Testing Tomorrow's Technology

Report of

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and Part 15, Subpart F, paragraph 15.509

And

Innovation, Science, and Economic Development Canada Certification Per
Industry Canada, RSS-GEN Issue 5, April 2018 General Requirements for Compliance of Radio Apparatus
And
Industry Canada RSS-220 Issue 1+ Amd 1, July 2018 Devices Using Ultra-Wideband (UWB) Technology

For the

Matrix Design Group LLC
Model: ExSENS

FCC ID: USKEX-10004808
IC: 11898A-10004808

UST Project: 19-0109
Report Issue Date: April 18, 2019

Total Pages in This Report: 30

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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: Alan Ghasiani

Name: 

Title: Compliance Engineer – President

Date: April 18, 2019

NVLAP LAB CODE 200162-0

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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Matrix Design Group LLC.

MODEL: ExSENS

FCC ID: USKEX-10004808

IC: 11898A-10004808

DATE: April 18, 2019

This report concerns (check one): Original grant [X]
Class 2 change

Equipment type: UWB Transmitter, GPR device

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.

Report prepared by:

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1 General Information

1.1 Purpose of this Report

This report is prepared to show that the Matrix Design Group, LLC Model ExSENS complies with the FCC Rules and Regulations of Part 15, Section 509.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on April 15, 2019 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Matrix Design Group, LLC Model ExSENS. It is a battery operated, ground penetrating, ultra wide band device used solely underground inside of mines to detect levels of various gasses.

Note: For testing, the EUT was elevated 1.5 m above the ground plane with the EUT's front side facing down. RF absorbing cones were placed underneath the EUT to simulate an earth ground.

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (2013)* and per FCC Part 15 Subpart F.

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, GA30004. This site has been fully described and registered with the FCC, with designation number 186022.

1.6 Related Submittals

No related submittals were made by US Tech.

Table 1. EUT and Peripherals

PERIPHERAL/ MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC (Pending)	CABLES P/D
EUT Matrix Design Group LLC	ExSENS	Engineering Sample	FCC ID: USKEX-10004808 IC: 11898A-10004808	N/A
Antenna See antenna details	--	--	--	--

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

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.
HORN ANTENNA	3115	EMCO	9107-3723	11/28/2020 2 yr.
LOG PERIODIC ANTENNA	3146	EMCO	9110-3236	5/1/2019 2 yr.
BICONICAL ANTENNA	3110B	EMCO	9306-1708	5/2/2019 2 yr
LOOP ANTENNA	6502	ETS Lindgren	9810-3246	1/22/2020 2 yr
PRE-AMPLIFER	8447D	HEWLETT-PACKARD	1937A02980	11/8/2019
PRE-AMPLIFER	8449B	HEWLETT-PACKARD	3008A00480	6/4/2019

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 F Intentional Radiator Limits for the transmitter portion of the EUT.

2.3 Frequency Range of Radiated Measurements (Part 15.33, 15.521(h))

2.3.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 5th harmonic of the peak level of fundamental frequency generated or 40 GHz, whichever is the lowest.

The highest frequency used to determine the frequency range over which measurements are made shall be based on the center frequency (fc). If the center frequency is less than 10 GHz there is no requirement to measure beyond 40 GHz.

2.4 Measurement Detector Function and Bandwidth (CFR 15.35, RSS-220 Section 7)

The radiated emissions limits shown herein are based on the following:

FCC Part 15.209, 15.509 and RSS-220 Section 6.2.1

2.4.1 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.

2.4.2 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 EUT Antenna Requirements (CFR 15.203, RSS-Gen 6.8)

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 module.

Table 3. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB_i	TYPE OF CONNECTOR
Antenna	Abracon Corp.	Chip	ACA-107-T	4.16	Surface mount soldered (SMD)

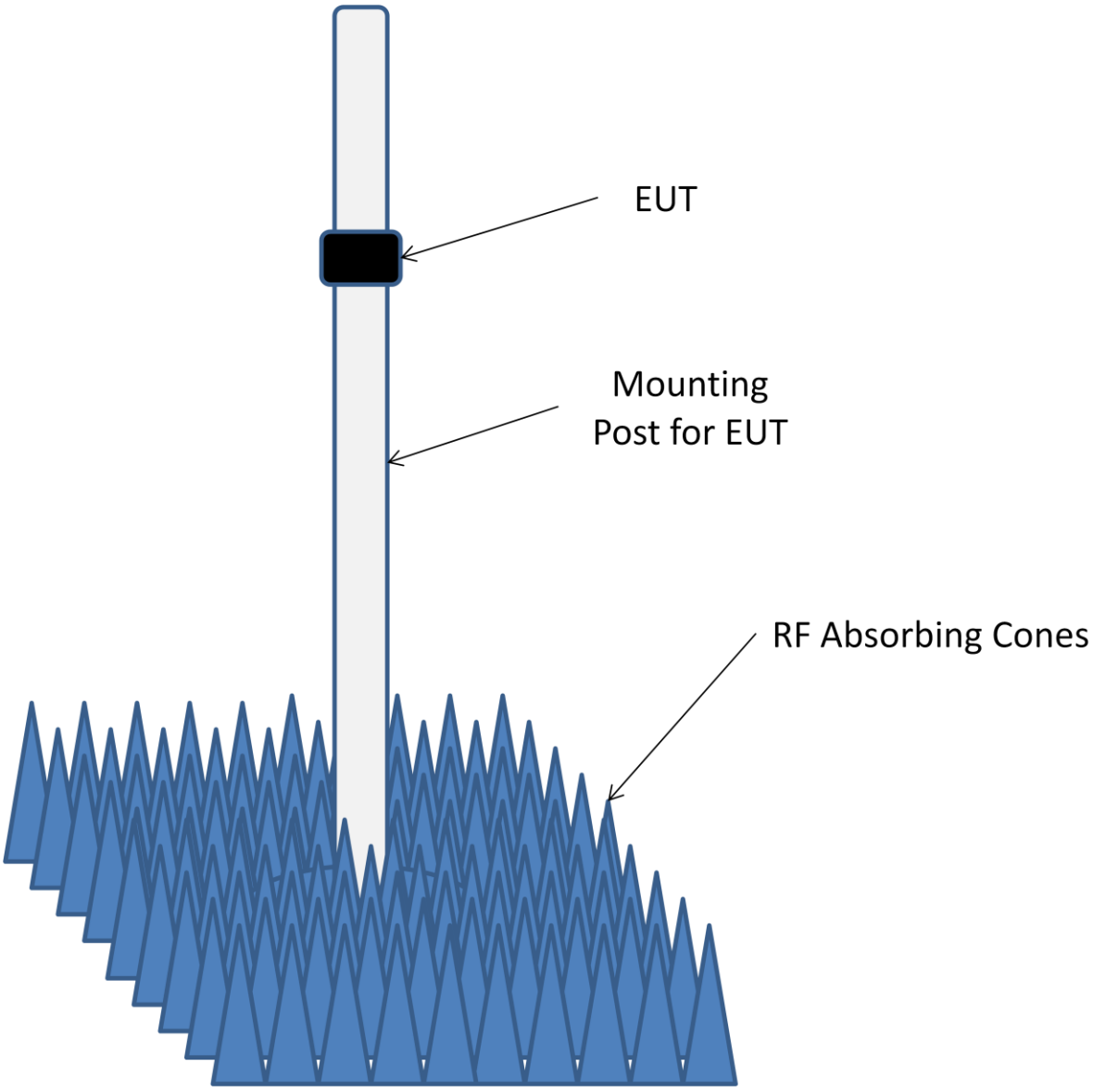


Figure 1. Block Diagram of Test Configuration

2.6 Restricted Bands of Operation (Part 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 cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement see paragraph 2.1

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

The EUT is battery powered. The EUT is indirectly connected the AC mains for testing purposes only. During normal operation the EUT is battery powered and will not be operated while directly or indirectly connected to the AC mains. This test was not applicable.

2.8 Intentional Radiator, Radiated Emissions (Highest Radiated Emissions at f_m) (CFR 15.509 (f), 15.521 (g), RSS-220 Section 6.2.1(g), RSS-Gen 8.9)

UWB devices where the highest radiated emission, $\mathbf{f_M}$ (The frequency at which the highest radiated emission occurs), is above 960 MHz have a limit on the peak level of the emission within a 50 MHz bandwidth of 0 dBm EIRP. A different RBW was used, therefore the peak emissions limit was adjusted per CFR 15.521 (g).The limit was also converted to peak field strength at 3 meters.

The antenna was positioned as it would be in normal operation and the fundamental emission was maximized to ensure the maximum reading and measured with the receiving antenna in both horizontal and vertical position. Below is the measured peak radiated emission at 3 meters.

RBW used: 1 MHz

Peak EIRP Limit	=	20 log (RBW/50)dBm EIRP
	=	20 log(1/50) dBm EIRP
	=	-33.97dBm EIRP
Peak Field Strength Limit	=	-33.97dBm EIRP +95.2
	=	61.22dBuV/m

The EUT was tested pointing downwards and radiating into RF absorbing cones. That data is presented in the following:

Table 4. Intentional Radiated Emissions (CFR 15.509 (f), RSS-220 Sect 6.2.1)

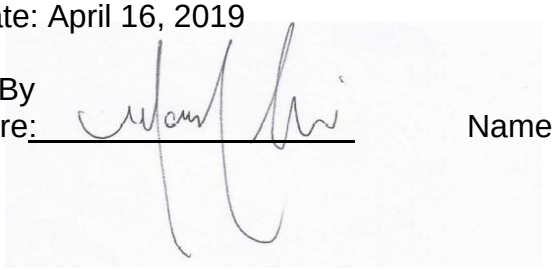
Frequency (MHz)	Distance / Polarization	Raw Test Data (dBuV)	Correction Factors (dB/m)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detection
3995	3.0m./VERT	56.89	2.01	58.90	61.2	2.3	**PK**
3995	3.0m./HORZ	55.44	2.02	57.46	61.2	3.7	**PK**

Note: Conducted RF output power level set to 0 dBm.

Sample Calculation at 3995 MHz:

Raw Test Data	56.89	dBuV
+ Correction Factors	2.01	dBm
Results	58.90	dBuV/m

Test Date: April 16, 2019

Tested By
Signature:  Name: Mark Afroozi

2.8.1 Pulse Repetition Frequency and Duty Cycle

The device employs pulse modulation and has a repetition rate of 166 Hz. The pulse signal has been verified below.

Pulse Rate: 166 Hz
Period= 6.011 mSec
Frequency= 1/seconds= 1/0.006 secs = 166 Hz

Duty Cycle correction factor: -1.88 dB
20 log ($TX_{on}/TX_{on}+TX_{off}$) = 20 log (4.839ms/6.011ms) = -1.88 dB

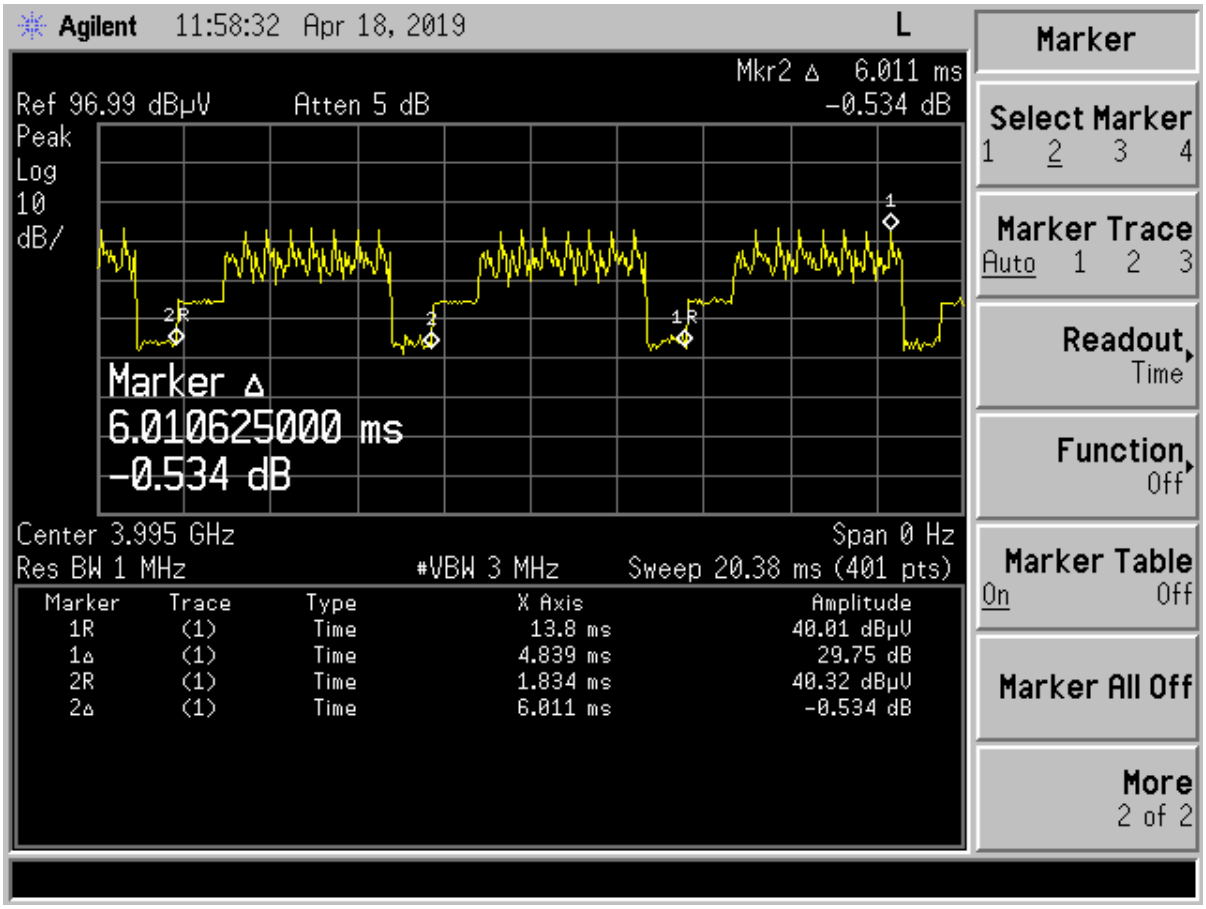


Figure 2. Pulse Repetition Frequency

2.9 UWB Bandwidth (CFR 15.509 (a), 15.521(e), RSS-220 Section 6.2.1(a))

The bandwidth of an imaging system under 15.509 must by below 10.6 GHz. The bandwidth is defined as the frequency band bounded by the points that are 10 dB below the highest radiated emissions, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M. If multiple bandwidths occur, then the maximum bandwidth is used.

F_m= 3995.0 MHz
F_H= 3752.5 MHz
F_L= 4325.0 MHz

The bandwidth was determined from a radiated measurement using the designated antenna with which EUT will operate in the final product. The receiving antenna's height was repeatedly varied from 1 m to 4 m and the polarity was adjusted several times. The turn table on which the EUT was placed was also rotated several times. This ensured that the true bandwidth of the EUT was measured. Below is the measured UWB bandwidth with the receiving antenna horizontal and vertical. Both polarities met the 10.6 GHz limit.

Emissions are contained within 3.753 GHz to 4.325 GHz which is below 10.6 GHz.

15.503 (d) an intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

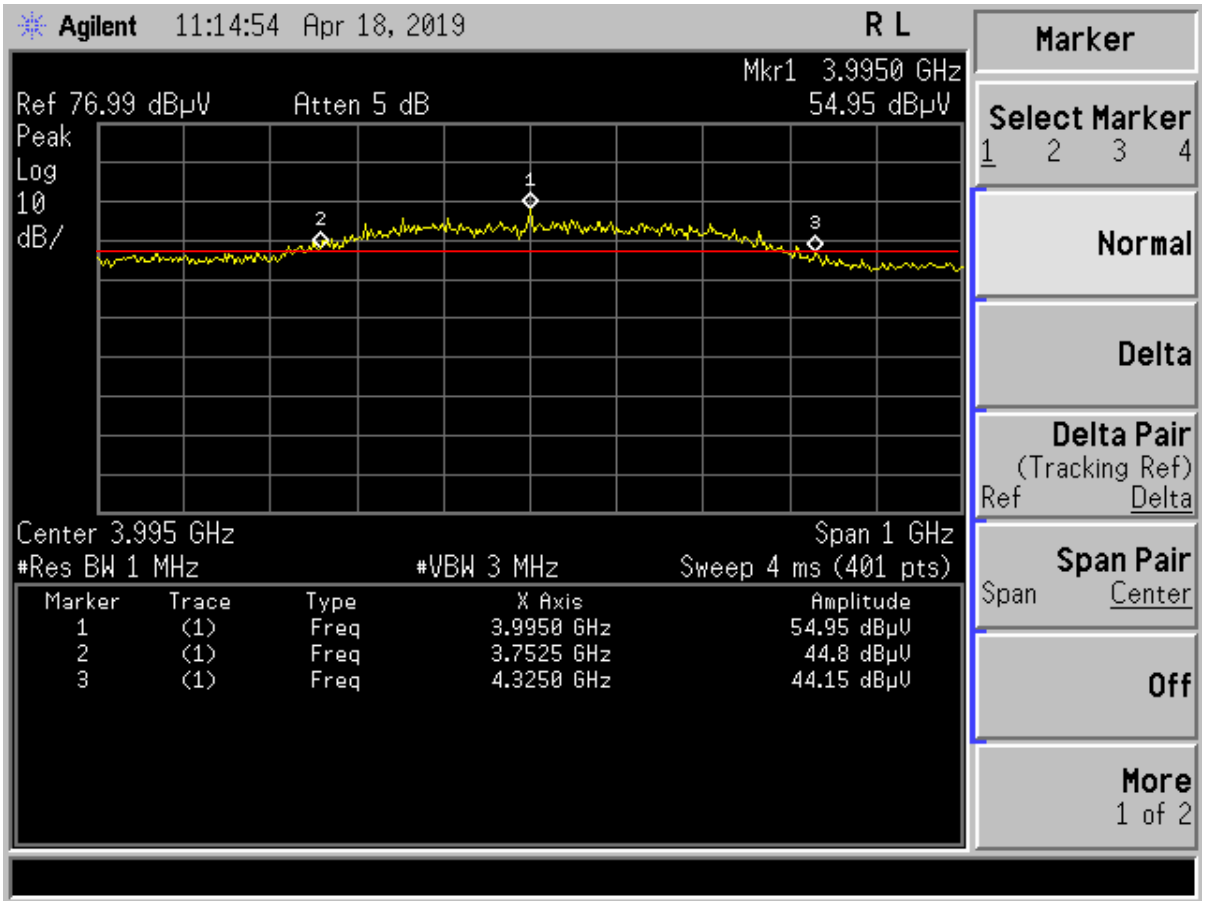


Figure 3. UWB f_L, f_M, f_H Measurement Plot

Fractional Bandwidth	0.141
UWB Bandwidth	572.5 MHz

The EUT has a fractional bandwidth of 0.141 when calculated using the formula referenced in 15.503(c): $2(F_H-F_L)/(F_H+F_L)$ = 2(4.325-3.7525 GHz)/(4.325+3.7525 GHz) = 0.141 < 0.20.

UWB Bandwidth: F_H+F_L = 4325.0 MHz - 3752.5 MHz = 572.5 MHz
Note: F_H & F_L determined to be the -10dB from the peak emission per 15.503(a). These frequencies are the upper and lower boundaries.

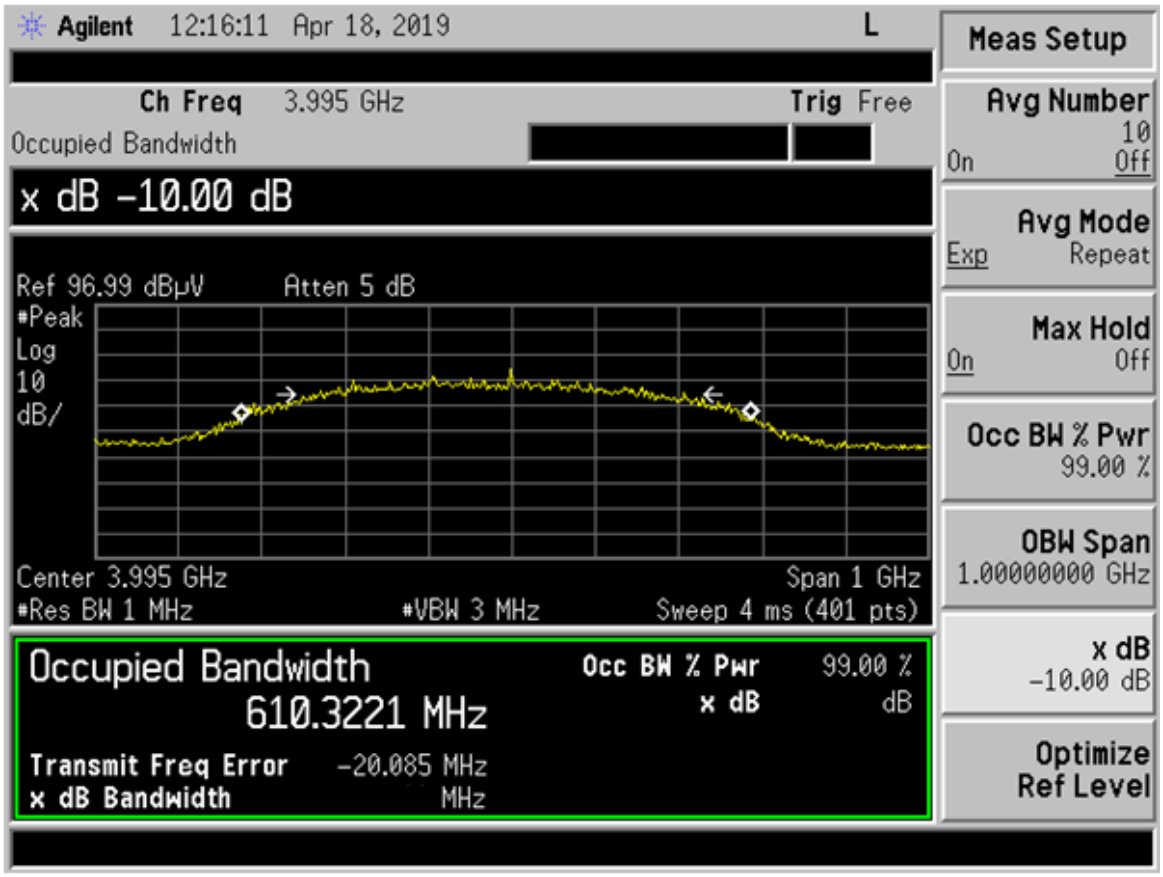


Figure 4. UWB 99% Bandwidth

99 % Occupied Bandwidth	
Frequency (MHz)	610.32

2.10 UWB Purpose, Part 90 License, and Coordination (CFR 15.509 (b))

The EUT, operating under CFR 15.509, is limited to GPR and wall imaging systems operating in authorized environments or commercial locations. Operation of this device shall be limited to parties eligible for licensing under the provisions of Part 90 of the Commission's rules (e.g. law enforcement agencies, scientific research institutes, commercial mining companies, construction companies and emergency rescue or fire fighting organizations.

2.11 Remote Switch (CFR 15.509 (c), RSS-220 Section 6.2.1(b))

A GPR that is designed to operate while being hand-held or a wall-imaging system must contain a manually operated switch or a remote switch that causes the transmitter to cease operation within 10 seconds of being released.

The EUT contains software and a manual icon. When the icon is pushed, all transmission will immediately cease.

2.12 Unintentional Radiator, Power line Emissions (CFR 15.207, 15.521 (j), RSS-Gen 8.8)

This EUT will not have access to the AC Main power line; therefore this requirement is not applicable.

2.13 Radiated Emissions at or Below 960 MHz (CFR 15.509 (d), 15.209, RSS-Gen 8.9)

The radiated emissions at or below 960 MHz from the transmitter shall not exceed the emissions levels in CFR 15.209. Furthermore the emissions due to the digital circuitry of the EUT must also comply with the limits for 15.109.

The worst-case radiated emission for the EUT in the range of below 960 MHz was 12 dB below the limit at 744.00 MHz. All other radiated emissions were at least 13 dB below the limits. This data can be found in the tables below.

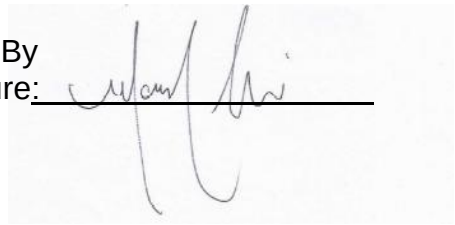
Table 5. Radiated Emissions Test Data Below 960 MHz

9 kHz to 960 MHz							
Test: Radiated Emissions				**Client:** Matrix Design Group, LLC			
Project: 19-0109				**Model:** ExSENS			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK or QP**
216	40.92	-14.67	26.25	43.5	3m./HORZ	17.3	**PK**
216	40.26	-14.67	25.59	43.5	3m./VERT	17.9	**PK**
312	38.90	-10.08	28.82	46.4	3m./HORZ	17.6	**PK**
312	38.92	-10.08	28.84	46.4	3m./VERT	17.6	**PK**
744	35.24	-1.89	33.35	46.4	3m./HORZ	13.0	**PK**
744	37.14	-2.79	34.35	46.4	3m./VERT	12.0	**PK**
All other emissions detected were more than 20 dB below the applicable limit.							

Sample Calculation at 216 MHz:

Magnitude of Measured Frequency	40.92	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-14.67	dB/m
Corrected Result	26.25	dBuV/m

Test Date: April 15, 2019

Tested By
Signature:  Name: Mark Afroozi

2.14 Radiated Emissions above 960 MHz (CFR 15.509 (d), 15.521(d,g,h), RSS-220 Section 6.2.1(d))

The radiated emissions above 960 MHz from the transmitter shall comply with the AVG limits in Table 5 when measured using a resolution bandwidth of 1 MHz. The following are the worst case emissions with the receiving antenna in both horizontal and vertical polarities. The emissions were maximized using a Peak Detector, and the final measurement was taken using an Average Detector.

Table 6. Radiated Emissions above 960 MHz, CFR 15.509 (d), 15.521(g), RSS-220 Section 6.2.1(d)

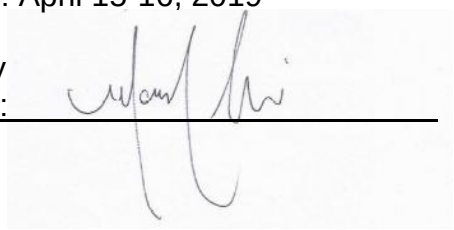
Frequency Range (MHz)	EIRP Limit (dBm)	Field Strength Limit at 3 meters (dBuV/m)
960 -1610	-65.3	30.0
1610 – 1990	-53.3	42.0
1990 – 3100	-51.3	44.0
3100 - 10600	-41.3	54.0
Above 10600	-51.3	44.0

The worst-case radiated emission for the EUT in the range above 960 MHz was 1.0 dB below the limit at 1106.30 MHz at a test height of 1.0 m. All other radiated emissions were at least 2.8 dB below the CFR 15.509 limits. This data can be found in the table below.

Table 7. Radiated Emissions from Transmitter Above 960 MHz

Above 960 MHz							
Test: Radiated Emissions				**Client:** Matrix Design Group, LLC			
Project: 19-0109				**Model:** ExSENS			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector AVG**
All emissions detected were more than 20 dB below the applicable limit.							

Test Date: April 15-16, 2019

Tested By
Signature:  Name: Mark Afroozi

2.15 Radiated Emissions in the GPS band (CFR 15.509 (e), 15.521(g), RSS-220 Section 6.2.1(e))

In addition to the radiated emissions limits from CFR 15.509 (d), the transmitter shall not exceed the following average limits, in Table 8 when measured using a resolution bandwidth of no less than 1 kHz.

Note: measurement taken with a resolution bandwidth of greater than 1 kHz was corrected using the following equation: recorded measurement (dBuV) + 10 log (RBW_{ref}/RBW_{meas})

Table 8. Radiated Emissions in the GPS band (CFR 15.509 (e), 15.221(g), RSS-220 Section 6.2.1(e))

Frequency Range (MHz)	EIRP Limit (dBm)	Field Strength Limit at 3 meters (dBuV/m)
1164-1240	-75.3	19.9
1559-1610	-75.3	19.9

The EUT was configured according to ANSI C63.10, Clause 10. During the testing the EUT was rated 360 degrees and the receive antenna was elevated between 1m and 4m to measure and record the maximum emissions being generated by the EUT. The receive antenna was oriented in both the horizontal and vertical polarity. The worst case data is recorded and presented in the tables below.

In each of these bands, the emissions from the transmitter were maximized using a larger bandwidth and the peak detector, then the resolution bandwidth was decreased and the final measurement was taken using the average detector. The spectrum analyzer settings were set to the following parameters:

Frequency start and stop: 1164 MHz to 1240 MHz and 1559 MHz to 1610 MHz. The resolution bandwidth was set to 1 kHz or 3 kHz, when the measurements were performed at 3 kHz a correction factor was used to correct the data collected at 3 kHz back to 1 kHz using the equation noted in the paragraph above. The video bandwidth was set to greater than or equal to the resolution bandwidth. The detector used was Peak or Average. The worse case emissions are seen below.

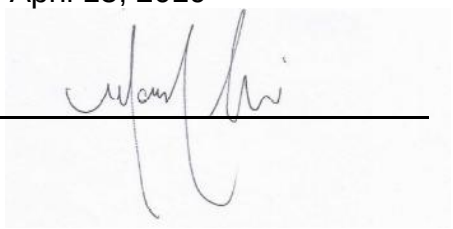
The EUT was tested pointing downwards and radiating into RF absorbing cones. That data is presented below.

The worst-case radiated emission for the EUT in the GPS band was 12.9 dB below the limit at 1238.50 MHz at a test height of 1.0 m. All other radiated emissions were at least 13.3 dB below the CFR 15.509 limits. This data can be found in the tables below.

Table 9. Radiated Emissions Test Data in The GPS Bands

1164 – 1240 MHz and 1559- 1610 MHz								
Test: Radiated Emissions					**Client:** Matrix Design Group, LLC			
Project: 19-0109					**Model:** ExSENS			
Frequency (MHz)	**Test Data (dBuv)**	**Additional Factor**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector AVG**
All emissions detected were more than 20 dB below the applicable limit								

Test Date: April 15, 2019

Tested By
Signature:  Name: Mark Afroozi

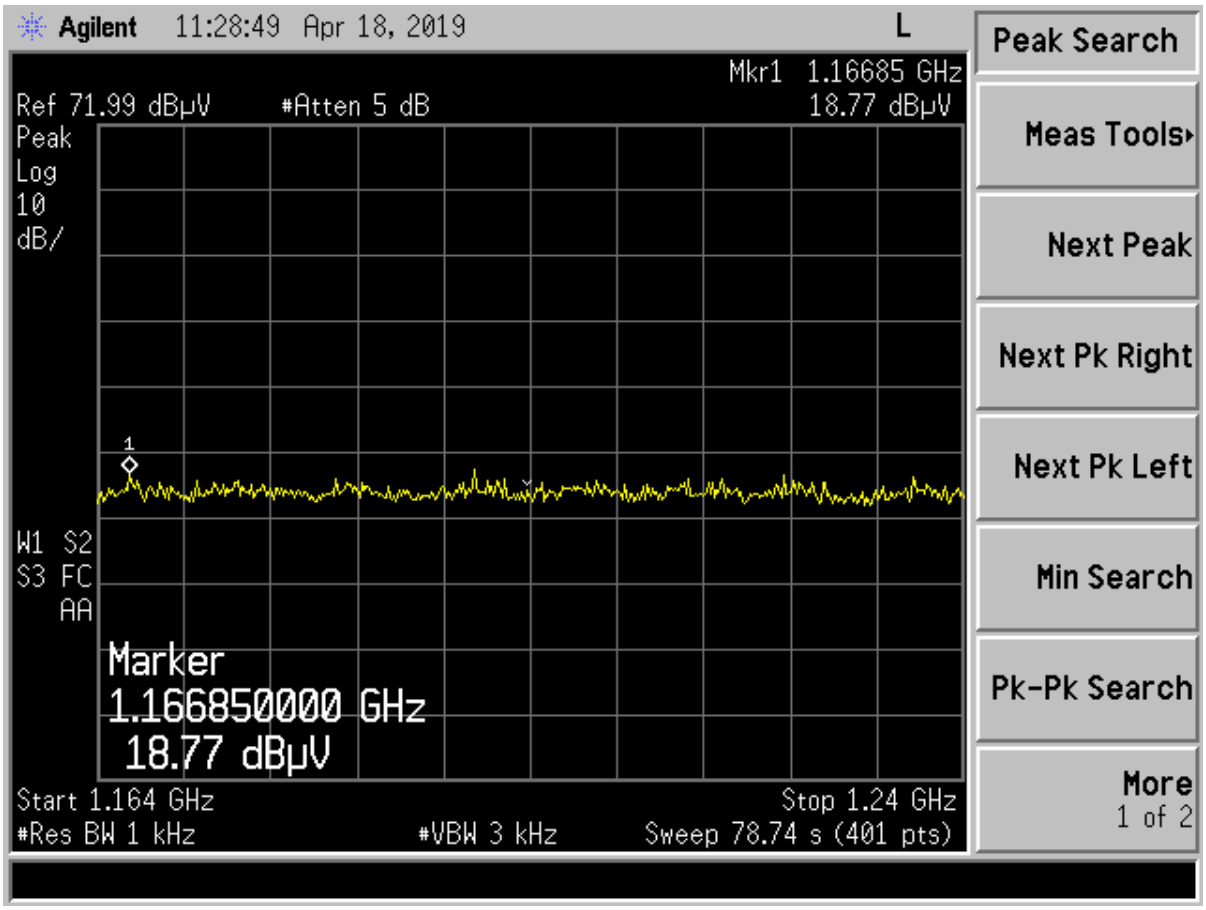


Figure 5. GPS Bands 1164 - 1204 MHz

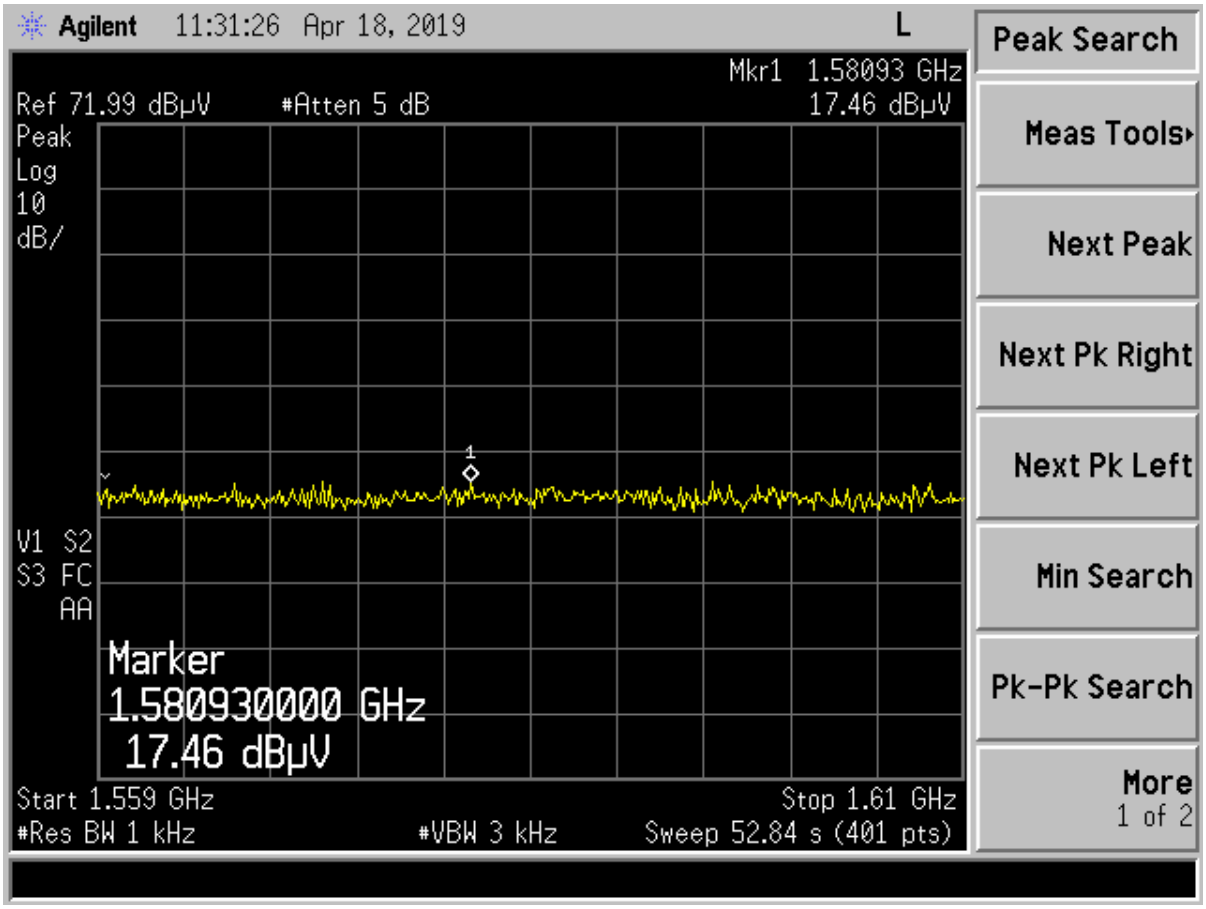


Figure 6. GPS Bands 1159 - 1610 MHz

2.16 Unintentional Radiator Power Lines Conducted Emissions (CFR 15.107)

The power line conducted voltage emission measurements were not performed because the EUT does not directly connect to the AC mains. The EUT is battery operated and does not operate while being charged. This test is not required.

2.17 Unintentional Radiator, Radiated Emissions (CFR 15.109)

The test data provided herein is to support the verification requirement for radiated emissions coming for the digital circuitry not directly associated with the operation of the transmitter.

Measurements were made with the analyzer's resolution bandwidth set to 120 kHz for measurements made below 1 GHz and 1 MHz for measurements made above 1 GHz. The video bandwidth was set to three times the resolution bandwidth; 1 MHz RBW and 3 MHz VBW. The test data were maximized for magnitude by rotating the turn-table through 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure.

Table 10. Radiated Emissions 30-1000 MHz

30-1000 MHz							
Test: Radiated Emissions				**Client:** Matrix Design Group, LLC			
Project: 19-0109				**Model:** ExSENS			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector AVG**
All emissions detected were more than 20 dB below the applicable limit.							

Test Date: April 15-16, 2019

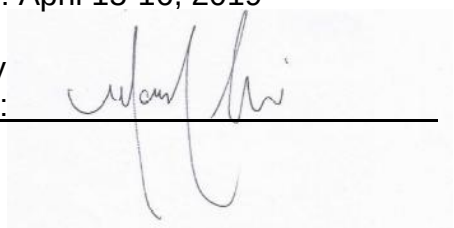
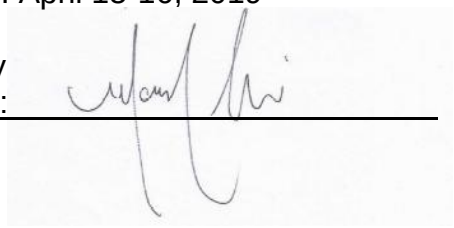
Tested By
Signature:  Name: Mark Afroozi

Table 11. Radiated Emissions above 1 GHz to 20 GHz

> 1 GHz							
Test: Radiated Emissions				**Client:** Matrix Design Group, LLC			
Project: 19-0109				**Model:** ExSENS			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector AVG**
All emissions detected were more than 20 dB below the applicable limit.							

Test Date: April 15-16, 2019

Tested By
Signature:  Name: Mark Afroozi

2.18 Measurement Uncertainty

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

2.16.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.85 dB.

This test is not applicable.

2.16.2 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 ± 5.40 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 ± 5.19 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.20 dB.

The data listed in this test report does not have sufficient margin to negate the effects of uncertainty. Therefore, the EUT conditionally meets this requirement.

3. Conclusion

The EUT is deemed to have meet all techinical requirements of Part 15 Subpart F for operating as a GPR device.

In addition the following requirements of Part 15.521 (a) to (j) have also been considered:

Technical requirements applicable to all UWB devices.

(a) UWB devices may not be employed for the operation of toys. Operation onboard an aircraft, a ship or a satellite is prohibited.	This has been considered.
(b) Manufacturers and users are reminded of the provisions of §§15.203 and 15.204.	Manufacturer is aware of these provisions.
(c) Emissions from digital circuitry used to enable the operation of the UWB transmitter shall comply with the limits in §15.209, rather than the limits specified in this subpart, provided it can be clearly demonstrated that those emissions from the UWB device are due solely to emissions from digital circuitry contained within the transmitter and that the emissions are not intended to be radiated from the transmitter's antenna. Emissions from associated digital devices, as defined in §15.3(k), e.g., emissions from digital circuitry used to control additional functions or capabilities other than the UWB transmission, are subject to the limits contained in Subpart B of this part.	This has been considered.
(d) Within the tables in §§15.509, 15.511, 15.513, 15.515, 15.517, and 15.519, the tighter emission limit applies at the band edges. Radiated emission levels at and below 960 MHz are based on measurements employing a CISPR quasi-peak detector. Radiated emission	This has been considered.

levels above 960 MHz are based on RMS average measurements over a 1 MHz resolution bandwidth. The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time. Unless otherwise stated, if pulse gating is employed where the transmitter is quiescent for intervals that are long compared to the nominal pulse repetition interval, measurements shall be made with the pulse train gated on. Alternative measurement procedures may be considered by the Commission.	
(e) The frequency at which the highest radiated emission occurs, fM, must be contained within the UWB bandwidth.	Please see the test data presented above.
(f) Imaging systems may be employed only for the type of information exchange described in their specific definitions contained in §15.503. The detection of tags or the transfer or data or voice information is not permitted under the standards for imaging systems.	The EUT is not an imaging system.
(g) When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, fM. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2. If RBW is greater than 3 MHz, the	This has been considered.

application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.	
(h) The highest frequency employed in §15.33 to determine the frequency range over which radiated measurements are made shall be based on the center frequency, fC, unless a higher frequency is generated within the UWB device. For measuring emission levels, the spectrum shall be investigated from the lowest frequency generated in the UWB transmitter, without going below 9 kHz, up to the frequency range shown in §15.33(a) or up to fC + 3/(pulse width in seconds), whichever is higher. There is no requirement to measure emissions beyond 40 GHz provided fC is less than 10 GHz; beyond 100 GHz if fC is at or above 10 GHz and below 30 GHz; or beyond 200 GHz if fC is at or above 30 GHz.	This has been considered.
(i) The prohibition in §2.201(f) and 15.5(d) of this chapter against Class B (damped wave) emissions does not apply to UWB devices operating under this subpart.	This has been considered.
(j) Responsible parties are reminded of the other standards and requirements cross referenced in §15.505, such as a limit on emissions conducted onto the AC power lines.	The has been considered.