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NEWBERRY, FL 32669 USA

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TIMCO ENGINEERING, Inc.

An IIA Company

FCC Part 74H
ISED PART RSS-210

Test Report

APPLICANT	**AUDIO-TECHNICA CORPORATION**
	2-46-1 Nishi-Naruse, Machida Tokyo 194-8666 JAPAN
FCC ID	JFZT220BI
IC	1752B-T220BI
MODEL NUMBER	ATW-T220bI
PRODUCT DESCRIPTION	HANDHELD WIRELESS MICROPHONE
STANDARD APPLIED	CFR 47 Part 74
DATE SAMPLE RECEIVED	1/3/2020
DATE TESTED	1/21/2020
TESTED BY	Tim Royer
APPROVED BY	Franklin Rose
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Report Version	Description	Issue Date
31AUT20_PT74_TestReport_	-----	Initial Issue	2/19/2020
	Rev1	Revised spurious emissions, Power output, frequency stability	5/22/2020
	Rev2	Added Modulation Characteristics	5/28/2020
	Rev3	Added Maximum Deviation Page 3	5/29/2020

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.

This report relates only to the Equipment Under Test (EUT) sample(s) tested.

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GENERAL REMARKS

Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.

☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669
Designation #: US1070

Tested by:

Name and Title	Tim Royer, Project Manager / EMC Testing Engineer
Date	02/17/2020

Reviewed and Approved by:

Name and Title	Franklin Rose, Project Manager / EMC Testing Technician
Date	02/17/200

GENERAL INFORMATION

EUT Description	**HANDHELD WIRELESS MICROPHONE**
FCC ID	JFZT220BI
IC	1752B-T220BI
Model Number	ATW-T220bI
Operating Frequency	487.125-506.500 MHz
Test Frequencies	487.13, 494.38, 506.5MHz
Modulation	FM
Maximum Deviation	±40kHz
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☐ DC Power
	☒ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☐ Mobile
	☒ Portable
Antenna Connector	UFL
Test Conditions	The temperature was 26ºC Relative humidity of 50%.
Modification to the EUT	No Modification to EUT.
Test Exercise	The EUT was placed in continuous transmit and was operated in "Test Mode" for digital emissions tests.
Applicable Standards	FCC CFR 47 Part 2, & 74, RSS-210, RSS-GEN KDB 971168 D01 V02R02 KDB 206256 ANSI/TIA 603-D:2010 ANSI C63.4 2014 ANSI C63.26 2015
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. **Designation #: US1070, ISED: 2056A**

RESULTS SUMMARY

FCC Rule Part	ISED Rules Part	Requirement	Test Item	Result
2.1046(a), 74.861(e)(1)(ii)	RSS-210 G.1 RSS-GEN	Conducted Power	RF Power Output	**PASS**
2.1049(c), 74.861(e)(5)	RSS-210 G.2 RSS-GEN	Operating Bandwidth	Occupied Bandwidth	**PASS**
2.1049(c), 74.861(e)(7)	RSS-210 G.4 RSS-GEN	Unwanted Emissions	Emission Mask	**PASS**
2.1053, 74.861(e)	RSS-210 RSS-GEN	Unwanted Emissions	Field Strength of Spurious Emissions	**PASS**
2.1055, 74.861(e)(4)	RSS-210 G.3 RSS-GEN	Frequency Tolerance	Frequency Stability	**PASS**

RF POWER OUTPUT

Rule Part No.: 2.1046(a), 74.861(e) (1)(ii), RSS-210

Requirement:

(e) For low power auxiliary stations operating in the 600 MHz duplex gap and the bands allocated for TV broadcasting, the following technical requirements apply:

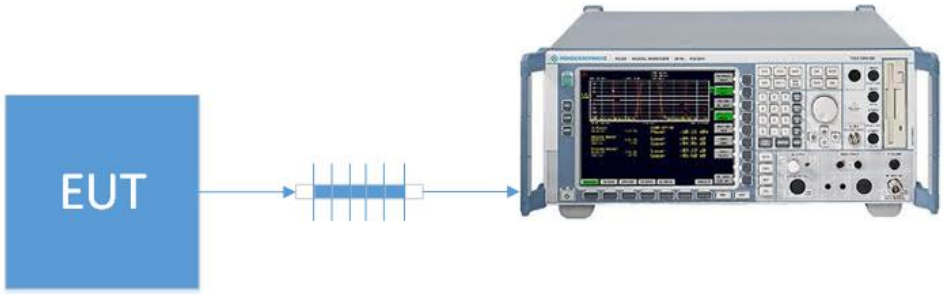
(1) The power may not exceed the following values.

(i) 54-72, 76-88, and 174-216 MHz bands: 50 mW EIRP

(ii) 470-608 and 614-698: 250 mW conducted power

Procedure: KDB 971168 D01 Average Power Measurements section 5.2.1
TIA-603-E, 2.2.1

Setup Diagram:



Test Data: Mean Output Power Measurement Table

Tuned Freq. MHz	Power Output		
	Level (dBm)	Level (mW)	Margin (mW)
487.1300	15.05	30.0	220.0
494.3800	15.13	32.6	217.4
506.5000	15.01	31.7	218.3

Results Meet Requirements

OCCUPIED BANDWIDTH

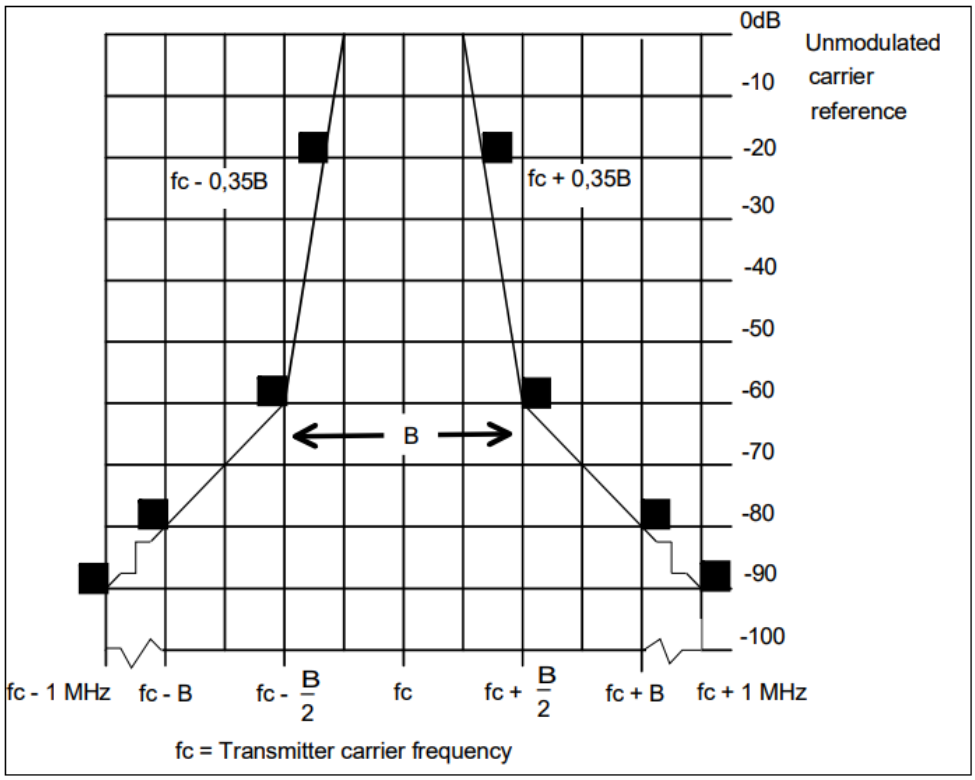
Rule Part No.: 2.1049(c), 74.802(c)(2), 74.861(e)(5)(7), RSS-210

Requirement:

(e) For low power auxiliary stations operating in the 600 MHz duplex gap and the bands allocated for TV broadcasting, the following technical requirements apply:

(5) The operating bandwidth shall not exceed 200 kHz.

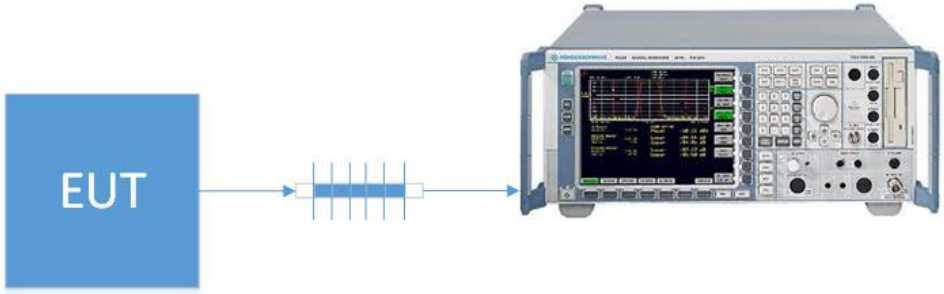
(7) Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2.2 (Figure 4) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08). The requirements of this paragraph (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in §73.3700(a)(2) of this chapter.



Procedure: KDB 971168 D01 Power Bandwidth 99% section 4.2
KDB 971168 D01 Spurious Emissions at antenna term section 6
ANSI C63.26, 5.4.4 (using Test Setup from TIA 603-E 2.2.11, below)

OCCUPIED BANDWIDTH

Setup Diagram:



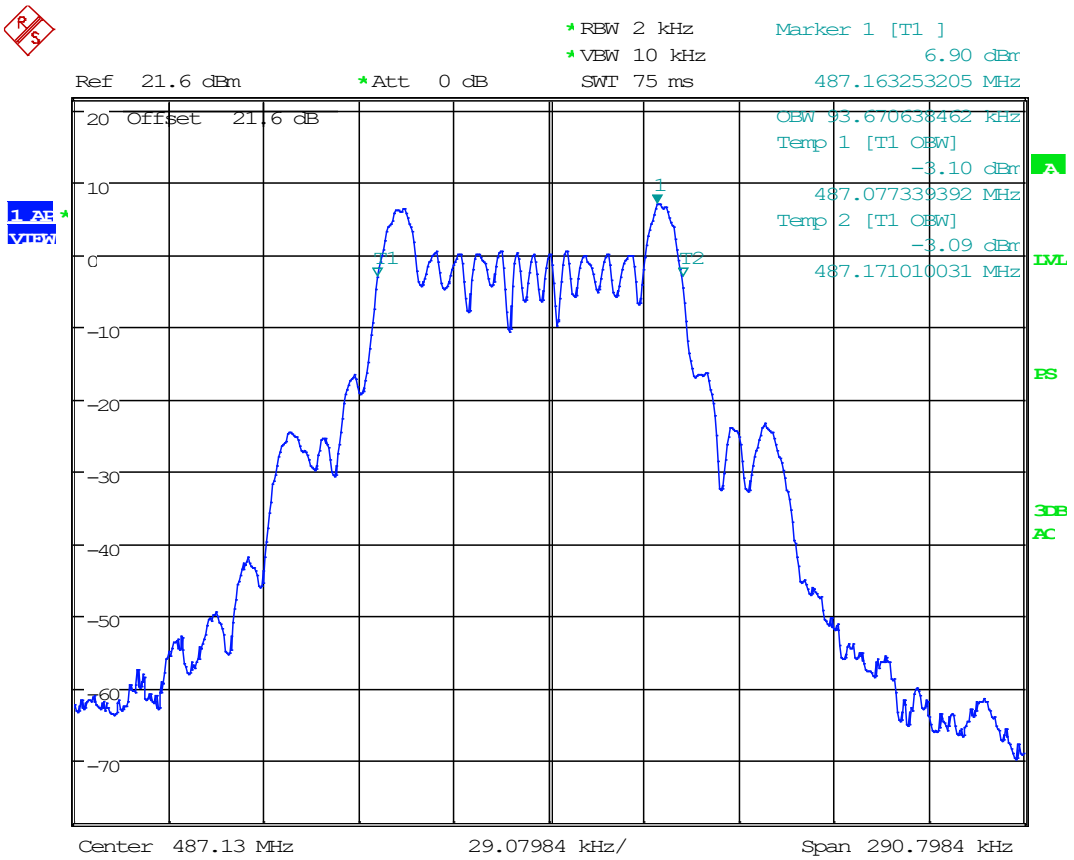
Test Data: Operating Bandwidth Measurement Table

Tuned Freq (MHz)	Measured 99% BW (KHz)	Margin (KHz)
487.13	93.67	106.33
494.38	93.67	106.33
506.5	94.13	105.87

Results Meet Requirements

OCCUPIED BANDWIDTH

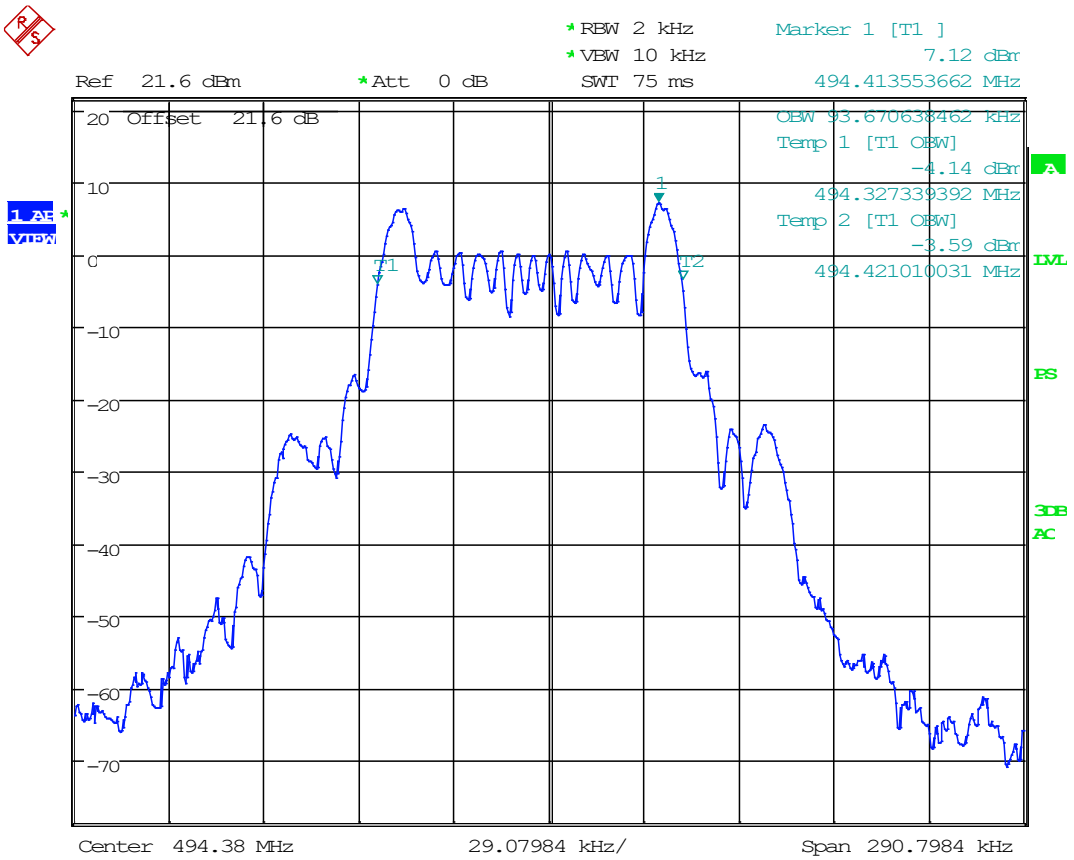
Test Data: 487.13 MHz 99% OBW Plot



Date: 14.FEB.2020 11:19:29

OCCUPIED BANDWIDTH

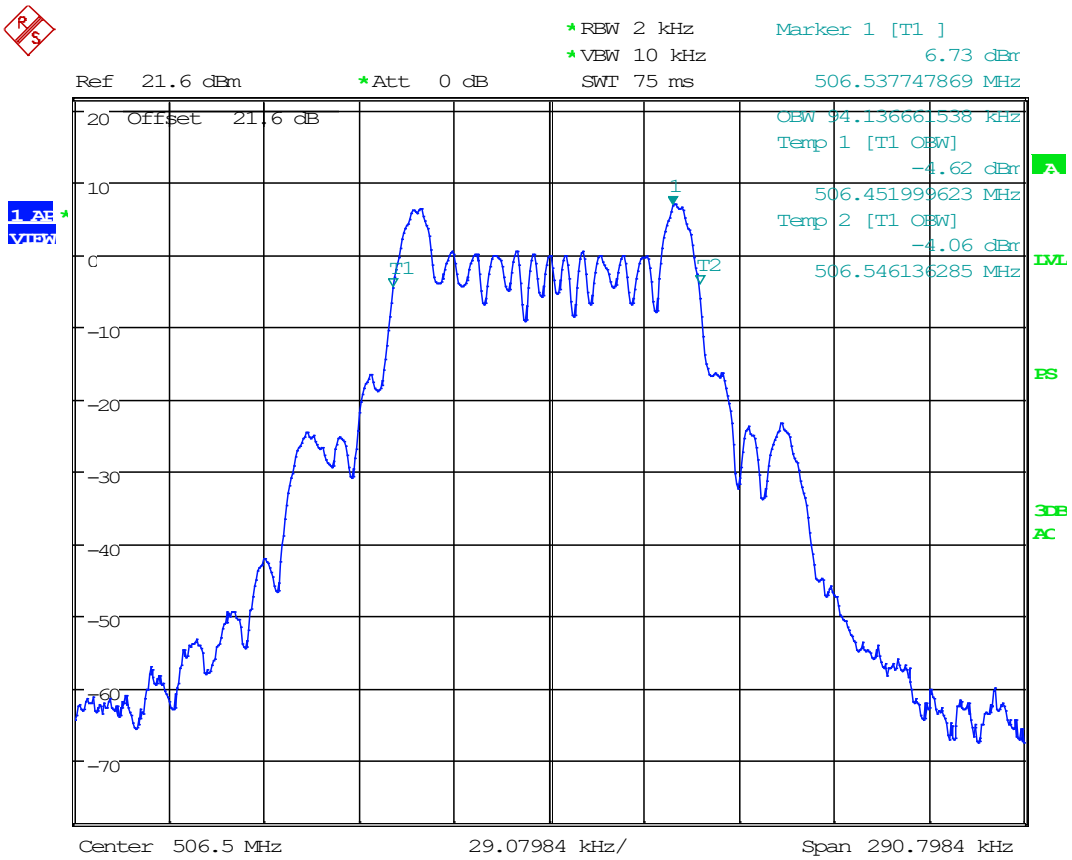
Test Data: 494.38 MHz 99% OBW Plot



Date: 14.FEB.2020 11:21:00

OCCUPIED BANDWIDTH

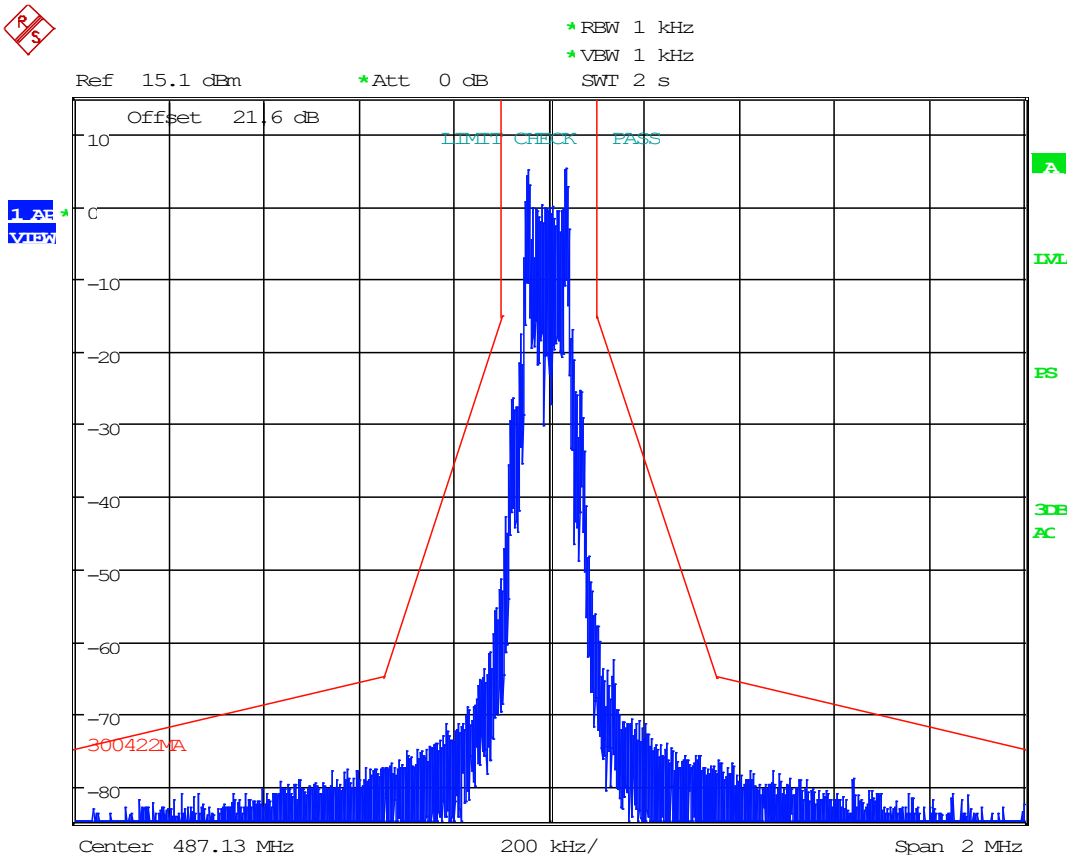
Test Data: 506. 5 MHz 99% OBW Plot



Date: 14.FEB.2020 11:21:56

OCCUPIED BANDWIDTH

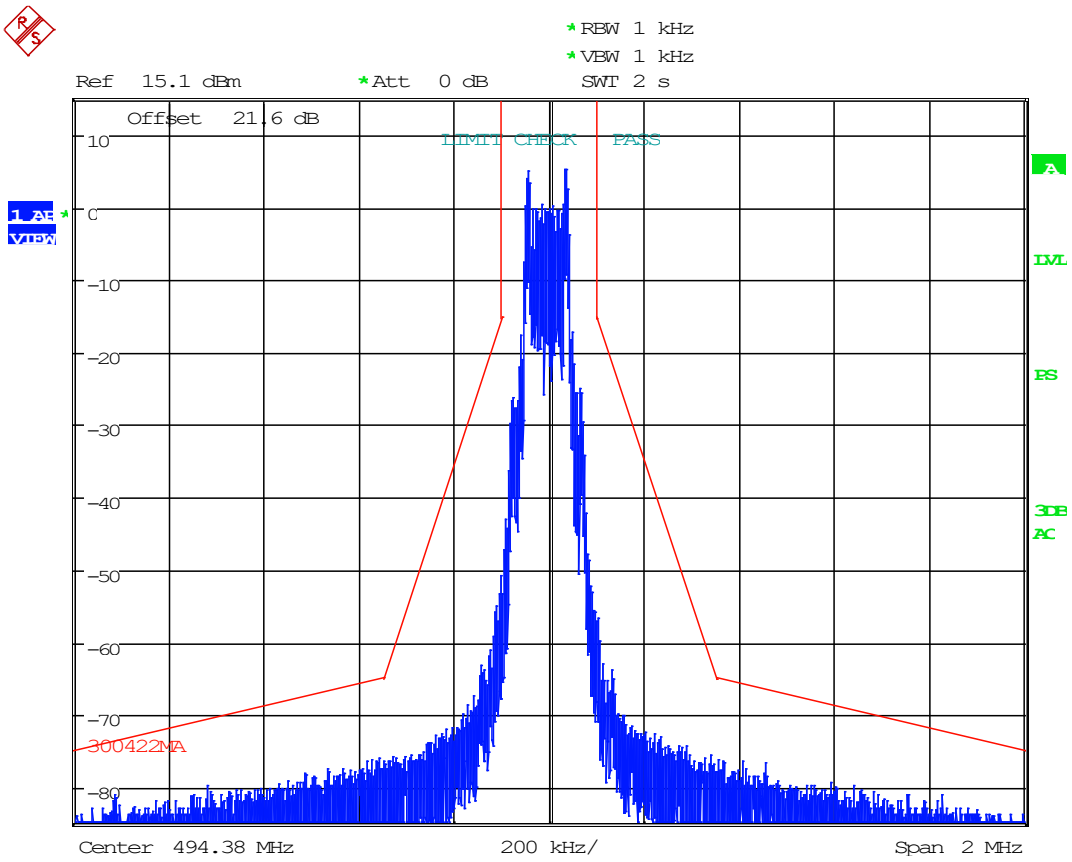
Test Data: 487.13 MHz Emission Mask Plot



Date: 14.FEB.2020 11:29:53

OCCUPIED BANDWIDTH

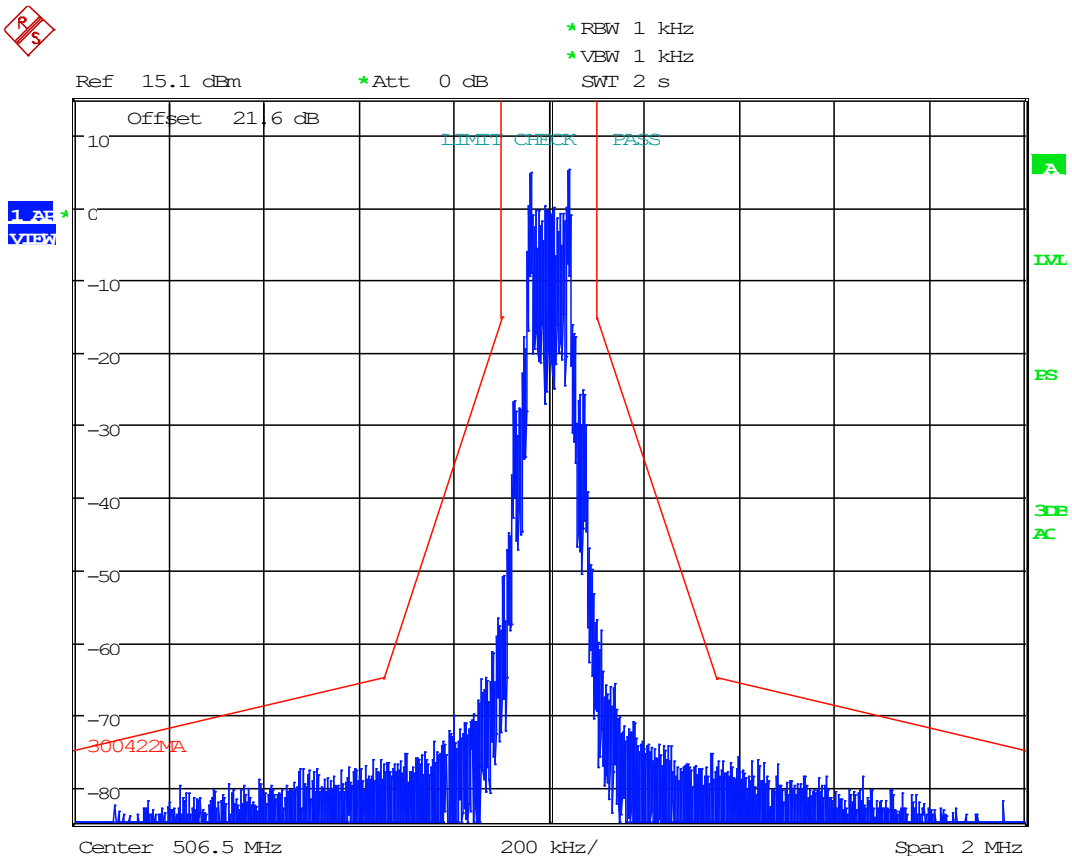
Test Data: 494.38 MHz Emission Mask Plot



Date: 14.FEB.2020 11:26:09

OCCUPIED BANDWIDTH

Test Data: 506.5 MHz Emission Mask Plot



Date: 14.FEB.2020 11:23:44

FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Part No.: 2.1053, 74.861(8)(7), EN 300-422 v1.4.1 sec 8.4.3, RSS-210

Requirement:

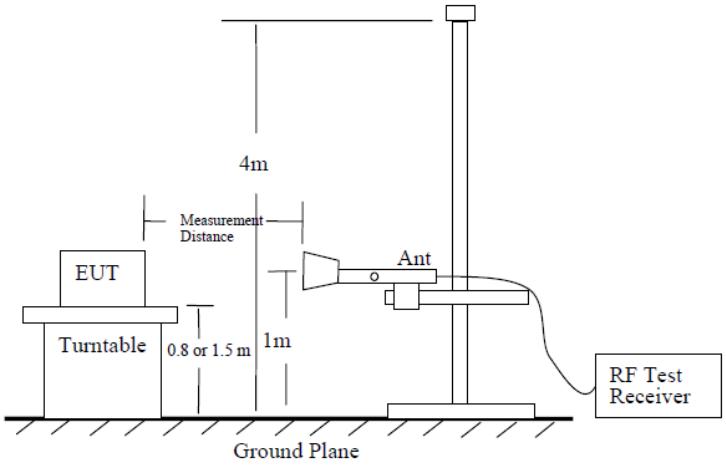
(7) Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2.2 (Figure 4) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08). The requirements of this paragraph (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in §73.3700(a)(2) of this chapter.

Table 3: Limits for spurious emissions

State	Frequency		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operation	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

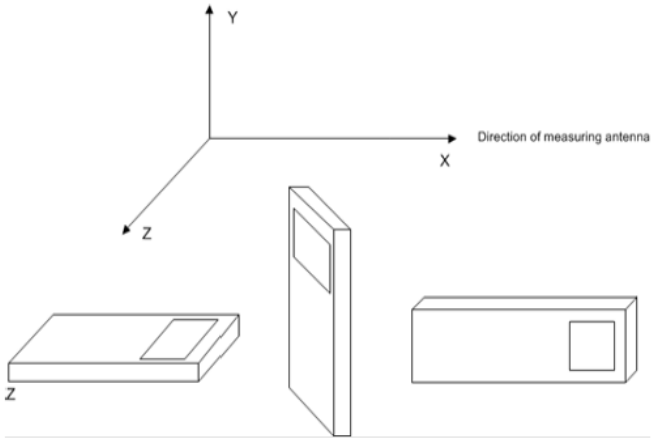
Procedure: KDB 971168 D01 Spurious Emissions at antenna term section 7
ANSI C63.26, 5.5.4
ANSI C63.4 General Radiated Testing and Site Validation

Test Site Setup:


4m
Measurement Distance
EUT
Ant
Turntable
0.8 or 1.5 m
1m
RF Test Receiver
Ground Plane

FIELD STRENGTH OF SPURIOUS EMISSIONS

EUT Orientation(s):



Note: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from the lowest frequency generated internally to at least the tenth harmonic of the fundamental. This test was conducted in accordance with the standard listed above using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669. The measurements below represent the worst case of all the frequencies tested.

Note: The six (6) highest emissions or more of each worst-case operational modes of the EUT are represented below. Emissions 20 dB below the limit are not required to be reported.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 487.13 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBµV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Margin (dB)
487.13	1461.40	10.67	V	4.43	28.41	43.51	3.000	43.511	**-53.866**	23.87
487.13	1461.40	12.31	V	4.43	28.41	45.15	3.000	45.151	**-52.226**	22.23
487.13	1948.50	14.63	V	5.11	32.25	51.99	3.000	51.988	**-45.389**	15.39
487.13	1948.50	16.08	H	5.11	32.25	53.44	3.000	53.438	**-43.939**	13.94
487.13	2435.70	11.88	H	5.62	32.43	49.93	3.000	49.930	**-47.447**	17.45
487.13	2435.70	12.91	V	5.62	32.43	50.96	3.000	50.960	**-46.417**	16.42
487.13	2922.80	17.48	V	6.25	32.79	56.52	3.000	56.516	**-40.861**	10.86
487.13	2922.80	17.98	H	6.25	32.79	57.02	3.000	57.016	**-40.361**	10.36
487.13	3409.90	16.84	V	6.78	32.92	56.54	3.000	56.540	**-40.837**	10.84
487.13	3409.90	17.82	H	6.78	32.92	57.52	3.000	57.520	**-39.857**	9.86
487.13	3897.00	13.19	H	6.82	33.48	53.49	3.000	53.493	**-43.884**	13.88
487.13	3897.00	13.48	V	6.82	33.48	53.78	3.000	53.783	**-43.594**	13.59
487.13	4384.20	10.69	V	7.31	33.72	51.72	3.000	51.721	**-45.656**	15.66
487.13	4384.20	11.29	H	7.31	33.72	52.32	3.000	52.321	**-45.056**	15.06
487.13	4871.30	15.89	H	7.27	33.98	57.14	3.000	57.140	**-40.238**	10.24
487.13	4871.30	14.80	V	7.27	33.98	56.05	3.000	56.050	**-41.328**	11.33

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 494.38 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBµV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Margin (dB)
494.38	1483.10	6.21	V	4.46	28.10	38.77	3.000	38.774	**-58.603**	28.60
494.38	1483.10	9.46	H	4.46	28.10	42.02	3.000	42.024	**-55.353**	25.35
494.38	1977.50	10.69	H	5.14	31.95	47.78	3.000	47.783	**-49.594**	19.59
494.38	1977.50	5.92	V	5.14	31.95	43.01	3.000	43.013	**-54.364**	24.36
494.38	2471.90	4.69	V	5.62	32.72	43.03	3.000	43.030	**-54.347**	24.35
494.38	2471.90	4.41	H	5.62	32.72	42.75	3.000	42.750	**-54.627**	24.63
494.38	2966.30	12.59	H	6.29	32.97	51.85	3.000	51.848	**-45.530**	15.53
494.38	2966.30	9.61	V	6.29	32.97	48.87	3.000	48.868	**-48.510**	18.51
494.38	3460.70	7.87	V	6.85	32.99	47.71	3.000	47.713	**-49.664**	19.66
494.38	3460.70	5.42	H	6.85	32.99	45.26	3.000	45.263	**-52.114**	22.11
494.38	3955.00	8.41	H	7.07	33.41	48.89	3.000	48.889	**-48.488**	18.49
494.38	3955.00	4.11	V	7.07	33.41	44.59	3.000	44.589	**-52.788**	22.79
494.38	4449.40	5.04	V	7.32	33.90	46.26	3.000	46.256	**-51.121**	21.12
494.38	4449.40	5.67	H	7.32	33.90	46.89	3.000	46.886	**-50.491**	20.49
494.38	4943.80	3.73	H	7.45	33.98	45.16	3.000	45.161	**-52.217**	22.22
494.38	4943.80	4.19	V	7.45	33.98	45.62	3.000	45.621	**-51.757**	21.76

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 506.5 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBµV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Margin (dB)
506.50	1013.00	1.61	V	3.72	27.51	32.84	3.000	32.838	**-64.540**	34.54
506.50	1013.00	0.02	H	3.72	27.51	31.25	3.000	31.248	**-66.130**	36.13
506.50	1519.50	8.50	H	4.52	27.95	40.97	3.000	40.973	**-56.404**	26.40
506.50	1519.50	6.05	V	4.52	27.95	38.52	3.000	38.523	**-58.854**	28.85
506.50	2026.00	5.90	V	5.21	31.66	42.77	3.000	42.767	**-54.610**	24.61
506.50	2026.00	10.29	H	5.21	31.66	47.16	3.000	47.157	**-50.220**	20.22
506.50	2532.50	5.41	H	5.68	32.66	43.75	3.000	43.747	**-53.630**	23.63
506.50	2532.50	7.19	V	5.68	32.66	45.53	3.000	45.527	**-51.850**	21.85
506.50	3039.00	12.21	V	6.36	33.35	51.92	3.000	51.924	**-45.454**	15.45
506.50	3039.00	8.60	H	6.36	33.35	48.31	3.000	48.314	**-49.064**	19.06
506.50	3545.50	6.17	H	6.80	33.35	46.32	3.000	46.321	**-51.056**	21.06
506.50	3545.50	7.95	V	6.80	33.35	48.10	3.000	48.101	**-49.276**	19.28
506.50	4052.00	4.13	V	7.18	33.44	44.75	3.000	44.751	**-52.626**	22.63
506.50	4052.00	-0.23	H	7.18	33.44	40.39	3.000	40.391	**-56.986**	26.99
506.50	4558.50	8.20	H	7.43	33.97	49.60	3.000	49.602	**-47.775**	17.77
506.50	4558.50	6.99	V	7.43	33.97	48.39	3.000	48.392	**-48.985**	18.98
506.50	5065.00	4.97	V	7.68	34.10	46.75	3.000	46.748	**-50.629**	20.63
506.50	5065.00	11.34	H	7.68	34.10	53.12	3.000	53.118	**-44.259**	14.26

FREQUENCY STABILITY

Rule Part No.: 2.1053, 74.861(e) (4), RSS-210

Requirement: The frequency tolerance of the transmitter shall be 0.005 percent.

Procedure: KDB 971168 D01 Spurious Emissions at antenna term section 9
TIA 603-D Carrier Frequency Stability 2.2.2

Test Data: Measurement Table

FCC Part 90 Limit	50.0	ppm
FCC Part 90 Limit, as ppb	50000	ppb (Parts per Billion)
FCC Part 90 Limit, as %	0.00500	%
Strictest Combined Limit, as Hz	25325.000	Hz
Combined Lower Limit	506.474675	MHz
Combined Upper Limit	506.525325	MHz
Rated Supply Voltage	3.0	○ AC ◉ DC

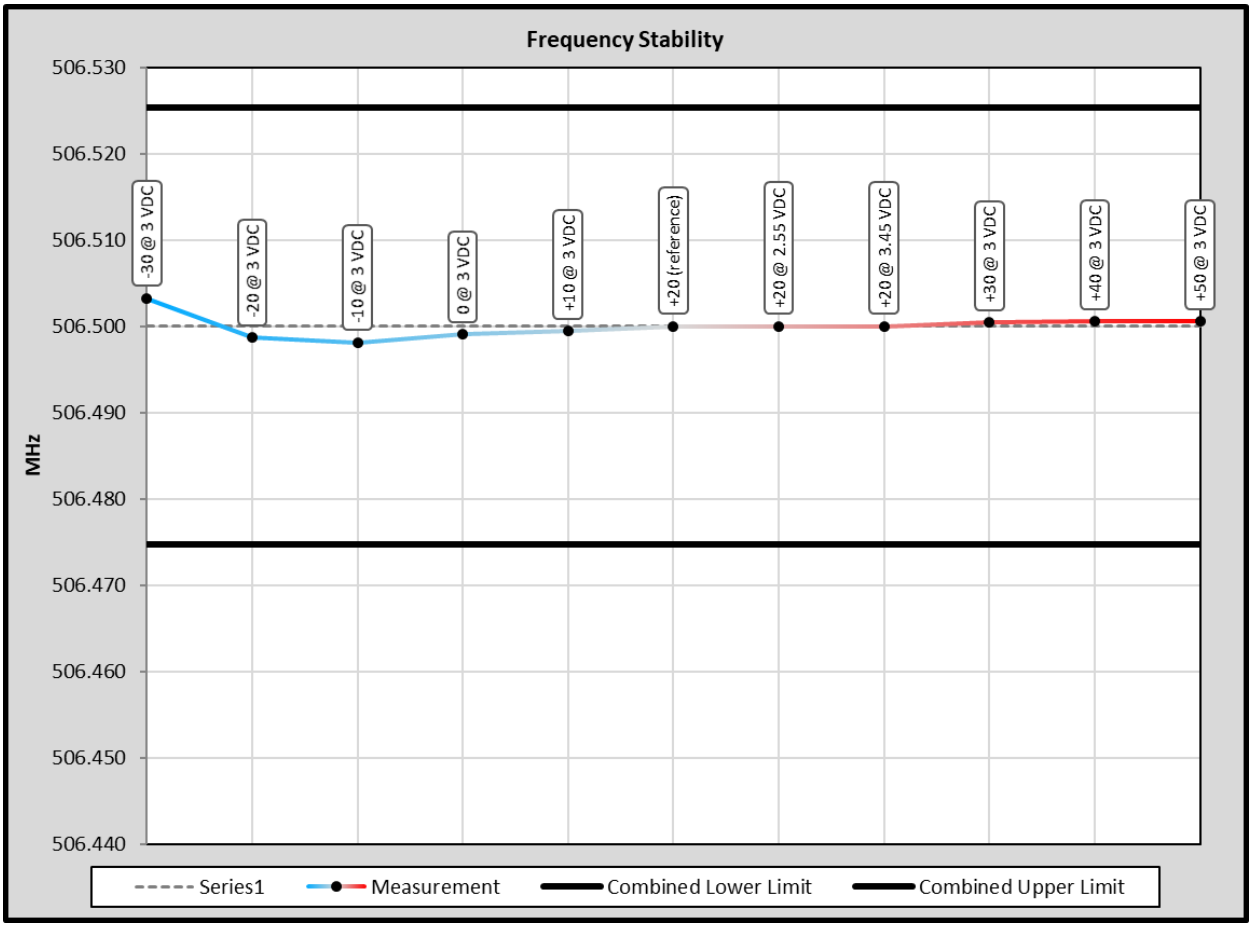
Temperature / Voltage Variation

Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (kHz)
-30	3.0	506.503220	-3.220
-20	3.0	506.498680	1.320
-10	3.0	506.498100	1.900
0	3.0	506.499060	0.940
+10	3.0	506.499460	0.540
+20 (reference)	3.0	506.500000	0.000
+20	2.6	506.500000	0.000
+20	3.5	506.500000	0.000
+30	3.0	506.500410	-0.410
+40	3.0	506.500554	-0.554
+50	3.0	506.500538	-0.538

Results Meet Requirements

FREQUENCY STABILITY

Test Data: Measurement Graph



Results Meet Requirements

STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Audio Frequency Response	±1.86dB	
Modulation limiting	±1.88%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. Within 6kHz and 25kHz of audio Freq.	 ±1.88% ±2.04%	
Rad Emissions Sub Meth up to 26.5GHz	±2.14dB	
Adjacent channel power	±1.47dB	(1)
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

Notes: (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

EMC EQUIPMENT LIST

Device	Manufacturer	Model	SN	Calibration Date	Cal Due Date
EMI Test Receiver R & S ESIB 40 firmware v 4.34.3 BIOS v3.3	Rohde & Schwarz	ESIB 40	100274	07/22/19	07/22/21
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 KMKM-0670-01 KFKF-0197-00	02/27/19	02/27/21
CHAMBER	Panashield	3M	N/A	03/15/19	03/15/21
Antenna: Active Loop	ETS-Lindgren	6502	00062529	12/11/17	12/11/20
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/20
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/20
Ant: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	01/30/17	01/30/20
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	N/A	N/A
Type K J Thermometer	Martel	303	080504494	11/06/17	11/06/20

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT