MPE CALCULATIONS - FCC

1.0 APPLICANT:

DATE: NAME OF APPLICANT: FCC ID:

02/13/2016 HONEYWELL INTERNATIONAL INC. CFS8DLTSSCBASE1

2.0 FCC RULES CONCERNING MAXIMUM PERMISSIBLE RF EXPOSURE:

<u>§ CFR 47 1.1310 Radiofrequency radiation exposure limits.</u>

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, 'Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation."

NOTE TO INTRODUCTORY PARAGRAPH:

These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3. Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,"

ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers.

3.0 UUT POWER OUTPUT AND ANTENNA GAIN

(Note - please see note on WiFi antenna gain on the last page of this report)

5800 Ant 1: 2.0dBi, 5800 Ant 2: 2.0dBi => Max = 2.0 dBi.

ZWAVE Ant 1 = 2.0dBi.

WIFI Ant 1 (when Ant 2 not transmitting): 1.0dBi, WIFI Ant 2 (when Ant 1 not transmitting): 1.0dBi => Max = 1.0 dBi. WIFI Ant 1 & 2 (both transmitting) Ant1/2 gain = 4.01 dBi directional gain.

3.1 MPE CALCULATIONS:

FCC GENERAL POPULATION / UNCONTROLED EXPOSURE LIMITS:

FOR 300 MHz to 1,500 MHz use F / 1500 mW/cm²; (§1.1310(e))

FOR 1,500 to 100,000 MHz use 1 mW/cm^{2;} (§1.1310(e))

EQUATIONS:

MAX AVG EIRP (mW) = 10^{(MAX COND PWR. + ANT GAIN + DUTY FACTOR)/10)}

THE FRIIS TRANSMISSION EQUATION = EIRP X DUTY CYCLE / (4 X PI X 20 CM^2)

MEASURED POWER:

• FOR 5800 RADIO (344.94 MHz), MAX MEAS. FIELD STRENGTH = 97.25 dBuV/m @ 3m which equates to 2.02dBm effective EIRP. Correcting for an antenna gain of 2.0dBi makes the actual EIRP = (2.02dBm -2.0dBi) = 0.02dBm.

FOR Z-WAVE RADIO (908.42 MHz), MAX MEAS. FIELD STRENGTH = 92.61 dBuV/m @ 3m which equates to -2.62dBm effective EIRP. Correcting for an antenna gain of 2.0dBi makes the actual EIRP = (-2.62dBm - 2.0dBi) = -4.62dBm

FOR WIFI RADIO, MAX MEASURED AVG COND. POWER = 10.68dBm @ 2437MHz.

BANDS AND FCC IDs

FCC ID

BAND CFS8DLTSSCBASE1 ALL

BAND:	CH No:	FREQ(Mhz)	TRP dbm	MAX COND. PWR or EIRP(dBm)	ANTENNA GAIN(db):	DUTY FACTOR (dB)	MAX AVG EIRP (mW)	FRISS mW/CM ² :	EXP LIMIT mW/CM ² :	% OF LIMIT:
5800	N/A	344.94	N/A	0.02	2	10.00	0.159	0.0000317	0.2300	0.0138
Z-WAVE	N/A	908.42	N/A	-4.62	2	0.00	0.547	0.0001088	0.6056	0.0180
WiFi	6	2437	N/A	10.86	4.01	0.00	30.690	0.0061056	1.0000	0.6106

MAXIMUM MPE OF THE AIO BASE UNIT AS % OF LIMIT IS

0.6423

4.0 RESULTS:

TEST RESULT: PASS

In the configuration tested the EUT complied with the standards specified above.

MPE CALCULATIONS - IC

1.0 APPLICANT:

DATE: NAME OF APPLICANT: IC NUMBER: 02/13/2016 HONEYWELL INTERNATIONAL INC. 573F-TSSCBASE1

2.0 IC RULES CONCERNING MAXIMUM PERMISSIBLE RF EXPOSURE:

RSS-102 § 2.5.2 Exemption Limits for Routine Evaluation - RF Exposure Evaluation.

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 *f* 0.6834 W (adjusted for tune-up tolerance), where *f* is in MHz;

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

3.0 UUT POWER OUTPUT AND ANTENNA GAIN

(Note - please see note on WiFi antena gain on the last page of this report)

5800 Ant 1: 2.0dBi, 5800 Ant 2: 2.0dBi => Max = 2.0 dBi. ZWAVE Ant 1 = 2.0dBi.

WIFI Ant 1 (when Ant 2 not transmitting): 1.0dBi, WIFI Ant 2 (when Ant 1 not transmitting): 1.0dBi => Max = 1.0 dBi. WIFI Ant 1 & 2 (both transmitting) Ant1/2 gain = 4.01 dBi directional gain.

3.1 MPE CALCULATIONS:

IC GENERAL POPULATION / UNCONTROLED EXPOSURE LIMITS:

FROM 300 MHz to 6 GHz use $(1.31 \times 10-2) \times f^{0.6834}$ for max field strength (W/m2)

EQUATIONS:

MAX AVG EIRP (mW) = 10^{(MAX COND PWR. + ANT GAIN + DUTY FACTOR)/10)}

THE FRIIS TRANSMISSION EQUATION = EIRP X DUTY CYCLE / (4 X PI X 20 CM^2)

MEASURED POWER:

- FOR 5800 RADIO (344.94 MHz), MAX MEAS. FIELD STRENGTH = 97.25 dBuV/m @ 3m which equates to 2.02dBm effective EIRP. Correcting for an antenna gain of 2.0dBi makes the actual EIRP = (2.02dBm -2.0dBi) = 0.02dBm.

- FOR Z-WAVE RADIO (908.42 MHz), MAX MEAS. FIELD STRENGTH = 92.61 dBuV/m @ 3m which equates to -2.62dBm effective EIRP. Correcting for an antenna gain of 2.0dBi makes the actual EIRP = (-2.62dBm - 2.0dBi) = -4.62dBm

- FOR WIFI RADIO, MAX MEASURED AVG COND. POWER = 10.68dBm @ 2437MHz.

BANDS AND IC NUMBERS

BAND ALL 573F-TSSCBASE1

BAND:	CH No:	FREQ(Mhz)	TRP dbm	MAX COND. PWR (dBm)	ANTENNA GAIN(db):	DUTY FACTOR (dB)	MAX AVG EIRP (mW)	FRISS mW/CM ² :	EXP LIMIT mW/CM ² :	% OF LIMIT:
5800	N/A	344.94	N/A	0.02	2	10.00	0.159	0.0000317	0.0711	0.0446
Z-WAVE	N/A	908.42	N/A	-4.62	2	0.00	0.547	0.0001088	0.1377	0.0790
WiFi	6	2437	N/A	10.86	4.01	0.00	30.690	0.0061056	0.2703	2.2588

MAXIMUM MPE OF THE AIO BASE UNIT AS % OF LIMIT IS:

2.3824

4.0 RESULTS:

TEST RESULT: PASS

In the configuration tested the EUT complied with the standards specified above.

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Note On WiFi Antenna Gain

The test unit has 2 WIFI antennas which, in addition to transmitting individually, are capable of transmitting the same data simultaneously. When the WIFI signal is transmitting on one antenna only, that antenna's directional gain is applied to the max conducted power on that antenna output to calculate the equivalent radiated field strength used in section 3.1. When the WIFI signal is transmitting on both antennas simultaneously, there is an equivalent multi-antenna directional gain figure which is calculated per FCC KDB 662911, section F(2)(i). For purposes of determining which section of KDB662911 applies, it is noted the antennas are correlated and have the same individual gain.

All measurements are in the table below. The 3 transmit cases (Ant 1 xmit, Ant 2 xmit, both xmit) are noted in the table. The approriate gain is used for each row. The last column uses the measured average conducted power scaled by the appropriate antenna gain to show the equivalent max average power that will be factored in the MPE calculations. The maximum value in this column dicates which row applies for the WiFi radio contribution to the MPE summary calculation in section 3.1. The row with the maximum value in the last column is highlighted in the table.

	Frequenc y (MHz)	Modulati on	Ch	Ant	Max Avg Cond Pwr (dBm)	Combined Avg Cond Pwr (Block 2 Only) (dBm)	Ant Individ gain (Block 1) or Multi- Antenna Directional Gain (Block 2) (dBi)	Equivalent Max Avg Power to consider for MPE calcs. (dBm)
Block 1	2412	802.11b	1	1	10.23	10.23	1.00	11.23
	2412			2	5.35	5.35	1.00	6.35
	2437		6	1	10.49	10.49	1.00	11.49
	2437			2	7.01	7.01	1.00	8.01
	2467		11	1	9.74	9.74	1.00	10.74
	2467			2	7.87	7.87	1.00	8.87
	2412	802.11a	1	1	8.82	8.82	1.00	9.82
	2412	g		2	3.36	3.36	1.00	4.36
	2437		6	1	10.48	10.48	1.00	11.48
	2437			2	6.35	6.35	1.00	7.35
	2467		11	1	6.53	6.53	1.00	7.53
	2467			2	4 04	4 04	1.00	5.04
	2412	802.11n	1	1	8.58	8.58	1.00	9.58
	2412	002.11	· ·	2	2 78	2 78	1.00	3 78
	2437		6	1	10.68	10.68	1.00	11.68
	2437		0	2	6.83	6.83	1.00	7.83
	2467		11	1	5.82	5.82	1.00	6.82
	2467			2	3.80	3.80	1.00	4.89
Block 2	2407	802 11h	1	1	8 37	10.01	1.00	14.02
DIOCK 2	2412	002.110	1	1	5.00	10.01	4.01	14.02
	2412		6	1	8.92	10 50	4 01	14 51
	2437		0	2	5.34	10.00	4.01	14.01
	2467		11	1	8.80	10.41	4.01	14.42
	2467			2	5.32			
	2412	802.11g	1	1	7.40	8.89	4.01	12.90
	2412		6	2	3.51	10.86	1.01	1/ 87
	2437		0	2	5.37	10.00	4.01	14.07
	2467		11	1	5.64	7.28	4.01	11.29
	2467	802 11n	1	2	2.26	8 00	1.01	12.01
	2412	002.1111	I	2	2.38	0.00	4.01	12.01
	2437		6	1	9.44	10.74	4.01	14.75
	2437			2	4.85			
	2467		11	1	5.46	6.75	4.01	10.76
	2467			2	0.85			

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