

Bently Nevada, Inc.

TEST REPORT FOR

El.mesh ISA100a wSIM Model: 185410
El.mesh ISA100a Repeater Model: 185450

Tested To The Following Standard:

FCC Part 15 Subpart C Section(s)

15.247
(DTS 2400-2483.5 MHz)

Report No.: 97677-19

Date of issue: July 19, 2016



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Bently Nevada, Inc.
1631 Bently Parkway South
Minden, NV 89423

REPORT PREPARED BY:

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Mariposa, CA 95338

REPRESENTATIVE: Nathan Weller
Customer Reference Number: 9000005842

Project Number: 97677

DATE OF EQUIPMENT RECEIPT:

July 14, 2016

DATE(S) OF TESTING:

July 14 - 15, 2016

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink, reading "Steve Behm", is positioned above a horizontal line.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.02

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Brea A	US0060	SL2-IN-E-1146R	3082D-1	90473	A-0147
Brea D	US0060	SL2-IN-E-1146R	3082D-2	100638	A-0147

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	NA1
15.247(b)(3)	Output Power	Mod. #1	Pass
15.247(e)	Power Spectral Density	Mod. #1	Pass
15.247(d)	RF Conducted Emissions	NA	NA1
15.247(d)	RF Conducted Emissions Band Edge	NA	NA1
15.247(d)	Radiated Emissions	Mod. #1	Pass
15.247(d)	Radiated Emissions Band Edge	NA	NA1
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable

NA1 = Not applicable for PCI or PCII verification.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions

Modification #1: Installed prior to testing:

Removed two low-pass filters from the radio output stage and replaced with bandpass filters. The radio is then recalibrated channel by channel and reprogrammed to appropriately compensate output power for the modified signal path

DAC settings listed in Summary of Conditions would be the maximum settings, with deviations noted in the specific tests. Production units will all use settings that are lower than the equivalent setting level for the specific unit.

wSIM unit: CH 0 = 3225, CH 8 = 3287, CH 15 = 3400.

Repeater unit: CH 0 = 3196, CH 8 = 3250, CH 15 = 3353.

wSIM unit with connector: CH 0 = 3136, CH 8 = 3223, CH 15 = 3351.

Repeater unit with connector: CH 0 = 3185, CH 8 = 3229, CH 15 = 3321.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions

The manufacturer declares: True radiated power is affected by the antenna interface, the antenna gain, and the enclosure, as follows:

adjustment for monopole $\frac{1}{4} \lambda$ antenna = 5.19dB (gain over isotropic)

housing/enclosure attenuation = 4dB nominal

total overall effective antenna gain (correction factor) = +1.19dB

EQUIPMENT UNDER TEST (EUT)

During testing numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
El.mesh ISA100a wSIM	Bently Nevada, Inc.	185410	16E00A4Z

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Lenovo	ThinkPad T500	L3B3906

Configuration 4

Equipment Tested:

Device	Manufacturer	Model #	S/N
El.mesh ISA100a Repeater	Bently Nevada, Inc.	185450	16D00WNU

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Lenovo	ThinkPad T500	L3B3906

Configuration 5

Equipment Tested:

Device	Manufacturer	Model #	S/N
El.mesh ISA100a wSIM	Bently Nevada, Inc.	185410	16D00WNC
El.mesh ISA100a Repeater	Bently Nevada, Inc.	185450	16D00WN8

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Lenovo	ThinkPad T500	L3B3906

- i. wSIM (antenna) with S/N: 16D00WNC and MAC Address: 0022:FF00:0002:3631
- ii. Repeater (antenna) with S/N: 16D00WN8 and MAC Address: 0022:FF00:0002:3636
- iii. wSIM (connector) with S/N: 16E00A4Z and MAC Address: 0022:FF00:0002:3516
- iv. Repeater (connector) with S/N: 16D00WNU and MAC Address: 0022:FF00:0002:376B

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	802.15.4 (Zigbee)
Operating Frequency Range:	2405-2480MHz
Modulation Type(s):	O-QPSK (DSSS)
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	1
Beamforming Type:	NA
Antenna Connection Type:	Integral
Nominal Input Voltage:	3.3
Firmware / Software used for Test:	wSIM communicator 2.01.00.05

FCC Part 15 Subpart C

15.247(b)(3) Output Power

Test Setup / Conditions			
Test Location:	Brea Lab D	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016	Test Date(s):	7/14/2016
Configuration:	3 and 4		
Test Setup:	<p>The EUT with added antenna port is placed on the test bench and powered via the USB port. A support laptop is used to set the device in constant transmit test mode. RF characteristic is measured at the antenna port. EUT is in continuous transmit mode.</p> <p>The DC input power was connected to 5V USB to ensure the device is operating at full input power capacity.</p> <p>Frequency range: 2405MHz to 2480MHz Frequencies tested: 2405MHz, 2445MHz, 2480MHz</p> <p>Power Setting wSIM (0022:FF00:0002:3516): Antenna connector Channel 0, 2405MHz = 3136 Channel 8, 2445MHz = 3323 Channel 15, 2480MHz = 3351</p> <p>Repeater (0022:FF00:0002:376B): Channel 0, 2405MHz = 3185 Channel 8, 2445MHz = 3229 Channel 15, 2480MHz = 3321</p>		
Modification:	Modification #1 was in place during testing.		

Environmental Conditions			
Temperature (°C)	20	Relative Humidity (%):	40

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02672	Spectrum Analyzer	Agilent	E4446A	9/30/2015	9/30/2017
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	11/2/2015	11/2/2017
P06554	Cable	Astrolab	32022-29094K-29094K-24TC	12/30/2015	12/30/2017

Test Data Summary - Voltage Variations – Configuration 3					
Frequency (MHz)	Modulation / Ant Port	V _{Minimum} (dBm)	V _{Nominal} (dBm)	V _{Maximum} (dBm)	Max Deviation from V _{Nominal} (dB)
2405	O-QPSK / Ant Port	NA	8.10	NA	NA
2445	O-QPSK / Ant Port	NA	8.43	NA	NA
2480	O-QPSK / Ant Port	NA	8.10	NA	NA

Test performed using operational mode with the highest output power, representing worst case.

Test Data Summary - Voltage Variations – Configuration 4					
Frequency (MHz)	Modulation / Ant Port	V _{Minimum} (dBm)	V _{Nominal} (dBm)	V _{Maximum} (dBm)	Max Deviation from V _{Nominal} (dB)
2405	O-QPSK / Ant Port	NA	8.56	NA	NA
2445	O-QPSK / Ant Port	NA	8.68	NA	NA
2480	O-QPSK / Ant Port	NA	8.11	NA	NA

Test performed using operational mode with the highest output power, representing worst case.

Parameter Definitions:

Measurements performed at input voltage V_{Nominal} ± 15%.

Parameter	Value
V _{Nominal} :	3.3
V _{Minimum} :	NA
V _{Maximum} :	NA

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery.

Test Data Summary - RF Conducted Measurement – Configuration 3					
Measurement Option: RBW > DTS Bandwidth					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2405	O-QPSK	Monopole / 1.19	8.10	≤30	Pass
2445	O-QPSK	Monopole / 1.19	8.43	≤30	Pass
2480	O-QPSK	Monopole / 1.19	8.10	≤30	Pass

Test Data Summary - RF Conducted Measurement – Configuration 4					
Measurement Option: RBW > DTS Bandwidth					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2405	O-QPSK	Monopole / 1.19	8.56	≤30	Pass
2445	O-QPSK	Monopole / 1.19	8.68	≤30	Pass
2480	O-QPSK	Monopole / 1.19	8.11	≤30	Pass

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):

$$Limit = 30 - Roundup\left(\frac{G-6}{3}\right)$$

For directional beamforming antennas, the limit is calculated in accordance with 15.247(c)(2) and KDB 662911.

Test Setup Photos



Configuration 3



Configuration 4

15.247(e) Power Spectral Density

Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016	Test Date(s):	7/15/2016
Configuration:	3		
Test Setup:	<p>The EUT with added antenna port is placed on the test bench and powered via the USB port. A support laptop is used to set the device in constant transmit test mode. RF characteristic is measured at the antenna port. The EUT is in continuous transmit mode.</p> <p>The DC input power was connected to 5V USB to ensure the device is operating at full input power capacity.</p> <p>Frequencies tested: 2405MHz, 2480MHz</p> <p>Power Setting wSIM (0022:FF00:0002:3516): Antenna connector Channel 0, 2405MHz = 3136 Channel 15, 2480MHz = 3351</p>		
Modification:	Modification #1 was in place during testing.		

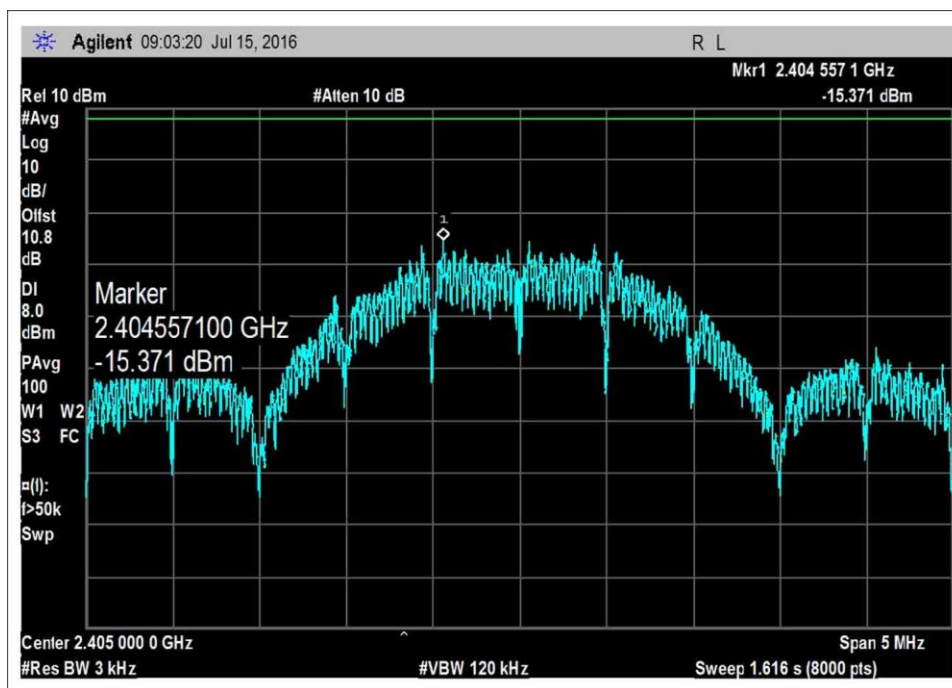
Environmental Conditions			
Temperature (°C)	25	Relative Humidity (%):	60

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02672	Spectrum Analyzer	Agilent	E4446A	9/30/2015	9/30/2017
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	11/2/2015	11/2/2017
P06554	Cable	Astrolab	32022-29094K-29094K-24TC	12/30/2015	12/30/2017

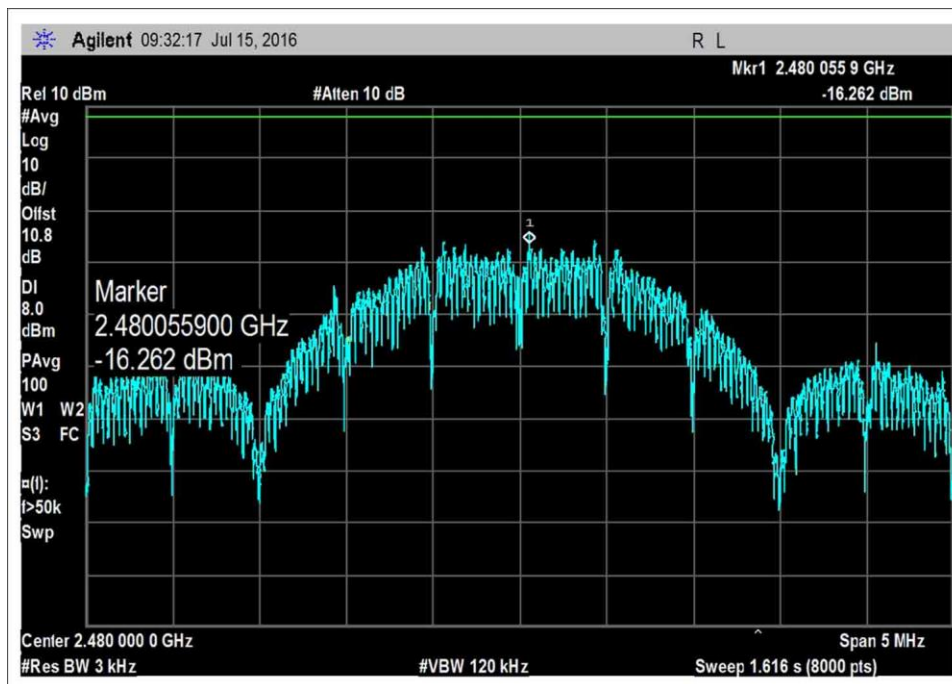
Test Data Summary - RF Conducted Measurement				
Measurement Method: AVGPSSD-1				
Frequency (MHz)	Modulation	Measured (dBm/3kHz)	Limit (dBm/3kHz)	Results
2405	O-QPSK	-15.4	≤8	Pass
2480	O-QPSK	-16.2	≤8	Pass

Test performed on Configuration 3, Low and High channel, worse case for verification purposes.

Plots

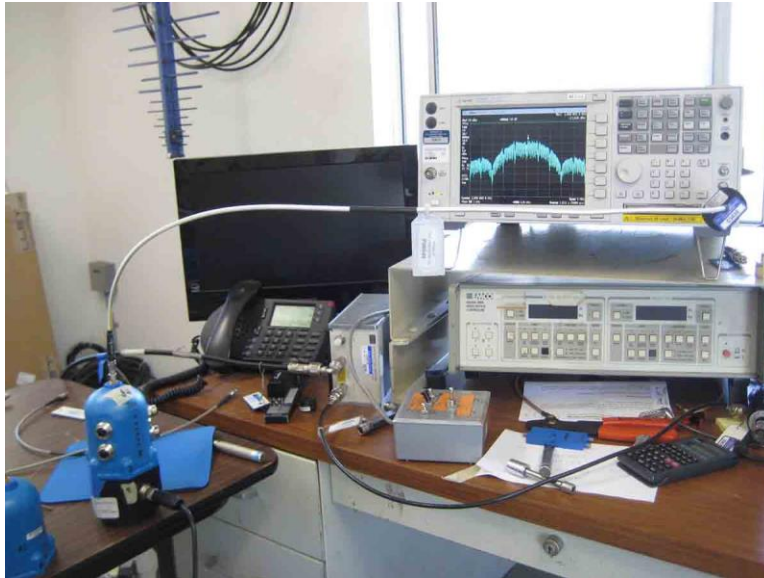


Low Channel



High Channel

Test Setup Photo



15.247(d) Radiated Emissions

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714 993 6112
 Customer: **Bently Nevada, Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **97677** Date: 7/14/2016
 Test Type: **Maximized Emissions** Time: 19:06:42
 Tested By: E. Wong Sequence#: 7
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

Test Conditions / Notes:

The EUT with added antenna port is placed on the Styrofoam table top and powered via the USB port. A support laptop is used to set the device in constant transmit test mode. Two sensor cables are connected to the wSIM. Radiated emissions is measured on OATS. The DC input power was connected to 5V USB to ensure the device is operating at full input power capacity.

Modulation: O-QPSK. Antenna type: monopole Antenna gain: 1.19dBi Duty cycle >= 99%. Continuous transmit
 Frequency range of test: 9kHz to 25000MHz. RBW=1MHz VBW=3MHz restricted band

Frequency / DAC setting

wSIM

2405MHz	3225
2445MHz	3287
2480MHz	3400

Repeater

2405MHz	3196
2445MHz	3250
2480MHz	3353

Verification testing: Harmonics of Fundamental Frequency for PCI/ PCII of FCCID : XFU-18541001, IC: 8349A-18541001. Replaced high pass filter with Bandpass filter in the RF path, conducted output power is reduced to less than 8.81dBm

Frequency range of measurement = 9 kHz- 25 GHz.

9kHz-150kHz;RBW=200Hz,VBW=200Hz;150kHz-30MHz;RBW=9kHz,VBW=9kHz;30MHz-1000 MHz;RBW=120 kHz,VBW=120 kHz, 1000 MHz-25000 MHz;RBW=1 MHz,VBW=1 MHz.

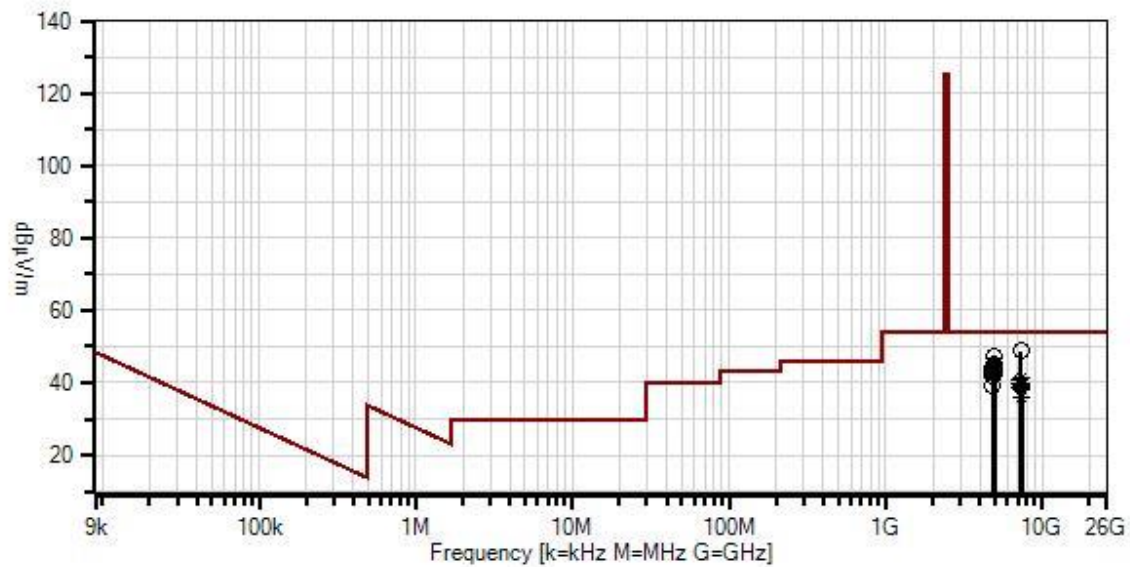
Test environment conditions: Temperature: 25°C, Relative Humidity: 40 %, Pressure: 100kPa

Site A

ANSI C63.10-2013

Modification #1 was in place during testing.

Bently Nevada, Inc. WD#: 97677 Sequence#: 7 Date: 7/14/2016
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



— Readings
 × QP Readings
 ▼ Ambient
 — 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

○ Peak Readings
 * Average Readings
 Software Version: 5.03.02

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	9/30/2015	9/30/2017
T2	AN00787	Preamp	83017A	6/10/2015	6/10/2017
T3	AN01646	Horn Antenna	3115	3/4/2016	3/4/2018
T4	ANP04382	Cable	LDF-50	6/6/2016	6/6/2018
T5	ANP06360	Cable	L1-PNMNM-48	6/6/2016	6/6/2018
T6	ANP06543	Cable	32022-29094K-29094K-24TC	11/30/2015	11/30/2017
T7	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	6/15/2015	6/15/2017
	AN03431	Attenuator	89-20-21	11/2/2015	11/2/2017
	AN01413	Horn Antenna	84125-80008	11/25/2014	11/25/2016
	AN00010	Preamp	8447D	3/14/2016	3/14/2018
	AN00314	Loop Antenna	6502	5/20/2016	5/20/2018
	AN01992	Biconilog Antenna	CBL6111C	12/4/2014	12/4/2016
	ANP05283	Attenuator	ATT-0218-06-NNN-02	5/5/2016	5/5/2018
	ANP05555	Cable	RG223/U	4/5/2016	4/5/2018
	ANP05569	Cable	RG-214/U	4/4/2016	4/4/2018

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	7336.250M	38.1	+0.0 +5.9	-40.3 +0.9	+32.8 +0.3	+11.0	+0.0	48.7	54.0 WSIM_2445MHz	-5.3	Vert
2	4889.000M	42.9	+0.0 +4.6	-40.2 +0.8	+30.0 +0.1	+8.9	+0.0	47.1	54.0 Repeater 2445MHz	-6.9	Horiz
3	4888.700M	41.0	+0.0 +4.6	-40.2 +0.8	+30.0 +0.1	+8.9	+0.0	45.2	54.0 Repeater 2445MHz	-8.8	Vert
4	4961.040M	40.3	+0.0 +4.6	-40.1 +0.8	+30.0 +0.1	+9.0	+0.0	44.7	54.0 Repeater 2480MHz	-9.3	Horiz
5	4811.000M	40.4	+0.0 +4.5	-40.4 +0.8	+30.0 +0.1	+8.8	+0.0	44.2	54.0 Repeater 2405MHz	-9.8	Horiz
6	4961.000M	39.6	+0.0 +4.6	-40.1 +0.8	+30.0 +0.1	+9.0	+0.0	44.0	54.0 WSIM 2480MHz	-10.0	Horiz
7	4961.017M	39.1	+0.0 +4.6	-40.1 +0.8	+30.0 +0.1	+9.0	+0.0	43.5	54.0 WSIM 2480MHz	-10.5	Vert
8	4809.000M	39.4	+0.0 +4.5	-40.4 +0.8	+30.0 +0.1	+8.8	+0.0	43.2	54.0 WSIM 2405MHz	-10.8	Vert
9	4890.920M	38.7	+0.0 +4.6	-40.2 +0.8	+30.0 +0.1	+8.9	+0.0	42.9	54.0 WSIM_2445MHz	-11.1	Vert
10	4961.170M	37.8	+0.0 +4.6	-40.1 +0.8	+30.0 +0.1	+9.0	+0.0	42.2	54.0 Repeater 2480MHz	-11.8	Vert

11	4808.867M	38.3	+0.0 +4.5	-40.4 +0.8	+30.0 +0.1	+8.8	+0.0	42.1	54.0 Repeater 2405MHz	-11.9	Vert
12	7441.626M Ave	30.5	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	41.6	54.0 Repeater 2480MHz	-12.4	Horiz
^	7441.626M	47.2	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	58.3	54.0 Repeater 2480MHz	+4.3	Horiz
14	7216.400M Ave	30.6	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	40.8	54.0 Repeater 2405MHz	-13.2	Horiz
^	7216.400M	46.8	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	57.0	54.0 Repeater 2405MHz	+3.0	Horiz
16	7213.417M Ave	29.6	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	39.8	54.0 WSIM 2405MHz	-14.2	Horiz
^	7213.417M	44.5	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	54.7	54.0 WSIM 2405MHz	+0.7	Horiz
18	7438.500M Ave	28.6	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	39.7	54.0 WSIM 2480MHz	-14.3	Horiz
^	7438.500M	43.3	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	54.4	54.0 WSIM 2480MHz	+0.4	Horiz
20	7216.400M Ave	29.4	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	39.6	54.0 Repeater 2405MHz	-14.4	Vert
^	7216.400M	44.9	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	55.1	54.0 Repeater 2405MHz	+1.1	Vert
22	7441.533M Ave	28.3	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	39.4	54.0 WSIM 2480MHz	-14.6	Vert
^	7441.533M	44.0	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	55.1	54.0 WSIM 2480MHz	+1.1	Vert
24	4810.783M	35.5	+0.0 +4.5	-40.4 +0.8	+30.0 +0.1	+8.8	+0.0	39.3	54.0 WSIM 2405MHz	-14.7	Horiz
25	7213.417M Ave	28.5	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	38.7	54.0 WSIM 2405MHz	-15.3	Vert
^	7213.417M	43.3	+0.0 +5.9	-40.2 +0.9	+32.5 +0.2	+10.9	+0.0	53.5	54.0 WSIM 2405MHz	-0.5	Vert
27	7333.500M Ave	27.9	+0.0 +5.9	-40.3 +0.9	+32.8 +0.3	+11.0	+0.0	38.5	54.0 Repeater 2445MHz	-15.5	Horiz
^	7333.500M	42.8	+0.0 +5.9	-40.3 +0.9	+32.8 +0.3	+11.0	+0.0	53.4	54.0 Repeater 2445MHz	-0.6	Horiz
29	7438.493M Ave	26.9	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	38.0	54.0 Repeater 2480MHz	-16.0	Vert
^	7438.493M	42.5	+0.0 +6.0	-40.4 +0.9	+33.1 +0.3	+11.2	+0.0	53.6	54.0 Repeater 2480MHz	-0.4	Vert
31	7333.500M Ave	25.4	+0.0 +5.9	-40.3 +0.9	+32.8 +0.3	+11.0	+0.0	36.0	54.0 Repeater 2445MHz	-18.0	Vert
^	7333.500M	40.7	+0.0 +5.9	-40.3 +0.9	+32.8 +0.3	+11.0	+0.0	51.3	54.0 Repeater 2445MHz	-2.7	Vert
33	7336.250M Ave	25.1	+0.0 +5.9	-40.3 +0.9	+32.8 +0.3	+11.0	+0.0	35.7	54.0 WSIM_2445MHz	-18.3	Horiz
^	7336.250M	39.0	+0.0 +5.9	-40.3 +0.9	+32.8 +0.3	+11.0	+0.0	49.6	54.0 WSIM_2445MHz	-4.4	Horiz

Test Setup Photos





SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.