RF Exposure Exhibit

EUT Name: TransAir PTC-3006

Model No.: PTC-3006

CFR Part 1.1310 and RSS 102

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Report/Issue Date: Aug 26, 2012
Report Number: 31260509.004 Appendix A

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1 Test Methodology

In this document, we evaluate the RF Exposure to human body due the intentional transmission from the transmitter (EUT). The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

1.1 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3-1.34	614	1.63	*(100)	6
1.34-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
30-1500	…	…	F/300	6
1500-100000	…	…	1.0	6
(B)Limits For General Population / Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
30-1500	…	…	F(MHz)/1500MHz	30
1500-100000	…	…	1.0	30

F = Frequency in MHz

*=Plane wave equivalent density

1.2 EUT Operating Condition

TransAir PTC-3006 will installed professionally in Lillee systems host and a minimum separation distance listed in the table below must be maintained between radiating structure and any person. Software provided enables to transmit on 216 to 222MHz, 3G and Wi-Fi band channels simultaneously.

RF exposure for co-location and simultaneous transmission is evaluated in this report.

EUT can be software configured for mobile or fixed installation.

Fixed installation with highest gain antenna of 14.1dBi

The antenna of the product, under normal use condition, should be at 2.32 m away from the body of any user for fixed installation. Warning statement to the user for keeping at least 2.25m or more separation distance with the antenna should be included in user's manual.

Mobile installation with highest gain antenna of 5.2dBi

The antenna of the product, under normal use condition, should be at 1.51 m away from the body of any user for fixed installation. Warning statement to the user for keeping at least 1.51m or more separation distance with the antenna should be included in user's manual.

1.3 Test Results

1.3.1 Antenna Gain

3 G Module FCC ID: QIPHC25 Antenna: AR001-GR108 GSM Quad-band Stubby highest gain 2dBi for 824 to 849Mhz and 3dBi for 1850 to 1910Mhz band

Wifi Module FCC ID: SWX-SR71E Antenna: 2.4 / 4.9 / 5.8 GHz Tri Band Rubber Duck; Model: RP-SMA highest gain: 6dBi

PTC radio: FCC ID: XTC-TRANSAIRP3000 RF; IC: 10249A-TAIRP3000RF Fixed/ base Station mode Highest gain antenna 14.1dBi

1.3.2 Base Station/ Fixed Station Configuration

Calculations for this report are based on highest permitted power for each band.

Band	Mode	Output Power dBm	Antenna gain (Max)	EIRP/ERP		Channels Available	Channels Used	Total EIRP	
				dBm	W			W	dBm
824.2-848.8	3G	32.5 (1.699W)	2.0	34.5	2.81	1	1	2.81	34.4
824.2-848.8	3G	27.8(0.603W)	2.0	29.8	0.954				
826.4-846.6	3G	27.07(0.502)	2.0	29.07	0.933				
1850.2-1909.8	3G	30.0 (1.0)	3.0	33	2.0	1	1	2.0	33.0
1850.2-1909.8	3G	28.0 (0.631)	3.0	31	1.25				
1852.2-1907.6	3G	26.9(0.49)	3.0	29.9	0.977				
2400 - 2483.5	OFDM	19.4	6.0	25.4	0.346	11	3	1.03	30.1
2401 - 2483.5	CCK	22.4	6.0	28.4	0.691[1]				
5150 - 5250	OFDM	15.4	6.0	21.4	0.138	4	3	0.414	26.1
5725 - 5850	OFDM	19.4	6.0	25.4	0.346	5	3	1.03	30.1
216-220	GMSK	45.5[2]	14.1	35.48	-	5	1		
216-220	16 QPSK	45.5[2]	14.1	35.48	-	5			
216-220	32 QPSK	45.5[2]	14.1	35.48	-	5			

[1]Note: CCK mode1channel is used

Table continued on next page

220-222	16 QPSK	45.5²	14.1	50.4	-	200		109.6	50.4
220-222	32 QPSK	45.5²	14.1	50.4	-	200			
						Totals:	8	134.56	51.29

Note 1: For PTC radio the output power for fixed stations is factory set max limit at 45.5dBm. The above calculation is based on max gain antenna of 14.1dBi and cable loss of 9.2dB. The equipment design prevents higher power by lockout/error message.

Note2: Power is variable actual power is chosen at the time installation depending on cable losses, ant height and gain and terrain as per FCC/ IC licensing procedures.

The highest measured power is +51.29 or 134.88W; average power.

Using the Friss transmission formula, the EIRP is Pout*G, and R is 20cm.

Pd= EIRP/(1600π)

Pd = (134880) / (1600π) = 26.83 mW/cm2, which is above the limit..

Calculating the distance at which Power density equals the limit

Calculation uses the free space transmission formula:

$$S = (PG)/(4\pi d^2)$$

Where: S is power density (W/m^2), P is output power (W), G is antenna gain relative to isotropic, d is separation distance from the transmitting antenna (m).

d = Sqroot (PG/4π) d in Cm when PG in mW/cm^2 Limit extended to 220MHz permissible power density 0.2 mW/cm^2

d = Sqroot 134880/4π0.2

D= 231.65 cms or d = 2.32 meters

1.3.3 Mobile Configuration

3 G Module FCC ID: QIPHC25 Antenna: AR001-GR108 GSM Quad-band Stubby antenna gain 2dBi

Wifi Module FCC ID: Antenna: 2.4 / 4.9 / 5.8 GHz Tri Band Rubber Duck Antenna RP-SMA

PTC radio: FCC ID: XTC-TRANSAIRP3RF; IC: 10249A-TAIRP3RF for Mobile mode highest antenna gain is 3.0dBi

Calculations for this report are based on highest power measurement.

Band	Mode	Output Power dBm (watts)	Antenna gain (Max)	EIRP		Channels Available	Channels Used	Total EIRP	
				dBm	W			W	dBm
824.2-848.8	3G	32.5 (1.699)	2.0	34.5	2.81	-	1	2.81	34.4
824.2-848.8	3G	27.8 (0.603)	2.0	29.8	0.954	-			
826.4-846.6	3G	27.07(0.502)	2.0	29.07	0.933	-			
1850.2-1909.8	3G	30.0 (1.0)	3.0	33	2.0	-		2.0	33.0
1850.2-1909.8	3G	(0.631)	3.0	33	2.0	-			
1852.2-1907.6	3G	(0.49)	3.0	33	2.0	-			
2400 - 2483.5	OFDM	19.4	6.0	25.4	0.346	11	3	1.03	30.1
2401 - 2483.5	CCK	22.4	6.0	28.4	0.691[1]				
5150 - 5250	OFDM	15.4	6.0	21.4	0.138	4	3 3	0.414	26.1
5725 - 5850	OFDM	19.4	6.0	25.4	0.346	5		1.03	30.1
216-220	GMSK	34	3	37	30.0	5	1	50.0	
216-220	16 QPSK	34	3	37	30	5			
216-220	32 QPSK	34	3	37	30	5			
220-222	GMSK	43.9	3	46.9	50	5			
220-222	16 QPSK	43.9	3	46.9	50	5			
220-222	32 QPSK	43.9	3	46.9	50	5			
						Totals:	8	57.284	47.58

Note1: The Max output power for mobile stations PTC radio is factory set max limit at 44.5dBm. The EIRP, calculation is based on max gain antenna of 5.2dBi and cable loss of 2.2dB. Power is limited to 30 watts erp as per RSS119 para 5.4.2

Note2: The PTC radio module design prevents higher power than 44.5dBm or 28.2Watts by lockout/error.

[1]CCK uses one channel only

Note 3: The antenna gain in the above table is adjusted taking account cable loss of 2.2dB. The highest gain antenna for PTC radio was 5.2dBi

The total simultaneous measured power is +47.58dBm or 57.28watts

Using the Friss transmission formula, the EIRP is Pout*G, and R is 20cm.

Pd= EIRP/(1600π)

Pd = (57280) / (1600π) = 11.39mW/cm2, which is above to the limit.

Calculation uses the free space transmission formula:

$$S = (PG)/(4\pi d^2)$$

Where: S is power density (W/m^2), P is output power (W), G is antenna gain relative to isotropic, d is separation distance from the transmitting antenna (m).

d = Sqroot (PG/4π) d in Cm when PG in mW/cm^2 Limit extended to 220MHz permissible power density 0.2 mW/cm^2

d = Sqroot [57280/4π0.2]

D= 151Cms or d = 1.51 meters

1.3.4 Sample Calculation

The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
$\pi \approx 3.1416$
R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).

1.3.5 PTC family Radio configuration

Ports	Model #: PTC-3201	Model #: PTC-3202	Model #: PTC-3203	Model #: PTC-3204	Model #: PTC-3001	Model #: PTC-3004	Model #: PTC-3006
Console	x	x	x	x	x	x	x
Eth0/1	x	x	x	x	x	x	x
220MHz PRI (N-type antenna port)	x	x	x		x	x	x
220MHZ SEC (N-type antenna port)	x	x			x	x	x
GPS (antenna port; can use TNC to SMA male connector)	x	x		x	x	x	x
3G (antenna port; can use TNC to SMA male connector)		x		x	x	x	x
WiFi PRI (antenna port; can use TNC to SMA male connector)				x	x	x	x
WiFi SEC (antenna port; can use TNC to SMA male connector)					x	x	x
DC IN	x	x	x	x	x	x	x
Serial port 1			x		x	x	x
Serial port 2			x		x	x	x

NAS622 chassis mounting kit with four screws	x	x	x	x		x	x
2 GB USB Flash Drive	x	x	x	x	x	x	x
Short name/ size description	2MCU	2MCU	2MCU	2MCU	1U	4MCU	6MCU