

# **Permissive Change Application**

#### For

Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and 15.247 and Innovation Science and Economic Development Canada Certification per RSS-Gen General Requirements for Radio Apparatus and RSS-247 Digital Transmission Systems (DTS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

For the

Murata Electronics North America Model: CCT24

> FCC ID: HSW-CCT24 IC: 4492A-CCT24 UST Project: 17-0439 Issue Date: April 9, 2018

> Total Pages in This Report: 75

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I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By:	Alan Ghasiani	
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Name: Man Shahan

Title: Compliance Engineer – President

Date April 9, 2018

TESTING

NVLAP LAB CODE 200162-0

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# MEASUREMENT TECHNICAL REPORT

COMPANYS NAME:	Murata Electronics North America
MODEL:	CCT24
FCC ID:	HSW-CCT24
IC:	4492A-CCT24

**DATE:** April 5, 2018

This report concerns (check one): Original grant Class II change 🛛				
Equipment type: DTS Transmitter Module				
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes No $\underline{X}$ If Yes, defer until: $\underline{N/A}_{date}$ agrees to notify the Commission by $\underline{N/A}_{date}$ of the intended date of announcement of the product so that the grant can be issued on that date.				
Report prepared by:				
US Tech 3505 Francis Circle Alpharetta, GA 30004				
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Permissive Change Letter Agency Agreement Application Forms Letter of Confidentiality Block Diagram(s) Schematic(s) Test Configuration Photographs Internal Photographs External Photographs Antenna Photographs RF Exposure User's Manual

#### **1** General Information

#### **1.1 Purpose of this Report**

The purpose of this report is to file for a Class II permissive change. The reason for the Class II permissive change is due to the following:

-EUT PCB modifications (no circuits in the transmit path changed) -EUT shielding improvements

-Transmitter Frequency shifted from originally approved frequencies (software level changes only)

The PCB changes consist of moving the up/down converter IC and associated passive components to the bottom of the board. Filtering was added to the receive path of this IC which is also placed on the back of the board. A 9 dB attenuator following the up/down converter was changed to a 0 dB attenuator and a 16 dB attenuator now precedes the up/down convertor. No other circuit changes were made. There were no changes made to the circuit in the transmit path. The transmit path remains unchanged.

The shielding changes include installing a single piece shield on the back of the board in addition to the shielding that was originally in place.

The transmit channels were moved a block down in frequency, 2.95 MHz. Formerly, channel 0 (lowest channel) was at 2409.55 MHz and channel 25 (highest channel) was at 2479.85 MHz. Now, channel 0 is 2406.6 MHz and channel 25 is 2476.9 MHz. Spacing and channel bandwidth has not been altered. This is a software change only; no hardware changes and no changes to the basic frequency determining and stabilization circuits, frequency multiplication stages, basic modulator circuit or maximum output power levels.

Due to the changes, the following test were performed to show that the EUT continues to comply with the relevant subpart:

- Spurious conducted emissions
- Spurious radiated emissions
- Occupied Bandwidth
- Conducted output power
- Bandedge measurements
- Restricted band measurements

# **1.2 Characterization of Test Sample**

The sample used for testing was received by US Tech on October 6, 2017 and March 14, 2018 in good operating condition.

#### **1.3 Product Description**

The Equipment Under Test (EUT) is the Murata Electronics North America, Model CCT24. The EUT is a 2.4 GHz transceiver designed for use in industrial and commercial monitoring and control markets.

Technical Information:

Detail	Description
Frequency Range	2406.60 – 2476.90 MHz
Number of Channels	38
Modulation Format	FSK
Data Rate(s)	362kbps
Operating Voltage	3.3VDC – 5.5VDC
Number of Inputs/Outputs	2(Tx/Rx Diversity)
Antenna Type / Gain	Corner Reflector / 14dBi
	PIFA / 4dBi
	CP Beam / 14dBi
	Patch / 12dBi
	Omni / 9dBi
	Yagi / 13.9dBi

#### 1.4 Configuration of Tested System

The Test Sample was tested per ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices for the intentional radiator aspect of the device and ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014) for the unintentional radiator aspect of the device as well as FCC subpart B and C of Part 15 and per FCC KDB Publication number 558074 v04 for Digital Transmission Systems Operating Under section 15.247.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided as separate exhibits.

### 1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

#### 1.6 Related Submittals

The EUT is subject to the following FCC authorizations:

- a) Certification under section 15.247 as a transmitter.
- b) Verification under 15.101 as a digital device and receiver.

# Table 1. EUT and Peripherals

EUT/ MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID/IC	CABLES P/D
Radio Module Murata	CCT24	000252	HSW-CCT24 4492A-CCT24	N/A
PERIPHERAL/ MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID/IC	CABLES P/D
Evaluation Board/ Murata	801039 REV A	E208126	None	1.5 m U P 1.5 m U D
Power Supply Adapter/ GlobTek Inc	GT-41052-1509	None	None	1.8 m U P
Antenna	Various	Various	None	N/A

U= Unshielded S= Shielded

P= Power D= Data



Figure 1. Block Diagram of Test Configuration

#### 2 Tests and Measurements

#### 2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are indicated.

#### Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	8593E	HEWLETT- PACKARD	3205A00124	10/25/2018
SPECTRUM ANALYZER	N9342CN	AGILENT	SG05310114	7/21/2018
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	6/22/2018
HORN ANTENNA	3115	EMCO	9107-3723	9/22/2018 2 yr.
PRE-AMPLIFIER	PRE-AMPLIFIER 8449B		3008A00480	12/01/2018

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

#### 2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

#### 2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 below.

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near the Top 1 near the Bottom
Greater than 10 MHz	3	1 near Top 1 near Middle 1 near Bottom

#### Table 3. Number of Test Frequencies for Intentional Radiators

Because the EUT operates at 2400 MHz to 2483.5 MHz, 3 test frequencies were used.

#### 2.4 Frequency Range of Radiated Measurements (Part 15.33)

#### 2.4.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10<sup>th</sup> harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

#### 2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following the following:

Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

#### Pulsed Transmitter Averaging (Duty Cycle)

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may be expressed logarithmically in dB.

For average radiated measurements, using a 5.083% duty cycle, the measured level was reduced by a factor -25.88dB. The duty cycle correction factor is determined using the formula 20log (5.083/100) = -25.88dB.

Detailed analysis of the duty cycle timing is provided in the Theory of Operation accompanying the original application for certification.

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Model:	CCT24

#### 2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this module.

REPORT REFERENCE	MANUFACTURER	MANUFACTURER TYPE OF MODE		GAIN dB <sub>i</sub>	TYPE OF CONNECTOR
Antenna 1	RF Venue	CP Beam	2.4 GHz CP Beam	14.0	RP-SMA to u.fl
Antenna 2	Murata	Patch	Patch P/N 800485	12.0	MMCX to u.fl
Antenna 3	World Products Inc	PIFA	WPANT100 80-S1A	4.0	u.fl
Antenna 4	Cushcraft	Yagi	PC2415	13.9	N type to u.fl
Antenna 5	Mobile Mark	Corner Reflector	SCR14- 2400CT	14.0	N type to u.fl
Antenna 6	Mobile Mark	Dipole	OD9-2400	9.0	N Type to u.fl

#### Table 4. Allowed Antenna(s)

#### 2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other spurious emissions are examined for this requirement in the sections below.

### 2.8 Intentional Radiator, Emissions Measurements (CFR 15.209, 15.247(d))

#### 2.8.1 Conducted Spurious emissions

The EUT was put into a continuous-transmit mode of operation and tested per ANSI C63.10:2013 and KDB 558074 v04, clause 11 for conducted out of band emissions in non restricted bands emanating from the antenna port over the frequency range of 30 MHz to 25 GHz. The measurements were performed on the EUT to identify and record the spurious signals that were related to the transmitter to show that all spurious emissions were at least 20 dB below the fundamental frequency.



Figure 2. Antenna Conducted Emissions Low Channel, 30 MHz – 1 GHz Green Line= Limit line



Figure 3. Antenna Conducted Emissions Low Channel, 1 GHz – 3 GHz Green Line= Limit line



Figure 4. Antenna Conducted Emissions Low Channel, 3 GHz – 25 GHz Green Line= Limit line



Figure 5. Antenna Conducted Emissions Mid Channel, 30 MHz – 1 GHz Green Line= Limit line



Figure 6. Antenna Conducted Emissions Mid Channel, 1 GHz – 3 GHz Green Line= Limit line



Figure 7. Antenna Conducted Emissions MId Channel, 3 GHz – 25 GHz Green Line= Limit line



Figure 8. Antenna Conducted Emissions High Channel, 30 MHz – 1 GHz Green Line= Limit line



Figure 9. Antenna Conducted Emissions High Channel, 1 GHz – 3 GHz Green Line= Limit line



Figure 10. Antenna Conducted Emissions High Channel, 3 GHz – 25 GHz Green Line= Limit line

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Model:	CCT24

### 2.8.2 Radiated Spurious Emissions

The EUT was placed into a continuous transmit mode of operation (>98%) duty cycle) and tested per ANSI C63.10:2013. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the device. A preliminary scan was performed on the EUT to find the worse case results. The EUT was tested in X, Y, and Z axes or in the orientation of normal operation if the device is designed to operate in a fixed position. For spurious emissions other than fundamental and harmonic emissions, spurious emissions emanating from the EUT enclosure, the antenna port was terminated with a 50 ohm load during testing. For fundamental and harmonic emissions the EUT was tested with each of the antennas reference in Table 4 above.

### Table 5. Spurious Radiated Emissions 150 kHz-30MHz (CFR 15.209)

Test By:	Test	: FCC Part 1	5.209	Client: Murata					
JF Pr	roject: 17-04	39		Model: CCT24					
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG		
	This test was not re-evaluated.								

## SAMPLE CALCULATION: N/A

Test Date: March 19, 2018 Tested By Signature:

# Table 6. Spurious Radiated Emissions (CFR 15.209), 30 MHz to 1000 MHz

30 MHz to 1000 MHz								
Test	t: Radiate	d Emissions			Cli	ent: Murata		
	Project: <sup>•</sup>	17-0439			Мо	del: CCT24		
Frequency (MHz)	Test Data (dBuv)	Additional Factor (dB)	AF+CA- AMP (dB/m)	Results (dBuV/m)	QP Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or QP
39.14	31.92		-13.81	18.11	40.0	3m./HORZ	21.9	PK
133.08	43.16		-14.73	28.43	43.5	3m./HORZ	15.1	PK
51.03	39.71		-17.17	22.54	40.0	3m./VERT	17.5	PK
124.50	39.99		-14.82	25.17	43.5	3m./VERT	18.3	PK
201.00	33.88		-13.59	20.29	43.5	3m./HORZ	23.2	PK
264.36	34.98		-11.83	23.15	46.0	3m./HORZ	22.8	PK
965.40	29.95		-1.30	28.65	54.0	3m./HORZ	25.3	PK
201.00	32.98		-13.89	19.09	43.5	3m./VERT	24.4	PK
262.50	33.80		-12.32	21.48	46.0	3m./VERT	24.5	PK
981.60	29.80		-2.19	27.61	54.0	3m./VERT	26.4	PK

#### SAMPLE CALCULATION at: 39.14 MHz

Magnitude of Measured Frequency	31.92	dBuV
+Additional Factor (Distance Extrapolation)	0.0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	-13.81	dB/m
Corrected Result	18.11	dBuV/m

Test Date: March 19, 2018 Tested By Signature:

# Table 7. Spurious Radiated Emissions (CFR 15.209) 1 GHz to 25 GHz

1 GHz to 25 GHz, Part 15.209 Limits									
Test: Radiated Emissions				Client: Murata					
	Project: 17-0439				Model: C	Model: CCT24			
Frequency (MHz)	Test Data (dBuv)	AF+CA-AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or AVG		
Besides t	he emission	s reported in the t	table below, a applicable	all other emis limit.	ssions were at le	east 20 dB f	rom the		

## SAMPLE CALCULATION at: N/A

Test Date: March 19, 2018 Tested By Signature:

Test: FCC Part 15, Para 15.209, 15.247(d)					Client: Murata Electronics North America				
	Proj	ect: 17-04	439			Model: CCT24			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode	
2406.6	87.86		31.26	119.12		3.0m./HORZ		PK	
2406.6	81.28		31.26	112.54		3.0m./HORZ		AVG	
4813.2*	46.68		5.58	52.26	74.0	3.0m./HORZ	21.7	PK	
4813.2*	38.36		5.58	43.94	54.0	3.0m./HORZ	10.1	AVG	
2440.80	85.24		31.26	116.50		3.0m./HORZ		PK	
2440.80	78.85		31.26	110.11		3.0m./HORZ		AVG	
4881.60*	45.49		5.52	51.01	74.0	3.0m./HORZ	23.0	PK	
4881.60*	38.45		5.52	43.97	54.0	3.0m./HORZ	10.0	AVG	
2476.90	84.37		31.26	115.63		3.0m./HORZ		PK	
2476.90	78.62		31.26	109.88		3.0m./HORZ		AVG	
4953.80*	45.57		5.81	51.38	74.0	3.0m./HORZ	22.6	PK	
4953.80*	38.48		5.81	44.29	54.0	3.0m./HORZ	9.7	AVG	

#### Table 8. Radiated Fundamental & Harmonic Emissions - ANTENNA 1

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247

2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic

3. Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

4. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4813.20 MHz:

Magnitude of Measured Frequency	46.68	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	5.58	dB/m
1 meter to 3 meter extrapolation	0.0	dB
Corrected Result	52.26	dBuV/m

Test Date: November 6, 2017 Tested By

Signature:

Test: FCC Part 15, Para 15.209, 15.247(d)					Client: Murata Electronics North America			
	Proj	ect: 17-04	439	· ·	Model: CCT24			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
2406.6	90.88		31.26	122.14		3.0m./HORZ		PK
2406.6	85.18		31.26	116.44		3.0m./HORZ		AVG
4813.2*	46.14		6.91	53.05	74.0	3.0m./HORZ	20.9	PK
4813.2*	37.76		6.91	44.67	54.0	3.0m./HORZ	9.3	AVG
2440.80	90.43		31.26	121.69		3.0m./HORZ		PK
2440.80	84.69		31.26	115.95		3.0m./HORZ		AVG
4881.60*	45.64		6.75	52.39	74.0	3.0m./HORZ	21.6	PK
4881.60*	38.47		6.75	45.22	54.0	3.0m./HORZ	8.8	AVG
2476.90	91.05		31.26	122.31		3.0m./HORZ		PK
2476.90	85.28		31.26	116.54		3.0m./HORZ		AVG
4953.80*	46.58		6.90	53.48	74.0	3.0m./HORZ	20.5	PK
4953.80*	38.70		6.90	45.60	54.0	3.0m./HORZ	8.4	AVG

#### Table 9. Radiated Fundamental & Harmonic Emissions - ANTENNA 2

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247

2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic

3. Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

4. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4813.20 MHz:

Magnitude of Measured Frequency	46.14	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	6.91	dB/m
1 meter to 3 meter extrapolation	0.0	dB
Corrected Result	53.05	dBuV/m

Test Date: November 6, 2017 Tested By Signature:

	laulated	i i unua				13 - ANT LINN		
<b>Test:</b> FCC Part 15, Para 15.209, 15.247(d)			Client: Murata Electronics North America					
	Proj	ect: 17-04	439			Model: CC	CT24	
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
2406.6	78.50		31.26	109.76		3.0m./HORZ		PK
2406.6	72.84		31.26	104.10		3.0m./HORZ		AVG
4813.2*	46.28		6.91	53.19	74.0	3.0m./HORZ	20.8	PK
4813.2*	37.74		6.91	44.65	54.0	3.0m./HORZ	9.3	AVG
								•
2440.80	78.98		31.26	110.24		3.0m./HORZ		PK
2440.80*	73.49		31.26	104.75		3.0m./HORZ		AVG
4881.60*	45.51		6.75	52.26	74.0	3.0m./HORZ	21.7	PK
4881.60*	37.65		6.75	44.40	54.0	3.0m./HORZ	9.6	AVG
2476.90	80.87		31.26	112.13		3.0m./HORZ		PK
2476.90	73.18		31.26	104.44		3.0m./HORZ		AVG
4953.80*	45.93		6.90	52.83	74.0	3.0m./HORZ	21.2	PK
4953.80*	37.13		6.90	44.03	54.0	3.0m./HORZ	10.0	AVG

#### Table 10 Padiated Fundamental & Harmonic Emissions - ANTENNA 3

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247 2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic

3. Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

4. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4813.20 MHz:

Magnitude of Measured Frequency	46.28	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	6.91	dB/m
1 meter to 3 meter extrapolation	0.00	dB
Corrected Result	53.19	dBuV/m

Test Date: November 6, 2017

Tested By Signature:

FCC ID:

Issue Date:

Customer:

Model:

Test Report Number:

IC:

Table 11. Radiated Fundamental & Harmonic Emissions- ANTENNA 4								
Test: FCC Part 15, Para 15.209, 15.247(d)				247(d)	Client: Murata Electronics North America			
	Proj	ect: 17-04	439			Model: CC	CT24	
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
2406.6	84.55		31.26	115.81		3.0m./HORZ		PK
2406.6	78.96		31.26	110.22		3.0m./HORZ		AVG
4813.2*	46.94		5.58	52.52	74.0	3.0m./HORZ	21.5	PK
4813.2*	37.75		5.58	43.33	54.0	3.0m./HORZ	10.7	AVG
2440.80	87.41		31.26	118.67		3.0m./HORZ		PK
2440.80	81.74		31.26	113.00		3.0m./HORZ		AVG
4881.60*	45.29		5.52	50.81	74.0	3.0m./HORZ	23.2	PK
4881.60*	38.35		5.52	43.87	54.0	3.0m./HORZ	10.1	AVG
				•				
2476.90	88.04		31.26	119.30		3.0m./HORZ		PK
2476.90	81.79		31.26	113.05		3.0m./HORZ		AVG
4953.80*	46.03		5.81	51.84	74.0	3.0m./HORZ	22.2	PK

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247 2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic

44.20

54.0

3.0m./HORZ

9.8

AVG

3. Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

5.81

4. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4813.20 MHz:

38.39

Magnitude of Measured Frequency	46.94	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	5.58	dB/m
1 meter to 3 meter extrapolation	0.0	dB
Corrected Result	52.52	dBuV/m

Test Date: November 6, 2017

Tested By Signature:

US Tech Test Report:

Test Report Number:

FCC ID:

Model:

Issue Date: Customer:

4953.80\*

IC:

<b>Test:</b> FCC Part 15, Para 15.209, 15.247(d)			Client: Murata Electronics North America					
	Proj	ect: 17-04	439		Model: CCT24			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
2406.6	91.07		30.07	121.14		3.0m./HORZ		PK
2406.6	84.80		30.07	114.87		3.0m./HORZ		AVG
4813.2*	50.42		3.79	54.21	74.0	3.0m./HORZ	19.8	PK
4813.2*	41.42		3.79	45.21	54.0	3.0m./HORZ	8.8	AVG
2440.80	89.84		30.11	119.95		3.0m./HORZ		PK
2440.80	84.17		30.11	114.28		3.0m./HORZ		AVG
4881.60*	46.37		3.75	50.12	74.0	3.0m./HORZ	23.9	PK
4881.60*	37.24		3.75	40.99	54.0	3.0m./HORZ	13.0	AVG
2476.90	89.89		30.13	120.02		3.0m./HORZ		PK
2476.90	84.17		30.13	114.30		3.0m./HORZ		AVG
4953.80*	46.56		4.08	50.64	74.0	3.0m./HORZ	23.4	PK
4953.80*	38.32		4.08	42.40	54.0	3.0m./HORZ	11.6	AVG

#### Table 12. Radiated Fundamental & Harmonic Emissions- ANTENNA 5

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247

2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic

3. Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

4. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4813.20 MHz:

Magnitude of Measured Frequency	50.42	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	3.79	dB/m
1 meter to 3 meter extrapolation	0.00	dB
Corrected Result	54.21	dBuV/m

Test Date: November 6, 2017

Tested By Signature:

<b>Test:</b> FCC Part 15, Para 15.209, 15.247(d)			Client: Murata Electronics North America					
	Proj	ect: 17-04	439		Model: CCT24			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
2406.6	84.17		31.26	115.43		3.0m./HORZ		PK
2406.6	77.89		31.26	109.15		3.0m./HORZ		AVG
4813.2*	45.79		5.58	51.37	74.0	3.0m./HORZ	22.6	PK
4813.2*	38.05		5.58	43.63	54.0	3.0m./HORZ	10.4	AVG
2440.80	84.87		31.26	116.13		3.0m./HORZ		PK
2440.80	79.36		31.26	110.62		3.0m./HORZ		AVG
4881.60*	46.48		5.52	52.00	74.0	3.0m./HORZ	22.0	PK
4881.60*	38.17		5.52	43.69	54.0	3.0m./HORZ	10.3	AVG
2476.90	82.68		31.26	113.94		3.0m./HORZ		PK
2476.90	77.09		31.26	108.35		3.0m./HORZ		AVG
4953.80*	45.30		5.81	51.11	74.0	3.0m./HORZ	22.9	PK
4953.80*	38.33		5.81	44.14	54.0	3.0m./HORZ	9.9	AVG

#### Table 13. Radiated Fundamental & Harmonic Emissions - ANTENNA 6

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247

2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic

3. Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

4. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4813.20 MHz:

Magnitude of Measured Frequency	45.79	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	5.58	dB/m
1 meter to 3 meter extrapolation	0.0	dB
Corrected Result	51.37	dBuV/m

Test Date: November 6, 2017 Tested By

Signature:

US Tech Test Report:	FCC Part 15/ RSS 247 Class II Permissive Change
FCC ID:	HSW-CCT24
IC:	4492A-CCT24
Test Report Number:	17-0439
Issue Date:	April 9, 2018
Customer:	Murata Electronics North America
Model:	CCT24

#### 2.9 Six (6) dB Bandwidth per CFR 15.247(a)(2)

The EUT antenna port was connected to a spectrum analyzer having a  $50\Omega$  input impedance. Measurements were performed following the guidelines of ANSI C63.10:2013.

# Table 14. 6 dB Bandwidth and 99% Occupied Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2406.60	1.273	0.5	1.4032
2440.80	1.263	0.5	1.4178
2476.90	1.261	0.5	1.4299

Test Date: March 23, 2018 Tested By

Signature:

111

Name<u>: John Freeman</u>

<b>₩ Agilent</b> 13:17:12 Mar 23, 2018 L	Trace/View
Ch Freq 2.40637 GHz Trig Fre Occupied Bandwidth	ee <b>Trace</b> <u>1</u> 2 3
Ref 25 dBm #Atten 30 dB Ext PG – 9 dB	Clear Write
#Samp Log 10 dB/	Max Hold
	Min Hold
Center 2.406 GHz Span 3 M #Res BW 100 kHz VBW 300 kHz Sweep 5 ms (401 pt	Hz (s)
Occupied Bandwidth         Осс ВМ % Рыг         99.00           1.4032 MHz         × dB         -6.00 c	% Blank
Transmit Freq Error254.693 kHzx dB Bandwidth1.273 MHz*	More 1 of 2

Figure 11. Six (6) dB Bandwidth– Low Channel
<b>₩ Agilent</b> 13:32:21 Mar 23, 2018 L	BW/Avg
Ch Freq     2.44077 GHz     Trig     Free       Occupied Bandwidth     Image: 100     Image: 100	Res BW 100.000000 kHz Auto Man Video BW
Ref 25 dBm *Atten 30 dB Ext PG -9 dB *Samp Log 10 dB/	300.00000 kHz Auto <u>Man</u> VBW/RBW 10.00000 Auto <u>Man</u> Average 100 On Off Avg Type
Center 2.441 GHz Span 3 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 5 ms (401 pts)	Video∙ <u>Auto</u> Man
Occupied Bandwidth         Осс ВМ % Рыг         99.00 %           1.4178 MHz         × dB         -6.00 dB           Transmit Freq Error         42.514 kHz         42.514 kHz           × dB Bandwidth         1.263 MHz*         400 kHz	EMI Res BW, None

Figure 12. Six (6) dB Bandwidth – Mid Channel

₩ Agilent 13:29:06 Mar 23, 2018 L	Trace/View
Ch Freq 2.4769 GHz Trig Free Occupied Bandwidth	<b>Trace</b> <u>1</u> 2 3
<b>RBW 100.0000000 kHz</b> Ref 25 dBm #Atten 30 dB Ext PG -9 dB	Clear Write
#Samp Log 10	Max Hold
	Min Hold
Center 2.477 GHz Span 3 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 5 ms (401 pts)	View
Occupied Bandwidth         Осс ВИ % Риг         99.00 %           1.4299 MHz         × dB         -6.00 dB	Blank
Transmit Freq Error 18.040 kHz × dB Bandwidth 1.262 MHz*	More 1 of 2

Figure 13. Six (6) dB Bandwidth – High Channel

# 2.10 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

Peak power within the band 2400 MHz to 2483.5 MHz was measured per FCC KDB Publication 558074 v04 and ANSI C63.10:2013 as an Antenna Conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, and attenuators to the antenna output terminals on the EUT. The spectrum analyzer was set for an impedance of 50  $\Omega$  with the RBW set greater than the 6 dB bandwidth of the EUT, and the VBW ≥ RBW. Peak antenna conducted output power is tabulated in the table following.

# Table 15. Peak Antenna Conducted Output Power per Part 15.247 (b) (3)

Frequency of Fundamental (MHz)	amental Measured Data Converted Data dBm (mW)		FCC Limit (mW Maximum)
2406.60	17.37	54.57	158.50 (22 dBm)
2440.80	17.68	58.61	158.50 (22 dBm)
2476.90	17.12	51.52	158.50 (22 dBm)

Note: Antenna gain exceeds 6.0 dBi by a maximum value of 8.0 dB, therefore the output power limit is reduced by 8.0 dB per Part 15.247(b)(4).

Test Date: March 21, <u>2</u>018

Tested By Signature:

Name: John Freeman



OutPut Power @ Low Freq

Figure 14. Peak Antenna Conducted Output Power, Low Channel

US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: Model:



#### OutPut Power @ Mid Freq

Figure 15. Peak Antenna Conducted Output Power, Mid Channel

US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: Model:



OutPut Power @ High Freq

Figure 16. Peak Antenna Conducted Output Power, High Channel

#### 2.11 Band Edge Measurements – (CFR 15.247 (d))

Band Edge measurements are made following the guidelines in ANSI C63.10:2013 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Antenna port conducted measurements are performed to demonstrate compliance with the requirement of 15.247(d) that all emissions outside of the band edges be attenuated by at least 20 dB when compared to its highest in-band value (contained in a 100 kHz band).

To capture the band edge set the Spectrum Analyzer frequency span large enough (usually around 3 MHz) to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. Conducted measurements are performed with RBW  $\geq$ 1% of the frequency span. In all cases, the VBW is set  $\geq$ RBW. See figure and calculations below for more detail. This measurement was performed with the EUT continuously transmitting on the low and high channels as well as in normal use mode. US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: <u>Model:</u>



Figure 17. Band Edge Compliance, Low Channel Delta – Peak

Measured Result	56.90	dB
Band Edge Limit	20.00	dB
Band Edge Margin	36.90	dB

US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: <u>Model:</u>

AM1 7.160870 MHz       Peak Search         Log       0.00       48/         10       0.00       48/         -10.00       -10.00       48/         LgAv       -20.00       -20.00         1V P       -30.00       -30.00	
IO dB/         0.00         Next Pea           -10.00         -10.00         Next Pea           LgAv         -20.00         Next Left P           1V P         -30.00         Next Left P	:h
LgAv -20.00 1V P -30.00 2S P	ak
28 P	чĸ
4S P -40.00 Next Right P	чĸ
FC -50.00 FT ETrg -60.00 Pk-Pk Searc	:h
-70:00 To Cente	er
Delta         More           _90.760160870         MHz           Center:2, 3990000006Hz         Span:18,0000000MHz	
RBW:100.000kHz #VBW:10.0 Hz Sweep:71.08 s	2

Figure 18. Band Edge Compliance, Low Channel Delta – Average

Measured Result	59.17	dB
Band Edge Limit	20.00	dB
Band Edge Margin	39.17	dB

US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: Model:

# Agilent13:54:25 2018.04.03	Peak
۵M1 -6.952174 MHz Ref:10.00dBm #Att:30.00dB 57.10 dB Log MPM	Peak Search
10 dB/ 0.00	Next Peak
LgAv -20.00/	Next Left PK
25 P 35 P 45 P FC	Next Right PK
FT ETrg -60.00	Pk-Pk Search
-80 00 Delta	To Center
Center:2.487000000GHz Span:26.000000MHz #RBW:100.000kHz #VBW:300.000kHz Sweep:53.05ms	More 1 of 2

Measured Result	57.10	dB
Band Edge Limit	20.00	dB
Band Edge Margin	37.10	dB

US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: Model:

₩ Agilent13:56:49 2018.	04.03		Peak	
Ref:10.00dBm #Att	۵M1 -7.291304 MHz 10.00dBm #Att:30.00dB 59.33 dB			
10 dB/ 0.00 <b>k</b>			Next Peak	
LgAv -20.00			Next Left PK	
2S P 3S P 4S P FC 50 00			Next Right PK	
FT ETrg -60.00	W.B.		Pk-Pk Search	
-70.00 -80.00 Delta			To Center	
_ <u>3076</u> 8291 <u>3</u> 04 MHz Center:2.487000000GHz #RBW:100.000kHz	#VBW:10.0 Hz	Span:26.000000MHz Sweep:71.09 s	More 1 of 2	
			<b>*</b> •	

Measured Result	59.33	dB
Band Edge Limit	20.00	dB
Band Edge Margin	39.33	dB

🔆 Agi	lent (	12:26:05	5 Mar	16,201	.8					L	Tra	ce/View
Ref 10 Peak Log	14 dBµ\	)	Atten	10 dB							<u>1</u>	Trace
10 dB/											C	lear Write
	1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	who who have	∿-v				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	<del>د</del>			Max Hold
												Min Hold
Start 2 #Res B Mark 1	2.31 GH 3 <u>W 1 MH</u> er T	IZ IZ race (1)	Type Fred	VE	<u>3W 3 MI</u> x 2.3'	Hz Axis 148 GHz	<u> </u>	veep 4	otop 2.3 ms (40 Amplite 48.19 dl	39 GHz 1 pts) ude BuU		View
23			Freq Freq		2.38	500 GHz 314 GHz			47.55 di 46.59 di	ВµV ВµV		Blank
												More 1 of 2

Figure 19. Antenna 1 Restricted Band Measurements 2.31 GHz to 2.39 GHz –Peak

Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2314.80	48.19	-0.27	47.92	74.0	3.0m./HORZ	26.1	PK
2350.00	47.55	-0.25	47.30	74.0	3.0m./HORZ	26.7	PK
2381.40	46.59	-1.15	45.44	74.0	3.0m./HORZ	28.6	PK

# Table 16. Antenna 1 Restricted Band Data (Peak)- Low Channel

∦¥ Agi	ilent 🛛	12:22:50	6 Mar 1	L6, 201	.8					L	Ma	rker
Ref 45 EmiAv	5.93 dB	µ۷	Atten	5 dB		2			3		Select 1 2	t Marker 3 <u>4</u>
10 dB/												Normal
												Delta
											D (Trad Ref	<b>elta Pair</b> :king Ref) <u>Delta</u>
Start : #Res E	2.31 GH 3W 1 MH	z z		VE	3W 3 M	Hz	Swee	р 40.62	Stop 2.3 2 s (40	39 GHz 1 pts)	S	pan Pair
Mark 1	er T	race (1)	Type Freq		X 2.3:	Axis 148 GHz			Amplitu 32.03 dB	ude 3µV	Span	<u>Center</u>
3		(1)	Freq Freq		2.3	500 GHZ 814 GHZ			32.5 di 32.28 di	зµ0 3µV		Off
												<b>More</b> 1 of 2

Figure 20. Antenna 1 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Average

|--|

Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(IVIHZ)	(aBuv)	(aB/m)	(aBuv/m)	(aBuv/m)	Polarization	(aB)	PK/QP/AVG
2314.80	32.03	-0.27	31.76	54.0	3.0m./HORZ	22.2	AVG
2350.00	32.60	-0.25	32.35	54.0	3.0m./HORZ	21.7	AVG
2381.40	32.28	-1.15	31.13	54.0	3.0m./HORZ	22.9	AVG



Figure 21. Antenna 2 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Peak

Table 18. A	ntenna 2 R	estricted	Band Data	(Peak)	- Low	Channel
-------------	------------	-----------	-----------	--------	-------	---------

Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2315.40	48.43	-0.27	48.16	74.0	3.0m./HORZ	25.8	PK
2350.00	49.33	-0.25	49.08	74.0	3.0m./HORZ	24.9	PK
2379.60	48.33	-1.15	47.18	74.0	3.0m./HORZ	26.8	PK

🔆 Agi	ilent	11:45:4	7 Mar:	15,201	.8					L	Tra	ce/Vi	ew
Ref 46	6.71 dE	ЗрУ	Atten	5 dB				Mkr3	3 2.37 32.6	96 GHz dBµV		Tr	ace
EmiAv Log						\$			3 \$		<u>1</u>	2	3
10 dB/											(	lear k	lrite
												MaxI	Hold
												Min I	Hold
Start 2 #Res E	2.31 G 3W 1 M	Hz Hz	Tuso	V	BW 3 MI	Hz	Swee	s p 40.62	Stop 2.3 2 s (40	39 GHz 1 pts)		,	View
1 2 3	.er	(1) (1) (1) (1)	Freq Freq Freq		2.3: 2.3: 2.3:	154 GHz 500 GHz 796 GHz			32.47 dl 32.86 dl 32.6 dl	аде ЗµV ЗµV ЗµV	_	В	lank
												<b>۲</b> 1	<b>fore</b> of 2

Figure 22. Antenna 2 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Average

Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2315.40	32.47	-0.27	32.20	54.0	3.0m./HORZ	21.8	AVG
2350.00	32.86	-0.25	32.61	54.0	3.0m./HORZ	21.4	AVG
2379.60	32.60	-1.15	31.45	54.0	3.0m./HORZ	22.6	AVG

# Table 19. Antenna 2 Restricted Band Data (AVG)- Low Channel



Figure 23. Antenna 3 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Peak

Table 20. Antenna 3 Restricted Band Data	(Peak	)- Low	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2315.40	49.00	-0.39	48.61	74.0	3.0m./VERT	25.4	PK
2350.00	49.33	-0.38	48.95	74.0	3.0m./VERT	25.0	PK
2380.00	54.13	-1.28	52.85	74.0	3.0m./VERT	21.1	PK

🔆 Agi	lent 1	L4:24:42	Mar 1	15,201	8			- L1 -			Trace/	/View
Ref_47	.1 dBµ	V	Atten	5 dB				Mkr	3 2.38 32.75	ии GHZ dBµV		Trace
EmiAv Log	1 * <b>◊</b>				~				3 •	*	1 <u>2</u>	3
10 dB/											Clea	r Write
											Ma	ax Hold
											м	in Hold
Start 2 #Res B	2.31 GH W 1 MH	z z		VE	3W 3 M	łz	Swee	р 40.62	Stop 2.3	39 GHz 1 pts)		Uiow
Mark 1	er T	race (1)	Type Freq		X 2.31	Axis 154 GHz			Amplitu 32.39 di	ude 3µV		410.11
2 3		(1) (1)	Freq Freq		2.38	500 GHz 300 GHz			32.79 dl 32.75 dl	3μV 3μV		Blank
												More 1 of 2

Figure 24. Antenna 3 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Average

Table 21. Antenna 3 Restricted Band Data	(AVG)- Low	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2315.40	32.39	-0.27	32.12	54.0	3.0m./HORZ	21.9	AVG
2350.00	32.79	-0.25	32.54	54.0	3.0m./HORZ	21.5	AVG
2380.00	32.75	-1.15	31.60	54.0	3.0m./HORZ	22.4	AVG



Figure 25. Antenna 4 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Peak

Table 22. Antenna 4 Restricted Band Data	(Peak)	)- Low	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Results Limits		Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2312.80	47.97	-0.19	47.78	74.0	3.0m./HORZ	26.2	PK
2360.60	49.00	-1.15	47.85	74.0	3.0m./HORZ	26.2	PK
2385.80	49.53	-1.15	48.38	74.0	3.0m./HORZ	25.6	РК

🔆 Agi	lent 🔅	17:23:3	2 Mar	16,201	.8					L	Tr	ace/V	liew
Ref_46	.35 dB	γŶ	Atter	5 dB				Mkr	3 2.38 31.7	58 GHz dBµV		т	race
EmiAv Log	1						2 \$			3	<u>1</u>	2	3
10 dB/												Clear	Write
	Mark	er	000									Мах	Hold
	2.38 31	.7 dł	иии BµV	GHZ								Min	Hold
Start 2 #Res B	2.31 GH 8W 1 MH er - T	łz łz race	Туре	VI	BW 3 MI x	Hz Axis	Swee	ep 40.62	top 2.3 2 s (40 Amplit	39 GHz 1 pts) ude			View
1 2 3			Fred Fred Fred		2.3 2.3 2.3	128 GHz 606 GHz 858 GHz			31.66 dl 32.03 dl 31.7 dl	840 ВµV ВµV ВµV		ļ	Blank
													<b>More</b> 1 of 2

Figure 26. Antenna 4 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Average

Table 23. Antenna 4 Restricted Band Data	(AVG	)- Low	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results Limits		Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2312.80	31.66	-0.19	31.47	54.0	3.0m./HORZ	22.5	AVG
2360.60	32.03	-1.15	30.88	54.0	3.0m./HORZ	23.1	AVG
2385.80	31.70	-1.28	30.42	54.0	3.0m./VERT	23.6	AVG

🔆 Agile	ent 16:42:	31 Mar 16,20	18	L	Marker
Ref 104 Peak	dBµV	Atten 10 dB		Mkr2 2.3500 GHz 47.25 dBµV	Select Marker
10 - dB/ -					Marker Trace <u>Auto</u> 1 2 3
	Marker		*****	3 	Readout, Frequency
	2.35000 47.25 c	0000 GHz ∄BµV			Function, Off
Start 2. #Res Bk Marke 1	31 GHz 1 MHz r Trace	L Type Freg	/BW 3 MHz X Axis 2 3110 6Hz	Stop 2.39 GHz Sweep 4 ms (401 pts) Amplitude 47 88 dBull	Marker Table <u>On</u> Off
2 3		Freq Freq	2.3500 GHz 2.3782 GHz	47.25 аВµV 48.18 аВµV	Marker All Off
					More 2 of 2

Figure 27. Antenna 5 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Peak

Table 24. Antenna	<b>5</b> Restricted	Band Data	(Peak)	- Low	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2311.00	47.08	-0.19	46.89	74.0	3.0m./HORZ	27.1	PK
2350.00	47.25	-0.25	47.00	74.0	3.0m./HORZ	27.0	PK
2378.20	48.18	-1.15	47.03	74.0	3.0m./HORZ	27.0	PK

🔆 Agi	lent 1	16:49:46	Mar 1	L6,201	8					L	Trace	e/View
Ref 46	.35 dBj	٧u	Atten	5 dB				Mkra	2 2.35 32.12	00 GHz dBµV		Trace
EmiAv Log	1 \$``				~	2			3 <b>\$</b>		<u>1</u>	2 3
10 dB/											Cle	ar Write
					1						I	1ax Hold
												Min Hold
Start 2 #Res B Mark	2.31 GH 3W 1 MH er T	Z Z race	Type	VE	<u>3W 3 M</u> x	Hz Axis	Swee	p 40.62	2 s (40 Amplitu 21 52 di	39 GHz 1 pts) ude Bull		View
23		(1) (1) (1)	Freq Freq		2.3	500 GHz 782 GHz			32.12 di 31.99 di	вµ∨ ВµV ВµV		Blank
												<b>More</b> 1 of 2

Figure 28. Antenna 5 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Average

Table 25. Antenna 5 Restricted Band Data	(AVG	)- Low Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2311.00	31.58	-0.19	31.39	54.0	3.0m./HORZ	22.6	AVG
2350.00	32.12	-0.25	31.87	54.0	3.0m./HORZ	22.1	AVG
2378.20	31.99	-1.15	30.84	54.0	3.0m./HORZ	23.2	AVG

🔆 Agi	lent 1	L4:56:40	6 Mar	16,201	.8					L	Tra	ce/View
Ref 10 Peak Log	4 dBµ∖		Atten	10 dB				Mkr3	3 2.38 46.63	28 GHz dBµV	<u>1</u>	Trace
10 dB/											C	lear Write
	\$ Stop	)				-2 -\$	h		<b>}</b>	<sup>3</sup> ♦		Max Hold
	2.39	0000	000	GHZ								Min Hold
Start 2 #Res B	2.31 GH W 1 MH	z z		V	BW 3 MI	Hz	S۲	veep 4	otop 2. ms (40	39 GHz 1 pts)		View
Mark 1 2 3	er T	race (1) (1) (1)	Type Fred Fred Fred	1	X 2.3: 2.3( 2.3(	Axis 158 GHz 520 GHz 328 GHz			Amplit 46.74 d 46.67 d 46.63 d	ude BµV BµV BµV		Blank
												<b>More</b> 1 of 2

### Figure 29. Antenna 6 Restricted Band Measurements 2.31 GHz to 2.39 GHz –Peak

Table 26. Antenna 6 Restricted Band Data	(Peak	)- Low	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2315.80	46.74	-0.27	46.47	74.0	3.0m./HORZ	27.5	PK
2352.00	46.67	-0.25	46.42	74.0	3.0m./HORZ	27.6	PK
2382.80	46.63	-1.15	45.48	74.0	3.0m./HORZ	28.5	PK

∦¥ Agi	ilent	1	5:16:20	∂ Mar∶	16,201	.8			Mler	2 2 2 2	L 28 CH-	Trac	e/View
Ref 48 EmiAv Log	6.36	dB⊧ ₁ ◊	٧L	Atten	5 dB		2 \$	·		32.19	20 0H2 1 dBµV 3	<u>1</u>	2 Trace
10 dB/												Cle	ear Write
													Max Hold
													Min Hold
Start 2 #Res E Mark 1	2.31 3W 1 :er	GH MH	Z Z race (1)	Type Frea	VI	<u>BW 3 MI</u> x 2 <b>.</b> 3:	Hz Axis 158 GHz	Swee	p 40.62	otop 2. 2 s (40 Amplit 32.18 d	39 GHz 1 pts) ude BuV		View
23		(	(1) (1)	Freq Freq		2.38	520 GHz 328 GHz			32.6 d 32.19 d	ВµV ВµV		Blank
													<b>More</b> 1 of 2

Figure 30. Antenna 6 Restricted Band Measurements 2.31 GHz to 2.39 GHz – Average

Table 27. Antenna	6 Restricted	Band Data	(AVG	)- Low	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2315.80	32.18	-0.27	31.91	54.0	3.0m./HORZ	22.1	AVG
2352.00	32.60	-0.25	32.35	54.0	3.0m./HORZ	21.7	AVG
2382.80	32.19	-1.15	31.04	54.0	3.0m./HORZ	23.0	AVG

🔆 Ag	ilent	12:31:5	6 Apr	9,2018	3					L	Peak Search
D. ( 7(	00 .00		0					Mkr1	2.483	54 GHz	
Ref /t Peak	5.99 dE		Htter						61.13	abha I	Meas Tools+
Log	<b>k</b>										
10	- Washing	m	man	Non many	- A	2				3	
aB/							and the second s	ماليلال	man	harmon	Next Peak
											Next Pk Right
	Mari	⊲er									<b>g</b>
	2.48	33541	250	GHz_	3	с					
	61	<u>.19 d</u>	BµV								Next Pk Left
Start 3	2.483 (	1 3Hz							Stop 2	5 GHz	
#Res E	BW 1 M	-lz		V	3W 3 M	Hz	Sw	eep 4	ms (40	1 pts)	Min Search
Mark	(er ]	race	Type		X 2.40	(Axis			Amplit	ude	
2		(1)	Fred		2.48	354 GHZ 175 GHz			47.53 d	вµ0 ВµV	
3		(1)	Fred		2.49	835 GHz			44.19 d	ВµѴ	Pk-Pk Search
											More
											1 of 2

Figure 31. Antenna 1 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Peak

Table 28. Antenna 1 Restricted Band Data	a (Peak)- High Channe	e
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.54	65.63	0.29	61.48	74.0	3.0m./HORZ	12.5	РК
2491.75	51.14	0.29	47.82	74.0	3.0m./HORZ	26.2	РК
2498.35	47.56	0.29	44.48	74.0	3.0m./HORZ	29.5	РК

🔆 Agi	ilent	12:30:51	Apr S	9,2018	;					L	Marker
Ref 64	.8 dB⊦	νV	Atten	5 dB				Mkr3	2.498 32.46	35 GHz dBµV	Select Marker
EmiHv Log 10											1 2 <u>3</u> 4
10 dB/						<u></u>					Marker Trace Auto 1 2 3
					7						<b>Readout</b> Frequency
											Function, Off
Start 2	2.483 (	Hz							Stop 2	5 GHz	Mankan Tabla
#Res E	3W 1 MH	lz		VE	3W 3 MI	Hz	Sv	weep 10	) s (40)	l pts)	
Mark	er I	race (1)	lype Fred		,X 2,483	862 6Hz			Amplitu 52.85 dB	ude Bull	<u>on</u> on
2		(1)	Freq		2.49	175 GHz			36.35 dB	βμV	
3		(1)	Freq		2.49	835 GHz			32.46 dł	ЗµV	Marker All Off
											More 2 of 2

Figure 32. Antenna 1 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Average

Table 29. Antenna 1 Re	estricted Band Data	(AVG)- Hig	h Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.54	52.85	0.29	53.14	54.0	3.0m./HORZ	.9	AVG
2491.75	36.35	0.29	36.64	54.0	3.0m./HORZ	17.4	AVG
2498.35	32.46	0.29	32.75	54.0	3.0m./HORZ	21.2	AVG

🔆 Agi	ilent	11:30:0	2 Marí	15,201	.8						Trace	/View
Ref 10 Peak Log	)6 dBµ	N 	Atten 3	10 dB				Mkr3 a	48.96	ors GHz dBµV	<u>1</u>	Trace
10 dB/											Cle	ar Write
			~		·····	2 9	nj	~~~~	adm	* ****	۲	lax Hold
												Min Hold
Start ( #Res E Mark	2.483 3W 1 M (er	GHz Hz Trace	Туре	VE	<u>3W 3 M</u> x	Hz Axis	<u>S</u> ł	veep 4	Stop 2 ms (40 Amplit	2.5 GHz 11 pts) ude		View
1 2 3		(1) (1) (1)	Freq Freq Freq		2.4830) 2.4915) 2.4989;	000 GHz 000 GHz 375 GHz			50.74 d 48.23 d 48.96 d	ΒμV ΒμV ΒμV		Blank
												More 1 of 2

Figure 33. Antenna 2 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Peak

Frequency	Test Data	AF+CA- AMP+DC	Results Limits		Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.00	50.74	0.29	51.03	74.0	3.0m./HORZ	23.0	PK
2491.50	48.23	0.29	48.52	74.0	3.0m./HORZ	25.5	PK
2498.93	48.96	0.29	49.25	74.0	3.0m./HORZ	24.7	PK

💥 Agi	ilent	11:22:09	) Mar (	15,201	.8					L	Am	olitude
Ref 49	1.57 dB	υV	Atten	5 dB			١	1kr3 2	.49893	75 GHz dBuV		
EmiAv Log						<b>.</b> ~				3	2	ket Level 19.57 dBµV
10 dB/											Ati <u>Auto</u>	t <b>enuation</b> 5.00 dB Man
											S	Scale/Div 10.00 dB
											So Log	ale Type
Start 2 #Res F	2.483 0 ≷⊌ 1 M⊧	iHz Iz		UF	зызмі	Hə	Śweej	n 1364	Stop 2 5 s (40	.5 GHz 1 nts)	Dree	al Cantan
Mark 1	er T	race (1)	Type Freq		2.4830	Axis 000 GHz	01100	p 10.0.	Amplit: 40.06 dl	ude 3µV	Pres	ercenter
2 3		(1) (1)	Freq Freq		2.49150 2.49893	000 GHz 375 GHz			32.05 di 31.95 di	3μ0 3μ0	<b>Pres</b> 0.000	<b>el Adjust</b> 100000 Hz
												<b>More</b> 1 of 3

Figure 34. Antenna 2 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Average

Table 31. Antenna 2 Restricted Band Data	(AVG)- H	igh Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results Limits		Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.00	40.06	0.29	40.35	54.0	3.0m./HORZ	13.6	AVG
2491.50	32.05	0.29	32.34	54.0	3.0m./HORZ	21.7	AVG
2498.93	31.95	0.48	32.43	54.0	3.0m./VERT	21.6	AVG

∦¥ Agi	ilent 1	4:49:58	8 Mar:	15,201	8					L	M	arker
Ref 10 Peak Log	)6 dBµ\		Atten	10 dB							Sele 1 2	<b>ct Marker</b> 2 3 <u>4</u>
10 dB/												Normal
		when	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~	5		····h	~~~~	unteren	°		Delta
											(Tr Ref	<b>Delta Pair</b> acking Ref) <u>Delta</u>
Start 2 #Res E	2.483 G 3W 1 MH	Hz z	T	VE	<u>3W 3 M</u>	Hz	Sv	veep 4	Stop 2 ms (40	.5 GHz 1 pts)	Snan	Span Pair
1 2 3	er i	(1) (1) (1) (1)	Freq Freq Freq		2.48308 2.49158 2.49974	850 GHz 800 GHz 450 GHz			56.96 di 49.74 di 48.8 di	лае 3µV 3µV 3µV	o pont	Off
												<b>More</b> 1 of 2

Figure 35. Antenna 3 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Peak

Table 32. Antenna 3 Restr	icted Band Data (I	Peak)- High Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.09	56.96	0.29	57.25	74.0	3.0m./HORZ	16.7	PK
2491.50	49.74	0.29	50.03	74.0	3.0m./HORZ	24.0	PK
2499.74	48.80	0.29	49.09	74.0	3.0m./HORZ	24.9	PK

∦ Agi	lent 1	15:00:56	6 Mari	15,201	.8					L	Trace	e/View
Ref 56 EmiAv Log	.3 dBµ	V	Atten	5 dB		2					<u>1</u>	<b>Trace</b> 2 3
10 dB/										- Å	Cle	ar Write
											ľ	1ax Hold
												Min Hold
Start 2 #Res B Mark 1	2.483 G 8W 1 MH er T	iHz Iz race (1)	Type Frea	VE	<u>3W 3 MI</u> x 2.4830/	Hz Axis 350 GHz	SI	weep 10	Stop 2 0 s (40 Amplite 47.72 d	.5 GHz 1 pts) ude BuU		View
2			Freq Freq		2.49150 2.4997	000 GHz 450 GHz			33.17 d 32 d	ВµV ВµV ВµV		Blank
												<b>More</b> 1 of 2

Figure 36. Antenna 3 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Average

Table 33. Antenna 3 Restricted Band Data	(AVG)	)- Higł	n Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.09	47.72	0.29	48.01	54.0	3.0m./HORZ	6.0	AVG
2491.50	33.17	0.29	33.46	54.0	3.0m./HORZ	20.5	AVG
2499.75	32.00	0.48	32.48	54.0	3.0m./VERT	21.5	AVG

🔆 Agi	lent 1	16:02:5	8 Mar	15,201	.8					L	Trace	/View
Ref 10	6 dBµ\	1	Atten	10 dB				Mkr3 2	2.49974 49.41	50 GHz dBµV		Trace
Peak Log											<u>1</u>	2 3
10 dB/											Cle	ar Write
	Mark	er		~_ <b>^</b> ~~~~	· · · · · · · · · · · · · · · · · · ·	\$			•••	3	I	1ax Hold
	2.48 49.	3085 41 d	BµV	6HZ								Min Hold
Start 2 #Res B Mark	2.483 G GW 1 MH er T	iHz Iz race	Туре	V	<u>3W 3 MI</u> x	Hz Axis	<u> </u>	меер 4	Stop 2 ms (40 Amplit	2.5 GHz 1 pts) ude		View
1 2 3		(1) (1) (1)	Frec Frec Frec		2.48308 2.49158 2.49974	850 GHz 000 GHz 450 GHz			50.43 d 49.14 d 49.41 d	ВµV ВµV ВµV		Blank
												<b>More</b> 1 of 2

Figure 37. Antenna 4 Restricted Band Measurements 2.4835 GHz to 2.5 GHz –Peak

Table 34. Antenna 4 Restricted Band Data	(Peak)	- High	Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.09	50.43	0.29	50.72	74.0	3.0m./HORZ	23.3	PK
2491.50	49.14	0.29	49.43	74.0	3.0m./HORZ	24.6	PK
2499.75	49.41	0.29	49.70	74.0	3.0m./HORZ	24.3	PK

🔆 Agi	lent 1	6:11:08	Mar (	15,201	8					L	Trac	e/View
Ref 50	.4 dBµ	V	Atten	5 dB				Mkr3 2	.49974 31.51	50 GHz dBµV		Trace
EmiAv Log			. V.							*3	<u>1</u>	2 3
10 dB/											Cle	ear Write
												Max Hold
												Min Hold
Start 2	2.483 G	Hz -			л эм		 ¢.		Stop 2	.5 GHz	-	
Mark	er T	z race	Type			Axis	<u> </u>	veep Iv	Amplit	ude		View
1 2 3		(1) (1) (1)	Freq Freq Freq		2.48308 2.49158 2.49974	850 GHZ 800 GHZ 450 GHZ			41.28 d 31.66 d 31.51 d	вро ВрО ВрО		Blank
												<b>More</b> 1 of 2

# Figure 38. Antenna 4 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Average

Table 35. Antenna 4 Restricted Band Data	(AVG)- H	ligh Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.09	41.28	0.29	41.57	54.0	3.0m./HORZ	12.4	AVG
2491.50	31.66	0.29	31.95	54.0	3.0m./HORZ	22.0	AVG
2499.75	31.51	0.29	31.80	54.0	3.0m./HORZ	22.2	AVG

US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: Model:

🔆 Agi	ilent (	16:23:1	5 Mar	16,201	.8					L	Marl	ker
D_f 10	M dBut	J	0++op	10 JR				Mkr3 2	49910	75 GHz		
Peak Log									47.52		Select 1 2	Marker <u>3</u> 4
10 dB/	1										<b>Marker</b> <u>Auto</u> 1	Trace
	¢ Mark	er		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	·		and the second	mahain	****	3 ••••	Re Fre	eadout,
	2.49	9107 92 d	SØØ BµV	GHZ							Fu	nction, Off
Start 2 #Res E	2.483 0 3W 1 MH	iHz Iz		VE	3W 3 MI	Hz	Si	veep 4	Stop 2 ms (40	.5 GHz 1 pts)	Marke	r Table
Mark 1	er T	race (1)	Type Frec		X 2.4832	Axis 125 GHz			Amplite 49.98 di	ude BµV	<u>un</u>	Uff
3		(1) (1)	Fred		2.49150 2.49910	800 GHZ 875 GHZ			47.95 di 47.92 di	вµ∪ ВµV	Marker	All Off
												More 2 of 2

# Figure 39. Antenna 5 Restricted Band Measurements 2.4835 GHz to 2.5 GHz –Peak

Table 36. Antenna 5 Restricted Band Data	(Peak)- High Cha	nnel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.21	49.98	0.29	50.27	74.0	3.0m./HORZ	23.7	PK
2491.50	47.95	0.29	48.24	74.0	3.0m./HORZ	25.8	PK
2499.11	47.92	0.29	48.21	74.0	3.0m./HORZ	25.8	PK

🔆 Agi	lent 1	16:56:28	8 Mar	16,201	.8					L	Trace	View
Ref 46	.35 dBj	μŶ	Atter	15 dB				Mkr3 2	49749. 31.33	25 GHz dBµV		Trace
EmiAv Log	<b>¢</b>				: •	>			з <b>О</b>		<u>1</u>	2 3
10 dB/											Cle	ar Write
	Stop		000								I	lax Hold
	2.50	0000	000	6HZ								Min Hold
Start 2 #Res B	2.483 G 3W 1 MH	iHz Iz		Vł	BW 3 MI	-lz	Sı	weep 10	Stop 2 0 s (40	.5 GHz 1 pts)		View
Mark 1 2	er I	race (1) (1)	lype Frec Frec		X 2.4832: 2.49150	Axis 125 GHz 200 GHz			Amplit 37.77 di 31 39 di	ude BµV Bull		
3		(1)	Fred		2.4974	925 GHz			31.33 d	ΒμV		Blank
												More 1 of 2

Figure 40. Antenna 5 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Average

Table 37. Antenna 5 Restricted Band	d Data (AVG)- High Channel
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Frequency	Test Data	AF+CA- AMP+DC Results Limits		TestAF+CA- DataResultsLimitsDis		Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG	
2483.21	37.77	0.29	38.06	54.0	3.0m./HORZ	15.9	AVG	
2491.50	31.39	0.29	31.68	54.0	3.0m./HORZ	22.3	AVG	
2499.11	31.33	0.29	31.62	54.0	3.0m./HORZ	22.4	AVG	

🔆 Agi	ilent 1	15:31:25	5 Marí	16,201	.8					L	Mar	ker
Ref 10	04 dBµ\	,	Atten	10 dB				Mkr3 2	.498729 49.78	50 GHz dBµV	Select	Marker
Peak Log											1 2	<u>3</u> 4
10 dB/											Marker Auto 1	Trace
	¦ ⊗ Mark	er				2 2		-*****	· · · · · · · · · · · · · · · · · · ·	3 <b>X</b>	<b>Re</b> Fro	adout,
	2.49 49.	8725 78 di	000 ВµV	GHz							Fu	nction, Off
Start 2 #Res B Mark	2.483 G <u>3W 1 MH</u> <er t<="" td=""><td>Hz Iz race</td><td>Type</td><td>V</td><td><u>3W 3 M</u></td><td>Hz ( Axis</td><td>Sv</td><td>veep 4</td><td>Stop 2. ms (40) Amplite</td><td>.5 GHz 1 pts) ude</td><td>Marke <u>On</u></td><td>r Table <sub>Off</sub></td></er>	Hz Iz race	Type	V	<u>3W 3 M</u>	Hz ( Axis	Sv	veep 4	Stop 2. ms (40) Amplite	.5 GHz 1 pts) ude	Marke <u>On</u>	r Table <sub>Off</sub>
2		(1) (1) (1)	Freq Freq Frec		2.49321 2.49150 2.49871	250H2 300 GHz 250 GHz			49.04 dE 47.25 dE 49.78 dE	зро ЗрО ВрО	Markei	r All Off
												More 2 of 2

Figure 41. Antenna 6 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Peak

Table 38. Antenna 6 Restricted	Band Data (P	<sup>2</sup> eak)- Hig	h Channel
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Frequency	Test Data	AF+CA- AMP+DC	Results	Limits	Distance /	Margin	Detector
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.21	49.04	0.29	49.33	74.0	3.0m./HORZ	24.7	РК
2491.50	47.25	0.29	47.54	74.0	3.0m./HORZ	26.5	РК
2498.73	49.78	0.29	50.07	74.0	3.0m./HORZ	23.9	PK

US Tech Test Report: FCC ID: IC: Test Report Number: Issue Date: Customer: Model:

∦ Agi	lent 1	5:34:54	Mar 1	l6,201	8			Wbr3 2	19872	L 50 GHZ	Tra	ace/Vie	w
Ref 46	.44 dB	V-	Atten	5 dB					31.73	dBhA		Tra	ice
Log	¢				_~	2				³ ♦ *	<u>1</u>	2	3
10 dB/												Clear Wr	ite
					1							Max H	old
												Min He	old
Start 2 #Res B	2.483 G W 1 MH	Hz z		VE	3W 3 MI	Hz	S	veep 10	Stop 2 0 s (40	.5 GHz 1 pts)		Ui	iow.
Mark 1	er T	race (1)	Type Freq		X 2.48321	Axis 125 GHz			Amplit 35.58 di	ude BµV		¥1	64
2 3		(1) (1)	Freq Freq		2.49150 2.49872	000 GHz 250 GHz			31.7 d 31.73 d	Вµ∨ Вµ∨		Bla	ank
												<b>Мс</b> 1 о	ore of 2

### Figure 42. Antenna 6 Restricted Band Measurements 2.4835 GHz to 2.5 GHz – Average

Frequency	Test Data	AF+CA- AMP+DC Results Limits Distance /		Distance /	Margin	Detector	
(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Polarization	(dB)	PK/QP/AVG
2483.21	35.58	0.29	35.87	54.0	3.0m./HORZ	18.1	AVG
2491.50	31.70	0.29	31.99	54.0	3.0m./HORZ	22.0	AVG
2498.73	31.73	0.29	32.02	54.0	3.0m./HORZ	22.0	AVG

# Table 39. Antenna 6 Restrict Band Data (AVG)- High Channel

# 2.12 Unintentional Radiator and Intentional Radiator, Radiated Emissions (CFR 15.109)

The test data provided herein is to support the verification requirement for digital devices due to the changes made to the EUT. The EUT in the continuously transmitting state is considered the worst case condition and the data collected while the EUT was in this condition was compared to the Part 15.109 limits.

The EUT was evaluated from 30 MHz to 12.5 GHz the data is presented in the table below. The data presented is with the EUT and its transmitter ON and transmitting.

Measurements were made with the analyzer's resolution bandwidth set to 120 kHz for measurements made below 1 GHz and 1 MHz for measurements made above 1 GHz. The video bandwidth was set to three times the resolution bandwidth; 1 MHz RBW and 3 MHz VBW. The test data were maximized for magnitude by rotating the turn-table through 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure.
## Table 40. Spurious Radiated Emissions (CFR 15.109), 30 MHz to 1000 MHz

30 MHz to 1000 MHz									
Test: Radiated Emissions				Client: Murata					
Project: 17-0439				Model: CCT24					
Frequency (MHz)	Test Data (dBuv)	Additional Factor (dB)	AF+CA- AMP (dB/m)	Results (dBuV/m)	QP Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or QP	
39.14	31.92		-13.81	18.11	40.0	3m./HORZ	21.9	PK	
133.08	43.16		-14.73	28.43	43.5	3m./HORZ	15.1	PK	
51.03	39.71		-17.17	22.54	40.0	3m./VERT	17.5	PK	
124.50	39.99		-14.82	25.17	43.5	3m./VERT	18.3	PK	
201.00	33.88		-13.59	20.29	43.5	3m./HORZ	23.2	PK	
264.36	34.98		-11.83	23.15	46.0	3m./HORZ	22.8	PK	
965.40	29.95		-1.30	28.65	54.0	3m./HORZ	25.3	PK	
201.00	32.98		-13.89	19.09	43.5	3m./VERT	24.4	PK	
262.50	33.80		-12.32	21.48	46.0	3m./VERT	24.5	PK	
981.60	29.80		-2.19	27.61	54.0	3m./VERT	26.4	PK	

SAMPLE CALCULATION at: 39.14 MHz

Magnitude of Measured Frequency	31.92	dBuV
+Additional Factor (Distance Extrapolation)	0.0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	-13.81	dB/m
Corrected Result	18.11	dBuV/m

Test Date: March 19, 2018 Tested By Signature:

Name: John Freemen

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# Table 41. Spurious Radiated Emissions (CFR 15.109) 1 GHz to 12.5 GHz

1 GHz to 25 GHz, Part 15.209 Limits									
Test: Radiated Emissions				Client: Murata					
Project: 17-0439				Model: CCT24					
Frequency (MHz)	Test Data (dBuv)	AF+CA-AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or AVG		
Besides the emissions reported in the table below, all other emissions were at least 20 dB from the applicable limit.									

## SAMPLE CALCULATION at: N/A

Test Date: March 19, 2018 Tested By Signature:

Name: John Freemen

#### 2.13 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4-2:2011. A coverage factor of k=2 was used to give a level of confidence of approximately 95%.

2.12.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is  $\pm$  2.78 dB.

2.12.2 Radiated Emissions Measurement Uncertainty

Measurement Uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is  $\pm$  5.40 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.19 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is  $\pm$  5.08 dB.

### 3 Conclusions

The EUT meets the requirements of the applicable standard when tested as presented in this test report.