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EMC testing of the Tektelic Communication Inc. * Kona Macro Ex Gateway in accordance with

FCC Part 15 Subpart C (15.247(d), 15.209, 15.205)

ANSI C63.10: 2013 /2020

ANSI C63.4: 2014

FCC ID: 2ALEPT0005158

Test Dates: December 19 / 20, 2024

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Prepared for: Tektelic Communication Inc.

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* Gateway contain LTE pre-certified module.

REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2025-01-02	I. Akram	Initial draft submitted for review.
DRAFT 2	2025-02-03	I. Akram	Added EUT Model# and serial# in section 1.3.
DRAFT 3	2025-03-06	I. Akram	Updated the EUIT name/added antenna information
Release 1	2025-04-07	I. Akram	Sign Off

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1.0 INTRODUCTION

1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with FCC Part 15.247 and ANSI C63.10:2013/2020 to gain FCC Class II permissive change for Low-Power License-Exempt transmitters. All test procedures, limits, criteria, and results described in this report apply only to the Tektelic Communication Inc. Kona Macro Ex Gateway test sample, referred to herein as the EUT (Equipment Under Test). This report does not imply product endorsement by the Electronics Test Centre, A2LA, nor any Canadian Government agency.

1.2 Applicant

This test report has been prepared for Tektelic Communication Inc., located in Calgary, Alberta, Canada.

1.3 Test Sample Description

As provided to ETC (Airdrie) by Tektelic Communication Inc.:

Product Name:	Kona Macro Ex Gateway	
Radio	LoRa	
Frequency Band	902 – 928 MHz	
Frequency Range	923.3 – 927.5 MHz	
Operating Mode	500KHz DTS	
Max Transmit Power (Conducted)	29.29 dBm (0.85) (W)	
LoRa	Associated External Antennas (Max. Gain)	WTTX-OMNI08600930-6NJ – 860-870 / 900-930 MHz – Gain: 6dBi
	Detachable/Non Detachable	External Antenna are detachable (Professional Installation)
Model#	T0009060	
Serial#	2450K0001	
Power supply:	48VDC	
Note: The Kona Macro Ex Gateway is a new variant with a metal enclosure to use it in the hazardous environment. There is no difference in radio circuitry between the Kona micro outdoor gateway variant and this new variant except the Kona Macro Ex Gateway enclosure is made of heavy-duty metal, and all antennas are external to the enclosure, and the highest gain of the antenna used with this variant is 6 dBi. As there is no change in the radio/digital circuitry in the new variant. Radiated emission tests are performed to determine the effect of the new enclosure on the emission profile. The EUT is installed in one fixed position at final installation. All three channels (LOW, MID, and HIGH) are analyzed to determine the worst channel. A full emission scan is performed on the worst channel with the highest external gain antenna (6 dBi). During radiated spurious emission analysis, both LTE (pre-certified) radio and LoRa radio are transmitting simultaneously to cover the co-location requirements.		

1.4 General Test Conditions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated. In order to meet the operational requirements during testing as per KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10-2013 clause 5.11 the device was programmed with a special firmware to transmit at a continuous transmit mode (100% duty cycle). Special firmware is strictly for testing purpose only and not available to end user. This special test case represents the worst-case duty cycle. Both Kona Gateways contain pre-certified LTE modules. All radiated spurious emission tests are performed when both radios are transmitting simultaneously. The environmental conditions are recorded during each test, and are reported in the relevant sections of this document.

1.5 Reference Standards

Standards	Description
FCC, title 47 CFR § 15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC, title 47 CFR § 15.207	Conducted limits for an intentional radiator that is designed to be connected to the public utility (AC) power line.
FCC, title 47 CFR § 15.107	Conducted limits for equipment that is designed to be connected to the public utility (AC) power line.
FCC, title 47 CFR § 15.209	Radiated emission limits; general requirements
FCC, title 47 CFR § 15.109	Radiated emission limits; from unintentional radiators digital devices.
ANSI C63.10:2013/2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio – Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 KHz to 40 GHz
558074 D01 15.247 Meas Guidance v05r02	Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules

1.6 Test Methodology

Test methods are specified in the Basic Standard as referenced and/or modified by the Product Standard in the part of Section 2 of this report associated with each particular test case. EUT is tested in RX mode to cover FCC Part 15 Sub Part B (Digital Circuitry) under SDOC, and the result is included in this test report.

1.6.1 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

1.6.2 Test Sample Verification, Configuration & Modifications

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

1.6.3 Uncertainty of Measurement:

The factors contributing to measurement uncertainty are identified and calculated in accordance with CISPR 16-4-2: 2011.

This uncertainty estimate represents an expended uncertainty expressed at approximately 95% confidence using a coverage factor of $k = 2$.

Test Method	Uncertainty
Radiated Emissions Level (9 KHz – 30 MHz)	± 4.72 dB
Radiated Emissions Level (30 MHz – 1 GHz)	± 5.55 dB
Radiated Emissions Level (1 GHz – 18 GHz)	± 4.90 dB

2.0 TEST CONCLUSION

STATEMENT OF COMPLIANCE

The customer equipment referred to in this report was found to comply with the requirements, as summarized below.

The EUT was subjected to the following tests. Compliance status is reported as **Compliant** or **Non-compliant**. **N/A** indicates the test was Not Applicable to the EUT.

The measurement uncertainty is not accounted for determination of the statement of compliance. The statement of compliance is based only on the measurement value recorded.

Note: Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

Test Case	Test Type	Specification	Test Sample	Result
2.1	Radiated Spurious Emission (Restricted Band)	FCC Part 15 Subpart C 15.205, 15.209 15.247(d)	Kona Macro Ex Gateway	Compliant
2.2	Radiated Emission	FCC Part 15 Subpart B 15.109	Kona Macro Ex Gateway	Compliant
2.3	RF Exposure	15.247(i)	Kona Macro Ex Gateway	Completed

Refer to the test data for applicable test conditions.

2.1 Radiated Spurious Emissions (within restricted band/Co-location)

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Macro Ex Gateway
Test Personnel: Imran Akram	Standard: FCC PART 15.247/15.209
Date: 2024-12-19/20 (22.8° C, 10.6 % RH)	Basic Standard: ANSI C63.10-2013

EUT status: Compliant

Specification: FCC PART 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional 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 30 dB instead of 20 dB. Attenuation below the general limits specified in §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)).

Radiated Emission Limit: FCC 15.209

Frequency (MHz)	Field Strength (μV/m)	Field Strength (dBμV/m) @ 3 meter
0.009 - 0.490	(266.66 – 4.9) @ 300 meter	128.52 – 93.8
0.490 - 1.705	48.98 – 14.08 @ 30 meter	73.8 – 62.97
1.705 - 30.0	30 @ 30 meter	69.54
30 - 88	100 **	40
88 - 216	150 **	43.52
216 - 960	200 **	46.02
Above 960	500	53.98

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Restricted Bands of Operation: FCC 15.205

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.0900000 – 0.1100000	8.2910000 - 8.2940000	16.804250 - 16.804750	162.01250 - 167.17000 █	1660.0000 – 1710.0000	3.6000000 – 4.4000000	14.470000 – 14.500000
0.4950000 – 0.5050000 █	8.3620000 - 8.3660000	25.500000 - 25.670000	167.72000 - 173.20000 █	1718.8000 – 1722.2000	4.5000000 – 5.1500000	15.350000 – 16.200000
2.1735000 – 2.1905000	8.3762500 - 8.3867500	37.500000 - 38.250000	240.00000 – 285.00000	2200.0000 – 2300.0000	5.3500000 – 5.4600000 █	17.700000 – 21.400000
4.1250000 – 4.1280000	8.4142500 - 8.4147500	73.000000 - 74.600000	322.00000 - 335.40000	2310.0000 – 2390.0000	7.2500000 – 7.7500000 █	22.010000 – 23.120000
4.1772500 – 4.1777500	12.290000 - 12.293000	74.800000 - 75.200000	399.90000 – 410.00000	2483.5000 – 2500.0000 █	8.0250000 – 8.5000000	23.600000 – 24.000000
4.2072500 – 4.2077500	12.519750 - 12.520250	108.00000 - 121.94000 █	608.00000 – 614.00000	2655.0000 – 2900.0000	9.0000000 – 9.2000000 █	31.200000 – 31.800000
5.6770000 – 5.6830000	12.576750 - 12.577250	123.00000 - 138.00000 █	960.00000 – 1240.0000 █	3260..0000 – 3267.0000	9.3000000 – 9.5000000	36.430000 – 36.500000
6.2150000 – 6.2180000	13.360000 - 13.410000	149.90000 - 150.05000 █	1300.0000 – 1427.0000 █	3332.0000 – 3339.0000	10.600000 – 12.700000	Above 38.600000
6.2677500 – 6.2682500	16.420000 - 16.423000	156.52475-156.52525	1435.0000 – 1626.5000	3345.8000 – 3358.0000	13.250000 – 13.400000	
6.3117500 – 6.3122500	16.694750 - 16.695250	156.70000 - 156.90000	1645.5000 – 1646.5000	3500.0000 – 3600.0000 █		

█ US only

█ Canada 108 – 138 MHz

█ *** Canada 960 – 1427 MHz

█ **** Canada only

2.1.1 Test Guidance: ANSI C63.10-2013, Clause 13.4.2

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna (as per KDB 460108).

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz. The EUT is raised to 150 cm above the ground plane, and the area between the EUT and the antenna mast is covered with RF absorbent material.

The scan is performed at discreet increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 – 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

2.1.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.1.3 Test Equipment

Testing was performed with the following equipment:

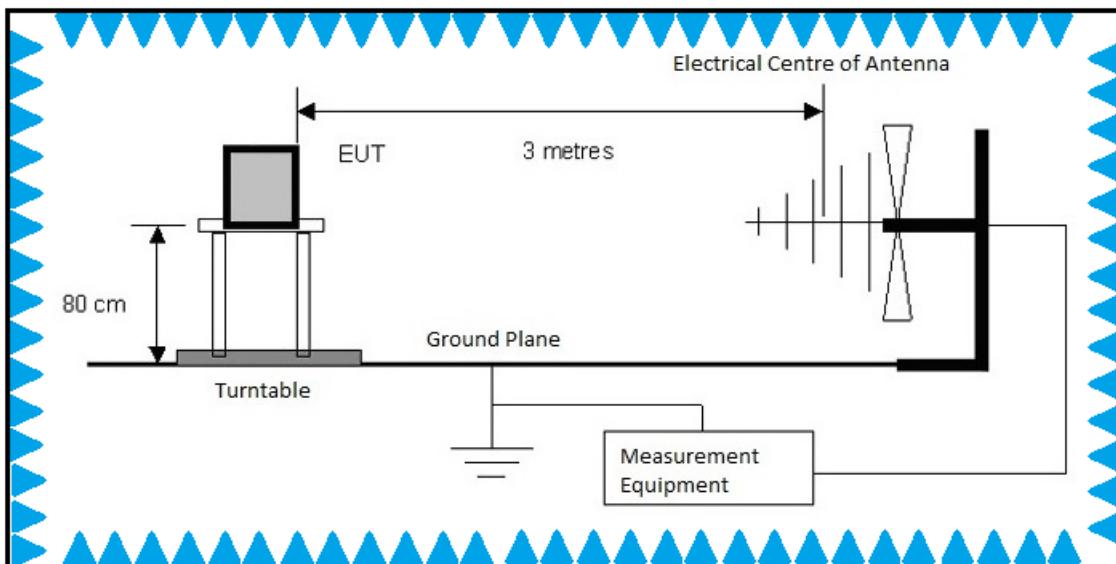
Equipment	Manufacturer	Model #	Asset #	Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1		N/A
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2024-08-15	2025-08-15
Loop Antenna (9KHz – 30MHz)	EMCO	6502	10868	2023-06-21	2025-06-21
Biconilog Antenna (30 – 1000 MHz)	AR	JB1	6905	2023-11-29	2025-11-29
DRG Horn (1 – 18 GHz)	EMCO	3115	19357	2022-10-05	2025-10-05
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2024-04-08	2025-04-08
Pre-Amplifier (30 – 1400 MHz)	HP	8447D	9291	2024-01-23	2025-01-23
L.N. Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21-5P	4354	2024-01-23	2025-01-23
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A-3600-KPA-01102006	4419	2024-01-23	2025-01-23
Re Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	2024-01-23	2025-01-23
0.9GHz Notch Filter	Microtronics	BRM20784	6947	2024-01-23	2025-01-23
High Pass Filter (1.4GHz)	K&L	4DH21-R1793/6000	6952	2024-01-18	2025-01-18

2.1.4 Test Sample Verification, Configuration & Modifications

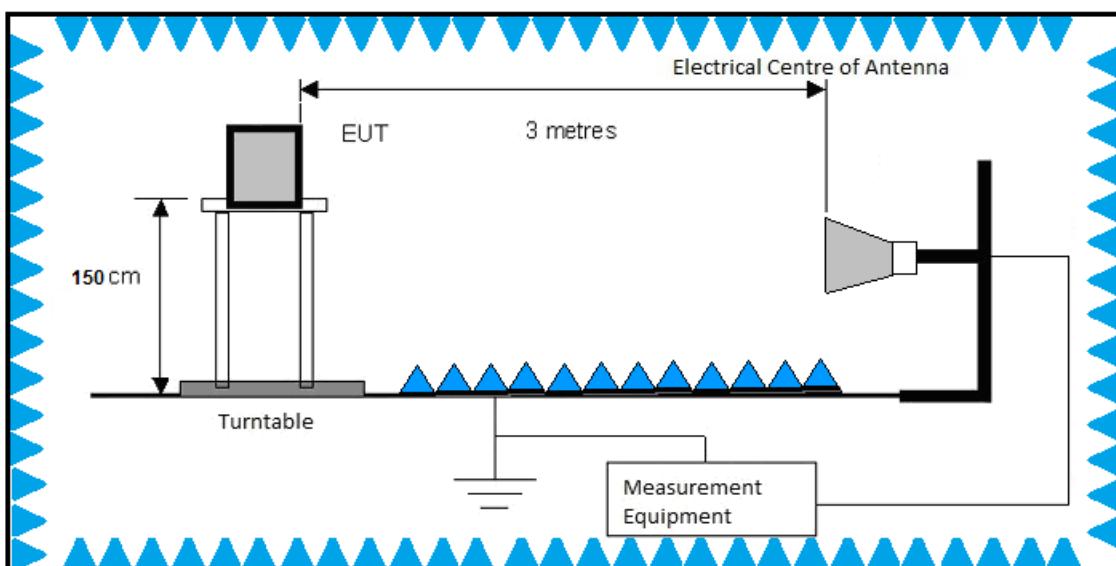
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation. LoRa radio is transmitting at low channel. LoRa and LTE were transmitting simultaneously to cover colocation testing.

The EUT met the requirements without modification.

Test setup diagram for Radiated Spurious Emissions testing (below 1GHz):



Test setup diagram for Radiated Spurious Emissions testing (above 1GHz):



2.1.5 Radiated Emissions Data: (Both LTE/LoRa transmitting simultaneously)

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

Meter Reading in dB μ V + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dB μ V/m.

Delta = Field Strength – Limit

Notes:

- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discreet increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
- Preliminary scans were performed for all channels in Transmit modes. The Low band channel 923.3 MHz was selected as the worst-case condition for detailed examination.
- In Transmit mode, the EUT was assessed up to 10.0 GHz.

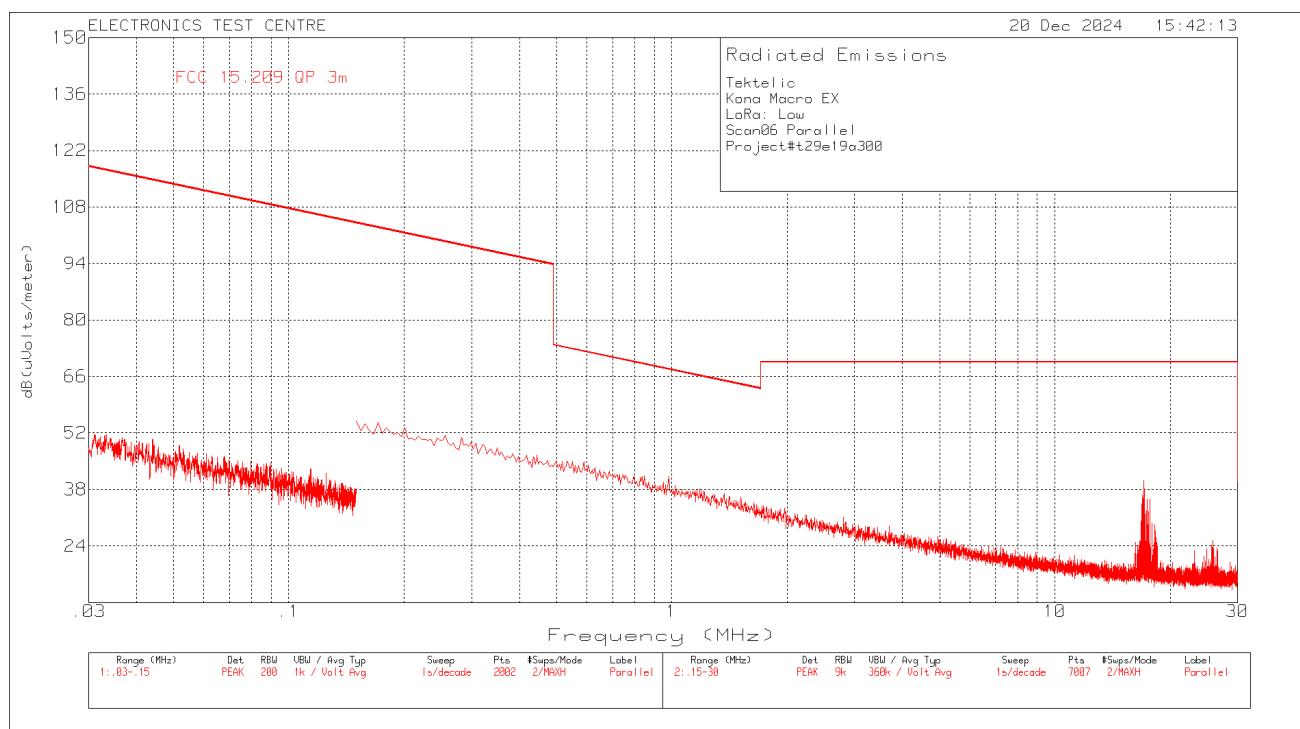
Negative values for Delta indicate compliance.

Freq. Marker	Freq. [MHz]	Raw reading [dB μ V]	Det	Antenna Factor [dB/m]	Loss/Gain [dB]	Corrected Reading [dB μ V/m]	FCC 15.209 Limit [dB μ V/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	*73.195	21.15	QP	12.2	2.1	35.45	40	-4.55	91	121	Vertical
2	*108.80	16.53	QP	16.7	2.6	35.83	43.52	-7.69	81	117	Vertical
3	*607.74	6.03	QP	22.8	5.9	34.73	46.02	-11.29	180	315	Vertical
1	*8.310	29.51	AV	36.8	-25.4	40.91	54	-13.09	319	146	Horizontal
		43.02	PK			54.4	74	-19.6			
2	*8.310	28.98	AV	36.8	-25.4	40.38	54	-13.62	341	241	Vertical
		42.95	PK			54.35	74	-19.65			

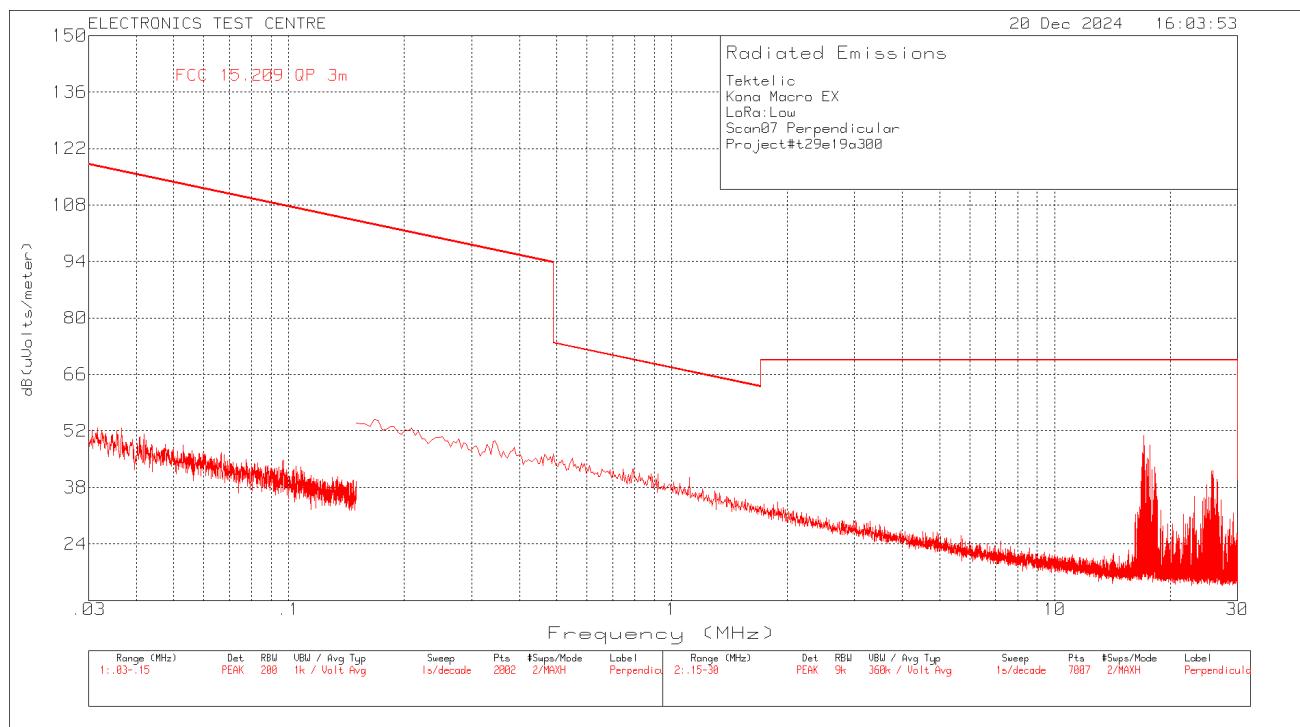
QP: Quasi-Peak Detector, PK: Peak Detector, AV: Average Detector

*** Spurious Emission in Restricted Band**

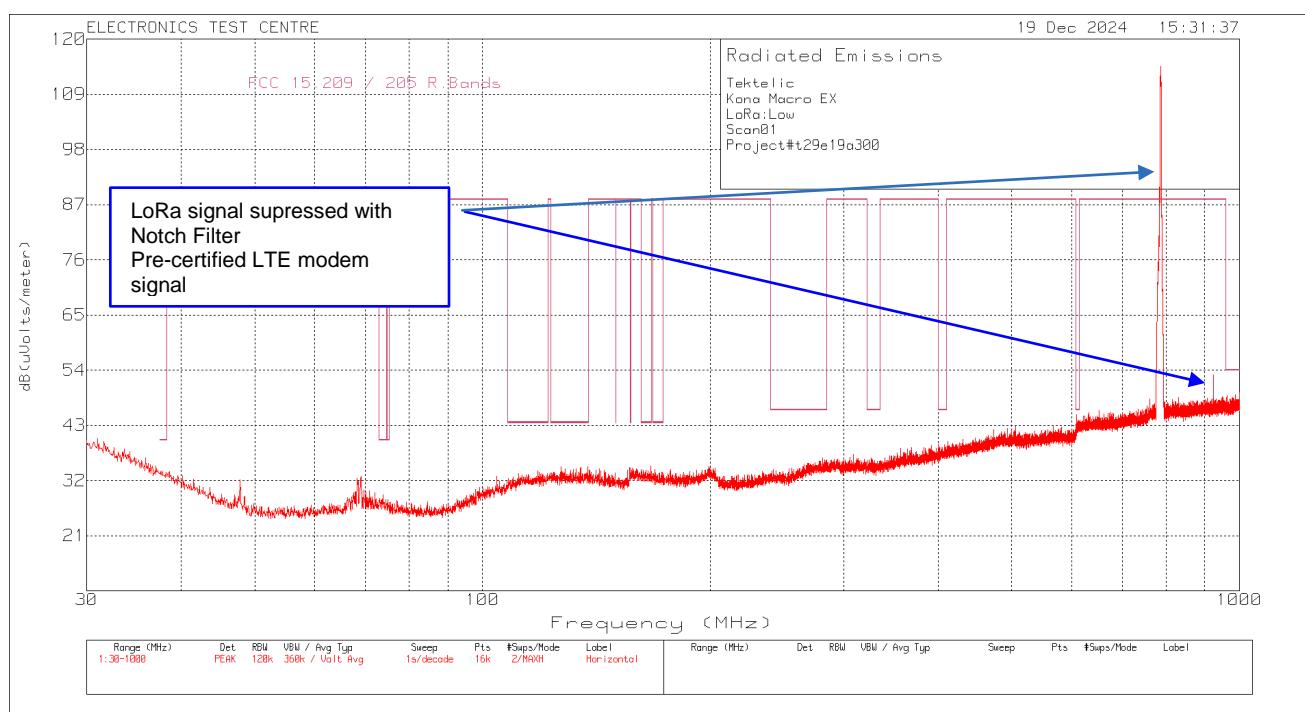
Plot of Radiated Emissions: Parallel



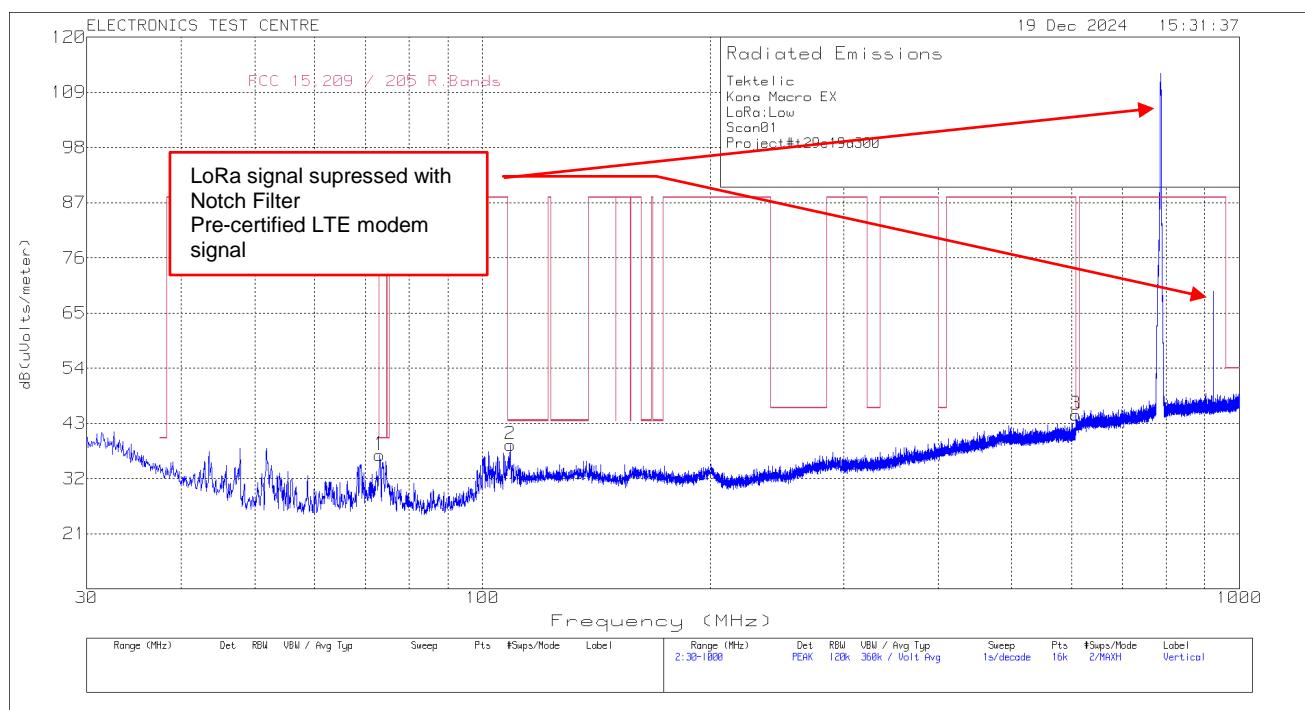
Plot of Radiated Emissions: Perpendicular



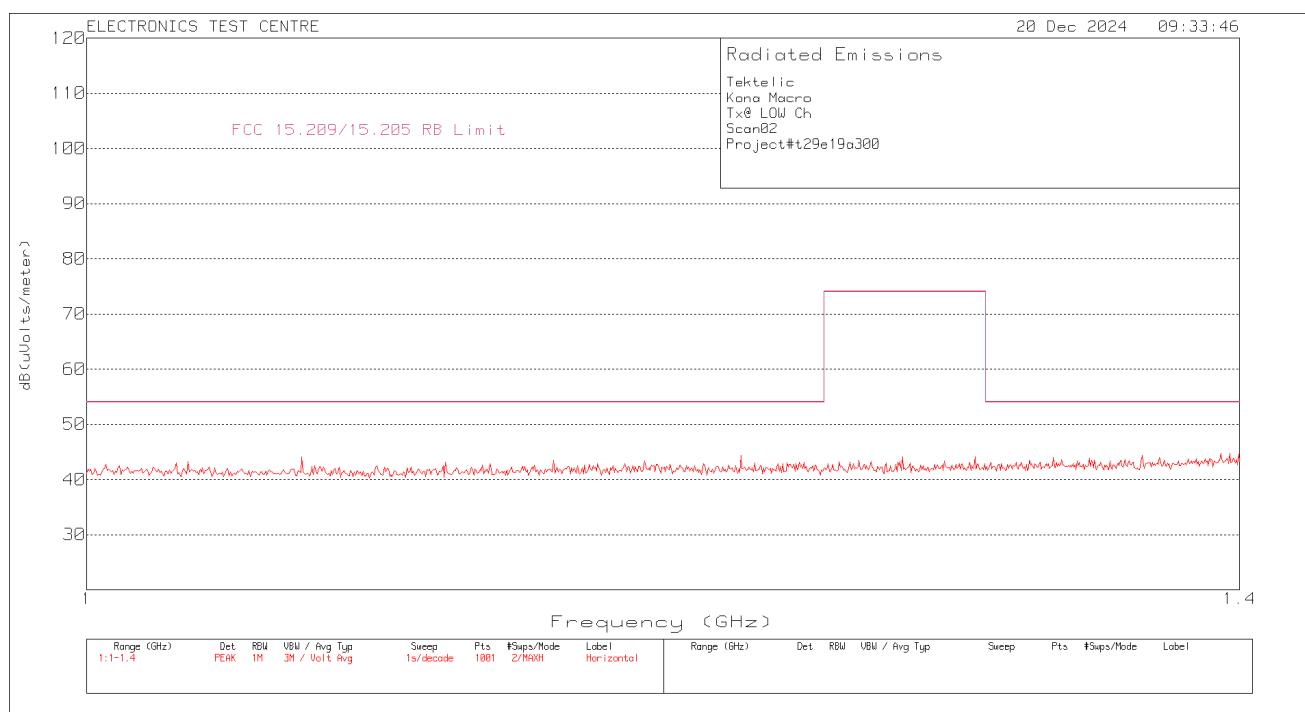
Plot of Radiated Emissions: Horizontal polarization



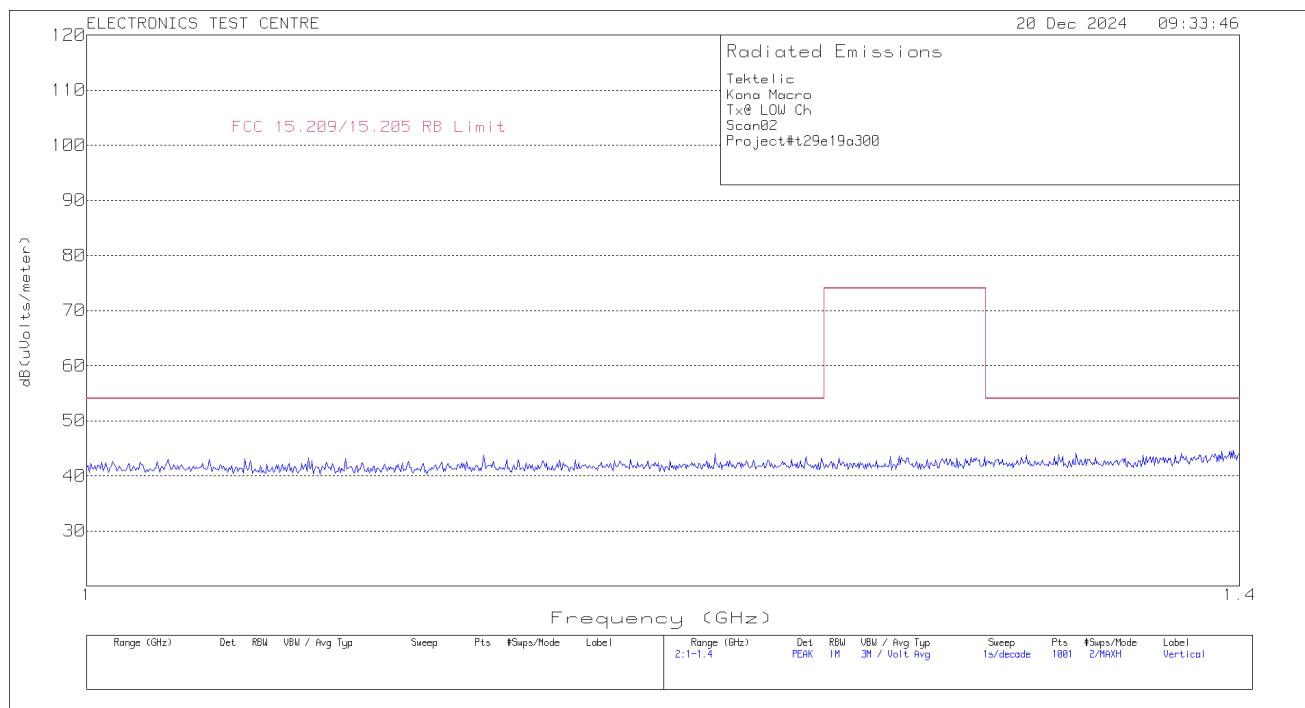
Plot of Radiated Emissions: Vertical polarization



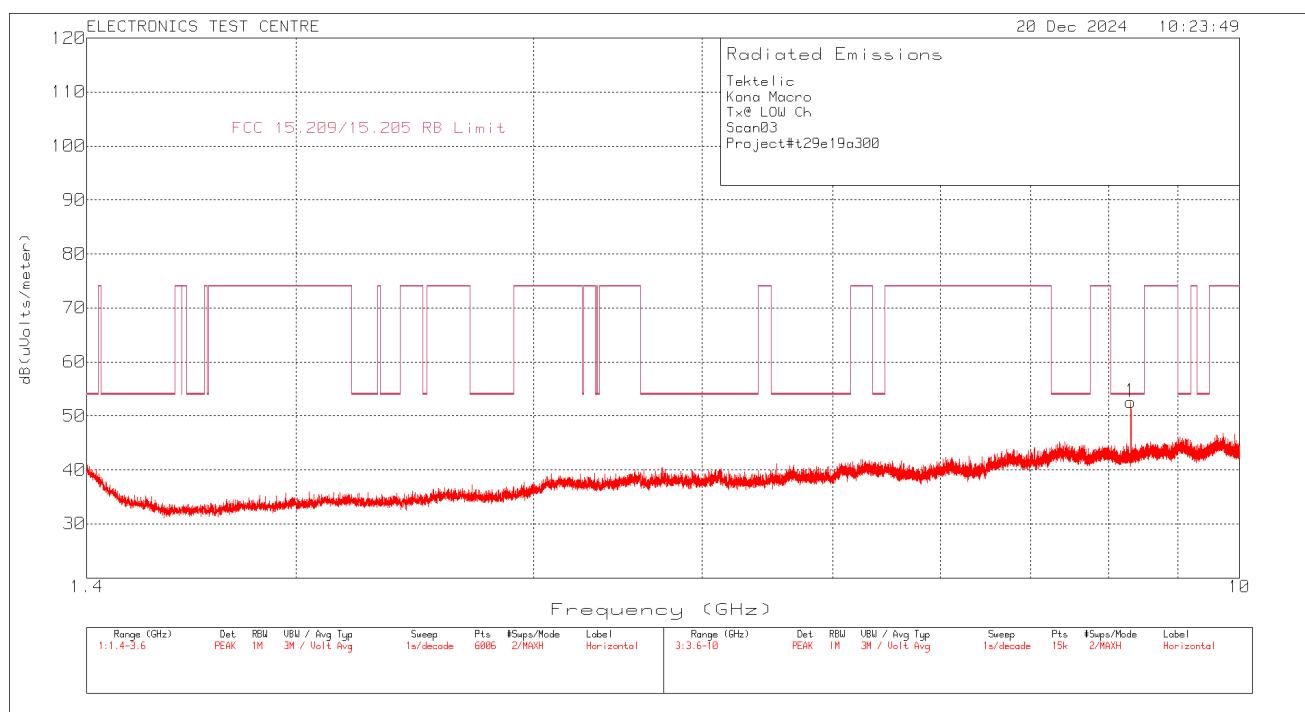
Plot of Radiated Emissions: Horizontal polarization



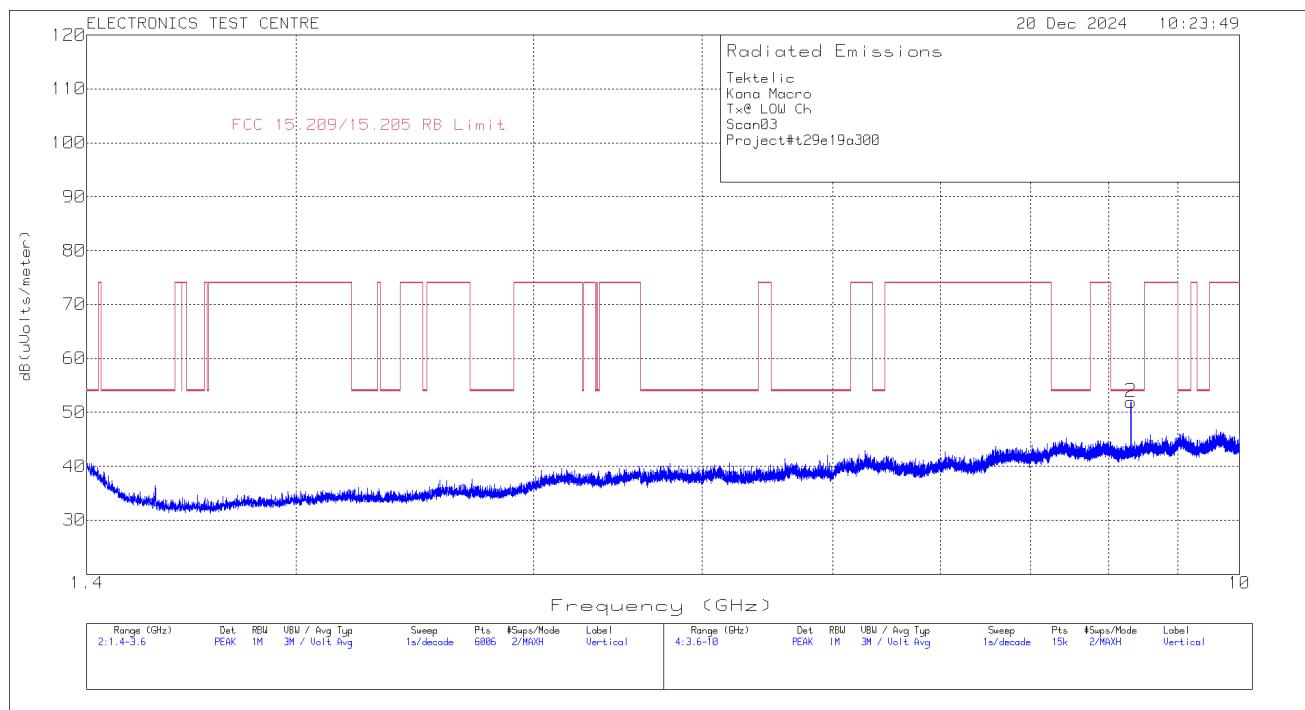
Plot of Radiated Emissions: Vertical polarization



Plot of Radiated Emissions: Horizontal polarization



Plot of Radiated Emissions: Vertical polarization



2.2 Radiated Emissions (RX Mode)

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Macro Ex Gateway
Test Personnel: Imran Akram	Standard: FCC Part 15.109
Date: 2024/12/20 (22.8° C, 10.6% RH)	Basic Standard: ANSI C63.4: 2014
	Class: A
EUT status: Compliant	

Frequency (MHz)	FCC Part 15.109 Class A Limit (3m)
30 – 88	49.54 (dB μ V/m)
88 – 216	53.98 (dB μ V/m)
216 – 960	56.90 (dB μ V/m)
Above 960	60.0 (dB μ V/m)

Criteria: The radiated emissions produced by a device, measured at a distance of 3 meters, shall not exceed the limits as specified.

2.2.1 Test Guidance:

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz.

The scan is performed at discreet increments of turntable azimuth and stepped antenna height, with peak detector and Max Hold function which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

After the pre-scan is completed, the frequencies of interest are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 – 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. This may produce a different reading than the pre scan trace. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

2.2.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.2.3 Test Equipment

Testing was performed with the following equipment:

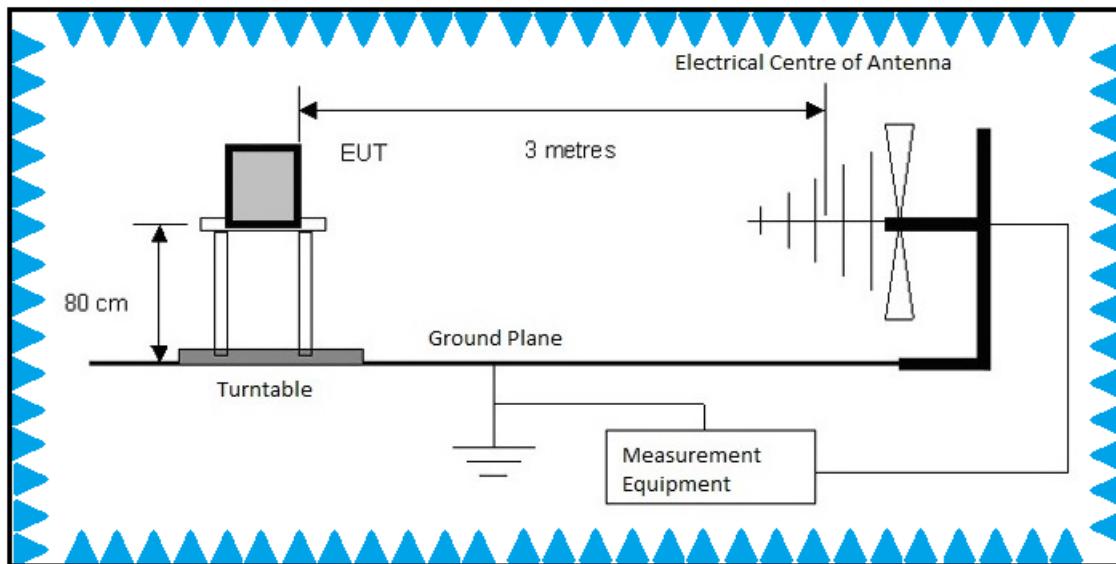
Equipment	Manufacturer	Model #	Asset #	Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2024-08-15	2025-08-15
Biconilog Antenna (30 – 1000 MHz)	AR	JB1	6905	2023-11-29	2025-11-29
DRG Horn (1000 – 18000 MHz)	EMCO	3115	19357	2022-10-05	2025-10-05
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2024-04-08	2025-04-08
Pre-Amplifier (30 – 1400 MHz)	HP	8447D	9291	2024-01-23	2025-01-23
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21-5P	4354	2024-01-23	2025-01-23
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A-3600-KPA-01102006	4419	2024-01-23	2025-01-23
Re Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	2024-01-23	2025-01-23

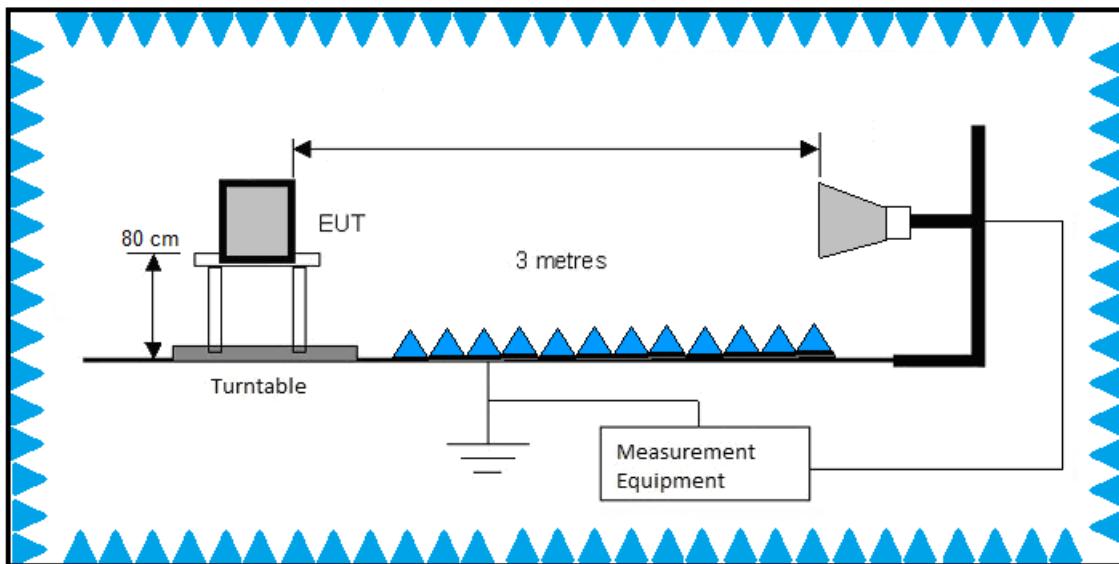
2.2.4 Test Sample Verification, Configuration & Modifications

To cover the unintentional radiated emission. The EUT was configured in receive mode. Unit was placed at the center of turntable in semi-anechoic chamber 80cm above the ground plane and at a distance of 3m from the test receive antenna.

The EUT met the requirements without modification. EUTs were powered with POE and internal battery for Enterprise and Photon respectively.

EUT RX configuration Block Diagram for Radiated Emissions testing:



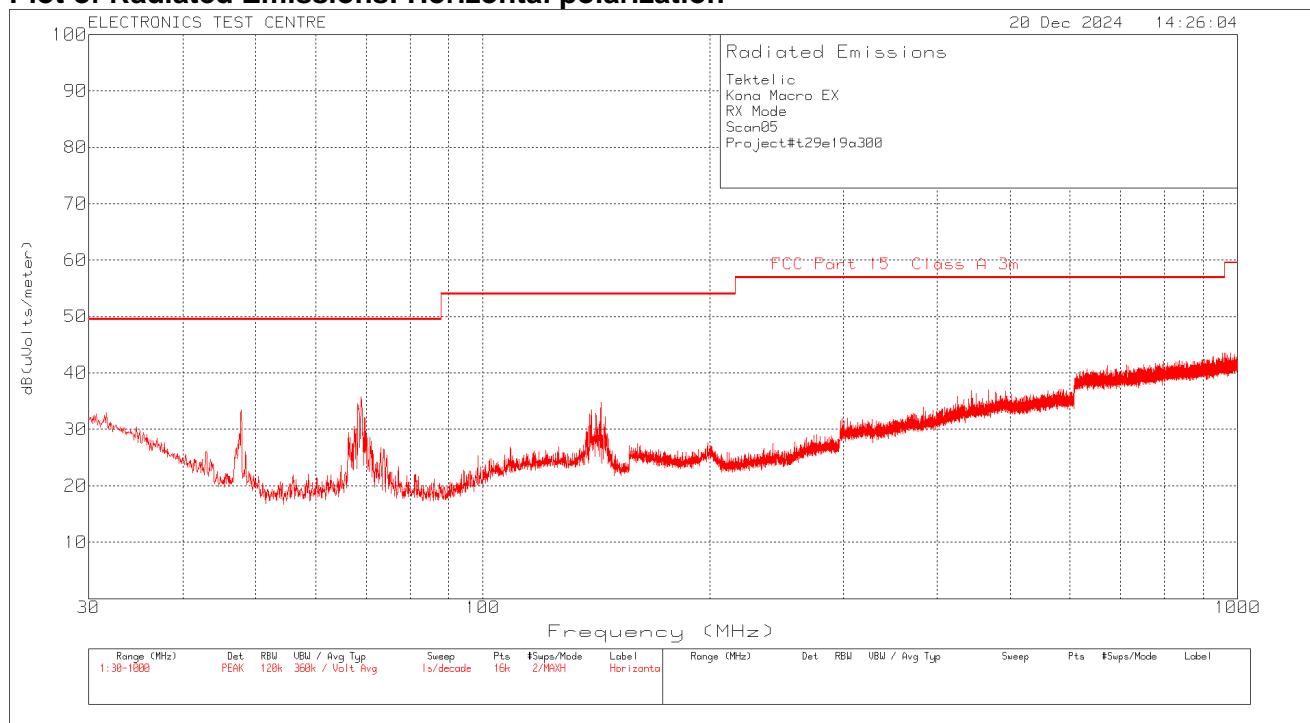


2.2.5 Radiated Emissions Data: Kona Enterprise Gateway

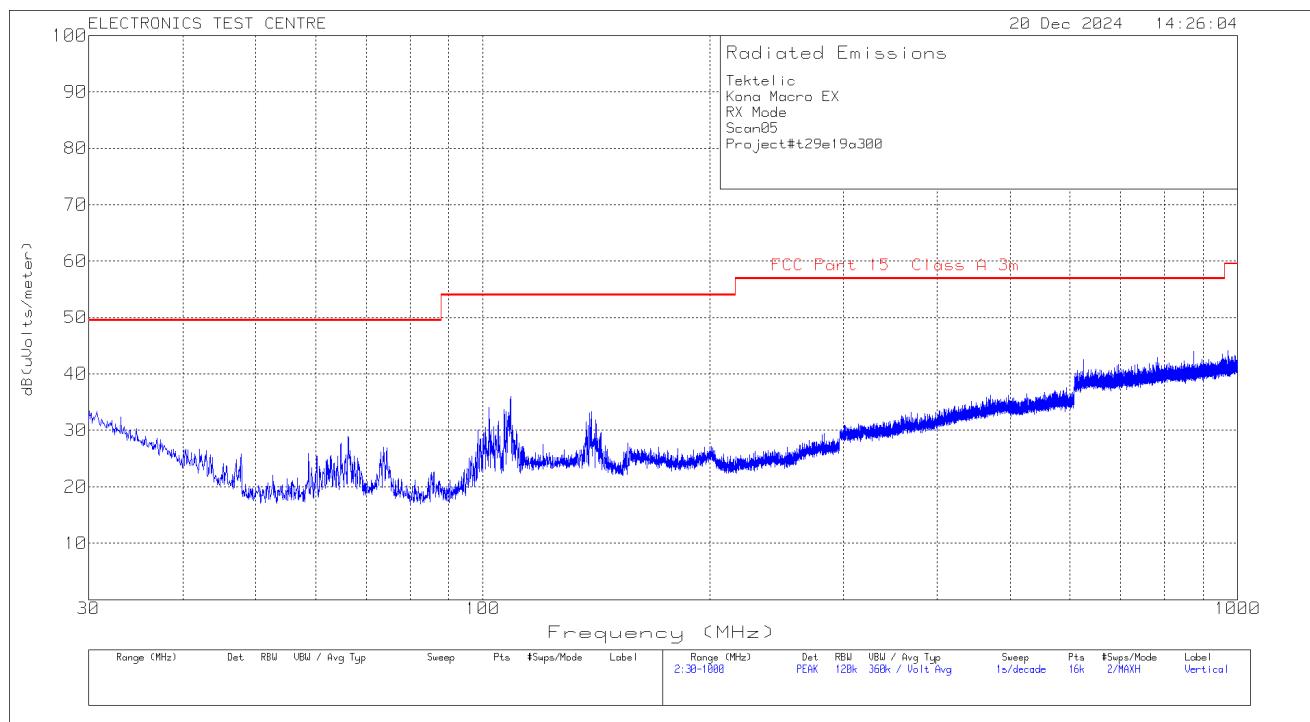
Radiated emission is more than 10 dB from limit

Meter Reading in dB μ V + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dB μ V/m.

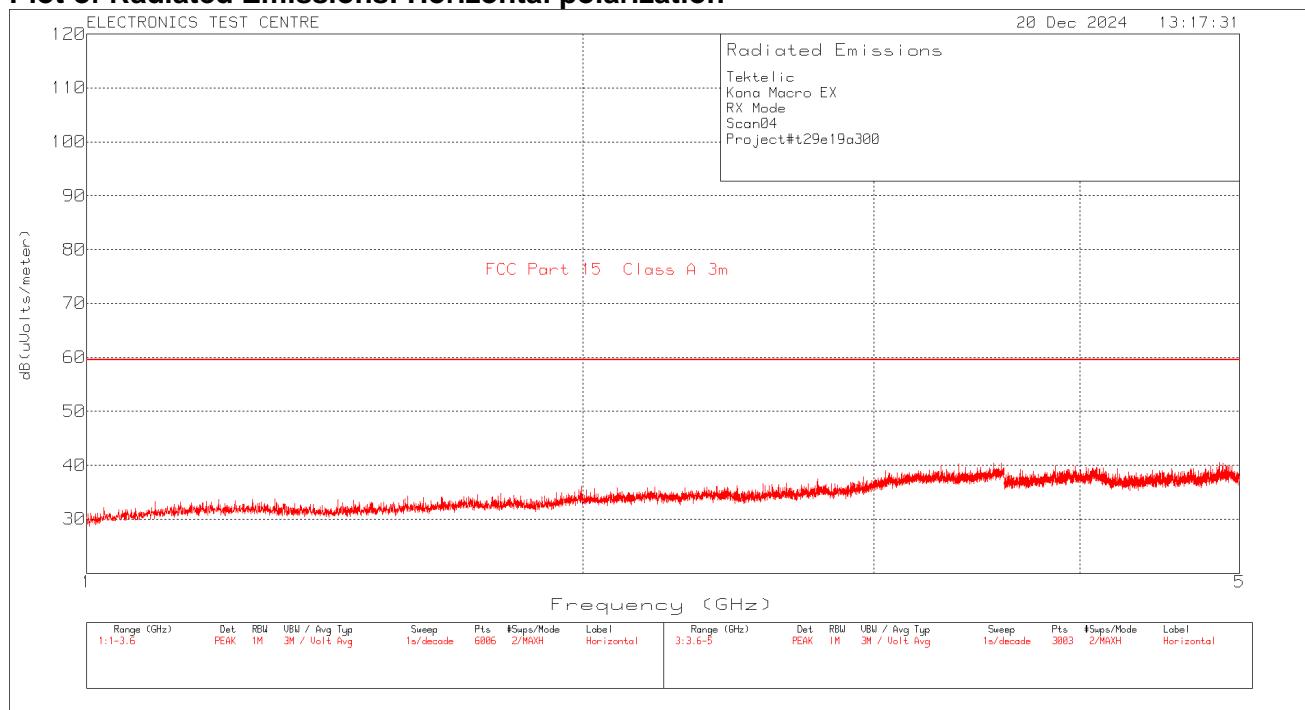
Plot of Radiated Emissions: Horizontal polarization



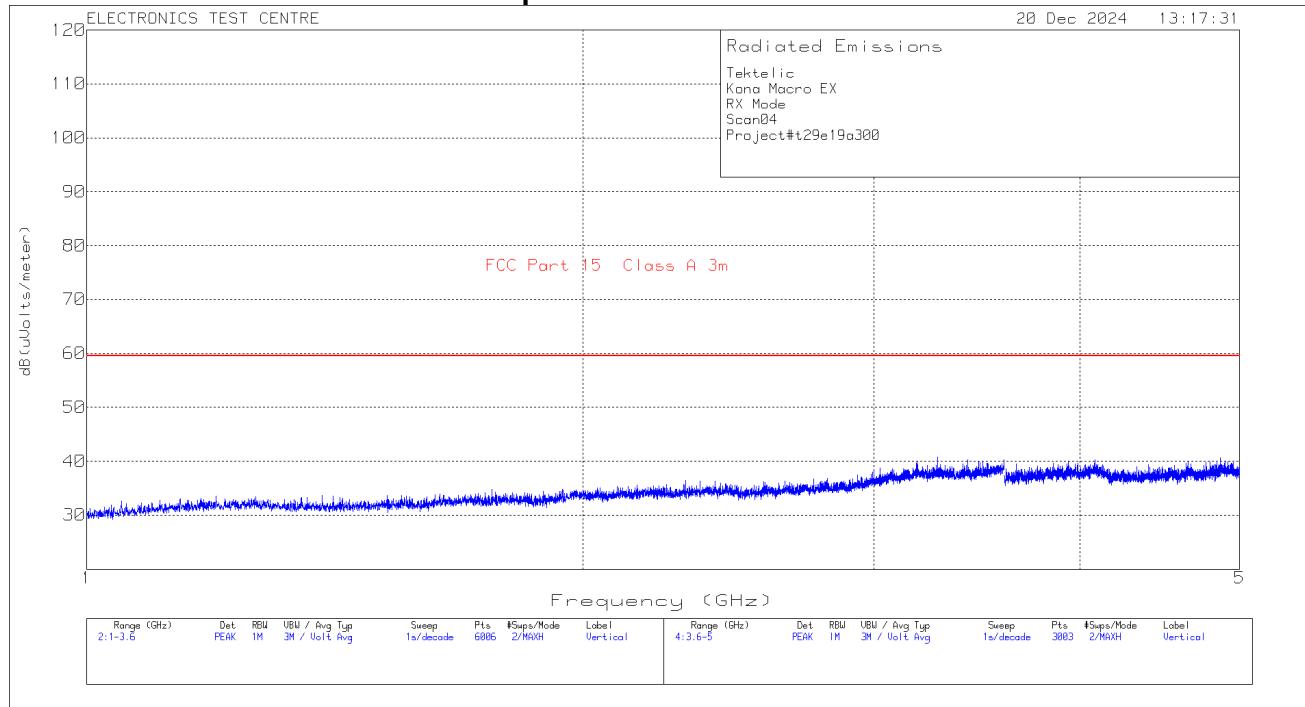
Plot of Radiated Emissions: Vertical polarization



Plot of Radiated Emissions: Horizontal polarization



Plot of Radiated Emissions: Vertical polarization



2.3 RF Exposure

Test Lab: Electronics Test Centre, Airdrie EUT: Kona Macro Ex Gateway

Test Personnel:

Date:

Standard: FCC PART 15.247

EUT Status: Calculated

Compliant: RF exposure assessment to be provided in a separate Exhibit.

3.0 TEST FACILITY

3.1 Location

The Kona Macro Ex Gateway was tested at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Anechoic Chamber (RFAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file # 2046A. This site is also listed with the FCC under Registration Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

3.2 Grounding Plan

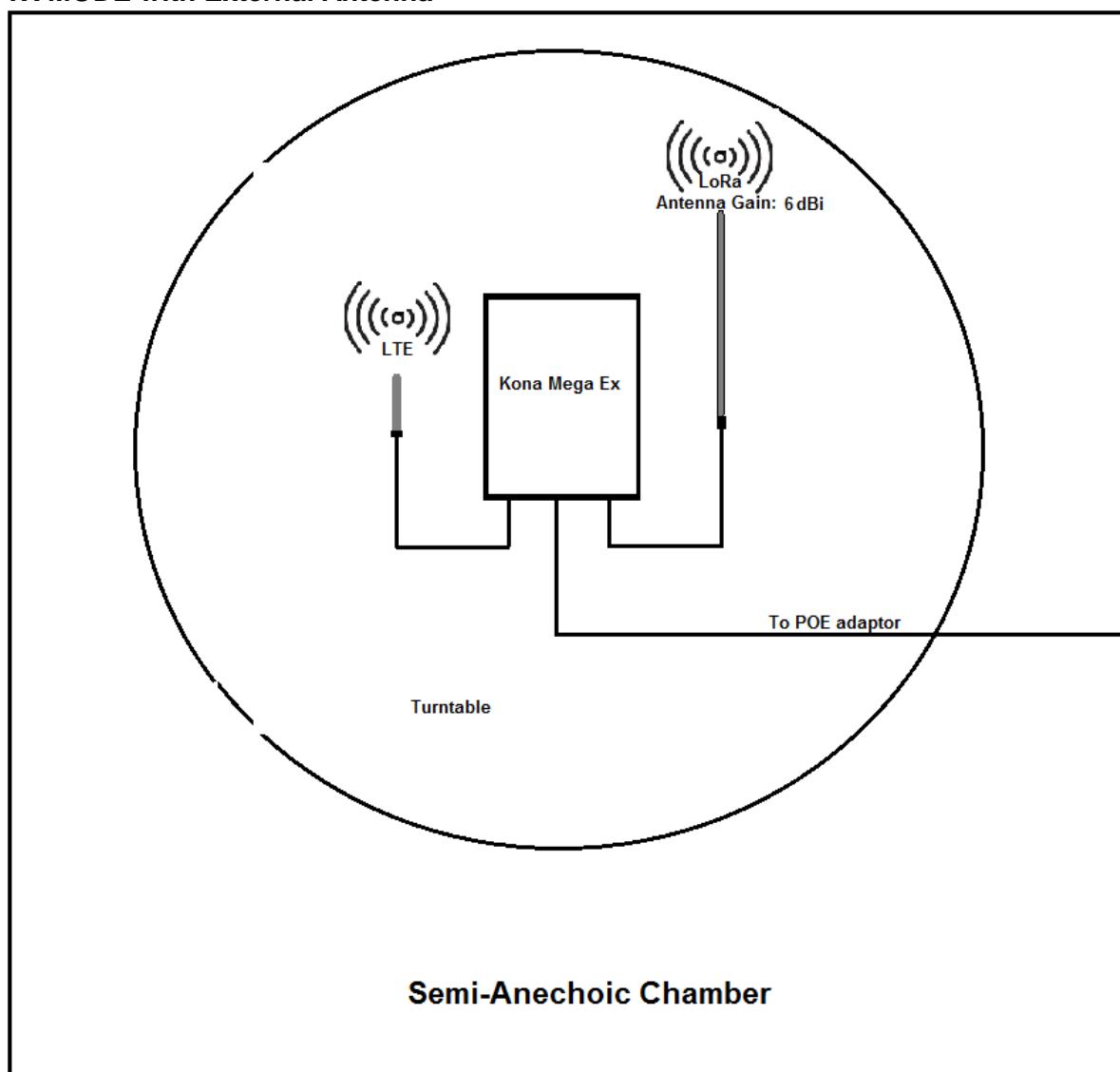
The Kona Macro Ex Gateway was placed at the center of the test chamber turntable 80-cm high below 1GHz and at 1.5m high above 1 GHz for transmits mode and 80cm high for RX mode from ground reference plane. The Kona Macro Ex Gateway enclosure ground is connected to GRP.

3.3 Power Supply

Power supplied DC power supply.

Appendix A – Test Setup Block Diagram

TX MODE with External Antenna



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