Electromagnetic Compatibility
Test Report

Test Report No: APT 231120
Issued on: November 23, 2020

Product Name
SciO Cup

Tested According to
FCC 47 CFR, Part 15, Subparts C

Tests Performed for
VeriFood Ltd.
PO Box 12414, Herzliya 4672211, Israel
+972-9-7724885

QualiTech EMC Laboratory
30 Hasivim Street,P.O.Box 7500
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Certificate 1633.01
Electrical Testing

Test Personnel

Tests Performed By: ----------
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EMC Lab. Manager
QualiTech EMC Laboratory

Test Report details:

Test commencement date: 24.09.2020

Test completion date: 02.11.2020

Customer's representative: Elad Heiman

Issued on: 23.11.2020

Revision details:

Version	Date	Details/Reasons
Rev. 1	23.11.2020	-
Rev. 2	22.09.2021	-

Assessment information:

This report contains an assessment of the EUT against Electromagnetic Compatibility based upon tests carried out on the samples submitted. The results contained in this report relate only to the items tested. Manufactured products will not necessarily give identical results due to production and measurement tolerances. QualiTech, EMC Lab does not assume responsibility for any conclusion and generalization drawn from the test results with regards to other specimens or samples of type of the equipment represented by test item.

The EUT was setup and exercised using the configuration, modes of operation and arrangements defined in this report only.

Modifications:

Modifications made to the EUT

None

Modifications made to the Test Standard

None

Summary of Compliance Status

The EUT was tested according to the following test methods.
Test results are given in full in section 4.

Test Case	Test Spec. Clause	Remarks
6dB Bandwidth	47 CFR §15.247 (a) (2),ANSI C63.10 Subclause 11.8.2 Option 2	Pass
Maximum Peak Output Power	47 CFR §15.247 (b) (3), ANSI C63.10 Subclause 11.9.1.1	Pass
DTS maximum power spectral density level in the fundamental emission	47 CFR §15.247 (e) (1),ANSI C63.10 Subclause 11.10.2	Pass
Radiated Spurious Emission in non-restricted frequency bands	47 CFR §15.247 (d),ANSI C63.10 Subclause 11.11.1(a)	Pass
Radiated Spurious Emissions, Restricted Bands	47 CFR §15.247 (d), §15.205, §15.209(a), ANSI C63.10. Subclause 11.12.1	Pass
Band-edge compliance of RF Conducted Emission	47 CFR §15.247 (d), ANSI C63.10. Subclause 11.13.2	Pass
Antenna Connector Requirements	47 CFR §15.203	Pass
Power line Emission measurements	47 CFR §15.207	Pass

Table of Contents

1. General

1.1. Referenced documents:

FCC Part 15	Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Part 15, Subpart C
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.2. General Description

Product name: SCiO Cup

Model: SCCUP01

FCC ID: 2AEKW-CP-SCM003

Description:

The SCiO cup is a portable Near Infrared device for grains and feed, food, and materials analysis

THE SCiO Cup is the world's fastest lab-grade analyzer, combining portability, accuracy, and ease of use. It revolutionizes feed food, and material analysis by moving decision making out of the lab and into the field, by using Near Infra-Red Spectroscopy (NIRS).

Maximum Radiated Peak Output Power: 0.7348 mW

Frequency range: 2400-2483.5 GHz

Type of Modulation:

Protocol	Modulation
Bluetooth	GFSK

Antenna Specification:

Type:
Antenna Gain: Max 1.3 dBi in the range 2.4 – 2.5 GHz

2. Method of Measurements

2.1. Radiated Emissions Measurements in the restricted bands:

For radiated emissions, which fall in the restricted bands the spectrum from 9 kHz to 25GHz was investigated following the guidelines in ANSI C63.10-2013, with the transmitter set to the lowest, middle and highest channel frequencies. Measurements were performed with peak detector and repeated averaged with VBW=10Hz. Only Peak detection plots are presented.

2.2. Radiated Emission measurements:

Measurements were performed at a 3-meter measurement distance in the semi-anechoic chamber in order to evaluate the radiated electromagnetic interference characteristics of the EUT. The EUT was placed on a non-metallic table/support, 0.8m for frequency below 1GHz and 1.5m for frequency above 1GHz above the turntable, was configured, arranged and operated in a manner consistent with typical application and load conditions. The test program of exercising the equipment ensured that various parts of the EUT were exercised to permit detection of all EUT disturbances.
An appropriate antenna depending upon the frequency range, per ANSI C63.10-2013 was used. While the turntable was being rotated, the height of the antenna was scanned from 1 to 4m. The highest radiated emission was detected by manipulating the system cables to the worst-case position. This process was repeated for both antenna polarizations. The spectrum up to 40GHz was investigated for spurious emissions, using a band-reject filter where appropriate.
The amplitudes of worst-case emission were measured with the detector modes and resolution bandwidths over various frequency ranges according to the requirements of ANSI C63.10-2013.

2.3. Worst Case Results:

Worst case result is determined as the channel with the highest output power and operating on charging mode with AC/DC adapter . Pre-scan has been conducted to determine the worst-case. Test result of various modulation modes/data rates and EUT's configurations(Battery operated mode, charging mode with AC/DC adapter) were investigated and worst case was reported.

FCC 15.31(e)
The EUT operates with AC/DC adaptor 110Vac ,60Hz with a new rechargeable battery
During power output measurement the AC input was varied between 85% and 115%
No change of power and frequency was observed-comply

2.4. Power Line Emission measurements:

The EUT was placed on a non-conductive table/support 80 cm above the reference ground plane. The EUT was configured in accordance with ANSI C63.10-2013 using a 50µH/50 ohm LISN.

Compliance with the provisions was based on the measurements of the radio frequency voltage between each line and the ground at the power terminal.

The EUT was operated in receive mode and then with DTS transmitters operating alternately and the worst case results were presented.

3. Test Facility & Uncertainty of Measurement

3.1. Accreditation/ Registration reference:

3.2. Accreditation/ Registration reference:

- *A2LA Certificate Number: 1633.01*
- *FCC Designation Number :IL1006*

3.3. Test Facility description

The tests were performed at the EMC Laboratory, QualiTech Division, ECI Telecom

Address: 30, Hasivim St., Petah Tikva, Israel.
Tel: 972-3-926-6994

Semi Anechoic Configuration:

Measurement distance	3m
Chamber dimensions	9.5m x 6.5m x 5.2m
Antenna height	1 - 4m
Shielding Effectiveness	Magnetic field ≥80dB at 15 kHz ≥90dB at 100 kHz Electric field >120dB from 1MHz to 1GHz >110dB from 1GHz to 10GHz
Absorbing material	Ferrite tiles on the walls and ceiling Emerson and Cuming absorbing material in selected positions on the walls
Normalized Site Attenuation measured at 5 positions	±3.9dB, 30MHz to 200MHz ±3dB, 200MHz to 1000MHz
Transmission Loss measured at 5 positions, at 1.5m height	±3dB, 1GHz to 18GHz

3.4. The measurement software used:

Software Name	Software Version
Test Software "TILE	Version 7.1.4.1

4. BLE: Report of Measurements and examinations

4.1. The minimum 6dB DTS bandwidth

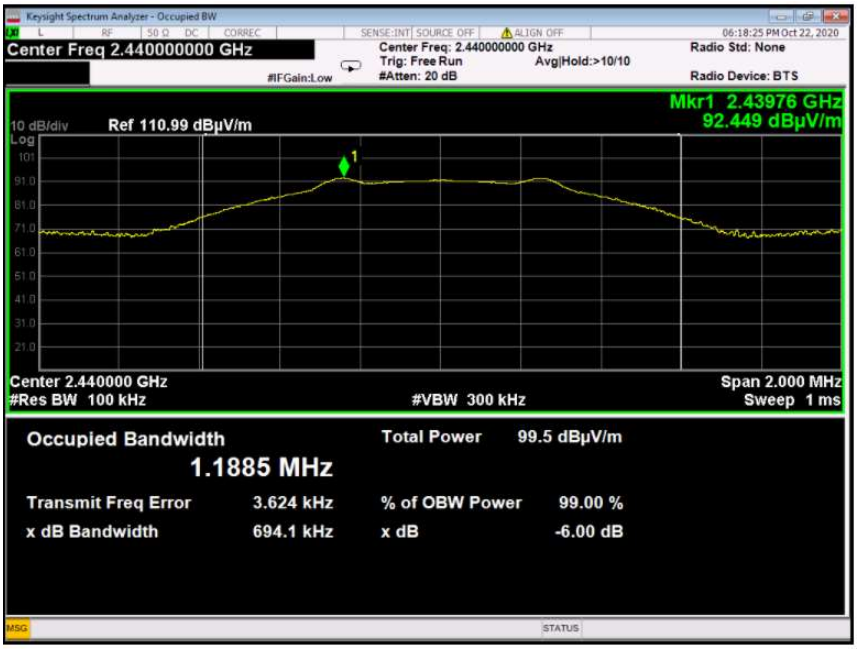
Reference document:	**47 CFR §15.247 (a) (2),**ANSI C63.10 Subclause 11.8.2 Option 2		
Test Requirements:	The minimum 6dB Bandwidth of DTS		
Operating conditions:	Under normal test conditions	Pass	
Method of testing:	Radiated		
S.A. Settings:	RBW: 100kHz, VBW: 300kHz, Span: 2MHz		
Hopping function:	Disabled		
Environment conditions:	Ambient Temperature: 24.3 °C	Relative Humidity: 49.8%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.1.1 – 4.1.3	

Test results:

Channel	Frequency, [MHz]	6dB BW, [kHz]	Limit([kHz]	Margin	Pass/Fail
Low	2402	705.0	>500	205.0	Pass
Mid	2440	694.1	>500	194.1	Pass
High	2480	694.6	>500	194.6	Pass

Plot 4.1.1: 6 dB bandwidth test results, GFSK, channel 0 (Low)

Plot 4.1.2: 6 dB bandwidth test results, GFSK, channel 39 (Mid)



Plot 4.1.3: 6dB bandwidth test results, GFSK, channel 78 (High)

4.2. Maximum Peak Output Power

Reference document:	**47 CFR §15.247 (b) (1), ANSI C63.10 Subclause 11.9.1.1**		
Test Requirements:	The maximum peak output power shall not exceed 1Watt (30dBm)		
Operating conditions:	Under normal test conditions	Pass	
Method of testing:	Conducted		
S.A. Settings:	RBW: 1MHz, VBW: 3MHz,		
Hopping function:	Disabled		
Environment conditions:	Ambient Temperature: 24.9°C	Relative Humidity: 50.1%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.2.1 – Plot 4.2.6	

Test results:

Type of modulation	Channel	Frequency (MHz)	Antenna position	Reading field (dBµV/m)	Max. peak output power*,** [dBm] EIRP	Antenna gain [dBi]	Max peak conducted output power [dBm]	Limit [dBm]	Delta [dB]	Pass/Fail
GFSK/BLE	Low	2402	H	93.854	-1.346	0.9	-2.246	30.00	-32.25	Pass
			V	94.459	-0.741	0.9	-1.641	30.00	-31.64	Pass
	Mid	2440	H	94.762	-0.438	0.9	-1.338	30.00	-31.34	Pass
			V	94.075	-1.125	0.9	-2.025	30.00	-32.03	Pass
	High	2480	H	94.674	-0.526	1.3	-1.826	30.00	-31.83	Pass
			V	95.024	-0.176	1.3	-1.476	30.00	-31.48	Pass

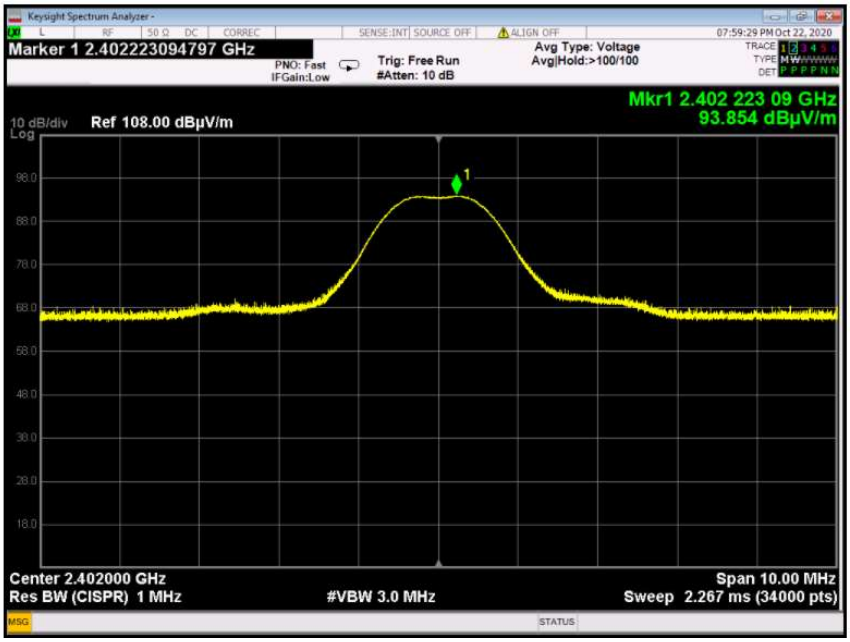
*Corrected for external attenuations & cable

**Conversion formula from field strength to P

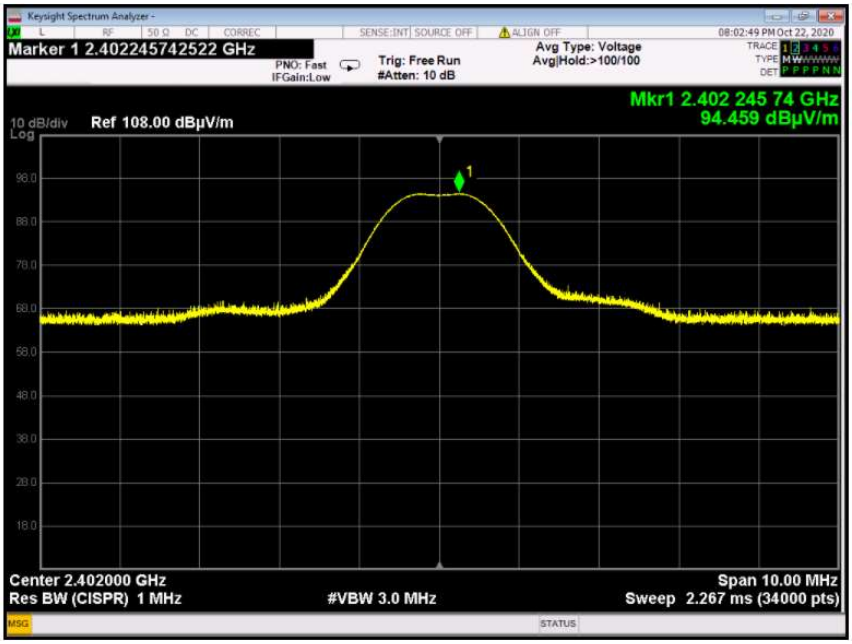
$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

EIRP = P x G = (E (V/m) x d) ² /30
Where:
P =Peak Power (W)
G = Antenna gain
E = electric field strength in V/m,
d = Measurement distance m-3m

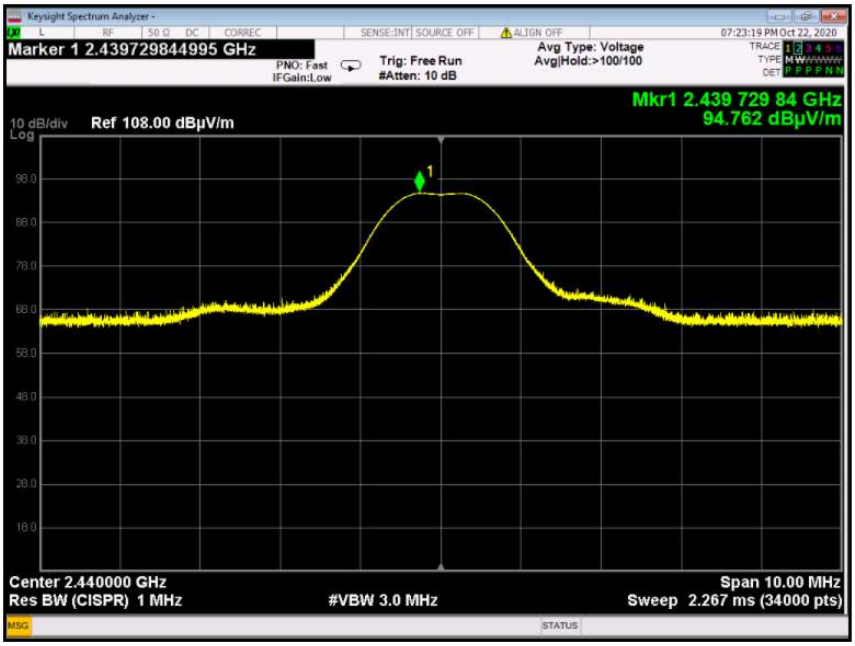
Plot 4.2.1: Maximum Peak Output Power test results, GFSK, channel 0 Horizontal Polarization



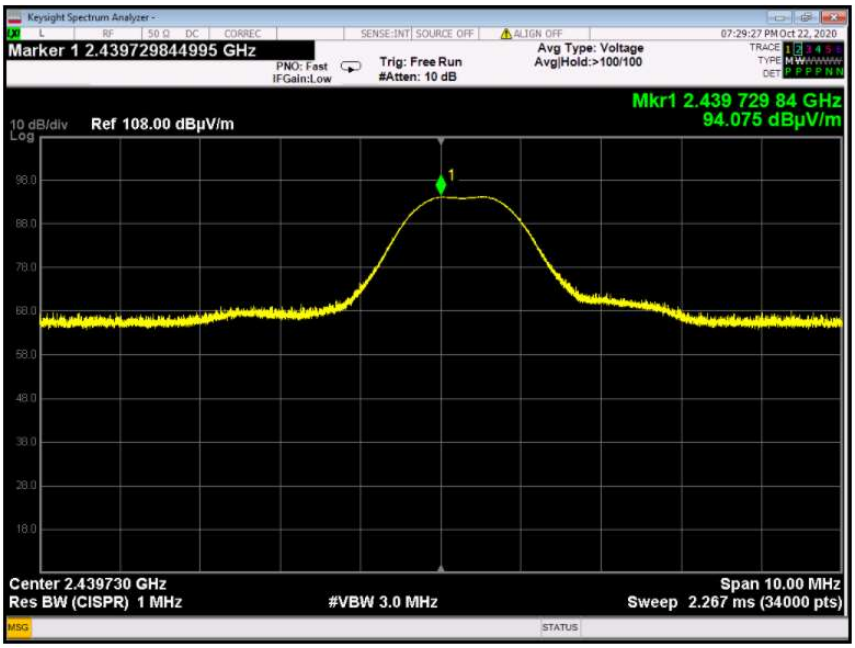
Plot 4.2.2: Maximum Peak Output Power test results, GFSK, channel 0 Vertical Polarization



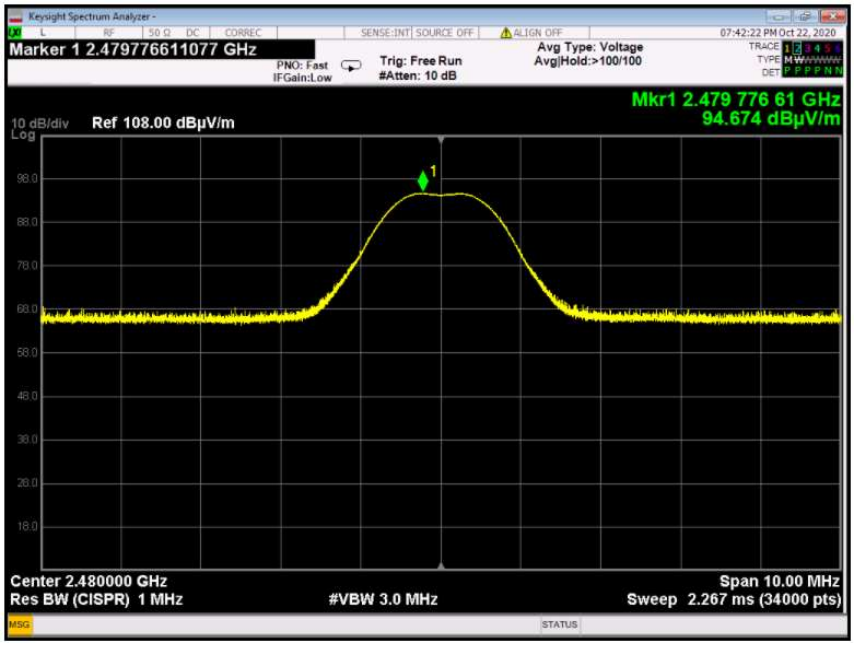
Plot 4.2.3: Maximum Peak Output Power test results, GFSK, channel 39 Horizontal Polarization



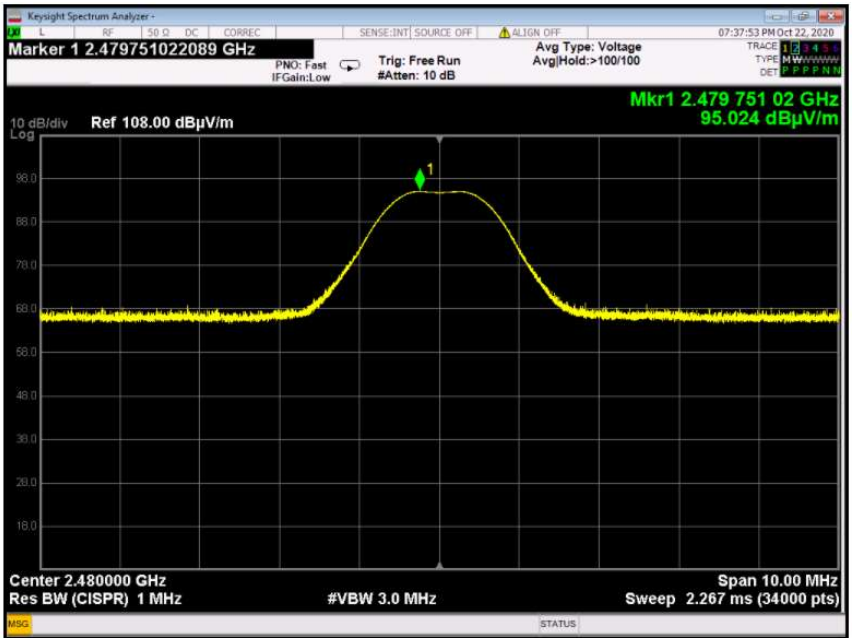
Plot 4.2.4: Maximum Peak Output Power test results, GFSK, channel 39 Vertical Polarization



Plot 4.2.5: Maximum Peak Output Power test results, GFSK, channel 78 Horizontal Polarization



Plot 4.2.6: Maximum Peak Output Power test results, GFSK, channel 78 Vertical Polarization



4.3. DTS maximum power spectral density level in the fundamental emission

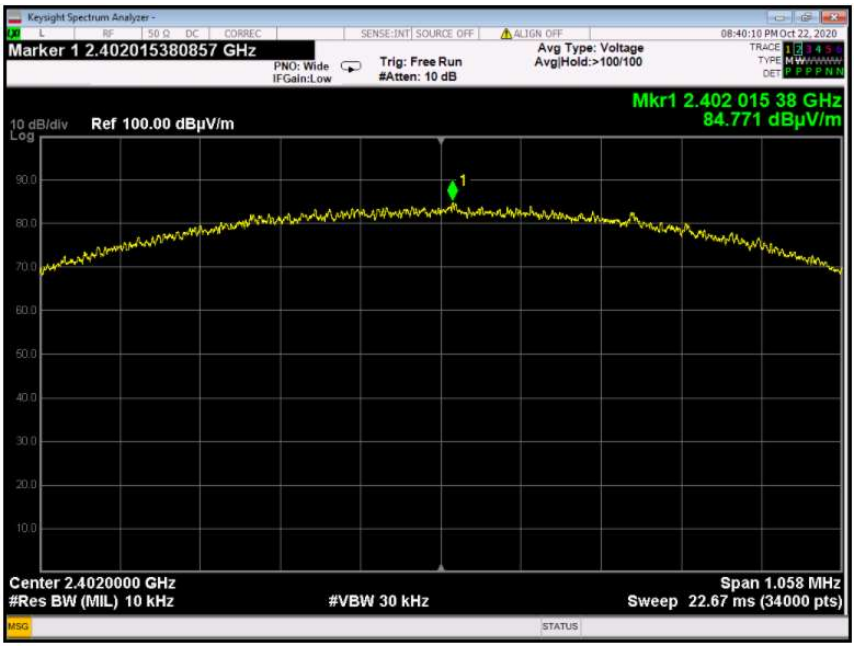
Reference document:	**47 CFR §15.247 (e) (1), ANSI C63.10 Subclause 11.10.2**		
Test Requirements:	DTS maximum power spectral density level in the fundamental emission		
Operating conditions:	Under normal test conditions	Pass	
Method of testing:	Radiated		
S.A. Settings:	RBW: 10KHz, VBW: 30KHz,		
Hopping function:	Disabled		
Environment conditions:	Ambient Temperature: 24.9°C	Relative Humidity: 50.1%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.3.1 – Plot 4.3.6	

Test results:

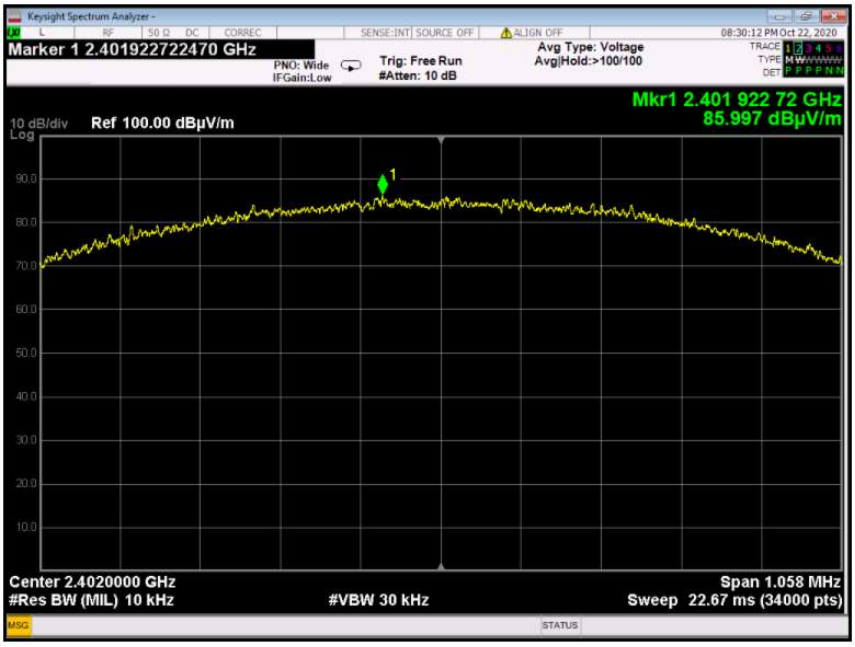
Type of modulation	Channel	Frequency (MHz)	Antenna position	Worst case reading (dBµV/m)	Max. power spectral density * [dBm] EIRP	Antenn a gain [dBi]	Max conducted power spectral density [dBm]	Limit [dBm]	Delta [dB]	Pass/ Fail
GFSK/BLE	Low	2402	H	84.771	-10.429	0.9	-11.329	8.00	-19.33	Pass
			V	85.997	-9.203	0.9	-10.103	8.00	-18.10	Pass
	Mid	2440	H	85.392	-9.808	0.9	-10.708	8.00	-18.71	Pass
			V	84.560	-10.64	0.9	-11.54	8.00	-19.54	Pass
	High	2480	H	85.618	-9.582	1.3	-10.882	8.00	-18.88	Pass
			V	85.074	-10.126	1.3	-11.426	8.00	-19.43	Pass

*Corrected for external attenuations & cable

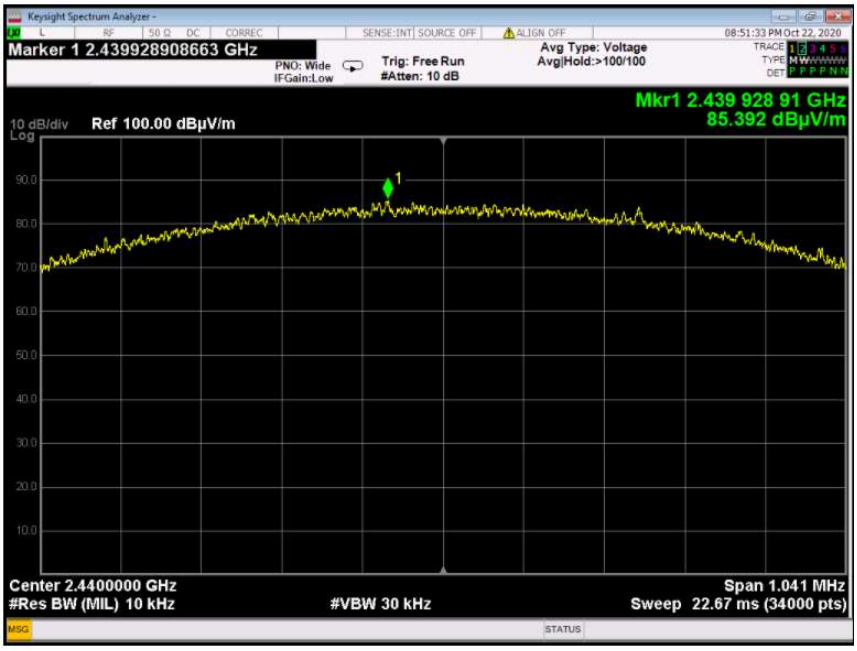
Plot 4.3.1: DTS maximum power spectral density level in the fundamental emission, channel 0 Horizontal Polarization



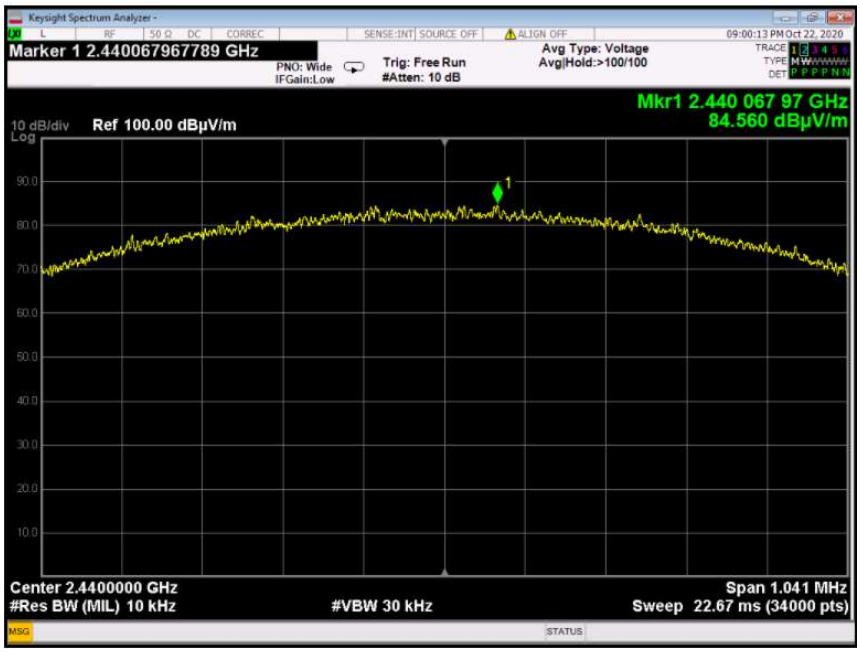
Plot 4.3.2: DTS maximum power spectral density level in the fundamental emission, channel 0 Vertical Polarization



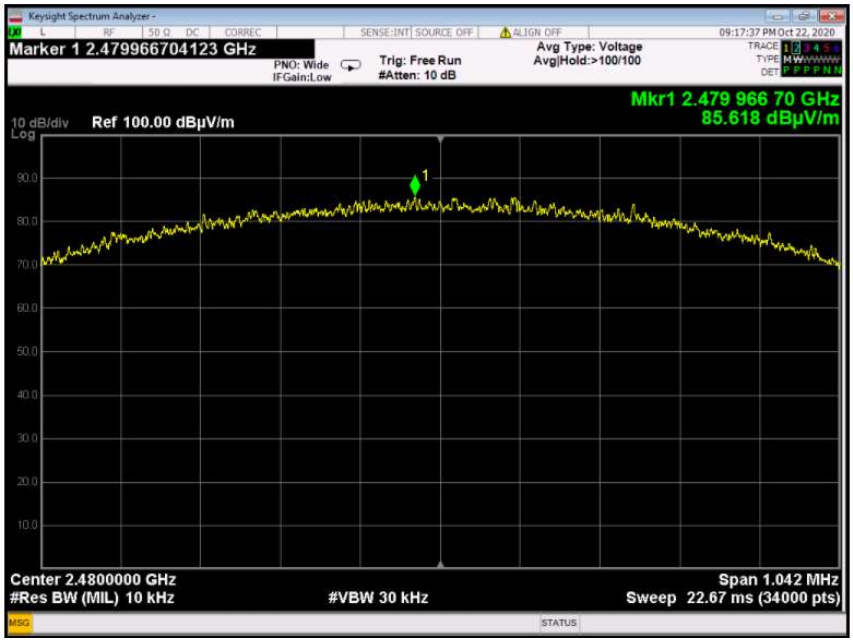
Plot 4.3.3: DTS maximum power spectral density level in the fundamental emission, channel 39 Horizontal Polarization



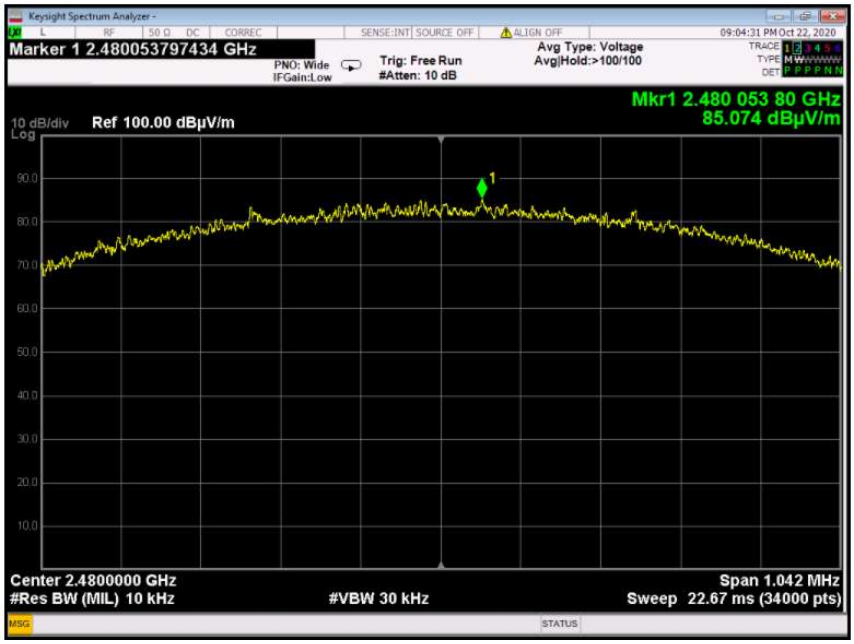
Plot 4.3.4: DTS maximum power spectral density level in the fundamental emission, channel 39 Vertical Polarization



Plot 4.3.5: DTS maximum power spectral density level in the fundamental emission, channel 78 Horizontal Polarization



Plot 4.3.6: DTS maximum power spectral density level in the fundamental emission, channel 78 Vertical Polarization



4.4. Spurious Emissions

4.4.1. Spurious Emissions - Radiated Measurements

Reference document:	**47 CFR §15.247 (d), ANSI C63.10 Subclause 11.11.1(a)**		
Test Requirements:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.		
Operating conditions:	Under normal test conditions	**Pass**	
Method of testing:	Radiated		
S.A. Settings:	f >1GHz: Peak: RBW= 1MHz, VBW= 3MHz, Average: VBW= 1 kHz f<1GHz: RBW: 100kHz,VBW: 300kHz		
Hopping function:	Disabled (lowest, middle, and highest channels to be investigated)		
Environment conditions:	Ambient Temperature: 24.9°C	Relative Humidity: 50.1%	Atmospheric Pressure: hPa
Test Result:	See below	Plots 4.4.1.1 – Plot 4.4.1.19	

All measurements were done in horizontal and vertical polarizations; the results show the worst case.

Test results below 1GHz:

Channel	Emission Frequency [MHz]	Detector Type	Antenna Polarization	Emission Level, [dBµV/m]	Ref.level, [dBµV/m]	Delta [dBc]	Limit, [dBc]	Pass/Fail
Low	120.00	Peak	H	38.621	93.69	-55.07	-20.0	Pass
	570.02	Peak	H	42.67	93.69	-51.02	-20.0	Pass
	570.02	Peak	V	42.20	93.69	-51.49	-20.0	Pass
Mid	570.02	Peak	H	41.87	93.69	-51.82	-20.0	Pass
	629.96	Peak	H	43.00	93.69	-50.69	-20.0	Pass
	689.97	Peak	H	39.89	93.69	-53.80	-20.0	Pass
	749.97	Peak	V	42.50	93.69	-51.19	-20.0	Pass
High	570.02	Peak	H	45.32	93.69	-48.37	-20.0	Pass
	749.97	Peak	H	44.22	93.69	-49.47	-20.0	Pass
	570.02	Peak	V	43.24	93.69	-50.45	-20.0	Pass

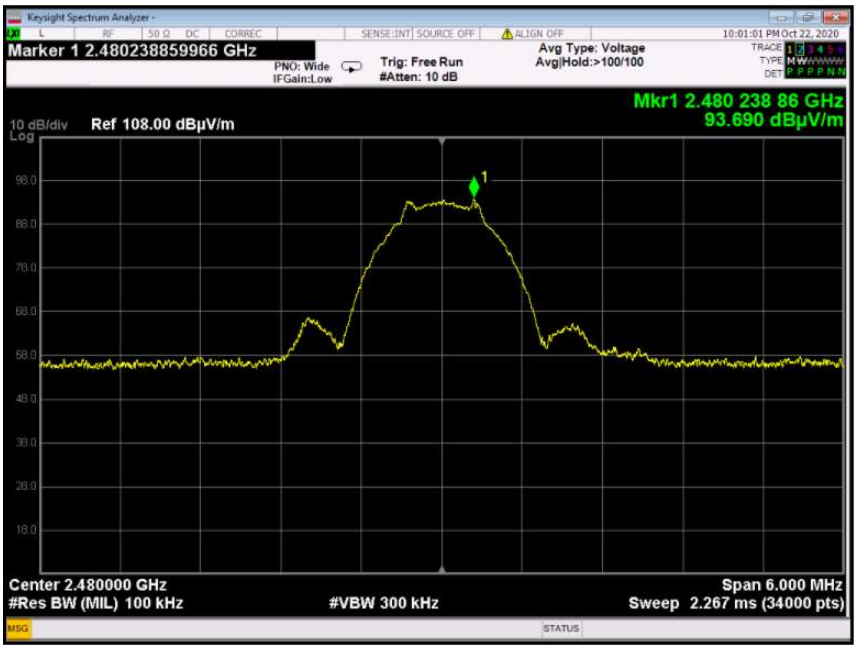
Test results above 1GHz:

Channel	Emission Frequency [GHz]	Detector Type	Antenna Polarization,	Emission Level, [dBµV/m]	Reference Level,, [dBµV/m]	Delta, [dBc]	Limit Delta, [dBc]	Pass/Fail
Low	9.928	Peak	H	41.544	93.69	-52.146	-20.0	Pass
	4.806	Peak	V	42.205	93.69	-51.485	-20.0	Pass
	7.205	Peak	V	39.072	93.69	-54.618	-20.0	Pass
	12.008	Peak	V	44.952	93.69	-48.738	-20.0	Pass
Mid	12.1988	Peak	H	43.907	93.69	-49.783	-20.0	Pass
	12.1988	Peak	V	42.547	93.69	-51.143	-20.0	Pass
High	12.3988	Peak	H	42.363	93.69	-51.327	-20.0	Pass
	12.398	Peak	V	42.458	93.69	-51.232	-20.0	Pass
	4.9576	Peak	V	40.261	93.69	-53.429	-20.0	Pass

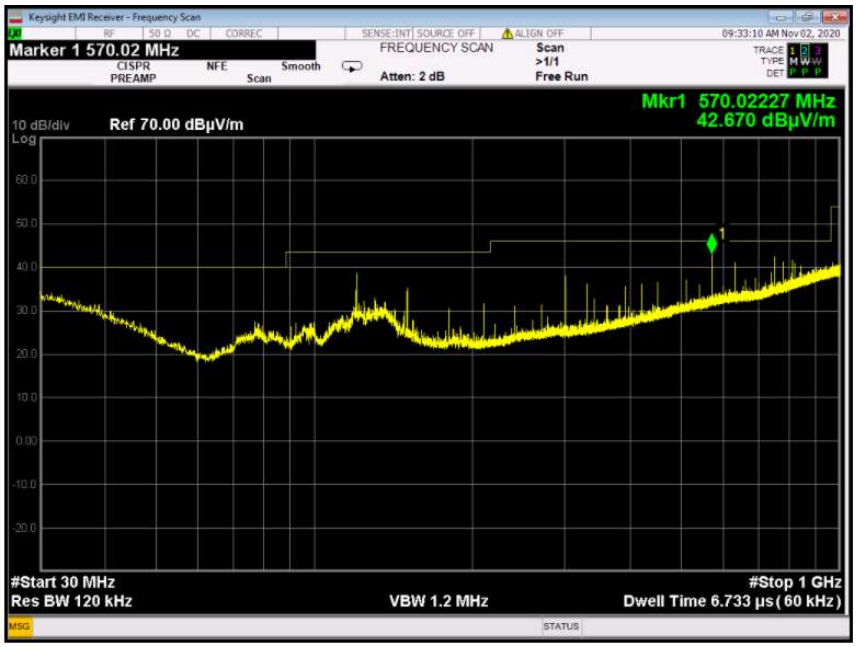
Note: Emission Level [dBµV/m] = Measured Emission [dBµV] + Correction-factor [dB (1/m)]

Correction Factor = Antenna factor + Cable Loss + Filter I/L

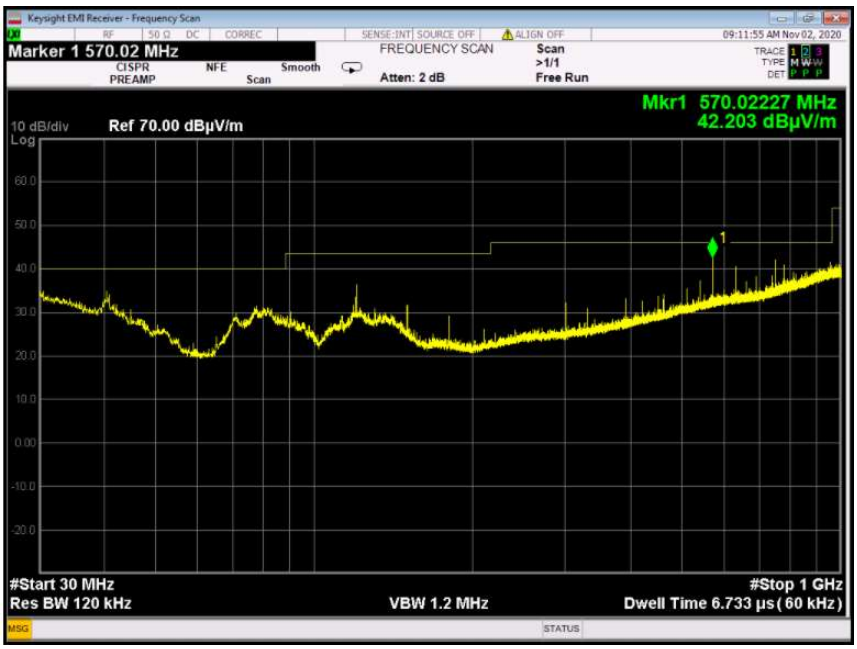
Plot 4.4.1.1: The maximum PSD Reference level Vertical Polarization



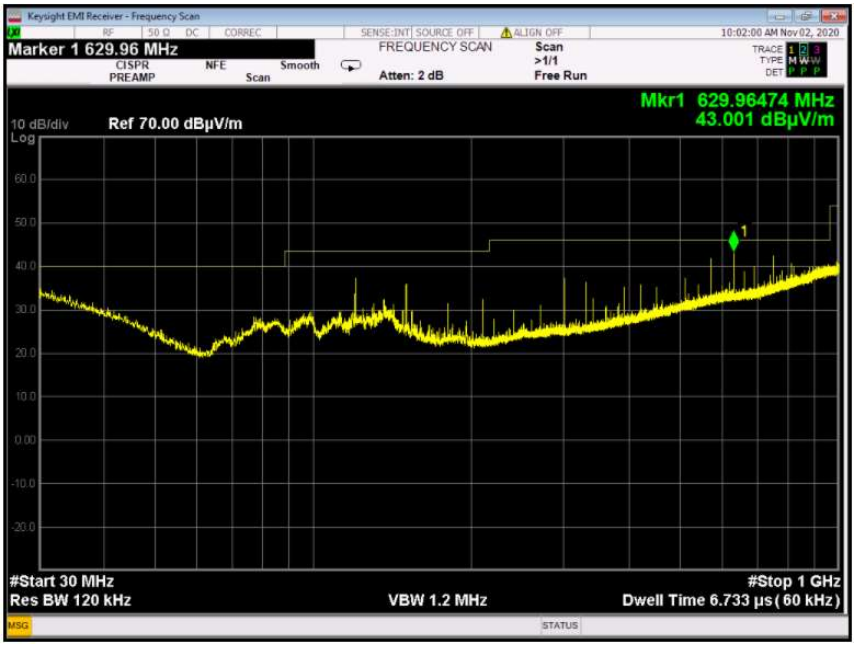
Plot 4.4.1.2: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2402 MHz, Horizontal Polarization



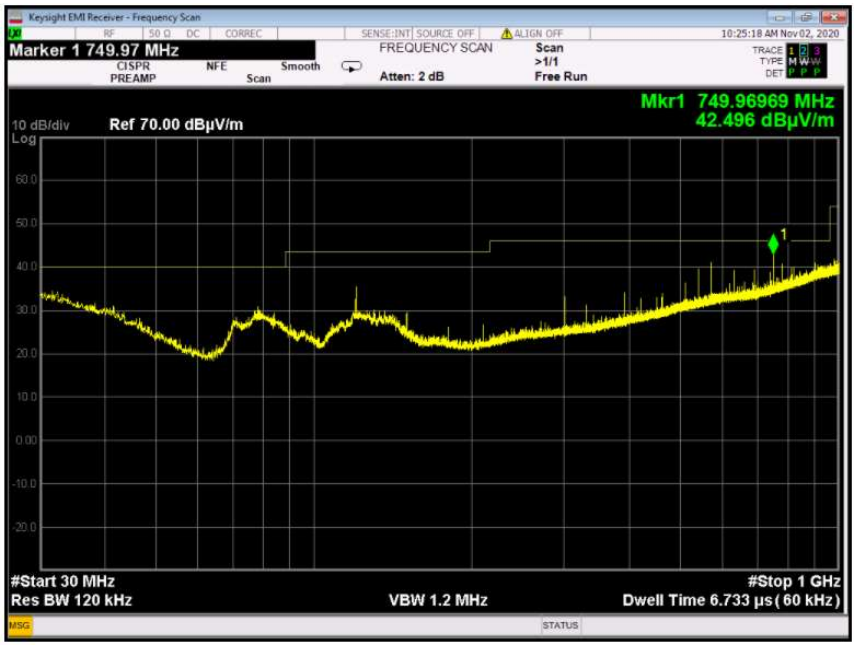
Plot 4.4.1.3: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2402 MHz, Vertical Polarization



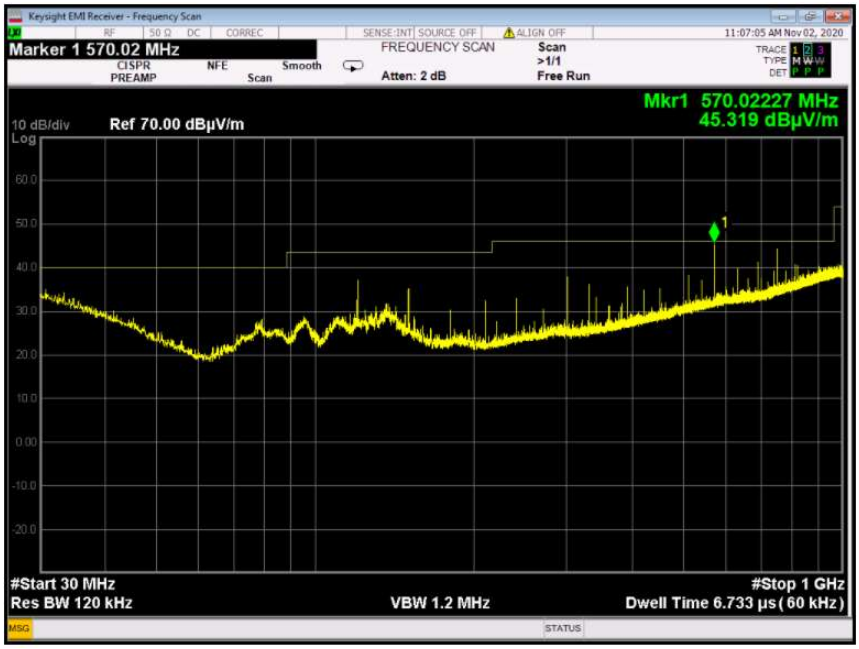
Plot 4.4.1.4: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2440 MHz, Horizontal Polarization



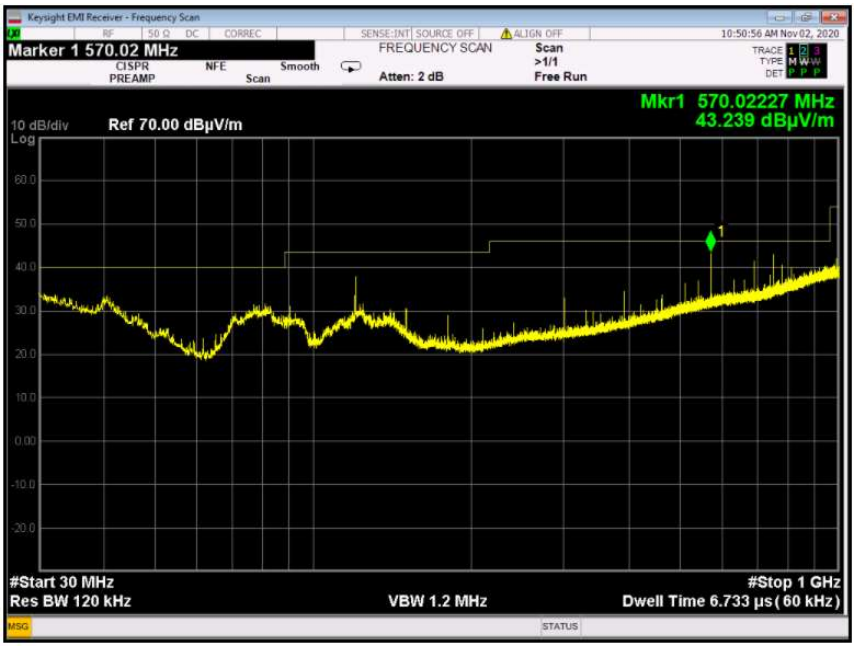
Plot 4.4.1.5: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2440 MHz, Vertical Polarization



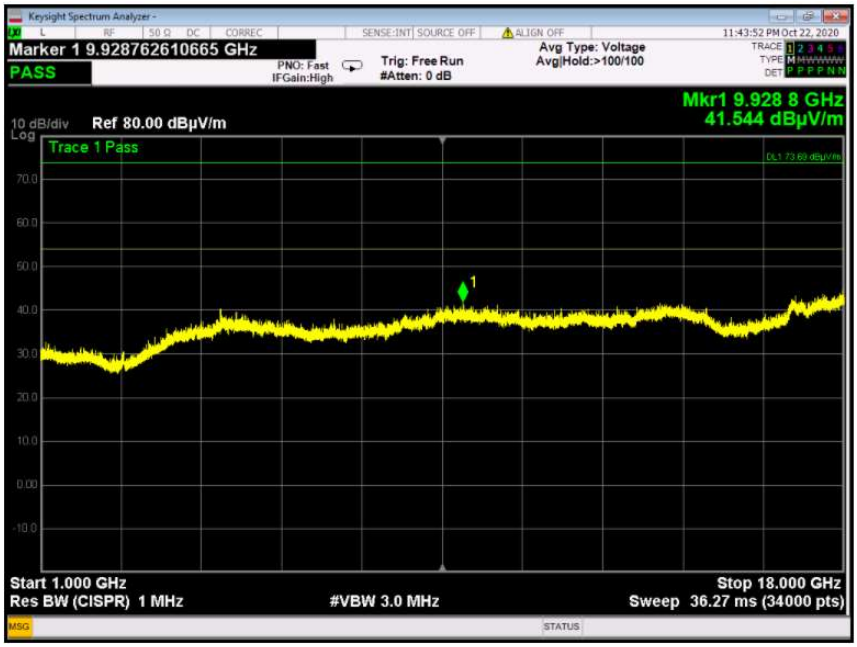
Plot 4.4.1.6: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2480 MHz, Horizontal Polarization



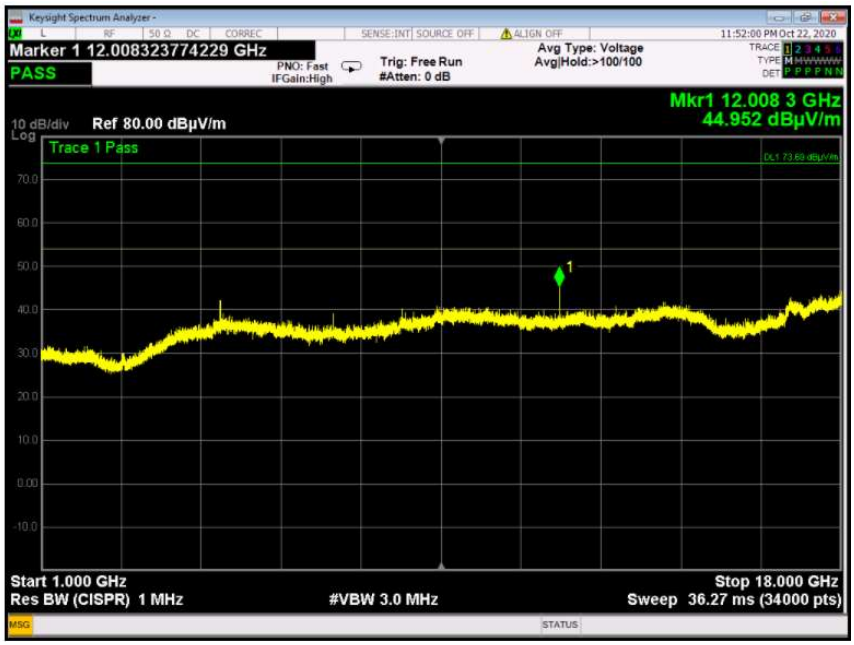
Plot 4.4.1.7: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2480 MHz, Vertical Polarization



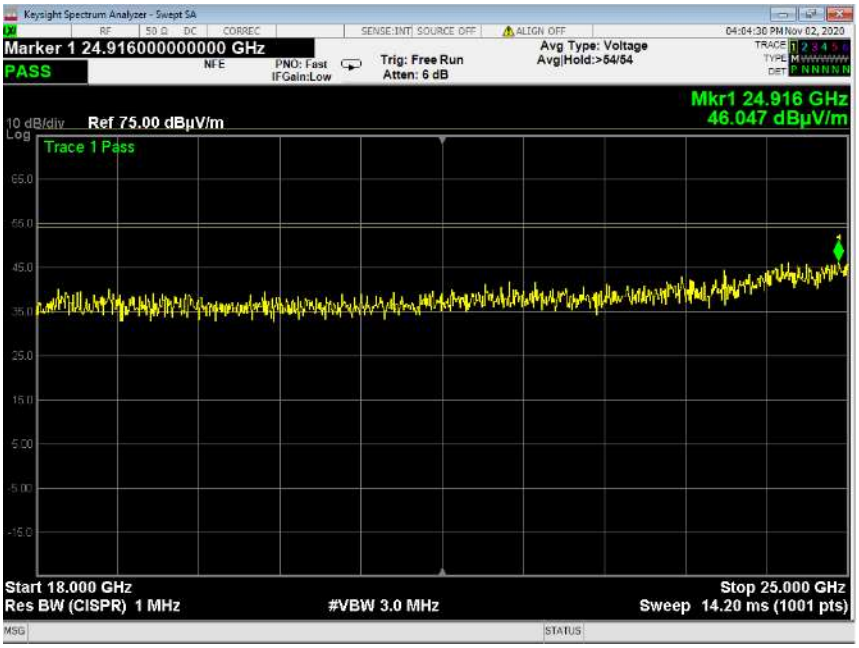
Plot 4.4.1.8 Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2402 MHz, Horizontal Polarization, Peak



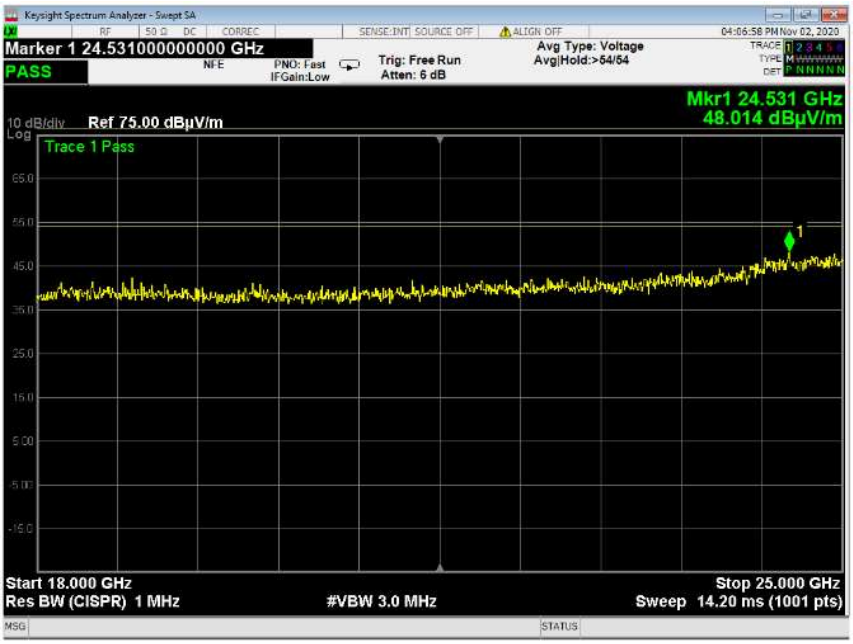
Plot 4.4.1.9 Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2402 MHz, Vertical Polarization, Peak



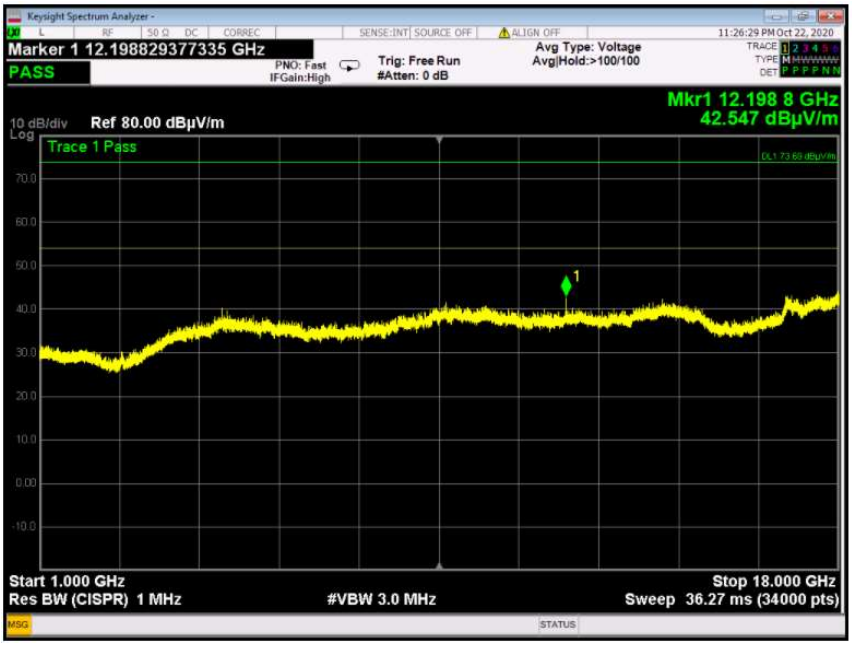
Plot 4.4.1.10: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2402 MHz, Horizontal Polarization



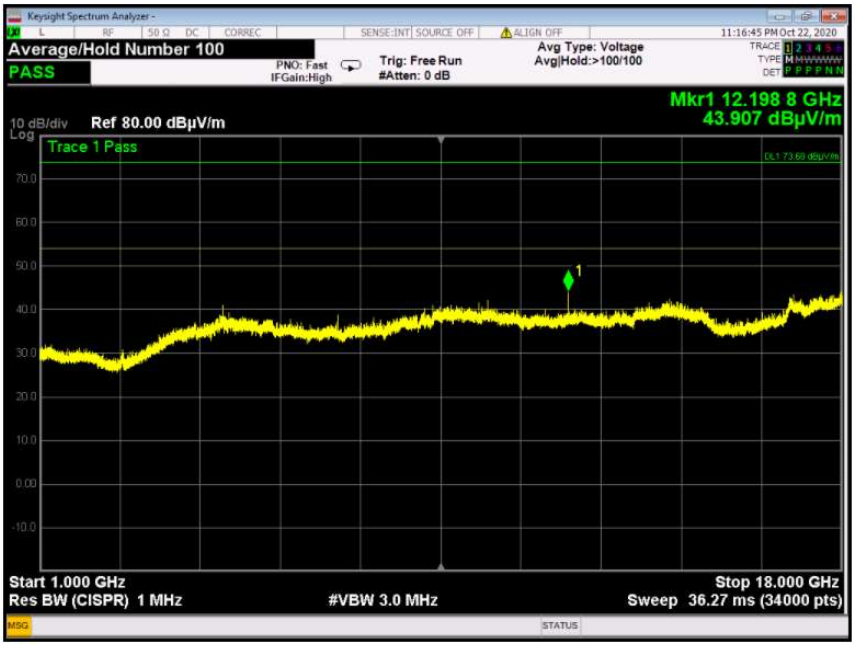
Plot 4.4.1.11: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2402 MHz, Vertical Polarization



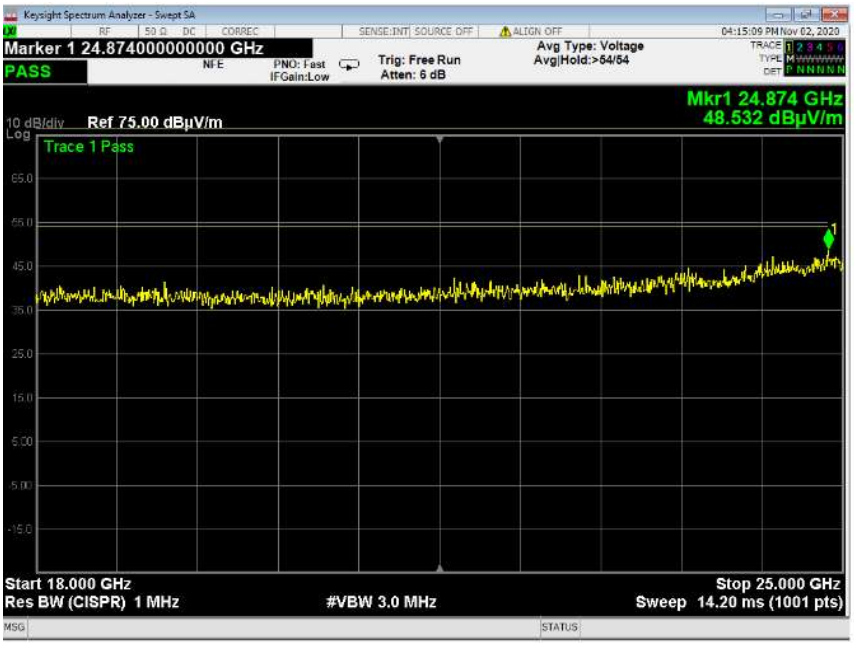
Plot 4.4.1.12: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2440 MHz, Horizontal Polarization, Peak



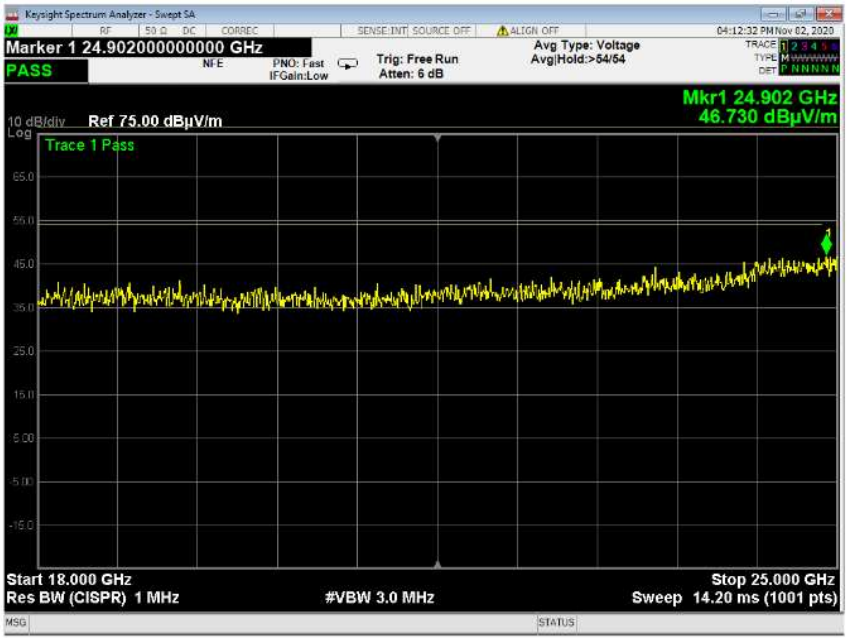
Plot 4.4.1.13: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2440 MHz, Vertical Polarization, Peak



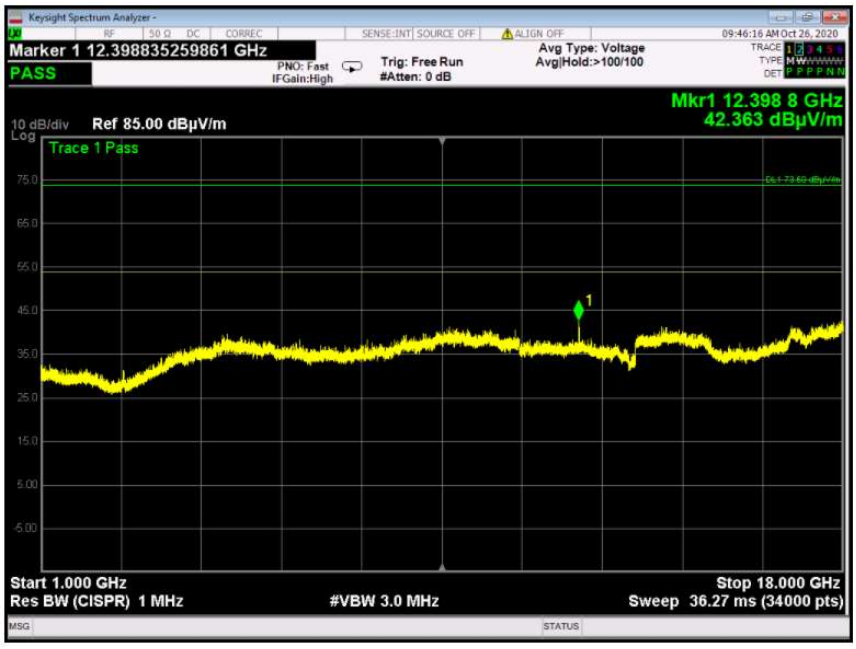
Plot 4.4.1.14: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2440 MHz, Horizontal Polarization



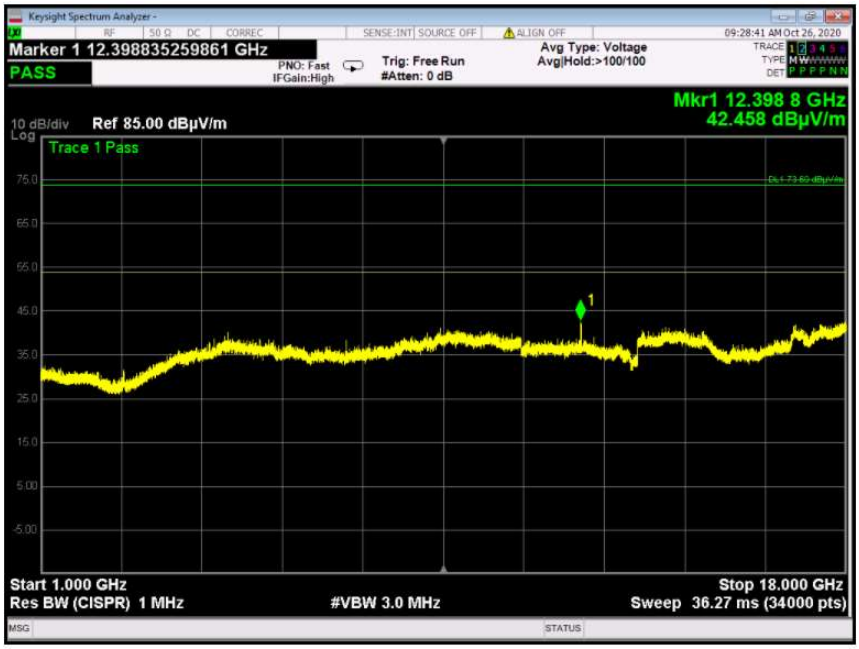
Plot 4.4.1.15: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2440 MHz, Vertical Polarization



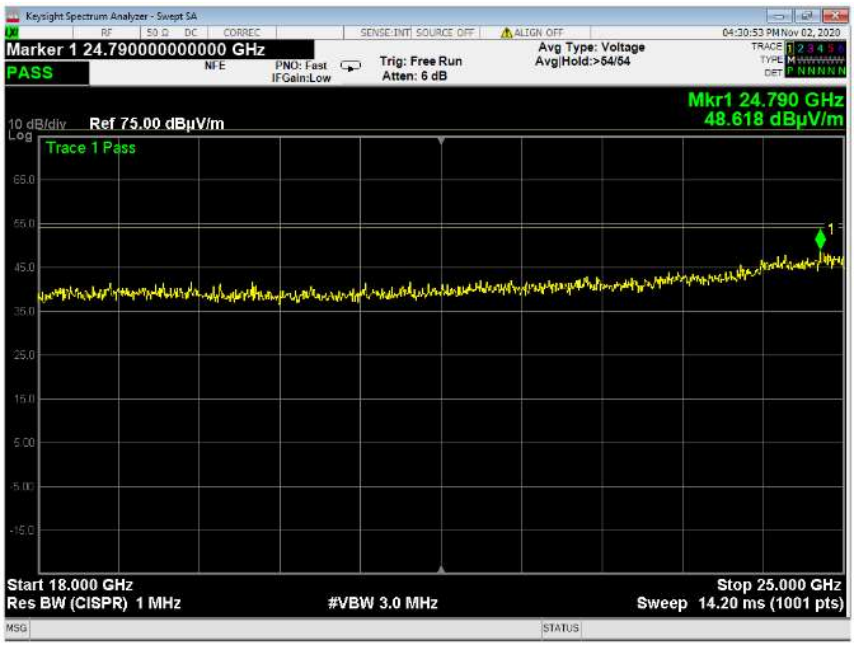
Plot 4.4.1.16: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2480 MHz, Horizontal Polarization Peak



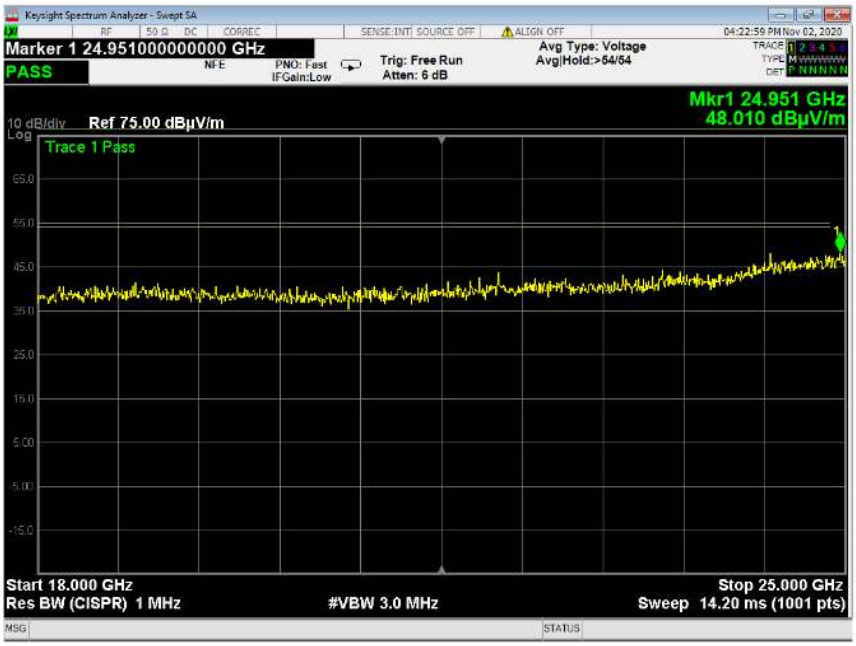
Plot 4.4.1.17: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2480 MHz, Vertical Polarization, Peak



Plot 4.4.1.18: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2480 MHz, Horizontal Polarization



Plot 4.4.1.19 Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2480 MHz, Vertical Polarization



4.4.2. Spurious Emissions in Restricted Bands Radiated Measurements

Reference document:	**47 CFR §15.247 (d) & §15.205& §15.209(a), ANSI C63.10. Subclause 11.12.1**		
Test Requirements:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c).		
Operating conditions:	Under normal test conditions	**Pass**	
Method of testing:	Radiated		
S.A. Settings:	f >1GHz: Peak: RBW= 1MHz, VBW= 3MHz, Average: VBW= 1 kHz f<1GHz: RBW: 100kHz,VBW: 300kHz		
Hopping function:	Disabled/Enabled		
Environment conditions:	Ambient Temperature: 23.8°c	Relative Humidity: 51.6%	Atmospheric Pressure: hPa
Test Result:	See below	See Plot 4.4.2.1 – Plot 4.4.2.14	

Test results below 1GHz:

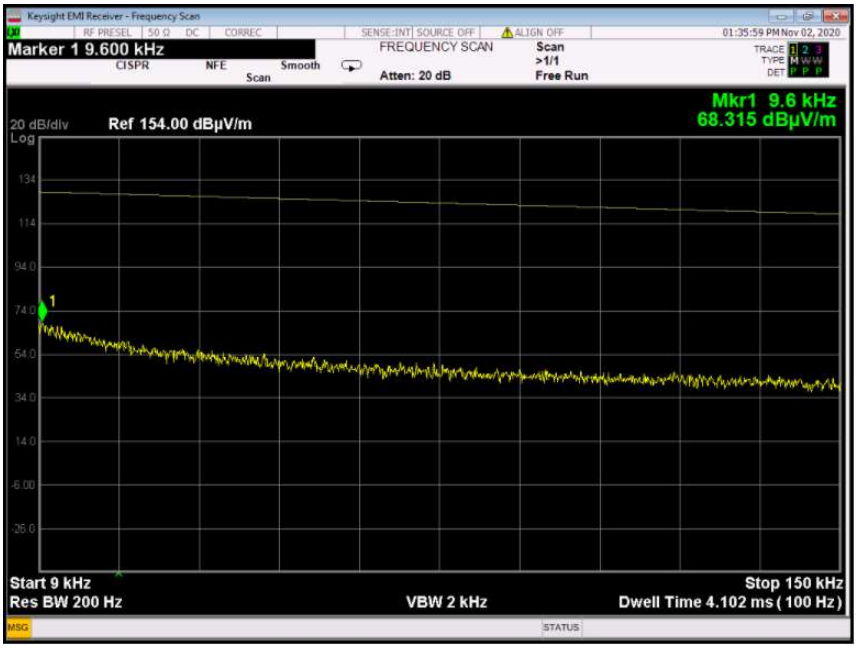
Channel	Emission Frequency [MHz]	Detector Type	Antenna Polarization	Emission Level, [dBµV/m]	Limit, [dBµV/m]	Delta, [dB]	Pass/Fail
Low	120.00	Peak	H	38.62	43.50	-4.88	Pass
	150.00	Peak	H	35.27	43.50	-8.23	Pass
	120.00	Peak	V	36.37	43.50	-7.13	Pass
	150.00	Peak	V	31.63	43.50	-11.87	Pass
Mid	120.00	Peak	H	37.39	43.50	-6.12	Pass
	150.00	Peak	H	35.97	43.50	-7.54	Pass
	120.00	Peak	V	35.48	43.50	-8.02	Pass
High	120.00	Peak	H	37.02	43.50	-6.48	Pass
	150.00	Peak	H	35.30	43.50	-8.20	Pass
	240.01	Peak	H	33.01	46.00	-13.00	Pass
	120.00	Peak	V	37.80	43.50	-5.70	Pass

Test results above 1GHz:

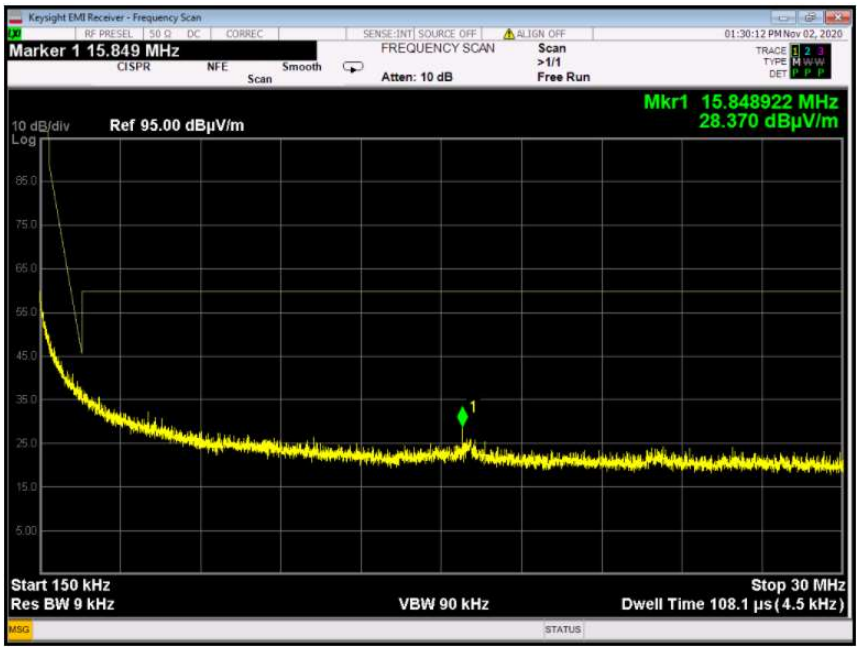
Channel	Emission Frequency, [MHz]	Detector Type	Antenna Polarization,	Emission Level, [dBµV/m]	Limit, [dBµV/m]	Delta, [dB]	Pass/Fail
Low	4.806	Peak	V	42.205	74.0	-31.80	Pass
		Average	V	38.944	54.0	-15.06	Pass
	4.806	Peak	H	40.811	74.0	-33.19	Pass
		Average	H	35.580	54.0	-18.42	Pass
	7.205	Peak	V	39.072	74.0	-34.93	~~Pass~~
		Average	V	33.572	54.0	-20.43	~~Pass~~
	12.008	Peak	V	44.952	74.0	-29.05	Pass
		Average	V	37.323	54.0	-16.68	Pass
Mid	12.1988	Peak	H	43.907	74.0	-30.09	Pass
		Average	H	34.133	54.0	-19.87	Pass
	12.1988	Peak	V	42.547	74.0	-31.45	Pass
		Average	V	35.002	54.0	-19.00	Pass
High	4.9576	Peak	V	40.261	74.0	-33.74	Pass
		Average	V	35.845	54.0	-18.16	Pass
	12.398	Peak	V	42.458	74.0	-31.54	Pass
		Average	V	38.712	54.0	-15.29	Pass
	12.398	Peak	H	42.363	74.0	-31.64	Pass
		Average	H	35.559	54.0	-18.44	Pass

Note: Radiated Emission [dBµV/m] = Measured Emission [dBµV] + Correction-factor [dB (1/m)]
Correction Factor = Antenna factor + Cable Loss

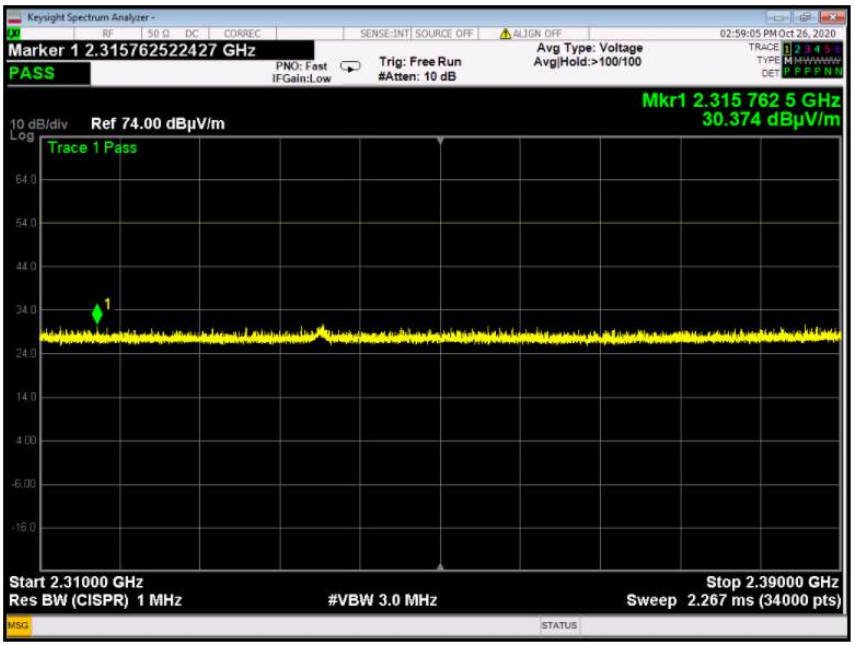
Plot 4.4.2.1: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Horizontal Polarization, 9 k-150 KHz



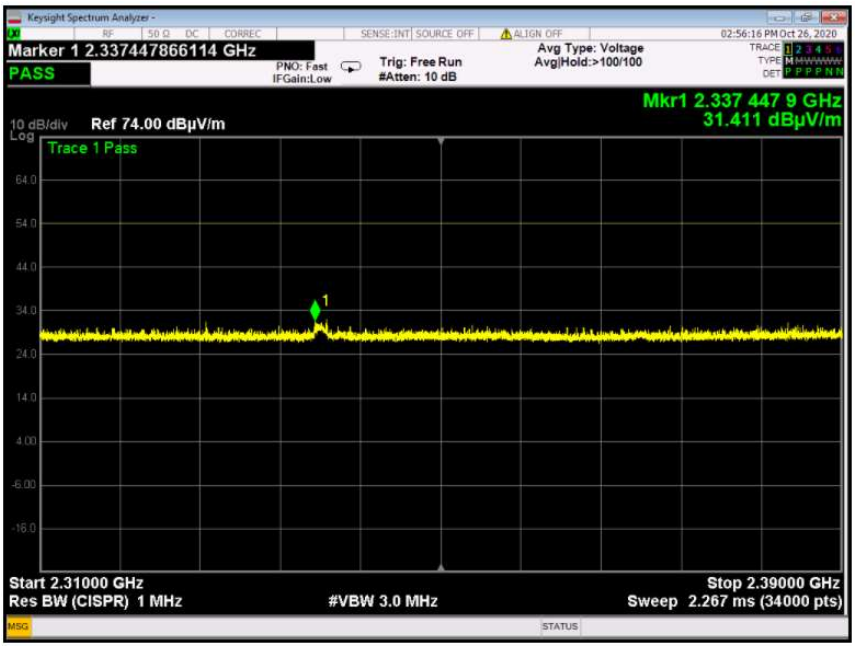
Plot 4.4.2.2: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Horizontal Polarization, 150K-30MHz



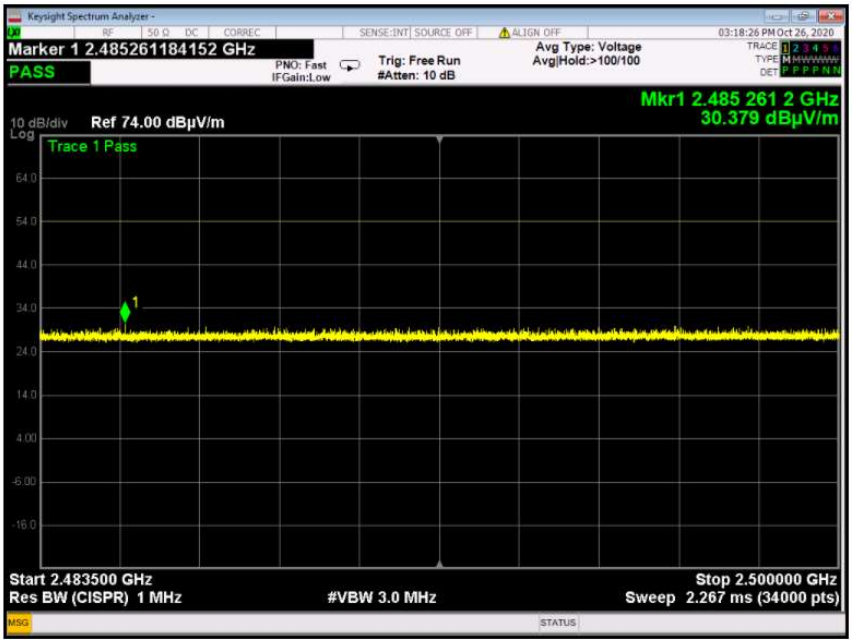
Plot 4.4.2.3: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Horizontal Polarization, 2310-2390MHz



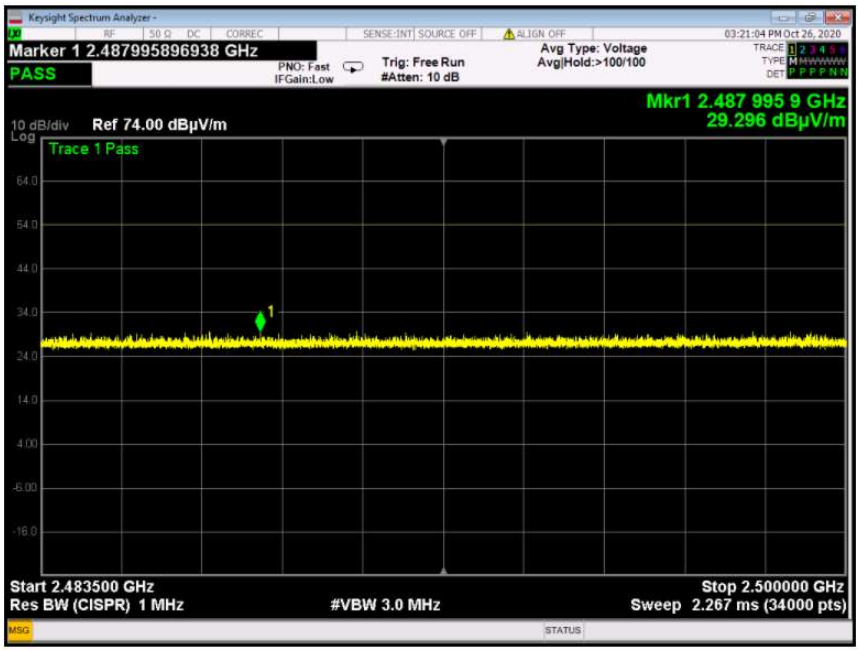
Plot 4.4.2.4: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Vertical Polarization 2310-2390MHz



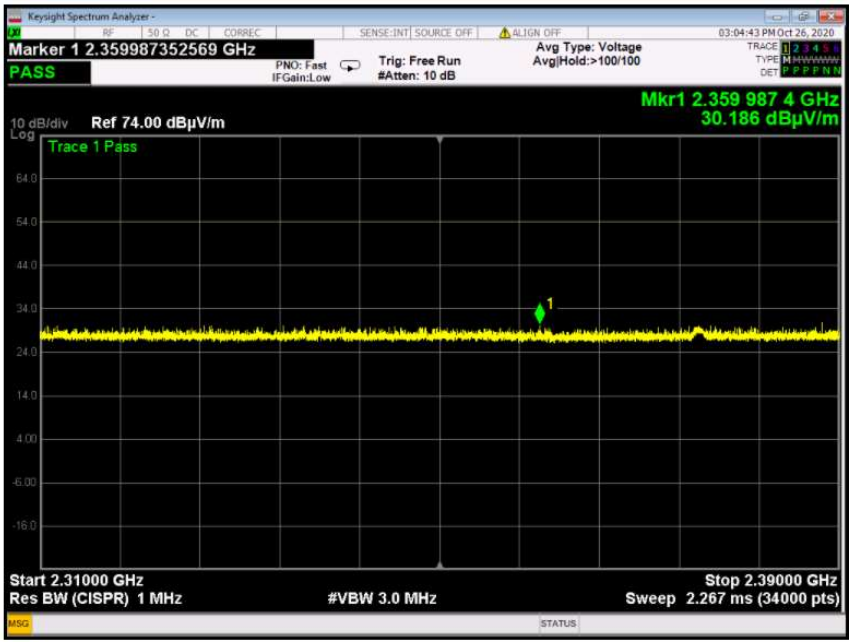
Plot 4.4.2.5: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Horizontal Polarization, 2483.5-2500MHz



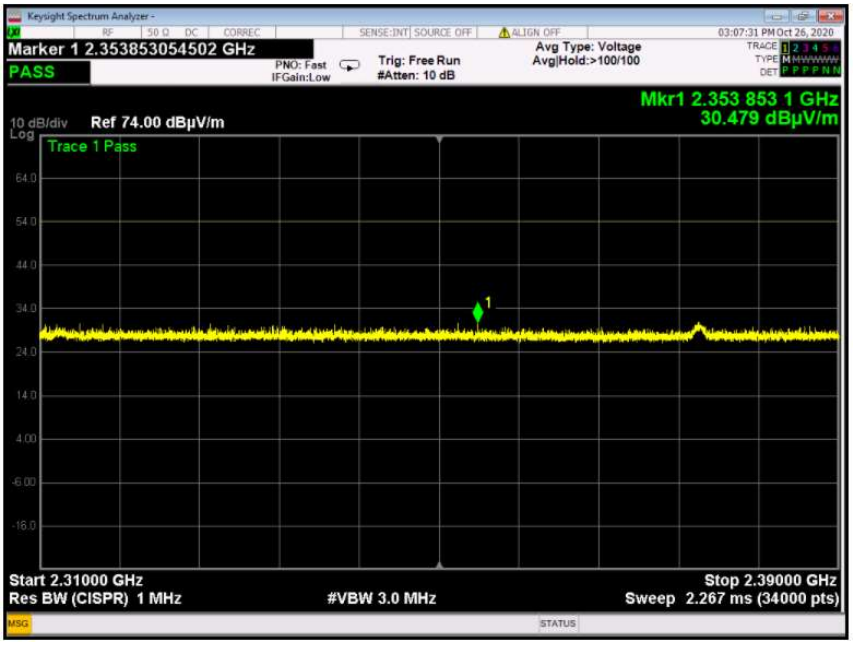
Plot 4.4.2.6: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Vertical Polarization 2483.5-2500MHz



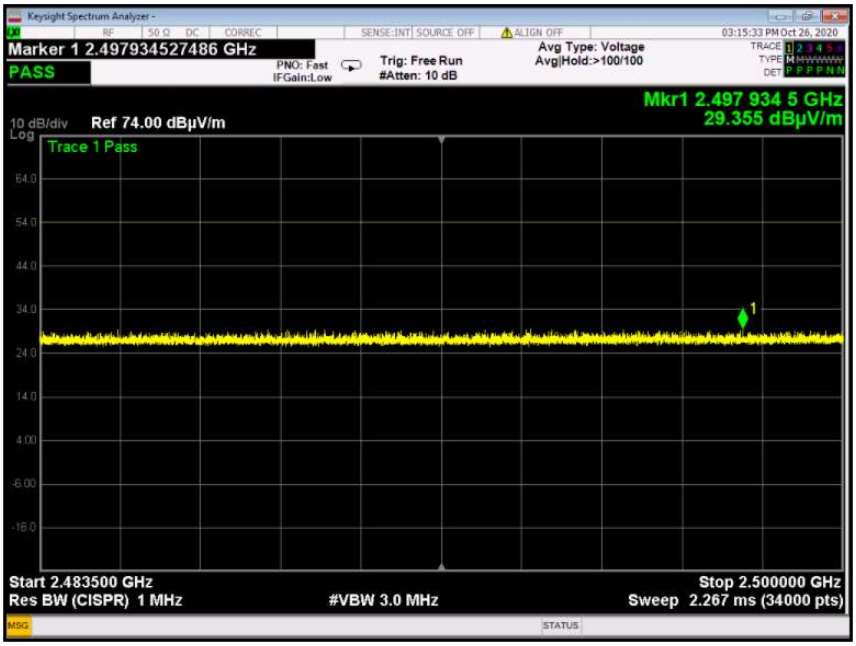
Plot 4.4.2.7: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Horizontal Polarization, 2310-2390MHz



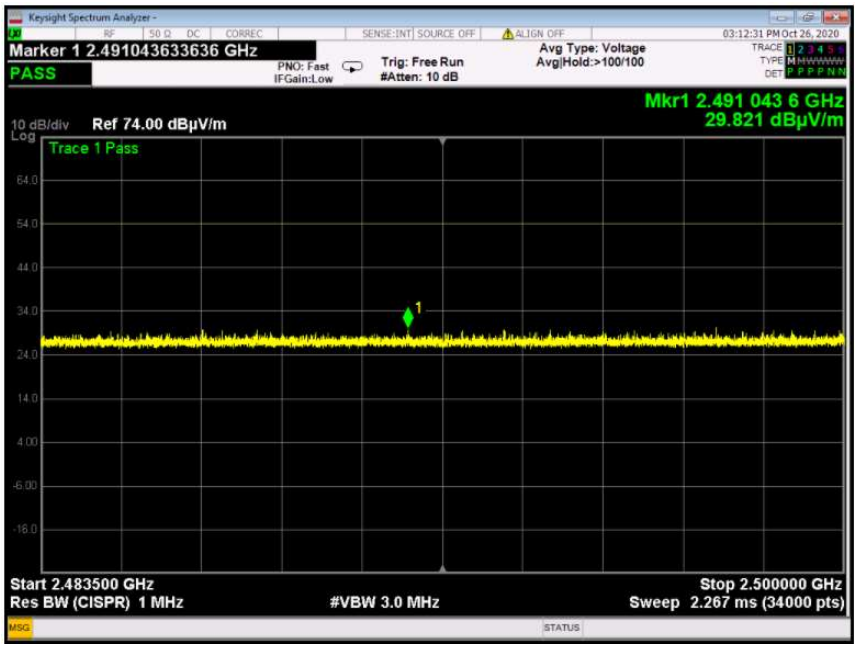
Plot 4.4.2.8: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Vertical Polarization 2310-2390MHz



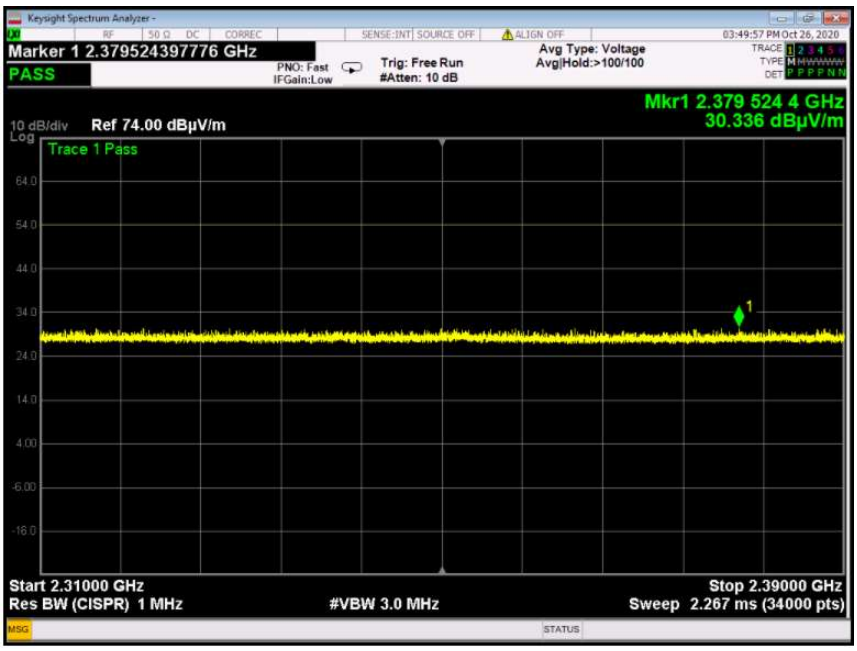
Plot 4.4.2.9: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Horizontal Polarization, 2483.5-2500MHz



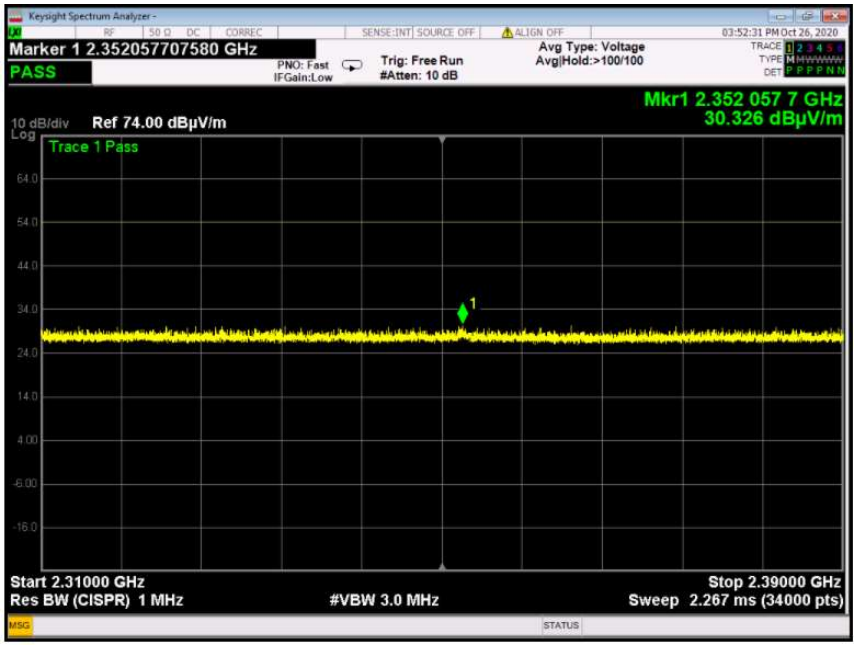
Plot 4.4.2.10: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Vertical Polarization 2483.5-2500MHz



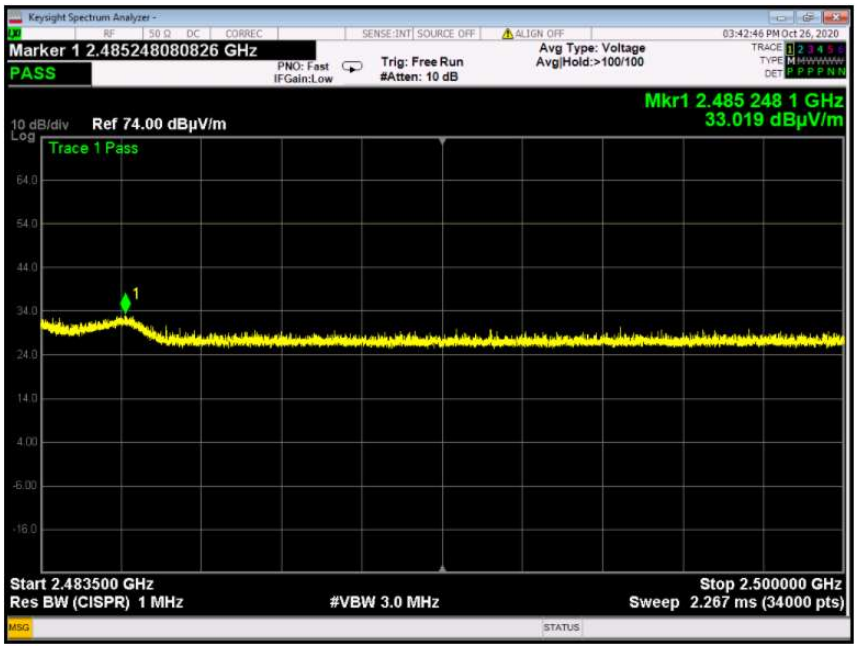
Plot 4.4.2.11: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Horizontal Polarization, 2310-2390MHz



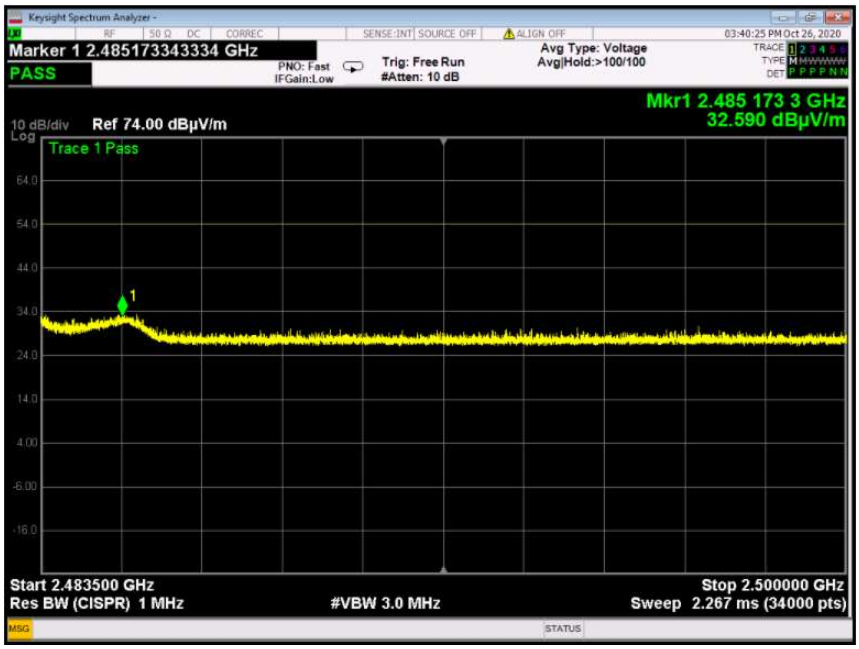
Plot 4.4.2.12: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Vertical Polarization 2310-2390MHz



Plot 4.4.2.13: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Horizontal Polarization, 2483.5-2500MHz



Plot 4.4.2.14: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Vertical Polarization 2483.5-2500MHz



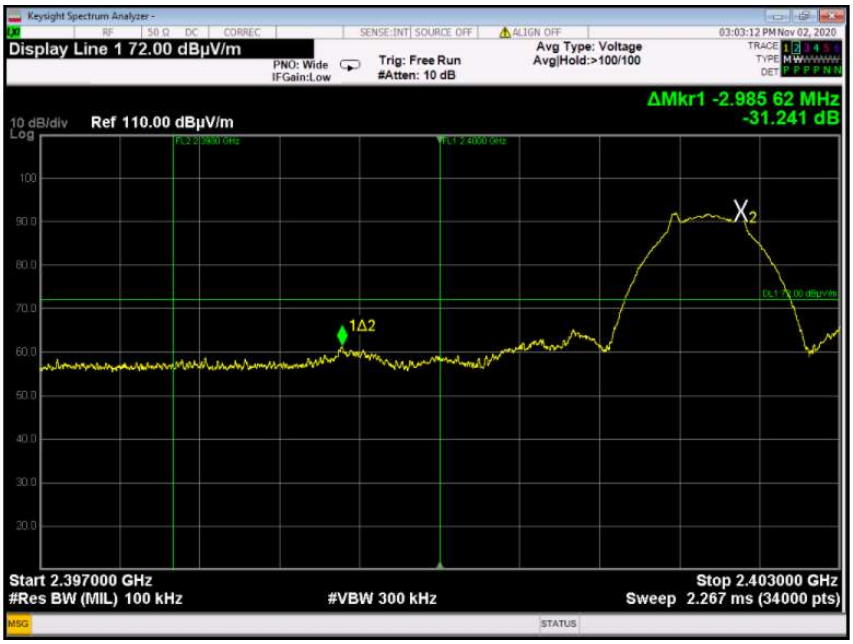
4.5. Band-edge compliance of RF Radiated Emission

Reference document:	**47 CFR §15.247 (d), ANSI C63.10:2013 section 11.13.2**		
Test Requirements and limit:	In any 100 kHz bandwidth outside the frequency band in which the digitally modulated radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB. Attenuation below the general limits specified in Section §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (See §15.205(c).		
Operating conditions:	Under normal test conditions	Pass	
Method of testing:	Radiated		
S.A. Settings:	RBW: 100kHz, VBW: 300kHz		
Hopping function:	NO		
Environment conditions:	Ambient Temperature: 23.6°C	Relative Humidity: 49.1%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.5.1 – Plot 4.5.4	

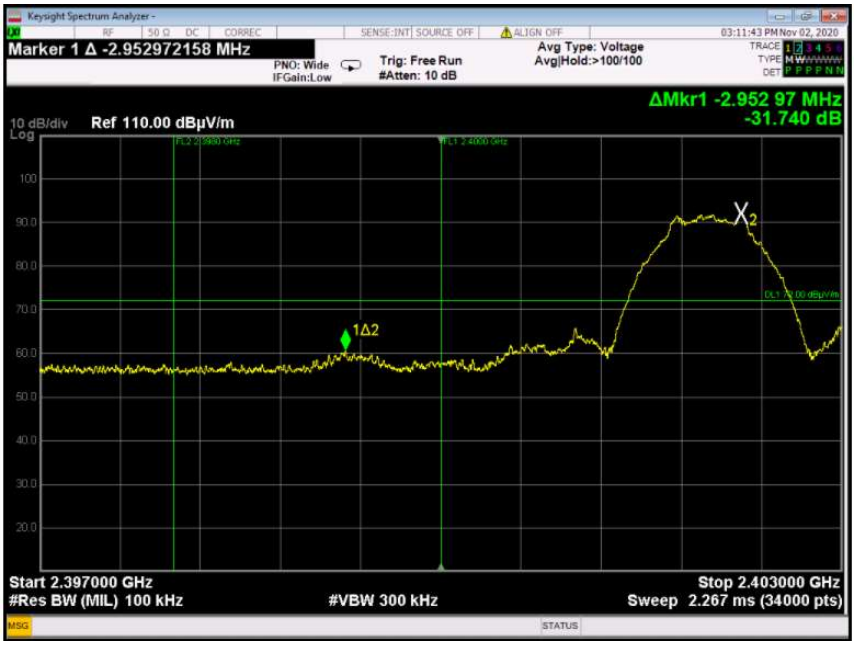
Test results

Antenna Position	Channel	Measured emission, [dBc]	Limit, [dBc]	Margin(db)	Result
horizontal	Low	-31.241	-20.00	-11.24	Pass
vertical	Low	-31.740	-20.00	-11.74	Pass
horizontal	High	-36.142	-20.00	-16.14	Pass
vertical	High	-38.039	-20.00	-18.04	Pass

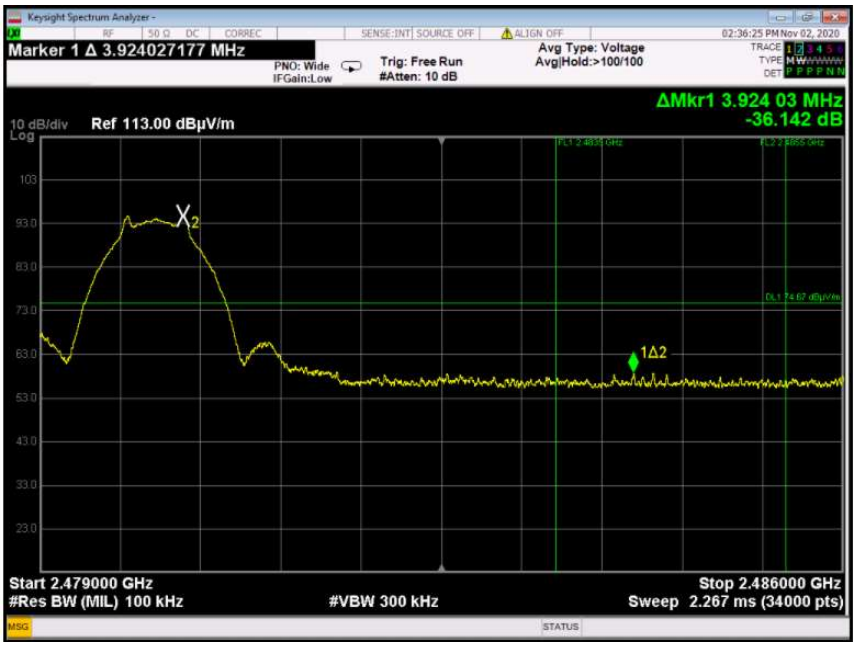
Plot 4.5.1: Band-edge test results, GFSK, channel 0, Horizontal Polarization



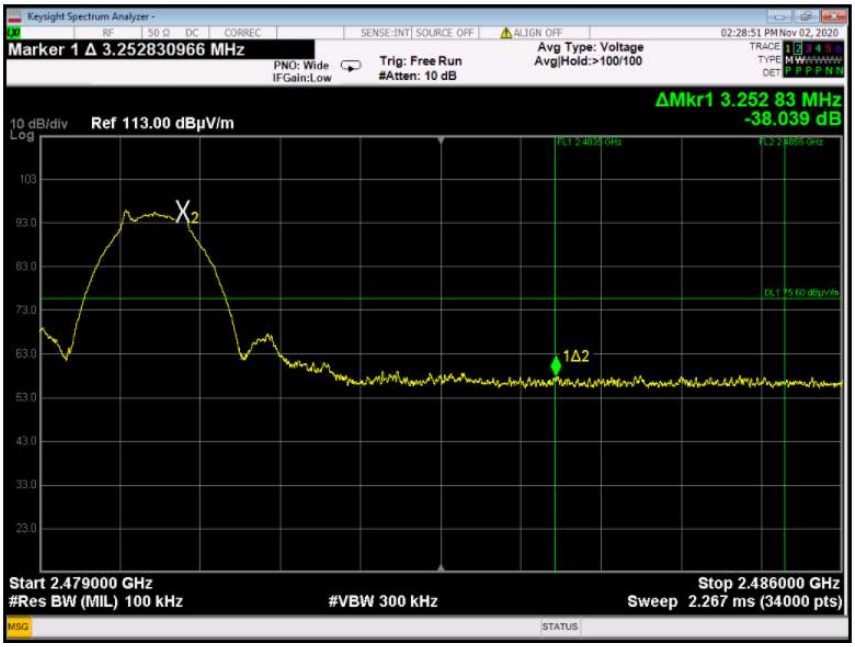
Plot 4.5.2: Band-edge test results, GFSK, channel 0, Vertical Polarization



Plot 4.5.3: Band-edge test results, GFSK, channel 78, Horizontal Polarization



Plot 4.5.4: Band-edge test results, GFSK, channel 78, Vertical Polarization



4.6. Antenna Connector Requirements

Reference document:	**47 CFR §15.203 RSS-Gen, Section 7.1.4**
Test Requirements:	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 provisions of this section.
Verdict	Integral Antenna -Comply

4.7. Power Line Emissions measurements

Reference document:	**47 CFR §207**		
Test Requirements:	The emissions from an intentional radiator shall not exceed the field strength levels specified in §15.207.Any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Sec.15.207.		
Operating conditions:	Under normal test conditions	**Pass**	
Method of testing:	Conducted Emissions		
S.A. Settings:	f <30MHz: RBW: 9kHz, VBW:30kHz		
Radio device:	Transmitting		
Environment conditions:	Ambient Temperature: 23.2°c	Relative Humidity: 48.1%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.7.1 - Plot 4.7.2	

Test Results:

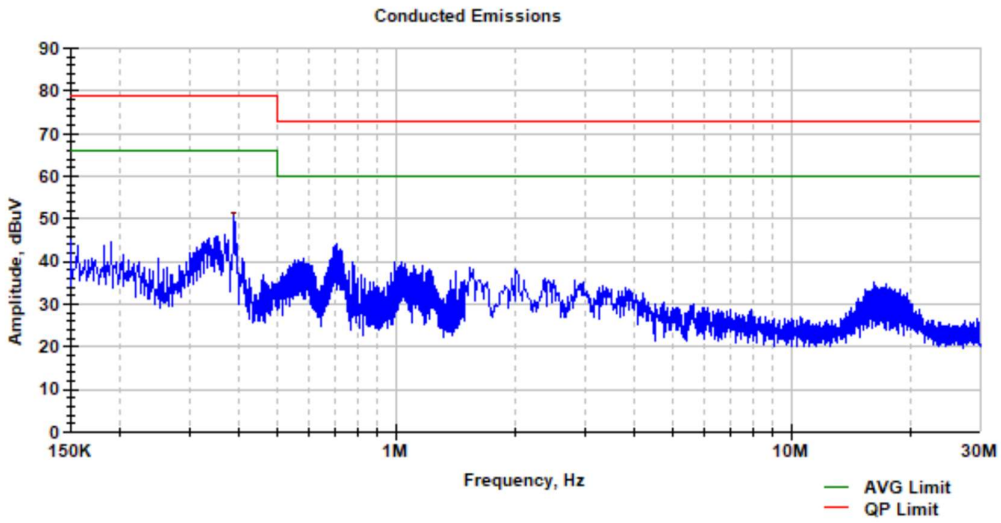
"Phase" Lead

Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AVG (dBuV)	AVG Limit (dBuV)	AVG Margin (dBuV)	Pass/Fail
0.154	49.0	39.0	79.0	-40.0	30.2	66.0	-35.8	Pass
0.391	51.8	50.6	79.0	-28.4	45.1	66.0	-20.9	Pass
0.585	41.3	38.7	73.0	-34.3	29.3	60.0	-30.7	Pass
0.738	44.4	38.3	73.0	-34.7	29.4	60.0	-30.6	Pass
1.037	40.3	37.1	73.0	-35.9	28.0	60.0	-32.0	Pass
1.175	39.5	37.7	73.0	-35.3	30.7	60.0	-29.3	Pass

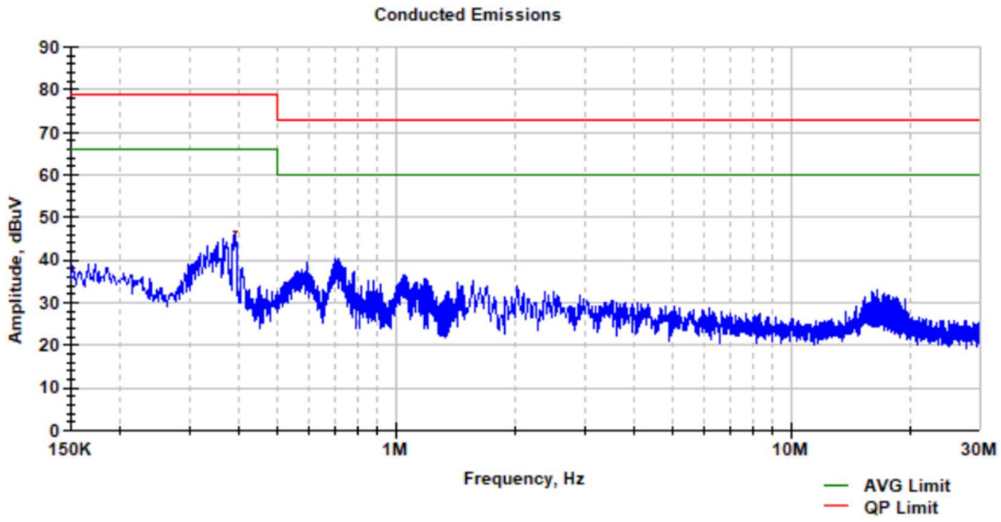
"Neutral" Lead

Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AVG (dBuV)	AVG Limit (dBuV)	AVG Margin (dBuV)	Pass/Fail
0.390	48.7	47.4	79.0	-31.6	42.8	66.0	-23.2	Pass
0.587	39.2	36.5	73.0	-36.5	28.0	60.0	-32.0	Pass
0.719	41.0	38.3	73.0	-34.7	30.0	60.0	-30.0	Pass
0.876	36.4	30.0	73.0	-43.0	20.9	60.0	-39.1	Pass
1.045	37.4	34.0	73.0	-39.0	26.5	60.0	-33.5	Pass
1.199	35.8	28.0	73.0	-45.0	19.7	60.0	-40.3	Pass

Plot 4.7.1: Power Supply Port, Phase Lead



Plot 4.7.2: Power Supply Port, Neutral Lead

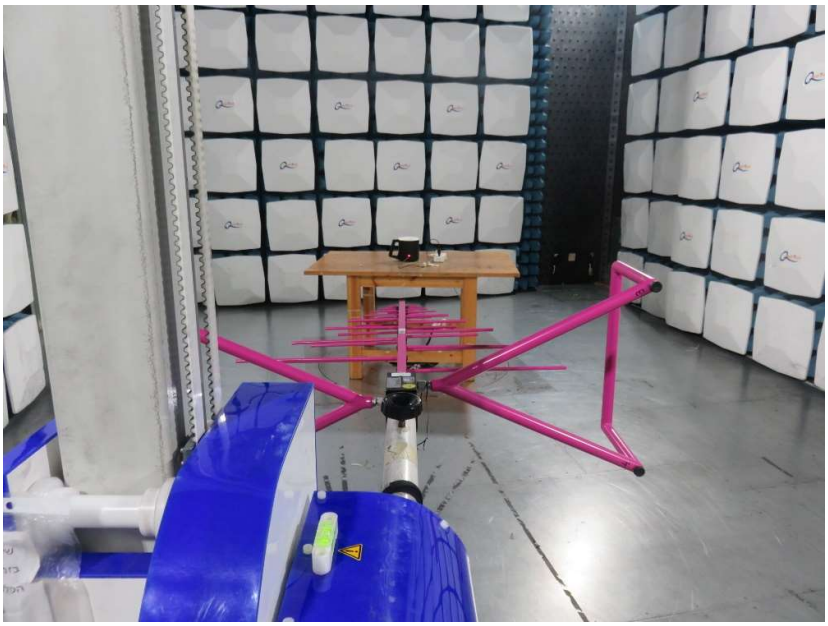


5. Appendix

Appendix A: Test Photographs

Photograph 1: Radiated Emission Testing 9kHz-30MHz

Photograph 2: Radiated Emission Testing 30MHz-1000MHz



Photograph 3: Radiated Emission Testing 1GHz-18GHz

Photograph 4: Radiated Emission Testing 18GHz-25GHz

Photograph 4: Conducted Emission Testing on AC Power Supply Port

Appendix B: List of Measuring Equipment used:

Description	Manufacturer	Model	Serial No.	Last Cal	Cal Due
RF Filter Section (2.9GHz)	HP	85460A	3448A00282	07/10/2020	07/10/2021
EMI Receiver (2.9GHz)	HP	8546A	3617A00318	07/10/2020	07/10/2021
Spectrum Analyzer 3Hz-44GHz	Agilent	E4446A	MY46180602	16/09/2020	16/09/2022
Signal Generator	Marconi	2024	1122681029	20/05/2020	20/05/2021
Signal Generator	Marconi	2025	202301940	18/02/2020	18/02/2021
Temp & Hum Meter	Zico	Zi-9622	141101658	20/02/2020	20/02/2021
Spectrum Analyzer 9KHz-22GHz	Agilent/HP	8593EM	3536A00131	08/09/2019	08/09/2021
Spectrum Analyzer 3Hz-44GHz	Agilent	E4446A	MY43360126	14/01/2020	14/01/2022
RF Transient Limiter	Agilent	11947A	3107A04119	20/11/2019	20/03/2021
LISN	FCC	50/250-25-2	9705	20/11/2019	20/03/2021
LISN	Schwarzbeck	NNBL 8226-2	8226120	05/12/2019	05/12/2020
Line impedance stabilization network, 9 kHz to 30 MHz, 3-Phase	Schwarzbeck	NNLK 8121	8121-526	07/10/2020	07/10/2021
RF Transient Limiter	Com Power Corporation	LIT-930A	22020024	06/10/2020	06/10/2022
Horn Antenna (EMM) 1-18GHz	A.R.A	DRG-118/A	17188	07/10/2020	07/10/2021
DCAMN (LISN) 150 kHz to 30 MHz	Schwarzbeck	PVDC 8300	30	19/04/2020	19/04/2023
Horn Antenna (for IMM) 1-18GHz	EMCO	3115	9602-4677	15/09/2019	15/09/2022
Horn Antenna 15-40 GHz	Schwarzbeck	BBHA 9170	BBHA9170214	12/03/2018	12/03/2021
Bilog Antenna 30MHz - 1000MHz	Teseq	CBL 6141B	34119	18/03/2019	18/03/2022
Spectrum Analyzer (9KHz-3.6GHz)	Agilent	N9010A	MY50060093	27/09/2017	27/09/2022
Universal Telecom ISN	FCC	F-071115-1057-1	20616	25/02/2020	25/02/2023
Oscilloscope	Tektronix	TDS 680C	B020110	17/11/2019	17/03/2021
15MHz Function / Arbitrary Waveform Generator	HP	33120A	US36027136	19/11/2019	19/03/2021
Attenuator 30 dB	HP	11708A	14454	27/11/2017	27/03/2021
Power sensor	HP	8481A	401821	26/11/2017	26/03/2021

Appendix C: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

QUALITECH

Petah-Tikva, Israel

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 31st day of May 2018.

President and CEO
For the Accreditation Council
Certificate Number 1633.01
Valid to December 31, 2020
Revised September 11, 2020

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

End of the Test Report