CANADA:

16 - 211 Schoolhouse Street

Coquitlam, British Columbia

Canada V3K 4X9

TEST REPORT
IC/FCC
IC RSS-Gen Issue 3 and RSS-210 Issue8
FCC 47CFR Part 15/C Section 15.249

Transmitter Intentional Radiator

Report Reference No. ..... : E10415-1103

Date of issue ..... : Rev 5.0 – October 13, 2011

Total number of pages..... : 37

Testing Laboratory..... : Quality Auditing Institute

Address..... :16 – 211 Schoolhouse Street, Coquitlam, BC, V3K 4X9, Canada

Accreditations.....:

ACCREDITED

IAS ISO17025 Accredited Laboratory No TL-239

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Applicant's name ..... : Recon Instruments Inc.

Address..... : 220-1050 Homer St. Vancouver BC, V6B 2W9, Canada

Contact..... : Hamid Abdollahi

hamid@reconinstruments.com

Industry Canada Registration : **9717A-006**

FCC Registration: **ZW5006**

Test specification:

Standard..... : RSS-Gen; RSS-210; FCC Part 15.249

Test procedure..... : RSS-Gen; FCC Part15/C; ANSI C63.4-2009

Non-standard test method.....: N/A

CANADA:

16 - 211 Schoolhouse Street

Coquitlam, British Columbia

Canada V3K 4X9

Test item description	:	Head Mounted Display system for sports goggles with Bluetooth.
Trade Mark	:	N/A
Manufacturer	:	Recon Instruments Inc.
Model/Type reference	:	RI-MOD
Ratings	:	+5Vdc Rechargeable Battery – charged by 100-240Vac 50-60Hz adapter via mini-USB cable

Testing procedure and testing location:	
Testing Laboratory:	Quality Auditing Institute
Testing location/ address.....:	16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada
Associated Laboratory:	Quality Auditing Institute EMC lab (Remote location)
Testing location/ address.....:	19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada
FCC Test Site Registration Number (OATS 10m and SAC-3m): 226383	
Industry Canada Site Registration Number (SAC-3m)……..: 9543B-1	
Industry Canada Test Site Registration Number (OATS-10m)..: 9543C-1	

Testing procedure:	
Tested by (name + signature).....:	David Johanson
Approved by (+ signature) .....:	Parminder Singh
Testing location/ address.....:	19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada

Sample Information:	
Model Number……:	RI-MOD
Company:……:	Recon Instruments Inc.
Received Date:……..:	August 05, 2011
Received By……..:	David Johanson
Sample Log……..:	QAI Product Control Log (QM 1301 - Sample Inventory)

Environmental Conditions:	
Day 1: Aug 05-2011	Indoor Temperature: 22ºC R.H.: 39%
Day 2: Aug 09-2011	Indoor Temperature: 21ºC R.H.: 45%
Day 3: Aug 10-2011	Outdoor Temperature: 19ºC R.H.: 52%
Day 4: Aug 11-2011	Indoor Temperature: 22ºC R.H.: 40%
Day 5: Aug 12-2011	Outdoor Temperature: 24ºC R.H.: 61%
Day 6: Aug 19-2011	Indoor Temperature: 21ºC R.H.: 42%

The following tests demonstrate the testimony to FCC and IC Electromagnetic compatibility testing for this product.

EMISSIONS
North America Regions: • CFR 47 Part 15 Subpart B and Subpart C, Section 15.249 • Industry Canada ICES-003, RSS-Gen and RSS-210

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Industry Canada and FCC Regulations for an un-licensed Intentional Radiator. Recon Instruments Inc. is responsible for the tested product configuration, continued product compliance with these standards listed, and for the appropriate auditing of subsequent products, as required.

This is to certify that the following report is true and correct to the best of our knowledge.

X 

Tested By
David Johanson RF/EMC Test Engineer

X 

Reviewed By
Parminder Singh Senior RF/ EMC Engineer

Measurement Uncertainty

Radio Frequency .....: ±1,5 x 10-5

Total RF power, conducted.....: ±1 dB

RF power density, conducted.....: ±2.75 dB

Spurious emissions, conducted.....: ±3 dB

All emissions, radiated.....: ±3.5 dB

Temperature.....: ±1ºC

Humidity.....: ±5 %

DC and low frequency voltages.....: ±3 %

Test Equipment List
Emissions

Manufacturer	Model	Description	Serial No.	Cal Due Date
ETS Lindgren	S201	3M Chamber 40GHz	1030	N/R
ETS Lindgren	Custom	Mast with Motor	N/R	N/R
ETS Lindgren	Custom	Turntable	N/R	N/R
Sunol Sciences	JB3	Biconilog Antenna 20MHz-3GHz	A120106	28-Oct-2011
Com-Power	AHA-118	Horn Antenna 1-18GHz	711041	11-Mar-2014
Com-Power	LI-115	LISN	241036	11-Feb-2012
Rohde & Schwarz	ESU	EMI Receiver	100011	29-Mar-2012

Product Description

MOD is a Head Mounted Display system that can be installed into Recon-Ready sports goggles, utilizing a GPS receiver, multiple motion sensors, a small LCD, a microprocessor, and a Bluetooth Low Energy (BLE) transceiver.

Operational Description

The GPS receiver and the sensors in the MOD measures the athlete's performances, displays the sensor data in real-time on a small LCD, and records the sensor data in non-volatile memory for post processing.

To navigate through the manual on MOD's LCD, the BLE transceiver is also implemented to receive control signals from a Recon-Ready Remote with FCC ID: ZW5001.

The test results for the Recon Remote can be found in a separate document.

EUT Testing Configuration

For the purpose of compliance testing, the EUT was powered using the +5Vdc power supply since the battery would not have enough power to complete the testing. The BLE transceiver inside the MOD was programmed to transmit the maximum output power at the low, mid and high channels of the Bluetooth band (2402, 2441 and 2480 MHz respectively). In order to set the goggle in a continuous transmission mode, with or without modulation, a command sender is used.

Manufacturer	Recon Instruments Inc.
Product Name	Head Mounted Display System with Bluetooth
Model No.	RI-MOD
Serial No.	AlpinaB20012
Product Software/Firmware Revision	2.0.0
Operating temperature range	-20º to +30º Celsius

Auxiliary Equipment

Description	+5Vdc Switch Mode Power Supply
Manufacturer	ENG
Model No.	3A-053WP05
Input	100-240Vac 50-60Hz 0.2A
Output	+5Vdc
Plug	NEMA 1-15 Un-polarized 2 prong blade Type A

Cables

Description	Length	Connector A	Connector B	Shielded	Ferrites
USB Power/Communications	1m	USB A	USB Micro B	Yes	No

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Requirements for the Canadian Market- IC
(Exigences pour le marché Canadien)

Summary for RSS-Gen issue 3 and RSS-210 Issue 8

Testing was performed pursuant to Industry Canada standards

Test	Standard	Description	Result
Digital Circuits Radiated Emissions	RSS-Gen (7.1.4) ICES-003	The radiated emissions are measured in the 30-1000MHz range	Complies
Digital Circuits AC Mains Conducted Emissions	RSS-Gen (7.1.4) ICES-003	The AC mains Conducted emissions are measured in the 0.15 to 30MHz range	Complies
Antenna Requirement	RSS-GEN(7.1.2)	Replaceable Antenna must use a unique connector	Complies Soldered non-replaceable antenna
Radiated Peak Power and Harmonics	RSS-210 (A2.9)(a)	Peak Power and Harmonics shall be measured at 3meters	Complies
Spurious Emissions outside of the band	RSS-210 (A2.9)(b)	Radiated Spurious emissions shall be 50dBc or 54dBuV in accordance with RSS-210 Table 2, whichever is less stringent 30-18000MHz	Complies
Spurious Emissions at bandedge	RSS-GEN (7.2.2)(b)	unwanted emissions falling into restricted bands of Table 3 shall comply with the limits specified in RSS-Gen Table 5	Complies
Occupied Bandwidth	RSS-GEN (4.6.1)	When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, is measured.	Complies
Transmitter Frequency Stability	RSS-GEN (4.7) and (7.2.6)	Measure the Frequency Stability over Voltage and temperature ranges	Complies

Part 1 - AC Mains Conducted Emissions

DATE: August 05, 2011

TEST STANDARD: ICES-003 Issue 4

TEST METHOD: RSS-Gen (7.1.4); CAN/CSA – CEI/IEC CISPR 22: 02

TEST VOLTAGE: 5Vdc from AC Power Adapter

MINIMUM STANDARD: Class B Limit:

Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50
Note 1 The lower limit shall apply at the transition frequencies Note 2 The limit decreases linearly with the logarithim of the frequency in the 0.15 to 0.50 MHz..		

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus. The equipment was operated and tested at 120Vac 60Hz while in “Continuous Mode” of operation.

METHOD OF MEASUREMENT: Measurements were made using a test receiver with 9 kHz bandwidth, CISPR Quasi-Peak and Average detector.

DEVICE DESCRIPTIONS: As described in the Equipment under Test Section, above.

MEASUREMENT DATA: See Appendix A for Conducted emissions Plots and corresponding data

MODIFICATIONS: The EUT did not require any modifications.

PERFORMANCE: Complies with Standard

Part 2 - Digital Circuits Radiated Emission Testing

DATE: August 05, 2011

TEST STANDARD: ICES-003 Issue 4

TEST METHOD: RSS-Gen (7.1.4); CAN/CSA – CEI/IEC CISPR 22: 02

TEST VOLTAGE: 5Vdc from AC Power Adapter

MINIMUM STANDARD: Class B Limit:

Frequency (MHz)	**Maximum Field Strength** (calculated) **dBμV/m at 3 m**	**Maximum Field Strength dBμV/m at 10 m**
30 - 230	40.45	30.0
230 - 1000	47.45	37.0
Note 1. The lower limit shall apply at the transition frequency Note 2. Additional provisions may be required for cases where interference occurs Note 3. The 3meter calculation is done for measurements performed at 3meters.		

METHOD OF MEASUREMENT: The equipment was set up in 3m Semi Anechoic Chamber for preliminary and final measurements; Radiated Emissions were performed at 3 meters for this unit. A typical application was tested.

Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable to maximize the emissions signal strength.

This product is designed to be worn on the body. The EUT was investigated in 3 orthogonal planes and the worst case data and plots were taken.

The transmitter was OFF and set for Receive mode for this test.

MODIFICATIONS: The EUT did not require any modifications.

MEASUREMENT DATA: The plots and data are contained in Appendix A.

PERFORMANCE: Complies with Standard

Part 3 - Antenna Requirements

DATE: August 05, 2011

TEST STANDARD: IC RSS-Gen Section 7.1.2

APPLICABLE REGULATIONS : - “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. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.”… “the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.”

RESULT : This unit meets this requirement. There are two antenna’s in this unit. Both antenna’s are soldered to the circuit board and is not accessible to the end-user.

GPS receiver – Pulse Electronics W3010

Bluetooth transceiver – Ethertronics Inc. p/n:M310210

Part 4 - Radiated Peak Power of the Fundamental and Harmonics

DATE: August 10, 2011

TEST STANDARD: IC RSS-210 Annex 2 Section (A2.9)(a)

TEST VOLTAGE: 5Vdc from AC Power Adapter

MINIMUM STANDARD:

(a) The field strengths measured at 3 meters shall not exceed the following:

Fundamental Frequencies (MHz)	Field Strength (millivolts/m)	
	Fundamental	Harmonics
902-928	50 (94dBuV)	0.5 (54dBuV)
2400-2483.5	50 (94dBuV)	0.5 (54dBuV)
5725-5875	50 (94dBuV)	0.5 (54dBuV)

TEST SETUP: The EUT was tested in our 3meter OATS and was positioned on the center of the Turntable and connected to a 5Vdc power supply. The Transmitter was set for Continuous transmission. The lowest, middle and highest channels in the 2400-2483.5MHz band were measured for all radiated emissions 30MHz to 26GHz.

MEASUREMENT METHOD: Measurements were made using an EMI Receiver with 1MHz RBW, Average detector using the appropriate Antennas, amplifiers and filters.

This product is designed to be worn on the body. The EUT was investigated in 3 orthogonal planes and the worst case data and plots were taken.

DEVICE DESCRIPTIONS: As described in the above EUT description and setup Section.

EMISSIONS DATA: No emissions were detected above 7.5GHz using the appropriate antennas and amplifiers. See data in Appendix B

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Part 5 - Spurious Radiated Emissions Testing

DATE: August 09, 2011

TEST STANDARD: IC RSS-210 Annex 2 Section (A2.9)(b)

RSS-Gen Section (7.2.5)

TEST VOLTAGE: 5Vdc from AC Power Adapter

TEST CONDITIONS: Indoor, Temperature and Humidity: 25°C, 62%

MINIMUM STANDARD: (b) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Table 5: General Field Strength Limits for Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

TEST SETUP: The EUT was tested in our 3meter OATS and was positioned on the center of the Turntable and connected to a 5Vdc power supply. The Transmitter was set for Continuous transmission. The lowest, middle and highest channels in the 2400-2483.5MHz band were measured for all radiated emissions 30MHz to 26GHz.

MEASUREMENT METHOD: Measurements were made using an EMI Receiver with 120kHz RBW Quasi-Peak or 1MHz RBW, Average detector using the appropriate Antennas, amplifiers and filters.

This product is designed to be worn on the body. The EUT was investigated in 3 orthogonal planes and the worst case data and plots were taken.

DEVICE DESCRIPTIONS: As described in the above EUT description and setup Section.

EMISSIONS DATA: No emissions were detected above 7.5GHz using the appropriate antennas and amplifiers. See data in Appendix B

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Part 6 - Spurious Radiated Emissions at Bandedge Testing

DATE: August 09, 2011

TEST STANDARD: IC RSS-210 Annex 2 Section (A2.9)(b)

RSS-Gen Section (7.2.2)(b)

TEST VOLTAGE: 5Vdc from AC Power Adapter

TEST CONDITIONS: Indoor, Temperature and Humidity: 25°C, 62%

MINIMUM STANDARD: unwanted emissions falling into restricted bands of Table 3 shall comply with the limits specified in RSS-Gen Table 5.

Table 5: General Field Strength Limits for Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 +	500	54.0

TEST SETUP: The EUT was tested in our 3meter OATS and was positioned on the center of the Turntable and connected to a 5Vdc power supply. The Transmitter was set for Continuous transmission. The lowest, middle and highest channels in the 2400-2483.5MHz band were measured for all radiated emissions 30MHz to 26GHz.

MEASUREMENT METHOD: Measurements were made using an EMI Receiver with 120kHz RBW Quasi-Peak or 1MHz RBW, Average detector using the appropriate Antennas, amplifiers and filters.

This product is designed to be worn on the body. The EUT was investigated in 3 orthogonal planes and the worst case data and plots were taken.

DEVICE DESCRIPTIONS: As described in the above EUT description and setup Section.

EMISSIONS DATA: See data in Appendix B

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Part 7 - Occupied Bandwidth Testing

DATE:	August 10, 2011
TEST STANDARD:	RSS-Gen Section (4.6.1)
TEST VOLTAGE:	5Vdc from AC Power Adapter
MINIMUM STANDARD:	When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
TEST SETUP:	The EUT was tested in our 3meter OATS and was positioned on the center of the Turntable and connected to a 5Vdc power supply. The Transmitter was set for Continuous transmission. The highest power channel was measured.
MEASUREMENT METHOD:	Measurements were made using an EMI Receiver with 120kHz RBW Sample Detector set on maximum hold using the appropriate Antennas, amplifiers and filters.
DEVICE DESCRIPTIONS:	As described in the above EUT description and setup Section.
EMISSIONS DATA:	See Data and Plots in Appendix B
OBSERVATIONS:	Since this product was tested per the requirements of RSS-210 A2.9, there was no reference to a required Bandwidth. It was decided that the 99% bandwidth was the appropriate measurement. The EUT performed as expected.
PERFORMANCE:	Complies.

Part 8 - Transmitter Frequency Stability

DATE:	September 14, 2011
TEST STANDARD:	RSS-Gen Section (4.7) and (7.2.6)
TEST VOLTAGE:	5Vdc from battery
MINIMUM STANDARD:	Not specified. (4.7)With the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below: (a) at temperatures of -30°C, +20°C and +50°C, and at the manufacturer's rated supply voltage; and (b) at a temperature of +20°C and at ±15 percent of the manufacturer's rated supply voltage. (7.2.6) Transmitter frequency stability for licence-exempt radio apparatus shall be measured in accordance with Section 4.7. Also, for licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C, +20°C and +50°C instead of at the temperatures specified in Section 4.7(a). If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standards, measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz.
TEST SETUP:	The EUT was bench tested and in our temperature chamber. Since this is a battery operated device, there was no measurement resulting from the AC voltage variation. The temperature was varied at +50, +20, and -30º Celsius. The transmitter was set for Carrier Wave (CW) mode and the lowest and highest channel Frequency was measured at each Temperature setting, after the Transmitter stabilized at the temperature.
MEASUREMENT METHOD:	Measurements were made using a Spectrum Analyzer with 1kHz RBW Average detector using the appropriate Antennas, amplifiers and filters.
DEVICE DESCRIPTIONS:	As described in the above EUT description and setup Section.
EMISSIONS DATA:	not required. The Occupied bandwidth lies within the 2.4 to 2.4385GHz designated band. See data below in the FCC Transmitter Frequency Stability section.
OBSERVATIONS:	The EUT performed as expected.
PERFORMANCE:	Complies.

Section II: Requirements for the US Market - FCC

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC CFR47 Part 15 subpart B - Unintentional Radiators, Class B and subpart C – Intentional Radiators

Summary for FCC CFR47, Part 15 Subpart B and Subpart C Section 15.249

Test	Standard	Description	Result
AC Mains Conducted Emissions	15.107	The AC mains Conducted emissions are measured in the 0.15 to 30MHz range	Complies
Digital Circuits Radiated Emissions	15.109	The radiated emissions are measured in the 30-1000MHz range	Complies
Antenna Requirement	15.203	Replaceable Antenna must use a unique connector	Complies
Radiated Fundamental and Harmonics Emissions	15.249(a)	Peak Fundamental and Harmonics shall be measured at 3meters	Complies
Spurious Emissions outside of the band and Bandedge	15.249(d) and (e)	Radiated Spurious emissions shall be 50dBc or the levels in 15.209	Complies
Occupied Bandwidth	15.209	Procedures for measuring the band edge requires a 20dB emission bandwidth	Complies
Transmitter Frequency Stability	15.215(c)	The 20dB bandwidth must remain within the designated frequency band over the expected variations in temperature and voltage range	Complies

Part 1 - AC Mains Conducted Emission

DATE: August 05, 2011

TEST STANDARD: FCC Part 15/B

TEST VOLTAGE: 5Vdc from AC Power Adapter

MINIMUM STANDARD: Class B Limit:

Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50
Note 1 The lower limit shall apply at the transition frequencies Note 2 The limit decreases linearly with the logarithim of the frequency in the 0.15 to 0.50 MHz..		

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus. The equipment was operated and tested at 120Vac 60Hz while in “Continuous Mode” of operation.

METHOD OF MEASUREMENT: Measurements were made using a test receiver with 9 kHz bandwidth, CISPR Quasi-Peak and Average detector.

DEVICE DESCRIPTIONS: As described in the Equipment under Test Section, above.

MEASUREMENT DATA: See Appendix A for Conducted emissions Plots and corresponding data

MODIFICATIONS: The EUT did not require any modifications.

PERFORMANCE: Complies with Standard

Part 2 - Digital Circuits Radiated Emission Testing

DATE: August 05, 2011

TEST STANDARD: FCC Part 15/B

TEST VOLTAGE: 5Vdc from AC Power Adapter

MINIMUM STANDARD: Class B Limit:

+Frequency (MHz)	Field Strength	
	uV/m @ 3-m	dBμV/m at 3m
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

METHOD OF MEASUREMENT: The equipment was set up in 3m Semi Anechoic Chamber for preliminary and final measurements; Radiated Emissions were performed at 3 meters for this unit. A typical application was tested.

Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable to maximize the emissions signal strength.

This product is designed to be worn on the body. The EUT was investigated in 3 orthogonal planes and the worst case data and plots were taken.

The transmitter was OFF and set for Receive mode for this test.

MODIFICATIONS: The EUT did not require any modifications.

MEASUREMENT DATA: See Appendix A for emissions plots and corresponding data

PERFORMANCE: Complies with Standard

Part 3 - Antenna Requirements

DATE: August 05, 2011

TEST STANDARD: FCC Part 15.203

APPLICABLE REGULATIONS : - “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. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.”… “the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.”

RESULT : This unit meets this requirement. There are two antenna’s in this unit. Both antenna’s are soldered to the circuit board and is not accessible to the end-user.

GPS receiver – Pulse Electronics W3010

Bluetooth transceiver – Ethertronics Inc. p/n:M310210

Part 4 - Radiated Peak Power of the Fundamental and Harmonics

DATE: August 10, 2011

TEST STANDARD: FCC Part 15.249(a)

TEST VOLTAGE: 5Vdc

TEST CONDITIONS: Indoor, Temperature and Humidity: 25°C, 62%

MINIMUM STANDARD:

(a) The field strengths measured at 3 meters shall not exceed the following:

Fundamental Frequencies (MHz)	Field Strength (millivolts/m)	
	Fundamental	Harmonics
902-928	50 (94dBuV)	0.5 (54dBuV)
2400-2483.5	50 (94dBuV)	0.5 (54dBuV)
5725-5875	50 (94dBuV)	0.5 (54dBuV)

TEST SETUP: The EUT was tested in our 3meter SAC and was positioned on the center of the Turntable and connected to a 5Vdc power supply. The Transmitter was set for Continuous transmission. The lowest, middle and highest channels in the 2400-2483.5MHz band were measured for all radiated emissions 30MHz to 26GHz.

MEASUREMENT METHOD: Measurements were made using an EMI Receiver with 1MHz RBW, Average detector using the appropriate Antennas, amplifiers and filters.

This product is designed to be worn on the body. The EUT was investigated in 3 orthogonal planes and the worst case data and plots were taken.

DEVICE DESCRIPTIONS: As described in the above EUT description and setup Section.

EMISSIONS DATA: No emissions were detected above 7.5GHz using the appropriate antennas and amplifiers. See data in Appendix B

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Part 5 - Spurious Radiated Emissions and Bandedge Testing

DATE: August 11, 2011

TEST STANDARD: FCC Part 15.249(d) and (e)

TEST VOLTAGE: 5Vdc

TEST CONDITIONS: Indoor, Temperature and Humidity: 25°C, 62%

MINIMUM STANDARD: (d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.
(e) As shown in § 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20dB under any condition of modulation.

15.209 General Field Strength Limits

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960+	500	54.0

TEST SETUP: The EUT was tested in our 3meter SAC and was positioned on the center of the Turntable and connected to a 5Vdc power supply. The Transmitter was set for Continuous transmission. The lowest, middle and highest channels in the 2400-2483.5MHz band were measured for all radiated emissions 30MHz to 18GHz.

MEASUREMENT METHOD: Measurements were made using an EMI Receiver with 120kHz RBW Quasi-Peak or 1MHz RBW, Average detector using the appropriate Antennas, amplifiers and filters.

This product is designed to be worn on the body. The EUT was investigated in 3 orthogonal planes and the worst case data and plots were taken.

DEVICE DESCRIPTIONS: As described in the above EUT description and setup Section.

EMISSIONS DATA: No emissions were detected above 7.5GHz using the appropriate antennas and amplifiers. See data and plots in Appendix A.

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Part 6 - Transmitter Frequency Stability

DATE: August 19, 2011

TEST STANDARD: FCC Part 15.215(c)

TEST VOLTAGE: 5Vdc provided by 120Vac adapter

MINIMUM STANDARD: The 20dB bandwidth must remain within the designated frequency band over the expected variations in temperature and voltage range

TEST SETUP: The EUT was bench tested and in our temperature chamber. The AC voltage was varied 102, 120 and 138Vac 60Hz and the Bandwidth measured at 20deg. Celsius for each voltage level at the bandedge. The temperature was varied at +30, +20, 0, -20 and -30deg. Celsius as per the manufacturers expected temperature range and the Bandwidth measured at 120Vac 60Hz for each temperature level at the bandedge. The Transmitter was set for Continuous transmission using the modulation for this product. The lowest, and highest channel bandwidth was measured at each Voltage and Temperature setting.

MEASUREMENT METHOD: Measurements were made using a Spectrum Analyzer with 1MHz RBW Average detector using the appropriate Antennas, amplifiers and filters.

DEVICE DESCRIPTIONS: As described in the above EUT description and setup Section.

EMISSIONS DATA: Channel 0 – 2.402GHz

Temperature (deg. Celsius)	Voltage (Vac at 60Hz)	Bandwidth level at band edge (dB from peak emission)
20	102	-37.24
20	120	-37.24
20	138	-37.24
-30	120	-38.44
-20	120	-38.38
0	120	-38.55
20	120	-37.24
30	120	-37.64

Channel 39 – 2.480GHz

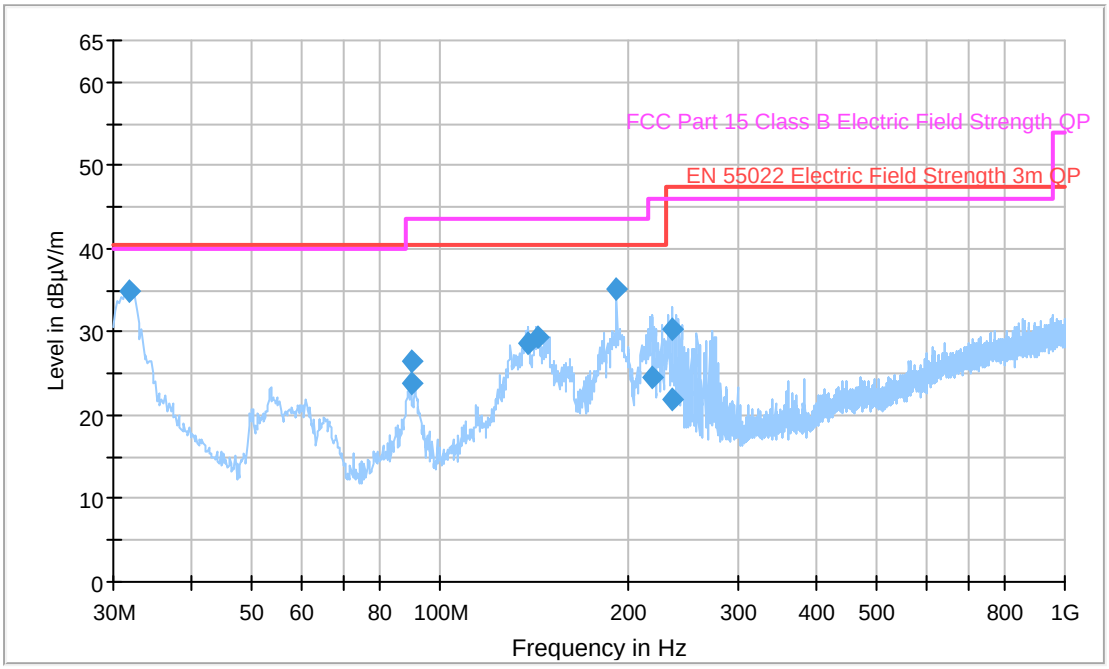
Temperature (deg. Celsius)	Voltage (Vac at 60Hz)	Bandwidth level at band edge (dB from peak emission)
20	102	-53.20
20	120	-53.20
20	138	-53.20
-30	120	-53.95
-20	120	-53.72
0	120	-53.94
20	120	-53.20
30	120	-53.09

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Appendix A. Report of Measurements Data and Plots

Quiescent Mode/Transmitter turned off



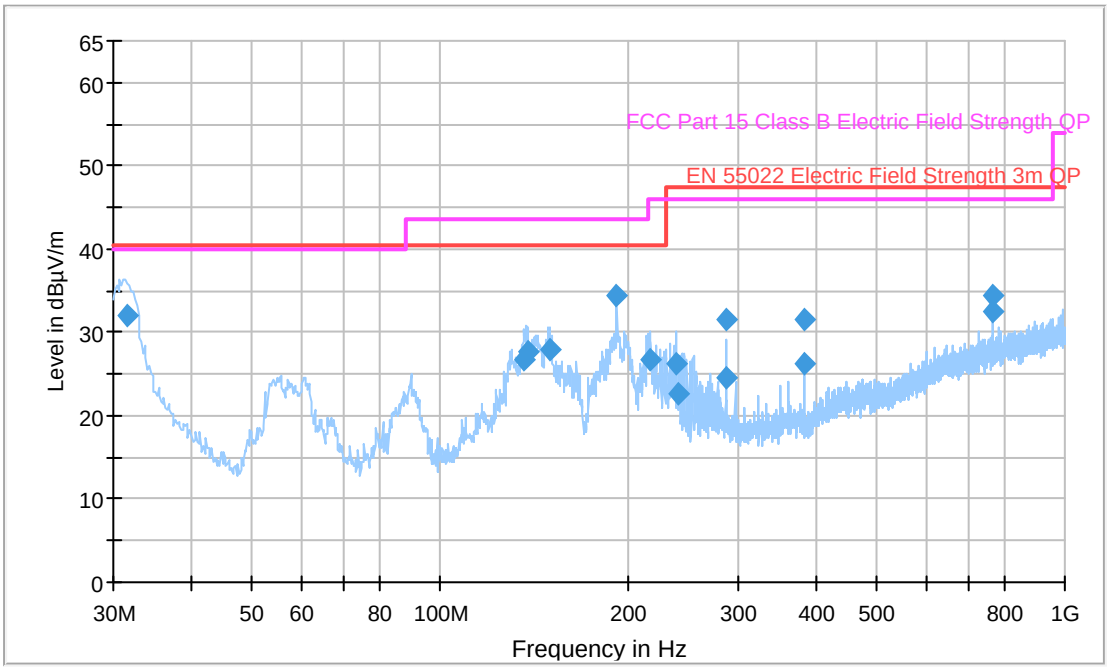
Plot for reference purposes only

Spurious Emissions 30-1000MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.819440	34.9	1000.00	120.000	101.0	V	-89.0	19.8	5.6	40.5
90.000240	23.8	1000.00	120.000	225.0	H	13.0	8.7	16.7	40.5
90.001200	26.6	1000.00	120.000	101.0	V	287.0	9.4	13.9	40.5
137.877840	28.7	1000.00	120.000	208.0	H	289.0	14.3	11.8	40.5
143.798720	29.4	1000.00	120.000	190.0	H	280.0	13.9	11.1	40.5
191.993360	35.0	1000.00	120.000	119.0	H	115.0	12.6	5.5	40.5
218.647280	24.5	1000.00	120.000	133.0	H	232.0	12.3	16.0	40.5
234.937120	21.8	1000.00	120.000	145.0	V	121.0	13.0	25.7	47.5
235.327840	30.3	1000.00	120.000	133.0	H	62.0	13.0	17.2	47.5

No Spurious Emissions detected 1000 to 2.4GHz

Spurious Emissions Transmitter On
Channel 0 - 2.402GHz; 20 – 2.441GHz; 2.480GHz

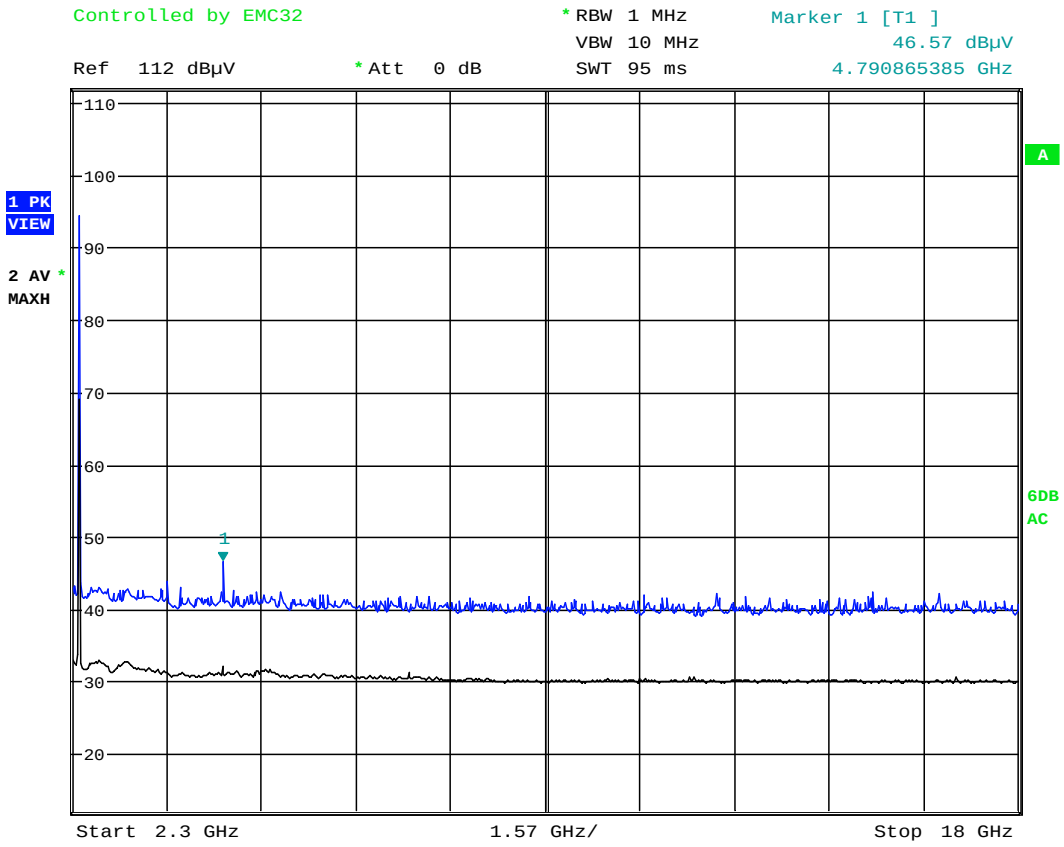


Plot for Reference purposes only

Spurious Emissions 30-1000MHz1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.615200	32.0	1000.00	120.000	100.0	V	0.0	19.9	8.5	40.5
138.086640	27.7	1000.00	120.000	210.0	H	294.0	14.3	12.8	40.5
149.840800	28.0	1000.00	120.000	209.0	H	305.0	13.7	12.5	40.5
192.010640	34.5	1000.00	120.000	133.0	H	298.0	12.6	6.0	40.5
216.617920	26.8	1000.00	120.000	100.0	H	276.0	12.3	13.7	40.5
239.471680	26.2	1000.00	120.000	130.0	H	49.0	13.1	21.3	47.5
287.996720	31.6	1000.00	120.000	100.0	H	162.0	14.8	15.9	47.5
384.016400	31.6	1000.00	120.000	100.0	H	109.0	16.8	15.9	47.5
767.975360	34.5	1000.00	120.000	100.0	H	315.0	23.1	13.0	47.5

Same results for all 3 channels; no channel specific emissions detected.
No Spurious Emissions detected 1000 to 2.4GHz



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Plot: Ch0 harmonic emissions 2.3 to 18GHz – Uncorrected – Reference only (the other channels are not shown since they have similar plots)

Channel 0 - 2.402GHz Modulated Fundamental and Harmonics 2.4-18GHz Average

Frequency (GHz)	Corrected Average (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Average Limit (dBµV/m)	Margin (dB)
2.40198	91.4	119	V	180	94.0	2.6
4.80396	37.3	100	V	54	54.0	16.7
7.2060	34.3	100	V	54	54.0	19.7

Channel 0 - 2.402GHz Modulated Fundamental and Harmonics 2.4-18GHz Peak

Frequency (GHz)	Corrected Peak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Peak Limit (dBµV/m)	Margin (dB)
2.40225	93.2	119	V	180	114.0	20.8
4.80396	42.6	100	V	54	74.0	31.4
7.2060	44.6	100	V	54	74.0	29.4

Channel 20 - 2.441GHz Modulated Fundamental and Harmonics 2.4-18GHz Average

Frequency (GHz)	Corrected Average (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Average Limit (dBµV/m)	Margin (dB)
2.4419	91.1	116	V	183	94.0	2.9
4.8839	38.2	100	V	168	54.0	15.8
7.3259	33.71	100	V	168	54.0	20.3

Channel 20 - 2.441GHz Modulated Fundamental and Harmonics 2.4-18GHz Peak

Frequency (GHz)	Corrected Peak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Peak Limit (dBµV/m)	Margin (dB)
2.4422	93.4	116	V	183	114.0	20.6
4.8839	43.1	100	V	168	74.0	30.9
7.3259	44.3	100	V	168	74.0	29.7

Channel 39 - 2.480GHz Modulated Fundamental and Harmonics 2.4-18GHz Average

Frequency (GHz)	Corrected Average (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Average Limit (dBµV/m)	Margin (dB)
2.4799	89.5	116	V	181	94.0	4.5
4.9600	30.1	100	V	153	54.0	23.9
7.440	34.1	100	V	153	54.0	19.9

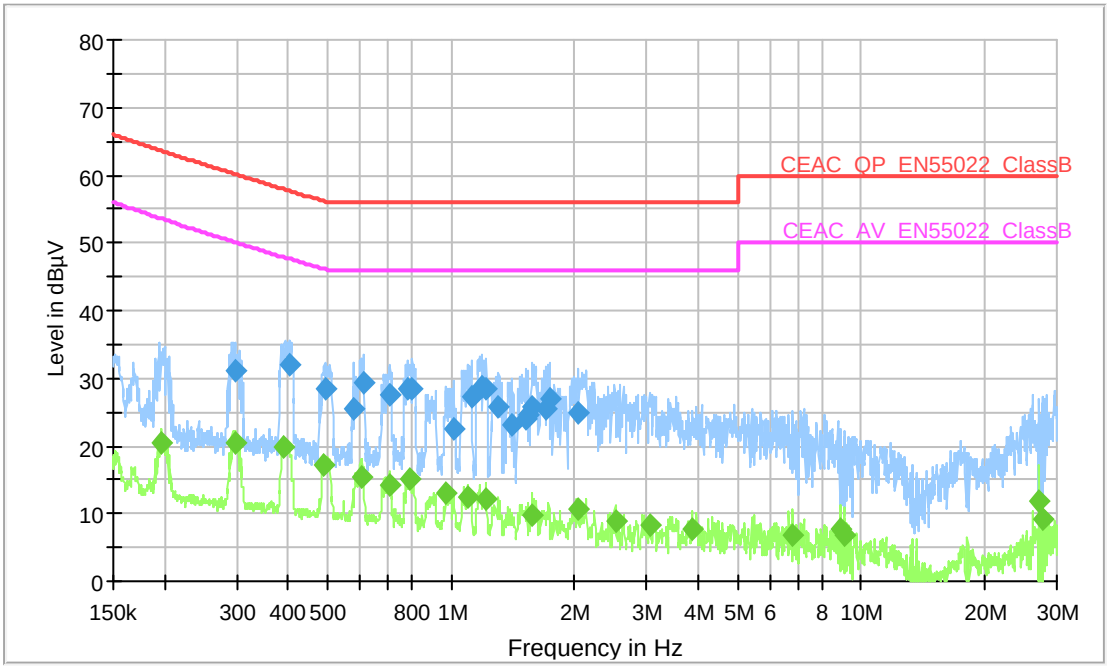
Channel 39 - 2.480GHz Modulated Fundamental and Harmonics 2.4-18GHz Peak

Frequency (GHz)	Corrected Peak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Peak Limit (dBµV/m)	Margin (dB)
2.4799	91.6	116	V	181	114.0	22.4
4.9600	38.2	100	V	153	74.0	35.8
7.440	44.1	100	V	153	74.0	29.9

All other emissions and harmonics were undetectable or 20dB lower than the limit line..

AC Mains Conducted Emissions Transmitter On

120Vac 60Hz Line

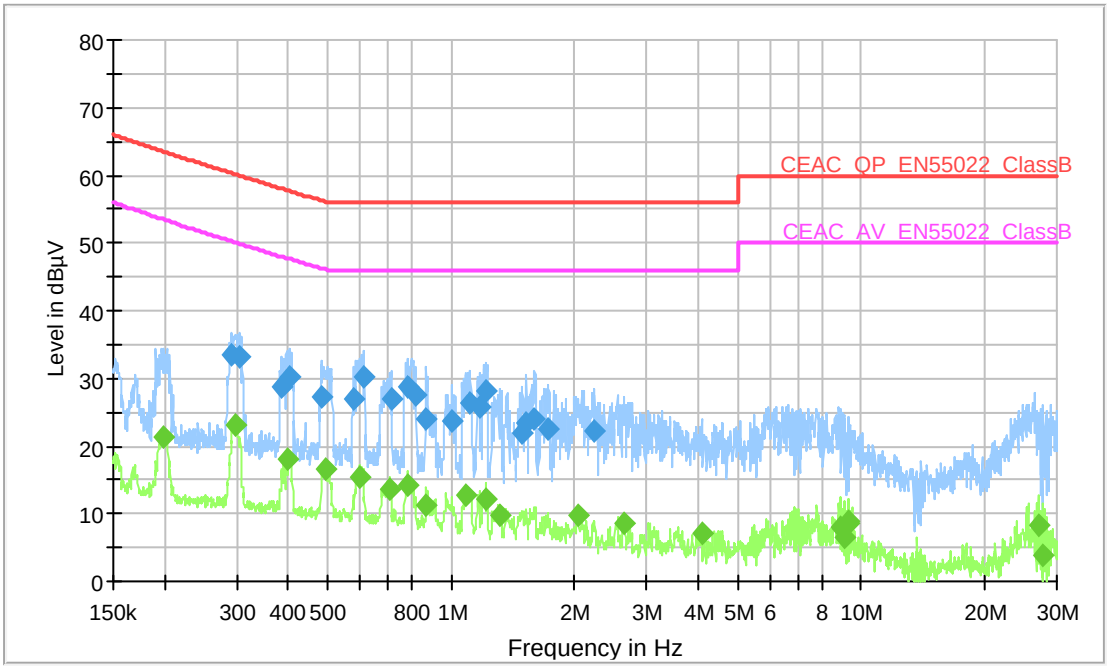


Quasi Peak emissions

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.297659	31.2	1000.00	9.000	On	L1	0.2	28.9	60.1
0.404901	32.1	1000.00	9.000	On	L1	0.2	25.5	57.6
0.491494	28.5	1000.00	9.000	On	L1	0.2	27.6	56.1
0.576681	25.3	1000.00	9.000	On	L1	0.3	30.7	56.0
0.611082	29.4	1000.00	9.000	On	L1	0.3	26.6	56.0
0.705627	27.5	1000.00	9.000	On	L1	0.3	28.5	56.0
0.786018	28.4	1000.00	9.000	On	L1	0.3	27.6	56.0
0.805091	28.5	1000.00	9.000	On	L1	0.3	27.5	56.0
1.017111	22.6	1000.00	9.000	On	L1	0.3	33.4	56.0
1.119487	27.3	1000.00	9.000	On	L1	0.3	28.7	56.0
1.191018	28.8	1000.00	9.000	On	L1	0.3	27.2	56.0
1.215054	28.5	1000.00	9.000	On	L1	0.3	27.5	56.0
1.305671	25.9	1000.00	9.000	On	L1	0.3	30.1	56.0
1.408663	23.2	1000.00	9.000	On	L1	0.3	32.8	56.0
1.528916	23.9	1000.00	9.000	On	L1	0.3	32.1	56.0
1.544267	24.5	1000.00	9.000	On	L1	0.3	31.5	56.0
1.581739	25.9	1000.00	9.000	On	L1	0.3	30.1	56.0
1.699703	25.5	1000.00	9.000	On	L1	0.3	30.5	56.0
1.734004	27.0	1000.00	9.000	On	L1	0.3	29.0	56.0
2.038617	25.0	1000.00	9.000	On	L1	0.3	31.0	56.0

Same plot and data for all channels.

120Vac 60Hz Neutral

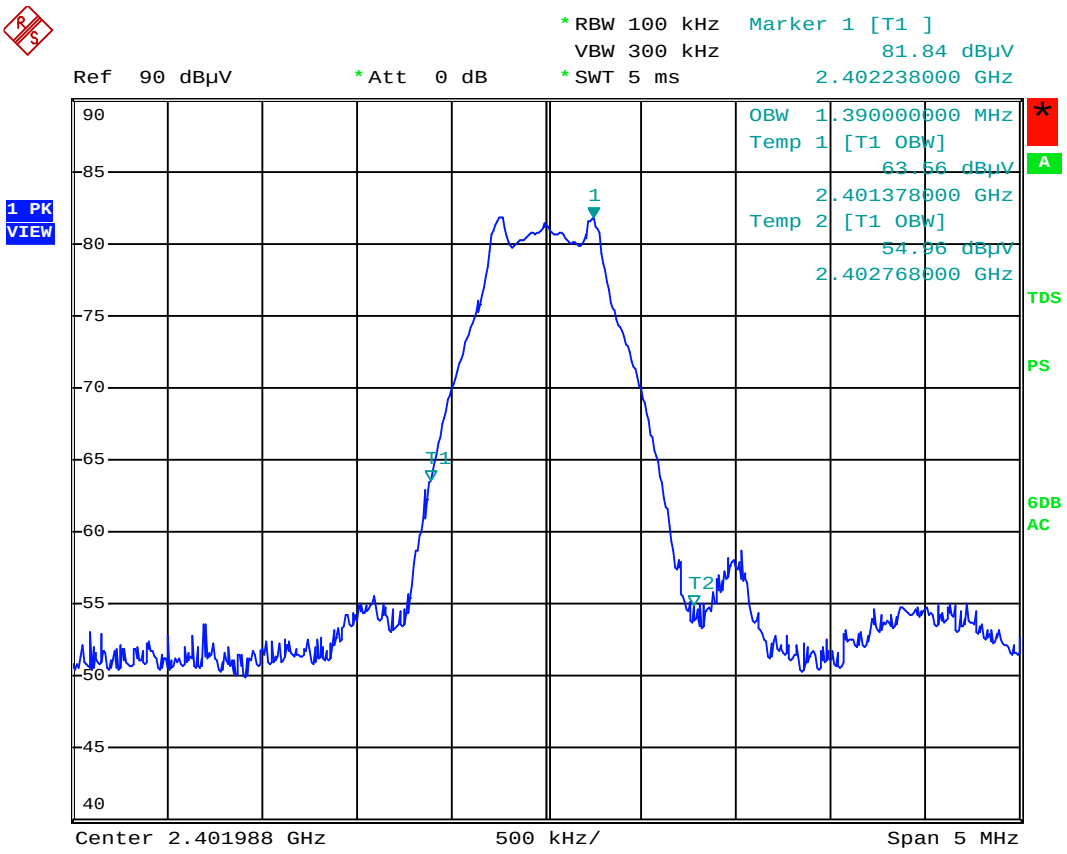


Quasi Peak emissions

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.292355	33.6	1000.00	9.000	On	L1	0.2	26.7	60.3
0.306103	33.3	1000.00	9.000	On	L1	0.2	26.6	59.9
0.385943	28.8	1000.00	9.000	On	L1	0.2	29.2	58.0
0.402481	30.3	1000.00	9.000	On	L1	0.2	27.4	57.7
0.481771	27.2	1000.00	9.000	On	L1	0.2	29.1	56.3
0.580148	27.1	1000.00	9.000	On	L1	0.3	28.9	56.0
0.609862	30.3	1000.00	9.000	On	L1	0.3	25.7	56.0
0.712712	26.9	1000.00	9.000	On	L1	0.3	29.1	56.0
0.784449	28.8	1000.00	9.000	On	L1	0.3	27.2	56.0
0.816430	27.7	1000.00	9.000	On	L1	0.3	28.3	56.0
0.870335	23.9	1000.00	9.000	On	L1	0.3	32.1	56.0
1.002985	23.6	1000.00	9.000	On	L1	0.3	32.4	56.0
1.108359	26.5	1000.00	9.000	On	L1	0.3	29.5	56.0
1.172133	25.8	1000.00	9.000	On	L1	0.3	30.2	56.0
1.217484	28.2	1000.00	9.000	On	L1	0.3	27.8	56.0
1.486742	22.1	1000.00	9.000	On	L1	0.3	33.9	56.0
1.528916	23.4	1000.00	9.000	On	L1	0.3	32.6	56.0
1.600815	24.0	1000.00	9.000	On	L1	0.3	32.0	56.0
1.720201	22.5	1000.00	9.000	On	L1	0.3	33.5	56.0
2.225950	22.2	1000.00	9.000	On	L1	0.3	33.8	56.0

Same plot and data for all channels.

Appendix B. Bandwidth and Bandedge Plots



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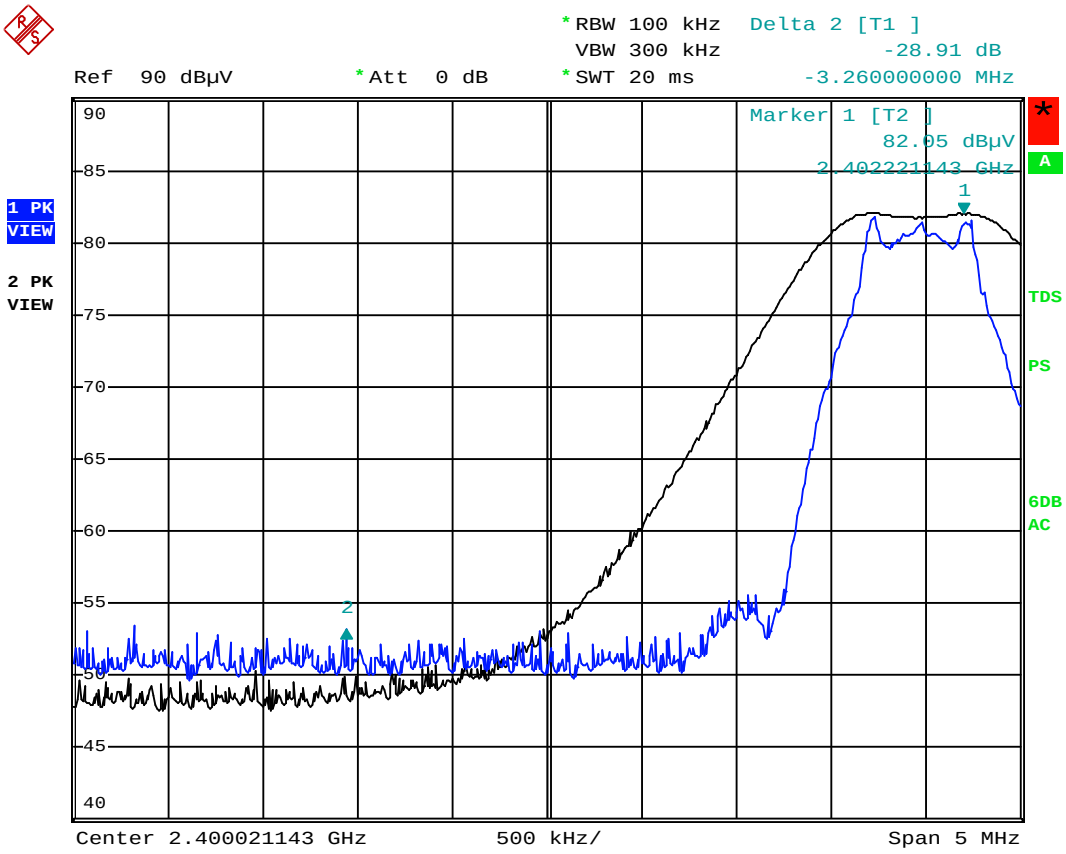
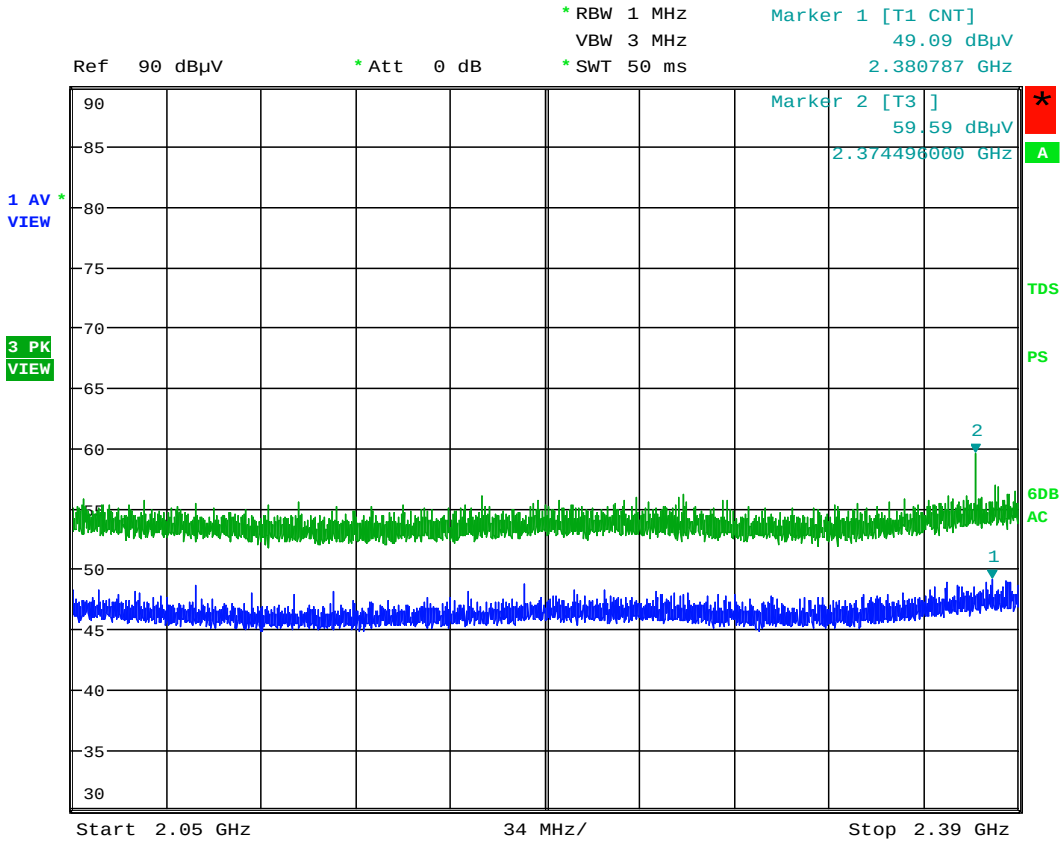
99% Bandwidth Measurement



Date: 10.AUG.2011 15:10:03

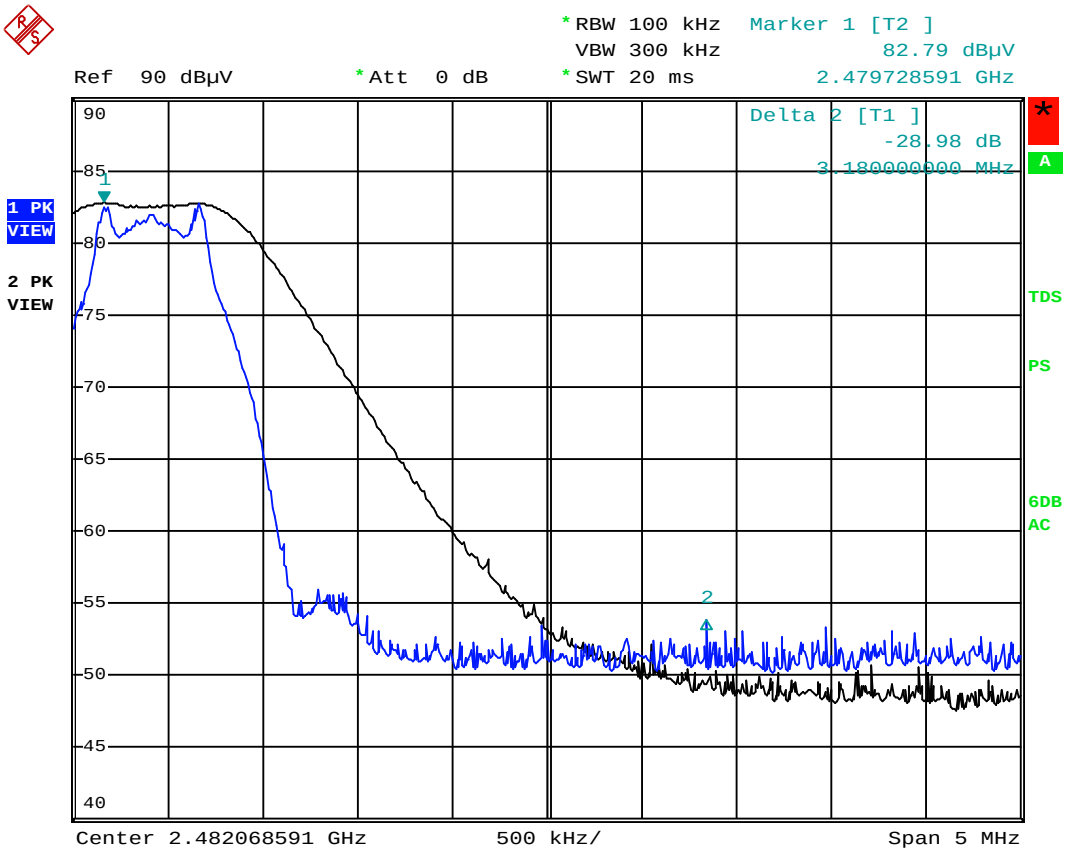
Low Channel Band Edge



Date: 31.AUG.2011 15:21:14

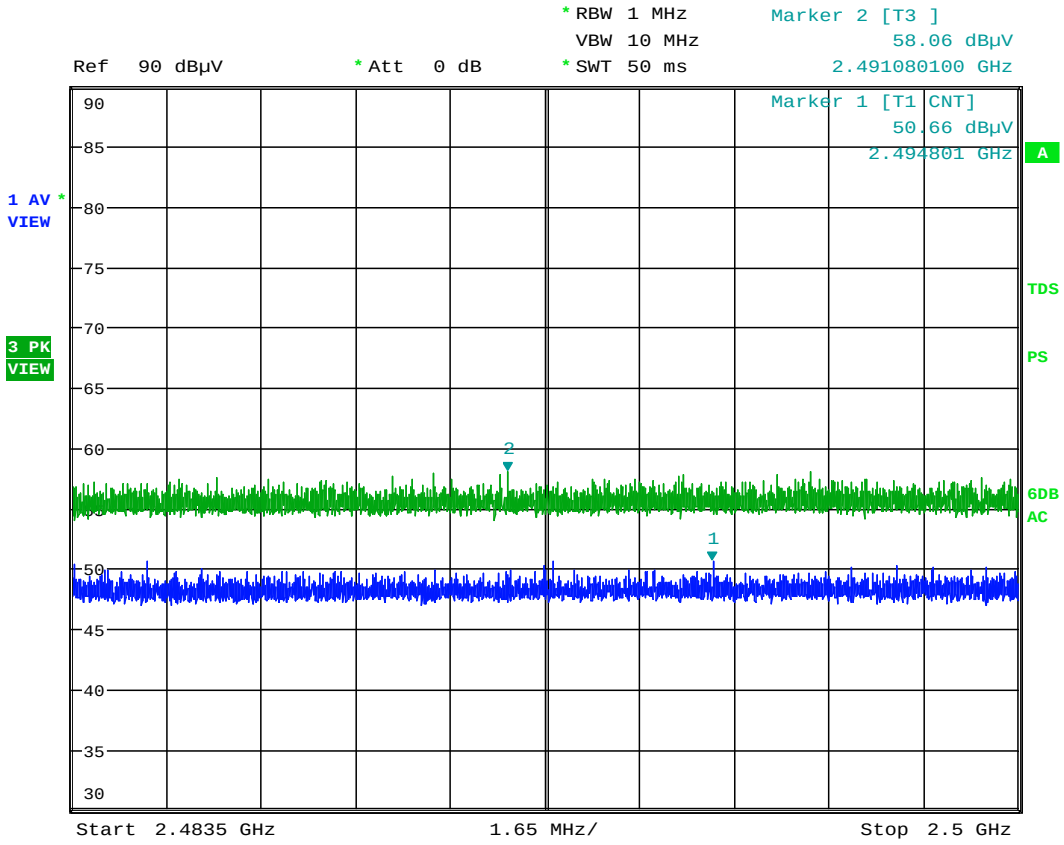
2.1 to 2.390 GHz restricted band plot.

(all pulses are momentary and are not signals from the product)



Date: 10.AUG.2011 15:18:14

High Channel Band Edge



Date: 31.AUG.2011 15:24:46

2.4835 to 2.500 GHz restricted band plot.

(all pulses are momentary and are not signals from the product)

Appendix C. EUT photos during the testing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