FCC PART 15.225
ISEDC RSS-210, ISSUE 10, DECEMBER 2019

TEST REPORT

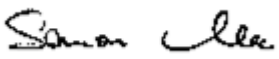
For

ChargePoint, Inc.

253 E. Hacienda Ave.,
Campbell, CA 95008, USA

FCC ID: W38-UICFGP
IC: 8854A-UICFGP

Report Type:	**Product Type:**
Class II Permissive Change	Contactless Smart Card Reader

Prepared By:	Christian McCaig RF Lead Engineer	
Report Number:	R2203072	
Report Date:	2022-06-23	
Reviewed By:	Simon Ma RF Supervisor	

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732-9164

ACCREDITED
CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2203072	Permissive change report	2022-06-23

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test report was prepared on behalf of *ChargePoint, Inc.*, and their product: UICFGP, FCC ID: W38-UICFGP, IC: 8854A-UICFGP, the "EUT" as referred to in this report. The EUT is a Contactless Smart Card Reader. The EUT was installed in host device model number: CPNK-F.

1.2 Objective

This report was prepared on behalf of *ChargePoint, Inc.* in accordance with FCC CFR47 §15.225 and ISEDC RSS-210, ISSUE 10, DECEMBER 2019.

The objective is to determine compliance with FCC Part 15.225 and ISEDC RSS-210 for Radiated Spurious Emissions testing for radio co-location configuration in host device.

This project is a Permissive Change II submission for the purpose of placing the module in new host (CPNK-F), and enabling colocation with LTE (FCC ID: W38-201903EG25G, IC: 8854A-201903EG25G) and Wi-Fi/BT (FCC ID: W38-60SIPT, IC: 8854A-602230C).

1.3 Related Submittal(s)/Grant(s)

N/A

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, 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.

1.5 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 ° C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2017 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2017 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report.

BACL's ISO/IEC 17025:2017 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
    1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
    2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
    3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
    1- All Scope 1-Licence-Exempt Radio Frequency Devices;
    2- All Scope 2-Licensed Personal Mobile Radio Services;
    3- All Scope 3-Licensed General Mobile & Fixed Radio Services;
    4- All Scope 4-Licensed Maritime & Aviation Radio Services;
    5- All Scope 5-Licensed Fixed Microwave Radio Services
    6- All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
    1- All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2

2- All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:
  1- All Radio Equipment, per KHCA 10XX-series Specifications;
  2- All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  3- All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  1- MIC Telecommunication Business Law (Terminal Equipment):
  - All Scope A1 - Terminal Equipment for the Purpose of Calls;
  - All Scope A2 - Other Terminal Equipment
  2- Radio Law (Radio Equipment):
  - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
  - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
  - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;

  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
  - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

2.2 EUT Exercise Software

The Host was configured to transmit through command lines provided by customer.

Please refer to the following power setting table.

Radio	Frequency	Modulation	Power Setting
5 GHz Wi-Fi	5230 MHz	802.11ac40	17
2.4 GHz Wi-Fi	2437 MHz	802.11g	19
RFID	902.75 MHz	-	Default
BT	2402 MHz	DH1	Default
Cellular Modem	1900 MHz	WCDMA Band II	Default

2.3 Equipment Modification

None.

2.4 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E6410

2.5 Remote Support Equipment

Manufacturer	Description	Model
Landworks	48V Lithium-Ion Batteru	BL482

2.6 Interface Ports and Cabling

Cable Description	Length (m)	To	From
Ethernet Cable	< 1 m	EUT	Laptop
Power Cables	< 1 m	EUT	Battery

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirements	Compliant
FCC §2.1091 ISED RSS-102	RF Exposure	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	N/A[1]
FCC §2.1053, §15.205, §15.209, ISEDC RSS-210 §8.9, §8.10	Radiated Spurious Emissions	Compliant

Note[1]: Device is powered by DC power supply.

4 FCC §15.203 & ISEDC RSS-Gen §6.8 - Antenna Requirements

4.1 Applicable Standards

According to FCC §15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According to ISEDC RSS-Gen §6.8: Transmitter Antenna

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For license-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

4.2 Antenna Description

Antenna Usage	Manufacturer, Model Number	Frequency Range (MHz)	Maximum Antenna Gain (dBi)	Antenna Type
2.4GHz Wi-Fi, BT Classic and BLE	-	2400-2483.5	1.25	Chip
5 GHz Wi-Fi	-	5150-5850	2.17	Chip
Cell Modem	Taoglas, PCS.68.A	617-960	-1	PCB Trace
		1710-2200	3.8	
		2490-2690	4	
RFID	Uniform Industrial Corp., UIC680FG-ANT_B REV4b	13.56	N/A	Loop

5 FCC §2.1091, §1.1310(d) (3) & ISEDC RSS-102 - RF Exposure

5.1 Applicable Standards

As per FCC §1.1310(d) (3), At operating frequencies above 6 GHz, the MPE limits listed in Table 1 in paragraph (e)(1) of this section shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part.

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	$*(900/f^2)$	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	$*(180/f^2)$	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

According to ISED RSS-102 Issue 5 §2.5.2, Exemption Limits for Routine Evaluation- RF Exposure Evaluation,

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MH and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

5.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

5.3 MPE Results for the FCC

RFID Standalone

Maximum Peak E.I.R.P. (dBm):	-19.27
Maximum Peak E.I.R.P. (mW):	0.012
Prediction distance (cm):	20
Prediction frequency (MHz):	13.56
Power density of prediction frequency at 20 cm (mW/cm^2):	0.0000024
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.979

According to the original RFID test report 2109FR29, issued by A Test Lab Techno Corp. On 09-30-2021, the highest field strength of the RFID radio was 95.01 dBuV/m measured at 1m.

75.93 dBuV/m @ 3m = 95.01 dBuV/m @ 1m - 40log(3m/1m),

e.i.r.p. = 75.93 dBuV/m @ 3m -95.2 dB = -19.27 dBm

The device is compliant with the FCC requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0000024 mW/cm^2. Limit is 0.979 mW/cm^2.

Wi-Fi/BT Standalone

Wi-Fi/BT Module FCC ID: W38-60SIPT, IC: 8854A-602230C

Worst Case: 802.11g, 2437 MHz

Maximum output power at antenna input terminal (dBm):	18.10
Maximum output power at antenna input terminal (mW):	64.57
Prediction distance (cm):	20
Prediction frequency (MHz):	2437
Maximum Directional Antenna Gain, typical (dBi):	1.25
Maximum Antenna Gain (numeric):	1.33
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0171
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement FCC MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0171 mW/cm^2. Limit is 1.0 mW/cm^2.

Worst Case: Bluetooth DH1, 2402 MHz

Maximum output power at antenna input terminal (dBm):	10.79
Maximum output power at antenna input terminal (mW):	11.99
Prediction distance (cm):	20
Prediction frequency (MHz):	2402
Maximum Directional Antenna Gain, typical (dBi):	1.25
Maximum Antenna Gain (numeric):	1.33
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0032
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement FCC MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0032 mW/cm^2. Limit is 1.0 mW/cm^2.

5 GHz Wi-Fi: 802.11n/ac40 mode, 5240 MHz

Maximum output power at antenna input terminal (dBm):	21.60
Maximum output power at antenna input terminal (mW):	144.54
Prediction distance (cm):	20
Prediction frequency (MHz):	5240
Maximum Antenna Gain, typical (dBi):	5.17
Maximum Antenna Gain (numeric):	3.29
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0946
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement FCC MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0946 mW/cm^2. Limit is 1.0 mW/cm^2.

Cellular Standalone

Cellular Module FCC ID: W38-201903EG25G, IC: 8854A-201903EG25G

Operating Band	Frequency (MHz)	Antenna Gain	Max. Conducted Average Output Power (dBm)	Power Density @ 20 cm (mW/cm^2)	Limit (mW/cm^2)	Ratio (%)
GSM850	824.2	-1	25.81	0.060	0.5495	10.96
GSM1900	1850.2	3.8	22.81	0.091	1	9.11
WCDMA Band II	1852.4	3.8	25	0.151	1	15.09
WCDMA Band IV	1712.4	3.8	25	0.151	1	15.09
WCDMA Band V	826.4	-1	25	0.050	0.5509	9.07
LTE B2	1850.7	3.8	25	0.151	1	15.09
LTE B4	1710.7	3.8	25	0.151	1	15.09
LTE B5	824.7	-1	25	0.050	0.5498	9.09
LTE B7	2502.5	4	25	0.158	1	15.80
LTE B12	699.7	-1	25	0.050	0.4665	10.71
LTE B13	779.5	-1	25	0.050	0.5197	9.62
LTE B25	1850.7	3.8	25	0.151	1	15.09
LTE B26 (814-824)	814.7	-1	25	0.050	0.5431	9.20
LTE B26 (824-849)	824.7	-1	25	0.050	0.5498	9.09
LTE B38	2572.5	4	25	0.158	1	15.80
LTE B41	2498.5	4	25	0.158	1	15.80

Worst Case Co-location MPE Calculation: RFID, Wi-Fi/BT, and Cell Modem

Radio	Max e.i.r.p. (dBm)	Evaluated Distance (cm)	Worst-Case Exposure Level	Limit	Worst-Case Ratios	Sum of Ratios	Limit
Worst Case							
Wi-Fi/BT	26.77	20	0.0946 mW/cm^2	1.0 mW/cm^2	9.46%	25.26%	100%
Cell Modem	29.00	20	0.158 mW/cm^2	1.0 mW/cm^2	15.80%		
NFC	-19.27	20	0.0000024 mW/cm^2	0.979 mW/cm^2	0.00025%		

5.4 RF Exposure Evaluation Exemption for IC

Maximum NFC e.i.r.p. = -19.27 dBm (0.012 mW), which is less than the exemption threshold, i.e., 1 W. Therefore, the RF exposure evaluation is exempt for NFC.

According to the original RFID test report 2109FR29, issued by A Test Lab Techno Corp. On 09-30-2021, the highest field strength of the RFID radio was 95.01 dBuV/m measured at 1m.

75.93 dBuV/m @ 3m = 95.01 dBuV/m @ 1m - 40log(3m/1m),

e.i.r.p. = 75.93 dBuV/m @ 3m -95.2 dB = -19.27 dBm

6 FCC §15.209 & RSS-Gen §8.9, §8.10- Spurious Radiated Emissions

6.1 Applicable Standard

As Per FCC §15.205(a) except as show 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	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.209: The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 Note 1	3
88 - 216	150 Note 1	3
216 - 960	200 Note 1	3
Above 960	500	3

Note 1: 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., Sections 15.231 and 15.241.

As per ISED RSS-Gen 8.9,

> Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for license-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

As per ISEDC RSS-Gen §8.10,

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

a. The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, *Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD)*.
b. Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.
c. Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7 – Restricted frequency bands[Note 1]		
MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

6.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 3MHz / Sweep = 100ms
(2) Average: RBW = 1MHz / VBW = 10Hz or 1/T / Sweep = Auto

6.4 Corrected Amplitude and Margin Calculation

For emissions below 1 GHz,

The Corrected Amplitude (CA) is calculated by adding the Correction Factor to the S.A. Reading. The basic equation is as follows:

CA = S.A. Reading + Correction Factor

For example, a corrected amplitude of 40.3 dBuV/m = S.A. Reading (32.5 dBuV) + Correction Factor (7.8 dB/m)

The Correction Factor is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) together. This calculation is done in the measurement software, and reported in the test result section. The basic equation is as follows:

Correction Factor = AF + CL + Atten – Ga

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

For emission above 1 GHz,

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

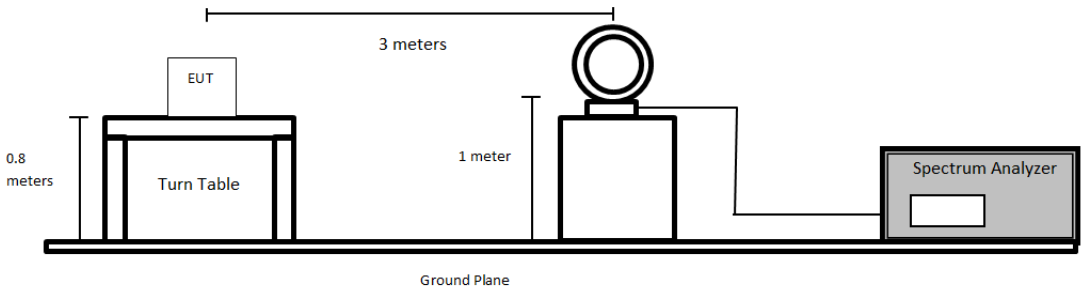
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

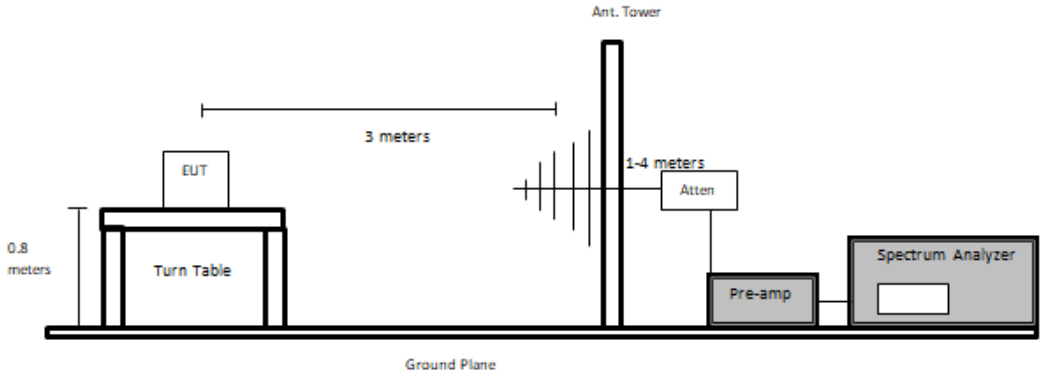
Margin = Corrected Amplitude – Limit

6.5 Test Setup Block Diagram

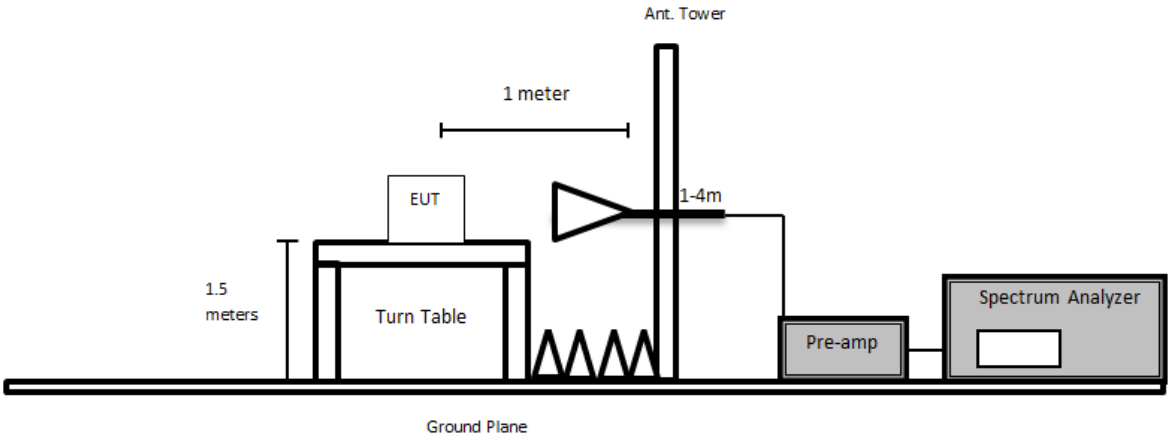
9 kHz to 30 MHz:



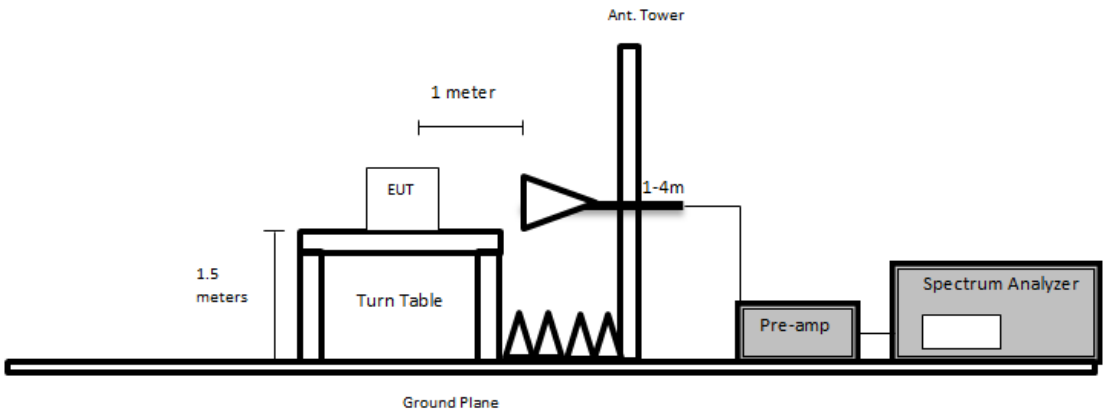
Below 1GHz:



1 GHz to 18 GHz (Asset #1192 Antenna used):



18 GHz to 40 GHz (Asset #91 and #92 Antennas used):



6.6 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
124	Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	10 0044	2021-05-14	2 years
287	Agilent	Spectrum Analyzer	E4446A	US44300386	2021-04-27	13 months
-	Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
658	HP/Agilent	Preamplifier	8449B OPT HO2	3008A0113	2021-05-06	1 year
459	HP	Preamplifier	8447D	2443A04374	2021-11-02	1 year
827	AH Systems	Preamplifier	PAM 1840 VH	170	2021-08-03	1 year
321	Sunol Sciences Corp	Biconilog Antenna	JB3	A020106-2	2021-11-22	2 years
1192	ETS Lindgren	Horn Antenna	3117	00218973	2021-09-14	2 years
91	Wisewave	Horn Antenna	ARH-4223-02	10555-02	2022-03-08	2 years
92	Wisewave	Horn Antenna	ARH-2823-02	10555-01	2022-03-17	2 years
458	ETS-Lindgren	Loop Antenna	6511	128222	2021-09-14	2 years
1228	Pasternack	Coaxial Cable, RG213	PE3496-800CM	2111301	2021-11-30	1 year
1077	Insulted Wire Corp	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960-KPS	DC 1917	2022-03-03	1 year
-	-	RF cable	-	-	Each time[1]	N/A
-	-	Notch filters	-	-	Each time[1]	N/A
714	Keysight Technologies	RF Limiter	11867A	MY42242932	2022-04-01	1 year
-	Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: cable and notch filters included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

6.7 Test Environmental Conditions

Temperature:	20-22 ºC
Relative Humidity:	42-50 %
ATM Pressure:	102.7 kPa

The testing was performed by Christian McCaig and Deepak Mishra from 2022-05-02 to 2022-05-06 in 5m chamber 3.

6.8 Summary of Test Results

According to the data hereinafter, the EUT complied with standards' radiated emissions limits, and had the worst margin of:

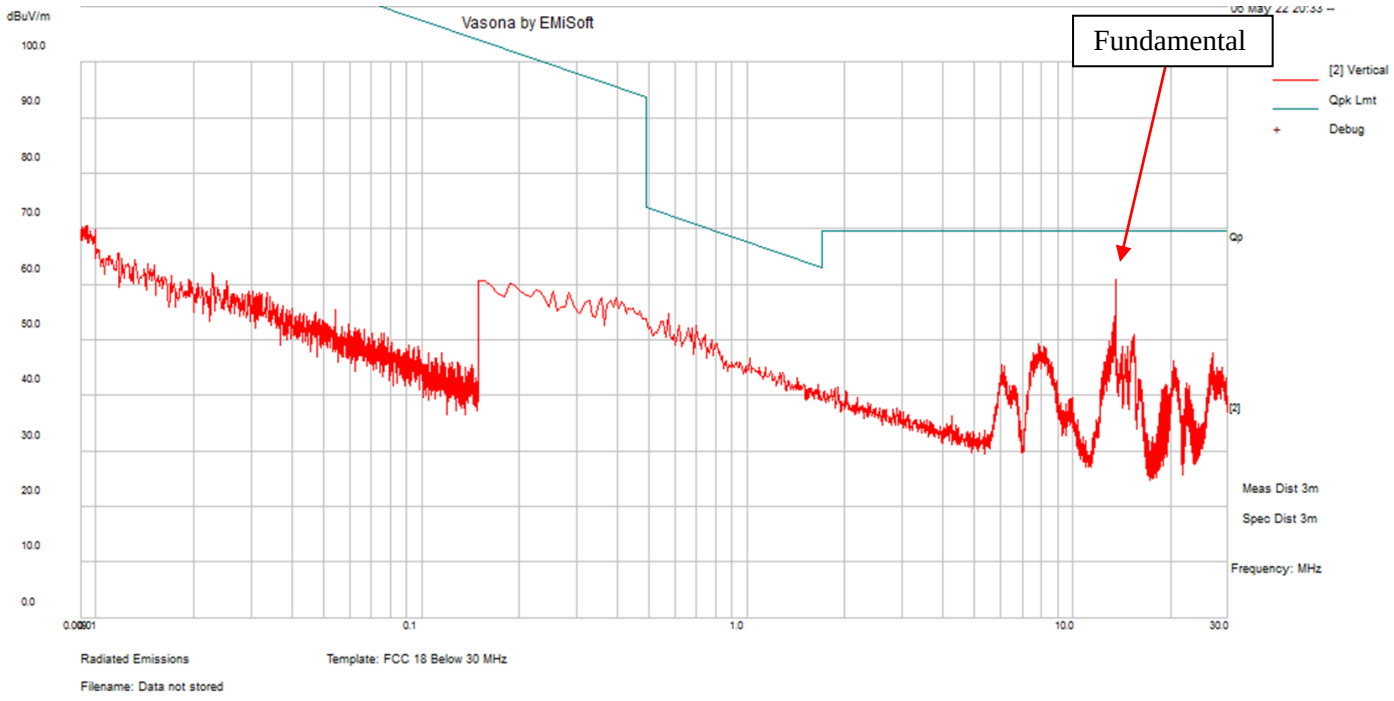
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-2.71	39662.505	Vertical	5GHz Wi-Fi + Cellular Modem + RFID

6.9 Radiated Emissions Test Result Data

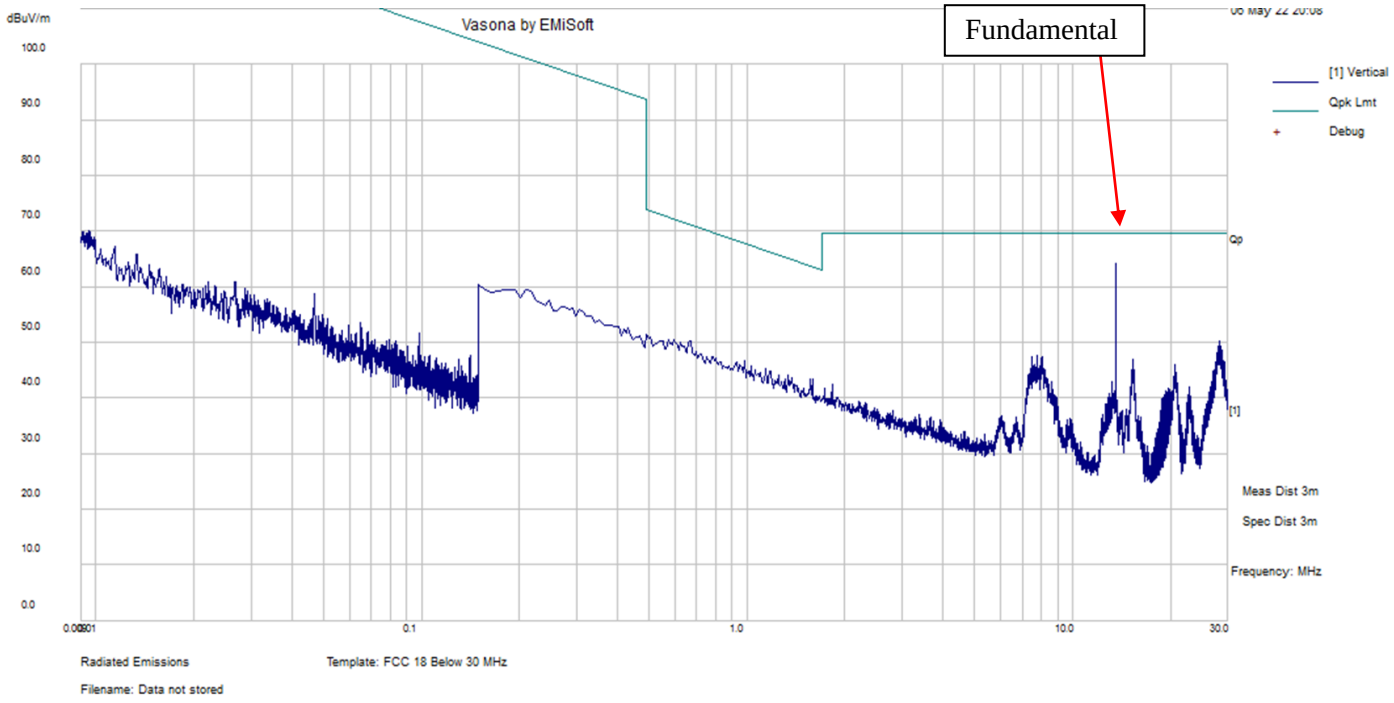
1) Below 30 MHz Radiated Field Strength at 3 meters

Worst Case: BT + Cellular Modem (WCDMA Band II) + RFID

Perpendicular

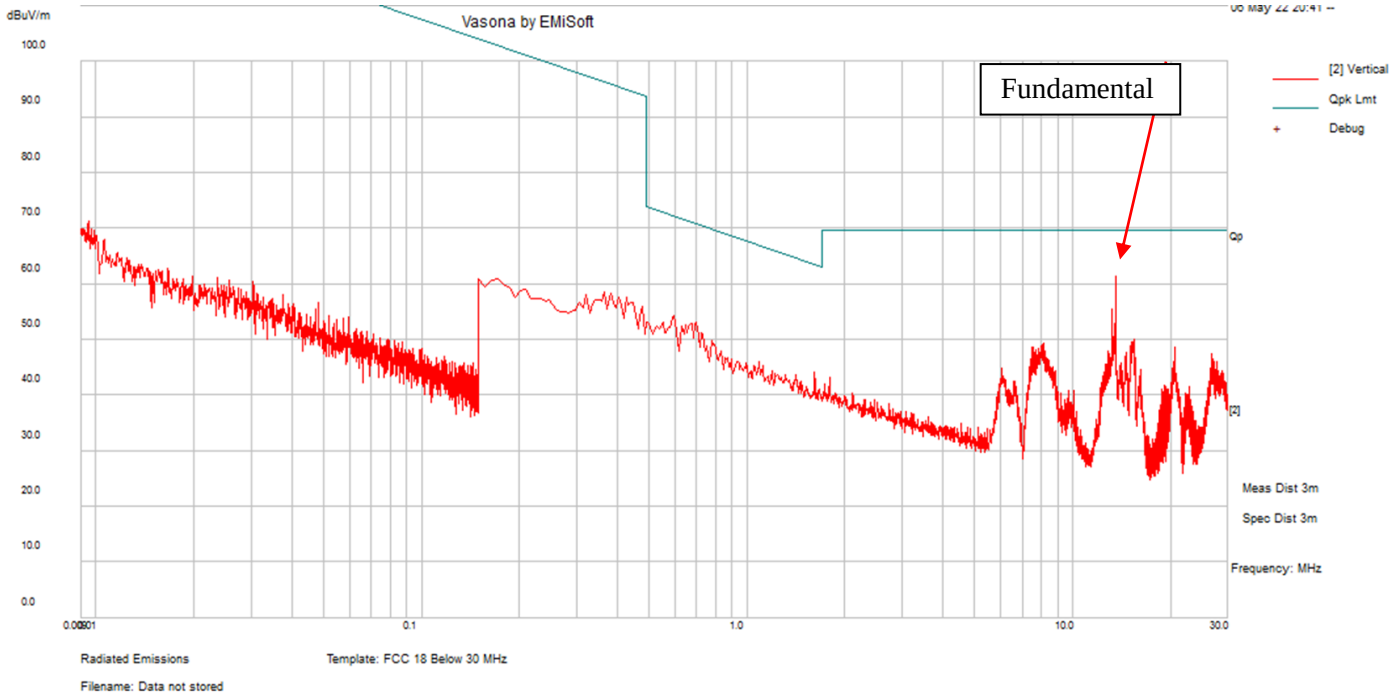


Parallel

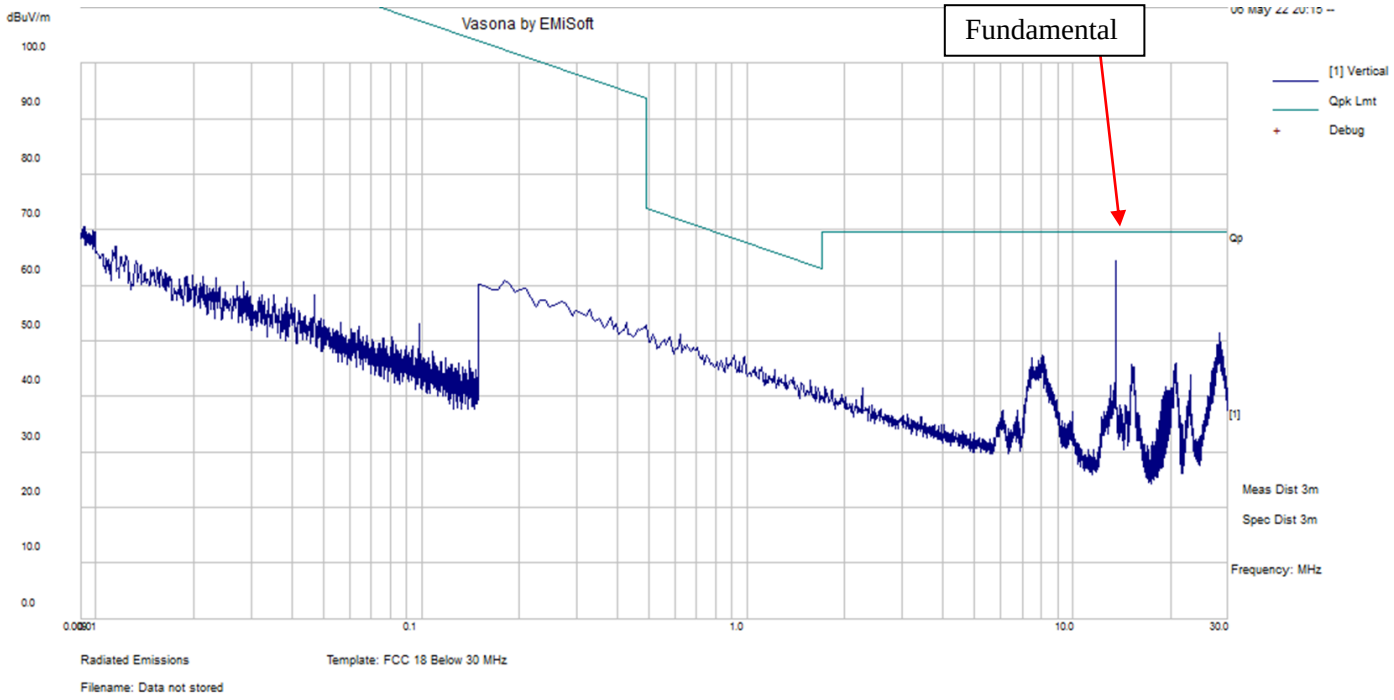

Fundamental
Vasona by EMiSoft
dBuV/m
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.1
1.0
10.0
30.0
[1] Vertical
Qpk Lmt
Debug
Qp
[1]
Meas Dist 3m
Spec Dist 3m
Frequency: MHz
Radiated Emissions
Template: FCC 18 Below 30 MHz
Filename: Data not stored

Worst Case: 2.4 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID

Perpendicular

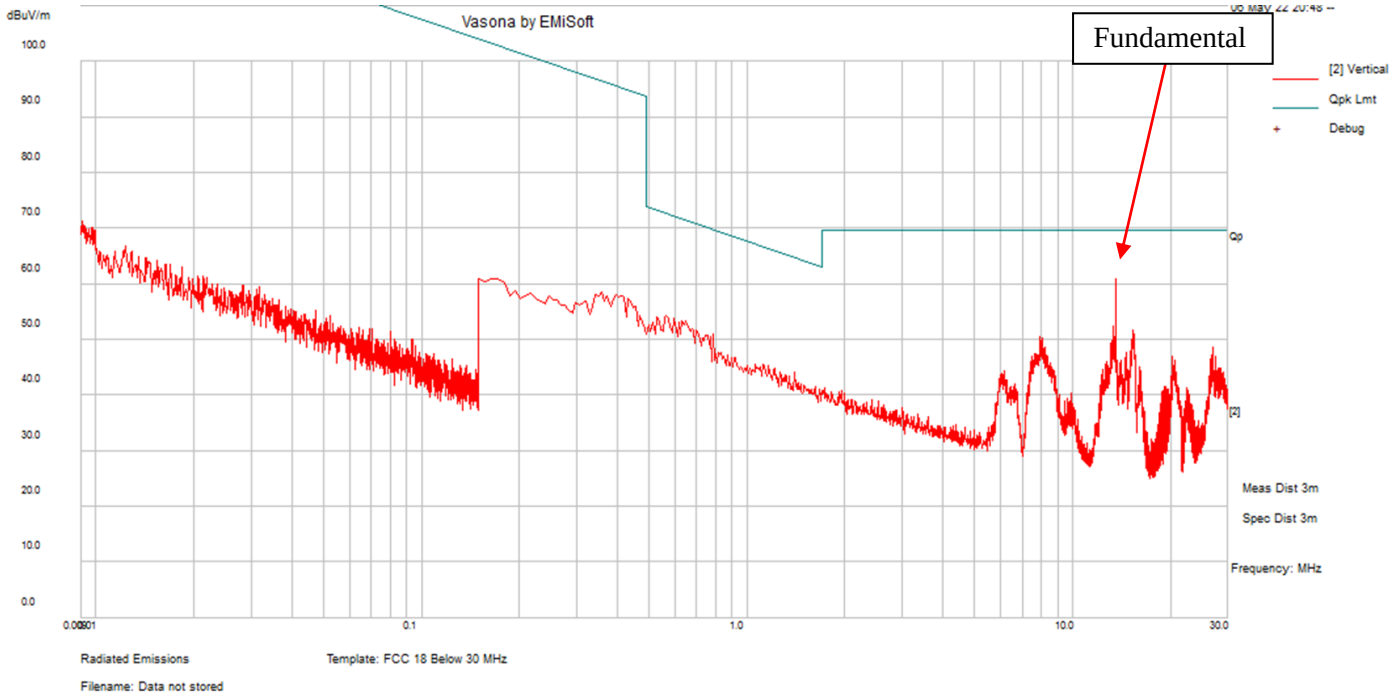


Parallel

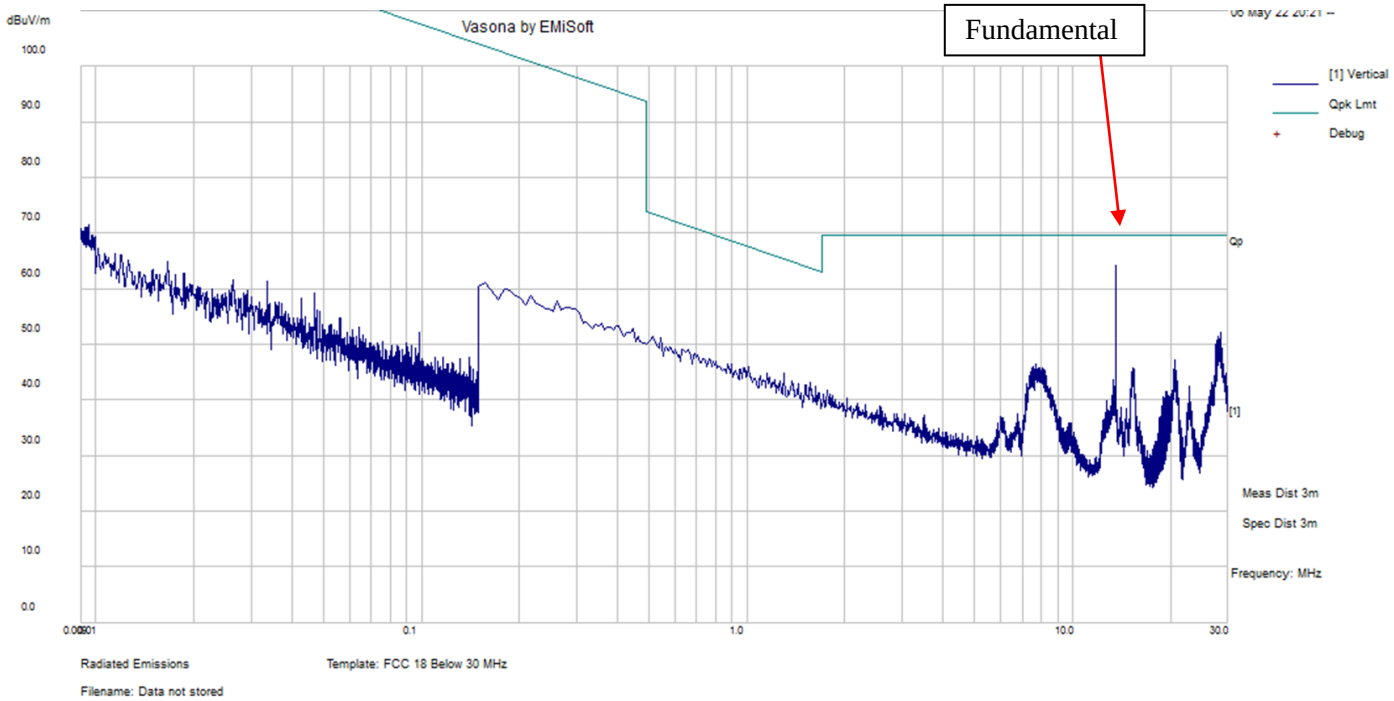


Worst Case: 5 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID

Perpendicular

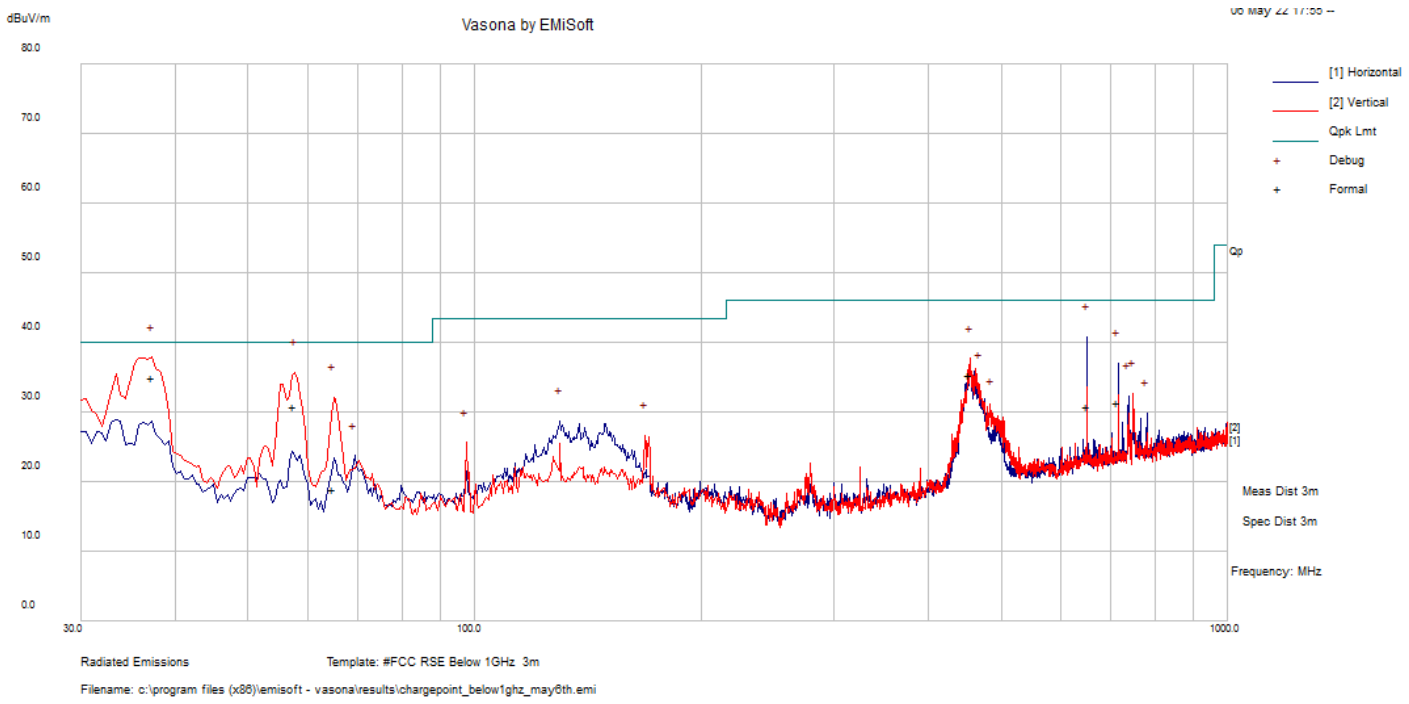


Parallel



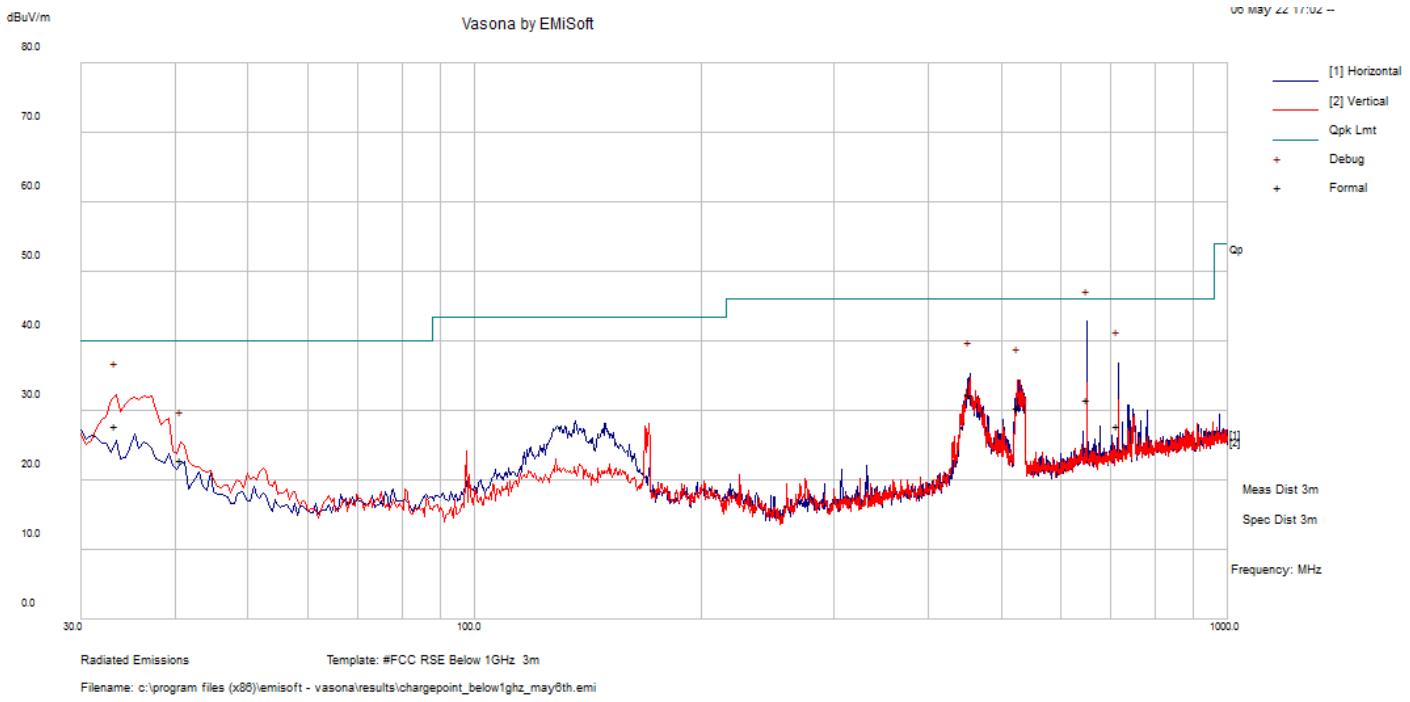
2) 30 MHz – 1 GHz at 3 meters

Worst Case: BT + Cellular Modem (WCDMA Band II) + RFID



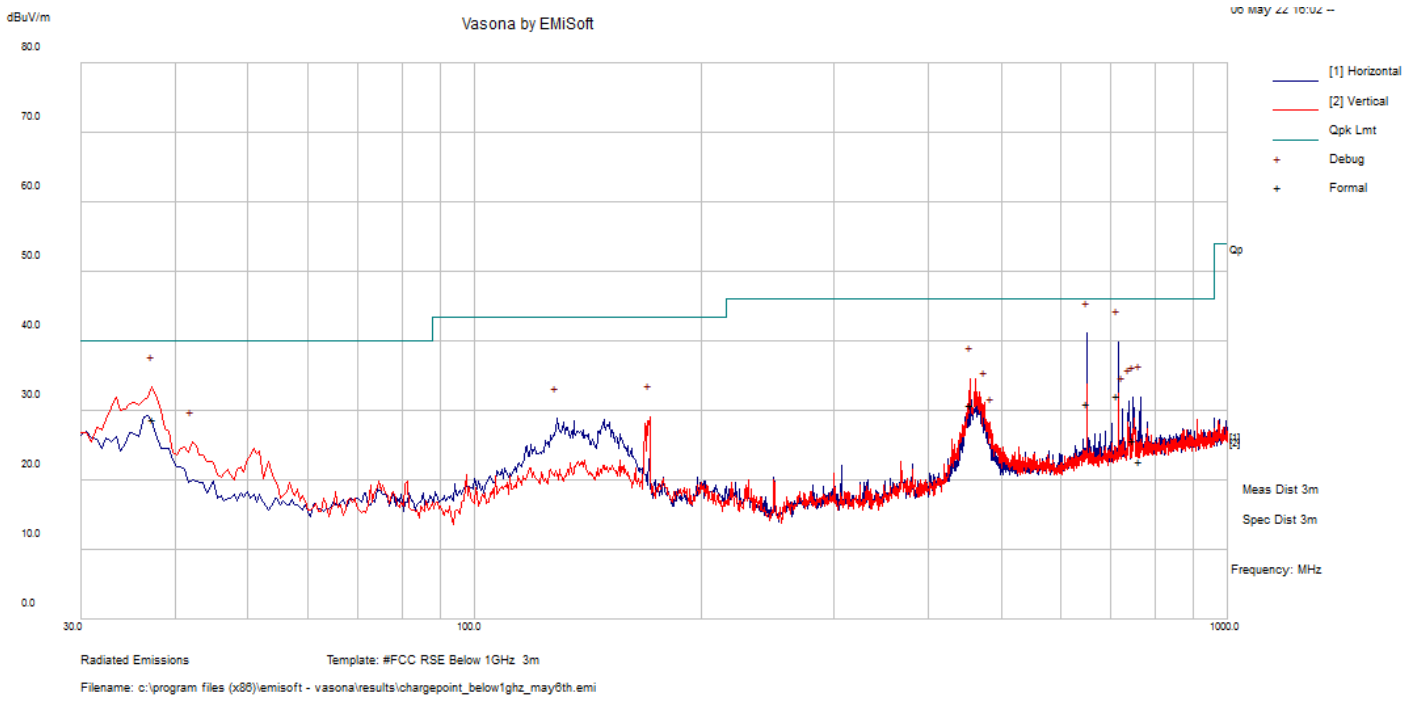
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
37.331	38.68	-3.67	35.01	266	V	334	40	-4.99	Pass
57.534	42.72	-11.92	30.8	156	V	7	40	-9.2	Pass
650.0745	28.95	1.82	30.77	109	H	213	46	-15.23	Pass
65.0075	30.22	-11.26	18.96	243	V	140	40	-21.04	Pass
454.64425	37.13	-1.7	35.43	126	V	275	46	-10.57	Pass
715.057	29.01	2.41	31.42	105	H	206	46	-14.58	Pass

Worst Case: 2.4 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
650.065	29.7	1.83	31.53	121	H	214	46	-14.47	Pass
33.29875	28.5	-0.61	27.89	216	V	148	40	-12.11	Pass
715.0585	25.47	2.41	27.88	126	H	160	46	-18.12	Pass
454.31075	34.03	-1.7	32.33	199	H	231	46	-13.67	Pass
525.59625	31	-0.58	30.42	193	V	78	46	-15.58	Pass
40.67275	29.19	-6.26	22.93	114	V	83	40	-17.07	Pass

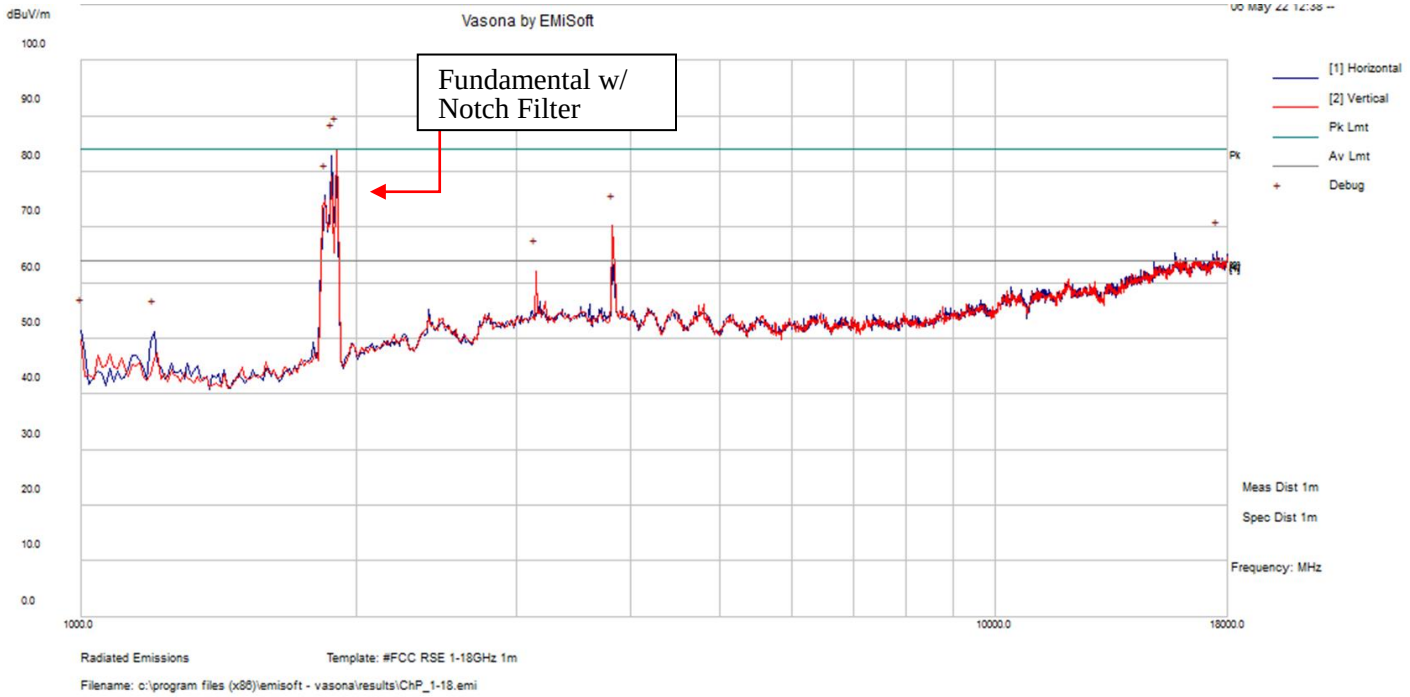
Worst Case: 5 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
650.06775	29.18	1.82	31	101	H	197	46	-15	Pass
715.05875	29.82	2.41	32.23	109	H	142	46	-13.77	Pass
37.439	32.44	-3.74	28.7	209	V	103	40	-11.3	Pass
454.97325	32.45	-1.7	30.75	113	V	261	46	-15.25	Pass
764.6795	19.67	3.05	22.72	145	H	330	46	-23.28	Pass
748.61175	23	2.74	25.74	106	H	26	46	-20.26	Pass

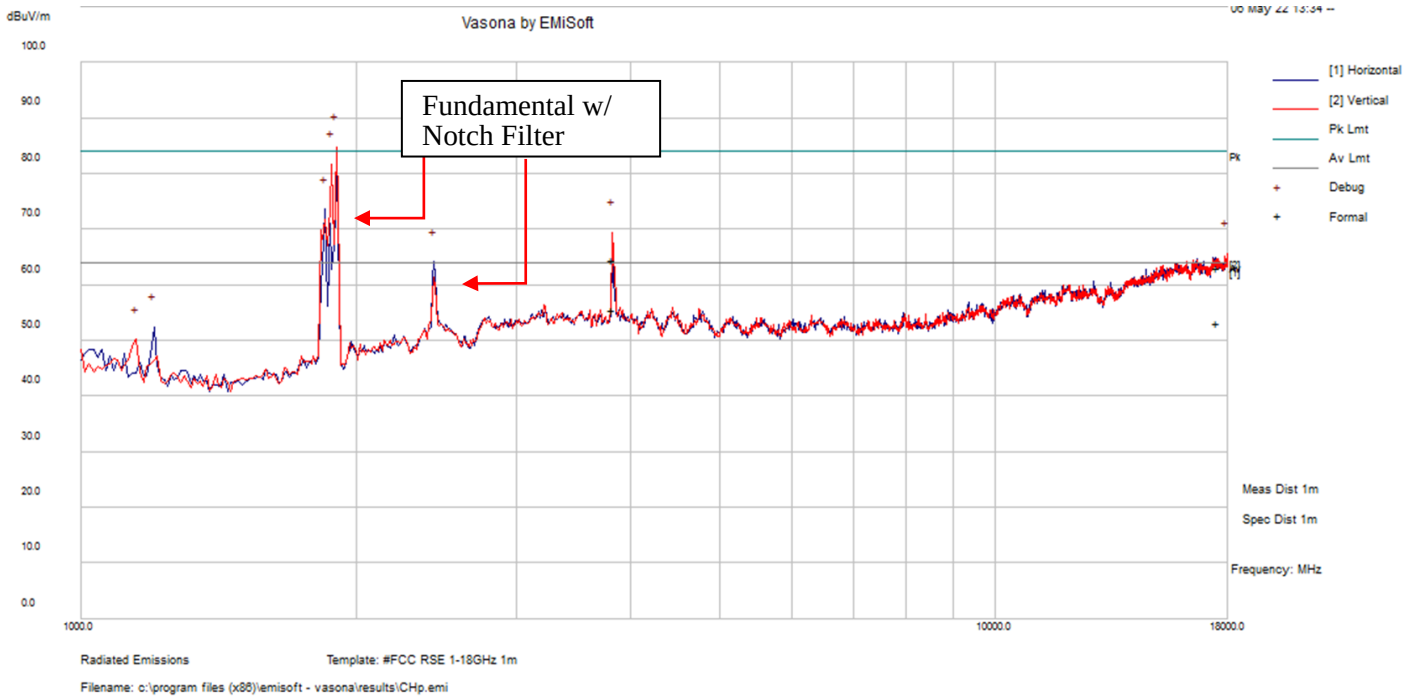
3) 1 to 18 GHz Vasona scan at 1 meter

Worst Case: BT + Cellular Modem (WCDMA Band II) + RFID



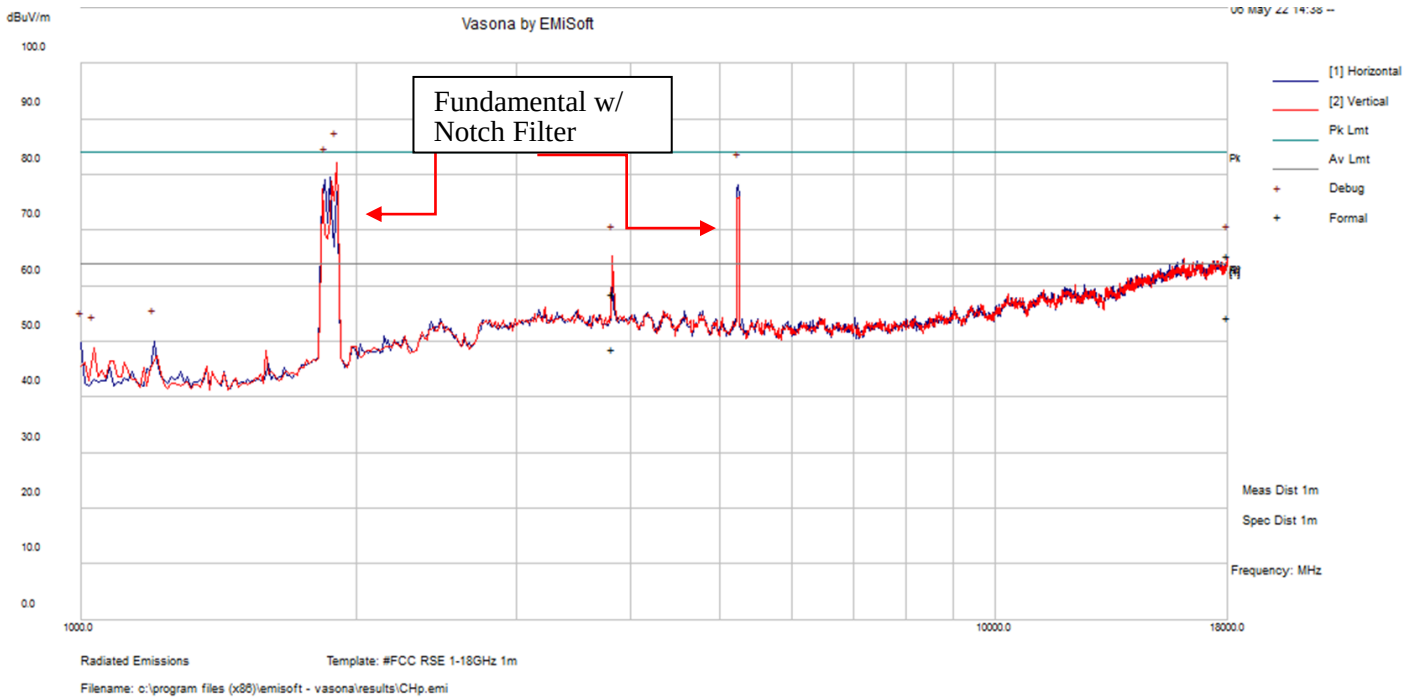
Frequency (MHz)	S.A. Reading (dBµV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
3817.1125	56.54	7.99	64.53	192	V	39	84	-19.47	Peak
17509.7	44.78	18.39	63.17	154	H	52	84	-20.83	Peak
3817.1125	47.44	7.99	55.43	192	V	39	64	-8.57	Average
17509.7	34.71	18.39	53.1	154	H	52	64	-10.9	Average

Worst Case: 2.4 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID



Frequency (MHz)	S.A. Reading (dBµV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
3816.5075	55.67	7.99	63.66	196	V	40	84	-20.34	Peak
17945.768	45.89	19.18	65.07	124	V	23	84	-18.93	Peak
3816.5075	46.8	7.98	54.78	196	V	40	64	-9.22	Average
17945.768	35.57	19.17	54.74	124	V	23	64	-9.26	Average

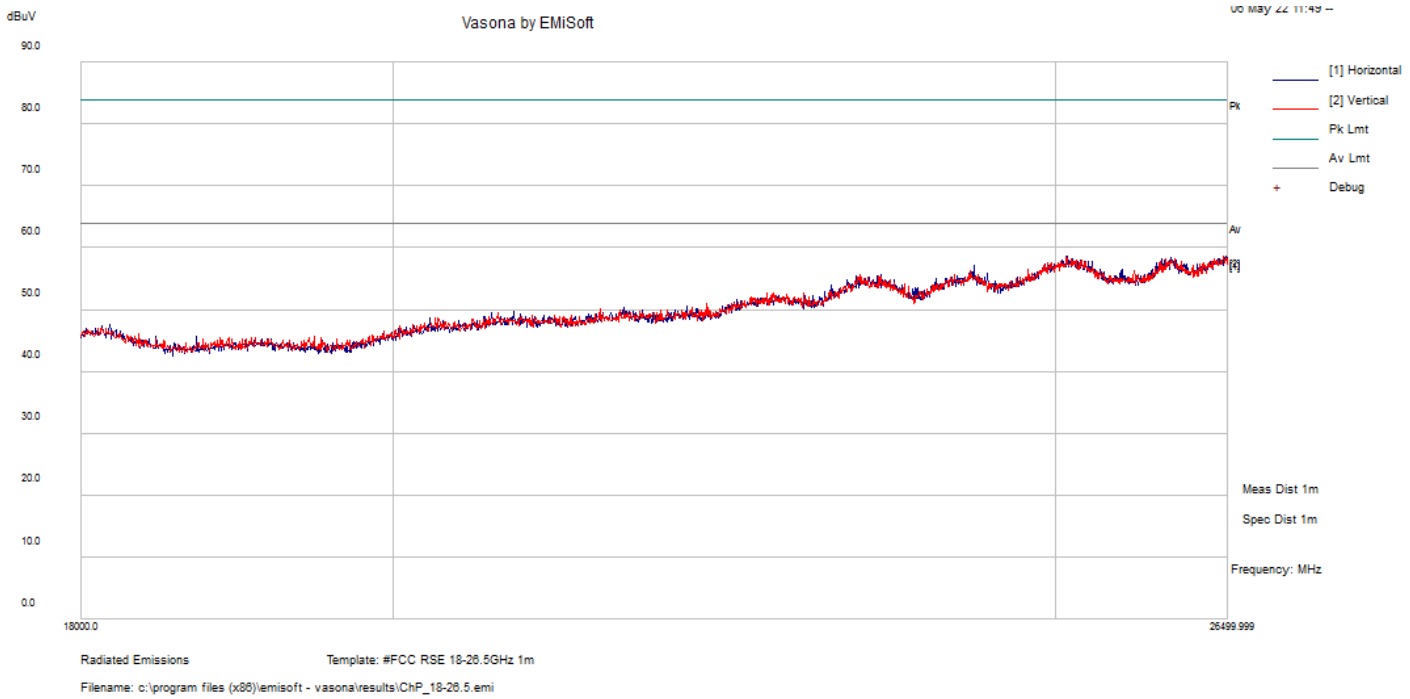
Worst Case: 5 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID



Frequency (MHz)	S.A. Reading (dBµV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
3816.8275	50.68	7.99	58.67	192	V	42	84	-25.33	Peak
17979.41	46.51	18.92	65.43	117	V	124	84	-18.57	Peak
3816.8275	40.76	7.98	48.74	192	V	42	64	-15.26	Average
17979.41	35.52	18.92	54.44	117	V	124	64	-9.56	Average

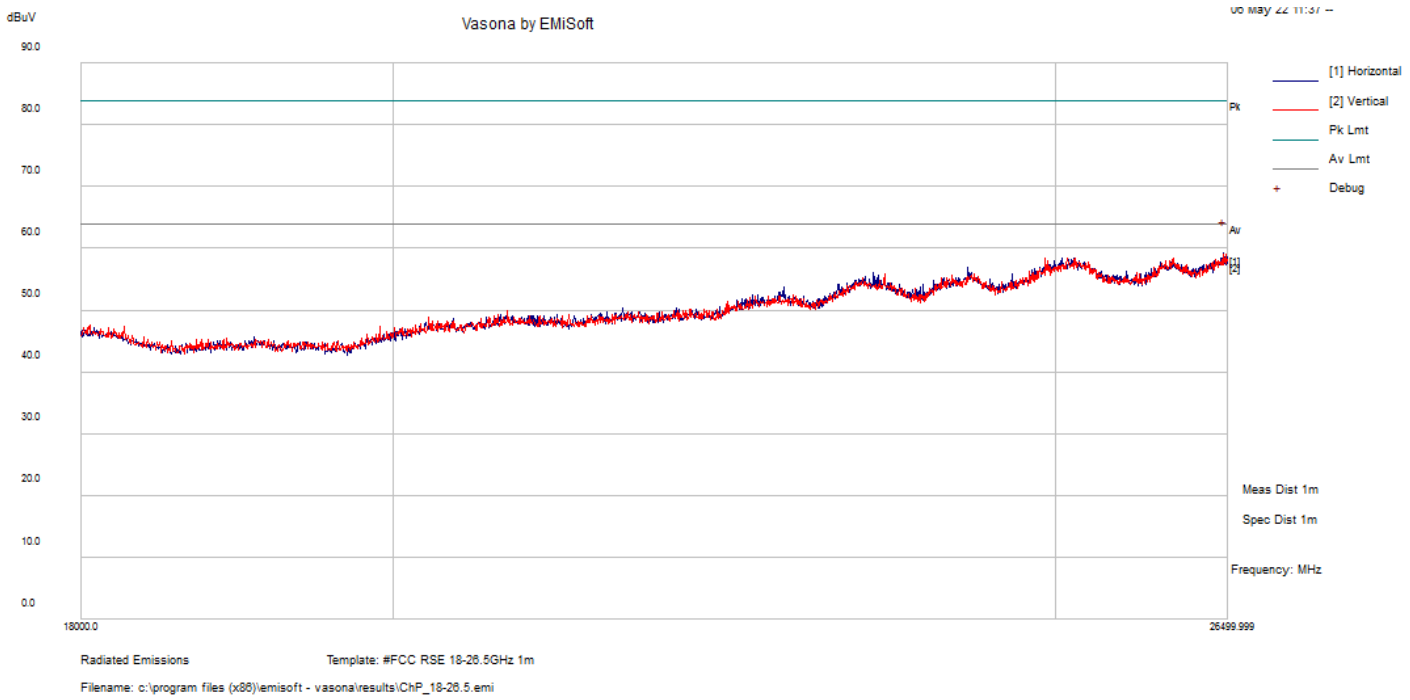
4) 18 – 26.5 GHz Worst Case Scan at 1 Meter

Worst Case: BT + Cellular Modem (WCDMA Band II) + RFID



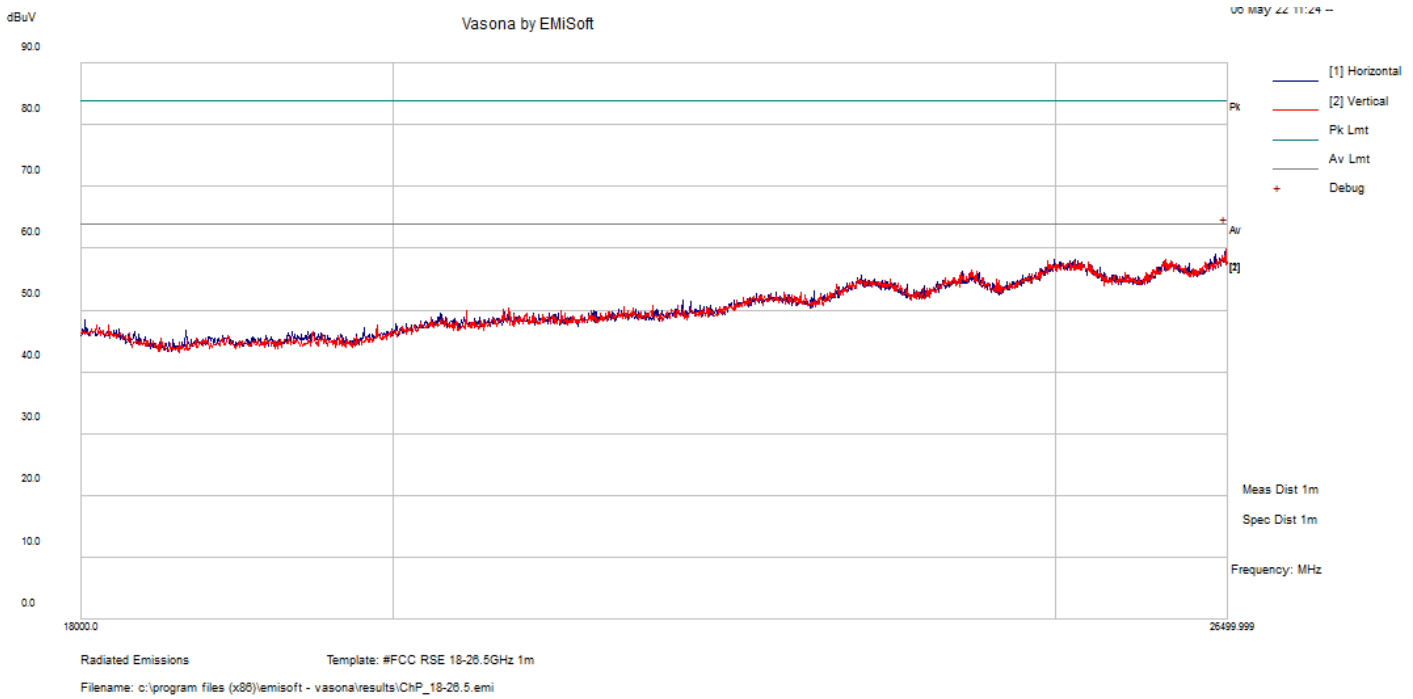
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
26462.812	36.27	23.07	59.34	300	V	0	64	-4.66	Ave

Worst Case: 2.4GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
26462.812	36.27	23.07	59.34	300	V	0	64	-4.66	Ave

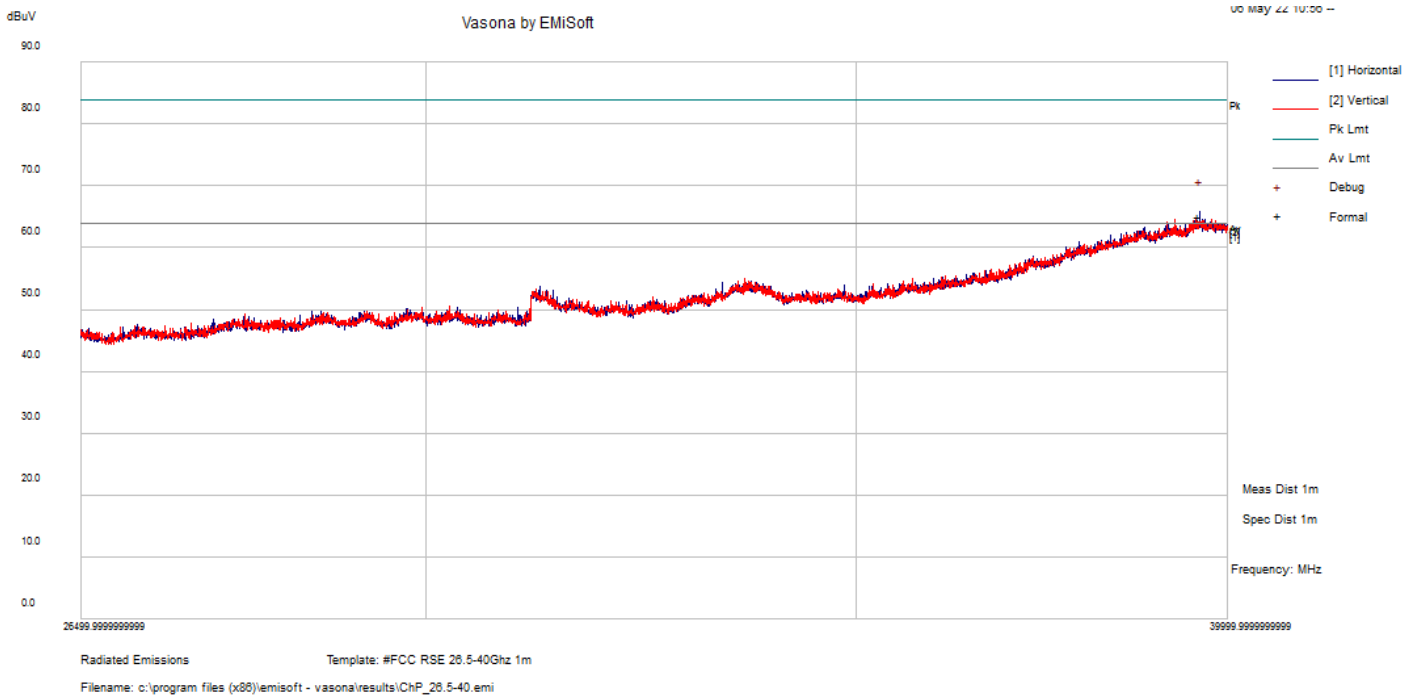
Worst Case: 5 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
26478.749	36.63	23.19	59.82	100	V	0	64	-4.18	Ave

5) 26.5 – 40 GHz Worst Case Scan at 1 Meter

Worst Case: 5 GHz Wi-Fi + Cellular Modem (WCDMA Band II) + RFID



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
39662.505	57.13	15.61	72.74	175	V	306	84	-11.26	Peak
39662.505	45.68	15.61	61.29	175	V	306	64	-2.71	Ave

7 Annex A – EUT Test Setup Photographs

Please refer to the attachment.

8 Annex B – EUT Host External Photographs

Please refer to the attachment.

9 Annex C – EUT Host Internal Photographs

Please refer to the attachment.

10 Annex D (Normative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

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 laboratory also meets A2LA *R222 - Specific Requirements EPA ENERGY STAR Accreditation Program*. 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 10th day of March 2021.

Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2022

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

Please follow the web link below for a full ISO 17025 scope

https://www.a2la.org/scopepdf/3297-02.pdf

--- END OF REPORT ---