Radio Frequency Exposure Test Report

EN 62311 January 2008
Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0Hz – 300GHz) (IEC 62311:2007, modified)

Model: 802.11a/g Compact Flash Module (Model: SDC-CF10AG)

COMPANY:	Summit Data Communications 526 South Main St. Suite 805 Akron, OH 44311
REPORT CREATED BY:	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	May 25, 2012
TOTAL NUMBER OF PAGES:	20

PROGRAM MGR /
TECHNICAL REVIEWER:

Mark E Hill
Staff Engineer

QUALITY ASSURANCE DELEGATE /
FINAL REPORT PREPARER:

David Guidotti
Senior Technical Writer

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	05-25-2012	First release	

TABLE OF CONTENTS

SCOPE

The European Committee for Electrotechnical Standardization (CENELEC) publishes standards regarding the evaluation of the rf exposure hazard of wireless communications devices. An evaluation has been performed on the Summit Data Communications model 802.11a/g Compact Flash Module (Model: SDC-CF10AG), pursuant to the relevant requirements of the following harmonized EN standard(s) covering essential requirements under article 3.1 of the R&TTE Directive:

- EN 62311 January 2008 "Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0Hz – 300GHz) (IEC 62311:2007, modified)

The evaluation was performed in accordance with the standard and the following document(s):

- Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300 GHz) (Official Journal L199 of 30 July 1999).

OBJECTIVE

The objective of the manufacturer is to comply with the harmonized standards identified in the previous section.

STATEMENT OF COMPLIANCE

The evaluation of Summit Data Communications model 802.11a/g Compact Flash Module (Model: SDC-CF10AG), in the configurations detailed within this report, complied with the relevant requirements of EN 62311. Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Summit Data Communications model SDC-CF10AG is a wireless local area network (802.11abg) module in compact flash format. The device is designed for installation into host devices by system integrators.

EN 62311 ASSESSMENT METHODS

EN 62311 allows for various assessment methods, including far field calculation, near field calculation, simulation, and numerical modeling. Assessments should be made in accordance with an existing basic standard. For the purposes of the assessment detailed in this test report the basic standard EN 50383 was used. The assessment is based on power levels and antenna gains detailed in this report and taken from the following test reports against the appropriate ETSI radio standard:

Test Report	Radio Standard(s)	Issued By
R71185	EN 300 328	Elliott Laboratories, An NTS Company 41039 Boyce Road, Fremont, CA. 94538-2435 USA
R71187	EN 301 893 (5150-5250 MHz)	
R71757	EN 301 893 (5250-5350 and 5470-5725MHz)	

The assessment has only considered the intentional signals transmitted by the device. As all other emissions complied with the limits detailed in the appropriate radio standard and were significantly lower than the intentional signal it was not considered necessary to include these signals in the assessment.

EN 50383 EVALUTATION METHODS

The evaluation method first requires a determination of the antenna region(s) in which the exposure occurs, and from this determination the appropriate evaluation method (calculation or measurement) can then be used.

ANTENNA REGION

There are three regions defined in Annex A of EN 50383 – Far field region, radiating near-field region and reactive near-field region.

For each region there is a preferred (or "reference") evaluation method and possible alternatives. When an alternative method is used it typically provides a more conservative evaluation of the rf hazard.

The region is determined, based on the minimum separation distance from the device antennas to persons and the size/gain of the antenna. The minimum separation distance is based on either a distance specified in the installation/user's manual or on an evaluation of intended use.

PREFERRED EVALUATION METHODS

The preferred (reference) evaluation methods, and first and second alternatives, for each region are detailed in EN 50383 Table 1 and summarized below.

FAR FIELD CALCULATION

For calculating the field in the far-field region the free space formula below is used to determine the electric field or power flux density at a distance r from the transmitting antenna.

$$E = \frac{\sqrt{30PG}}{r}$$

$$S = \frac{PG}{4\pi r^2}$$

S = Power flux density W/m^2
E = Field Strength in V/m
P = Power in Watts
G = Gain of antenna (numeric gain)
r = distance in meters

RADIATING NEAR FIELD

When human exposure is in the radiating near-field the reference method is a SAR evaluation, as detailed above. The first alternative to SAR measurements are E-field and H-field measurements. The second alternative is a calculation, and the possible calculation methods are either the synthetic model or cylindrical wave model.
The synthetic model splits the antenna into n small sources and the field is calculated using:

$$E = \sum \alpha_n \frac{\sqrt{30.P_n G_n}}{r_n} e^{j(\gamma_n + \frac{2\pi r_n}{\lambda})}$$

E = Field Strength in V/m
P_n = Power in Watts radiated by element n
G_n = Gain of antenna element n
r_n = Distance in meters from element n

The cylindrical wave model allows direct calculation of the power flux density, S, using:

$$S = \frac{P}{\pi D r} \frac{180}{\delta}$$

S = Power flux density W/m^2
P = Power in watts radiated (W)
D = Length of antenna (m)
r = Distance in meters from the antenna

The cylindrical wave model is valid for a range of distances where r_c (the distance at which the Cylinder and far-field wave models give the same result) lies in the radiating near-field, and where the distance is less than r_c. At distances greater than r_c the far field model (refer to the far-field calculation information in the previous section) is more appropriate.

REACTIVE NEAR FIELD

When human exposure is in the reactive near-field the reference method is a SAR evaluation. If the total radiated power is below limits detailed in section 7.1.2 of EN 50383 then the device is assumed to comply and measurements are not considered necessary. Further, whole-body SAR measurement methods are not currently specified and so localized SAR evaluations are used. Localized SAR evaluations are limited to operating frequencies between 0.8 and 3 GHz, antenna apertures less than 0.6m x 0.3m and investigation distances of less than 40cm.

The alternative to SAR measurements are E-field and H-field measurements.

LIMITS

The limits are taken from the reference levels detailed in either Annex II or Annex III of *Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC)*. Annex III reference levels may only be used when the exposure is not highly localized.

Compliance with the basic restrictions is ensured where the ratio of the measured/calculated value to the basic restriction / reference level is less than or equal to 1.

MULTIPLE TRANSMITTERS

When the evaluation has to account for simultaneous transmissions from co-located devices the individual transmitters are evaluated separately. The sum of the individual ratios of measured/calculated value to basic restriction / reference level has to be less than 1 for compliance to be demonstrated.

EVALUATION RESULTS

SEPARATION DISTANCE

The separation distance used in the assessment was 20cm, based on the following statement in the installation and regulatory guid.

To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be operated in conjunction with any other antenna or transmitter.

LIMIT

As the basis for compliance is being based on the far-field model, the reference level for equivalent plane wave power density is used as the basis for determining compliance. At the operating frequencies of the device, the limits are:

Frequency Band (MHz)	Power Density W/m^2
2400-2483.5 MHz	10
5150-5350 MHz	10
5470-5725 MHz	10

CALCULATIONS

The table below contains the calculations to determine the reactive near-field, radiating near-field and far-field boundaries. It also shows the value for r_c, the distance at which the far-field and cylindrical wave models produce the same value of power flux density.

Frequency (MHz)	2462	5300	5700
Wavelength (m)	0.122	0.057	0.053
Antenna Gain (dBi)	3.8	5.1	5.1
Antenna Gain (numeric)	2.4	3.2	3.2
Antenna Length (m)	0.18	0.18	0.18
Evaluation distance (m)	0.2	0.2	0.2
Beamwidth (degrees)	360	360	360
Transmit Power (dBm)	17.6	16.4	16.2
Far Field Boundary	>0.53m	>1.14m	>1.23m
Radiating Near Field	0.03m < r <= 0.53m	0.01m < r <= 1.14m	0.01m < r <= 1.23m
Reactive Near-Field	r <=0.03m	r <=0.01m	r <=0.01m
r_c	0.22	0.29	0.29

For operation in the 2400-2483.5, 5150-5350, and 5470-5725 MHz bands the exposure evaluation is in the radiating near-field. The cylindrical model is appropriate as the evaluation distance of 0.2m is at a distance that does not exceed r_c, therefore the cylindrical model was used to provide a conservative estimate of the rf hazard.

Frequency (MHz)	2462	5300	5700
Cylindrical Model Estimation (W/m^2)	0.25	0.19	0.18
Limit	10	10	10
Percentage of Limit	2.5	1.9	1.8

RESULT – SINGLE TRANSMITTER

The estimated power density at a distance of 0.2m from the transmitting antenna is 0.25 W/m^2. This is 2.5% of the limit, therefore the device complies with the requirements of EN 503085, based on the evaluation methods of EN 50383 and the reference levels detailed in *Council Recommendation of 12 July 1999.*

The calculations assumed the device may operate continuously. Although the interface protocol does not limit operating duty cycle, the actual operation would not typically be 100% and so the estimates are conservative.

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2) and were calculated in accordance with NAMAS document NIS 81 and M3003. They have been taken from the radio test report on which the output power measurements used in the evaluation of the device were taken.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted	dBm	25 to 7000 MHz	± 0.52 dB

Appendix A Test Equipment Calibration Data

The evaluation detailed in the test report was based on calculation. No test equipment was required. The test equipment and associated measurements uncertainties used to determine the output power measurements on which this evaluation was based can be found in Elliott test report(s) R71185, R71187, and R71757.

Appendix B Test Configuration Photographs

The evaluation detailed in the test report was based on calculation. As no measurements were made, test configuration photographs are not applicable.

Appendix C Antenna Data Sheets

The evaluation detailed in the test report was based on calculations that used specific information about the gain and dimensions of the antenna(s) to be used with the device. The data sheets from which this information was taken are attached to this Appendix.

CENTURION™

Specifications

NanoBlade

Model Number:
NanoBlade

Internal Antenna - Embedded

Specifications:

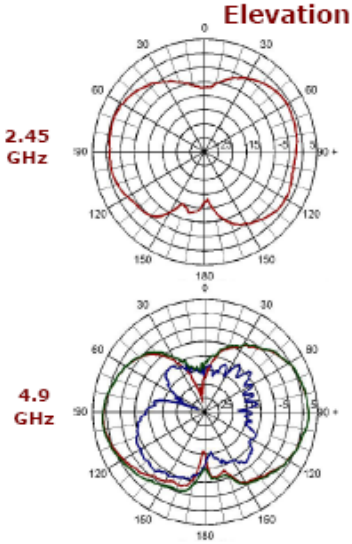
- Covers 2.4 to 2.5 GHz for 802.11b, and 4.9 to 6 GHz for 802.11a and all US, European, and Japanese WLAN applications
- Coaxial cable pigtail with various connector choices
- Omni-directional patterns at all frequencies with increased gain in upper bands for optimal coverage
- Conformance to European RoHS Directive 2002/95/EC

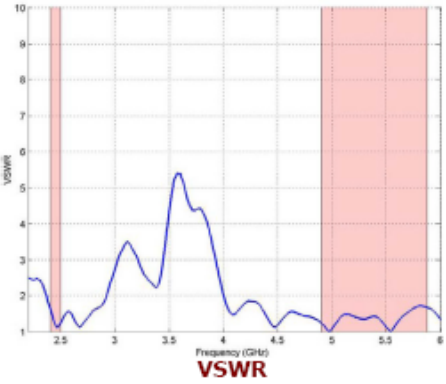
Frequency	2.4 - 2.5 GHz 4.9 – 6.0 GHz
Gain	3.8 dBi (2.45 GHz) 4.7 dBi (4.9 GHz) 5.1 dBi (5.25 GHz) 4.5 dBi (5.875 GHz)
Polarization	Vertical, Omni-directional
Nominal Impedance	50 ohms
VSWR	<2:1
Size	2" x 0.65"

Cables & Connectors:

Model #	Part #	Cable	Connector
NanoBlade-IP04	CAF94505	100mm, Ø 1.13mm	IPEX MHF
NanoBlade-FL04	MAF95056	100mm RG-178	Flying Lead
NanoBlade-MMCX4	CAF94504	100mm RG-178	RA-MMCX

Elevation Patterns, Phi=0





VSWR

Specifications subject to change without notice.

NanoBlade a – 12/23/05

CENTURION
3425 N.44th Street, LINCOLN, NE 68504 USA
SALES PHONE: 800.228.4563
PHONE: 402.467.4491 • FAX: 402.467.4528
www.centurion.com • sales@centurion.com

QS-9000 REGISTERED ISO 9001

LARSEN® DUAL/WIDE BAND ANTENNAS

WLAN and Wi-Fi deployment is growing rapidly and so is the need for advanced technologies and multi band antennas. The roll-out of the 4.9 GHz band for public safety networks, requiring virturally the same antenna technology, represented a challenge for equipment manufacturers desiring to keep costs down and unique inventory to a minimum.

In response to these demands, Larsen has developed a unique line of products with "dual/wide band" capabilities. These products are designed to cover 802.11a, b and g, as well as the 4.9 GHz band. They are also designed to deliver superior electrical performance through efficient signal coverage. Larsen antenna designs cover virtually every requirement from the router to complete indoor coverage.

R380.900.500
Dual band omni ceiling

R380.900.908
Bi-directional ceiling mount

R380.500.314
Dual band swivel mount dipole

R380.900.909
Dual band mast/wall mountable directional patch

LARSEN® ANTENNAS

3611 NE 112th Avenue
Vancouver WA 98682
Tel: 800-268-3662
International: 360-944-7551

www.larsen-antennas.com
info@larsen.pulseeng.com

L603.A (02/07)
Dual/Wide Band

Pulse® A TECHNITROL COMPANY

LARSEN® DUAL/WIDE BAND ANTENNAS

MODEL	FREQUENCY (MHz)
R380.500.314	2400-2500 / 4900-5900

SPECIFICATIONS	
GAIN	1.6 dBi / 5 dBi Max
VSWR	2:1
IMEPDANCE	50 Ohms
POLARIZATION	Linear Vertical
RADIATION PATTERN	E Plane: 85° Low Band 30° High Band H Plane: Omni-directional
OPERATING TEMPERATURE	-22° to +158° F
RADOME ENCLOSURE	PC / ABS
CONNECTOR	RP-TNC
COAX	Order Separately
DIMENSIONS	Bent: 6.1" H x 1.55" W Straight 7.15" H x .57" Dia

MODEL	FREQUENCY (MHz)
R380.900.908	2400-2500 / 4900-5900

SPECIFICATIONS	
GAIN	4.5 dBi / 5 dBi
VSWR	2 Maximum
IMEPDANCE	50 Ohms
POLARIZATION	Linear Vertical
RADIATION PATTERN	Omni-directional
MAXIMUM INPUT POWER	10 Watts
OPERATING TEMPERATURE	+32° to +167° F
RADOME ENCLOSURE	UV Stabalized ABS
CONNECTOR	SMA Jack (Female)
COAX	2' RG-58A/U (white)
DIMENSIONS	3" H x 6.9" L x 1.8" D
MOUNTING	Direct Feed 3/4" hole

MODEL	FREQUENCY (MHz)
R380.900.909	2400-2500 / 4900-5900

SPECIFICATIONS	
GAIN	5.5 dBi / 9 dBi
VSWR	2 Typical
IMEPDANCE	50 Ohms
POLARIZATION	Linear Vertical
PATTERN	Directional Patch
3 dB BEAMWIDTH IN H PLANE	97° / 65°
3 dB BEAMWIDTH IN E PLANE	68° / 50°
FRONT TO BACK RATIO	-15 dB Minimum
MAXIMUM INPUT POWER	20 Watts
OPERATING TEMPERATURE	+32° to +167° F
RADOME ENCLOSURE	UV Stabalized ABS / PC
CONNECTOR	RP-TNC Plug (Male)
COAX	3' RG-58A/U (white)
DIMENSIONS	4.72" H x 3.5" W x 1.65" D
MOUNTING	Wall / Corner / Mast

MODEL	FREQUENCY (MHz)
R380.900.500	2400-2500 / 4900-5900

SPECIFICATIONS	
GAIN	2 dBi
VSWR	2 Maximum
IMEPDANCE	50 Ohms
POLARIZATION	Vertical
RADIATION PATTERN	E Plane: Dipolar H Plane: Omni-directional
CROSS POLARIZATION	-15 dB
MAXIMUM INPUT POWER	20 Watts
OPERATING TEMPERATURE	-49° to +194° F
RADOME ENCLOSURE	ABS
CONNECTOR	N
COAX	12" RG-58A/U (white)
DIMENSIONS	.44" H x 3" Diameter
MOUNTING	Direct Feed 3/4" hole

LARSEN® ANTENNAS

3611 NE 112th Avenue
Vancouver WA 98682
Tel: 800-268-3662
International: 360-944-7551

www.larsen-antennas.com
info@larsen.pulseeng.com

L603.A (02/07)
Dual/Wide Band

Pulse® A TECHNITROL COMPANY

09/21/2007 12:53 3304347931 SUMMIT PAGE 02/03
09/17/2007 17:44 7784476928 LXE INC PAGE 02/03

RF ANTENNA ASSEMBLY
Volex Part Number VLX-510004-A

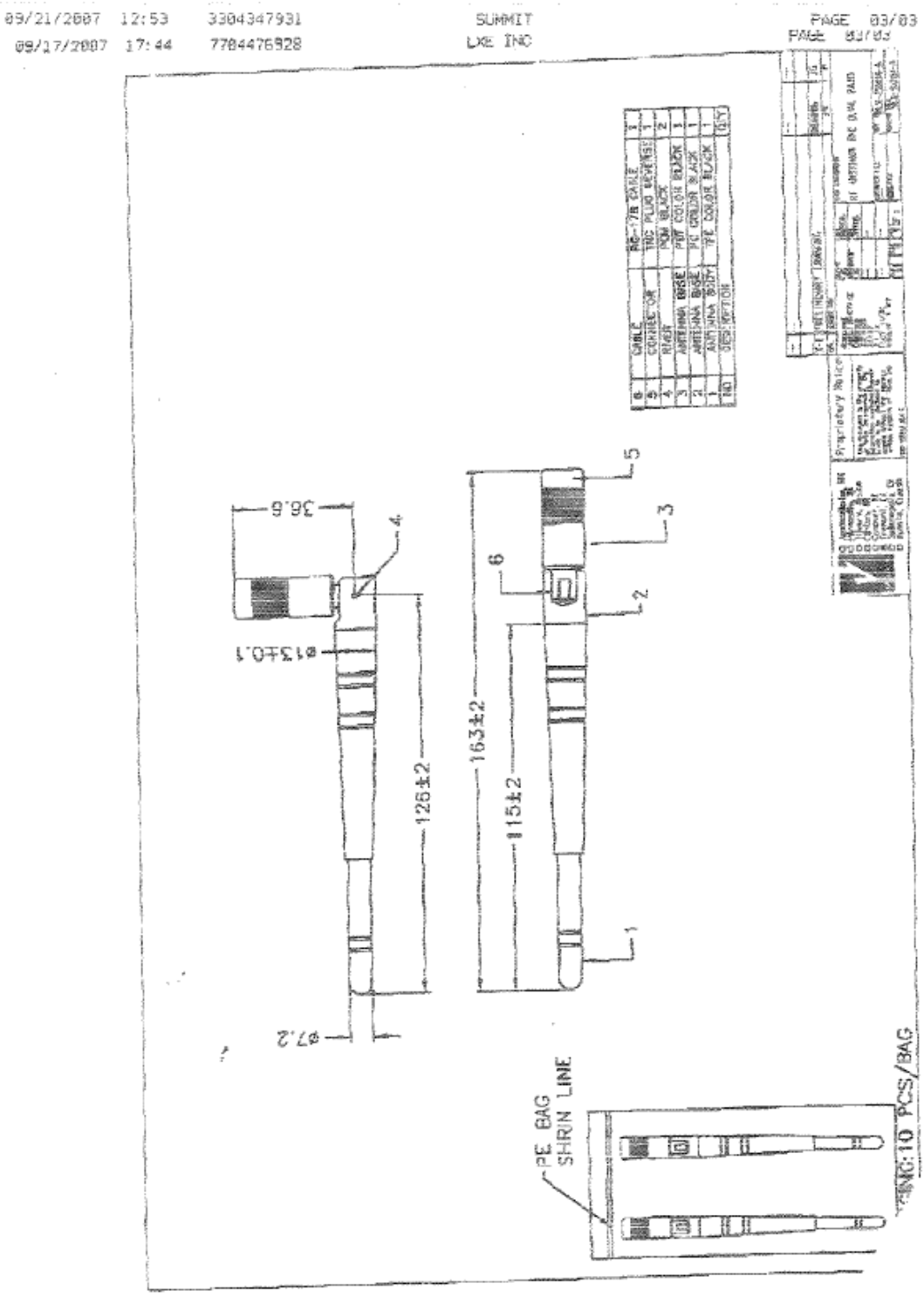
Specification:

1. **Electrical Properties:**

1.1	Frequency Range	2.4~ 2.5GHz * 4.9GHz~5.825GHz
1.2	Impedance	50 ohms Nominal
1.3	VSWR	1.92 Max
1.4	Return Loss	-10 dB Maximum
1.5	Radiation	Omni-directional
1.6	Gain (peak)	2.4Hhz~2.5Ghz @2.3dBi (real) 4.9Hhz~5.825Ghz @1.9dBi (real)
1.7	Polarization	Linear Vertical
1.8	Admitted Power	1 W

2. **Physical Properties**

2.1	Cable	RG-178 Coaxial Cable
2.2	Operating Temp	-20°C ~ +65°C
2.3	Storage Temp	-30°C ~ +75°C
2.4	Antenna Cover	TPE
2.5	Antenna Base	PC
2.6	Antenna Base	PBT
2.7	Connector	TNC Plug Reverse
2.8	Color	Black


09/21/2007 12:53 3304347931 SUMMIT PAGE 03/03
09/17/2007 17:44 7704476928 LXE INC
PAGE 03/03
36.6
ø13±0.1
126±2
ø7.2
163±2
115±2
PE BAG
SHRIN LINE
PACK:10 PCS/BAG

End of Report

This page is intentionally blank and
marks the last page of this test report.