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RF Exposure Exhibit

EUT Name: TransAir PTC-3200

Model No.: PTC-3201. PTC-3202, PTC-3203, PTC-3204

CFR Part 1.1310 and RSS 102

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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/f²)	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/f²)	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-3200 shall be installed professionally 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.

For RF Exposure calculation the highest configuration was used

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 2.32m 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 1.51m 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: FCCID: XTC-TRANSAIRP3200; IC: 10249A-TAIRP3200 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 dBm	EIRP/ERP W	Channels Available	Channels Used	Total EIRP W	Total EIRP dBm
824.2-848.8	3G	32.5 (1.699W)	2.0	34.5	2.81				
824.2-848.8	3G	27.8(0.603W)	2.0	30.8	1.2	1	1	2.81	34.4
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				
1850.2-1909.8	3G	28.0 (0.631)	3.0	31	1.25	1	1	2.0	33.0
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	24.4	0.691				
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	45.5²	14.1	35.48	-	5			
216-220	16 QPSK	45.5²	14.1	35.48	-	5	1		
216-220	32 QPSK	45.5²	14.1	35.48	-	5			

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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	134.88	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.

Note3: For calculation purpose CCK operation is limited to 1Channel only

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

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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-TRANSAIRP3200; IC: 10249A-TAIRP3200 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 dBm	EIRP W	Channels Available	Channels Used	Total EIRP W	Total EIRP dBm
824.2-848.8	3G	32.5 (1.699)	2.0	34.5	2.81	-		2.81	34.4
824.2-848.8	3G	27.8 (0.603)	2.0	30.8	1.2	-			
826.4-846.6	3G	27.07(0.502)	2.0	29.07	0.933	-	1		
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	24.4	0.691				
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	34	3	37	30.0	5			
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	1	50.0	
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

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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.

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

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1.3.4 Sample Calculation

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

Where;
   Pd = power density in mW/cm2
   $Pout$ = 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
Console	x	x	x	x
Eth0/1	x	x	x	x
220MHz PRI (N-type antenna port)	x	x	x	
220MHZ SEC (N-type antenna port)	x	x		
GPS (antenna port; can use TNC to SMA male connector)	x	x		
3G (antenna port; can use TNC to SMA male connector)		x	x	x
WiFi PRI (antenna port; can use TNC to SMA male connector)				x
WiFi SEC (antenna port; can use TNC to SMA male connector)				
DC IN	x	x	x	x
Serial port 1			x	x
Serial port 2			x	x
NAS622 chassis mounting kit with four screws	x	x	x	x
2 GB USB Flash Drive	x	x	x	x
Short name/ size description	2MCU	2MCU	2MCU	2MCU