Panasonic Avionics Corp.

TEST REPORT FOR

Bluetooth Radio
Model: Laird BT-850

Tested to The Following Standards:

FCC Part 15 Subpart C Section 15.247
(DTS 2400-2483.5 MHz)

Report No.: 103959-8

Date of issue: Janurary 14, 2021

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 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.

Test Certificate # 803.01

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:	REPORT PREPARED BY:
Panasonic Avionics Corp. 26200 Enterprise Way Lake Forrest, CA 92630	Samantha Mossman CKC Laboratories, Inc. 5046 Sierra Pines Drive Mariposa, CA 95338
Representative: Steve Dang	Project Number: 103959

DATE OF EQUIPMENT RECEIPT:	December 16, 2020
DATE(S) OF TESTING:	December 16 and 18, 2020

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, 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.

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	5.03.19

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

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	NP
15.247(b)(3)	Output Power	NA	Pass
15.247(e)	Power Spectral Density	NA	NP
15.247(d)	RF Conducted Emissions & Band Edge	NA	NP
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NP

NA = Not Applicable
NP = CKC laboratories was not contracted to perform test.

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

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

Summary of Conditions
No modifications were made during testing.

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
Note: PCII of a single modular approved radio, Original FCCID: U6YBT850 with new antennas and cable. Power setting: Specific Power Table index 0

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 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Bluetooth Radio	Panasonic Avionics Corp.	Laird BT-850	NA

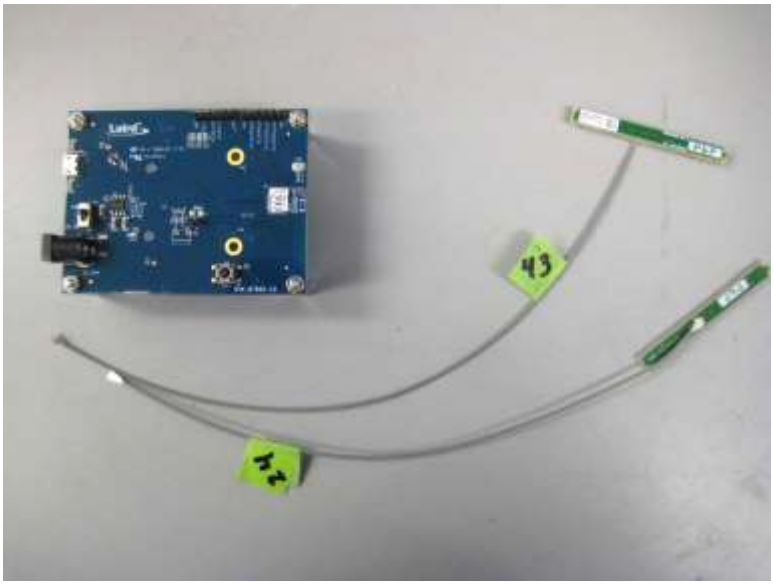
Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Inspiron 15	PA004933
Development board	Laird	DVK-BT850-1.0	PA004933

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Radio Module
Type of Wideband System:	DTS
Operating Frequency Range:	2402-2480MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	98%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Ant: PCB trace, R8U2FJ8436Z, ant gain +3.0dBi, paired with Cable 43 Ant: PCB trace, R8U5FJ8946Z, ant gain -1.2dBi, paired with Cable 24
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	3.3V DC
Firmware / Software used for Test:	Firmware PN: BT850-ST-PA-01-CT

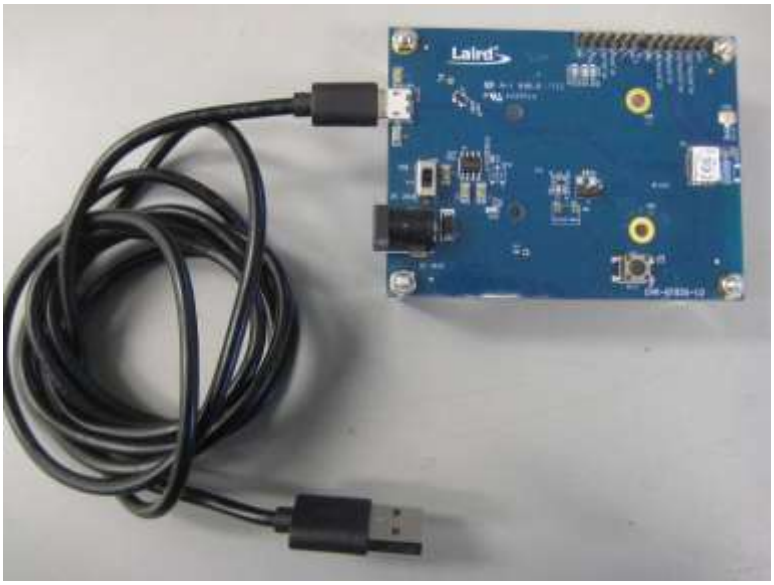
EUT and Accessory Photo(s)



Antenna

Support Equipment Photo(s)

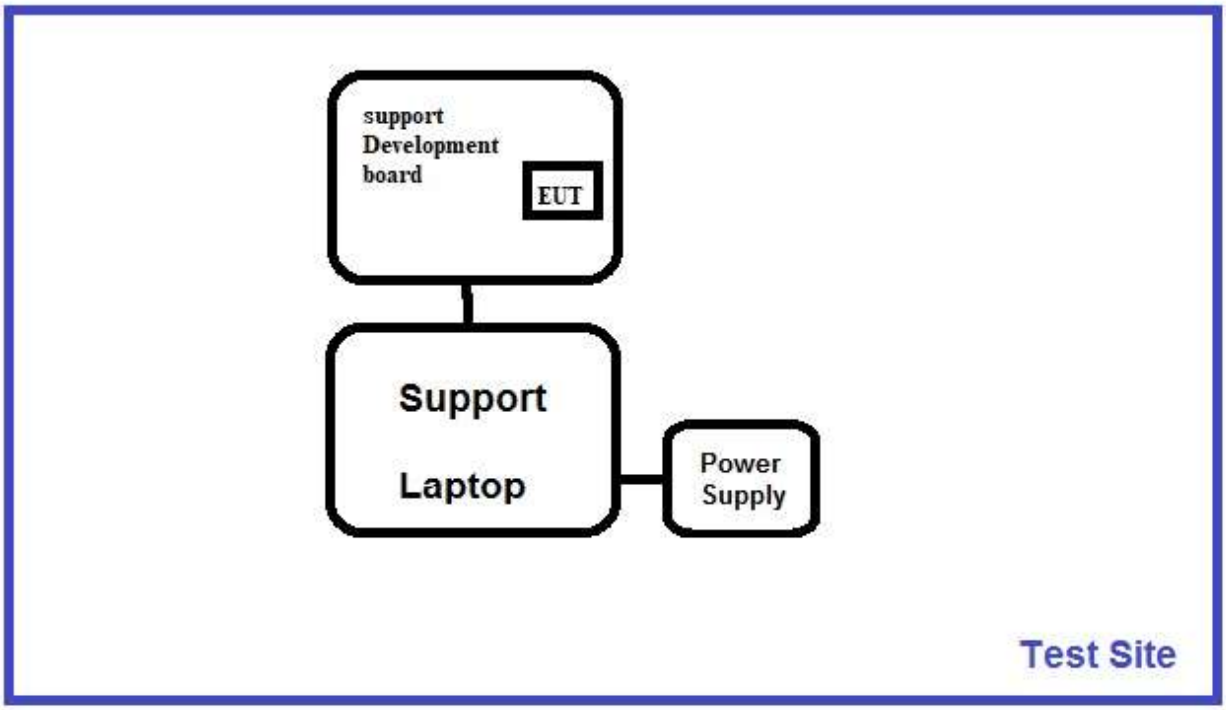
Laptop



Development Board

Block Diagram of Test Setup(s)

Test Setup Block Diagram



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 15.247 Meas. Guidance v05r02	Test Date(s):	12/16/2020
Configuration:	1		
Test Setup:	The single modulator approved radio is placed on the test bench conducted measurement measured at antenna port. 2402MHz, 2441MHz, 2480MHz. Power setting: Specific Power Table index 0		

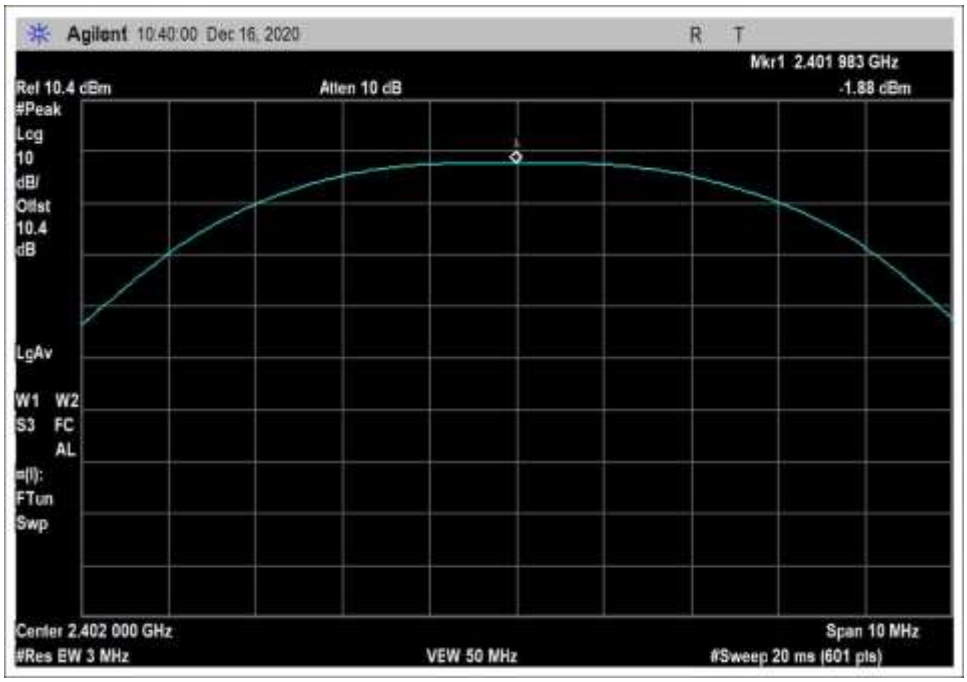
Environmental Conditions			
Temperature (ºC)	20	Relative Humidity (%):	23

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02869	Spectrum Analyzer	Agilent	E4440A	8/3/2020	8/3/2021
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	12/20/2019	12/20/2021
07243	Cable	H&S	32022-29094K-29094K-24TC	5/29/2020	5/29/2022

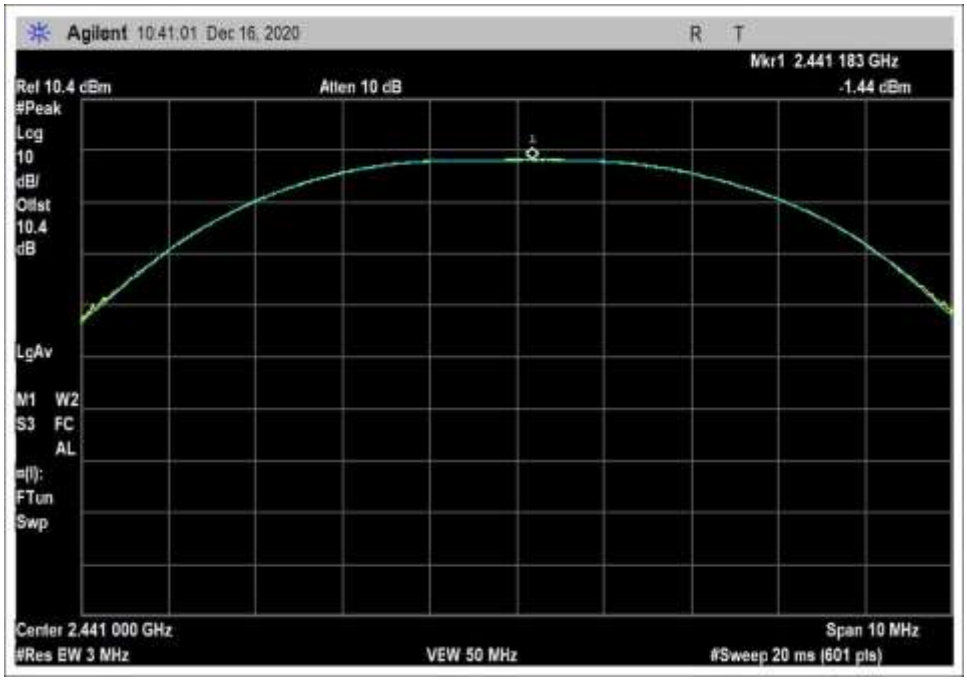
Power Output Test Data Summary - Radiated Measurement					
Measurement Option: RBW > DTS Bandwidth					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2402	GFSK (BLE)	PCB Trace *	-1.88	≤ 30	Pass
2441	GFSK (BLE)	PCB Trace *	-1.44	≤ 30	Pass
2480	GFSK (BLE)	PCB Trace *	-1.88	≤ 30	Pass

* antennas listed in equipment general product information.

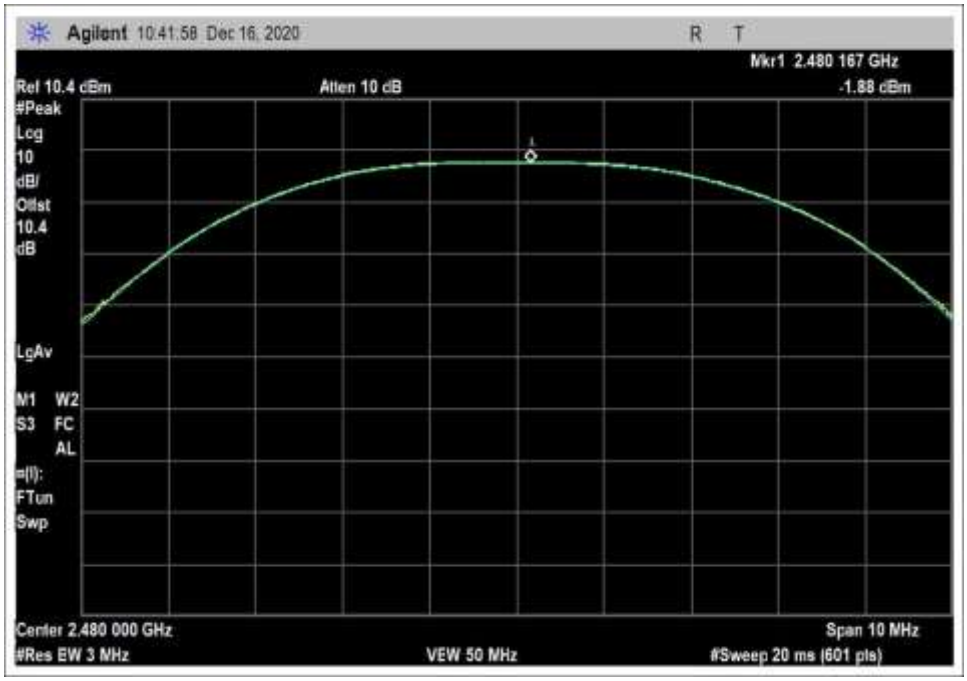
Plots



BLE_2402MHz, Low Channel



BLE_2441MHz, Middle Channel



BLE_2480MHz, High Channel

Test Setup Photo(s)

15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112		
Customer:	**Panasonic Avionics Corp.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103959**	Date:	12/18/2020
Test Type:	**Radiated Scan**	Time:	11:18:17
Tested By:	E. Wong	Sequence#:	4
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is installed on support development board and placed on Styrofoam block, connected to a support laptop for configuration purposes.

Evaluation of PCII with new antenna. Worst case emission evaluation based on original certification and pre-scan.

2402MHz, 2441MHz, 2480MHz

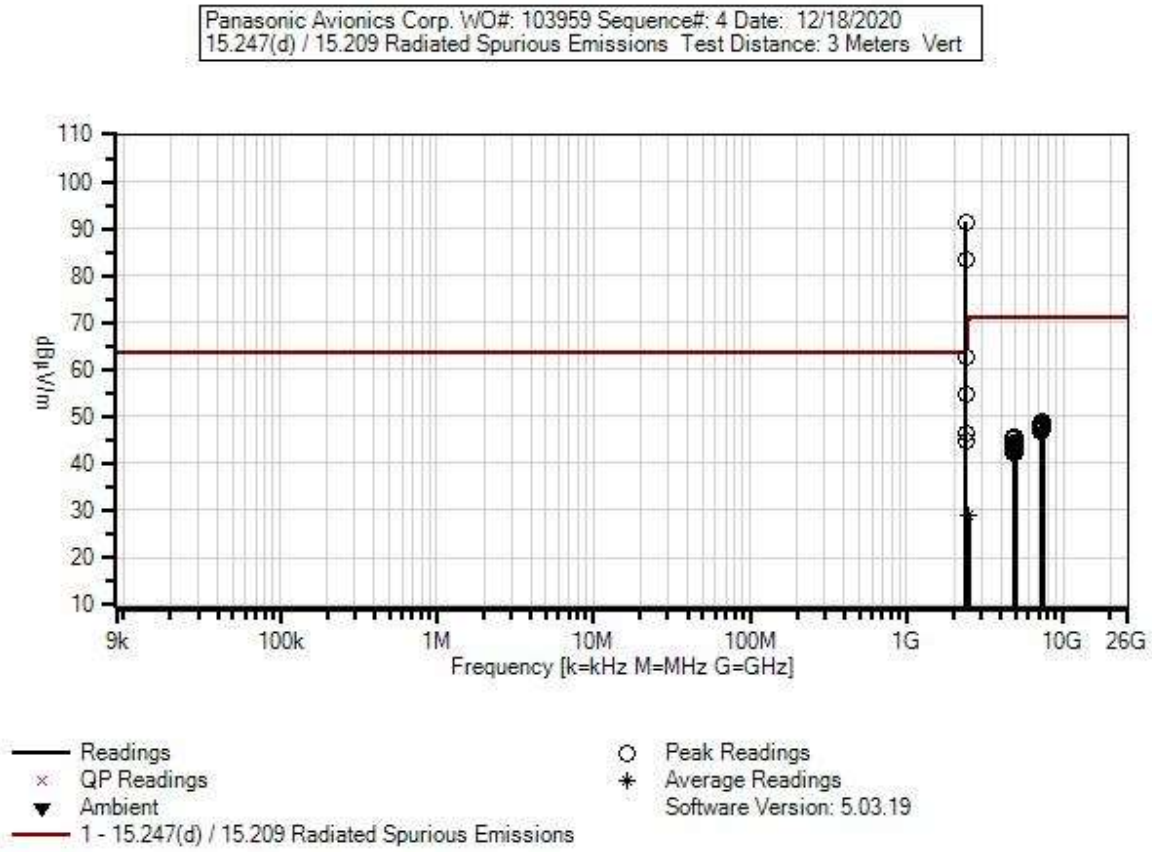
BLE GFSK

Ant 1: R8U2FJ8436Z, ant gain: +3.0dBi, paired with Cable 43
Ant 2: R8U5FJ8946Z, ant gain: -1.2dBi, paired with Cable 24

Frequency range of measurement = 1 - 12 GHz.
1000 MHz-12000 MHz; RBW=1MHz, VBW=3 MHz

Test environment conditions:
Temperature: 17°C
Relative Humidity:44%
Atmospheric Pressure:100kPa

Site D
ANSI C63.10-2013



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	AN01646	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07656	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T4	AN00787	Preamp	83017A	5/31/2019	5/31/2021
T5	ANP07138	Cable	ANDL1-PNMNM-60	3/4/2019	3/4/2021
T6	ANP04382	Cable	LDF-50	5/15/2020	5/15/2022

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist. Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	7439.800M	32.6	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	49.1	54.0 Ant2_2480MHz_BLE_Z	-4.9	Horiz
2	7323.100M	32.9	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	48.9	54.0 Ant2_2441MHz_BLE_Z	-5.1	Vert
3	7440.000M	32.3	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	48.8	54.0 Ant1_2480MHz_BLE_X	-5.2	Vert
4	7440.000M	32.1	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	48.6	54.0 Ant2_2480MHz_BLE_X	-5.4	Horiz
5	7325.000M	32.5	+0.0 +7.5	+37.0 +11.1	+0.8	-40.3	+0.0	48.6	54.0 Ant2_2441MHz_BLE_X	-5.4	Vert
6	7440.000M	32.1	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	48.6	54.0 Ant2_2480MHz_BLE_X	-5.4	Vert
7	7205.850M	32.9	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	48.5	54.0 Ant2_2402MHz_BLE_X	-5.5	Vert
8	7325.000M	32.4	+0.0 +7.5	+37.0 +11.1	+0.8	-40.3	+0.0	48.5	54.0 Ant2_2441MHz_BLE_X	-5.5	Horiz
9	7323.100M	32.5	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	48.5	54.0 Ant2_2441MHz_BLE_Y	-5.5	Horiz
10	7206.000M	32.7	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	48.3	54.0 Ant2_2402MHz_BLE_Z	-5.7	Vert
11	7321.600M	32.3	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	48.3	54.0 Ant1_2441MHz_BLE_Y	-5.7	Horiz
12	7205.850M	32.7	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	48.3	54.0 Ant2_2402MHz_BLE_X	-5.7	Horiz
13	7439.800M	31.8	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	48.3	54.0 Ant2_2480MHz_BLE_Y	-5.7	Vert
14	7439.800M	31.8	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	48.3	54.0 Ant2_2480MHz_BLE_Y	-5.7	Horiz
15	7441.000M	31.7	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	48.2	54.0 Ant1_2480MHz_BLE_Y	-5.8	Vert
16	7440.100M	31.7	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	48.2	54.0 Ant1_2480MHz_BLE_Z	-5.8	Horiz

17	7206.000M	32.6	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	48.2	54.0	-5.8	Ant1_2402MHz_BLE-X	Vert
18	7207.900M	32.5	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	48.1	54.0	-5.9	Ant1_2402MHz_BLE_Z	Vert
19	7322.830M	32.0	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	48.0	54.0	-6.0	Ant1_2441MHz_BLE_Z	Horiz
20	7323.000M	31.9	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	47.9	54.0	-6.1	Ant1_2441MHz_BLE_X	Horiz
21	7323.100M	31.8	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	47.8	54.0	-6.2	Ant2_2441MHz_BLE_Z	Horiz
22	7439.800M	31.3	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	47.8	54.0	-6.2	Ant2_2480MHz_BLE_Z	Vert
23	7322.830M	31.8	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	47.8	54.0	-6.2	Ant1_2441MHz_BLE_Z	Vert
24	7323.100M	31.7	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	47.7	54.0	-6.3	Ant2_2441MHz_BLE_Y	Vert
25	7440.000M	31.2	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	47.7	54.0	-6.3	Ant1_2480MHz_BLE_X	Horiz
26	7207.900M	32.0	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	47.6	54.0	-6.4	Ant1_2402MHz_BLE_Y	Horiz
27	7206.900M	31.9	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	47.5	54.0	-6.5	Ant1_2402MHz_BLE-X	Horiz
28	7440.100M	31.0	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	47.5	54.0	-6.5	Ant1_2480MHz_BLE_Z	Vert
29	7205.800M	31.8	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	47.4	54.0	-6.6	Ant2_2402MHz_BLE_Y	Vert
30	7206.000M	31.8	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	47.4	54.0	-6.6	Ant2_2402MHz_BLE_Z	Horiz
31	7206.000M	31.8	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	47.4	54.0	-6.6	Ant2_2402MHz_BLE_Y	Horiz
32	7440.100M	30.8	+0.0 +7.6	+37.3 +11.2	+0.8	-40.4	+0.0	47.3	54.0	-6.7	Ant1_2480MHz_BLE_Y	Horiz
33	7321.600M	31.3	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	47.3	54.0	-6.7	Ant1_2441MHz_BLE_Y	Vert

34	7323.000M	31.2	+0.0 +7.5	+36.9 +11.1	+0.8	-40.3	+0.0	47.2	54.0	-6.8	Ant1_2441MHz_BLE_X	Vert
35	7207.900M	31.4	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	47.0	54.0	-7.0	Ant1_2402MHz_BLE_Y	Vert
36	2390.030M	48.0	+0.0 +4.0	+28.3 +5.6	+0.5	-39.8	+0.0	46.6	54.0	-7.4	Ant1_2402MHz_BLE_Y_Bandedge_L	Vert
37	4804.900M	37.2	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	45.7	54.0	-8.3	Ant1_2402MHz_BLE-X	Horiz
38	4880.600M	36.6	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	45.6	54.0	-8.4	Ant1_2441MHz_BLE_Y	Vert
39	2400.000M	56.3	+0.0 +4.0	+28.3 +5.6	+0.5	-39.8	+0.0	54.9	63.5	-8.6	Ant2_2402MHz_BLE_Y_Bandedge_L -20dBc	Vert
40	2400.000M	64.0	+0.0 +4.0	+28.3 +5.6	+0.5	-39.8	+0.0	62.6	71.3	-8.7	Ant1_2402MHz_BLE_Y_Bandedge_L -20dBc	Vert
41	4805.270M	36.5	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	45.0	54.0	-9.0	Ant1_2402MHz_BLE_Y	Vert
42	2390.000M	46.2	+0.0 +4.0	+28.3 +5.6	+0.5	-39.8	+0.0	44.8	54.0	-9.2	Ant2_2402MHz_BLE_Y_Bandedge_L	Vert
43	4960.950M	35.3	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	44.4	54.0	-9.6	Ant1_2480MHz_BLE_Y	Vert
44	4959.800M	35.0	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	44.1	54.0	-9.9	Ant2_2480MHz_BLE_Z	Vert
45	4960.000M	35.0	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	44.1	54.0	-9.9	Ant2_2480MHz_BLE_X	Vert
46	4881.830M	34.8	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	43.8	54.0	-10.2	Ant1_2441MHz_BLE_Z	Horiz
47	4960.000M	34.6	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	43.7	54.0	-10.3	Ant2_2480MHz_BLE_X	Horiz
48	4882.000M	34.6	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	43.6	54.0	-10.4	Ant1_2441MHz_BLE_X	Horiz
49	4959.800M	34.5	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	43.6	54.0	-10.4	Ant2_2480MHz_BLE_Y	Vert

50	4805.270M	34.9	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	43.4	54.0	-10.6	Ant1_2402MHz_BLE_Y	Horiz
51	4960.000M	34.3	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	43.4	54.0	-10.6	Ant1_2480MHz_BLE_X	Horiz
52	4804.070M	34.8	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	43.3	54.0	-10.7	Ant2_2402MHz_BLE_Z	Horiz
53	4805.270M	34.8	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	43.3	54.0	-10.7	Ant1_2402MHz_BLE_Z	Vert
54	4959.800M	34.1	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	43.2	54.0	-10.8	Ant2_2480MHz_BLE_Y	Horiz
55	4960.050M	34.1	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	43.2	54.0	-10.8	Ant1_2480MHz_BLE_Z	Vert
56	4803.870M	34.7	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	43.2	54.0	-10.8	Ant2_2402MHz_BLE_Y	Horiz
57	4959.800M	34.0	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	43.1	54.0	-10.9	Ant2_2480MHz_BLE_Z	Horiz
58	4882.100M	34.1	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	43.1	54.0	-10.9	Ant2_2441MHz_BLE_Y	Vert
59	4960.050M	34.0	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	43.1	54.0	-10.9	Ant1_2480MHz_BLE_Z	Horiz
60	4960.950M	33.8	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	42.9	54.0	-11.1	Ant1_2480MHz_BLE_Y	Horiz
61	4882.000M	33.8	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.8	54.0	-11.2	Ant1_2441MHz_BLE_X	Vert
62	4882.100M	33.8	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.8	54.0	-11.2	Ant2_2441MHz_BLE_Z	Vert
63	4803.900M	34.2	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	42.7	54.0	-11.3	Ant2_2402MHz_BLE_X	Horiz
64	4882.100M	33.7	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.7	54.0	-11.3	Ant2_2441MHz_BLE_Y	Horiz
65	4804.070M	34.2	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	42.7	54.0	-11.3	Ant2_2402MHz_BLE_Z	Vert
66	4803.870M	34.2	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	42.7	54.0	-11.3	Ant2_2402MHz_BLE_Y	Vert

67	4960.000M	33.6	+0.0 +5.9	+33.8 +8.6	+0.7	-39.9	+0.0	42.7	54.0	-11.3	Ant1_2480MHz_BLE_X	Vert
68	4880.600M	33.7	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.7	54.0	-11.3	Ant1_2441MHz_BLE_Y	Horiz
69	4884.000M	33.6	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.6	54.0	-11.4	Ant2_2441MHz_BLE_X	Horiz
70	4880.600M	33.4	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.4	54.0	-11.6	Ant1_2441MHz_BLE_Z	Vert
71	4882.100M	33.4	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.4	54.0	-11.6	Ant2_2441MHz_BLE_Z	Horiz
72	4803.900M	33.9	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	42.4	54.0	-11.6	Ant2_2402MHz_BLE_X	Vert
73	4805.270M	33.8	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	42.3	54.0	-11.7	Ant1_2402MHz_BLE_Z	Horiz
74	4884.000M	33.2	+0.0 +5.9	+33.7 +8.6	+0.7	-39.9	+0.0	42.2	54.0	-11.8	Ant2_2441MHz_BLE_X	Vert
75	7207.530M	32.3	+0.0 +7.5	+36.6 +11.0	+0.8	-40.3	+0.0	47.9	71.3	-23.4	Ant1_2402MHz_BLE_Z	Horiz
76	2483.500M Ave	30.2	+0.0 +4.1	+28.2 +5.7	+0.5	-39.9	+0.0	28.8	54.0	-25.2	Ant1_2480MHz_BLE_Y_Bandedge_H	Vert
^	2483.550M	52.5	+0.0 +4.1	+28.2 +5.7	+0.5	-39.9	+0.0	51.1	54.0	-2.9	Ant1_2480MHz_BLE_Y_Bandedge_H	Vert
^	2483.500M	48.2	+0.0 +4.1	+28.2 +5.7	+0.5	-39.9	+0.0	46.8	54.0	-7.2	Ant2_2480MHz_BLE_Y_Bandedge_H	Vert
79	4804.000M	35.8	+0.0 +5.8	+33.5 +8.5	+0.7	-40.0	+0.0	44.3	71.3	-27.0	Ant1_2402MHz_BLE-X	Vert
80	2402.630M	92.7	+0.0 +4.0	+28.3 +5.6	+0.5	-39.8	+0.0	91.3	125.2	-33.9	Ant1_2402MHz_BLE_Y_Bandedge_L_fundamental 100kHz	Vert
81	2402.630M	84.9	+0.0 +4.0	+28.3 +5.6	+0.5	-39.8	+0.0	83.5	125.2	-41.7	Ant2_2402MHz_BLE_Y_Fundamental 100kHz	Vert

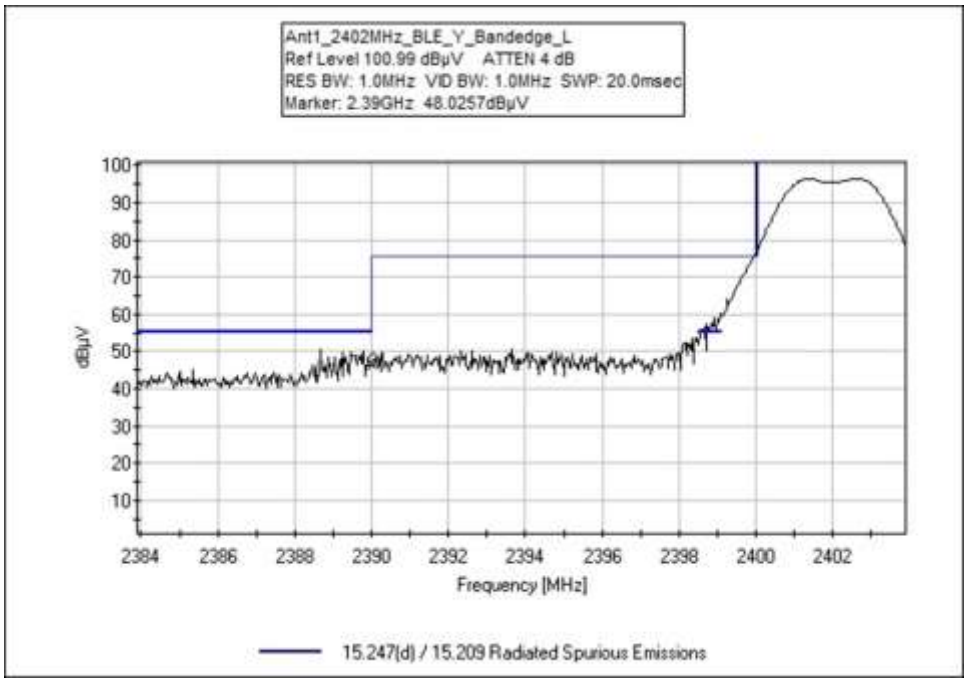
Band Edge Summary					
Antenna 1					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2390.0	GFSK (BLE)	PCB Trace *	46.6	<54	Pass
2400.0	GFSK (BLE)	PCB Trace *	62.6	< 71.3	Pass
2483.5	GFSK (BLE)	PCB Trace *	28.8(ave)	<54	Pass

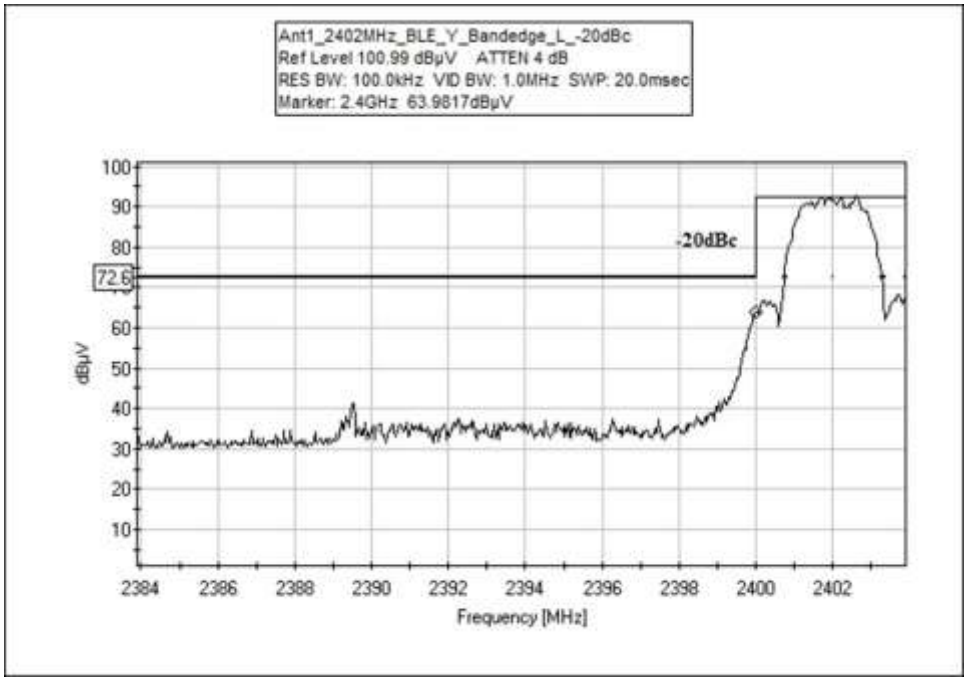
* antennas listed in equipment general product information

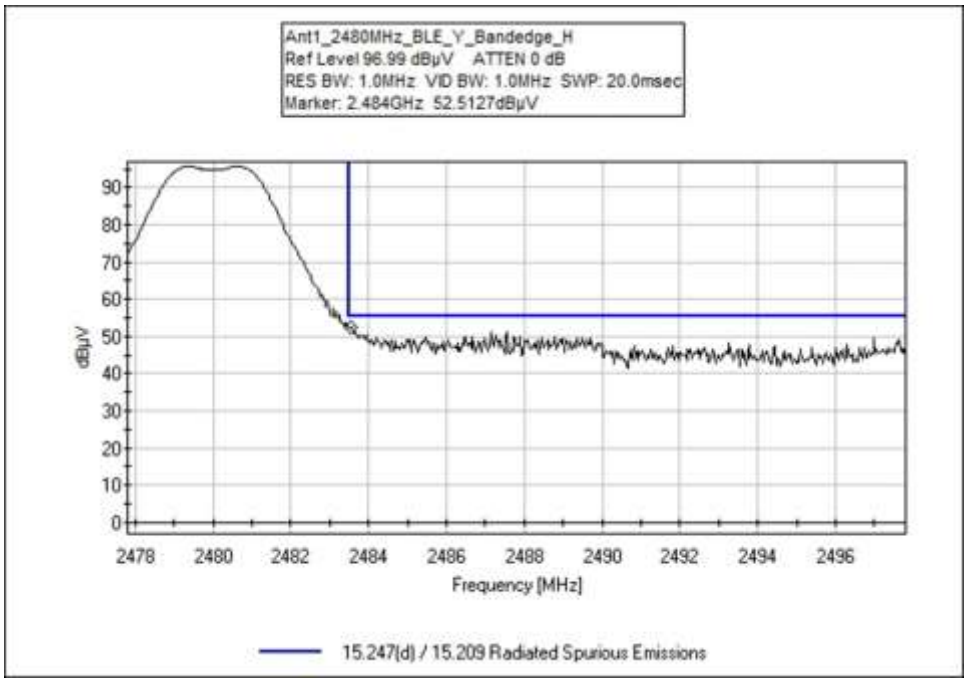
Band Edge Summary					
Antenna 2					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2390.0	GFSK (BLE)	PCB Trace *	44,8	<54	Pass
2400.0	GFSK (BLE)	PCB Trace *	54.9	<63.5	Pass
2390.0	GFSK (BLE)	PCB Trace *	44,8	<54	Pass

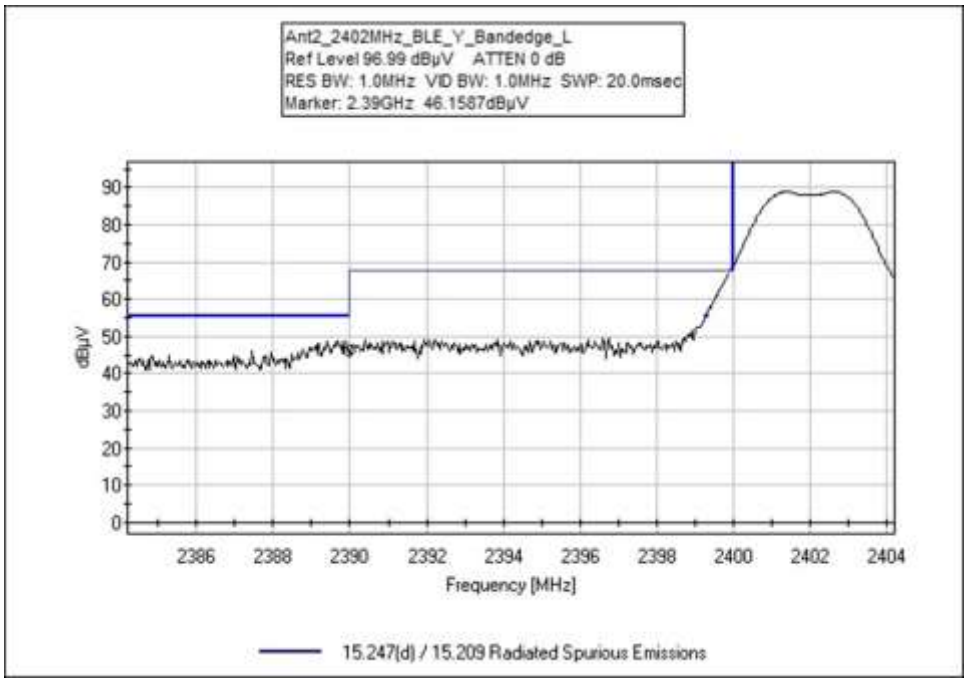
* antennas listed in equipment general product information

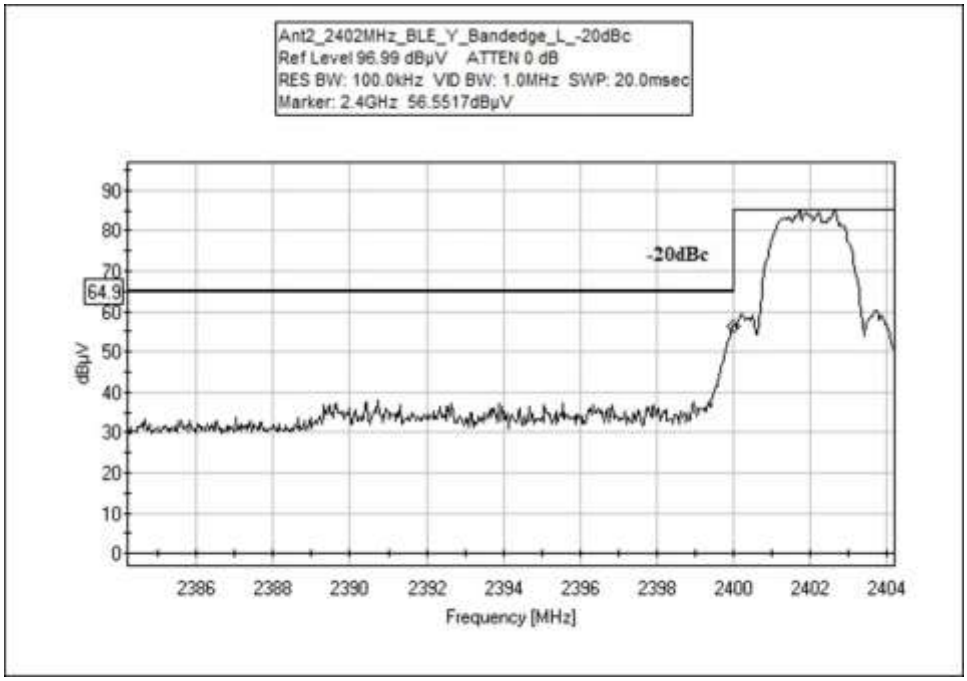
Band Edge Plots

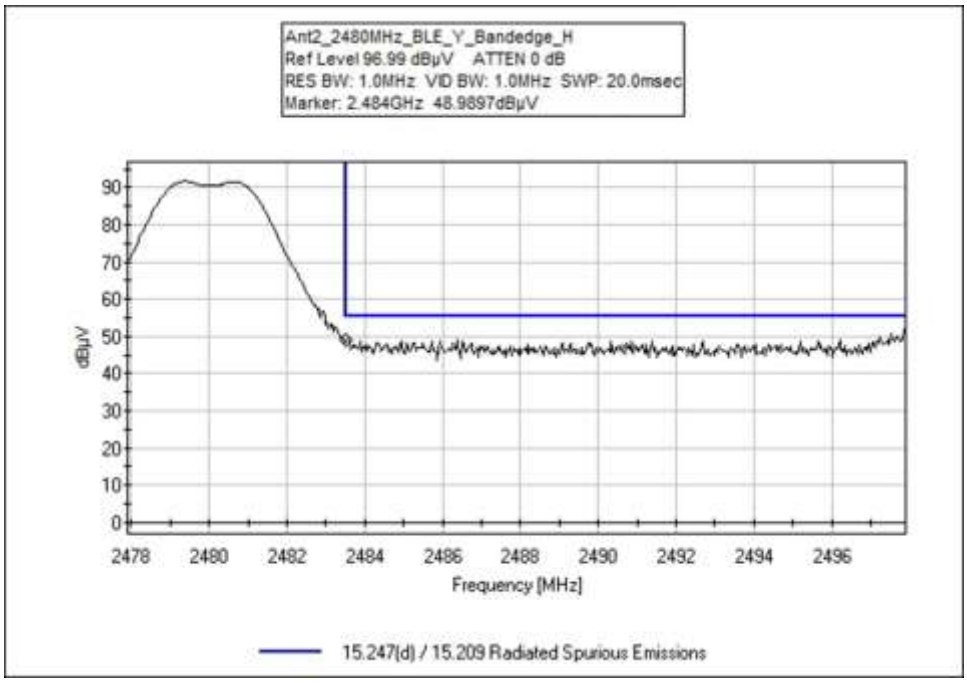



Ant1_2402MHz_BLE_Y_Bandedge_L_-20dBc
Ref Level 100.99 dBµV ATTEN 4 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 2.4GHz 63.9817dBµV
-20dBc
72.6
dBµV
Frequency [MHz]

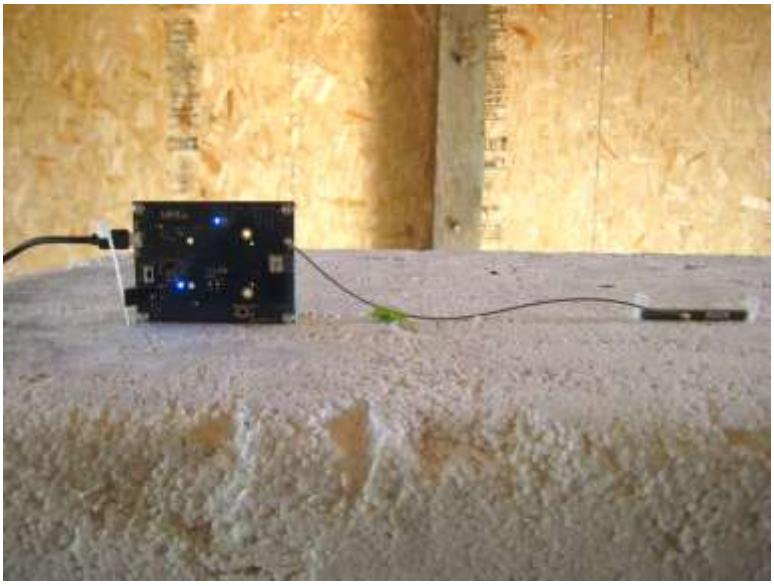

Ant1_2480MHz_BLE_Y_Bandedge_H
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 2.484GHz 52.5127dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Ant2_2402MHz_BLE_Y_Bandedge_L
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 2.39GHz 46.1587dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Ant2_2402MHz_BLE_Y_Bandedge_L_-20dBc
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 2.4GHz 56.5517dBµV
-20dBc
64.9
dBµV
Frequency [MHz]



Test Setup Photo(s)



General Test Setup

Below 1GHz

Below 1GHz

Above 1GHz

Above 1GHz

X Axis

Y Axis

Z Axis

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

Uncertainties reported are worst case for all CKC Laboratories' sites and 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 dBµV/m, the spectrum analyzer reading in dBµV 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	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/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.