



## FCC RF EXPOSURE ASSESSMENT

This assessment is addressing human exposure to radio frequency electromagnetic fields (RF-EMF) transmitted by the Nokia Solutions and Networks AirScale Base Transceiver Station Remote Radio Head Model AHFIHA.

It provides the RF exposure compliance boundaries for this product when it is operated with a typical external antenna, such as CommScope antenna assembly model “FFV4Q4-65B-R7-V2”. The assessment is performed regarding both general population and occupational exposure. Outside of these compliance boundaries, human exposure to RF-EMF is below the limits defined by the US Federal Communications Commission (FCC).

### Equipment Under Test Technical Characteristics

Radio Product Name	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	
FCC ID	VBNAHFIHA-01	
Supported Frequency Ranges	Band 25: BTS RX: 1850 to 1915 MHz/BTS TX: 1930 to 1995 MHz Band 66: BTS RX: 1710 to 1780 MHz/BTS TX: 2110 to 2200 MHz Band 7: BTS RX: 2500 to 2570 MHz/BTS TX: 2620 to 2690 MHz	
Supported Technology	Band 25: LTE, NB IoT, NR, GSM (B2) and WCDMA (B2) Band 66: LTE, NB-IoT, and NR Band 7: LTE, NB-IoT, and NR	
Duplexing Technology	FDD	
Number of TX/RX Paths	4TX/4RX	
Beamforming	No	
Rated Power	Radio Total: 640 W (4x160 W) or 58.1dBm	Band Total: 240 W (4x60 W) or 53.8dBm
Technology Duty Cycle	100%	
Antenna Product Name	CommScope antenna assembly model “FFV4Q4-65B-R7-V2”	
Maximum Antenna Gain	Band 25: 17.1 dBi (16.6 dBi +/- 0.5 dB) Band 66: 17.1 dBi (16.6 dBi +/- 0.5 dB) Band 7: 17.3 dBi (16.8 dBi +/- 0.5 dB)	
Electric Tilt Range	2 – 12 Degrees	
Dimensions	Width x Depth x Length: 498mm x 197mm x 2100mm	

This report presents compliance boundary only for bands B25, B66 and B7. Additional transmitters in other bands can be connected to the same antenna. The combined compliance boundary should be assessed by the entity putting the base station site into service leveraging the transmitted power values for additional transmitters using the information from antenna datasheet.



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### RF Exposure Limits

The United States RF exposure limits are defined by 47CFR 1.1310 “Radiofrequency radiation exposure limits”. The Nokia Solutions and Networks AirScale Base Transceiver Station Remote Radio Head Model AHFIHA is installed on walls or poles in fixed locations. The power density limits for the AHFIHA operational frequency ranges are provided in the following table.

General Population/Uncontrolled Exposure			Occupational/Controlled Exposure		
B25	B66	B7	B25	B66	B7
10.0 W/m <sup>2</sup>	10.0 W/m <sup>2</sup>	10.0 W/m <sup>2</sup>	50.0 W/m <sup>2</sup>	50.0 W/m <sup>2</sup>	50.0 W/m <sup>2</sup>

B25, B66 and B7 United States RF Exposure Power Density Limits

### RF Exposure Calculations

The relationship between power density and EIRP is from US FCC OET Bulletin 65 Edition 97-01, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields and its supplements” page 19 equation as follows:

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

S = power density

P = power input into the antenna

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

R = distance to the center of the radiation of the antenna

The following calculations include a technology duty cycle factor of 100 % for time averaging and a power tolerance of 1.5 dB due to electronic component dispersion and operational environmental conditions (temperature). The FCC RF Exposure Limits are identical for each band → so the worst-case power density will be where the band 7 transmitter power is maximum because the band 7 antenna gain is highest for the antenna being used. The RF compliance distances are provided for the time-averaged maximum transmitted power of 903 W (58.06dBm + 1.5dB), split into 339 W for band B25 (37.5%), 225 W for band B66 (25.0%) and 339W for band B7 (37.5%).



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### General Population RF Exposure assessment calculations

Frequency (MHz)	Power	Power + 1.5dB Tolerance	Antenna Gain	EIRP + 1.5dB Tolerance	R (meters)	PD Calculated	PD Limit	Exposure Ratio
Band 25 (1930)	4x60W = 240W or 53.8dBm	55.3dBm or 338.8W	17.1dBi	72.4dBm or 17378W	19.4	3.674 W/m <sup>2</sup>	10.0 W/m <sup>2</sup>	0.367
Band 66 (2110)	4x40W = 160W or 52.0dBm	53.5dBm or 223.9W	17.1dBi	70.6dBm or 11482W	19.4	2.428 W/m <sup>2</sup>	10.0 W/m <sup>2</sup>	0.243
Band 7 (2620)	4x60W = 240W or 53.8dBm	55.3dBm or 338.8W	17.3dBi	72.6dBm or 18197W	19.4	3.848 W/m <sup>2</sup>	10.0 W/m <sup>2</sup>	0.385
Radio	640W or 58.06dBm	59.56dBm or 903.6W						TER = 0.995

B25 PD calculated =  $EIRP / 4\pi R^2 = 17378 / [4\pi(19.4)^2] = 17378 / 4729.5 = 3.674 \text{ W/m}^2$

B66 PD calculated =  $EIRP / 4\pi R^2 = 11482 / [4\pi(19.4)^2] = 11482 / 4729.5 = 2.428 \text{ W/m}^2$

B7 PD calculated =  $EIRP / 4\pi R^2 = 18197 / [4\pi(19.4)^2] = 18197 / 4729.5 = 3.848 \text{ W/m}^2$

TER =  $3.674/10 + 2.428/10 + 3.848/10 = 0.367 + 0.243 + 0.385 = 0.995$

### Occupational RF Exposure assessment calculations

Frequency (MHz)	Power	Power + 1.5dB Tolerance	Antenna Gain	EIRP + 1.5dB Tolerance	R (meters)	PD Calculated	PD Limit	Exposure Ratio
Band 25 (1930)	4x60W = 240W or 53.8dBm	55.3dBm or 338.8W	17.1 dBi	72.4dBm or 17378W	8.7	18.27 W/m <sup>2</sup>	50.0 W/m <sup>2</sup>	0.365
Band 66 (2110)	4x40W = 160W or 52.0dBm	53.5dBm or 223.9W	17.1 dBi	70.6dBm or 11482W	8.7	12.07 W/m <sup>2</sup>	50.0 W/m <sup>2</sup>	0.241
Band 7 (2620)	4x60W = 240W or 53.8dBm	55.3dBm or 338.8W	17.3dBi	72.6dBm or 18197W	8.7	19.13 W/m <sup>2</sup>	50.0 W/m <sup>2</sup>	0.383
Radio	640W or 58.06dBm	59.56dBm or 903.6W						TER = 0.989

B25 PD calculated =  $EIRP / 4\pi R^2 = 17378 / [4\pi(8.7)^2] = 17378 / 951.1 = 18.27 \text{ W/m}^2$

B66 PD calculated =  $EIRP / 4\pi R^2 = 11482 / [4\pi(8.7)^2] = 11482 / 951.1 = 12.07 \text{ W/m}^2$

B7 PD calculated =  $EIRP / 4\pi R^2 = 18197 / [4\pi(8.7)^2] = 18197 / 951.1 = 19.13 \text{ W/m}^2$

TER =  $18.27/50 + 12.07/50 + 19.13/50 = 0.365 + 0.241 + 0.383 = 0.989$

## Conclusion

The RF exposure compliance distances for the Nokia Solutions and Networks AirScale Base Transceiver Station Remote Radio Head Model AHFIHA, connected with a typical external antenna, such as CommScope antenna assembly model "FFV4Q4-65B-R7-V2", are:

- a) 19.4 meters for General Population/Uncontrolled Exposure
- b) 8.7 meters for Occupational/Controlled Exposure