

TEST REPORT

Report Number: R12464606-E2

Applicant : Stryker Medical 3800 East Centre Avenue Portage, MI 49002, USA

- Model : 650700080203
- FCC ID : Z7A-6507
 - IC : 4919E-6507
- **EUT Description** : Near Field Magnetic Induction Communication Module
- Test Standard(s) : FCC 47 CFR PART 15 SUBPART C ISED RSS-210 ISSUE 10 ISED RSS-GEN ISSUE 5 +A2

Date Of Issue: 2021-09-09

Prepared by: UL LLC 12 Laboratory Dr. Research Triangle Park, NC 27709 U.S.A. TEL: (919) 549-1400



REVISION HISTORY

Rev.	lssue Date	Revisions	Revised By
v1	2021-05-05	Initial Release	Niklas Haydon
V2	2021-05-12	Removed Photos for photo exhibit	Noah Bennett
V3	2021-08-25	Addressed TCB feedback	Noah Bennett
V4	2021-09-09	Added note to section 6.1 regarding enclosure being entirely plastic. Updated report to a2La accreditation information.	Brian T. Kiewra

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1. ATTESTATION OF TEST RESULTS

DATE TESTED:	2020-11-16 to 2020-12-01
SAMPLE RECEIVE DATE:	2020-11-13
SERIAL NUMBER:	671990182
MODEL:	650700080203
EUT DESCRIPTION:	Near Field Magnetic Induction Communication Module
COMPANY NAME:	Stryker Medical 3800 East Centre Avenue Portage, MI 49002, USA

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Compliant
ISED RSS-210 Issue 10, Annex B.6	Compliant
ISED RSS-GEN Issue 5 +A1	Compliant

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

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FORM NO: CCSUP47011 TEL: (919) 549-1400

UL LLC 12 Laboratory Dr., RTP, NC 27709; USA

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5+A1, and RSS-210 Issue 10.

3. TEST SUMMARY

This report contains data provided by the customer which can impact the validity of results UL LLC is only responsible for the validity od results adter the integration of the data provided by the customer.

FCC Clause	ISED Clause	Requirement	Result	Comments
FCC §15.215	IC RSS-GEN Section 6.7	15.215(c)	Reporting Purposes Only.	None.
FCC §15.225	IC RSS-210, Annex B.6 IC RSS-GEN, Section 8.9 (Transmitter)	15.225(a), (b), (c), (d), (e)	Compliant	None.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification #0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	1150067	2180C	703469
\boxtimes	Building: 2800 Perimeter Park Dr Morrisville, NC 27560, U.S.A	US0067	27265	703409

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5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. **DECISION RULES**

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U _{Lab}
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance Loop, 9KHz to 30 MHz	2.87 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Frequency Error with Spectrum Analyzer	141.16 Hz
Worst Case Occupied Bandwidth	1.22%

Uncertainty figures are valid to a confidence level of 95%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided: Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB - 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided: Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss. 36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The Near Field Magnetic Induction Communication (NFMIC) module is a Stryker proprietary radio module to facilitate communication between a mobile ambulance cot and a Stryker ambulance fastener.

The NFMIC only operates in a single mode.

Note: The enclosure the device was tested in was completely plastic.

6.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes one integral loop coil antennas, each with an area of 0.00007984 square meters.

6.3. MAXIMUM ELECTRIC FIELD STRENGTH

The maximum E-field reading at 30m is 19.11 dBuV/m.

6.4. SOFTWARE AND FIRMWARE

The firmware and test utility installed in the EUT during testing was //depot/R&D/Projects/IMS-004/Testing/EMC Testing SW/Hex files/C1339-BRN-COMMCU-0-08_cont_tx_at_pwr_up.hex #1/1.

6.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated with in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed in the Z orientation.

The EUT does not operate on AC Mains. When installed in the ambulance cot, the cot only charges via Wireless Power Transfer, connected to a DC power source. The EUT is never intented to be installed or connected to AC Mains. Therefore, AC Mains testing was not completed.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List						
Description	Manufacturer	Model	Serial Number	FCC ID		
DC Power Supply	BK Precision	1715A	17151057405110457	NA		

I/O CABLES

	I/O Cable List							
	Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks	
ľ	1	DC Port	1	Wires	Power	<3m	9Vdc nominal	

SETUP DIAGRAM

Please refer to R12464606-EP1 for setup diagrams and setup photos.

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7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Equipment ID Description		Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 2				
		Agilent			
72822	Spectrum Analyzer	Technologies	E4446A	2020-01-02	2021-01-02
76023		Cincinnati Sub-			
(EC0225)	Temp/Humid Chamber	Zero	ZPH-8-3.5-SCT/AC	2020-05-27	2021-05-27
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	Antenna Port Software	UL	Version 2020.10.22	NA	NA

Test Equipment Used - Wireless Conducted 2 Measurement Ed	zauloment

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip.					
ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	(Loop Ant.)			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-07-27	2021-07-27
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009- 30MHz	Various	Various	2020-07-29	2021-07-29
N-SAC02	Gain-loss string: 25- 1000MHz	Various	Various	2020-07-29	2021-07-29
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2020-07-16	2021-07-16
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
s/n 200037610	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

8. MEASUREMENT METHOD

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Frequency Stability: ANSI C63.10-2013 Clause 6.8

General Radiated emissions: ANSI C63.10 Section 6.3 to 6.5

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

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9. OCCUPIED AND EMISSIONS BANDWIDTH

9.1. LIMITS AND PROCEDURE

<u>LIMITS</u>

None; for reporting purposes only.

FCC §15.215 (c) and RSS-GEN, ANSI C63.10 Sections 6.9.2 and 6.9.3 were used for the measurement procedure.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1-5% of the occupied or emissions bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

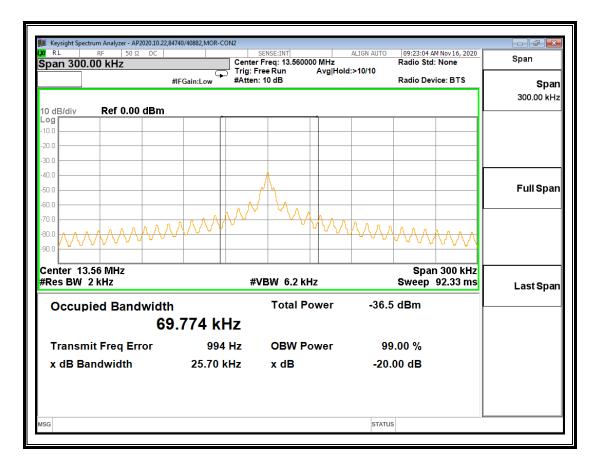
<u>RESULTS</u>

9.2. 99% AND 20dB BANDWIDTH

Mode	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
Operating	13.56	69.77	25.60

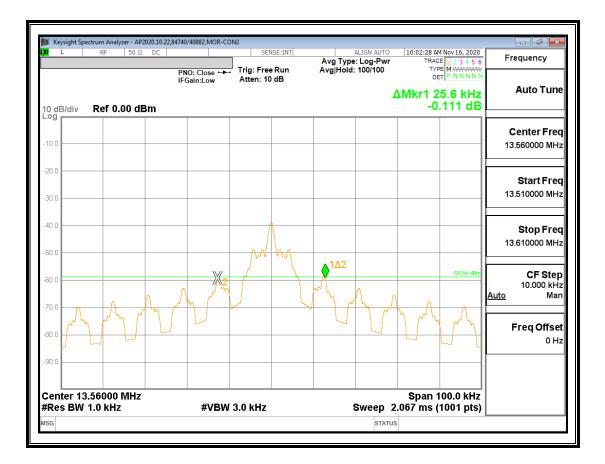
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9.2.1. 99% BANDWIDTH



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9.2.2. 20 dB BANDWIDTH



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10. FREQUENCY STABILITY

10.1. LIMITS AND PROCEDURE

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

RSS-210 Annex B.6: Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

TEST PROCEDURE

ANSI 63.10:2013 Clause 6.8.1 and 6.8.2

TEST INFORMATION Date: 2020-11-16, 2020-12-01 Tester: 40882

	Reference Frequency: EUT Channel 13.56 MHz @ 20°C Limit: ± 100 ppm = 1.356 kHz														
Power Supply	Envir. Temp		Frequency Deviation Measureed with Time Elapse												
VDC	(°C)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)					
9.00	50	13.5599646	3.596	13.5599478	4.834	13.5599375	5.596	13.5599529	4.458	± 100					
9.00	40	13.5599487	4.774	13.5599639	3.649	13.5599649	3.575	13.5599817	2.338	± 100					
9.00	30	13.5600062	0.530	13.5599754	2.805	13.5600034	0.738	13.5600061	0.535	± 100					
9.00	20	13.5600134	0.000	13.5599927	1.530	13.5600131	0.024	13.5599599	3.949	± 100					
9.00	10	13.5600387	-1.863	13.5600058	0.558	13.5600270	-1.000	13.5600526	-2.893	± 100					
9.00	0	13.5600628	-3.640	13.5600417	-2.088	13.5600159	-0.182	13.5600071	0.467	± 100					
9.00	-10	13.5600301	-1.232	13.5600351	-1.600	13.5600208	-0.544	13.5600322	-1.388	± 100					
9.00	-20	13.5599771	2.674	13.5600209	-0.554	13.5599749	2.840	13.5599833	2.223	± 100					
7.65	20	13.5599810	2.386	13.5599764	2.729	13.5600044	0.664	13.5599794	2.504	± 100					
10.35	20	13.5600231	-0.715	13.5599802	2.448	13.5599990	1.063	13.5599849	2.101	± 100					

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11. RADIATED EMISSION TEST RESULTS

11.1. LIMITS AND PROCEDURE

<u>LIMIT</u>

§15.225 IC RSS-210, Annex B.6 IC RSS-GEN, Section 8.9 (Transmitter)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits	Limits for radiated disturbance of an intentional radiator										
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)									
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**	3									
88 - 216	150**	3									
216 - 960	200**	3									
Above 960	500	3									

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

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is: Limit (dBuV/m) = 20 log limit (uV/m)

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In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

TEST PROCEDURE

ANSI C63.10, 2013

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

Since the EUT contains a digital device operating at 13.56 MHz, the frequency range was expanded to 1 GHz, as specified in the following table

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

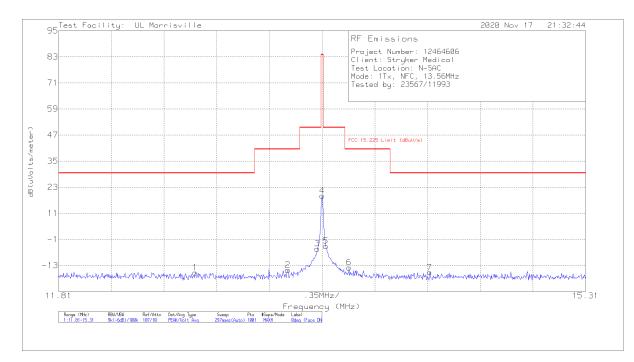
RESULTS

11.2. FUNDAMENTAL AND TRANSMISSION SPURIOUS EMISSIONS

Note for below 30 MHz scans: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).

The below 30 MHz limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω . For example, the measurement frequency 61.4 kHz resulted in a level of -29.39 dBuV/m, which is equivalent to -29.39 - 51.5 = -80.39 dBuA/m, which has the same margin, -61.23 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

FUNDAMENTAL 0°

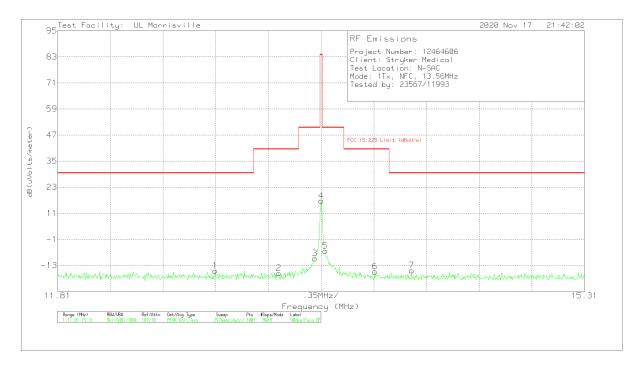


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.7165	12.57	Pk	10.4	.7	-40	-16.33	29.5	-45.83	330
2	13.3325	13.69	Pk	10.4	.8	-40	-15.11	40.5	-55.61	330
3	13.5285	23.5	Pk	10.4	.8	-40	-5.3	50.5	-55.8	330
4	13.56	47.91	Pk	10.4	.8	-40	19.11	84	-64.89	330
5	13.5845	24.69	Pk	10.4	.8	-40	-4.11	50.5	-54.61	330
6	13.7385	14.84	Pk	10.4	.8	-40	-13.96	40.5	-54.46	330
7	14.274	12.56	Pk	10.4	.8	-40	-16.24	29.5	-45.74	330

Pk - Peak detector

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FUNDAMENTAL 90°

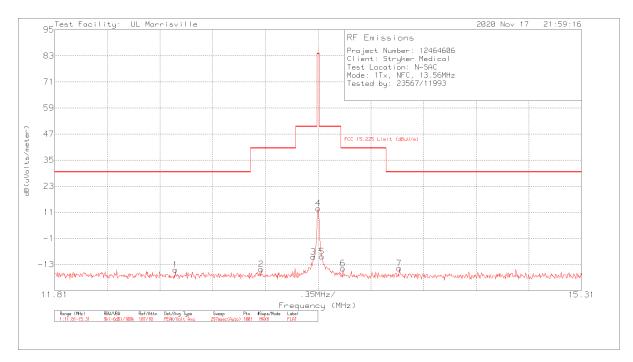


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.8565	13.44	Pk	10.4	.7	-40	-15.46	29.5	-44.96	219
2	13.28	12.21	Pk	10.4	.8	-40	-16.59	40.5	-57.09	219
3	13.518	19.02	Pk	10.4	.8	-40	-9.78	50.5	-60.28	219
4	13.56	45.51	Pk	10.4	.8	-40	16.71	84	-67.29	219
5	13.588	22.47	Pk	10.4	.8	-40	-6.33	50.5	-56.83	219
6	13.917	12.97	Pk	10.4	.8	-40	-15.83	40.5	-56.33	219
7	14.162	13.53	Pk	10.4	.8	-40	-15.27	29.5	-44.77	219

Pk - Peak detector

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FUNDAMENTAL FLAT (PARALLEL TO GRP)

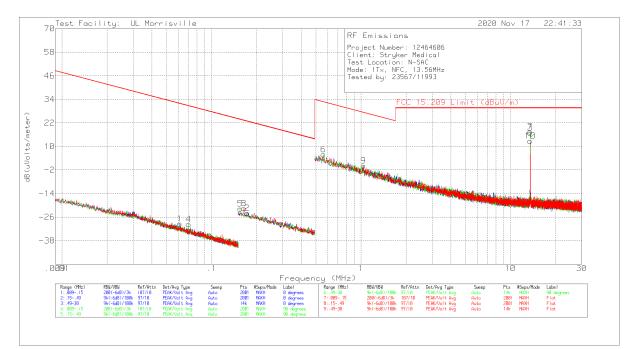


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	12.6115	13.42	Pk	10.4	.7	-40	-15.48	29.5	-44.98	350
2	13.182	13.66	Pk	10.4	.7	-40	-15.24	40.5	-55.74	350
3	13.5285	19.26	Pk	10.4	.8	-40	-9.54	50.5	-60.04	350
4	13.56	41.56	Pk	10.4	.8	-40	12.76	84	-71.24	350
5	13.5845	19.41	Pk	10.4	.8	-40	-9.39	50.5	-59.89	350
6	13.7245	13.93	Pk	10.4	.8	-40	-14.87	40.5	-55.37	350
7	14.099	13.99	Pk	10.4	.8	-40	-14.81	29.5	-44.31	350

Pk - Peak detector

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SPURIOUS AND HARMONICS EMISSIONS 9 kHz TO 30 MHZ

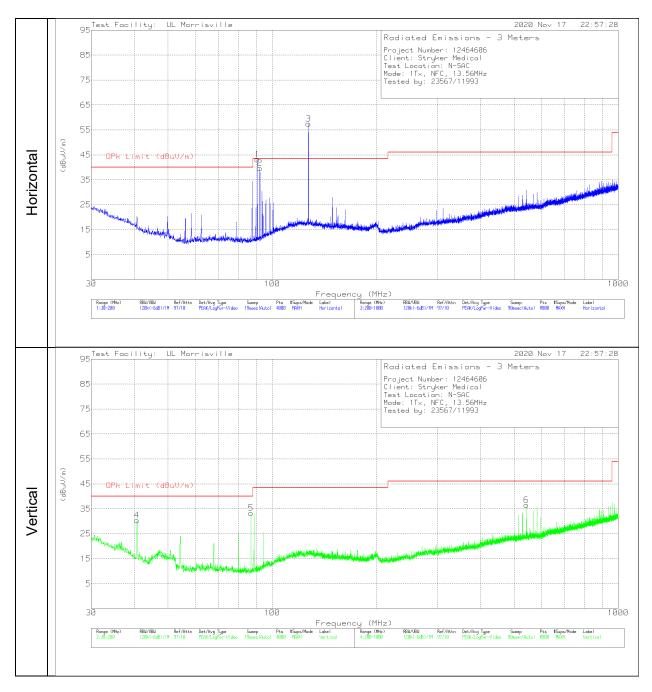


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 FCC 15.209 QP/Avg Limit (dBuV/m) (dBuV/m)		Worst-Case Margin (dB)	Azimuth (Degs)
1	.0614	39.01	Pk	11.5	.1	-80	-29.39	31.84	51.84	-61.23	0-360
4	.07034	39.01	Pk	11.2	.1	-80	-29.69	30.66	50.66	-60.35	0-360
5	.15544	47.35	Pk	10.8	.1	-80	-21.75	23.77	43.77	-45.52	0-360
8	.16462	47.48	Pk	10.8	.1	-80	-21.62	23.27	43.27	-44.89	0-360
2	.1738	45.11	Pk	10.8	.1	-80	-23.99	22.8	42.8	-46.79	0-360
6	.56167	34.87	Pk	10.8	.2	-40	5.87	32.61	-	-26.74	0-360
9	1.0423	28.99	Pk	11	.2	-40	.19	27.24	-	-27.05	0-360
3	13.56171	45.78	Pk	10.4	.8	-40	16.98	29.54	-	-12.56	0-360
7	13.56171	46.31	Pk	10.4	.8	-40	17.51	29.54	-	-12.03	0-360
10	13.56171	41.6	Pk	10.4	.8	-40	12.8	29.54	-	-16.74	0-360

Pk - Peak detector

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SPURIOUS AND HARMONIC EMISSIONS 30MHz to 1000MHz



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Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)		Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	40.6703	42.61	Pk	19.1	-31.3	30.41	40	-9.59	0-360	101	V
5	86.8372	50.49	Pk	13.4	-30.6	33.29	40	-6.71	0-360	101	V
1	90.3713	23.83	Qp	13.8	-30.5	7.13	43.52	-36.39	317	338	Н
2	92.0623	23.58	Qp	14.2	-30.5	7.28	43.52	-36.24	251	250	Н
3	127.4181	23.44	Qp	20	-30.1	13.34	43.52	-30.18	174	126	Н
6	542.4445	39.35	Pk	24.3	-27.1	36.55	46.02	-9.47	0-360	101	V

Pk - Peak detector Qp - Quasi-Peak detector

Note: Markers 1, 2, and 3 were found to be transient signals.

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12. SETUP PHOTOS

Please refer to R12464606-EP1 for setup photos and setup diagrams.

END OF REPORT

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