




FCC ISED RF Test Report

Test Report Number	PLI-21033041-LC-FCC-IC-RF-Cellular
FCC ID ISED ID	U6YRDAA8190 216P-RDAA8190
Applicant	Panasonic Avionics Corporation
Applicant Address	26200 Enterprise Way, Lake Forest, CA 92630
Product Name	Enhanced Cell Modem
Model (s)	RD-AA8190-01
Date of Receipt	02/25/2021
Date of Test	04/05/2021-04/23/2021
Report Issue Date	04/23/2021
Test Standards	47CFR Part 22 47CFR Part 24 47CFR Part 27 47CFR Part 90 RSS-130 Issue 2: Feb 2019 RSS-132 Issue 3: Jan 2013 RSS-133 Issue 6: Jan 2018 RSS-139 Issue 3: Jul 2015 RSS-195 Issue 2: Apr 2014 RSS-199 Issue 3: Dec 2016
Test Result	PASS
	<p>Issued by:</p> <p>Vista Compliance Laboratories 1261 Puerta Del Sol, San Clemente, CA 92673 USA www.vista-compliance.com</p>
	
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REVISION HISTORY

Report Number	Version	Description	Issued Date
PLI-21033041-LC-FCC-IC-RF-Cellular	01	Initial report	04/23/2021

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1 Test Summary

Test Item	Test Requirement	Test Method	Result
Field Strength of Spurious Radiation	2.1046 22.917 (a), 24.238 (a), 90.691, 27.53 (f), (g), (h), (c)(2) and (5) RSS-130(4.7.1) and (4.7.2) RSS-132 (5.5) RSS-133 (6.5) RSS-139 (6.6) RSS-195 (5.6.2) RSS-199 (4.5) SRSP-510(5.1.2)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01 KDB 412172 D01 Determining ERP and EIRP v01r01	Pass

2 General Information

2.1 Applicant

Applicant	Panasonic
Applicant address	26200 Enterprise Way, Lake Forest, CA 92630
Manufacturer	Panasonic
Manufacturer Address	26200 Enterprise Way, Lake Forest, CA 92630

2.2 Product information

Product Name	Enhanced Cell Modem
Model Number	RD-AA8190-01
Family Models	N/A
Serial Number	CAG 1UL05 (Panasonic Asset No.: 0089717)
Frequency Band	802.11b/g/n:2412MHz-2462MHz 802.11a/n/ac:5180MHz-5240MHz, 5260MHz-5320MHz, 5500MHz-5720MHz, 5745MHz-5825MHz WCDMA B2, B5, B4 LTE B2, B4, B5, B7, B12, B13, B25, B26, B30 and B41
Type of modulation	802.11b: DSSS(DBPSK/DQPSK/ CCK) 802.111a/g/n/ac: OFDM(BPSK/QPSK/16QAM/64QAM/ 256QAM) WCDMA: QPSK LTE CAT-M1: QPSK, 16QAM LTE NB-IOT: BPSK, QPSK
Equipment Class	DTS, PCB
Antenna Information	Wi-Fi antennas: - 3 x External dipole antennas, 3 dBi gain for 2.4GHz, 5 dBi gain for 5GHz Cellular antenna: - 2 x External antenna, 1 dBi gain over supported frequency range
Clock Frequencies	N/A
Input Power	28VDC or 110/220VAC
Power Adapter Manufacturer/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	Cellular module and transmit simultaneously with Wi-Fi
Additional Info	Cellular module integrated: Sierra EM7455 Radio Module Wi-Fi module integrated: Panasonic M120000015

2.3 Test standard and method

Test standard	47CFR Part 22 47CFR Part 24 47CFR Part 27 47CFR Part 90 RSS-130 Issue 2: Feb 2019 RSS-132 Issue 3: Jan 2013 RSS-133 Issue 6: Jan 2018 RSS-139 Issue 3: Jul 2015 RSS-195 Issue 2: Apr 2014 RSS-199 Issue 3: Dec 2016 SRSP-510 Issue 5: Feb 2009 RSS-Gen Issue 5: Mar 2019
Test method	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01 KDB 412172 D01 Determining ERP and EIRP v01r01

3 Test Site Information

Lab performing tests	Vista Laboratories, Inc.
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.vista-compliance.com

Test Condition	Temperature	Humidity	Atmospheric Pressure
RF Testing	23.5°C	58.2%	996 mbar
Radiated Emission Testing	23.5°C	58.2%	996 mbar

4 Modification of EUT / Deviations from Standards

N/A

5 Test Configuration and Operation

5.1 EUT Test Configuration

The EUT has the option to be powered by an external 28VDC power source, or a 220VAC power source. Testing was performed under both input power configuration. The CMW500 communication tester was used to establish WCDMA/LTE links. A test laptop is used to establish Ethernet communication with EUT. Test software was provided by applicant and used to exercise the Wi-Fi operation. Testing was completed with worst case radio configuration.

The following software was used to monitor EUT performance

Software	Description
EMISOFT Vasona	EMC/RF Spurious emission test software used during testing
eCM test tools	RF test software to exercise the Wi-Fi (2.4/5GHz)

5.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
-	-	-	-

6 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Conducted Measurement (30MHz - 18GHz)	±1.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

7 Test Results

7.1 Strength of Spurious Radiation

7.1.1 Requirement

§ 2.1051,22.917(a), 24.238(a), 27.53 (f), (g), (h) and (c)(2) and (5)

RSS-130(4.7.1) and (4.7.2), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6), RSS-195 (5.6.2), RSS-199(4.5)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

FCC 47 CFR Part 90, Clause 90.691

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i) $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment, and
- (ii) $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

RSS-195, Clause 5.6.2

The transmitter unwanted emissions shall be measured with a resolution bandwidth of 1 MHz. A smaller resolution bandwidth is permitted provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz. However, in the 1 MHz bands immediately adjacent to the edges of the frequency range(s) in which the equipment is allowed to operate, a resolution bandwidth of as close as possible to, without being less than 1% of the occupied bandwidth, shall be employed provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz.

Equipment shall comply with the following unwanted emission limits:

Frequency (MHz)	Attenuation (dB)
<2200	$43 + 10 \log_{10}(p)$
2200 - 2288	$70 + 10 \log_{10}(p)$
2288 - 2292	$67 + 10 \log_{10}(p)$
2292 - 2296	$61 + 10 \log_{10}(p)$
2296 - 2300	$55 + 10 \log_{10}(p)$
2300 - 2305	$43 + 10 \log_{10}(p)$
2305 - 2320	$43 + 10 \log_{10}(p)$ ^{Note}
2320 - 2324	$55 + 10 \log_{10}(p)$
2324 - 2328	$61 + 10 \log_{10}(p)$
2328 - 2337	$67 + 10 \log_{10}(p)$
2337 - 2341	$61 + 10 \log_{10}(p)$
2341 - 2345	$55 + 10 \log_{10}(p)$
2345 - 2360	$43 + 10 \log_{10}(p)$ ^{Note}
2360 - 2365	$43 + 10 \log_{10}(p)$
2365 - 2395	$70 + 10 \log_{10}(p)$
>2395	$43 + 10 \log_{10}(p)$

RSS-199, Clause 4.5

In the 1 MHz band immediately outside and adjacent to the channel edge, the unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for base station and fixed subscriber equipment, and 2% for mobile subscriber equipment. Beyond the 1 MHz band, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% or 2% of the occupied bandwidth, as applicable.

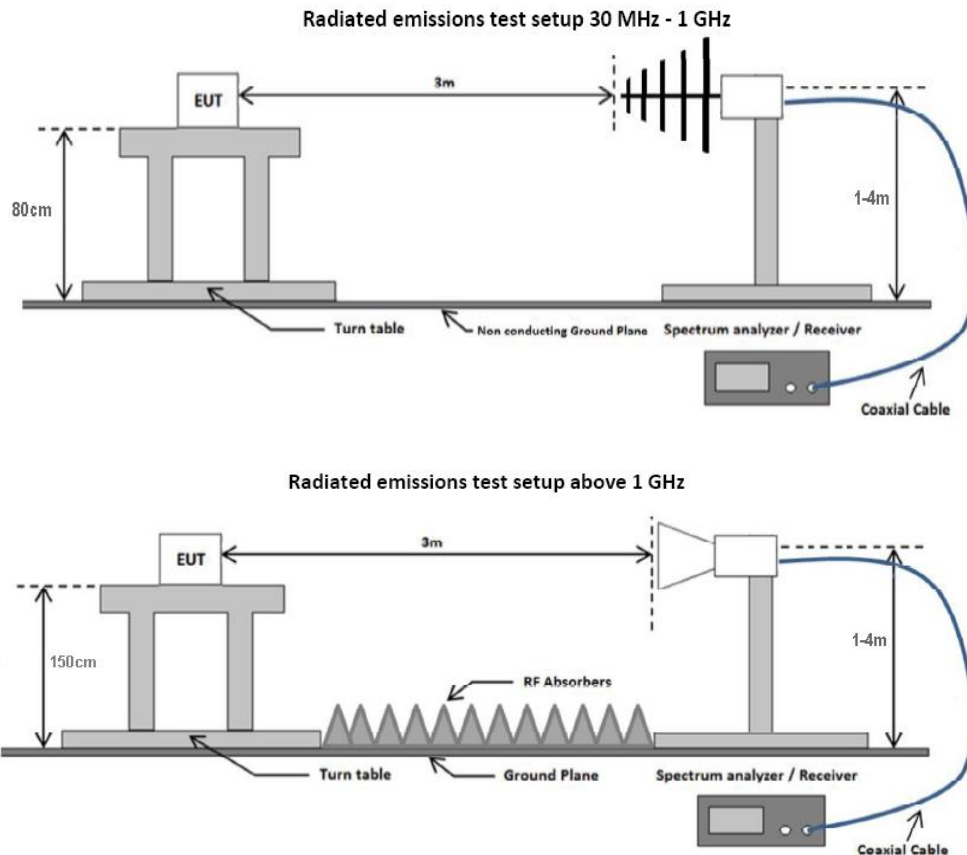
Equipment shall comply with the following unwanted emission limits:

- (a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$.
- (b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:
 - (i) $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
 - (ii) $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
 - (iii) $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ at or below 2490.5 MHz.

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

7.1.2 Test setup



7.1.3 Test Procedure

ANSI C63.26: 2015 section 5.5

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 7

Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

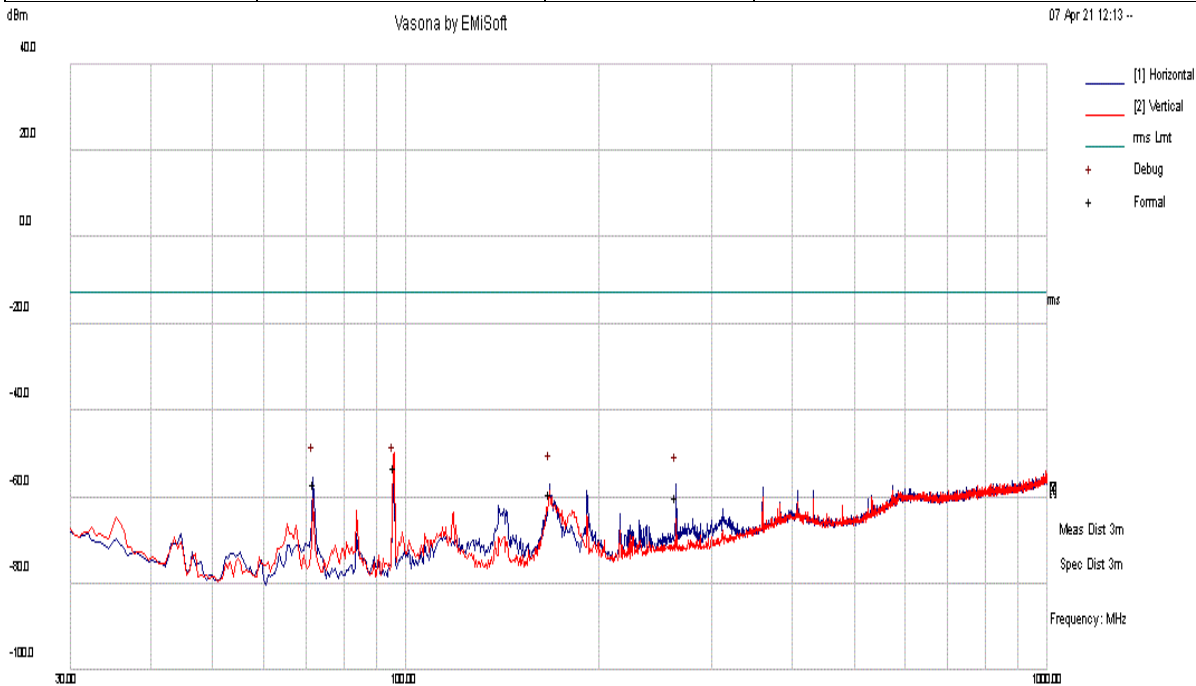
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.

5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

7.1.4 Test Result

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	Part 24E & RSS 133	Mode:	2.4G 11b mid + WCDMA B2
Frequency Range:	30 MHz - 1 GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



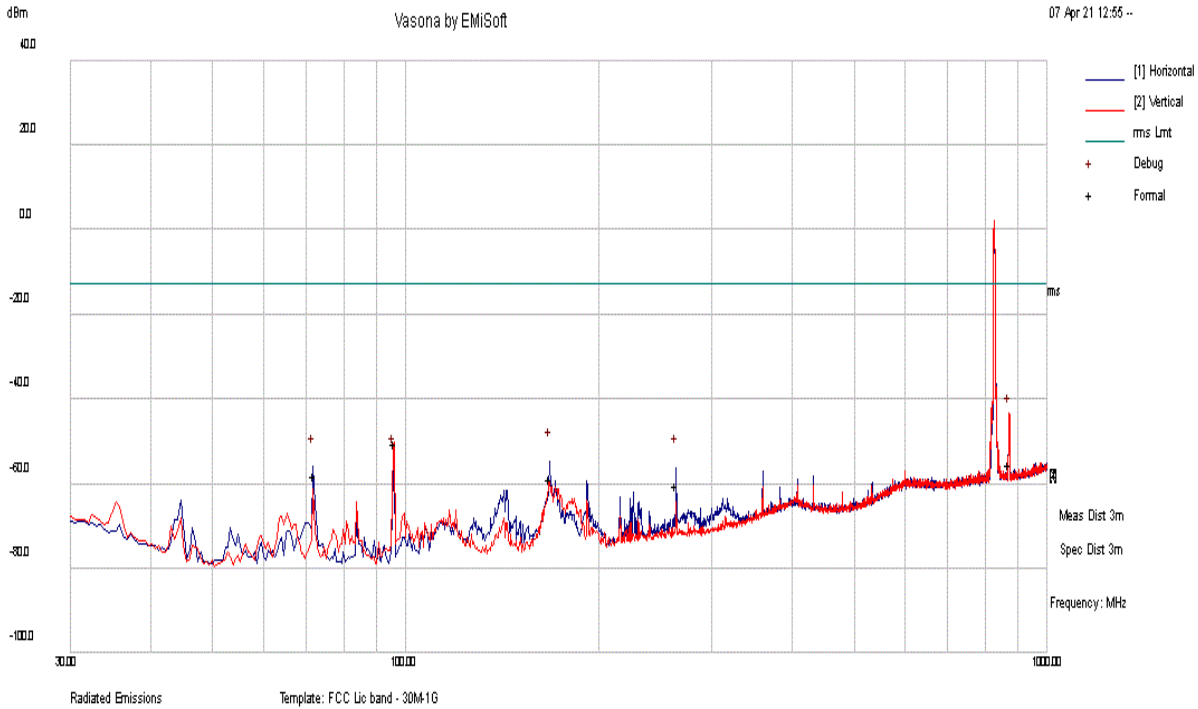
Radiated Emissions Template: FCC Lic band - 30M-1G

Res BW 1MHz

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
71.958	-51.7	15	-20.1	-56.9	RMS Max	H	292	0	-13	-43.9	Pass
95.933	-48.8	15.3	-19.5	-53	RMS Max	V	103	317	-13	-40	Pass
167.903	-57.9	16.2	-17.5	-59.2	RMS Max	H	101	0	-13	-46.2	Pass
263.835	-62.5	17.1	-14.5	-59.9	RMS Max	H	141	204	-13	-46.9	Pass
71.958	-51.7	15	-20.1	-56.9	RMS Max	H	292	0	-13	-43.9	Pass

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	Part 22 & RSS 132	Mode:	5G 11a 5500+WCDMA B5
Frequency Range:	30 MHz - 1 GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

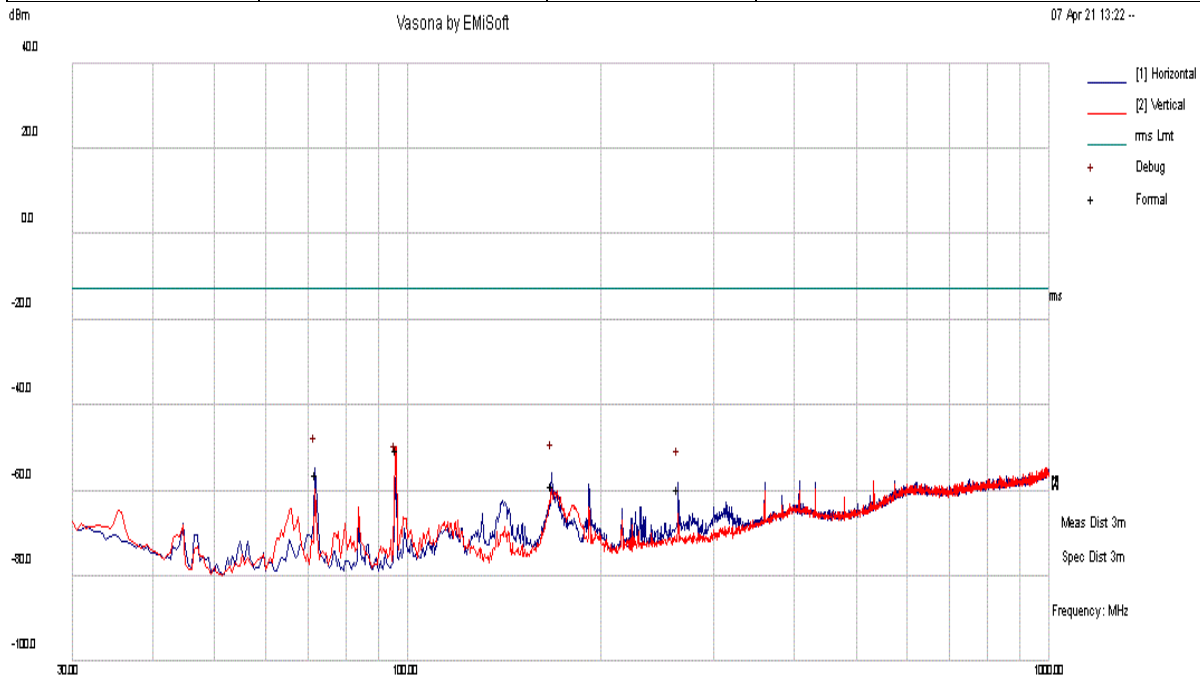


Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
872.349	-70.8	19.3	-3.8	-55.4	RMS Max	V	133	148	-13	-42.4	Pass
167.897	-57.5	16.2	-17.5	-58.7	RMS Max	H	108	19	-13	-45.7	Pass
263.835	-62.9	17.1	-14.5	-60.2	RMS Max	H	166	186	-13	-47.2	Pass
71.945	-52.7	15	-20.1	-57.8	RMS Max	H	238	360	-13	-44.8	Pass
95.937	-46.1	15.3	-19.5	-50.4	RMS Max	V	100	204	-13	-37.4	Pass

Note: Frequency at around 835MHz is EUT fundamental emission.

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	Part 24E & RSS 133	Mode:	2.4G 11b +LTE B2
Frequency Range:	30 MHz - 1 GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



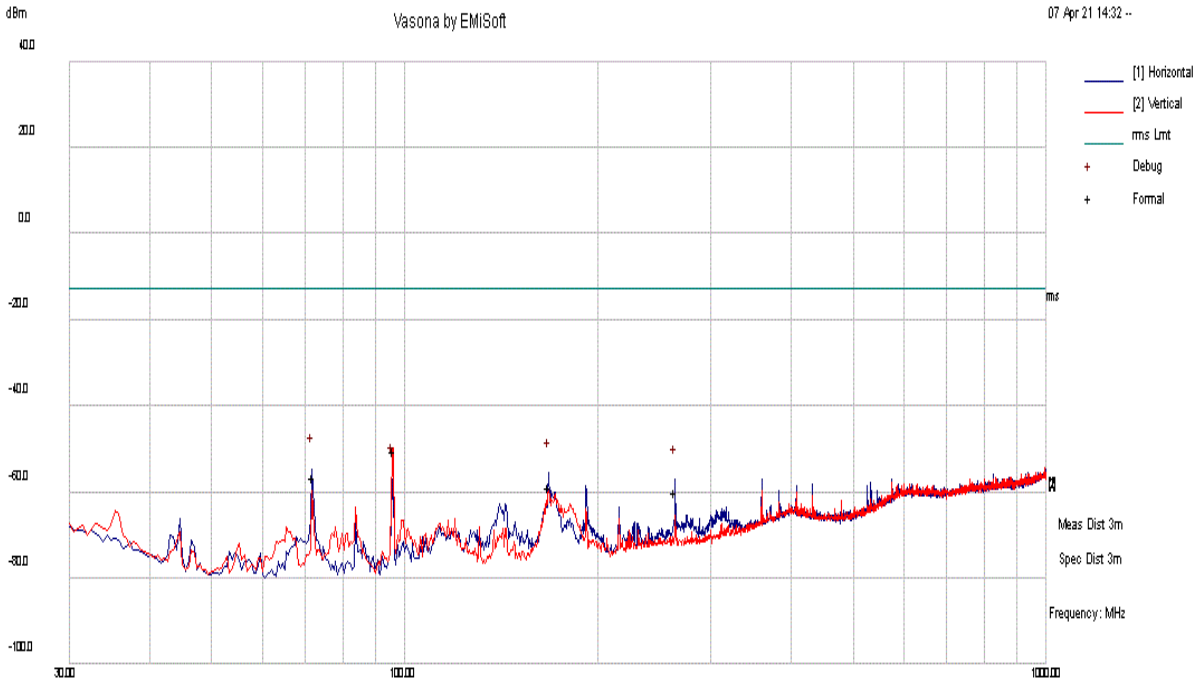
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	Res On (Hz)
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Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
71.96	-51	15	-20.1	-56.2	RMS Max	H	251	330	-13	-43.2	Pass
167.904	-57.5	16.2	-17.5	-58.8	RMS Max	H	116	26	-13	-45.8	Pass
95.94	-46.1	15.3	-19.5	-50.3	RMS Max	V	100	185	-13	-37.3	Pass
263.826	-62.1	17.1	-14.5	-59.5	RMS Max	H	126	197	-13	-46.5	Pass

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	Part 27 & RSS 139	Mode:	5G 11a 5500+LTE B4
Frequency Range:	30 MHz - 1 GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



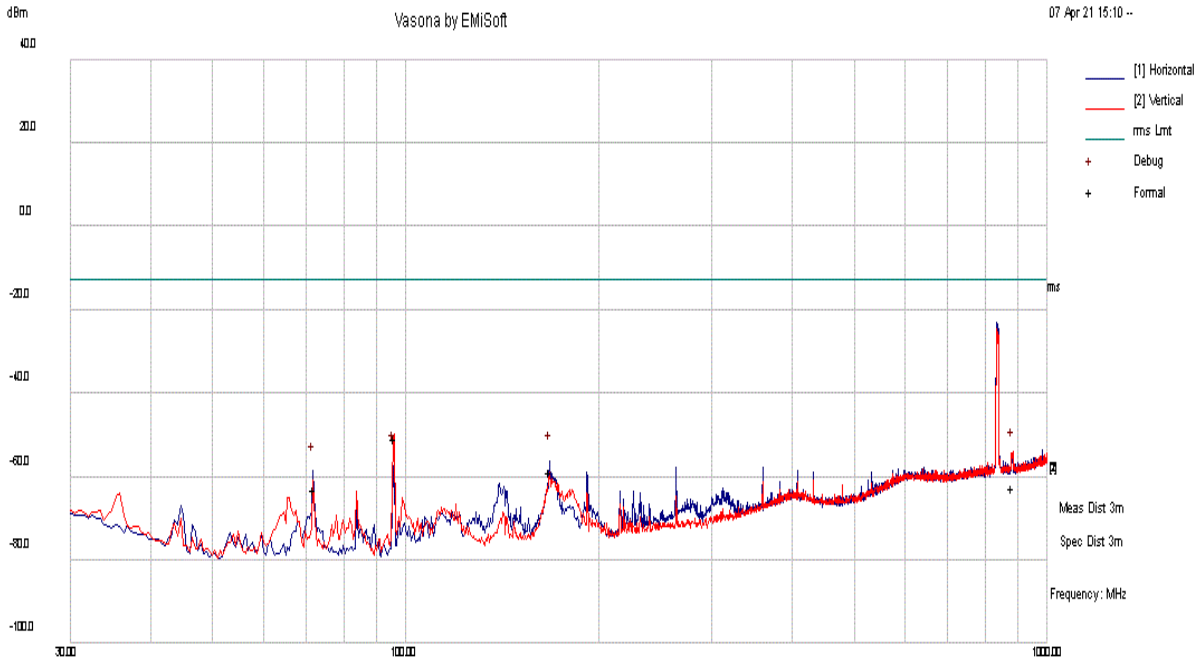
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120 Res BW [MHz]

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
71.951	-51.3	15	-20.1	-56.4	RMS Max	H	238	343	-13	-43.4	Pass
167.896	-57.4	16.2	-17.5	-58.7	RMS Max	H	111	26	-13	-45.7	Pass
95.935	-46.3	15.3	-19.5	-50.5	RMS Max	V	100	157	-13	-37.5	Pass
263.836	-62.6	17.1	-14.5	-59.9	RMS Max	H	136	192	-13	-46.9	Pass

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	Part 22 & RSS 132	Mode:	2.4G 11b+LTE B5
Frequency Range:	30 MHz - 1 GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Radiated Emissions Template: FCC Uo band - 30M-1G
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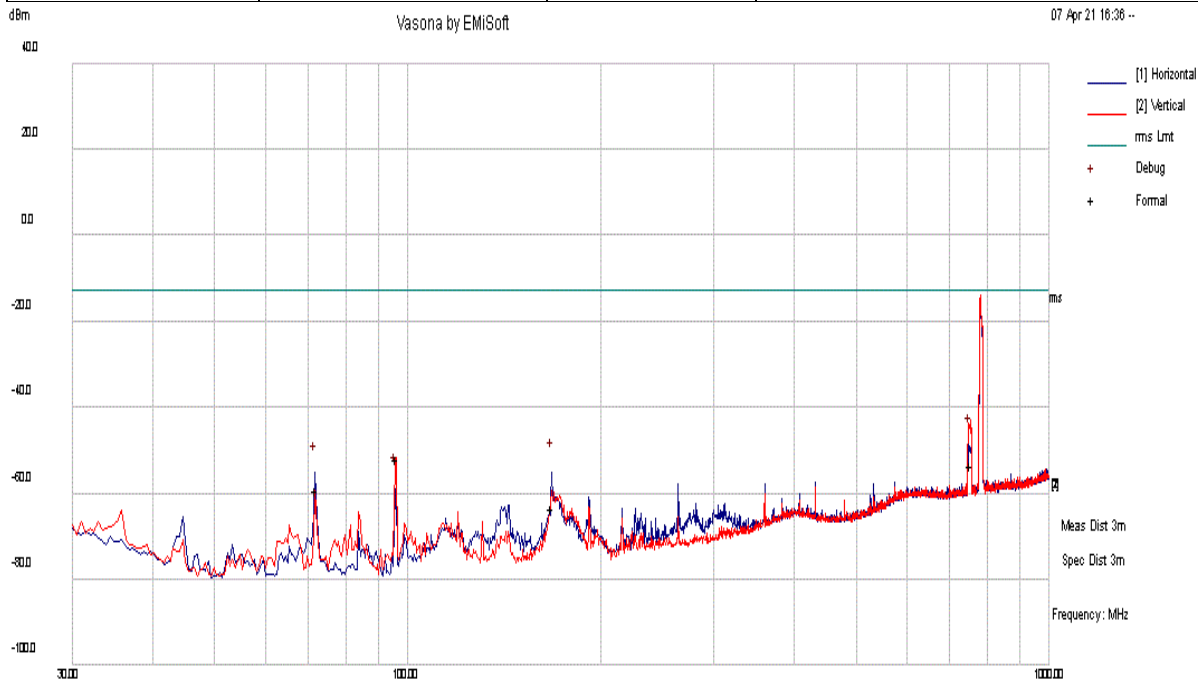
	Res BW [Hz]
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Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
882.088	-77.9	19.3	-3.8	-62.4	RMS Max	V	122	0	-13	-49.4	Pass
167.9	-57.3	16.2	-17.5	-58.6	RMS Max	H	152	22	-13	-45.6	Pass
95.946	-46.3	15.3	-19.5	-50.6	RMS Max	V	108	165	-13	-37.6	Pass
71.893	-57.9	15	-20.1	-63.1	RMS Max	H	279	174	-13	-50.1	Pass

Note: Frequency at around 835 MHz is EUT fundamental emission.

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	Part 27 & RSS 130	Mode:	5G 11a 5500+LTE B13
Frequency Range:	30 MHz - 1 GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Radiated Emissions Template: FCC Lic band - 30M1G

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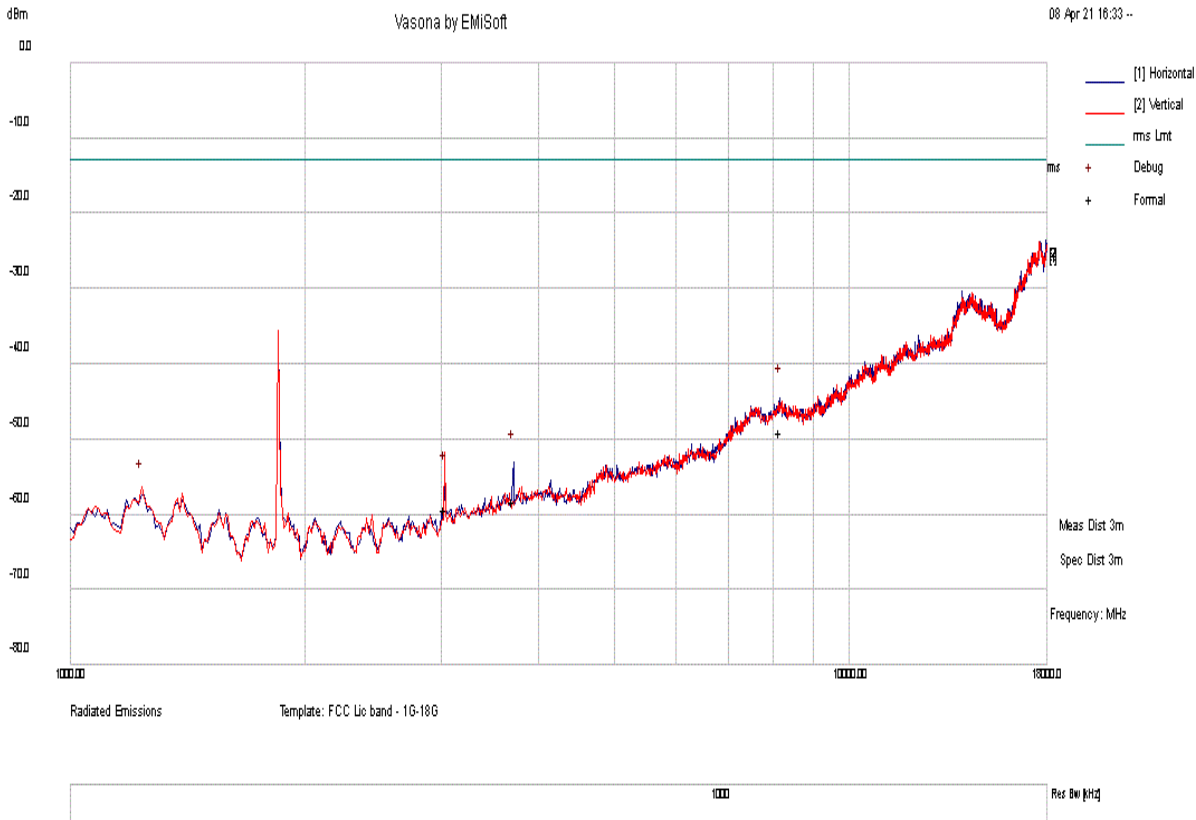
	Res BW 4MHz
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Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
753.671	-67.5	19	-4.7	-53.2	RMS Max	V	190	282	-13	-40.2	Pass
167.9	-62.2	16.2	-17.5	-63.5	RMS Max	V	100	99	-13	-50.5	Pass
71.911	-53.9	15	-20.1	-59	RMS Max	H	258	0	-13	-46	Pass
95.942	-47.7	15.3	-19.5	-51.9	RMS Max	V	101	180	-13	-38.9	Pass

Note: Frequency at around 780 MHz is EUT fundamental emission.

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	Part 24E & RSS 133	Mode:	2.4G 11b mid+WCDMA B2
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

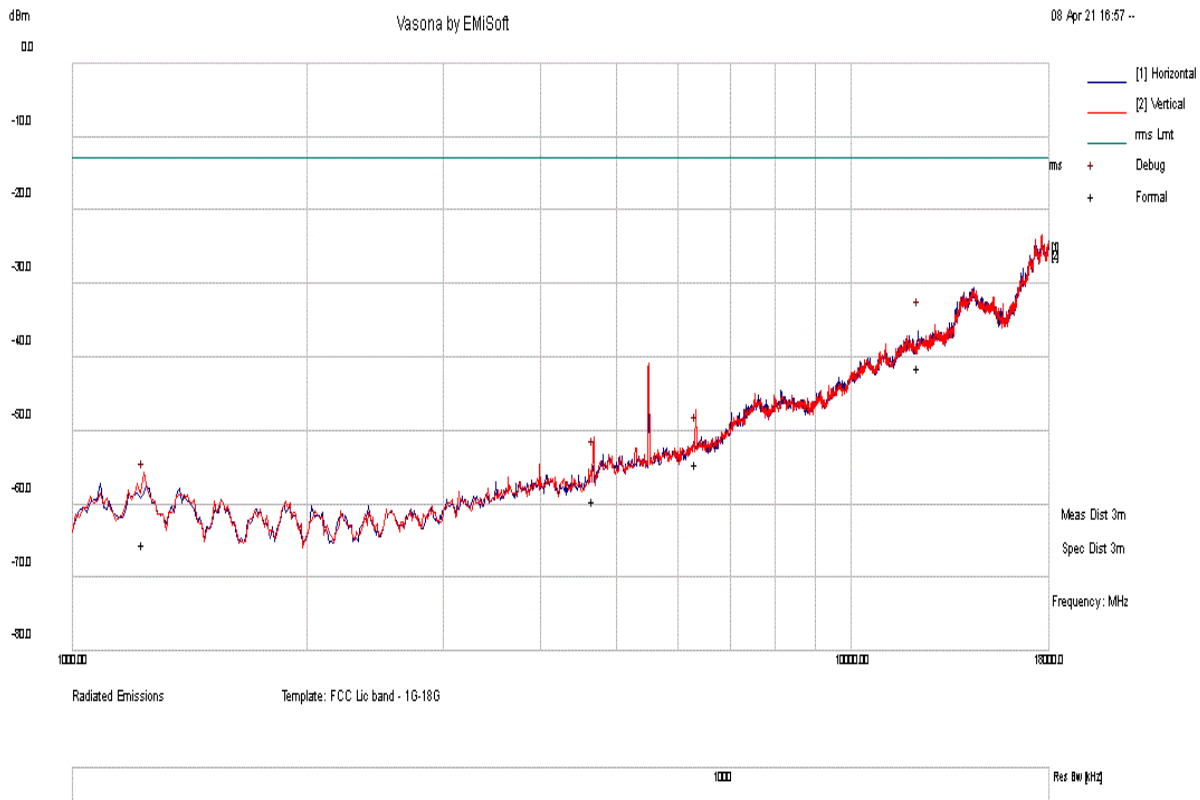


Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
8158.206	-84.5	21.6	14	-48.9	RMS Max	H	170	14	-13	-35.9	Pass
3707.045	-79.2	17.9	3.2	-58.1	RMS Max	H	300	351	-13	-45.1	Pass
3030.351	-76.6	17.2	0.1	-59.3	RMS Max	V	202	136	-13	-46.3	Pass

Note: Frequency at around 1900MHz is EUT fundamental emission.

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	Part 22 & RSS 132	Mode:	5G 11a 5500+WCDMA B5
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

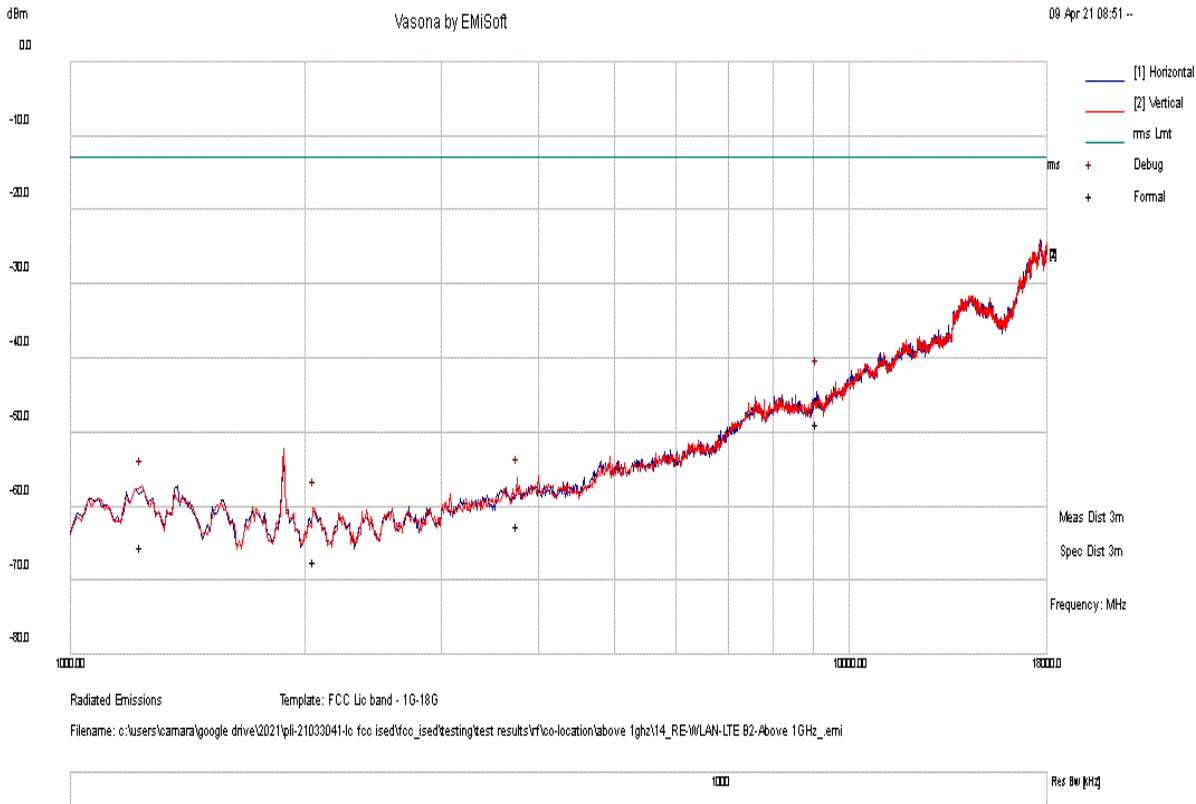


Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
12220.367	-83.9	25.2	17.3	-41.5	RMS Max	H	101	33	-13	-28.5	Pass
6331.835	-82.6	19.6	8.5	-54.5	RMS Max	V	159	218	-13	-41.5	Pass
4678.458	-84	18.6	6	-59.4	RMS Max	V	134	114	-13	-46.4	Pass
1234.778	-81.8	15.8	0.5	-65.5	RMS Max	V	134	175	-13	-52.5	Pass

Note: Frequency at around 5500MHz is EUT fundamental emission.

RADIATED EMISSIONS 1 - 18 GHZ

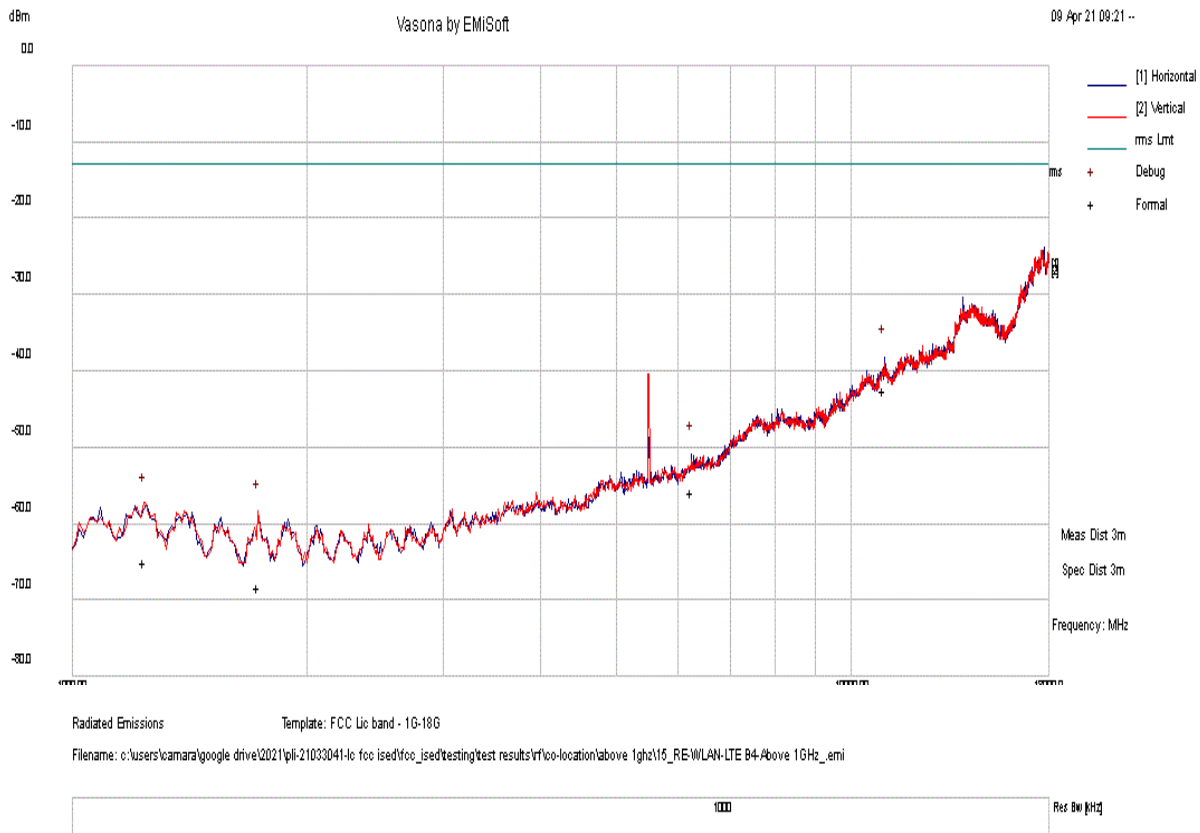
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Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
9106.95	-85	21.9	14.4	-48.7	RMS Max	H	182	38	-13	-35.7	Pass
3751.64	-83.8	17.9	3.4	-62.4	RMS Max	V	100	94	-13	-49.4	Pass
1233.731	-81.7	15.8	0.5	-65.4	RMS Max	V	387	155	-13	-52.4	Pass
2055.856	-81.3	16.3	-2.3	-67.4	RMS Max	V	136	258	-13	-54.4	Pass

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	Part 27 & RSS 139	Mode:	5G 11a 5500+LTE B4
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

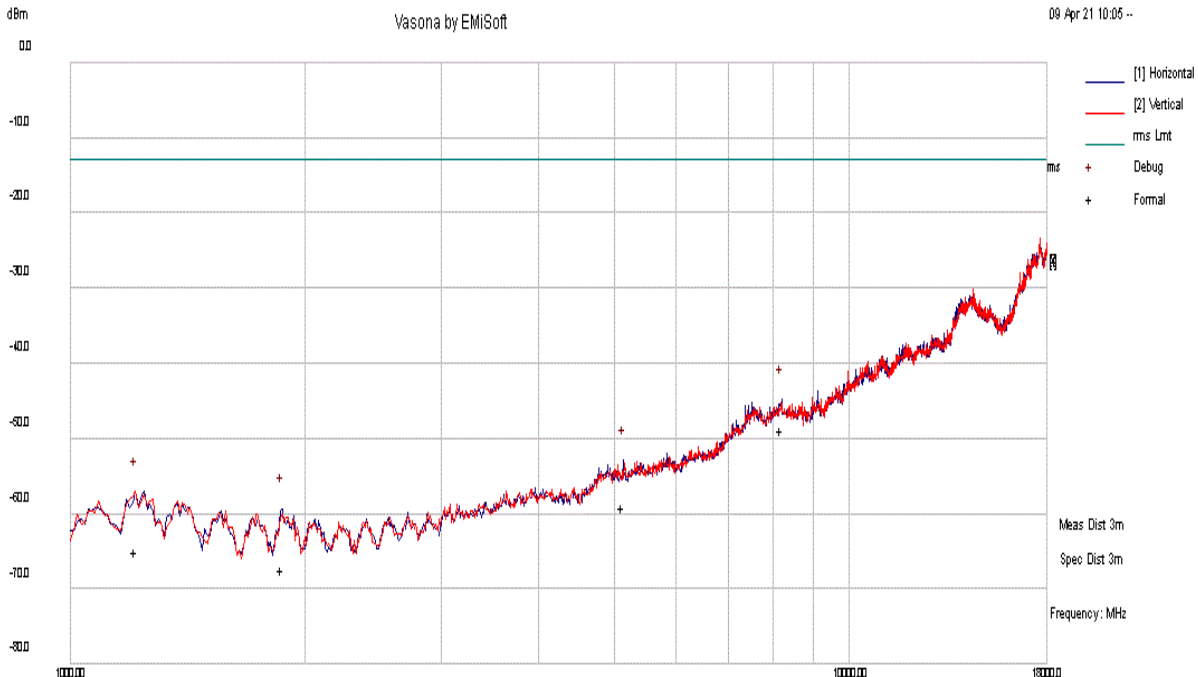


Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
11041.059	-83.9	24.3	17.2	-42.5	RMS Max	H	127	107	-13	-29.5	Pass
6249.708	-84	19.6	8.5	-55.9	RMS Max	H	273	320	-13	-42.9	Pass
1236.405	-81.3	15.8	0.5	-65	RMS Max	V	336	360	-13	-52	Pass
1735.735	-82	16.2	-2.4	-68.2	RMS Max	V	160	326	-13	-55.2	Pass

Note: Frequency at around 5500MHz is EUT fundamental emission.

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	Part 22 & RSS 132	Mode:	2.4G 11b+LTE B5
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



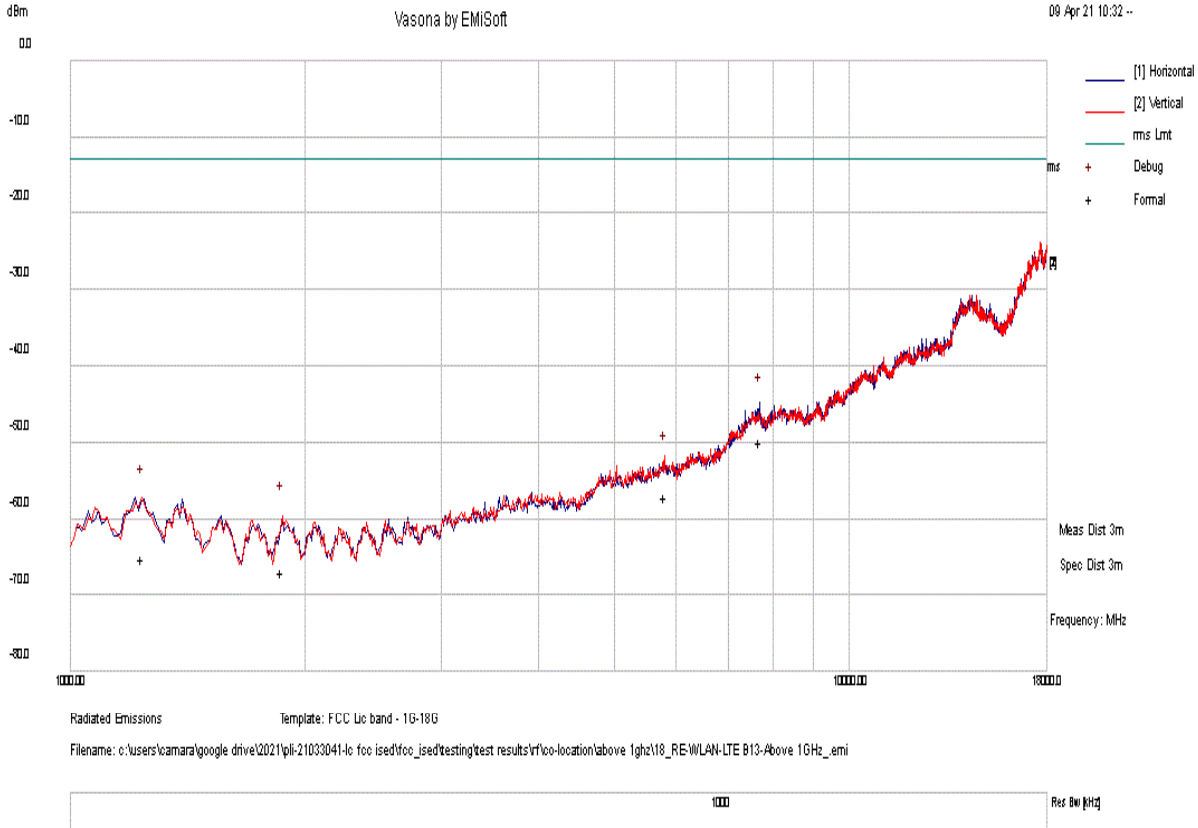
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Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
8203.881	-84.4	21.6	14.1	-48.7	RMS Max	H	125	338	-13	-35.7	Pass
5133.075	-84.8	18.7	7.2	-59	RMS Max	H	247	104	-13	-46	Pass
1213.536	-81.4	15.7	0.7	-65	RMS Max	V	255	27	-13	-52	Pass
1866.952	-82	16.2	-1.4	-67.2	RMS Max	H	313	169	-13	-54.2	Pass

RADIATED EMISSIONS 1 - 18 GHZ

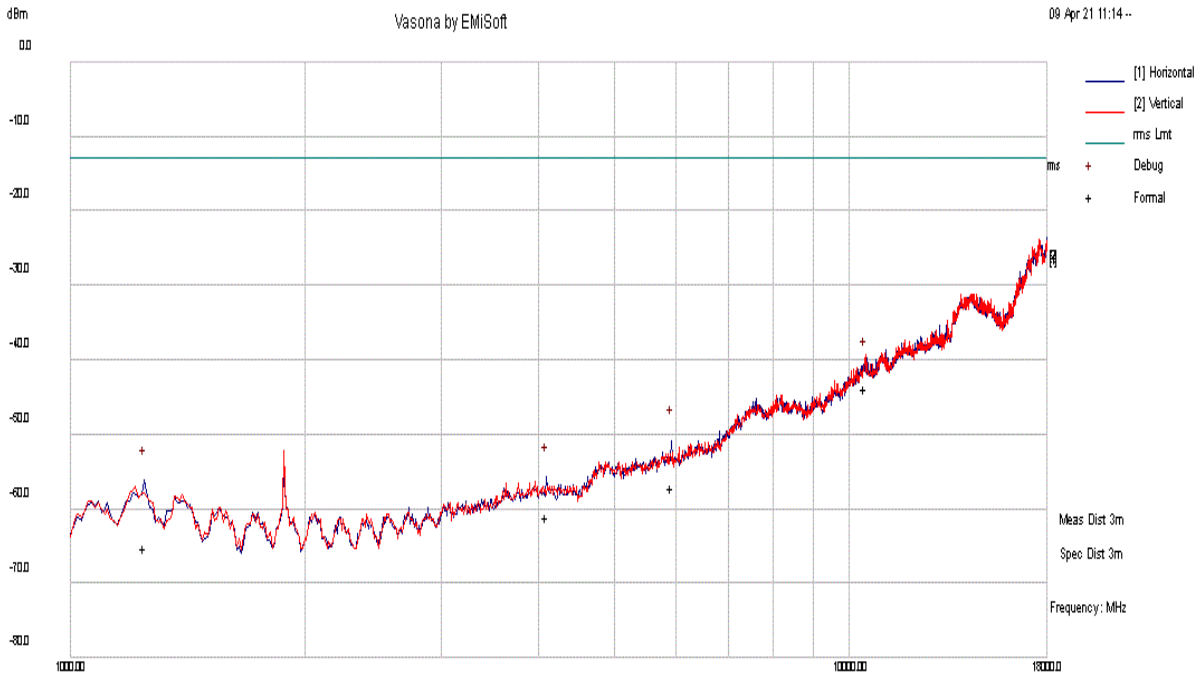
Test Standard:	Part 27 & RSS 130	Mode:	5G 11a 5500+LTE B13
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
7698.237	-84.3	21.6	12.8	-49.9	RMS Max	H	295	310	-13	-36.9	Pass
5807.518	-83.8	19.3	7.5	-57.1	RMS Max	V	181	0	-13	-44.1	Pass
1237.287	-81.4	15.8	0.5	-65.1	RMS Max	V	201	266	-13	-52.1	Pass
1870.578	-81.7	16.2	-1.5	-66.9	RMS Max	V	103	272	-13	-53.9	Pass

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	Part 24E & RSS 133	Mode:	2.4G 11b+LTE B25
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Radiated Emissions Template: FCC Lic band - 1G-18G

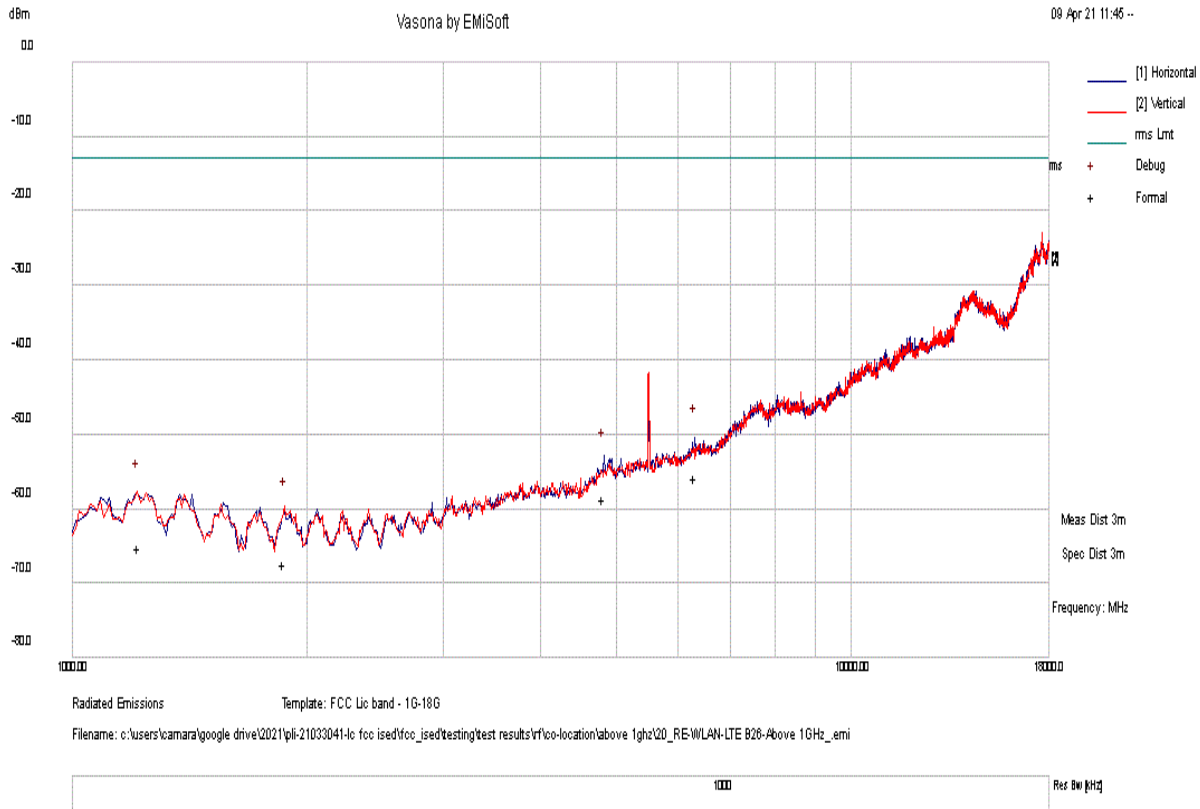
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Res BW [Hz]

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10510.254	-84	23.7	16.5	-43.8	RMS Max	V	254	215	-13	-30.8	Pass
5918.438	-84.2	19.5	7.6	-57.2	RMS Max	H	311	306	-13	-44.2	Pass
4091.985	-83.4	18.3	4.2	-61	RMS Max	H	281	108	-13	-48	Pass
1243.312	-81.4	15.8	0.5	-65.1	RMS Max	H	137	170	-13	-52.1	Pass

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	Part 90	Mode:	5G 11a 5500+LTE B26
Frequency Range:	1 GHz - 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

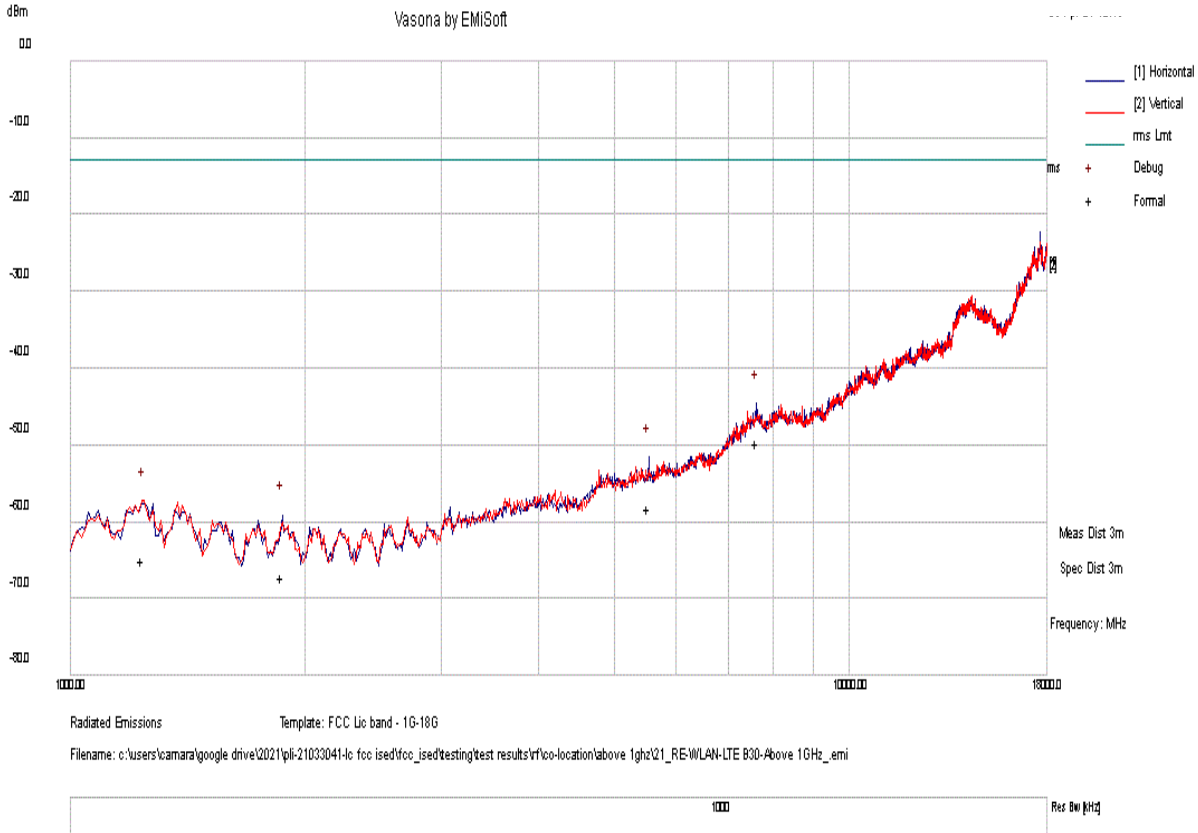


Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
6314.203	-83.8	19.6	8.5	-55.7	RMS Max	H	175	34	-13	-42.7	Pass
4817.764	-83.9	18.6	6.6	-58.7	RMS Max	H	386	0	-13	-45.7	Pass
1215.065	-81.6	15.8	0.7	-65.2	RMS Max	V	280	176	-13	-52.2	Pass
1872.67	-82	16.2	-1.5	-67.2	RMS Max	V	335	0	-13	-54.2	Pass

Note: Frequency at around 5500MHz is EUT fundamental emission.

RADIATED EMISSIONS 1 - 18 GHZ

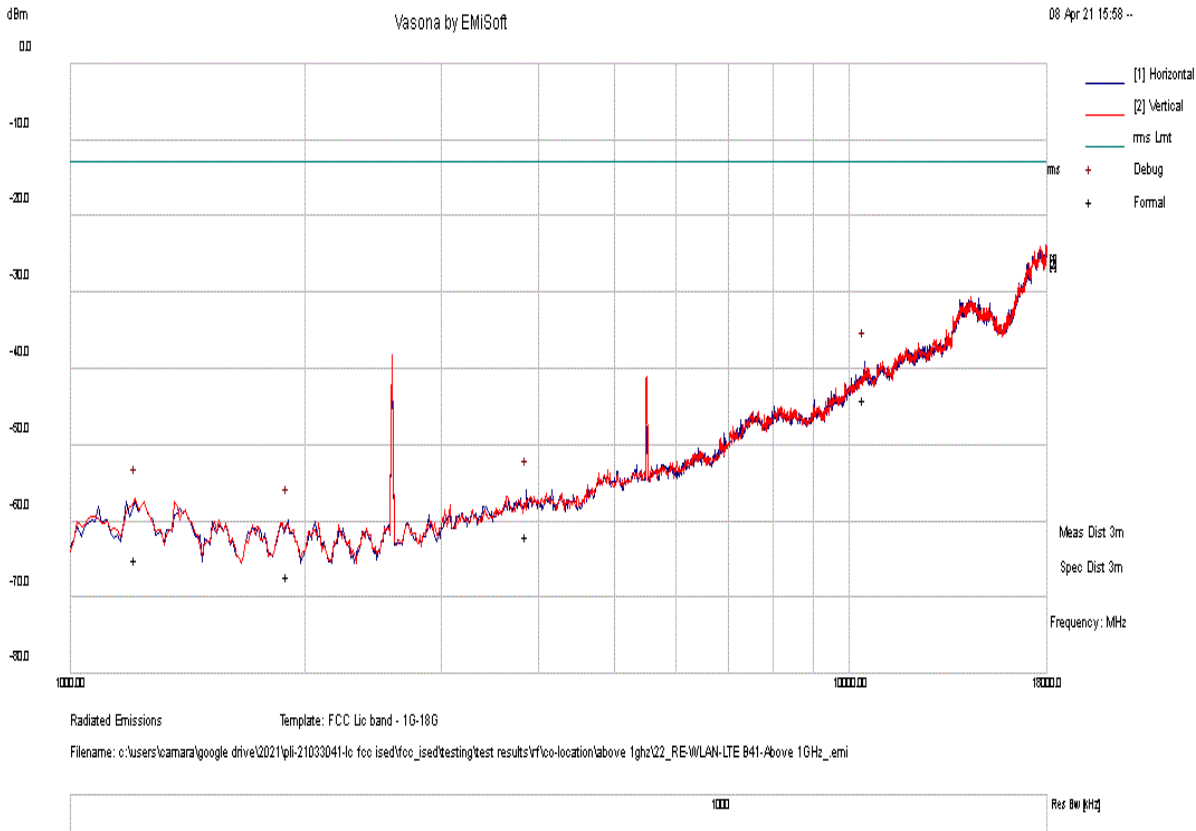
Test Standard:	Part 27	Mode:	2.4G 11b+LTE B30
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
7612.706	-83.8	21.6	12.5	-49.7	RMS Max	H	185	78	-13	-36.7	Pass
5536.369	-84.4	18.7	7.5	-58.2	RMS Max	H	100	352	-13	-45.2	Pass
1237.534	-81.3	15.8	0.5	-65	RMS Max	V	360	342	-13	-52	Pass
1870.507	-81.9	16.2	-1.5	-67.2	RMS Max	H	333	67	-13	-54.2	Pass

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	Part 27 & RSS 199	Mode:	5G 11a 5500+LTE B41
Frequency Range:	1 GHz – 18GHz	Test Date:	04/05/2021-04/23/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10476.658	-84.1	23.7	16.5	-43.9	RMS Max	V	113	203	-13	-30.9	Pass
3860.614	-84.1	18	4.2	-61.8	RMS Max	H	256	54	-13	-48.8	Pass
1213.475	-81.3	15.7	0.7	-64.9	RMS Max	V	212	21	-13	-51.9	Pass
1902.422	-81.7	16.2	-1.7	-67.2	RMS Max	H	288	24	-13	-54.2	Pass

Note: Frequency at around 5500MHz is EUT WLAN fundamental emission and the 2600MHz is EUT cellular fundamental emission.

18GHz – 40GHz test result

Note: no substantial emission is found other than the noise floor.
Different modes have been verified.

8 EUT and Test Setup Photos

See FCC exhibits

9 Test Instrument List

Equipment	Manufacturer	Model	Instrument Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	10/18/19	10/18/21
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	6/17/20	6/17/21
EMC Test Receiver	R&S	ESL6	100230	6/14/20	6/14/21
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/20	5/4/21
LISN (9KHz – 30MHz)	Com-Power	LI-550C	20140050	01/29/2021	01/29/2022
LISN (9KHz – 30MHz)	Com-Power	LI-550C	20140051	01/29/2021	01/29/2022
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2020	11/15/2021
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/14/2020	5/14/2021
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	6/24/20	6/24/21
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	7/16/2020	7/16/2021
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/5/2020	5/5/2021
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/15/2020	5/15/2021
RF Attenuator	Pasternack	PE7005-3	VL061	7/16/2020	7/16/2021
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	7/16/2020	7/16/2021
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/16/20	5/16/21
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	7/16/2020	7/16/2021
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	7/16/2020	7/16/2021
RE test cable (>18GHz)	Sucoflex	104	344903/4	7/16/2020	7/16/2021
Pulse limiter	Com-Power	LIT-930A	531727	7/16/2020	7/16/2021
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	7/16/2020	7/16/2021
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	7/16/2020	7/16/2021
Vector Signal Generator	Keysight	N5182A	US47080548	6/17/20	6/17/21
RF Power Amplifier (80-1000MHz)	Ophir	5226FE	1013/1815	N/A	N/A
RF Power Amplifier (700-6000MHz)	Ophir	5293FE	1063/1815	N/A	N/A
Horn Antenna (1-18GHz)	FT-RF	HA-07M18G-NF	180010HA	N/A	N/A
Wideband Communication	R&S	CMW500	147508	5/8/2020	5/8/2021