



FCC / ISED Test Report

FOR:
BI Incorporated

Model:
TAD-200

Product Description:

Transdermal Alcohol Detector, continuously monitors for alcohol consumption through a noninvasive skin sensor worn on a client's ankle. TAD also includes radio frequency monitoring capabilities so clients can be monitored for curfews and alcohol use with the same device. If a client drinks alcohol while wearing

FCC ID: CSQTAD200
IC ID: 1499A-TAD200

Applied Rules and Standards:

47 CFR Part: 15.231
RSS-210 Issue 10 & RSS-Gen Issue 5

REPORT #: EMC_BIINC_020_22001_FCC_15_231_Rev3

DATE: 2023-05-11



A2LA Accredited

IC recognized #
3462B-1

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TABLE OF CONTENTS

1	ASSESSMENT	3
2	ADMINISTRATIVE DATA	4
2.1	IDENTIFICATION OF THE TESTING LABORATORY ISSUING THE EMC TEST REPORT	4
2.2	IDENTIFICATION OF THE CLIENT	4
2.3	IDENTIFICATION OF THE MANUFACTURER	4
3	EQUIPMENT UNDER TEST (EUT)	5
3.1	EUT SPECIFICATIONS	5
3.2	EUT SAMPLE DETAILS	5
3.3	ACCESSORY EQUIPMENT (AE) DETAILS	5
3.4	TEST SAMPLE CONFIGURATION	6
3.5	MODE OF OPERATION	6
3.6	JUSTIFICATION FOR WORST CASE MODE OF OPERATION	6
4	SUBJECT OF INVESTIGATION	7
5	MEASUREMENT RESULTS SUMMARY	7
6	MEASUREMENT UNCERTAINTY	8
6.1	ENVIRONMENTAL CONDITIONS DURING TESTING:	8
6.2	DATES OF TESTING:	8
6.3	DECISION RULE	8
7	MEASUREMENT PROCEDURES	9
7.1	RADIATED MEASUREMENT	9
8	TEST RESULT DATA	12
8.1	FIELD STRENGTH	12
8.2	EMISSION BANDWIDTH	14
8.3	RADIATED TRANSMITTER SPURIOUS EMISSIONS AND RESTRICTED BANDS	16
8.4	PERIODIC OPERATION	22
9	TEST SETUP PHOTOS	24
10	TEST EQUIPMENT AND ANCILLARIES USED FOR TESTING	24
11	HISTORY	25

1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.231 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-210 & RSS-Gen Issue 5.

No deviations were ascertained.

Company	Description	Model #
BI Incorporated	Transdermal Alcohol Detector, continuously monitors for alcohol consumption through a noninvasive skin sensor worn on a client's ankle. TAD also includes radio frequency monitoring capabilities so clients can be monitored for curfews and alcohol use with the same device. If a client drinks alcohol while wearing	TAD-200

Responsible for Testing Laboratory:

2023-05-11	Compliance	Arndt Stoecker (Director of Regulatory Service)	
Date	Section	Name	Signature

Responsible for the Report:

2023-05-11	Compliance	Cheng Song (EMC Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Compliance Manager:	Arndt Stoecker
Responsible Project Leader:	Cathy Palacios

2.2 Identification of the Client

Client Firm/Name:	BI Incorporated
Street Address:	6265 Gunbarrel Avenue, Suite B
City/Zip Code	Boulder CO 80301
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	TAD-200
HW Version :	VER 1.05
SW Version :	VER 1.05
FCC-ID :	CSQTAD200
IC:	1499A-TAD200
PMN:	TAD-200
Radio Information:	<u>Periodic radio</u> • Frequency of operation: 318.2MHz
Power Supply/ Rated Operating Voltage Range:	3.3 V (nom)
Operating Temperature Range	Tmin: -5 °C / Tmax: 55 °C
Sample Revision	☐ Prototype Unit; ☐ Production Unit; ☒ Pre-Production

3.2 EUT Sample details

EUT #	Model Number	HW Version	SW Version	Notes/Comments
1	TAD-200	VER 1.05	VER 1.05	EUT in normal operation mode
2	TAD-200	VER 1.05	VER 1.05	EUT in continuous transmitting mode

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1				

3.4 Test Sample Configuration

Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	DC/ Battery
2	EUT#2	DC/ Battery

3.5 Mode of Operation

Operating mode #	Comments
Op. 1	Periodic 2FSK transmission same as the EUT should transmit in reality at 318.2 MHz
Op. 2	Continuous 2FSK transmission at the maximum output power and duty cycle 318.2 MHz

3.6 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on 318.2 channels, and highest possible duty cycle and output power. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT. The worst case is with EUT in Y-axis and with antenna in vertical polarization.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.231 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-210 & RSS-Gen Issue 5 of ISED Canada.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.231(c) RSS-210 A1.3	Emission Bandwidth	Nominal	Op. 2	■	□	□	Complies
§15.231(b) RSS-210 A1.2	Field strength	Nominal	Op. 2	■	□	□	Complies
§15.231(b); §15.205 RSS-210 A1.2	TX Spurious emissions- Radiated	Nominal	Op. 2	■	□	□	Complies
§15.231(a,3) RSS Gen 210 A1.1.C	Periodic Transmission	Nominal	Op. 1	■	□	□	Complies
§2.1055; RSS-133 6.3	Frequency Stability	Extreme	-	□	■	□	See Note 1
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	-	□	■	□	See Note 1 Note 2

Note1: NA= Not Applicable; NP= Not Performed.

Note2: This device does not connect to AC network; hence the test is not applicable.

6 **Measurement Uncertainty**

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

Measurement System	EMC 1	EMC 2
Conducted Emissions (mains port)	1.12 dB	0.46 dB
Radiated Emissions		
(<30 MHz)	3.66 dB	3.88 dB
(30 MHz – 1 GHz)	3.17 dB	3.34 dB
(1 GHz – 3 GHz)	5.01 dB	4.45 dB
(> 3 GHz)	4.0 dB	4.79 dB

6.1 **Environmental Conditions During Testing:**

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

6.2 **Dates of Testing:**

12/15/2022 - 02/10/2023

6.3 **Decision Rule**

Cetecom advanced follows [ILAC G8:2019 chapter 4.2.1 \(Simple Acceptance Rule\)](#).

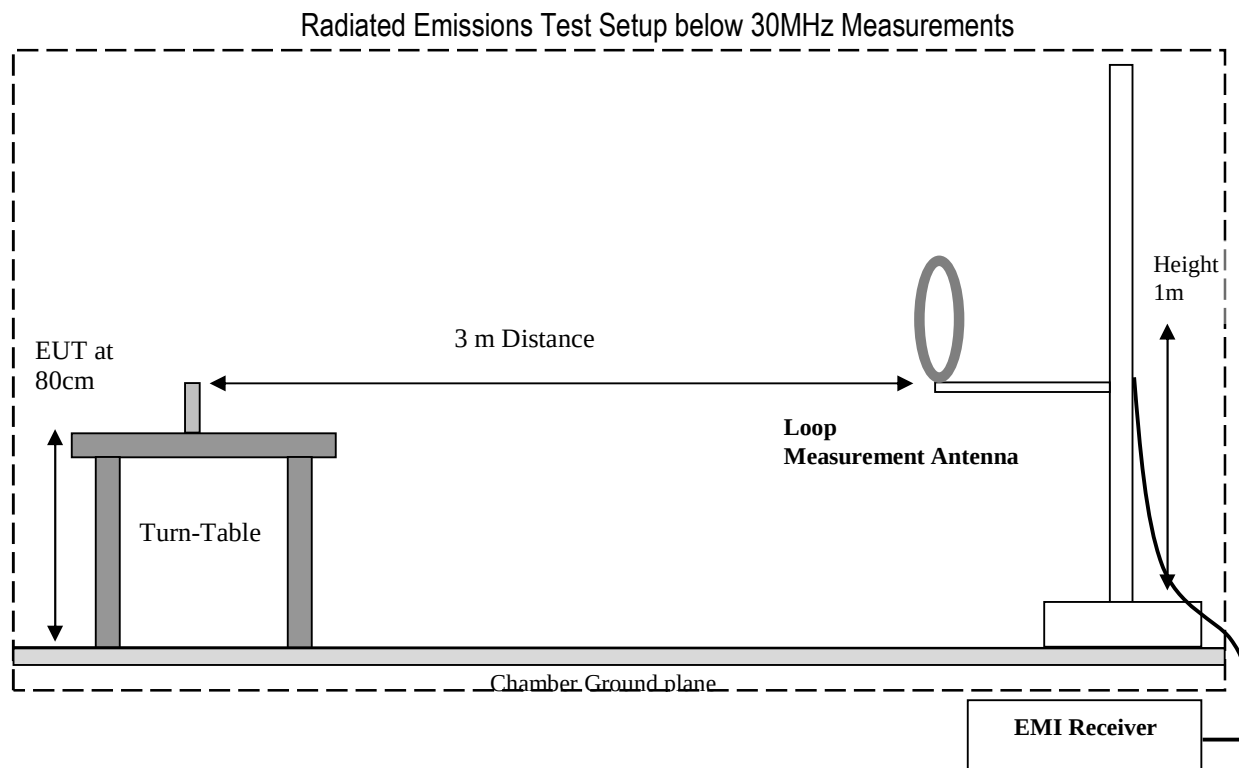
“Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.”

7 Measurement Procedures

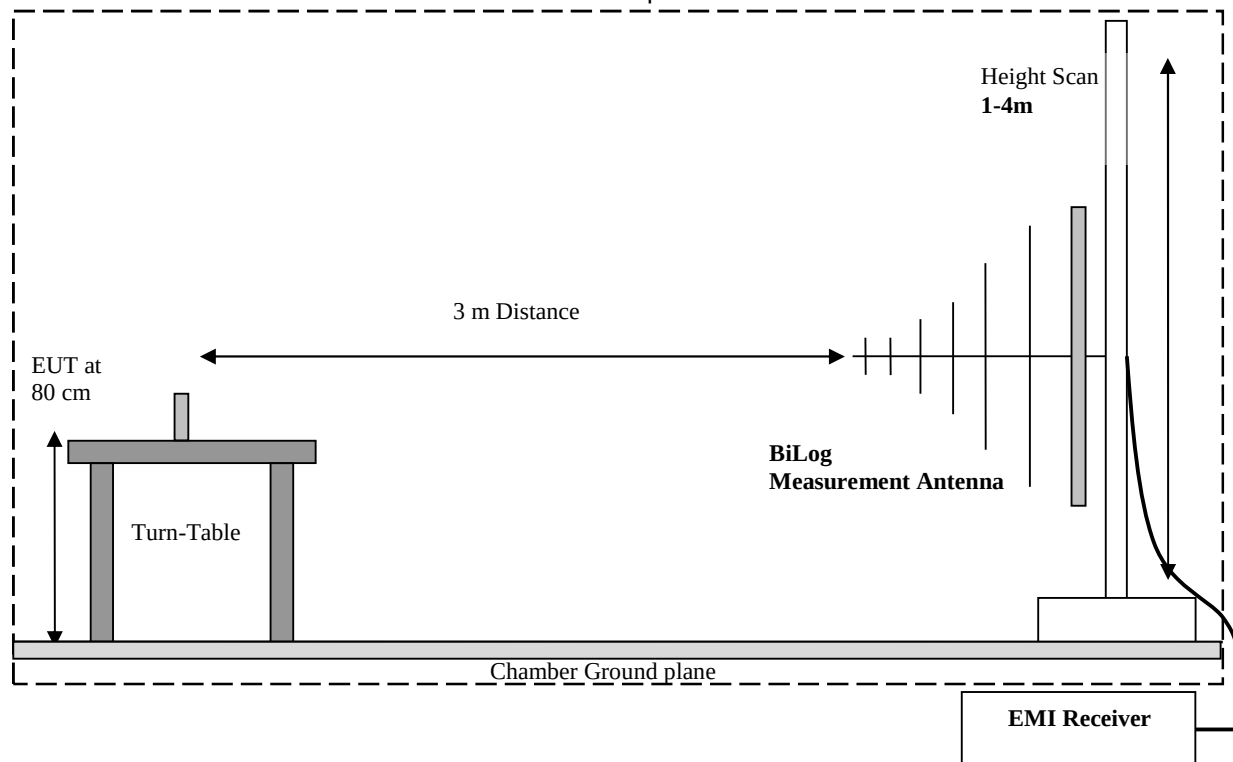
7.1 Radiated Measurement

The radiated measurement is performed according to ANSI C63.10 (2020)

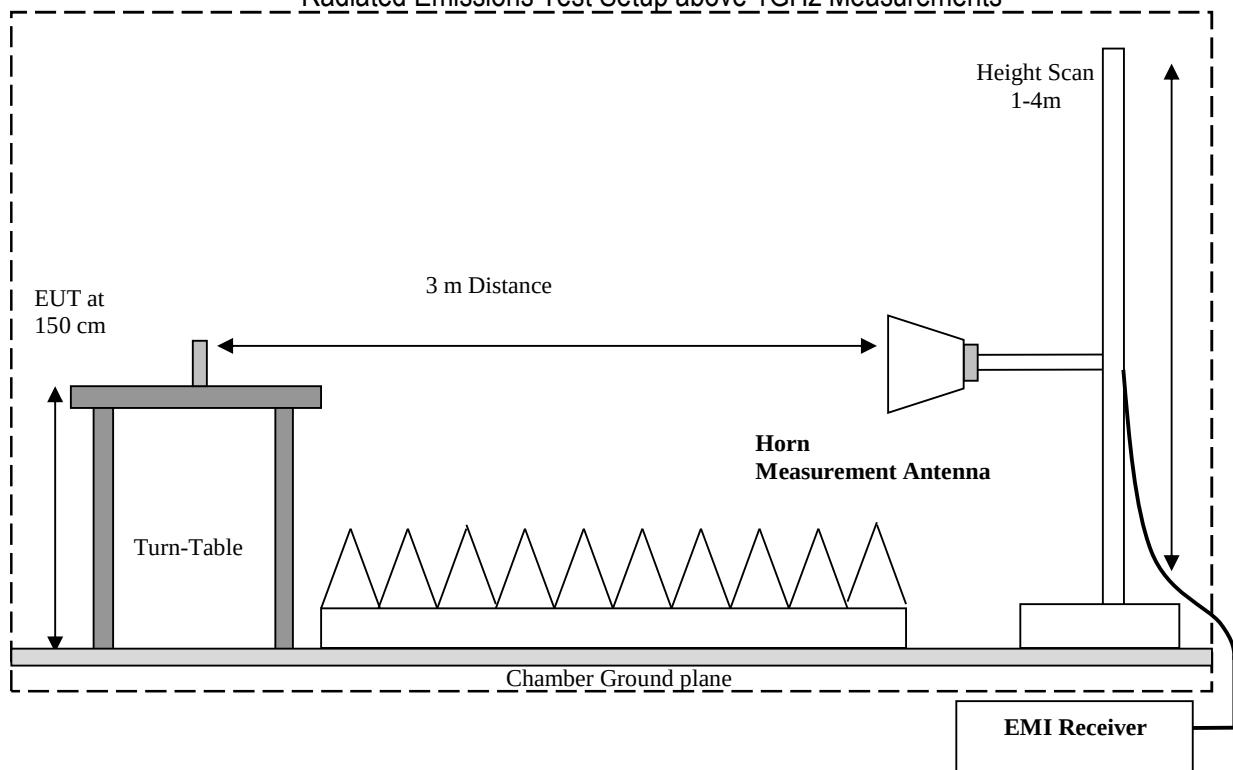
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dB μ V
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

Frequency (MHz)	Measured SA (dB μ V)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dB μ V/m)
1000	80.5	3.5	14	98.0

8 Test Result Data

8.1 Field strength

8.1.1 Measurement according to ANSI C63.10 (2020)

Spectrum Analyzer settings:

- $RBW \geq \text{Bandwidth}$
- $VBW \geq 3 \times RBW$
- $\text{Span} \geq 3 \times RBW$
- Sweep = Auto couple
- Detector function = RMS
- Trace = Max hold
- Use peak marker function to determine the peak amplitude level

8.1.2 Limits:

Maximum Peak Output Power:

- §15.231(b) and RSS 210 A1.1: In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

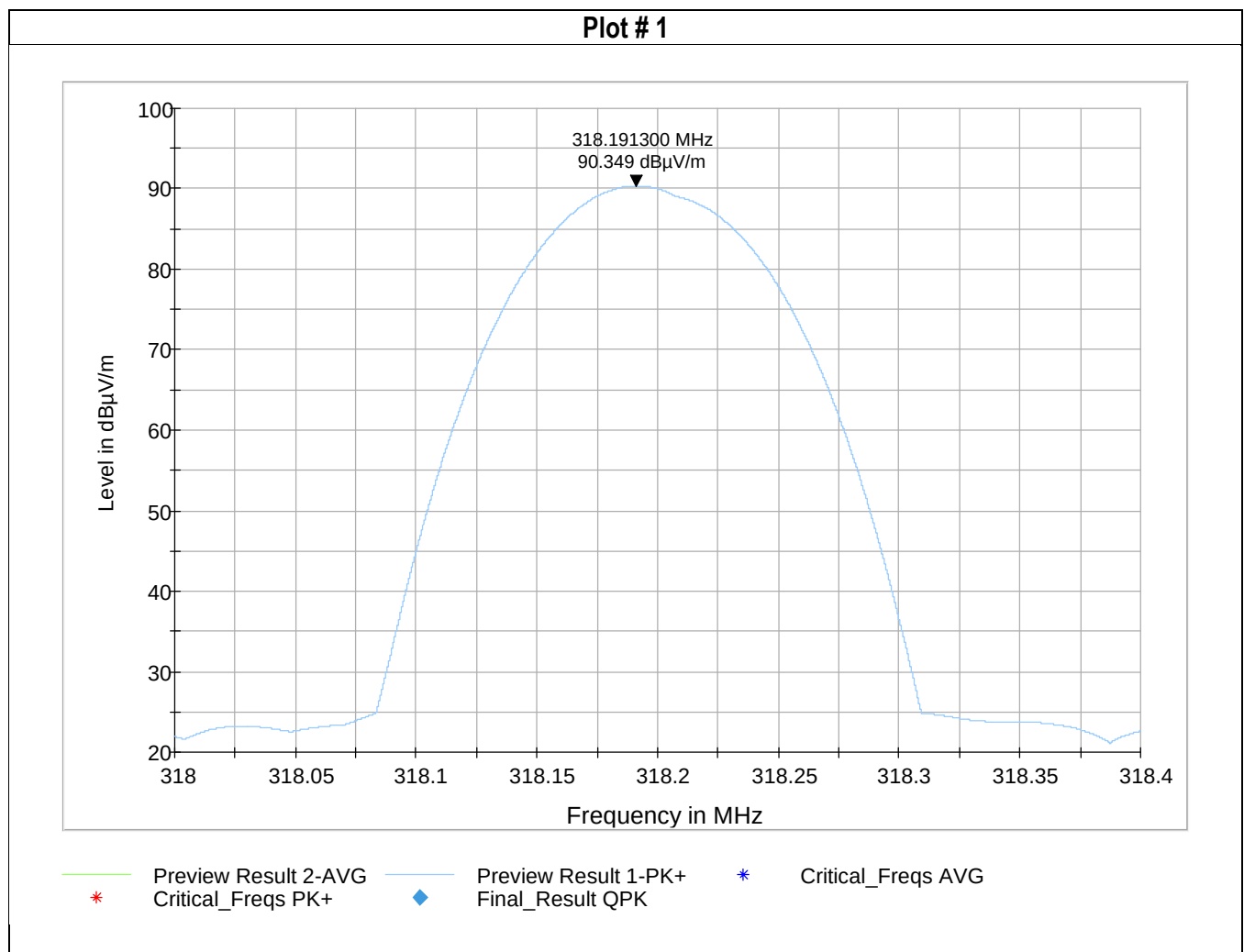
8.1.3 Test conditions and setup:

Ambient Temperature	EUT operating mode	Power Input
23° C	Op. 2	Battery

8.1.4 Measurement result:

Plot #	EUT Set-Up #	Fundamental frequency (MHz)	Modulation	Fundamental Field Strength (dB μ V/m)	Corrected For Duty Cycle* (dB μ V/m)	Limit (dB μ V/m)	Result
1	2	318.2	2FSK	90.35	70.35	75.81	Pass

8.1.5 Measurement Plots:



8.2 Emission Bandwidth

8.2.1 Measurement according to ANSI C63.10 (2020)

Spectrum Analyzer settings:

- Set RBW = 100 kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

8.2.2 Limits:

- FCC §15.231(c): The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.
- RSS-210 A1.1.3: The 99% bandwidth shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz and 900 MHz.

8.2.3 Test conditions and setup:

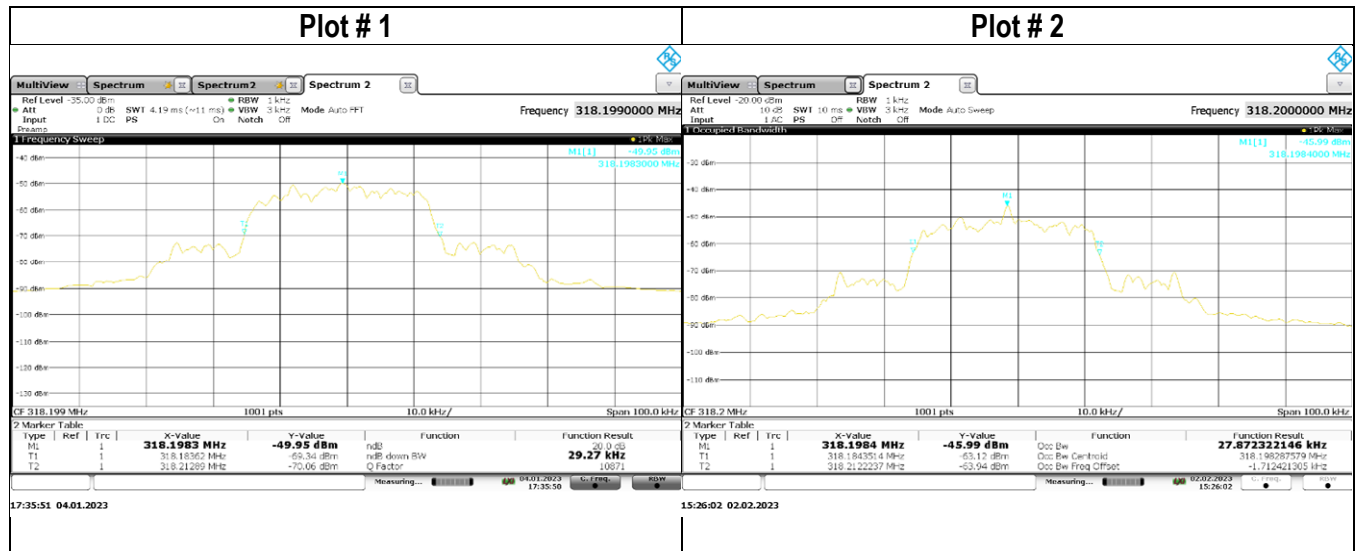
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	2	Op. 2	3.3 V Battery

8.2.4 Measurement result:

Plot #	Frequency (MHz)	Modulation	20 dB Bandwidth (KHz)	Limit (KHz)	Result
1	318.2	2FSK	29.27	29.27	Pass

Plot #	Frequency (MHz)	Modulation	99% Emissions Bandwidth (KHz)	Limit (KHz)	Result
2	318.2	2FSK	27.87	27.87	Pass

8.2.5 Measurement Plots:



8.3 Radiated Transmitter Spurious Emissions and Restricted Bands

8.3.1 Measurement according to ANSI C63.10 (2020)

Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak
- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)
- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz
- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) = $20 \log (D/d) = 20 \log (300m / 3m) = 40dB$

8.3.2 Limits:

- §15.231(b) and RSS 210 A1.1: In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

- FCC §15.205 & RSS-Gen 8.10: Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- 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 (see §15.205(b)).

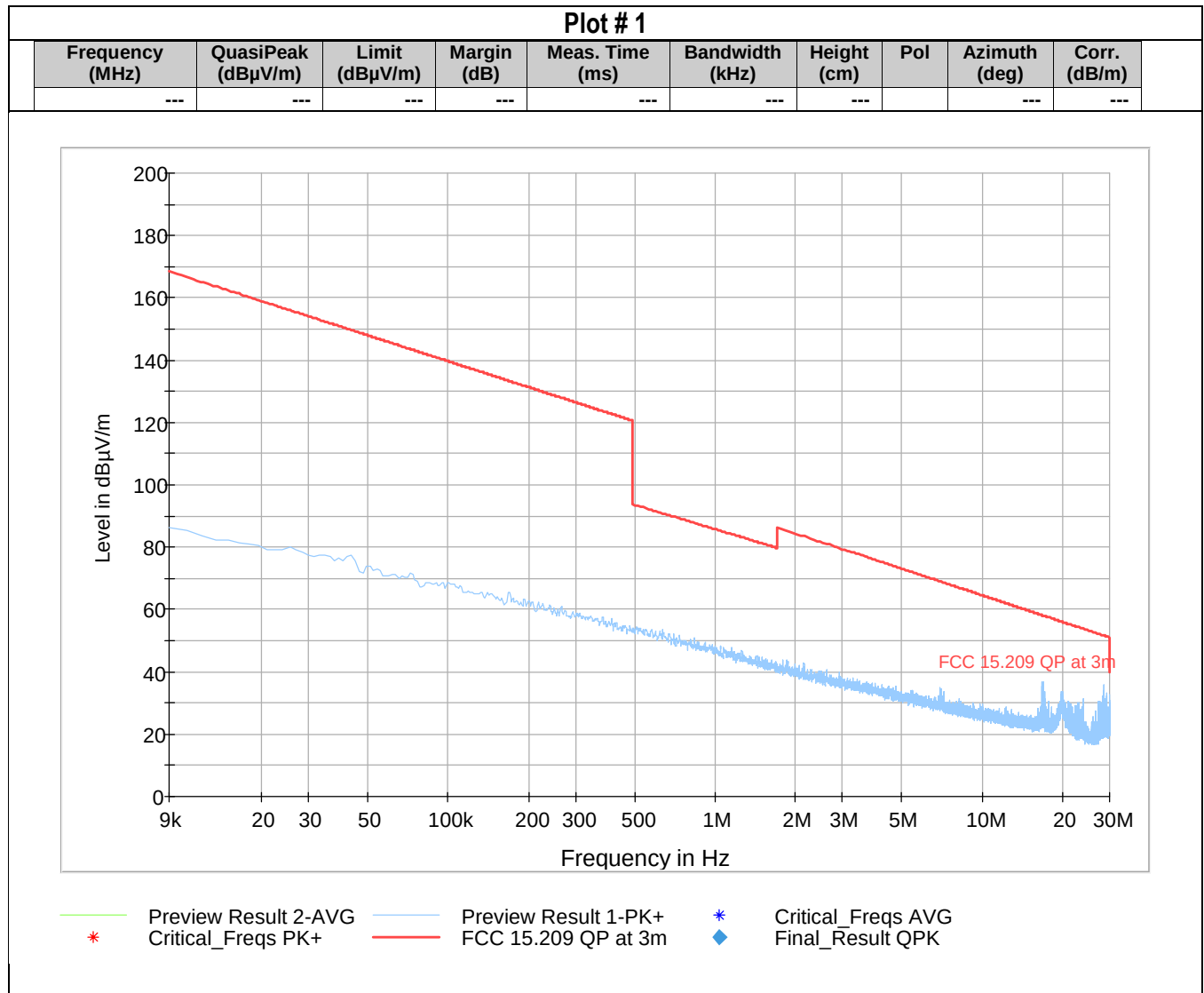
8.3.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	2	Op. 2	Battery

8.3.4 Measurement result:

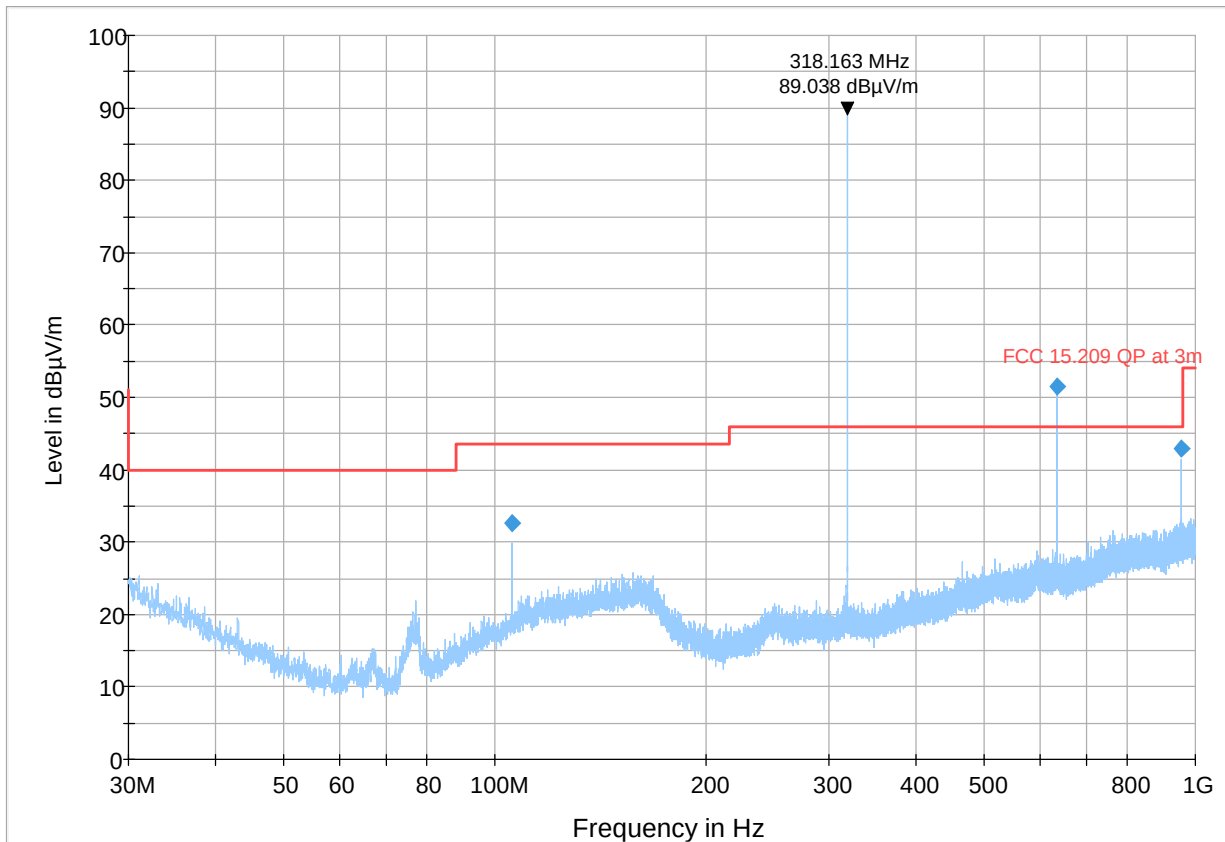
Plot #	Modulation	Scan Frequency	Limit	Result
1	2FSK	9 kHz – 30 MHz	See section 8.3.2	Pass
2	2FSK	30 MHz – 1 GHz	See section 8.3.2	Pass
3	2FSK	1 GHz – 3 GHz	See section 8.3.2	Pass
4	2FSK	3 GHz – 4 GHz	See section 8.3.2	Pass

8.3.5 Measurement Plots:



Plot # 2

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
105.68	32.64	43.50	10.86	500.0	120.0	204.0	V	25.0	22.0
636.40	51.41	46.02	-5.39	500.0	120.0	100.0	V	46.0	28.2
954.56	42.99	46.02	3.03	500.0	120.0	141.0	H	241.0	32.0

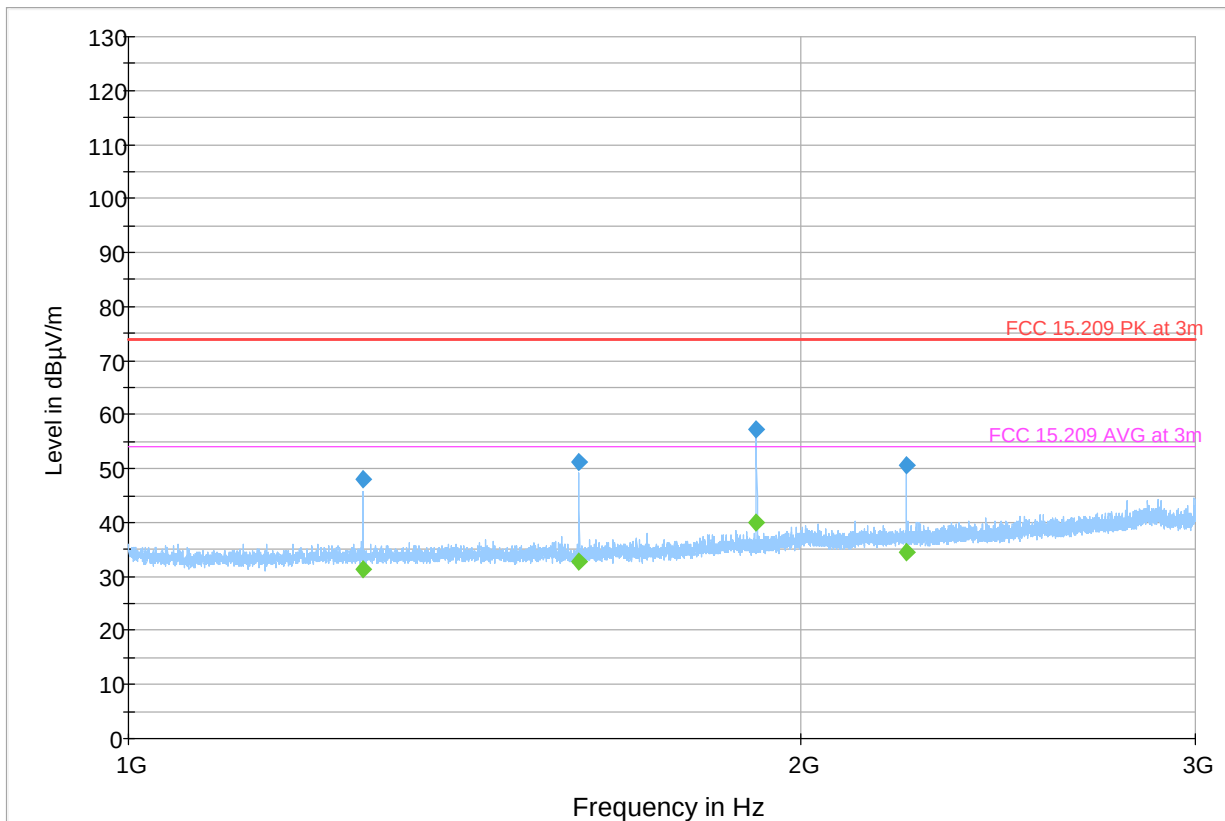


Preview Result 2-AVG Preview Result 1-PK+ FCC 15.209 QP at 3m Final_Result C

Note: 636.40MHz is the 2nd harmonic of fundamental frequency, the radiated spurious emissions final result is 51.41 dBμV/m which can pass FCC 15.231 (b) spurious limit of 55.81 dBμV/m.

Plot # 3

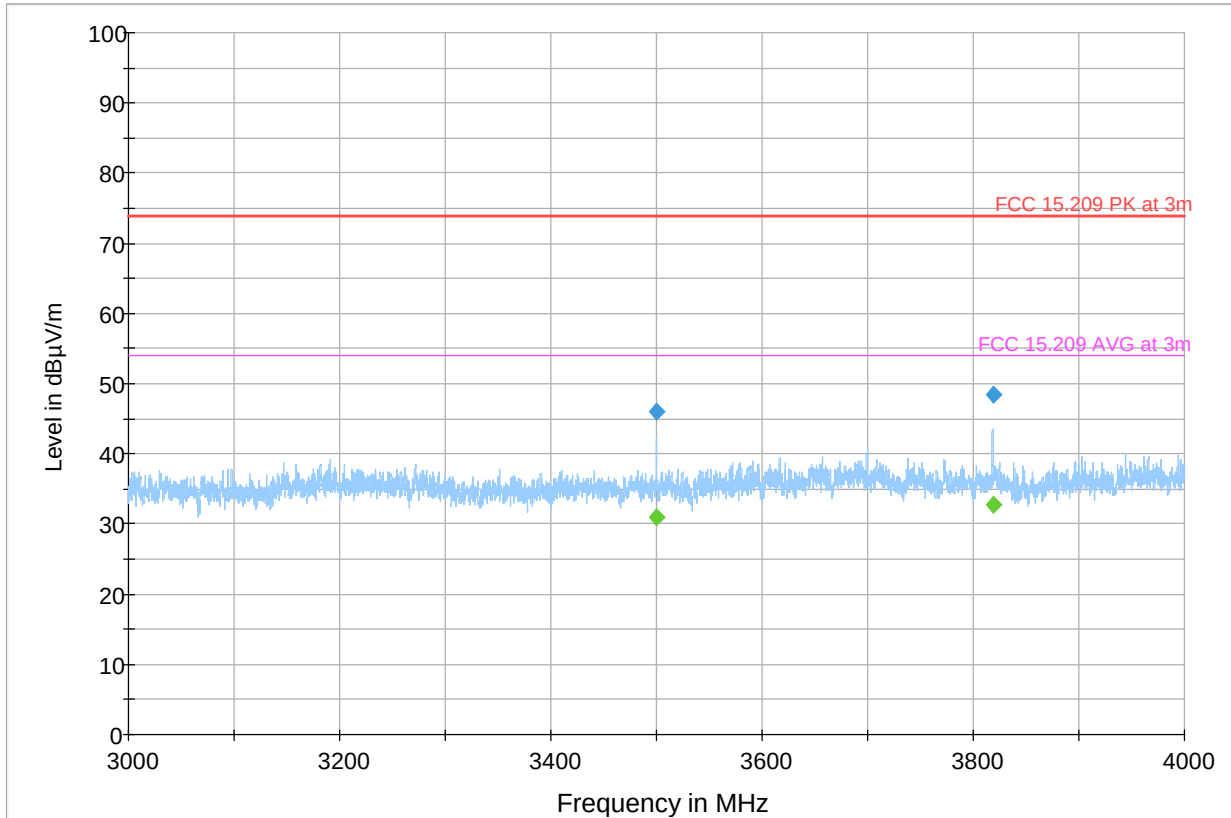
Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1272.71	---	31.30	53.98	22.68	500.0	1000.0	219.0	V	217.0	2.8
1272.71	48.02	---	73.98	25.96	500.0	1000.0	219.0	V	217.0	2.8
1591.00	51.10	---	73.98	22.88	500.0	1000.0	125.0	H	26.0	3.4
1591.00	---	32.76	53.98	21.22	500.0	1000.0	125.0	H	26.0	3.4
1909.14	---	39.89	53.98	14.09	500.0	1000.0	133.0	H	209.0	4.5
1909.14	57.26	---	73.98	16.72	500.0	1000.0	133.0	H	209.0	4.5
2227.43	50.57	---	73.98	23.41	500.0	1000.0	173.0	H	162.0	5.9
2227.43	---	34.59	53.98	19.39	500.0	1000.0	173.0	H	162.0	5.9



Preview Result 2-AVG Preview Result 1-PK+ FCC 15.209 PK at 3m
FCC 15.209 AVG at 3m Final_Result PK+ Final_Result CAV

Plot # 4

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3500.10	45.92	---	73.98	28.06	500.0	1000.0	350.0	H	147.0	-7.1
3500.10	---	31.05	53.98	22.93	500.0	1000.0	350.0	H	147.0	-7.1
3818.43	48.55	---	73.98	25.43	500.0	1000.0	100.0	H	28.0	-6.2
3818.43	---	32.82	53.98	21.16	500.0	1000.0	100.0	H	28.0	-6.2



Preview Result 2-AVG Preview Result 1-PK+ FCC 15.209 PK at 3m
FCC 15.209 AVG at 3m Final_Result PK+ Final_Result CAV

8.4 Periodic Operation

8.4.1 Limits:

- FCC §15.231 (a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:
 - (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
- RSS-210 A1.1: Devices shall comply with the following for momentary operation:
 - C. Periodic transmissions at regular, predetermined intervals are not permitted, except as specified in Section A.1.4. However, polling or supervision transmissions that determine system integrity of transmitters used in security or safety applications are permitted, provided the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

8.4.2 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	Op. 1	3.3 V Battery

8.4.3 Measurement result:

Plot #	Frequency (MHz)	Number of pulses 6 minutes
1	318.2	17

Plot #	Frequency (MHz)	Pulse duration [ms]
2	318.2	9.1

Total duration of transmission = Number of pulses per hour X pulse duration = 0.155 seconds per 6 min.

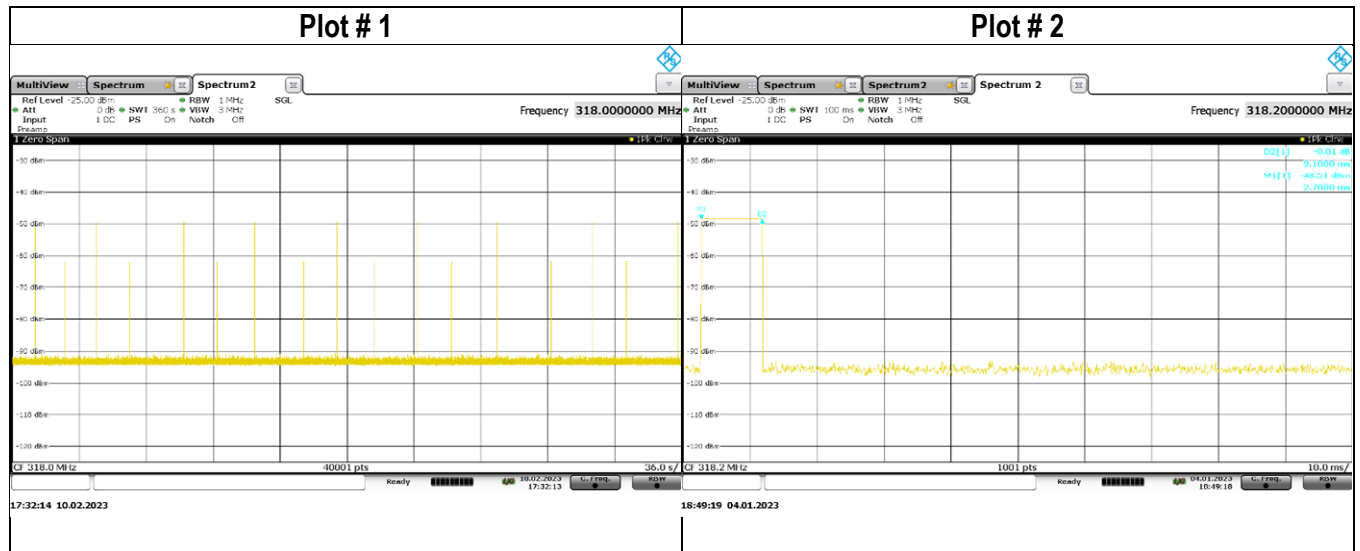
Duty cycle = 9.1 ms / 100 ms = 9.1%

Duty cycle correction factor = $20 \cdot \log(0.091)$ = -20.82 dB

According to ANSI, a correction factor of 20dB is the maximum allowed (peak limit to avg limit).

20dB duty cycle correction is applied on Fundamental Field Strength in section 8.1.4.

8.4.4 Measurement Plots:



9 Test setup photos

Setup photos are included in supporting file name: "EMC_BIINC_020_22001_FCC_15_231_Setup_Photos"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 YEARS	10/30/2020
BILOG ANTENNA	A.H. SYSTEMS	BiLA2G	569	3 YEARS	11/16/2021
HORN ANTENNA	EMCO	3115	00035111	3 YEARS	9/28/2021
HORN ANTENNA	ETS LINDGREN	3117-PA	00169547	3 YEARS	9/1/2020
ESW.EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101715	3 YEARS	9/14/2021
THERMOMETER HUMIDITY MONITOR	CONTROL COMPANY	36934-164	191872028	3 YEARS	10/20/2021

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.

Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

11 History

Date	Report Name	Changes to report	Report prepared by
2023-02-13	EMC_BIINC_020_22001_FCC_15_231	Initial Version	Cheng Song
2023-04-06	EMC_BIINC_020_22001_FCC_15_231_Rev1	Updated Duty Cycle calculation	Cheng Song
2023-04-07	EMC_BIINC_020_22001_FCC_15_231_Rev2	Updated section 8.1.1, removed DTS Updated section 8.1.4, Fundamental Field Strength after duty cycle correction Updated section 8.3.5, Plot # 2 Updated section 8.4.3, Applied 20 dB as duty cycle correction factor	Cheng Song
2023-05-11	EMC_BIINC_020_22001_FCC_15_231_Rev3	Updated section 8.3.1, Distance conversion factor above 30MHz	Cheng Song