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 C, paragraphs 15.207, 15.209 and 15.247

For the

Okyanus Teknoloji Bilgisayar ve Yazilim San. Tic.

Model Numbers: FT-06DCH, FT-06DCH-POE, FT-06DCH-POE-IO

FCC ID: 2AUFI-FT-06DCH

UST Project: 20-0187

Issue Date: July 23, 2020

Total Pages: 48

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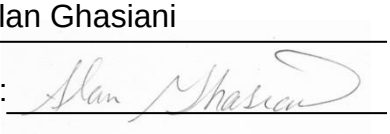
I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible for Test):

By: Alan Ghasiani

Name: 

Title: Compliance Engineer – President

Date: July 23, 2020

TESTING
NVLAP LAB CODE 200162-0

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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Okyanus Teknoloji Bilgisayar Ve Yazilim San. Tic.
Alparslan is merkezi, Haldun Taner Sk. No. 27B Blok
Kat: 4 Daire: 15, Istanbul, Turkey 334173

MODELS: FT-06DCH, FT-06DCH-POE, FT-06DCH-POE-IO
FCC ID: 2AUFI-FT-06DCH
DATE: July 23, 2020

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

Equipment type: 2.4 GHz Transmitter (802.15.4)

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:
IEEE 802.15.4 (IEEE 802.15.4) transceiver device
Output power: 13.81 dBm (24.04 mW)
Frequency of operation: 2405-2480 MHz

Summary of Test Results

FCC Rule	Description of Test	Result
15.247(b)(3)	Peak Output Power	PASS
15.247(a)(2)	6 dB Bandwidth	PASS
15.247(d)	Conducted & Radiated Spurious Emissions	PASS
15.247(e)	Power Spectral Density	PASS
15.209	Spurious Radiated Emissions	PASS
15.207	Power line Conducted Emissions	PASS

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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 FCC Rules and Regulations Part 15, Section 247.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on June 8, 2020 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Okyanus Teknoloji Bilgisayar ve Yazilim San. Tic., Models FT-06DCH, FT-06DCH-POE, and FT-06DCH-POE-IO. It is a reader device that is part of a real time location system (RTLS). The EUT collects signals from the tags, readers and other sensors within the system and sends them to a router. The EUT operates over a frequency range of 2.4 GHz (IEEE 802.15.4) and 4.4 GHz (Ultra Wide Band) by using an integrated 2.4 GHz radio and on-board UWB radio module.

This test report evaluates the 2.4 GHz intentional transmitter part of the product for compliance to Part 15 Subpart C. For testing purposes the FT-06DCH-POE-IO was determined to be the worst-case model to cover all models for this evaluation. The evaluation of the UWB radio has been performed in a separate test report. The UWB is pending Limited Modular Approval under FCC ID: 2AUFI-UWB001.

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* for the intentional radiator aspect of the device and *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014)* for the unintentional radiator aspect of the device as well as FCC subpart B and C of Part 15 and per FCC KDB Publication number 558074 v03r05 for Digital Transmission Systems Operating Under section 15.247.

Digital RF conducted and radiated emissions data below 1 GHz were taken with the measuring receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz respectively. All measurements performed above 1.0 GHz were made with an RBW of 1 MHz. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was set to 3 times the RBW or as required per the standard throughout the evaluation process.

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 for spurious and fundamental emissions 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. Its designation number is 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 Submittal(s)/Grant(s)

The EUT is subject to the following FCC Equipment Authorizations:

a) Certification of the IEEE 802.15.4 2.4 GHz transmitter incorporated within the EUT, see test data presented herein.
b) Certification of the UWB transmitter under FCC Part 15.519; test results included in a separate report.
c) SDoC as a Class B Digital Device.

Table 1. Supporting Equipment

EUT MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
EUT Okyanus	FT-06DCH-POE-IO	1906200010	2AUFI-FT-06DCH Contains: 2AUFI-UWB001	P, U D, S
Antenna	See antenna details herein.			
PERIPHERAL MANUFACTURER	**MODEL NUMBER**	**SERIAL NUMBER**	**FCC/IC ID**	**CABLES P/D**
Peripheral POE	JL383A	246000001792A	N/A	D, S

S= Shielded, U= Unshielded, 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 included herein.

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	1/29/2022 2 yr.
SPECTRUM ANALYZER	DSA815*	RIGOL	DSA8A18030 0138	12/10/2021 2 yr.
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	1937A02980	5/13/2021
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	5/13/2021
LOOP ANTENNA	6502	ETS Lindgren	9810-3246	4/6/2022 2 yr.
BICONICAL ANTENNA	3110B	EMCO	9306-1708	6/27/2021 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.
HIGH PASS FILTER	H3R020G2	MICROWAVE CHIRCUITS	001DC9528	5/11/2021
8 dB ATTENUATOR	VAT-8 15542	MINI-CIRCUITS	30519	Verified before use
LISN	8028-50-TS24-BNC	Solar Electronics	910495	5/8/2021
LISN	8028-50-TS24-BNC	Solar Electronics	910494	5/8/2021

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 modifications were made by US Tech to bring the EUT into compliance with FCC Part 15.247 requirements.

2.3 Number of Measurements for Intentional Radiators (15.31(m))

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 as follows.

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 over 2.4 GHz to 2.4835 GHz, 3 test frequencies will be used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 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 10th harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range shall be investigated from 30 MHz to 1000 MHz or to the requirements of CRF15.33 (b)(1).

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

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

2.6 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 4. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB_i	TYPE OF CONNECTOR
External Antenna	Pulse Electronics	Dipole	W1010	2.0	SMA (Male)

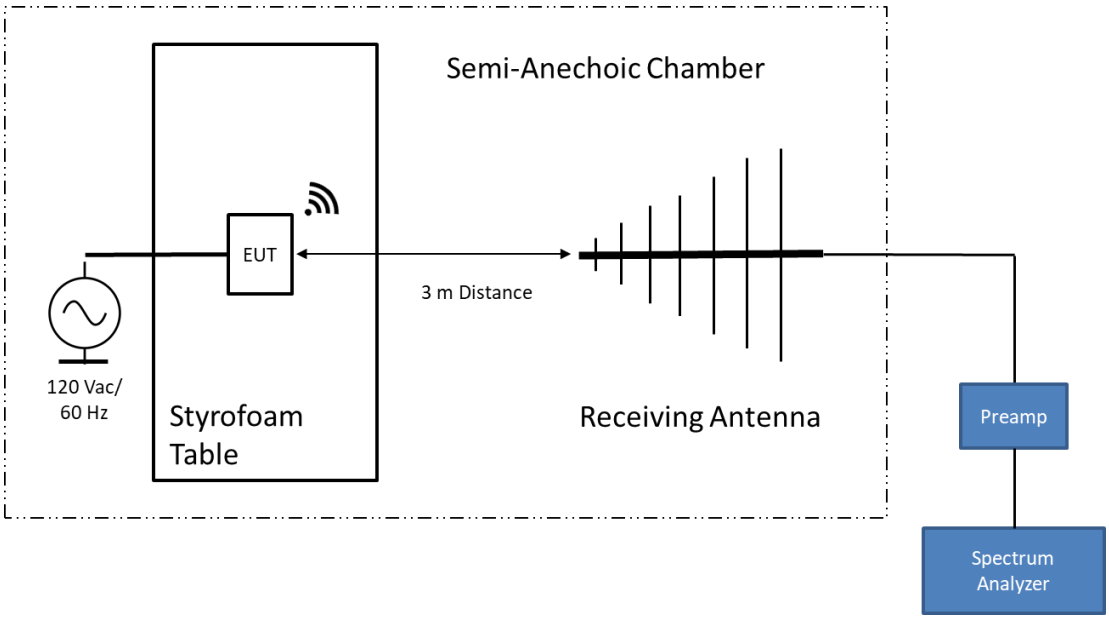


Figure 1. Block Diagram of Test Configuration

2.7 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 cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement see paragraph 2.10.

2.8 Transmitter Duty Cycle (Part15.35 (c))

The EUT employs pulse transmission however for testing purpose the EUT was programmed to transmit at a rate >98%. The pulse transmission requirements of this subpart were acknowledged and considered during testing.

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 also be expressed logarithmically in dB.

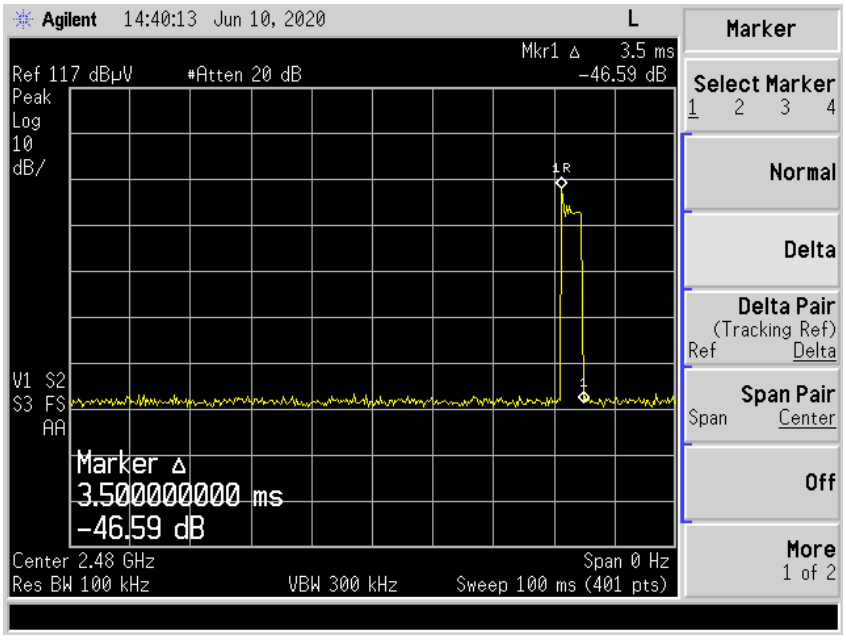


Figure 2. Duty Cycle Screen Shot

Note: There is only a single pulse in a 100 mSec time interval.
DC correction factor = 20 log (TXon/100mSec) = 20*log (0.0350) = **-29.1 dB**

2.9 Antenna Conducted Intentional and Spurious Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a))

The EUT was put into a continuous-transmit mode of operation and tested per ANSI C63.10-2013 for conducted out of band emissions radiating from the antenna port over the frequency range of 30 MHz to ten times the highest clock frequency generated or used in this case, 25 GHz. A conducted scan was performed on the EUT to identify and record spurious signals that were related to the transmitter. Antenna conducted emissions of a significant magnitude that fell within restricted bands were then measured as radiated emissions inside the semi-anechoic chamber. The conducted emissions graphs are found in Figures 3 through 8 below. The limit for antenna conducted power is 1 Watt (30 dBm) per CFR 15.247 (b)(3).

For conducted RF antenna port tests, the RBW was set to 100 kHz, video bandwidth (VBW) > RBW, and scanned up through the 10^{th} harmonic of the fundamental frequency. All harmonics and spurious emissions must be at least 20 dB down from the fundamental frequency.

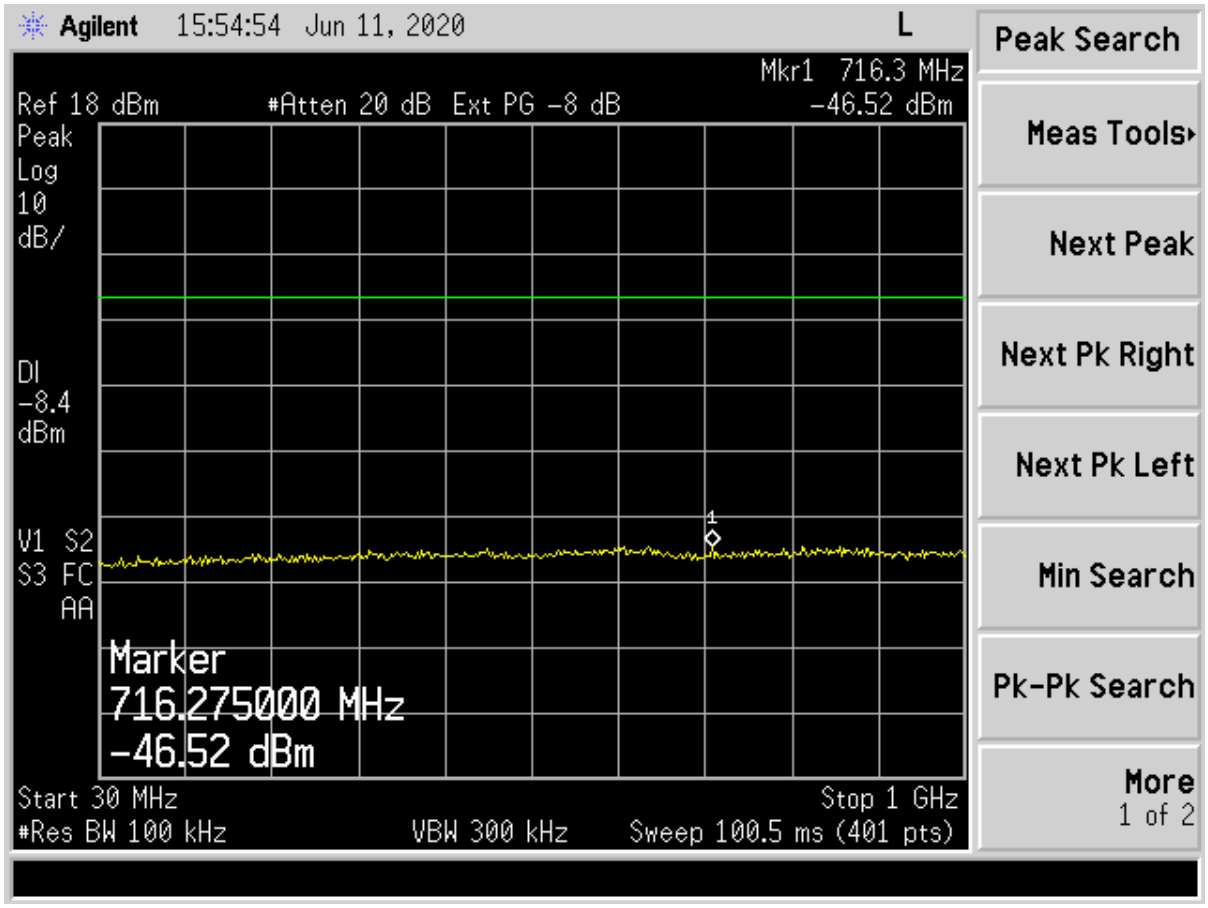


Figure 3. Conducted Spurious Emissions, Low Channel, 30 MHz - 1000 MHz

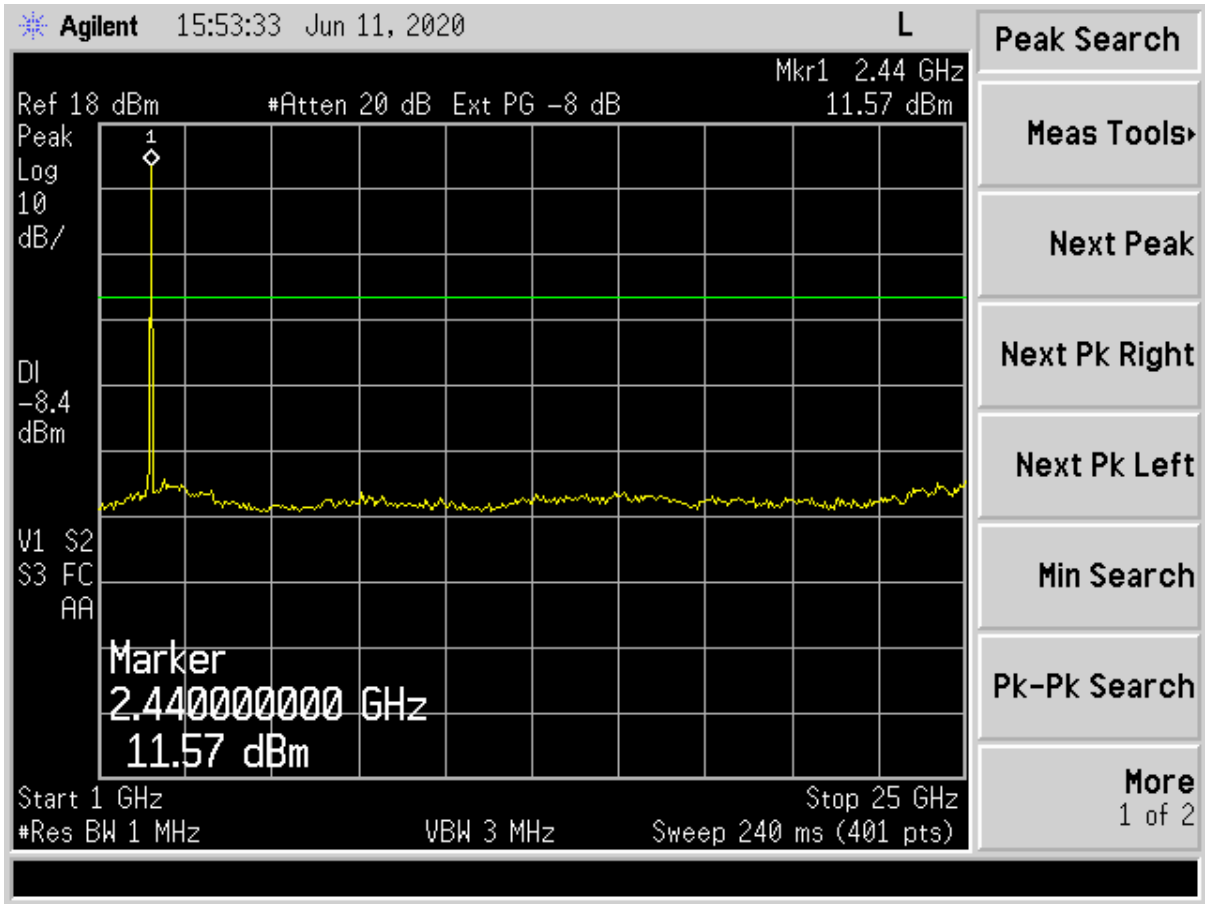


Figure 4. Conducted Spurious Emissions, Low Channel, 1 GHz – 25 GHz

** Large emission shown is the fundamental frequency.

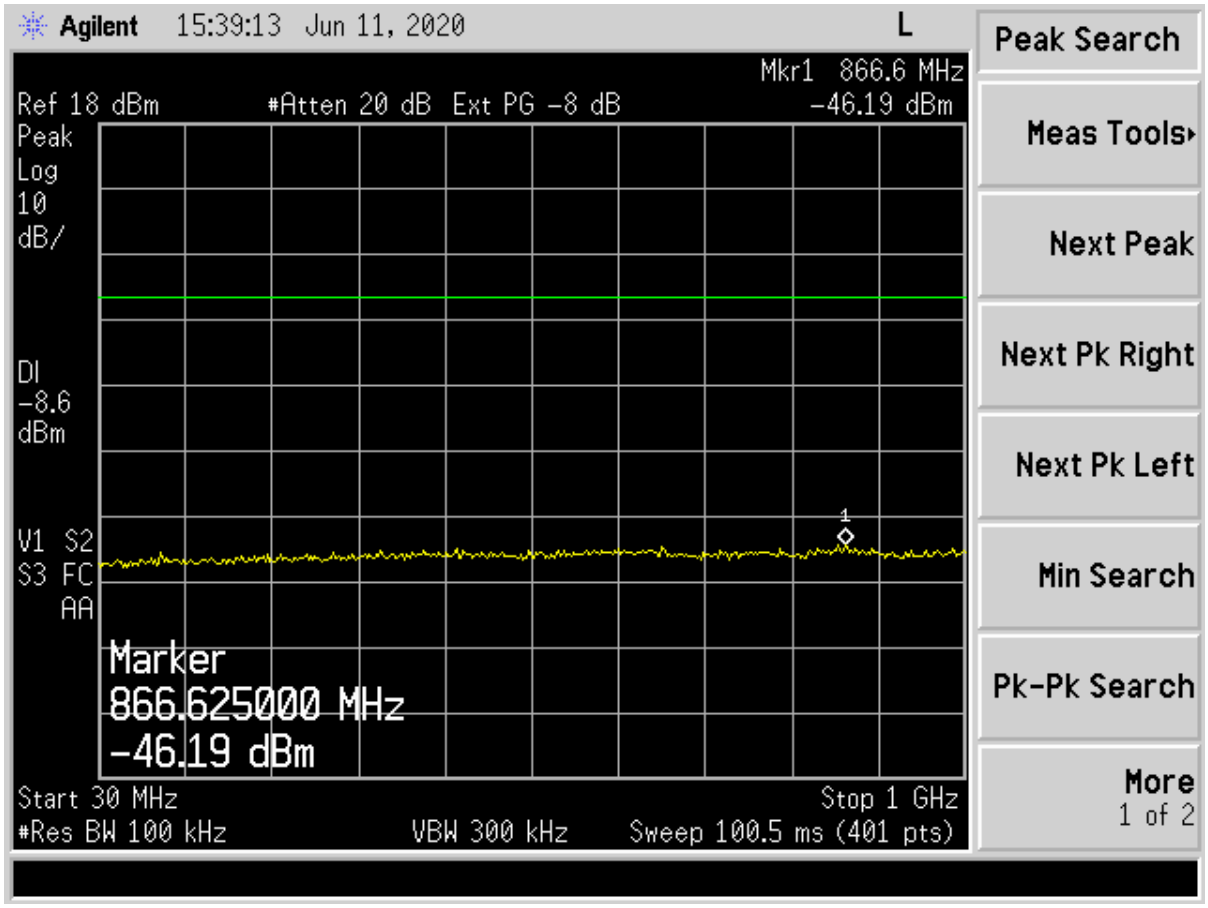


Figure 5. Conducted Spurious Emissions, Mid Channel, 30 MHz - 1000 MHz

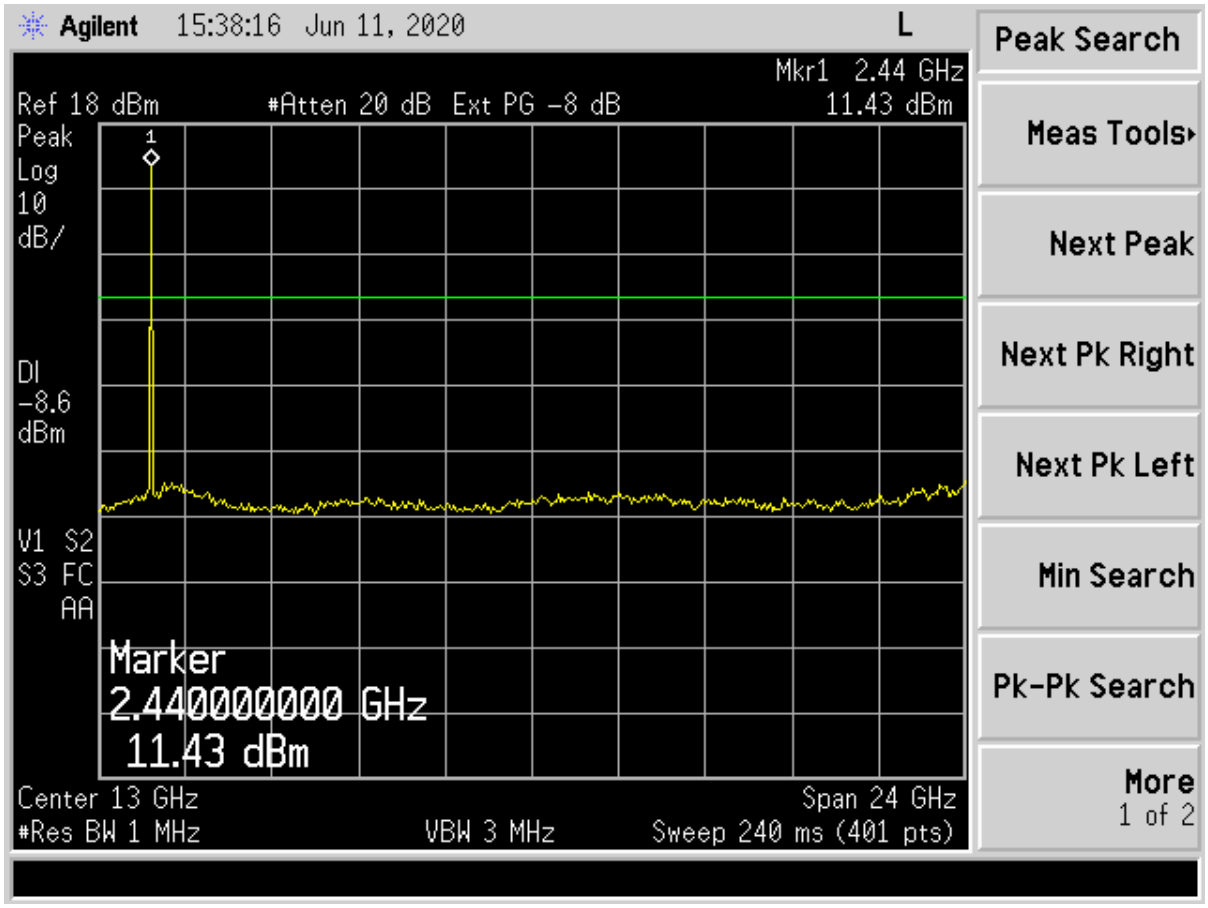


Figure 6. Conducted Spurious Emissions, Mid Channel, 1 GHz – 25 GHz

** Large emission shown is the fundamental frequency.

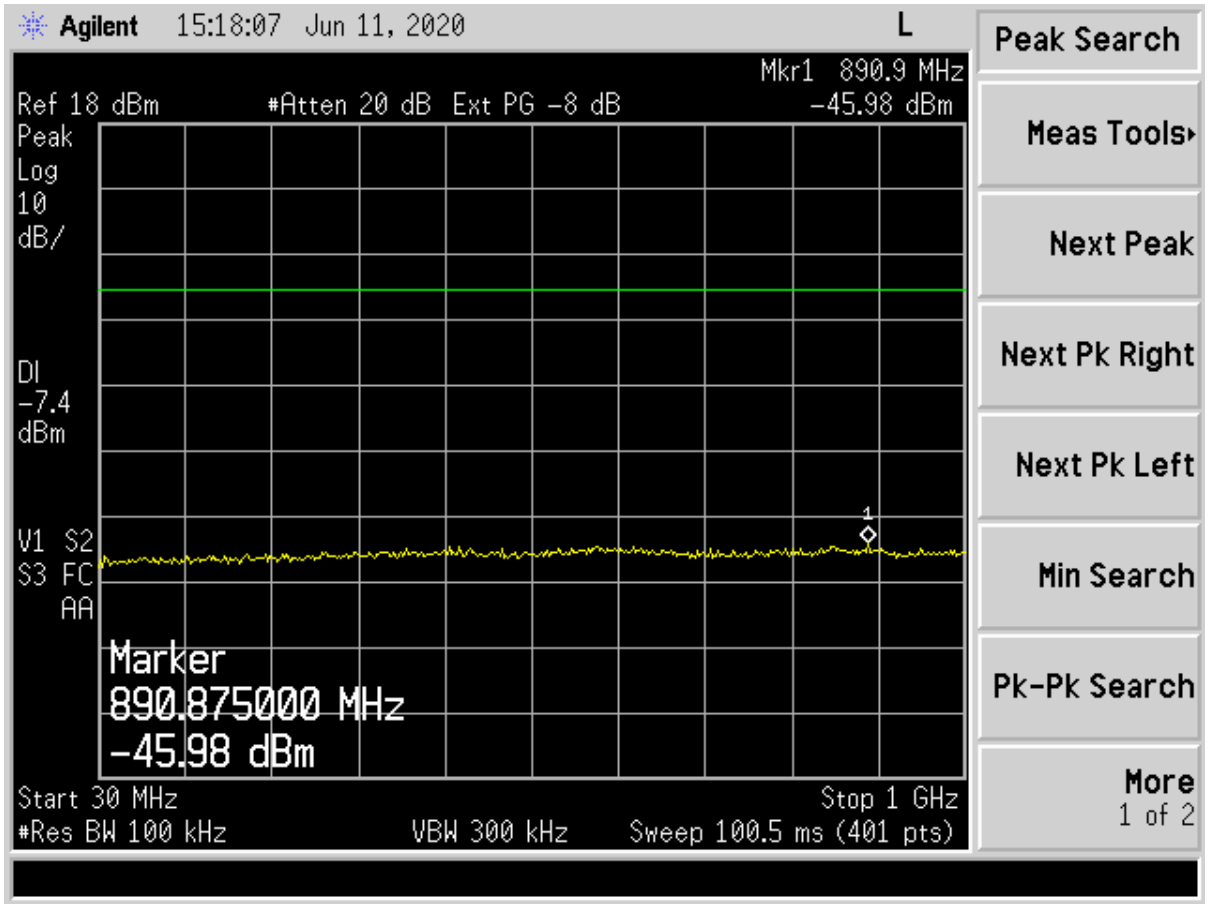


Figure 7. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz

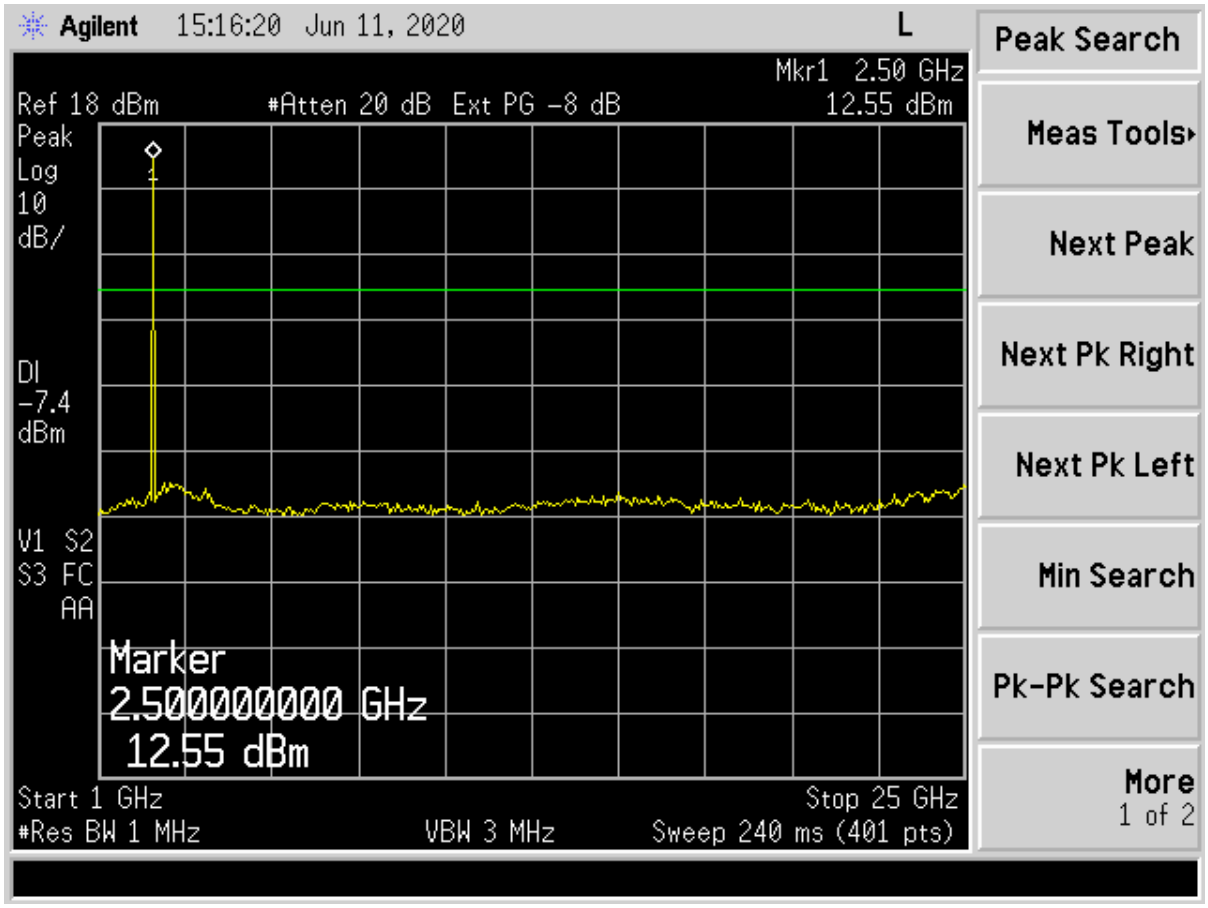


Figure 8. Conducted Spurious Emissions, High Channel, 1 GHz – 25 GHz

** Large emission shown is the fundamental frequency.

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d))

On the test site, the EUT was placed on top of a non-conductive table, 80 cm above the floor for measurements below 1 GHz and 150 cm above the floor for measurements > 1 GHz. The EUT was also evaluated in three orthogonal positions to determine the worst-case position. The front of the EUT faced the measurement antenna located 3 meters away. Each signal measured was maximized by raising and lowering the receive antenna between 1 and 4 meters in height while monitoring the ever-changing spectrum analyzer display (with channel A in the Clear-Write mode and channel B in the Max-Hold mode) for the largest signal visible. That exact antenna height where the signal was maximized was recorded for reproducibility purposes. Also, the EUT was rotated about its Y-axis 360 degrees clockwise and counterclockwise while monitoring the Spectrum Analyzer display for maximum. The EUT azimuth was recorded for reproducibility purposes. The EUT was measured when both maxima were simultaneously satisfied.

For radiated measurements, the EUT was set into a continuous transmission mode. Below 1 GHz, the RBW of the measuring instrument was set equal to 120 kHz with a VBW ≥ RBW. Peak measurements above 1 GHz were measured using a RBW = 1 MHz, with a VBW ≥ RBW. The results of peak radiated spurious emissions falling within restricted bands are given in Table 5 below.

For Average measurements above 1 GHz, the emissions were measured using RBW = 1 MHz and VBW = 10 Hz or the duty cycle correction factor was applied to the Peak recorded value. The results of average radiated spurious emissions falling within restricted bands are given in Table 6 following.

Table 5. Peak Radiated Fundamental & Harmonic Emissions

Tested By: AF	**Test:** FCC Part 15,247(d)			**Client:** Okyanus Teknoloji				
	Project: 20-0187			**Model:** FT-05DCH-POE-IO				
Frequency (MHz)	**Test Data (dBuV)**	**Additional Factor**	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detector**
Low Channel - PEAK								
2405.00	78.13	--	28.83	106.96	--	3.0m./HORZ	--	**PK**
*4810.00	51.27	--	4.15	55.42	74.0	3.0m./HORZ	18.6	**PK**
*7215.00	50.93	-9.50	9.56	50.99	74.0	1.0m./HORZ	23.0	**PK**
Mid Channel - PEAK								
2440.00	79.89	--	28.98	108.87	--	3.0m./HORZ	--	**PK**
*4880.00	50.39	--	4.27	54.66	74.0	3.0m./HORZ	19.3	**PK**
*7320.00	50.82	-9.50	10.14	51.46	74.0	1.0m./HORZ	22.5	**PK**
High Channel– PEAK								
2480.00	78.68	--	28.99	107.67	--	3.0m./HORZ	--	**PK**
*4960.00	50.78	--	4.70	55.48	74.0	3.0m./HORZ	18.5	**PK**
*7440.00	50.61	-9.50	10.41	51.52	74.0	1.0m./HORZ	22.5	**PK**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements made at 1 meter are extrapolated back to 3 meter using an inverse extrapolation factor of -9.5 dB. This value is added in the Additional Factor column.

Sample Calculation at 2405.00 MHz:

Magnitude of Measured Frequency	78.13	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss - Amplifier Gain	28.83	dB/m
Corrected Result	106.96	dBuV/m

Test Date: June 10, 2020

Tested By
Signature: Afzal Fazal Name: Afzal Fazal

Table 6. Average Radiated Fundamental & Harmonic Emissions

Tested By: AF	**Test:** FCC Part 15,247(d)			**Client:** Okyanus Teknoloji				
	Project: 20-0187			**Model:** FT-05DCH-POE-IO				
Frequency (MHz)	**Test Data (dBuV)**	**Additional Factor**	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detector**
Low Channel - Average								
2405.00	20.28	--	28.83	49.11	--	3.0m./HORZ	--	**AVG**
*4810.00	28.94	--	4.15	33.09	54.0	3.0m./HORZ	20.9	**AVG**
*7215.00	30.05	-9.50	9.56	30.11	54.0	1.0m./HORZ	23.9	**AVG**
Mid Channel–Average								
2440.00	20.44	--	28.98	49.42	--	3.0m./HORZ	--	**AVG**
*4880.00	29.01	--	4.27	33.28	54.0	3.0m./HORZ	20.7	**AVG**
*7320.00	29.37	-9.50	10.14	30.01	54.0	1.0m./HORZ	24.0	**AVG**
High Channel–Average								
2480.00	20.27	--	28.99	49.26	--	3.0m./HORZ	--	**AVG**
*4960.00	29.18	--	4.70	33.88	54.0	3.0m./HORZ	20.1	**AVG**
*7440.00	28.95	-9.50	10.41	29.86	54.0	1.0m./HORZ	24.1	**AVG**

1.(*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements made at 1 meter are extrapolated back to 3 meter using an inverse extrapolation factor of -9.5 dB. This value is added in the Additional Factor column.

Sample Calculation at 2405.00 MHz:

Magnitude of Measured Frequency	20.28	dBuV
+Additional Factor (filter + duty cycle)	0.00	dB
+Antenna Factor + Cable Loss - Amplifier Gain - Duty Cycle	28.83	dB/m
Corrected Result	49.11	dBuV/m

Test Date: June 10, 2020

Tested By
Signature: Afzal Fazal Name: Afzal Fazal

2.11 Band Edge Measurements – (CFR 15.247 (d))

Band Edge measurements are made following the guidelines in ANSI C63.10-2013 with the EUT initially operating on the lowest channel and then operating on the highest channel within its band of operation. Antenna port conducted measurements are performed to demonstrate compliance with the requirement of 15.247(d) that all emissions outside of the band edges be attenuated by at least 20 dB when compared to its highest in-band value (contained in a 100 kHz band). Because these frequencies occur above 1000 MHz, they have a peak and average requirement.

To capture the band edge, the spectrum analyzer frequency span was set large enough (usually around 10 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. Conducted measurements are performed with RBW at 100 kHz and VBW is set ≥ RBW. See figures and calculations below for more detail.

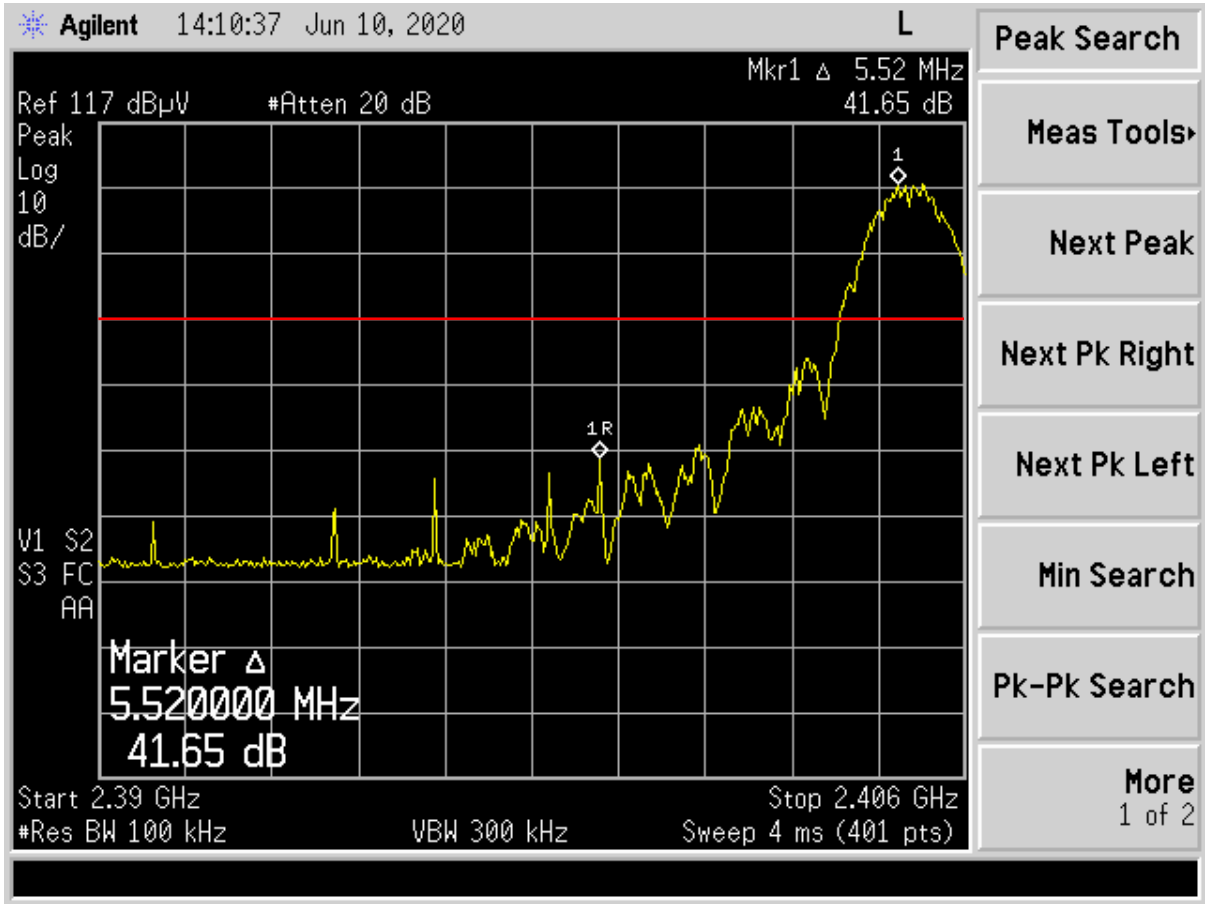


Figure 9. Band Edge Compliance, Low Channel, Delta - Peak

Band Edge Compliance = PASS

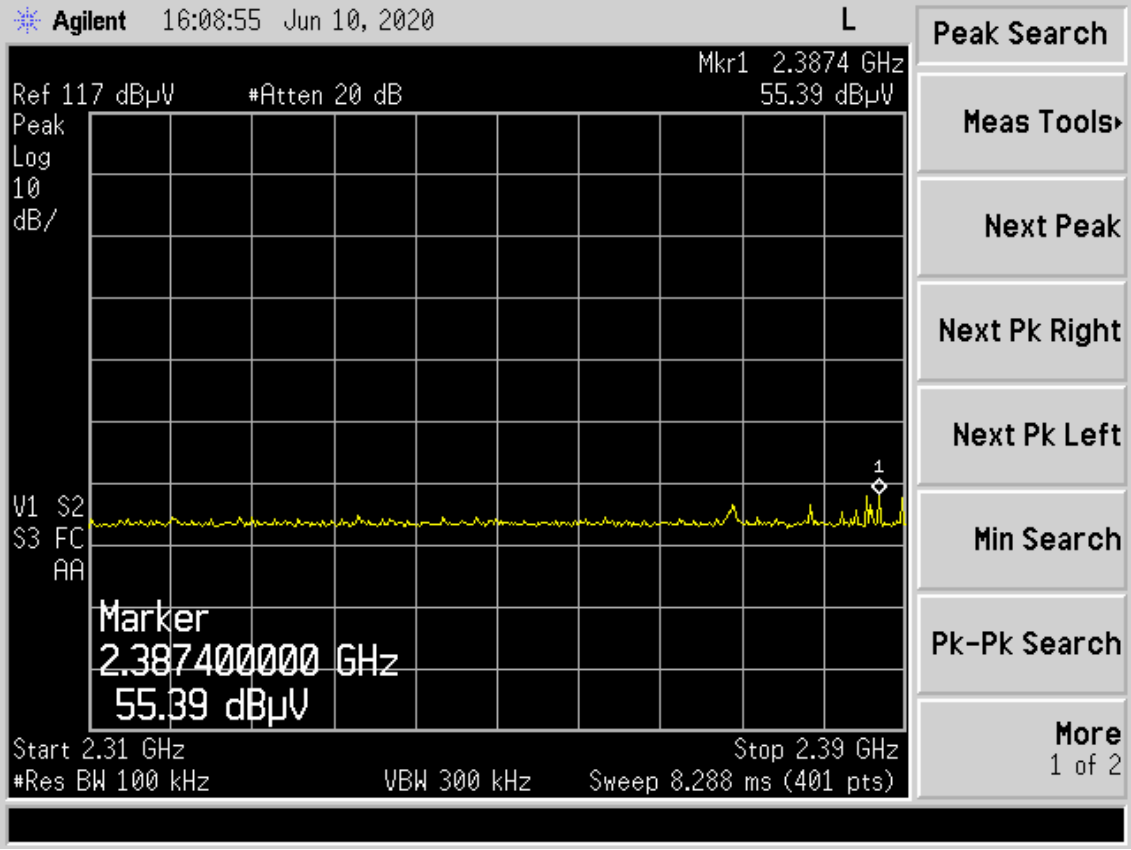


Figure 10. Restricted Band, Low Channel

2310 MHz to 2390 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				**Client:** Okyanus Teknoloji			
Project: 20-0187				**Model:** FT-05DCH-POE-IO			
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**
2387.40	55.40	-5.93	49.47	74.0	3.0m./HORZ	24.5	**PK**
2335.80	55.40	-5.93	49.47	54.0	3.0m./HORZ	4.5	**PK**

Note: Peak value meets the limit.

Test Date: June 10, 2020

Tested By
Signature: Afzal Fazal Name: Afzal Fazal

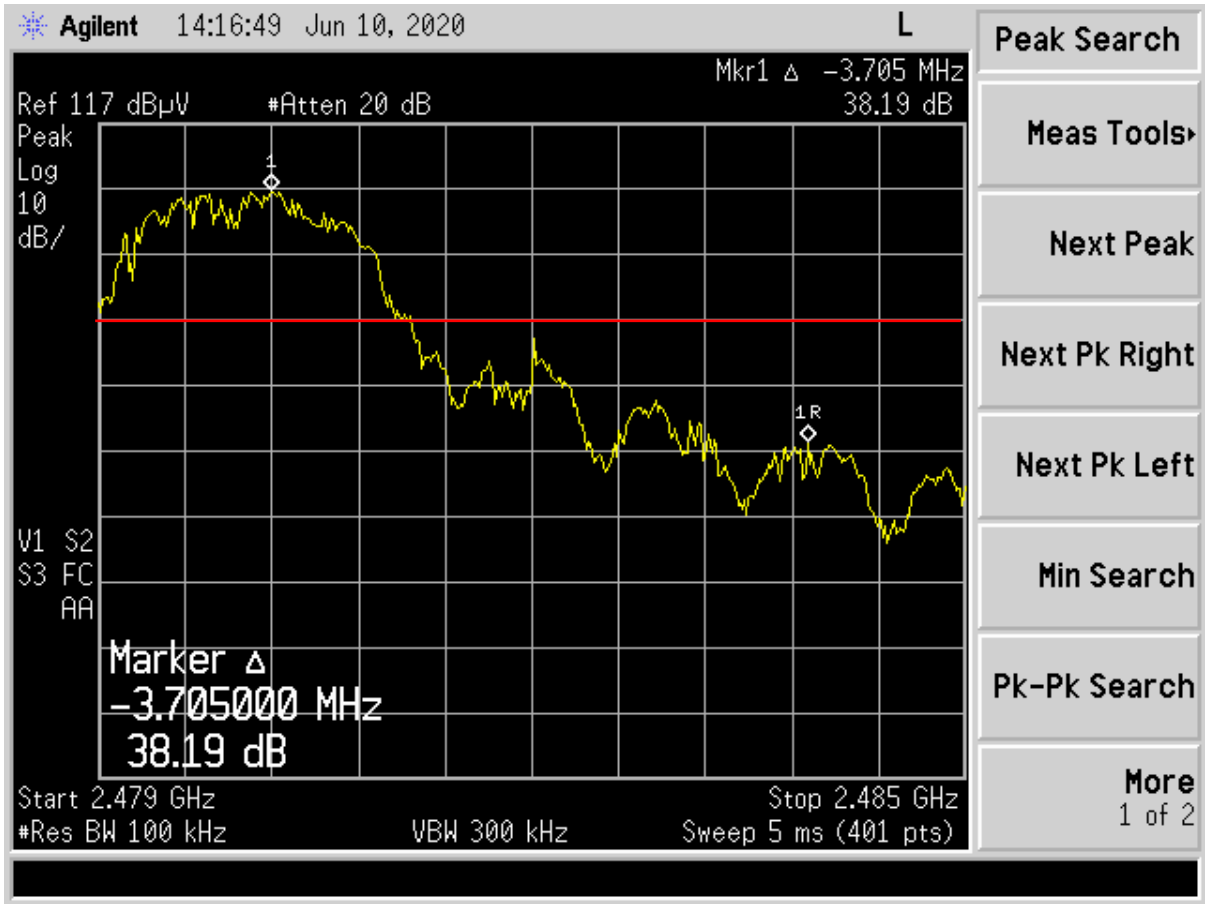


Figure 11. Band Edge Compliance, High Channel, Delta – Peak

Band Edge Compliance = PASS

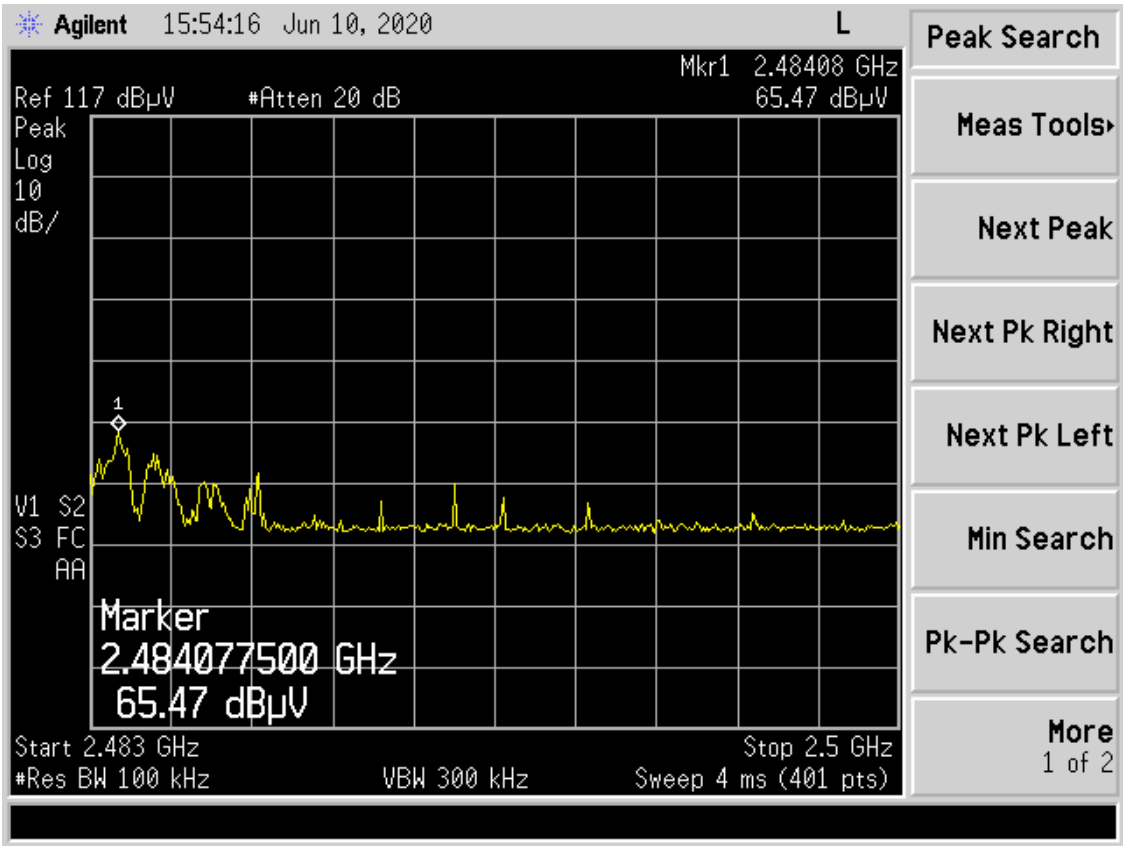


Figure 12. Restricted Band, High Channel

2310 MHz to 2390 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				**Client:** Okyanus Teknoloji			
Project: 20-0187				**Model:** FT-05DCH-POE-IO			
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	65.47	-5.50	59.97	74.0	3.0m./HORZ	14.0	**PK**
2485.60	65.47	-34.6*	30.87	54.0	3.0m./HORZ	23.1	**PK**

(*)= Duty Cycle correction factor of -29.1 dB was added to the correction loss to correct the Peak value to AVG.

Test Date: June 10, 2020

Tested By
Signature: Afzal Fazal Name: Afzal Fazal

2.12 Six (6) dB Bandwidth per CFR 15.247(a)(2)

The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed per ANSI C63.10-2013, clause 11.8. The RBW was set to 100 kHz and the VBW ≥ RBW. The results of this test are given in the table and figures following

Table 7. Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2405.00	1.220	0.5
2440.00	1.200	0.5
2480.00	1.270	0.5

Test Date: June 10, 2020

Tested By
Signature: Afzal Fazal Name: Afzal Fazal

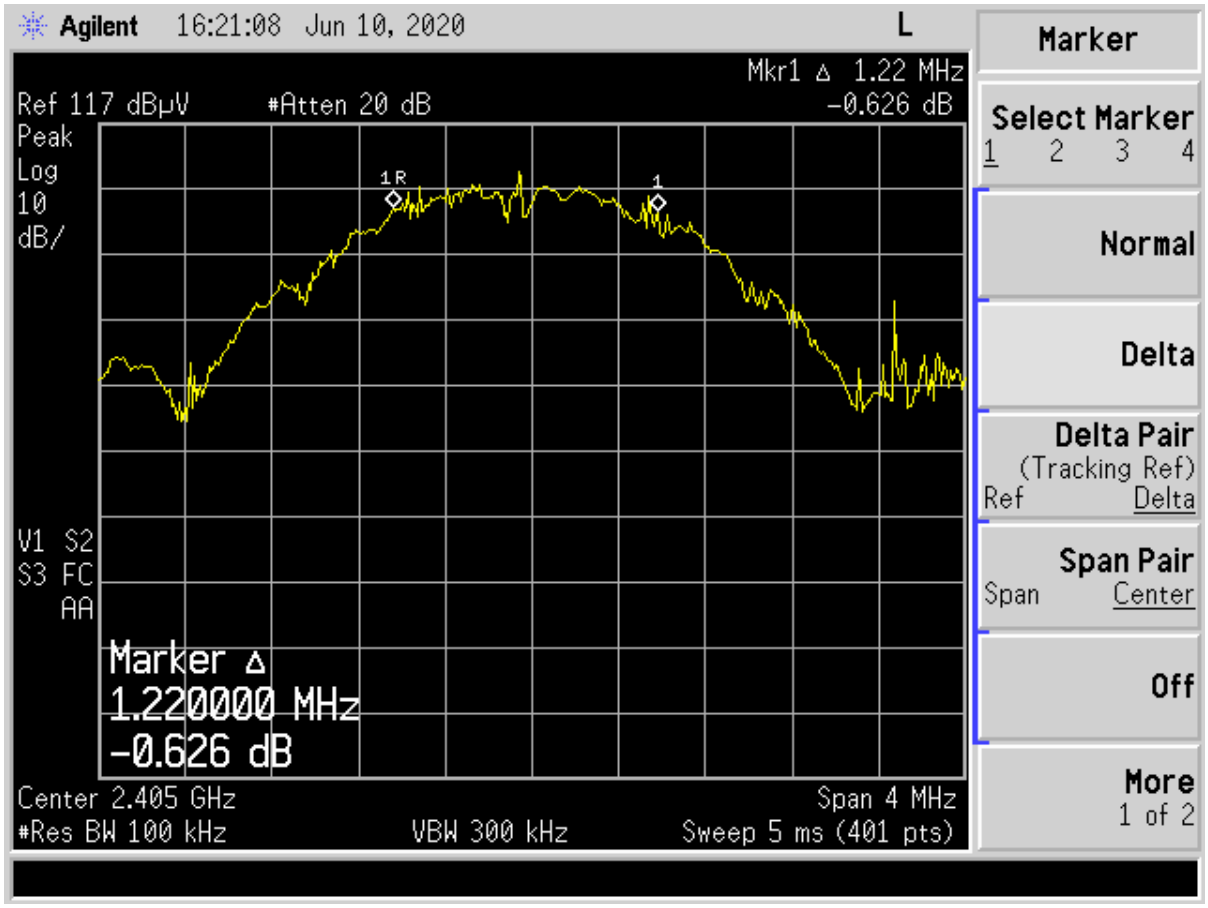


Figure 13. 6 dB Bandwidth, Low Channel

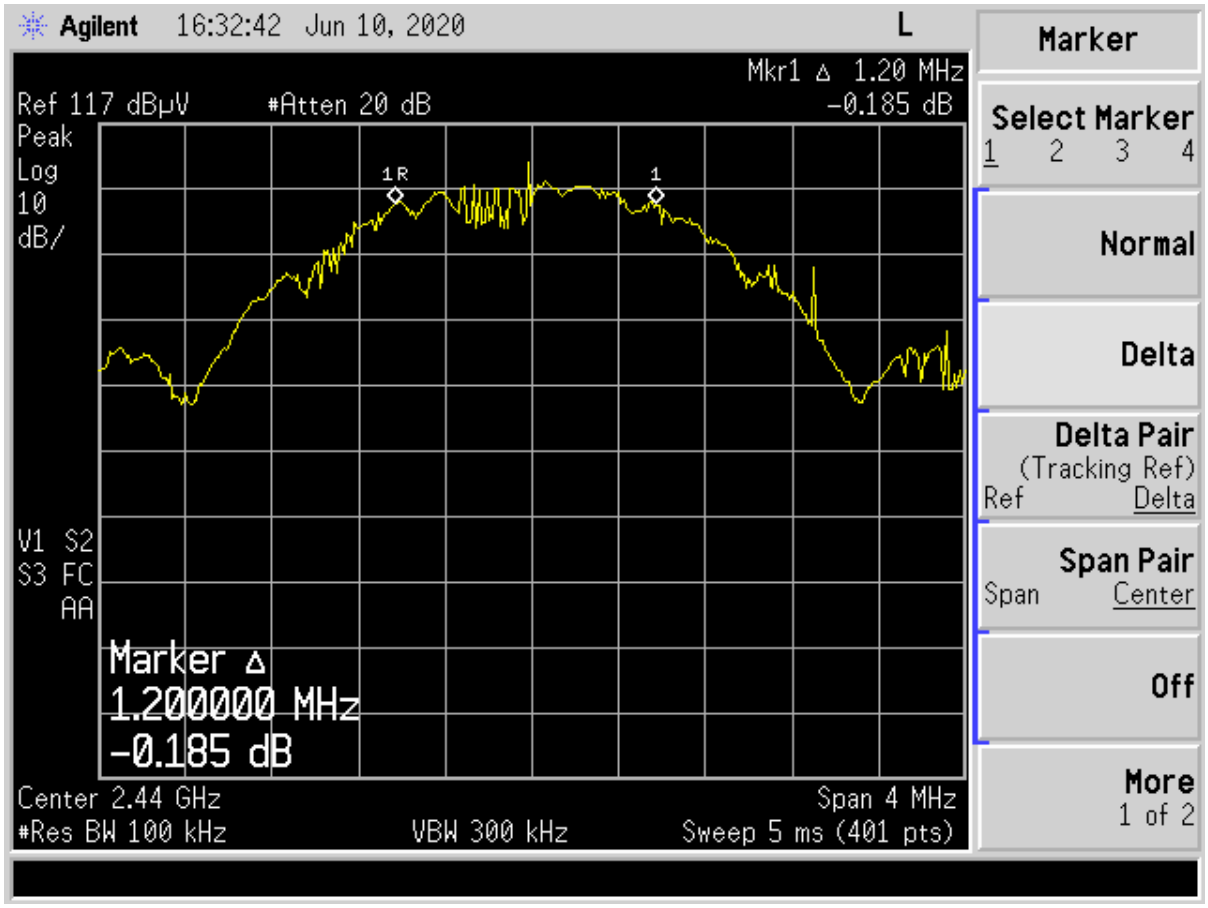


Figure 14. 6 dB Bandwidth, Mid Channel

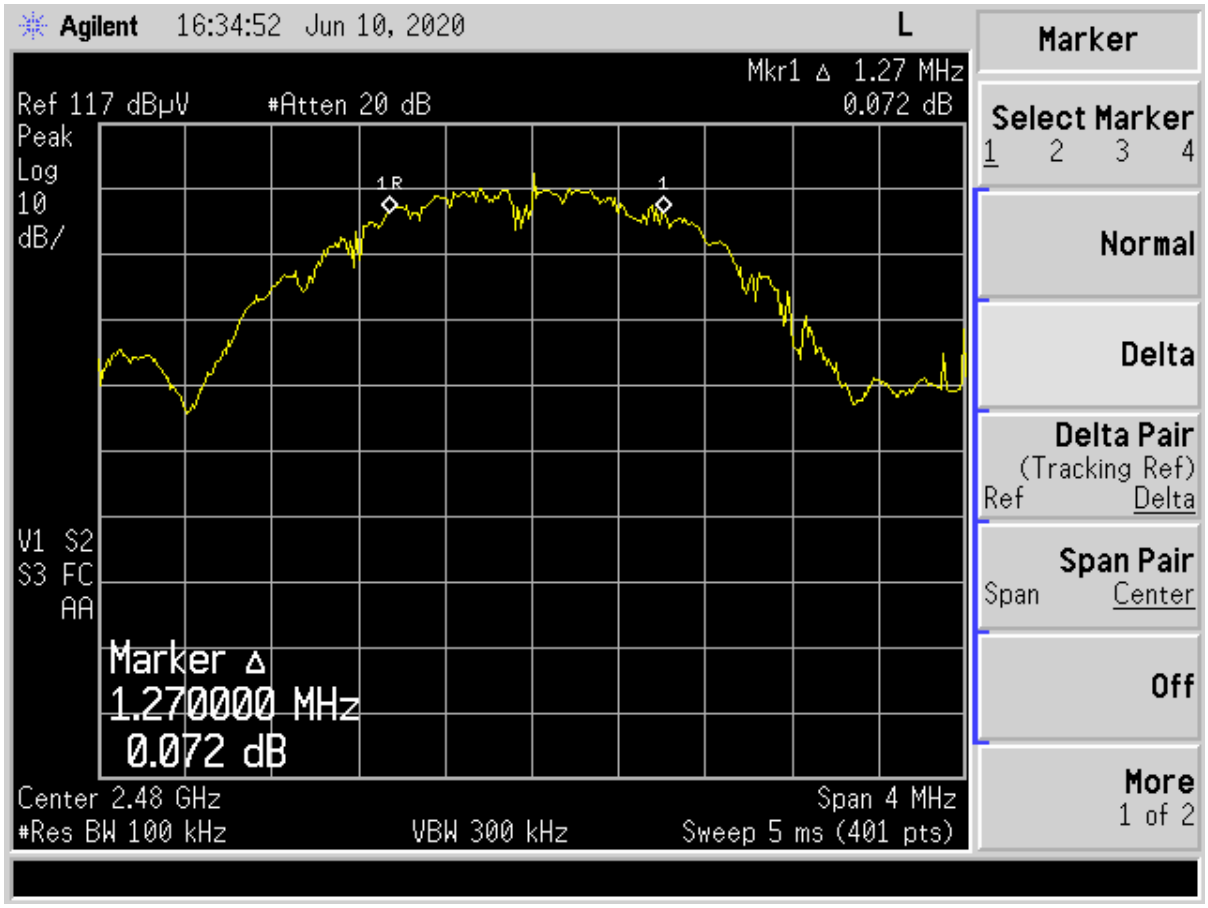


Figure 15. 6 dB Bandwidth, High Channel

2.13 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

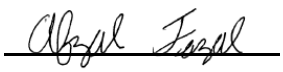
The transmitter was programmed to operate at a maximum output power across the bandwidth.

Peak power within the band 2400 MHz to 2483.5 MHz was measured per ANSI C63.10-2013 as an antenna conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, and attenuators to the antenna output terminals on the EUT. The spectrum analyzer was set to an RBW of 3 MHz, and the VBW ≥ RBW. Peak antenna conducted output power is tabulated below.

Table 8. Peak Antenna Conducted Output Power per Part 15.247 (b)(3)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Converted Data (mW)	FCC Limit (mW Maximum)
2405	12.86	19.32	1000
2440	12.73	18.75	1000
2480	13.01	19.99	1000

Test Date: June 12, 2020

Tested By
Signature:  Name: Afzal Fazal

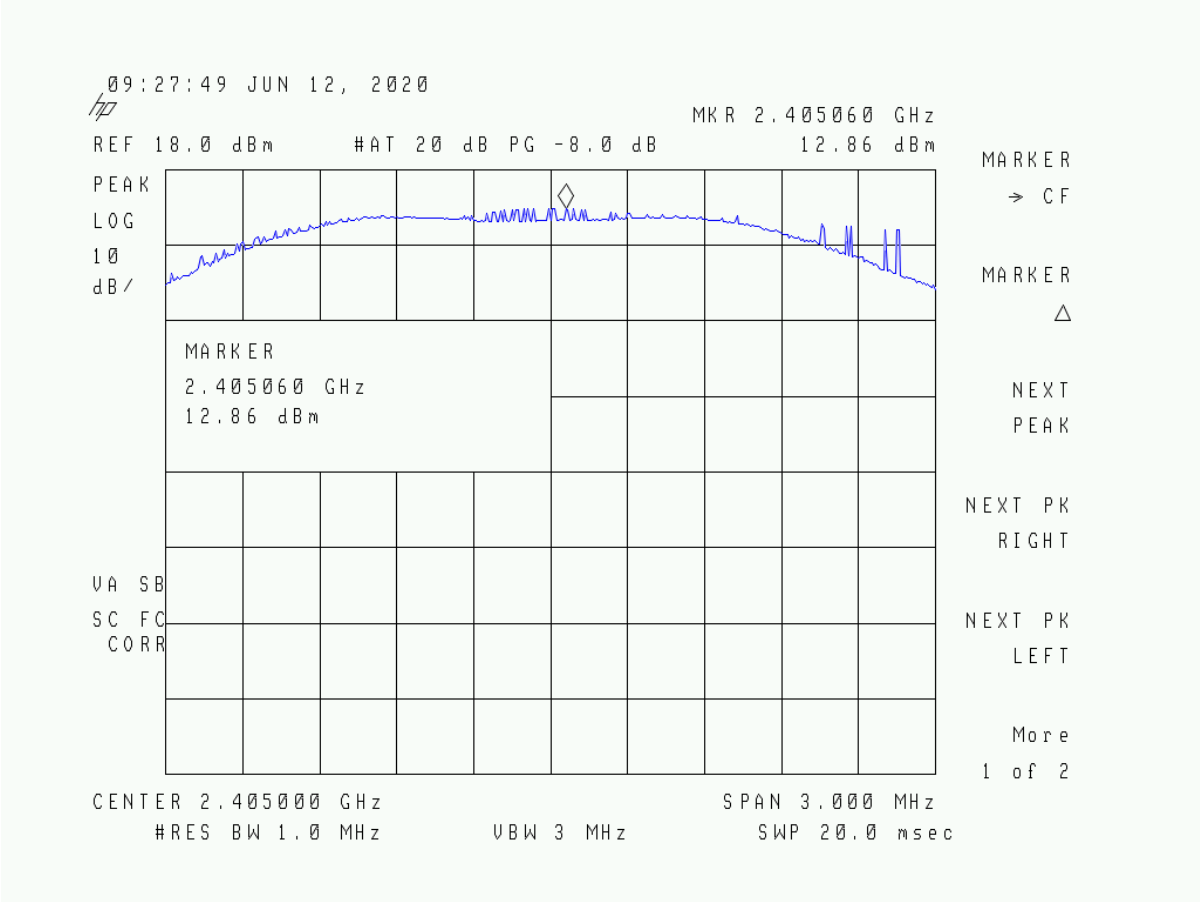


Figure 16. Peak Antenna Conducted Output Power, Low Channel

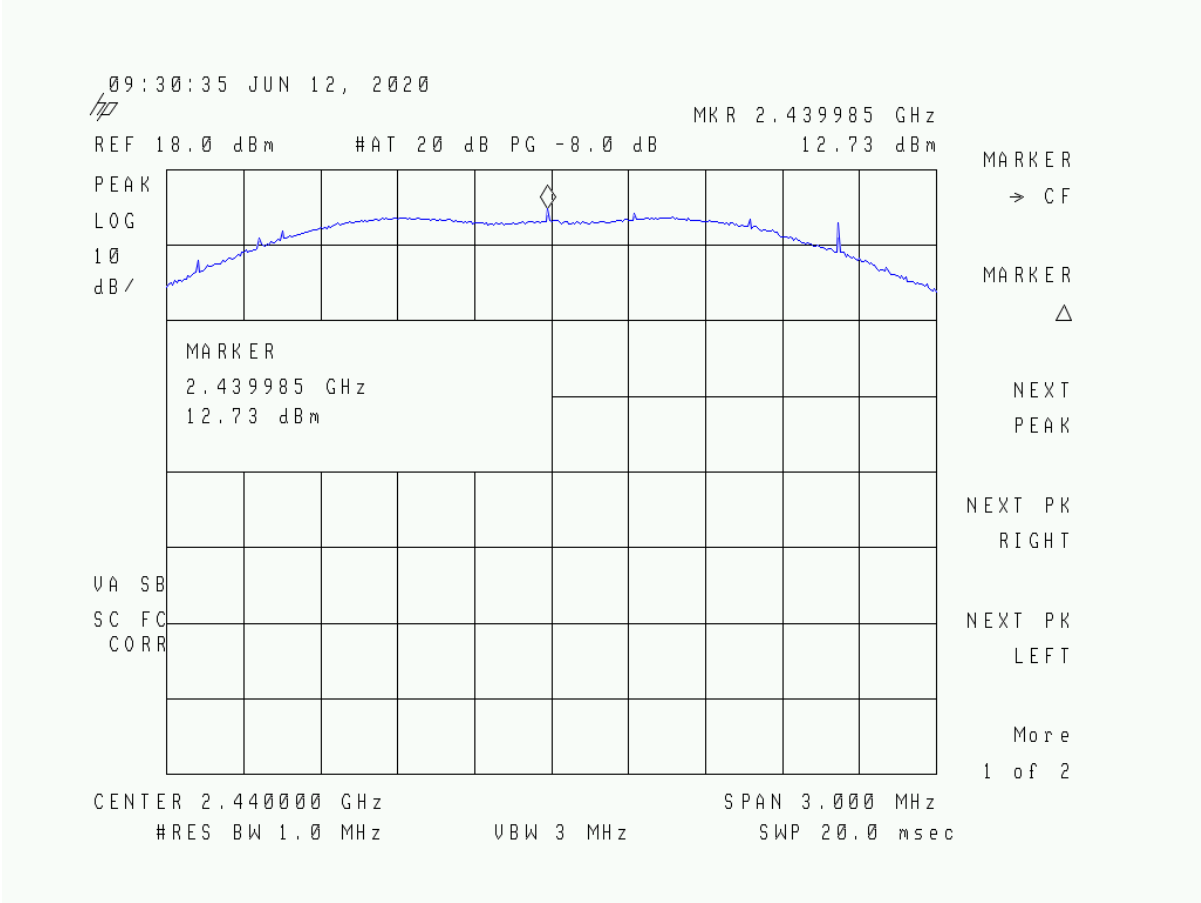


Figure 17. Peak Antenna Conducted Output Power, Mid Channel

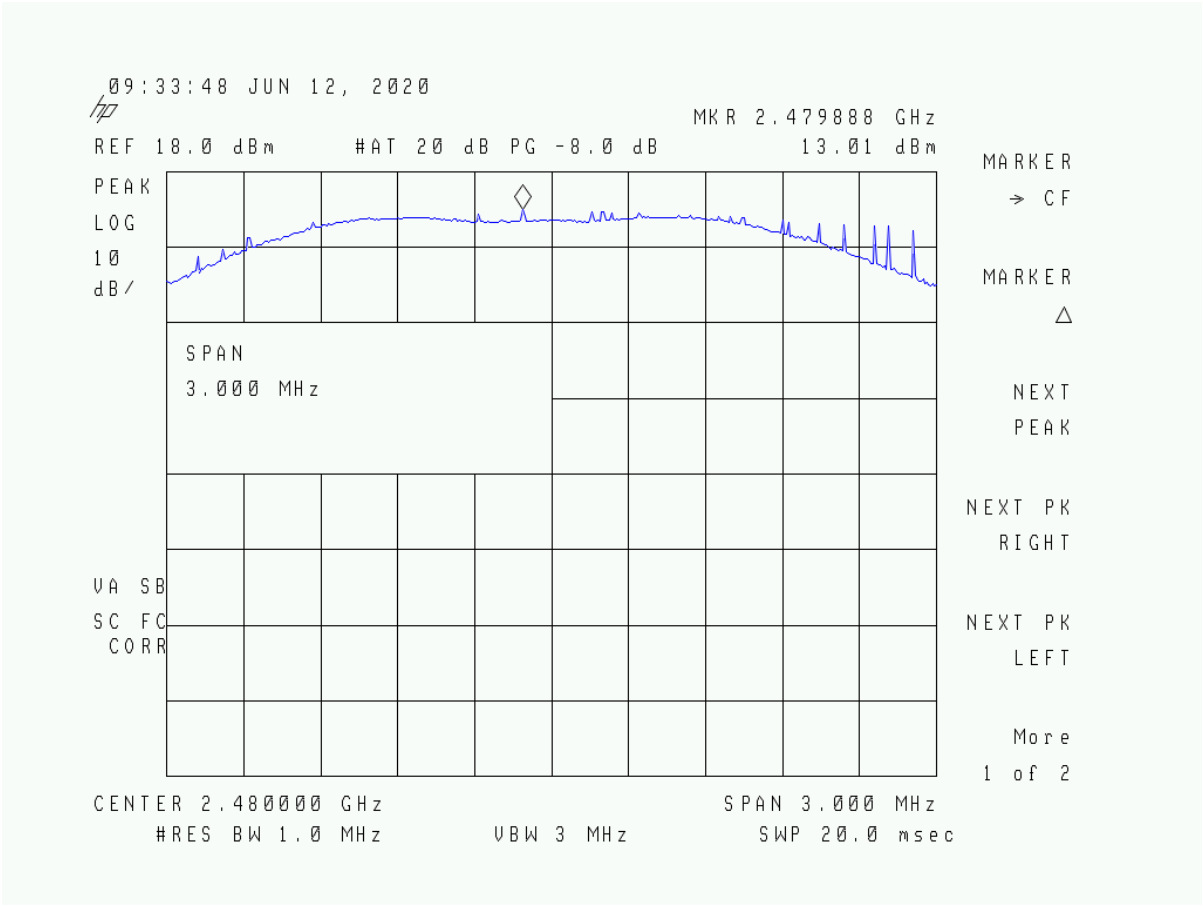


Figure 18. Peak Antenna Conducted Output Power, High Channel

2.14 Power Spectral Density (CFR 15.247(e))

The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of ANSI C63.10-2013. The RBW was set to 3 kHz and the Video Bandwidth was set to ≥ RBW. The trace capture time was set to (Span/3 kHz).

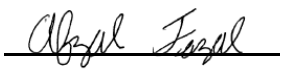
In accordance with 15.247 (e), the power spectral density shall be no greater than +8 dBm per any 3 kHz band.

Results are shown in the table and figures below. All are less than +8 dBm per 3 kHz band.

Table 9. Power Spectral Density for Low, Mid and High Bands

Frequency (MHz)	Results (dBm/3 kHz)	FCC Limit (dBm/3 kHz)
2405	3.94	+8.0
2440	3.43	+8.0
2480	2.85	+8.0

Test Date: June 11, 2020

Tested By
Signature:  Name: Afzal Fazal

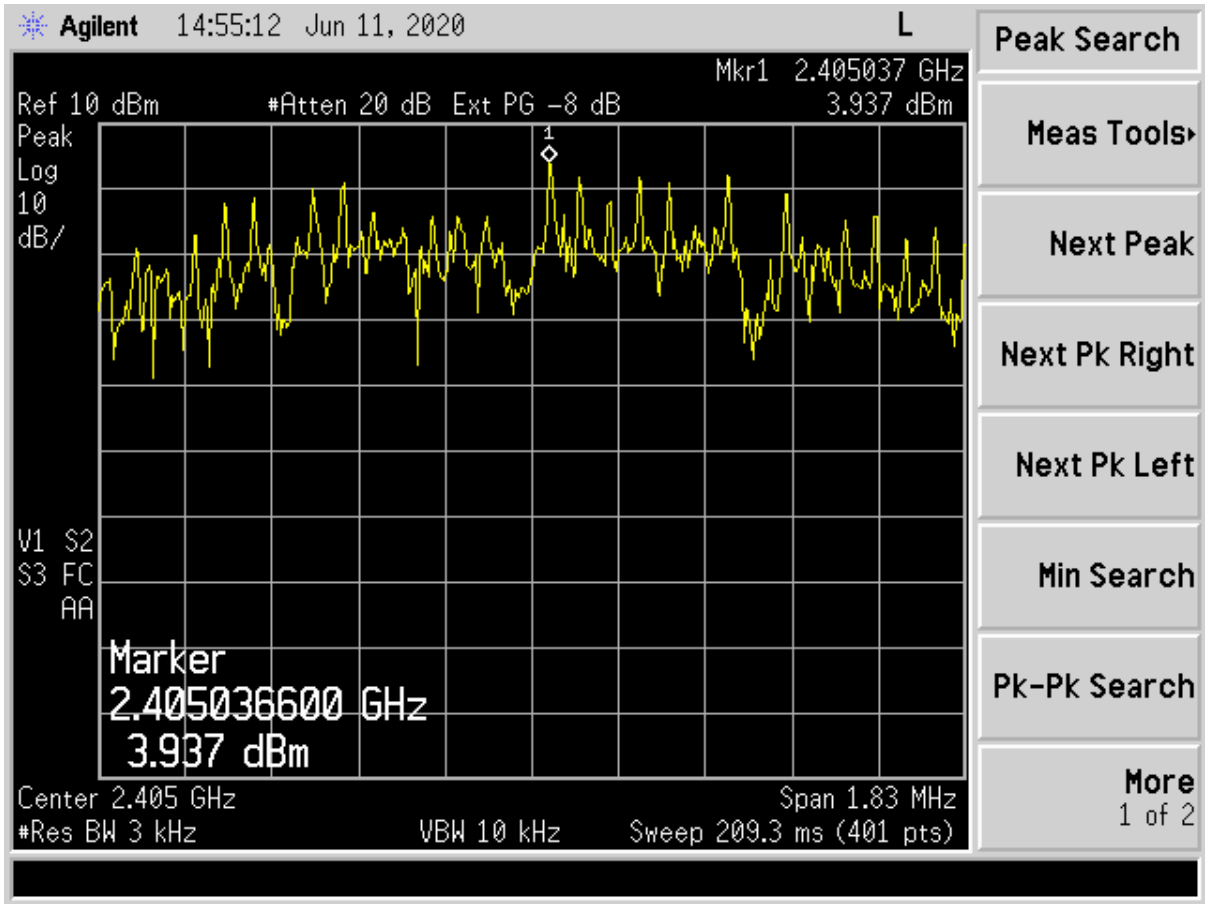


Figure 19. Peak Power Spectral Density, Low Channel

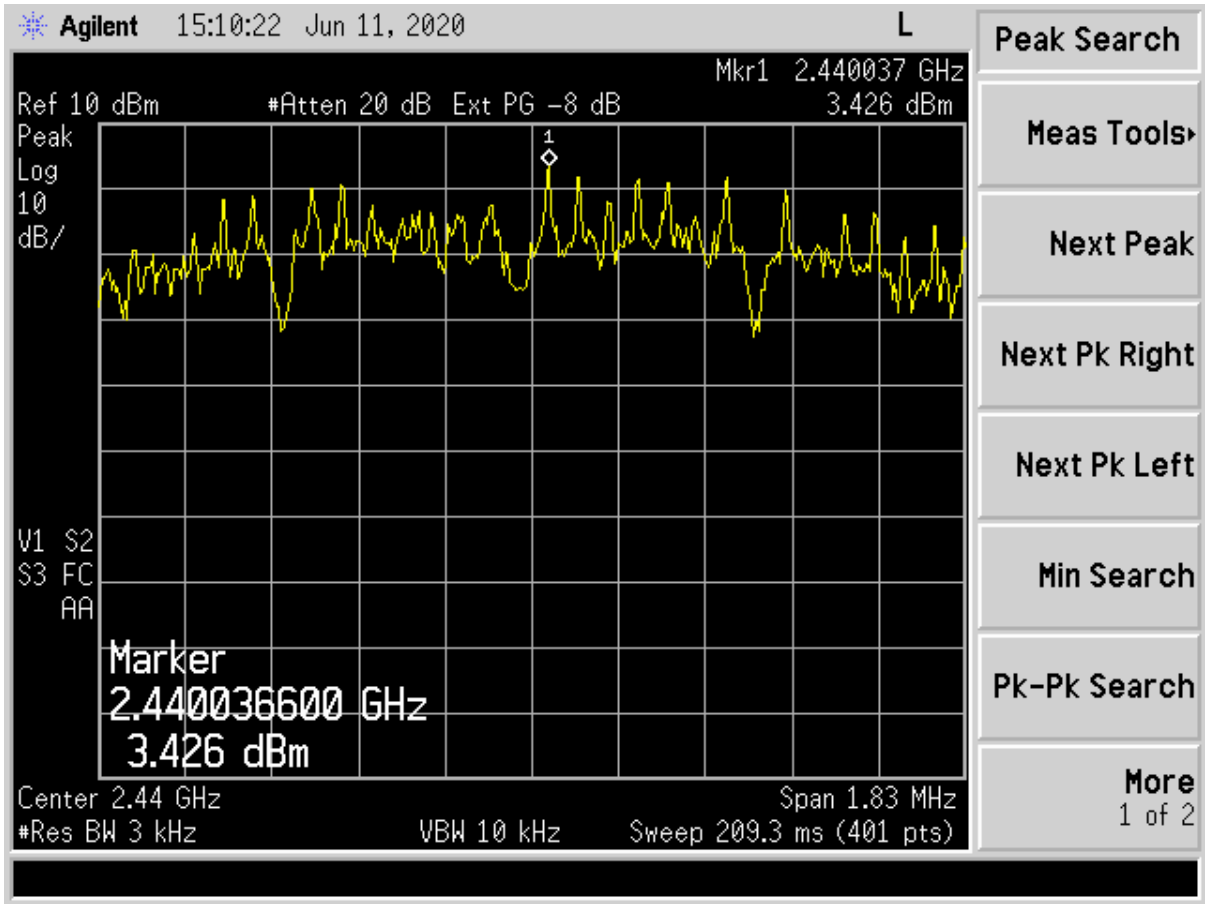


Figure 20. Peak Power Spectral Density, Mid Channel

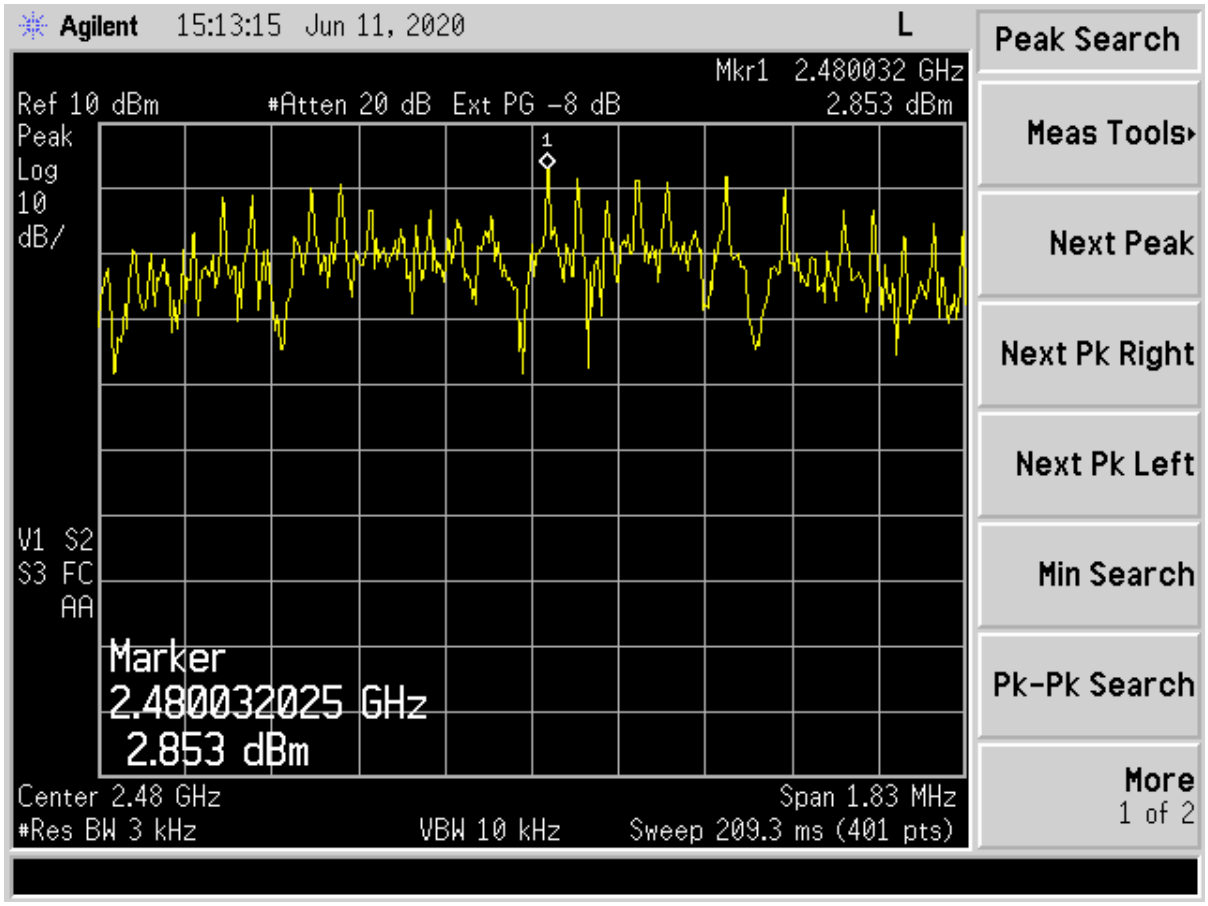


Figure 21. Peak Power Spectral Density, High Channel

2.15 Intentional Radiator Power Lines 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.

Table 10. Power Line Conducted Emissions

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: AF						
Frequency (MHz)	**Test Data (dBuV)**	**LISN+CL (dB)**	**Corrected Results (dBuV)**	**Limits (dBuV)**	**Margin (dB)**	**Detector**
Phase @ 120 Vac/60Hz						
0.1728	42.46	1.13	43.59	54.8	11.2	**PK**
0.7716	36.54	0.37	36.91	46.0	9.1	**PK**
1.1530	34.35	0.35	34.70	46.0	11.3	**PK**
9.2330	34.25	0.42	34.67	50.0	15.3	**PK**
19.7000	42.78	0.52	43.30	50.0	6.7	**PK**
20.3830	43.68	0.32	44.00	50.0	6.0	**PK**
Neutral @ 120 Vac/60Hz						
0.1506	44.35	1.62	45.97	56.0	10.0	**PK**
0.7725	34.59	0.39	34.98	46.0	11.0	**PK**
1.1530	33.55	0.37	33.92	46.0	12.1	**PK**
9.9500	34.29	0.45	34.74	50.0	15.3	**PK**
19.7000	42.15	0.55	42.70	50.0	7.3	**PK**
26.5500	43.65	0.36	44.01	50.0	6.0	**PK**

(*) Denotes that Quasi-Peak Limits were used.

SAMPLE CALCULATION AT: 0.1728 MHz

Magnitude of Measured Frequency	42.46	dBuV
+LISN+ Cable Loss	1.13	dB
Corrected Result	43.59	dBuV/m

Test Date: June 9, 2020
Tested By
Signature: Afzal Fazal Name: Afzal Fazal

2.16 Intentional Radiator, Radiated Emissions (CFR 15.209)

The test data provided herein is to support the verification requirement for radiated emissions coming from the EUT in a transmitting state per 15.109 and 15.209 and were investigated from 9kHz or the lowest operating clock frequency to 12 GHz and tested as detailed in ANSI C63.10:2013, Clause 6.4-6.6. Data is presented in the tables below.

Radiated emissions within the band of 9 kHz to 30 MHz were investigated using a calibrated loop antenna and per the requirements of ANSI C63.10:2013.

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 turntable 360 degrees clockwise and counterclockwise and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure.

The worst-case configuration was determined to be the EUT set along its X plane. The test data is presented in the following paragraph.

Note: the POE switch was turned OFF during testing since the POE switch is not part of the EUT. The EUT with POE switch turned ON has been evaluated in a separate report for which the EUT was evaluated to Part 15 Subpart B, Class A requirements.

Table 11. Spurious Radiated Emissions (9 kHz – 30 MHz)

Test By: AF	Test: FCC Part 15.209 Project: 20-0187			Client: Okyanus Teknoloji			
Frequency (MHz)	**Test Data (dBuV)**	**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.							

SAMPLE CALCULATION AT: N/A

Test Date: June 11, 2020

Tested By
Signature: Afzal Fazal Name: Afzal Fazal

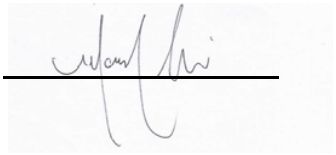
Table 12. Spurious Radiated Emissions (30 MHz – 1000 MHz)

Test By: MA	Test: FCC Part 15.209				Client: Okyanus Teknoloji		
	Project: 20-0187				Model: FT-06DCH		
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**DETECTOR PK / QP/AVG**
47.46	52.25	-16.41	35.84	40.0	3m./VERT	4.2	**PK**
64.02	51.66	-18.31	33.35	40.0	3m./VERT	6.7	**PK**
102.81	50.70	-14.92	35.78	43.5	3m./VERT	7.7	**PK**
110.29	49.86	-15.37	34.49	43.5	3m./HORZ	9.0	**PK**
161.44	46.77	-11.98	34.79	43.5	3m./VERT	8.7	**QP**
162.92	49.49	-12.87	36.62	43.5	3m./HORZ	6.9	**QP**
189.00	48.44	-10.81	37.63	43.5	3m./HORZ	5.9	**PK**
212.51	43.27	-14.38	28.89	43.5	3m./VERT	14.6	**PK**
225.03	44.53	-14.18	30.35	46.0	3m./HORZ	15.7	**PK**
249.95	50.09	-13.06	37.03	46.0	3m./VERT	9.0	**PK**
375.00	45.23	-9.69	35.54	46.0	3m./HORZ	10.5	**PK**
375.00	46.27	-9.79	36.48	46.0	3m./VERT	9.5	**PK**
750.02	46.72	-1.55	45.17	46.0	3m./HORZ	0.8	**QP**

SAMPLE CALCULATION AT: 47.46 MHz

Magnitude of Measured Frequency	52.25	dBuV
+Antenna Factor + Cable Loss- Amplifier Gain	-16.41	dB
Corrected Result	35.84	dBuV/m

Test Date: July 23, 2020

Tested By
Signature: 

Name: Mark Afroozi

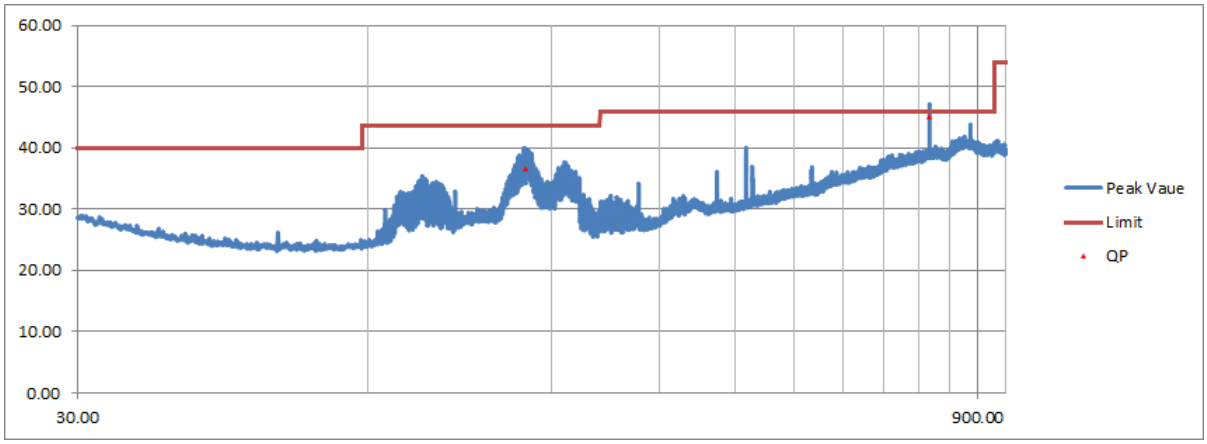


Figure 22. Graphical Radiated Emissions Data, 30 MHz – 1 GHz, Horizontal

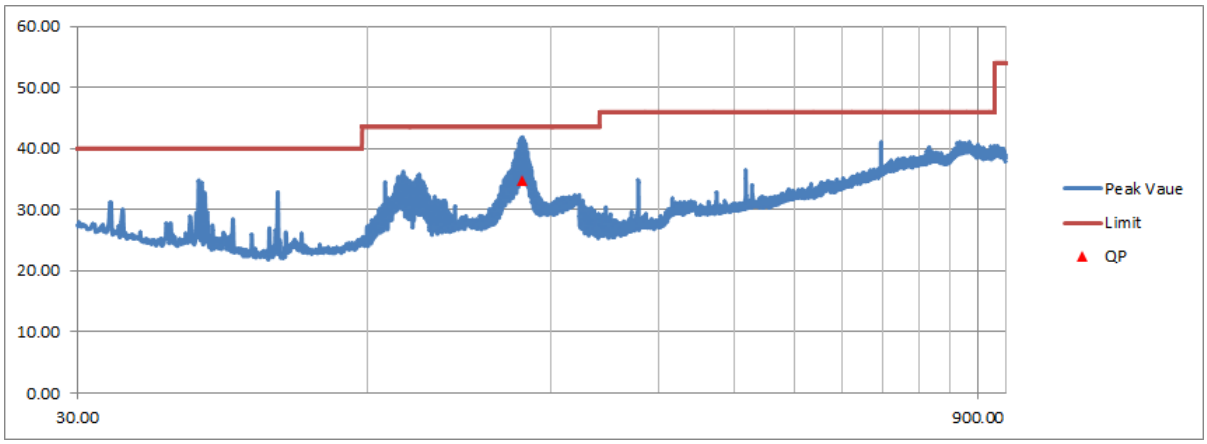
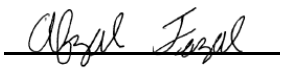


Figure 23. Graphical Radiated Emissions Data, 30 MHz – 1 GHz, Vertical

Table 13. Spurious Radiated Emissions (> 1 GHz)

Test By: AF	Test: FCC Part 15.209 Project: 20-0187				Client: Okyanus Teknoloji		
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**DETECTOR PK / QP/AVG**
All emissions were greater than 20 dB below the limit.							

Test Date: June 11, 2020

Tested By
Signature:  Name: Afzal Fazal

2.17 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%. This value includes all elements of measurement.

2.17.1 Conducted Emissions Measurement Uncertainty

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

2.17.2 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.

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 have met the requirements of the standards cited within the test report when tested as detailed in the present test report.