

4.5.5 Maximum Measured Radiated Emissions - 40 GHz to 100 GHz – FCC Part 30

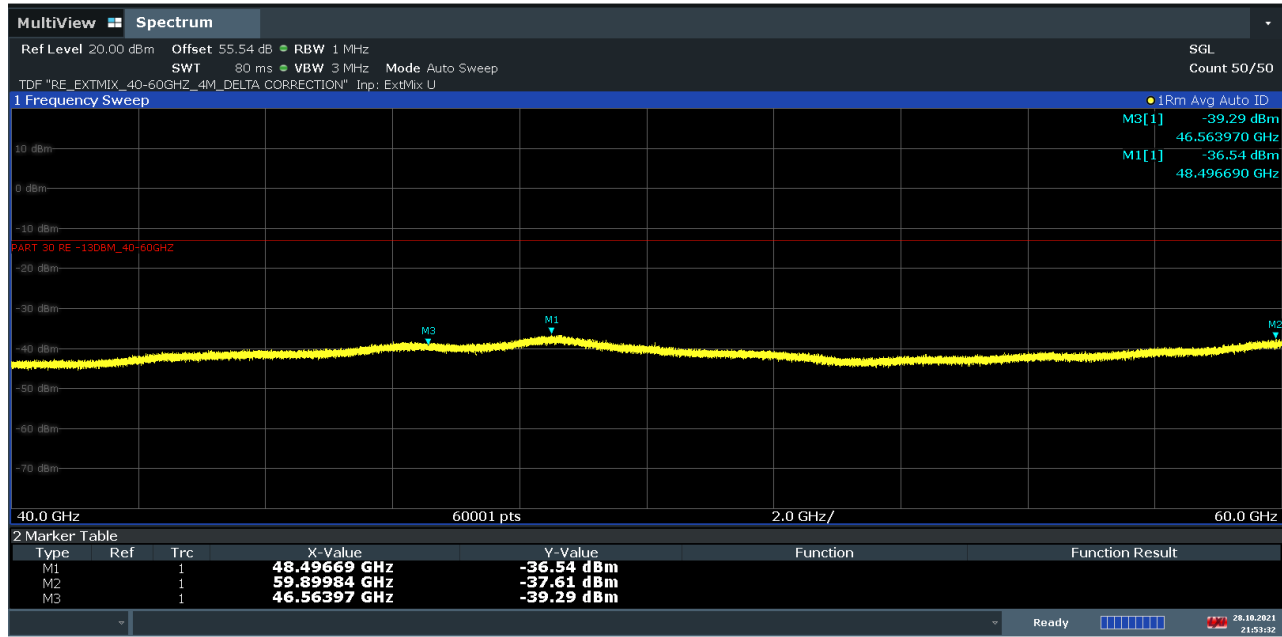
Measured with 1 MHz RBW, RMS detector and bore sighted to maximum beam/ maximum emissions location

Worse case margin is 5.47 dB at 90.175 GHz

U Band 40GHz-60GHz Tested 10/28/2021

Horizontal Polarization -

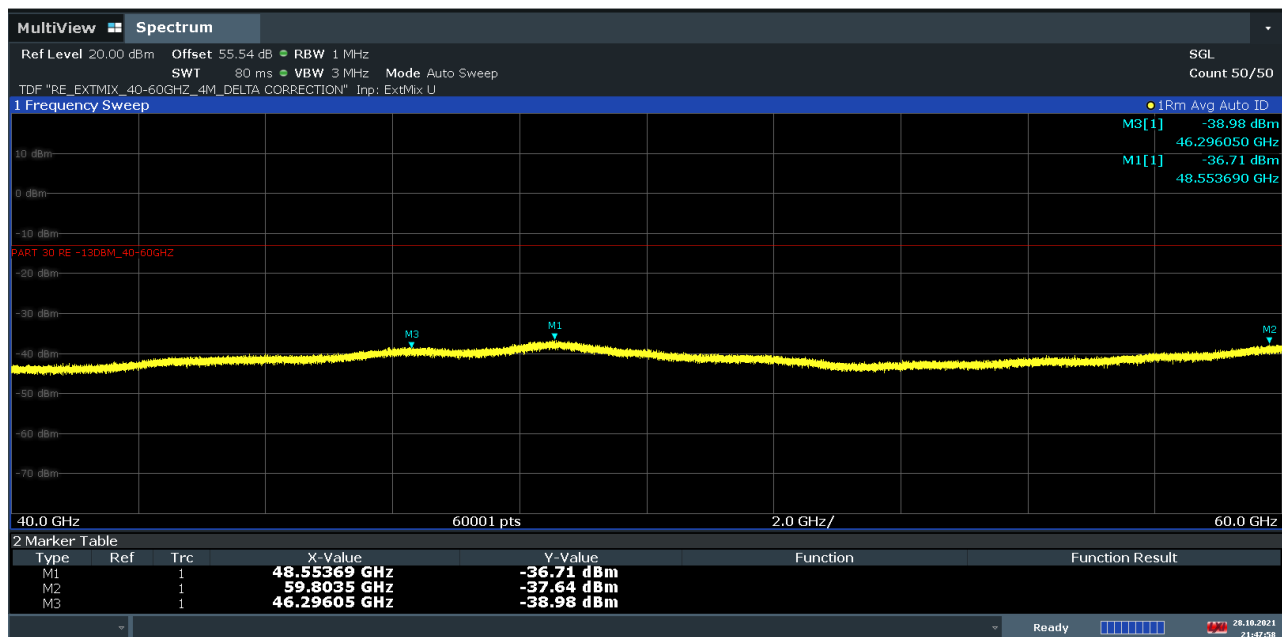
AWGUC/D 24 GHz 4m, sn YK213300003



21:53:33 28.10.2021

Vertical Polarization

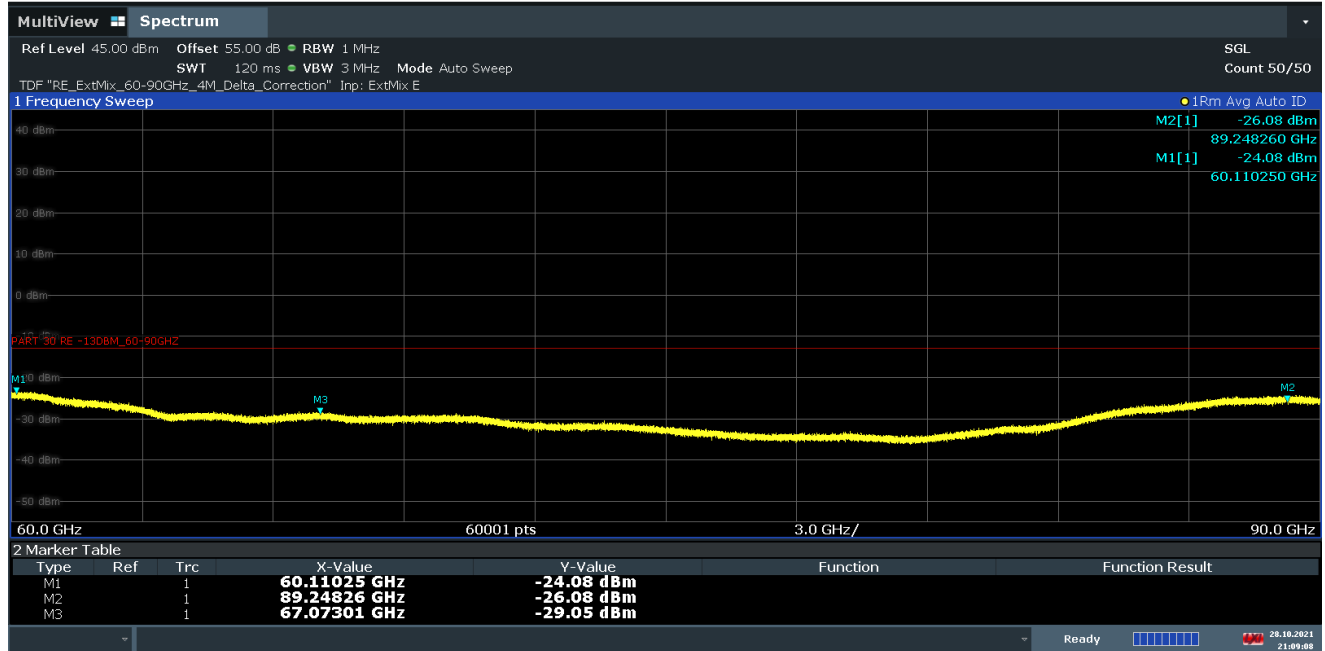
AWGUC/D 24 GHz 4m, sn YK213300003



21:47:58 28.10.2021

E Band - 60GHz-90GHz **Tested 10/28/2021**
Horizontal Polarization

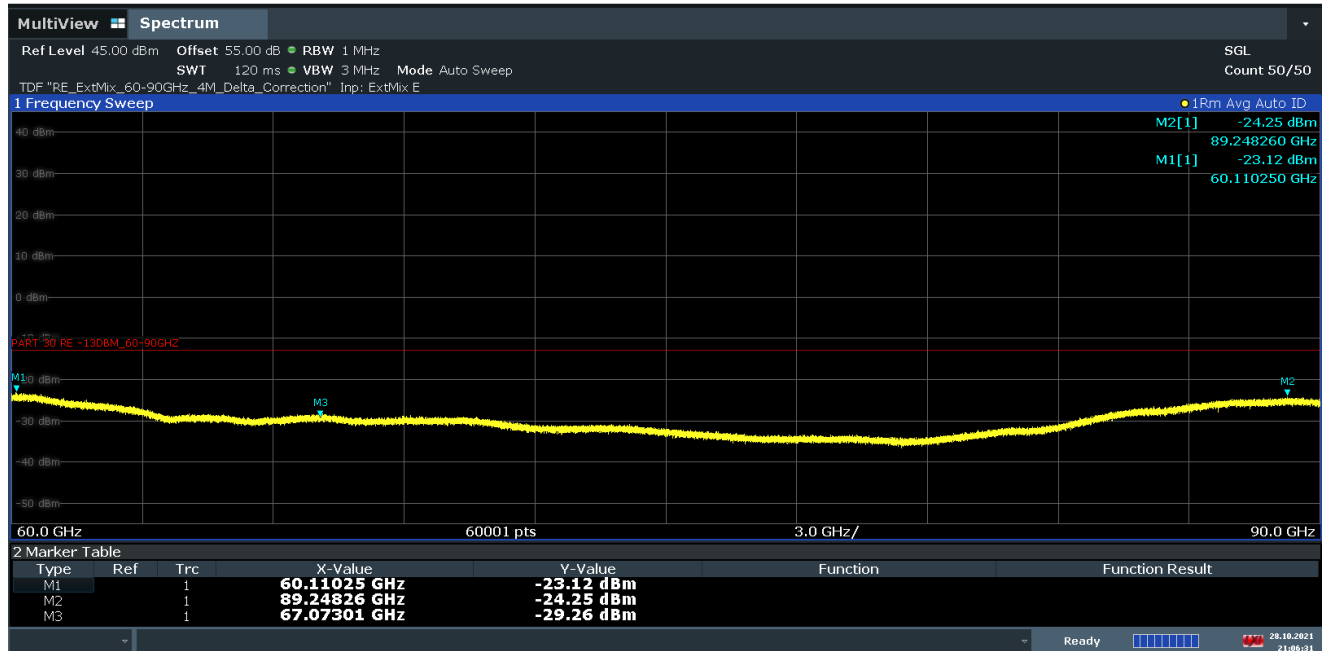
2021-0122 AWGUC/D 24 GHz 4m, sn YK213300003



21:09:08 28.10.2021

Vertical Polarization

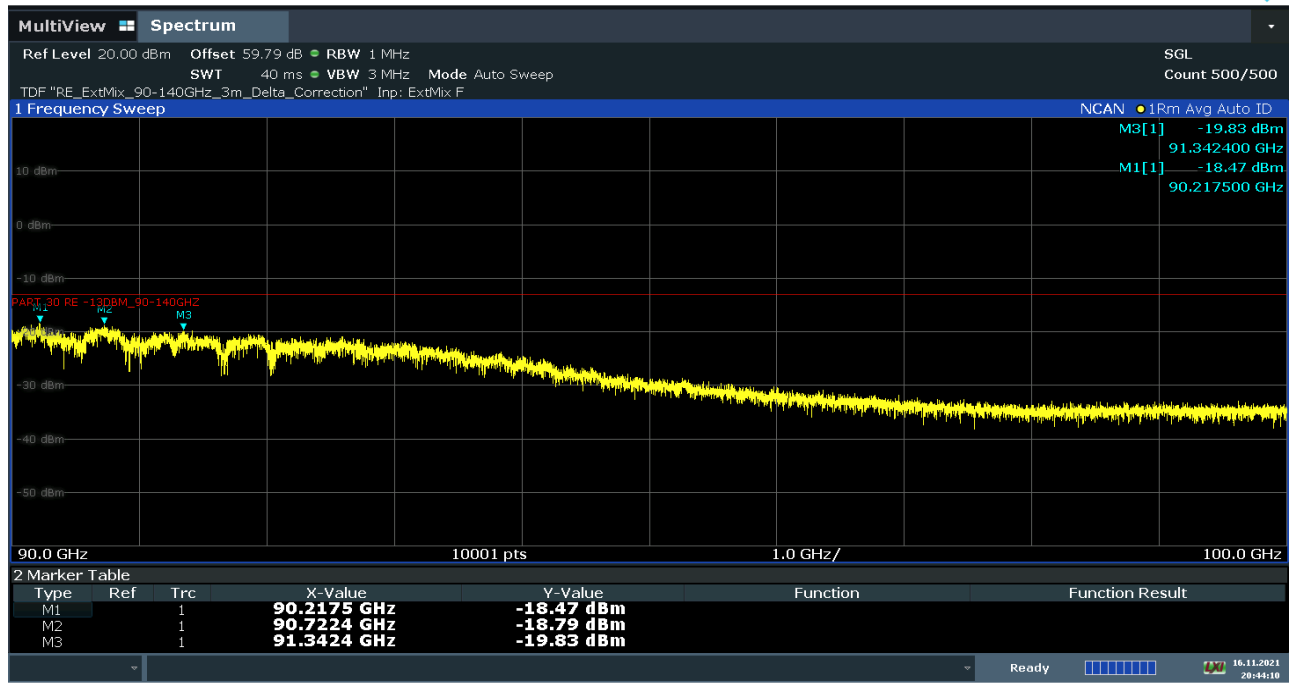
2021-0122 AWGUC/D 24 GHz 4m, sn YK213300003



21:06:32 28.10.2021

F Band - 90GHz-100GHz **Tested 11/16/2021**
Horizontal Polarization

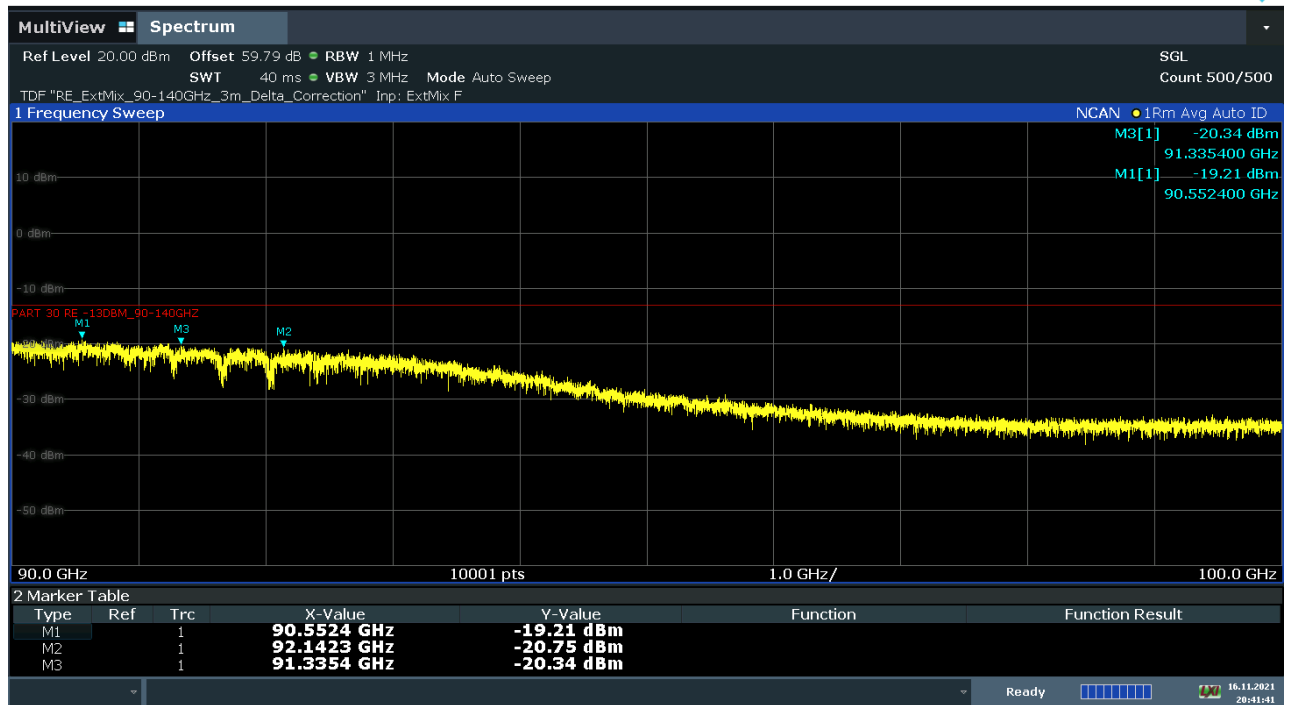
2021-0122 AWGUC/D - s/n YK213300003(dc)



20:44:11 16.11.2021

Vertical Polarization

2021-0122 AWGUC/D - s/n YK213300003(dc)



20:41:42 16.11.2021

4.6 Section 2.1055 MEASUREMENT OF FREQUENCY STABILITY

This measurement evaluates the frequency difference between the actual transmit carrier frequency and the specified transmit frequency assignment. Only the portion of the transmitter system containing the frequency determining and stabilizing circuitry need be put in an environmental chamber and subjected to the temperature variation test per FCC Section 2.1055 and RSS-133. The unit which provides baseband signals, such as BBU (baseband unit), can be located outside the chamber if it is a separated unit.

The temperatures to which the UUT were subjected ranged from a high temperature of +50°C system ambient to a low temperature of -30°C system ambient with measurements recorded at 10°C increments.

Transmit frequency error measures the deviation between the actual transmit frequency and the assigned frequency. The transmit frequency error in this case was measured by capturing the transmitted signal using a receiving antenna and then cabling it to an MXA signal analyzer. The system level frequency stability testing resulted in compliance with established design criteria.

4.6.1 Frequency Stability Results AC Model:

Frequency Stability testing was completed on: AWGUC, 24GHz HP (CF = 24,799MHz). Testing was performed from 10/18/2021 through 10/19/2021 on the radio, which was located in the T-15 Thermal chamber of the Global Product Compliance Laboratory (GPCL) test facility located in Building 4, Room 4-280, Murray Hill, NJ, by Joe Bordonaro from GPCL. The worst case AC powered deviation was 32.491 Hz which is 0.00131 ppm.

Table A: AC Unit Under Test

Series	Vendor	Serial Number	Comcode
AWGUC	Nokia	YK213200172	475946A.X21

Table 1: Instruments Used for Measurement

Type	Model	Vendor	Serial Number	Cal Due Date
AC Source	6813A	HP	3524A-00321	N/A

4.6.2 Frequency Stability Results DC Model:

Frequency Stability testing was completed on: AWGUD, 24GHz HP (CF = 24,799MHz). Testing was performed from 10/20/2021 through 10/21/2021 on the radio, which was located in the T-15 Thermal chamber of the Global Product Compliance Laboratory (GPCL) test facility located in Building 4, Room 4-280, Murray Hill, NJ, by Joe Bordonaro from GPCL. The worst case DC powered deviation was 15.156 Hz which is 0.000611 ppm.

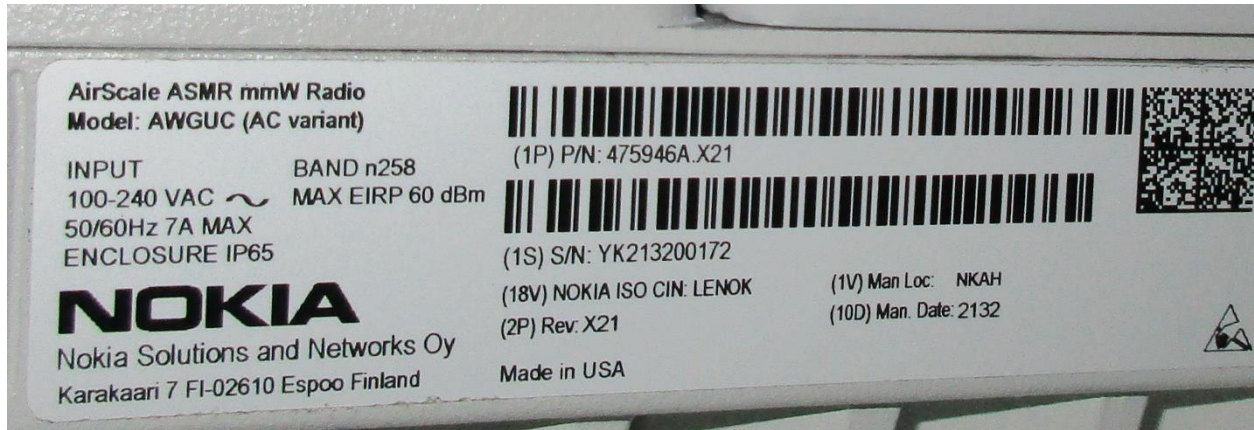
Table B: DC Unit Under Test

Series	Vendor	Serial Number	Com Code #
AWGUD	NOKIA	YK213300013	475947.X21

Table 2: Instruments Used for Measurement

Type	Model	Vendor	Serial Number	Cal Due Date
DC Source	PWR800L	KIKUSUI	ML002991	N/A

Serial Number (AC Unit)



Serial Number (DC Unit)



AWGUC - AC Version

Frequency Block Tested: (CF = 24,799MHz)
 Baseline Measurement at +25°C

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	24.708
0.5	13.902
1.0	32.491
1.5	-5.9632
2.0	-3.5779
2.5	7.6792
3.0	26.165
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	-12.112
0.5	25.883
1.0	10.763
1.5	-4.0826
2.0	14.527
2.5	6.1958
3.0	2.3077
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	12.207
0.5	18.209
1.0	1.9476
1.5	4.0972
2.0	16.295
2.5	-1.5442
3.0	10.500
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	-9.9313
0.5	6.9788
1.0	-1.1973
1.5	15.209
2.0	-2.2873
2.5	3.6210
3.0	8.4003
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	8.6460
0.5	4.9022
1.0	9.2091
1.5	5.2536
2.0	9.3968
2.5	5.1216
3.0	2.3902
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	-1.3972
0.5	5.1478
1.0	-1.1536
1.5	8.0663
2.0	1.5377
2.5	10.321
3.0	4.4776
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	-4.6449
0.5	1.1633
1.0	-3.9155
1.5	3.7426
2.0	5.5559
2.5	8.4897
3.0	-7.0667
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	2.1322
0.5	-3.5439
1.0	8.3080
1.5	10.100
2.0	-7.9146
2.5	7.1067
3.0	1.4241
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	4.1684
0.5	-1.6042
1.0	3.1329
1.5	-4.8563
2.0	3.8613
2.5	2.4065
3.0	-6.5856
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	8.8316
0.5	-2.3721
1.0	0.91888
1.5	10.043
2.0	-4.0925
2.5	5.2028
3.0	-1.9135
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Upon return to +25°C.

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	8.2998
0.5	3.2283
1.0	-6.1159
1.5	7.3547
2.0	0.7768
2.5	3.0173
3.0	-1.2171
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at 103% of Nominal Voltage, 123.6VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	9.6911
0.5	2.5345
1.0	5.8370
1.5	8.0009
2.0	2.9795
2.5	9.0576
3.0	6.4509
938 MHz (±0.05ppm) ±0.05ppm = ±46.9Hz	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at 106% of Nominal Voltage, 127.2VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	3.6105
0.5	1.1397
1.0	6.8525
1.5	3.9151
2.0	3.6609
2.5	16.937
3.0	4.9854
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at 109% of Nominal Voltage, 130.8VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	5.6700
0.5	9.9617
1.0	2.5313
1.5	-2.2211
2.0	10.694
2.5	0.37411
3.0	6.1338
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at 112% of Nominal Voltage, 134.4VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	7.7834
0.5	-1.6358
1.0	-0.9997
1.5	6.6183
2.0	11.035
2.5	2.2877
3.0	-7.1256
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at 115% of Nominal Voltage, 138VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	4.8669
0.5	2.8763
1.0	-0.8990
1.5	14.424
2.0	5.6437
2.5	2.9544
3.0	7.2765
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	5.5560
0.5	2.8242
1.0	4.4994
1.5	10.031
2.0	11.483
2.5	1.9123
3.0	9.7521
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at -3% of Nominal Voltage, 116.4VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	9.4315
0.5	-0.71108
1.0	8.8000
1.5	-0.1279
2.0	9.0629
2.5	2.7951
3.0	-2.7621
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at -6% of Nominal Voltage, 112.8VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	12.796
0.5	5.6904
1.0	7.7379
1.5	4.0627
2.0	0.50239
2.5	4.9529
3.0	10.060
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at -9% of Nominal Voltage, 109.2VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	2.3927
0.5	7.5713
1.0	1.3137
1.5	-4.3851
2.0	0.3050
2.5	3.6536
3.0	12.950
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at -12% of Nominal Voltage, 105.6VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	11.752
0.5	2.6264
1.0	0.9843
1.5	6.6548
2.0	12.602
2.5	4.9257
3.0	15.407
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, 102VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	5.5910
0.5	2.7012
1.0	6.0360
1.5	13.277
2.0	4.1869
2.5	8.7662
3.0	0.71097
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	Pass

Thermal Chamber Profile Plot (AC Unit)



AWGUD - DC Version

Frequency Block Tested: (CF = 24,799MHz)

Baseline Measurement at +25°C

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	2.7112
0.5	6.5987
1.0	8.0395
1.5	4.3450
2.0	11.224
2.5	3.5333
3.0	-1.5585
FCC SPECIFICATION	38,447.76MHz (±0.05ppm) ±0.05ppm = ±1922.45Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	3.4489
0.5	9.7334
1.0	-11.372
1.5	0.8146
2.0	8.1973
2.5	-3.5004
3.0	5.5717
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.6994
0.5	0.42531
1.0	3.1825
1.5	6.8799
2.0	-2.2228
2.5	4.1854
3.0	11.583
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.2040
0.5	-4.5352
1.0	9.0833
1.5	3.0190
2.0	-8.1505
2.5	0.75913
3.0	4.4509
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	6.6739
0.5	0.48179
1.0	5.0184
1.5	10.753
2.0	6.9017
2.5	1.2086
3.0	4.1849
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	4.1533
0.5	9.2370
1.0	0.42679
1.5	-1.7024
2.0	2.4376
2.5	10.152
3.0	-1.8577
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.1076
0.5	4.3889
1.0	-2.8881
1.5	6.6939
2.0	-1.0445
2.5	2.8652
3.0	7.4240
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	5.7636
0.5	-2.9105
1.0	4.3265
1.5	1.6146
2.0	10.154
2.5	-2.9570
3.0	-0.6048
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	2.2524
0.5	0.44534
1.0	-1.2329
1.5	4.3643
2.0	1.0141
2.5	-5.2274
3.0	7.4521
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	6.2216
0.5	1.8756
1.0	-0.8106
1.5	6.1937
2.0	-2.8280
2.5	-9.0027
3.0	5.3320
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Upon return to +25°C.

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.0311
0.5	5.5337
1.0	-2.1647
1.5	2.4128
2.0	-7.7732
2.5	-1.0734
3.0	4.7754
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 103% of Nominal Voltage, -49.44VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	8.8681
0.5	3.0074
1.0	13.789
1.5	4.8005
2.0	1.4253
2.5	11.441
3.0	4.7489
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 106% of Nominal Voltage, -50.88VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	6.7628
0.5	2.3924
1.0	7.0801
1.5	12.059
2.0	1.1462
2.5	11.946
3.0	-4.8682
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 109% of Nominal Voltage, -52.32VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	4.2478
0.5	-2.4981
1.0	14.270
1.5	2.1643
2.0	0.50383
2.5	7.3942
3.0	-2.6555
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 112% of Nominal Voltage, -53.76VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	4.5308
0.5	-5.2533
1.0	0.69417
1.5	-1.2995
2.0	5.4932
2.5	2.5899
3.0	1.4675
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 115% of Nominal Voltage, -55.20VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	7.2140
0.5	4.0089
1.0	-2.0143
1.5	2.5669
2.0	-1.7275
2.5	-2.6334
3.0	7.5105
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48.0VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	2.8968
0.5	12.054
1.0	5.0661
1.5	12.303
2.0	1.6452
2.5	-2.9384
3.0	7.8915
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -3% of Nominal Voltage, -46.56VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.9055
0.5	5.6571
1.0	0.4540
1.5	12.511
2.0	-4.2704
2.5	8.1035
3.0	2.9248
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

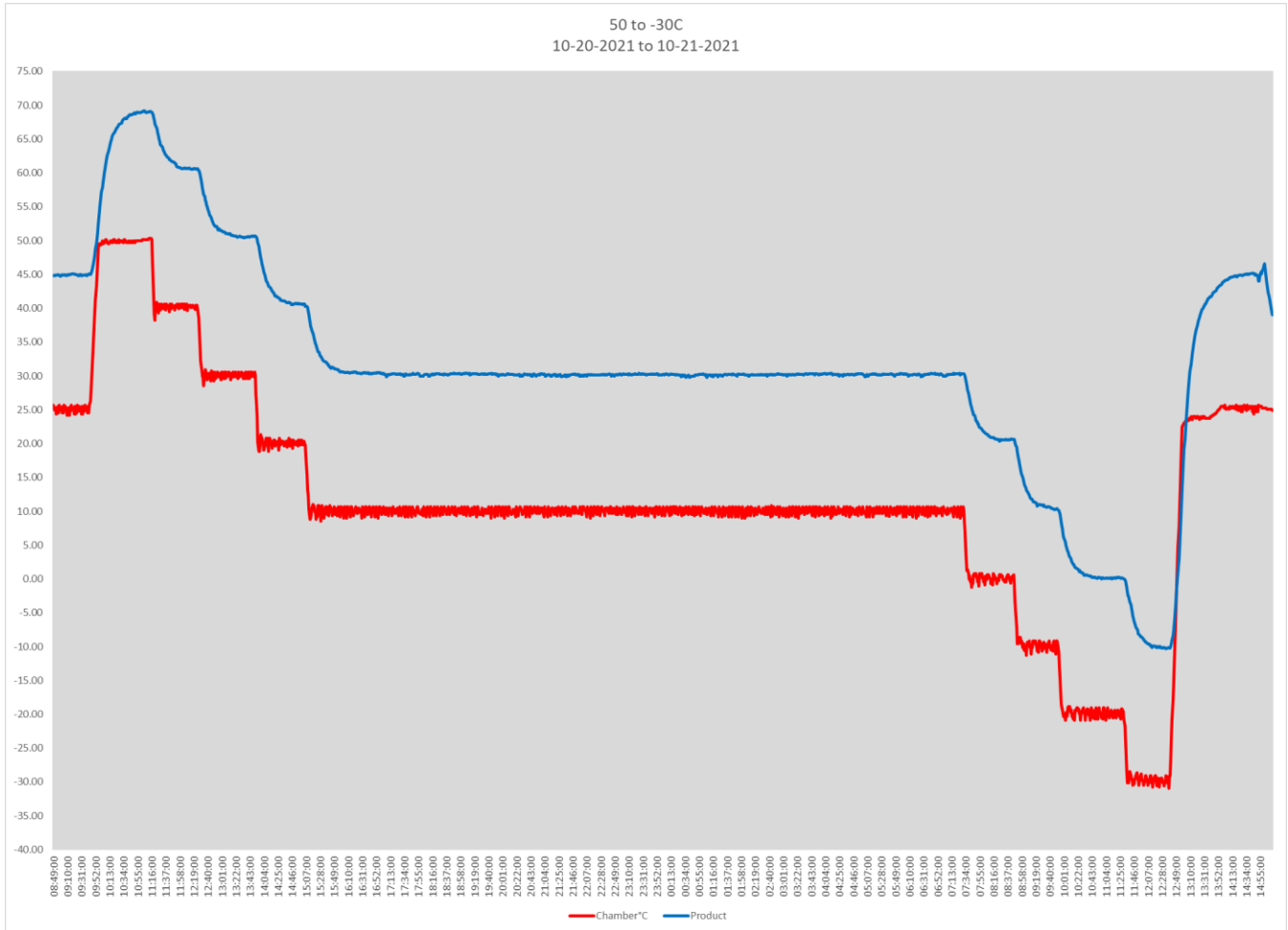
Transmit Frequency Deviation at +25°C at -6% of Nominal Voltage, -45.12VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	4.9528
0.5	4.4198
1.0	1.7739
1.5	-7.1200
2.0	4.8812
2.5	8.7831
3.0	3.8884
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -9% of Nominal Voltage, -43.68VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	3.5949
0.5	-4.3547
1.0	10.686
1.5	7.5812
2.0	4.4032
2.5	15.156
3.0	8.3266
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -12% of Nominal Voltage, -42.24VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	4.7686
0.5	3.2619
1.0	5.5532
1.5	-1.4867
2.0	6.1045
2.5	2.5843
3.0	2.1811
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, -40.80VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	5.4820
0.5	13.189
1.0	5.3562
1.5	2.1582
2.0	-2.8595
2.5	6.3918
3.0	8.2778
FCC SPECIFICATION	24799 MHz (±0.05ppm) ±0.05ppm = ± 1239.95Hz
FCC RESULT	PASS

Thermal Chamber Profile Plot (DC Unit)



4.7 List of Test Equipment

4.7.1 List of Radio Measurements Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E1461	A-Info	Horn Antenna	Pyramidal standard gain horn antenna 22 - 33 GHz WR34 25dB	LB-34-25-C2-KF	J202026030	Factory, - in Service 2020-03-04	2023-03-04	RC	Active
E1384	Rohde & Schwarz	Spectrum Analyzer	2 Hz to 85 GHz	FSW85	101537	2020-08-25	2022-08-25	RC	Active
E485	Kikusui	Power Supply	0-55VDC,120 Amps	PAD 55-120L	DL000416	CNR	CNR	CNR	Active
E772	Sunol Sciences Corp	Modular Controller	Tower / Turntable Controller	SC104V	060107-1	CNR	CNR	CNR	Active
E1255	ETS Lindgren	Controller	Multi-Device Controller	2090	00078509	CNR	CNR	CNR	Active
E1150	Extech	Data Logger	Pressure Humidity Temp Data Logger	SD700	Q752767	2021-01-11	2023-01-11	RC	Active

RC: Requires Calibration CNR: Calibration Not Required CNR-V: Calibration Not Required, Must Be Verified SPV: System Performance Verified Test Dates: 9/15-22/2021 -

4.7.2 List of Radiated Emissions Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E601	A.H. Systems	Biological Antenna	25 - 2000 MHz	SAS-521-2	408	2019-12-03	2021-12-03	RC	Active
E1525	A.H. Systems	Pre-Amplifier	18 GHz-40 GHz, 37 dB	PAM-1840VH	186	2020-11-30	2022-11-30	RC	Active
E1527	ETS Lindgren	Horn Antenna	Double Ridge,10-40 GHz	3116C	00227823	2020-08-13	2022-08-13	RC	Active
E1073	ETS Lindgren	Horn Antenna	Double-Ridge, 1-18 GHz	3117	00135198	2019-08-22	2021-09-22	RC	Active
E447	Hewlett Packard	Preamplifier	1-26.5 GHz	8449B	3008A01384	2020-08-31	2022-08-31	RC	Active
E1472	Reactel, Inc.	Filter, High Pass	27 - 40 GHz,	11HS-X27G-K11	SN20-02	2020-09-08	2022-09-08	CNR-V	Active
E1476	Reactel, Inc.	Filter, Low Pass	DC - 20 GHz	11LS-X20GS11	SN20-01	2020-09-15	2022-09-15	CNR-V	Active
E1308	Rohde & Schwarz	Harmonic Mixer	90-140 GHz	FS-Z140	101008	2021-10-29	2024-10-29	RC	Active
E1311	Rohde & Schwarz	Harmonic Mixer	40 - 60 GHz	FS-Z60	100977	2021-10-06	2024-10-06	RC	Active
E1312	Rohde & Schwarz	Harmonic Mixer	60 - 90 GHz	FS-Z90	101719	2021-09-28	2024-09-28	RC	Active
E1260	Rohde & Schwarz	Spectrum Analyzer	2 Hz – 67 GHz	FSW67	104007	2020-08-21	2022-08-21	RC	Active
E908	Rohde & Schwarz	Test Receiver	20Hz to 40 GHz	ESIB40	100100	2020-04-17	2022-04-17	RC	Active
E813	Sonoma Instrument Co.	Amplifier	9kHz-1GHz	310N	186750	2020-10-20	2022-10-20	RC	Active
E1452	A-Info	Horn Antenna	Pyramidal standard gain horn antenna 18 to 26.5 GHz WR42, 25 dB	LB-42-25-C2-KF	J202066361	2020-07-24	2023-07-24	RC	Active
E1373	A-Info	Horn Antenna	Pyramidal standard gain horn antenna 26.5-40GHz WR28, 25 dB	LB-28-25-C2-KF	J202062735	2018-12-05	2021-12-05	RC	Active
E483	Kikusui	Power Supply	DC 55 Volts 120 Amps	PAD 55-120L	DM000112			CNR	Active

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E588	Sunol Sciences Corp	System Controller	Tower & Turntable Controller	SC99V	32802-1	n/a	n/a	CNR	Active
E1268	Trilithic	Filter, Low Pass	DC - 1620 MHz	23042	200802040	2021-09-14	2023-09-14	CNR-V	Active
E1315	RS Microwave Company, Inc.	Filter, precision waveguide	DC - 40 GHz, 20W, 2.5dB	P/N 60733A	007	Factory, - in Service 2018-07-01		CNR-V	Active
E1498	Reactel, Inc.	Filter, Low Pass	DC - 22 GHz, 1 dB	11LS-X22-6GK11	20-01	2020-06-16	2022-06-16	CNR-V	Active
E1330	Sage Millimeter, Inc.	Horn Antenna	U-band pyramidal standard gain horn antenna - 40 to 60 GHz	SAR-2309-19-S2	14853-01	Factory, - in Service 2018-07-01		CNR-V	Active
E1332	Sage Millimeter, Inc.	Horn Antenna	E-band pyramidal standard gain horn antenna - 60 to 90 GHz.	SAR-2309-12-S2	14853-01	Factory, - in Service 2018-07-01		CNR-V	Active
E1335	Sage Millimeter, Inc.	Horn Antenna	F-band pyramidal standard gain horn antenna - 90 to 140 GHz	SAR-2309-08-S2	14853-02	Factory, - in Service 2018-07-01		CNR-V	Active

CNR: Calibration Not Required

CNR-V: Calibration Not Required, Must Be Verified

Test Dates: 9/15/2021 – 11/16/2021

4.7.3 List of Frequency Stability Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
TH513-T15	Envirotronics	Controller	Chamber Controller	Envirotronics SPPCM	SP000077	2020-02-27	2022-02-27	Requires Calibration	Active
TH-T15	Envirotronics	Thermal Chamber	Thermal Chamber	N/A	3015242			CNR	Active
TH071	Extech	Data Logger	Barometric Pressure /Humidity/ Temperature	SD700	Q668911	2019-12-27	2021-12-27	Requires Calibration	Active
TH044	Fluke	Multimeter	Digital Multimeter (DMM)	83III	74910377	2020-02-25	2022-02-25	Requires Calibration	Active
TH079	Yokogawa	Recorder	SmartDac+ paperless recorder	GP20	S5P506676	2020-02-25	2022-02-25	Requires Calibration	Active
MY57431033	KeySight Technologies	MXA Signal Analyzer	20 Hz-44 GHz (Analysis Bandwidth 125 MHz)	N9020B	MY57120303	2020-07-08	2022-07-08	Requires Calibration	Active

Test Dates: 10/18/2021 – 10/21/2021

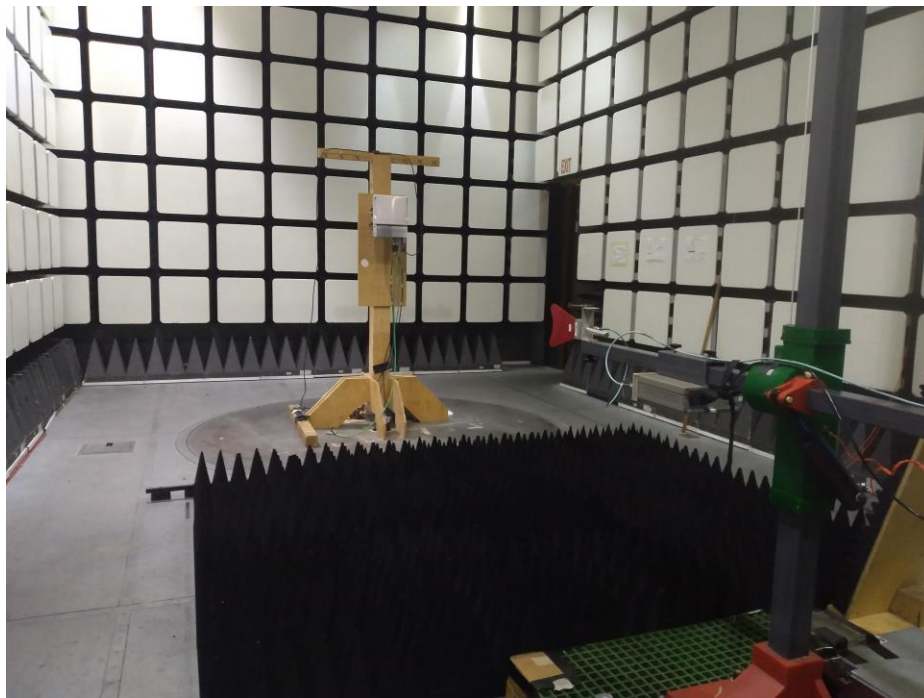
4.8 PHOTOGRAPHS OF THE TEST SETUPS

Radiated Emissions Test

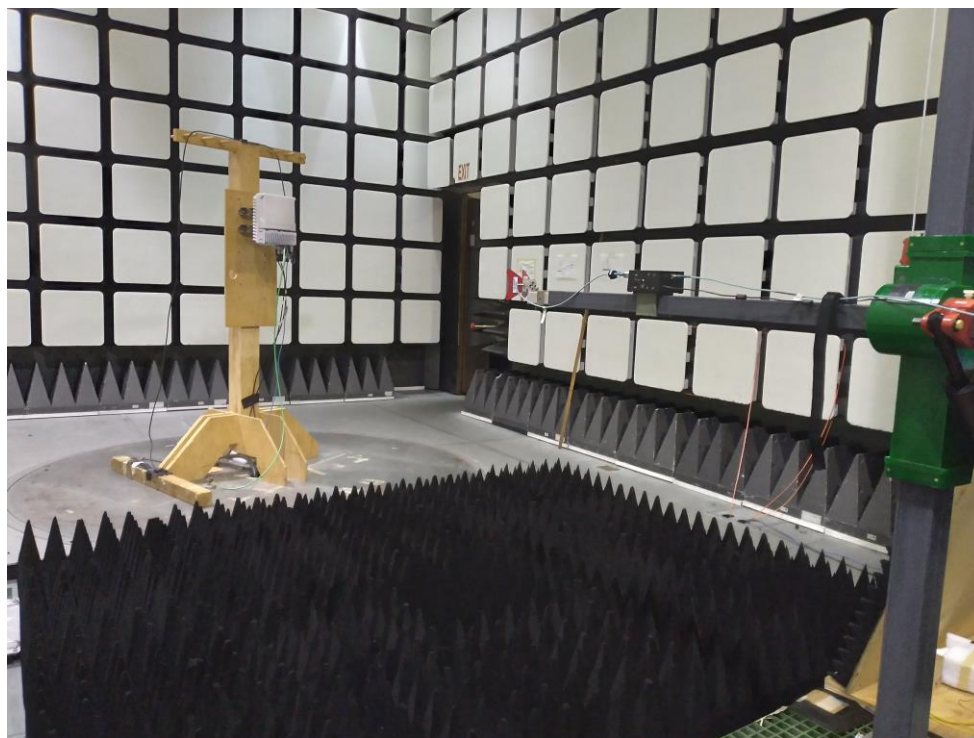
30 MHz-1 GHz



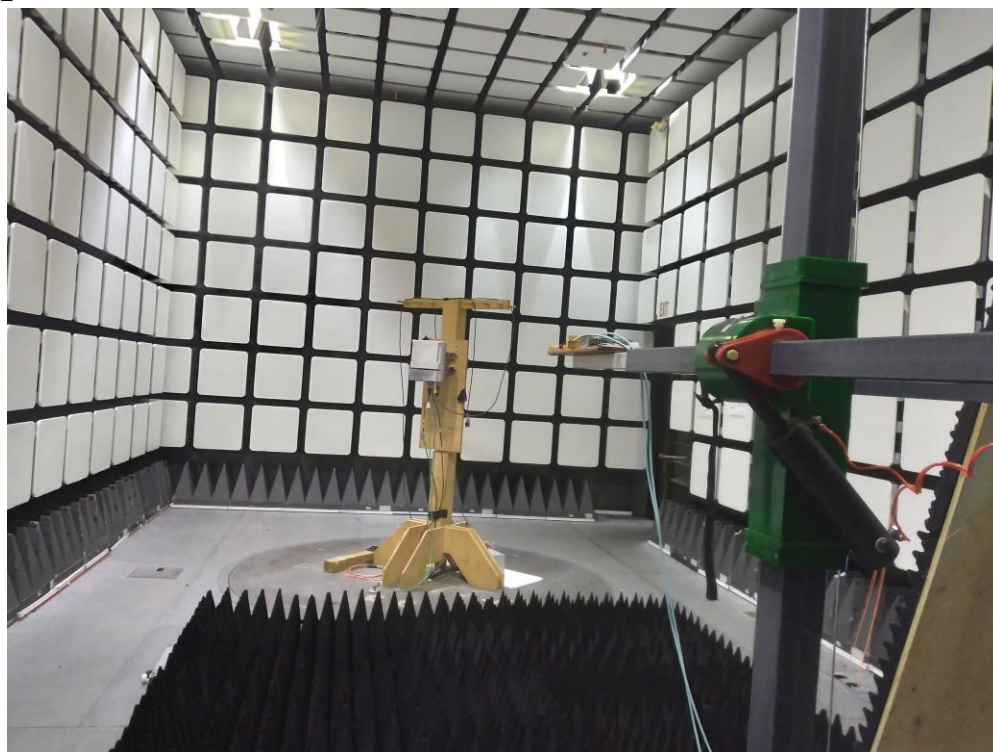
1 GHz – 18 GHz



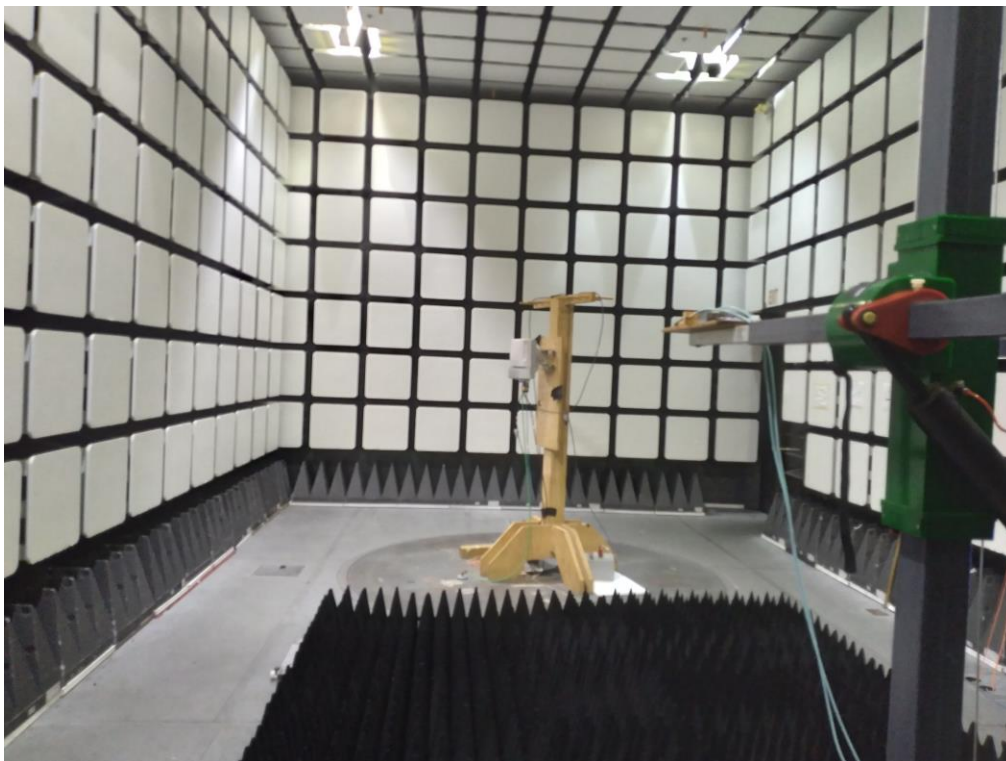
18GHz-40GHz



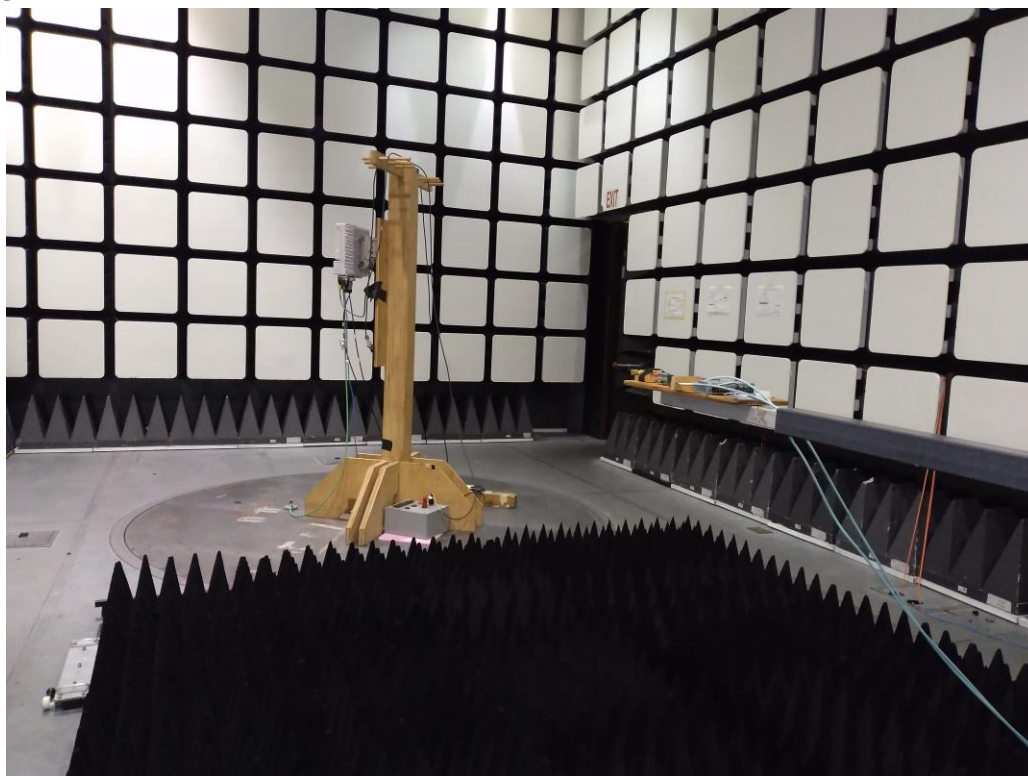
40GHz-60 GHz



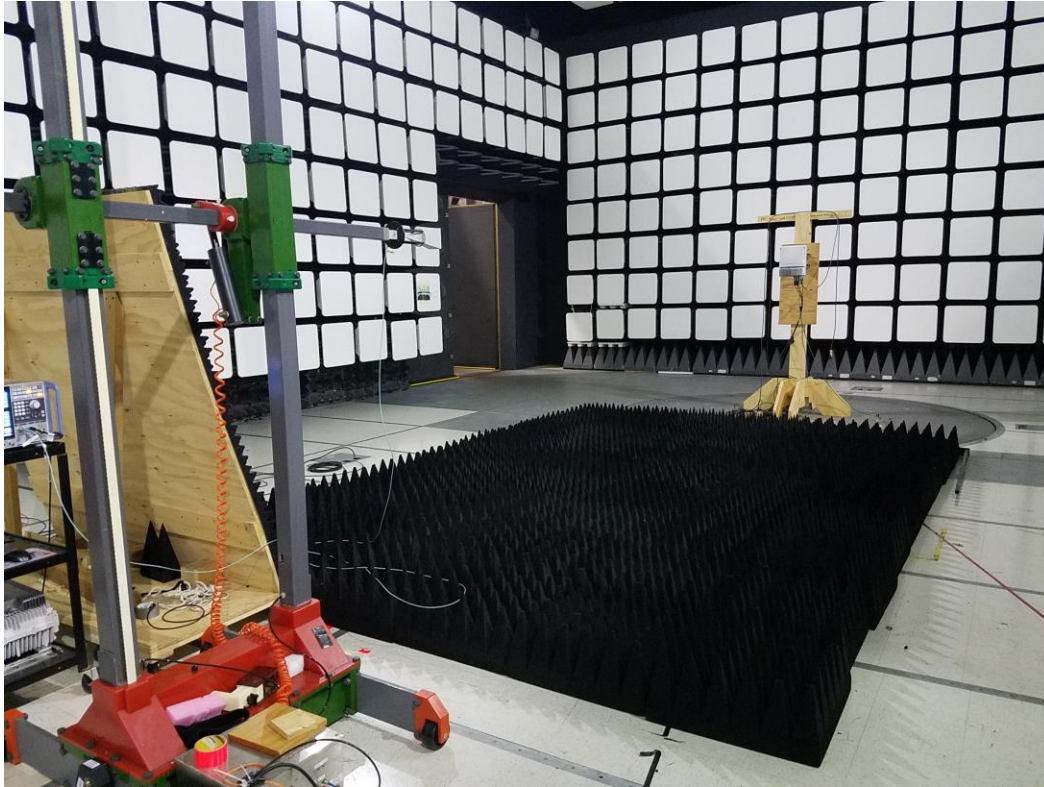
60GHz-90 GHz



90GHz-100 GHz



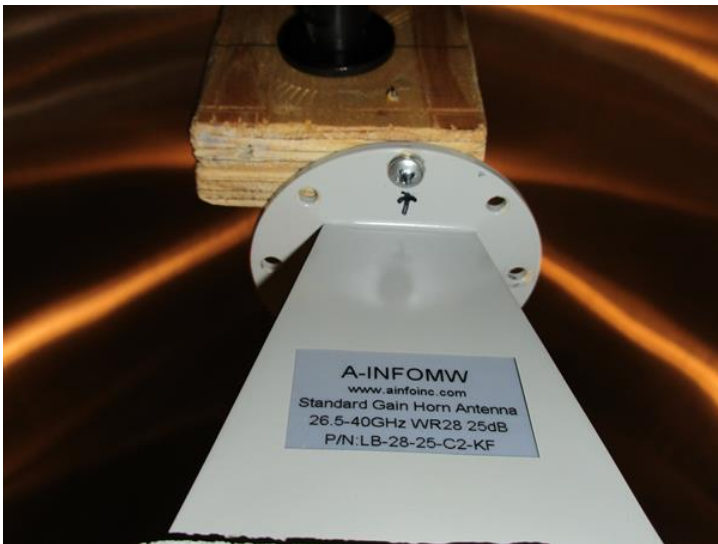
Radio Testing
22GHz -33 GHz



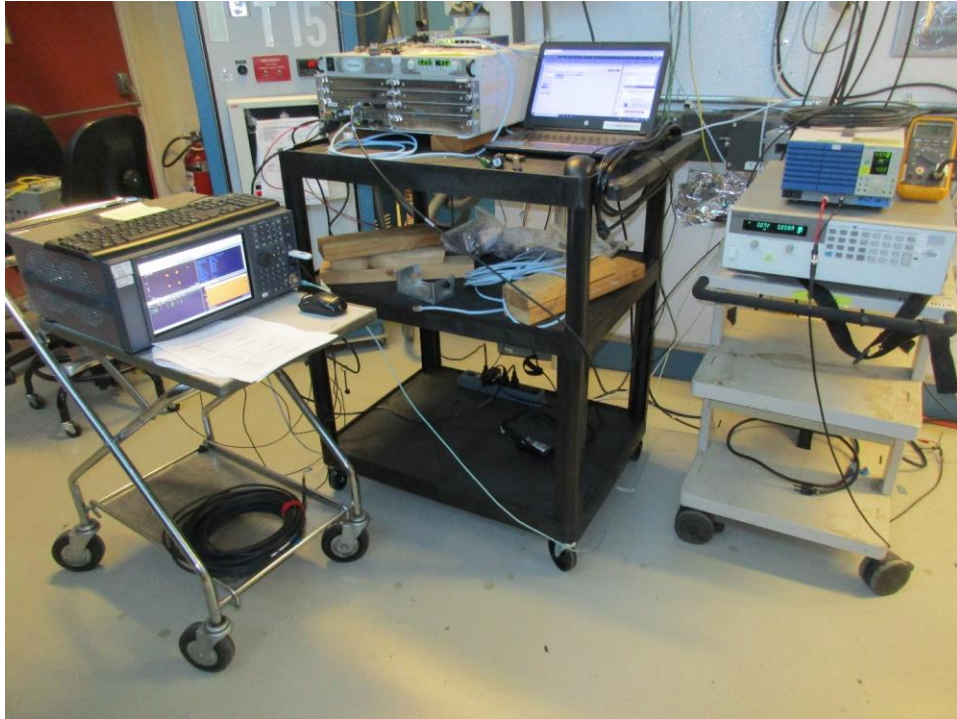
Test Sample Label



Frequency Stability Test - in thermal chamber



Frequency Stability - Support Equipment Setup



4.9 FACILITIES AND ACCREDITATION

Measurement facilities at Nokia, Global Product Compliance Laboratory (GPCL) a member of the Nokia family of companies, was used to collect the measurement data in the test report. The laboratory, which is part of Nokia Bell Labs, is located at 600-700 Mountain Avenue, Murray Hill, New Jersey 07974-0636 USA.

The field strength measurements of radiated spurious emissions were made in a FCC registered five meter semi-anechoic chamber AR-4, (FCC Registration Number: 395774) **NVLAP** Lab Code: 100275-0 and IC (Filing Number: 6933F-5) which is maintained by Nokia Bell Labs in Murray Hill, New Jersey. The sites were constructed and are continuously in conformance with the requirements of ANSI C63.4 and CISPR Publication 22.

Nokia Global Product Compliance Laboratory FCC OET Accredited Test Firm Scope List is accessible at:

https://apps.fcc.gov/oetcf/eas/reports/ViewTestFirmAccredScopes.cfm?calledFromFrame=N&RequestTimeout=500®num_specified=N&test_firm_id=7007

and is as listed in the Table below.

OET Accredited Test Firm Scope List
Test Firm: Nokia, Global Product Compliance Lab

Scope	FCC Rule Parts	Maximum Assessed Frequency, MHz	Status	Expiration Date	Recognition Date
Unintentional Radiators	FCC Part15, Subpart B	40000	Approved	9/30/2022	7/6/2017
Intentional Radiators	FCC Part 15 Subpart C	40000	Approved	9/30/2022	6/5/2018
U-NII without DFS Intentional Radiators	FCC Part 15, Subpart E	40000	Approved	9/30/2022	6/5/2018
U-NII with DFS Intentional Radiators	FCC Part 15, Subpart E	40000	Approved	9/30/2022	6/5/2018
Commercial Mobile Services	Part 22 (cellular), Part 24, Part 25 (below 3 GHz), Part 27	40000	Approved	9/30/2022	6/5/2018
General Mobile Radio Services	Part 22 (non-cellular), Part 90 (below 3 GHz), Part 95 (below 3 GHz), Part 97 (below 3 GHz), Part 101 (below 3 GHz)	40000	Approved	9/30/2022	6/5/2018
Citizens Broadband Radio Services	Part 30	40000	Approved	9/30/2022	7/6/2017
Microwave and Millimeter Bands Radio Services	Part 25, Part30, Part 74, Part 90 (90M DSRC, Y, Z), Part 95 (M & L), Part 101	200000	Approved	9/30/2022	7/6/2017

Nokia Global Product Compliance Laboratory is accredited with the US Department of Commerce National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 7 Code of Federal Regulations for offering test services for selected test methods in Electromagnetic Compatibility; Voluntary Control Council for Interference (VCCI), Japan; Australian Communications and Media Authority (ACMA). The laboratory is ISO 9001:2008 Certified.

**United States Department of Commerce
National Institute of Standards and Technology**

NVLAP® 

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 100275-0

Nokia, Global Product Compliance Lab
Murray Hill, NJ

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Electromagnetic Compatibility & Telecommunications

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2020-09-25 through 2021-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 100275-0

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This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2021-09-24 through 2022-09-30
Effective Dates



[Signature]
For the National Voluntary Laboratory Accreditation Program