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FCC and Industry Canada
Class II Permissive Change Test Report
(FCC Part 15.247; IC RSS210)

For the

CERVIS Inc.

smaRT 206 Base Unit

FCC ID: LOBSBU200

IC: 7955A-SBU200

WLL Report# **11105 Rev. 1**
September 10, 2009

Re-issued October 12, 2009

Prepared for:

Cervis Inc.
170 Thorn Hill Road
Warrendale, Pa 15086

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

ACCREDITED
Testing Certificate 2675.01

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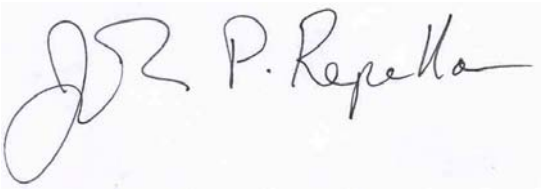

John P. Repella
EMC Compliance Engineer

Reviewed by:

Steven D. Koster
EMC Operations Manager

Abstract

This report has been prepared on behalf of Cervis, Inc. to support Application for a Class II Permissive Change to existing certified equipment. The test report and application are submitted for a Digital Transmission System under Part 15.247 (7/2008) of the FCC Rules & Regulations and Industry Canada RSS210 issue 6 September 2005. This Permissive Change Test Report documents the test configuration and test results for a Cervis, Inc. smaRT 206 Radio Module.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

The Cervis, Inc. smaRT 206 Radio Module remains in compliance with the limits for a Digital Transmission System under Part 15.247 (7/2008) and Industry Canada RSS210 issue 6, September 2005.

Revision History	Reason	Date
Rev 0	Initial Release	September 10, 2009
Rev 1	Added Duty Cycle correction information	October 12, 2009

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List of Tables

1 Introduction

1.1 Reason for Class II Permissive Change

The addition of an external Sleeve Dipole Omni directional antenna. The antenna has the following gain characteristics:

@2.4 GHz = 2.0 dBi

1.2 Compliance Statement

The Cervis, Inc. smaRT 206 Radio Module remains in compliance with the limits for a Digital Transmission System under Part 15.247 (7/2008) and Industry Canada RSS210 issue 6 Annex 8.

1.3 Test Scope

Tests for radiated emissions and conducted Peak Power (at antenna terminal) were performed. All measurements were performed in accordance with Knowledge Data Base (KDB) publication number 558074 entitled "Measurement of Digital Transmission Systems operating under Section 15.247". The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.4 Contract Information

Customer:	Cervis, Inc. Thorn Hill Road Warrendale, PA 15086
Purchase Order Number:	51230
Quotation Number:	65067A

1.5 Test Dates

Testing was performed on the following date(s):	8/19/2009

1.6 Test and Support Personnel

Washington Laboratories, LTD	John Repella
Client Representative	Anthony Di Tommaso

1.7 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**c**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**d**eci**B**el
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**m**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**uMber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification & Description

The Symbol device is a smaRT 206 Base Unit.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Cervis, Inc.
FCC ID:	LOBSBU200
Industry Canada Number	7955A-SBU200
Model:	smaRT 206 Base Unit
FCC Rule Parts:	§15.247
Industry Canada Rule Parts:	RSS210 issue 6 annex 8
Frequency Range:	2405-2480MHz
Maximum Output Power:	1.8797mW (2.741dBm)@ 2.4GHz band
Antenna Connector	External
Antenna Type	Sleeve Dipole, Omni directional
Antenna Gain	@ 2.4 GHz = 2 dBi
Power Source & Voltage:	12VDC
Highest TX spurious level	??uV/m @3m
Highest RX spurious level	??uV/m @3m

2.2 Test Configuration

The smaRT 206 Radio Module was configured using a Symbol MT2090 base unit with all host shielding and enclosure elements removed around the module to fully expose the EUT. The module was programmed to the desired channels from a support laptop using hyperterminal to access the test program. Conducted power tests were performed on a second unit with the antenna replaced by a cable.

2.3 Testing Algorithm

The smaRT 206 Base Unit was programmed for operation via a serial cable connected to a laptop running hyperterminal.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

KDB558074: "Measurement of Digital Transmission Systems operating under Section 15.247."

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n\text{-}1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = nuMber of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 4.55$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Radiated/Conducted emissions testing

Test Name:	**Radiated Emissions**	Test Date:	**08/21/2009**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00618	HP 8563A	Analyzer, Spectrum	04/10/2010
00522	HP, 8449B	Pre-Amplifier, 1-26.5GHz	07/21/2010
00644	Sunol Science JB1	BiConalog Antenna	12/29/2009
00425	ARA, DRG-118/A	Antenna, DRG, 1-18GHz	08/30/2009
00069	HP, 85650A	Adapter, QP	06/28/2010
00073	HP, 8568B	Analyzer, Spectrum	06/28/2010
00071	HP, 85685A	Preselector, RF	06/28/2010
00520	Megaphase, LLC TM40-K1K1-36	Cable, Coaxial - 36" Long - 40GHz 2.9mm	09/29/2009

4 Test Results

4.1 FCC Part15.247 (b) RF (RSS210 issue 6 annex 8.4) Power Output: (FCC Part §2.1046)

To measure the output power the output from the transmitter was connected to the input of a wideband power meter. The original grant RF power levels and the original report filing levels are reported in the below tables along with the measured RF power levels.

This is applicable for the 2405-2480MHz band of this device.

Table 3: Part 15.247 RF Power Output Results

Grant listed as 0.00173 Watts for 2405-2480 MHz

Channel and/or Frequency	Peak Measured Level (dBm)	Peak Measured Level (mWatts)	Original Grant Report Level (dBm)	Original Grant Report Level (mWatts)	Limit (dBm)
2405 MHz	2.67	1.8492	2.33	1.71	30
2440 MHz	2.74	1.8797	2.38	1.73	30
2480 MHz	2.425	1.7478	2.33	1.71	30

4.2 Radiated Spurious Emissions: (FCC Part §15.247, IC RSS210 issue 6 Annex 8.5)

The EUT must comply with the requirements for radiated spurious emissions that fall within the restricted bands. These emissions must meet the limits specified in §15.209 and §15.35(b) for peak measurements.

4.2.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

3 Orthogonals of the EUT were scanned in the restricted bands up to the 10th harmonic with the worst case readings shown.

4.2.2 Duty Cycle Plots

FCC Part 15.35 allows a Duty Cycle correction for transmit signals that are less than 100mSec in duration. The following plots show this correction to be used in radiated emissions measurement and can not exceed 20dB. The calculation is:

10LOG(On Time per 100ms/100ms)

10LOG(860us/100ms)=20.655dB (20dB maximum used)

A diode detector connected to an oscilloscope was used to capture this measurement. The pulse characteristics are shown in the following figures. The pulse signal is “on” for 860us at a repetition rate of 103.2 ms. The duty cycle correction factor is in excess of 20dB, so a maximum correction of 20dB is used in the radiated emissions data tables.

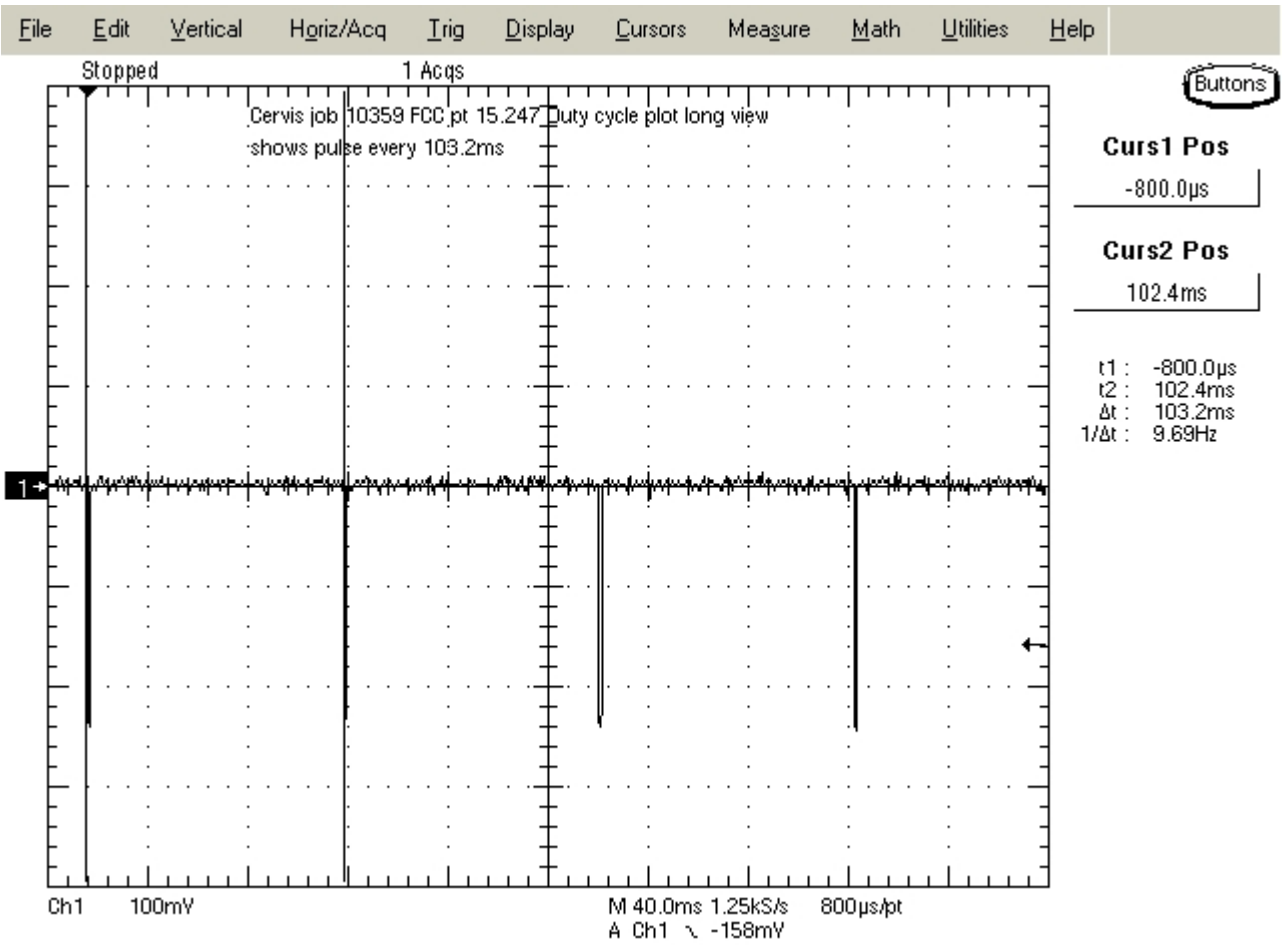

Figure 4-1. Duty Cycle- Shows Pulse Repetition Rate

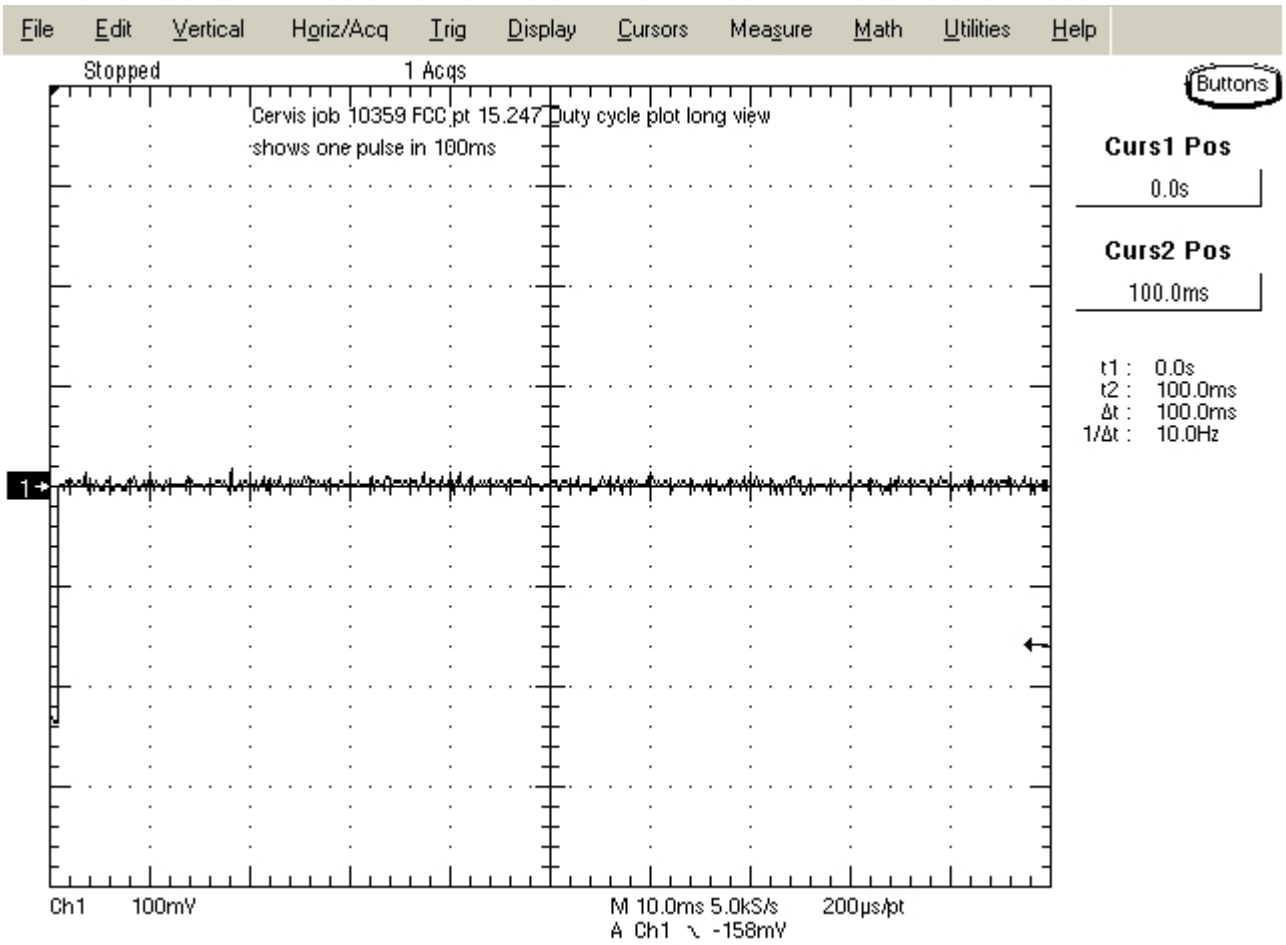

Figure 4-2. Duty Cycle- 100mSec View

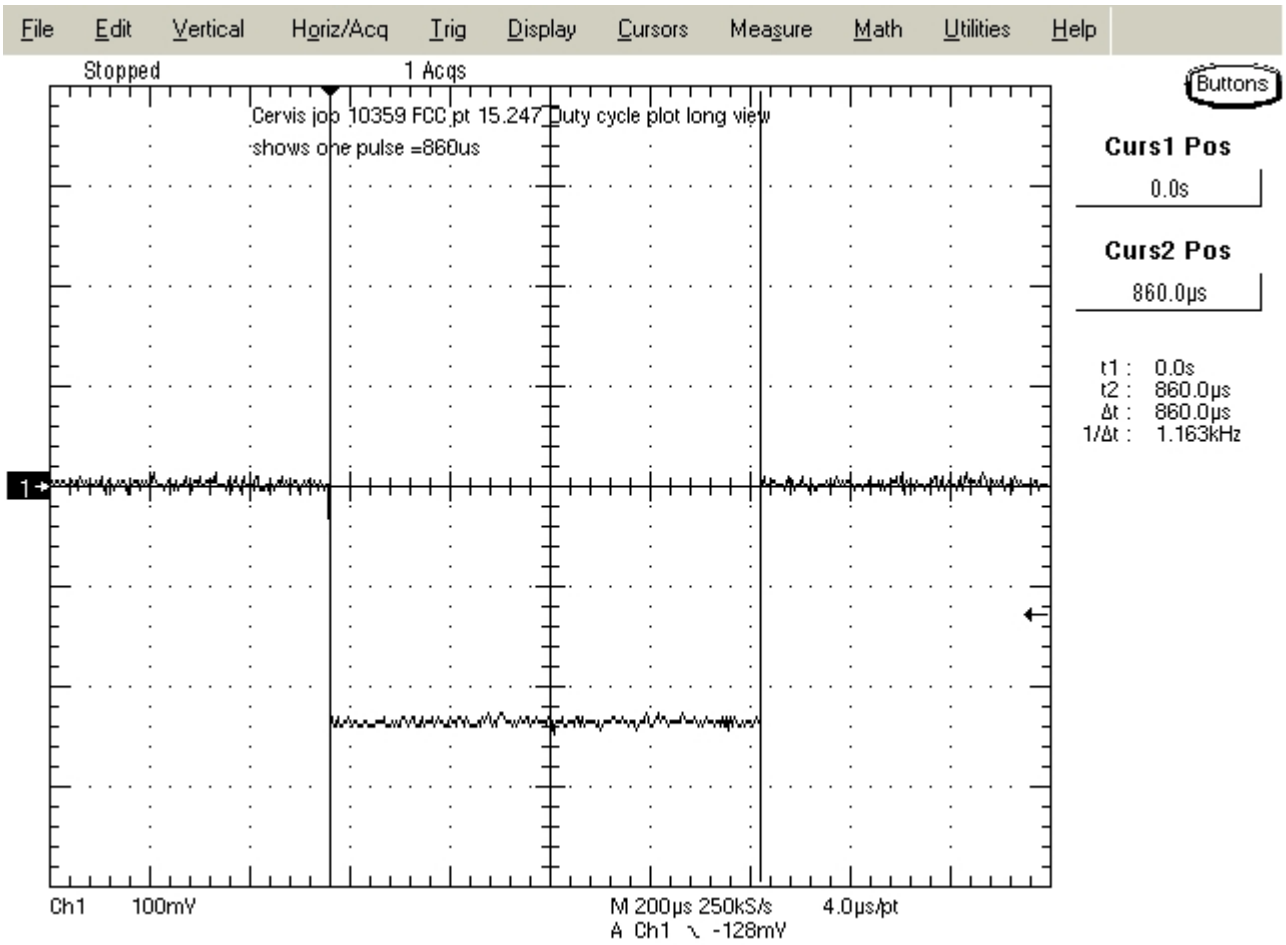

Figure 4-3. Duty Cycle- Single Pulse View

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.) 1MHz (Peak)

Table 4: Radiated Emission Test Data, Low Frequency Data (<1GHz)

Frequency (MHz)	Pol H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
Low Chan @2405MHz											
34.655	V	180.0	1.0	7.2	16.7	0.3	0.0	24.2	16.2	100.0	-15.8
43.380	V	315.0	1.0	5.5	10.9	1.0	0.0	17.4	7.4	100.0	-22.6
52.260	V	270.0	1.2	5.2	7.6	1.0	0.0	13.8	4.9	100.0	-26.2
57.100	V	180.0	1.0	10.2	7.2	1.1	0.0	18.5	8.4	100.0	-21.5
83.790	V	180.0	1.2	13.7	7.7	1.4	0.0	22.8	13.8	100.0	-17.2
150.230	V	270.0	1.3	6.4	11.8	1.9	0.0	20.0	10.1	150.0	-23.5
166.560	V	90.0	1.2	4.6	11.6	2.0	0.0	18.2	8.2	150.0	-25.3
43.540	H	0.0	2.9	3.2	10.9	1.0	0.0	15.0	5.6	100.0	-25.0
52.400	H	270.0	3.0	3.7	7.6	1.0	0.0	12.3	4.1	100.0	-27.7
57.100	H	270.0	3.2	3.5	7.2	1.1	0.0	11.8	3.9	100.0	-28.2
83.790	H	270.0	3.2	6.4	7.7	1.4	0.0	15.5	6.0	100.0	-24.5
150.230	H	225.0	2.6	6.0	11.8	1.9	0.0	19.6	9.6	150.0	-23.9
166.560	H	225.0	2.6	6.4	11.6	2.0	0.0	20.0	10.0	150.0	-23.5
High Chan @2480MHz											
34.655	V	180.0	1.0	7.2	16.7	0.3	0.0	24.2	16.2	100.0	-15.8
43.380	V	315.0	1.0	5.5	10.9	1.0	0.0	17.4	7.4	100.0	-22.6
52.260	V	270.0	1.2	5.2	7.6	1.0	0.0	13.8	4.9	100.0	-26.2
57.100	V	180.0	1.0	16.8	7.2	1.1	0.0	25.1	18.0	100.0	-14.9
83.790	V	180.0	1.2	13.7	7.7	1.4	0.0	22.8	13.8	100.0	-17.2
150.230	V	270.0	1.3	6.4	11.8	1.9	0.0	20.0	10.1	150.0	-23.5
166.560	V	90.0	1.2	4.2	11.6	2.0	0.0	17.8	7.8	150.0	-25.7
223.980	V	315.0	1.5	4.0	11.3	2.4	0.0	17.6	7.6	200.0	-28.4
43.540	H	0.0	2.9	3.0	10.9	1.0	0.0	14.8	5.5	100.0	-25.2
52.400	H	270.0	3.0	3.5	7.6	1.0	0.0	12.1	4.0	100.0	-27.9
57.100	H	270.0	3.2	4.1	7.2	1.1	0.0	12.4	4.2	100.0	-27.6
83.790	H	270.0	3.2	6.2	7.7	1.4	0.0	15.3	5.8	100.0	-24.7
150.230	H	225.0	2.6	6.4	11.8	1.9	0.0	20.0	10.1	150.0	-23.5
166.560	H	225.0	2.6	6.8	11.6	2.0	0.0	20.4	10.5	150.0	-23.1
223.980	H	270.0	1.2	7.6	11.3	2.4	0.0	21.2	11.5	200.0	-24.8

Table 5: Radiated Emission Test Data, High Frequency (>1GHz), Low channel @ 2405 MHz

(Restricted Bands)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Duty Cycle correction (dB)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
2405MHz												
4810.000	V	180.0	1.5	63.1	0.0	32.8	2.0	35.4	62.5	1338.3	5000.0	-11.4
12025.00	V	180.0	1.0	48.2	0.0	39.7	3.8	35.5	56.2	648.5	5000.0	-17.7
Average												
4810.000	V	180.0	1.5	63.1	-20.0	32.8	2.0	35.4	42.5	133.8	500.0	-11.4
12025.00	V	180.0	1.0	48.2	-20.0	39.7	3.8	35.5	36.3	65.1	500.0	-17.7
Peak												
4810.000	H	180.0	1.5	58.2	0.0	32.8	2.0	35.4	57.6	758.7	5000.0	-16.4
12025.00	H	180.0	1.0	48.2	0.0	39.7	3.8	35.5	56.3	650.7	5000.0	-17.7
Average												
4810.000	H	180.0	1.5	58.2	-20.0	32.8	2.0	35.4	37.6	75.9	500.0	-16.4
12025.00	H	180.0	1.0	48.2	-20.0	39.7	3.8	35.5	36.3	65.1	500.0	-17.7

Table 6: Radiated Emission Test Data, High Frequency (>1GHz), Center channel @ 2440 MHz

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Duty Cycle correction (dB)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
2440.000												
4880.000	V	90.0	1.5	63.2	0.0	33.0	2.0	35.4	62.8	1381.3	5000.0	-11.2
7320.000	V	0.0	1.5	51.6	0.0	36.9	3.3	35.4	56.4	658.5	5000.0	-17.6
12200.00	V	90.0	1.0	49.2	0.0	39.8	4.2	35.4	57.7	770.6	5000.0	-16.2
Average	V			0.0								
4880.000	V	90.0	1.5	63.2	-20.0	33.0	2.0	35.4	42.8	138.1	500.0	-11.2
7320.000	V	0.0	1.5	51.6	-20.0	36.9	3.3	35.4	36.4	65.8	500.0	-17.6
12200.00	V	90.0	1.0	49.2	-20.0	39.8	4.2	35.4	37.7	77.1	500.0	-16.2
Peak				0.0								
4880.000	H	120.0	1.5	62.9	0.0	33.0	2.0	35.4	62.5	1334.5	5000.0	-11.5
7320.000	H	90.0	1.5	49.4	0.0	36.9	3.3	35.4	54.2	511.1	5000.0	-19.8
12200.00	H	90.0	1.0	47.5	0.0	39.8	4.2	35.4	56.0	633.6	5000.0	-17.9
Average												
4880.000	H	120.0	1.5	62.9	-20.0	33.0	2.0	35.4	42.5	133.4	500.0	-11.5
7320.000	H	90.0	1.5	49.4	-20.0	36.9	3.3	35.4	34.2	51.1	500.0	-19.8
12200.00	H	90.0	1.0	47.5	-20.0	39.8	4.2	35.4	36.0	63.4	500.0	-17.9

Table 7: Radiated Emission Test Data, High Frequency (>1GHz), High channel @ 2480 MHz

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Duty Cycle correction (dB)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
2480MHz												
4960.000	V	120.0	1.5	61.5	0.0	33.2	2.0	35.4	61.3	1161.8	5000.0	-12.7
7440.000	V	120.0	1.5	50.0	0.0	37.0	3.6	35.5	55.1	570.4	5000.0	-18.9
12400.00	V	180.0	1.0	48.1	0.0	39.8	4.5	35.3	57.2	721.5	5000.0	-16.8
Average												
4960.000	V	120.0	1.5	61.5	-20.0	33.2	2.0	35.4	41.3	116.2	500.0	-12.7
7440.000	V	120.0	1.5	50.0	-20.0	37.0	3.6	35.5	35.1	57.0	500.0	-18.9
12400.00	V	180.0	1.0	48.1	-20.0	39.8	4.5	35.3	37.2	72.2	500.0	-16.8
Peak												
4960.000	H	180.0	1.5	61.6	0.0	33.2	2.0	35.4	61.4	1175.3	5000.0	-12.6
7440.000	H	20.0	1.5	51.2	0.0	37.0	3.6	35.5	56.3	654.9	5000.0	-17.7
12400.00	H	180.0	1.0	48.2	0.0	39.8	4.5	35.3	57.3	729.9	5000.0	-16.7
Average												
4960.000	H	180.0	1.5	61.6	-20.0	33.2	2.0	35.4	41.4	117.5	500.0	-12.6
7440.000	H	20.0	1.5	51.2	-20.0	37.0	3.6	35.5	36.3	65.5	500.0	-17.7
12400.00	H	180.0	1.0	48.2	-20.0	39.8	4.5	35.3	37.3	73.0	500.0	-16.7

4.3 Receiver Radiated Spurious Emissions: (RSS-Gen [7.2.3.2])

The EUT must comply with the requirements for radiated spurious emissions from the receiver. These emissions must meet the limits specified in RSS-Gen.

4.3.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Additionally, as the device is portable, the emissions were checked in three orthogonal with the worst case being reported. The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	100kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.)

4.3.2 Test Summary

The EUT complied with the requirements for receiver radiated emissions IC RSS-Gen.

Table 8: Radiated Emission Test Data (Receiver)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
UNIT UPRIGHT		Worst Case									
34.655	V	180.0	1.0	7.2	16.7	0.3	0.0	24.2	16.2	100.0	-15.8
43.380	V	315.0	1.0	5.5	10.9	1.0	0.0	17.4	7.4	100.0	-22.6
52.260	V	270.0	1.2	5.2	7.6	1.0	0.0	13.8	4.9	100.0	-26.2
57.100	V	180.0	1.0	10.2	7.2	1.1	0.0	18.5	8.4	100.0	-21.5
83.790	V	180.0	1.2	13.7	7.7	1.4	0.0	22.8	13.8	100.0	-17.2
150.230	V	270.0	1.3	6.4	11.8	1.9	0.0	20.0	10.1	150.0	-23.5
43.540	H	0.0	2.9	3.2	10.9	1.0	0.0	15.0	5.6	100.0	-25.0
52.400	H	270.0	3.0	3.7	7.6	1.0	0.0	12.3	4.1	100.0	-27.7
57.100	H	270.0	3.2	3.5	7.2	1.1	0.0	11.8	3.9	100.0	-28.2
83.790	H	270.0	3.2	6.4	7.7	1.4	0.0	15.5	6.0	100.0	-24.5