Date(s):	March 27-28, 2017	April 10-12, 2017
	March 30, 2017	April 14, 2017
	April 4, 2017	April 17-18, 2017
	April 6, 2017	May 19, 2017

Prepared for: United Technology Electronic Controls, Inc.
Attn: Raj Chadichal
3650 W 200 N
Huntington, IN 46750

Report Issued by:

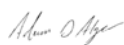
Signature:



Date: May 19, 2017

Report Reviewed by: Adam Alger, Quality Systems Engineer

Signature:



Date: May 19, 2017

Report Constructed by:

Signature:



Date: May 18, 2017

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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

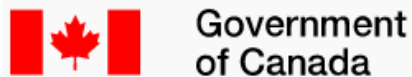
Scope of accreditation includes all test methods listed herein, unless otherwise noted.



Federal Communications Commission (FCC) – USA

Accredited recognition of two 3 meter Semi-Anechoic Chambers

Accredited Test Firm Registration Number: 953492



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: UTC, Inc.	Page 3 of 90	Name: Cor7C
Report: TR 316392 A		Model: Cor7C
Job: C-2630		Serial: Engineering Sample

1 TEST REPORT SUMMARY

During **March 27-April 18, 2017** the Equipment Under Test (EUT), **Cor7C**, as provided by **United Technology Electronic Controls, Inc.** 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	Reported
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	20 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	Reported
FCC: 15.207 IC: RSS-GEN 8.8	AC Power Line Conducted Emissions	0.150-30 MHz	ANSI C63.10	Pass

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	United Technology Electronic Controls, Inc. (UTC)
Contact Person	Raj Chadichal
Address	3650 W 200 N, Huntington, IN 46750

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Cor 7C
Model Number	TSTWRH01
Serial Number	Engineering Sample
FCC ID	2AK6N – TSTWRH01
IC ID	703A – TSTWRH01

2.2 Product Description

The Côr 7C thermostat model is a Wi-Fi connected device and can be remotely controlled by the free mobile app* (Android or iOS compatible devices). The Côr 7 series thermostats combines temperature and humidity control for added home comfort. They are 7-day, 5/2-day, 1-day programmable, wall-mounted and low-voltage controls. They have no need for batteries to store user-configured settings in memory. During power loss its internal memory saves settings for an unlimited time, and the clock continues to run for at least 24 hours.

When using the Côr thermostat programmable schedule you can customize your homes comfort for times you are home, sleeping or want to save energy while you're away with different heating and cooling setpoints and times. You can set your schedule for 4 periods per day or 2 periods per day. Programming the days of the week is simple and flexible. The Côr Thermostats features Touch-N-Go® on the thermostat and in the mobile app* for quick and easy temperature change without changing programming schedules.

* Thermostat must be connected to the internet and registered to a user account.



- A. Fan (On or Auto)
- B. Touch-N-Go®
- C. Weather icon
- D. Hold
- E. View Menu Options (Schedule, Alerts, Settings, Wi-Fi®)
- F. Start Button – wakes up the screen from idle
- G. Information button scrolls through display options for test box
- H. Active period (wake, away, home, sleep) and day of the week icons
- I. Temperature adjustment (up/dn)
- J. Indoor temperature
- K. Change equipment mode (heat, cool, etc.)
- L. Current equipment mode icon
- M. Wi-Fi® signal strength icon

2.3 Modifications Incorporated for Compliance

Client understands the modifications.

For WLAN testing, the high channel (11 – 2462 MHz) must operate at a reduced power for the 802.11n standard to meet compliance. As a result, channel 10 at full power was tested as high channel, in addition to channel 11 at reduced power, for testing 802.11n data rates.

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

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Job: C-2630		Serial: Engineering Sample

2.5 Additional Information

WLAN

Real Time Tuning Tool (RTTT or RT³) software Version 2.0.0.55 was used to program WLAN. Firmware file wl18xx-fw-4.bin was loaded through the RTTT program and all radio settings are accessed and set through drop down boxes and radio buttons.

The software runs on a laptop computer physically connected to the EUT via a USB to UART cable. The EUT operates on WLAN channels 1 (2412 MHz) to 11 (2462 MHz).

BLE

HCITester software Version 3.0.0.37 was used to program BLE. Firmware file TIInit_11.8.3.bts is opened and run by user when software is started, then the EUT is programmed by entering HCI commands in the software command window.

The software runs on a laptop computer that is physically connected to the EUT via a USB to UART cable. The EUT operates on frequencies 2402 MHz to 2480 MHz.

Antenna

EUT has a PCB Inverted-F trace antenna with a gain of 3.3 dBi.

Power Supply

Throughout testing, the EUT was powered by the following off-the-shelf 120 VAC to 24 VAC power supply:

Manufacturer	TRIAD
Description	Class 2 Power Supply
Model Number	WAU24-450
Input	120 V, 60 Hz, 15 W
Output	20 VAC, 450 mA

3 REFERENCES

Publication	Edition	Date
47 CFR, Parts 0-15 (FCC)		2017
RSS 247	2	2017
RSS GEN	4	2014
ANSI C63.10		2013
FCC KDB 558074 D01 v04		2017

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

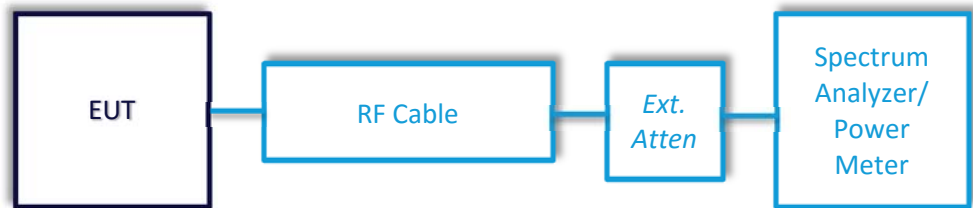
Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9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

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	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 Antenna Port Conducted Emissions – Duty Cycle

Operator	Shane Dock / Kimberly Bay
QA	Kimberly Bay / Shane Dock
Test Date	March 30, 2017 / April 6 & 11, 2017
Location	Conducted RF Test Bench
Temp. / R.H.	21-22°C / 36-40% RH
Method	ANSI C63.10 2013 Section 11.6

Test Parameters

Frequency	WLAN: 2412 MHz, BLE: 2402 MHz
Settings	Zero Span
Settings	RBW = 8 MHz, VBW = 50 MHz
Notes	Modulated signal used for testing
Example Calculation	$\text{Duty Cycle} = (\text{on-time}) / (\text{on-time} + \text{off-time})$ $\text{Ex: } (390.5 \mu\text{s}) / (390.5 \mu\text{s} + 234.5 \mu\text{s}) = 0.625$ $\text{Duty Cycle Correction} = 10 \log (1/\text{duty cycle})$ $\text{Ex: } 10 \log (1/0.625) = 2.04$

Instrumentation



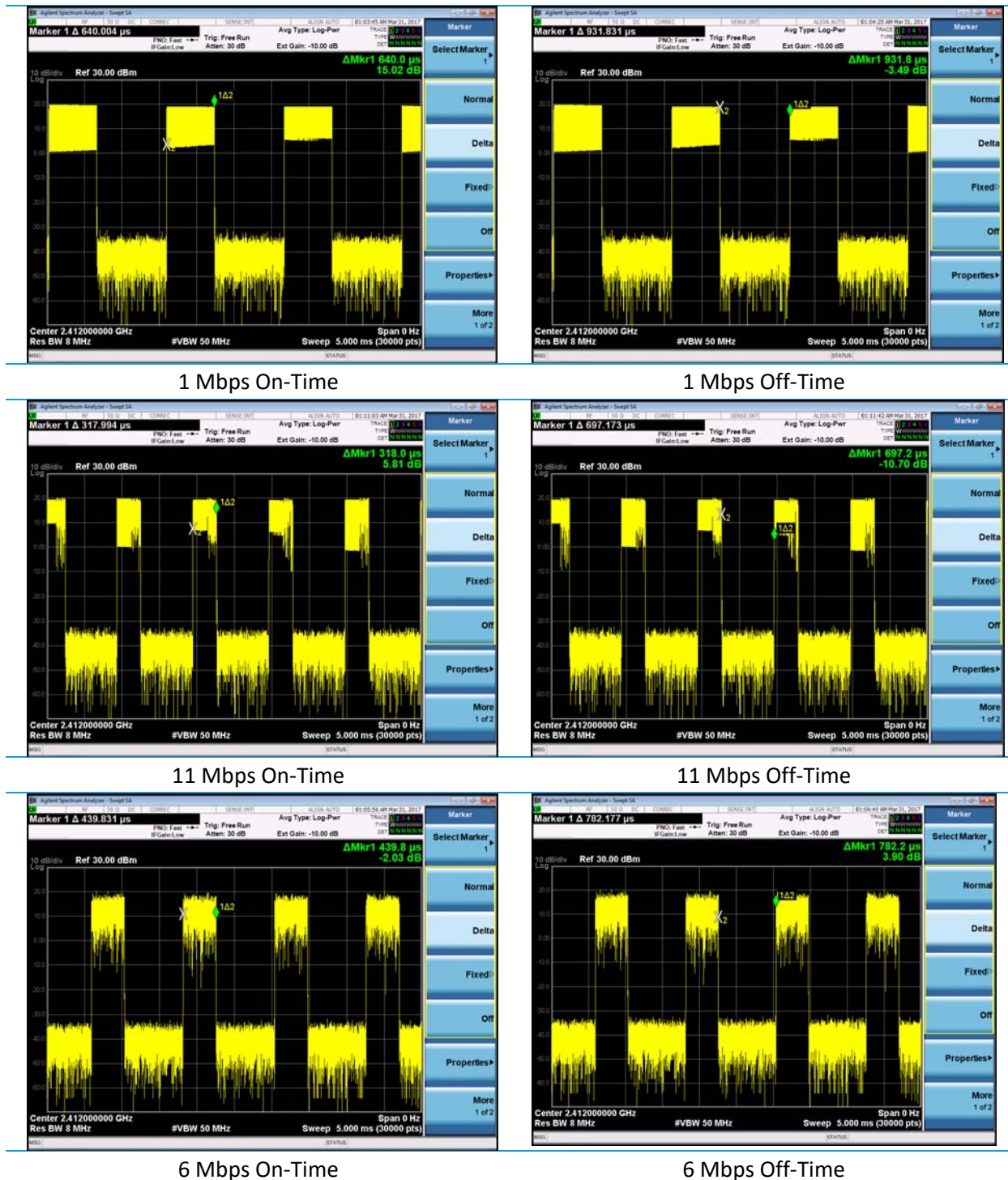
Date: 20-Dec-2016 Test: Duty Cycle & Occupied Bandwidth (6dB & 20dB) Job #: C-2630
 PE: Kim Customer: United Technology Electronic Controls Quote #: 316392

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration

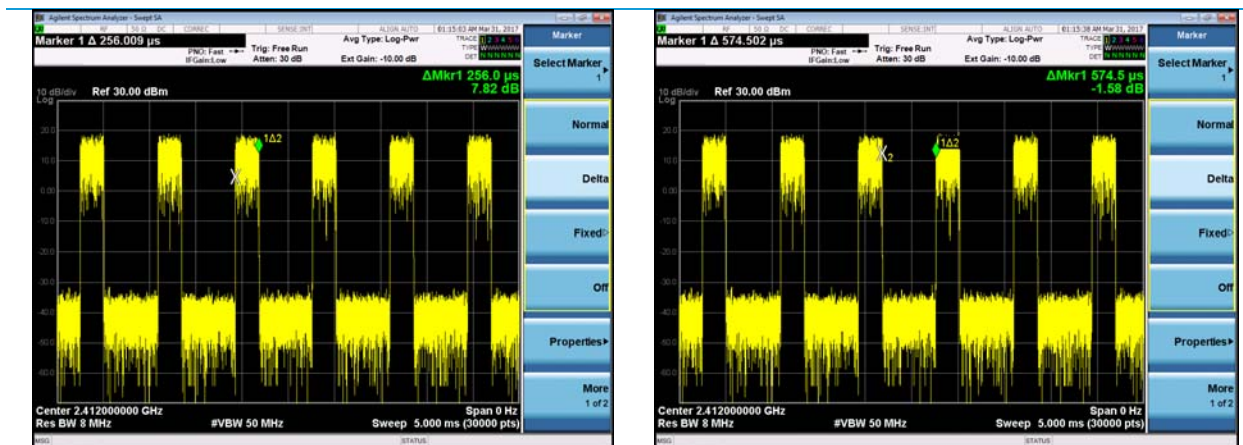
Table – Duty Cycle and Correction Factor – WLAN and BLE

Data Rate	Duty Cycle	Correction Factor
1 Mbps	0.407	3.90
11 Mbps	0.313	5.04
6 Mbps	0.360	4.44
54 Mbps	0.308	5.11
MCS0	0.326	4.87
MCS7	0.303	5.19
BLE	1.000	0.00

Plots – Duty Cycle On and Off-Times - WLAN

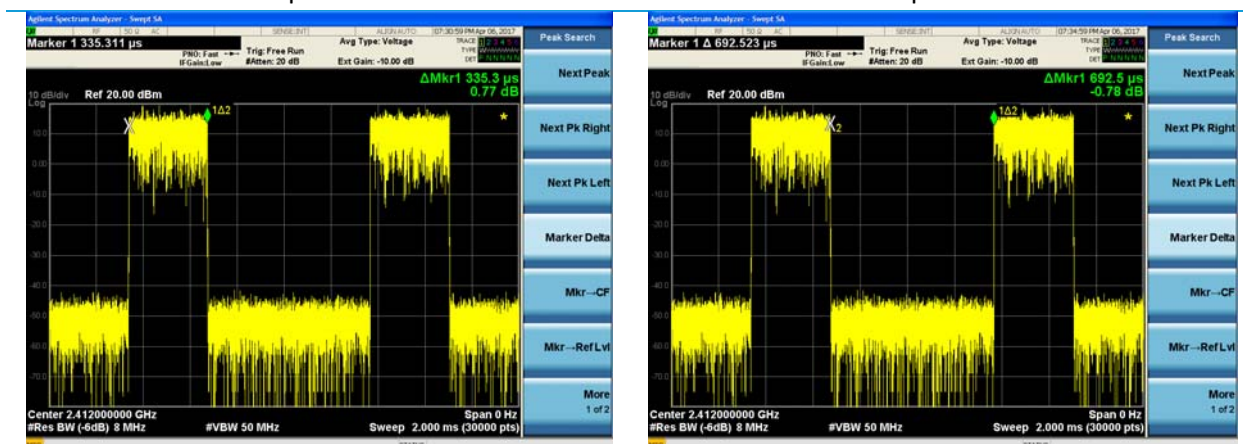


Plots – Duty Cycle On and Off-Times – WLAN, continued



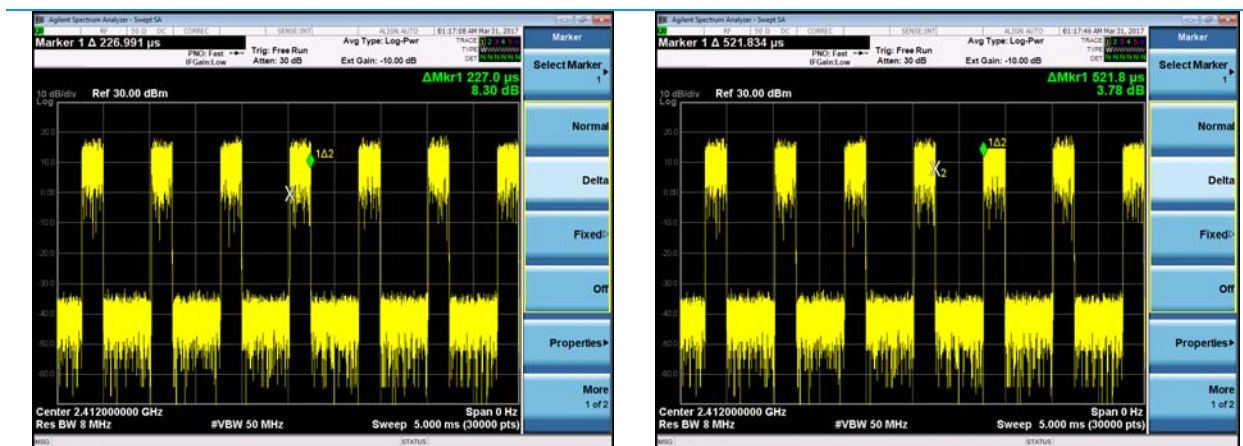
54 Mbps On-Time

54 Mbps Off-Time



MCS0 On-Time

MCS0 Off-Time



MCS7 On-Time

MCS7 Off-Time

5.1.2 Antenna Port Conducted Emissions – Bandwidth

Operator	Shane Dock / Kimberly Bay
QA	Kimberly Bay / Shane Dock
Test Date	March 30, 2017 / April 6, 2017
Location	Conducted RF Test Bench
Temp. / R.H.	22°C / 36% RH
Requirement	6 dB BW – FCC 15.247 (a)(2) / RSS-247 Section 5.2 (a)
Method	6dB BW - ANSI C63.10 2013 Section 11.8.2 Option 2 OBW (99%) – ANSI C63.10 2013 Section 6.9.3

Limits:

6 dB BW

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Parameters

Frequency	WLAN: 2412, 2437, and 2462 MHz BLE: 2402, 2440, and 2480 MHz
Settings	Peak detector
Settings	<u>Span</u> – WLAN: 30 MHz, BLE: 3 MHz
Settings	<u>6 dB BW</u> : RBW = 100 kHz, VBW ≥ 3RBW
Settings	<u>OBW</u> : RBW = 390 kHz (2.6 to 3.9% OBW), except MCS0 RBW = 200 kHz (1.3% OBW) VBW ≥ 3xRBW
EUT	Modulated signal

Instrumentation



Date: 20-Dec-2016

Test: Duty Cycle & Occupied Bandwidth (6dB & 20dB)

Job #: C-2630

PE: Kim

Customer: United Technology Electronic Controls

Quote #: 316392

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration

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Job: C-2630		Serial: Engineering Sample

Table – 6 dB and 99% Bandwidth - WLAN

802.11 Standard	Data Rate (Mbps)	Channel	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB BW Minimum Limit (MHz)
b	1	1	10.1	14.6	0.5
		6	10.1	14.7	0.5
		11	10.1	14.7	0.5
b	11	1	10.5	14.5	0.5
		6	10.4	14.6	0.5
		11	10.4	14.6	0.5
g	6	1	15.1	16.6	0.5
		6	15.1	19.4	0.5
		11	15.1	16.7	0.5
g	54	1	15.5	16.6	0.5
		6	15.1	16.8	0.5
		11	15.1	16.6	0.5
n	MCS0	1	15.1	17.5	0.5
		6	15.1	18.0	0.5
		11	15.1	17.4	0.5
n	MCS7	1	15.1	17.6	0.5
		6	15.1	17.9	0.5
		11	15.1	17.6	0.5

Table – 6 dB Bandwidth- BLE

Frequency (MHz)	6 dB Bandwidth (MHz)	6 dB BW Minimum Limit (MHz)
2402	0.697	0.5
2440	0.716	0.5
2462	0.713	0.5

Plots – 6 dB BW – WLAN



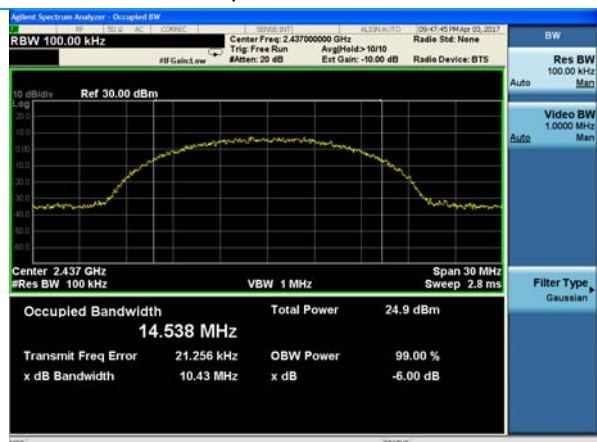
1 Mbps – Low Channel



11 Mbps – Low Channel



1 Mbps – Mid Channel



11 Mbps – Mid Channel



1 Mbps – High Channel



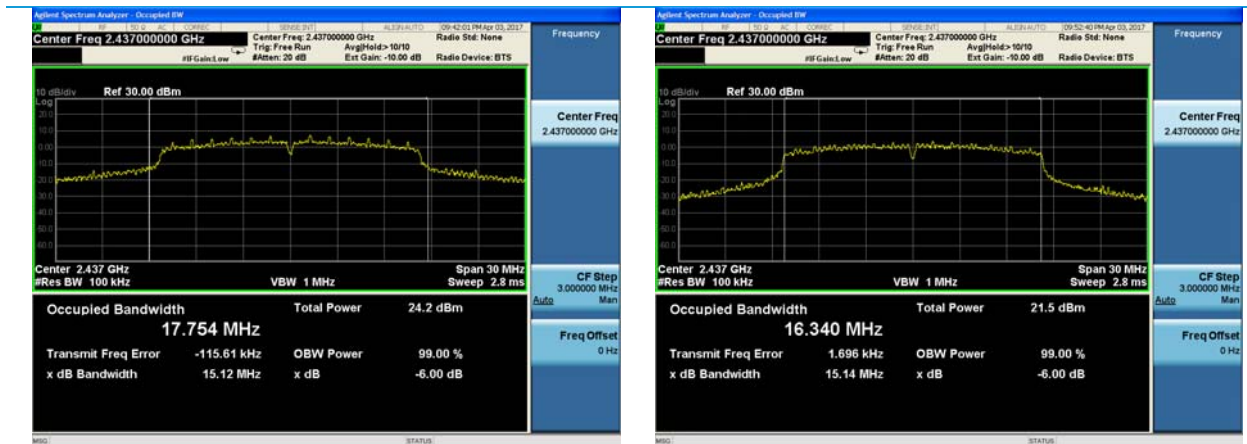
11 Mbps – High Channel

Plots – 6 dB BW – WLAN, continued



6 Mbps – Low Channel

54 Mbps – Low Channel



6 Mbps – Mid Channel

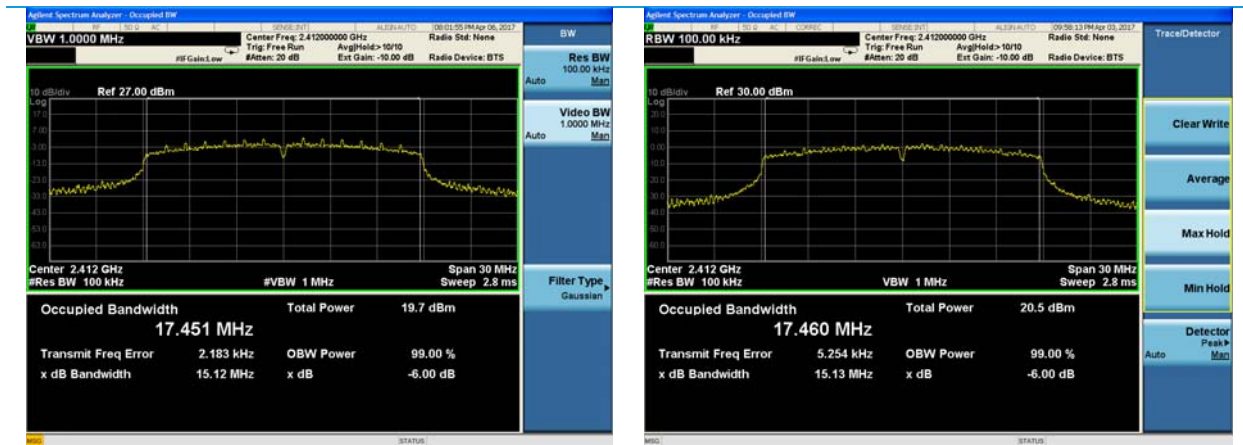
54 Mbps – Mid Channel



6 Mbps – High Channel

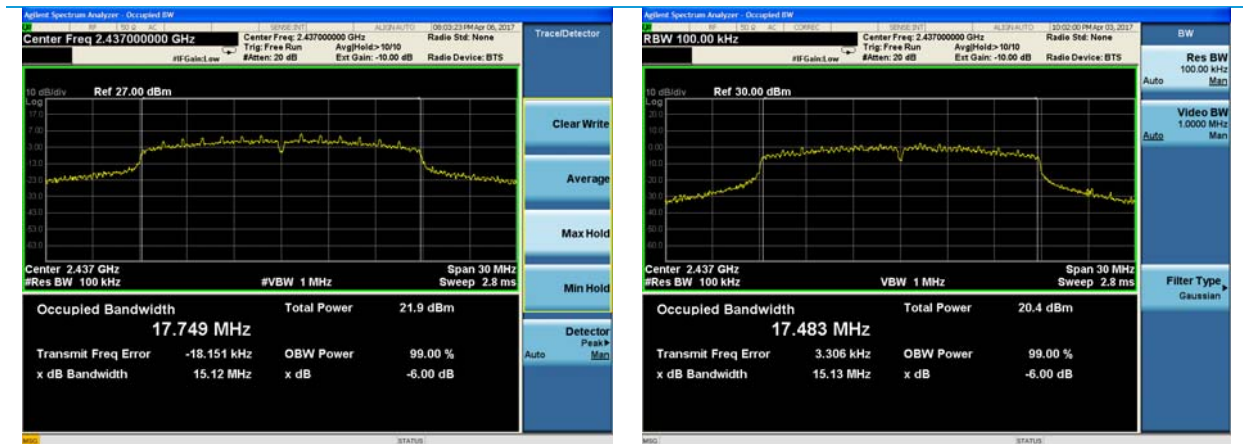
54 Mbps – High Channel

Plots – 6 dB BW – WLAN, continued



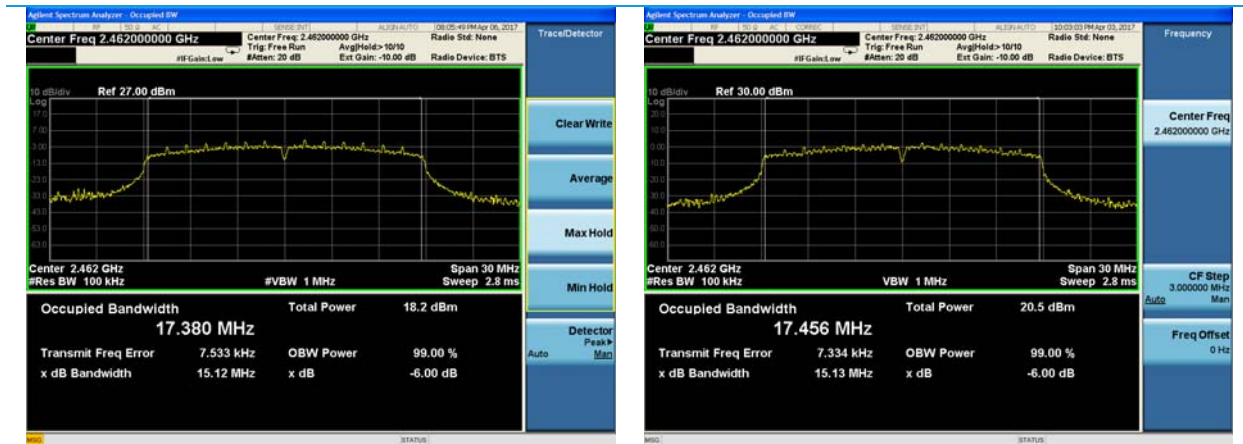
MCS0 – Low Channel

MCS7 – Low Channel



MCS0 – Mid Channel

MCS7 – Mid Channel



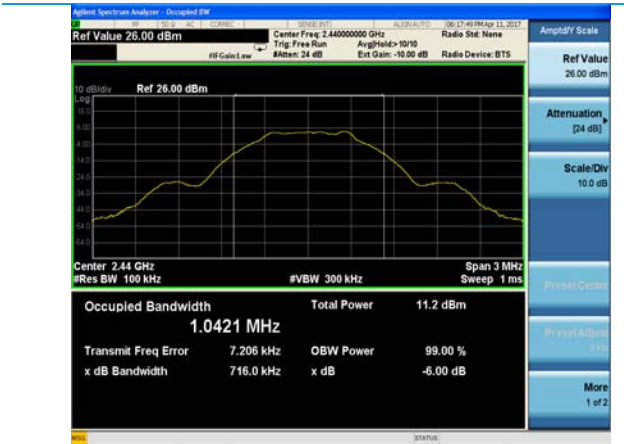
MCS0 – High Channel

MCS7 – High Channel

Plots – 6 dB BW – BLE



BLE – Low Channel



BLE – Mid Channel



BLE – High Channel

Plots – 99% BW – WLAN



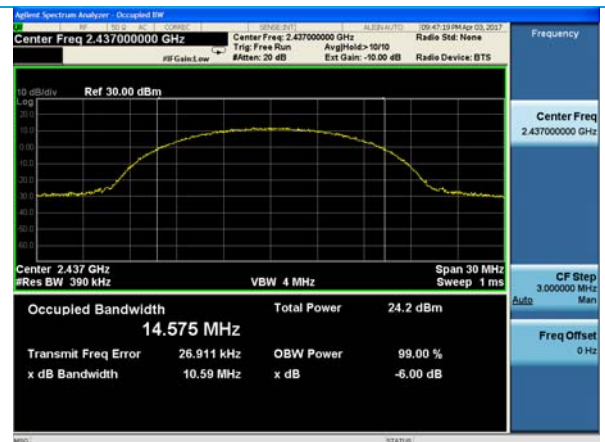
1 Mbps – Low Channel



11 Mbps – Low Channel



1 Mbps – Mid Channel



11 Mbps – Mid Channel



1 Mbps – High Channel

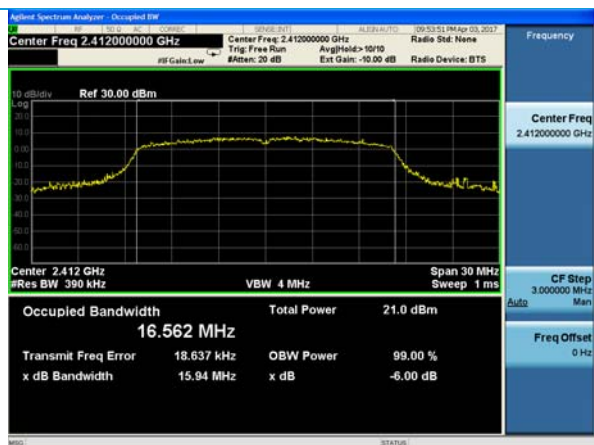


11 Mbps – High Channel

Plots – 99% BW – WLAN, continued



6 Mbps – Low Channel



54 Mbps – Low Channel



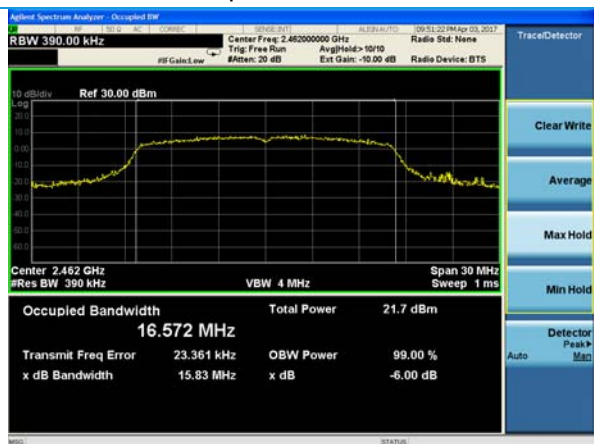
6 Mbps – Mid Channel



54 Mbps – Mid Channel



6 Mbps – High Channel

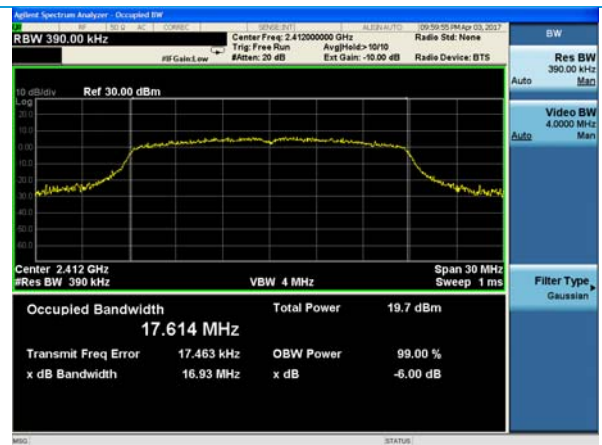


54 Mbps – High Channel

Plots – 99% BW – WLAN, continued



MCS0 – Low Channel



MCS7 – Low Channel



MCS0 – Mid Channel



MCS7 – Mid Channel



MCS0 – High Channel



MCS7 – High Channel

5.1.3 Antenna Port Conducted Emissions – Conducted Output Power (Pout)

Operator	Shane Dock / Kimberly Bay
QA	Kimberly Bay / Aidi Zainal
Test Date	March 30, 2017 / April 6 & 11 & 14, 2017
Location	Conducted RF Test Bench
Temp. / R.H.	21-22°C / 36-40% R.H.
Requirement	FCC 15.247 (b) / RSS-247 Section 5.4
Method	WLAN: ANSI C63.10 2013 Section 11.9.2.2.4 Method AVGSA-2 BLE: KDB 558074 D01 v04 Section 9.1.1

Limits:

Pout Maximum Limit

30 dBm

Test Parameters

Frequency	WLAN: 2412, 2437, and 2462 MHz; MCS0 & MCS7 also used 2457 MHz (see Note) BLE: 2402, 2440, and 2480 MHz
Settings	<u>Detector</u> – WLAN: Average, BLE: Peak
Settings	<u>Span</u> – WLAN: 30 MHz, BLE: 3 MHz
Settings	<u>BW</u> – WLAN: RBW = 470 kHz, VBW = 3 MHz; BLE: RBW = 1 MHz, VBW = 3 MHz
EUT	Modulated signal
Note	Channel 11 operated in reduced power for 802.11n, due to exceeding limits at full power. Both channels 10 (at full power) and 11 (at reduced power) are tested here to show compliance.
Example Calculation	Conducted Average output power = average power + duty cycle correction Power margin = Power limit – Conducted output power

Instrumentation



Date: 20-Dec-2016

Test: Conducted Power Output

Job #: C-2630

PE: Kim

Customer: United Technology Electronic Controls

Quote #: 316392

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960143	PhaseFlex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration

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Job: C-2630		Serial: Engineering Sample

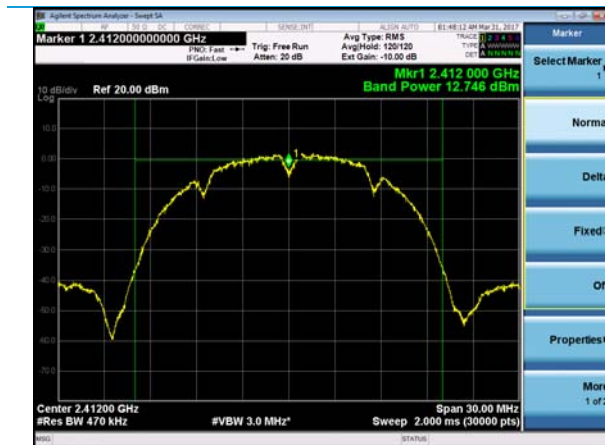
Table – Conducted Output Power - WLAN

802.11 Standard	Data Rate (Mbps)	Channel	Pout Measured (dBm)	Duty Cycle Correction (dB)	Maximum Pout (dBm)	Pout Limit (dBm)	Pout Margin (dB)
b	1	1	12.7	3.9	16.6	30	13.4
		6	13.3	3.9	17.2	30	12.8
		11	13.1	3.9	17.0	30	13.0
b	11	1	11.8	5.0	16.8	30	13.2
		6	11.6	5.0	16.6	30	13.4
		11	11.9	5.0	16.9	30	13.1
g	6	1	9.2	4.4	13.6	30	16.4
		6	12.2	4.4	16.6	30	13.4
		11	9.5	4.4	13.9	30	16.1
g	54	1	7.9	5.1	13.0	30	17.0
		6	8.3	5.1	13.4	30	16.6
		11	8.1	5.1	13.2	30	16.8
n	MCS0	1	7.4	4.9	12.3	30	17.7
		6	9.3	4.9	14.2	30	15.8
		10	9.5	4.9	14.4	30	15.6
		11	6.0	4.9	10.9	30	19.1
n	MCS7	1	6.6	5.2	11.8	30	18.2
		6	7.1	5.2	12.3	30	17.7
		10	6.3	5.2	11.5	30	18.5
		11	5.7	5.2	10.9	30	19.1

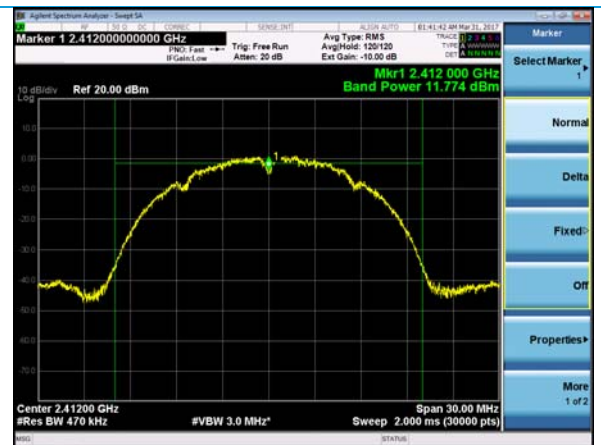
Table –Conducted Output Power - BLE

Frequency (MHz)	Pout Measured (dBm)	Pout Limit (dBm)	Pout Margin (dB)
2402	4.2	30	25.8
2440	4.7	30	25.3
2462	4.7	30	25.3

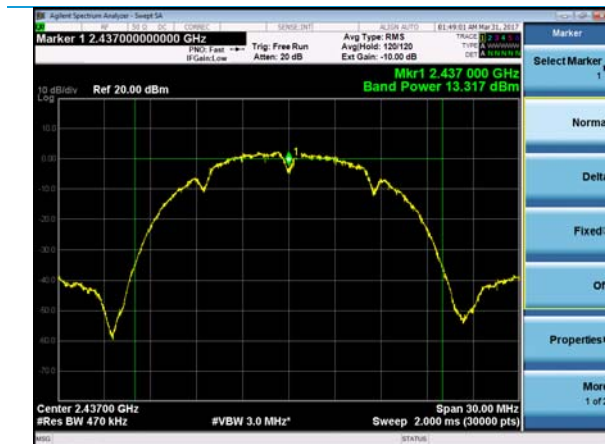
Plots – Conducted Output Power – 802.11b



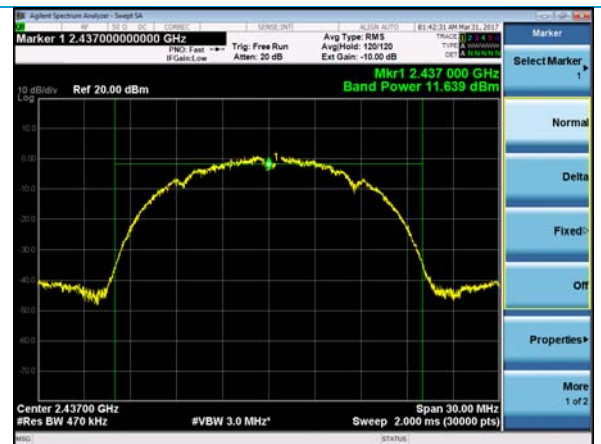
1 Mbps – Low Channel



11 Mbps – Low Channel



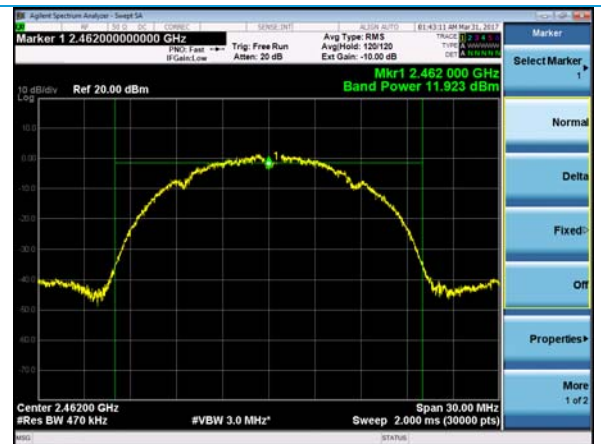
1 Mbps – Mid Channel



11 Mbps – Mid Channel

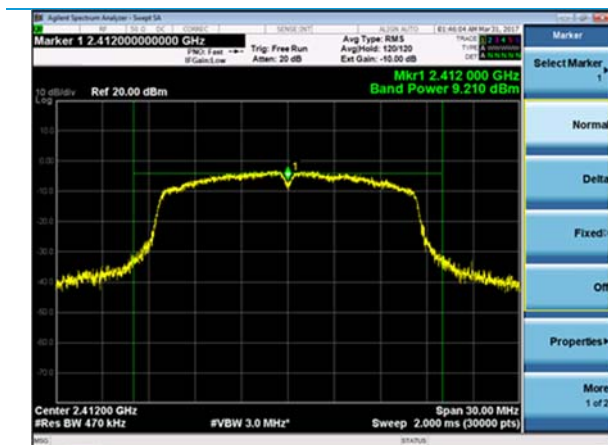


1 Mbps – High Channel

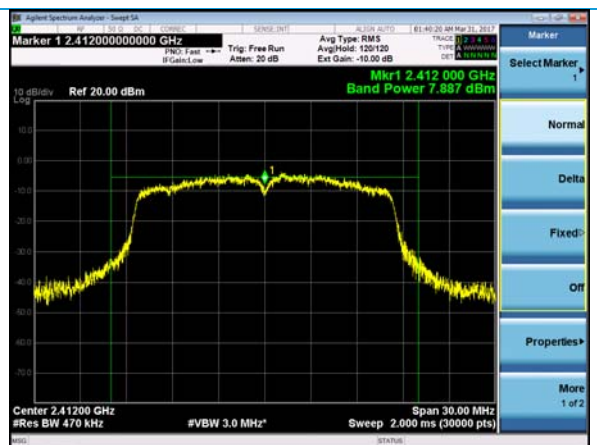


11 Mbps – High Channel

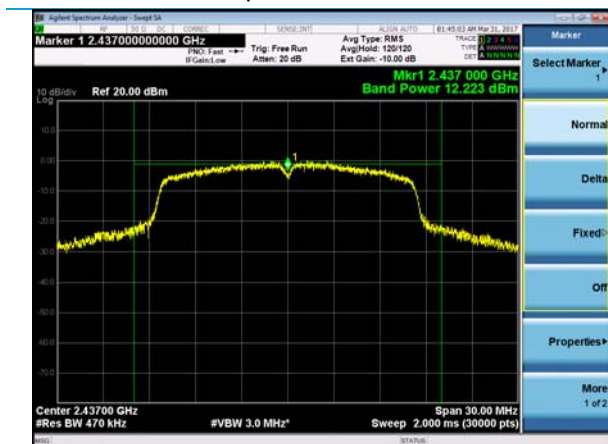
Plots – Conducted Output Power – 802.11g



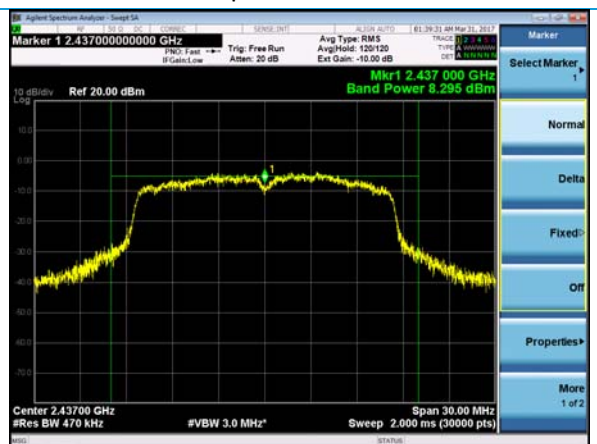
6 Mbps – Low Channel



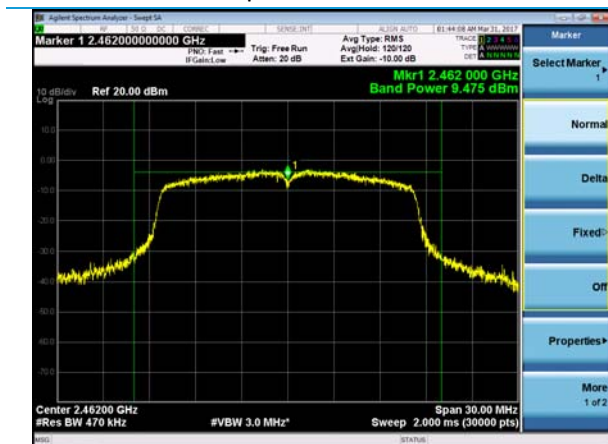
54 Mbps – Low Channel



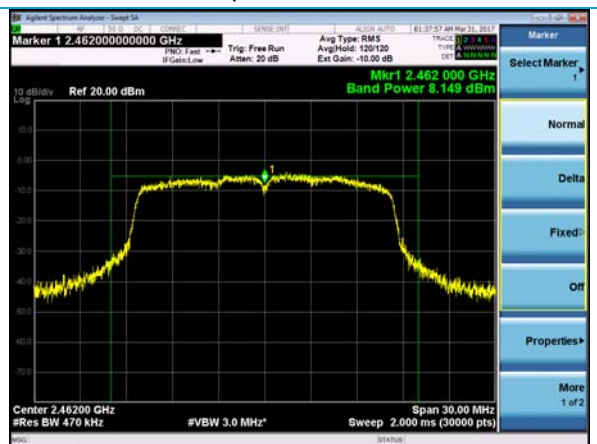
6 Mbps – Mid Channel



54 Mbps – Mid Channel



6 Mbps – High Channel



54 Mbps – High Channel

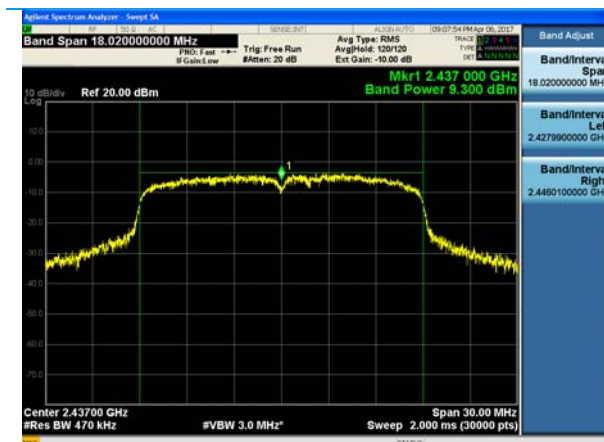
Plots – Conducted Output Power – 802.11n



MCS0 – Low Channel



MCS0 – Channel 10

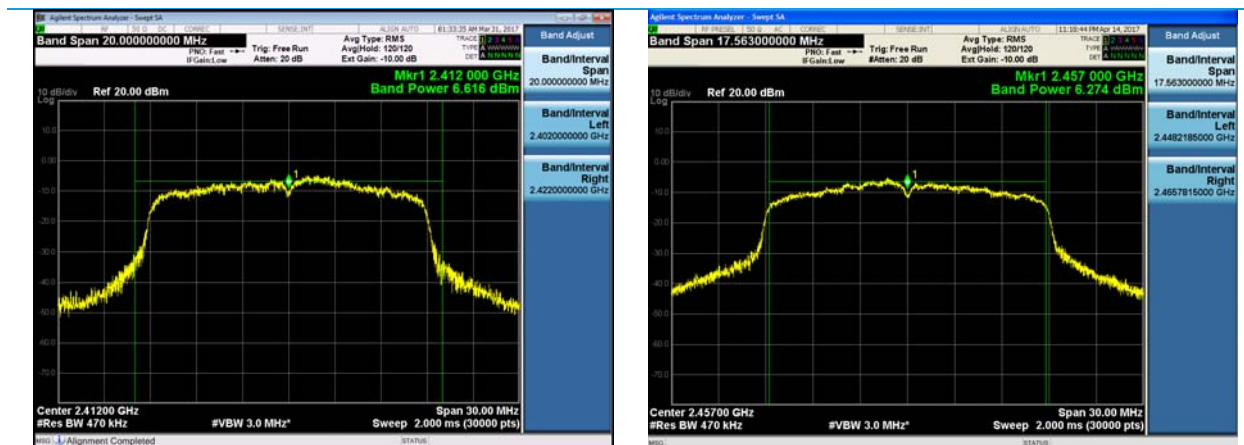


MCS0 – Mid Channel



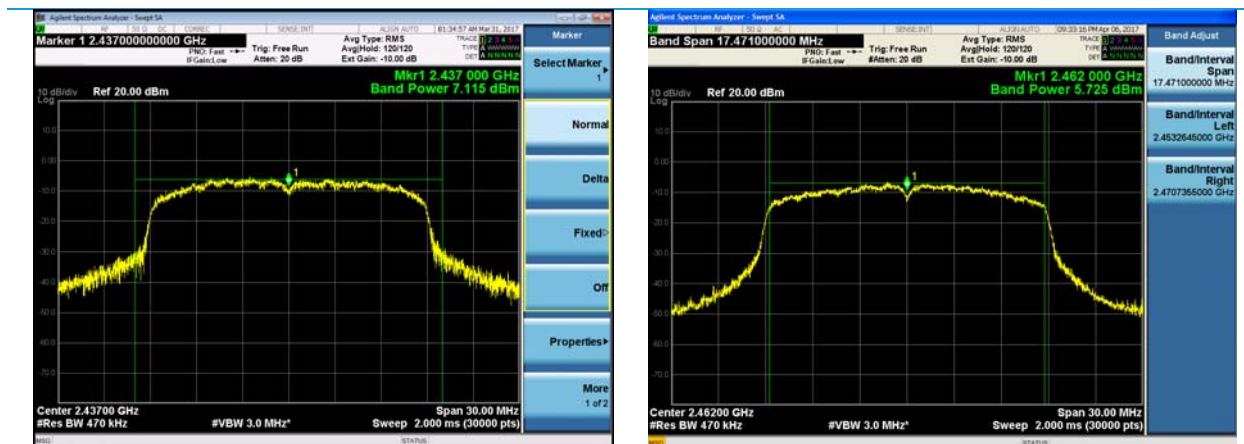
MCS0 – Channel 11

Plots – Conducted Output Power – 802.11n, continued



MCS7 – Low Channel

MCS7 – Channel 10



MCS7 – Mid Channel

MCS7 – Channel 11

Plots – Conducted Output Power – BLE



BLE – Low Channel



BLE – Mid Channel



BLE – High Channel

5.1.4 Antenna Port Conducted Emissions – Power Spectral Density (PSD)

Operator	Shane Dock / Kimberly Bay
QA	Kimberly Bay / Aidi Zainal
Test Date	March 30, 2017 / April 10-11, 2017
Location	Conducted RF Test Bench
Temp. / R.H.	21-22°C / 36-40% R.H.
Requirement	FCC 15/247 (e) / RSS-247 Section 5.2 (b)
Method	WLAN: ANSI C63.10 2013 Section 11.10.5 Method AVGPSD-2 BLE: ANSI C63.10 2013 Section 11.10.2 Method PKPSD

Limits:

PSD Maximum Limit in 3-kHz

8 dBm

Test Parameters

Frequency	WLAN: 2412, 2437, and 2462 MHz; MCS0 & MCS7 also used 2457 MHz (see Note) BLE: 2402, 2440, and 2480 MHz
Settings	<u>Detector</u> – WLAN: Average, BLE: Peak
Settings	<u>Span</u> – WLAN: 30 MHz, BLE: 3 MHz
Settings	<u>BW</u> – RBW = 100 kHz, VBW = 300 kHz
EUT	Modulated signal
Note	Channel 11 operated in reduced power for 802.11n, due to exceeding limits at full power. Both channels 10 (at full power) and 11 (at reduced power) are tested here to show compliance.
Example Calculation	Corrected PSD = Peak PSD + Duty Cycle Correction PSD Margin = PSD Limit – Corrected PSD

Instrumentation



Date : 20-Dec-2016

Test : Power Spectral Density

Job # : C-2630

PE: Kim

Customer : United Technology Electronic Controls

Quote # : 316392

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration

Company: UTC, Inc.	Page 31 of 90	Name: Cor7C
Report: TR 316392 A		Model: Cor7C
Job: C-2630		Serial: Engineering Sample

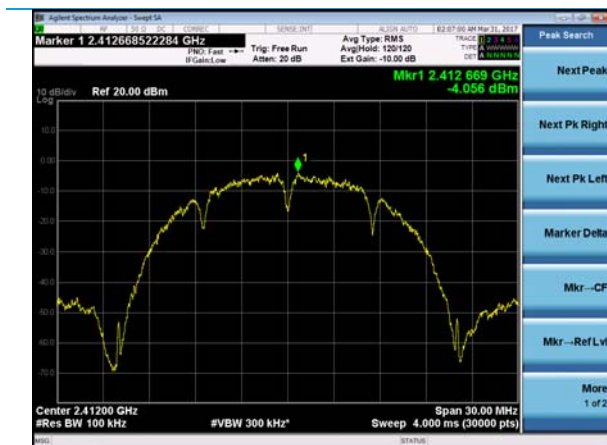
Table – Power Spectral Density - WLAN

802.11 Standard	Data Rate (Mbps)	Channel	PSD Measured in 100-kHz (dBm)	Duty Cycle Correction (dB)	PSD Corrected (dBm)	PSD limit in 3-kHz (dBm)	PSD Margin (dB)
b	1	1	-4.1	3.9	-0.2	8	8.2
		6	-3.3	3.9	0.6	8	7.4
		11	-3.0	3.9	0.9	8	7.1
b	11	1	-5.7	5.0	-0.7	8	8.7
		6	-4.5	5.0	0.5	8	7.5
		11	-4.8	5.0	0.2	8	7.8
g	6	1	-8.1	4.4	-3.7	8	11.7
		6	-6.1	4.4	-1.7	8	9.7
		11	-7.5	4.4	-3.1	8	11.1
g	54	1	-9.2	5.1	-4.1	8	12.1
		6	-9.7	5.1	-4.6	8	12.6
		11	-9.6	5.1	-4.5	8	12.5
n	MCS0	1	-9.5	4.9	-4.6	8	12.6
		6	-7.2	4.9	-2.3	8	10.3
		10	-7.2	4.9	-2.3	8	10.3
		11	-11.4	4.9	-6.5	8	14.5
n	MCS7	1	-10.9	5.2	-5.7	8	13.7
		6	-10.1	5.2	-4.9	8	12.9
		10	-9.8	5.2	-4.6	8	12.6
		11	-12.4	5.2	-7.2	8	15.2

Table – Power Spectral Density - BLE

Frequency (MHz)	PSD Measured in 100-kHz (dBm)	PSD Limit in 3-kHz (dBm)	PSD Margin (dB)
2402	3.4	8	4.6
2440	3.8	8	4.2
2462	3.9	8	4.1

Plots – Power Spectral Density – 802.11b



1 Mbps – Low Channel



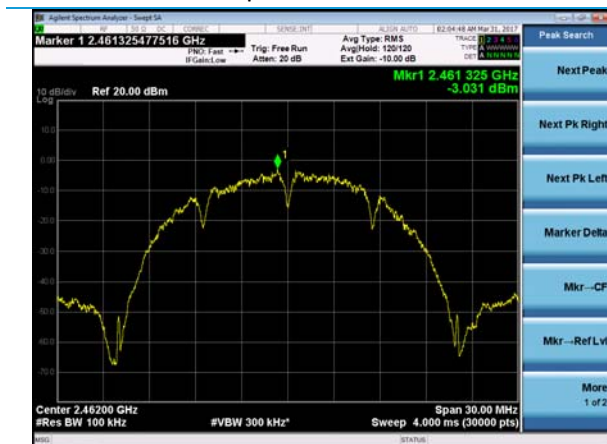
11 Mbps – Low Channel



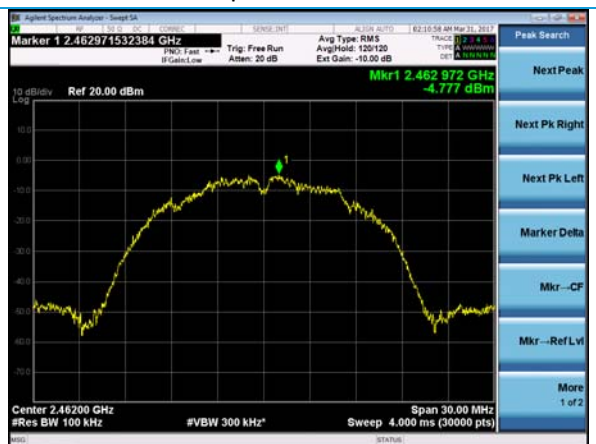
1 Mbps – Mid Channel



11 Mbps – Mid Channel

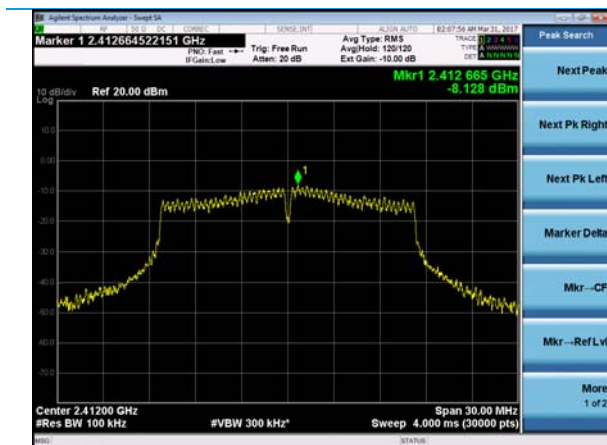


1 Mbps – High Channel

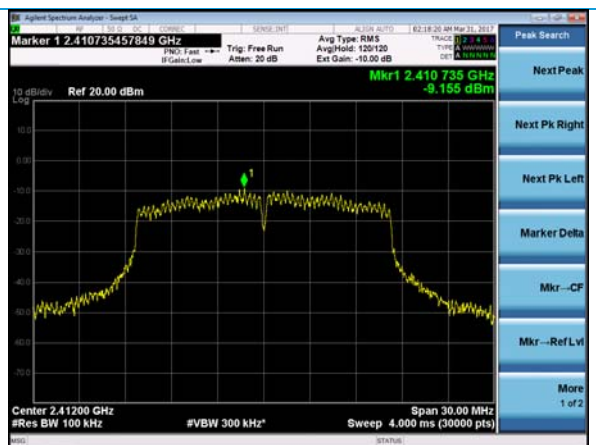


11 Mbps – High Channel

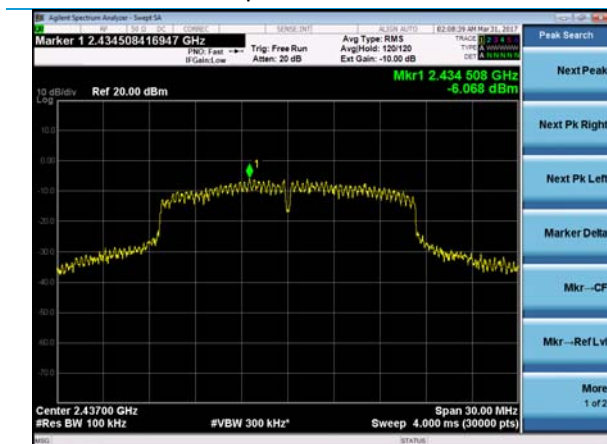
Plots – Power Spectral Density – 802.11g



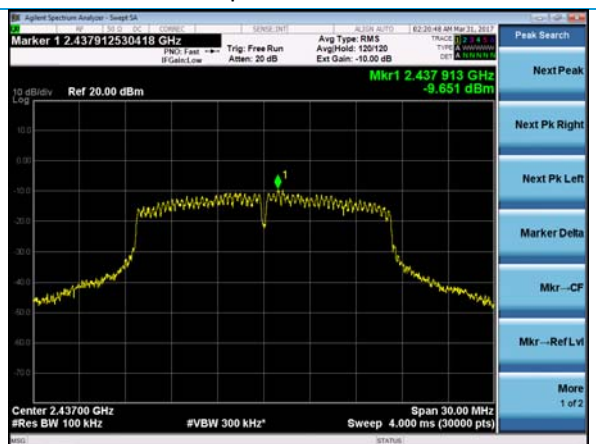
6 Mbps – Low Channel



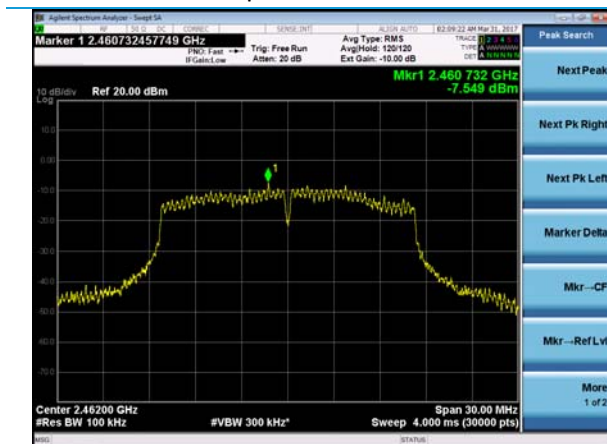
54 Mbps – Low Channel



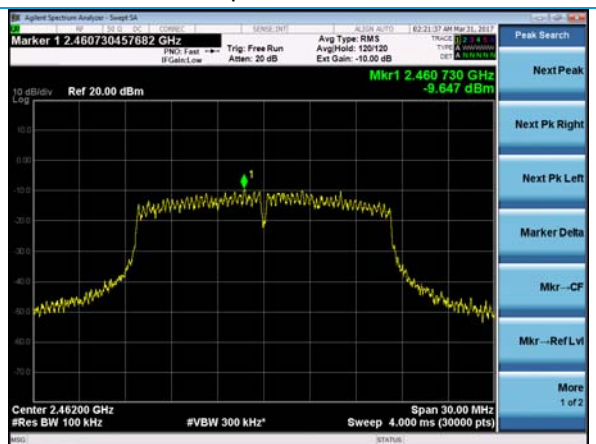
6 Mbps – Mid Channel



54 Mbps – Mid Channel

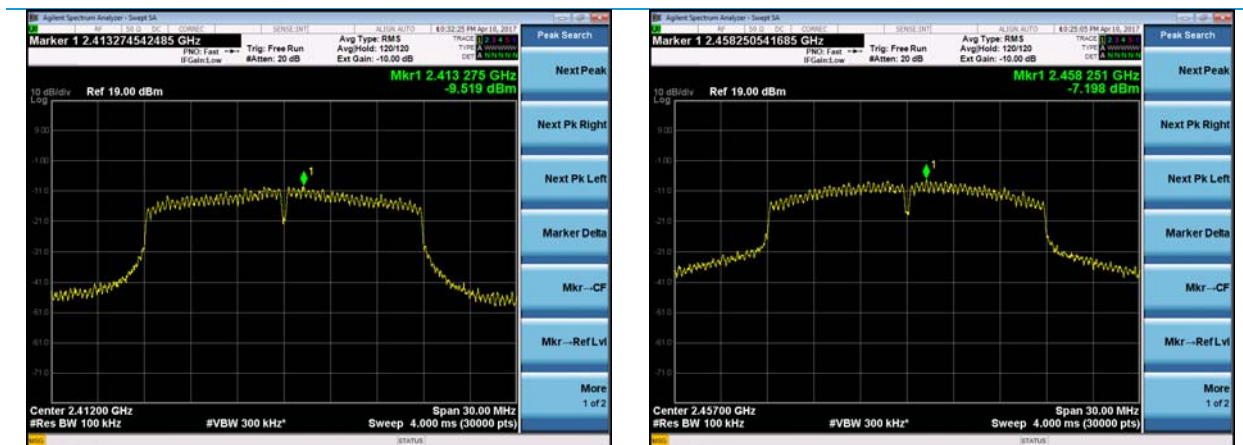


6 Mbps – High Channel



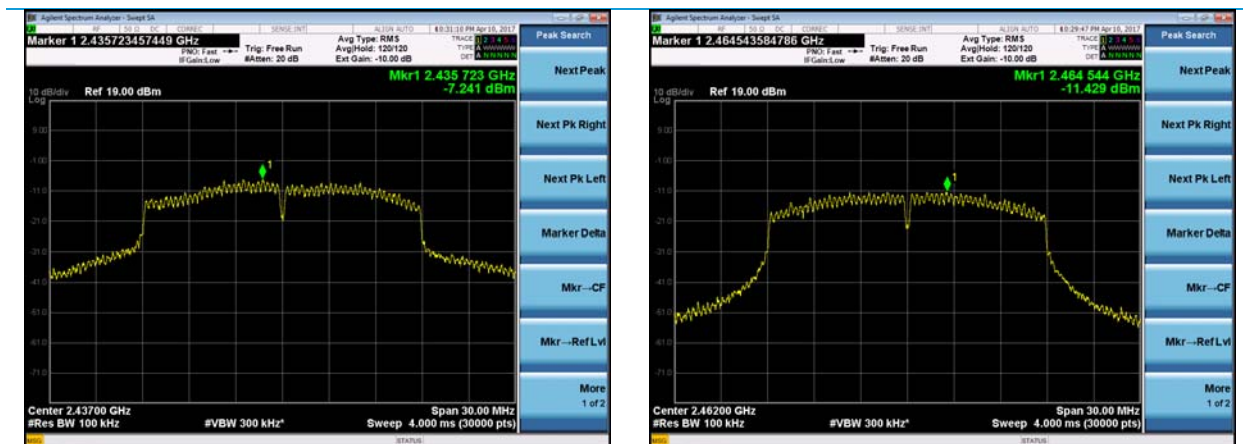
54 Mbps – High Channel

Plots – Power Spectral Density – 802.11n



MCS0 – Low Channel

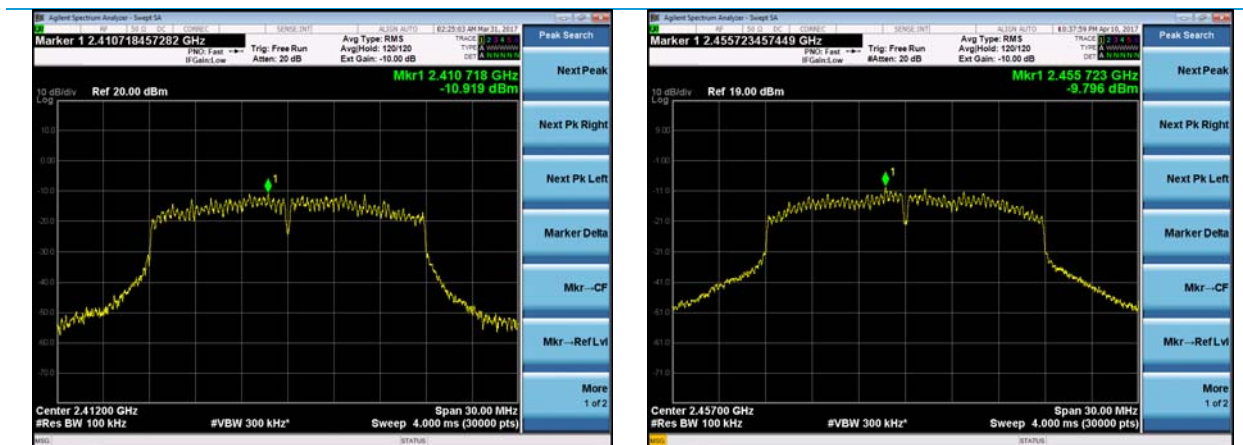
MCS0 – Channel 10



MCS0 – Mid Channel

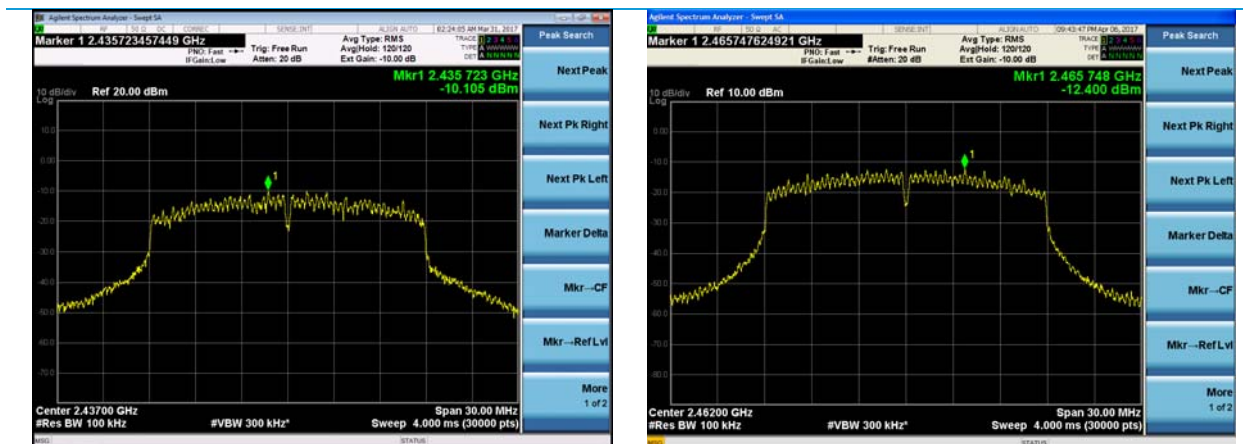
MCS0 – Channel 11

Plots – Power Spectral Density – 802.11n, continued



MCS7 – Low Channel

MCS7 – Channel 10



MCS7 – Mid Channel

MCS7 – Channel 11

Plots – Power Spectral Density – BLE



BLE – Low Channel



BLE – Mid Channel



BLE – High Channel

5.1.5 Antenna Port Conducted Emissions – 100 kHz Band-Edge

Operator	Shane Dock / Kimberly Bay
QA	Kimberly Bay / Shane Dock
Test Date	March 30, 2017 / April 10-11, 2017 & May 19, 2017
Location	Conducted RF Test Bench
Temp. / R.H.	21-22°C / 36-40% R.H.
Requirement	FCC 15.247 (d) / RSS-247 Section 5.5
Method	ANSI C63.10 2013 Section 6.10

Limits:

Radio	Limit	Notes
WLAN	-30 dBc	Limit when Pout measurements performed as RMS average measurements
BLE	-20 dBc	Limit when Pout measurements performed as peak measurements

Test Parameters

Frequency	2310-2390 MHz 2483.5-2500 MHz
Settings	Peak Detector
Settings	RBW = 100 kHz, VBW = 300 kHz
EUT	Modulated Signal
Note	Channel 11 operated in reduced power for 802.11n, due to exceeding limits at full power. Both channels 10 (at full power) and 11 (at reduced power) are tested here to show compliance.

Instrumentation



Date : 20-Dec-2016

Test : Band-Edge

Job # : C-2630

PE:

Customer : United Technology Electronic Controls

Quote #: 316392

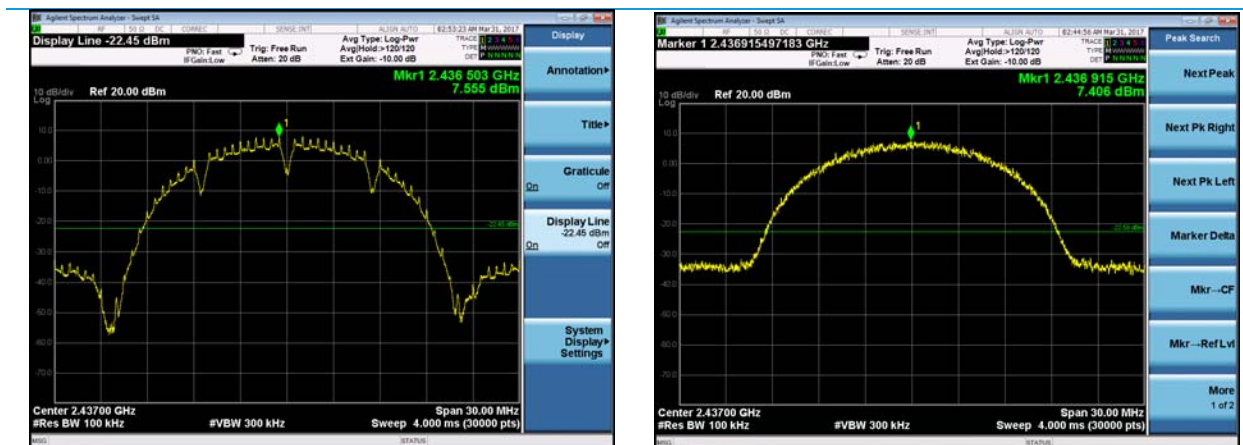
No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration

Company: UTC, Inc.	Page 38 of 90	Name: Cor7C
Report: TR 316392 A		Model: Cor7C
Job: C-2630		Serial: Engineering Sample

Table – Band Edge Results –WLAN & BLE

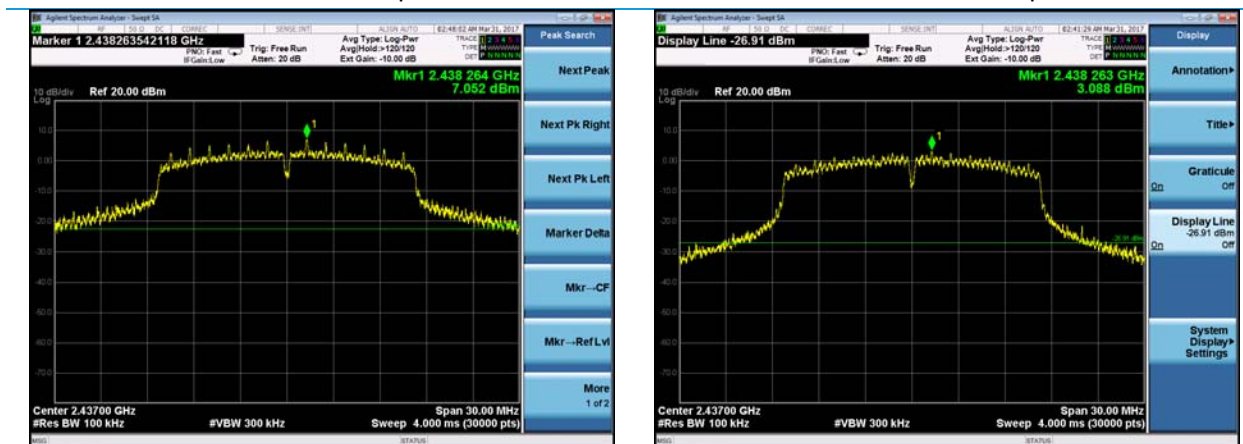
Data Rate	Band-Edge	Frequency (MHz)	Reading (dBm)	Limit (dBm)	Margin (dB)
1 Mbps	Lower	2397	-32.23	-22.45	9.78
1 Mbps	Upper	2484	-50.77	-22.45	28.32
11 Mbps	Lower	2399	-33.98	-22.59	11.39
11 Mbps	Upper	2486	-48.33	-22.59	25.74
6 Mbps	Lower	2400	-27.15	-22.95	4.20
6 Mbps	Upper	2484	-40.07	-22.95	17.12
11 Mbps	Lower	2399	-29.62	-26.91	2.71
11 Mbps	Upper	2484	-38.22	-26.91	11.31
MCS0	Lower	2399	-25.96	-23.52	2.44
MCS0 (Ch. 10)	Upper	2485	-37.69	-23.52	14.17
MCS0 (Ch. 11)	Upper	2484	-41.16	-23.52	17.64
MCS7	Lower	2399	-32.66	-27.65	5.01
MCS 7 (Ch. 10)	Upper	2484	-44.46	-27.65	16.81
MCS7 (Ch. 11)	Upper	2485	-41.56	-27.65	13.91
BLE	Lower	2389	-51.02	-16.14	34.88
BLE	Upper	2486	-55.81	-16.14	39.67

Plots – Reference Levels for 100 kHz - WLAN



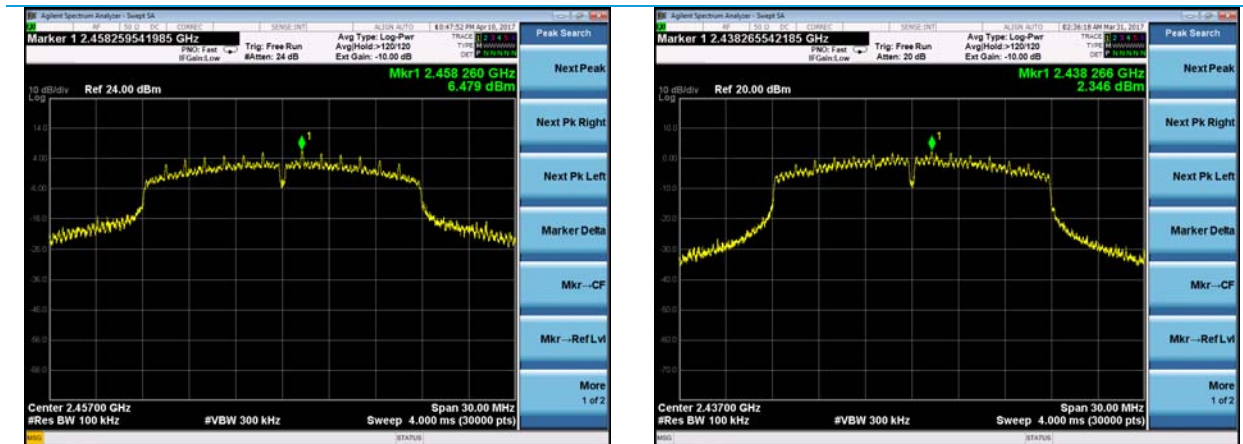
802.11b – 1 Mbps

802.11b – 11 Mbps



802.11g – 6 Mbps

802.11g – 54 Mbps



802.11n – MCS0

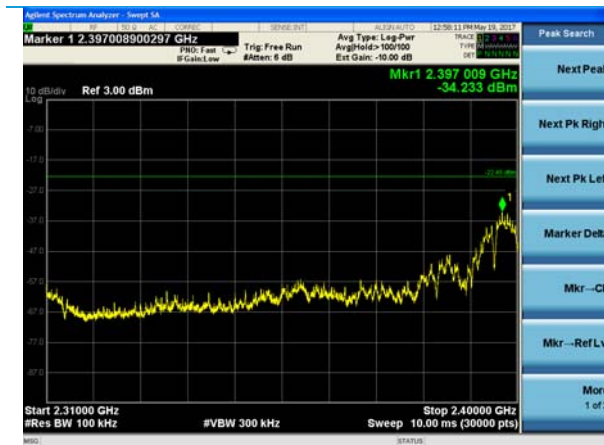
802.11n – MCS7

Plots – Reference Level for 100 kHz- BLE

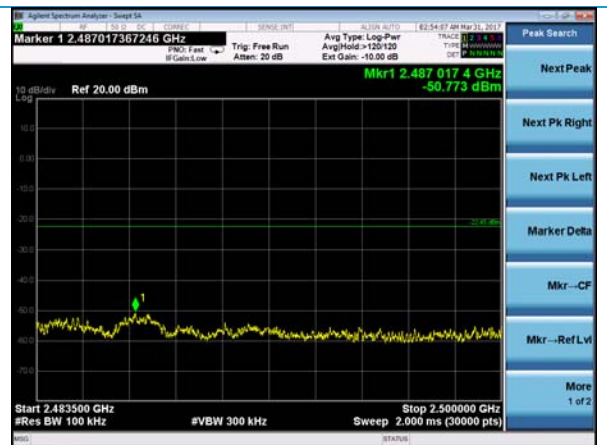


Company: UTC, Inc.	Page 41 of 90	Name: Cor7C
Report: TR 316392 A		Model: Cor7C
Job: C-2630		Serial: Engineering Sample

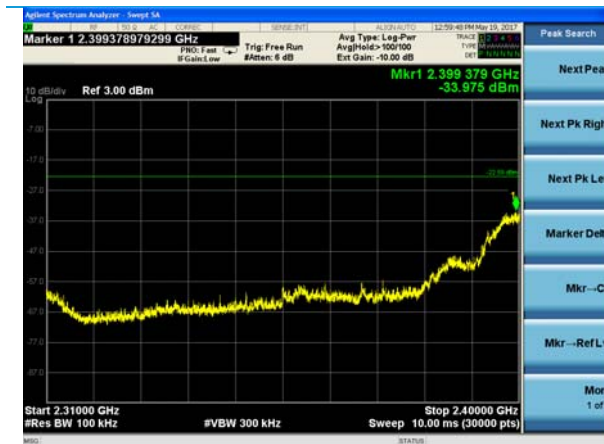
Plots – 100 kHz Band Edges - WLAN



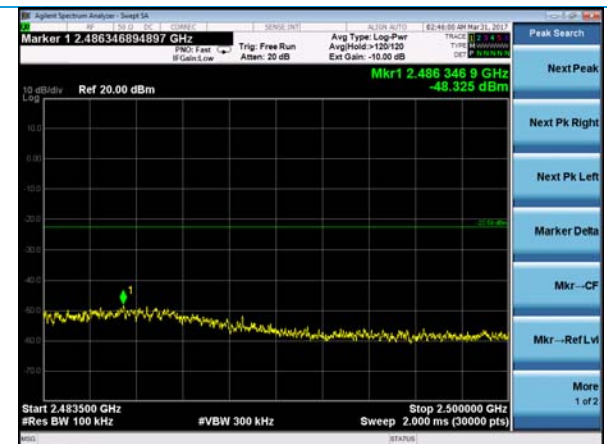
1 Mbps – Lower Band Edge



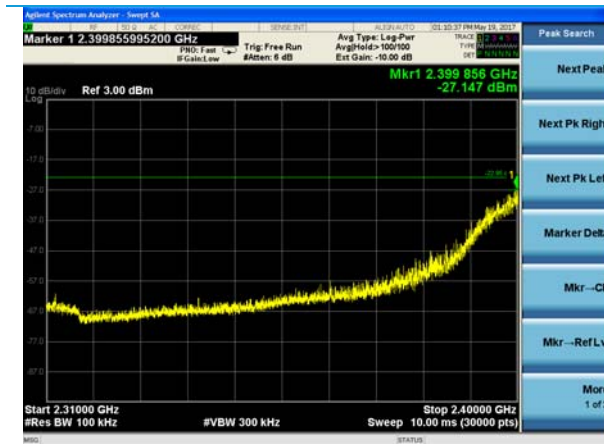
1 Mbps – Upper Band Edge



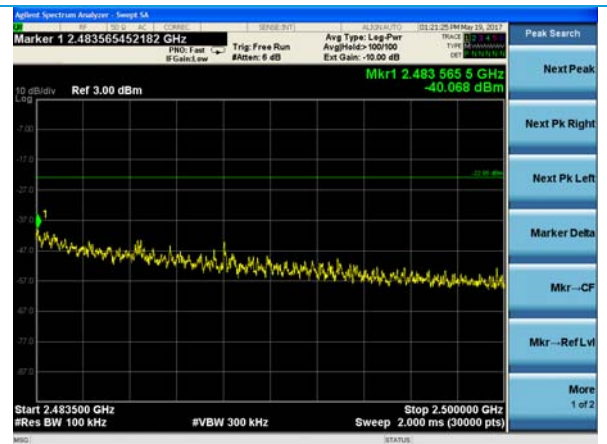
11 Mbps – Lower Band Edge



11 Mbps – Upper Band Edge

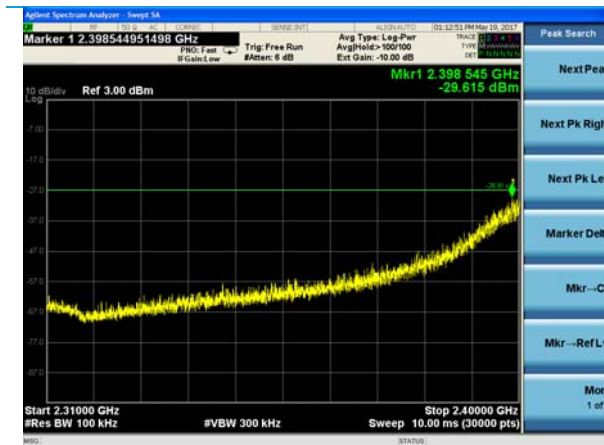


6 Mbps – Lower Band Edge

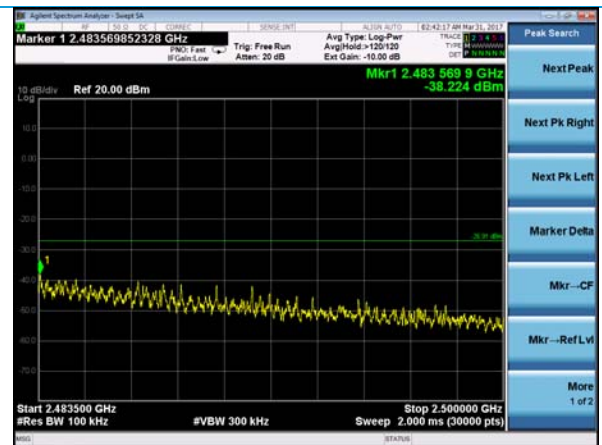


6 Mbps – Upper Band Edge

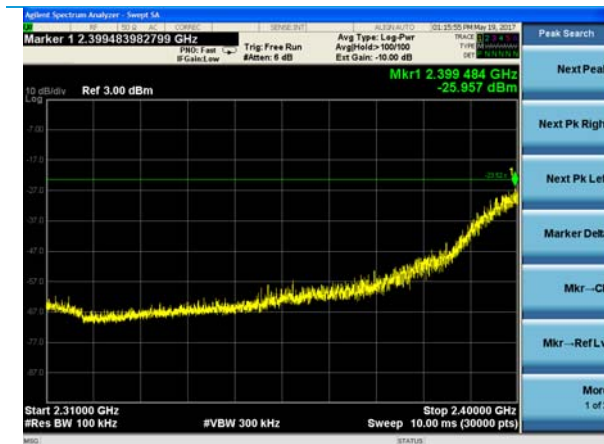
Plots – 100 kHz Band Edges – WLAN, continued



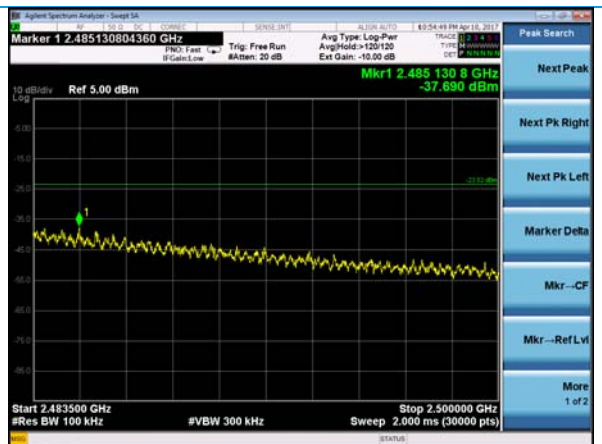
54 Mbps – Lower Band Edge



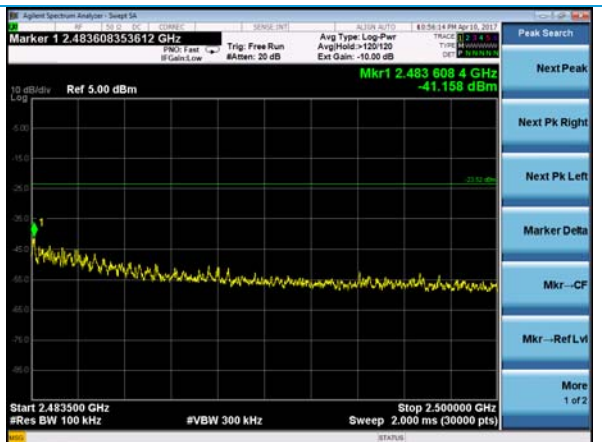
54 Mbps – Upper Band Edge



MCS0 – Lower Band Edge

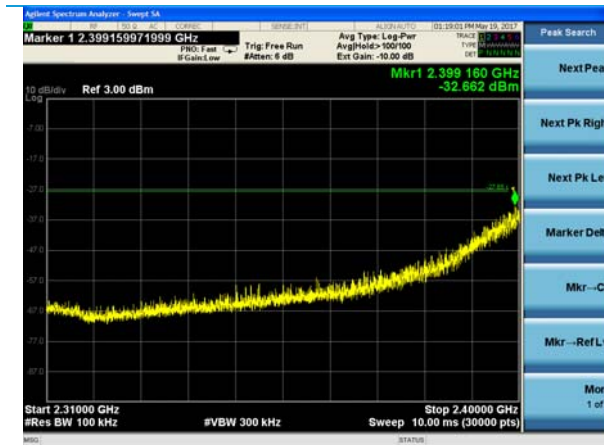


MCS0 – Upper Band Edge – Channel 10

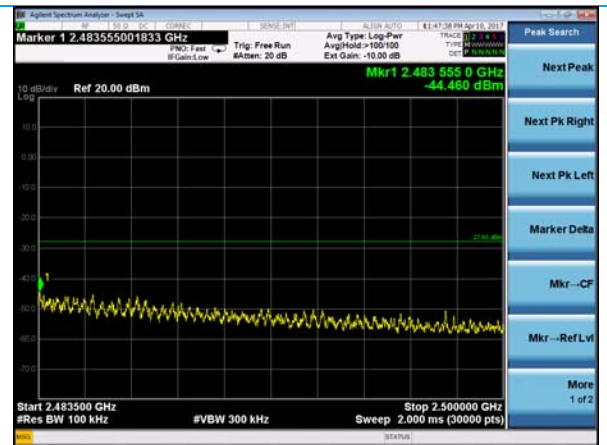


MCS0 – Upper Band Edge – Channel 11

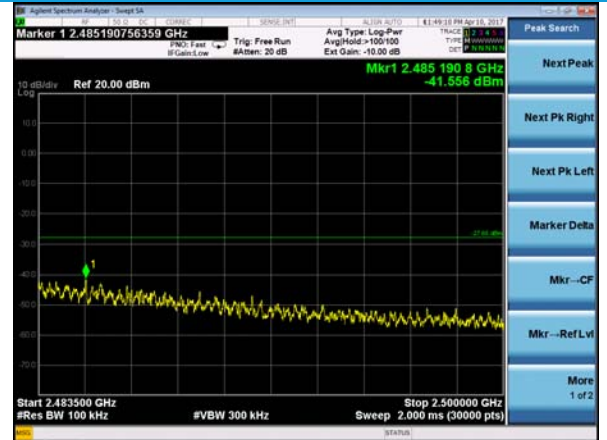
Plots – 100 kHz Band Edges – WLAN & BLE



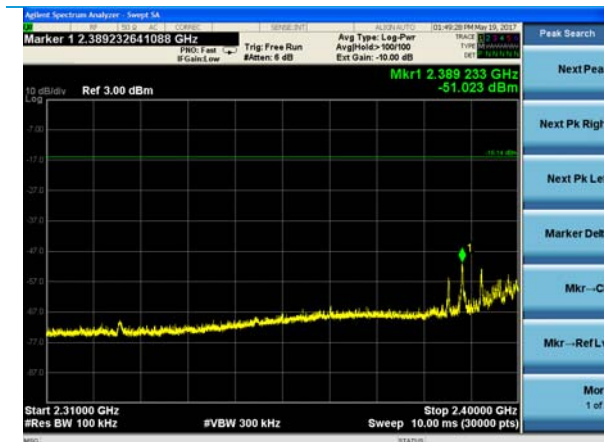
MCS7 – Lower Band Edge



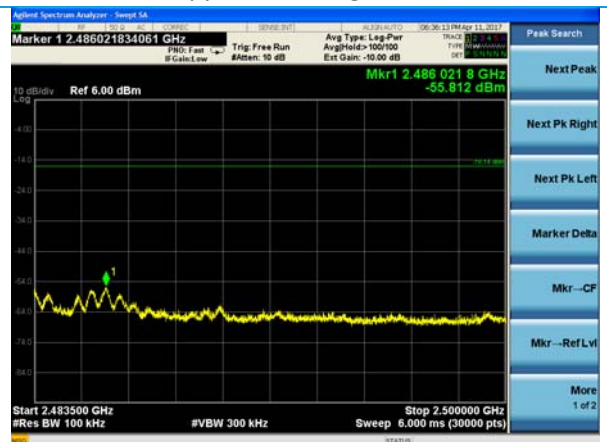
MCS7 – Upper Band Edge – Channel 10



MCS7 – Upper Band Edge – Channel 11



BLE – Lower Band Edge



BLE – Upper Band Edge

5.1.6 Antenna Port Conducted Emissions – 100 kHz Spurious Emissions

Operator	Shane Dock / Kimberly Bay
QA	Kimberly Bay / Shane Dock
Test Date	March 30, 2017 / April 10-11, 2017
Location	Conducted RF Test Bench
Temp. / R.H.	21-22°C / 36-40% R.H.
Requirement	FCC 15.247 (d) / RSS-247 Section 5.5
Method	ANSI C63.10 2013 Sections 6.5 and 6.6

Limits:

Radio	Limit	Notes
WLAN	-30 dBc	Limit when Pout measurements performed as RMS average measurements
BLE	-20 dBc	Limit when Pout measurements performed as peak measurements

Test Parameters

Frequency	30 MHz – 25 GHz
Settings	Peak Detector
Settings	RBW = 100 kHz, VBW ≥ 3xRBW
EUT	Modulated Signal
Note	Channel 11 operated in reduced power for 802.11n, due to exceeding limits at full power. Both channels 10 (at full power) and 11 (at reduced power) are tested here to show compliance.
Note	No emissions were found within 15 dB of the limit.

Instrumentation



Date: 20-Dec-2016

Test: Spurious Emissions

Job #: C-2630

PE: Kim

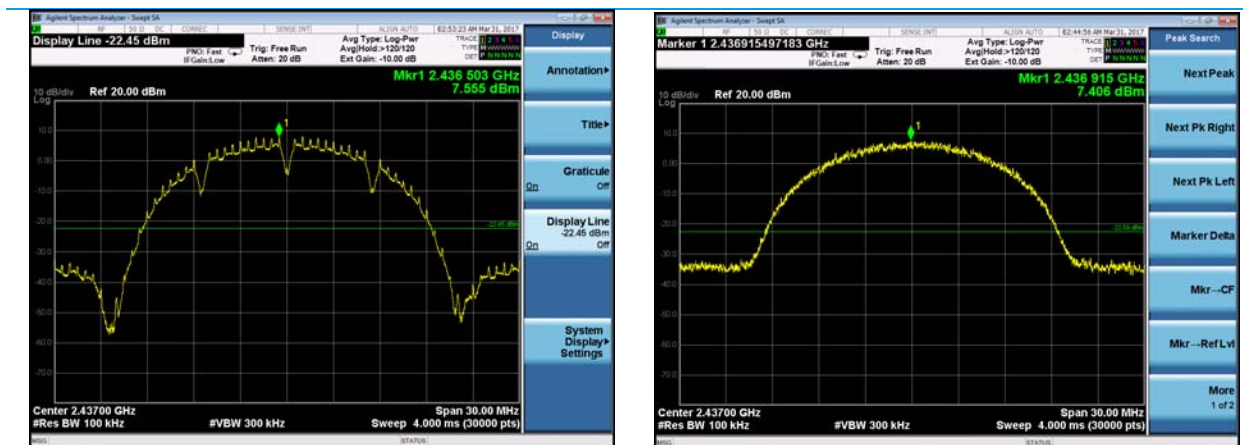
Customer: United Technology Electronic Controls

Quote #: 316392

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration

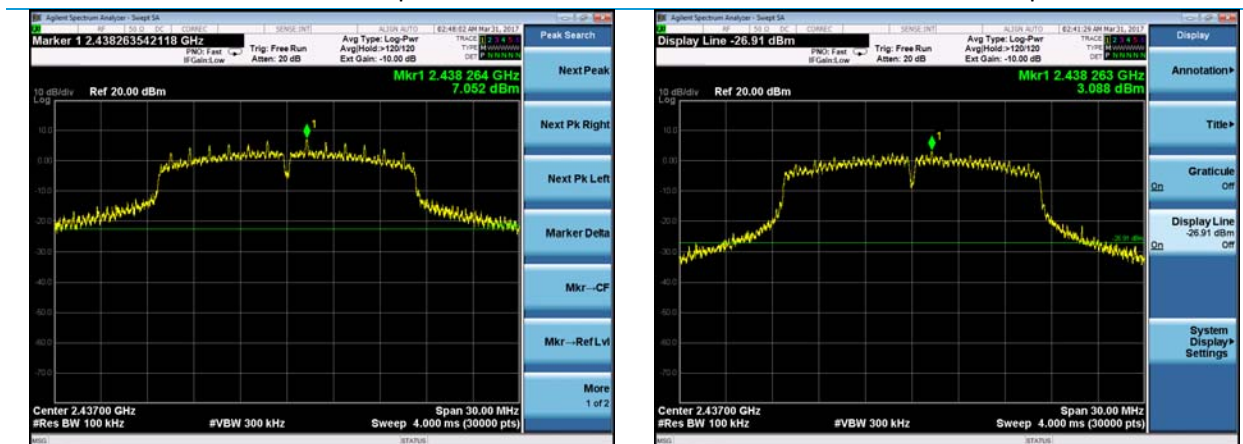
Company: UTC, Inc.	Page 45 of 90	Name: Cor7C
Report: TR 316392 A		Model: Cor7C
Job: C-2630		Serial: Engineering Sample

Plots – Reference Levels for 100 kHz - WLAN



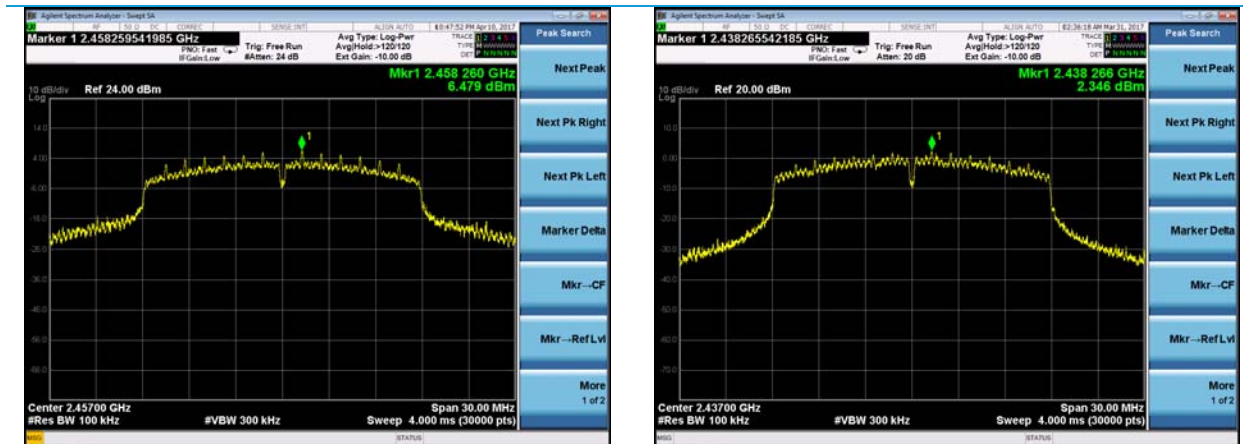
802.11b – 1 Mbps

802.11b – 11 Mbps



802.11g – 6 Mbps

802.11g – 54 Mbps



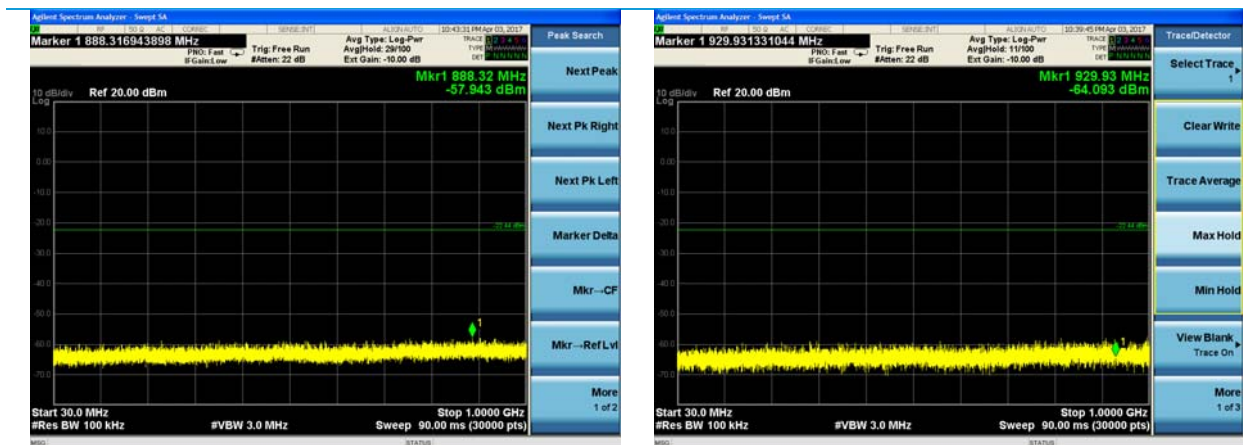
802.11n – MCS0

802.11n – MCS7

Plots – Reference Level for 100 kHz- BLE

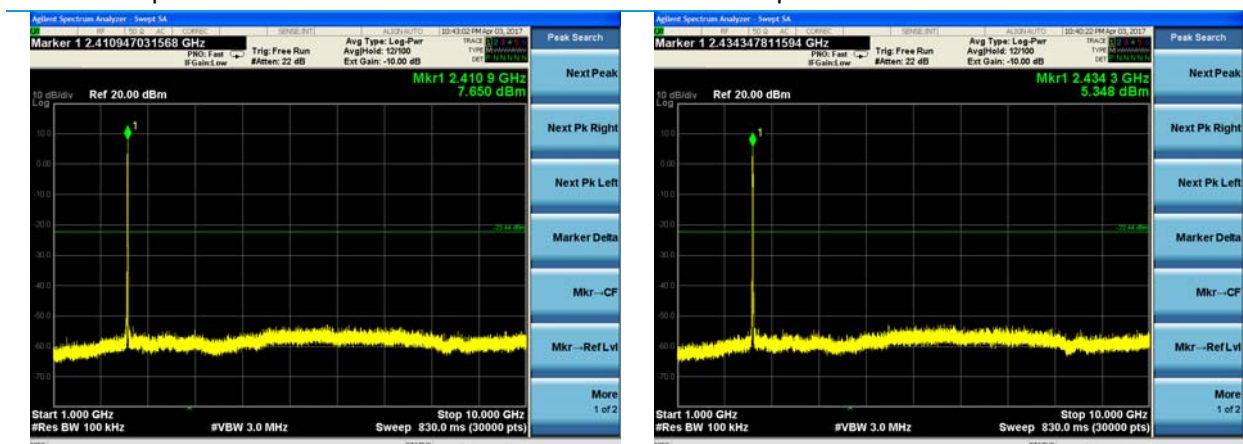


Plots – 100 kHz Conducted Spurious Emissions – 802.11b



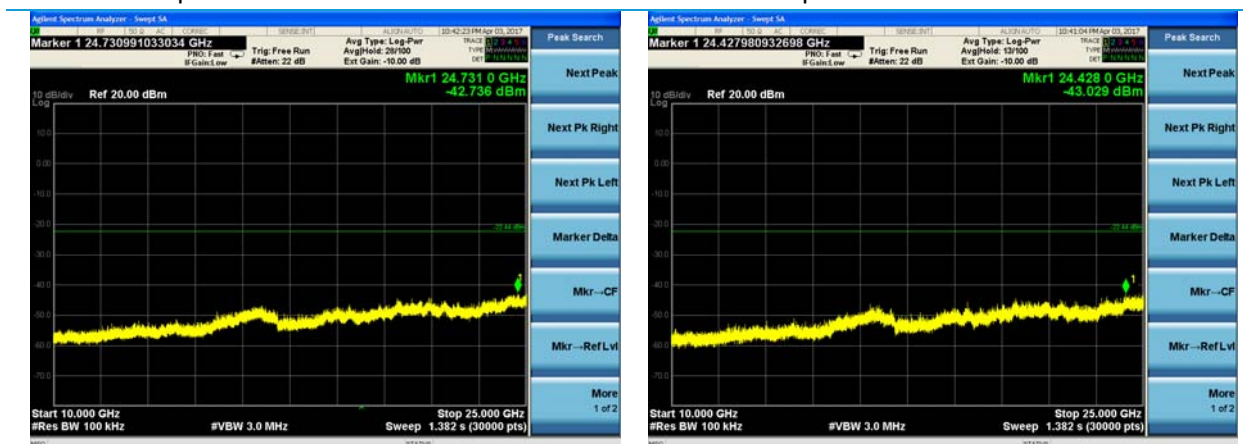
1 Mbps – Low Channel – 30-1000 MHz

1 Mbps – Mid Channel – 30-1000 MHz



1 Mbps – Low Channel – 1-10 GHz

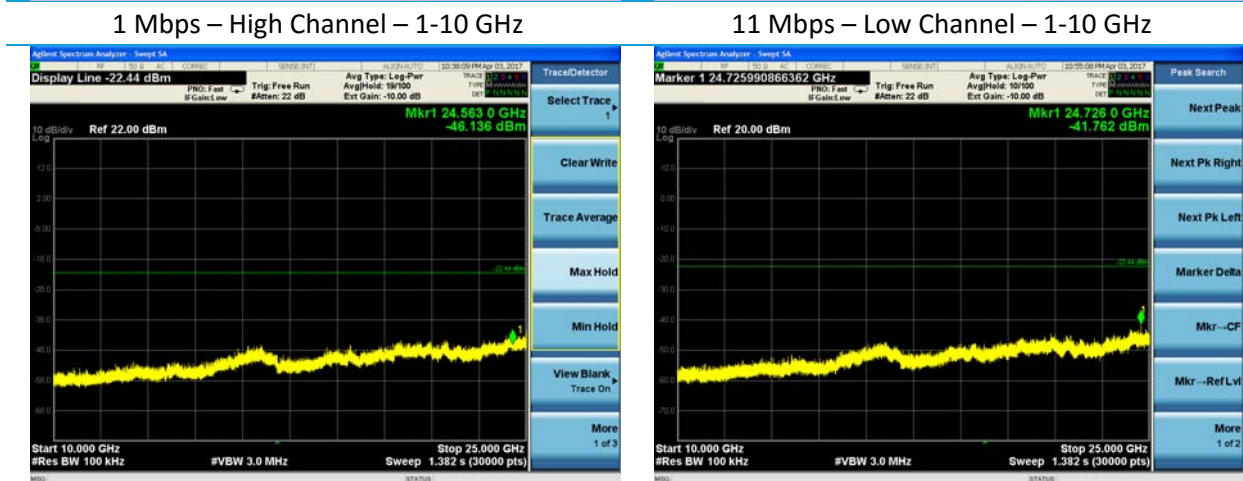
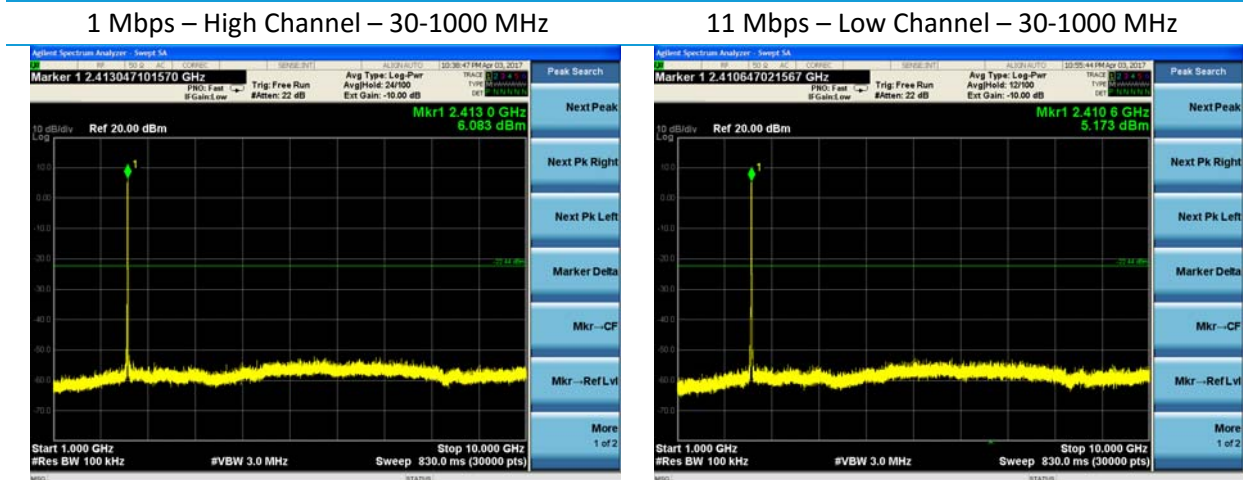
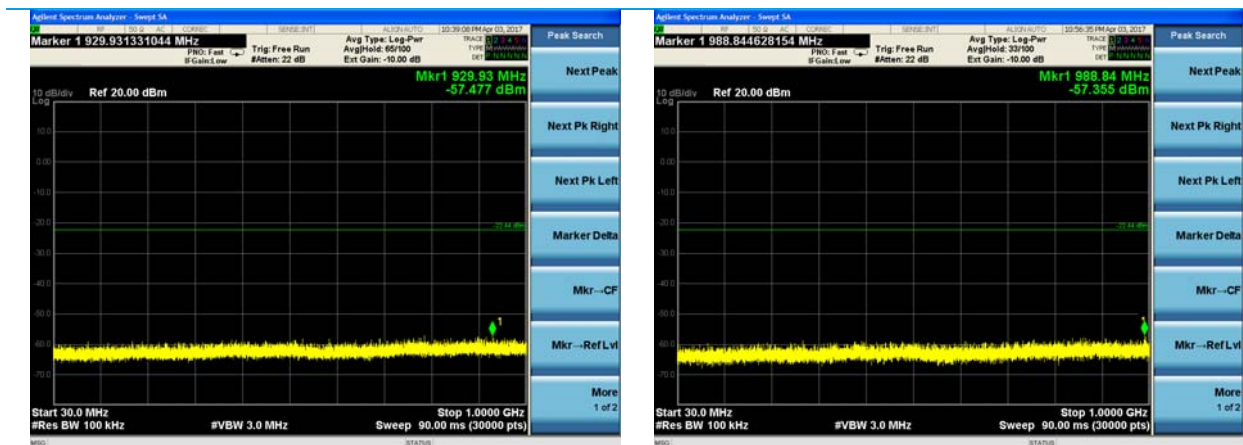
1 Mbps – Mid Channel – 1-10 GHz



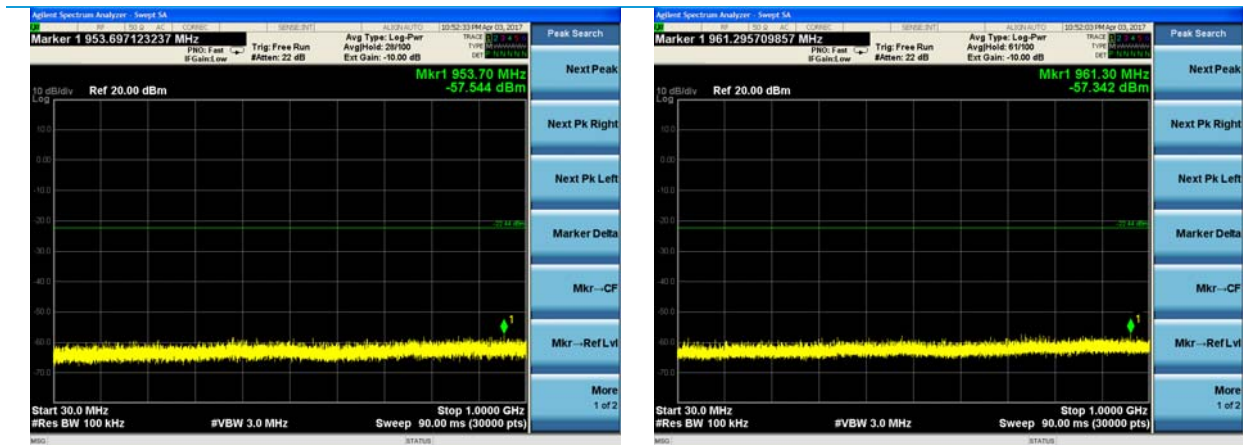
1 Mbps – Low Channel – 10-25 GHz

1 Mbps – Mid Channel – 10-25 GHz

Plots – 100 kHz Conducted Spurious Emissions – 802.11b, continued

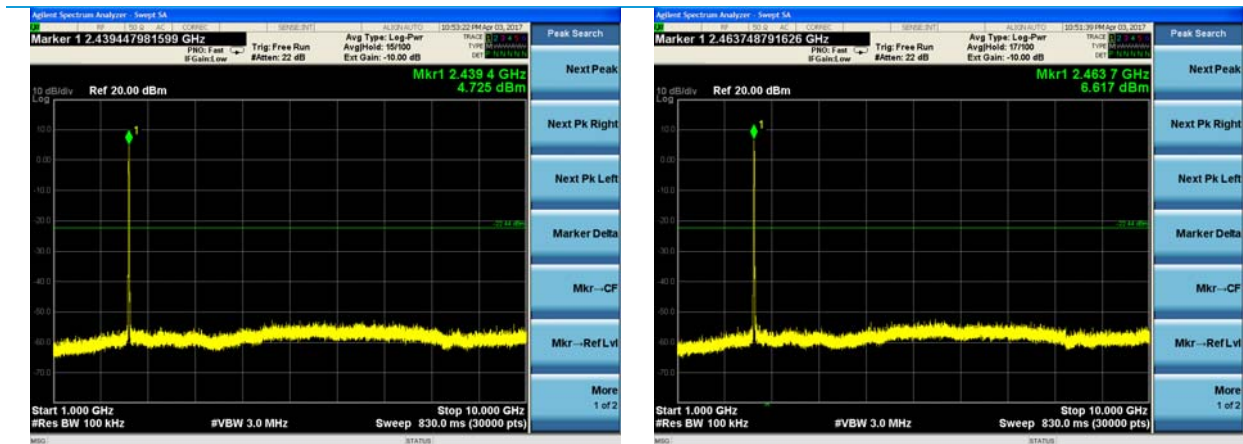


Plots – 100 kHz Conducted Spurious Emissions – 802.11b, continued



11 Mbps – Mid Channel – 30-1000 MHz

11 Mbps – High Channel – 30-1000 MHz



11 Mbps – Mid Channel – 1-10 GHz

11 Mbps – High Channel – 1-10 GHz



11 Mbps – Mid Channel – 10-25 GHz

11 Mbps – High Channel – 10-25 GHz