Engineering Test Report No. 2004710-01		
Report Date	November 25, 2020	
Manufacturer Name	Honeywell	
Manufacturer Address	3825 Ohio Avenue St. Charles, IL 60174	
Model No.	Photo/Thermal self-test smoke detector, Model No. FSP-951T-SELFT	
Date Received	November 23, 2020	
Test Dates	November 23, 2020 through November 25, 2020	
Specifications	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 FCC “Code of Federal Regulations” Title 47, Part15, Subpart 15B Innovation, Science, and Economic Development Canada, RSS-247 Innovation, Science, and Economic Development Canada, RSS-GEN	
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515	FCC Reg. Number: 269750 IC Reg. Number: 2987A CAB Identifier: US0107
Signature	Mark E. Longinotti	
Tested by	Mark E. Longinotti	
Signature	Raymond J Klouda	
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	A000733800	

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1. Report Revision History

Revision	Date	Description
–	07 DEC 2020	Initial Release of Engineering Test Report No. 2004710-01

2. Introduction

2.1. Scope of Tests

This document presents the results of a series of RF emissions tests that were performed on the Honeywell Photo/Thermal self-test smoke detector (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was manufactured and submitted for testing by Honeywell located in St. Charles, IL.

2.2. Purpose

The test series was performed to determine if the EUT meets the RF emission requirements of the FCC “Code of Federal Regulations” Title 47, Part15, Subpart C, Sections 15.247 for a Digital Modulation intentional radiator operating within the 2400-2483.5MHz band.

The test series was also performed to determine if the EUT meets the RF emission requirements of the Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-Gen and Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-247 for a Digital Modulation intentional radiator operating within the 2400-2483.5MHz band.

Testing was performed in accordance with ANSI C63.10-2013.

2.3. Identification of the EUT

The EUTs were identified as follows:

EUT Identification	
Product Description	Photo/Thermal self-test smoke detector
Model/Part No.	FSP-951T-SELFT
S/N	Sample #1 and Sample #2
Device Type	Digitally Modulated Transmission Device
Band of Operation	2400-2483.5MHz
Modulation Type	BLE: GSFK
Software/Firmware Version	S05-0120 Rev. A
Conducted Output Power	0.0537mW (-12.7dBm)
Antenna Type	Inverted F
Antenna Gain (dBi)	-1dBi
6dB Bandwidth	871.288kHz
Occupied Bandwidth (99% CBW)	1.04MHz
Size of EUT	4” Diameter x 2.0” Height

Two samples were provided by Honeywell personnel, Serial Number Sample #1 was assigned to the EUT used for all antenna port conducted emissions tests. (Sample #1 was modified by placing a coaxial cable at the antenna connector on the EUT.) Serial Number Sample #2 was assigned to the EUT used for all radiated emissions tests.

Per Honeywell personnel, the following models are electrically identical to FSP-951T-SELFT:

- FSP-951-SELFT
- FST-951-SELFT

3. Power Input

During normal operation, the EUT was powered by 24VDC from a control panel. For testing purposes, the EUT was powered with 24VDC via a 2 wire power harness from the Control Panel Simulator.

4. Grounding

The EUT was not connected to ground.

5. Support Equipment

The EUT was submitted for testing along with the following support equipment:

Description	Model #	S/N
Control Panel Simulator	Endcal	N/A
Dell Laptop Computer	Latitude 7490	N/A

6. Interconnect Leads

The following interconnect cables were submitted with the test item:

Item	Description
UART Cable	Used to connect the Laptop Computer to the EUT

7. Modifications Made to the EUT

No modifications were made to the EUT during the testing.

8. Modes of Operation

The EUT and all peripheral equipment were energized. The unit was programmed to transmit in one of the following modes:

Mode	Description
2402MHz	Power Setting = 0
2426MHz	Power Setting = 0
2480MHz	Power Setting = 0

9. Test Specifications

The tests were performed to selected portions of, and in accordance with the following test specifications:

- Federal Communications Commission “Code of Federal Regulations”, Title 47, Part 15, Subpart C
- ANSI C63.4-2014, “American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz”
- ANSI C63.10-2013, “American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices”
- Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance For Compliance Measurements On Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 April 2, 2019 KDB 558074 D01v05r02
- RSS-247 Issue 2, February 2017, “Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices”
- RSS-Gen Issue 5, March 2019, Amendment 1, Innovation, Science, and Economic Development Canada, “Spectrum Management and Telecommunications, Radio Standards Specification, General Requirements for Compliance of Radio Apparatus”

10. Test Plan

No test plan was provided. Instructions were provided by personnel from Honeywell and used in conjunction with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247, Innovation, Science, and Economic Development Canada, RSS-247, and ANSI C63.10-2014 specifications.

11. Deviation, Additions to, or Exclusions from Test Specifications

There were no deviations, additions to, or exclusions from the test specifications during this test series.

12. Laboratory Conditions

Ambient Parameters	Value
Temperature	22°C
Relative Humidity	18%
Atmospheric Pressure	1026mb

13. Summary

The following EMC tests were performed and the results are shown below:

Test Description	Requirements	Test Methods	S/N	Results
6dB Bandwidth	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #1	Conforms
Occupied Bandwidth (99%)	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #1	Conforms
Maximum Peak Conducted Output Power	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #1	Conforms
Effective Isotropic Radiated Power (EIRP)	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #2	Conforms
Duty Cycle Factor Measurements	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #2	N/A
Case Spurious Radiated Emissions	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #2	Conforms
Band-Edge Compliance	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #1, Sample #2	Conforms
Power Spectral Density	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	Sample #1	Conforms

14. Sample Calculations

For Powerline Conducted Emissions:

The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

Formula 1: VL (dBuV) = MTR (dBuV) + CF (dB).

For Radiated Emissions:

The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external preamplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

Formula 1: FS (dBuV/m) = MTR (dBuV) + AF (dB/m) + CF (dB) + (- PA (dB)) + DC (dB)

To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

Formula 2: FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

15. Statement of Conformity

The Honeywell Photo/Thermal self-test smoke detector, Model No. FSP-951T-SELFT, did fully conform to the selected requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 and Innovation, Science, and Economic Development Canada, RSS-247.

16. Certification

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 and Innovation, Science, and Economic Development Canada, RSS-247 test specifications. The data presented in this test report pertains to the EUT on the test date specified. Any electrical or mechanical modifications made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

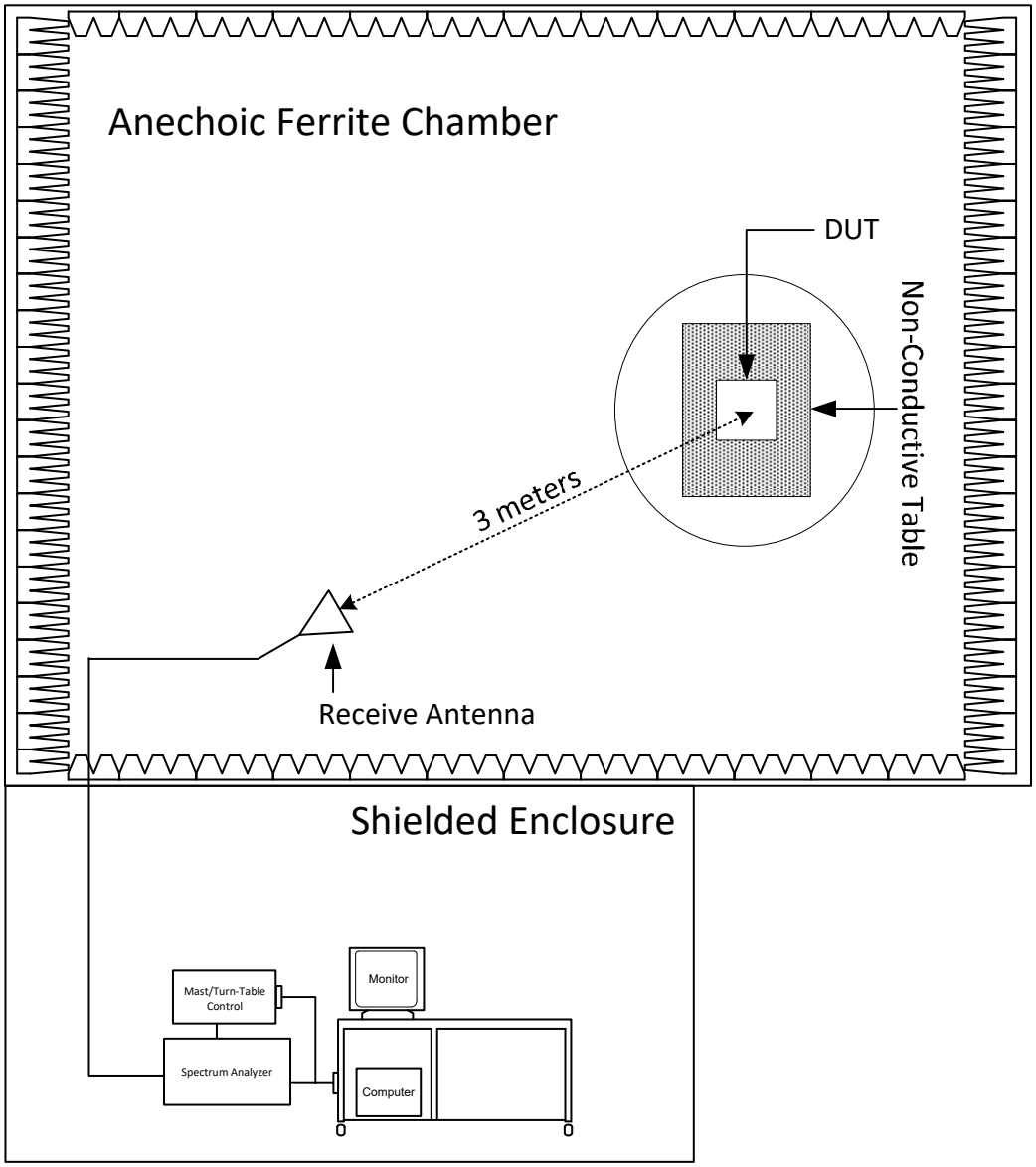
17. Photographs of EUT

18. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW0	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G	PL2926/0646	20GHZ-26.5GHZ	9/24/2020	9/24/2021
APW10	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL9609/1139	1GHZ-20GHZ	4/2/2020	4/2/2021
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
CDZ4	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
GRE1	SIGNAL GENERATOR	AGILENT	E4438C	MY42081749	250KHZ-6GHZ	2/25/2020	2/25/2021
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	10/20/2020	10/20/2021
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/28/2020	4/28/2022
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	4/7/2020	4/7/2022
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/23/2020	3/23/2021
RBG3	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101592	2HZ-44GHZ	4/24/2020	4/24/2021
SHC2	Power Supplies	HENGFU	HF60W-SL-24	A11372702	24V	NOTE 1	
VBV2	CISPR EN FCC ICES RE.EXE	ELITE	CISPR EN FCC ICES RE.EXE	---	---	N/A	
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	9/6/2019	9/6/2021

N/A: Not Applicable I/O: Initial Only CNR: Calibration Not Required
NOTE 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

19. Block Diagram of Test Setup



Radiated Measurements Test Setup

20. 6dB Bandwidth

Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #1
Mode	See Below

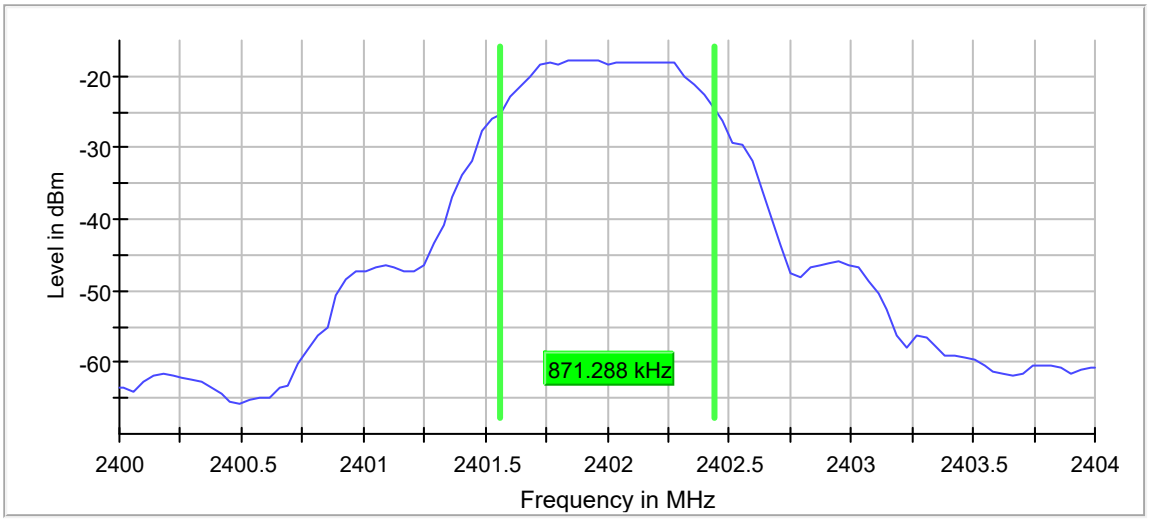
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Notes	None

Requirements
Systems using digital modulation techniques shall have a minimum 6 dB bandwidth of 500 kHz

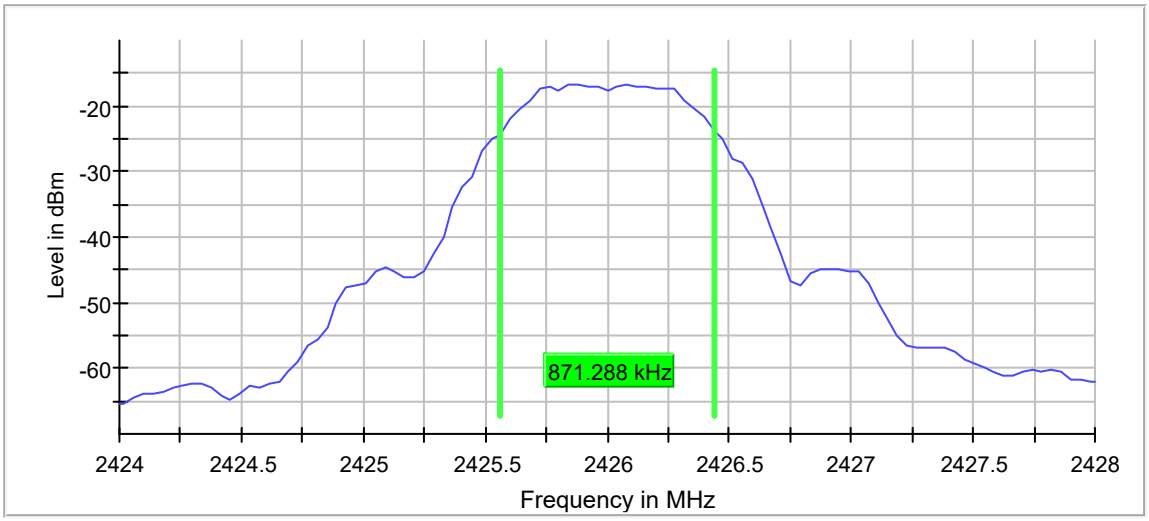
Procedures
The antenna port of the EUT was connected to the spectrum analyzer. The EUT was allowed to transmit continuously. The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 100kHz, the video bandwidth (VBW) was set to the same as or 3 times greater than the RBW, and the span was set to 2 times the RBW. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

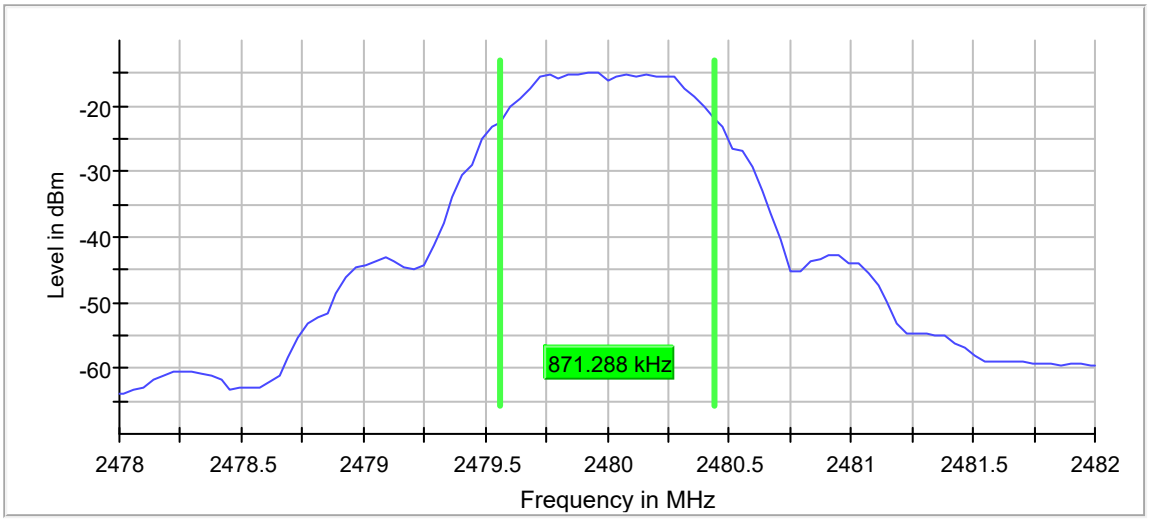
Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	6dB BW = 871.288kHz
Notes	None



Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Parameters	6dB BW = 871.288kHz
Notes	None



Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Parameters	6dB BW = 871.288kHz
Notes	None



21. Occupied Bandwidth (99%)

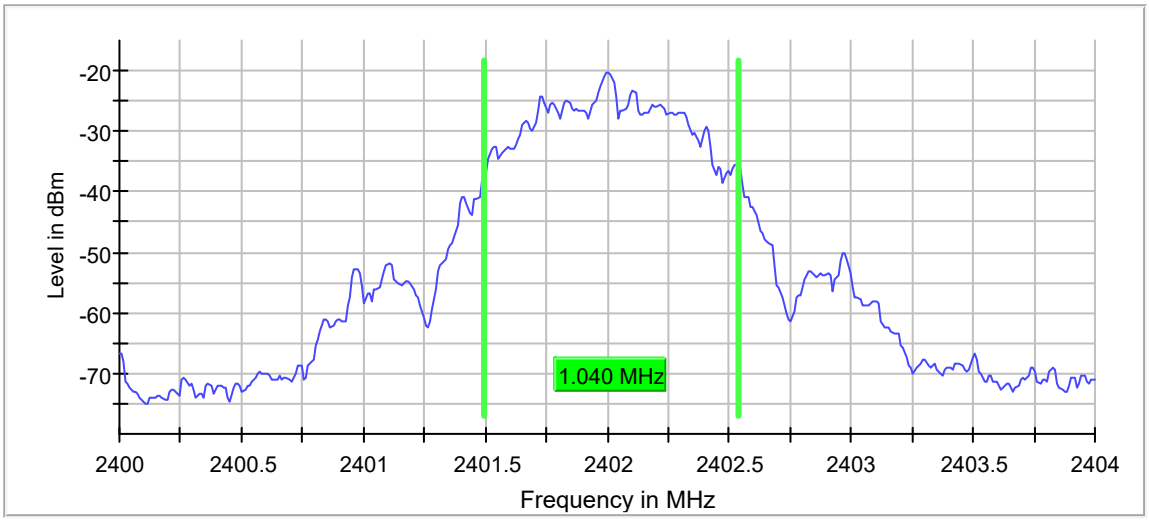
Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #1
Mode	See Below

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Notes	None

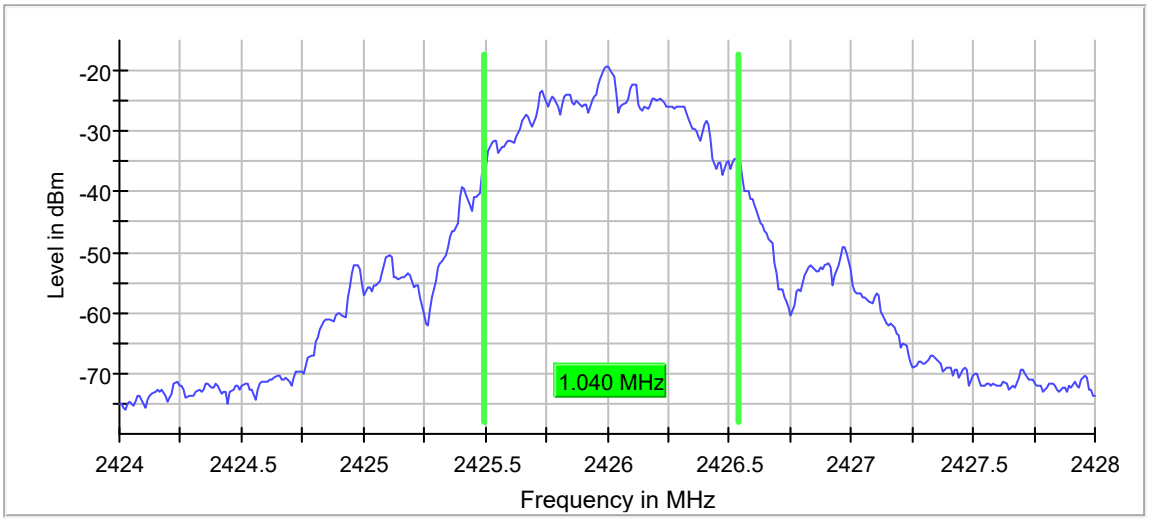
Procedures
The antenna port of the EUT was connected to the spectrum analyzer. The EUT was allowed to transmit continuously. The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 1% to 5% of the actual occupied bandwidth, the video bandwidth (VBW) was set 3 times greater than the RBW, and the span was set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

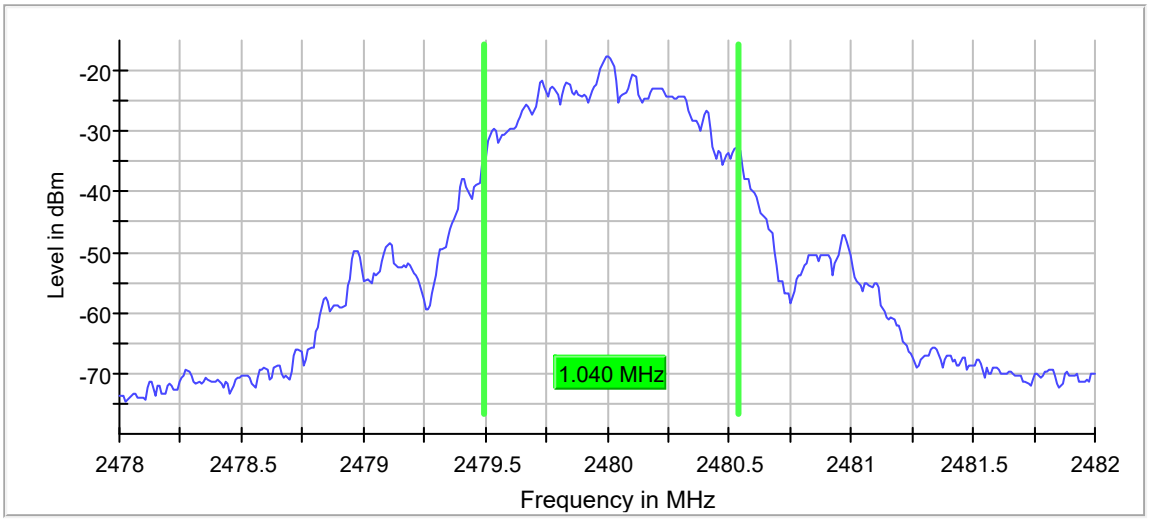
Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	OBW = 1.04MHz
Notes	None



Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Parameters	OBW = 1.04MHz
Notes	None



Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Parameters	OBW = 1.04MHz
Notes	None



22. Maximum Peak Conducted Output Power

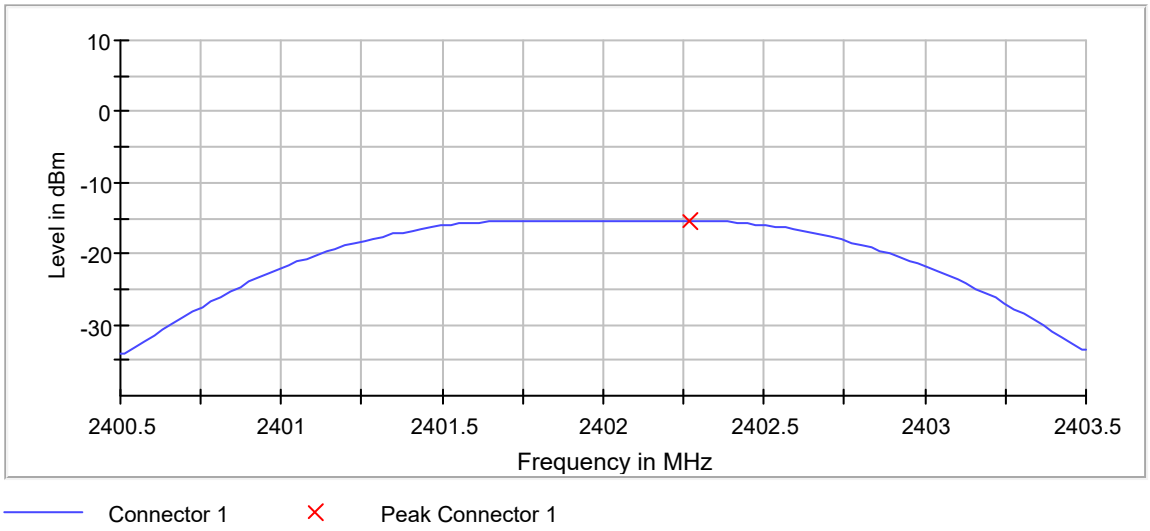
Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #1
Mode	See Below

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Notes	None

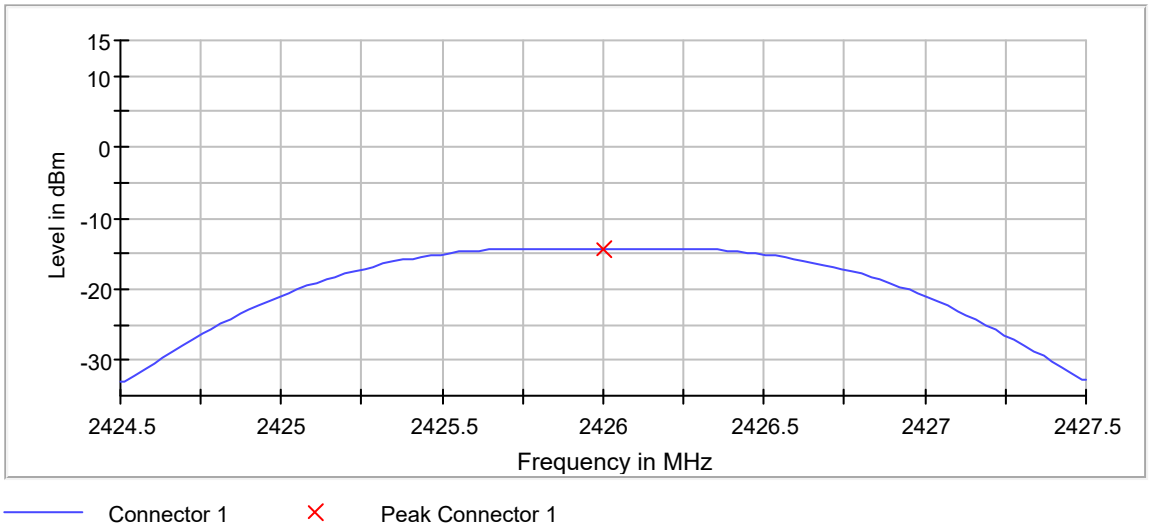
Requirements
The output power shall not exceed 1W (30dBm).

Procedures
The antenna port of the EUT was connected to the spectrum analyzer. The EUT was set to transmit separately at the low, middle, and high channels. The resolution bandwidth (RBW) was set to greater than the 6dB bandwidth. The span was set to greater than 3 times the RBW. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high channels.

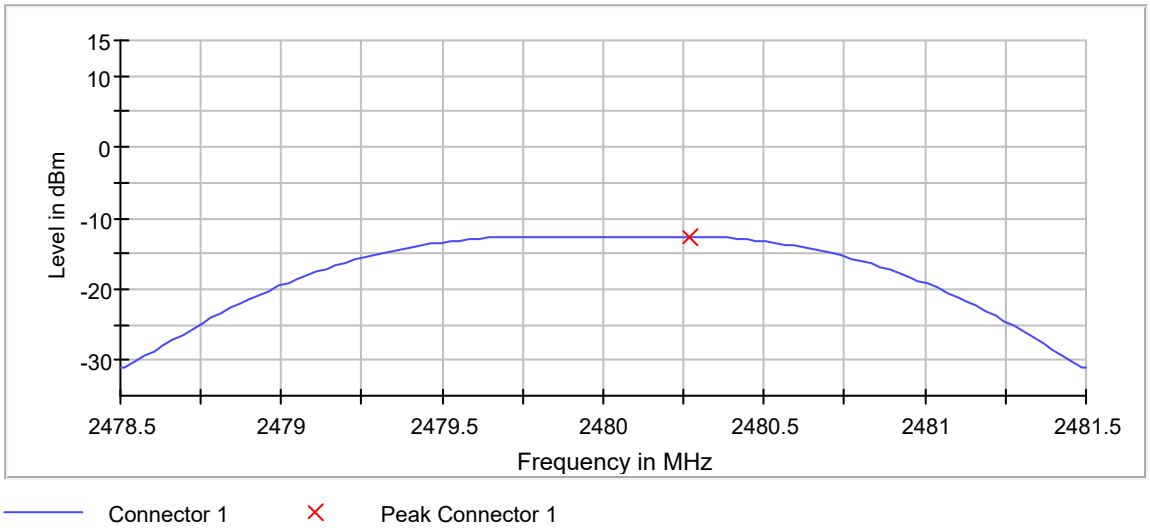
Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	Output Power = 0.0295mW (-15.3dBm)
Notes	None



Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Parameters	Output Power = 0.0363mW (-14.4dBm)
Notes	None



Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Parameters	Output Power = 0.0537mW (-12.7dBm)
Notes	None



23. Effective Isotropic Radiated Power (EIRP)

Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #1
Mode	See Below

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Double-ridged waveguide (or equivalent)
Notes	None

Requirements
The output power shall not exceed 4W (36dBm).

Procedures
The EUT was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle and high channels. The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a dipole antenna (double ridged waveguide antenna for all measurements above 1GHz) was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss (and antenna gain for all measurements above 1GHz), as required. The peak power output was calculated for low, middle, and high hopping frequencies.

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Carrier Frequency	2402MHz
Parameters	EIRP = 0.015mW (-18.3dBm)
Notes	None

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2402.00	H	41.5	-20.7	5.2	2.7	-18.3	36.0	-54.3
2402.00	V	35.4	-27.9	5.2	2.7	-25.5	36.0	-61.5

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Carrier Frequency	2426MHz
Parameters	EIRP = 0.017mW (-17.7dBm)
Notes	None

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2426.00	H	43.0	-20.0	5.1	2.8	-17.7	36.0	-53.7
2426.00	V	36.8	-26.2	5.1	2.8	-23.9	36.0	-59.9

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Carrier Frequency	2480MHz
Parameters	EIRP = 0.039mW (-14.1dBm)
Notes	None

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2480.00	H	46.1	-16.3	5.0	2.8	-14.1	36.0	-50.1
2480.00	V	38.4	-24.2	5.0	2.8	-22.0	36.0	-58.0

24. Duty Cycle Factor Measurements

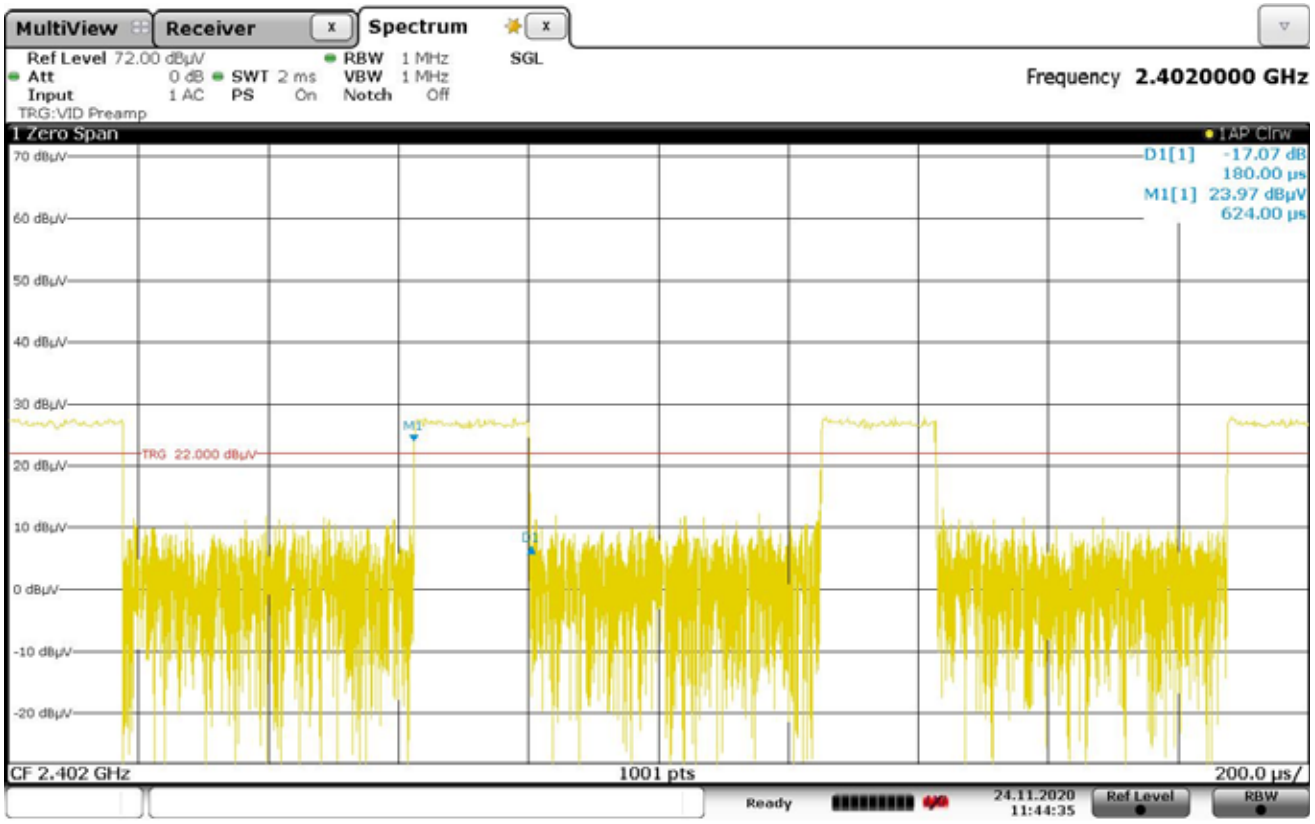
Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #2
Mode	See Below

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Notes	None

Procedures
The duty cycle factor is used to convert peak detected readings to average readings when pulsed modulation is employed. This factor is computed from the time domain trace of the pulse modulation signal. With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a zero span width with 200usec/div. The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of the “on-time”. The trace is recorded. Next the spectrum analyzer center frequency is set to the transmitter frequency with a zero span width and 10msec/div. This shows if the word is longer than 100msec or shorter than 100msec. If the word period is less than 100msec, the display is set to show at least one word. The on-time and off-time are then measured. The on-time is total time signal level exceeds the 4th division. Off-time is time under for the word period. The duty cycle is then computed as the (On-time/ word period) where the word period = (On-time + Off-time).

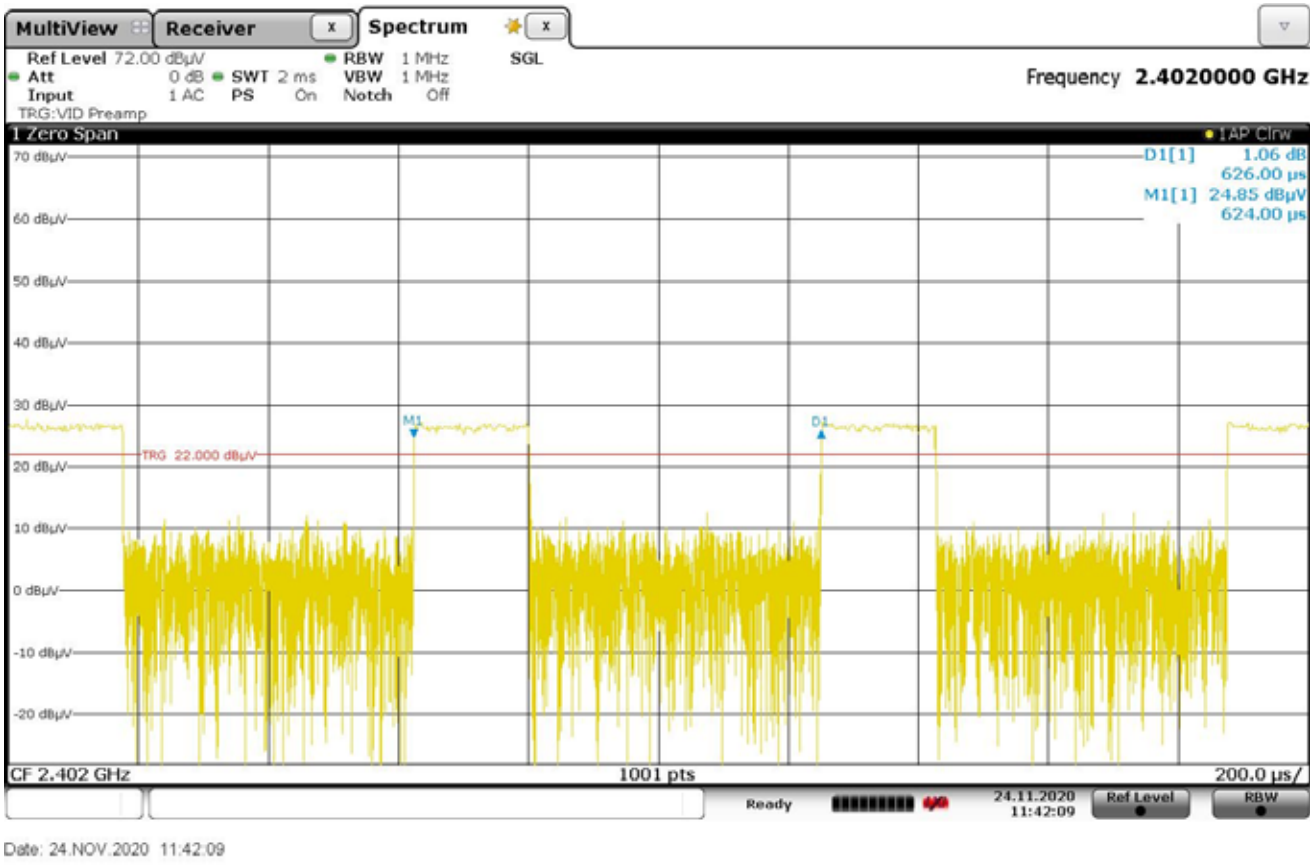
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	On time = 180usec
Notes	None



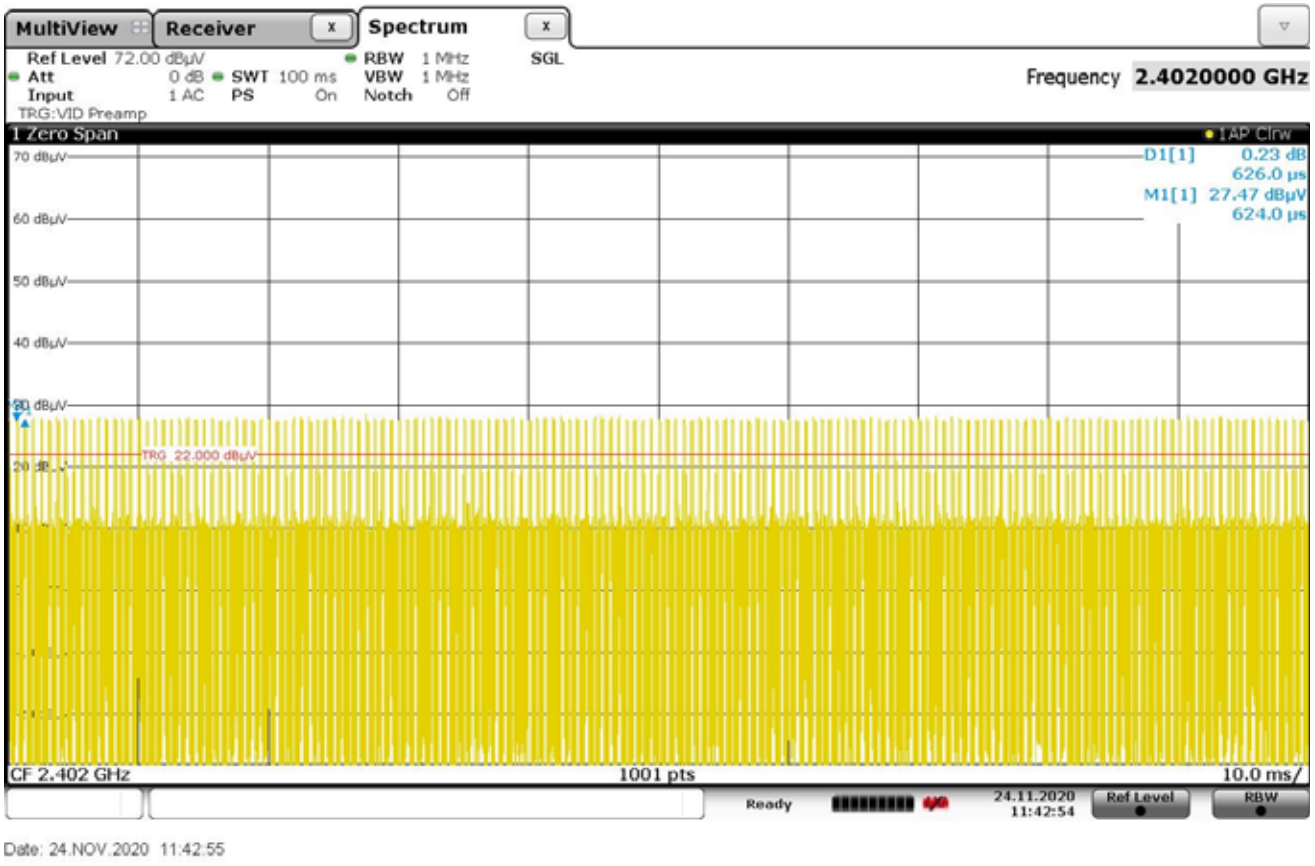
Date: 24.NOV.2020 11:44:35

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	626usec period
Notes	None



Date: 24.NOV.2020 11:42:09

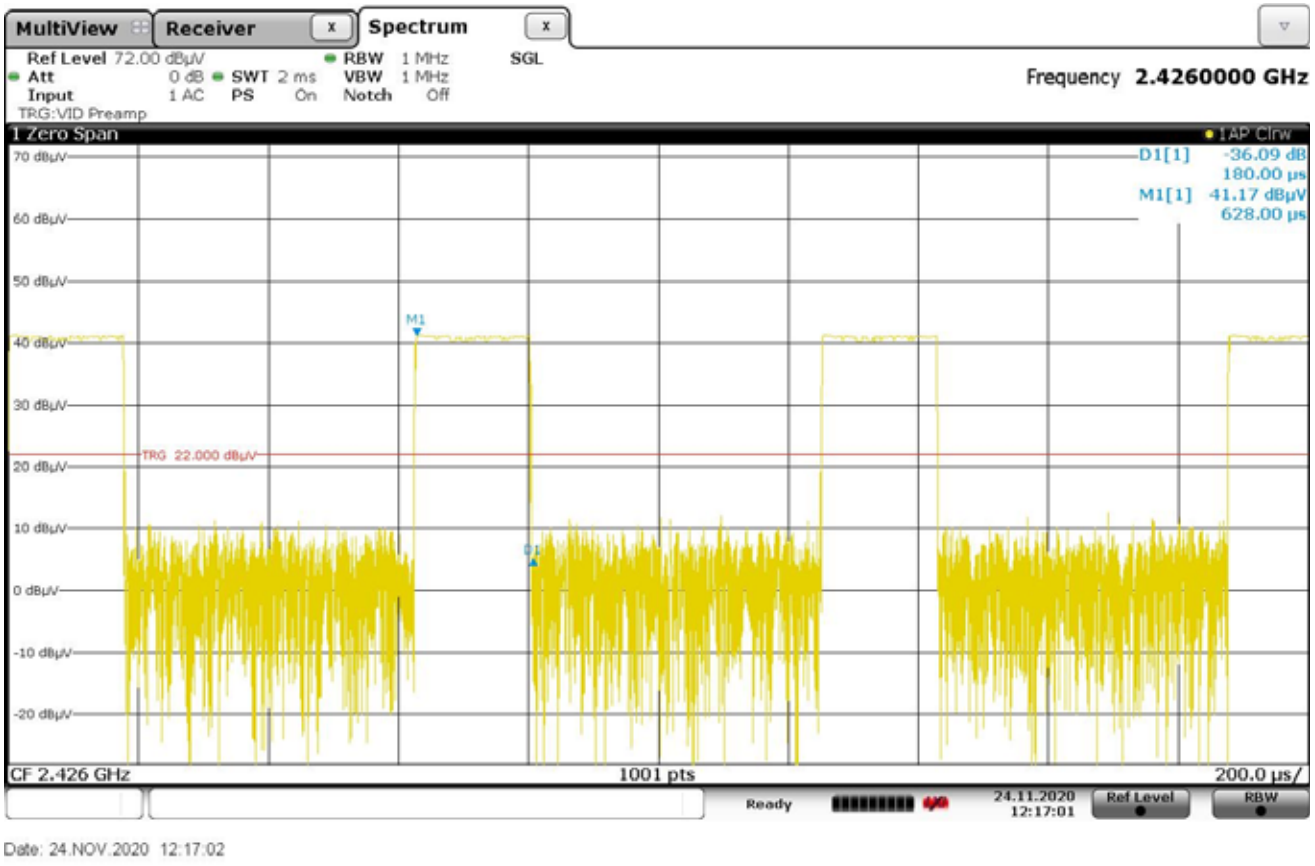
Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	100msec sweep shows the duty cycle is constant
Notes	None



Duty Cycle (D) = 180usec/626usec = 0.288

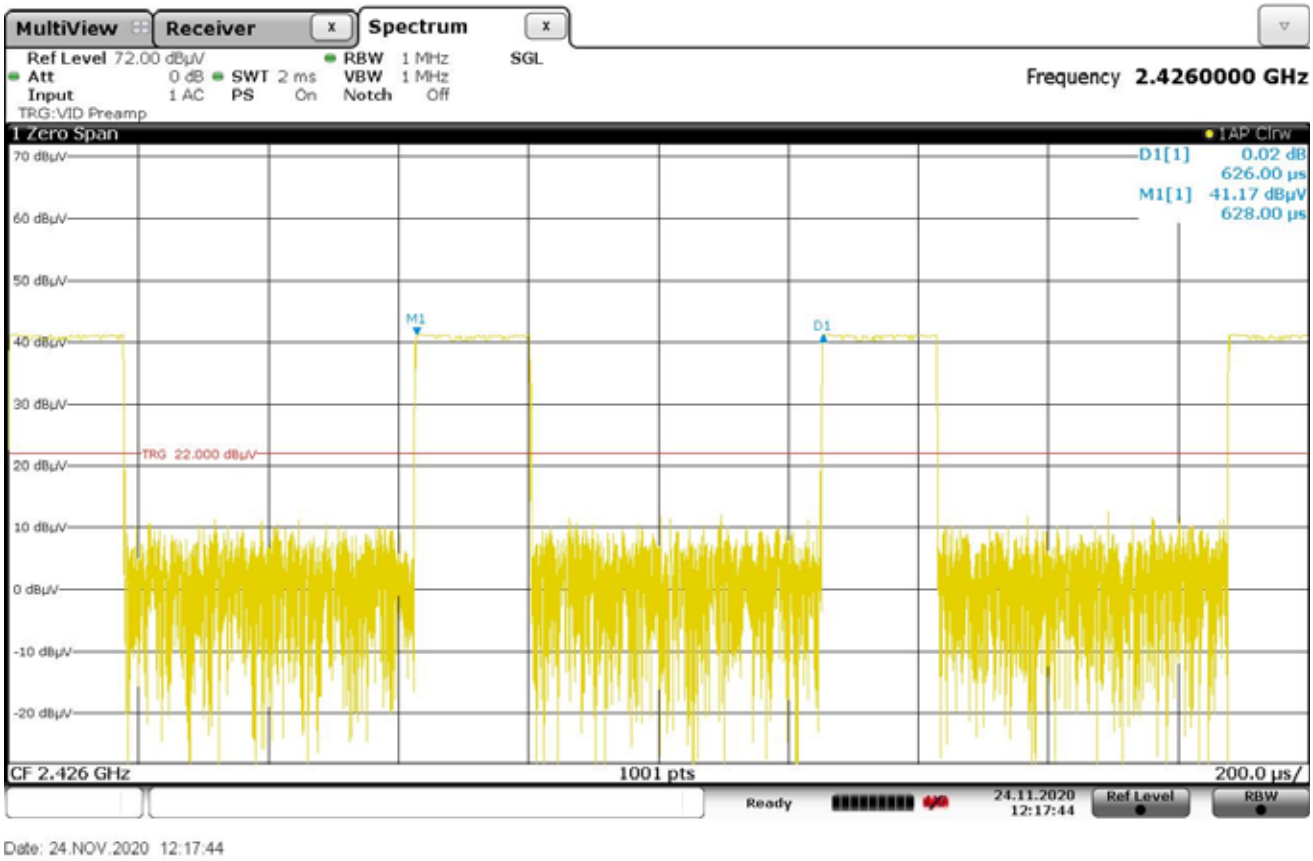
$\text{Duty Cycle Factor} = 20\log(\frac{1}{D})$ = 10.83

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Parameters	On time = 180usec
Notes	None



Date: 24.NOV.2020 12:17:02

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Parameters	626usec period
Notes	None



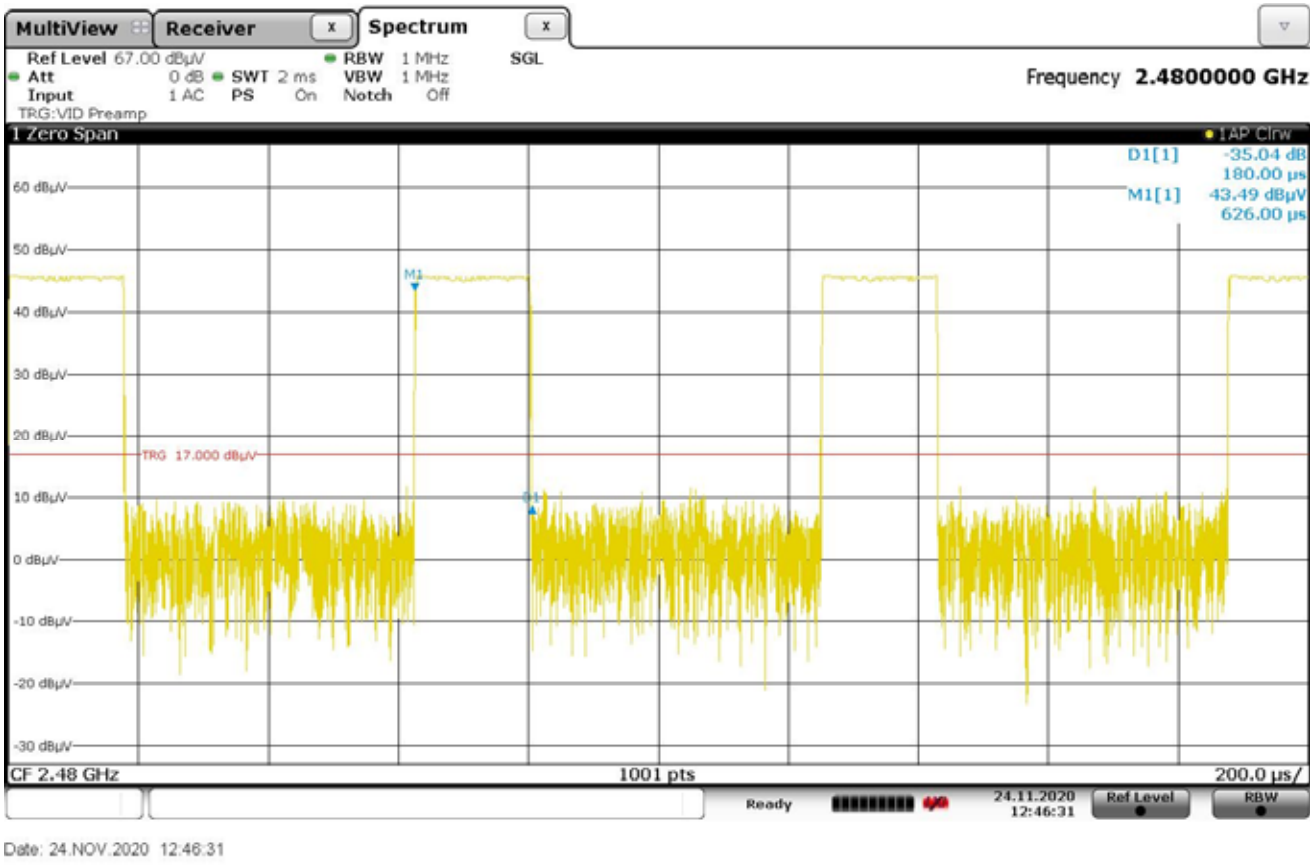
Date: 24.NOV.2020 12:17:44

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Parameters	100msec sweep shows the duty cycle is constant
Notes	None

Duty Cycle (D) = 180usec/626usec = 0.288

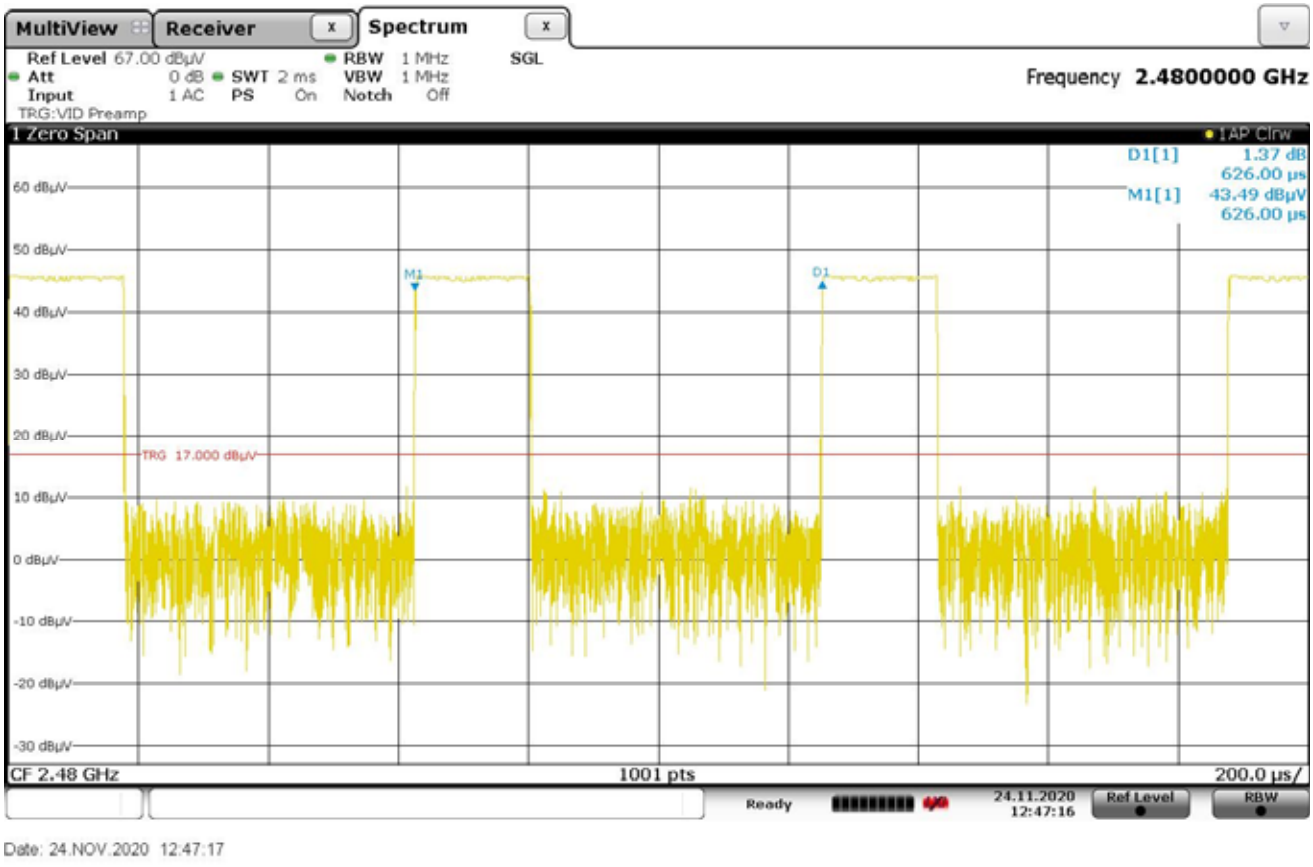
$\text{Duty Cycle Factor} = 20\log(\frac{1}{D})$ = 10.83

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Parameters	On time = 180usec
Notes	None



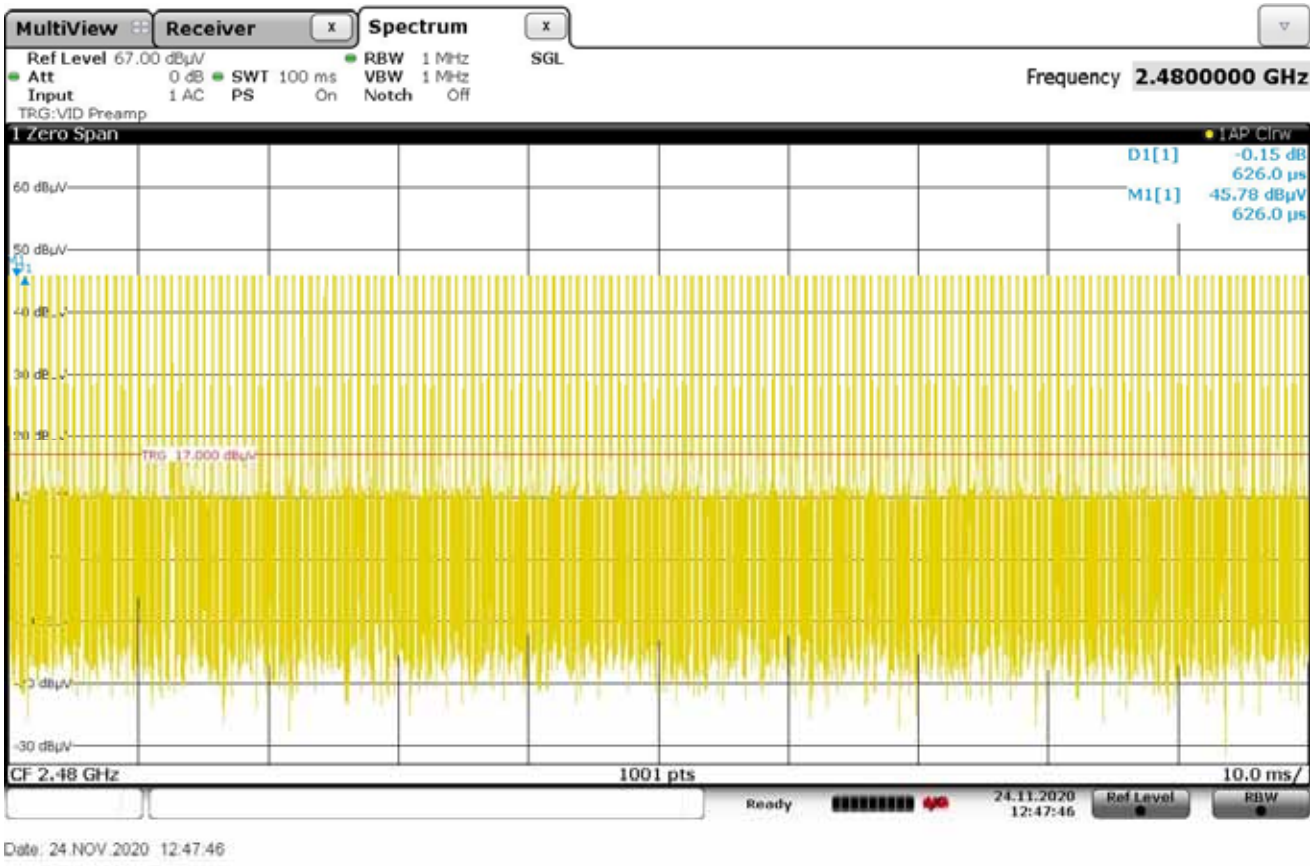
Date: 24.NOV.2020 12:46:31

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Parameters	626usec period
Notes	None



Date: 24.NOV.2020 12:47:17

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Parameters	100msec sweep shows the duty cycle is constant
Notes	None



Duty Cycle (D) = 180usec/626usec = 0.288

$\text{Duty Cycle Factor} = 20\log(\frac{1}{D})$ = 10.83

25. Case Spurious Radiated Emissions

Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #2
Mode	See Below

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Notes	The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Procedures
Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads. Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function. The final open field emission tests were then manually performed over the frequency range of 30MHz to 25GHz. 1) For all harmonics not in the restricted bands, the following procedure was used: a) The field strength of the fundamental was measured using a double ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a

non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

b) The field strengths of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:

i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.

d) All harmonics not in the restricted bands must be at least 20 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.

2) For all emissions in the restricted bands, the following procedure was used:

a) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a non-conductive stand. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.

c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:

i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.

d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.

e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment

under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

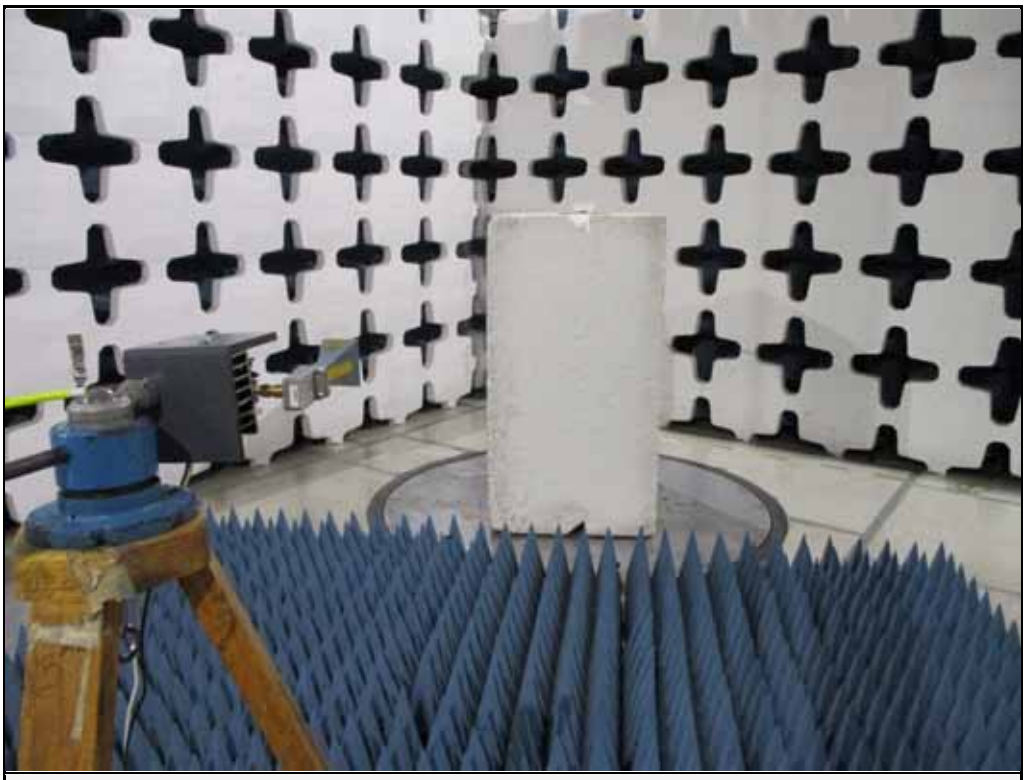
f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken.

Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization Horizontal

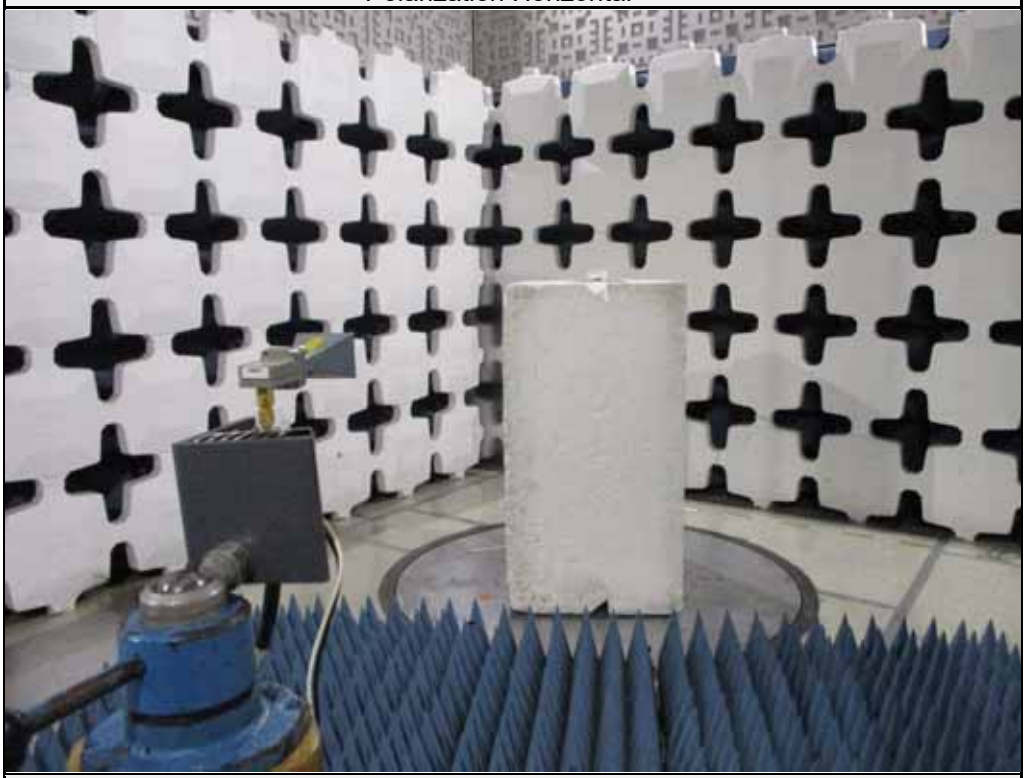
Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization Vertical

Test Setup for Spurious Radiated Emissions, 1GHz to 18GHz – Antenna Polarization Horizontal

Test Setup for Spurious Radiated Emissions, 1GHz to 18GHz – Antenna Polarization Vertical



Test Setup for Spurious Radiated Emissions, 1GHz to 18GHz – Antenna Polarization Horizontal



Test Setup for Spurious Radiated Emissions, 1GHz to 18GHz – Antenna Polarization Vertical

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2402MHz
Parameters	Peak Measurements in the Restricted Bands
Notes	None

Frequency (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
4804.00	H	50.3	Ambient	4.8	34.5	-40.2	49.4	294.2	5000.0	-24.6
4804.00	V	49.8	Ambient	4.8	34.5	-40.2	48.9	277.8	5000.0	-25.1
12010.00	H	48.3	Ambient	8.0	38.6	-39.9	55.0	565.0	5000.0	-18.9
12010.00	V	48.7	Ambient	8.0	38.6	-39.9	55.4	591.6	5000.0	-18.5
19216.00	H	32.2	Ambient	2.2	40.4	-28.2	46.6	213.4	5000.0	-27.4
19216.00	V	32.4	Ambient	2.2	40.4	-28.2	46.8	217.6	5000.0	-27.2

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2402MHz
Parameters	Average Measurements in the Restricted Bands
Notes	None

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4804.00	H	35.3	Ambient	4.8	34.5	-40.2	10.8	45.2	182.1	500.0	-8.8
4804.00	V	35.4	Ambient	4.8	34.5	-40.2	10.8	45.3	184.2	500.0	-8.7
12010.00	H	34.5	Ambient	8.0	38.6	-39.9	10.8	52.1	401.4	500.0	-1.9
12010.00	V	34.5	Ambient	8.0	38.6	-39.9	10.8	52.1	401.4	500.0	-1.9
19216.00	H	15.1	Ambient	2.2	40.4	-28.2	10.8	40.3	103.0	500.0	-13.7
19216.00	V	14.9	Ambient	2.2	40.4	-28.2	10.8	40.1	101.1	500.0	-13.9

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2402MHz
Parameters	Peak Measurements not in the Restricted Bands
Notes	None

							Peak	Peak	Peak	
		Meter		CBL	Ant	Pre	Total	Total	Limit	
Freq.	Ant	Reading		Fac	Fac	Amp	dBuV/m	uV/m	uV/m	Margin
MHz	Pol	(dBuV)	Ambient	(dB)	(dB/m)	(dB)	at 3m	at 3 m	at 3 m	(dB)
2402.00	H	40.5		3.4	32.2	0.0	76.1	6406.1		
2402.00	V	33.0		3.4	32.2	0.0	68.6	2701.4		
7206.00	H	59.6		6.1	35.7	-40.3	61.1	1131.2	5000.0	-12.9
7206.00	V	57.4		6.1	35.7	-40.3	58.9	878.1	5000.0	-15.1
9608.00	H	38.6		6.8	36.7	-40.3	41.8	122.9	5000.0	-32.2
9608.00	V	38.2		6.8	36.7	-40.3	41.4	117.3	5000.0	-32.6
14412.00	H	37.9	Ambient	8.7	39.8	-39.6	46.9	220.4	5000.0	-27.1
14412.00	V	37.7	Ambient	8.7	39.8	-39.6	46.7	215.4	5000.0	-27.3
16814.00	H	37.3	Ambient	9.4	43.4	-39.2	51.0	353.4	5000.0	-23.0
16814.00	V	37.4	Ambient	9.4	43.4	-39.2	51.1	357.4	5000.0	-22.9

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2426MHz
Parameters	Peak Measurements in the Restricted Bands
Notes	None

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4852.00	H	50.1	Ambient	4.9	34.4	-40.2	49.2	287.9	5000.0	-24.8
4852.00	V	49.7	Ambient	4.9	34.4	-40.2	48.8	275.0	5000.0	-25.2
7278.00	H	62.8		6.1	35.7	-40.3	64.3	1645.5	5000.0	-9.7
7278.00	V	59.2		6.1	35.7	-40.3	60.7	1087.2	5000.0	-13.3
12130.00	H	48.2	Ambient	8.0	38.8	-39.9	55.1	566.6	5000.0	-18.9
12130.00	V	48.8	Ambient	8.0	38.8	-39.9	55.7	607.2	5000.0	-18.3
19408.00	H	32.5	Ambient	2.2	40.4	-27.7	47.4	233.4	5000.0	-26.6
19408.00	V	32.1	Ambient	2.2	40.4	-27.7	47.0	225.0	5000.0	-26.9

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2426MHz
Parameters	Average Measurements in the Restricted Bands
Notes	None

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4852.00	H	35.3	Ambient	4.9	34.4	-40.2	10.8	45.2	182.3	500.0	-8.8
4852.00	V	35.3	Ambient	4.9	34.4	-40.2	10.8	45.2	182.3	500.0	-8.8
7278.00	H	40.40		6.1	35.7	-40.3	10.8	52.8	434.3	500.0	-1.2
7278.00	V	39.0		6.1	35.7	-40.3	10.8	51.4	369.7	500.0	-2.6
12130.00	H	33.2	Ambient	8.0	38.8	-39.9	10.8	50.9	350.6	500.0	-3.1
12130.00	V	33.2	Ambient	8.0	38.8	-39.9	10.8	50.9	350.6	500.0	-3.1
19408.00	H	14.8	Ambient	2.2	40.4	-27.7	10.8	40.5	106.4	500.0	-13.4
19408.00	V	14.9	Ambient	2.2	40.4	-27.7	10.8	40.6	107.3	500.0	-13.4

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2426MHz
Parameters	Peak Measurements not in the Restricted Bands
Notes	None

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2426.00	H	42.5		3.5	32.4	0.0	78.4	8276.8		
2426.00	V	35.1		3.5	32.4	0.0	71.0	3530.7		
9704.00	H	38.4	Ambient	6.9	36.8	-40.3	41.8	122.8	5000.0	-32.2
9704.00	V	37.4	Ambient	6.9	36.8	-40.3	40.8	109.4	5000.0	-33.2
14556.00	H	38.2	Ambient	8.8	40.0	-39.6	47.4	235.7	5000.0	-26.5
14556.00	V	38.2	Ambient	8.8	40.0	-39.6	47.4	235.7	5000.0	-26.5
16982.00	H	37.9	Ambient	9.5	43.2	-39.2	51.4	371.6	5000.0	-22.6
16982.00	V	37.6	Ambient	9.5	43.2	-39.2	51.1	359.0	5000.0	-22.9
21834.00	H	21.6	Ambient	2.2	40.6	-28.9	35.5	59.6	5000.0	-38.5
21834.00	V	21.6	Ambient	2.2	40.6	-28.9	35.5	59.8	5000.0	-38.5
24260.00	H	21.6	Ambient	2.2	40.6	-29.4	35.0	56.3	5000.0	-39.0
24260.00	V	21.7	Ambient	2.2	40.6	-29.4	35.2	57.3	5000.0	-38.8

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2480MHz
Parameters	Peak Measurements in the Restricted Bands
Notes	None

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4960.00	H	50.6	Ambient	4.9	34.3	-40.0	49.8	310.1	5000.0	-24.2
4960.00	V	49.9	Ambient	4.9	34.3	-40.0	49.1	286.0	5000.0	-24.9
7440.00	H	61.0		6.2	35.6	-40.3	62.5	1338.6	5000.0	-11.4
7440.00	V	58.6		6.2	35.6	-40.3	60.1	1015.4	5000.0	-13.8
12400.00	H	48.6	Ambient	8.0	39.0	-40.0	55.6	604.4	5000.0	-18.4
12400.00	V	49.4	Ambient	8.0	39.0	-40.0	56.4	662.7	5000.0	-17.6
19840.00	H	32.3	Ambient	2.2	40.4	-28.0	46.9	220.7	5000.0	-27.1
19840.00	V	32.1	Ambient	2.2	40.4	-28.0	46.7	217.2	5000.0	-27.2
22320.00	H	32.2	Ambient	2.2	40.6	-28.8	46.1	202.6	5000.0	-27.8
22320.00	V	32.7	Ambient	2.2	40.6	-28.8	46.7	215.6	5000.0	-27.3

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2480MHz
Parameters	Average Measurements in the Restricted Bands
Notes	None

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4960.00	H	34.5	Ambient	4.9	34.3	-40.0	10.8	44.6	169.0	500.0	-9.4
4960.00	V	34.5	Ambient	4.9	34.3	-40.0	10.8	44.6	169.0	500.0	-9.4
7440.00	H	39.50		6.2	35.6	-40.3	10.8	51.9	391.9	500.0	-2.1
7440.00	V	38.8		6.2	35.6	-40.3	10.8	51.2	361.5	500.0	-2.8
12400.00	H	33.4		8.0	39.0	-40.0	10.8	51.3	365.5	500.0	-2.7
12400.00	V	33.5		8.0	39.0	-40.0	10.8	51.4	369.7	500.0	-2.6
19840.00	H	15.2	Ambient	2.2	40.4	-28.0	10.8	40.6	107.5	500.0	-13.4
19840.00	V	15.1	Ambient	2.2	40.4	-28.0	10.8	40.6	106.7	500.0	-13.4
22320.00	H	15.6	Ambient	2.2	40.6	-28.8	10.8	40.4	104.3	500.0	-13.6
22320.00	V	15.5	Ambient	2.2	40.6	-28.8	10.8	40.3	103.7	500.0	-13.7

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2480MHz
Carrier Frequency	2480MHz
Parameters	Peak Measurements not in the Restricted Bands
Notes	None

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2480.00	H	45.7		3.5	32.5	0.0	81.7	12208.9		
2480.00	V	36.7		3.5	32.5	0.0	72.7	4331.9		
9920.00	H	39.1	Ambient	7.0	37.0	-40.3	42.8	138.7	5000.0	-31.1
9920.00	V	38.3	Ambient	7.0	37.0	-40.3	42.0	126.5	5000.0	-31.9
14880.00	H	37.5	Ambient	8.9	40.4	-39.6	47.2	230.1	5000.0	-26.7
14880.00	V	37.7	Ambient	8.9	40.4	-39.6	47.4	235.4	5000.0	-26.5
17360.00	H	37.8	Ambient	9.7	42.4	-39.4	50.4	332.6	5000.0	-23.5
17360.00	V	37.6	Ambient	9.7	42.4	-39.4	50.2	325.0	5000.0	-23.7
24800.00	H	22.9	Ambient	2.2	40.6	-29.3	36.4	66.3	5000.0	-37.6
24800.00	V	22.6	Ambient	2.2	40.6	-29.3	36.1	63.8	5000.0	-37.9

26. Band-Edge Compliance

Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #1
Mode	See Below

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted (low band-edge) & Radiated (high band-edge)
Type of Test Site	Semi-Anechoic Chamber for radiated tests
Notes	None

Procedures

Low Band Edge

1) The antenna port of the EUT was connected to the spectrum analyzer.
2) The EUT was set to transmit continuously at the channel closest to the low band-edge.
3) To determine the band edge compliance, the following spectrum analyzer settings were used:

a. Center frequency = low band-edge frequency.
b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
c. Resolution bandwidth (RBW) = 100kHz.
d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
f. The analyzer's display was plotted using a 'screen dump' utility.

High Band Edge

1) The EUT was set to transmit continuously at the channel closest to the high band-edge.
2) A double ridged waveguide was placed 3 meters away from the EUT. The antenna was connected to the input of a spectrum analyzer.
3) The center frequency of the analyzer was set to the high band edge (2483.5MHz)
4) The resolution bandwidth was set to 1MHz.
5) To ensure that the maximum or worst case emission level was measured, the following steps were taken:

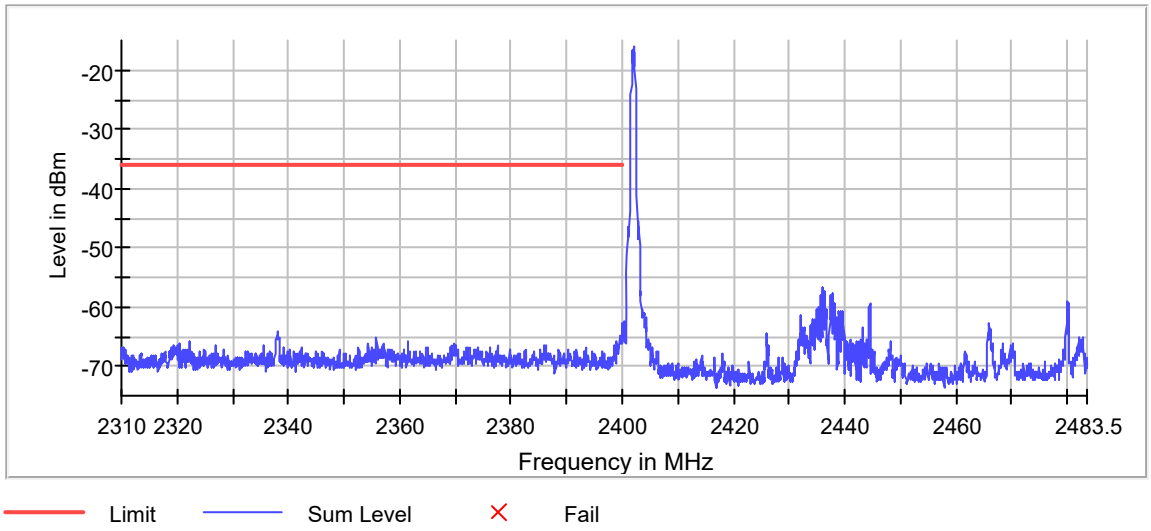
a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
b. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna

polarization to maximize the readings.

6) The highest measured peak reading was recorded.
7) The highest measured average reading was recorded.

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	Low Band-Edge
Notes	None



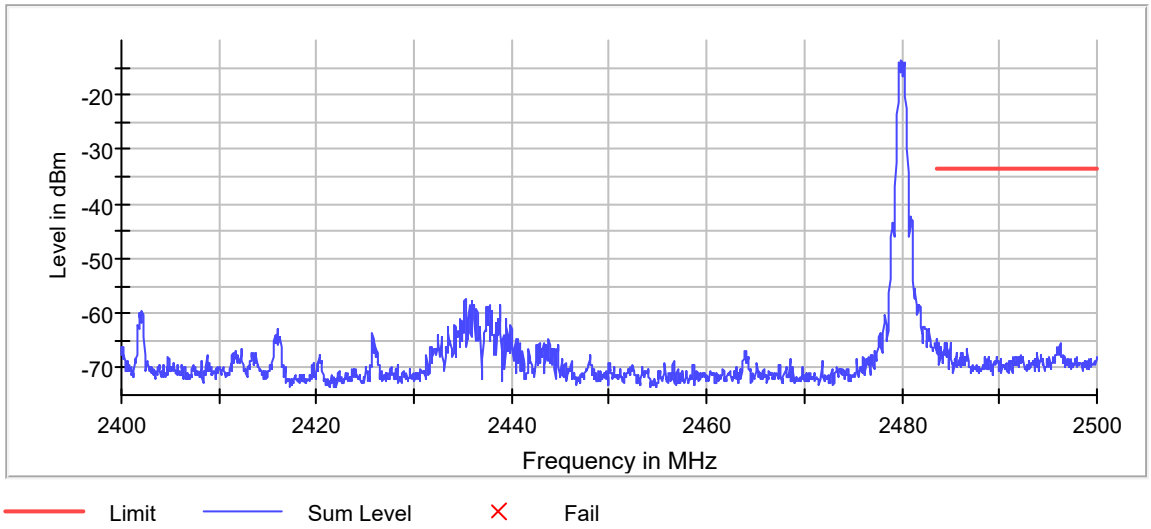
Inband Peak

Frequency (MHz)	Level (dBm)
2401.975000	-16.2

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-62.8	26.6	-36.2	PASS
2399.925000	-63.7	27.5	-36.2	PASS
2338.025000	-64.2	28.0	-36.2	PASS
2337.975000	-64.3	28.1	-36.2	PASS
2338.175000	-64.8	28.6	-36.2	PASS
2399.525000	-64.9	28.7	-36.2	PASS
2399.875000	-64.9	28.7	-36.2	PASS
2337.925000	-65.0	28.8	-36.2	PASS
2399.475000	-65.0	28.8	-36.2	PASS
2355.875000	-65.0	28.8	-36.2	PASS
2355.825000	-65.0	28.9	-36.2	PASS
2399.675000	-65.1	29.0	-36.2	PASS
2338.075000	-65.2	29.0	-36.2	PASS
2338.125000	-65.2	29.0	-36.2	PASS
2338.275000	-65.3	29.1	-36.2	PASS

Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #2
Mode	Transmit at 2480MHz
Carrier Frequency	2480MHz
Parameters	High Band-Edge
Notes	None



Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2483.50	H	16.7	Ambient	3.5	32.5	0.0	52.7	432.9	5000.0	-21.3
2483.69	V	16.4	Ambient	3.5	32.5	0.0	52.4	418.2	5000.0	-21.6

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2483.50	H	1.0	Ambient	3.5	32.5	0.0	10.8	47.9	247.1	500.0	-6.1
2483.69	V	1.0	Ambient	3.5	32.5	0.0	10.8	47.9	247.1	500.0	-6.1

27. Power Spectral Density

Test Information	
Manufacturer	Honeywell
Product	Photo/Thermal self-test smoke detector
Model	FSP-951T-SELFT
Serial No	Sample #1
Mode	Transmit at 2402MHz

Information	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	EMC Test Bench
Type of Antennas Used	NA
Notes	None

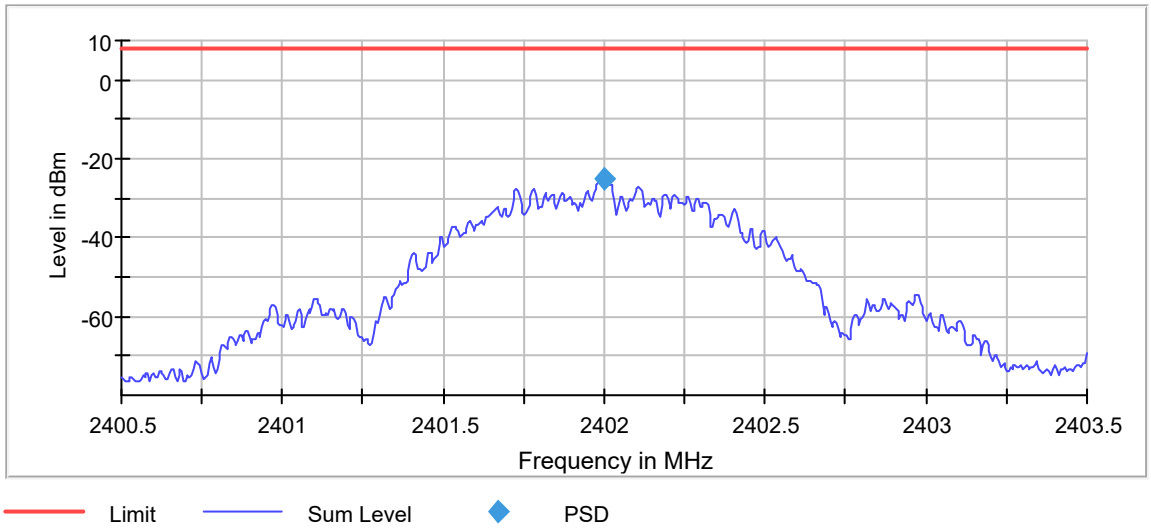
Requirements
The power spectral density from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Procedures
The EUT was placed on the non-conductive stand and set to transmit continuously. The antenna port of the EUT was connected to the spectrum analyzer. To determine the power spectral density, the following steps were followed: 1) Center frequency = transmit frequency 2) Span = 1.5 times the DTS (6 dB) bandwidth 3) Resolution bandwidth (RBW): 3kHz ≤ RBW ≤ 100kHz 4) Sweep time = auto 5) The peak detector and 'Max-Hold' function was engaged. 6) The display line represents the 8 dBm limit 7) The analyzer's display was plotted using a 'screen dump' utility. 8) If the measured value exceeded the limit, the RBW was reduced (no less than 3kHz) and repeated.

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

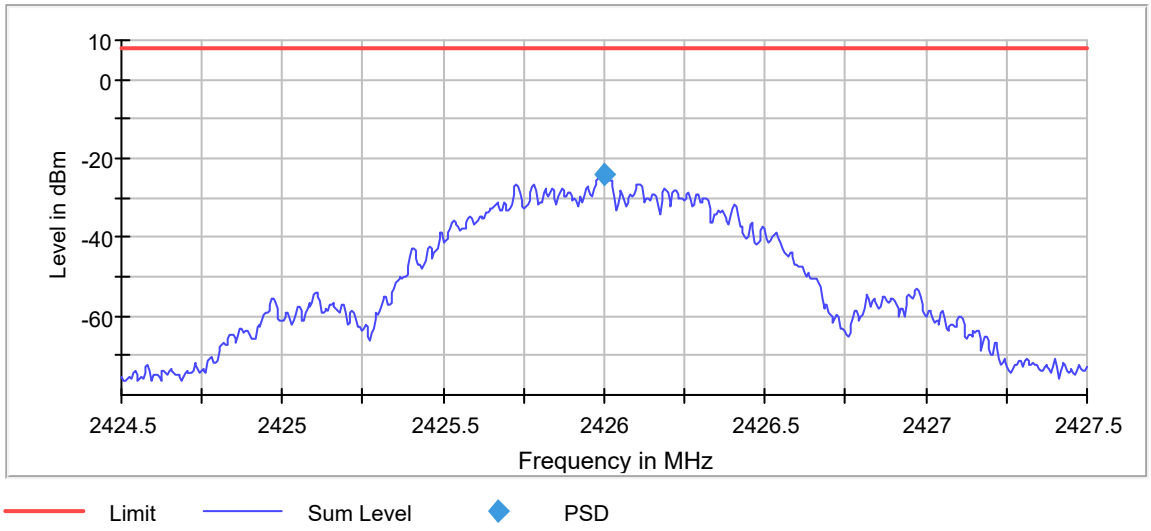
Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2402MHz
Parameters	PSD = -25.297dBm
Notes	None

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)
2402.000000	2401.997500	-25.297	8.0



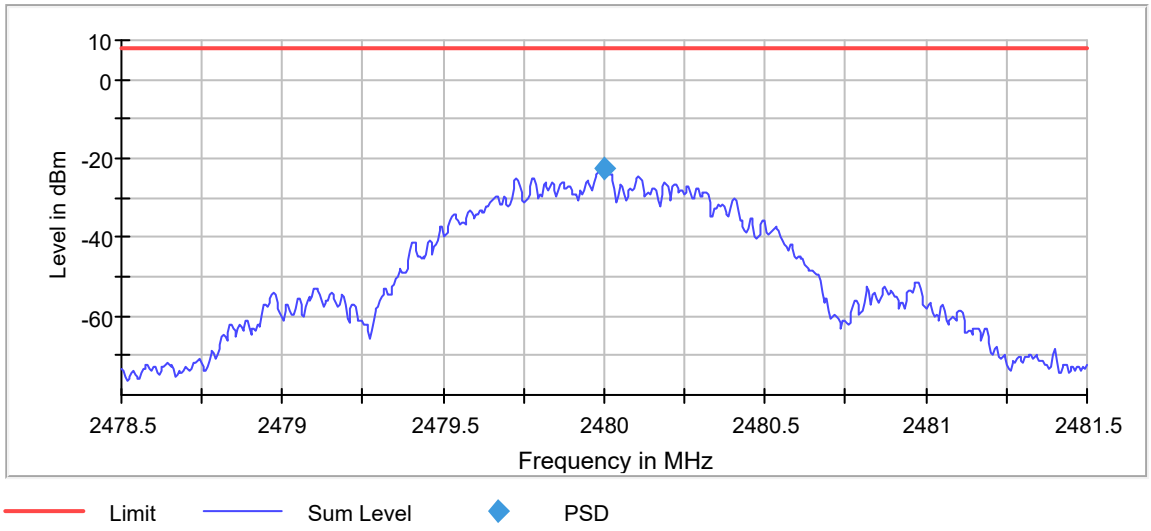
Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2426MHz
Parameters	PSD = -24.200dBm
Notes	None

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)
2426.000000	2425.997500	-24.200	8.0



Test Details	
Manufacturer	Honeywell
Model	FSP-951T-SELFT
S/N	Sample #1
Mode	Transmit at 2480MHz
Parameters	PSD = -22.543dBm
Notes	None

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)
2480.000000	2479.997500	-22.543	8.0



28. Scope of Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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ELECTRICAL

Valid to: June 30, 2021 Certificate Number: 1786.01

In recognition of the successful completion of the A2LA Accreditation Program evaluation process, accreditation is granted to this laboratory to perform the following automotive electromagnetic compatibility and other electrical tests:

Test Technology:	Test Method(s)[1]:
Transient Immunity	ISO 7637-2 (including emissions); ISO 7637-3; ISO 16750-2:2012, Sections 4.6.3 and 4.6.4; CS-11979, Section 6.4; CS.00054, Section 5.9; EMC-CS-2009.1 (CI220); FMC1278 (CI220, CI221, CI222); GMW 3097, Section 3.5; SAE J1113-11; SAE J1113-12
Electrostatic Discharge (ESD)	ISO 10605 (2001, 2008); CS-11979 Section 7.0; CS.00054, Section 5.10; EMC-CS-2009.1 (CI 280); FMC1278 (CI280); SAE J1113-13; GMW 3097 Section 3.6
Conducted Emissions	CISPR 25 (2002, 2008), Sections 6.2 and 6.3; CISPR 25 (2016), Sections 6.3 and 6.4; CS-11979, Section 5.1; CS.00054, Sections 5.6.1 and 5.6.2; GMW 3097, Section 3.3.2; EMC-CS-2009.1 (CE 420); FMC1278 (CE420, CE421)
Radiated Emissions Anechoic	CISPR 25 (2002, 2008), Section 6.4; CISPR 25 (2016), Section 6.5; CS-11979, Section 5.3; CS.00054, Section 5.6.3; GMW 3097, Section 3.3.1; EMC-CS-2009.1 (RE 310); FMC1278 (RE310)
Vehicle Radiated Emissions	CISPR 12; ICES-002

Test Technology:	Test Method(s)[1]:
Bulk Current Injection (BCI)	ISO 11452-4; CS-11979, Section 6.1; CS.00054, Section 5.8.1; GMW 3097, Section 3.4.1; SAE J1113-4; EMC-CS-2009.1 (RI112); FMC1278 (RI112)
Bulk Current Injections (BCI) *(Closed Loop Method)*	ISO 11452-4; SAE J1113-4
Radiated Immunity Anechoic *(Including Radar Pulse)*	ISO 11452-2; ISO 11452-5; CS-11979, Section 6.2; CS.00054, Section 5.8.2; GMW 3097, Section 3.4.2; EMC-CS-2009.1 (RI114); FMC1278 (RI114); SAE J1113-21
Radiated Immunity Magnetic Field	ISO 11452-8
Radiated Immunity Reverb	ISO/IEC 61000-4-21; GMW 3097, Section 3.4.3; EMC-CS-2009.1 (RI114); FMC1278 (RI114); ISO 11452-11
Radiated Immunity *(Portable Transmitters)*	ISO 11452-9; EMC-CS-2009.1 (RI115); FMC1278 (RI115)
Vehicle Radiated Immunity (ALSE)	ISO 11451-2
Electrical Loads	ISO 16750-2, Sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.11, and 4.12
Dielectric Withstand Voltage	MIL-STD-202, Method 301; EIA-364-20D
Insulation Resistance	MIL-STD-202, Method 302; SAE/USCAR-2, Revision 6, Section 5.5.1; EIA-364-21D
Contact Resistance	MIL-STD-202, Method 307; SAE/USCAR-2, Revision 6, Section 5.3.1; EIA/ECA-364-23C; USCAR21-3 Section 4.5.3
DC Resistance	MIL-STD-202, Method 303
Contact Chatter	MIL-STD-202, Method 310; SAE/USCAR-2, Revision 6, Section 5.1.9
Voltage Drop	SAE/USCAR-2, Revision 6, Section 5.3.2; USCAR21-3 Section 4.5.6

Test Technology:	Test Method(s)[1]:
Emissions	
Radiated and Conducted (3m Semi-anechoic chamber, up to 40 GHz)	47 CFR, FCC Part 15 B (using ANSI C63.4:2014); 47 CFR, FCC Part 18 (using FCC MP-5:1986); ICES-001; ICES-003; ICES-005; IEC/CISPR 11, Ed. 4.1 (2004-06); AS/NZS CISPR 11 (2004); IEC/CISPR 11 Ed 5 (2009-05) + A1 (2010); KN 11 (2008-5) with RRL Notice No. 2008-3 (May 20, 2008); CISPR 11; EN 55011; KN 11; CNS 13803 (1997, 2003); CISPR 14-1; EN 55014-1; AS/NZS CISPR 14.1; KN 14-1; IEC/CISPR 22 (1997); EN 55022 (1998) + A1(2000); EN 55022 (1998) + A1(2000) + A2(2003); EN 55022 (2006); IEC/CISPR 22 (2008-09); AS/NZS CISPR 22 (2004); AS/NZS CISPR 22, 3rd Edition (2006); KN 22 (up to 6 GHz); CNS 13438 (up to 6 GHz); VCCI V-3 (up to 6 GHz); CISPR 32; EN 55032; KN 32
Current Harmonics	IEC 61000-3-2; EN 61000-3-2; KN 61000-3-2
Flicker and Fluctuations	IEC 61000-3-3; EN 61000-3-3; KN 61000-3-3
Immunity	
Electrostatic Discharge	IEC 61000-4-2, Ed. 1.2 (2001); IEC 61000-4-2 (1995) + A1(1998) + A2(2000); EN 61000-4-2 (1995); EN 61000-4-2 (2009-05); KN 61000-4-2 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-2; EN 61000-4-2; KN 61000-4-2; IEEE C37.90.3 2001
Radiated Immunity	IEC 61000-4-3 (1995) + A1(1998) + A2(2000); IEC 61000-4-3, Ed. 3.0 (2006-02); IEC 61000-4-3, Ed. 3.2 (2010); KN 61000-4-3 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-3; EN 61000-4-3; KN 61000-4-3; IEEE C37.90.2 2004
Electrical Fast Transient/Burst	IEC 61000-4-4, Ed. 2.0 (2004-07); IEC 61000-4-4, Ed. 2.1 (2011); IEC 61000-4-4 (1995) + A1(2000) + A2(2001); KN 61000-4-4 (2008-5); RRL Notice No. 2008-5 (May 20, 2008); IEC 61000-4-4; EN 61000-4-4; KN 61000-4-4
Surge	IEC 61000-4-5 (1995) + A1(2000); IEC 61000-4-5, Ed 1.1 (2005-11); EN 61000-4-5 (1995) + A1(2001); KN 61000-4-5 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-5; EN 61000-4-5; KN 61000-4-5; IEEE C37.90.1 2012

Test Technology:	Test Method(s)[1]:
Immunity (cont'd)	
Conducted Immunity	IEC 61000-4-6 (1996) + A1(2000); IEC 61000-4-6, Ed 2.0 (2006-05); IEC 61000-4-6 Ed. 3.0 (2008); KN 61000-4-6 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); EN 61000-4-6 (1996) + A1(2001); IEC 61000-4-6; EN 61000-4-6; KN 61000-4-6
Power Frequency Magnetic Field Immunity	IEC 61000-4-8 (1993) + A1(2000); IEC 61000-4-8 (2009); EN 61000-4-8 (1994) + A1(2000); KN 61000-4-8 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-8; EN 61000-4-8; KN 61000-4-8
Voltage Dips, Short Interrupts, and Line Voltage Variations	IEC 61000-4-11, Ed. 2 (2004-03); KN 61000-4-11 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-11; EN 61000-4-11; KN 61000-4-11
Ring Wave	IEC 61000-4-12, Ed. 2 (2006-09); EN 61000-4-12:2006; IEC 61000-4-12; EN 61000-4-12; KN 61000-4-12
Generic and Product Specific EMC Standards	IEC/EN 61000-6-1; AS/NZS 61000-6-1; KN 61000-6-1; IEC/EN 61000-6-2; AS/NZS 61000-6-2; KN 61000-6-2; IEC/EN 61000-6-3; AS/NZS 61000-6-3; KN 61000-6-3; IEC/EN 61000-6-4; AS/NZS 61000-6-4; KN 61000-6-4; EN 50130-4; IEC 61326-1; IEC/CISPR 14-2; EN 55014-2; AS/NZS CISPR 14.2; KN 14-2; IEC/CISPR 24; AS/NZS CISPR 24; EN 55024; KN 24; IEC 60601-1-2; JIS T0601-1-2
TxRx EMC Requirements	EN 301 489-1; EN 301 489-3; EN 301 489-9; EN 301 489-17; EN 301 489-19; EN 301 489-52;
European Radio Test Standards	ETSI EN 300 086-1; ETSI EN 300 086-2; ETSI EN 300 113-1; ETSI EN 300 113-2; ETSI EN 300 220-1; ETSI EN 300 220-2; ETSI EN 300 330-1; ETSI EN 300 330-2; ETSI EN 300 440-1; ETSI EN 300 440-2; ETSI EN 300 422-1; ETSI EN 300 422-2; ETSI EN 300 328; ETSI EN 301 893; ETSI EN 301 511; ETSI EN 301 908-1; ETSI EN 908-2; ETSI EN 908-13; ETSI EN 301 413; ETSI EN 302 502

Test Technology:	Test Method(s)[1]:
Canadian Radio Tests	RSS-102 (RF Exposure Evaluation only); RSS-111; RSS-112; RSS-117; RSS-119; RSS-123; RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133; RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141; RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192; RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210; RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222; RSS-236; RSS-238; RSS-243; RSS-244; RSS-246; RSS-247; RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-GEN
Mexico Radio Tests	IFT-008; NOM-208-SCFI
Japan Radio Tests	Radio Law No. 131, Ordinance of MPT No. 37, 1981, MIC Notification No. 88:2004, Table No. 22-11; ARIB STD-T66, Regulation 18
Taiwan Radio Tests	LP-0002
Australia/New Zealand Radio Tests	AS/NZS 4268; Radiocommunications (Short Range Devices) Standard (2014)
Hong Kong Radio Tests	HKCA 1039 Issue 6; HKCA 1042; HKCA 1033 Issue 7; HKCA 1061; HKCA 1008; HKCA 1043; HKCA 1057; HKCA 1073
Korean Radio Test Standards	KN 301 489-1; KN 301 489-3; KN 301 489-9; KN 301 489-17; KN 301 489-52
Unlicensed Radio Frequency Devices *(3 Meter Semi-Anechoic Room)*	47 CFR FCC Part 15C, 15D, 15E, 15F, 15G, 15H (using ANSI C63.10:2013, ANSI C63.17:2013 and FCC KDB 905462 D02 (v02))
Licensed Radio Service Equipment	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101; ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015;
OTA (Over the Air) Performance GSM, GPRS, EGPRS UMTS (W-CDMA) LTE including CAT M1 A-GPS for UMTS/GSM LTS A-GPS, A-GLONASS, SIB8/SIB16 Large Device/Laptop/Tablet Testing Integrated Device Testing WiFi 802.11 a/b/g/n/ac	CTIA Test Plan for Wireless Device Over-the-Air Performance (Method for Measurement for Radiated Power and Receiver Performance) V3.8.2; CTIA Test Plan for RF Performance Evaluation of WiFi Mobile Converged Devices V2.1.0

Test Technology:	Test Method(s)[1]:
Electrical Measurements and Simulation	
AC Voltage / Current	FAA AC 150/5345-10H
(1mV to 5kV) 60 Hz	FAA AC 150/5345-43J
(0.1V to 250V) up to 500 MHz	FAA AC 150/5345-44K
(1µA to 150A) 60 Hz	FAA AC 150/5345-46E
DC Voltage / Current	FAA AC 150/5345-47C
(1mV to 15-kV) / (1µA to 10A)	FAA EB 67D
Power Factor / Efficiency / Crest Factor	
(Power to 30kW)	
Resistance	
(1mΩ to 4000MΩ)	
Surge	
(Up to 10 kV / 5 kA) (Combination Wave and Ring Wave)	

On the following products and materials:
Telecommunications Terminal Equipment (TTE), Radio Equipment, Network Equipment, Information Technology Equipment (ITE), Automotive Electronic Equipment, Automotive Hybrid Electronic Devices, Maritime Navigation and Radio Communication Equipment and Systems, Vehicles, Boats and Internal Combustion Engine Driven Devices, Automotive, Aviation, and General Lighting Products, Medical Electrical Equipment, Motors, Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment, Household Appliances, Electric Tools, Low-voltage Switchgear and Control gear, Programmable Controllers, Electrical Equipment for Measurement, Control and Laboratory Use, Base Materials, Power and Data Transmission Cables and Connectors

[1] When the date, revision or edition of a test method standard is not identified on the scope of accreditation, the laboratory is expected to be using the current version within one year of the date of publication, per part C., Section 1 of A2LA *R101 - General Requirements - Accreditation of ISO-IEC 17025 Laboratories*.

Testing Activities Performed in Support of FCC Declaration of Conformity and Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[2]

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
Unintentional Radiators Part 15B	ANSI C63.4:2014	40000
Industrial, Scientific, and Medical Equipment Part 18	FCC MP-5 (February 1986)	40000
Intentional Radiators Part 15C	ANSI C63.10:2013	40000
Unlicensed Personal Communication Systems Devices Part 15D	ANSI C63.17:2013	40000

Testing Activities Performed in Support of FCC Declaration of Conformity and Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[2]

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
U-NII without DFS Intentional Radiators Part 15E	ANSI C63.10:2013	40000
U-NII with DFS Intentional Radiators Part 15E	FCC KDB 905462 D02 (v02)	40000
UWB Intentional Radiators Part 15F	ANSI C63.10:2013	40000
BPL Intentional Radiators Part 15G	ANSI C63.10:2013	40000
White Space Device Intentional Radiators Part 15H	ANSI C63.10:2013	40000
Commercial Mobile Services (FCC Licensed Radio Service Equipment) Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
General Mobile Radio Services (FCC Licensed Radio Service Equipment) Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97, and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment) Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
Maritime and Aviation Radio Services Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	40000
Microwave and Millimeter Bands Radio Services Parts 25, 30, 74, 90 (above 3 GHz), 97 (above 3 GHz), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
Broadcast Radio Services Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000

Testing Activities Performed in Support of FCC Declaration of Conformity and Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[2]

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
Signal Boosters Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters) Section 90.219	ANSI C63.26:2015	40000

[2]Accreditation does not imply acceptance to the FCC equipment authorization program. Please see the FCC website (https://apps.fcc.gov/oetcf/eas/) for a listing of FCC approved laboratories.

Accredited Laboratory

A2LA has accredited

ELITE ELECTRONIC ENGINEERING INC.

Downers Grove, IL

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 8th day of August 2019.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1786.01
Valid to June 30, 2021

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.