

Test Report

Prepared for: **Ainstein AI, Inc.**

Address: **1421 Research Park Dr. Suite 2A**
Lawrence, KS 66049-3858

Product: **XR-2**

Test Report No: **R20241030-00-E1** **Rev: B**

Approved by: 
Fox Lane,
EMC Test Engineer

DATE: **September 30, 2026**

Total Pages: **33**

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REVISION PAGE

Rev. No.	Date	Description
0	17 June 2026	Issued by FLane Prepared by FLane
A	20 July 2026	Changed Peak EIRP to Average EIRP External photos added - FL
B	30 September 2026	Updated Measurement uncertainty statement Included KDB reference 653005 D01 Included confirmation of production device – FL



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1.0 SUMMARY OF TEST RESULTS

The worst-case measurements were reported in this report. Summary of test results presented in this report correspond to the following section (Please see the checked box below for the rule part used):

FCC Part 95M RSS-251

The EUT has been tested according to the following specifications:

- (1) US Code of Federal Regulations, Title 47, Part 95M
- (2) ISSED RSS-251, Issue 2
- (3) ISSED RSS-Gen, Issue 5

APPLIED STANDARDS AND REGULATIONS		
Standard Section	Test Type	Result
FCC Part 95.3367 RSS-251 Section 8/9 KDB 653005 D01	Field Strength / EIRP	Complies
FCC Part 95.3379(a) RSS-251 Section 10 RSS-Gen Issue 5 KDB 653005 D01	Unwanted Emissions	Complies
FCC Part 95.3379(b) RSS-251 Section 7 and 11 KDB 653005 D01	Occupied Bandwidth Frequency Stability	Complies
RSS-251 Section 6 KDB 653005 D01	Modulation Characteristics	Complies



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2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	XR-2
FCC ID	2ATMB-XR2
IC ID	26683-XR2
HVIN	XR-2
EUT Received	19 May 2026
EUT Tested	19 May 2026 - 20 May 2026
Serial No.	03CH012263270002 (EUT is production ready device)
Operating Band	76 – 81 GHz
Device Type	☒ FMCW Radar
Power Supply / Voltage	External 12VDC Marine Battery

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

2.2 DESCRIPTION OF TEST MODES

The operating range of the EUT is dependent on the device type found in section 2.1:

For Transmissions:

Channel	Frequency
Low	77.2 GHz
Mid	78.4 GHz
High	79.6 GHz

These are the only 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 frequencies and designations.

2.3 DESCRIPTION OF SUPPORT UNITS

None

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3.0 LABORATORY AND GENERAL TEST 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
 FCC Lab accreditation No: 134067
 Industry Canada Test Site Registration No: 4294A
 NCC CAB Identification No: US0177

Environmental conditions varied slightly throughout the tests:

Relative humidity of $35 \pm 4\%$
 Temperature of $22 \pm 3^\circ$ Celsius



3.2 TEST PERSONNEL

No.	PERSONNEL	TITLE	ROLE
1	Fox Lane	Test Engineer	Testing and Report
2	Ethan Schmidt	Test Engineer	Testing

Notes:

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

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3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Keysight MXE Signal Analyzer (44GHz)	N9038A	MY59050109	July 14, 2025	July 15, 2027
Keysight MXE Signal Analyzer (26.5GHz)	N9038A	MY56400083	July 15, 2025	July 16, 2027
SunAR RF Motion	JB1	A082918-1	July 22, 2025	July 22, 2026
ETS EMCO Red Horn Antenna	3117	00274578	February 5, 2025	February 5, 2027
EMCO Horn Antenna	3116	2576	July 31, 2024	July 31, 2027
Agilent Preamp*	87405A	3207A01475	July 18, 2025	July 18, 2027
ETS Red Preamplifier (Orange)*	3115-PA	00218576	July 18, 2025	July 18, 2027
RF Cable (preamplifier to antenna)*	MFR-57500	01-07-002	July 18, 2025	July 18, 2027
Keysight, External Harmonic Mixer, 75-110G	M1971W	MY56390145	February 26, 2026	February 25, 2031
Sage Standard Gain Horn Antenna, 75-110G	SAZ-2410-10-S1	16434-01	CNR	CNR
Cable to M1971W, 75-110G	SLU18-SMNM-01.00M	121108	February 26, 2026	February 25, 2031
Cable to M1970V-002, 75-110G	SLU18-SMNM-01.00M	121099	February 26, 2026	February 25, 2031
Keysight, External Harmonic Mixer, 50-80G	M1970V-002	MY51391050	February 25, 2026	February 24, 2031
Pasternack Standard Gain Horn Antenna, 50-80G	PE9881-24	32/2016	CNR	CNR
Agilent External Harmonic Mixer, 33-50G	11970Q	3903A03916	March 10, 2026	March 9, 2031
Pasternack Standard Gain Horn Antenna, 33-50G	SH122-23	SH122-23	CNR	CNR
OML Diplexer	DPL313B	181004-2	CNR	CNR
Keysight External Harmonic Mixer, 90G-140G	M08HWDX	200707-1	July 7, 2020	July 5, 2028
OML Std. Gain Horn, 90G-140G, 24dBi	M08RH	20070701	CNR	CNR
Keysight External Harmonic Mixer, 140G-220	M05HWDX	200707-1	July 7, 2020	July 5, 2028
OML Std. Gain Horn, 140G-220G, 24dBi	M05RH	20070701	CNR	CNR
Keysight, External Harmonic Mixer, 220-325G	M03HLWD	230320-1	March 20, 2023	March 18, 2031
OML Std. Gain Horn, 220-325G, 24dBi	M03RH		CNR	CNR
ETS – Lindgren- VSWR on 10m Chamber	10m Semi-anechoic chamber-VSWR	4740 Discovery Drive	November 20, 2025	November 20, 2028
NCEE Labs-NSA on 10m Chamber*	10m Semi-anechoic chamber-NSA	NCEE-001	April 13, 2026	April 13, 2028
RF Cables (3m Ant. to Control room Bulkhead)	MFR-57500	1E3874	July 18, 2025	July 18, 2027
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	July 18, 2025	July 18, 2027
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3874	July 18, 2025	July 18, 2027



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RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	July 18, 2025	July 18, 2027
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	July 18, 2025	July 18, 2027
N connector bulkhead (control room)*	PE9128	NCEEBH2	July 18, 2025	July 18, 2027
TDK Emissions Lab Software	V11.25	700307	NA	NA

*Internal Characterization

Notes:

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

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3.4 GENERAL TEST PROCEDURE AND SETUP FOR RADIO MEASUREMNTS

Measurement type presented in this report (Please see the checked box below):

Conducted ☒

The conducted measurements were performed by connecting the output of the transmitter directly into a spectrum analyzer using an impedance matched cable and connector soldered to the EUT in place of the antenna. The information regarding resolution bandwidth, video bandwidth, span and the detector used can be found in the graphs provided in Appendix C. All the radio measurements were performed using the sections from ANSI 63.26.

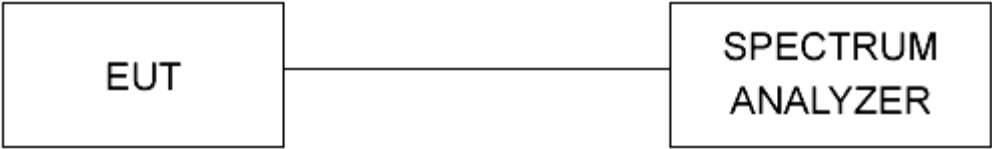


Figure 1 - Bandwidth Measurements Test Setup

Radiated ☒

All the radiated measurements were taken at a distance of 3m from the EUT. The information regarding resolution bandwidth, video bandwidth, span and the detector used can be found in the graphs provided in Appendix C. All the radio measurements were performed using the sections from ANSI 63.26.

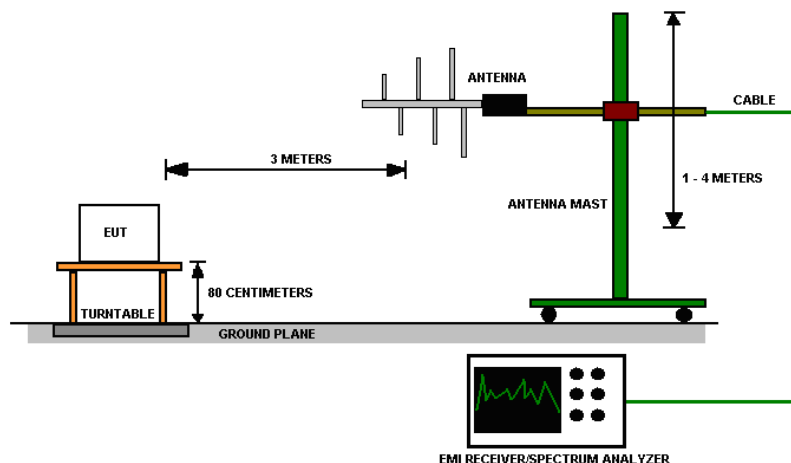


Figure 2 - Radiated Emissions Test Setup

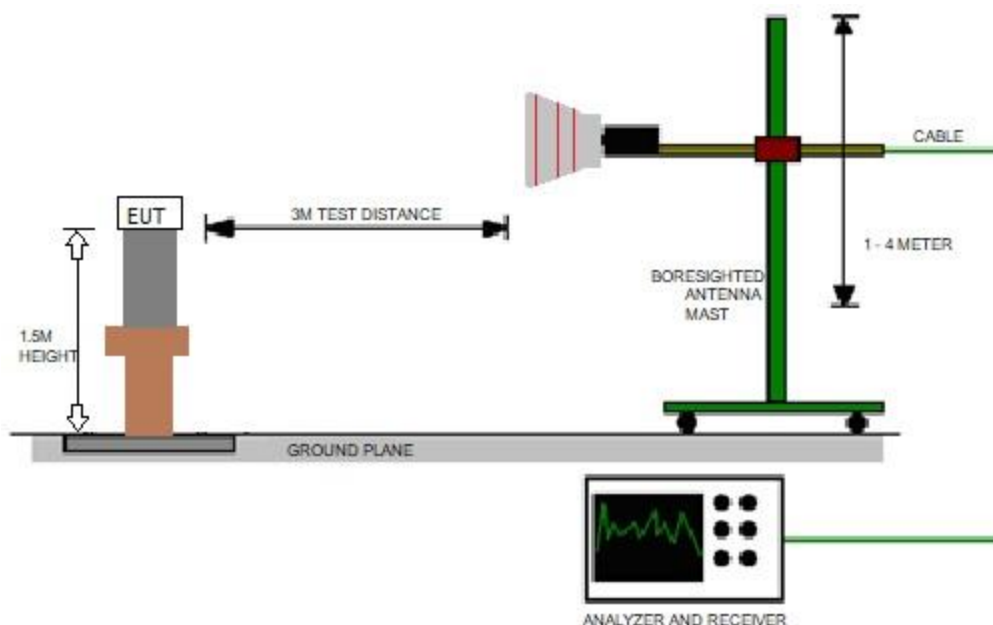


Figure 3 - Radiated Emissions Test Setup



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4.0 RESULTS

Fundamental, 95M										
Ch	Frequency	SA Reading (Peak) [SAR]	Antenna Factor [AF]	Cable loss [CL]	DCCF (for power) [DCCF]	FS Level (Peak) (FSL)	Test Distance [TD]	EIRP	Average Limit (Part 95M)	Margin
	GHz	dBm/m	dB	dB	dB	dBm/m	m	dBm EIRP	dBm EIRP	dB
Low	77.200000	-20.511	44.016	0.592	13.872	10.22	1	12.45	50.00	37.55
Mid	78.400000	-19.738	44.150	0.592	13.872	11.13	1	13.36	50.00	36.64
High	79.600000	-19.7	44.282	0.592	13.872	11.30	1	13.53	50.00	36.47
FSL=SAR+AF+CL+MF-DCCF; EIRP = FSL + 2.23; Margin=Limit-EIRP;										

*Plots shown in Output Power/Field Strength Section

Bandwidth		
Ch	Frequency	Occupied Bandwidth
	GHz	kHz
Low	77.200000	629.79
Mid	78.400000	489.13
High	79.600000	455.81



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4.1 OUTPUT POWER/FIELD STRENGTH

Test Method:

All the radio measurements were performed using the sections from ANSI C63.26 Sec. 5.2.4.3

Limits of field strength measurements:**For FCC Part 95.3367 76–81 GHz Band Radar Service radiated power limits:**

The fundamental radiated emission limits within the 76–81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as follows:

- (a) The maximum power (EIRP) within the 76–81 GHz band shall not exceed 50 dBm based on measurements employing a power averaging detector with a 1 MHz Resolution Bandwidth (RBW).
- (b) The maximum peak power (EIRP) within the 76–81 GHz band shall not exceed 55 dBm based on measurements employing a peak detector with a 1 MHz RBW.

RSS-251 Section 8:

The radar device's total average e.i.r.p. shall not exceed 50 dBm over the occupied bandwidth.

RSS-251 Section 9:

The radar device's peak e.i.r.p. spectral density shall not exceed 55 dBm/MHz.

Test procedures:

Details can be found in section 3.4 of this report.

Deviations from test standard:

No deviation.

Test setup:

Details can be found in section 3.4 of this report.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:**Pass****Comments:**

1. All the measurements were found to be compliant.
2. Compiled values can be found in the Results section, 4.
3. Peak results compared against average limit to show compliance.

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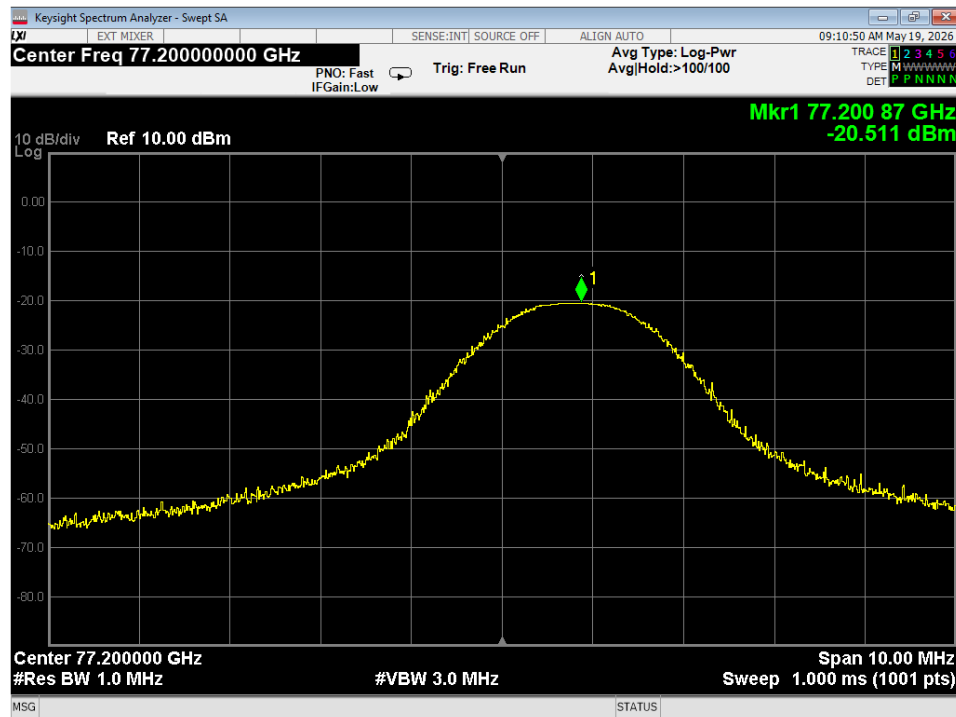


Figure 4 - Analyzer Measurement – Fundamental, Low Channel

Uncorrected measurement as recorded on spectrum analyzer.

See section 4.0 for tabulated data

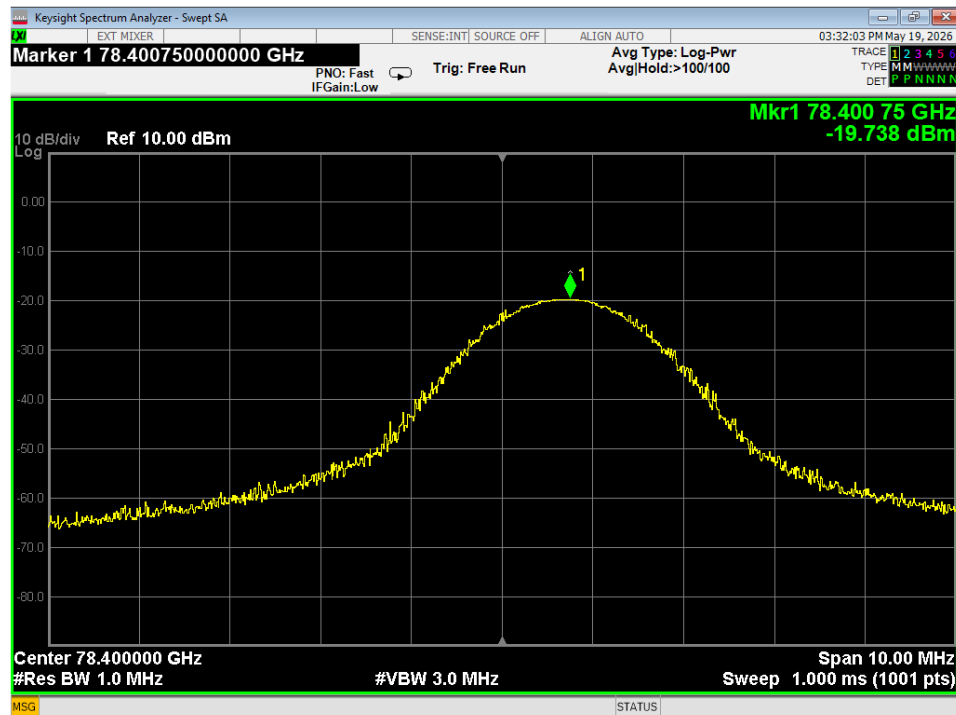


Figure 5 - Analyzer Measurement – Fundamental, Mid Channel

Uncorrected measurement as recorded on spectrum analyzer.

See section 4.0 for tabulated data

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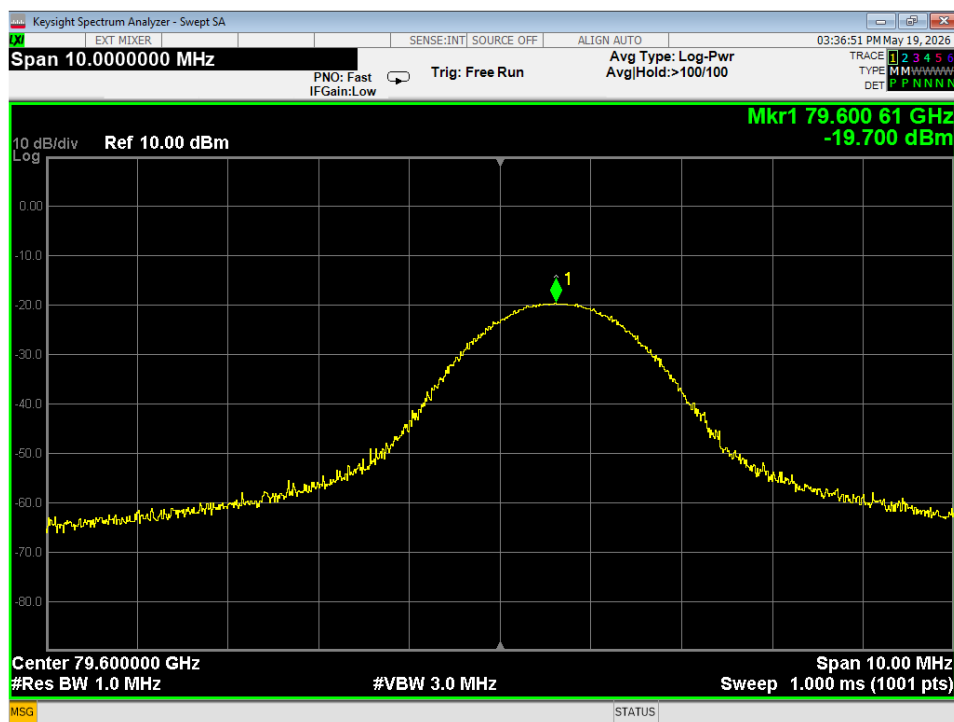


Figure 6 - Analyzer Measurement – Fundamental, High Channel
 Uncorrected measurement as recorded on spectrum analyzer.
 See section 4.0 for tabulated data

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4.2 BANDWIDTH

Test Method:

All the radio measurements were performed using the sections from ANSI C63.26 Sec. 5.4

Limits of bandwidth measurements:

For FCC Part 95 Device:

Device must remain within the allotted band.

Test procedures:

Details can be found in section 3.4 of this report.

Deviations from test standard:

No deviation.

Test setup:

Test setup details can be found in section 3.4 of this report.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the measurements were found to be compliant.

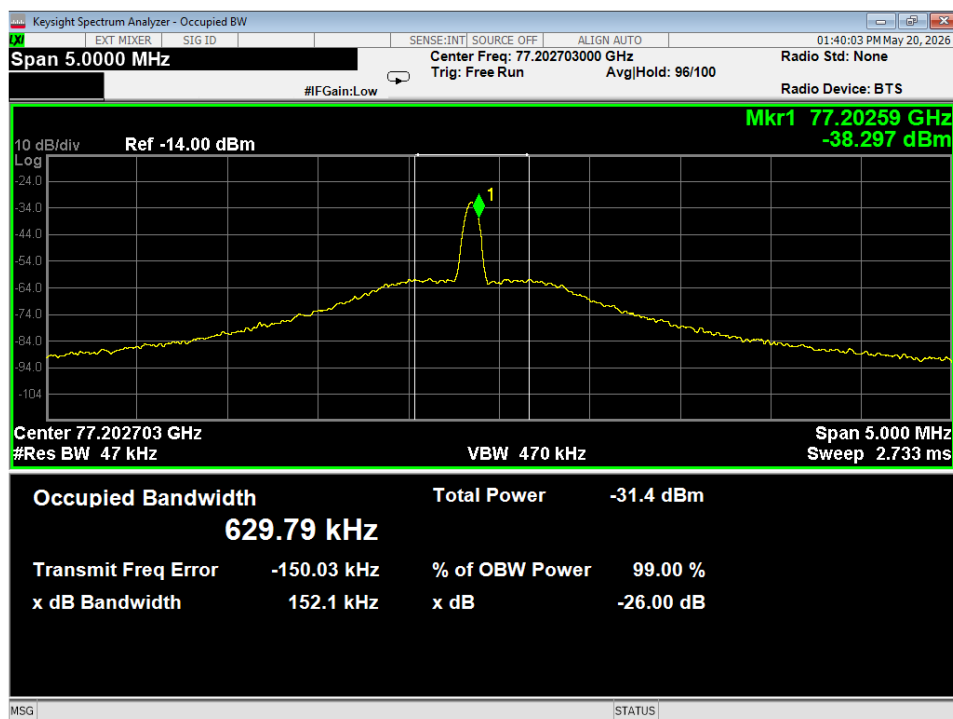


Figure 7 - Analyzer Measurement – 99% Bandwidth, Low Channel

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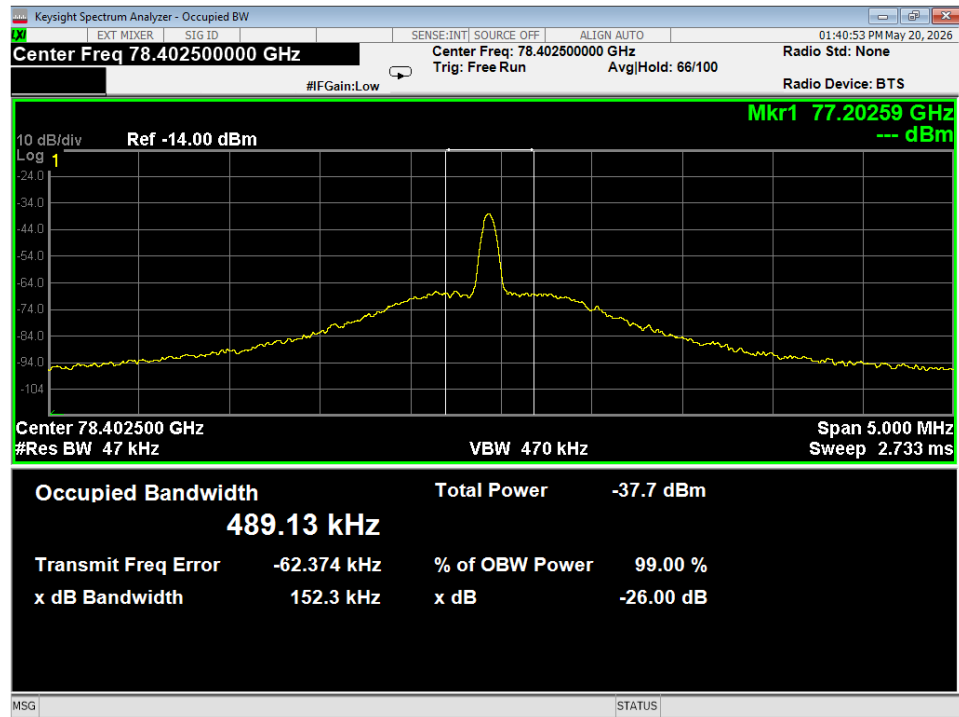


Figure 8 - Analyzer Measurement – 99% Bandwidth, Mid Channel

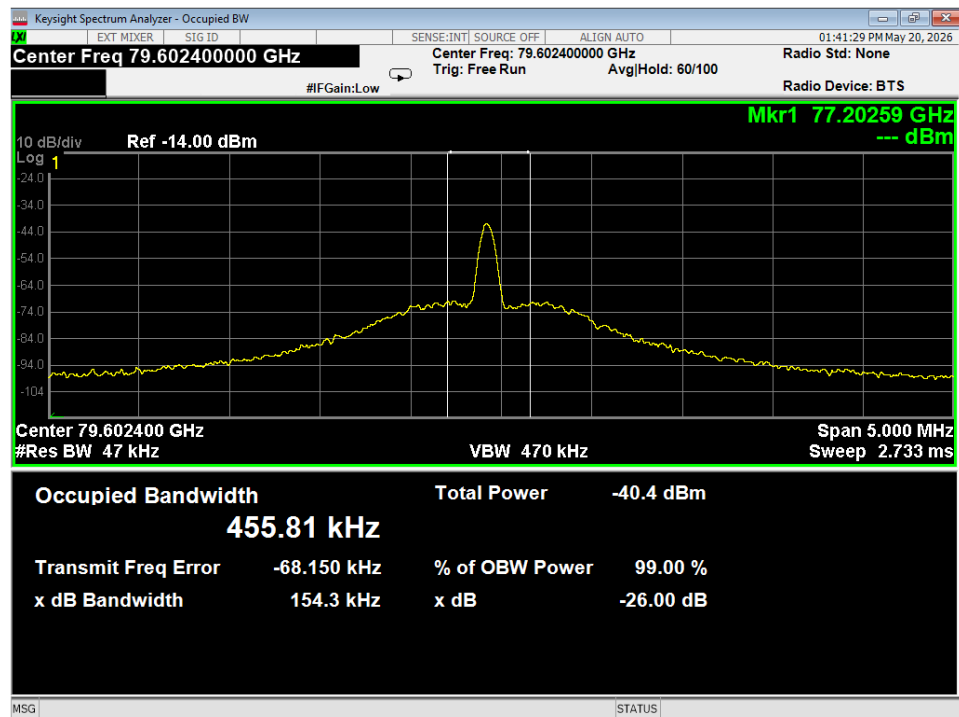


Figure 9 - Analyzer Measurement – 99% Bandwidth, High Channel

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4.3 DUTY CYCLE

Transmissions of unit under test maintained a duty cycle of >98%

Worst-case real-world duty cycle declared by manufacturer, 4.1%

DCCF (For Emissions) = $20 \cdot \log(1/0.041)$ = **27.744dB**

DCCF (For Power/EIRP) = $10 \cdot \log(1/0.041)$ = **13.872**

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4.4 RADIATED EMISSIONS

Test Method: ANSI C63.26 Sec. 5.5

Limits for radiated emissions measurements:

Emissions radiated outside of the specified bands shall be applied to the limits in 95.3379. see section 4.0 for further spurious emissions.

FREQUENCIES (MHz)	FIELD STRENGTH ($\mu\text{V/m}$)	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) = $20 * \log * \text{Emission level } (\mu\text{V/m})$.
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.
4. The EUT was tested for spurious emissions. The worst-case emissions are presented.



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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 from 30MHz-1Ghz and 1.5m for measurements from 1GHz and higher. For measurements >18GHz EUT was placed before a high frequency horn antenna and rotated to emit worst case emissions. Distance was varied, see corresponding section for details.
- 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.



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

Deviations from test standard:

No deviation.

EUT operating conditions

Details can be found in section 2.1 of this report.



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Test results:

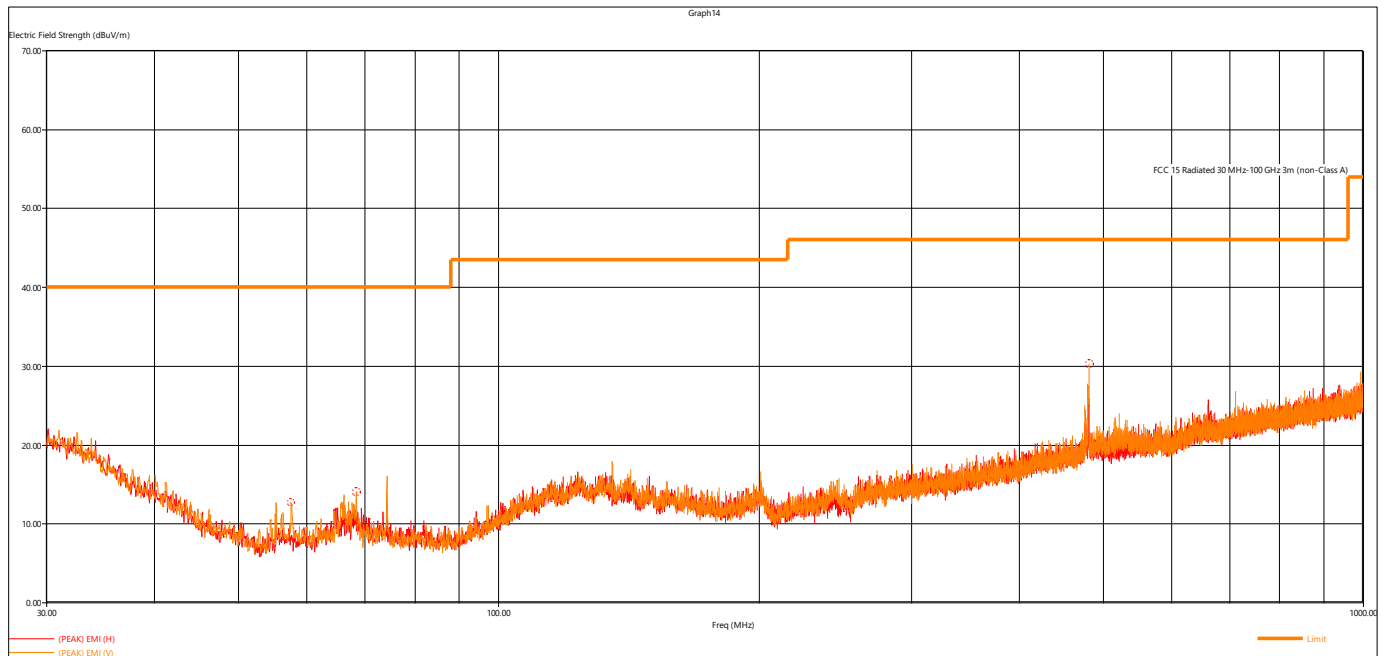


Figure 10 - Radiated Emissions Plot, 30MHz – 1GHz, Radar, Low Channel

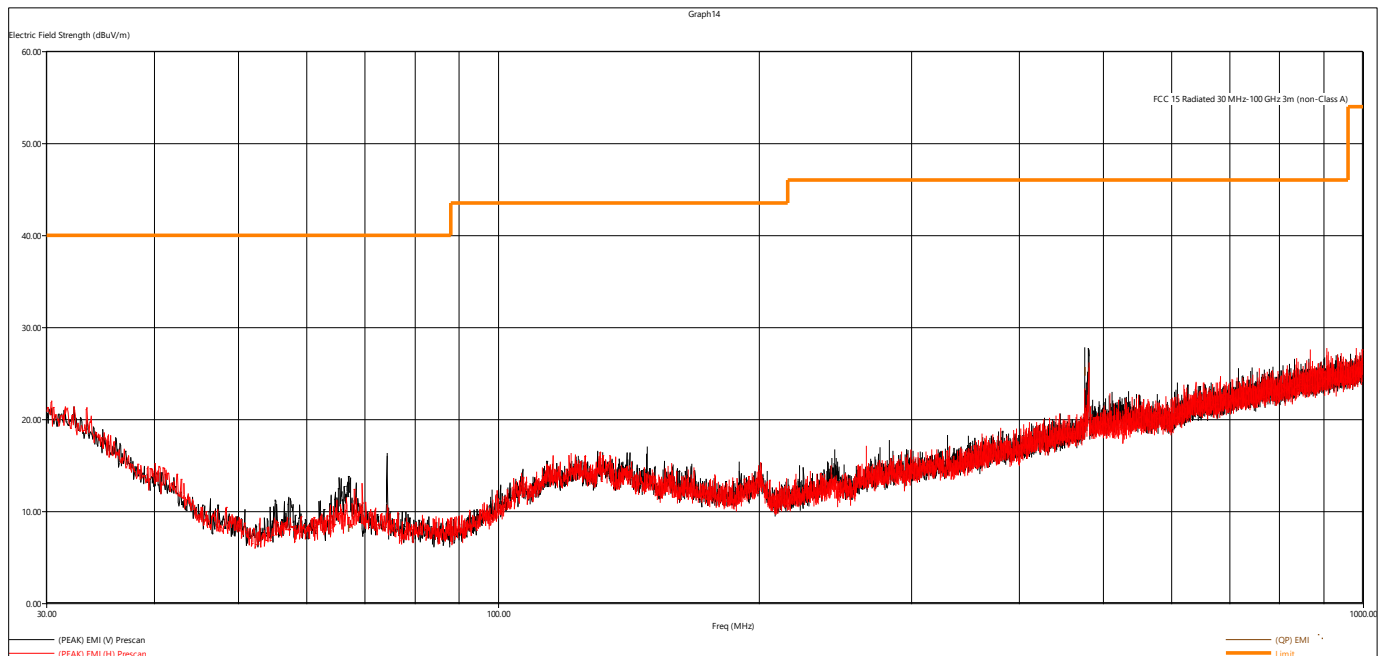


Figure 11 - Radiated Emissions Plot, 30MHz – 1GHz, Radar, Mid Channel

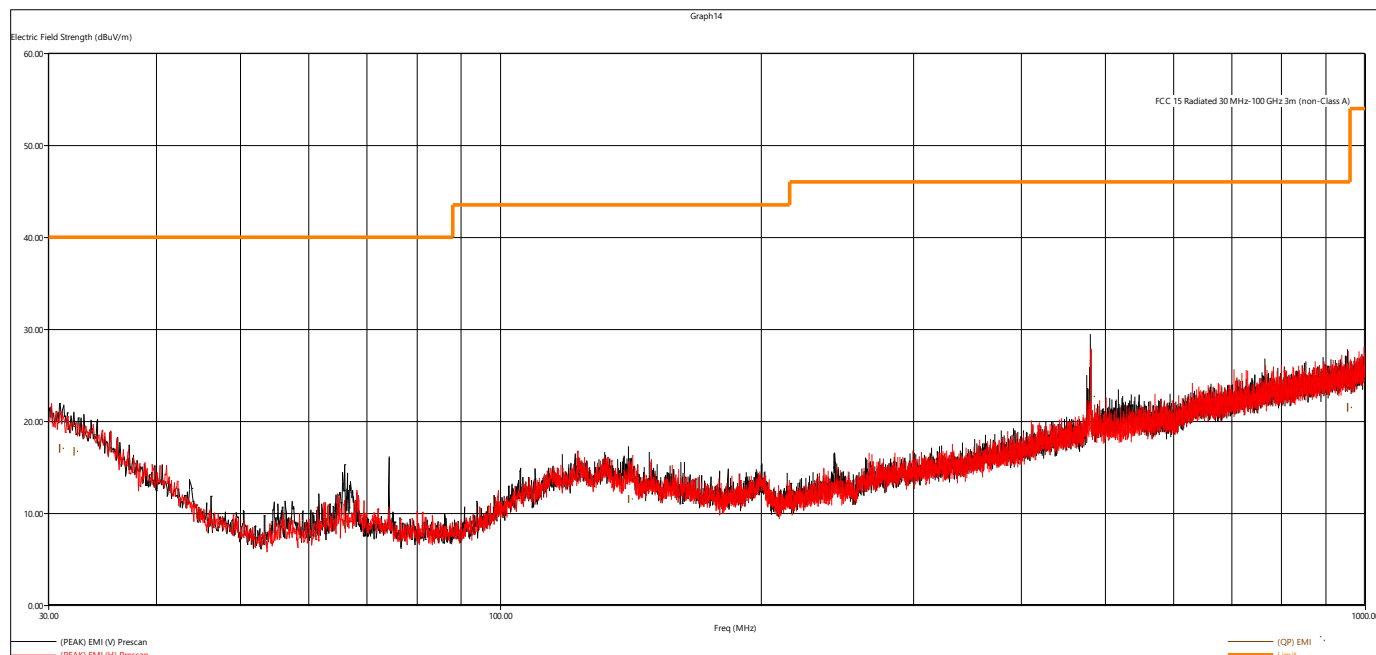


Figure 12 - Radiated Emissions Plot, 30MHz – 1GHz, Radar, High Channel

Quasi-Peak Measurements							
Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel
MHz	dBuV/m	dBuV/m	dB	cm.	deg.		
57.604320	8.85	40.00	31.15	145.43	75.50	V	Low
68.359200	6.91	40.00	33.09	120.47	337.75	V	Low
481.422480	25.76	46.02	20.26	123.10	355.00	V	Low
57.604320	8.85	40.00	31.15	145.43	75.50	V	Low
66.959039	8.13	40.00	31.87	112.47	125.25	V	Mid
476.319360	25.12	46.02	20.90	130.02	265.00	V	Mid
30.962640	16.98	40.00	23.02	123.88	277.25	V	High
32.054880	16.65	40.00	23.35	234.14	0.25	V	High
66.060960	8.72	40.00	31.28	104.83	333.50	V	High
140.430000	11.52	43.52	32.00	129.25	3.75	V	High
480.948000	22.62	46.02	23.40	212.17	259.50	V	High
952.966560	21.37	46.02	24.65	200.71	195.00	V	High

Emissions >1GHz were investigated, all other emissions were found to be at least 6dB below the appropriate limits.
Other test channels were investigated, worst case was reported.

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



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FCC Average Spurious Measurements

Ch	Detector	Frequency	SA reading (SAR)	Antenna Factor (AF)	Mixer Factor (MF)	Cable loss (CL)	DCCF	Test Distance	FS level @ Test Distance (FSL)	FS level @ 3m (FSL3 dBm)	FS level @ 3m (FSL3 dBuV)	Average Limit Part 95M	Margin
		GHz	dBm	dB		dB	dB	m	dBm/m	dBm/m	dBμv/m	dBμV/m	dB
Low	Peak	27.5998	-89.04	46.92	0.00	2.31	27.74	0.50	-67.55	-83.12	23.88	53.98	30.10
Mid	Peak	26.1335	-89.47	46.59	0.00	3.05	27.74	0.50	-67.58	-83.14	23.86	53.98	30.12
High	Peak	23.4453	-89.15	46.01	0.00	2.92	27.74	0.50	-67.96	-83.52	23.48	53.98	30.50
Low	Peak	32.6728	-88.15	48.52	0.00	3.47	27.74	0.50	-63.91	-79.47	27.53	53.98	26.45
Mid	Peak	31.3471	-87.43	47.28	0.00	3.42	27.74	0.50	-64.47	-80.04	26.96	53.98	27.02
High	Peak	31.8915	-87.01	47.71	0.00	3.84	27.74	0.50	-63.20	-78.77	28.23	53.98	25.75
Low	Peak	34.1319	-93.59	37.93	20.87	0.00	27.74	0.50	-62.54	-78.10	28.90	53.98	25.08
Mid	Peak	34.6646	-95.05	38.06	20.33	0.00	27.74	0.50	-64.40	-79.96	27.04	53.98	26.94
High	Peak	33.3294	-93.18	37.72	21.01	0.00	27.74	0.50	-62.19	-77.75	29.25	53.98	24.73
Low	Peak	40.7838	-94.20	39.47	22.25	0.00	27.74	0.50	-60.22	-75.79	31.21	93.5449	62.33
Mid	Peak	45.9858	-94.25	40.52	22.45	0.00	27.74	0.50	-59.03	-74.59	32.41	93.5449	61.13
High	Peak	46.6915	-94.17	40.65	22.61	0.00	27.74	0.50	-58.65	-74.21	32.79	93.5449	60.75
Low	Peak	61.8938	-70.69	44.42	0.00	0.00	27.74	1.00	-54.02	-63.56	43.44	93.5449	50.11
Mid	Peak	58.5935	-71.32	44.46	0.00	0.00	27.74	1.00	-54.60	-64.15	42.85	93.5449	50.69
High	Peak	60.1430	-72.07	44.49	0.00	0.00	27.74	1.00	-55.32	-64.87	42.13	93.5449	51.41
Low	Peak	70.6403	-71.13	44.24	0.00	0.00	27.74	1.00	-54.62	-64.17	42.83	93.5449	50.71
Mid	Peak	69.4105	-73.96	44.09	0.00	0.00	27.74	1.00	-57.61	-67.15	39.85	93.5449	53.69
High	Peak	70.7937	-69.51	44.26	0.00	0.00	27.74	1.00	-52.99	-62.53	44.47	93.5449	49.08
Low	Peak	88.1918	-66.61	45.17	0.00	0.00	27.74	1.00	-49.18	-58.72	48.28	93.5449	45.27
Mid	Peak	87.6325	-64.54	45.12	0.00	0.00	27.74	1.00	-47.17	-56.71	50.29	93.5449	43.26
High	Peak	90.3800	-65.18	45.39	0.00	0.00	27.74	1.00	-47.53	-57.08	49.92	93.5449	43.62
Low	Peak	102.4295	-58.67	46.47	0.00	0.00	27.74	1.00	-39.94	-49.48	57.52	93.5449	36.03
Mid	Peak	104.0293	-56.55	46.61	0.00	0.00	27.74	1.00	-37.69	-47.23	59.77	93.5449	33.77
High	Peak	105.6298	-57.26	46.74	0.00	0.00	27.74	1.00	-38.26	-47.80	59.20	93.5449	34.35
Low	Peak	110.4245	-81.51	47.12	34.05	0.00	27.74	0.25	-28.08	-49.66	57.34	93.5449	36.20
Mid	Peak	110.4460	-82.64	47.13	34.05	0.00	27.74	0.25	-29.21	-50.79	56.21	93.5449	37.34
High	Peak	114.4990	-81.40	47.44	33.84	0.00	27.74	0.25	-27.87	-49.45	57.55	93.5449	35.99
Low	Peak	135.4575	-83.48	48.90	37.25	0.00	27.74	0.25	-25.08	-46.66	60.34	93.5449	33.21
Mid	Peak	132.9350	-83.12	48.74	38.86	0.00	27.74	0.25	-23.27	-44.85	62.15	93.5449	31.40
High	Peak	132.8810	-82.62	48.73	36.67	0.00	27.74	0.25	-24.96	-46.54	60.46	93.5449	33.09
Low	Peak	143.4630	-76.42	43.42	38.09	0.00	27.74	0.25	-22.66	-44.24	62.76	93.5449	30.78
Mid	Peak	143.4285	-76.48	43.46	38.09	0.00	27.74	0.25	-22.68	-44.26	62.74	93.5449	30.81
High	Peak	142.7195	-76.44	43.49	38.09	0.00	27.74	0.25	-22.61	-44.19	62.81	93.5449	30.73
Low	Peak	174.3830	-77.11	51.09	44.60	0.00	27.74	0.25	-9.16	-30.74	76.26	93.5449	17.28
Mid	Peak	174.3820	-76.08	51.09	44.60	0.00	27.74	0.25	-8.13	-29.71	77.29	93.5449	16.26
High	Peak	174.4775	-76.64	51.10	44.60	0.00	27.74	0.25	-8.69	-30.27	76.73	93.5449	16.82



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Low	Peak	181.1410	-78.25	51.42	41.00	0.00	27.74	0.25	-13.57	-35.15	71.85	93.5449	21.70
Mid	Peak	181.2465	-77.77	51.43	41.00	0.00	27.74	0.25	-13.09	-34.68	72.32	93.5449	21.22
High	Peak	181.2130	-77.45	51.43	41.00	0.00	27.74	0.25	-12.77	-34.35	72.65	93.5449	20.90
Low	Peak	212.4785	-75.68	52.81	52.39	0.00	27.74	0.25	1.77	-19.81	87.19	95.7634	8.57
Mid	Peak	212.4915	-75.49	52.81	52.39	0.00	27.74	0.25	1.96	-19.63	87.37	95.7634	8.39
High	Peak	212.3760	-75.18	52.81	52.39	0.00	27.74	0.25	2.27	-19.32	87.68	95.7634	8.08
Low	Peak	235.5070	-79.04	53.70	63.89	0.00	27.74	0.10	10.81	-18.73	88.27	95.7634	7.49
Mid	Peak	235.6065	-78.98	53.71	63.89	0.00	27.74	0.10	10.87	-18.67	88.33	95.7634	7.44
High	Peak	235.7020	-78.27	53.71	63.89	0.00	27.74	0.10	11.58	-17.96	89.04	95.7634	6.72

FSL = SAR + AF + MF + CL - DCCF; FSL3 = FSL + 20*log(TD/3)

**Emissions were investigated up to 240GHz, all emissions found to be below labs noise floor, all emissions found to be at least 6dB below limit line

Average Spurious Measurements, IC

Ch	Detector	Frequency	SA reading (SAR)	Antenna Factor (AF)	Mixer Factor (MF)	DCCF	Cable loss (CL)	Test Distance	FS level @ Test Distance	FS level @ 3m (FSL3 dBm)	EIRP	Average Limit RSS-251	Margin to RSS-251
		GHz	dBm	dB	dB	dB	dB	m	dBm/m	dBm/m	dBm (EIRP)	dBm (EIRP)	dB
Low	Peak	27.5998	-89.04	46.92	0.00	27.74	2.31	0.50	-67.55	-83.11	-71.34	-30	41.34
Mid	Peak	26.1335	-89.47	46.59	0.00	27.74	3.05	0.50	-67.58	-83.14	-71.37	-30	41.37
High	Peak	23.4453	-89.15	46.01	0.00	27.74	2.92	0.50	-67.95	-83.52	-71.75	-30	41.75
Low	Peak	32.6728	-88.15	48.52	0.00	27.74	3.47	0.50	-63.91	-79.47	-67.70	-30	37.70
Mid	Peak	31.3471	-87.43	47.28	0.00	27.74	3.42	0.50	-64.47	-80.03	-68.26	-30	38.26
High	Peak	31.8915	-87.01	47.71	0.00	27.74	3.84	0.50	-63.20	-78.76	-66.99	-30	36.99
Low	Peak	34.1319	-93.59	37.93	20.87	27.74	0.00	0.50	-62.54	-78.10	-66.33	-30	36.33
Mid	Peak	34.6646	-95.05	38.06	20.33	27.74	0.00	0.50	-64.39	-79.96	-68.19	-30	38.19
High	Peak	33.3294	-93.18	37.72	21.01	27.74	0.00	0.50	-62.19	-77.75	-65.98	-30	35.98
Low	Peak	40.7838	-94.20	39.47	22.25	27.74	0.00	0.50	-60.22	-75.78	-64.01	-30	34.01
Mid	Peak	45.9858	-94.25	40.52	22.45	27.74	0.00	0.50	-59.02	-74.58	-62.81	-30	32.81
High	Peak	46.6915	-94.17	40.65	22.61	27.74	0.00	0.50	-58.64	-74.21	-62.44	-30	32.44
Low	Peak	61.8938	-70.69	44.42	0.00	27.74	0.00	1.00	-54.02	-63.56	-51.79	-30	21.79
Mid	Peak	58.5935	-71.32	44.46	0.00	27.74	0.00	1.00	-54.60	-64.14	-52.37	-30	22.37
High	Peak	60.1430	-72.07	44.49	0.00	27.74	0.00	1.00	-55.32	-64.86	-53.09	-30	23.09
Low	Peak	70.6403	-71.13	44.24	0.00	27.74	0.00	1.00	-54.62	-64.16	-52.39	-30	22.39
Mid	Peak	69.4105	-73.96	44.09	0.00	27.74	0.00	1.00	-57.60	-67.15	-55.38	-30	25.38
High	Peak	70.7937	-69.51	44.26	0.00	27.74	0.00	1.00	-52.99	-62.53	-50.76	-30	20.76
Low	Peak	88.1918	-66.61	45.17	0.00	27.74	0.00	1.00	-49.18	-58.72	-46.95	-30	16.95
Mid	Peak	87.6325	-64.54	45.12	0.00	27.74	0.00	1.00	-47.16	-56.71	-44.94	-30	14.94
High	Peak	90.3800	-65.18	45.39	0.00	27.74	0.00	1.00	-47.53	-57.07	-45.30	-30	15.30
Low	Peak	102.4295	-58.67	46.47	0.00	27.74	0.00	1.00	-39.94	-49.48	-37.71	-30	7.71
Mid	Peak	104.0293	-56.55	46.61	0.00	27.74	0.00	1.00	-37.68	-47.23	-35.46	-30	5.46



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High	Peak	105.6298	-57.26	46.74	0.00	27.74	0.00	1.00	-38.26	-47.80	-36.03	-30	6.03
Low	Peak	110.4245	-81.51	47.12	34.05	27.74	0.00	0.25	-28.07	-49.66	-37.89	-30	7.89
Mid	Peak	110.4460	-82.64	47.13	34.05	27.74	0.00	0.25	-29.21	-50.79	-39.02	-30	9.02
High	Peak	114.4990	-81.40	47.44	33.84	27.74	0.00	0.25	-27.86	-49.45	-37.68	-30	7.68
Low	Peak	135.4575	-83.48	48.90	37.25	27.74	0.00	0.25	-25.07	-46.66	-34.89	-30	4.89
Mid	Peak	132.9350	-83.12	48.74	38.86	27.74	0.00	0.25	-23.26	-44.85	-33.08	-30	3.08
High	Peak	132.8810	-82.62	48.73	36.67	27.74	0.00	0.25	-24.95	-46.54	-34.77	-30	4.77
Low	Peak	143.4630	-76.42	43.42	38.09	27.74	0.00	0.25	-22.65	-44.24	-32.47	-30	2.47
Mid	Peak	143.4285	-76.48	43.46	38.09	27.74	0.00	0.25	-22.67	-44.26	-32.49	-30	2.49
High	Peak	142.7195	-76.44	43.49	38.09	27.74	0.00	0.25	-22.60	-44.19	-32.42	-30	2.42

FSL = SAR + AF + MF + CL – DCCF; FSL3 = FSL + 20*log(TD/3)



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4.5 FREQUENCY ERROR

Test Method:

All the radio measurements were performed using the sections from ANSI C63.26 Sec. 5.6

Limits of Frequency Error:

95.3379 76–81 GHz Band Radar Service unwanted emissions limits:

Fundamental emissions must be contained within the frequency bands(76GHz - 81GHz). specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range –20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

RSS-251 Section 7:

The radar device's occupied bandwidth (i.e. 99% emission bandwidth) shall be contained in the 76-81 GHz frequency band.

RSS-251 Section 11:

The radar device's occupied bandwidth (i.e. 99% emission bandwidth) shall be maintained within the 76-81 GHz frequency band while subjected to all conditions of operation specified in RSS-Gen.

Test procedures:

Details can be found in section 3.4 of this report.

Deviations from test standard:

Temperature range tested -20C to 55C

Test setup:

Test setup details can be found in section 3.4 of this report.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

NA



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Temperature Frequency Deviation				
Temperature (C°)	Voltage	Frequency Error (MHz)		
	(VDC)	Ch 1	Ch 2	Ch 3
		77.2 GHz	78.4 GHz	79.6 GHz
-20°C	12	2.64	2.64	2.61
0°C	12	1.64	1.67	1.65
20°C	12	0.712	0.687	0.627
55°C	12	0.643	0.691	0.768

Voltage Frequency Deviation		Nominal Voltage: 12V		
Voltage (V)	Temperature (C°)	Frequency Error (MHz)		
		Ch 1	Ch 2	Ch 3
		77.2 GHz	78.4 GHz	79.6 GHz
13.8	20°C	0.942	0.964	1.1
12	20°C	1.09	1.15	1.29
10.2	20°C	1.11	1.04	1.03

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4.5 EXTERNAL PHOTOS

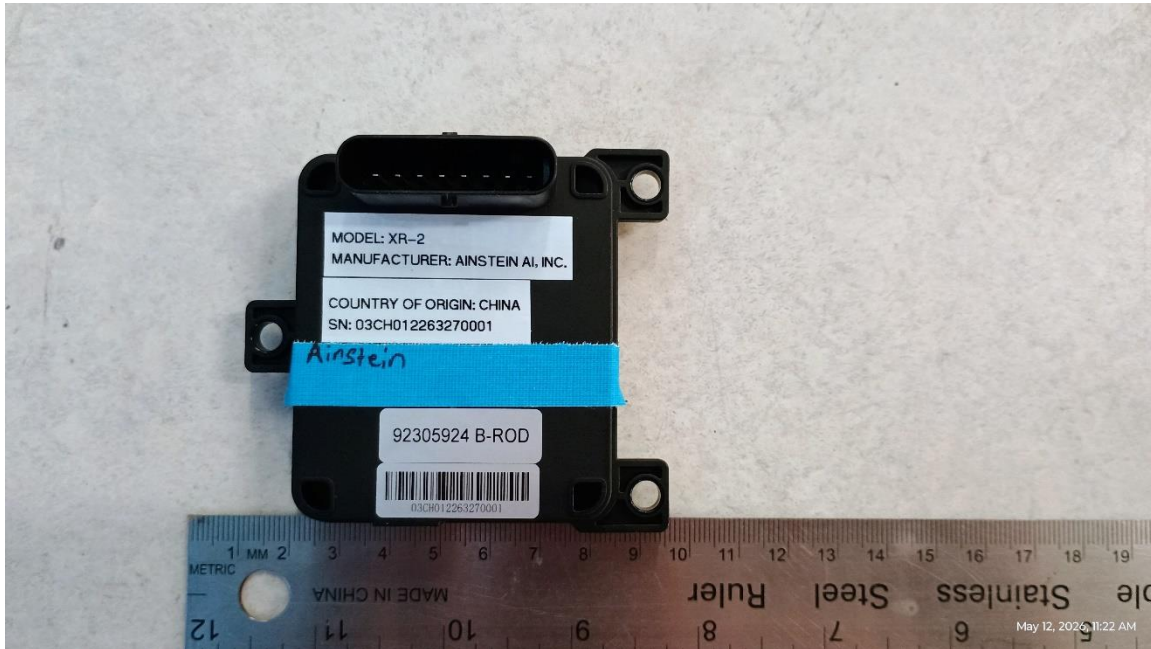


Figure 13 – External Photos 1

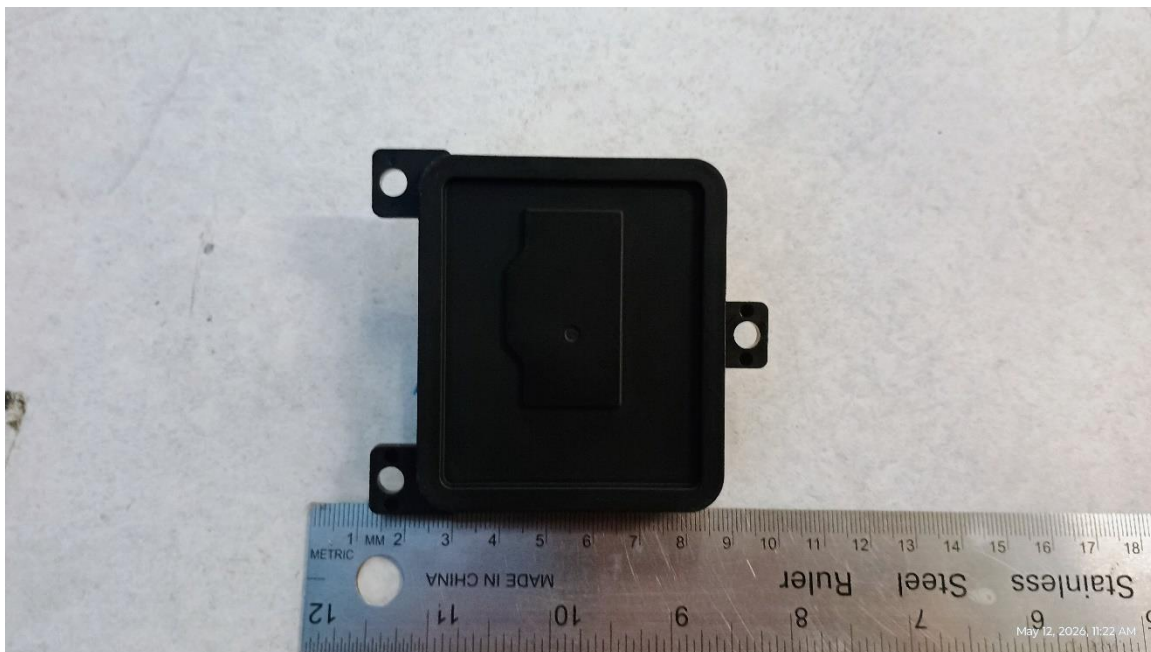


Figure 14 - External Photos 2

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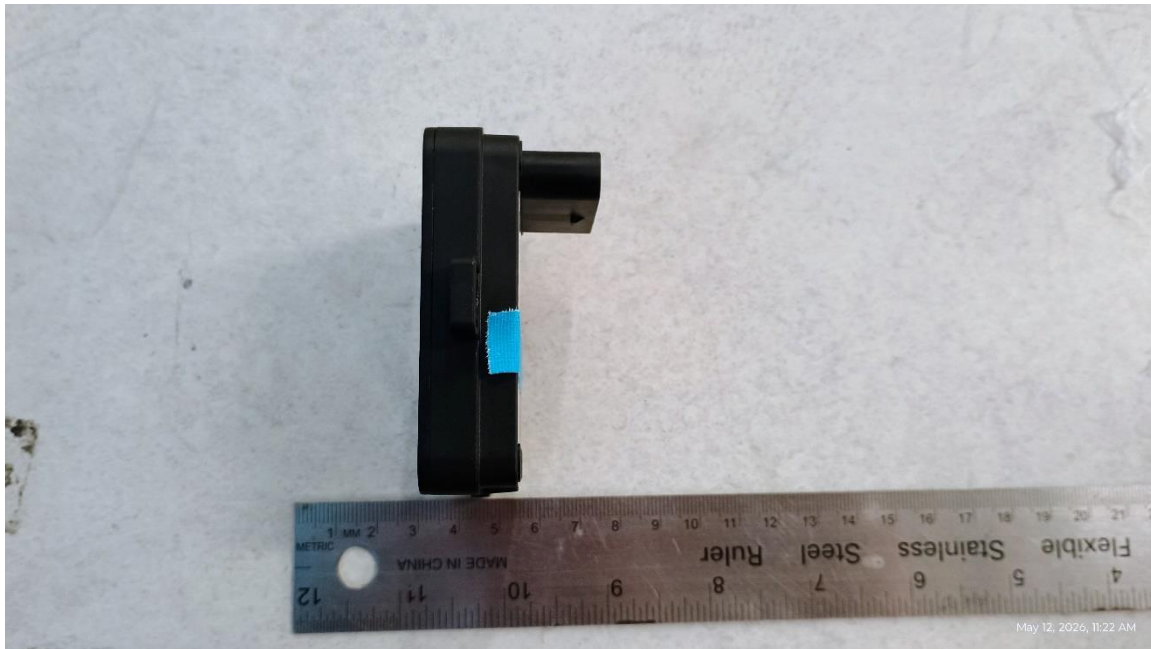


Figure 15 - External Photos 3

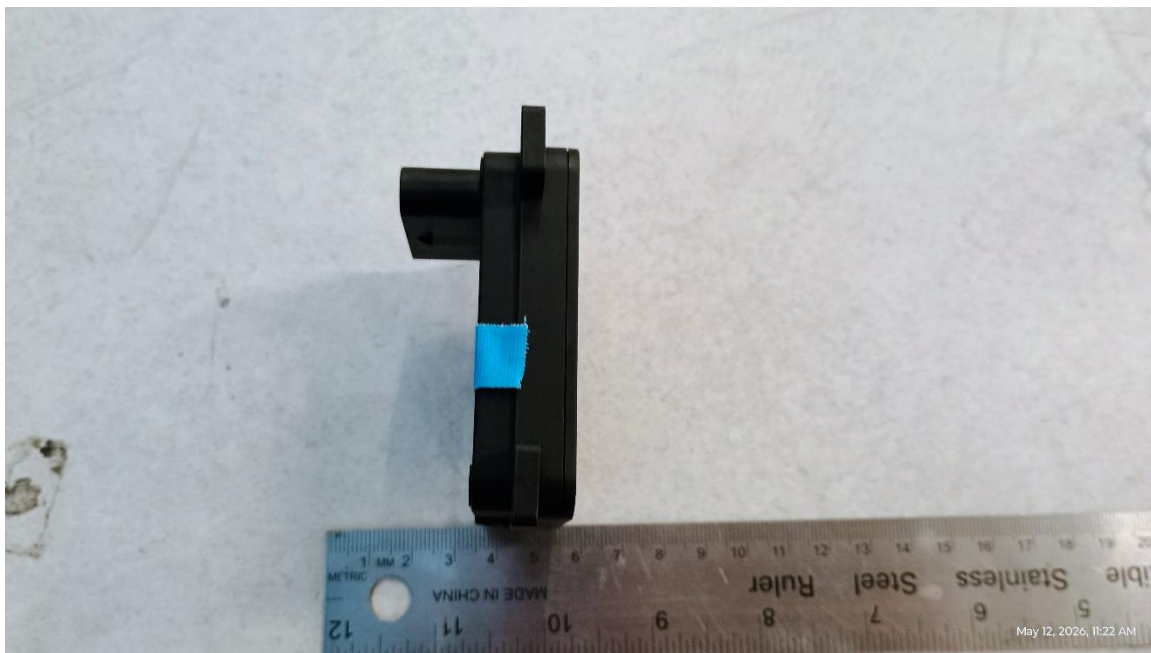


Figure 16 – External Photos 4

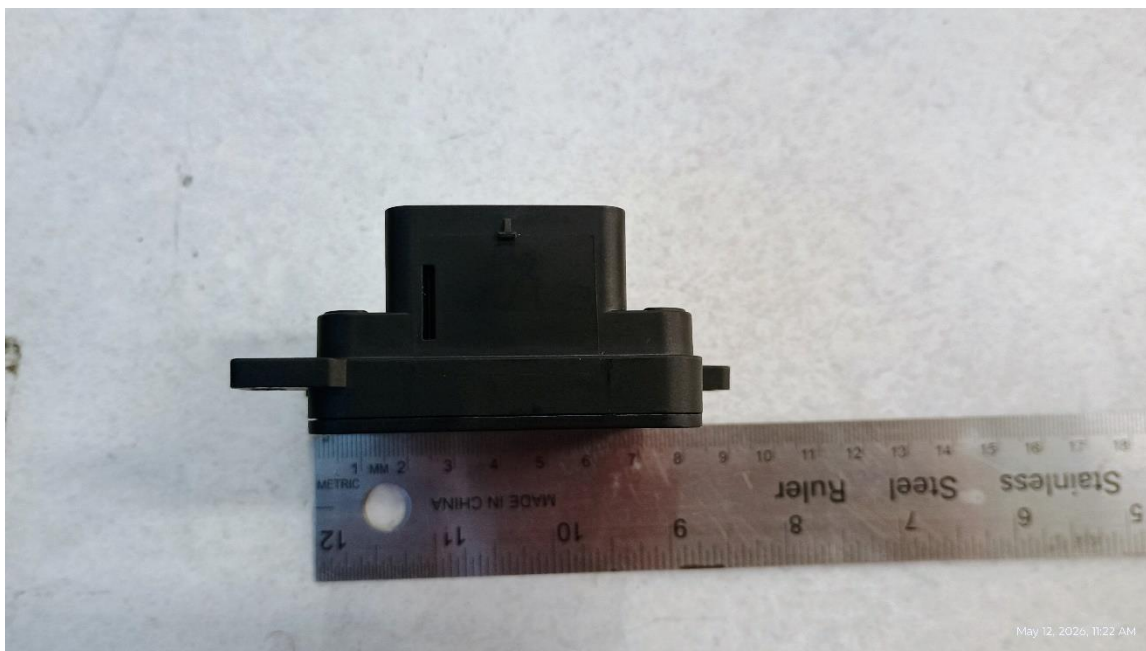


Figure 17 – External Photos 5



Figure 18 – External Photos 6



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APPENDIX A: SAMPLE CALCULATION

Field Strength Calculation

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

$$FS = RA + AF - (-CF + AG) + AV$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dB μ V is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dB μ V/m.

$$FS = 55 + 12 - (-1.1 + 20) + 0 = 48.1 \text{ dB}\mu\text{V/m}$$

The 48.1 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(48.1 \text{ dB}\mu\text{V/m})/20] = 254.1 \mu\text{V/m}$$

AV is calculated by taking the $20 \cdot \log(T_{\text{on}}/100)$ where T_{on} is the maximum transmission time in any 100ms window.

EIRP Calculations

In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation;

$$EIRP (\text{Watts}) = [\text{Field Strength (V/m)} \times \text{antenna distance (m)}]^2 / 30$$

$$\text{Power (watts)} = 10^{[\text{Power (dBm)}]/10} / 1000$$

$$\text{Voltage (dB}\mu\text{V)} = \text{Power (dBm)} + 107 \text{ (for } 50\Omega \text{ measurement systems)}$$

$$\text{Field Strength (V/m)} = 10^{[\text{Field Strength (dB}\mu\text{V/m)} / 20] / 10^6}$$

$$\text{Gain} = 1 \text{ (numeric gain for isotropic radiator)}$$

Conversion from 3m field strength to EIRP (d=3):

$$EIRP = [FS(\text{V/m}) \times d^2]/30 = FS [0.3] \text{ for } d = 3$$

$$EIRP (\text{dBm}) = FS(\text{dB}\mu\text{V/m}) - 10(\log 10^9) + 10\log[0.3] = FS(\text{dB}\mu\text{V/m}) - 95.23$$

$10\log(10^9)$ is the conversion from micro to milli.



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APPENDIX B – MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been present for tests performed in this test report: Conformity with the specified requirements is determined by comparing the measured results directly to the applicable limits. Measurement uncertainty is not applied to adjust or attribute to the measured value for the purpose of compliance determination.

Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±4.50
Radiated Emissions, 3m	1GHz - 18GHz	±4.49
Emissions, conducted	30MHz – 18GHz	±3.03
Radiated Emissions	18GHz – 26.5GHz	±6.00
Radiated Emissions	26.5GHz – 325GHz	±8.00

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



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REPORT END