



Measurement of RF Interference from a  
Cascade Networks Model Cyclone Transciever ISM  
Band (2400 to 2483.5MHz) using the Maxrad Model  
MFB24010 Omni-directional Antenna, a MaxRad  
Model 24013-120R Antenna and a Radio Waves  
Model SP6-2/5 Dish Antenna

For : Cascade Networks, Inc.  
Longview WA

P.O. No. :  
Date Received : January 19<sup>th</sup>, 2004  
Date Tested : January 19<sup>th</sup> through January 24, 2004  
Test Personnel: Richard E. King  
Specification : FCC "Code of Federal Regulations" Title 47  
Part 15.247, Subpart C

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## Measurement of RF Emissions from a Cascade Networks Cyclone Transciever

### **1.0 INTRODUCTION:**

**1.1 Description of Test Item** - This document presents the results of tests performed to determine if the Cascade Networks Cyclone Transciever (ISM Band) would meet the FCC requirements when using a MaxRad Model MFB24010 omni-directional antenna, a MaxRad Model 24013-120R omni-directional antenna and a Radiowaves, Inc. Model SP6-2/5 dish antenna. The test item is a Motorola Canopy transciever modified by Cascade Networks and designed to transmit in the 2400MHz to 2483.5MHz band. The tests were performed for Cascade Networks Inc, of Longview, Washington.

**1.2 Purpose** - The test series was performed to determine if the test item meets the requirements of the radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2001.

**1.3 Deviations, Additions and Exclusions** - There were no deviations, additions to, or exclusions from the test specification during this test series.

**1.4 Applicable Documents** - The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2002
- ANSI C63.4-2001, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

**1.5 Subcontractor Identification** - This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

**1.6 Laboratory Conditions** The temperature at the time of the test was 23°C and the relative humidity was 11%.

## **2.0 TEST ITEM SETUP AND OPERATION:**

The test item is a Cascade Networks Cyclone Transciever with external antennas. A block diagram of the test item setup is shown as Figure 1.

**2.1 Power Input** - The test item was powered with 24VDC from a Motorola model SADB-1129 transformer via the 45 feet of CAT 5 ethernet cable.

**2.2 Grounding** - The test item was grounded via the 45 feet of CAT 5 ethernet cable to the transformer.

**2.3 Peripheral Equipment** - The test item was submitted with a Panasonic ToughBook laptop that was used to power and communicate with the test item via one 45 foot long CAT 5 ethernet cable.

**2.4 Interconnect Cables** - The test item was connected to the laptop via a 45 foot long CAT 5 ethernet cable.

**2.5 Operational Mode** - For all tests the test item was placed on a 80cm high non-conductive stand. The test item and all peripheral equipment were energized.

For all tests, the test item was controlled and powered by the laptop computer. Through the computer the test item was set to transmit continuously in a continuous wave mode. The tests were performed with the test item transmitting at 2400MHz, 2440MHz and 2483.5MHz.

## **3.0 TEST EQUIPMENT:**

**3.1 Test Equipment List** - A list of the test equipment used can be found on Table I. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

**3.2 Calibration Traceability** Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

## **4.0 REQUIREMENTS, PROCEDURES AND RESULTS:**

### **4.1 Powerline Conducted Emissions**

**4.1.1 Requirements** – Since conducted emissions will be provided by Cascade Networks, no conducted emission measurements were taken.

### **4.2 Antenna Conducted Emissions Measurements:**

**4.2.1 Requirements** – Per section 15.247(c), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In

addition, radiated emissions which fall on the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a) (see§ 15.205(c)).

**4.2.2 Procedures** – The transmitter was connected to a spectrum analyzer through two 20dB attenuators. The resolution bandwidth was set to 100kHz with a video bandwidth of 1MHz. The maximum meter reading was recorded for the harmonics starting with the 2<sup>nd</sup> harmonic up to the 10<sup>th</sup> harmonic. The peak emissions in a 100kHz bandwidth was measured for the low, middle and high channels.

**4.2.3 Results:** The antenna conducted emissions for the low, middle and high channel are shown on data page 12. As can be seen by the data the test item did meet the emissions limits of 15.247(c).

### 4.3 Radiated Measurements

**4.3.1 Requirements** - Per section 15.247(c), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall on the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a) (see§ 15.205(c)).

Paragraph 15.209(a) has the following radiated emission limits:

Frequency MHz	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30.0-88.0	100	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

**4.3.2 Procedures** - Radiated measurements were manually performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals

from entering the enclosure on these leads.

The radiated emission tests were performed on all harmonics which fall in restricted bands.

To ensure that maximum emission levels were measured, the following steps were taken:

- 1) Measurements were made using an average detector and a standard gain horn antenna.
- 2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:
  - (a) The test item was rotated so that all of its sides were exposed to the receiving antenna.
  - (b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
  - (c) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

Photographs of the test item setup with each antenna are presented as Figures 2, 3 and 4.

#### **4.3.3 Results** - The radiated emission levels are presented on data pages 13 through 15.

As can be seen by the data the test item did meet the emissions limits of 15.247(c).

### **5.0 CONCLUSIONS:**

It was determined that the Cascade Networks Cyclone Transciever tested with the MaxRad Model MFB24010 omni-directional antenna, a MaxRad Model 24013-120R omni-directional antenna and a Radiowaves, Inc. Model SP6-2/5 dish antenna, did fully meet the selected emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15.247, Subpart C, Section 15.205 et seq. for Intentional Radiators, when tested per ANSI C63.4-2001.

### **6.0 CERTIFICATION:**

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the test item at the test date as operated by Cascade Networks, Inc. personnel. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

### **7.0 ENDORSEMENT DISCLAIMER:**

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

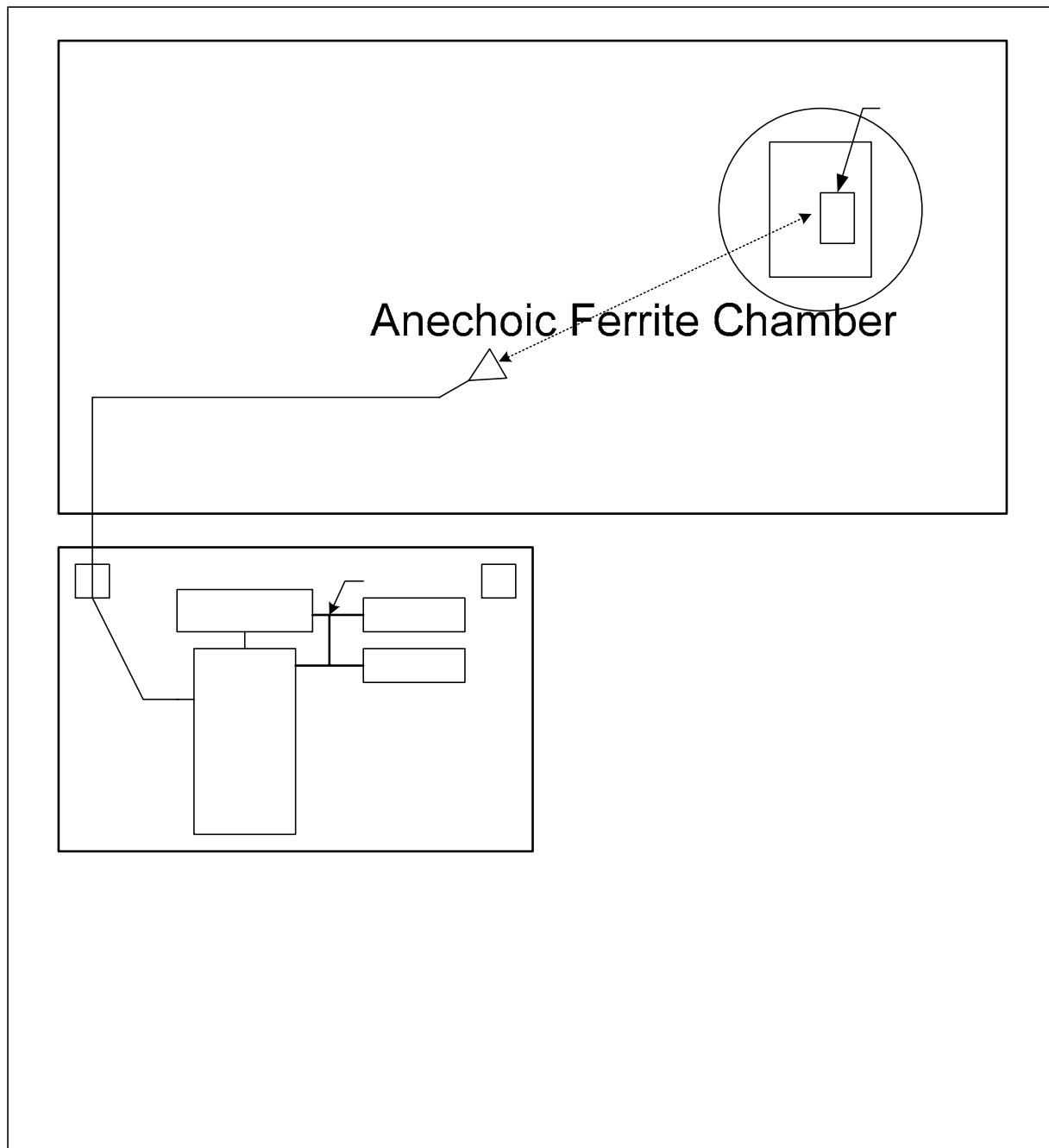


TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC.							Page: 1	
Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
<b>Equipment Type: ACCESSORIES, MISCELLANEOUS</b>								
XPRO	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/001		4.8-20GHZ	07/03/03	12	07/03/04
XZGO	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	3439A02724	---	N/A		
<b>Equipment Type: AMPLIFIERS</b>								
APHO	POWER AMPLIFIER	HEWLETT PACKARD	11975A	2304A00322	2-8GHZ		NOTE 1	
APKO	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	3008A00662	1-26.5GHZ	02/04/04	12	02/04/05
<b>Equipment Type: ANTENNAS</b>								
NHA0	STANDARD GAIN HORN ANTENNA	NARDA	640	---	8.2-12.4GHZ		NOTE 1	
NHE0	STANDARD GAIN HORN ANTENNA	NARDA	639	---	12.4-18GHZ		NOTE 1	
NHG0	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ		NOTE 1	
NHH0	STANDARD GAIN HORN ANTENNA	NARDA	V637	---	26.5-40GHZ		NOTE 1	
NHH1	STANDARD GAIN HORN ANTENNA	NARDA	V637	---	26.5-40GHZ		NOTE 1	
NWG0	RIDGED WAVE GUIDE (DCC-MAT	AEL	H1479	104	1-12.4GHZ	11/26/03	12	11/26/04
NWI0	RIDGED WAVE GUIDE	AEL	H1498	153	2-18GHZ	09/05/03	12	09/05/04
<b>Equipment Type: ATTENUATORS</b>								
T2D0	20DB, 25W ATTENUATOR (DCC-	WEINSCHEL	46-20-43	AV5813	DC-18GHZ	01/22/04	12	01/22/05
T2D9	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BH5445	DC-18GHZ	12/29/03	12	12/29/04
T2DD	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BH5449	DC-18GHZ	12/03/03	12	12/03/04
TVCO	VARIABLE ATTENUATOR	HEWLETT PACKARD	R382A	1281	26.5-40GHZ	08/13/03	12	08/13/04
<b>Equipment Type: CONTROLLERS</b>								
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---		N/A	
<b>Equipment Type: METERS</b>								
MPAO	POWER METER	HEWLETT PACKARD	432A	1141A08696	0.01-40GHZ	07/01/03	12	07/01/04
MPAD	THERMISTOR MOUNT	HEWLETT PACKARD	R486A	3322	26.5-40GHZ	09/30/03	12	09/30/04
<b>Equipment Type: RECEIVERS</b>								
RAB0	SPECTRUM ANALYZER	HEWLETT PACKARD	85680A	1818A00258	100HZ-1.5GHZ	05/10/02	DAMAGED	
RAC1	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3407A08369	100HZ-22GHZ	02/04/04	12	02/04/05
RACB	RF PRESELECTOR	HEWLETT PACKARD	85685A	3506A01491	20HZ-2GHZ	02/04/04	12	02/04/05
RAE1	SPECTRUM ANALYZER (DCC-CEM	HEWLETT PACKARD	85660A	2209A01336	100HZ-22GHZ	02/06/03	12	02/06/04
RAF3	QUASIEAK ADAPTER	HEWLETT PACKARD	85650A	3303A01775	0.01-1000MHZ	02/04/04	12	02/04/05
RAI0	FREQUENCY MIXER	HEWLETT PACKARD	11970A	2332A00292	26-40GHZ	06/02/03	N/A	
<b>Equipment Type: SIGNAL GENERATORS</b>								
GBX1	SYNTHESIZED SWEEPER	HEWLETT PACKARD	83630A	3420A00857	10MHZ-26.5GHZ		NOTE 1	
GSB0	SWEEP OSCILLATOR	HEWLETT PACKARD	8350B	2309A02104	0.01-40GHZ	06/10/03	12	06/10/04
GSBC	TUNING HEAD	HEWLETT PACKARD	83572B	2429A00203	26.5-40GHZ	06/09/03	12	06/09/04

Cal. Interval: Listed in Months I/O: Initial Only N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.



Hpi8 cbl

Turn Table & Mast  
Controller

Computer

Figure 2

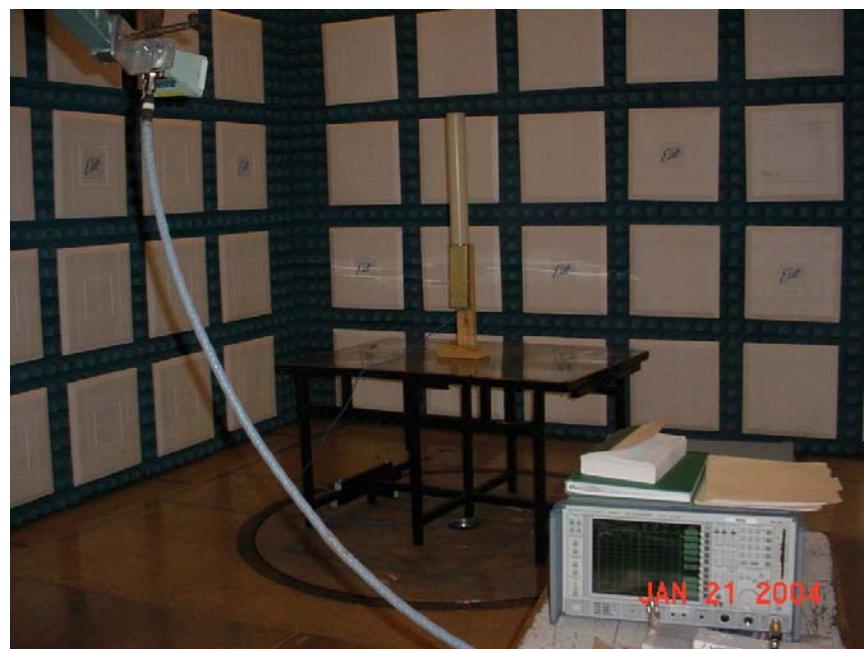


Test Setup For Measurement of radiated emissions MaxRad Model MFB24010 omni-directional



antenna

Figure 3



Test Setup For Measurement of radiated emissions MaxRad Model 24013-120R antenna

Figure 4



Test Setup For Measurement of radiated emissions Radiowaves, Inc. Model SP6-2/5 dish antenna

**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**S/N** : None given  
**SPECIFICATION** : FCC-15.247 Antenna Conducted Emissions  
**DATE** : January 22, 2004  
**NOTES** : Low & Middle Channel

**LOW Channel**

FREQ MHz	MTR dBm	MTR RDG	Amb.	BW	Attenuation	15.247	
						TOTAL dBm	LIMIT 20dBc
2400.0	-18.3			100kHz/1M	40.0	21.7	
4800.0	-78.5			100kHz/1M	40.0	-38.5	1.7
7200.0	-98.0	Amb.		100kHz/1M	40.0	-58.0	1.7
9600.0	-93.7	Amb.		100kHz/1M	40.0	-53.7	1.7
12000.0	-90.6	Amb.		100kHz/1M	40.0	-50.6	1.7
14400.0	-91.5	Amb.		100kHz/1M	40.0	-51.5	1.7
16800.0	-90.6	Amb.		100kHz/1M	40.0	-50.6	1.7
19200.0	-91.5	Amb.		100kHz/1M	40.0	-51.5	1.7
21600.0	-89.7	Amb.		100kHz/1M	40.0	-49.7	1.7
24000.0	-91.5	Amb.		100kHz/1M	40.0	-51.5	1.7

**MID Channel**

FREQ MHz	MTR dBm	MTR RDG	Amb.	BW	Attenuation	15.247	
						TOTAL dBm	LIMIT 20dBc
2440.0	-18.7			100kHz/1M	40.0	21.3	
4880.0	-81.0			100kHz/1M	40.0	-41.0	1.3
7320.0	-92.5	Amb.		100kHz/1M	40.0	-52.5	1.3
9760.0	-92.5	Amb.		100kHz/1M	40.0	-52.5	1.3
12200.0	-90.6	Amb.		100kHz/1M	40.0	-50.6	1.3
14640.0	-90.6	Amb.		100kHz/1M	40.0	-50.6	1.3
17080.0	-92.5	Amb.		100kHz/1M	40.0	-52.5	1.3
19520.0	-92.5	Amb.		100kHz/1M	40.0	-52.5	1.3
21960.0	-89.7	Amb.		100kHz/1M	40.0	-49.7	1.3
24400.0	-90.6	Amb.		100kHz/1M	40.0	-50.6	1.3

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 Richard E. King

**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**S/N** : None given  
**SPECIFICATION** : FCC-15.247 Antenna Conducted Emissions  
**DATE** : January 22, 2004  
**NOTES** : High Channel

**HIGH Channel**

FREQ MHz	MTR dBm	RDG Amb.	BW	Attenuation	15.247	
					TOTAL dBm	LIMIT 20dBc
2482.5	-22.8		100kHz/1M	40.0	17.19	
4965.0	-87.6		100kHz/1M	40.0	-47.64	-2.8
7447.5	-91.5	Amb.	100kHz/1M	40.0	-51.48	-2.8
9930.0	-91.5	Amb.	100kHz/1M	40.0	-51.48	-2.8
12412.5	-90.6	Amb.	100kHz/1M	40.0	-50.57	-2.8
14895.0	-90.5	Amb.	100kHz/1M	40.0	-50.50	-2.8
17377.5	-89.7	Amb.	100kHz/1M	40.0	-49.74	-2.8
19860.0	-90.6	Amb.	100kHz/1M	40.0	-50.57	-2.8
22342.5	-90.6	Amb.	100kHz/1M	40.0	-50.57	-2.8
24825.0	-90.6	Amb.	100kHz/1M	40.0	-50.57	-2.8

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**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**ANTENNA** : MaxRad MFB24010  
**S/N** : None given  
**SPECIFICATION** : FCC-15.247 Radiated Emissions  
**DATE** : January 23, 2004  
**NOTES** : LOW & MID Channels

**LOW Channel**

FREQ MHz	ANT POL	MTR RDG dBuV	Amb.	BW	Dist. Corr. Fac	ANT FAC	CABLE LOSS	PRE AMP	TOTAL		15.209 LIMIT dBuV/m
									dBuV/m	dBuV/m	
4800.0	H	13.0	*	1M/10		34.2	0.5	0.0	47.7		54.0
4800.0	V	13.8	*	1M/10		34.2	0.5	0.0	48.5		54.0
12000.0	H	14.9	*	1M/10	-9.5	41.3	1.0	0.0	47.7		54.0
12000.0	V	14.9	*	1M/10	-9.5	41.3	1.0	0.0	47.7		54.0
19200.0	H	15.9	*	1M/10	-9.5	42.6	0.0	0.0	49.0		54.0
19200.0	V	15.9	*	1M/10	-9.5	42.6	0.0	0.0	49.0		54.0
24000.0	H	15.5	*	1M/10	-9.5	42.6	0.0	0.0	48.6		54.0
24000.0	V	15.5	*	1M/10	-9.5	42.6	0.0	0.0	48.6		54.0

**MIDDLE Channel**

FREQ MHz	ANT POL	MTR RDG dBuV	Amb.	BW	Dist. Corr. Fac	ANT FAC	CABLE LOSS	PRE AMP	TOTAL		15.209 LIMIT dBuV/m
									dBuV/m	dBuV/m	
4880.0	H	14.5	*	1M/10		34.2	0.5	0.0	49.2		54.0
4880.0	V	14.4	*	1M/10		34.2	0.5	0.0	49.1		54.0
7320.0	H	13.6	*	1M/10		38.8	0.8	0.0	53.1		54.0
7320.0	V	13.5	*	1M/10		38.8	0.8	0.0	53.1		54.0
12200.0	H	15.3	*	1M/10	-9.5	41.3	1.0	0.0	48.1		54.0
12200.0	V	15.4	*	1M/10	-9.5	41.3	1.0	0.0	48.2		54.0
19520.0	H	14.7	*	1M/10	-9.5	42.6	0.0	0.0	47.8		54.0
19520.0	V	14.8	*	1M/10	-9.5	42.6	0.0	0.0	47.9		54.0

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 Richard E. King

**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**ANTENNA** : MaxRad MFB24010  
**S/N** : None given  
**SPECIFICATION** : FCC-15.247 Radiated Emissions  
**DATE** : January 23, 2004  
**NOTES** : High Channel

**HIGH Channel**

FREQ MHz	ANT POL	MTR RDG dBuV		Amb.	BW	Dist. Corr. Fac	ANT FAC	CABLE LOSS	PRE AMP	TOTAL dBuV/m	15.209 LIMIT
		MTR dBuV	RDG dBuV								15.209 LIMIT
4965.0	H	14.8	Amb.	1M/10		34.2	0.5	0.0	49.5	54.0	
4965.0	V	14.8	Amb.	1M/10		34.2	0.5	0.0	49.5	54.0	
7447.5	H	13.7	Amb.	1M/10		38.8	0.8	0.0	53.2	54.0	
7447.5	V	13.7	Amb.	1M/10		38.8	0.8	0.0	53.2	54.0	
12412.5	H	15.4	Amb.	1M/10	-9.5	41.3	1.0	0.0	48.2	54.0	
12412.5	V	15.8	Amb.	1M/10	-9.5	41.3	1.0	0.0	48.6	54.0	
19860.0	H	15.2	Amb.	1M/10	-9.5	42.6	0.0	0.0	48.3	54.0	
19860.0	V	15.2	Amb.	1M/10	-9.5	42.6	0.0	0.0	48.3	54.0	
22342.5	H	15.3	Amb.	1M/10	-9.5	41.5	0.0	0.0	47.3	54.0	
22342.5	V	15.3	Amb.	1M/10	-9.5	41.5	0.0	0.0	47.3	54.0	

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Richard E. King

**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**ANTENNA** : MaxRad MFB24013-120  
**S/N** : None given  
**SPECIFICATION** : FCC-15C Radiated Emissions  
**DATE** : January 23, 2004  
**NOTES** : Low & MID. Channel

**LOW Channel**

FREQ MHz	ANT POL	MTR RDG dBuV			Dist. Corr. Fac	ANT	CABLE	Pre.	TOTAL	15.209	LIMIT
			Amb.	BW						dBuV/m	
4800.00	H	13.0	*	1M/10		34.2	0.5	0.0	47.7	54.0	
4800.00	V	13.0	*	1M/10		34.2	0.5	0.0	47.7	54.0	
12000.00	H	14.9	*	1M/10	-9.5	41.3	1.0	0.0	47.8	54.0	
12000.00	V	14.9	*	1M/10	-9.5	41.3	1.0	0.0	47.7	54.0	
19200.00	H	15.6	*	1M/10	-9.5	42.6	0.0	0.0	48.7	54.0	
19200.00	V	15.8	*	1M/10	-9.5	42.6	0.0	0.0	48.9	54.0	
24000.00	H	15.5	*	1M/10	-9.5	42.6	0.0	0.0	48.6	54.0	
24000.00	V	15.5	*	1M/10	-9.5	42.6	0.0	0.0	48.6	54.0	

**MIDDLE Channel**

FREQ MHz	ANT POL	MTR RDG dBuV			Dist. Corr. Fac	ANT	CABLE	Pre.	TOTAL	15.209	LIMIT
			Amb.	BW						dBuV/m	
4880.00	H	13.0	*	1M/10		34.2	0.5	0.0	47.7	54.0	
4880.00	V	13.0	*	1M/10		34.2	0.5	0.0	47.7	54.0	
7320.00	H	13.5	*	1M/10		38.8	0.8	0.0	53.1	54.0	
7320.00	V	13.5	*	1M/10		38.8	0.8	0.0	53.1	54.0	
12200.0	H	15.3	*	1M/10	-9.5	41.3	1.0	0.0	48.1	54.0	
12200.0	V	15.3	*	1M/10	-9.5	41.3	1.0	0.0	48.1	54.0	
19520.0	H	14.7	*	1M/10	-9.5	42.6	0.0	0.0	47.8	54.0	
19520.0	V	14.7	*	1M/10	-9.5	42.6	0.0	0.0	47.8	54.0	

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 Richard E. King



**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**ANTENNA** : MaxRad MFB24013-120  
**S/N** : None given  
**SPECIFICATION** : FCC-15C Radiated Emissions  
**DATE** : January 23, 2004  
**NOTES** : HIGH Channel

**HIGH Channel**

FREQ MHz	ANT POL	MTR RDG dBuV	Amb.	BW	Dist. Corr. Fac	ANT FAC	CABLE LOSS	Pre. AMP.	TOTAL dBuV/m	15.209	LIMIT dBuV/m
										15.209	
4965.0	H	14.8	*	1M/10		34.2	0.5	0.0	49.5	54.0	
4965.0	V	14.8	*	1M/10		34.2	0.5	0.0	49.5	54.0	
7447.5	H	13.7	*	1M/10		38.8	0.8	0.0	53.2	54.0	
7447.5	V	13.7	*	1M/10		38.8	0.8	0.0	53.3	54.0	
12412.5	H	15.4	*	1M/10	-9.5	41.3	1.0	0.0	48.2	54.0	
12412.5	V	15.5	*	1M/10	-9.5	41.3	1.0	0.0	48.3	54.0	
19860.0	H	15.2	*	1M/10	-9.5	42.6	0.0	0.0	48.3	54.0	
19860.0	V	15.2	*	1M/10	-9.5	42.6	0.0	0.0	48.3	54.0	
22342.5	H	15.3	*	1M/10	-9.5	41.5	0.0	0.0	47.3	54.0	
22342.5	V	15.3	*	1M/10	-9.5	41.5	0.0	0.0	47.3	54.0	

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Richard E. King

**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**ANTENNA** : RadioWaves SP6-2/5 N/S  
**S/N** : None given  
**SPECIFICATION** : FCC-15.247 Radiated Emissions  
**DATE** : January 23, 2004  
**NOTES** : LOW & MID Channels

**LOW Channel**

FREQ MHz	ANT POL	MTR RDG dBuV	Dist. Corr.			ANT FAC	CABLE LOSS	Pre. AMP.	TOTAL dBuV/m	15.209 LIMIT dBuV/m
			Amb.	BW	Fac					
4800.00	H	13.0	*	1M/10		34.2	0.5	0.0	47.7	54.0
4800.00	V	13.1	*	1M/10		34.2	0.5	0.0	47.8	54.0
12000.00	H	14.9	*	1M/10	-9.5	41.3	1.0	0.0	47.7	54.0
12000.00	V	14.9	*	1M/10	-9.5	41.3	1.0	0.0	47.7	54.0
19200.00	H	15.9	*	1M/10	-9.5	42.6	0.0	0.0	49.0	54.0
19200.00	V	15.9	*	1M/10	-9.5	42.6	0.0	0.0	49.0	54.0
24000.00	H	15.5	*	1M/10	-9.5	42.6	0.0	0.0	48.6	54.0
24000.00	V	15.5	*	1M/10	-9.5	42.6	0.0	0.0	48.6	54.0

**MIDDLE  
Channel**

FREQ MHz	ANT POL	MTR RDG dBuV	Dist. Corr.			ANT FAC	CABLE LOSS	Pre. AMP.	TOTAL dBuV/m	15.209 LIMIT dBuV/m
			Amb.	BW	Fac					
4880.00	H	14.3	*	1M/10		34.2	0.5	0.0	49.0	54.0
4880.00	V	15.1	*	1M/10		34.2	0.5	0.0	49.8	54.0
7320.00	H	13.5	*	1M/10		38.8	0.8	0.0	53.1	54.0
7320.00	V	13.6	*	1M/10		38.8	0.8	0.0	53.2	54.0
12200.0	H	15.3	*	1M/10	-9.5	41.3	1.0	0.0	48.1	54.0
12200.0	V	15.3	*	1M/10	-9.5	41.3	1.0	0.0	48.1	54.0
19520.0	H	14.7	*	1M/10	-9.5	42.6	0.0	0.0	47.8	54.0
19520.0	V	14.8	*	1M/10	-9.5	42.6	0.0	0.0	47.9	54.0

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 Richard E. King

**MANUFACTURER** : Cascade Networks  
**MODEL** : Cyclone Transceiver  
**ANTENNA** : RadioWaves SP6-2/5 N/S  
**S/N** : None given  
**SPECIFICATION** : FCC-15.247 Radiated Emissions  
**DATE** : January 23, 2004  
**NOTES** : High Channel

**HIGH Channel**

FREQ MHz	ANT POL	MTR RDG dBuV			Dist. Corr. Fac	ANT FAC	CABLE	Pre.	TOTAL dBuV/m	15.209 LIMIT dBuV/m
			Amb.	BW						
4965.0	H	14.83	*	1M/10	34.2	0.5	0.0	49.5	54.0	
4965.0	V	14.86	*	1M/10	34.2	0.5	0.0	49.6	54.0	
7447.5	H	13.71	*	1M/10	38.8	0.8	0.0	53.3	54.0	
7447.5	V	14.32	*	1M/10	38.8	0.8	0.0	53.9	54.0	
12412.5	H	15.44	*	1M/10	-9.5	41.3	1.0	48.3	54.0	
12412.5	V	15.30	*	1M/10	-9.5	41.3	1.0	48.1	54.0	
19860.0	H	15.23	*	1M/10	-9.5	42.6	0.0	48.3	54.0	
19860.0	V	15.21	*	1M/10	-9.5	42.6	0.0	48.3	54.0	
22342.5	H	15.30	*	1M/10	-9.5	41.5	0.0	47.3	54.0	
22342.5	V	15.30	*	1M/10	-9.5	41.5	0.0	47.3	54.0	

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