



Testing Tomorrow's Technology

Application

For

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart B, paragraph 15.109, Subpart C, paragraphs 15.207, 15.209 and 15.249

And

**Innovation Science and Economic Development Canada
Certification Per
IC RSS-Gen General Requirements for Radio Apparatus (Issue 5)
And
RSS-210, License Exempt Radio Apparatus Category I Equipment (Issue 9)**

For the

**Inventek Systems
Model: ISM14585-L35-P8**

**FCC ID: O7P-14585
IC ID: 10147A-14585**

**UST Project: 18-0392
Issue Date: October 31, 2019**

Total Pages in This Report: 41

**3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com**



I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: George Yang

Name: 

Title: Laboratory Manager

Date October 31, 2019



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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Inventek Systems

MODEL: ISM14585-L35-P8

FCC ID: O7P-14585

IC ID: 10147A-14585

DATE: October 18, 2019

This report concerns (check one): Original grant
Class II change

Equipment type: 2402 – 2480 MHz Transmitter Module

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No X

If yes, defer until: N/A
date

agrees to notify the Commission by N/A
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transmitter details:

BLE 5.0 SiP transmitter module

Operating frequency: 2402 – 2480 MHz

Summary of Test Results

FCC Rule	Description of Test	Result
15.207	Power line conducted emissions	PASS
15.209	Radiated spurious emissions	PASS
15.249(a)	Radiated spurious emissions	PASS
15.249(d)	Out of band spurious emissions	PASS

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Agency Agreement
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Test Configuration Photographs
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1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 249 and RSS-210 Issue 9.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on September 23, 2019 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the Inventek 2.4 GHz BLE 5.0 SiP Module, Model: ISM14585-L35-P8. The EUT is an embedded wireless Bluetooth low energy (BLE) IoT radio, based on the Dialog Semiconductor DA14585 radio SoC (System on Chip). The ISM14585-L35 offers designers all the benefits of the industry-leading DA14580 technology but with even greater flexibility to create more advanced applications from the smallest footprints and power budgets. The Inventek ISM14585-L35 provides smarter, more flexible, and even lower power BLE connectivity with an integrated 32bit Cortex™-M0 (16MHz), processor, an integrated PMU (Power Management Unit), an integrated PA (Power Amplifier), an integrated RTC, 128kB of ROM, 64KB OTP, 1MB SPI Flash as well as a foot print compatible options for an additional integrated 4Mb, 8Mb, or 16Mb of Flash.

Radio: BLE 5.0 SiP
Range: 2402-2480 MHz
Modulation: GFSK
Data Rate: Mbps (Max): 1 Mbps
Channels: 40

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1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014)*, and *ANSI C63.10.2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in separate Appendices

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC under designation number US5301. Additionally, this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

1.6 Related Submittals

The EUT is subject to the following FCC authorizations:

- a) Certification under section 15.249 as a transmitter.

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Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
Inventek	ISM14585-L35-P8	Engineering Sample	FCC ID: O7P-14585 IC ID: 10147A-14585	UD
Dell (Laptop)	Latitude E6400	00180-833-274-349	Unknown	-
Dell (Power Supply Adapter)	SA90Ps0-00	CN-0YD644-69802-6BE-00PQ	Not Applicable	3.0 m UP
Antenna See antenna details	--	--	--	--

U= Unshielded
S= Shielded
P= Power
D= Data

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2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are indicated.

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	8/17/2020 2 yr.
SPECTRUM ANALYZER	DSA815	RIGOL	DSA8A18030 0138	1/11/2020 2 yr (extended)
LOOP ANTENNA	SAS- 200/562	A. H. Systems	142	1/22/2020 2 yr.
BICONICAL ANTENNA	3110B	EMCO	9307-1431	10/23/2019 2 yr
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	2/1/2021 2 yr
HORN ANTENNA	3115	EMCO	9107-3723	11/28/2020 2 yr
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT- PACKARD	1937A02980	5/7/2020
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT- PACKARD	3008A00480	4/8/2020
HIGH PASS FILTER	H3R020G2	MICROWAVE CHIRCUITS	001DC9528	4/2/2020
LISN x 2	9247-50-TS- 50-N	SOLAR ELECTRONICS	955824 and 955825	4/3/2020

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

2.3 Number of Measurements for Intentional Radiators (CFR 15.31(m), RSS-Gen 6.8)

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 below.

Table 3. Number of Test Frequencies for Intentional Radiators

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of Operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near the top 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 1 near bottom

Because the EUT operates at 2402 MHz to 2480 MHz, 3 test frequencies were used.

2.4 Frequency Range of Radiated Measurements (CFR 15.33, RSS-Gen 6.13)

2.4.1 Intentional Radiator

The spectrum was investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10th harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

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2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range tested was 30 MHz to 1000 MHz, or to 5 times the highest internal clock frequency.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35, RSS-Gen 6.9, 6.13)

The radiated and conducted emissions limits shown herein are based on the parameters listed below.

2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may be expressed logarithmically in dB.

NOTE: If the transmitter was programmed to transmit at >98% duty cycle, then, wherever applicable (where the detection mode was AVG), the duty cycle factor calculated will be applied.

2.6 EUT Antenna Requirements (CFR 15.203, RSS-Gen 6.7)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this device.

Table 4. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dBi	TYPE OF CONNECTOR
Internal Antenna	Inventek Systems	Integrated	N/A	-1.0	Internally embedded
External Antenna	Inventek Systems	Trace	B24P-W	+3.2	W.FL

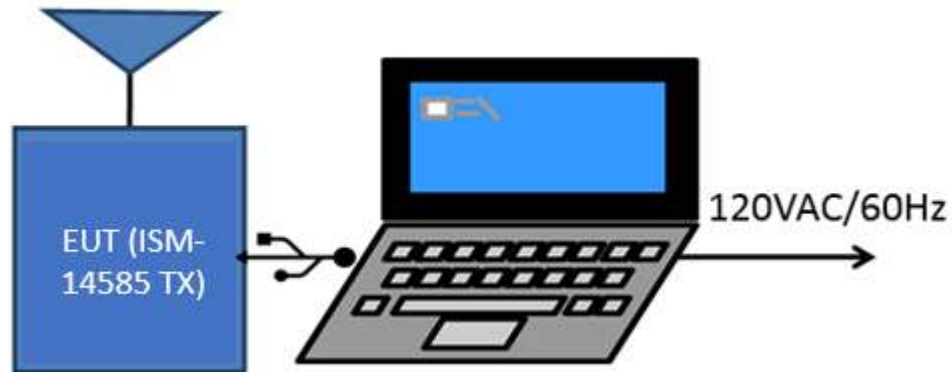


Figure 1. Block Diagram of Test Configuration

Note: The laptop is used for programming the radio module only.

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2.7 Restricted Bands of Operation (CFR 15.205, RSS-Gen 8.10)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious emissions cannot exceed the limits of 15.209. Radiated harmonics and other spurious emissions are examined for this requirement see paragraph 2.1

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2.8 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207, RSS-8.8)

The EUT was evaluated for compliance to 15.207 emissions.

Table 5. Power Line Conducted Emissions Test Data, Part 15.207

150KHz to 30 MHz						
Test: Power Line Conducted Emissions				Client: Inventek Systems		
Project: 18-0392				Model: ISM14585		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Results (dBuV)	AVG Limits (dBuV)	Margin (dB)	Detector PK, QP, or AVG
Phase						
0.1797	50.65	0.39	51.04	*64.5	13.5	PK
0.1797	47.96	0.39	48.35	54.5	6.2	QP
0.5713	42.73	0.14	42.87	*56.0	13.1	PK
0.5713	39.47	0.14	39.61	46.0	6.4	QP
3.8720	43.77	0.21	43.98	*56.0	12.0	PK
3.8720	37.65	0.21	37.86	46.0	8.1	QP
5.1230	40.13	0.24	40.37	50.0	9.6	PK
10.5430	32.58	0.42	33.00	50.0	17.0	PK
24.1090	30.32	0.73	31.05	50.0	18.9	PK
Neutral						
0.1527	51.52	0.45	51.97	*65.9	13.9	QP
0.1527	36.67	0.45	37.12	55.9	18.7	AVG
0.5456	39.86	0.14	40.00	46.0	6.0	PK
2.7670	39.54	0.18	39.72	46.0	6.3	PK
5.9630	36.65	0.24	36.89	50.0	13.1	PK
11.6520	30.32	0.41	30.73	50.0	19.3	PK
28.0230	30.77	0.91	31.68	50.0	18.3	PK

(*) Indicates Quasi-Peak limits were used.

Sample Calculation at: 0.1797 MHz

Magnitude of Measured Frequency	50.65	dBuV
+Antenna Factor + Cable Loss	0.39	dB
Corrected Result	51.04	dBuV/m

Test Date: October 4, 2019

Tested By

Signature: 

Name: Afzal Fazal

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2.9 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249(a),(c), RSS 210, A2.9 (a))

Radiated Spurious measurements: the EUT was programmed to transmit at its maximum rated output power level, +6.0 dBm and placed into a continuous transmit mode of operation transmitting at >98% duty cycle and tested per ANSI C63.10:2013. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the device. To obtain worse case results the EUT was tested in X, Y and Z axes or in the orientation of normal operation if the device is designed to operation in a fixed position.

Radiated measurements were then conducted between the frequency range of 9 KHz (or lowest frequency used/generated by the device) up to the tenth harmonic of the device (no greater than 40 GHz). In the band below 30 MHz a resolution bandwidth (RBW) of 9 kHz was used; emissions below 1 GHz were tested with a RBW of 120 KHz and emissions above 1 GHz were tested with a RBW of 1 MHz. All video bandwidth settings were at least three times the RBW value.

The EUT was investigated to CFR 15.209, General requirements for unwanted spurious emissions. Both radios are exactly identical except for the antenna connection. For thoroughness both radio versions were evaluated and test data for each version has been included here for review.

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Table 6. Spurious Radiated Emissions Below 30 MHz

9 kHz to 30 MHz, 15.209 limits							
Test: Radiated Emissions				Client: Inventek Systems			
Project: 18-0392				Model: ISM414585-EVB			
Frequency (MHz)	Test Data (dBuv)	AF+CA-AMP (dB/m)	Results (dBuV/m)	QP Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or AVG
No emissions seen higher than 20 dB below the applicable limit.							

Sample Calculation: N/A

Test Date: October 3, 2019

Tested By

Signature: 

Name: Afzal Fazal

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**Table 7. Spurious Radiated Emissions (other than Fundamental & Harmonics)
 – Internal Antenna**

Test: FCC Part 15, Paragraph 15.209, 15.249(a)					Client: Inventek Systems			
Project: 18-0392					Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
45.31	44.29	-	-15.13	29.16	40.0	3m./VERT	10.8	QP
63.00	49.82	-	-17.00	32.82	40.0	3m./VERT	7.2	QP
63.46	50.43	-	-17.00	33.43	40.0	3m./HORZ	6.6	QP
99.75	48.69	-	-17.17	31.52	43.5	3m./HORZ	12.0	PK
99.75	52.14	-	-17.17	34.97	43.5	3m./VERT	8.5	PK
120.05	46.94	-	-15.44	31.50	43.5	3m./HORZ	12.0	PK
126.74	47.81	-	-14.93	32.88	43.5	3m./HORZ	10.6	PK
128.89	47.71	-	-14.91	32.80	43.5	3m./VERT	10.7	PK
135.47	48.29	-	-14.60	33.69	43.5	3m./HORZ	9.8	PK
286.18	47.96	-	-11.59	36.37	46.0	3m./HORZ	9.6	PK
231.78	47.57	-	-14.08	33.49	46.0	3m./VERT	12.5	PK
232.46	48.95	-	-14.08	34.87	46.0	3m./HORZ	11.1	PK
1102.02	47.85	-	-10.00	37.85	54.0	3.0m./HORZ	16.1	PK
1195.04	50.14	-	-9.70	40.44	54.0	3.0m./VERT	13.6	PK
7199.85	42.29	-9.50	15.00	47.79	54.0	1.0m./VERT	6.2	PK
12000.00	22.68	-9.50	23.46	36.64	54.0	1.0m./HORZ	17.4	AVG
13000.00	21.41	-9.50	23.49	35.40	54.0	1.0m./VERT	18.6	AVG
17900.00	20.29	-9.50	37.19	47.98	54.0	1.0m./HORZ	6.0	AVG
17900.00	20.14	-9.50	36.94	47.58	54.0	1.0m./VERT	6.4	AVG

All other emissions were more than 20 dB below the applicable limit.

1. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
2. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with the duty cycle programmed for >98% ON time in continuous transmit mode.
3. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at: 45.31 MHz

Magnitude of Measured Frequency	44.29	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-15.13	dB/m
Duty Cycle Correction Factor	None	dB
Corrected Result	29.16	dBuV/m

Test Date: October 2, 2019

Tested By

Signature: 

Name: Afzal Fazal

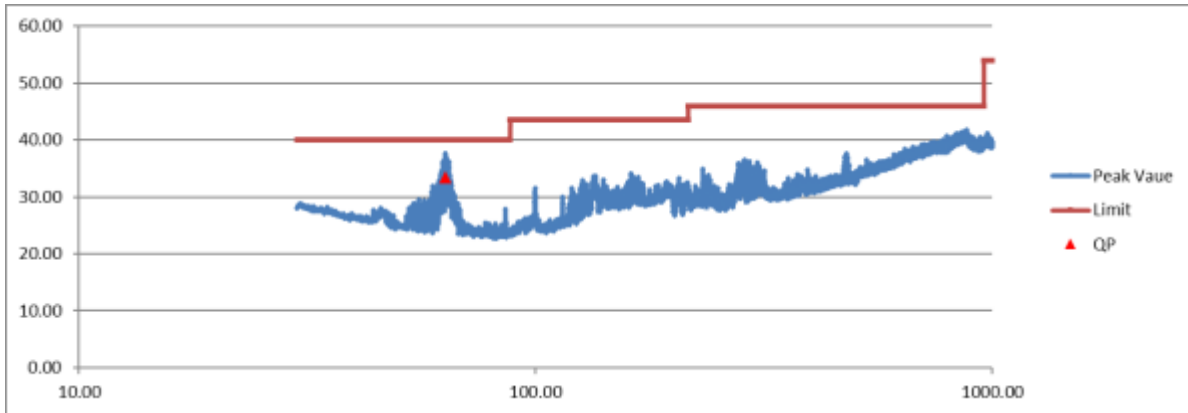


Figure 2. Radiated Emissions Graphical Data, 30-1000 MHz – Horizontal (Internal Antenna)

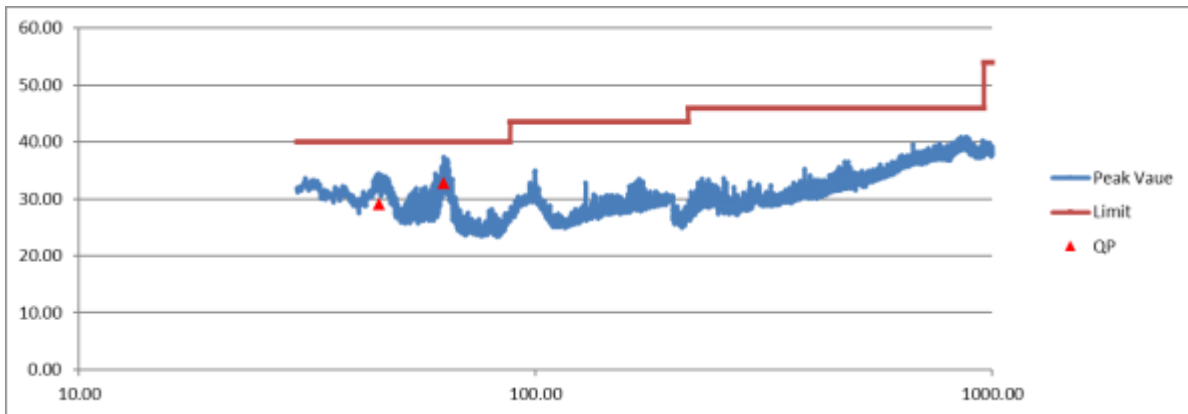


Figure 3. Radiated Emissions Graphical Data, 30-1000 MHz – Vertical (Internal Antenna)

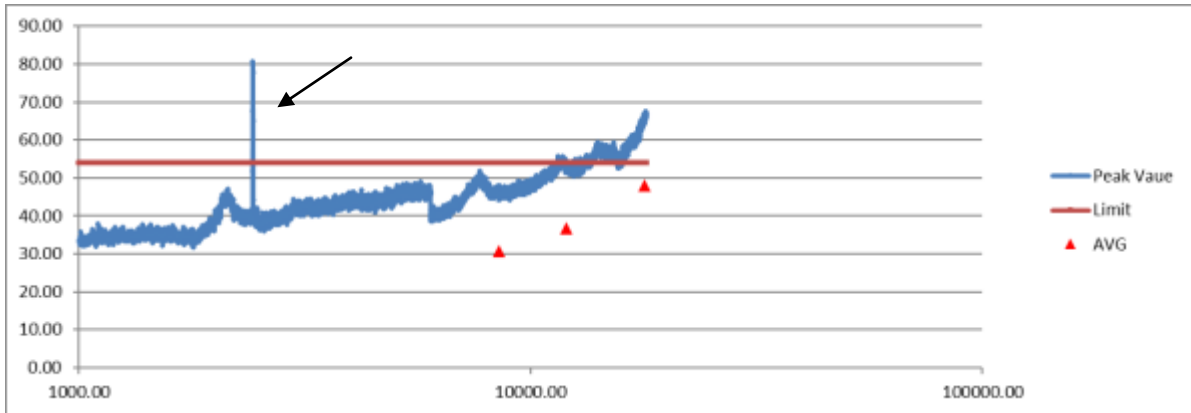


Figure 4. Radiated Emissions Graphical Data, 1-18 GHz – Horizontal (Internal Antenna)

Note: Arrow points to fundamental signal from the radio module. These emissions are ignored for the verification test.

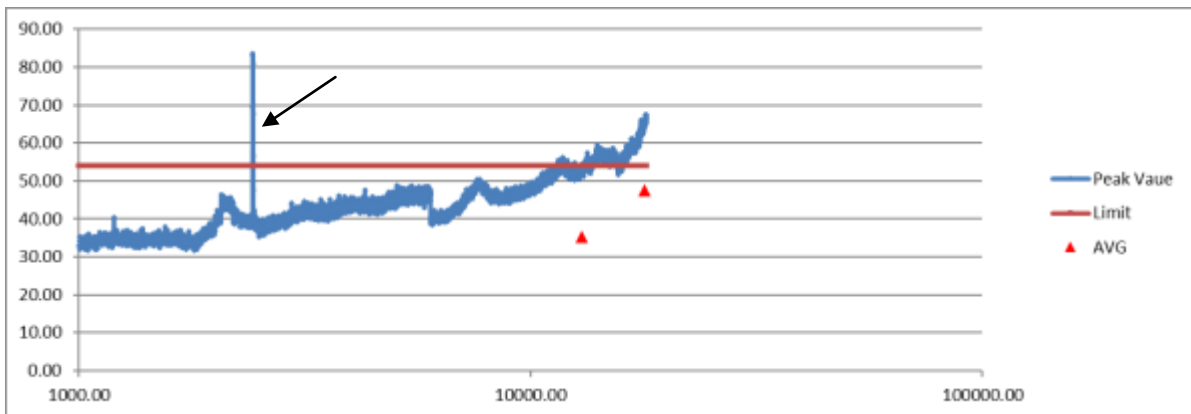


Figure 5. Radiated Emissions Graphical Data, 1-18 GHz – Vertical (Internal Antenna)

Note: Arrow points to fundamental signal from the radio module. These emissions are ignored for the verification test.

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Table 8. Spurious Radiated Emissions (other than Fundamental & Harmonics) – External Antenna


Test: FCC Part 15, Paragraph 15.209, 15.249(a)					Client: Inventek Systems			
Project: 18-0392					Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
46.10	46.44	-	-15.33	31.11	40.0	3m./VERT	8.9	QP
60.39	47.83	-	-16.69	31.14	40.0	3m./HORZ	8.9	QP
60.39	50.68	-	-16.69	33.99	40.0	3m./VERT	6.0	QP
99.75	50.35	-	-17.17	33.18	43.5	3m./VERT	10.3	PK
120.05	49.37	-	-15.44	33.93	43.5	3m./HORZ	9.6	QP
120.39	48.27	-	-15.44	32.83	43.5	3m./VERT	10.7	PK
126.40	49.82	-	-14.93	34.89	43.5	3m./VERT	8.6	PK
127.19	50.32	-	-14.83	35.49	43.5	3m./HORZ	8.0	QP
134.00	49.35	-	-14.49	34.86	43.5	3m./VERT	8.6	PK
135.36	48.57	-	-14.60	33.97	43.5	3m./HORZ	9.5	QP
233.26	48.73	-	-14.11	34.62	46.0	3m./HORZ	11.4	PK
233.95	49.18	-	-14.11	35.07	46.0	3m./VERT	10.9	PK
278.18	47.83	-	-11.85	35.98	46.0	3m./HORZ	10.0	PK
1193.04	50.10	-	-9.70	40.40	54.0	3.0m./VERT	13.6	PK
1259.05	47.74	-	-9.32	38.42	54.0	3.0m./HORZ	15.6	PK
8663.41	41.76	-9.50	15.36	47.62	54.0	1.0m./VERT	6.4	PK
13000.00	21.18	-9.50	23.37	35.05	54.0	1.0m./HORZ	19.0	AVG
13000.00	21.12	-9.50	23.49	35.11	54.0	1.0m./VERT	18.9	AVG
17900.00	20.04	-9.50	37.19	47.73	54.0	1.0m./HORZ	6.3	AVG
17900.00	20.57	-9.50	36.94	48.01	54.0	1.0m./VERT	6.0	AVG

- Notes: 1. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
 2. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with the duty cycle programmed for >98% ON time in continuous transmit mode.
 3. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at: 46.10 MHz

Magnitude of Measured Frequency	46.44	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-15.33	dB/m
Duty Cycle Correction Factor	None	dB
Corrected Result	31.11	dBuV/m

Test Date: October 3, 2018

Tested By
 Signature: 

Name: Afzal Fazal

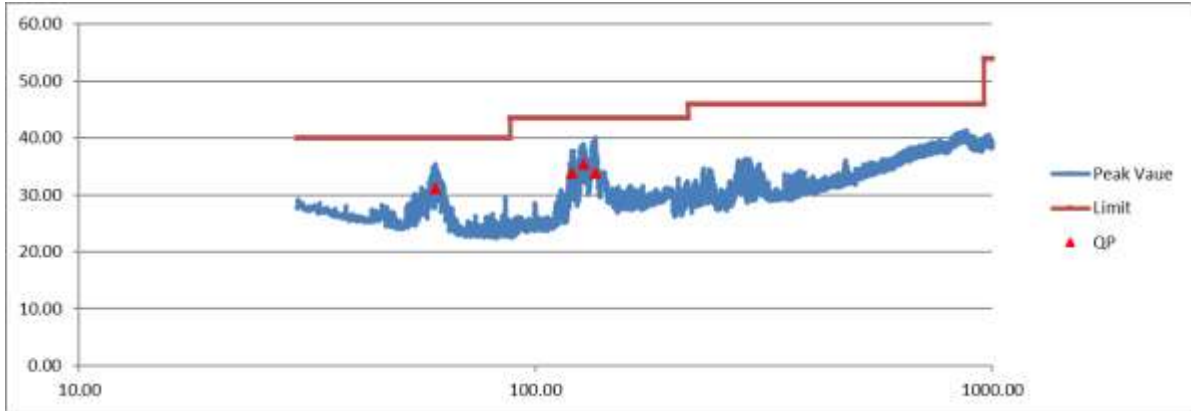


Figure 6. Radiated Emissions Graphical Data, 30-1000 MHz – Horizontal (External Antenna)

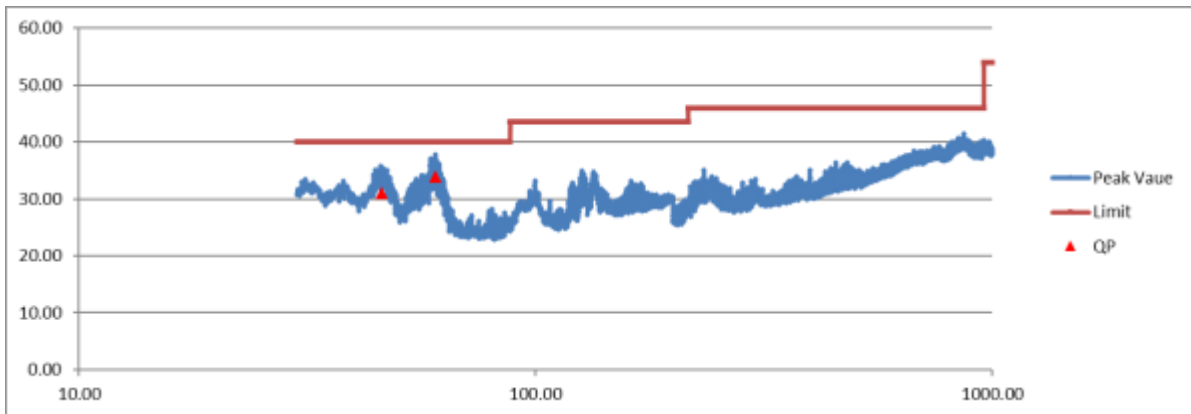


Figure 7. Radiated Emissions Graphical Data, 30-1000 MHz – Vertical (External Antenna)

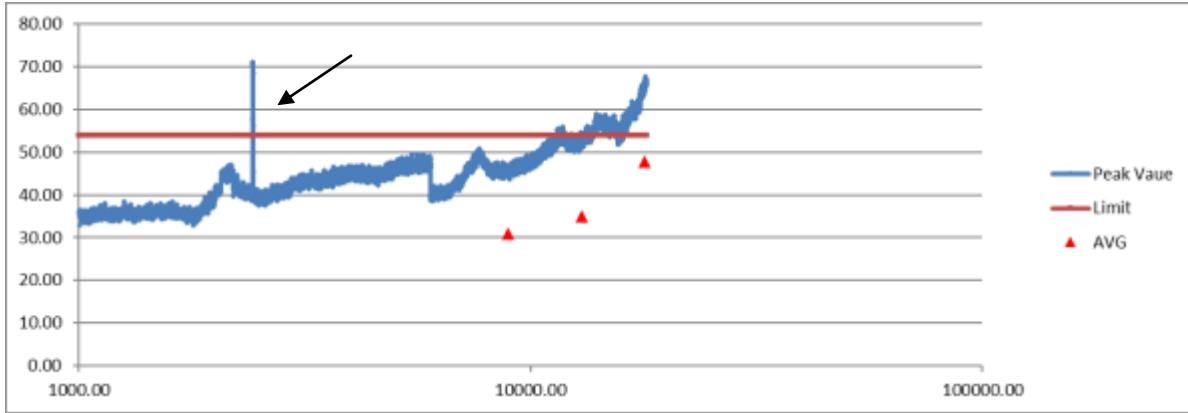


Figure 8. Radiated Emissions Graphical Data, 1-18 GHz – Horizontal (External Antenna)

Note: Arrow points to fundamental signal from the radio module. These emissions are ignored for the verification test.

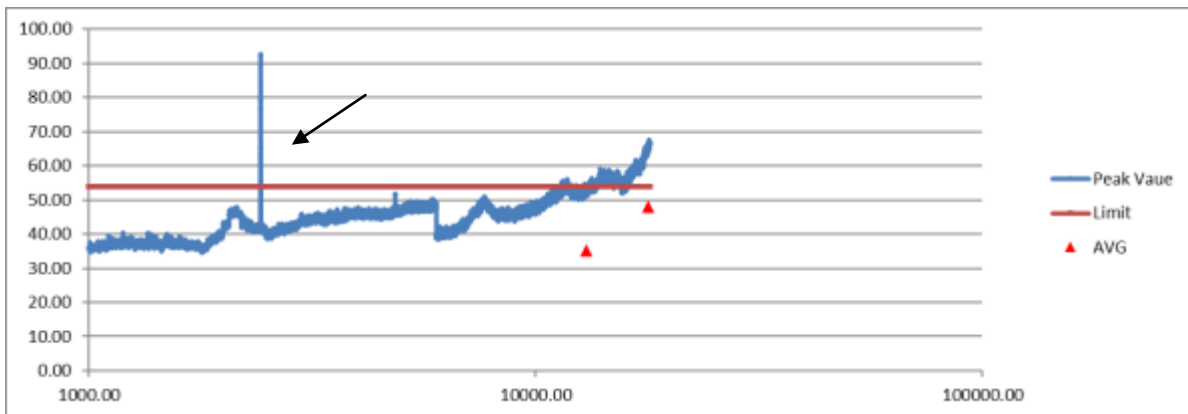


Figure 9. Radiated Emissions Graphical Data, 1-18 GHz – Vertical (External Antenna)

Note: Arrow points to fundamental signal from the radio module. These emissions are ignored for the verification test.

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Table 9. Fundamental Emissions – Internal Antenna (Peak & AVG)

Test: FCC Part 15, Paragraph 15.209, 15.249(a)					Client: Inventek Systems			
Project: 18-0392					Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
Low - Channel								
2402.00	99.50	-	-3.13	96.37	114.0	3.0m./HORZ	17.6	PK
2402.00	96.17	-	-3.13	93.04	94.0	3.0m./HORZ	1.0	AVG
Mid - Channel								
2426.00	99.58	-	-3.04	96.54	114.0	3.0m./HORZ	17.5	PK
2426.00	96.09	-	-3.04	93.05	94.0	3.0m./HORZ	1.0	AVG
High - Channel								
2480.00	96.47	-	-3.68	92.79	114.0	3.0m./HORZ	21.2	PK
2480.00	94.41	-	-3.68	90.73	94.0	3.0m./HORZ	3.3	AVG

Notes:

1. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
2. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with the duty cycle programmed for >98% ON time in continuous transmit mode.
3. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at: 2402.00 Mhz

Magnitude of Measured Frequency	99.50	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-3.13	dB/m
Corrected Result	96.37	dBuV/m

Test Date: October 1, 2019

Tested By

Signature: 

Name: Afzal Fazal

US Tech Test Report:
 FCC ID:
 IC:
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 Customer:
 Model:

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Table 10. Harmonics Emissions – Internal Antenna (Peak & AVG)

Test: FCC Part 15, Paragraph 15.209, 15.249(a)					Client: Inventek Systems			
Project: 18-0392					Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
Low - Channel								
4804.00	49.56	-	7.85	57.41	74.0	3.0m./HORZ	16.6	PK
4804.00	27.10	-	7.85	34.95	54.0	3.0m./HORZ	19.0	AVG
7206.00	50.27	-9.50	15.59	56.36	74.0	1.0m./HORZ	17.6	PK
7206.00	26.75	-9.50	15.59	32.84	54.0	1.0m./HORZ	21.2	AVG
Mid - Channel								
4852.00	50.27	-	8.07	58.34	74.0	3.0m./HORZ	15.7	PK
4852.00	26.68	-	8.07	34.75	54.0	3.0m./HORZ	19.3	AVG
7278.00	49.94	-9.50	16.25	56.69	74.0	1.0m./HORZ	17.3	PK
7278.00	26.41	-9.50	16.25	33.16	54.0	1.0m./HORZ	20.8	AVG
High - Channel								
4960.00	49.39	-	8.52	57.91	74.0	3.0m./HORZ	16.1	PK
4960.00	26.82	-	8.52	35.34	54.0	3.0m./HORZ	18.7	AVG
7440.00	49.19	-9.50	18.47	58.16	74.0	1.0m./HORZ	15.8	PK
7440.00	25.77	-9.50	18.47	34.74	54.0	1.0m./HORZ	19.3	AVG

Notes:

1. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
2. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with the duty cycle programmed for >98% ON time in continuous transmit mode.
3. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at: 4804.00 MHz

Magnitude of Measured Frequency	49.56	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	7.85	dB/m
Duty Cycle Correction Factor	None	dB
Corrected Result	57.41	dBuV/m

Test Date: October 1, 2019

Tested By

Signature: 

Name: Afzal Fazal

US Tech Test Report:
 FCC ID:
 IC:
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 Issue Date:
 Customer:
 Model:

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Table 11. Fundamental Emissions – External Antenna (Peak & AVG)

Test: FCC Part 15, Paragraph 15.209, 15.249(a)					Client: Inventek Systems			
Project: 18-0392					Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
Low - Channel								
2402.00	98.45	-	-3.13	95.32	114.0	3.0m./HORZ	18.7	PK
2402.00	96.15	-	-3.13	93.02	94.0	3.0m./HORZ	1.0	AVG
Mid - Channel								
2426.00	98.45	-	-3.04	95.41	114.0	3.0m./HORZ	18.6	PK
2426.00	96.09	-	-3.04	93.05	94.0	3.0m./HORZ	1.0	AVG
High - Channel								
2480.00	99.24	-	-3.68	95.56	114.0	3.0m./HORZ	18.4	PK
2480.00	96.34	-	-3.68	92.66	94.0	3.0m./HORZ	1.3	AVG

Notes:

1. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
2. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with the duty cycle programmed for >98% ON time in continuous transmit mode.
3. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at: 2402.00 MHz

Magnitude of Measured Frequency	98.45	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-3.13	dB/m
Corrected Result	95.32	dBuV/m

Test Date: October 1, 2019

Tested By

Signature: 

Name: Afzal Fazal

US Tech Test Report:
 FCC ID:
 IC:
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 Customer:
 Model:

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Table 12. Harmonics Emissions – External Antenna (Peak & AVG)

Test: FCC Part 15, Paragraph 15.209, 15.249(a)					Client: Inventek Systems			
Project: 18-0392					Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
Low - Channel								
4804.00	49.51	-	7.85	57.36	74.0	3.0m./HORZ	16.6	PK
4804.00	26.78	-	7.85	34.63	54.0	3.0m./HORZ	19.4	AVG
7206.00	50.21	-9.50	15.59	56.30	74.0	1.0m./HORZ	17.7	PK
7206.00	26.72	-9.50	15.59	32.81	54.0	1.0m./HORZ	21.2	AVG
Mid - Channel								
4852.00	49.14	-	8.07	57.21	74.0	3.0m./HORZ	16.8	PK
4852.00	26.60	-	8.07	34.67	54.0	3.0m./HORZ	19.3	AVG
7278.00	50.00	-9.50	16.25	56.75	74.0	1.0m./HORZ	17.3	PK
7278.00	26.45	-9.50	16.25	33.20	54.0	1.0m./HORZ	20.8	AVG
High - Channel								
4960.00	49.26	-	8.52	57.78	74.0	3.0m./HORZ	16.2	PK
4960.00	26.77	-	8.52	35.29	54.0	3.0m./HORZ	18.7	AVG
7440.00	49.69	-9.50	18.47	58.66	74.0	1.0m./HORZ	15.3	PK
7440.00	25.82	-9.50	18.47	34.79	54.0	1.0m./HORZ	19.2	AVG

Notes:

1. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
2. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with the duty cycle programmed for >98% ON time in continuous transmit mode.
3. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at: 4804.00 MHz

Magnitude of Measured Frequency	49.51	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	7.85	dB/m
Duty Cycle Correction Factor	None	dB
Corrected Result	57.36	dBuV/m

Test Date: October 1, 2019

Tested By

Signature: 

Name: Afzal Fazal

US Tech Test Report:
FCC ID:
IC:
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Customer:
Model:

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2.10 Band Edge Measurements (CFR 15.249(d), RSS-Gen 8.10)

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Radiated measurements are performed to demonstrate compliance with the requirement of 15.249(d) that all emissions outside of the band edges be attenuated by at least 50 dB or 15.209 limits, when compared to its highest in-band value (contained in a 100 kHz band).

To capture the band edge, set the Spectrum Analyzer frequency span to 2 MHz to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. See figure and calculations following for more detail.

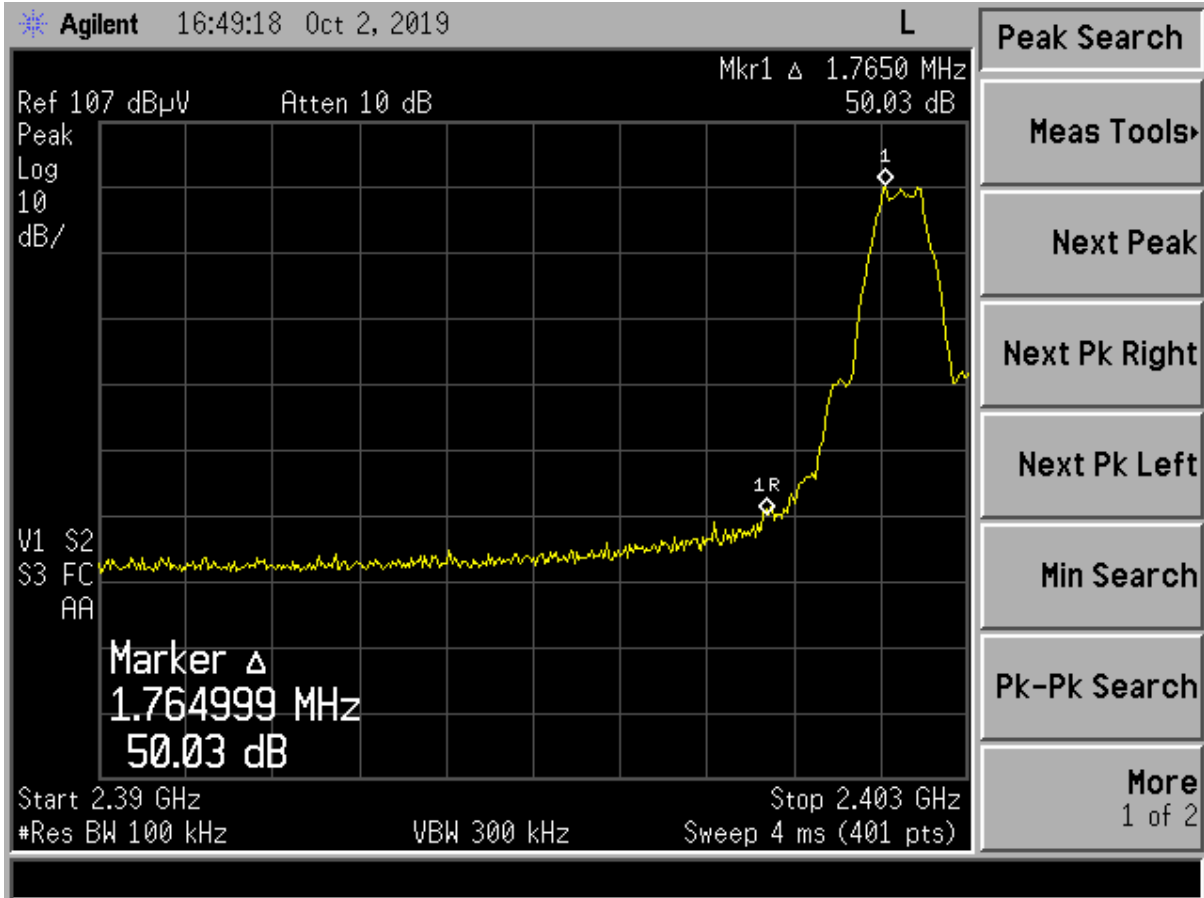


Figure 10. Band Edge Compliance (Internal Antenna) Low Channel Delta - Peak

Low Channel Corrected Measured Value from Table 9	99.50	dBuV
Low Channel Band Edge Delta from Figure 10	-50.03	dB
Calculated Result	49.47	dBuV/m
Band Edge Limit	54.00	dBuV/m
Calculated Result	49.47	dBuV/m
Band Edge Margin	4.53	dBuV/m

Peak value meets AVG limit.

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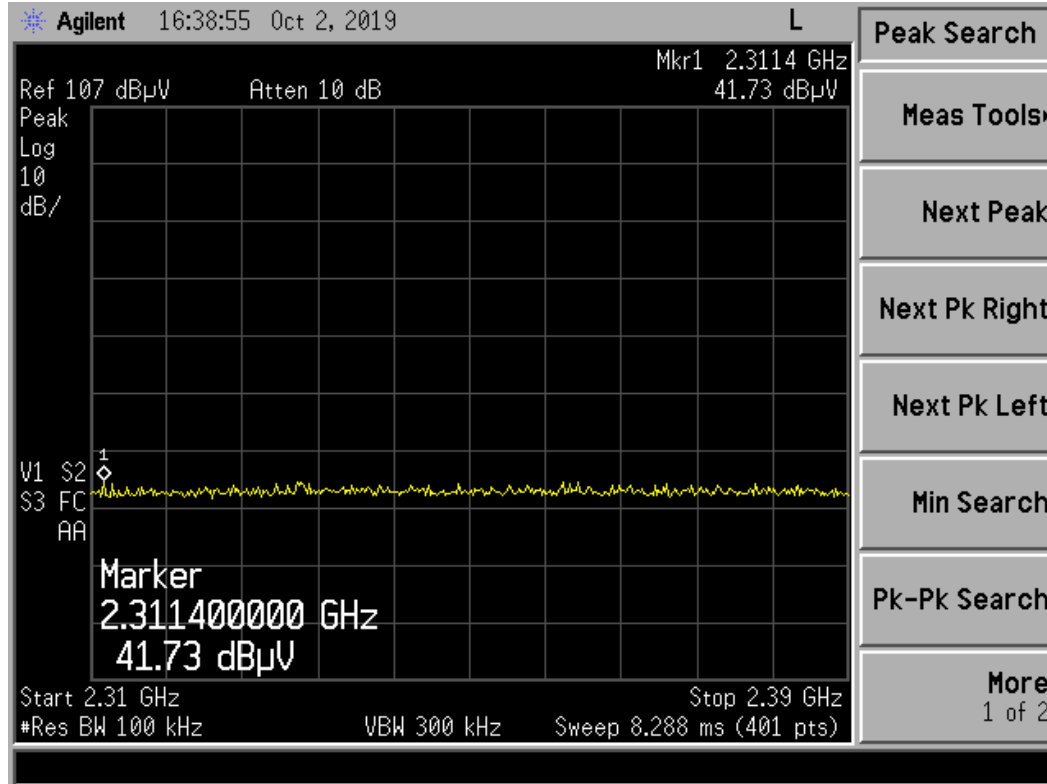


Figure 11. Radiated Restricted Band 2310 MHz to 2390 MHz (Internal Antenna) Peak

Table 13. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

2310 MHz to 2390 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				Client: Inventek Systems			
Project: 18-0392				Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	PK Limits (dBuV/m)	Antenna Distance/Polarization	Margin (dB)	Detector PK, or AVG
2311.40	41.73	-2.45	39.28	54.0	3.0m./HORZ	14.7	PK

Test Date: October 2, 2019

Tested By

Signature: *Afzal Fazal*

Name: Afzal Fazal

Peak value meets AVG limit.

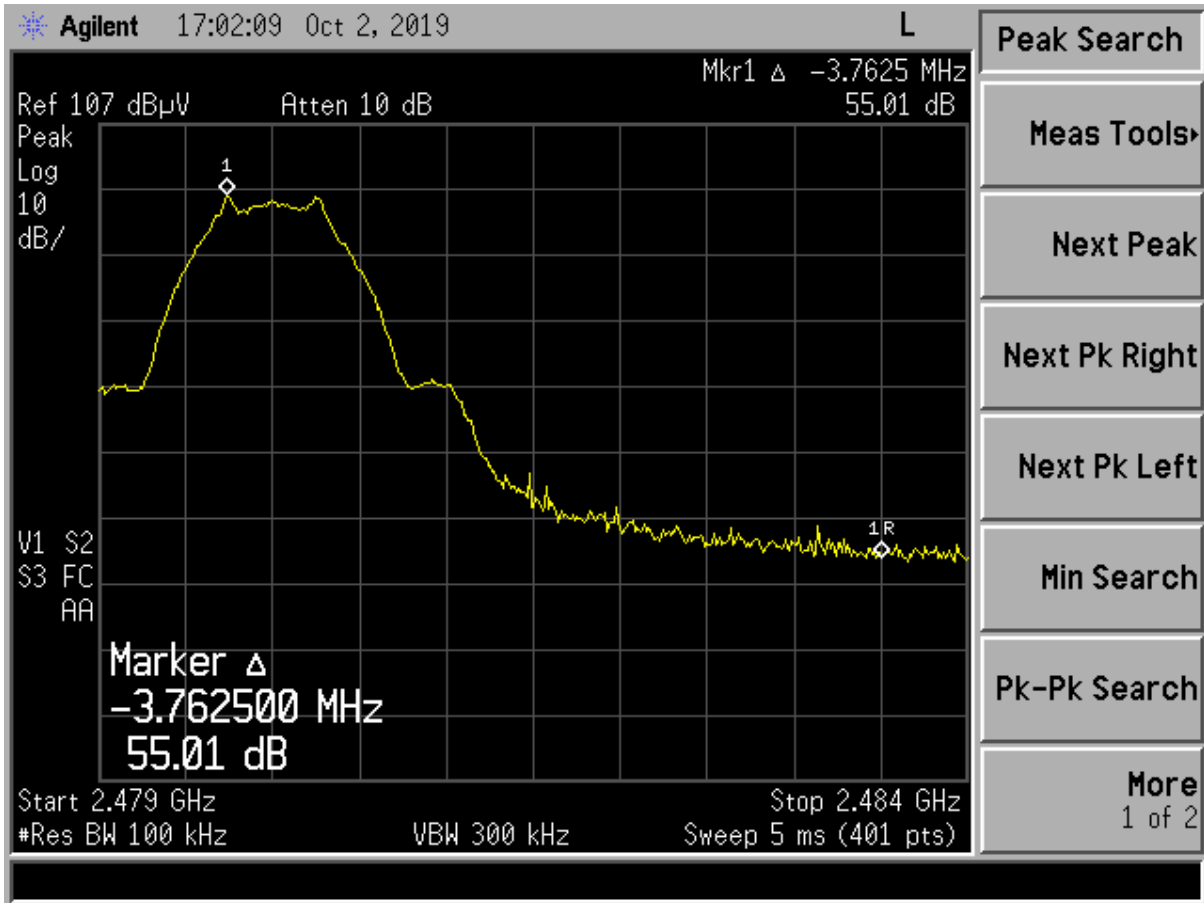


Figure 12. Band Edge Compliance (Internal Antenna) High Channel Delta – Peak

High Channel Corrected Measured Value from Table 9	96.47	dBuV
High Channel Band Edge Delta from Figure 12	-55.01	dB
Calculated Result	41.46	dBuV/m
Band Edge Limit	54.00	dBuV/m
Calculated Result	41.46	dBuV/m
Band Edge Margin	12.54	dBuV/m

Peak value meets AVG limit.

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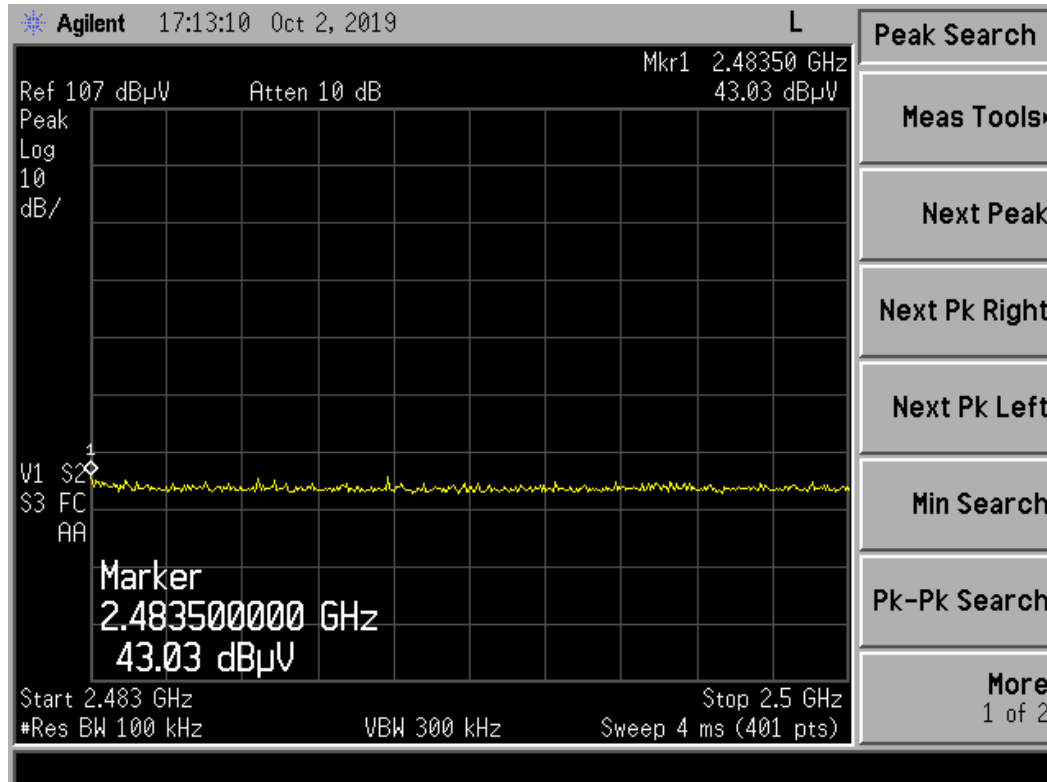


Figure 13. Radiated Restricted Band 2483.5 MHz to 2500 MHz (Internal Antenna) Peak

Table 14. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

2483.5 MHz to 2500 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				Client: Inventek Systems			
Project: 18-0392				Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	PK Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or AVG
2483.50	43.03	-3.68	39.35	54.0	3.0m./HORZ	14.6	PK

Test Date: October 2, 2019

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

Peak value meets AVG limit.

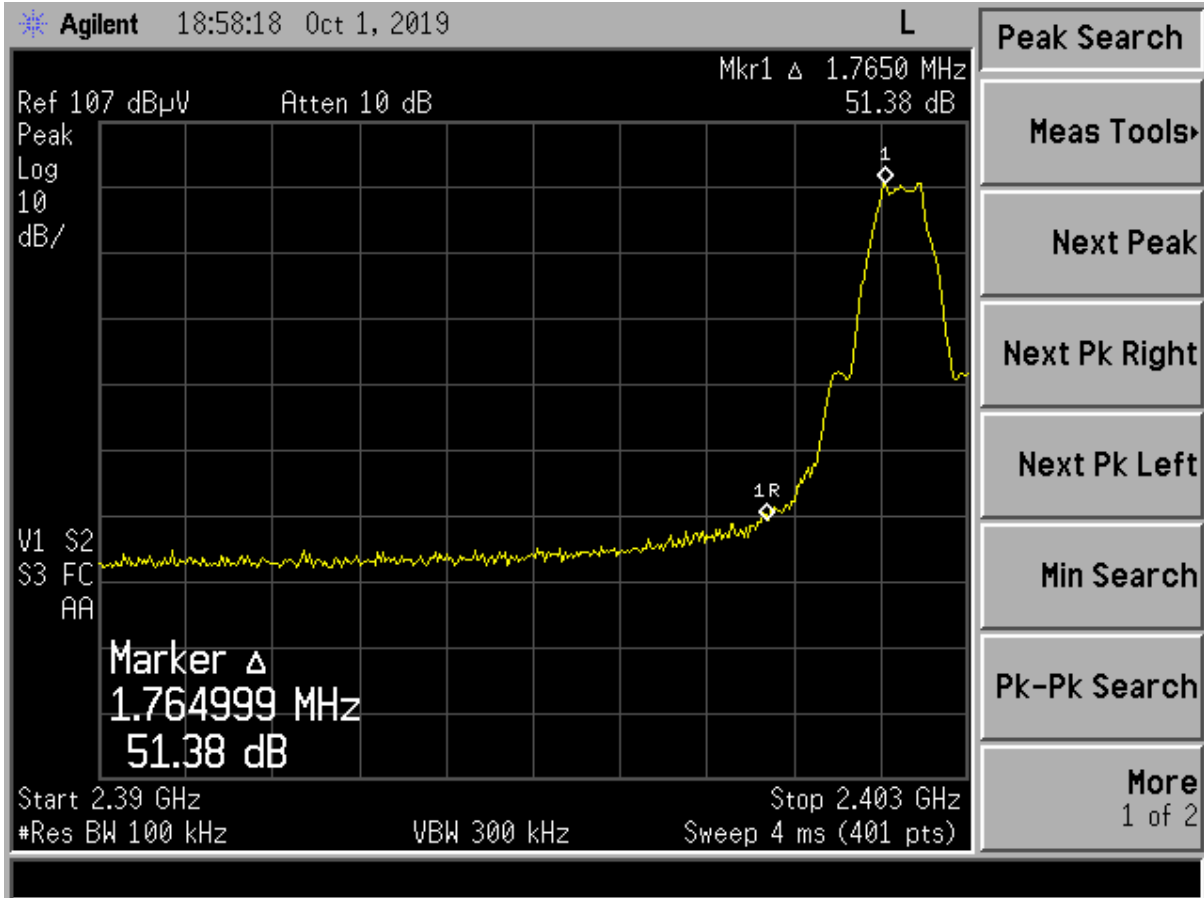


Figure 14. Band Edge Compliance (External Antenna) Low Channel Delta - Peak

Low Channel Corrected Measured Value from Table 11	98.45	dBuV
Low Channel Band Edge Delta from Figure 14	-51.38	dB
Calculated Result	47.07	dBuV/m
Band Edge Limit	54.00	dBuV/m
Calculated Result	47.07	dBuV/m
Band Edge Margin	6.93	dBuV/m

Peak value meets AVG limit.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
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 Customer:
 Model:

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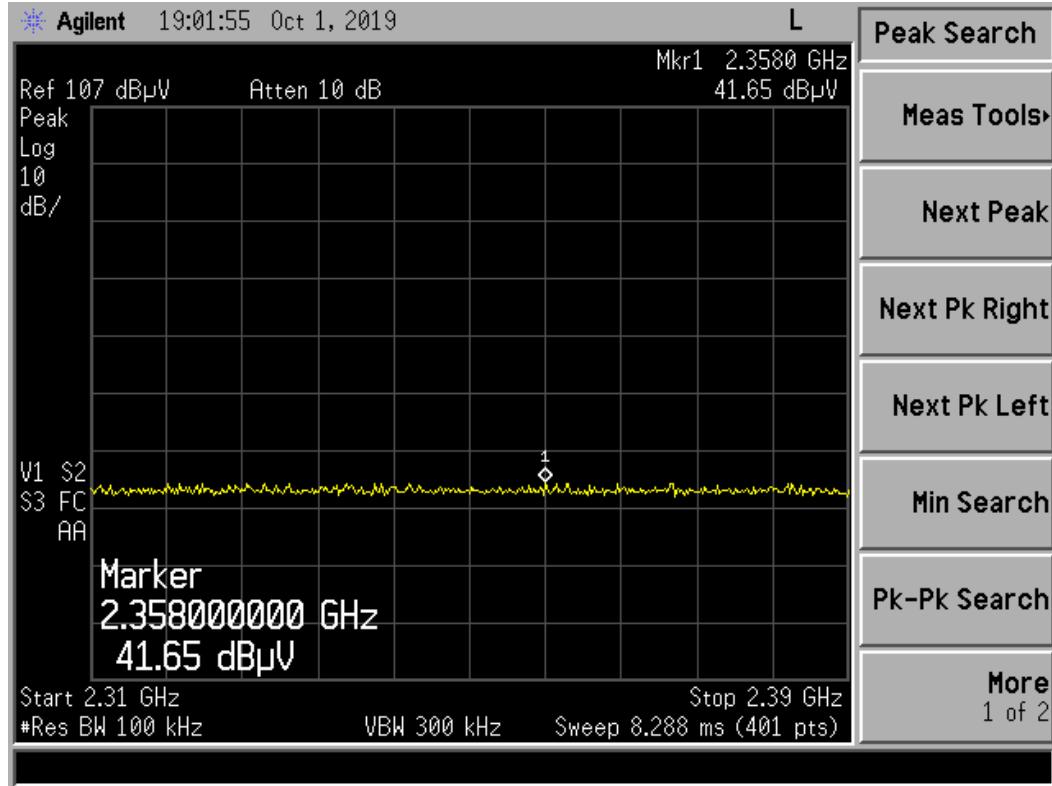


Figure 15. Radiated Restricted Band 2310 MHz to 2390 MHz (External Antenna) Peak

Table 15. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

2310 MHz to 2390 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				Client: Inventek Systems			
Project: 18-0392				Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	PK Limits (dBuV/m)	Antenna Distance/Polarization	Margin (dB)	Detector PK, or AVG
2358.00	41.65	-2.69	38.96	54.0	3.0m./HORZ	15.0	PK

Test Date: October 1, 2019

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

Peak value meets AVG limit.

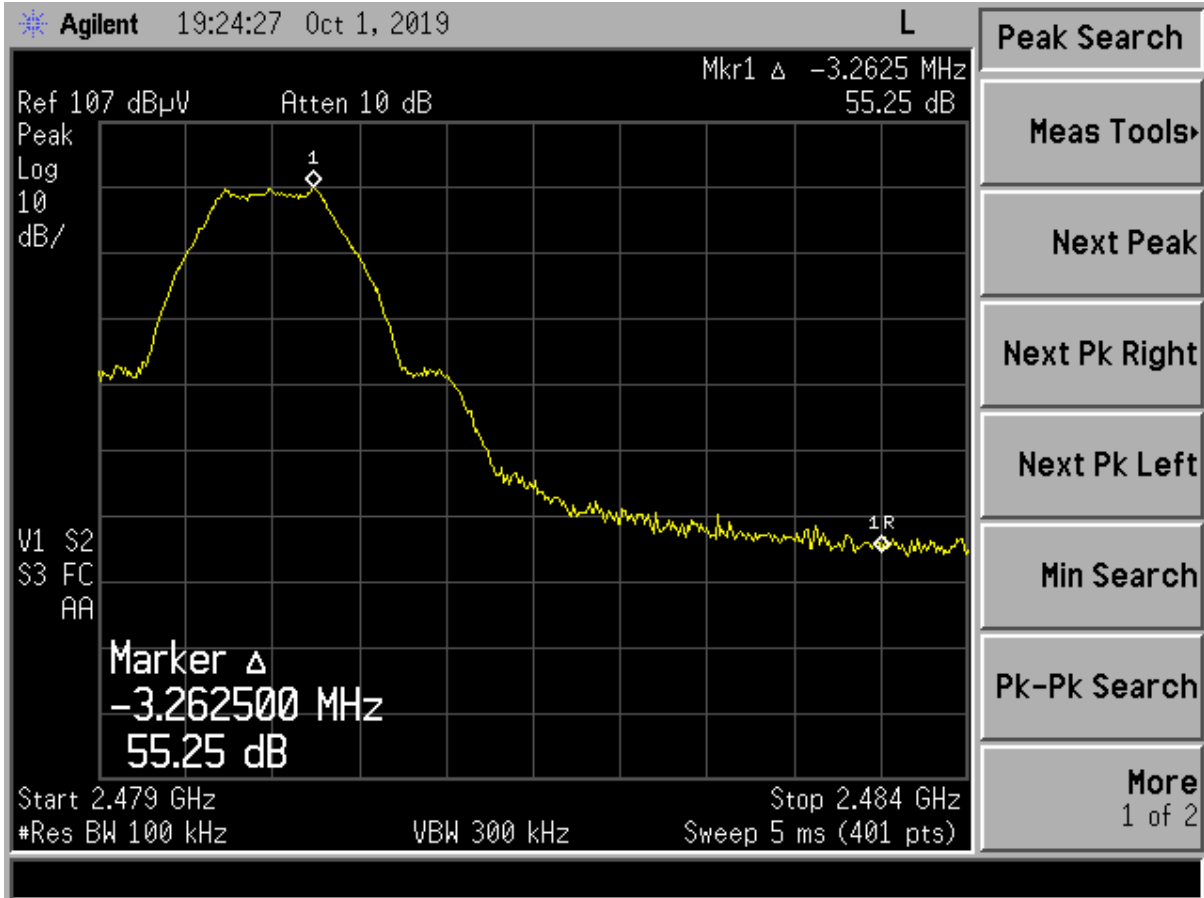


Figure 16. Band Edge Compliance (External Antenna) High Channel Delta – Peak

High Channel Corrected Measured Value from Table 11	99.24	dBuV
High Channel Band Edge Delta from Figure 16	-55.25	dB
Calculated Result	43.99	dBuV/m
Band Edge Limit	54.00	dBuV/m
Calculated Result	43.99	dBuV/m
Band Edge Margin	10.01	dBuV/m

Peak value meets AVG limit.

US Tech Test Report:
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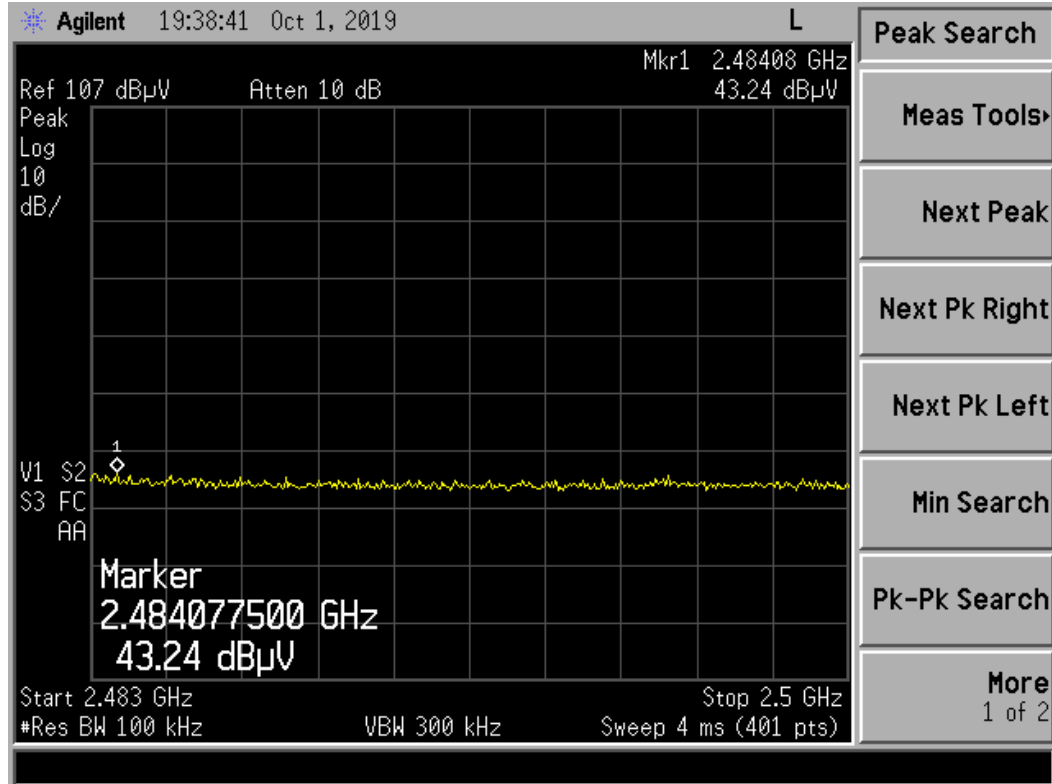


Figure 17. Radiated Restricted Band 2483.5 MHz to 2500 MHz (External Antenna) Peak

Table 16. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

2483.5 MHz to 2500 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				Client: Inventek Systems			
Project: 18-0392				Model: ISM14585			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	PK Limits (dBuV/m)	Antenna Distance/Polarization	Margin (dB)	Detector PK, or AVG
2484.08	43.24	-3.68	39.56	54.0	3.0m./HORZ	14.4	PK

Test Date: October 1, 2019

Tested By

Signature: *Afzal Fazal*

Name: Afzal Fazal

Peak value meets AVG limit.

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2.11 99% Occupied Bandwidth (CFR 2.1049, RSS-Gen 6.6)

These measurements were performed while the EUT was in a constant transmit mode. A method similar to the marker delta method was used to capture the points. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW \geq RBW. The results of this test are given in Table 20 and Figures 16-18.

Table 17. 20 dB Bandwidth and 99% Occupied Bandwidth

Frequency (MHz)	20 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2402	1.165	1.070
2426	1.204	1.081
2480	1.154	1.056

Test Date: October 31, 2019

Tested By
Signature: _____



Name: George Yang

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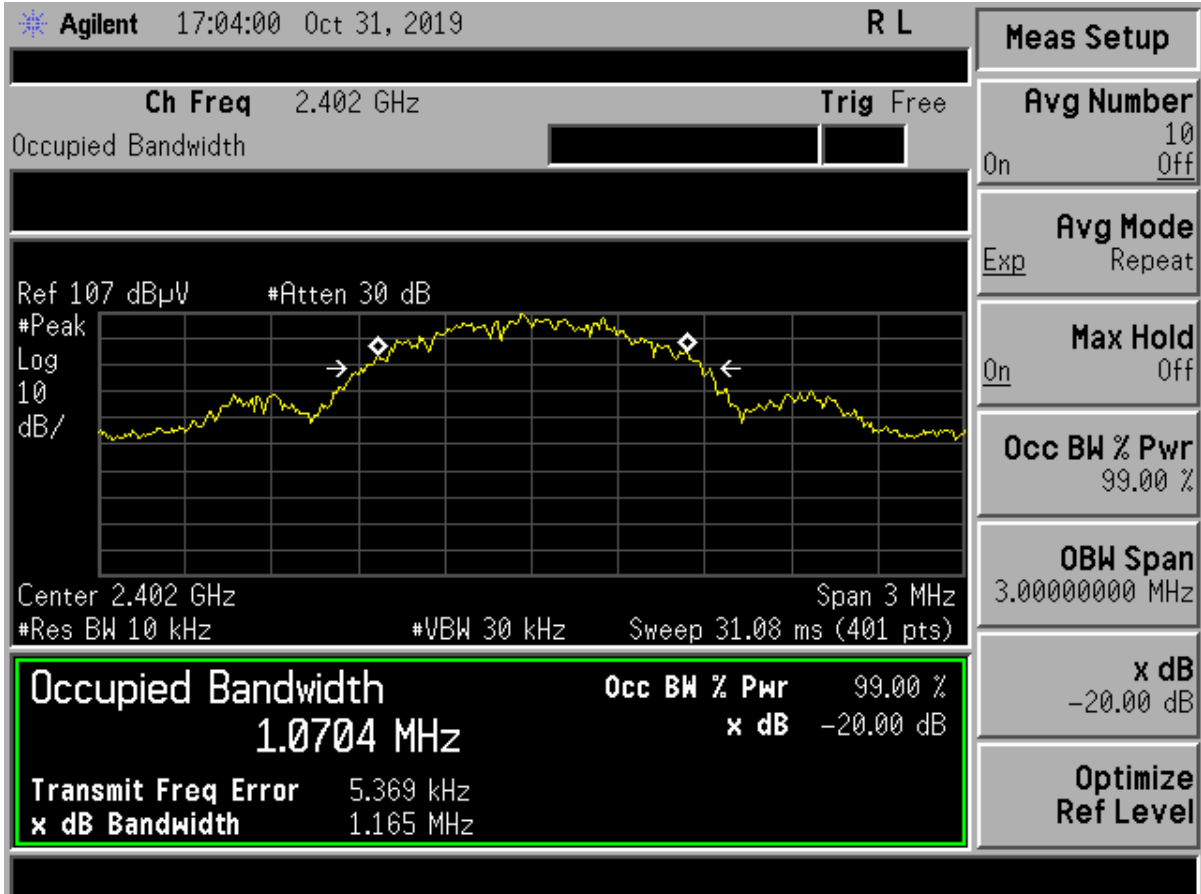


Figure 18. 99% Occupied Bandwidth – Low Channel

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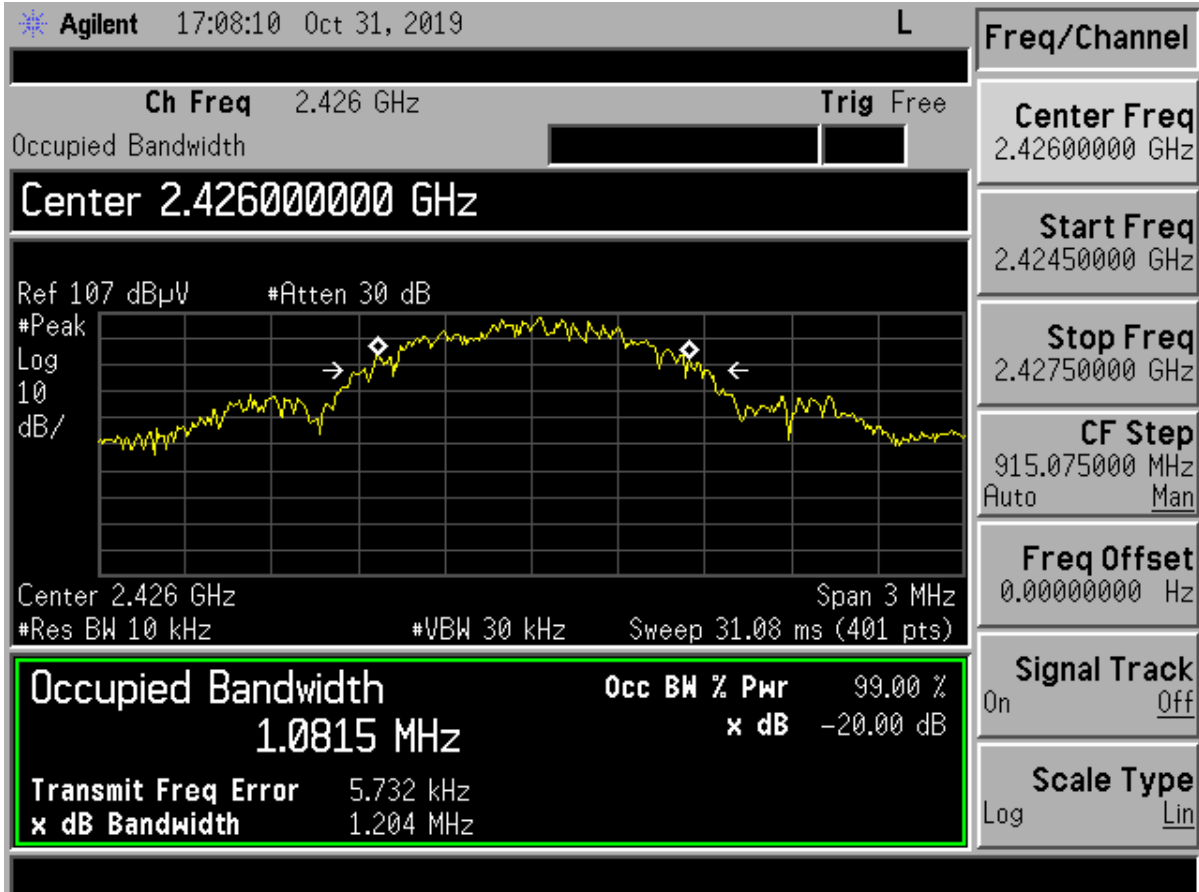


Figure 19. 99% Occupied Bandwidth – Mid Channel

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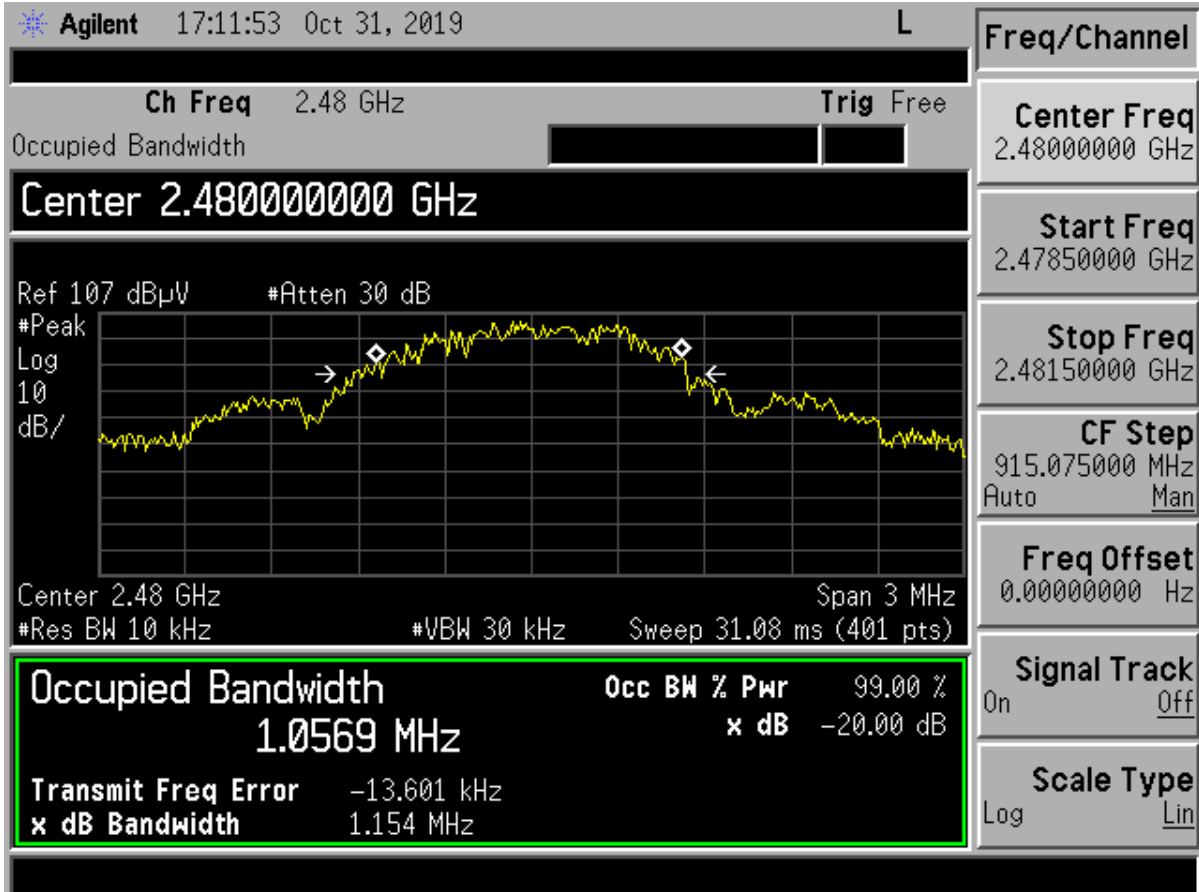


Figure 20. 99% Occupied Bandwidth – High Channel

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2.12 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4-2:2011. A coverage factor of $k=2$ was used to give a level of confidence of approximately 95%.

2.12.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.78 dB.

2.12.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.3 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.1 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.1 dB.

3 Conclusions

The EUT is deemed to meet the requirements of the test standards cited herein when tested in the configuration detailed in this test report.