

1. Purpose

This report evaluates the RF exposure of the APX.V2 headset. This report follows the calculations outlined in OET bulletin 65, Edition 97-01.

2. References

- RSS-102, Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), Issue 5
- FCC 47 CFR Part 1, section 1.310
- FCC KDB 447498 DO1, RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices, V6
- OET bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields, Edition 97-01

3. Equipment Description

Description:	DECT 7.0 Headset
Model:	APX.V2
Additional Model(s):	APX379-OH.V2, APX379-BH.V2, APX379-HH.V2, APX377-OH.V2, APX377-BH.V2, AP377-HH.V2, FHW507.V2, UHW507.V2, FHW505.V2, UWH505.V2, UHW503.V2, FL659C, FL659AM, FL657C, FL651C, FL653DL, FL652C, FL653H
Brand Name(s):	Sonetics Corporation
Serial Number:	APX379V2FW002
IPEI:	03:7B:E9:55:E0
HW version:	Rev A
FW Version:	490-4100-00
FCC ID:	V9N950350000
IC:	7895A-950350000
Equipment type:	End Product

3.1. Radiation Sources

Mode	Description	
UPCS	Frequency Range	1921.536 – 1928.448 MHz
	Channels	5
	Modulations	GFSK
	Max Conducted power [dBm]	20.34
	Antenna gain [dBi]	0
ISM	Frequency Range	2400 – 2483.5 MHz
	Channels	79
	Modulations	GFSK
	Max Conducted power [dBm]	2.69
	Antenna gain [dBi]	1.1

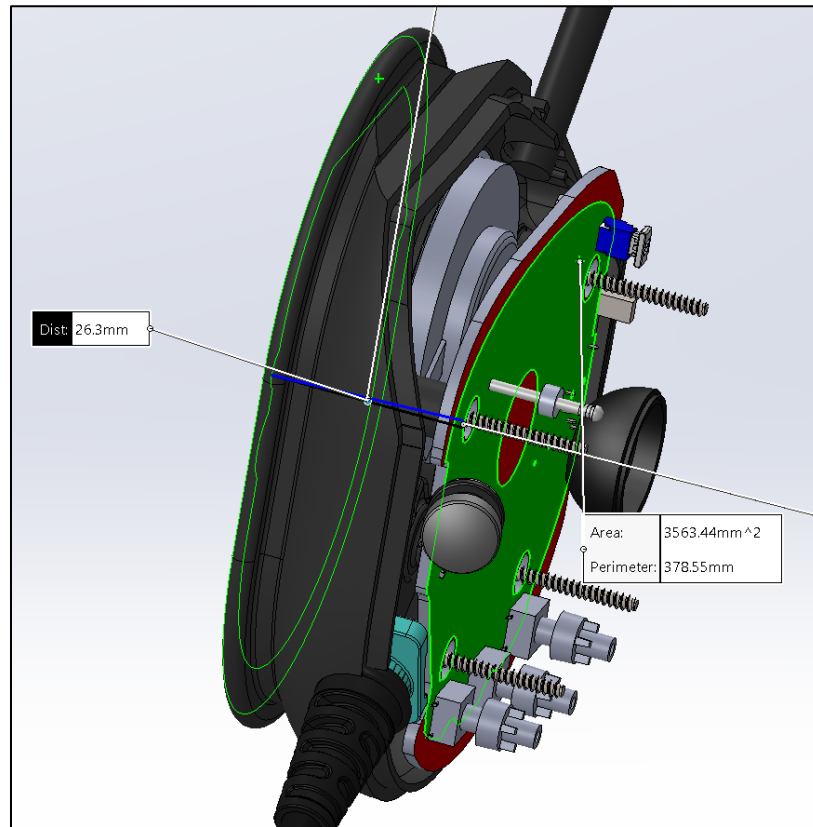


Figure 1 – Minimum Distance to Head

4. RF Exposure Classifications

The tables below show the IC and FCC limits for mobile devices in the General public exposure category:

FCC Limits – Occupational / Controlled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [mW/cm ²]	Averaging time [min]
0.3 - 30	614	1.63	100	6
3.0 - 30	1842/f	4.89/f	900 / f ²	6
30 - 300	61.4	0.163	1	6
300 - 1500	N/A	N/A	f/300	6
1500 - 100000	N/A	N/A	5	6

FCC Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [mW/cm ²]	Averaging time [min]
0.3 - 1.34	614	1.63	100	30
1.34 - 30	842/f	2.19/f	180/f ²	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	N/A	N/A	f/1500	30
1500 - 100000	N/A	N/A	1	30

IC Limits – Occupational / Controlled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [W/m ²]	Averaging time [min]
1.0 - 10.0	600/f	4.9/f	N/A	6
10.0 - 30.0	60	4.9/f	N/A	6
30 - 300	60	0.163	10	6
300 - 1500	3.54 * f ^{0.5}	.0094*f ^{0.5}	f/30	6
1500 - 15000	137	0.364	50	6

IC Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [W/m ²]	Averaging time [min]
1.0 - 10.0	280/f	2.19/f	N/A	30
10.0 - 30.0	28	2.19/f	N/A	30
30 - 300	28	0.073	2	30
300 - 1500	1.585*f ^{0.5}	.0042*f ^{0.5}	f/150	30
1500 - 15000	61.4	0.163	5	30

5. Assessment

OET bulletin 65 uses the following equation to predict the strength of an RF field at a given distance:

$$S = \frac{P * G}{4 * \pi * R^2}$$
$$S_D = \frac{P * D * G}{4 * \pi * R^2}$$

Where:

S = Power density (mW/cm² or W/m²)

S_D = Duty cycle power density (mW/cm² or W/m²)

P = Power input to the antenna (mW)

D = minimum duty cycle (%) (KDB 447498 DO1 - Section 6.1)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm)

The results of the assessment are shown below:

UPCS Assessment Results		
Variable	Value	Unit
Assessment frequency (f)	1921.536	MHz
Peak Conducted Power (P)	20.34	dBm
	108.14	mW
Product Duty Cycle (D _p)	4.2	%
Minimum Duty Cycle (D) (KDB 447498 DO1 - Section 6.1)	50	%
Peak Conducted Power with Duty Cycle (P _D)	10.17	dBm
	10.40	mW
Peak Antenna Gain (G)	0	dBi
	1	
Distance (R)	26.3	cm
Power Density (S _D)	0.12	mW/cm ²
	1.20	W/m ²

ISM Assessment Results		
Variable	Value	Unit
Assessment frequency (f)	2402	MHz
Peak Conducted Power (P)	2.69	dBm
	1.86	mW
Peak Antenna Gain (G)	1.1	dBi
	1.29	
Distance (R)	2.53	cm
Power Density (S)	0.03	mW/cm ²
	0.30	W/m ²

The power density of the EUT is below the FCC/IC MPE limit.

5.1. Product Duty Cycle Justification

DECT is broken into 24 time slots per channel. The headset will only transmit in one of those time slots which yields a 42ms pulse and a 4.2% duty cycle since there are 100 pulses per second.

Time DECT Frequency Spectrum																									
Cycle = 10ms		Time Slots																							
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
RF Channels	0																								
	1																								
	2								a											a					
	3																								
	4																								
	5																								
	6							b												b					
	7																								
	8																								
	9																								
		Down Link											Uplink												

Figure 2 – Time DECT Frequency Spectrum

6. SAR Test Exclusion

KDB 447498 DO1 General RF Exposure Guidance 4.3.1.a 4.3.2.b and 7.2.a uses the following equation for simultaneous transmission SAR exposure.

$$S = \frac{P}{R} * \sqrt{f} \text{ for } \leq 50 \text{ mm separation distance}$$

$$S = \frac{P}{R} * \frac{\sqrt{f}}{X} \text{ for } \leq 50 \text{ mm separation distance}$$

$$S_{Total} = S_{ISM} + S_{UPCS}$$

$$S_{simultaneous \text{ Transmission}} = \frac{(S_{ISM} + S_{UPCS})}{1.6} + \sum MPE \text{ ratios} \leq 1.0$$

Where:

P = Max Power (mW)

R = Separation Distance (mm)

f = Frequency (GHz)

X = 7.5 for 1-g SAR and 18.75 for 10-g SAR

S = SAR Calculated Value (W/kg)

MPE ratios = Maximum permissible exposure ratios

Simultaneous Transmit SAR Test Exclusion Calculation Results		
Variable	Value	Unit
ISM Assessment frequency (f)	2.402	GHz
ISM Peak Conducted Power (P)	1.86	mW
UPCS Assessment frequency (f)	1.921	GHz
UPCS Peak Conducted Power (P)	10.40	mW
Separation Distance (R)	25.3	mm
Section 4.3.1.a - Standalone SAR Test Exclusion		
ISM SAR Value	0.11	W/kg
UPCS SAR Value	0.55	W/kg
1-g SAR Limit	≤ 3.0	W/kg
10-g SAR Limit	≤ 7.5	W/kg
Section 4.3.2.b - Simultaneous Transmission SAR Test Exclusion		
ISM 1-g SAR (S _{ISM-1-g})	0.02	W/kg
UPCS 1-g SAR (S _{ISM-1-g})	0.07	W/kg
ISM 10-g SAR (S _{ISM-10-g})	0.01	W/kg
UPCS 10-g SAR (S _{ISM-10-g})	0.03	W/kg
S _{Total} 1-g SAR	0.09	W/kg
S _{Total} 10-g SAR	0.04	W/kg
Simultaneous Transmission SAR Limit	≤ 0.10	W/kg
Section 7.2.a - Transmitters Used in Mobile Device Exposure Conditions for Simultaneous Transmission Operations		
MPE Total (See Table 1)	0.3	%
S _{Simultaneous Transmission}	0.36	N/A
Simultaneous Transmission Limit	≤ 1.0	N/A

For Simultaneous Transmission, the calculated levels are below the specified limits.

6.1. MPE Ratio Calculation

The MPE ratio was calculated using foot note link 68 link to excel spreadsheet for estimating the [MPE compliance boundary](#). The information stated below was entered into the spread sheet and the Max % MPE of 0.3 was used for determining simultaneous transmission value per section 7.2.a. A value of 0.2 cm was used for the X distance for conservative calculations as the value of 0.256 cm was rounded up to 0.3 in the calculator.

Table 1 – MPE FCC Excel Table Calculations

Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		1921.54	2402
MPE Limit	mW/cm ²		1.00	1.00
Max % MPE	%	0.3	0.3	0.0
Power	(W)	0.012	0.010	0.002
Antenna Gain	dBi		1.00	1.10
EIRP	(W)	0.02	0.013	0.002
X	(cm)		0.2	0.2
Y	(cm)		0.0	0.0