

FCC Part 15 Subpart B and C Compliance Test Report

Industry Canada RSS-210 Issue 5

Applicant Name: Tranzeo Wireless Technologies Inc.

Product Name: Wireless

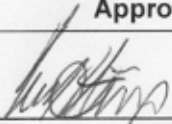
Model No.: TR-CPE

FCC ID: QRF-TR-CPE

Date of Test Report:

Date of Test completion:

Report Version: 1.1

Approvals		
Approved By	 Robert Stirling P.Eng	7/3/03 Date

Report Revision		
Rev. #	Report Change	Date
1.1	Frequency correction in section 6.5	July 3

Table of Contents

FCC PART 15 SUBPART B AND C COMPLIANCE TEST REPORT.....	1
<i>Table of Contents</i>	<i>2</i>
1.0 GENERAL INFORMATION	4
1.1 EUT DESCRIPTION	4
1.2 OPERATIONAL DESCRIPTION	4
1.3 TEST FACILITIES	5
1.4 TEST SYSTEM DETAILS	5
1.5 EUT MODIFICATIONS.....	5
1.6 EUT TESTING CONFIGURATION.....	5
1.7 TEST RESULTS	5
2.0 CONDUCTED EMISSIONS.....	6
2.1 TEST EQUIPMENT	6
2.2 TEST STANDARD.....	6
2.3 TEST SETUP	6
2.4 TEST LIMITS	6
2.5 TEST RESULTS	7
2.5.1 EMISSIONS PLOTS	8
2.6 TEST RESULTS	10
2.6.1 EMISSIONS PLOTS	11
2.7 TEST RESULTS	13
2.7.1 EMISSIONS PLOTS	14
2.8 TEST RESULTS	16
2.8.1 EMISSIONS PLOTS	17
3.0 PEAK POWER OUTPUT.....	19
3.1 TEST EQUIPMENT	19
3.2 TEST SETUP	19
3.3 LIMITS	19
3.4 TEST STANDARD.....	19
3.5 TEST RESULTS	19
4.0 RADIATED EMISSIONS.....	20
4.1 TEST EQUIPMENT	20
4.2 TEST SETUP	20
4.3 TEST STANDARD.....	20
4.4 LIMITS	20
4.5 TEST RESULT	21
4.6 EMISSIONS PLOTS	22
5.0 RADIATED HARMONIC AND SPURIOUS EMISSIONS.....	23
5.1 TEST EQUIPMENT	23
5.2 TEST SETUP	23
5.3 TEST STANDARD.....	23
5.4 LIMITS	23
5.5 TEST RESULT CHANNEL 1	24
5.6 TEST RESULT CHANNEL 6	25
5.7 TEST RESULT CHANNEL 11	26
6.0 BAND EDGE.....	27
6.1 TEST EQUIPMENT	27
6.2 TEST SETUP	27

6.3	TEST STANDARD.....	27
6.4	LIMITS	27
6.5	TEST RESULT CHANNEL 1	28
6.5.1	CHANNEL 1 BAND EDGE PLOT HORIZONTAL.....	28
6.5.2	CHANNEL 1 BAND EDGE PLOT VERTICAL	29
6.6	TEST RESULT CHANNEL 11	30
6.6.1	CHANNEL 11 BAND EDGE PLOT HORIZONTAL AVERAGE	30
6.4.2	CHANNEL 11 BAND EDGE PLOT VERTICAL AVERAGE	31
7.0	OCCUPIED BANDWIDTH.....	32
7.1	TEST EQUIPMENT	32
7.2	TEST SETUP	32
7.3	TEST STANDARD.....	32
7.4	LIMITS	32
7.5	TEST RESULT CHANNEL 1	33
7.5.1	CHANNEL 1 OCCUPIED BANDWIDTH PLOT	33
7.6	TEST RESULT CHANNEL 6	34
7.6.1	CHANNEL 6 OCCUPIED BANDWIDTH PLOT	34
7.7	TEST RESULT CHANNEL 11	35
7.7.1	CHANNEL 11 OCCUPIED BANDWIDTH PLOT	35
8.0	POWER SPECTRAL DENSITY	36
8.1	TEST EQUIPMENT	36
8.2	TEST SETUP	36
8.3	TEST STANDARD.....	36
8.4	LIMIT	36
8.5	TEST RESULT CHANNEL 1	37
8.5.1	CHANNEL 1 POWER SPECTRAL DENSITY PLOT.....	37
8.6	TEST RESULT CHANNEL 6	38
8.6.1	CHANNEL 6 POWER SPECTRAL DENSITY PLOT.....	38
8.7	TEST RESULT CHANNEL 11	39
8.7.1	CHANNEL 11 POWER SPECTRAL DENSITY PLOT.....	39
9.0	RF EXPOSURE EVALUATION.....	40
9.1	FRIES FORMULA	40
9.2	EUT OPERATION CONDITION.....	40
9.3	TEST RESULT OF RF EXPOSURE EVALUATION	41
9.3.1	ANTENNA GAIN	41
9.3.2	OUTPUT POWER INTO ANTENNA AND RF EXPOSURE EVALUATION DISTANCE	41
10.0	TEST PHOTOS.....	42

1.0 General Information

1.1 EUT Description

Product Name : Access Point, Bridge, Repeater
Trade Name : Tranzeo Wireless Technologies Inc
FCC ID : QRF-TR-CPE
Model No. : TR-CPE
Frequency Range : 2412 MHz to 2462 MHz
Number of Channels : 11
Transmit Rate : Max is 11Mbps
Type of modulation : Direct Sequence Spread Spectrum
Antenna Type : Permanent
Antenna Gain : 15 dB Gain
Product Software : Tranzeo Firmware version 2.0.0
Test Software : Laneval
Operator Channel Selection : By Software
Method :
Power Adapter : SINCHO ELECTRIC CO LTD
Input: AC 120 V 60 Hz, 10 W
Output: DC 12 V, 500 mA, non-shielded cable

Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 1	2412 MHz	Channel 5	2432 MHz	Channel 9	2452 MHz
Channel 2	2417 MHz	Channel 6	2437 MHz	Channel 10	2457 MHz
Channel 3	2422 MHz	Channel 7	2442 MHz	Channel 11	2462 MHz
Channel 4	2437 MHz	Channel 8	2447 MHz		

Note:

- 1.0 This device is a 2.4 GHz wireless router includes a 2.4 GHz receiving function and a 2.4 GHz transmitting function.
- 2.0 Channels 1, 6 and 11 were selected to cover the full transmitting range of the transmitter.
- 3.0 The tests were conducted on a production model sample to demonstrate compliance with FCC Part 15 Subpart C section 15.247 for spread spectrum devices.
- 4.0 The transmit rate of 11Mbps was used for all the measurements after an investigation was performed show that this was the worst case transmit rate.

1.2 Operational Description

The EUT is a wireless bridge with 11 channels, with a max transmit rate of 11Mbps.

1.3 Test Facilities

Protocol EMC
28945 McTavish Rd.
Abbotsford B.C., Canada, V4X 2E7

Phone: 604-607-0012
Fax: 604-607-0019

FCC Registration Number 96437
Industry Canada Registration Number IC3384

1.4 Test System Details

The following equipment listed below is all equipment and cables used on the EUT side of the testing.

Description	Manufacturer	Model No.	Serial No.	FCC ID.
A Computer	Daewoo	CT5840	908C3D02117	N/A

Signal Cable Type	Signal Cable Description
A CAT5 LAN Cable	EUT to DC injection Block (This Block also connects the EUT with whatever host PC you are using)
B CAT5 LAN Cable	DC Block to 1 m LAN cable going to a PC

1.5 EUT Modifications

There were no modifications required for this unit to comply with FCC Part 15 Subpart B and C section 15.247 and Industry Canada RSS-210 Issue 5.

1.6 EUT Testing Configuration

The EUT was setup on the emissions test site. The host computer was connected to the USB wireless LAN adapter to give us a way to change the transmitting channels on the EUT. The provided test software gave us the ability to put the EUT in TXM mode which turns off the DSS mode and produces a solid state for easier measuring of harmonics and other tests. This option is only available on the test software for Protocol EMC.

1.7 Test Results

The TR-3315 complies with FCC Part 15 Subpart C and Industry Canada RSS-210 Issue 5.



Industry
Canada

Industrie
Canada

2.0 Conducted Emissions

2.1 Test Equipment

Device	Model Number	Serial No.	Last Cal.	Next Cal
LISN	Solar 8012-50-R-24-BNC	863092	09/18/02	09/18/03
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	01/13/03	01/13/04
RF-Preselector	Hewlett Packard 85685A	3107A01222	01/10/03	01/10/04
Quasi-Peak Adapter	Hewlett Packard 85650A	2043A00240	01/13/03	01/13/04
Turntable	Protocol	Custom	N/A	N/A

2.2 Test Standard

FCC Part 15 Subpart C Section 15.207 Conducted emission limits.

2.3 Test Setup

The EUT was setup in its normal operating mode for the duration of the test. All lines were tested to find the maximum conducted emissions that the EUT emitted. All Conducted Emissions measurements were performed according to ANSI C63.4: 1992 on conducted measurement. Conducted Emissions were tested over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9kHz.

2.4 Test Limits

Class B Limits:

Frequency (MHz)	Maximum Level (dB μ V)	Maximum Level (dB μ V)
	Quasi-Peak	Average
0.15 - 0.50	66-56 (Log Delta)	56-46 (Log Delta)
0.50 - 5.00	56	46
5.00 - 30.0	60	50

2.5 Test Results

Product : TR-CPE
Test Item : Conducted Emissions
Test Site : Protocol EMC
Test Mode : Receiving mode

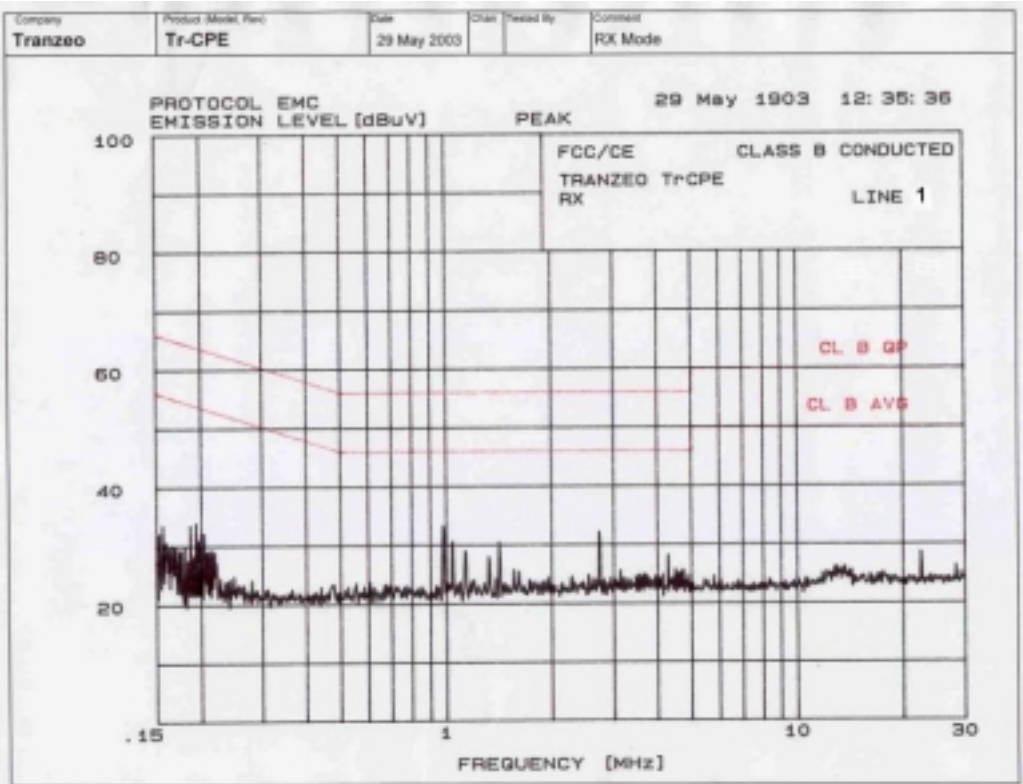
Line 1

Frequency MHz	Test Reading	Delta Limit
0.9821	33.3	-12.7
2.728	32.2	-13.8
1.046	30.6	-15.4
1.415	30.5	-15.5
1.133	29.0	-17.0

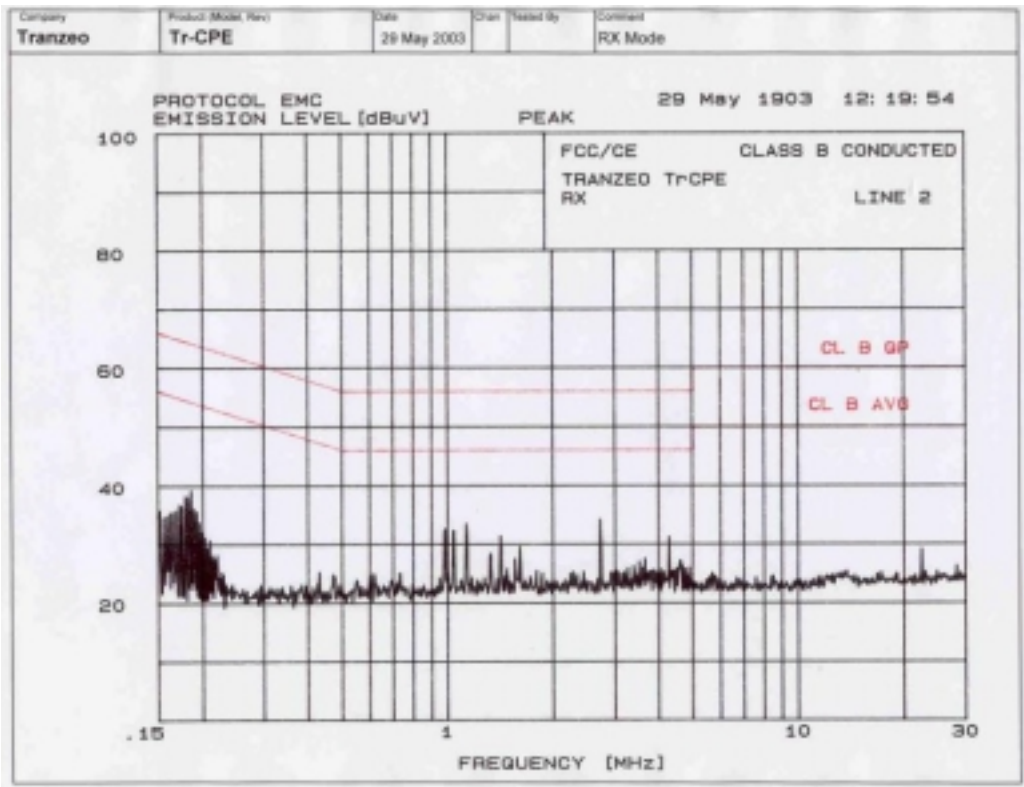
Line 2

Frequency MHz	Test Reading	Delta Limit
2.728	34.2	-11.8
1.133	33.5	-12.5
0.9873	32.6	-13.4
1.041	32.3	-13.7
1.415	31.4	-14.6

2.5.1 Emissions Plots



Line 1 Conducted Emissions



Line 2 Conducted Emissions

2.6 Test Results

Product : TR-CPE
Test Item : Conducted Emissions
Test Site : Protocol EMC
Test Mode : Transmitting Mode Channel 1

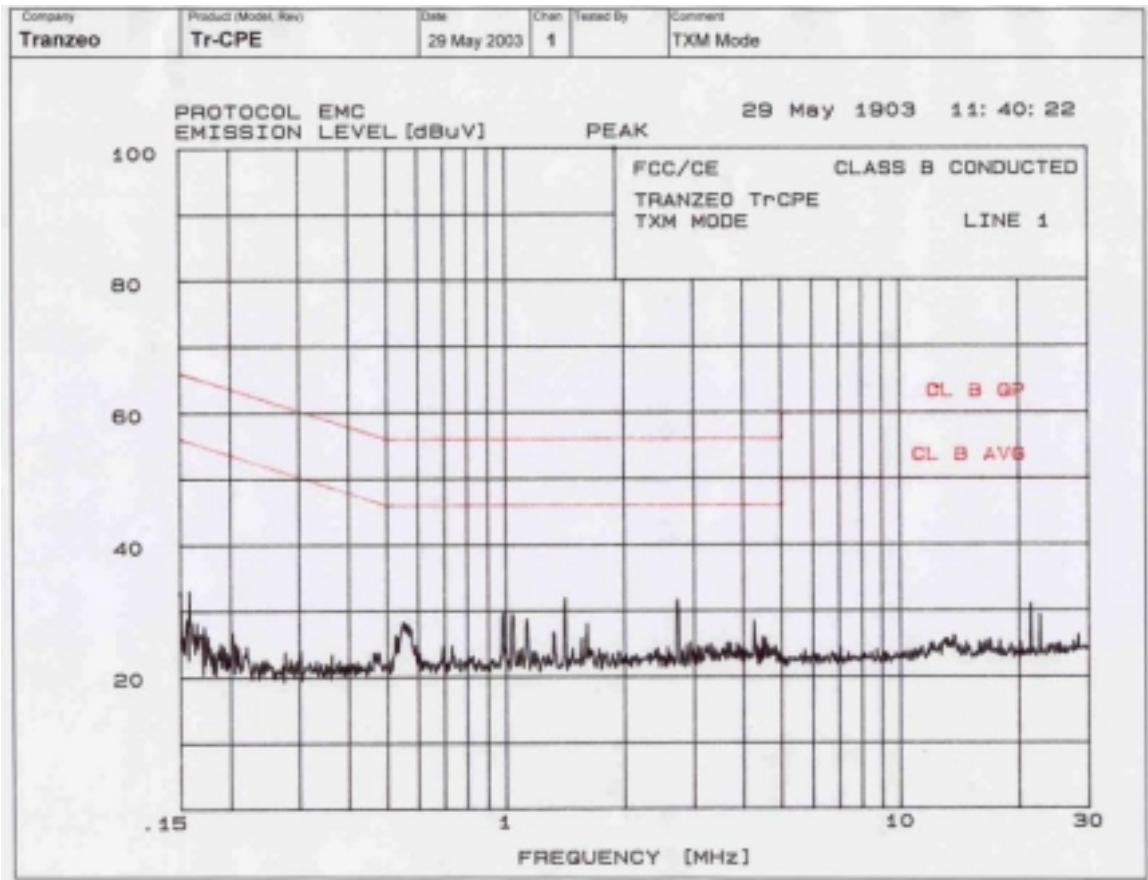
Line 1

Frequency MHz	Test Reading	Delta Limit
1.415	31.9	-14.1
2.728	31.6	-14.4
0.9873	29.6	-16.4
1.041	29.5	-16.5
1.133	28.7	-17.3

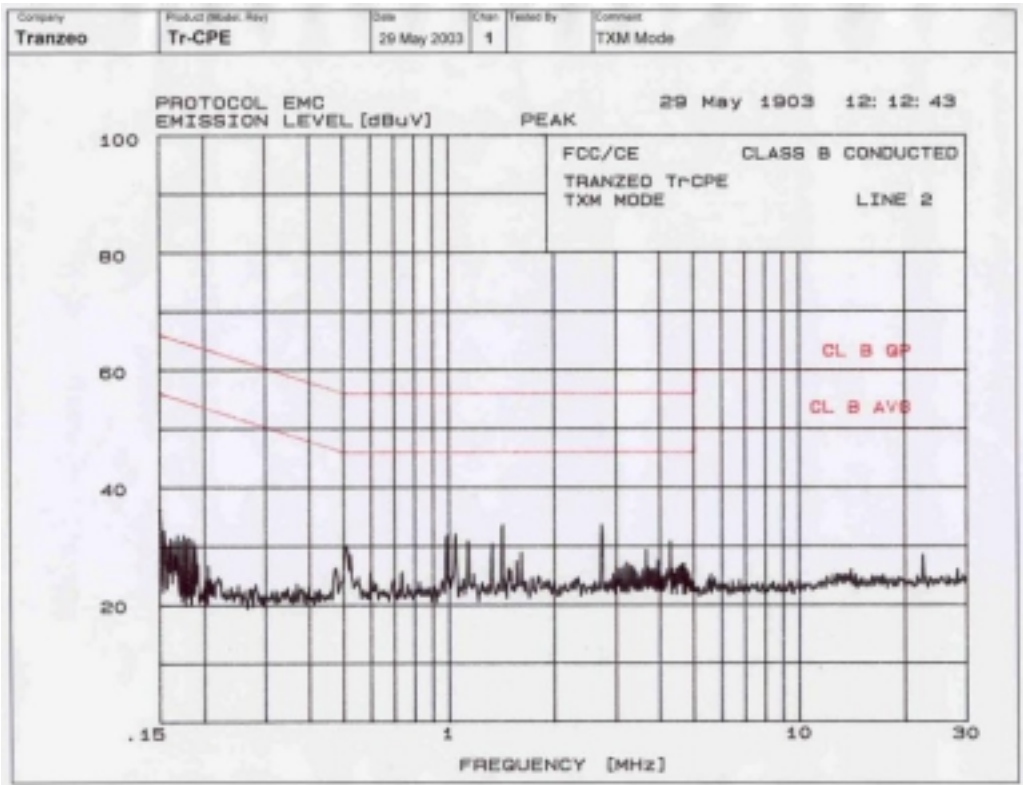
Line 2

Frequency MHz	Test Reading	Delta Limit
1.422	33.6	-12.4
2.728	33.6	-12.4
1.046	32.0	-14.0
0.9873	31.8	-14.2
1.133	30.9	-15.1

2.6.1 Emissions Plots



Line 1 Conducted Emissions



Line 2 Conducted Emissions

2.7 Test Results

Product : TR-CPE
Test Item : Conducted Emissions
Test Site : Protocol EMC
Test Mode : Transmitting Mode Channel 6

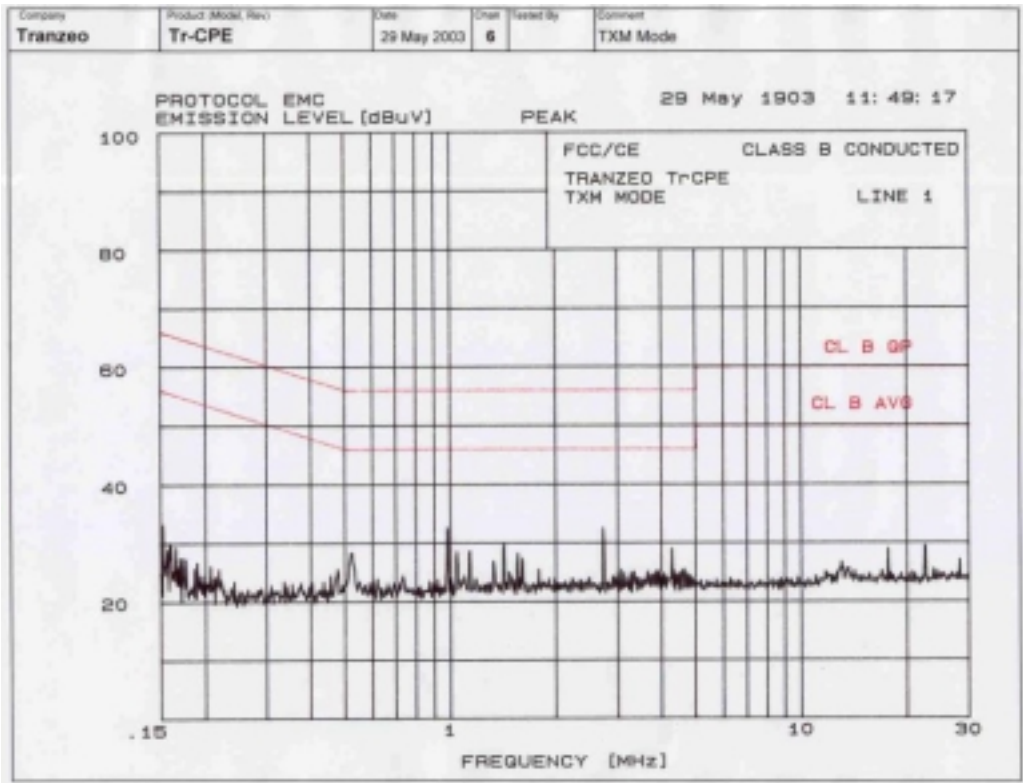
Line 1

Frequency MHz	Test Reading	Delta Limit
0.9821	32.6	-13.4
2.728	32.5	-13.5
1.422	29.8	-16.2
4.277	29.0	-17.0
1.139	28.6	-17.4

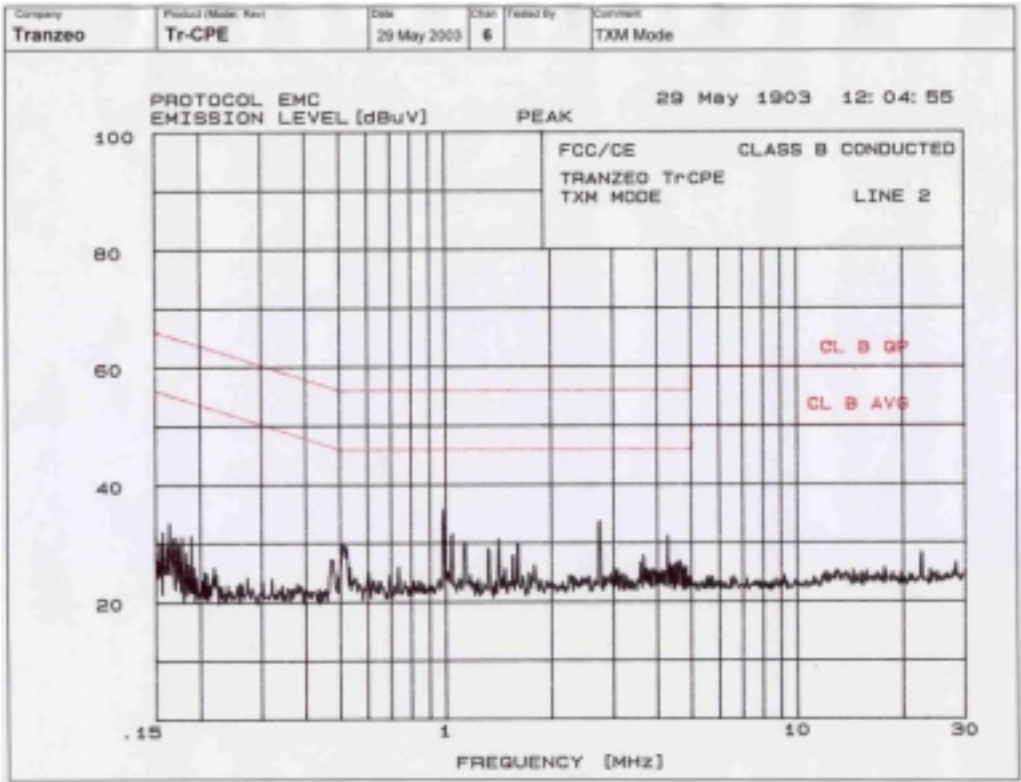
Line 2

Frequency MHz	Test Reading	Delta Limit
0.9873	35.7	-10.3
2.742	33.7	-12.3
1.046	31.5	-14.5
4.277	31.2	-14.8
1.415	30.7	-15.3

2.7.1 Emissions Plots



Line 1 Conducted Emissions



Line 2 Conducted Emissions

2.8 Test Results

Product : TR-CPE
Test Item : Conducted Emissions
Test Site : Protocol EMC
Test Mode : Transmitting Mode Channel 11

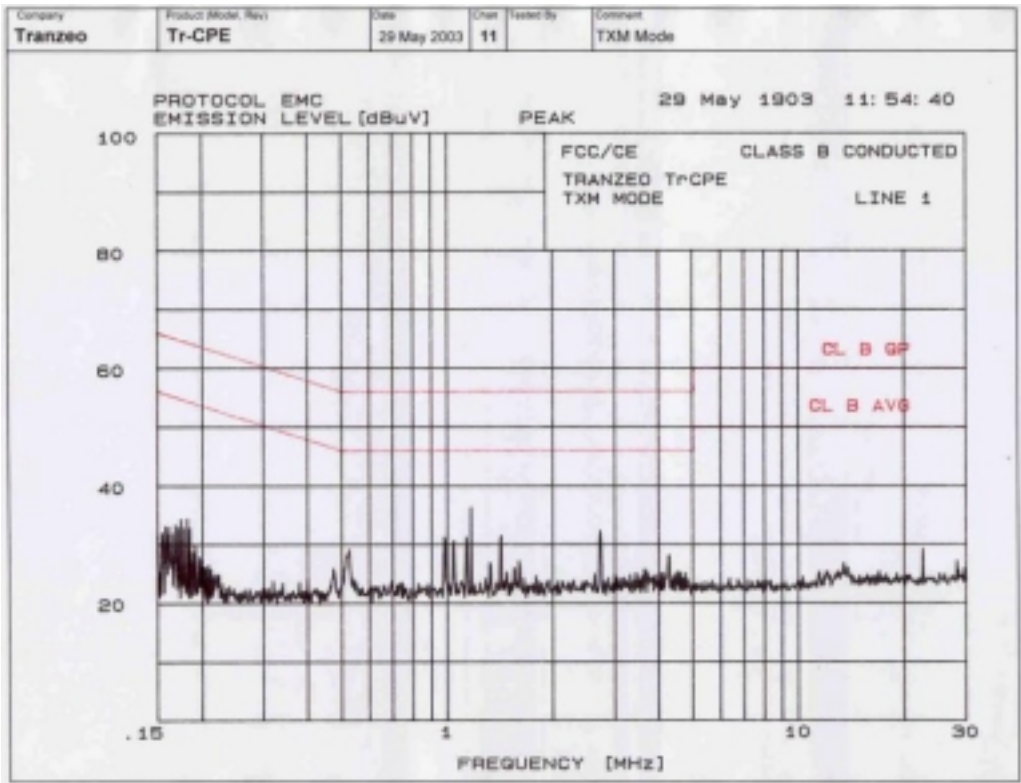
Line 1

Frequency MHz	Test Reading	Delta Limit
1.169	36.3	-9.7
2.728	32.3	-13.7
1.422	31.4	-14.6
0.9821	31.2	-14.8
1.133	31.2	-14.8

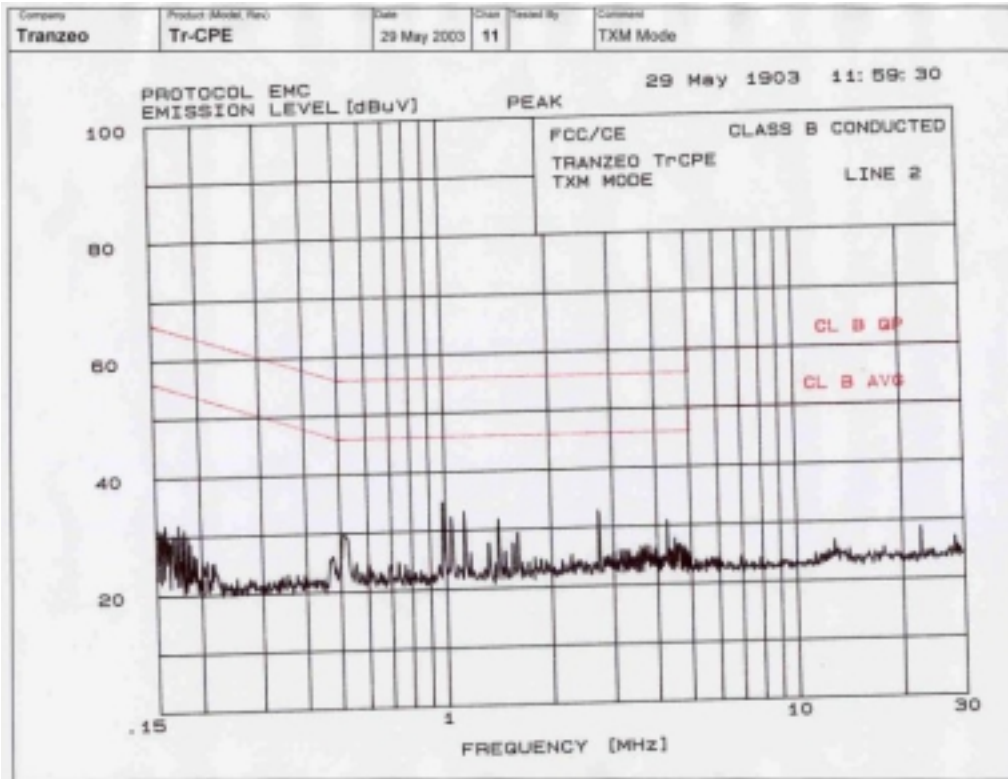
Line 2

Frequency MHz	Test Reading	Delta Limit
0.9821	34.9	-11.1
1.133	33.2	-12.8
2.728	32.8	-13.2
1.041	32.3	-13.7
1.415	31.8	-14.2

2.8.1 Emissions Plots



Line 1 Conducted Emissions



Line 2 Conducted Emissions

3.0 Peak Power Output

3.1 Test Equipment

Device	Model Number	Serial No.	Last Cal.	Next Cal
RF Peak Power Meter	Pacific Measurement Model 1045	512	07/01/02	07/01/03

3.2 Test Setup

The EUT's was connected to a power meter at the RF output for the duration of the test. Test EUT was placed in full transmit mode. This test is a Conducted power measurement.

3.3 Limits

The maximum peak power shall be less than 1 Watt = 30 dBm.

3.4 Test Standard

FCC CFR47, Part 15, Subpart B 15.247b

3.5 Test Results

Product : TR-CPE
Test Item : Peak Output Power
Test Site : Tranzeo Wireless Technologies
Test Mode : TXM Mode

Channel #	Frequency (MHz)	Measurement	Required Limit	Result
1	2412	15.90 dBm	30 dBm	Pass
6	2437	14.95 dBm	30 dBm	Pass
11	2462	14.05 dBm	30 dBm	Pass

4.0 Radiated Emissions

4.1 Test Equipment

Device	Model Number	Serial No.	Last Cal.	Next Cal
Antenna	EMCO 3105 Horn	2024	10/30/02	10/30/03
Antenna	Microlab FXR K638A Horn		03/04/03	03/04/04
Antenna	EMCO 3141 Bilog	1127	09/26/02	09/26/03
Harmonic Mixer	HP11971K Mixer	2332A01250	03/04/03	03/04/04
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	01/13/03	01/13/04
RF-Preselector	Hewlett Packard 85685A	3107A01222	01/10/03	01/10/04
Quasi-Peak Adapter	Hewlett Packard 85650A	2043A00240	01/13/03	01/13/04
Microwave Amplifier	HP8349A	2512A00824	09/13/02	09/13/03
Tower	Rhientech Labs	Custom	N/A	N/A
Turntable	Protocol	Custom	N/A	N/A

4.2 Test Setup

The EUT was placed in receive mode for the duration of the test. The EUT was rotated 360 degrees to determine the worst case angle for the maximum emissions level. The antenna was raised and lowered from 1 m to 4 m to find the maximum emissions level. Both horizontal and vertical antenna polarization were tested to find the worst case polarization. This test was performed at a distance of 3 m from the EUT to the measurement antenna.

4.3 Test Standard

FCC Part 15 Subpart C Section 15.209 Radiated emission limits.

4.4 Limits

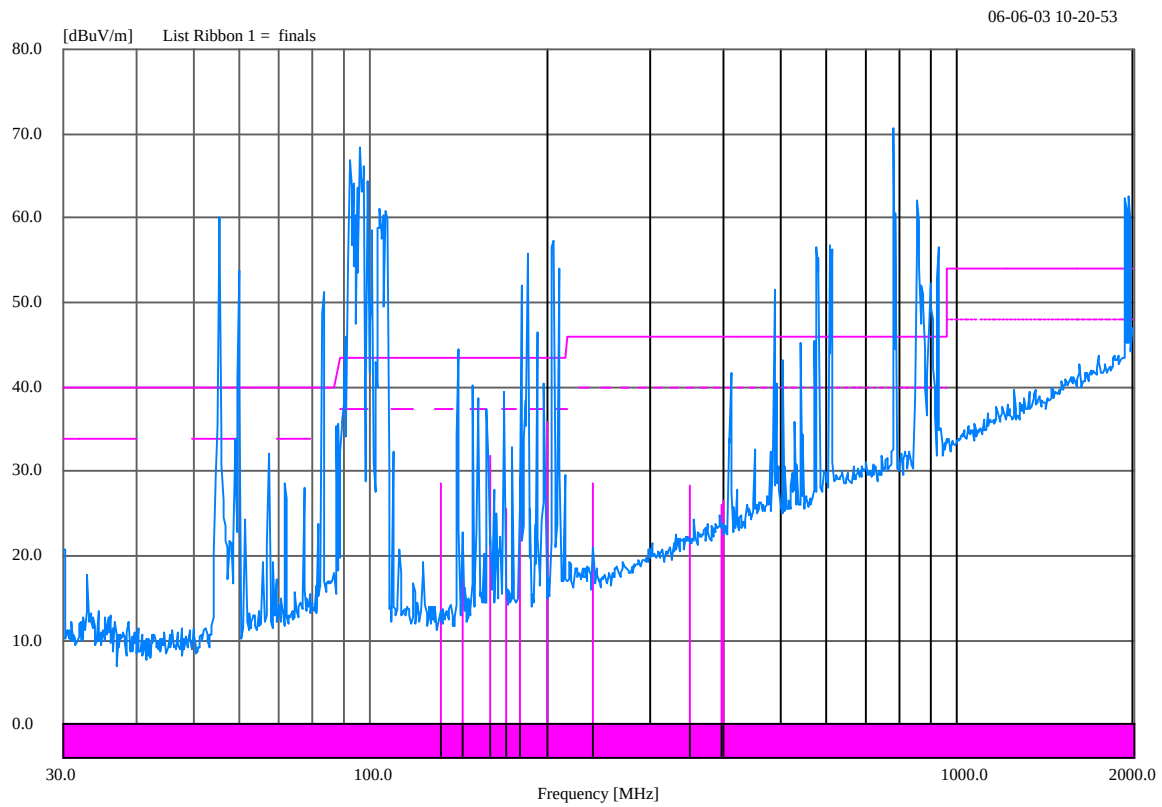
Frequency (MHz)	Maximum Field Strength $\mu\text{V/m}$ at 3m	Maximum Field Strength $\text{dB}\mu\text{V/m}$ at 3m
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

4.5 Test Result

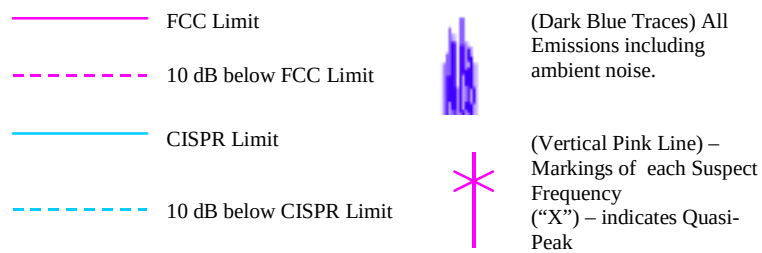
Product : TR-CPE
Test Item : Radiated Emissions
Test Site : Protocol EMC
Test Mode : Receive mode

Frequency (MHz)	Pol	Height (m)	Angle (deg)	Un Corr Pk (dB)	Tot Corr (dB)	Peak (dBuV/m)	DelLim-Pk FCC (dB)
132.004558	Vert	1.2m	10	18.70	9.84	28.54	-14.96
144.018500	Vert	1.0m	75	11.20	10.42	21.62	-21.88
159.990884	Vert	1.0m	65	19.50	12.50	32.00	-11.50
170.027934	Vert	1.5m	270	14.10	11.35	25.45	-18.05
179.990170	Vert	1.3m	0	17.90	11.50	29.40	-14.10
200.026625	Horz	1.0 m	270	24.20	11.80	36.00	-7.50
240.031682	Horz	1.0 m	280	14.90	13.82	28.72	-17.28
351.960879	Vert	1.1m	330	10.40	17.91	28.31	-17.69
395.980728	Vert	1.0m	320	7.30	18.89	26.19	-19.81
400.005508	Vert	1.0m	180	7.60	19.00	26.60	-19.40

4.6 Emissions Plots



Radiated Emissions



5.0 Radiated Harmonic and Spurious Emissions

5.1 Test Equipment

Device	Model Number	Serial No.	Last Cal.	Next Cal
Antenna	EMCO 3105 Horn	2024	10/30/02	10/30/03
Antenna	Microlab FXR K638A Horn		03/04/03	03/04/04
Antenna	EMCO 3141 Bilog	1127	09/26/02	09/26/03
Harmonic Mixer	HP11971K Mixer	2332A01250	03/04/03	03/04/04
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	01/13/03	01/13/04
RF-Preselector	Hewlett Packard 85685A	3107A01222	01/10/03	01/10/04
Quasi-Peak Adapter	Hewlett Packard 85650A	2043A00240	01/13/03	01/13/04
Microwave Amplifier	HP8349A	2512A00824	09/13/02	09/13/03
Tower	Rhientech Labs	Custom	N/A	N/A
Turntable	Protocol	Custom	N/A	N/A

5.2 Test Setup

The EUT was placed in full transmit mode for the duration of the test not DSS mode (Tranzeo has created a function in their software that turns DSS mode off so that we have a full transmit signal). The EUT was rotated 360 degrees to determine the worst case angle for the maximum emissions level. The antenna was raised and lowered from 1 m to 4 m to find the maximum emissions level. Both horizontal and vertical antenna polarization were tested to find the worst case polarization. Channels 1, 6, 11 were tested. This test was performed at a distance of 3 m from the EUT to the measurement antenna.

5.3 Test Standard

FCC CFR47, Part 15, Subpart B 15.247c

5.4 Limits

Fundamental Limit = 137 dB μ V/m

Harmonics and Spurious Emissions = 20 dBc

Restricted Band Emissions = AVG 54 dB μ V/m

5.5 Test Result Channel 1

Product : TR-CPE
 Test Item : Harmonic Emissions
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Harmonic	Frequency (MHz)	Polarity	Uncor Pk (dBμV)	Tot Corr (dB)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Delta Limit (dB)	dBc
1 st	2412	Horz	75.5	36.4	111.9	137.00	-25.1	-
2 nd	4824	Horz	24.0	29.2	53.2	74.00*	-20.8	-58.7
3 rd	7236	Horz	28.8	30.3	59.1	91.9	-32.8	-52.8
4 th	9648	Horz	29.7	34.1	63.8	91.9	-28.1	-48.1
5 th	12060	Horz	29.4	33.5	62.9	74.00*	-11.1	-49.0
6 th	14472	Horz	31.5	35.0	66.5	74.00*	-7.5	-45.4
7 th	16884	Horz	31.6	29.8	61.4	91.9	-30.5	-50.5
8 th	19296	Vert	38.0	22.6	60.6	74.00*	-13.4	-51.3
9 th	21708	Vert	38.0	22.6	60.6	91.9	-31.3	-51.3
10 th	24120	Vert	38.1	22.6	60.7	91.9	-31.2	-51.2

*These Harmonics are in restricted band and are subject to Average limit of 54 (dBμV/m)

Harmonic	Frequency (MHz)	Polarity	Uncor Average (dBμV)	Tot Corr (dB)	Average (dBμV/m)	Average Limit (dBμV/m)	Delta Limit (dB)
2 nd	4824	Horz	11.7	-3.8	7.9	54.00*	-46.1
5 th	12060	Horz	16.9	0.5	17.4	54.00*	-36.6
6 th	14472	Horz	18.6	2.0	20.6	54.00*	-33.4
8 th	19296	Vert	26.0	-10.4	15.6	54.00*	-38.4

Note:

1 Receiver Settings (Peak Detector) RBW: 1 MHz VBW: 1 MHz
 2 Receiver Settings (Average Detector) RBW: 1 MHz VBW: 30 Hz
 3 Harmonics 8, 9 and 10 are not listed because there is no measurable signal at those frequencies.

5.6 Test Result Channel 6

Product : TR-CPE
 Test Item : Harmonic Emissions
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Harmonic	Frequency (MHz)	Polarity	Uncor Pk (dBμV)	Tot Corr (dB)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Delta Limit (dB)	dBc
1 st	2437	Horz	74.1	36.7	110.8	137.0	-26.2	-
2 nd	4874	Vert	24.6	28.7	53.3	74.0*	-20.7	-57.5
3 rd	7311	Horz	29.4	30.4	59.8	74.0*	-14.2	-51.0
4 th	9748	Horz	29.7	33.7	63.4	90.8	-27.4	-47.4
5 th	12185	Horz	30.1	32.2	62.3	74.0*	-11.7	-48.5
6 th	14622	Horz	32.3	33.9	66.2	90.8	-24.6	-44.6
7 th	17059	Vert	31.6	33.1	64.7	90.8	-26.1	-46.1
8 th	19496	Vert	38.2	22.6	60.8	74.0*	-13.2	-50.0
9 th	21933	Vert	38.2	22.6	60.8	90.8	-30.0	-50.0
10 th	24370	Vert	38.9	22.6	61.5	90.8	-29.3	-49.3

*These Harmonics are in restricted band and are subject to Average limit of 54 (dBμV/m)

Harmonic	Frequency (MHz)	Polarity	Uncor Average (dBμV)	Tot Corr (dB)	Average (dBμV/m)	Average Limit (dBμV/m)	Delta Limit (dB)
2 nd	4874	Vert	18.3	-4.3	14.0	54.0	-40.0
3 rd	7311	Horz	15.7	-2.6	13.1	54.0	-40.9
5 th	12185	Horz	16.2	-0.8	15.4	54.0	-38.6
8 th	19496	Vert	21.8	-6.3	15.5	54.0	-38.5

Note:

1 Receiver Settings (Peak Detector) RBW: 1 MHz VBW: 1 MHz
 2 Receiver Settings (Average Detector) RBW: 1 MHz VBW: 30 Hz
 3 Harmonics 8, 9 and 10 are not listed because there is no measurable signal at those frequencies.

5.7 Test Result Channel 11

Product : TR-CPE
 Test Item : Harmonic Emissions
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Harmonic	Frequency (MHz)	Polarity	Uncor Pk (dBμV)	Tot Corr (dB)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Delta Limit (dB)	dBc
1 st	2462	Horz	74.1	36.5	110.6	137.0	-26.4	-
2 nd	4924	Vert	24.8	28.3	53.1	74.0*	-20.9	-57.5
3 rd	7386	Horz	28.5	30.1	58.6	74.0*	-15.4	-52
4 th	9848	Horz	30.6	33.8	64.4	90.6	-26.2	-46.2
5 th	12310	Horz	30.1	33.2	63.3	74.0*	-10.7	-47.3
6 th	14772	Vert	32.1	34.7	66.8	90.6	-23.8	-43.8
7 th	17234	Horz	31.1	32.1	63.2	90.6	-27.4	-47.4
8 th	19696	Vert	38.6	22.6	61.2	74.0*	-12.8	-49.4
9 th	22158	Vert	38.8	22.6	61.4	74.0*	-12.6	-49.2
10 th	24620	Vert	38.2	22.6	60.8	90.6	-29.8	-49.8

*These Harmonics are in restricted band and are subject to Average limit of 54 (dBμV/m)

Harmonic	Frequency (MHz)	Polarity	Uncor Average (dBμV)	Tot Corr (dB)	Average (dBμV/m)	Average Limit (dBμV/m)	Delta Limit (dB)
2 nd	4924	Vert	11.4	-4.7	6.7	54.0	-47.3
3 rd	7386	Horz	15.4	-2.9	12.5	54.0	-41.5
5 th	12310	Horz	16.0	0.2	16.2	54.0	-37.8
8 th	19696	Vert	26.0	-10.4	15.6	54.0	-38.4
9 th	22158	Vert	26.0	-10.4	15.6	54.0	-38.4

Note:

- 1 Receiver Settings (Peak Detector) RBW: 1 MHz VBW: 1 MHz
- 2 Receiver Settings (Average Detector) RBW: 1 MHz VBW: 30 Hz
- 3 Harmonics 8, 9 and 10 are not listed because there is no measurable signal at those frequencies.

6.0 Band Edge

6.1 Test Equipment

Device	Model Number	Serial No.	Last Cal.	Next Cal
Antenna	EMCO 3105 Horn	2024	10/30/02	10/30/03
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	01/13/03	01/13/04
RF-Preselector	Hewlett Packard 85685A	3107A01222	01/10/03	01/10/04
Quasi-Peak Adapter	Hewlett Packard 85650A	2043A00240	01/13/03	01/13/04
Microwave Amplifier	HP8349A	2512A00824	09/13/02	09/13/03
Tower	Rhientech Labs	Custom	N/A	N/A
Turntable	Protocol	Custom	N/A	N/A

6.2 Test Setup

The EUT was placed in full transmit mode for the duration of the test not DSS mode (Tranzeo has created a function in their software that turns DSS mode off so that we have a full transmit signal). The EUT was rotated 360 degrees to determine the worst case angle for the maximum emissions level. The antenna was raised and lowered from 1 m to 4 m to find the maximum emissions level. Both horizontal and vertical antenna polarization were tested to find the worst case polarization. Channels 1, 6, 11 were tested. This test was performed at a distance of 3 m from the EUT to the measurement antenna.

6.3 Test Standard

FCC CFR47, Part 15, Subpart B 15.247c

6.4 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on an RF radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

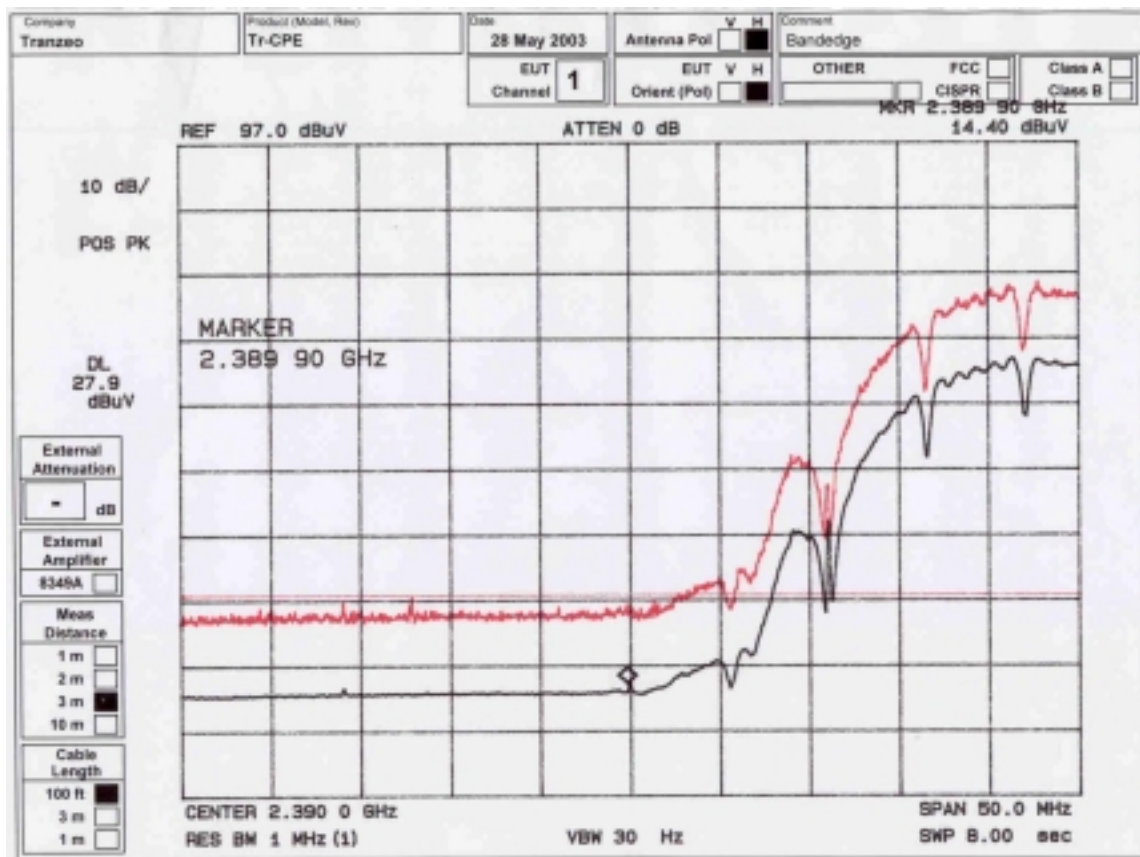
6.5 Test Result Channel 1

Product : TR-CPE
 Test Item : Band Edge Measurement
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

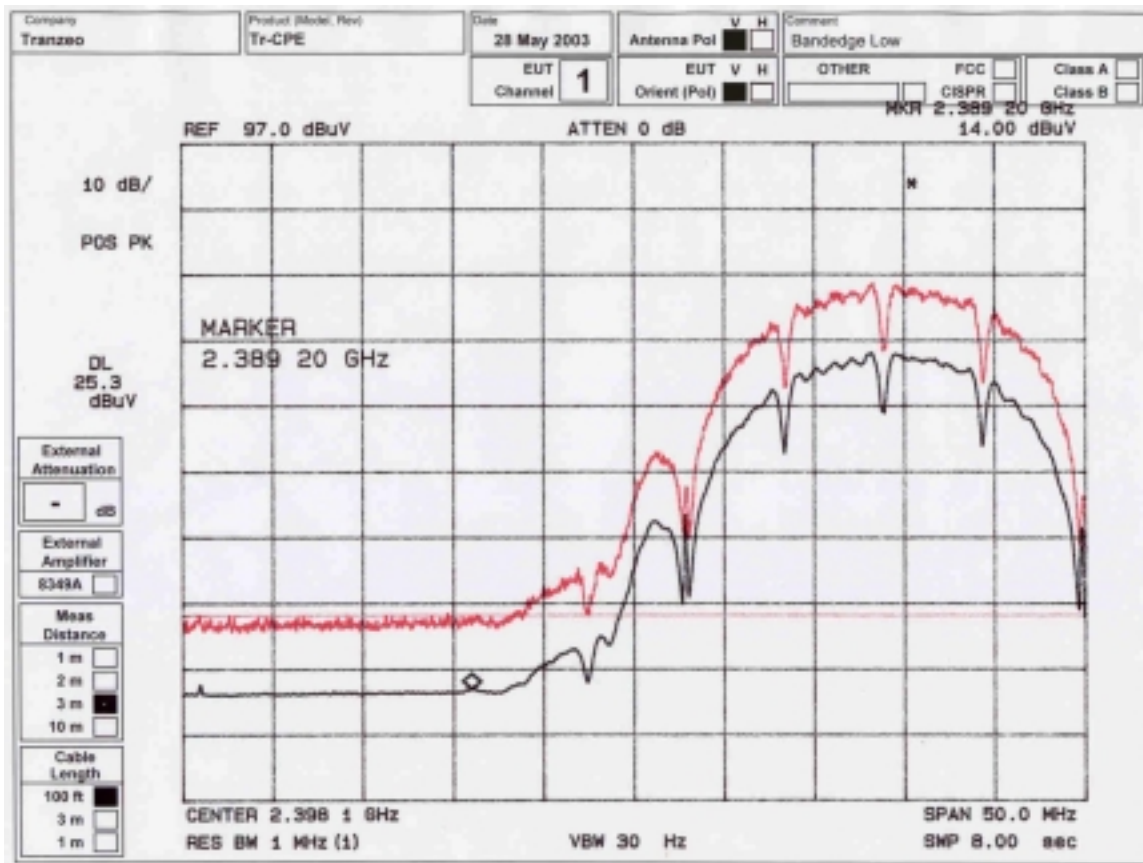
Orientation	Frequency MHz	Limit dBc	Result
Horizontal	<2400	>20	Pass
Vertical	<2400	>20	Pass

Frequency (MHz)	Polarity	Uncor Average (dB μ V)	Tot Corr (dB)	Average (dB μ V/m)	Average Limit (dB μ V/m)	Delta Limit (dB)
2383.7	Horz	14.4	36.5	50.9	54.00*	-3.1
2383.6	Vert	14.0	36.5	50.5	54.00*	-3.5

6.5.1 Channel 1 Band Edge Plot Horizontal



6.5.2 Channel 1 Band Edge Plot Vertical



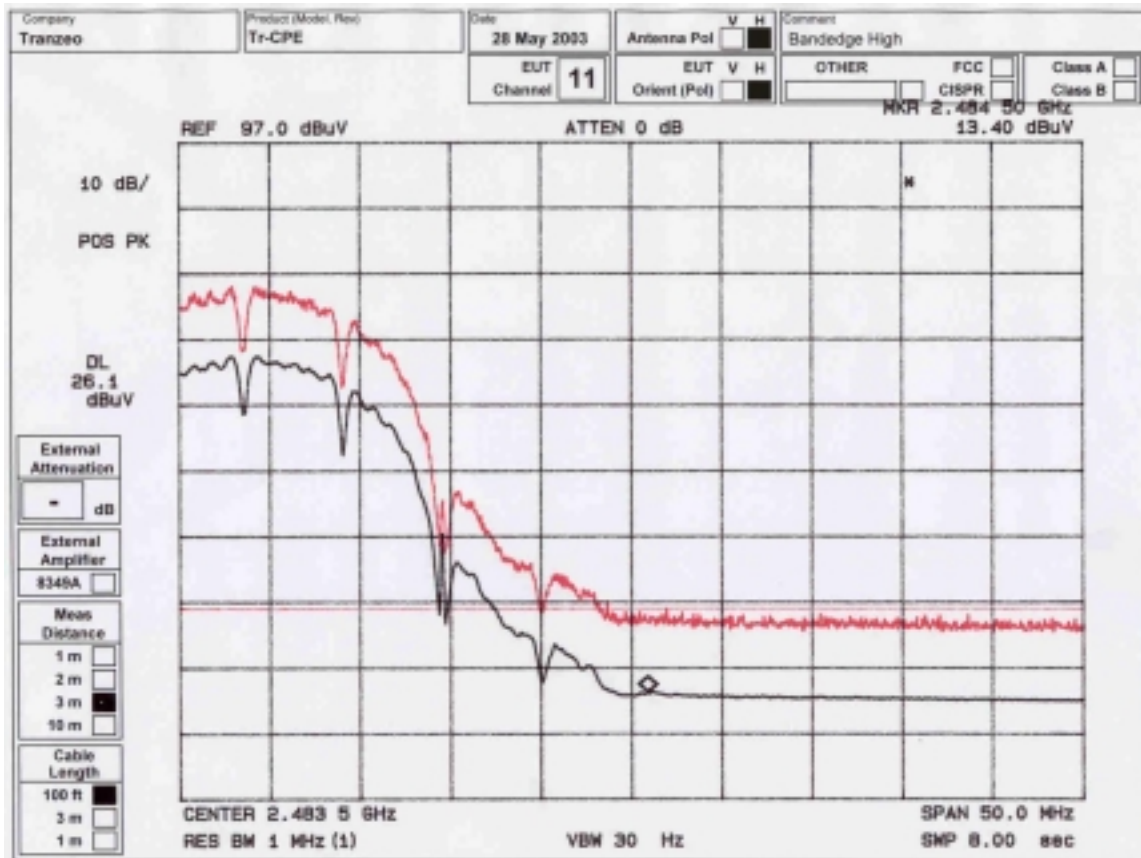
6.6 Test Result Channel 11

Product : TR-CPE
 Test Item : Band Edge Measurement
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

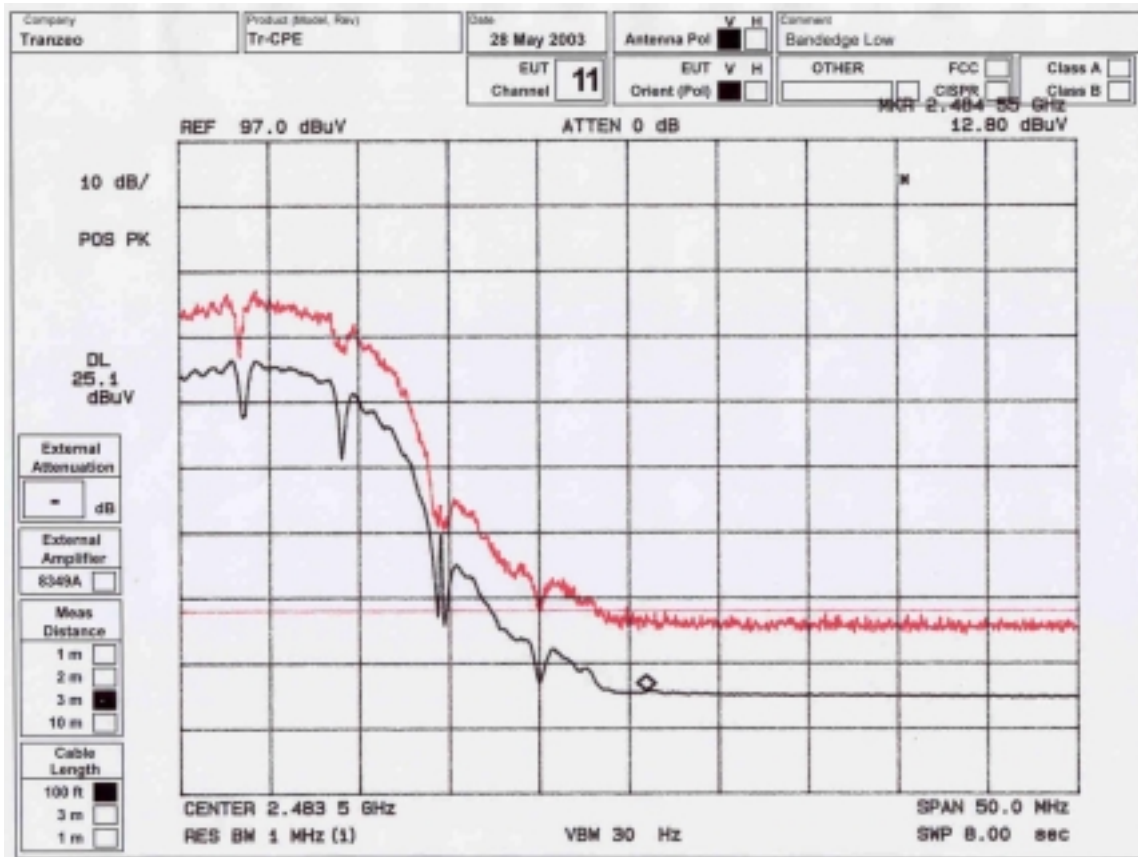
Orientation	Frequency MHz	Limit dBc	Result
Horizontal	<2400	>20	Pass
Vertical	<2400	>20	Pass

Frequency (MHz)	Polarity	Uncor Average (dBμV)	Tot Corr (dB)	Average (dBμV/m)	Average Limit (dBμV/m)	Delta Limit (dB)
2483.7	Horz	13.4	36.5	49.9	54.00*	-4.1
2483.6	Vert	12.8	36.5	49.3	54.00*	-4.7

6.6.1 Channel 11 Band Edge Plot Horizontal Average



6.4.2 Channel 11 Band Edge Plot Vertical Average



7.0 Occupied Bandwidth

7.1 Test Equipment

Device	Model Number	Serial No.	Last Cal.	Next Cal
Antenna	EMCO 3105 Horn	2024	10/30/02	10/30/03
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	01/13/03	01/13/04
RF-Preselector	Hewlett Packard 85685A	3107A01222	01/10/03	01/10/04
Quasi-Peak Adapter	Hewlett Packard 85650A	2043A00240	01/13/03	01/13/04
Microwave Amplifier	HP8349A	2512A00824	09/13/02	09/13/03
Tower	Rhientech Labs	Custom	N/A	N/A
Turntable	Protocol	Custom	N/A	N/A

7.2 Test Setup

The EUT was placed in full transmit mode for the duration of the test not DSS mode (Tranzeo has created a function in their software that turns DSS mode off so that we have a full transmit signal). The EUT was rotated 360 degrees to determine the worst case angle for the maximum emissions level. The antenna was raised and lowered from 1 m to 4 m to find the maximum emissions level. Both horizontal and vertical antenna polarization were tested to find the worst case polarization. Channels 1, 6, 11 were tested. This test was performed at a distance of 3 m from the EUT to the measurement antenna.

7.3 Test Standard

FCC CFR47, Part 15, Subpart B 15.247a

7.4 Limits

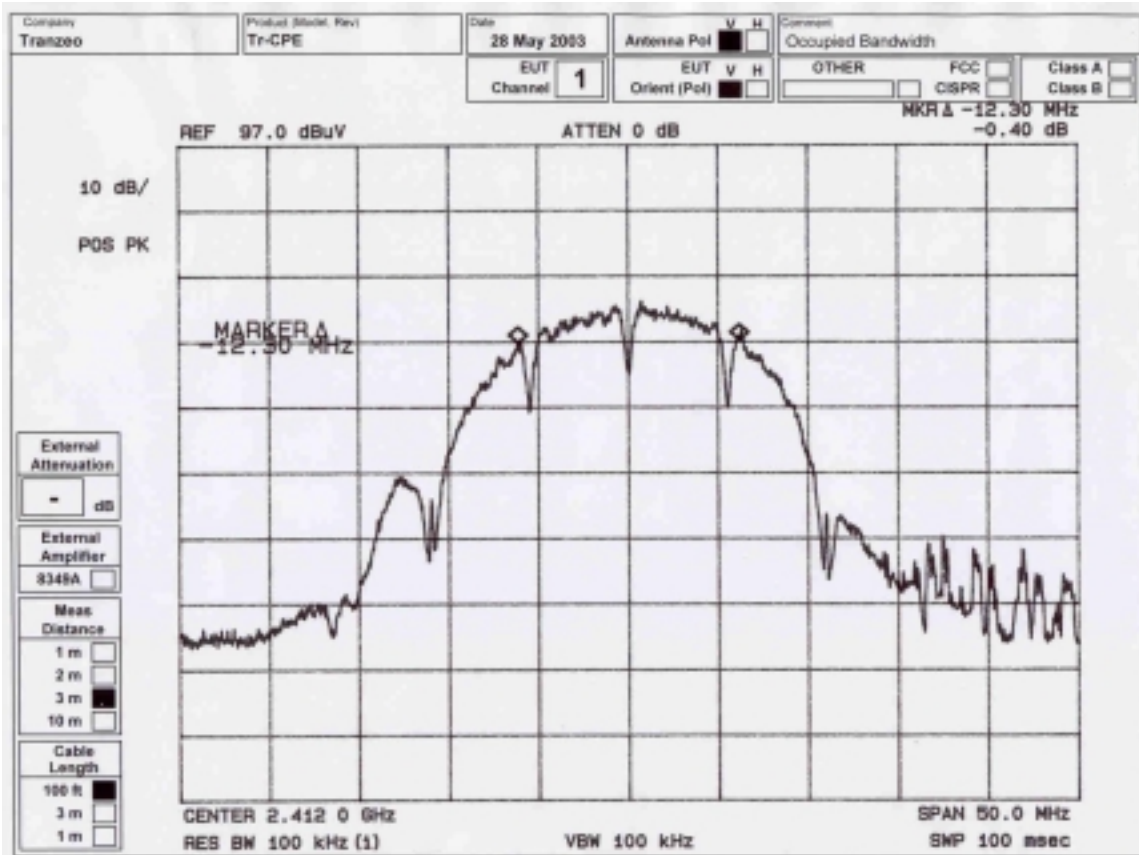
The minimum bandwidth shall be at least 500 kHz.

7.5 Test Result Channel 1

Product : TR-CPE
 Test Item : Occupied Bandwidth
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Orientation	Frequency MHz	Measurement Level	Limit kHz	Result
Vertical	2412	12.3 MHz	>500	Pass

7.5.1 Channel 1 Occupied Bandwidth Plot

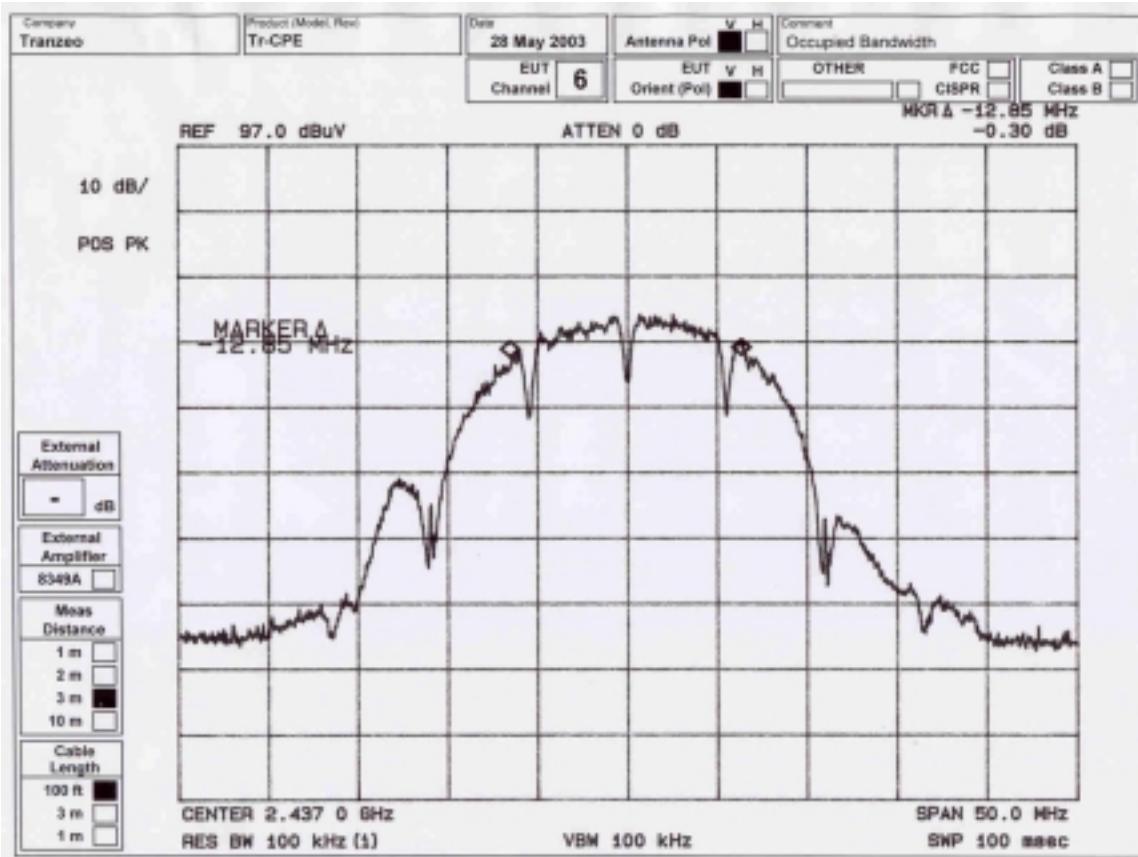


7.6 Test Result Channel 6

Product : TR-CPE
 Test Item : Occupied Bandwidth
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Orientation	Frequency MHz	Measurement Level	Limit kHz	Result
Vertical	2437	12.65 MHz	>500	Pass

7.6.1 Channel 6 Occupied Bandwidth Plot

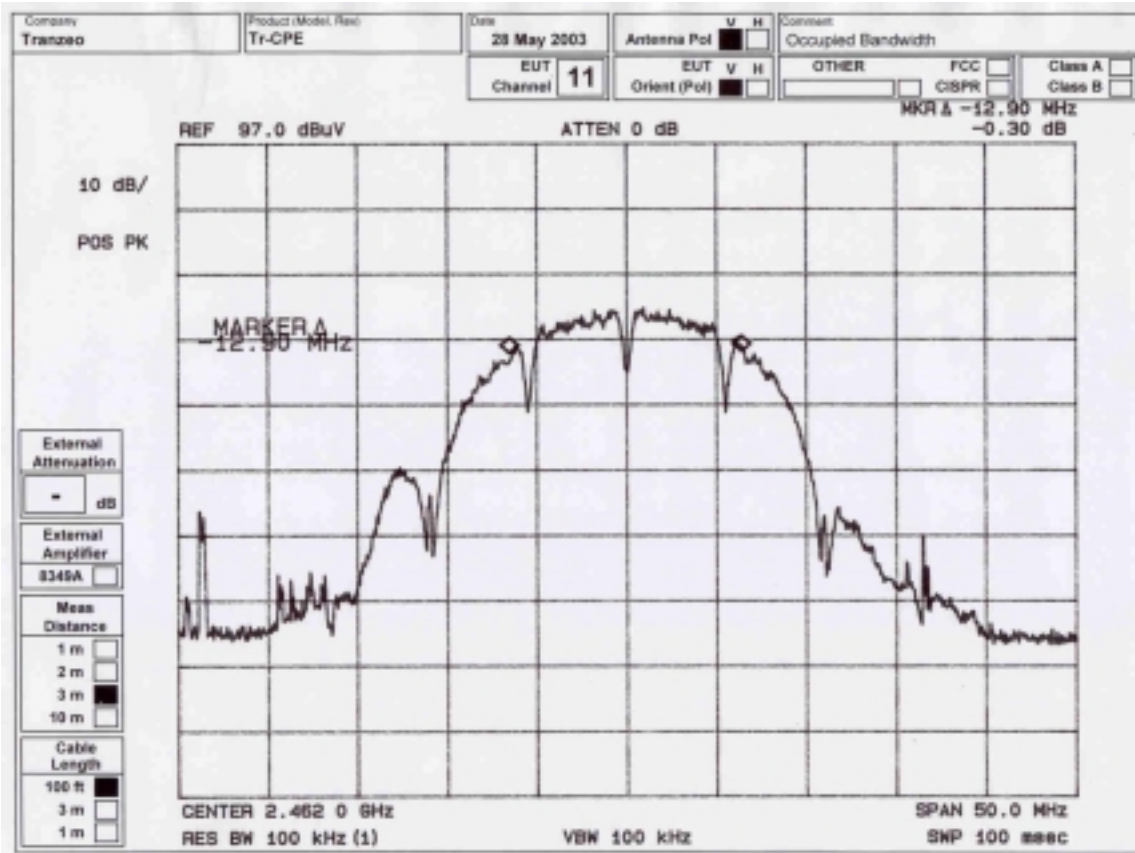


7.7 Test Result Channel 11

Product : TR-CPE
 Test Item : Occupied Bandwidth
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Orientation	Frequency MHz	Measurement Level	Limit kHz	Result
Vertical	2462	12.9 MHz	>500	Pass

7.7.1 Channel 11 Occupied Bandwidth Plot



8.0 Power Spectral Density

8.1 Test Equipment

Device	Model Number	Serial No.	Last Cal.	Next Cal
Antenna	EMCO 3105 Horn	2024	10/30/02	10/30/03
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	01/13/03	01/13/04
RF-Preselector	Hewlett Packard 85685A	3107A01222	01/10/03	01/10/04
Quasi-Peak Adapter	Hewlett Packard 85650A	2043A00240	01/13/03	01/13/04
Microwave Amplifier	HP8349A	2512A00824	09/13/02	09/13/03
Tower	Rhientech Labs	Custom	N/A	N/A
Turntable	Protocol	Custom	N/A	N/A

8.2 Test Setup

The EUT was placed in full transmit mode for the duration of the test not DSS mode (Tranzeo has created a function in their software that turns DSS mode off so that we have a full transmit signal). The EUT was rotated 360 degrees to determine the worst case angle for the maximum emissions level. The antenna was raised and lowered from 1 m to 4 m to find the maximum emissions level. Both horizontal and vertical antenna polarization were tested to find the worst case polarization. Channels 1, 6, 11 were tested. This test was performed at a distance of 3 m from the EUT to the measurement antenna.

8.3 Test Standard

FCC CFR47, Part 15, Subpart B 15.247d

8.4 Limit

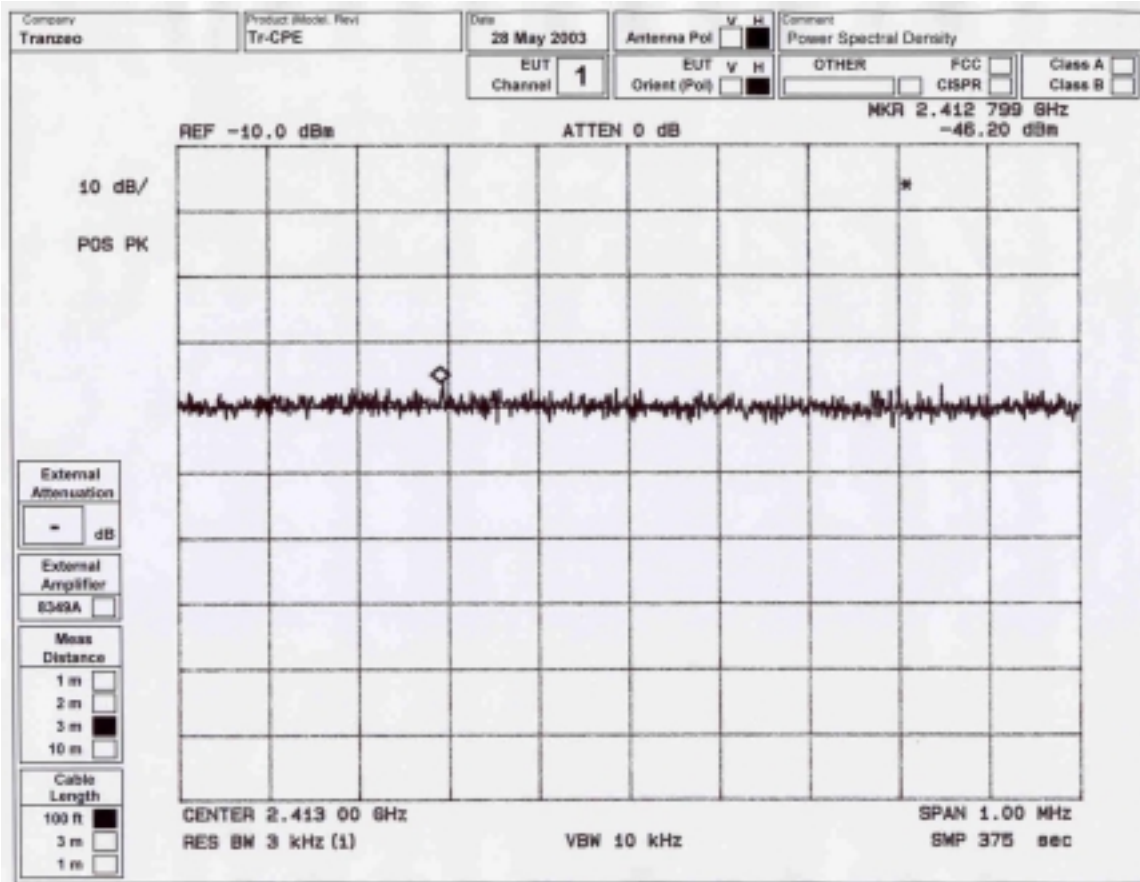
The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

8.5 Test Result Channel 1

Product : TR-CPE
 Test Item : Power Spectral Density
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Orientation	Frequency MHz	Measurement dBm	Limit dBm	Result
Horz	2413.13	-9.7	+8	Pass

8.5.1 Channel 1 Power Spectral Density Plot

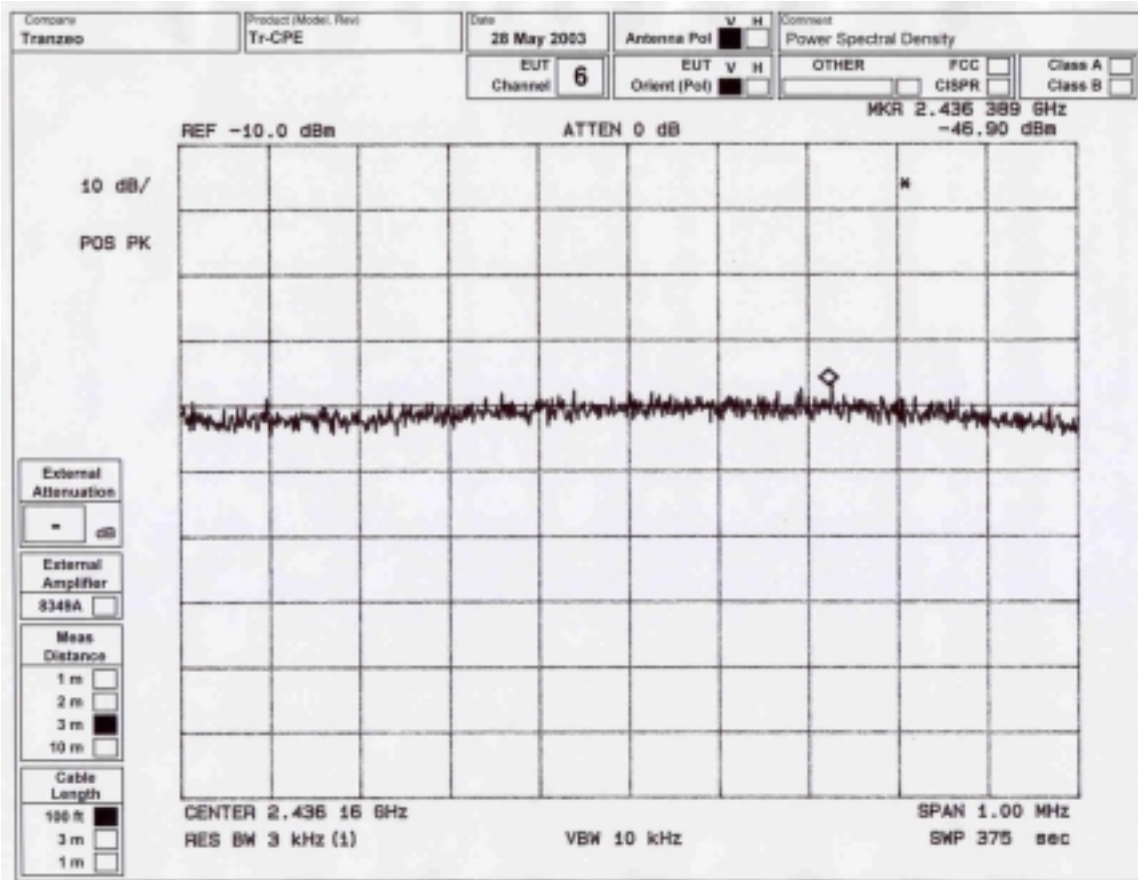


8.6 Test Result Channel 6

Product : TR-CPE
 Test Item : Power Spectral Density
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Orientation	Frequency MHz	Measurement dBm	Limit dBm	Result
Horz	2438.13	-10.4	+8	Pass

8.6.1 Channel 6 Power Spectral Density Plot

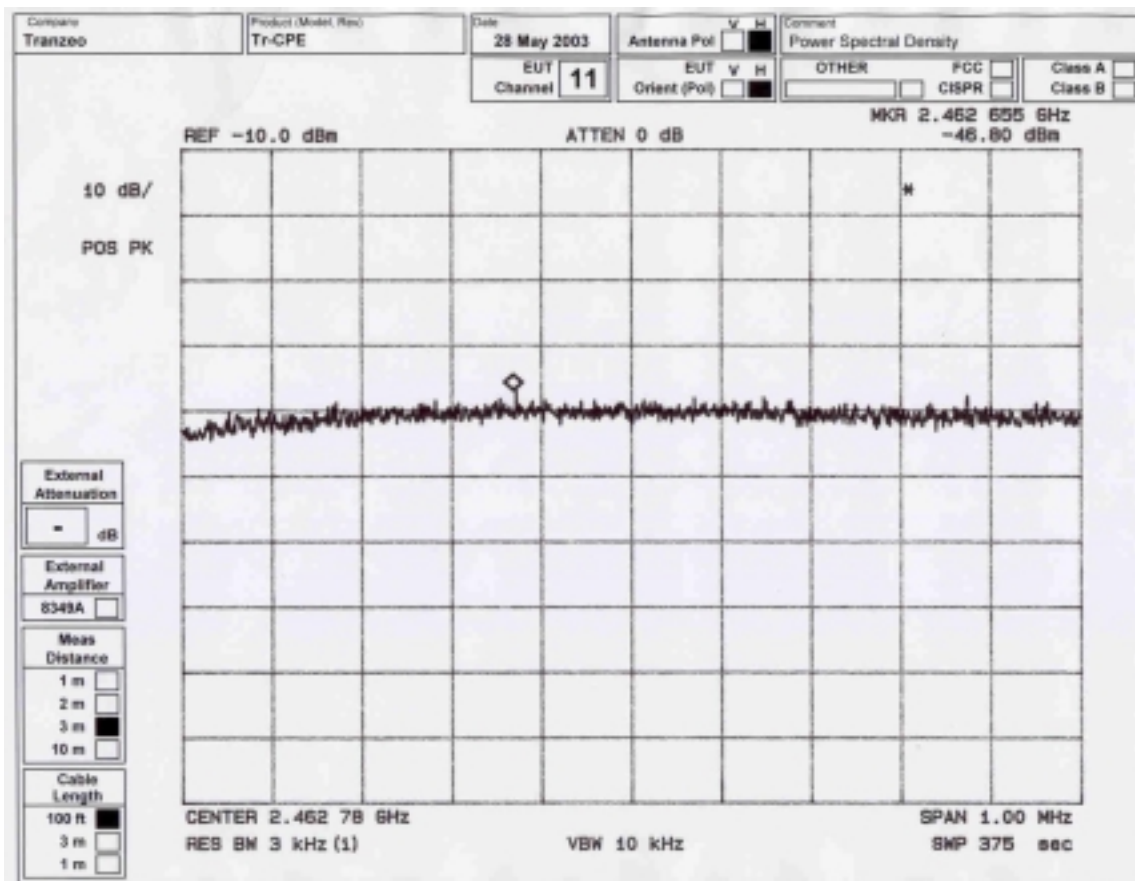


8.7 Test Result Channel 11

Product : TR-CPE
 Test Item : Power Spectral Density
 Test Site : Protocol EMC
 Test Mode : Full Transmit Mode

Orientation	Frequency MHz	Measurement dBm	Limit dBm	Result
Horz	2467.31	-10.3	+8	Pass

8.7.1 Channel 11 Power Spectral Density Plot



9.0 RF Exposure Evaluation

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to RF radiation as specified in 1.1307(b)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

9.1 Fries Formula

Fries transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$ Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

9.2 EUT Operation condition

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

9.3 Test Result of RF Exposure Evaluation

Product : TR-CPE
Test Item : RF Exposure Evaluation Data
Test Site : Protocol EMC
Test Mode : Full Transmit Mode

9.3.1 Antenna Gain

Antenna Gain: The maximum antenna gain for this product is 15dBi as stated by the manufacture.

9.3.2 Output Power into Antenna and RF Exposure Evaluation Distance

Channel	Channel Frequency (MHz)	Output Power to Antenna	Minimum Allowable Distance from Skin(cm)
1	2412	39 mW	6.82
6	2437	31 mW	6.08
11	2462	28 mW	5.74

After performing the calculation it was found that the required distance from the skin is 6.82 cm in order to comply with the 1 mW/cm^2 . As this distance is less than 20-cm separation requirement no RF exposure limit warning or SAR test are required.

10.0 Test Photos

The Test photos are in an attached document.