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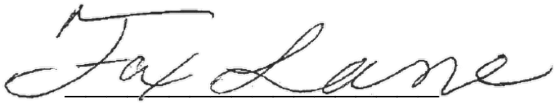
FCC/ISED Test Report

Prepared for:	**Digital Monitoring Products**
Address:	**2500 North Partnership Blvd. Springfield, MO 65803**
EUT:	**PC0245**
FCC ID:	**CCKPC0245**
IC:	**5251A-PC0245**
Test Report No:	**R20221024-20-E1B**
Approved by:	 **Fox Lane, EMC Test Engineer**
DATE:	**April 17, 2023**
Total Pages:	**36**

ilac-MRA A2LA ACCREDITED TESTING LABORATORY CERTIFICATE NO. 1953.01

REVISION PAGE

Rev. No.	Date	Description
0	13 December 2022	Issued by FLane Prepared by BWinter
A	6 April 2023	Corrected IC/FCCID - FLane
B	17 April 2023	Updated EUT Name, added Antenna gain to results - FLane

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1.0 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

(1) US Code of Federal Regulations, Title 47, Part 15
(2) ISED RSS-Gen, Issue 5
(3) ISED RSS-247, Issue 2

ANSI C63.10-2013 was used as a test method, with guidance from KBD 558074 D01 v05

SUMMARY			
Standard Section	**Test Type and Limit**	**Result**	**Remark**
FCC 15.203	Unique Antenna Requirement	Pass	Internal antenna
FCC 15.35 RSS-Gen, 6.10	Duty cycle of pulsed emissions	Informative only	Duty cycle was applied
FCC 15.209 RSS-Gen, 7.1	Receiver Radiated Emissions	Pass	Meets the requirement of the limit.
FCC 15.247(a)(1)(i) RSS-247, 5.1(c)	Maximum Bandwidth, Limit: Max. 250kHz	Pass	Meets the requirement of the limit.
FCC 15.247(b)(1) RSS-247, 5.1	Maximum Peak Output Power, Limit: Max. 24 dBm	Pass	Meets the requirement of the limit.
FCC 15.209 RSS-Gen, 8.9 RSS-247, 5.5	Transmitter Radiated Emissions	Pass	Meets the requirement of the limit.
FCC 15.247(a) (1) (i) RSS-247, 5.1(c)	Frequency hopping system, Limit: Max. 0.4 Seconds in 20 Second Period	Pass	Meets the requirement of the limit.
FCC 15.209, 15.205 RSS-Gen, 8.9 RSS-247, 5.5	Band Edge Measurement, Limit: 20dB less than the peak value of fundamental frequency	Pass	Meets the requirement of the limit.
FCC 15.207 RSS-Gen. 8.8	Conducted AC Emissions	NA	NA

2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary
The Equipment Under Test (EUT) was PC0245, a wireless receiver manufactured by DMP wireless devices. It operates in the 902 to 928 MHz ISM band and has transmit and receive capabilities.

EUT	PC0245
EUT Received	10/25/2022
EUT Tested	10/31/2022 - 12/5/2022
Serial No.	010782 (Assigned by test lab)
Operating Band	902 – 928 MHz
Device Type	FHSS
Power Supply	External Battery, 12VDC
Antenna	Helical Spring Atenna, 5.56

NOTE: For more detailed features description, please refer to the manufacturer's specifications or user's manual.

2.2 DESCRIPTION OF TEST MODES

The EUT operates on, and was tested at the frequencies below:

Channel	Frequency
Low	903.3
Middle	915.0
High	926.6

These are the only three representative channels tested in the frequency range according to FCC Part 15.31 and RSS-Gen Table A1. See the operational description for a list of all channel frequency and designations.

This EUT was set to transmit in a worse-case scenario with modulation on. The manufacturer modified the unit to transmit continuously on the lowest, highest and one channel in the middle.

2.3 DESCRIPTION OF SUPPORT UNITS

None

3.0 LABORATORY DESCRIPTION

3.1 LABORATORY DESCRIPTION

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

A2LA Certificate Number:	1953.01
FCC Accredited Test Site Designation No:	US1060
Industry Canada Test Site Registration No:	4294A-1
NCC CAB Identification No:	US0177

Environmental conditions varied slightly throughout the tests.

3.2 TEST PERSONNEL

No.	PERSONNEL	TITLE	ROLE
1	Nic Johnson	Technical Manager	Review of Results
2	Blake Winter	Test Engineer	Testing and Report
3	Ethan Schmidt	Test Engineer Intern	Testing and Report

Notes:
All personnel are permanent staff members of NCEE Labs. No testing or review was sub-contracted or performed by sub-contracted personnel.

3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Keysight MXE Signal Analyzer (26.5GHz)	N9038A	MY56400083	July 19, 2022	July 19, 2024
Keysight MXE Signal Analyzer (44GHz)	N9038A	MY59050109	July 19, 2022	July 19, 2024
SunAR RF Motion**	JB1	A082918-1	July 26, 2022	July 26, 2024
ETS Horn Antenna	3115	00218655	July 21, 2022	July 21, 2024
Rohde & Schwarz Preamplifier*	TS-PR18	3545700803	April 4, 2022	April 4, 2024
Trilithic High Pass Filter*	6HC330	23042	April 22, 2022	April 22, 2024
MiniCircuits High Pass Filter*	VHF-1320+	15542	April 4, 2022	April 4, 2024
ETS – Lindgren- VSWR on 10m Chamber	10m Semi-anechoic chamber-VSWR	4740 Discovery Drive	July 30, 2020	July 30, 2023
NCEE Labs-NSA on 10m Chamber	10m Semi-anechoic chamber-NSA	NCEE-001	May 24, 2022	May 24, 2025
TDK Emissions Lab Software	V11.25	700307	NA	NA
RF Cable (preamplifier to antenna)*	MFR-57500	01-07-002	April 4, 2022	April 4, 2024
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	September 24, 2021	September 24, 2023
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3864	September 24, 2021	September 24, 2023
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	September 24, 2021	September 24, 2023
N connector bulkhead (10m chamber)**	PE9128	NCEEBH1	September 24, 2021	September 24, 2023
N connector bulkhead (control room)**	PE9128	NCEEBH2	September 24, 2021	September 24, 2023

*Internal Calibration
**2 year cal cycle
***device was calibrated after testing date and found to be in cal.

Notes:
All equipment is owned by NCEE Labs and stored permanently at NCEE Labs facilities.

4.0 DETAILED RESULTS

Radio Measurements									
CHANNEL	Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)	Conducted OUTPUT POWER* (dBm)	Conducted OUTPUT POWER (mW)	RESULT	Cable loss	Antenna Factor	Antenna Gain (dBi)	Uncorrected Radiated Received Power (dBm)
Low	74.48	71.89	15.53	35.73	Pass	5.32	26.60	5.54	-22.62
Mid	74.16	71.85	19.03	79.98	Pass	5.39	26.50	5.54	-19.09
High	74.35	71.86	18.77	75.34	Pass	5.43	26.53	5.54	-19.42
20 dB Bandwidth Limit = 250 kHz max			Peak Output Power Limit = 30 dBm; *Conducted Output Power = Uncorrected Radiated Received Power + Cable Loss + Antenna Factor + EIRP Conversion from 3m(11.77dB) – Antenna Gain						

Unrestricted Band-Edge							
CHANNEL	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level (dBm)	Relative Fundamental (dBm)	Measurement Type	Delta (dB)	Min Delta (dB)	Result
Low	902	-84.94	-22.82	Peak	62.12	20	Pass
High	928	-81.90	-19.64	Peak	62.26	20	Pass

Peak Vs Average Limit- Restricted Band-Edge									
CHANNEL	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Measurement Type	Limit (dBuV/m @ 3m)*	Margin	Result	Cable loss	Antenna Factor	Uncorrected out of band (dBuV)**
Low	608-614	32.33	Peak	46.02	13.69	Pass	4.44	22.8	5.09
High	960-1000	39.62	Peak	53.98	14.36	Pass	5.47	27.1	7.05
*Limit shown is the peak limit taken from FCC Part 15.209; Peak values are compared to average limit to show compliance. **Uncorrected out of band in some instances: dBuV = dBm + 107dB.									

4.1 DUTY CYCLE

Manufacturer declared duty cycle:

Manufacturer declares worst case duty cycle is 15ms within a 100ms window.

Duty Cycle Correction Factor(DCCF) = 20*log(Duty Cycle)

-16.47dB = 20*log(0.15)

4.2 RADIATED EMISSIONS

Test Method: ANSI C63.10:2013, Section 6.5, 6.6

Limits for radiated emissions measurements:

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH (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	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 * log * Emission level (µV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

Test procedures:

a. The EUT was placed on the top of a rotating table above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The table was 0.8m high for measurements form 30MHz-1Ghz and 1.5m for measurements from 1GHz and higher.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.

d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The EUT was maximized in all 3 orthogonal positions. The results are presented for the axis that had the highest emissions.

h. The orientation with the worst-case emissions was used for final measurements.

i. Receive mode emissions were tested and found to be within the measurement noise floor of the test laboratory

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.

2. The resolution bandwidth 1 MHz for all measurements and at frequencies above 1GHz, A peak detector was used for all measurements above 1GHz. Measurements were made with an EMI Receiver.

Deviations from test standard:

No deviation.

Test setup:

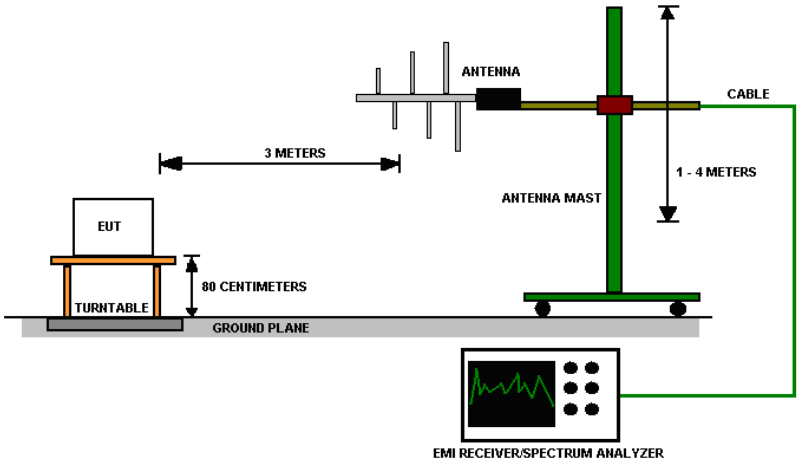

Figure 1 - Radiated Emissions Test Setup

EUT operating conditions
The EUT was powered by internal battery unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Test results:

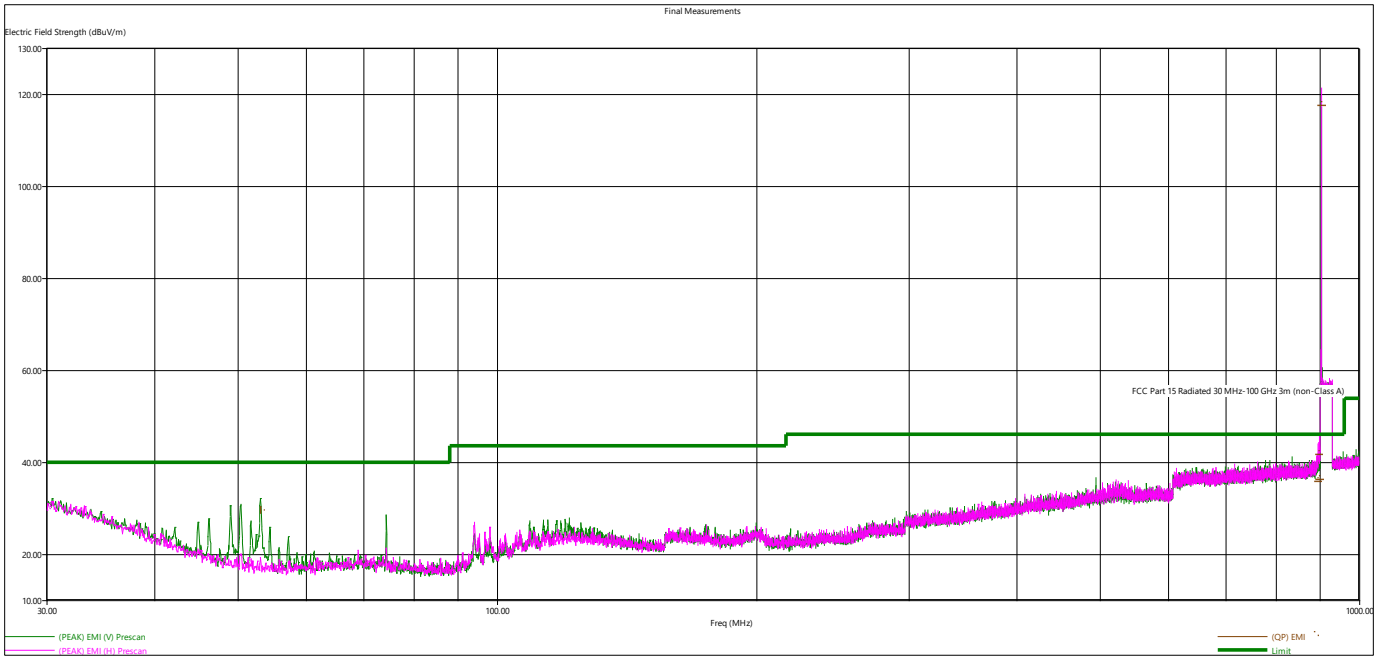

Figure 2 - Radiated Emissions Plot, 30 MHz-1 GHz Low Channel

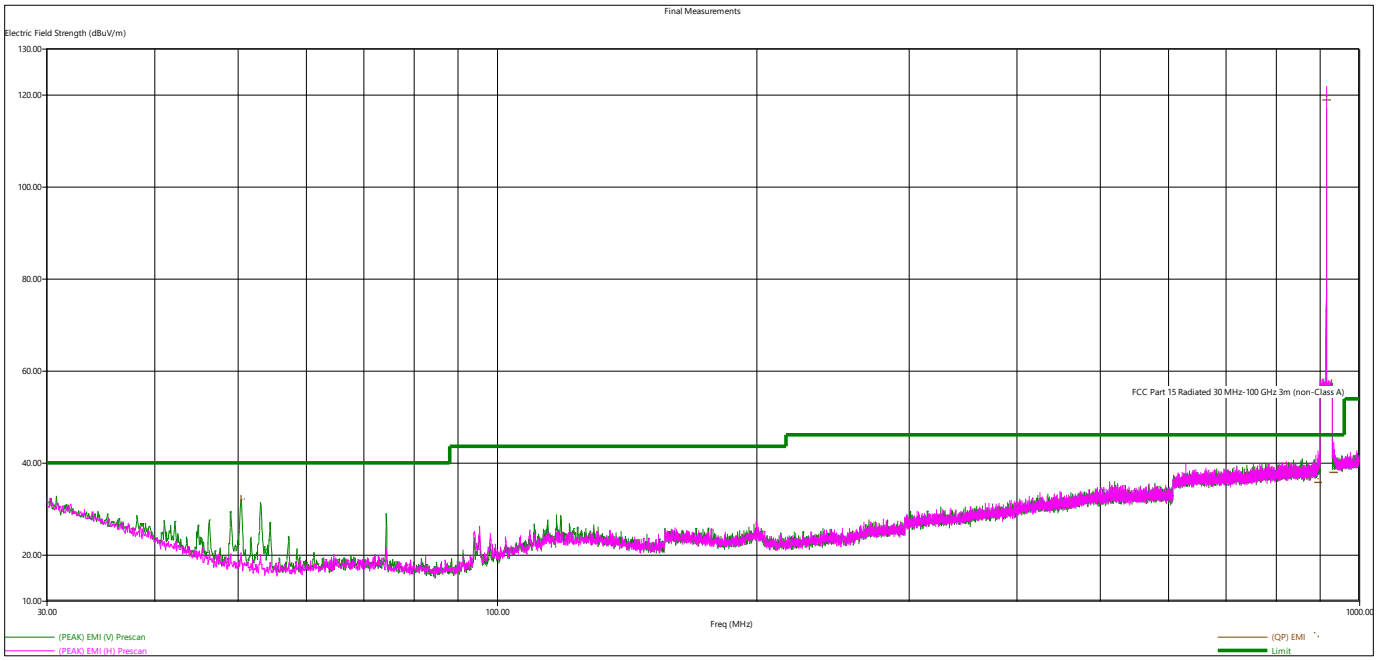

Figure 3 - Radiated Emissions Plot, 30 MHz-1 GHz, Mid Channel

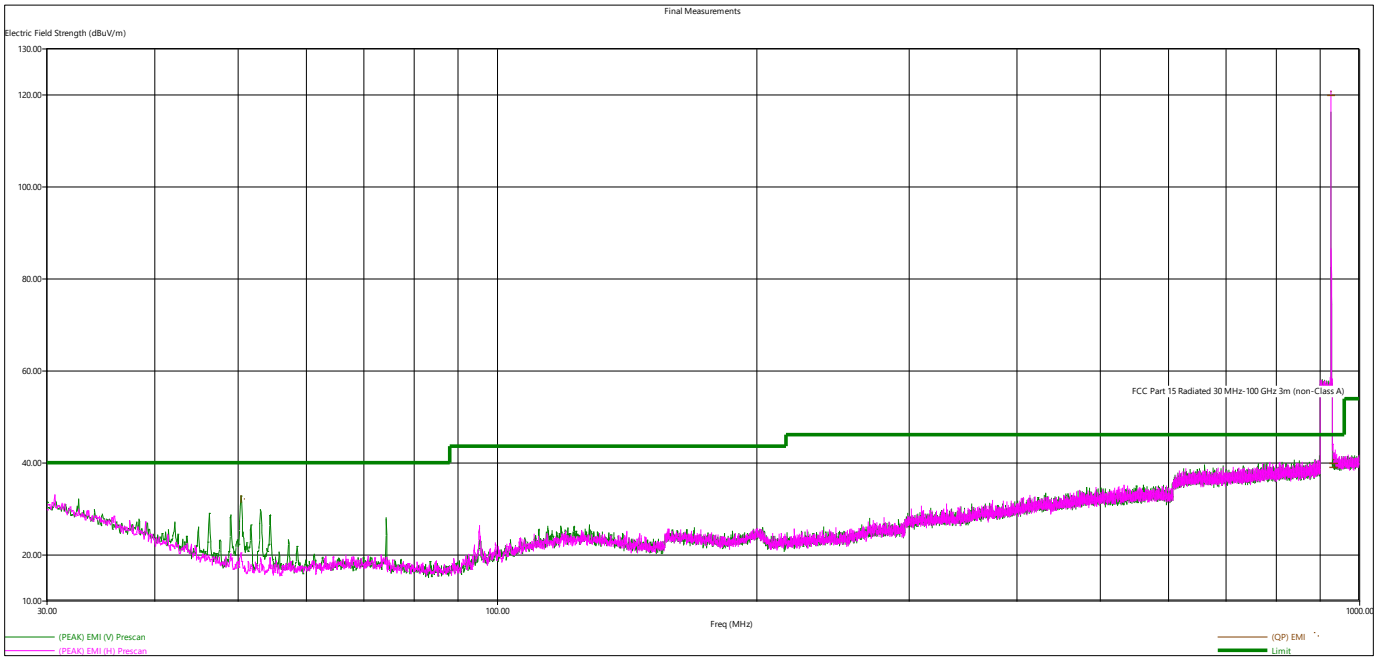

Figure 4 - Radiated Emissions Plot, 30 MHz-1 GHz High Channel

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value - Emission level.
5. The EUT was measured in both the horizontal and vertical orientation. It was found that the Horizontal position produced the highest emissions, and this orientation was used for all testing. See Annex A for test photos.

Quasi-Peak Measurements, 30 MHz -1 GHz, Low Channel						
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
894.138960	35.72	46.02	10.30	390.00	75.00	H
897.282960	41.51	46.02	4.51	243.00	359.00	H
898.508880	36.09	46.02	9.93	219.00	85.00	H
53.028960	29.58	40.00	10.42	104.00	178.00	V
903.343200	117.57	NA	NA	228.00	339.00	H

*All other measurements found to be at least 6dB below the limit line.

Quasi-Peak Measurements, 30 MHz -1 GHz, Mid Channel						
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
894.165840	35.61	46.02	10.41	195.00	342.00	H
50.358720	31.96	40.00	8.04	105.00	175.00	V
914.977920	118.69	NA	NA	223.00	339.00	H
932.121360	37.74	46.02	8.28	218.00	338.00	H

*All other measurements found to be at least 6dB below the limit line.

Quasi-Peak Measurements, 30 MHz -1 GHz, High Channel						
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
50.366160	32.01	40.00	7.99	121.00	337.00	V
926.691840	119.75	NA	NA	219.00	4.00	H
930.591840	39.71	46.02	6.31	214.00	338.00	H
931.956240	38.86	46.02	7.16	224.00	0.00	H

*All other measurements found to be at least 6dB below the limit line.

Peak Measurements, 1 GHz - 10 GHz, Low Channel						
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
1806.600000	74.43	97.57*	23.14	158.00	344.00	V
2709.958000	59.19	73.98	14.79	388.00	163.00	V
4516.586000	59.24	73.98	14.74	200.00	210.00	H
5419.666000	58.75	73.98	15.23	99.00	150.00	H
6323.224000	57.81	73.98	16.17	100.00	113.00	H
9936.804000	64.37	73.98	9.61	200.00	145.00	H
3613.408000	61.41	73.98	12.57	200.00	193.00	V
7226.610000	57.82	73.98	16.16	500.00	337.00	V
8130.030000	50.14	73.98	23.84	100.00	11.00	V
9032.850000	56.25	73.98	17.73	500.00	329.00	V

*Harmonics in an unrestricted band must be at least 20dB below the fundamental level.

Peak Measurements, 1 GHz - 10 GHz, Mid Channel						
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
1829.968000	72.21	73.98	1.77	248.00	347.00	V
2745.048000	55.17	73.98	18.81	114.00	34.00	V
4575.080000	61.41	73.98	12.57	199.00	336.00	H
5489.826000	55.12	73.98	18.86	200.00	117.00	H
9149.692000	56.68	73.98	17.30	399.00	75.00	H
3659.938000	61.30	73.98	12.68	300.00	184.00	V
6404.880000	58.75	73.98	15.23	200.00	0.00	V
7319.896000	53.05	73.98	20.93	99.00	14.00	V
8235.030000	59.60	73.98	14.38	500.00	359.00	V

Peak Measurements, 1 GHz - 10 GHz, High Channel						
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
1853.308000	72.76	73.98	1.22	291.00	353.00	V
2780.064000	60.79	73.98	13.19	498.00	30.00	V
4633.312000	59.42	73.98	14.56	300.00	334.00	H
5560.044000	58.86	73.98	15.12	200.00	121.00	H
9266.992000	61.80	73.98	12.18	200.00	315.00	H
3706.702000	64.65	73.98	9.33	100.00	349.00	V
6486.498000	54.60	73.98	19.38	100.00	349.00	V
7413.604000	58.42	73.98	15.56	200.00	10.00	V
8340.340000	55.69	73.98	18.29	500.00	359.00	V

Average Measurements, 1 GHz- 10 GHz, Low Channel						
Frequency	**Average Level***	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
1806.6	57.96	97.57**	39.61	158	344	V
2709.96	42.72	53.98	11.26	388	163	V
4516.59	42.77	53.98	11.21	200	210	H
5419.67	42.28	53.98	11.7	99	150	H
6323.22	41.34	53.98	12.64	100	113	H
9936.8	47.9	53.98	6.08	200	145	H
3613.41	44.94	53.98	9.04	200	193	V
7226.61	41.35	53.98	12.63	500	337	V
8130.03	33.67	53.98	20.31	100	11	V
9032.85	39.78	53.98	14.2	500	329	V

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the table above.
*Average Level = Peak Level – 16.47 (Duty Cycle Correction Factor from section 4.1)
**In unrestricted bands, harmonics must be at least 20dB below fundamental levels.

Average Measurements, 1 GHz- 10 GHz, Mid Channel						
Frequency	**Average Level***	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
1829.97	55.74	98.69**	42.95	248	347	V
2745.05	38.7	53.98	15.28	114	34	V
4575.08	44.94	53.98	9.04	199	336	H
5489.83	38.65	53.98	15.33	200	117	H
9149.69	40.21	53.98	13.77	399	75	H
3659.94	44.83	53.98	9.15	300	184	V
6404.88	42.28	53.98	11.7	200	0	V
7319.9	36.58	53.98	17.4	99	14	V
8235.03	43.13	53.98	10.85	500	359	V

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the table above.
*Average Level = Peak Level – 16.47 (Duty Cycle Correction Factor from section 4.1)
**In unrestricted bands, harmonics must be at least 20dB below fundamental levels.

Average Measurements, 1 GHz - 10 GHz, High Channel						
Frequency	**Average Level***	**Limit**	**Margin**	**Height**	**Angle**	**Pol**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**	
1853.31	56.29	99.75	43.46	291	353	V
2780.06	44.32	53.98	9.66	498	30	V
4633.31	42.95	53.98	11.03	300	334	H
5560.04	42.39	53.98	11.59	200	121	H
9266.99	45.33	53.98	8.65	200	315	H
3706.7	**48.18**	**53.98**	**5.8**	**100**	**349**	**V**
6486.5	38.13	53.98	15.85	100	349	V
7413.6	41.95	53.98	12.03	200	10	V
8340.34	39.22	53.98	14.76	500	359	V

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the table above.
*Average Level = Peak Level – 16.47 (Duty Cycle Correction Factor from section 4.1)
**In unrestricted bands, harmonics must be at least 20dB below fundamental levels.

4.3 PEAK OUTPUT POWER

Test Method: ANSI C63.10, Section(s) 7.8.5

Limits of bandwidth measurements:
For an FHSS system with 50 channels or more, the output power is required to be less than 1000 mW or 30 dBm.

EIRP was calculated from field strength measurements using ANSI C63.10:2013, Section 9.5, Equation (22). The field strength was measured at a 3m distance and maximized.

Test procedure: Conducted

Deviations from test standard:
No deviation.

Test setup:

See Section 4.2

EUT operating conditions:
The EUT was powered by internal battery unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Test results:
Refer to section 4.0 for the results table.

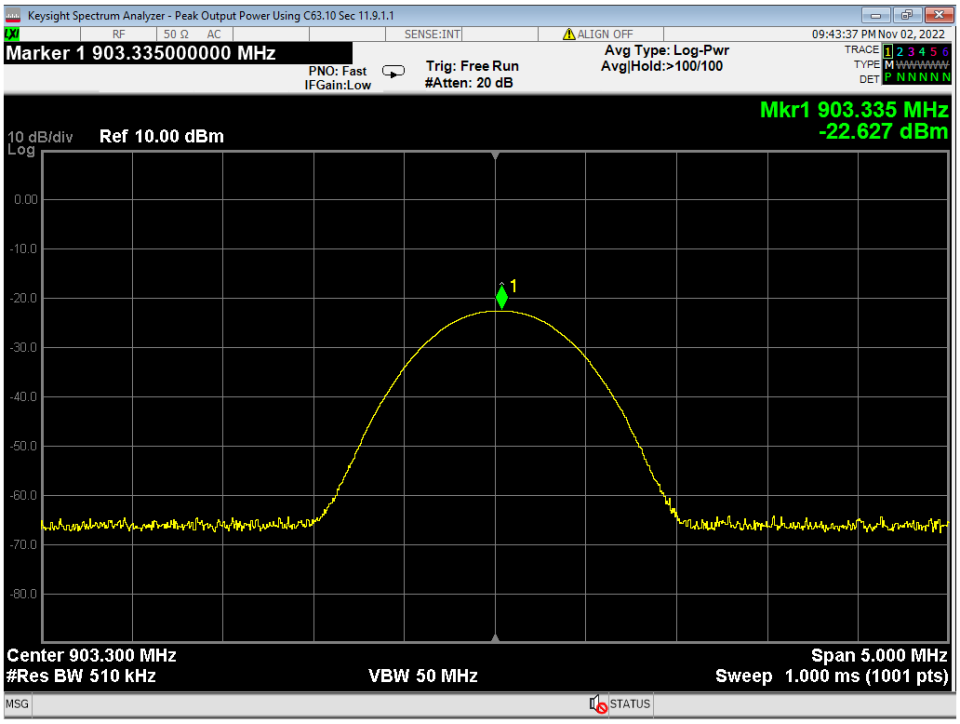

Figure 5 – Uncorrected Output Power, Low Channel.

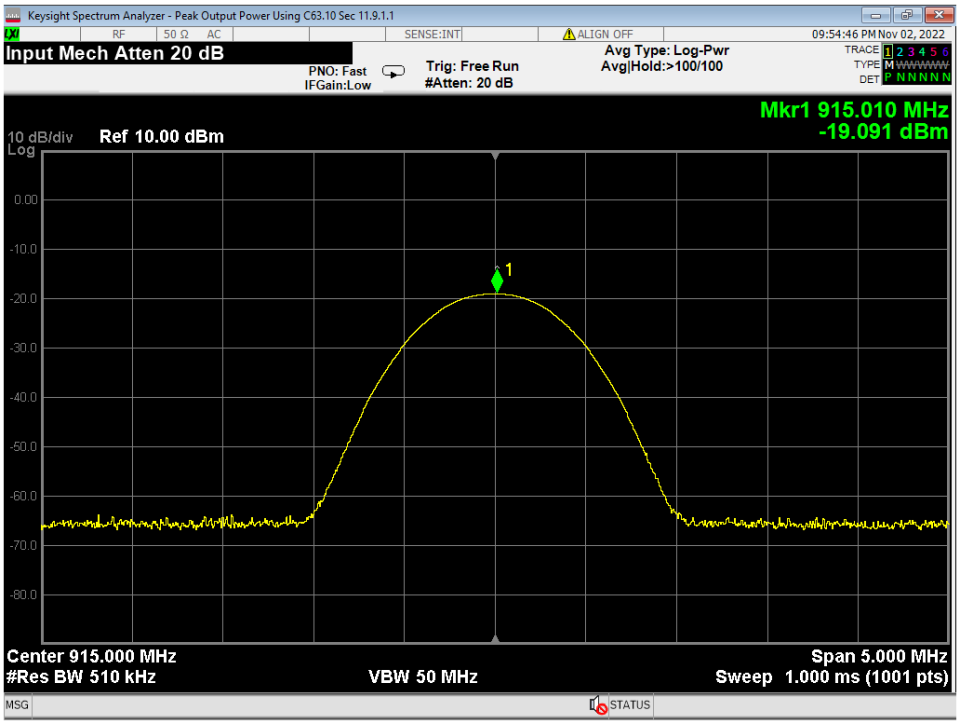

Figure 6 – Uncorrected Output Power, Mid Channel

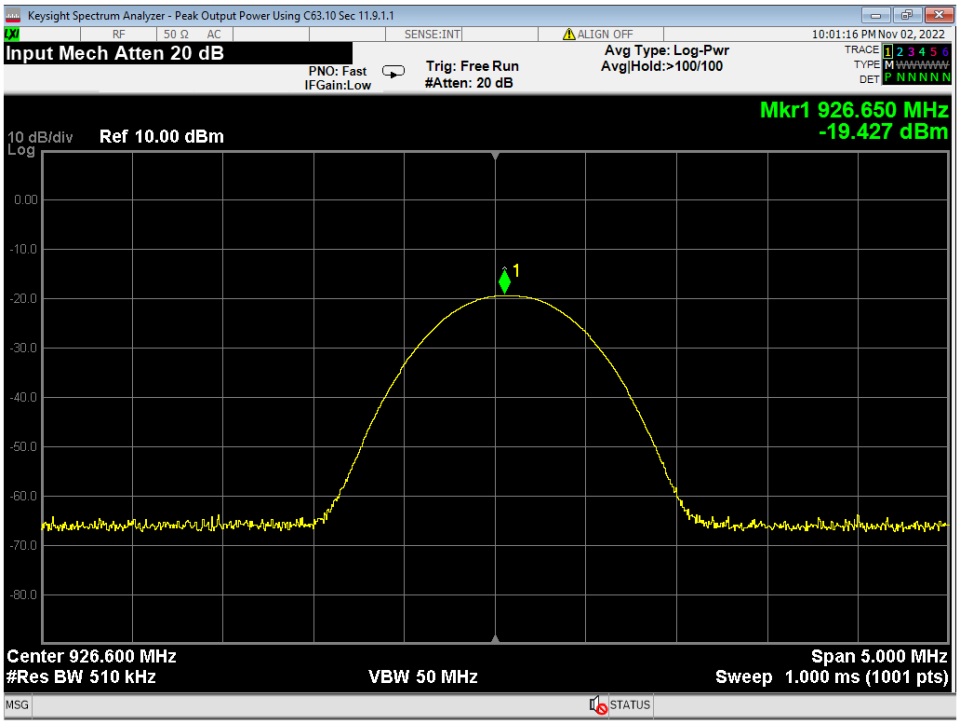

Figure 7 – Uncorrected Output Power, High Channel

4.4 BANDWIDTH

Test Method: ANSI C63.10, Section(s) 6.9.2 (20 dB BW)
ANSI C63.10, Section(s) 6.9.3 (99% BW)

Limits of bandwidth measurements:
From FCC Part 15.247 (1) (i) and RSS-247 5.1(c)

The maximum allowed 20 dB bandwidth of the hopping channel is 250 kHz.

Test procedures:
Bandwidth measurement was taken at a distance of 3m from the EUT. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3 kHz RBW.

The 20dB bandwidth is defined as the bandwidth of which is higher than peak power minus 20dB.

The 99% occupied bandwidth was measured using the test receiver's occupied bandwidth function.

Test setup:

All the measurements were done at 3m test distance while operating at low, mid, and high channels. See Section 4.3 for more details.

Deviations from test standard:
No deviation.

Test setup:

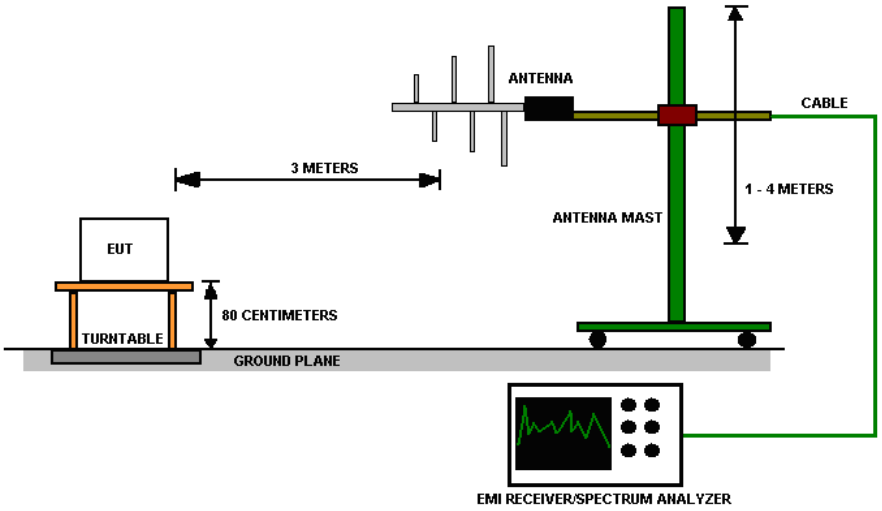

Figure 8 - Bandwidth Measurements Test Setup

EUT operating conditions:
The EUT was powered by internal battery unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Test results:

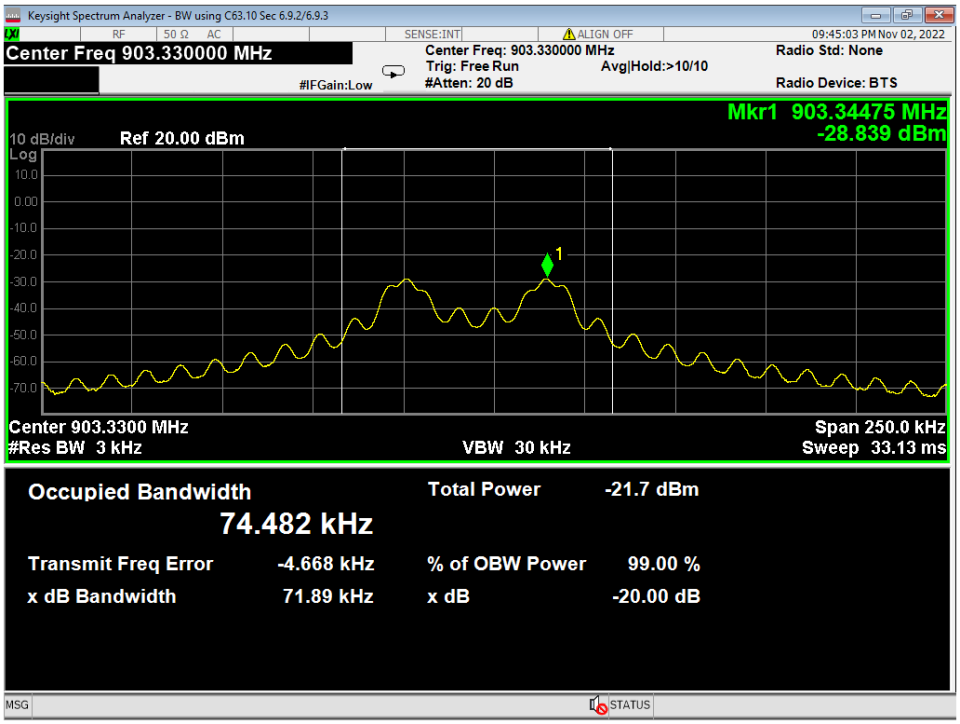

Figure 9 –Bandwidth, Low Channel

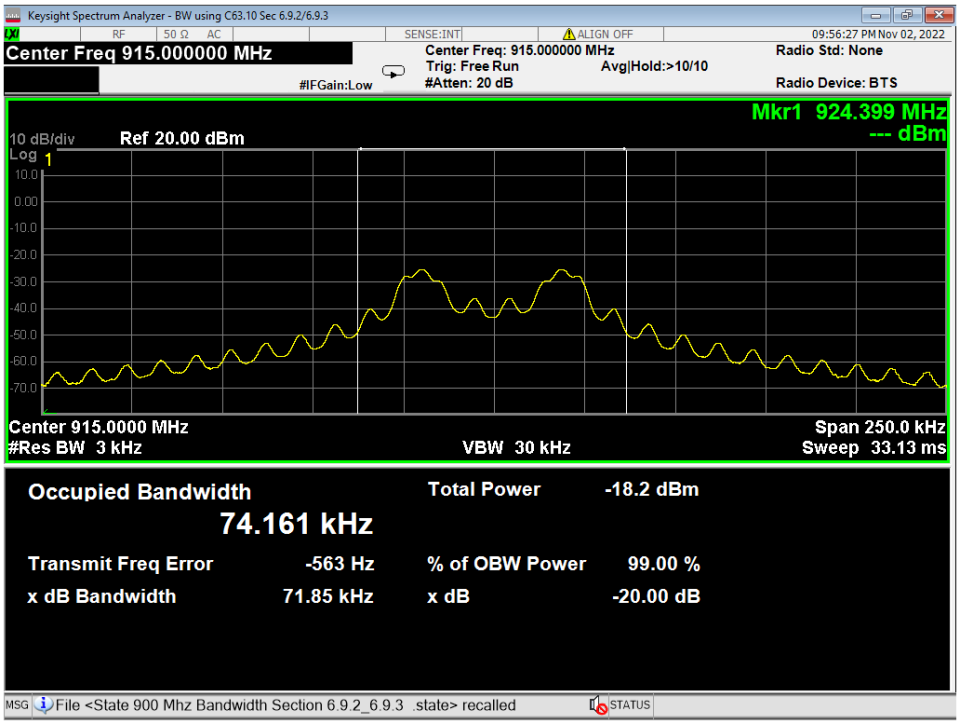

Figure 10 - Bandwidth, Mid Channel

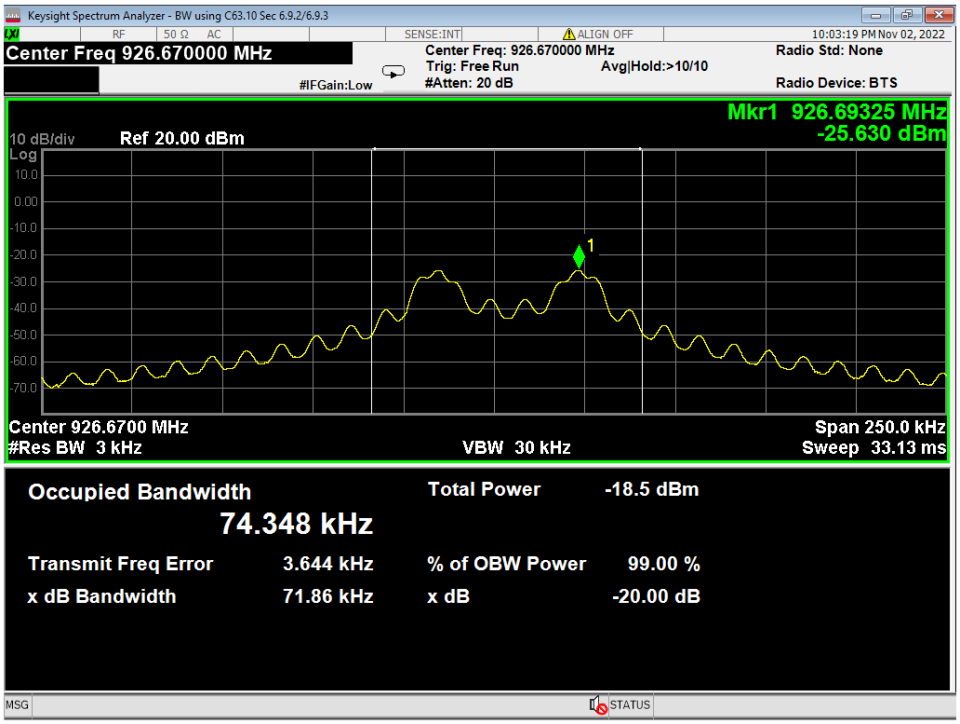

Figure 11 - Bandwidth, High Channel

4.5 BANDEDGES

Test Method: ANSI C63.10, Section(s) 6.10.6

Limits of bandedge measurements:
For emissions outside of the allowed band of operation (902 – 928MHz), the emission level needs to be 20dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

Test procedures:
All measurements were taken at a distance of 3m from the EUT.

The EUT was maximized in all 3 orthogonal positions in a similar manner as described in Section 4.2.

Deviations from test standard:
No deviation.

Test setup:
All the measurements were done at 3m test distance while operating on the highest and lowest channel depending on which band edge was investigated.

EUT operating conditions:
The EUT was powered by internal battery unless specified and set to transmit continuously on the lowest frequency channel and the highest frequency channel.

Test results:
Refer to section 4.0 for the results table.

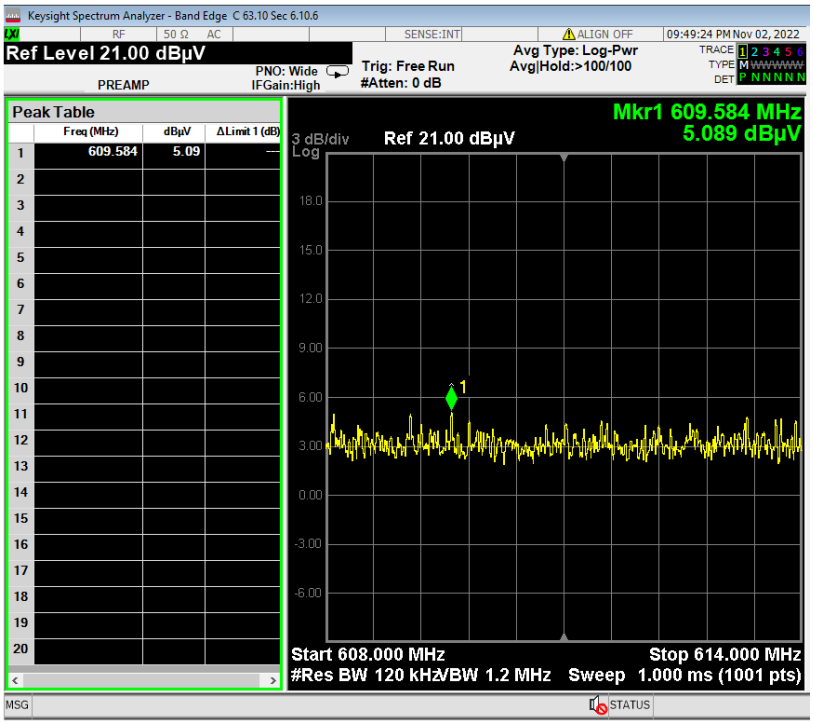

Figure 12 – Uncorrected Band-edge Measurement, Low Channel, Restricted Frequency, Continuous

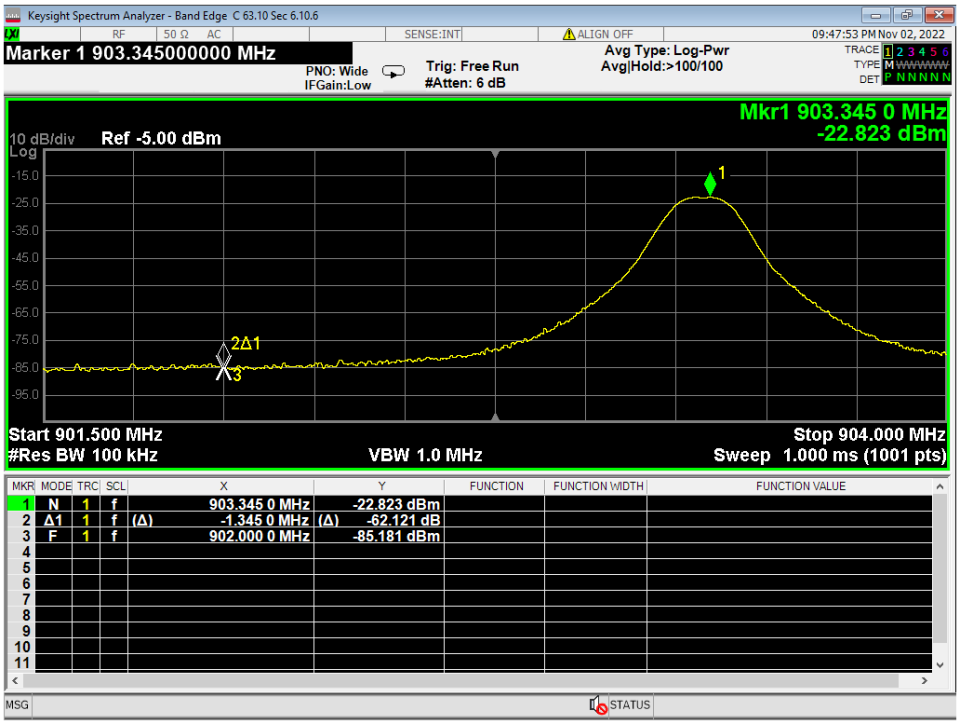

Figure 13 – Uncorrected Band-edge Measurement, Low Channel, Unrestricted Frequency, Continuous

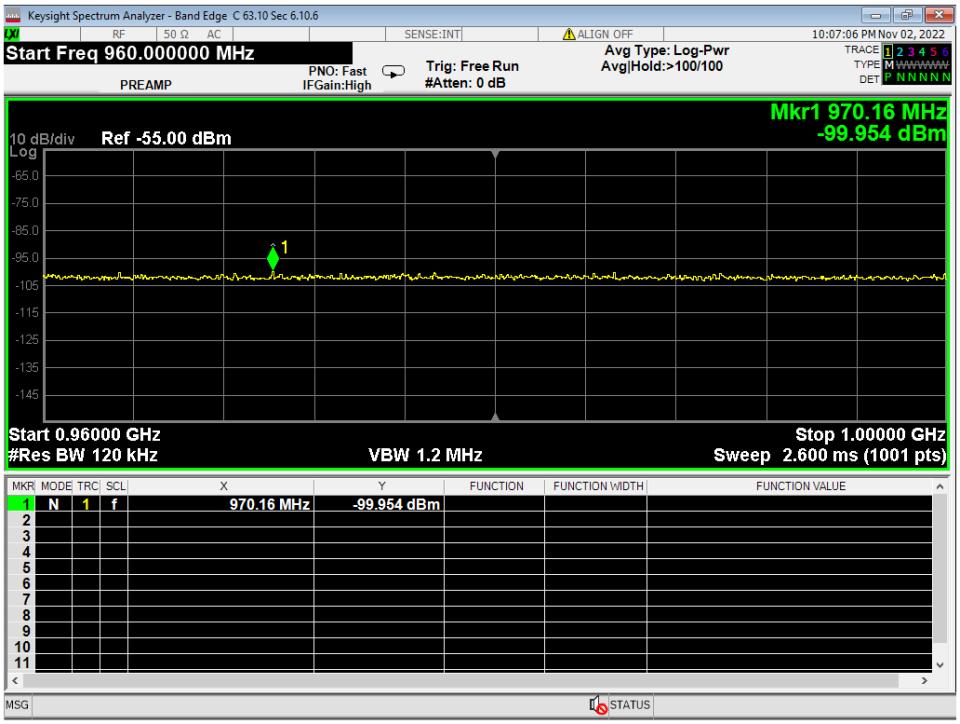

Figure 14 – Uncorrected Band-edge Measurement, High Channel, Restricted Frequency, Continuous

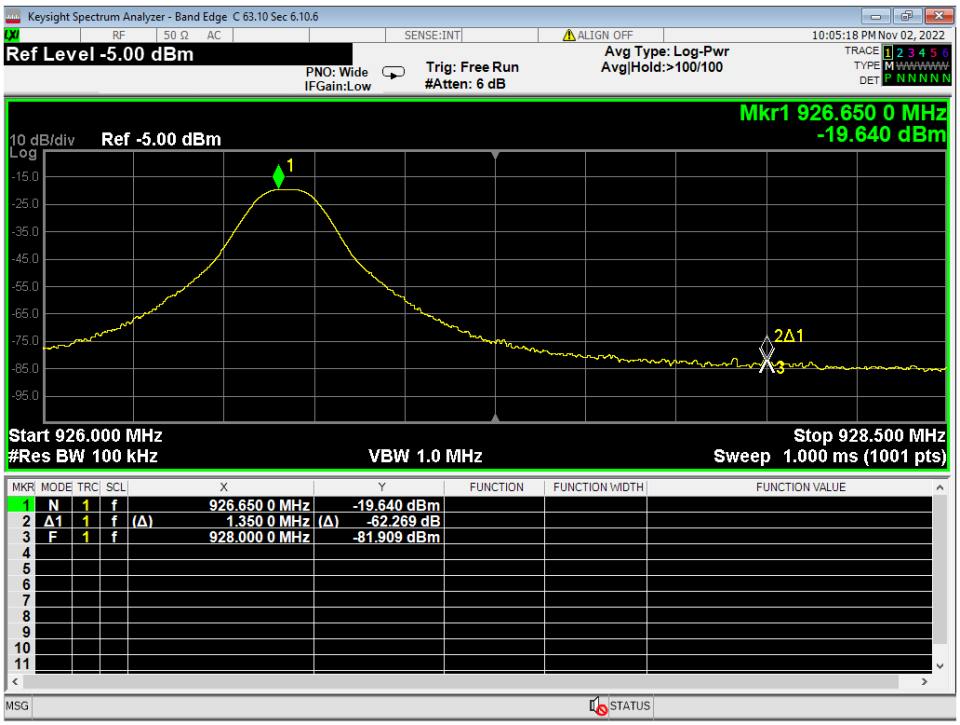

Figure 15 – Uncorrected Band-edge Measurement, High Channel, Unrestricted Frequency, Continuous

4.6 CARRIER FREQUENCY SEPARATION, NUMBER OF HOPPING CHANNELS, TIME OF OCCUPANCY

Test Method: ANSI C63.10, Section 7.8.2, 7.8.3, 7.8.4

Limits for Time of Occupancy
Average time of occupancy on any frequency should not to exceed 0.4 seconds within a 20 second period.

Test procedures:
The method from FCC DA 00-705

All measurements were taken at a distance of 3m from the EUT.

Test setup:
All the measurements were performed at 3m test distance while hopping mode was enabled.

EUT operating conditions:
The EUT was powered internal battery unless otherwise specified and set to Hopping mode. Both Low interference mode and Standard mode were investigated, worst case was reported.

Test results:

Lowest recorded Period was 1.574 seconds, 20s/1.574s = 12.706 transmissions within 20 second Dwell.

On time recorded was 29.51ms

Time of Occupancy =
On time * number of transmissions over 20 seconds
29.51ms * 12.706 transmissions = 374.95ms < 400ms (15.247 Limit)

Total Hop Count =
52 Channels

Minimum Frequency Separation = 360.8kHz
Limit = 20dB Bandwidth = 71.89kHz

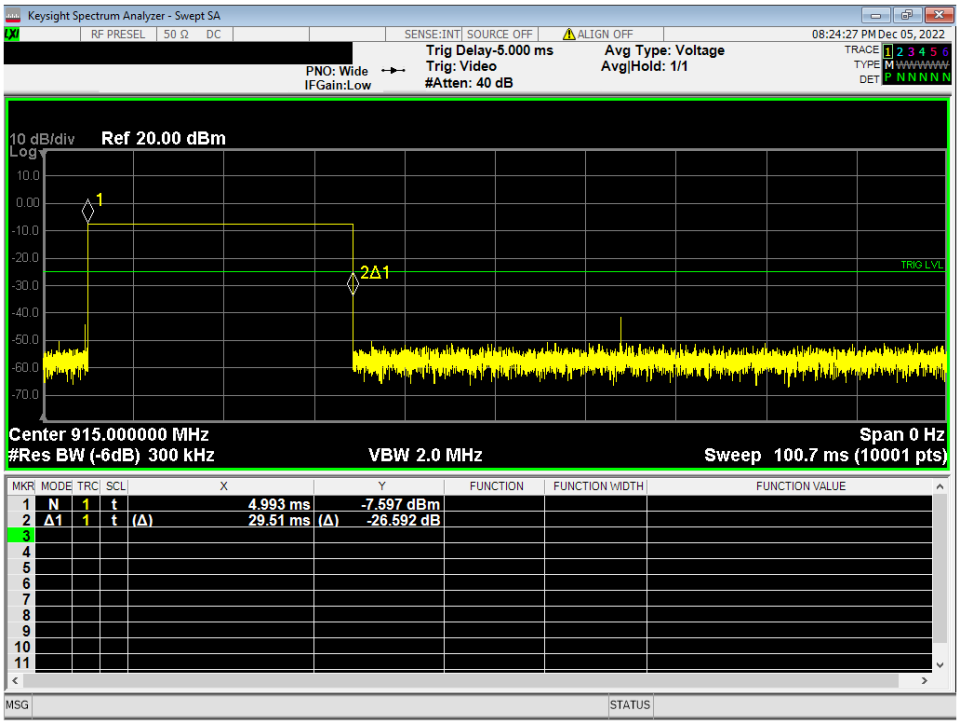

Figure 16 – On time

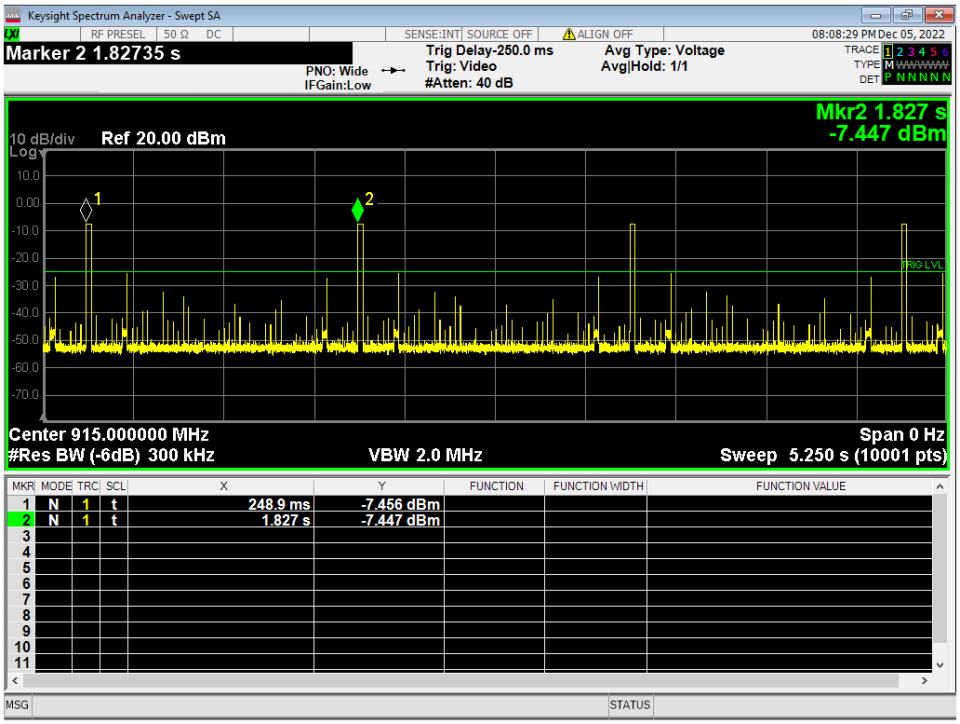

Figure 17 – Period

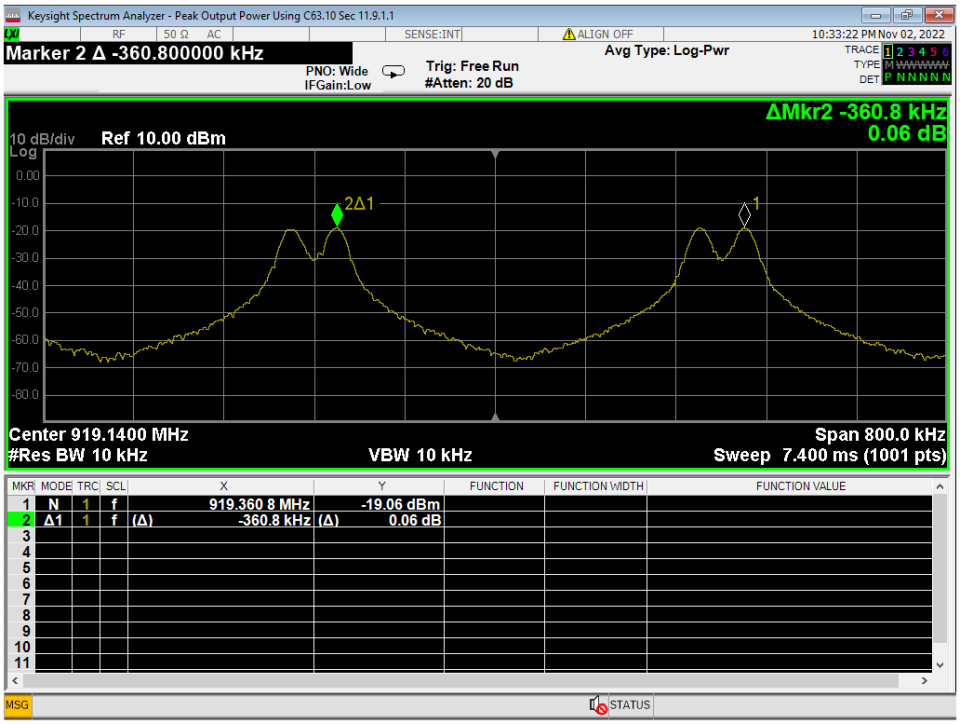

Figure 18 – Minimum Frequency Separation, 363.0 kHz

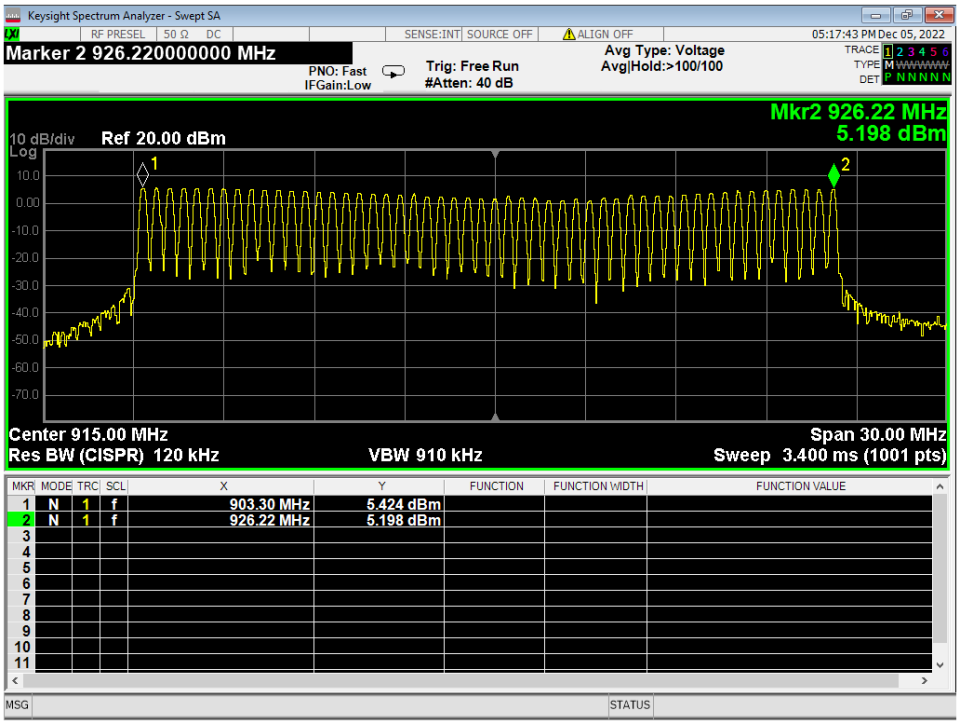

Figure 19 – Hop Count, 902-908MHz

APPENDIX A: SAMPLE CALCULATION

Radiated Emissions

The field strength is calculated in decibels (dB) by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = R + AF – (-CF + AG)$$

where FS = Field Strength

R = Receiver Amplitude Receiver reading in dBµV

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Preamplifier Amplifier Gain

Assume a receiver reading of 55.00 dBµV is obtained. The Antenna Factor of 12.00 and a Cable Factor of 1.10 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.10 dBµV/m.

FS = 55.00 + 12.00 – (-1.10 + 20.00) = 48.1 dBµV/m

The 48.1 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm [(48.1 dBµV/m)/20]= 254.1 µV/m

Conducted Emissions

Receiver readings are compared directly to the conducted emissions limits in decibels (dB) by adding the cable loss and LISN insertion loss to the receiver reading. The basic equations with a sample calculation is as follows;

$$FS = R + IL – (-CF)$$

where V = Conducted Emissions Voltage Measurement

R = Receiver reading in dBµV

IL = LISN Insertion Loss

CF = Cable Attenuation Factor

APPENDIX B – MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels apply to tests performed in this test report:

Test	Frequency Range	NCEE Labs Uncertainty Value (dB)	Maximum Uncertainty Values per CISPR 16-4-2:2011/A1:2018
AC Line Conducted Emissions	150kHz - 30MHz	3.03	3.60
Radiated Emissions, 3m	30MHz - 1GHz	4.19	5.34
Radiated Emissions, 3m	1GHz – 18GHz	5.08	5.48

Expanded uncertainty values are calculated to a confidence level of 95%.

NCEE Labs meets the maximum uncertainty requirements per CISPR 16-4-2:2011/A1:2018, and therefore does not require a minimum passing margin to state that an EUT is less than the field strength limits of the applicable CISPR, IEC or EN limit per CISPR 16-4-2:2011/A1:2018, Section 4.1.

NCEE Labs employs tilting when testing at 3m test distance. The maximum uncertainty associated with this method is used.

Maximum uncertainty values show the worse-case of all test distances used.

REPORT END