Testing Tomorrow's Technology

Report of

Title 47 USC, 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 15.519

For the

Okyanus Teknoloji Biligisayar ve Yazilim San. Tic.

Model Numbers: FT-05FL, FT-05FLC_O, FT-05FL_O, FT-05FLC

FCC ID: 2AUFI-FT-05FL

UST Project: 19-0287

Report Issue Date: November 5, 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: November 5, 2019

NVLAP LAB CODE 200162-0

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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: OKYANUS TEKNOLOJI BILGISAYAR VE YAZILIM SAN. TIC.

MODELS: FT-05FL, FT-05FLC_O, FT-05FL_O, FT-05FLC

FCC ID: 2AUFI-FT-05FL

DATE: November 5, 2019

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

Equipment type: UWB Transmitter Handheld use

Transmitter details:

UWB Transmitter
Date Rate: 110 kbps, 850 kbps, 6.8 Mbps (Highest data rate used for testing)
Maximum field strength: 72.89 dBuV/m @ 3m
F_m = 4410.5 MHz
F_C = 4410.5 MHz
F_H = 4688.0 MHz
F_L = 4133.0 MHz

Summary of Test Results

FCC Rule	Description of Test	Result
Part 15.519(a)	Handheld considerations	PASS
Part 15.519(b)	UWB must be contained b/w 3.1 GHz to 10.6 GHz	PASS
Part 15.519(c)	Radiated emissions	PASS
Part 15.519(d)	Radiated emissions	PASS
Part 15.519(e)	Peak level emissions	PASS
Part 15.519(f)	UWB statement	PASS

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1 General Information

1.1 Purpose of this Report

This report is prepared to show that the OKYANUS TEKNOLOJI BILGISAYAR VE YAZILIM SAN. TIC. Models FT-05FL, FT-05FLC_O, FT-05FL_O, and FT-05FLC comply with the FCC Rules and Regulations of Part 15.519, technical requirements for handheld UWB systems.

The host device incorporates three radios: one 2.4 GHz IEEE 802.15.4 (ZigBee) radio and two UWB radios that are identical and transmit simultaneously on the same fundamental frequency. The test data presented in this report shows the worst case results. No additional emissions were generated due to simultaneous transmission beyond the emissions reported in this test report. The maximum permissible exposure (MPE) exhibit will show the summation of all emissions from all outputs for the two UWB radios.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on July 25, 2019 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Okyanus Teknoloji Biligisayar ve Yazilim San. Tic. Model FT-05FL. The EUT is a two part collision avoidance system and is a member of the Okyanus Teknoloji Biligisayar ve Yazilim San.Tic. family. The first part is the Collision Avoidance Alarm Center which gives visual and buzzer warnings and has a display which can adjust measurement between reader and personnel tags or forklifts. The second part is the Collision Avoidance Reader which sends messages to the alarm center via RF transmissions.

The EUT being evaluated throughout this report is the Collision Avoidance Reader. It incorporates two different wireless radio technologies. The first is a 2.4 GHz ISM band radio (ZigBee) utilizing IEEE 802.15.4 technology and the second is a radio that utilizes Ultra Wide Band (UWB) technology. This evaluation is for the UWB radio feature.

The device comes in 4 Versions, bearing 4 different Model Numbers:

1. FT-05FLC_O - (Interactive + Relay Output) - This is the full version of the device and is the version used as the representative worst-case sample for testing to cover all 4 models. It has two 4.4 GHz UWB radios and one 2.4 GHz RF radio. It is designed to operate with the other Collision Avoidance Readers. It transmits data and the other safe-zone devices detect this signal. The purpose of this is to prevent collisions between vehicles. There are three relay outputs in the Collision Avoidance Alarm Center that are used with this model. This allows customers to have contact outputs when an alarm occurs.

2. FT-05FL_O – (Relay Output) - This device is identical to the FT-05FLC_O but does not contain a second UWB radio.

3. FT-05FLC – (Interactive) - This device is identical to the FT-05LC_O except that it does not provide any relay outputs in the Collision Avoidance Alarm Center.

4. FT-05FL – This device is identical to the FT-05LC_O except that it has neither the second UWB radio nor the relay outputs.

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. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in a separate exhibit.

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, with designation number 186022.

1.6 Related Submittals

The EUT is subject to the following FCC authorizations:

a) Certification under Part 15 Subpart F as a UWB transmitter.
b) Verification under Part 15 Subpart B as a digital device.

The verification requirement shares many common report elements with the certification report; therefore, though this report is mostly intended to provide data for the certification process, this data can also be used to show compliance to the requirements of the verification limits under Part 15 Subpart B.

Table 1. EUT and Peripherals

MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
(EUT) Okyanus Teknoloji Bilgisayar Ve Yazilim San. Tic	FT-05FL	Engineering Sample	2AUFI-FT-05FL	--
Antenna See antenna details	--	--	--	--

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

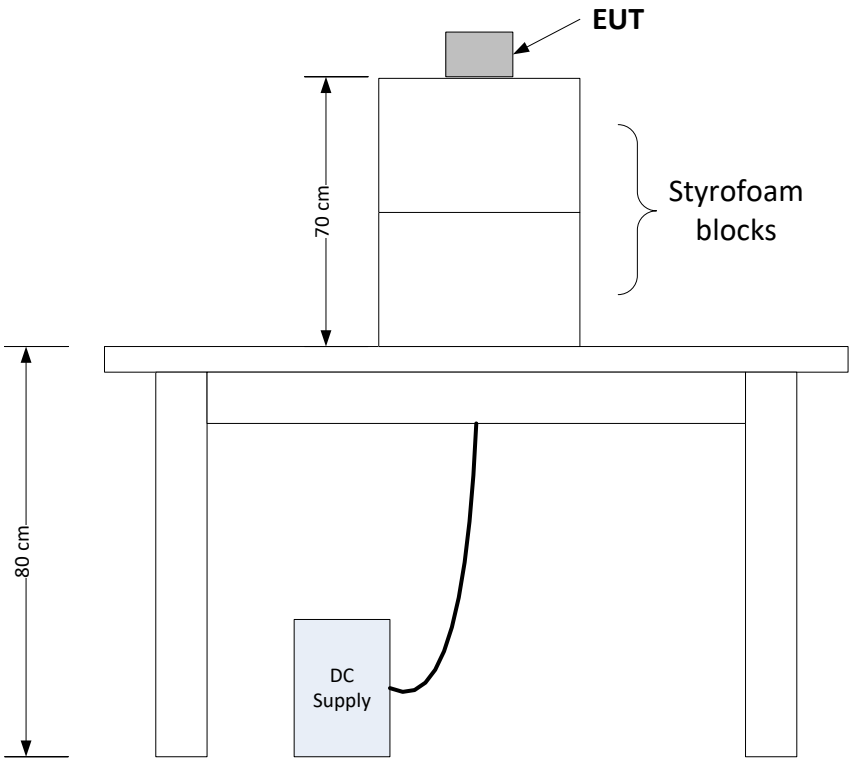


Figure 1. Block Diagram of Test Configuration

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	8593E	HEWLETT-PACKARD	3205A00124	10/25/2019
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
LOOP ANTENNA	6502	EMCO	9810-3246	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
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 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 5^{th} 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)

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

FCC Part 15.209, 15.519

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 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)

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
PCB Antenna	Taiyo Yuden	Chip	AH086M55003	2.7	SMD

2.6 Restricted Bands of Operation (Part 15.205)

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

2.7 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207)

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.207, per ANSI C63.10:2013, Clause 6.2, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmission.

The EUT is battery powered; however, it may be indirectly connected to the AC mains via approved DC power supply adapters. In this case a DC bench power supply was used to supply the EUT with the needed input voltage. The measurements were made with the DC bench supply in place. The DC bench supply is a linear supply and has no internal filter or circuits that will contribute to the EUT emissions characteristics.

2.8 Intentional Radiator, Radiated Emissions (CFR 15.519 (f), 15.521 (g))

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: 5 MHz

Peak EIRP Limit	=	20 log (RBW/50)dBm EIRP
	=	20 log(5/50) dBm EIRP
	=	-20 dBm EIRP
Peak Field Strength Limit	=	-20 dBm EIRP +95.2
	=	75.2 dBuV/m

Note 1: The EUT was programmed to transmit at a power level setting of 8 for all emissions testing. This is the maximum power permitted by programming which can only be done by the grantee. The end user or buyer of the equipment has no access to programming software.
Note 2: The test data presented below is data collected from the radio that broadcast the highest emissions.

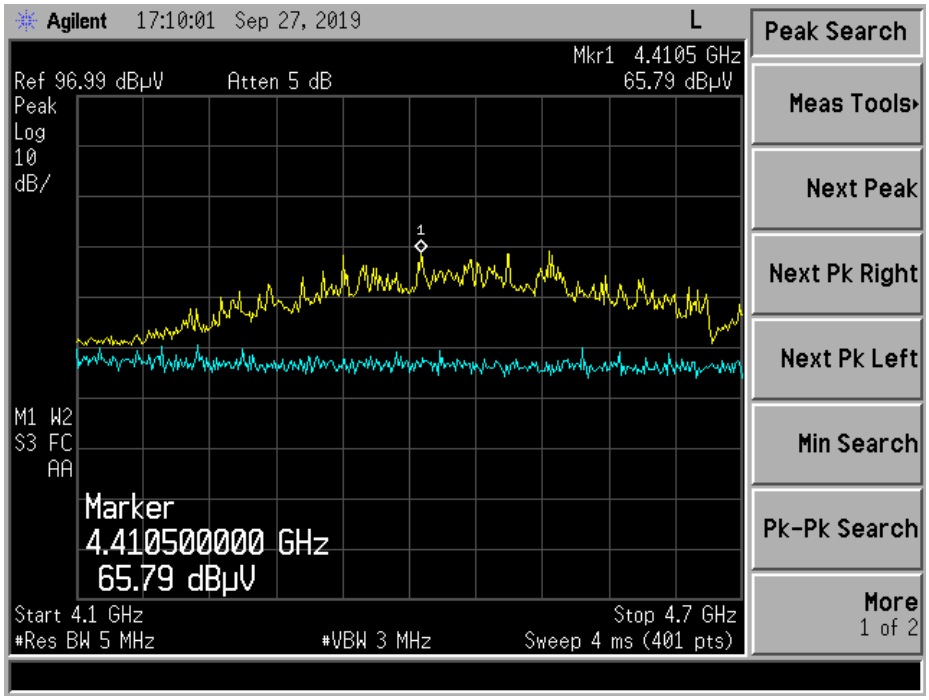


Figure 2. Worst Case Fundamental Signal (f_m)

Table 4. Intentional Radiated Emissions (CFR 15.519 (f))

Frequency (MHz)	Distance / Polarization	Raw Test Data (dBuV)	Correction Factors (dB/m)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detection
4410.50	3.0m./VERT	65.79	7.10	72.89	75.2	2.3	**PK**
4494.50	3.0m./HORZ	65.59	7.21	72.80	75.2	2.4	**PK**

Sample Calculation at 4410.5 MHz:

Raw Test Data	65.79	dBuV
+ Correction Factors	7.10	dBm
Results	72.89	dBuV/m

Test Date: September 27, 2019

Tested By
Signature: _____ Name: George Yang

2.8.1 Pulse Repetition Frequency and Duty Cycle

The device employs pulse modulation and has a repetition rate of 8.7 Hz. The pulse signal has been verified below. The plots below show the TX ON and TX OFF times. This data was used to calculate the pulse rate and Duty Cycle correction factor.

Pulse Rate: 8.7 Hz
Period= 115 mSec
Frequency= 1/seconds= 1/0.115 secs = 8.7 Hz

Duty Cycle correction factor: -27.4 dB
20 log (TX_{on}/TX_{on}+TX_{off}) = 20 log (5.000ms/117.5ms) = -27.4 dB

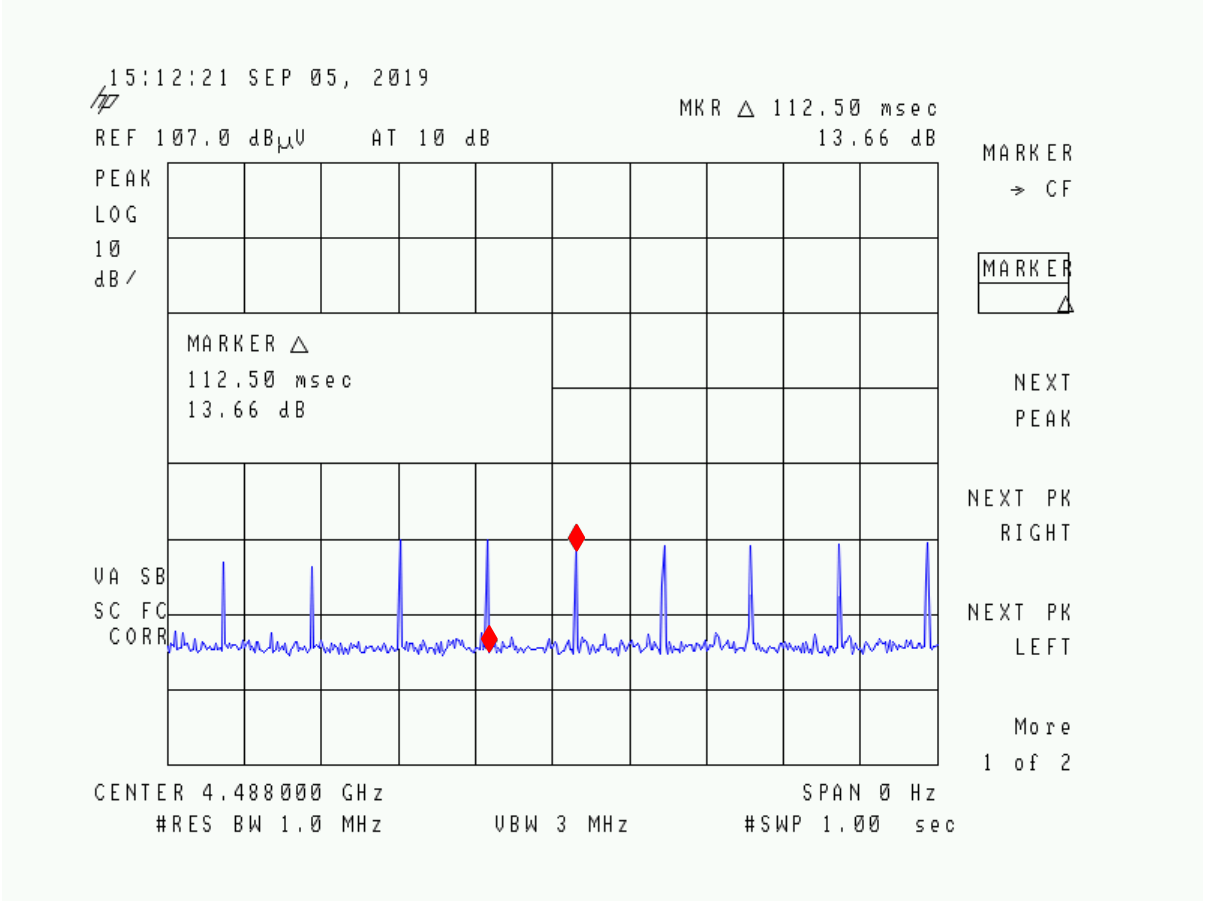


Figure 3. Duty Cycle (TX OFF)

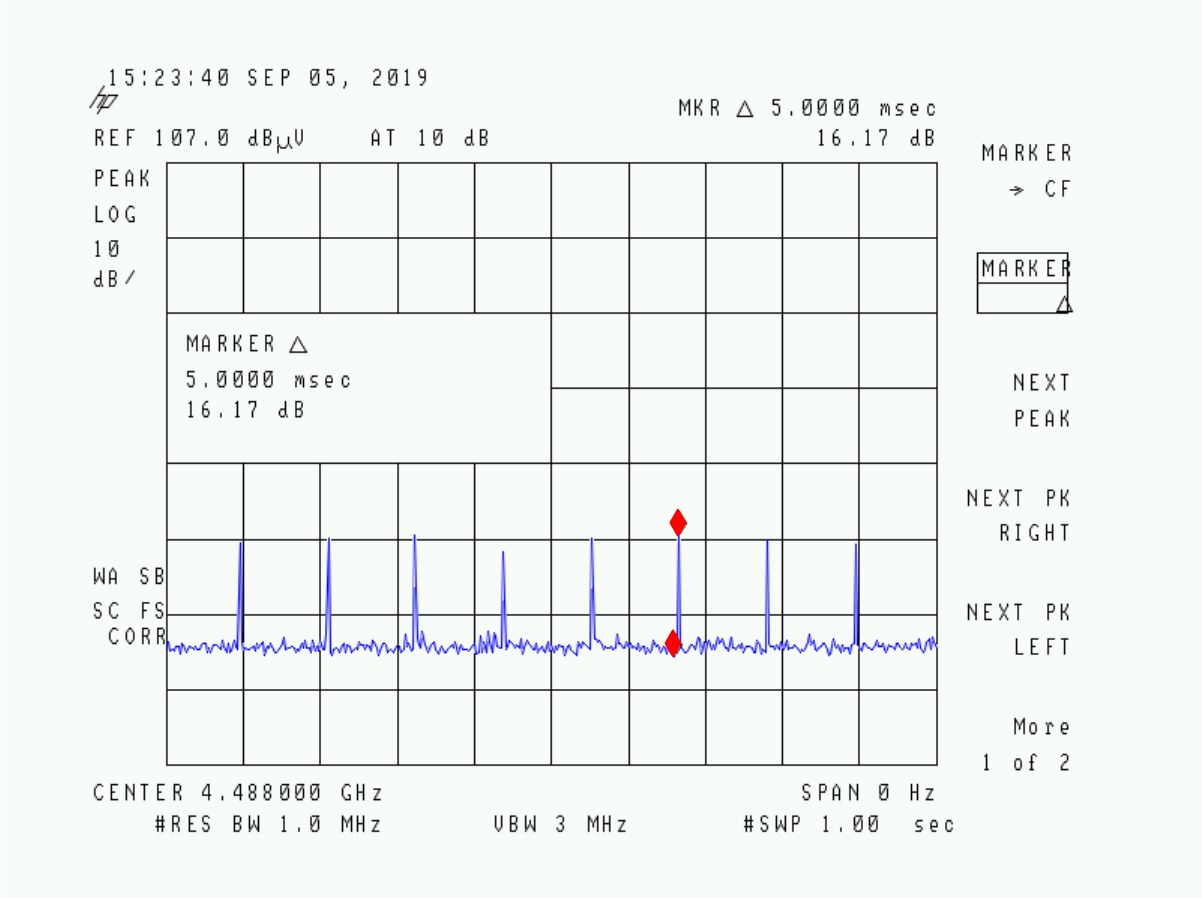


Figure 4. Duty Cycle (TX ON) Single Pulse Width

2.9 UWB Bandwidth (CFR 15.519(b), 15.521(e), RSS-220 Section 6.2.1(a))

Bandwidth measurements were made in accordance with ANSI C63.10-2013 Clause 10.1. The bandwidth of a handheld UWB system under 15.519 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 $\mathbf{f_H}$ and the lower boundary is designated $\mathbf{f_L}$. The frequency at which the highest radiated emission occurs is designated $\mathbf{f_M}$. If multiple bandwidths occur, the maximum bandwidth is used.

The bandwidth was determined from a radiated measurement using the designated antenna with which the 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. Additionally, the turn table on which the EUT was placed was 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.

Bandwidth emissions are contained within 3.1 GHz to 10.6 GHz which meets the requirements of 15.519(b).

Per FCC Part 15.503 (d) *Ultra-wideband (UWB) Transmitter.* 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.

The fractional bandwidth as calculated below is less than 0.20; however, the UWB bandwidth is greater than 500 MHz; therefore, the EUT meets this requirement.

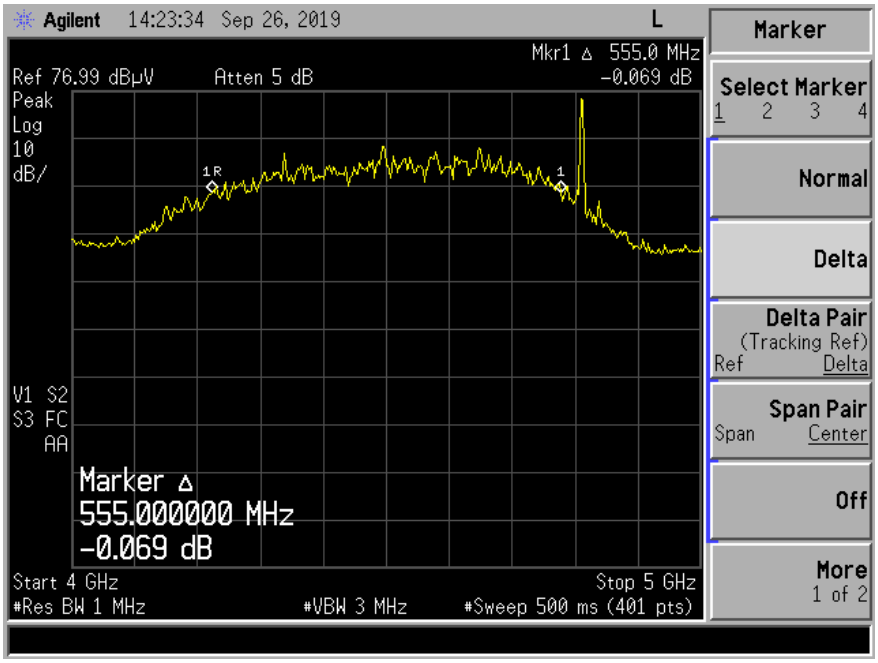


Figure 5. UWB f_L, f_M, f_H Measurement Plot

The EUT's bandwidth is 555 MHz; therefore, it meets the specifications for a UWB device.

** Note: Large spike @ 4800 MHz is a harmonic of the 2.4 GHz radio's fundamental frequency.

F_m= 4410.5 MHz
F_L= 4133.0
F_H= 4688.0
F_c= (Fh + Fl)/2 = 4410.5 MHz

2.10 UWB Purpose, Part 90 License, and Coordination (CFR 15.519 (a))

This device is designed to be used only in a handheld infrastructure as detailed in the User Guide provided in the submittal documentation. Without first setting up the network, the device will not function as intended. The device is designed such that it will not be intentionally directed outside of the building. There are no provisions for the use of outdoor mounting antennas. There are no provisions for the use of field disturbance sensors. The device is designed such that it shall transmit only when the intentional radiator is sending information to an associated receiver.

In regards to the following requirements:

A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

The device only broadcasts for 5 milliseconds and if there is no acknowledgment it goes back to sleep mode. Details are found in the Theory of Operation exhibit for the device.

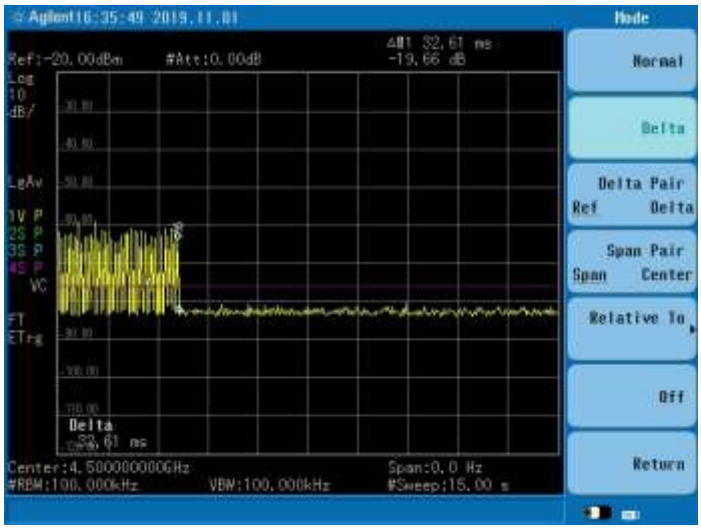


Figure 6. EUT Time-Out Plot (Transmission Ceases within 10 Seconds)

The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

There are no provisions for the use of outdoor mounting antennas. The system is designed around the use of transceiver devices that have their own integral antennas. No externally mounted antennas will be necessary for operation.

2.11 Unintentional Radiator, Power line Emissions (CFR 15.207, 15.521 (j))

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.207, per ANSI C63.10:2013, Clause 6.2, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmission.

The worst-case results for conducted emissions were 12.2 dB below the specification limit at 24.2000 MHz on the Phase Lead. All other measured signals were at least 15.6 dB below the specification limit. Those results are given in the table below.

Table 5. Power Line Conducted Emissions

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: JF	Specification Requirement: FCC Part 15.207		Project No.: 19-0287	Manufacturer: Okyanus Teknoloji Model: FT-05FL		
Frequency (MHz)	**Test Data (dBuV)**	**LISN+CL (dB)**	**Corrected Results (dBuV)**	**Limits (dBuV)**	**Margin (dB)**	**Detector**
Phase @ 120 Vac/ 60 Hz						
0.1838	29.89	0.07	29.96	54.3	24.4	**PK**
0.8017	28.66	0.58	29.24	46.0	16.8	**PK**
1.4930	30.13	0.31	30.44	46.0	15.6	**PK**
5.1750	27.47	0.06	27.53	50.0	22.5	**PK**
12.0833	29.90	0.44	30.34	50.0	19.7	**PK**
24.2000	36.72	1.13	37.85	50.0	12.2	**PK**
Neutral @ 120 Vac/ 60 Hz						
0.1533	29.14	0.13	29.27	55.8	26.6	**PK**
0.9033	28.76	0.09	28.85	46.0	17.2	**PK**
1.3267	29.56	0.18	29.74	46.0	16.3	**PK**
6.3667	27.57	0.26	27.83	50.0	22.2	**PK**
12.6167	26.52	0.73	27.25	50.0	22.8	**PK**
24.2000	29.98	1.57	31.55	50.0	18.5	**PK**

Sample Calculation at: 0.1838 MHz

Magnitude of Measured Frequency	29.89	dBuV
+LISN Factor + Cable Loss+ Amplifier Gain	.07	dB/m
Corrected Result	29.96	dBuV/m

Test Date: September 18, 2019

Tested By
Signature: _____ Name: John Freeman

2.12 Radiated Emissions at or Below 960 MHz (CFR 15.519(c), 15.209)

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.

Table 6. Radiated Emissions Test Data below 960 MHz

Test By: MA	Test: FCC Part 15.209/517(c)				Client: Okyanus Teknoloji			
	Project: 19-0287				Model: FT-05FL			
Frequency (MHz)	**Test Data (dBuV)**	**Additional Factors**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**DETECTOR PK / QP/AVG**
All emissions were more than 20 dB below the applicable limit.								

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION AT: N/A

Test Date: September 26, 2019

Tested By
Signature: _____ Name: Mark Afroozi

2.13 Radiated Emissions above 960 MHz (CFR 15.519(c), 15.521(d,g,h))

The radiated emissions above 960 MHz from the transmitter shall comply with the AVG limits in Table 7 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 7. Radiated Emissions above 960 MHz, CFR 15.519(c), 15.521(g)

Frequency Range (MHz)	EIRP Limit (dBm)	Field Strength Limit at 3 meters (dBuV/m)
960 -1610	-75.3	19.9
1610 – 1990	-63.3	31.9
1990 – 3100	-61.3	33.9
3100 - 10600	-41.3	53.9
Above 10600	-61.3	33.9

Table 8. Radiated Emissions from Transmitter Above 960 MHz

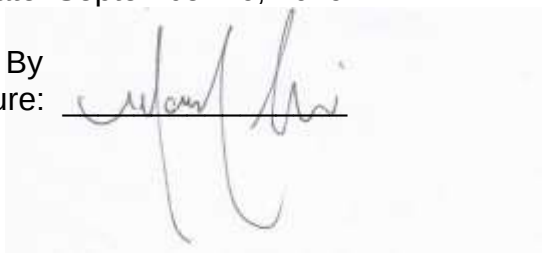
Test By: MA	Test: FCC Part 15.109/15.209				Client: Okyanus Teknoloji			
	Project: 19-0287				Model: FT-05FL			
Frequency (MHz)	**Test Data (dBuV)**	**Additional Factors**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**DETECTOR PK/QP/AVG**
All emissions were more than 20 dB below the applicable limit.								

Note: measurements taken at 1 meter were corrected using an inverse extrapolation factor of -9.5 dB to correct the value for 3 meters.

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION AT: N/A

Test Date: September 26, 2019

Tested By
Signature: 

Name: Mark Afroozi

2.14 Radiated Emissions in the GPS band (CFR 15.519(d), 15.521(g))

In addition to the radiated emissions limits from CFR 15.519(c), 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: measurements taken with a resolution bandwidth of greater than 1 kHz were corrected using the following equation: recorded measurement (dBuV) + 10 log (RBW_{ref}/RBW_{meas})

Table 9. Radiated Emissions in the GPS band (CFR 15.519 (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	-85.3	9.9
1559-1610	-85.3	9.9

The EUT was configured according to ANSI C63.10, Clause 10. During the testing, the EUT was rotated 360 degrees clockwise and counterclockwise and the receive antenna was elevated and lowered 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 polarities. The worst case data is recorded and presented in the tables following.

In each of these bands, the emissions from the transmitter were maximized using a larger bandwidth and 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:

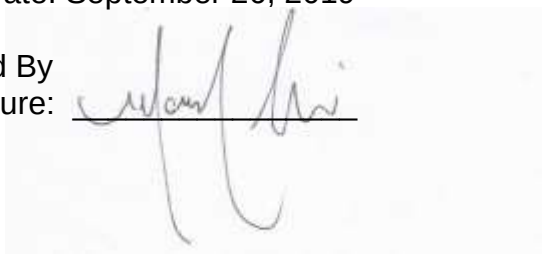
Frequency start and stop: 1164 MHz to 1240 MHz and 1559 MHz to 1610 MHz. The resolution bandwidth was set to 1 kHz or 3 kHz. When the measurements were performed at 3 kHz a correction factor was used to correct the data collected at 3 kHz back to 1 kHz using the equation noted above. The video bandwidth 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.

Table 10. Radiated Emissions per 15.519(d)

1164 – 1240 MHz and 1559- 1610 MHz								
Test: Radiated Emissions					**Client:** Okyanus Teknoloji			
Project: 19-0287					**Model:** FT-05FL			
Frequency (MHz)	**Test Data (dBuv)**	**Additional Factor**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector**
1167.99	21.30	--	-9.76	11.54	29.9	3.0m./VERT	18.4	**PK**
1588.84	20.34	--	-8.05	12.29	29.9	3.0m./VERT	17.6	**PK**
1167.99	21.30	-27.40	-9.76	-15.86	9.9	3.0m./VERT	25.8	**AVG**
1588.84	20.34	-27.40	-8.05	-15.11	9.9	3.0m./VERT	25.0	**AVG**
All other emissions were more than 20 dB below the applicable limit.								

Note: Duty Cycle correction factor of -27.40 dB has been applied to Peak values to correct for AVG detection.

Test Date: September 26, 2019

Tested By
Signature: 

Name: Mark Afroozi

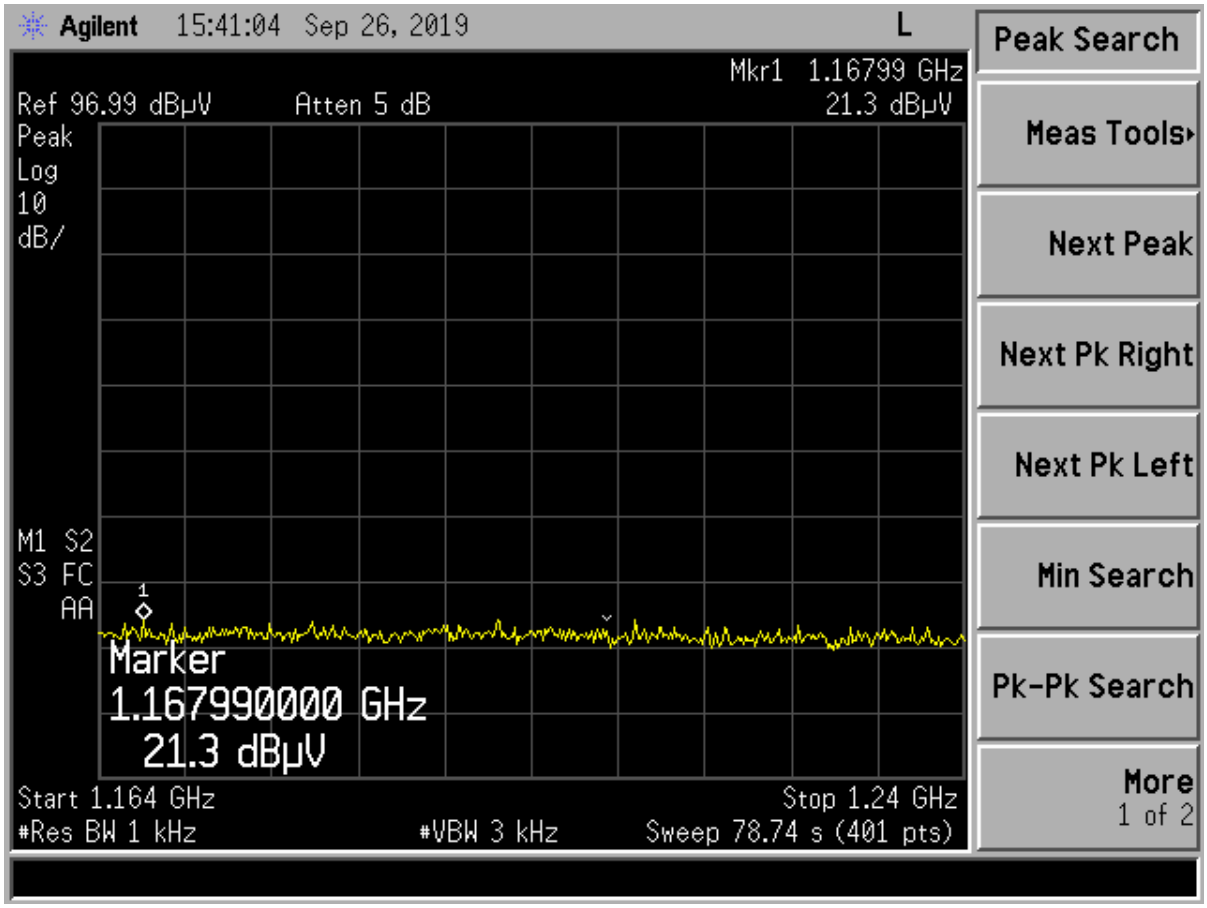


Figure 7. 1164 - 1240 MHz Worst Case Plot

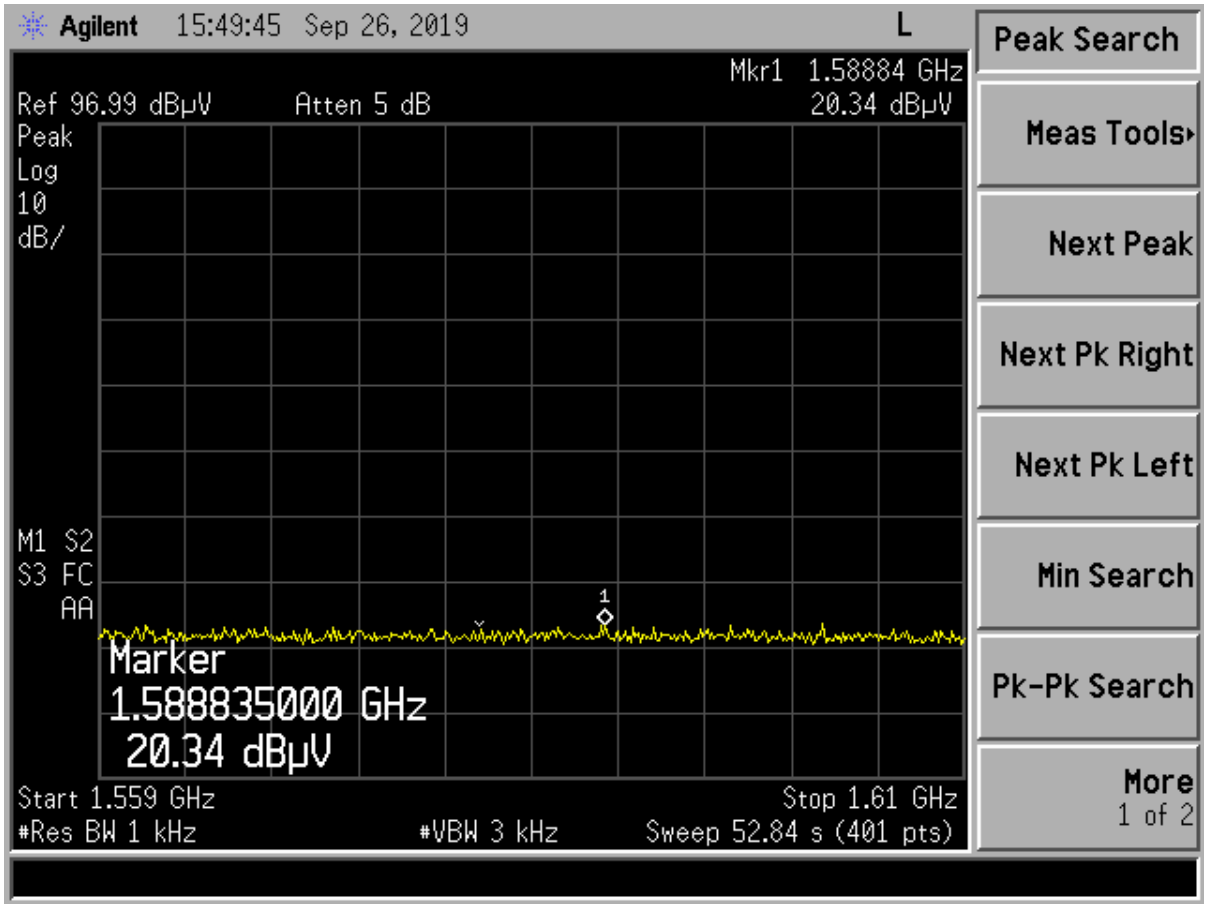


Figure 8. 1559 - 1610 MHz Worst Case Plot

2.15 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%.

2.15.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.85 dB. The data listed in this test report does have sufficient margin to negate the effects of uncertainty; therefore, the EUT unconditionally meets this requirement.

2.15.2 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 have sufficient margin to negate the effects of uncertainty. Therefore, the EUT unconditionally meets this requirement.

END TEST REPORT