

January 4, 1999

Mr. Richard Fabina
Federal Communication Commission
Equipment Approval Services
P.O. Box 358315
Pittsburgh, PA 15251-5315

RE: Response to fax dated 11-18-98
Correspondence ID: 4726

SU: FCC ID: N7R-CM-AER
Model: AIR I/O CM

Applicant: TELXON CORPORATION
8302 New Trails Drive
The Woodlands, TX 77381

Dear Mr. Fabina,

Item 1: New schematics have been rescanned and uploaded, hopefully with better resolution in (jpeg) format and are labeled as files:
N7R-CM-AER Sch pg 1 of 17 through pg 17 of 17.

Item 2: New photos were taken as requested and have been scanned, uploaded and are labeled as files:
N7R-CM-AER interior photo (please note that this also shows the component view)
N7R-CM-AER foil view
N7R-CM-AER module component view
N7R-CM-AER module foil view

Item 3: New exterior photos were taken as requested and have been scanned, uploaded and are labeled as files:
N7R-CM-AER External Front View
N7R-CM-AER External Rear View

Item 4: The correct label and the proposed label placement on the back of the unit have been rescanned and are uploaded under the file names:
N7R-CM-AER label
N7R-CM-AER label placement

Item 5: Radiated emission are provided for each antennae used with margin to the restricted bands 15.247, 15.209

Item 6: The radio manufacturer has provided detailed information on the compliance with 2.1033, we have provided plots to confirm this. The information has been scanned, uploaded, and the files are labeled as follows:

N7R-CM-AER item 6 pg 1 of 4 through pg 4 of 4

Item 7: Refer to item 6 above.

Item 8: Refer to item 6 above.

Item 9: Refer to item 6 above.

Item 10: Output power measurements are made using a Spectrum Analyzer directly.

Item 11: EIRP calculations are attached

Item 12: The measurements were made at (3) meters using 100 kHz BW. Refer to Attachment 3 for further information.

Item 13: All conducted emissions were re done in screen room. Have rescanned the conducted test results from the report, uploaded, and the files are labeled as follows:

N7R-CM-AER conducted test results pg 1 of 2

N7R-CM-AER conducted test results pg 2 of 2

Item 14: Have scanned the AC line conducted test results, uploaded, and files are labeled as follows:

N7R-CM-AER conducted test pg 1 of 2

N7R-CM-AER conducted test pg 2 of 2

Item 15: Only Schematics are confidentiality Have scanned the Letter from Telxon requesting Confidentiality. The file is labeled as:

N7R-CM-AER Request for Confidentiality

Item 16: We have been talking to your people for several weeks. The problem seems to be in understanding the set-up and file conversions that take place in the internet. We have purchased a new scanner and hope this helps to resolving the picture issue. Due to the previous poor quality of information, I have rescanned the following documents and uploaded for your review (if needed)

Comment

Cover Letter from Wayne Langston, Inc.
Agent Authorization from Telxon

Upload File Name

N7R-CM-AER cover letter
N7R-CM-AER Agent Authorization

I sincerely apologize for all the problems and inconveniences this on-line submittal has created. This has been a learning experience for us. We want to thank you for all your help and assistance on this issue.

Respectfully,
Wayne Langston

Attachment 1

EIRP calculations for all antennas using worse case 2mw antennae input @ 2441 MHz.

1. Production Dipole:	2.5 dBi	.78 gain
2.	6.0 dBi	3.98 gain
3.	3 dBi / 5.0 dBi	3.162 gain
4.	6.0 dBi	3.98 gain
5.	13.5 dBi	22.38 gain

Note: Per OST 65 $S = PG / 4 \pi R^2$ for 100 % ground reflection

Maximum MPE from OST 65, page 29, Appendix A

$S = 1 \text{ mw} / \text{cm}^2$

$$S = PG / 4 \pi R^2 = \text{EIRP} / 4 \pi R^2$$

Gain: Max measured output Power 2.0 mw or .002 watt

The following is calculations for the distance from the antennae where a 1 mw per centimeter² exists.

1. Production dipole 2.5 dBi 1.78 gain numeric

$$\begin{aligned} R &= \sqrt{PG / 4 \pi S} = \sqrt{2 \times 1.78 / 3.14 (1)} \\ &= \sqrt{1.13375} \\ &= 1.0647 \text{ CM} \end{aligned}$$

2. Cushcraft (S2406P) 6 dBi 3.98 gain numeric

$$\begin{aligned} R &= \sqrt{PG / 4 \pi S} = \sqrt{2 \times 3.98 / 3.14 (1)} \\ &= \sqrt{2.535 \text{ CM}} \\ &= 1.592 \text{ CM} \end{aligned}$$

3. Cushcraft (S2403B) 5.0 dBi

3.162 gain

$$\begin{aligned} R &= \sqrt{PG / \Pi (1)} = \sqrt{2 \times 3.162 / 3.14} \\ &= \sqrt{2.014} \\ &= 1.419 \text{ CM} \end{aligned}$$

4. Cushcraft (S2406CR) 6.0 dBi

3.98 gain

$$\begin{aligned} R &= \sqrt{PG / \Pi (1)} := \sqrt{2 \times 3.98 / 3.14 (1)} \\ &= 1.592 \text{ CM} \end{aligned}$$

5. Telex (HGY15) 13.5 dBi

22.38

$$\begin{aligned} R &= \sqrt{PG / \Pi (1)} = \sqrt{2 \times 3.98 / 3.14 (1)} \\ &= \sqrt{14.2547} \\ &= 3.77 \text{ CM} \end{aligned}$$

The above calculations show that the normal separation of 20 cm for mobile devices will not cause a hazard to the user. Therefore in SAR measurements are labeling is required.

Per OST 65 Table 1, Appendix A normally labeling of these devices is not required.

Attachment 2

Measurement @ 3 meters

Freq. (MHz)	Level (dB)	A _f /C _L (dB)	H _A (M) Hor/Ver	Rotation °	Results (dB)	Comments	
						Margin	Limit
33.1	20.8	15.7	1.0V	180	36.5	3.5	40
44.0	12.4	14.0	1.5V	45	26.4		40
48.0	18.0	13.3	1.5V	45	31.3	8.7	40
50.0	14.6	13.3	1.2V	180	27.9		
54.0	11.2	13.3	1.0V	190	24.5		
60.0	18.7	12.0	2.0V	190	30.7		
61.2	19.0	12.0	2.0V	180	31.0		
64.0	20.5	12.0	2.5V	170	37.5	2.5	40
68.0	19.3	12.0	1.5V	180	31.3		
72.0	20.0	10.3	1.0V	180	30.3		
80.0	21.3	10.0	1.0V	90	31.3		
120.0	18.0	18.3	1.0V	45	36.3	6.7	43
144.0	14.1	18.6	1.0V	95	32.7		43
146.8	17.3	18.6	1.5V	88	35.9		43
146.8-300		No Signal Found					
60.0	11.4	12.0	1.0H	90	23.4		40
61.2	20.5	12.0	1.5H	180	32.5	7.5	40
120.0	13.6	18.3	1.5H	180	31.9		43
144.0	11.9	18.6	2.5H	90	30.5		43

Limit Par. 15.209	30-88	100 uv/m	40 dBuv
	88-216	150 uv/m	43 dBuv
	216-960	200 uv/m	46 dBuv
	960 -	500 uv/m	54 dBuv

Test Equipment:

Above was taken using a Rhode & Schwarz ESVP receivers using CISPR bandwidth and QP detector.

EMCO Biconical used from 30-300 MHz

Roberts's dipoles were used for 300-1000 MHz

WL, Log periodic was used above 1 GHz

All calibrated: August 1998

Attachment 3

Test Equipment for conducted emission on HP 8591E and an R&S ESH3

1. Line conducted

HP 8591 with ESH3-Z2 pulse limit on a Schwarzbeck LISN. 50 Ohm 50 uH or R&S ESH3 receiver with ESH3-Z2 limits

Radio-----AC----line 1 & 2 -----Limiter -----HP Receiver
Schwarzbeck Lisn

2. Antenna Power Conducted

HP8592 Spectrum analyzer, and 10 dB pad

HP-----10 dB pad-----transmitter-----control

TEK 491 Spectrum analyzer and 10 dB pad

TEK-----10 dB pad-----transmitter-----control

3. Radiated (3) meter Tests

R& S Receiver ESVP 30-300 MHz

Roberts Dipole 300-1000 MHz

WLI Log Periodic 1000-8 Gig

HP 8591 1000 – 1.8 Gig

HP-----Mini Circuits-----Log Periodic
10 dB Preamp Rigid Coax

HP 8591 E 1.8 – 4.5 Gig

HP-----Mini Circuit Mixer-----Preamp-----Log Periodic
1 Rigid Coax
1
1
LO

Or:

(Preferred) HP 8592E 1-22 GIG

HP-----Mini Circuit Preamp-----Log Periodic
10 dB Rigid Coax

Or:

TEK 491 1-12.4 Gig

TEK-----Mini circuit Preamp-----
10 dB Rigid Coax

Attachment 4

1. All equipment was calibrated August 1998 and due August 1999
2. NVLAP on site audit performed on August 1998.
3. Per 15.209 .009-30 MHz. H field measurements no significant emanations using a R&S active loop and ESA receiver were found at 10 meter. All spurious measurement were made using a HP 8592 and mini circuit preamp, all levels were derived from the following formulas

$$\text{Level} = \text{HP Reading} = (\text{AF}) = (\text{CF}) - (\text{Preamp})$$

For 10 Ft of Rigid coax

@ 2.5 Gig

AF = 36 dB @ 3 meter

CF = 1.0 dB

@ 5.0 Gig

AF = 43 dB

CF = 1.4 dB

@ 7.3 Gig

AF = 46 dB

CF = 1.9 dB

Preamp 20 dB

Test Setup

HP----- + 20 dB preamp-----Log

10 Ft Rigid coax

Above calculations were omitted for the attached Antenna data to simplify the chart

Telxon Production Dipole 2.15 dBi

Measurement Data

Freq. (MHz)	Corrected Level Peak	Average (dB)	H _a (m) Hor./Ver.	Limit per § 15.247(c)	Limit per § 15.209	Margin
Carrier: Low						
2402	96.3	90.4	H	N/A	N/A	
2402	96.9	90.9	V	N/A	N/A	
4804	50.0	34.8	V	76.3	54	19.2
4804	49.9	32.2	H	76.3	54	21.8
7206	48.0	31.1	H	76.3	54	22.9
7206	50.3	37.3	V	76.3	54	16.7

Figure 5

Freq. (MHz)	Corrected Level Peak	Average (dB)	H _a (m) Hor./Ver.	Limit per § 15.247(c)	Limit per § 15.209	Margin
Carrier: Middle						
2440	98.3	93.2	V	N/A		
2440	94.9	90.1	H	N/A		
4880	49.9	41.3	H	78.3	54	12.7
4880	51.8	42.1	V	78.3	54	11.9
7320	49.3	41.4	V	78.3	54	12.6
7320	47.3	38.9	H	78.3	54	15.1

Figure 6

Freq. (MHz)	Corrected Level Peak	Average (dB)	H _a (m) Hor./Ver.	Limit per § 15.247(c)	Limit per § 15.209	Margin
Carrier: High						
2478	96.3	90.3	V	N/A		
2478	96.1	90.1	H	N/A		
4956	53.8	41.5	H	76.3	54	12.5
4956	52.1	96.1	V	76.3	54	7.9
7434	52.1	43.1	V	76.3	54	10.9
7434	50.1	41.2	H	76.3	54	12.8

Figure 7

Note: + 20 dB uV is noise floor of setup

Date: 11-30-98

EUT Model/Name: 6 dBi S2406 CR

Test Performed: Cispr Emissions

Freq. (MHz)	Level (dBuV) PK	A _f /C _L (dBm) AV	H _A (M) Hor/Ver	Limit		Comments/Margin
			LOW	15.247	15.209	
2402	101.6	92.1	H			
5402	101.3	91.3	H			
4804	40.0	25.6	H	81.6	54	28.4
4404	39.1	24.7	V	81.6	54	29.3
7206	38.1	23.1	H	81.6	54	30.9
7206	37.1	20.9	V	81.6	54	33.1
			MED			
2440	102.1	94.9	H			
2440	101.9	92.1	V			
4880	40.1	22.9	H	82.1	54	31.1
4880	39.4	21.3	V	82.1	54	33.0
7320	32.1	25.1	H	82.1	54	28.9
7320	29.9	22.9	V	82.1	54	31.1
			High			
2478	101.0	91.8	H			
2478	100.9	90.3	V			
4956	40.1	23.8	H	81.0	54	30.2
4956	39.1	21.1	V	81.0	54	32.9
7434	39.0	22.9	H	81.0	54	31.1
7434	38.7	21.1	V	81.0	54	32.9

Note: + 20 dBuV is noise floor of setup

Date: 11-28-98

EUT Model/Name: 6 dBi S2406P

Test Performed: Cispr Emissions

Freq. (MHz)	Level (dBuV) PK	A _f /C _L (dBm) AV	H _A (M) Hor/Ver	Limit		Comments/Margin
			LOW	15.247	15.209	
2402	101.6	92.1	H			
2402	101.1	91.3	H			
4804	40.0	25.3	H	81.9	54	28.7
4804	39.1	24.1	V	81.9	54	29.9
7206	39.1	24.3	H	81.9	54	29.3
7206	37.3	22.1	V	81.9	54	39.1
			MED			
2440	103.1	95.2	H			
2440	102.9	94.1	V			
4880	40.1	24.9	H	83.1	54	29.1
4880	39.7	21.3	V	83.1	54	30.9
7320	33.4	25.3	H	83.1	54	28.7
7320	29.9	22.4	V	83.1	54	31.6
			High			
2478	100.9	91.2	H			
2478	100.4	90.9	V			
4956	40.1	24.9	H	80.9	54	29.1
4956	38.3	23.4	V	80.9	54	30.6
7434	39.1	25.1	H	80.9	54	29.0
7434	37.3	24.9	V	8.9	54	29.1

Note: + 20 dBuV is noise floor of setup

Date: 11-29-98

EUT Model/Name: 5 dBi S2403BE (3 dBd = dbd + 2 = dBi = 5 dBi)

Test Performed: Cispr Emissions

Freq. (MHz)	Level (dBuV) PK	A _f /C _L (dBm) AV	H _A (M) Hor/Ver	Limit		Comments/Margin
			LOW	15.247	15.209	
2402	98.9	88.9	H	N/a		
2402	95.9	85.1	H	N/a		
4804	40.0	28.1	H	78.9	54	25.9
4804	33.1	22.5	V	78.9	54	31.5
7206	39.1	24.3	H	78.9	54	29.5
7206	32.4	21.3	V	78.9	54	32.7
			MED			
2440	99.3	89.7	H	N/a		
2440	96.8	86.1	V	N/a		
4880	43.1	31.3	H	79.3	54	22.7
4880	38.1	28.1	V	79.3	54	25.9
7320	39.1	23.1	H	79.3	54	30.9
7320	35.2	20.4	V	79.3	54	33.6
			High			
2478	98.3	88.5	H	N/a		
94.9	85.1	90.9	V	N/a		
4956	39.1	24.1	H	78.3	54	29.9
4956	33.8	20.1	V	78.3	54	33.9
7434	38.1	29.1	H	78.3	54	24.9
7434	32.9	26.5	V	78.3	54	27.5

Note: + 20 dBuV is noise floor of setup

Date: 11-28-98

EUT Model/Name: 13.5 dBi Yagi

Test Performed: Cispr Emissions

Freq. (MHz)	Level (dBuV) PK	A _f /C _L (dBm) AV	H _A (M) Hor/Ver	Limit		Comments/Margin
LOW				15.247	15.209	
2402	107.9	98.3	H	N/a		
2402	106.1	97.1	V	N/a		
4804	43.0	30.1	H	87.9	54	23.9
4804	42.1	29.1	V	87.9	54	24.9
7206	41.1	28.3	28.3	87.9	54	25.7
7206	39.1	27.2	V	87.9	54	26.8
MED						
2440	108.1	98.7	H	N/a		
2440	107.1	98.0	V	N/a		
4880	43.1	33.1	H	88.1	54	20.9
4880	41.7	32.0	V	88.1	54	22.0
7320	39.1	30.1	H	88.1	54	23.9
7320	37.3	29.1	V	88.1	54	24.9
High						
2478	106.1	98.0	H	N/a		
2478	105.9	97.1	V	N/a		
4956	41.1	37.1	H	86.1	54	16.9
4956	40.2	35.1	V	86.1	54	18.9
7434	40.1	30.1	H	86.1	54	23.9
7434	39.1	29.7	V	86.1	54	24.3

Note: + 20 dBuV is noise floor of setup