Manufacturer:	**Knox Company** **1601 West Deer Valley Road** **Phoenix, Arizona 85027 USA**
Applicant:	**Same as Above**
Radio Module Model:	**CC3100MODR11MAMOB**
FCC ID:	**2AOVI-KNOX-RAS**
Testing Commenced:	2022-07-18
Testing Ended:	2022-10-19
Summary of Test Results:	**In Compliance** The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant. Wireless transmitter is pre-certified; testing was performed due to change in antenna.

Standards:

- **FCC Part 15 Subpart C, Section 15.247**
- **FCC Part 15.31(e)**
- **ANSI C63.10:2013**

Evaluation Conducted by:

Julius Chiller, EMC/Wireless Engineer

Report Reviewed by:

Ken Littell, Vice President of EMC

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TABLE OF CONTENTS

Section	Title	Page
1	ADMINISTRATIVE INFORMATION	4
2	SUMMARY OF TEST RESULTS/MODIFICATIONS	5
3	ENGINEERING STATEMENT	6
4	EUT INFORMATION AND DATA	7
5	LIST OF MEASUREMENT INSTRUMENTATION	9
6	RADIATED SPURIOUS EMISSIONS	10
7	TEST SETUP PHOTOGRAPHS	35

1 ADMINISTRATIVE INFORMATION

1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD**.**

1.2 Measurement Procedure:

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement under Section 15.247 and in KDB558074. A list of the measurement equipment can be found in Section 5.

1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used, and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data and are expressed with a 95% confidence factor. Note: Only measurements listed below which relate to tests included in this Test Report are applicable to it.

Measurement Range	Expanded Uncertainty	Combined Uncertainly
Radiated Emissions <1 GHz @ 3m	±5.07dB	±2.54
Radiated Emissions <1 GHz @10m	±5.09dB	±2.55
Radiated Emissions 1 GHz to 2.7 GHz	±3.62dB	±1.81
Radiated Emissions 2.7 GHz to 18 GHz	±3.10dB	±1.55
AC Power Line Conducted Emissions, 150kHz to 30 MHz	±2.76dB	±1.38

This Uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.4 Document History

Document Number	Description	Issue Date	Approved By
F2P27819B-01E	First Issue	2022-10-19	K. Littell

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Radiated Spurious Emission	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies

Modifications Made to the Equipment
None

3 ENGINEERING STATEMENT

This report has been prepared on behalf of **Knox Company** to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.247 of the FCC Rules using ANSI C63.10:2013 and KDB558074 standards. The test results found in this test report relate only to the items tested.

4 EUT INFORMATION AND DATA

4.1 Equipment Under Test:

Radio Module Model: **CC3100MODR11MAMOB**
FCC ID: **2AOVI-KNOX-RAS**
Serial No.: 0

4.2 Trade Name:

Knox Company

4.3 Power Supplies:

XP Power VEL36US120-US-JA used to power the Host device which was used to power the module that was placed outside of the Host.

4.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

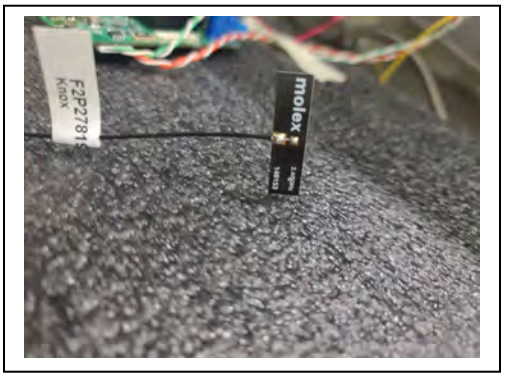
4.5 Antenna:

Molex 1461530200 Patch Antenna, 2.6dBi

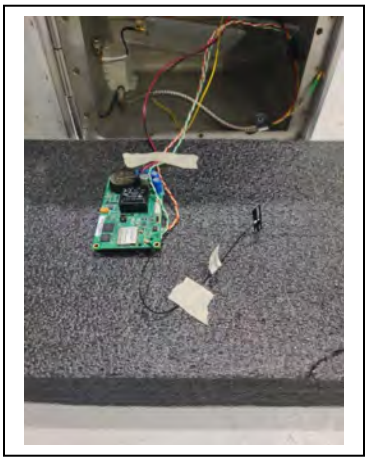
4.6 Accessories:

Device	Manufacturer	Model Number	Serial Number
Power Supply	XP Power	VEL36US120-US-JA	None Specified
Power Supply	GlobTek	GT-83082-3612-W2	None Specified
RFID UHF Reader	Keonn	ADRD-M4-ESMA-24-160	100349501220730000002
RFID UHF Antenna	Keonn	ADAN-p11US-ENSMA-200.01	10001650119277000337
Power Supply	CUI, Inc.	ETSA240270U	None Specified

Antenna



Module Antenna



4.7 Test Item Condition:

The equipment to be tested was received in good condition.

4.8 Testing Algorithm:

EUT's 2.4 GHz radio was set to transmit on the low, mid and high channels within the 2.4 GHz band. Spurious and Band Edge measurements were recorded.

5 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	Albatross Projects	B83117-DF435-T261	US140023	2023-08-22
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2023-03-31
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2023-10-12
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	2023-07-30
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	2022-10-31
Pre-Amplifier	CL285	Com-Power	PAM-0207	322	2023-03-30
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2023-09-22
Horn Antenna	CL098	Emco	3115	9809-5580	2023-01-26
Software:	Tile Version 3.4.B.3		Software Verified: 2022-07-19 to 2022-10-19		
Software:	EMC 32, Version 8.53.0		Software Verified: 2022-07-19 to 2022-10-19		
Temp/Hum. Recorder	CL293	Thermpro	TP50	1	2023-04-15
Temp/Hum. Recorder	CL294	Thermpro	TP50	2	2023-04-15

6 RADIATED SPURIOUS EMISSIONS

Radiated emissions were measured in a Semi-Anechoic Chamber. All emissions generated that fall in the restricted bands per FCC Part 15.205 were examined.

6.1 Requirements:

All emissions that fall in the restricted bands defined in FCC Part 15.205 shall not exceed the maximum field strength listed in FCC Part 15.209(a).

6.2 Radiated Spurious Emission Test Data

Test Date(s):	2022-07-18 to 2022-10-19	**Test Engineer:**	J. Chiller
Standard(s):	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	22.2ºC
		Relative Humidity:	48%

Notes: Plots are peak, max hold prescan data included only to determine what frequencies to investigate and measure. The EUT was initially placed in a semi-anechoic chamber and rotated in all three orthogonal positions to maximize the emissions. Characterization measurements were then performed to determine at which frequencies significant emissions occurred. These graphs are shown below.

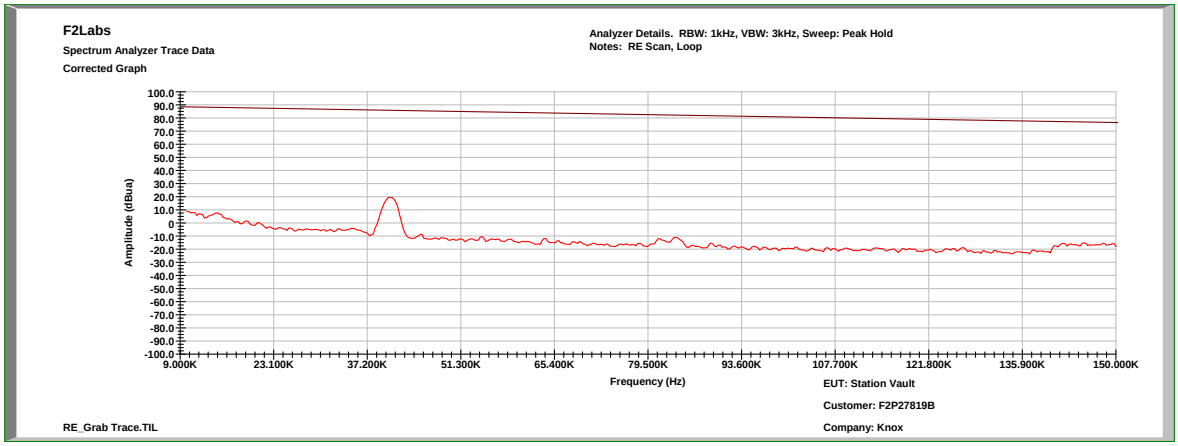
The equipment was fully exercised with all cabling attached to the EUT and was positioned for maximum emissions. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable was adjusted 360 degrees to determine the maximum field strength. The tables of measured results can be found below.

In the following plots, the black line indicates ambient noise, and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables. The plots are for reference only and the limit lines are not actual limit lines but merely a guide.

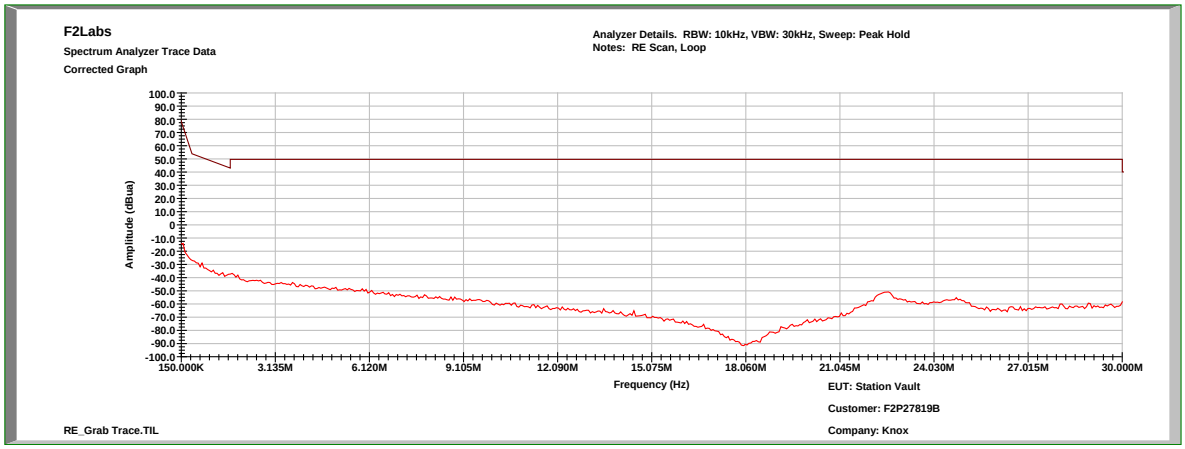
Scans were also made with all three radios transmitting a continuous modulated signal to ensure no EMC Collocation issues of simultaneous transmissions.

Scans include all channels.

Characterization Scan, 0.009 MHz to 0.15 MHz



Characterization Scan, 0.15 MHz to 30 MHz

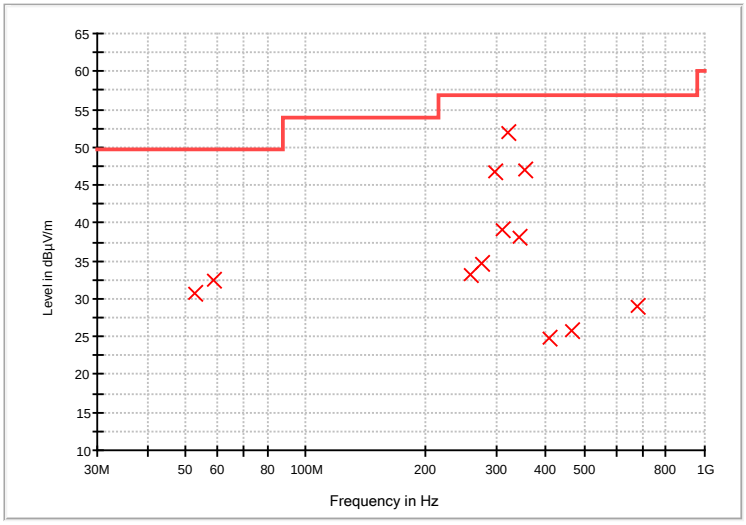


Measurements

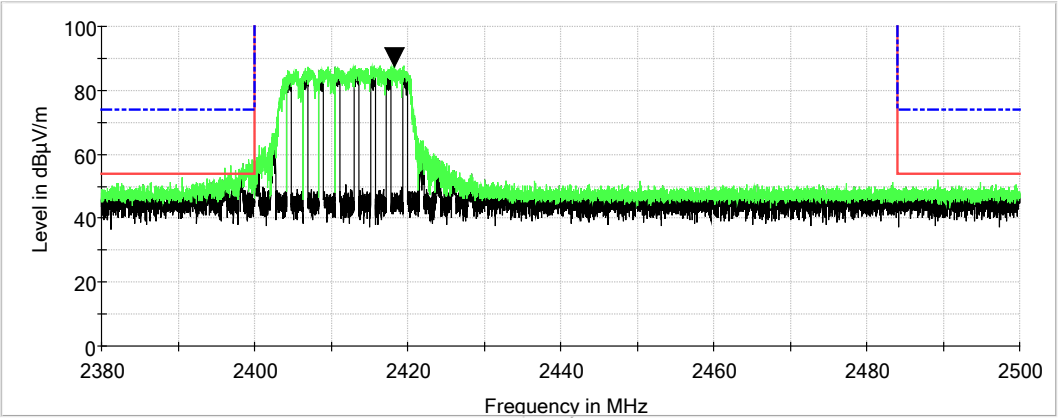
Note: Measurements include data from all channels.

QuasiPeak

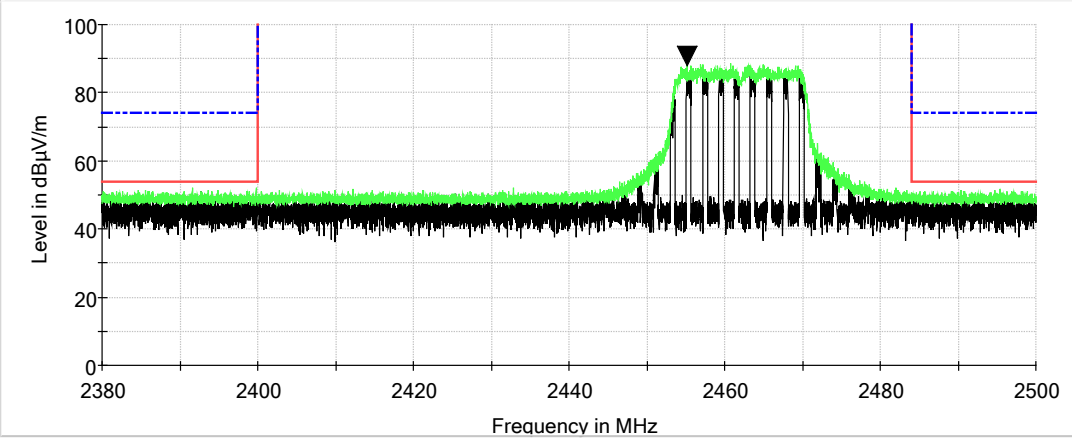
Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (deg)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
52.528800	H	100.00	0.00	32.3	-1.5	30.80	49.6	-18.8
58.723000	H	100.00	0.00	34.2	-1.7	32.50	49.6	-17.1
257.280700	H	100.00	0.00	29.3	3.9	33.20	56.9	-23.7
276.907600	H	100.00	0.00	29.4	5.3	34.70	56.9	-22.2
296.859600	H	100.00	0.00	41.3	5.5	46.80	56.9	-10.1
311.313000	H	100.00	0.00	33.1	6.0	39.10	56.9	-17.8
321.898000	H	100.00	0.00	45.6	6.2	51.80	56.9	-5.1
340.686000	H	100.00	0.00	31.8	6.4	38.20	56.9	-18.7
354.219231	H	100.00	0.00	40.1	6.9	47.00	56.9	-9.9
406.251000	H	100.00	0.00	16.3	8.5	24.80	56.9	-32.1
465.320000	H	100.00	0.00	15.9	9.9	25.80	56.9	-31.1
677.898000	H	100.00	0.00	15.9	13.1	29.00	56.9	-27.9



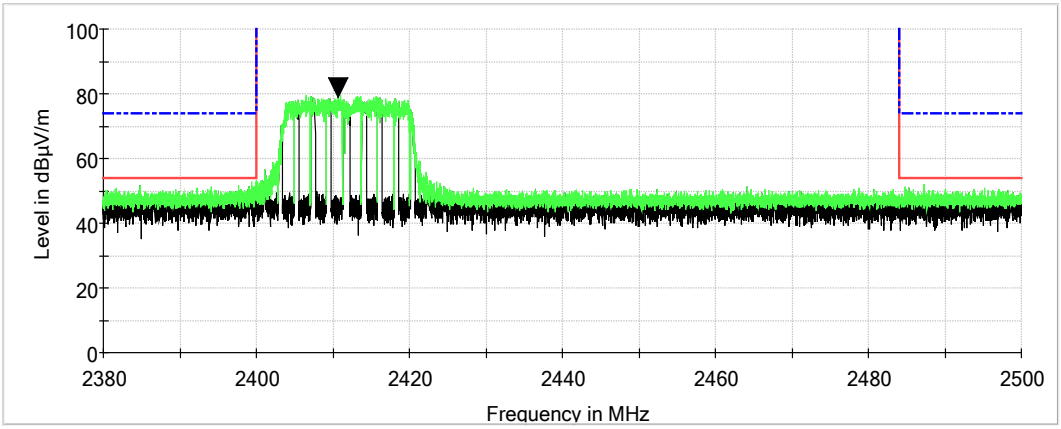
OFDM: Lower Band Edge, Vertical



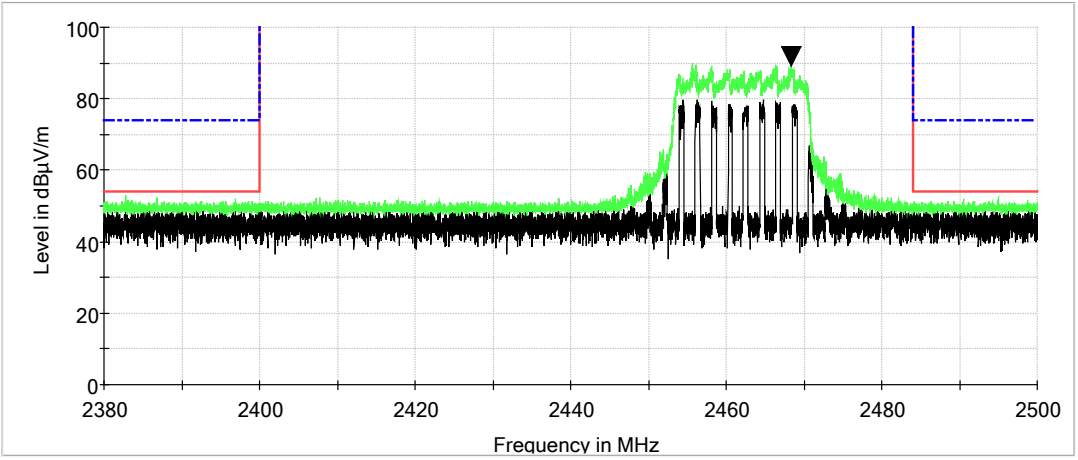
OFDM: Upper Band Edge, Vertical



OFDM: Lower Band Edge, Horizontal

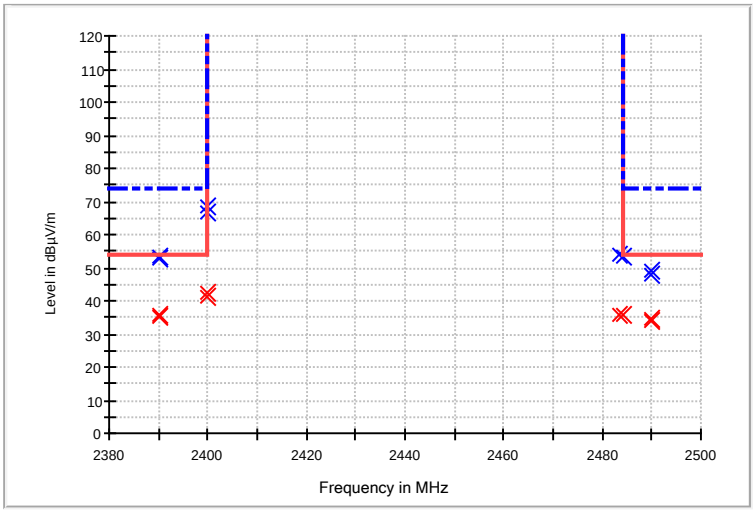


OFDM: Upper Band Edge, Horizontal

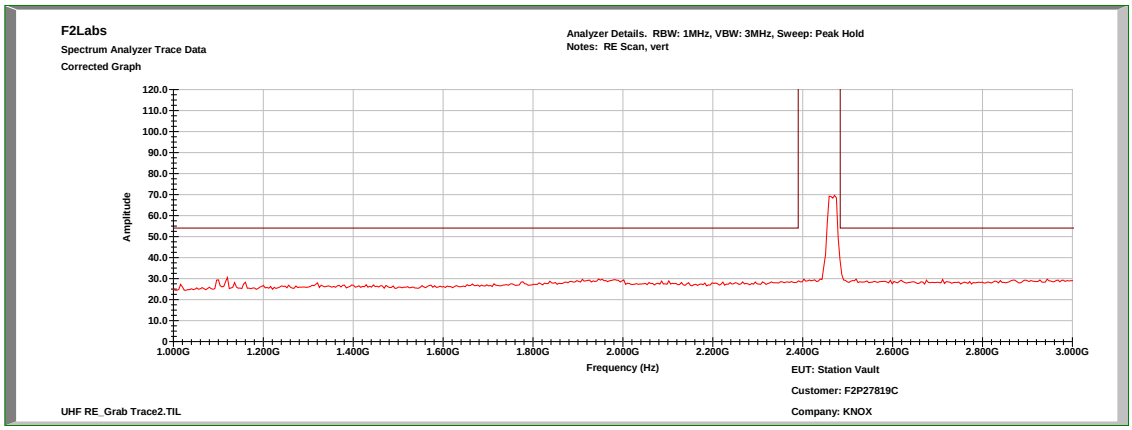


OFDM: Band Edge Measurements

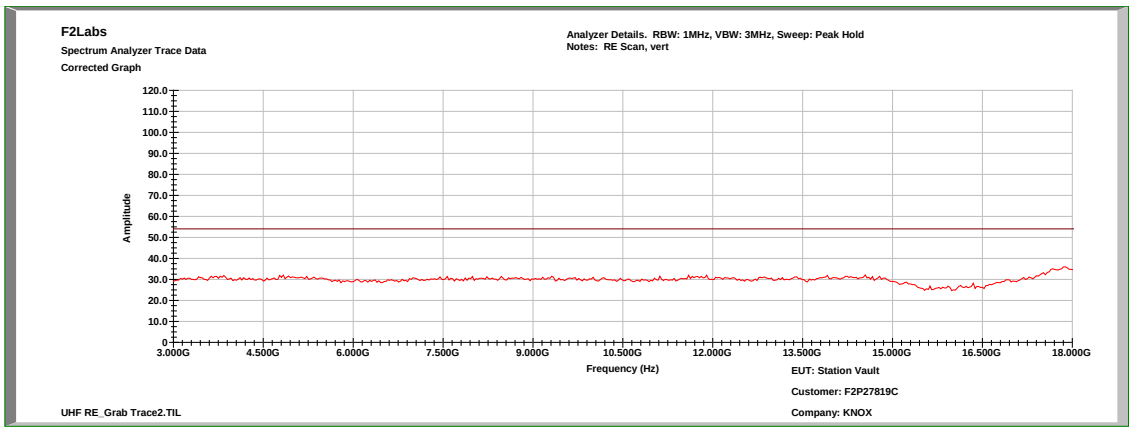
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Limit - MaxPeak (dBµV/m)	Margin - MaxPeak (dB)
2390.000000	52.9	35.2	1000.000	150.0	H	260.0	10.6	18.8	54.0	74.0	21.1
2390.000000	53.3	35.5	1000.000	150.0	V	244.0	10.6	18.5	54.0	74.0	20.7
2400.000000	66.8	41.2	1000.000	150.0	H	260.0	10.5	12.8	54.0	74.0	7.2
2400.000000	68.3	42.2	1000.000	150.0	V	244.0	10.5	11.8	54.0	74.0	5.7
2483.500000	54.1	35.5	1000.000	150.0	V	93.0	10.5	18.5	54.0	74.0	19.9
2483.500000	53.6	35.9	1000.000	150.0	H	36.0	10.5	18.1	54.0	74.0	20.4
2490.000000	49.2	34.8	1000.000	150.0	H	36.0	10.6	19.2	54.0	74.0	24.8
2490.000000	48.0	34.2	1000.000	150.0	V	93.0	10.6	19.8	54.0	74.0	26.0



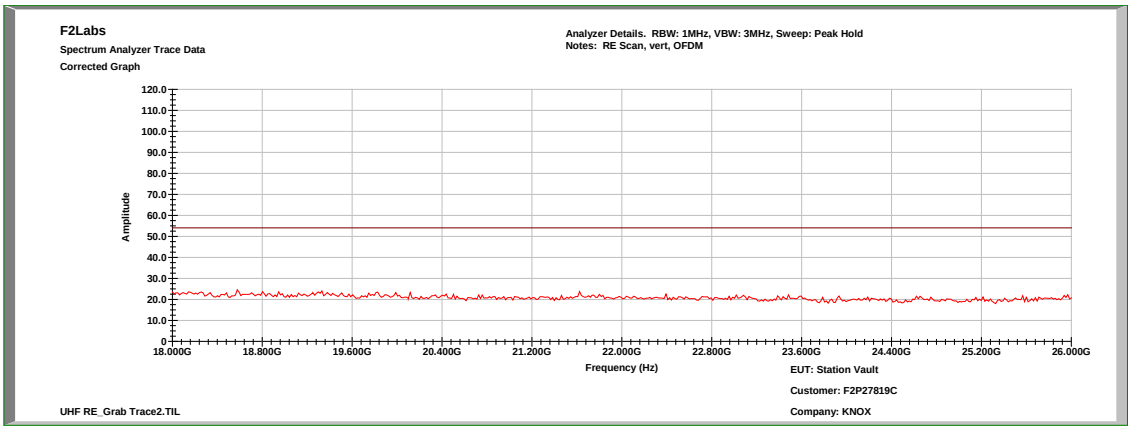
OFDM: Characterization Scan, 1 GHz to 3 GHz, Vertical



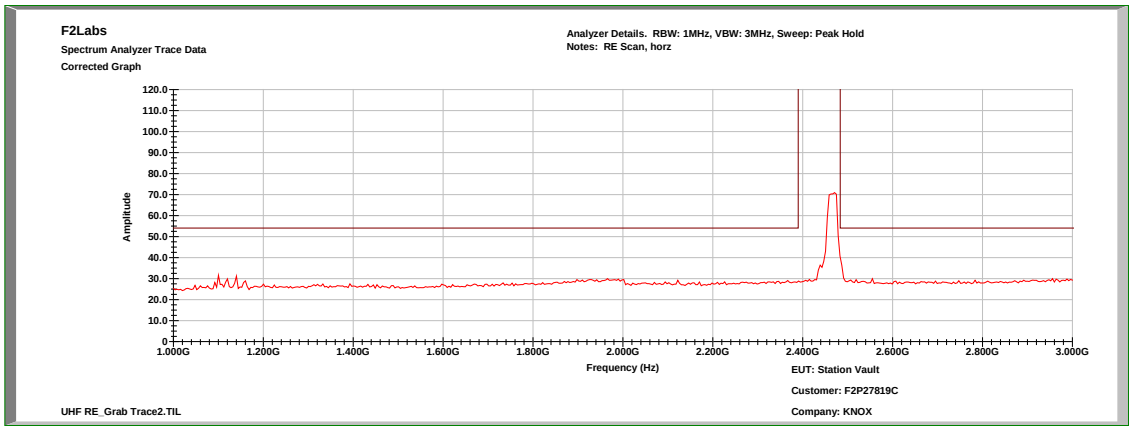
OFDM: Characterization Scan, 3 GHz to 18 GHz, Vertical



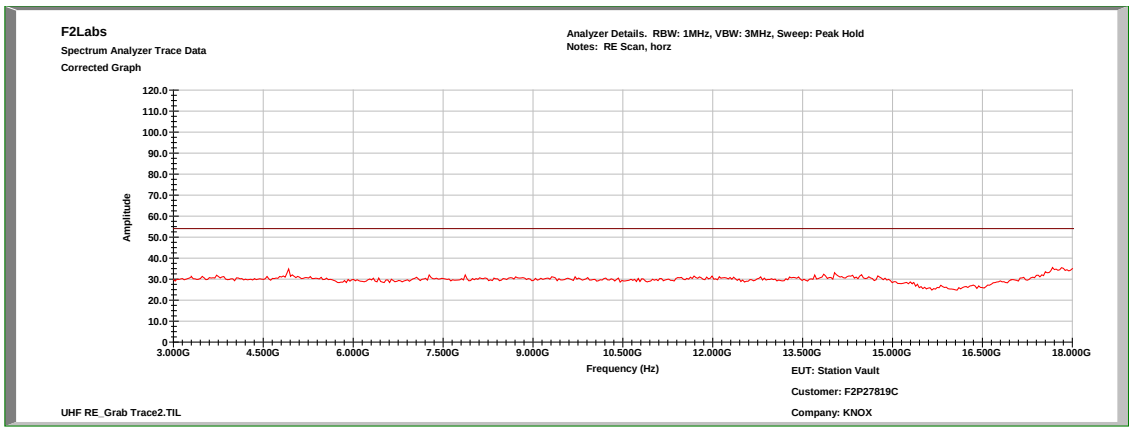
OFDM: Characterization Scan, 18 GHz to 26 GHz, Vertical



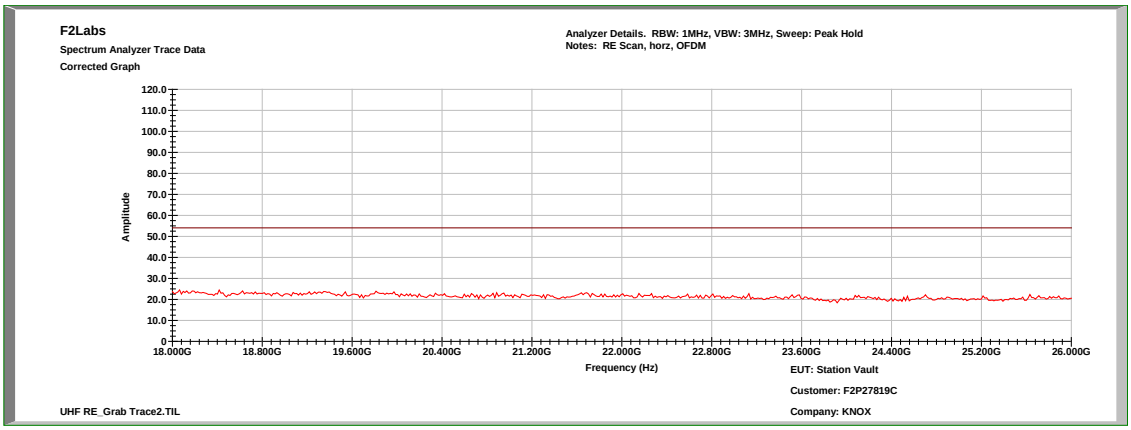
OFDM: Characterization Scan, 1 GHz to 3 GHz, Horizontal



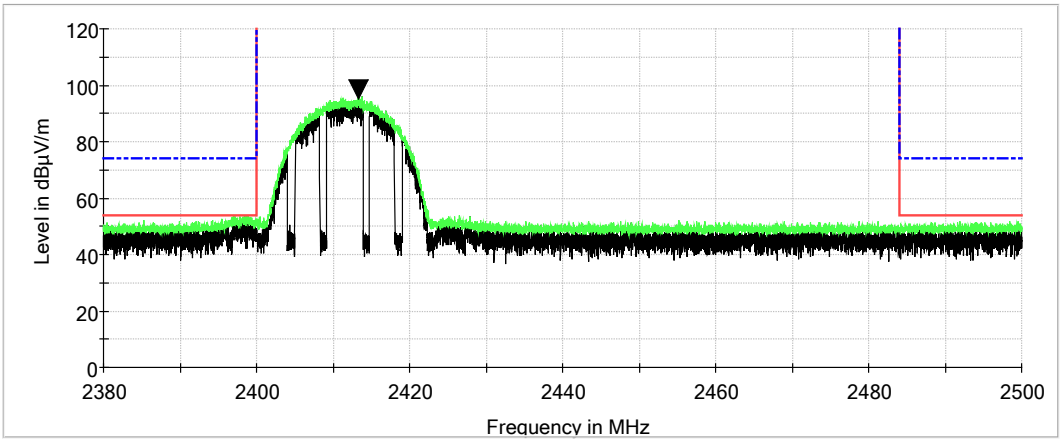
OFDM: Characterization Scan, 3 GHz to 18 GHz, Horizontal



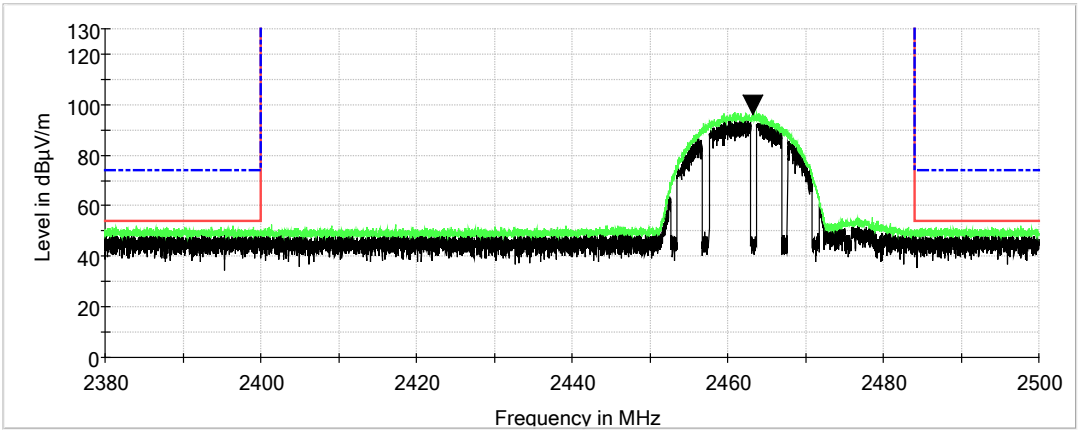
OFDM: Characterization Scan, 18 GHz to 26 GHz, Horizontal



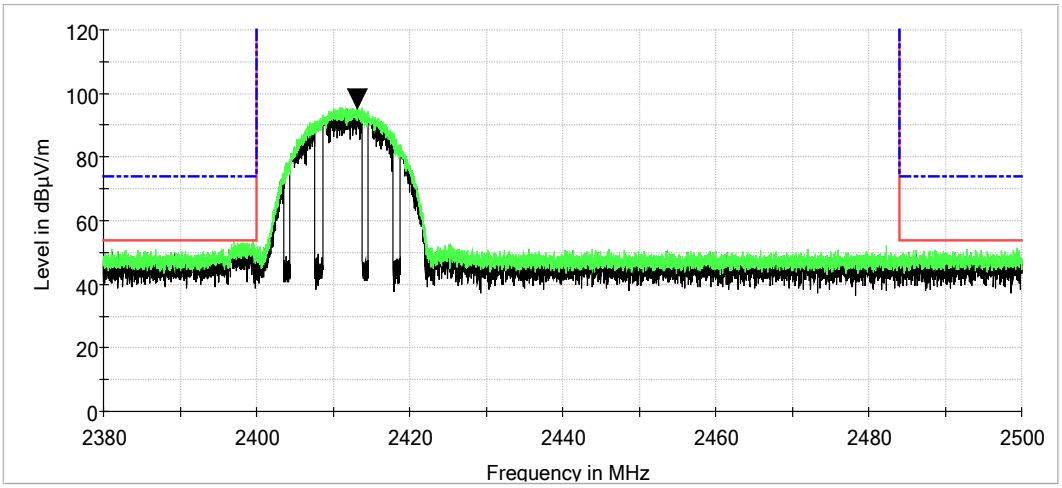
CCK 11: Lower Band Edge, Vertical



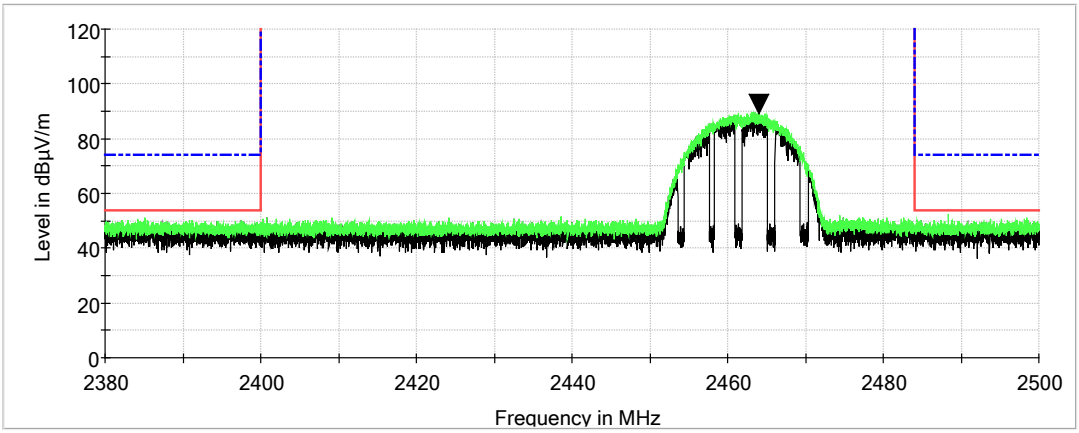
CCK11: Upper Band Edge, Vertical



CCK 11: Lower Band Edge, Horizontal

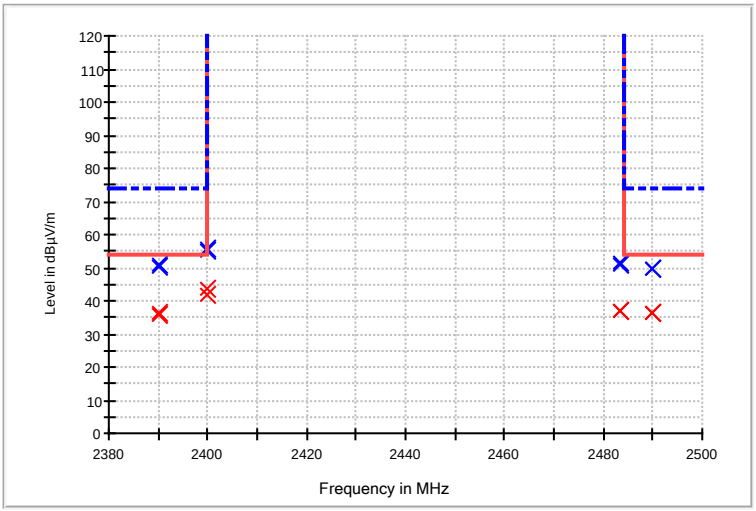


CCK 11: Upper Band Edge, Horizontal

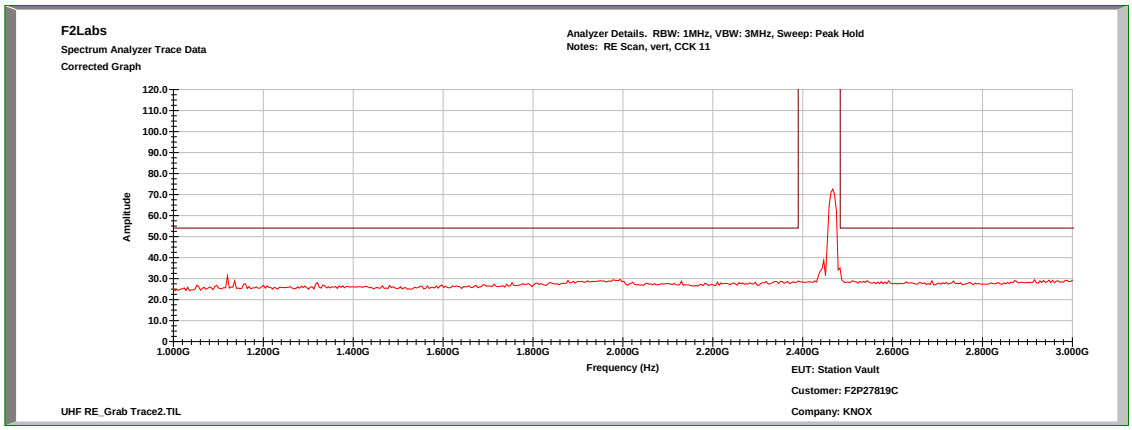


CCK 11: Band Edge Measurements

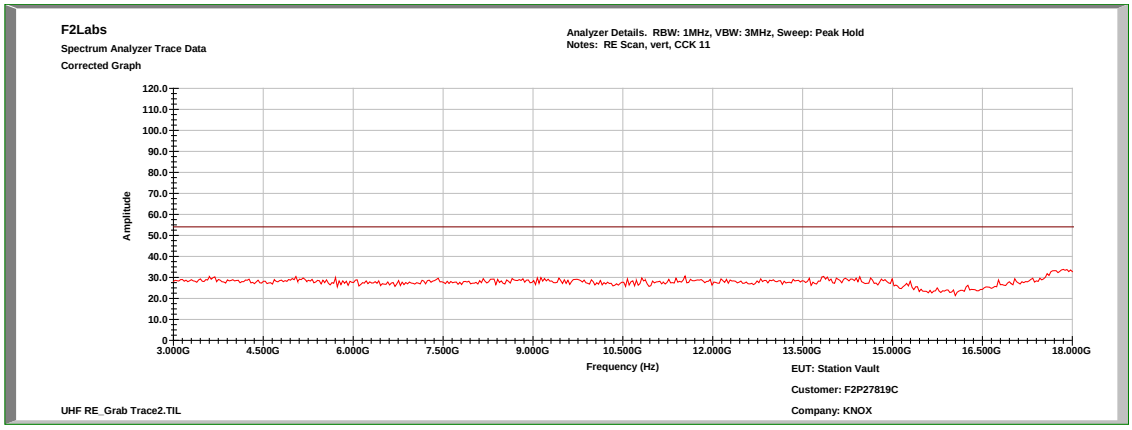
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Limit - MaxPeak (dBµV/m)	Margin - MaxPeak (dB)
2390.000000	50.7	36.7	1000.000	150.0	V	224.0	10.6	17.3	54.0	74.0	23.3
2390.000000	50.3	36.0	1000.000	150.0	H	32.0	10.6	18.0	54.0	74.0	23.7
2400.000000	54.9	42.0	1000.000	150.0	H	32.0	10.5	12.0	54.0	74.0	19.1
2400.000000	55.9	43.4	1000.000	150.0	V	224.0	10.5	10.6	54.0	74.0	18.1
2483.500000	50.9	37.2	1000.000	150.0	H	44.0	10.5	16.8	54.0	74.0	23.1
2483.500000	51.5	37.2	1000.000	150.0	V	268.0	10.5	16.8	54.0	74.0	22.5
2490.000000	49.8	36.5	1000.000	150.0	H	44.0	10.6	17.5	54.0	74.0	24.2
2490.000000	49.9	36.3	1000.000	150.0	V	268.0	10.6	17.7	54.0	74.0	24.1



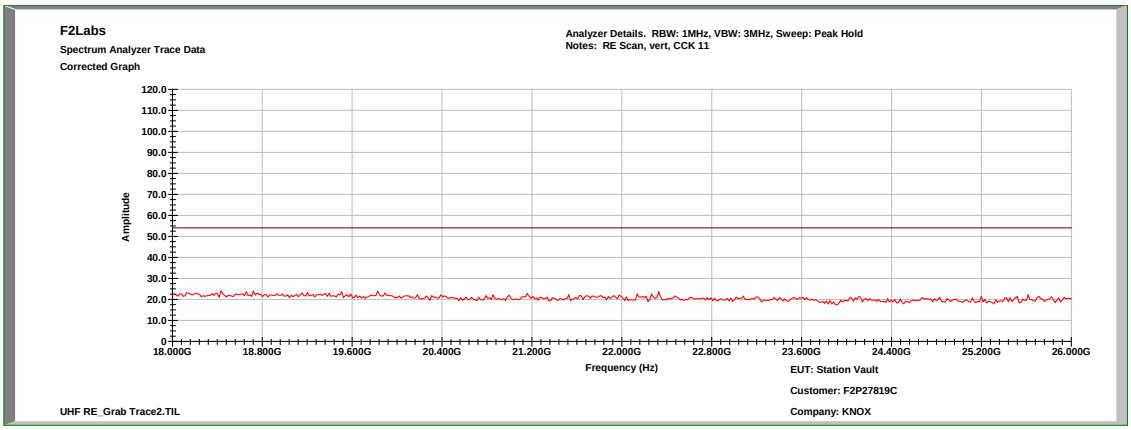
CCK 11: Characterization Scan, 1 GHz to 3 GHz, Vertical



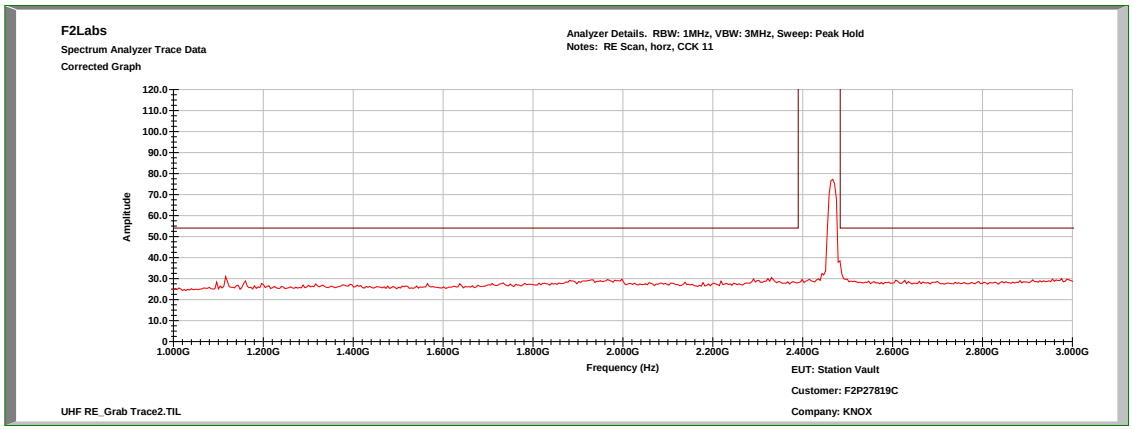
CCK 11: Characterization Scan, 3 GHz to 18 GHz, Vertical



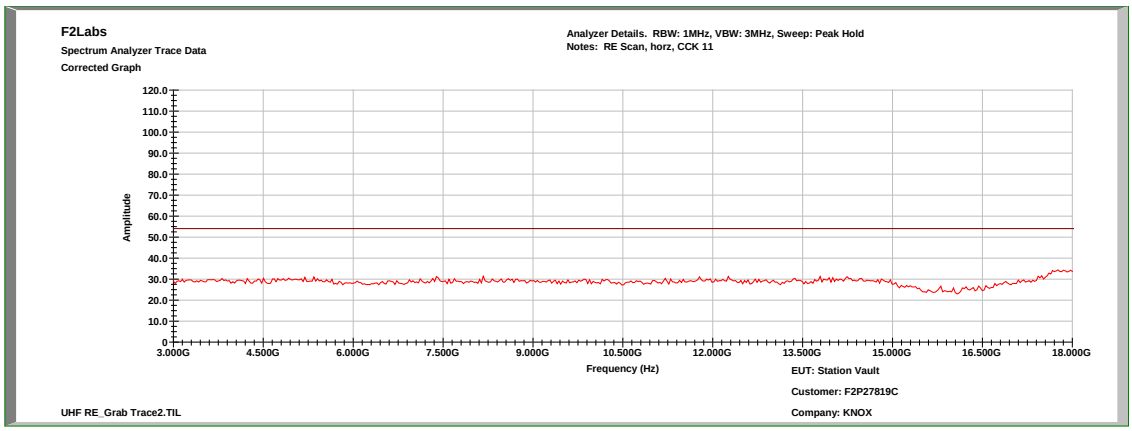
CCK 11: Characterization Scan, 18 GHz to 26 GHz, Vertical



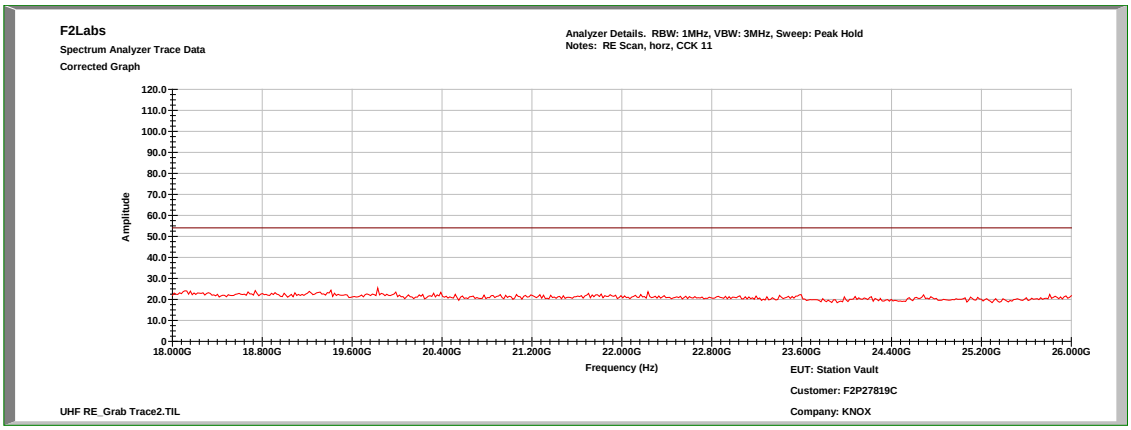
CCK 11: Characterization Scan, 1 GHz to 3 GHz, Horizontal



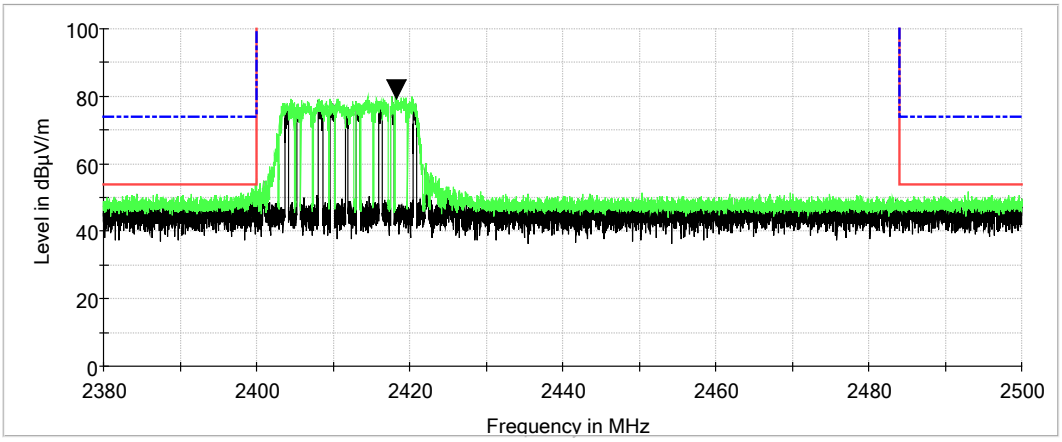
CCK 11: Characterization Scan, 3 GHz to 18 GHz, Horizontal



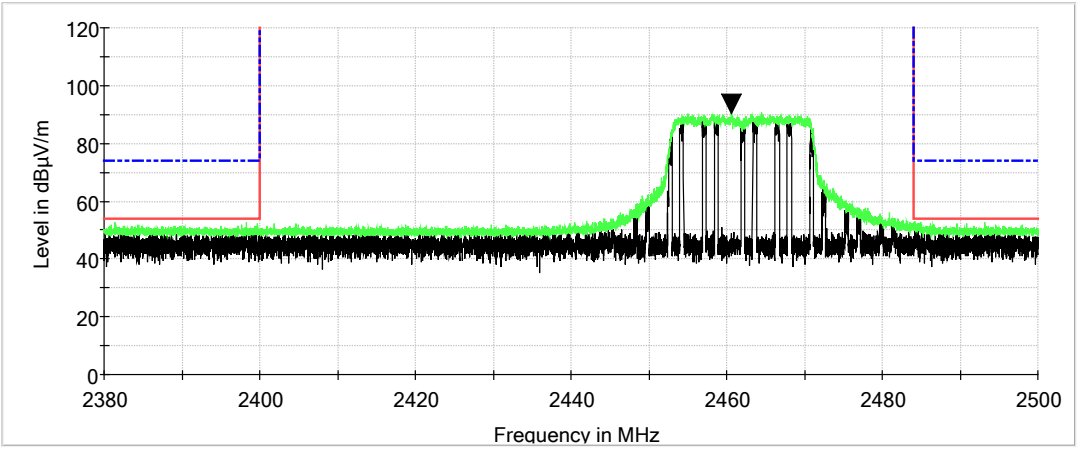
CCK 11: Characterization Scan, 18 GHz to 26 GHz, Horizontal



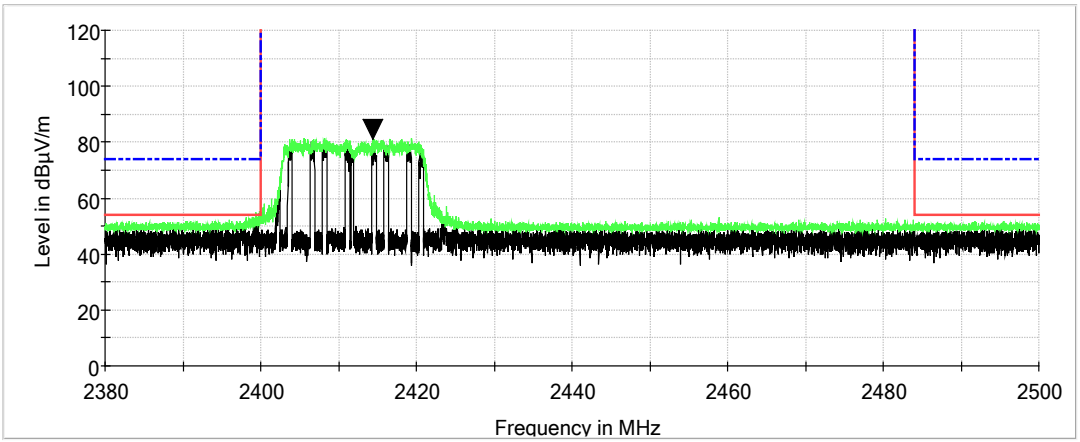
HT 20: Lower Band Edge, Vertical



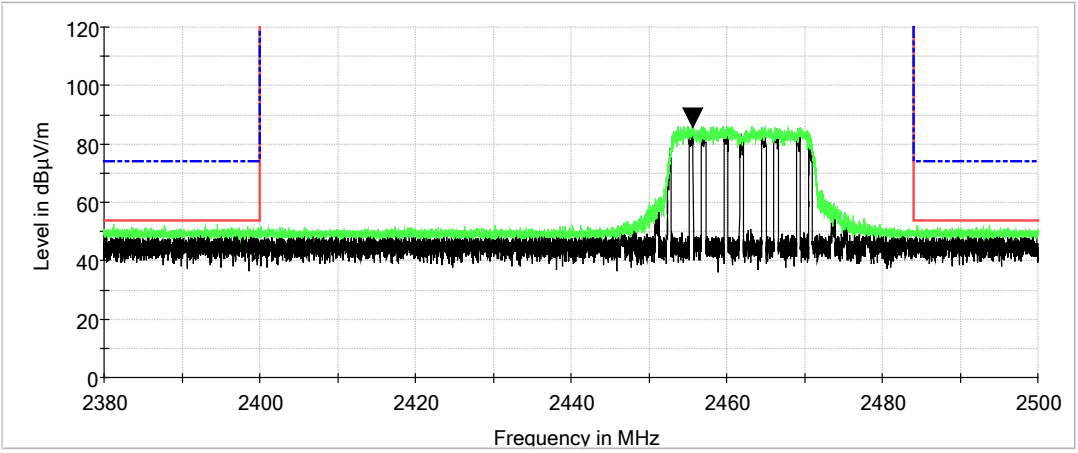
HT 20: Upper Band Edge, Vertical



HT 20: Lower Band Edge, Horizontal

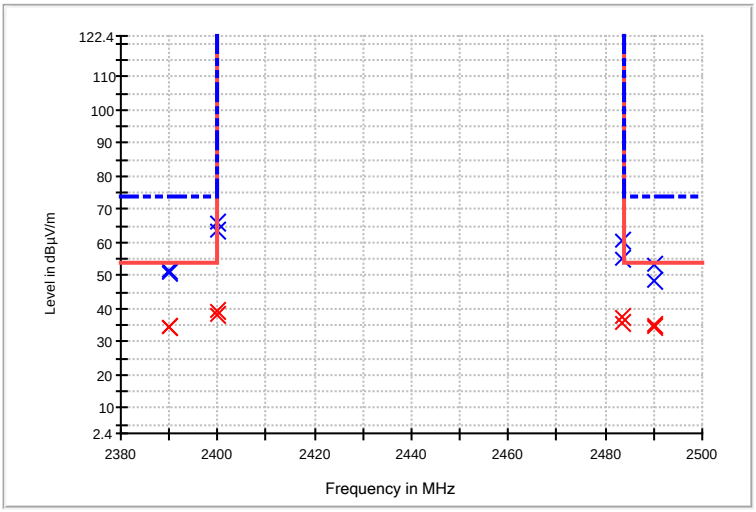


HT 20: Upper Band Edge, Horizontal

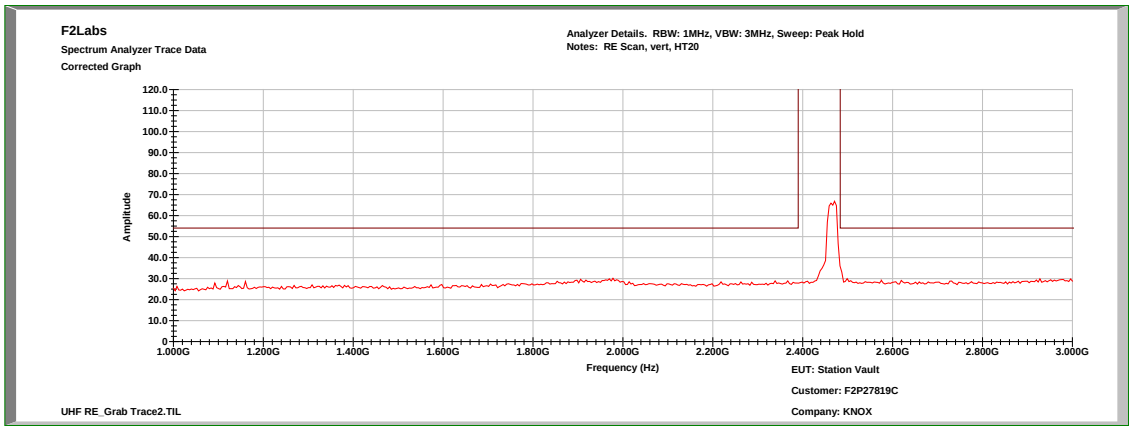


HT 20: Band Edge Measurements

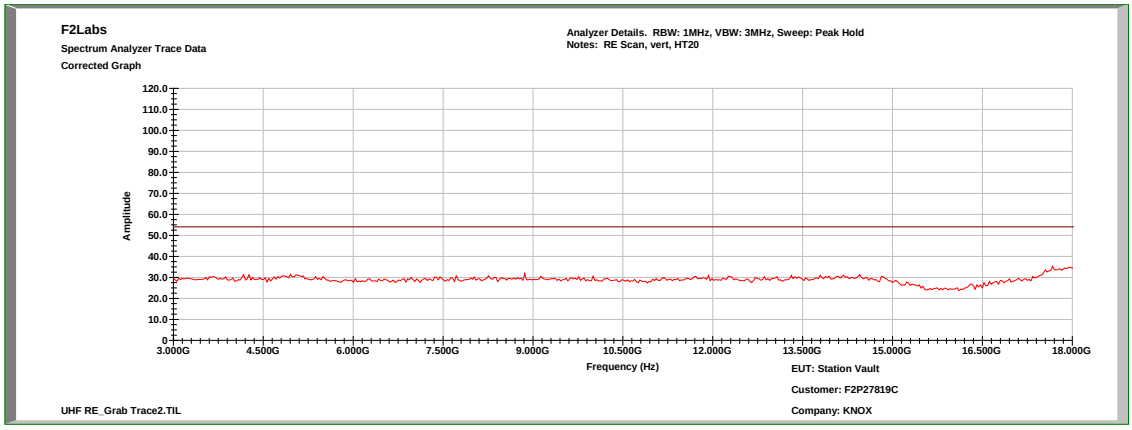
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Limit - MaxPeak (dBµV/m)	Margin - MaxPeak (dB)
2390.000000	51.1	34.8	1000.000	150.0	H	257.0	10.6	19.2	54.0	74.0	22.9
2390.000000	51.2	34.8	1000.000	150.0	V	0.0	10.6	19.2	54.0	74.0	22.8
2400.000000	63.8	38.2	1000.000	150.0	V	0.0	10.5	15.8	54.0	74.0	10.2
2400.000000	66.1	39.3	1000.000	150.0	H	257.0	10.5	14.7	54.0	74.0	7.9
2483.500000	55.4	35.9	1000.000	150.0	H	49.0	10.5	18.1	54.0	74.0	18.6
2483.500000	60.8	37.8	1000.000	150.0	V	241.0	10.5	16.2	54.0	74.0	13.2
2490.000000	48.6	34.6	1000.000	150.0	H	49.0	10.6	19.4	54.0	74.0	25.4
2490.000000	53.1	35.0	1000.000	150.0	V	241.0	10.6	19.0	54.0	74.0	20.9



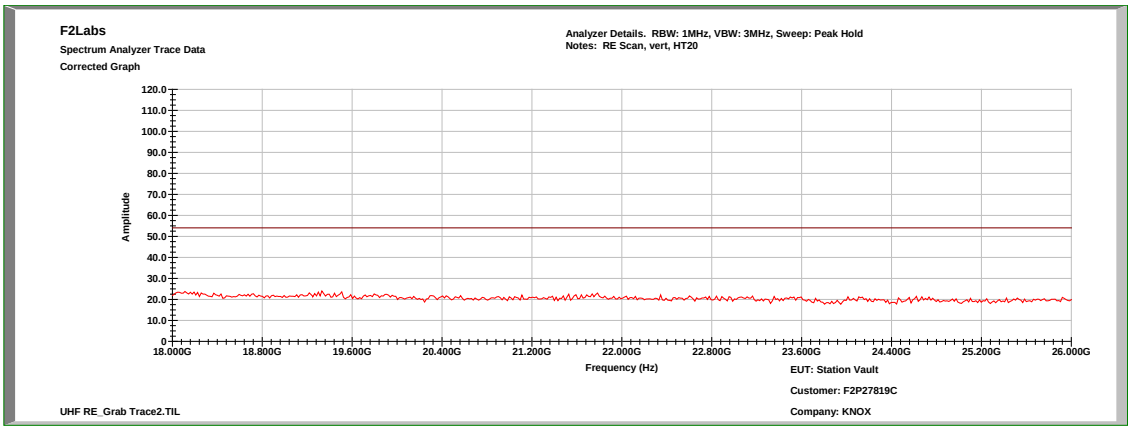
HT 20: Characterization Scan, 1 GHz to 3 GHz, Vertical



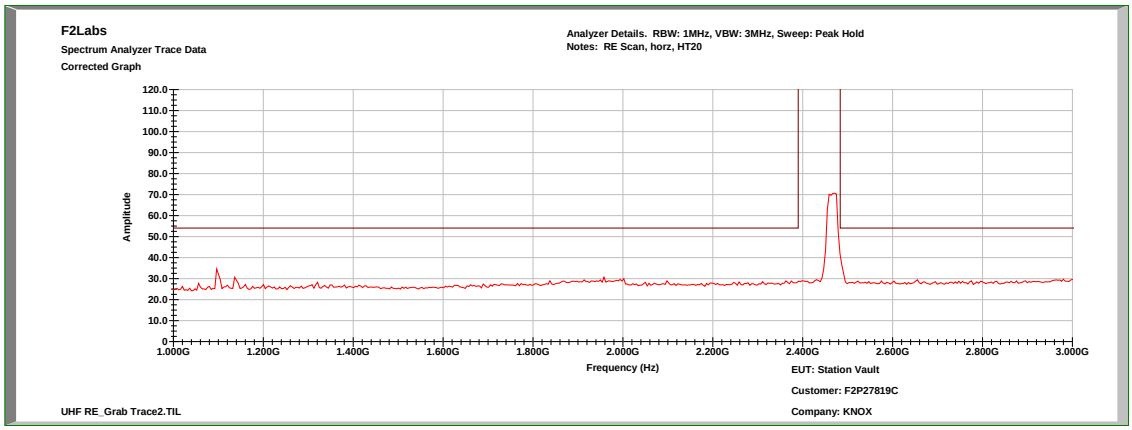
HT 20: Characterization Scan, 3 GHz to 18 GHz, Vertical



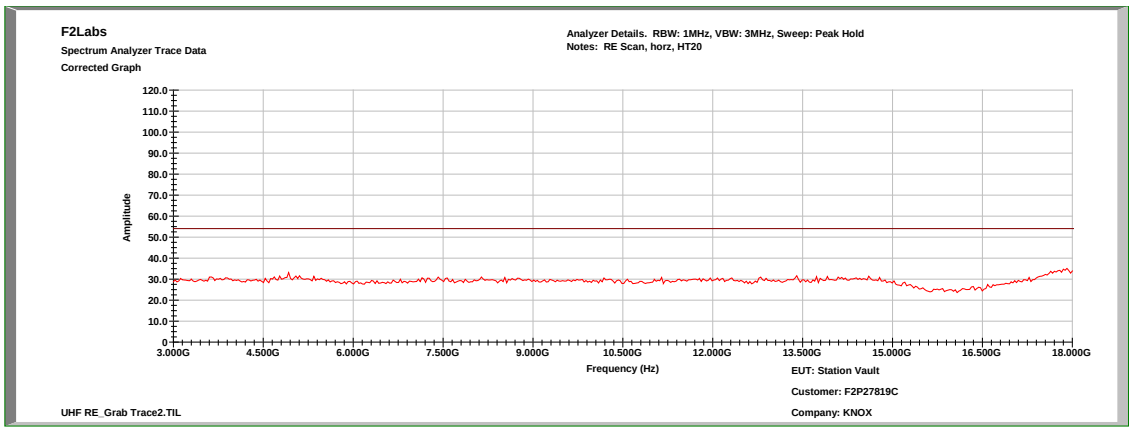
HT 20: Characterization Scan, 18 GHz to 26 GHz, Vertical



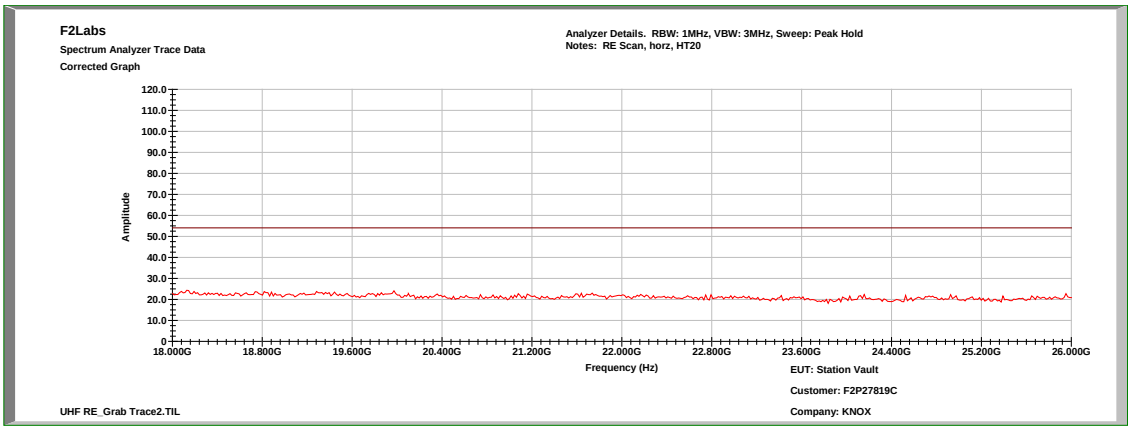
HT 20: Characterization Scan, 1 GHz to 3 GHz, Horizontal



HT 20: Characterization Scan, 3 GHz to 18 GHz, Horizontal

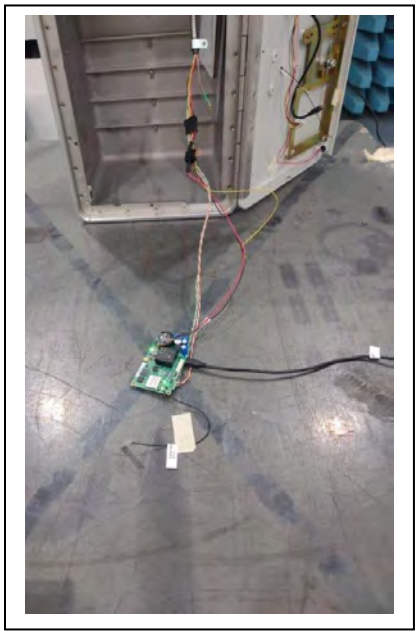


HT 20: Characterization Scan, 18 GHz to 26 GHz, Horizontal

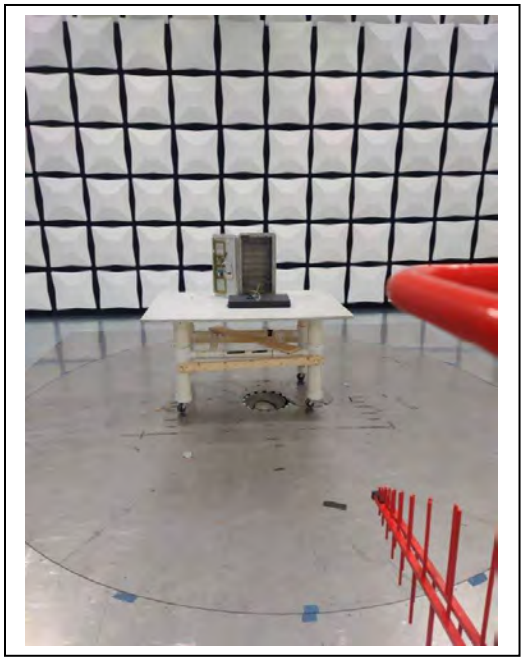


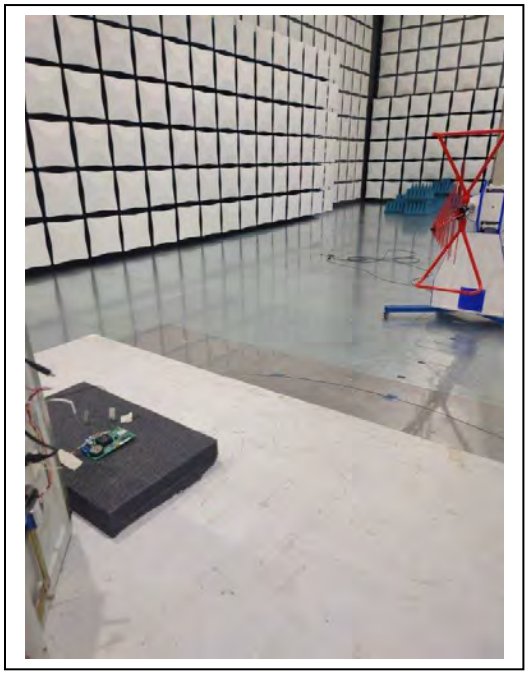
7 TEST SETUP PHOTOGRAPHS

Radiated Spurious Emission, 0.15 MHz to 30 MHz



Radiated Spurious Emission, Less than 1 GHz





Radiated Spurious Emission, Greater than 1 GHz