RF Exposure and Transmitter Power Considerations for the Infarm Gateway

Contains FCC ID: 2A2CI-INF001-CL and FCC ID: 2A2CI-INF001-WF

For mobile product operation the FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20 cm from a device to the body of a user.

The transmitter operation for the Infarm Gateway utilizes a certified BT LE, 2.4GHz +, 5GHz WiFi module (FCC ID: 2A2CI-INF001-WF), together with a certified cellular module PLS62-W (FCC ID: 2A2CI-INF001-CL).

These modules have been certified for the following operating bands:

BT BR/ BT LE: 2402-2480MHz

WLAN: 2412-2462MHz

5180-5700MHz

*GSM/ CDMA850/ LTE B5: 824-849MHz

*GSM/ CDMA1900/ LTE B2: 1850-1910MHz

**Note: BT BR and GSM operating bands are disabled in the Infarm Gateway*

LTE B4: 1710 - 1755MHz

LTE B7: 2500 - 2570MHz

LTE B12: 699 - 716MHz

LTE B18: 815 - 830MHz

LTE B19: 830 - 845MHz

The following FCC Rule Parts and procedures are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

KDB447498 D01 v06
Mobile and Portable Devices RF Exposure Procedures and Equipment Authorisation Policies

MPE CALCULATIONS

The MPE calculation used to calculate the safe operating distance for the user is:

$$S = EIRP/4 \pi R^2$$

Where S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P x G)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (safe operating distance)

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC §1.1310 (e) **for f >1500MHz , S_{req} = 1.0 mW/cm^2**

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC §1.1310 (e) **for f <1500MHz, S_{req} = f/1500 mW/cm^2**

(f = operating frequency)

VALUES

Powers are from BT LE/ WLAN FCC Grant listings and cellular module FCC Grant SAR test report.

See submitted spec sheets for antenna gain values

Frequency Range (MHz)	Operating Band	TX Max. Conducted Power Average (dBm)	Antenna Gain (dBi)	EIRP (mW)	Calculated Distance R @ S_{req} (cm)	Power Density S mw/ cm^2		
						Limit S_{req}	Calculated S_n @ 20cm	S_n/S_{req}
2402 - 2480	BT LE	-1.1	+5.0	2.45	0.44	1.0	0.0005	0.0005
2412 - 2462	WLAN	13.12	+5.0	64.9	2.27	1.0	0.013	0.013
5180 - 5700	WLAN	4.8	+5.0	9.5	0.87	1.0	0.0019	0.0019
824 - 849	CDMA V LTE 5, 18, 19	+25	+3.0	631	9.6	0.55	0.13	0.24
1850 - 1910	CDMA II LTE 2	+25	+4.0	794	7.95	1.0	0.16	0.16
1710 - 1755	CDMA IV LTE 4	+25	+4.0	794	7.95	1.0	0.16	0.16

2500 - 2570	LTE 7	+25	+5.0	1000	8.9	1.0	0.2	0.2
699 - 716	LTE 12	+25	+3.0	631	10.33	0.47	0.13	0.28

KDB447498 D01 v06 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS

Worst case summation of calculated MPE ratios S_n/S_{req}.

BT LE and 2.4GHz WLAN operation:

$$\textbf{ie: } \Sigma MPE_{ratios} = (S_1/ S_{req1}) + (S_2/ S_{req2})$$

$$= 0.0005 + 0.01$$

$$\textbf{= 0.0105}$$

LTE B12 and 2.4GHz WLAN operation:

$$\textbf{ie: } \Sigma MPE_{ratios} = (S_1/ S_{req1}) + (S_6/ S_{req6})$$

$$= 0.013 + 0.28$$

$$\textbf{= 0.293}$$

Σ of MPE ratios<1.0, so in accordance with KDB447498 Section 7.2, simultaneous transmission test exclusion applies.

Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure will not be exceeded for the Infarm Gateway using the listed antennas.