LSR
Design. Create. Certify. *Connect.*
ACCREDITED TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

TEST REPORT # 315160 A
LSR Job #: C-2234

Compliance Testing of:
TiS10-TiS65

Test Date(s):
6/3/15 – 7/6/15, 9-11-15

Prepared For:
Attention: Kyle Lundequam
Fluke Corporation
3550 Annapolis Lane N#70
Minneapolis, MN 55447

This Test Report is issued under the Authority of:
Tom Smith, VP of EMC Test Services

Signature: Thomas T. Smith Date: 9-11-15

Test Report Reviewed by:	Project Engineer:
Tom Smith, VP of EMC Test Services	Khairul Aidi Zainal, Senior EMC Engineer.
Signature: Thomas T. Smith Date: 9-11-15	Signature: Date: 9/11/15

TABLE OF CONTENTS

EXHIBIT 1. INTRODUCTION

1.1 - Scope

References:	FCC Part 15, Subpart C, Section 15.247 RSS GEN issue 4 and RSS 247 issue 1
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15. IC : Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-Power License-Exempt Transmitters.
Test Procedures:	FCC KDB 558074 D01 DTS Measurement Guidance v03r03 ANSI C63.10

1.2 – Normative References

Publication	Year	Title
FCC CFR Parts 0-15	2015	Code of Federal Regulations – Telecommunications
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
RSS-247 Issue 1	2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-GEN Issue 4	2014	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
FCC KDB 558074 D01 DTS Measurement Guidance v03r03	2015	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

1.3 - LS Research, LLC Test Facility

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) as conforming to ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted. Accreditation status can be verified at A2LA’s web site: www.a2la2.net.

1.4 – Location of Testing

All testing was performed at the following location utilizing the facilities listed below, unless otherwise noted.

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA,

List of Facilities Located at LS Research, LLC:

Semi-Anechoic Chamber

1.5 – Test Equipment Utilized

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated by a calibration laboratory accredited to the requirements of ISO/IEC 17025, and traceable to the SI standard.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 – Client Information

Manufacturer Name:	Fluke Corporation
Address:	3550 Annapolis Lane N#70, Minneapolis, MN 55447
Contact Name:	Kyle Lundequam

2.2 - Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	Thermal Imager
Model Number:	TiS65
Serial Number:	TiS65-15069005: Radiated measurements A15050019: Conducted measurements

2.3 - Associated Antenna Description

The antenna associated with the EUT is a Johanson Technology high frequency ceramic chip antenna, part number 2450AT18B100. The chip antenna has a peak gain of 0.5dBi.

2.4 - EUT'S Technical Specifications

EUT Frequency Range (in MHz)	2412MHz – 2462MHz (WLAN)
RF Power in Watts (Conducted measurement)	
Minimum:	2.4GHz WLAN 802.11 b: 0.0134watts 802.11 g: 0.0069watts 802.11 n (HT20): 0.0072watts 802.11 n (HT40): 0.0031watts 2.4 GHz BLE: 0.0025watts
Maximum:	2.4GHz WLAN 802.11 b: 0.0149watts 802.11 g: 0.0085watts 802.11 n (HT20): 0.0093watts 802.11 n (HT40): 0.0038watts 2.4 GHz BLE: 0.0028watts
Conducted Output Power, average (in dBm)	2.4GHz WLAN 802.11 b: Maximum = 11.7dBm Minimum = 11.3dBm 802.11 g: Maximum = 9.3dBm Minimum = 8.4dBm 802.11 n (HT20): Maximum = 9.7dBm Minimum = 8.6dBm 802.11 n (HT40): Maximum = 5.8dBm Minimum = 4.9dBm 2.4 GHz BLE : Maximum = 4.4dBm Minimum = 4.0dBm
Field Strength at 3 meters (Maximum)	Not Applicable
99% Bandwidth	2.4GHz WLAN: 802.11 b: 14.6MHz 802.11 g: 16.6MHz 802.11 n (HT20): 17.7MHz 802.11 n (HT40): 36.0MHz 2.4GHz BLE: 1.03MHz
Type of Modulation	OFDM (WLAN), DSSS(WLAN), GFSK (BLE)
Occupied Bandwidth (6dB BW)	2.4GHz WLAN: 802.11 b: 11.0MHz 802.11 g: 16.0MHz 802.11 n (HT20):16.7MHz

	802.11 n (HT40): 35.8MHz 2.4 GHz BLE: 707.2kHz
Transmitter Spurious (worst case) at 3 meters	52.5dBµV/m at 4924MHz
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Microprocessor/Transceiver Model #	Microprocessor: DM3730CUSA Transceiver: LBEP5CLWTC-631
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	Ceramic chip antenna
Gain	Peak Gain in 2.4GHz band = 0.5 dBi
EUT will be operated under FCC Rule Part(s)	Title 47 part 15.247
EUT will be operated under RSS Rule Part(s)	RSS 247
Modular Filing	☐ Yes ☒ No
Portable or Mobile?	portable

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	X	RF Evaluation

The EUT was evaluated against the SAR test exclusion threshold listed in KDB 447498 D01 General RF Exposure Guidance v05r02, section 4.3 (1). The EUT was found to be compliant with the SAR exclusion threshold, 10-g extremity, for 100MHz to 6000MHz.

Frequency = 2.462GHz
ERP (dBm) = 11.7dBm
ERP (mW)= 14.9milliwatt
Minimum separation distance = 5mm

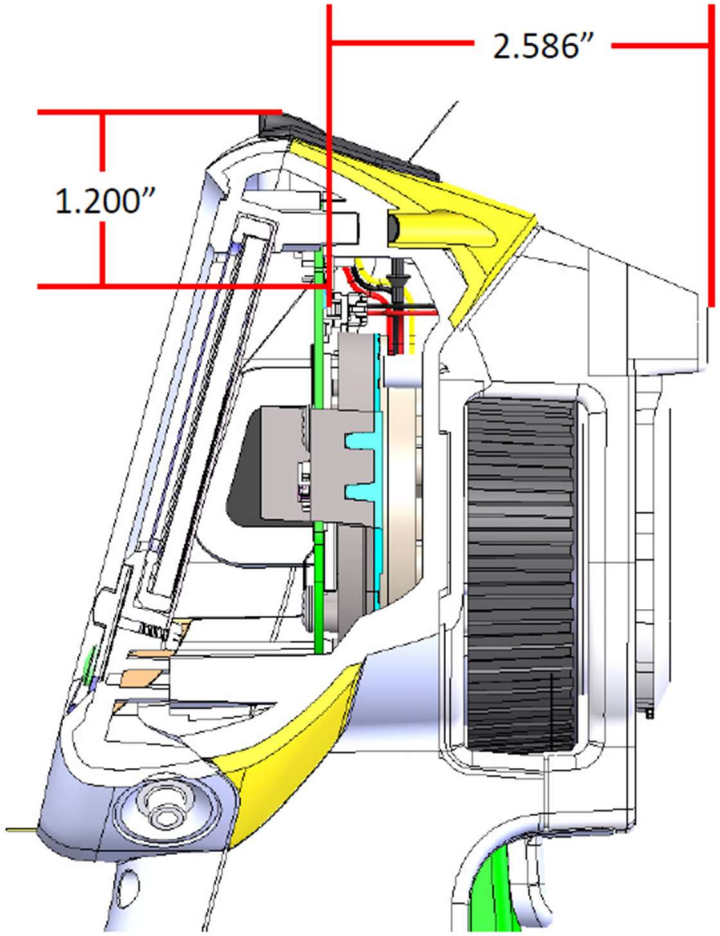
[14.9mw/5mm]*[√2.48GHz] = 4.7 = **≤ 7.5**

When evaluated against RSS 102 issue 5 section 2.5, table 1:

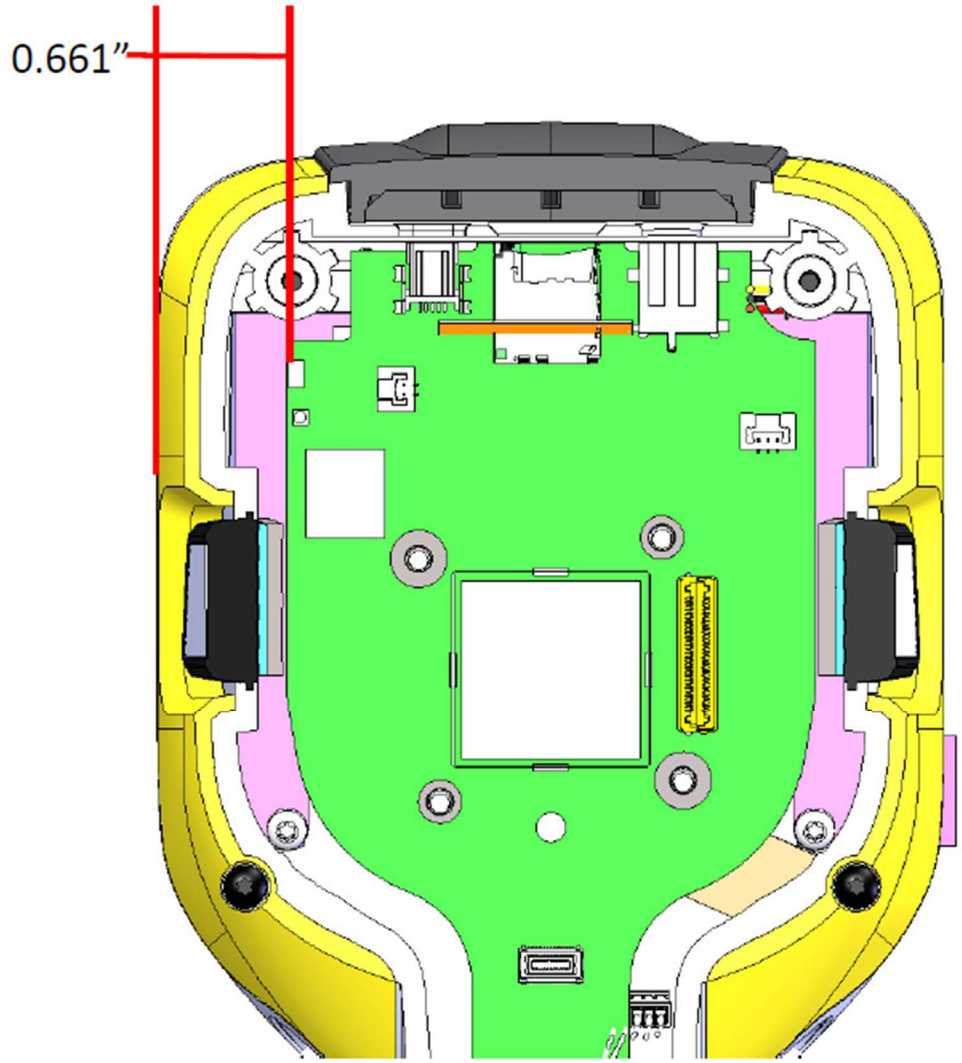
Frequency = 2.462GHz
EIRP (dBm) = 11.7dBm 0.5dBi = 12.2dBm
ERP (mW)= 16.6milliwatt

The EUT antenna separation distance to the extremity is greater than 15 mm (refer to figure below), hence is excluded from SAR.

ANTENNA LOCATION 1 – All Models



Prepared For: Fluke Corporation	Model #: TiS10-65	Report #: 315160 A
EUT: TiS65	Serial #: Radiated: TiS65-15069005 Conducted:A15050019	LSR Job #: C-2234



Note: Bluetooth and WLAN radios do not transmit at the same time. Please refer to Appendix D for BT and WLAN Coexistence information.

2.5 - Product Description

The Fluke, TiS10, TiS20, TiS40, TiS45, TiS50, TiS55, TiS60, and TiS65 Thermal Imagers (the Product or Imager) are handheld, infrared imaging cameras for use in many applications. These applications include equipment troubleshooting, preventive and predictive maintenance, building diagnostics, and research and development. All Imagers display thermal images on a high-visibility, industrial-quality (320X240) LCD touch screen and can save images to a removable memory card. Saved images and data can be transferred through the memory card to a PC, a direct USB connection to the PC, or by wireless transfer to a PC or mobile device. The TiS family has two mechanical versions: The TiS10, TiS20, TiS40, TiS50, and TiS60 use a fixed focus IR lens. The TiS45, TiS55, and TiS65 use a manual focus lens, which includes an external focus ring.

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 - Climate Test Conditions

Temperature:	70 -71° F
Humidity:	32-42%
Pressure:	728-741mmHg

3.2 - Applicability & Summary Of EMC Emission Test Results

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	Yes
FCC : 15.247 (a)(1) IC : RSS 210 A8.1 (a)	20 dB Bandwidth	Yes
FCC : 15.247(b) & 1.1310 IC : RSS 247 5.4	Maximum Output Power	Yes
FCC : 15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes
FCC :15.247(d) IC : RSS 247 5.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC:15.247 (a)(2) IC: RSS 247 5.2	6 dB Bandwidth of a Digital Modulation System	Yes
FCC:15.247 (d) IC: RSS 247 5.2	Power Spectral Density of a Digital Modulation System	Yes
FCC : 15.247(c), 15.209 & 15.205 IC : RSS GEN	Transmitter Radiated Emissions	Yes

3.3 - Modifications Incorporated In The EUT For Compliance Purposes

☒ None ☐ Yes (explain below)

3.4 - Deviations & Exclusions From Test Specifications

☒ None ☐ Yes (explain below)

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-247, Issue 1.

Note: If some emissions are seen to be within 3 dB of their respective limits; as these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. UNWANTED EMISSIONS INTO THE RESTRICTED FREQUENCY BANDS.

5.1 - Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.10-2013. The EUT was placed on an 80cm high non-conductive pedestal below 1 GHz and 150cm non-conductive pedestal above 1 GHz, centered on a flush mounted turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in continuous transmit mode for final testing using power as provided by an AC to DC power supply that comes with the EUT. The unit has the capability to operate on 3 channels, controllable via proprietary software provided by the manufacturer.

The applicable limits apply at a 3 meter distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels to comply with FCC Part 15.31(m).

5.2 - Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 25000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 18 GHz while a standard gain horn antenna was used in the 18 GHz to 25 GHz range. The maximum radiated RF emissions between 30MHz to 25 GHz were found by raising and lowering the sense antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities.

The EUT was positioned in 3 orthogonal orientations.

5.3 - Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at a calibration laboratory accredited to ISO 17025, and are traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz).

5.4 - Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 and Canada RSS-247, Issue 1, for a DTS transmitter. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 - Calculation of Radiated Emissions Limits and reported data.

Reported data:

For both fundamental and spurious emissions measurement, the data reported includes all necessary correction factors. These correction factors are loaded onto the EMI receiver when measurements are performed.

Reported Measurement data = Raw receiver measurement (dBµV/m) + Antenna correction Factor + Cable factor (dB) + Miscellaneous factors when applicable (dB) – amplification factor when applicable (dB).

Generic example of reported data at 200 MHz:

Reported Measurement data = 18.2 (raw receiver measurement) + 15.8 (antenna factor) + 1.45 (cable factor) = 35.45 (dBµV/m).

As specified in 15.247 (d), radiated emissions that fall within the restricted band described in 15.205(c), must comply with the general emissions limit.

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands. The mentioned limits correspond to those limits listed in RSS GEN.

Frequency (MHz)	3 m Limit µV/m	3 m Limit (dBµV/m)	1 m Limit (dBµV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-40,000	500	54.0	63.5

Sample conversion of field strength (µV/m to dBµV/m):
dBµV/m = 20 log $_{10}$ (100)= 40 dBµV/m (from 30-88 MHz)

Per KDB 558074 section 10, an EIRP measurement can be converted to field strength using this relationship:

EIRP = E (electric field strength in dBµV/m) + 20log(d)-104.8
E = EIRP – 20log(d) + 104.8
Sample conversion:
For EIRP = -56.6 dBm,
E (dBµV/m) = -56.6 – 20log(3m) +104.8 = 38.7 dBµV/m
For EIRP = -60.9 dBm,
E (dBµV/m) = -60.9 – 20log(3m) + 104.8 = 34.4 dBµV/m

5.6 - Data:

Manufacturer:	Fluke					
Date(s) of Test:	6/26/15-7/2/15					
Project Engineer(s):	Khairul Aidi Zainal					
Test Engineer(s):	Khairul Aidi Zainal					
Voltage:	120VAC					
Operation Mode:	continuous transmit, modulated					
Environmental Conditions in the Lab:	Temperature: 70° F Relative Humidity: 32%					
EUT Power:	X	Single Phase 120VAC		3 Phase ___VAC		
		Battery		Other: Bench DC Supply		
EUT Placement:	X	80cm non-conductive pedestal	X	150cm non-conductive pedestal		
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

Frequency (MHz)	Ant	EUT	Height (cm)	Azimuth (°)	Peak (dBuV/m)	Q.Peak (dBuV/m)	Average (dBuV/m)	Peak limit (dBuV/m)	Q.Peak limit (dBuV/m)	Average limit (dBuV/m)	Peak margin (dB)	Q.Peak margin (dB)	Average margin (dB)	Notes
1041.7	H	V	195.4	215	52.2	N/A	45.0	74.0	N/A	54.0	21.8	N/A	9.0	1
4824.0	V	S	346.9	341	53.5	N/A	50.9	74.0	N/A	54.0	20.5	N/A	3.1	
4874.0	V	S	358.5	342	54.5	N/A	51.7	74.0	N/A	54.0	19.5	N/A	2.3	
4924.0	V	S	355.1	344	54.2	N/A	52.5	74.0	N/A	54.0	19.8	N/A	1.5	
1000.0	V	F	239.4	298	45.6	45.1	43.5	74.0	54.0	54.0	28.4	8.9	10.5	1
194.4	H	V	100.0	118	N/A	31.2	N/A	N/A	43.0	N/A	N/A	11.8	N/A	1
38.4	V	V	100.0	212	N/A	31.8	N/A	N/A	40.0	N/A	N/A	8.2	N/A	1
420.0	H	V	100.0	143	N/A	40.0	N/A	N/A	46.0	N/A	N/A	6.0	N/A	1
592.0	V	V	100.0	19	N/A	44.7	N/A	N/A	46.0	N/A	N/A	1.3	N/A	1
560.0	V	V	100.0	330	N/A	45.9	N/A	N/A	46.0	N/A	N/A	0.1	N/A	1

Notes:

1. Not a transmitter related emission.
2. H: Horizontal, V: Vertical, S: Side, F: Flat.
3. Refer to exhibit 5.5 on explanation of how data is reported.

5.7 – Screen Captures.

The screen captures below are those using the Peak detector of the analyzer. In addition, the screen captures presented are those which were deemed to be an appropriate representation of the spectrum scan.

30 to 300 MHz, 3m distance.

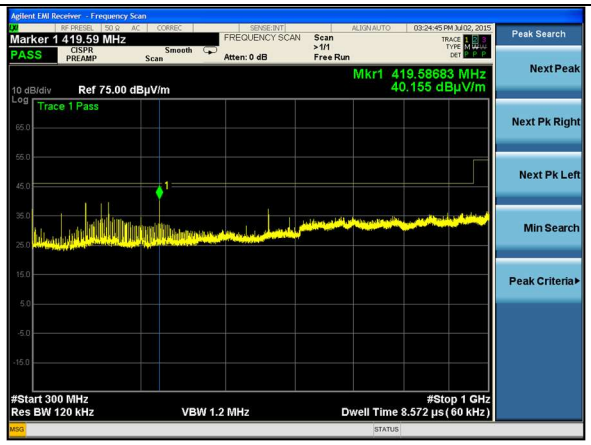
Horizontal Transmitter enabled

Horizontal Transmitter disabled

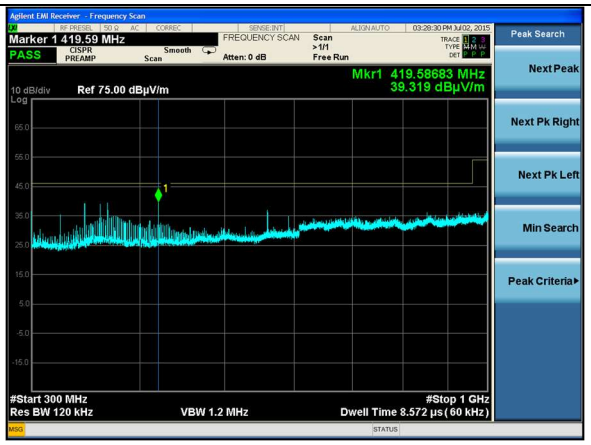
Vertical Transmitter enabled

Vertical Transmitter disabled

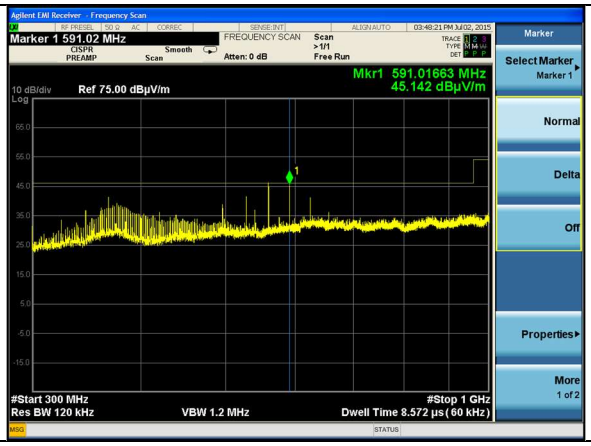
300 to 1000 MHz, 3m distance.



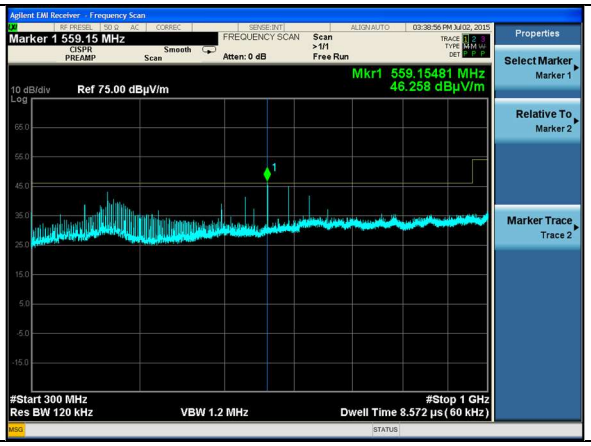
Horizontal Transmitter enabled



Horizontal Transmitter disabled



Vertical Transmitter enabled



Vertical Transmitter disabled

1000 to 2400 MHz, 3m distance.

Horizontal (Reduced bandwidth)	Vertical (Reduced bandwidth)

.

2310 to 2390 MHz, 3m distance.

Average	Peak

Notes:

1. The plot above taken when EUT was in IEEE 802.11g mode and represents worst case. IEEE 802.11b, IEEE 802.11n (HT20) and IEEE 802.11n (HT40) modes were tested and found to be lower in emission.
2. Table below shows points on the plot of the maximum emission:

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2390.0	64.6	74.0	9.4	2390.0	47.7	54.0	6.3

Note: The range 2483.5 to 2500 MHz is in section 8 of this report (Band-edges).

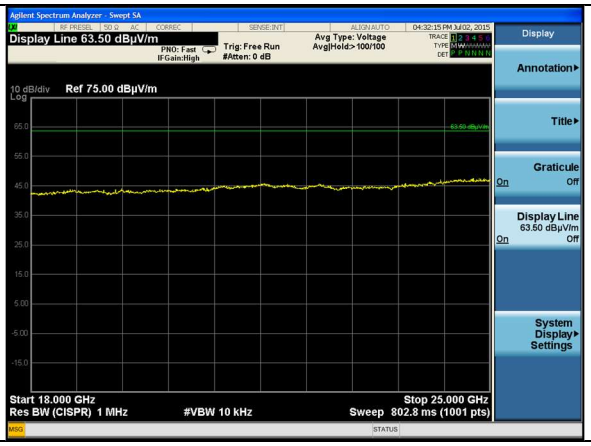
2500 to 4000 MHz, 3m distance.

Horizontal (Reduced bandwidth)

Vertical (Reduced bandwidth)

4000 to 25000 MHz, 3m distance.

4000 to 18000 MHz (reduced bandwidth)



18000 to 25000 MHz (reduced bandwidth)

EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4 and with Title 47 CFR, FCC Part 15, Industry Canada RSS GEN. The EUT was placed on a non-conductive table, with a height of 80 cm above the reference ground plane. The power supply was then plugged into a 50Ω (ohm), Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the EMI receiver System. The LSIN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

6.2 Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1, Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

6.3 Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. All cables are calibrated and checked periodically for conformance. The emissions are measured on the EMI System, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

6.4 Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 and RSS GEN 7.2.4 for Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

6.5 FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBµV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

6.6 CONDUCTED EMISSIONS TEST DATA CHART

Frequency Range inspected: 150 KHz to 30 MHz

Manufacturer:	Fluke					
Date(s) of Test:	9/11/15					
Project Engineer:	Khairul Aidi Zainal					
Test Engineer:	Khairul Aidi Zainal					
Voltage:	120 VAC and 230VAC					
Operation Mode:	Continuous transmit, modulated					
Environmental Conditions in the Lab:	Temperature: 71° F Relative Humidity: 40%					
Test Location:	X	AC Mains Test area				Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:		Peak	X	Quasi-Peak	X	Average

120VAC, 60Hz

		Quasi-Peak			Average		
Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.159	1	46.7	65.5	18.8	32.0	55.5	23.5
0.347	1	44.9	59.0	14.1	36.2	49.0	12.8
3.952	1	38.6	56.0	17.4	30.8	46.0	15.2
5.392	1	33.2	60.0	26.8	25.4	50.0	24.6
0.159	2	46.0	65.5	19.5	30.5	55.5	25.0
0.455	2	42.6	56.8	14.2	32.6	46.8	14.2
3.871	2	38.8	56.0	17.2	31.5	46.0	14.5
5.922	2	34.1	60.0	25.9	26.6	50.0	23.4

Notes:

1) The emissions listed are characteristic of the power supply used and not that of the transmitter. Changing transmit channels did not change the emissions.

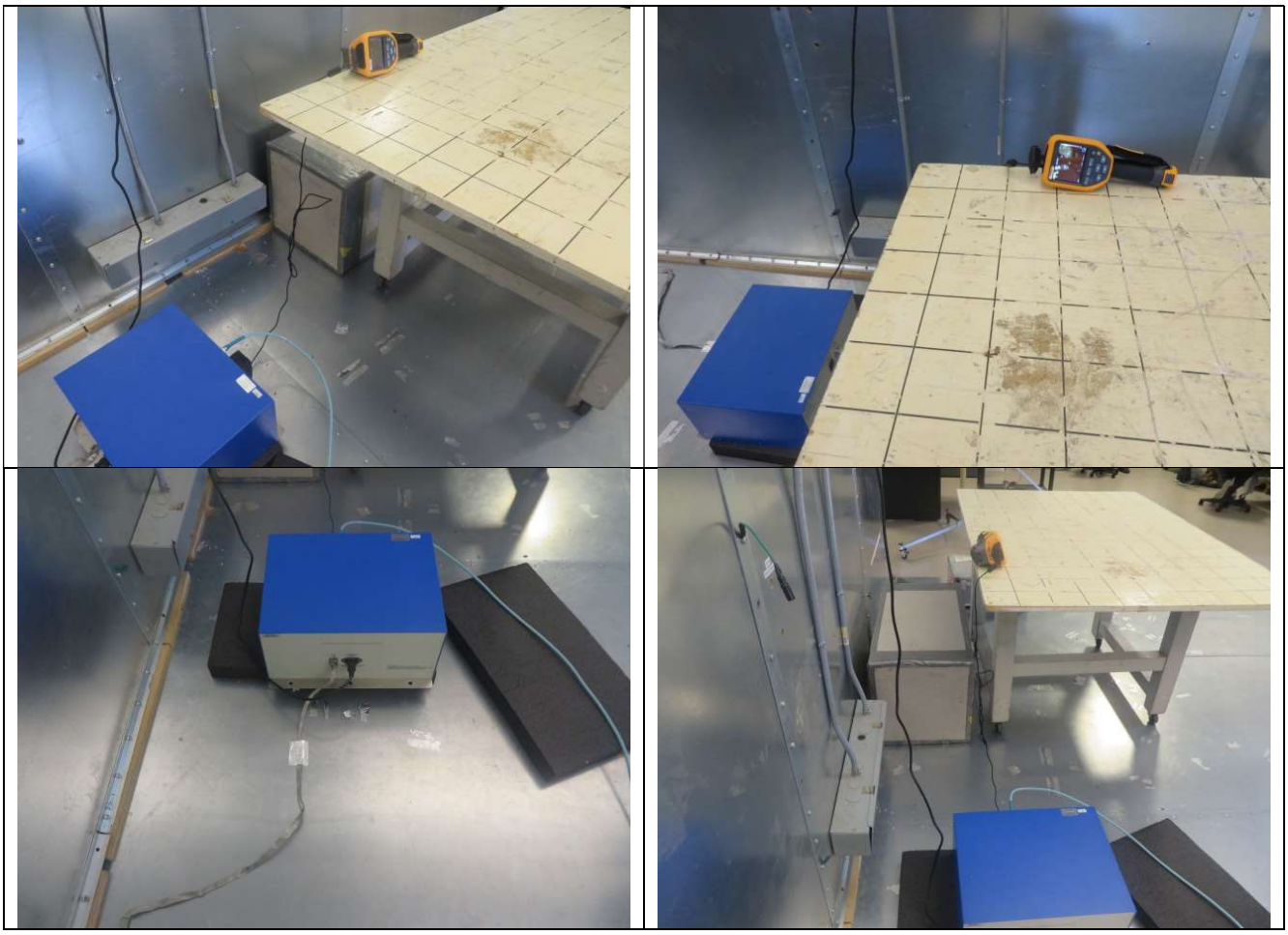
230VAC, 50Hz

		Quasi-Peak			Average		
Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.173	1	46.3	64.8	18.5	37.3	54.8	17.5
0.406	1	45.3	57.7	12.4	34.0	47.7	13.7
0.604	1	42.9	56.0	13.1	33.3	46.0	12.7
0.995	1	42.3	56.0	13.7	33.1	46.0	12.9
0.159	2	44.2	65.5	21.3	32.7	55.5	22.8
0.397	2	45.1	57.9	12.8	35.3	47.9	12.6
0.512	2	43.0	56.0	13.0	34.4	46.0	11.6
0.995	2	42.8	56.0	13.2	33.7	46.0	12.3

Notes:

1) The emissions listed are characteristic of the power supply used and not that of the transmitter. Changing transmit channels did not change the emissions.

6.7 Test Setup Photo(s) – Conducted Emissions Test



Prepared For: Fluke Corporation	Model #: TiS10-65	Report #: 315160 A
EUT: TiS65	Serial #: Radiated: TiS65-15069005 Conducted:A15050019	LSR Job #: C-2234

6.8 Screen Captures – Conducted Emissions Test

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized.

120 VAC, 60Hz

Line 1

Line 2

230 VAC, 50Hz

Line 1

Line 2

EXHIBIT 7. OCCUPIED BANDWIDTH

Test Engineer(s): Khairul Aidi Zainal

7.1 - Limits

For a DTS system operating in the 2400 to 2483.5 MHz band, the 6dB emission bandwidth limit is 500 kHz.

7.2 - Method of Measurements

For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. A bandwidth measurement function that is built into the spectrum analyzer was used to measure the 20dB/emission bandwidth while the 6dB bandwidth was measured using **FCC OET KDB 558074 section 8 option2.**

Note:
The 20dB bandwidth was measured for use with the measurement method prescribed in FCC OET KDB 558074 for maximum conducted power.

7.3 - Test Data

WLAN

802.11 Standard	Data Rate (MBPS)	Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)	6dB Bandwidth minimum limit (MHz)
b	1 (DBPSK)	1	10.1	14.6	17.0	0.5
		6	10.1	14.6	16.9	0.5
		11	10.1	14.6	16.8	0.5
b	11 (8QPSK)	1	10.4	14.6	16.9	0.5
		6	11.0	14.6	17.0	0.5
		11	10.6	14.6	16.9	0.5
g	6 (BPSK)	1	15.1	16.6	18.5	0.5
		6	15.1	16.5	18.0	0.5
		11	15.1	16.5	18.1	0.5
g	54 (64QAM)	1	16.0	16.4	17.7	0.5
		6	15.4	16.3	17.4	0.5
		11	15.1	16.3	17.5	0.5
n (HT20)	MCS0 (BPSK)	1	15.1	17.7	19.3	0.5
		6	15.1	17.6	18.8	0.5
		11	15.1	17.6	19.0	0.5
n (HT20)	MCS7 (64QAM)	1	16.7	17.6	18.6	0.5
		6	15.1	17.5	18.5	0.5
		11	15.1	17.4	18.4	0.5
n (HT40)	MCS0 (BPSK)	3	35.2	36.0	37.9	0.5
		6	35.2	35.9	37.9	0.5
		9	35.2	36.0	38.0	0.5
n (HT40)	MCS7 (64QAM)	3	35.4	35.8	37.7	0.5
		6	35.5	36.0	37.7	0.5
		9	35.8	35.9	37.6	0.5

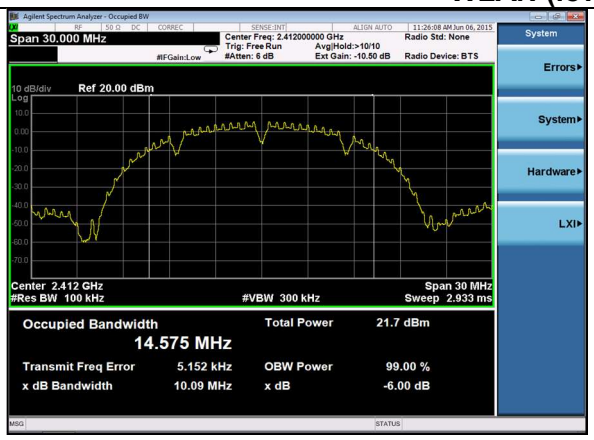
BLE

Data Rate (MBPS)	Channel (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)	6dB Bandwidth minimum limit (kHz)
1	2402	683.6	1.03	1.19	500.0
	2440	694.6	1.03	1.19	500.0
	2480	707.2	1.03	1.19	500.0

7.4 – Screen Captures

Examples of bandwidth measurements:

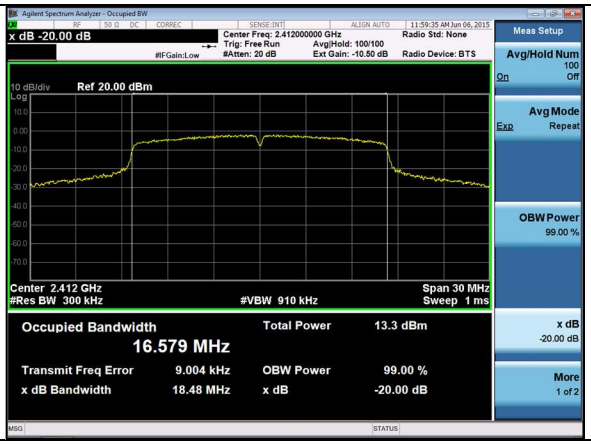
WLAN (lowest channel)



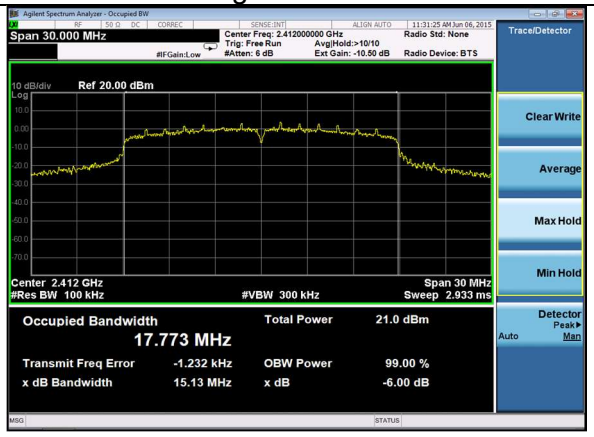
802.11b 6dB bandwidth

802.11b -20dB and 99% bandwidth

802.11g 6dB bandwidth

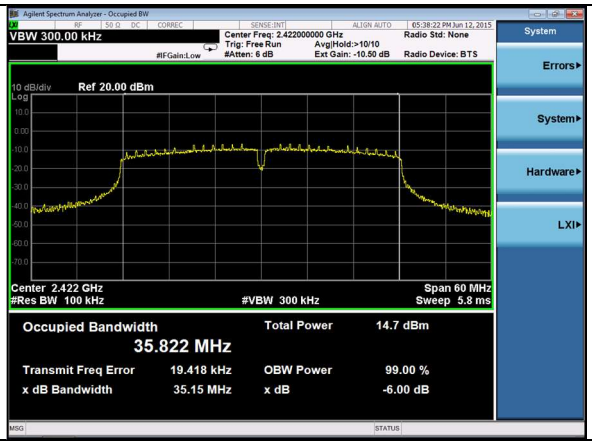


802.11g -20dB and 99% bandwidth

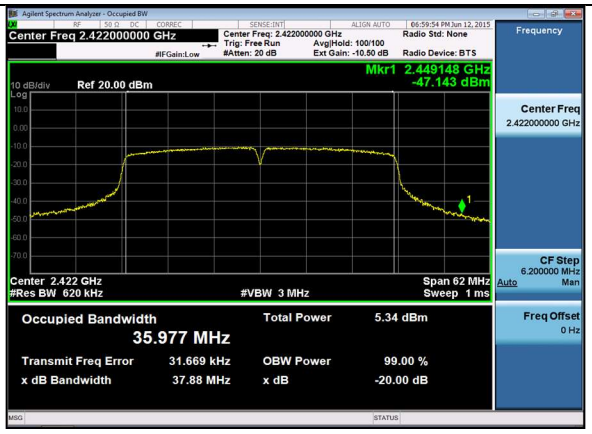


802.11n (HT20) 6dB bandwidth

802.11n (HT20) -20dB and 99% bandwidth



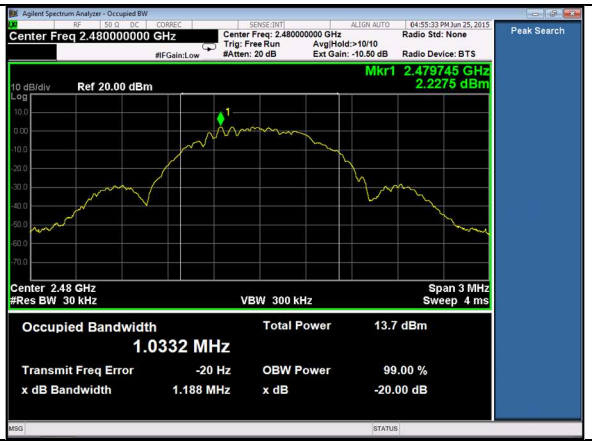
802.11n (HT40) 6dB bandwidth



802.11n (HT40) -20dB and 99% bandwidth

BLE

6dB bandwidth



-20dB and 99% bandwidth

EXHIBIT 8. BAND EDGE MEASUREMENTS

Test Engineer(s): Aidi Zainal

8.1 - Method of Measurements

FCC 15.247 require a measurement of spurious emission levels at the restricted band to be compliant to the general emissions limit, in particular at the Band-Edges where the intentional radiator operates. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

The Band-edge measurements were performed conducted (100kHz bandwidth) and radiated. The measurement of band-edge was performed to satisfy FCC 15.247(d).

Per FCC KDB 558074 D01 Measurement Guidance v03r03 (section 11), conducted measurements were performed with 100 kHz bandwidth for all emissions outside of the band of operation. Emissions in the restricted band, a bandwidth of 120kHz (below 1000MHz) and 1MHz (above 1000MHz) were used in accordance with C63.4 and was performed radiated.

For both conducted and radiated measurements, correction factors and the cable loss factors were entered into the EMI Receiver database. **As a result, the plots taken from the EMI Receiver accounts for all applicable correction factor as well as cable loss, and can therefore be entered into the database as a corrected meter reading.**

8.2. Band edge screen captures.

The data presented below are samples selected from the various data rates and channels tested.

Band-edge in Restricted Band

Wlan Data:

A. 1 MBPS

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2487.9	58.9	74.0	15.1	2488.7	46.8	54.0	7.2

B. 11 MBPS

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2486.0	59.0	74.0	15.0	2486.1	45.1	54.0	8.9

C. 6 MBPS

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2484.5	68.1	74.0	5.9	2483.5	47.0	54.0	7.0

D. 54 MBPS

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2484.6	64.9	74.0	9.1	2483.6	43.5	54.0	10.5

E. MCS0 HT20

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2483.7	65.8	74.0	8.2	2483.5	44.9	54.0	9.1

F. MCS7 HT20

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2483.7	67.4	74.0	6.6	2483.5	43.9	54.0	10.1

G. MCS0 HT40

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2483.7	65.8	74.0	8.2	2483.5	44.4	54.0	9.6

H. MCS0 HT40

Peak Frequency (MHz)	Peak (dBuV/m)	Peak limit (dBuV/m)	Peak Margin (B)	Average Frequency (MHz)	Average (dBuV/m)	Average limit (dBuV/m)	Average Margin (B)
2489.0	60.2	74.0	13.8	2483.5	43.8	54.0	10.2