



FCC 47 CFR Part 90 & 22 Test Report for FCC ID P3THRHU1444S-B, referencing FCC ID P3THRHU1444S

APPLICANT	FIPLEX COMMUNICATIONS INC.
ADDRESS	2101 NW 79th Ave. MIAMI FL 33122 USA
FCC ID	P3THRHU1444S-B
MODEL NUMBER	HRHU1444S-B
PRODUCT DESCRIPTION	MULTI-BAND REMOTE INDUSTRIAL BOOSTER
DATE SAMPLE RECEIVED	05/06/2019
FINAL TEST DATE	08/15/2019
TESTED BY	Tim Royer
APPROVED BY	Franklin Rose
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Report Version	Description	Issue Date
2101UT19TestReport_	Rev1	Initial Issue	08/21/2019

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

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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 Engineer
Date	08/21/2019

Reviewed and Approved by:



Name and Title	Franklin Rose, Project Manager / EMC Specialist
Date	08/21/2019

GENERAL INFORMATION

EUT Definition: FCC 90.219(a)

Signal booster. A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications. Signal booster systems may contain both Class A and Class B signal boosters as components.

EUT Technical Specifications:

EUT Description	MULTI-BAND REMOTE INDUSTRIAL BOOSTER		
EUT Details	Remote Unit Bi-Directional Multi Band (VHF, UHF L, UHF M, UHF H, 800 MHz) Class B DAS Signal Booster for Public Safety Operations		
FCC ID	P3THRHU1444S-B		
Model Number	HRHU1444S-B		
Operating Frequency	VHF Band 1: 150.8 – 156.2475 MHz VHF Band 2: 157.1875 – 161.575 MHz UHF Low Band, Part 90, Band 1: 453 – 454 MHz UHF Low Band, Part 22, Band 2: 454 - 455 MHz UHF Low Band, Part 90, Band 3: 456 – 461 MHz UHF Mid Band: 482.5 – 484.2 MHz UHF High Band: 506.4 – 507.3 MHz 800 MHz Band: 851 – 869 MHz		
EUT Power Source	☒ 110–120Vac, 50– 60Hz	☐ DC Power	☐ Battery Operated
Test Item	☐ Engineering Prototype	☐ Pre-Production	☒ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	2 external N Type		
Test Conditions	The temperature was 26°C Relative humidity of 50%.		
Modification to the EUT	No Modification to EUT.		
Test Exercise	The EUT was operated in accordance with the service manual using software supplied by the manufacturer.		
Applicable Standards	TIA 603-E:2016, ANSI C63.26, FCC CFR 47 Part 2, Part 90, KDB 935210 D05 v01r02, section 4, KDB 484596 D01 v01		
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070		

The present document shall be constructed per the guidelines found in KDB 484596 D01 “Referencing Test Data” v01

EMISSION DESIGNATION

Rule Part No.: FCC Part 2.202(g)

Note: All signals used here are representative of the type of signals which will be passed through this EUT, as outlined in KDB 935210 s.4.1.

Analog Signals

Emission Designator	Description	Modulation Type	M (modulation Freq., kHz)	R (rate, baud)	D (deviation, kHz)	K (numeric constant)	S (symbols)	Bandwidth Calculation	Necessary Bandwidth
4K00F3E	Narrowband Analog FM Voice	FM	1.0	-	1.0	1.0	-	$B_n = 2M + 2DK$	4.00
11K2F3E	Narrowband Analog FM Voice	FM	3.0	-	2.5	1.0	-		11.00

Digital Signals

Emission Designator	Description	Modulation Type	M (modulation Freq., kHz)	R (rate, baud)	D (deviation, kHz)	K (numeric constant)	S (symbols)	Bandwidth Calculation	B _n (necessary bandwidth, kHz)
4K00F1E	Narrow NXDN Voice	4FSK	-	4800	1.55	0.516	4	$B_n = (R/\log_2 S) + 2DK$	4.00
4K00F1D	Narrow NXDN Data	4FSK	-	4800	1.55	0.516	4		4.00
4K00F1W	Narrow NXDN Voice/Data	4FSK	-	4800	1.55	0.516	4		4.00
8K30F1E	Wide NXDN Voice	4FSK	-	4800	3	0.984	4		8.30
8K30F1D	Wide NXDN Data	4FSK	-	4800	3	0.984	4		8.30
8K30F1W	Wide NXDN Voice & Data	4FSK	-	4800	3	0.984	4		8.30
4K00F2D	Narrow NXDN CW ID	4FSK	0.8	4800	1.2	1.0	4	$B_n = 2M + 2DK$	4.00
8K30F2D	Wide NXDN CW ID	4FSK	1.15	4800	3	1	4		8.30
7K60FXE	DMR Voice	4FSK	-	9600	1.8	0.778	4	$B_n = (R/\log_2 S) + 2DK$	7.60
7K60FXD	DMR Data	4FSK	-	9600	1.8	0.778	4		7.60
8K10F1E	P25 Phase I C4FM Voice	4FSK	-	9600	1.8	0.916	4	$B_n = (R/\log_2 S) + 2DK$	8.10
8K10F1D	P25 Phase I C4FM Data	4FSK	-	9600	1.8	0.916	4		8.10
8K10F1W	P25 Phase II H-CPM Voice/Data	4FSK	-	9600	1.8	0.916	4		8.10
9K80F1E	P25 Phase II H-DQPSK Voice	QPSK	-	12000	-	0.817	4	$B_n = 2RK/\log_2 S$	9.80
9K80F1D	P25 Phase II H-DQPSK Data	QPSK	-	12000	-	0.817	4		9.80

TEST FREQUENCIES

Rule Part No.: KDB 935210 s.4

All tests specified in KDB 935210 D05, Section 4 are intended for each band/block of operation. The bands/blocks of operation of this EUT are as follows:

EUT Operational Band(s): KDB 935210 D02, Appendix D, Table D.3

Table D.3 – Various Part 90 PLMRS band allocations, rule parts/sections, and service types for Section 90.219 purposes (for info only – see rules for details, also KDB Publication 634817 [R14])

Fl. (MHz)	–	Fl. (MHz)	Rule(s)	Misc. Notes
150.8	–	162.0125	90	
450	–	470	90 (selected bands)	
470	–	512	90	
851	–	854	90 NPSPAC (PS) [90.617(a)(1)]	B9B/B9A
854	–	860	90 Interleaved PS; B/ILT; SMR [90.614(a); 90.613 ch. nos. 1-470] ^a	B9B/B9A
860	–	861	90 Expansion B/ILT; SMR [90.614(a); 90.613 ch. nos. 470-550] ^a	B9B/B9A
861	–	862	90 Guardband	B9B/B9A
862	–	869	CMRS 90 ESMR [90.614(b); 90.613 ch. nos. 551-830]	B2190-S

Frequencies for Testing: FCC Pt. 22.561

Band	EUT Frequencies	Test Frequencies
VHF Band, Downlink		
VHF Band 1	150.8 – 156.2475 MHz	151.0 MHz 156.240625 MHz
VHF Band 2	157.1875 – 161.575 MHz	161.56875 MHz
UHF Low Band, Downlink		
UHF Low Band 1 (90)	453 - 454 MHz	453 MHz
UHF Low Band 2 (22)	454 - 455 MHz	454.5 MHz
UHF Low Band 3 (90)	456 - 461 MHz	456.00625 MHz 461 MHz
UHF Mid Band, Downlink		
UHF Mid Band 1	482.5 – 484.2 MHz	483 MHz
UHF High Band, Downlink		
UHF High Band 1	506.4 – 507.3 MHz	507 MHz
800 Band, Downlink		
800 MHz Band	851 – 869 MHz	851.00625 MHz 860 MHz 868.99375 MHz

Note: Testing frequencies were rounded to the nearest channel center frequency allowed by the EUT.

Introduction (KDB 484596 Section 3 a)

In order to re-use data from the testing of previously certified equipment known as FCC ID P3THRHU1444S, this document attests that the present filing for FCC ID P3THRHU1444S-B is electrically identical to, and is equipped with identical software/firmware as the previous FCC ID P3THRHU1444S by the same manufacturer.

The need to re-file identical equipment under a new FCC ID is due to the need to file using a different FCC Equipment Class for Industrial Booster devices with a passband that exceeds 75 kHz.

Explain the Differences (KDB 484596 Section 3 b)

Previous filing FCC ID P3THRHU1444S was tested using a software filter setting that limited channel width to 60 kHz, however the present filing for FCC ID P3THRHU1444S-B has been re-tested using a software filter setting limiting channel width to 180 kHz, above the 75 kHz passband width limit for Class A devices.

This necessitates a change in FCC 47 CFR Part 90 Equipment Class from B9A to B9B, which necessitates a new FCC ID and new Grant of Certification, though no change (electrical, software, or otherwise) has been made to the equipment in question.

In regard to the FCC 47 CFR Part 22 frequency range to be granted under the equipment class B2I, the previous FCC ID P3THRHU1444S test data will be used for the current FCC ID P3THRHU1444S-B as well.

No change (electrical, software, or otherwise) has been made to the equipment in question.

Spot Check Verification Data (KDB 484596 Section 3 c)

A table has been provided for the comparison of test results between FCC ID P3THRHU1444S and FCC ID P3THRHU1444S-B:

Applied Rule Part(s)	Test	FCC ID P3THRHU1444S Result	FCC ID P3THRHU1444S-B Result
KDB 935210 s.4, FCC Pt. 90.531(a)	Test Frequencies	For Reporting Only	Identical
KDB 935210 s.4.1	Input Signals	For Reporting Only	Identical
KDB 935210 s.4.2	AGC Threshold	For Reporting Only	Identical
KDB 935210 s.4.3, FCC Pt. 90.219(a), FCC Pt. 90.219(d)(7)	Out-of-Band Rejection	CLASS A DEVICE	Spot-Checked, CLASS B DEVICE
KDB 935210 s.4.4, FCC Pt. 2.1049(c), FCC Pt. 90.219(e)(4)(ii), FCC Pt. 90.210(c)	Input vs. Output Signal Comparison	PASS	Identical
KDB 935210 s.4.5, FCC Pt. 90.219(e)(1), FCC Pt. 90.219(e)(4)(iii)	RF Power Output (and Gain)	PASS	Identical
FCC Pt. 2.1033(c)(8)	Power Input to the Final Power Amplifier	For Reporting Only	Identical
KDB 935210 s.4.6, FCC Pt. 90.219(e)(2)	Noise Figure	PASS	Identical
KDB 935210 s.4.7.2, FCC Part 2.1051(a), FCC Pt. 90.219(d)(6)(i), FCC Pt. 90.219(e)(3)	Intermodulation Spurious Emissions	PASS	Identical
KDB 935210 s.4.7.3, FCC Part 2.1051(a), FCC Pt. 90.219(e)(3)	Spurious Emissions at Antenna Terminals	PASS	Identical
KDB 935210 s.4.8, FCC Part 2.1055(a)(1), FCC Part 2.1055(b), FCC Pt. 90.219(e)(4)(i)	Frequency Stability	n/a	n/a
KDB 935210 s.4.9, FCC Part 2.1053(a), FCC Pt. 90.219(e)(3)	Field Strength of Spurious Emissions	PASS	Spot-Checked, PASS

OUT OF BAND REJECTION FCC ID P3THRHU1444S-B

Rule Part No.: KDB 935210 s.4.3, FCC Pt. 90.219(a), FCC Pt. 90.219(d)(7)

(a) *Definitions.* The definitions in this paragraph apply only to the rules in this section.

Class A signal booster. A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.

Class B signal booster. A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.

Requirements:

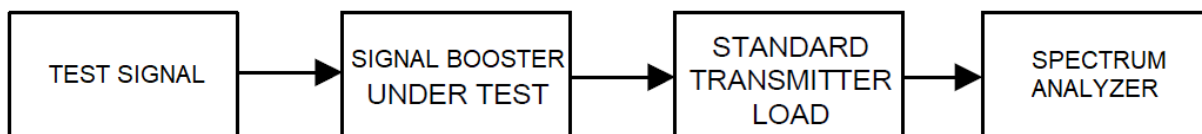
(7) Signal booster passbands are limited to the service band or bands for which the operator is authorized. In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B booster should not encompass both commercial services (such as ESMR and Cellular Radiotelephone) and part 90 Land Mobile and Public Safety Services.

Test Procedure: KDB 935210 s.4.3

Adjust the internal gain control of the EUT to the maximum gain for which equipment certification is sought.

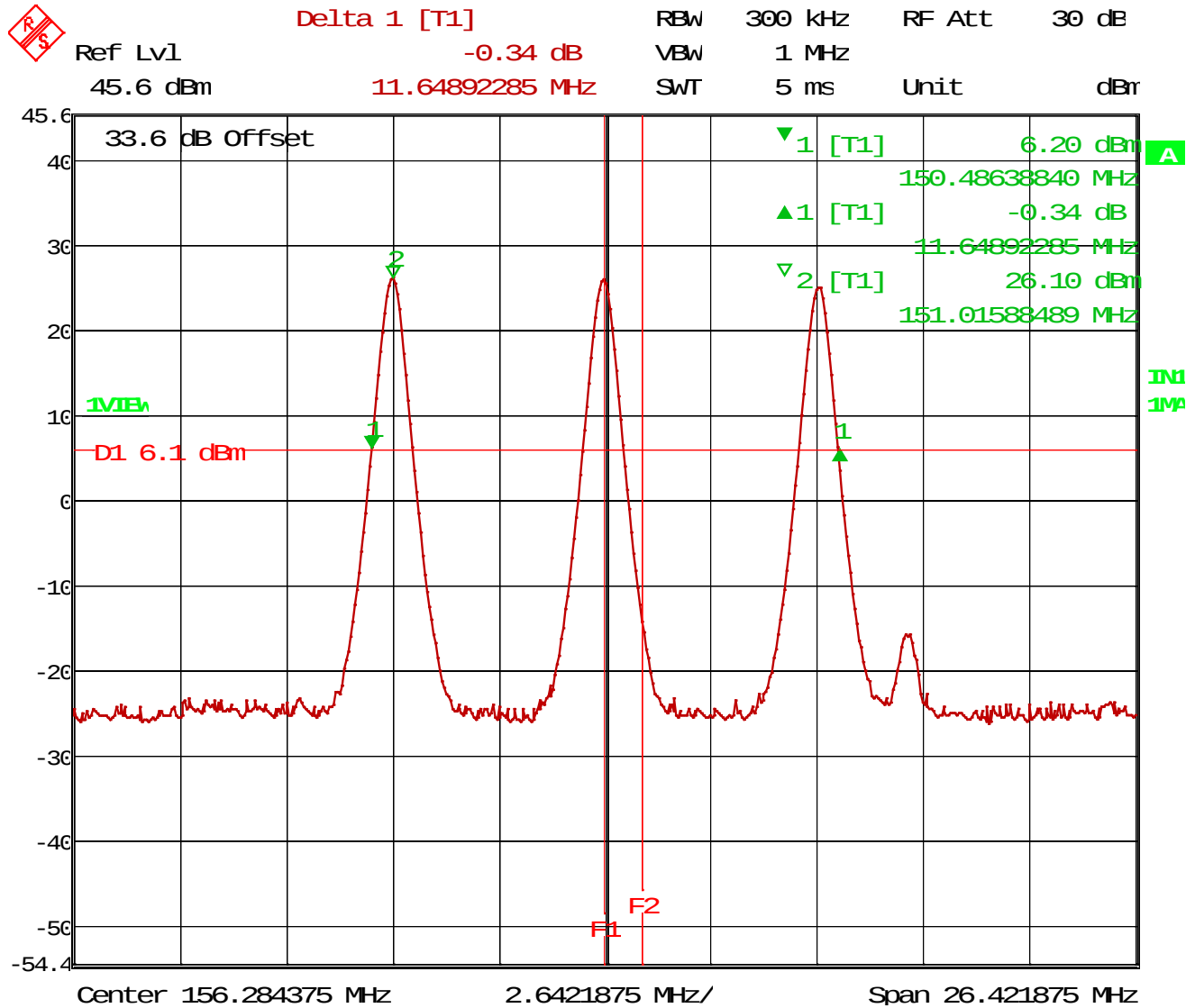
- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
 - 1) Frequency range = $\pm 250\%$ of the manufacturer's specified pass band.
 - 2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.
 - 3) Dwell time = approximately 10 ms.
 - 4) Frequency step = 50 kHz.
- c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer's rated passband, and VBW = $3 \times$ RBW.
- e) Set the detector to Peak and the trace to Max-Hold.
- f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f_0 , and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).
- g) Capture the frequency response plot for inclusion in the test report.

Test Setup Block Diagram: KDB 935210 s.4.3



OUT OF BAND REJECTION FCC ID P3THRHU1444S-B

Test Data: VHF Band Downlink Passband



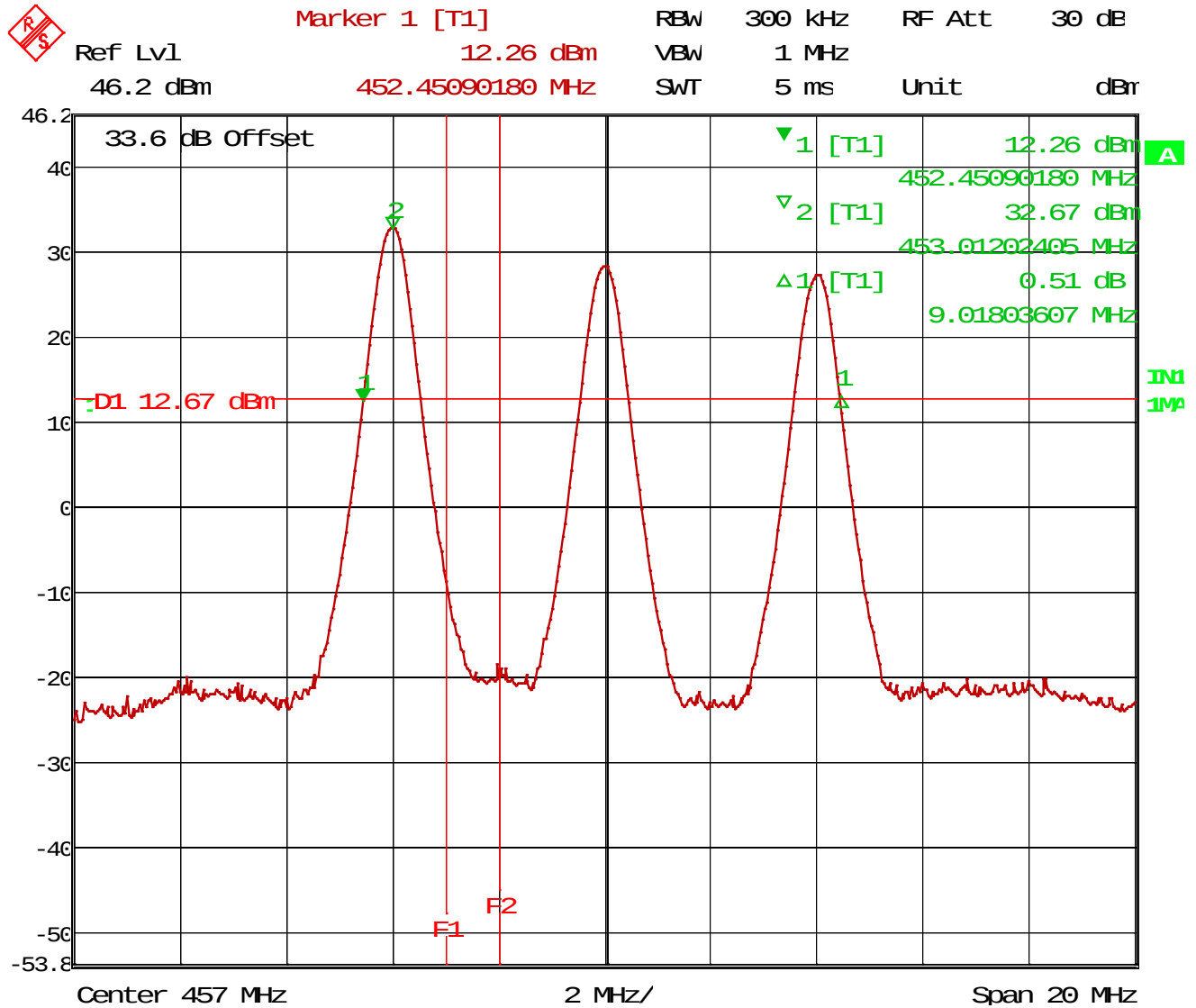
RESULT:

CLASS B DEVICE, Channelized Equipment with ≥ 75 kHz Passband

VHF PASSBAND = 11.65 MHz

OUT OF BAND REJECTION FCC ID P3THRHU1444S-B

Test Data: UHF Low, Part 90 Downlink Passband



Date: 1.JAN.1997 03:01:44

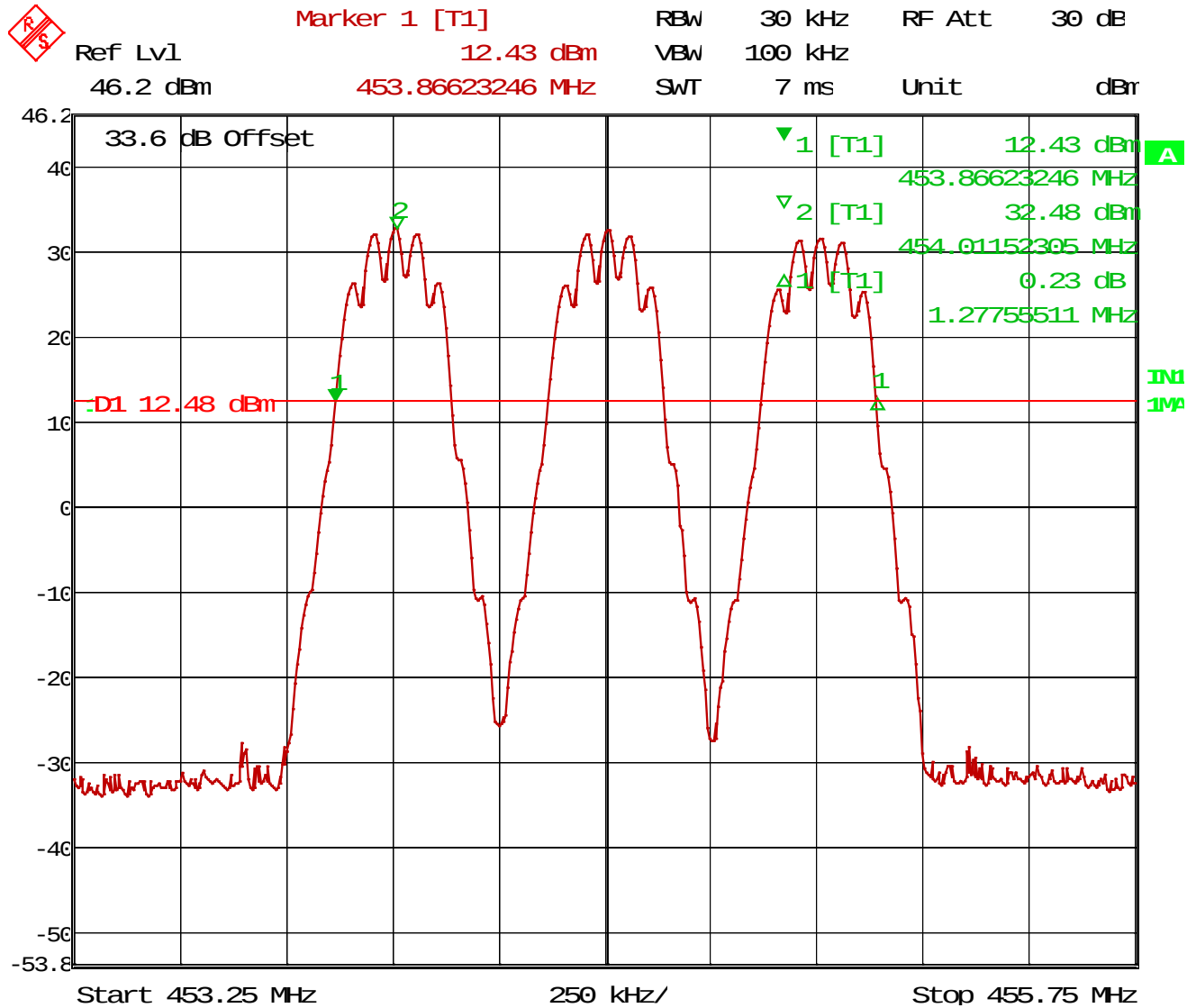
RESULT:

CLASS B DEVICE, Channelized Equipment with ≥ 75 kHz Passband

UHF LOW PASSBAND = 9.02 MHz

OUT OF BAND REJECTION FCC ID P3THRHU1444S-B

Test Data: UHF Low, Part 22 Downlink Passband



Date: 1.JAN.1997 02:54:45

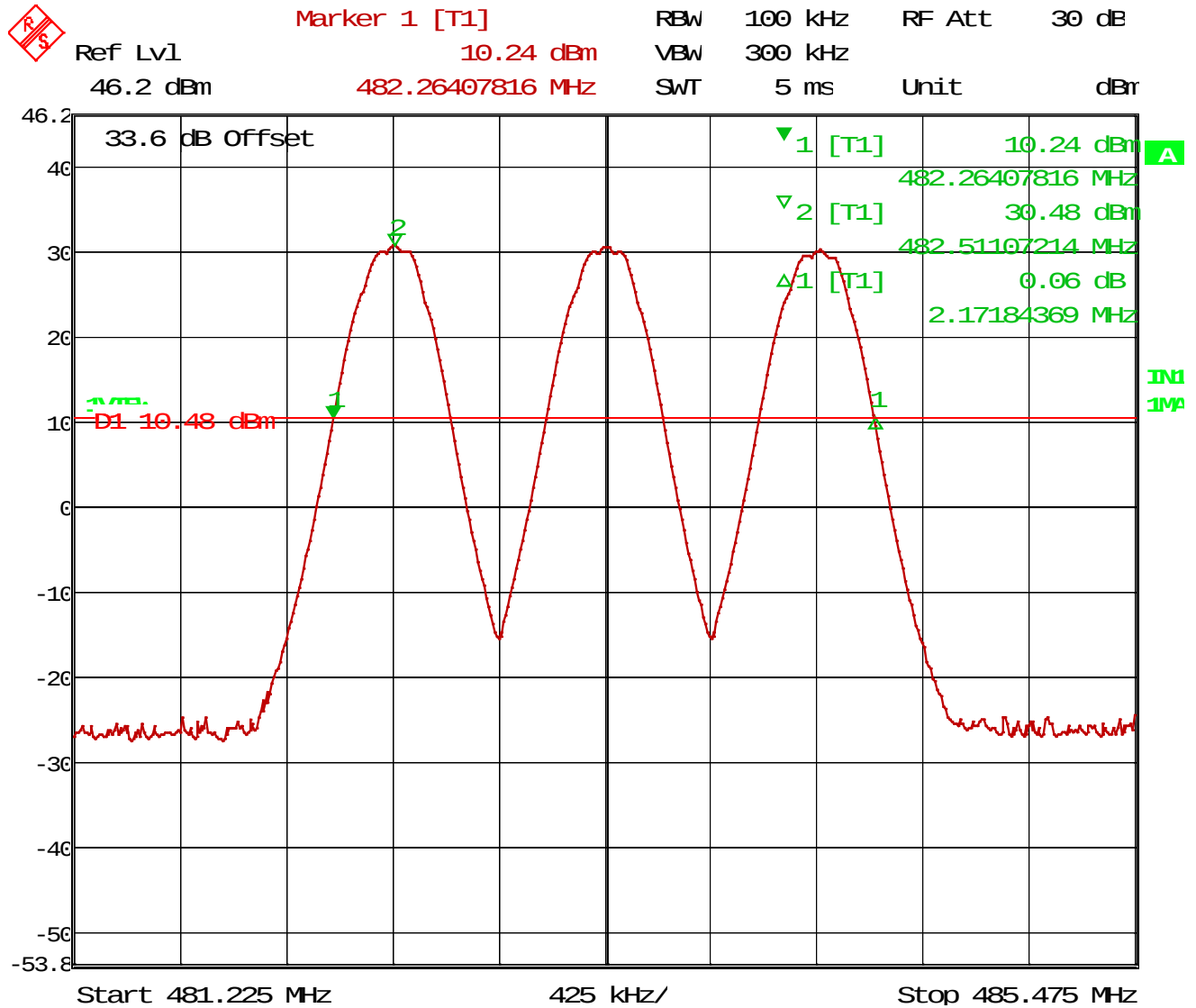
RESULT:

CLASS B DEVICE, Channelized Equipment with ≥ 75 kHz Passband

UHF LOW Part 22 PASSBAND = 1.28 MHz

OUT OF BAND REJECTION FCC ID P3THRHU1444S-B

Test Data: UHF Mid Downlink Passband



Date: 1.JAN.1997 02:36:15

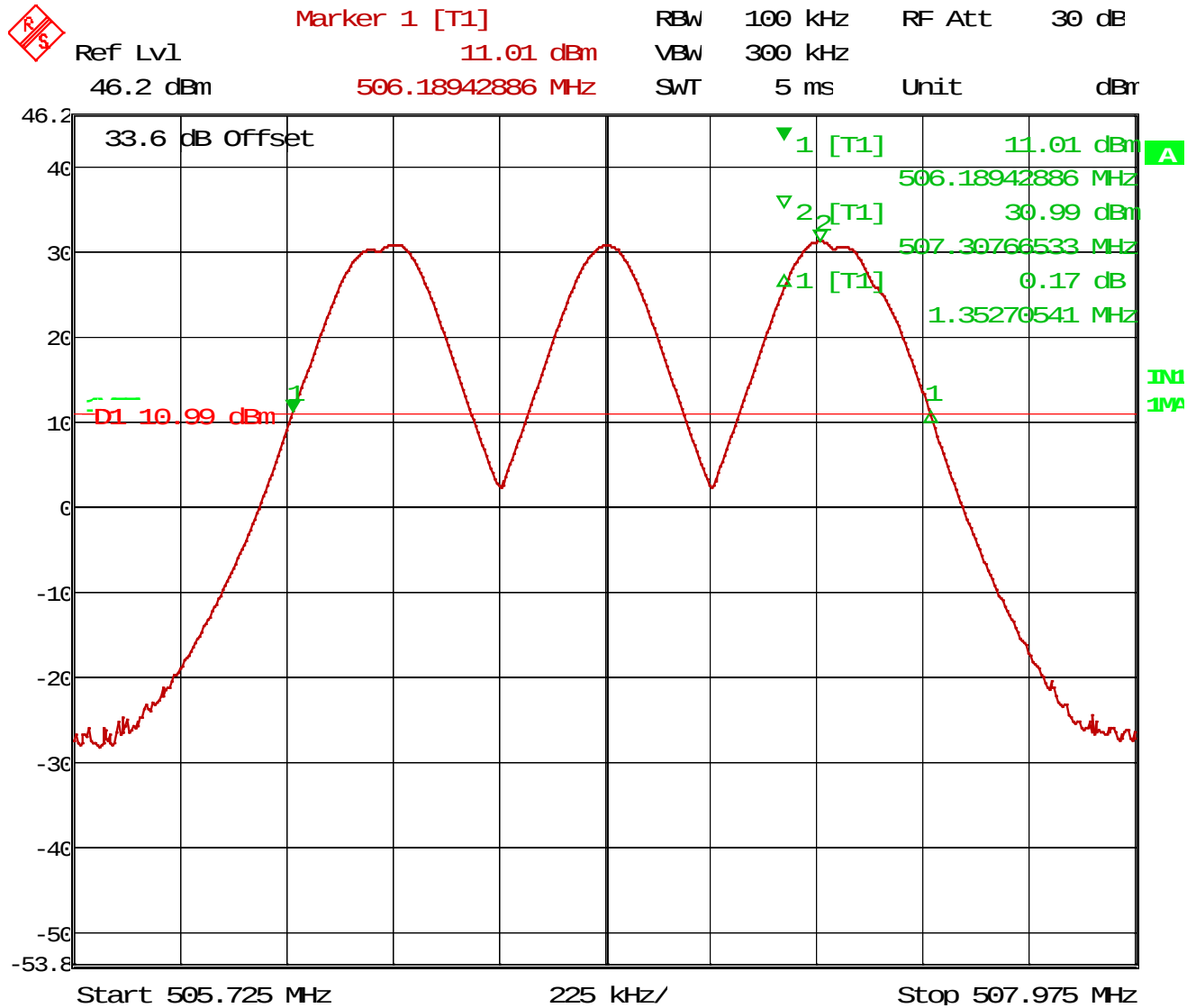
RESULT:

CLASS B DEVICE, Channelized Equipment with ≥ 75 kHz Passband

UHF MID PASSBAND = 2.17 MHz

OUT OF BAND REJECTION FCC ID P3THRHU1444S-B

Test Data: UHF High Downlink Passband



Date: 1.JAN.1997 02:44:14

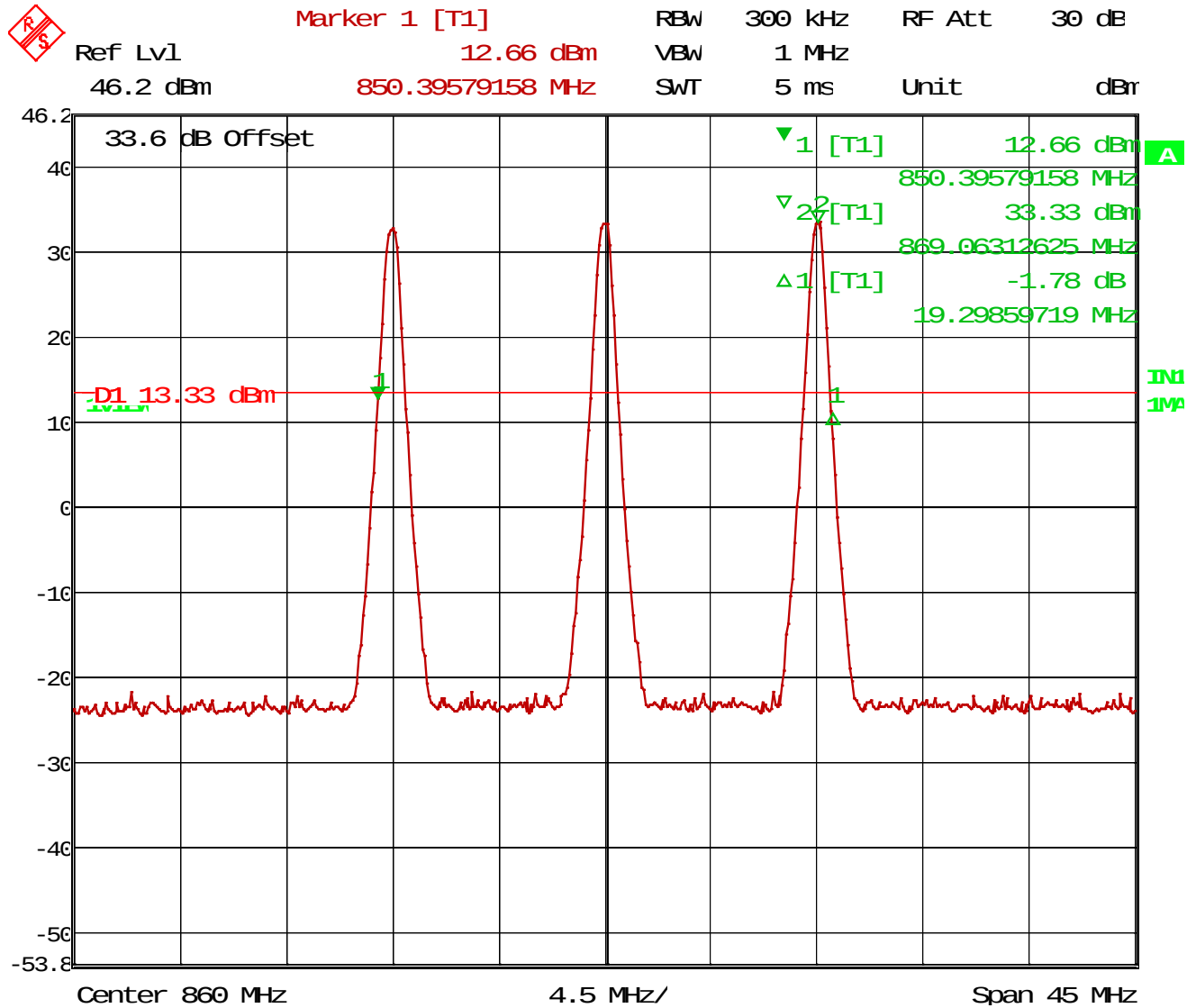
RESULT:

CLASS B DEVICE, Channelized Equipment with ≥ 75 kHz Passband

UHF HIGH PASSBAND = 1.35 MHz

OUT OF BAND REJECTION FCC ID P3THRHU1444S-B

Test Data: 800 Band Downlink Passband



Date: 1.JAN.1997 01:42:39

RESULT:

CLASS B DEVICE, Channelized Equipment with ≥ 75 kHz Passband

800 MHz PASSBAND = 19.30 MHz

FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Part No.: KDB 935210 s.4.9, FCC Part 2.1053(a), FCC Pt. 90.219(e)(3)

Refer to the applicable rule part(s) for specified limits on unwanted (out-of-band/out-of-block and spurious) emissions (e.g., Section 90.210).

Requirements:

(e) *Device Specifications.* In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(3) Spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

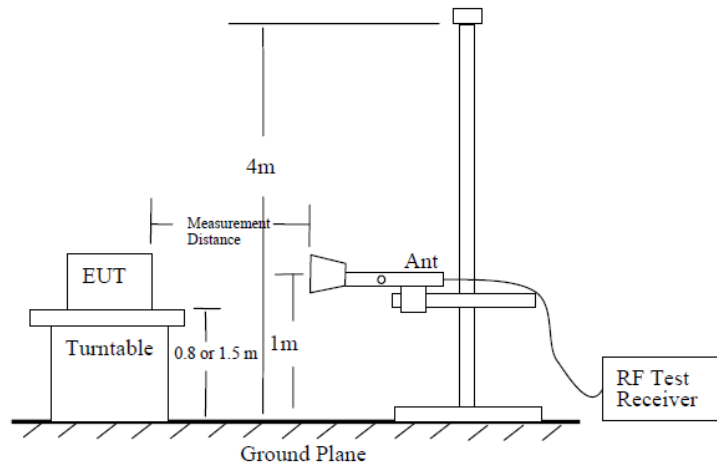
Test Procedure: KDB 935210 s.4.7.3, TIA 603-E

Spurious emissions shall be measured using a single test signal sequentially tuned to the low, middle, and high channels or frequencies within each authorized frequency band of operation.

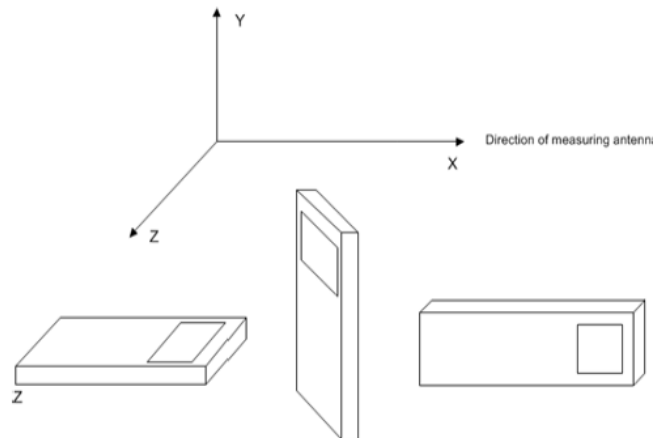
- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to produce a CW signal.
- c) Set the frequency of the CW signal to the center channel of the EUT passband.
- d) Set the output power level so that the resultant signal is just below the AGC threshold (see 4.2).
- e) Connect a spectrum analyzer to the output of the EUT, using appropriate attenuation as necessary.
- f) Set the RBW = 100 kHz. (i.e., for 30 MHz to 1 GHz PLMRS and/or PSRS booster devices)
- g) Set the VBW = $3 \times$ RBW.
- h) Set the Sweep time = auto-couple.
- i) Set the detector to PEAK.
- j) Set the spectrum analyzer start frequency to 30 MHz (or the lowest radio frequency signal generated in the EUT, without going below 9 kHz if the EUT has additional internal clock frequencies), and the stop frequency to 10 times the highest allowable frequency of the EUT passband.
- k) Select MAX HOLD, and use the marker peak function to find the highest emission(s) outside the passband. (This could be either at a frequency lesser or greater than the passband frequencies.)
- l) Capture a plot for inclusion in the test report.
- m) Repeat steps c) to l) for each authorized frequency band/block of operation.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Site Setup:



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

FIELD STRENGTH OF SPURIOUS EMISSIONS

VHF Band Radiated Spurious Emissions FCC ID P3THRHU1444S

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
151	906.00	27.00	H	3.55	22.28	3.00	52.83	-44.55	-25.00	19.55
151	906.00	21.93	V	3.55	22.28	3.00	47.76	-49.62	-25.00	24.62
151	1057.00	18.18	V	3.78	26.81	3.00	48.77	-48.61	-25.00	23.61
151	1208.00	16.96	H	3.96	28.11	3.00	49.03	-48.35	-25.00	23.35
151	1208.00	15.92	V	3.96	28.11	3.00	47.99	-49.39	-25.00	24.39
151	1359.00	15.53	H	4.26	28.70	3.00	48.49	-48.89	-25.00	23.89
156.240625	468.70	28.27	H	2.52	16.62	3.00	47.41	-49.96	-25.00	24.96
156.240625	937.40	27.85	V	3.59	22.60	3.00	54.04	-43.34	-25.00	18.34
156.240625	937.40	21.16	H	3.59	22.60	3.00	47.35	-50.03	-25.00	25.03
156.240625	1093.70	18.06	H	3.83	27.12	3.00	49.01	-48.37	-25.00	23.37
156.240625	1249.90	15.94	V	4.00	28.42	3.00	48.36	-49.02	-25.00	24.02
156.240625	1406.20	15.10	V	4.35	28.42	3.00	47.87	-49.51	-25.00	24.51
161.56875	484.70	28.65	H	2.60	16.81	3.00	48.06	-49.31	-25.00	24.31
161.56875	646.30	23.97	V	2.96	19.82	3.00	46.75	-50.63	-25.00	25.63
161.56875	1131.00	17.66	V	3.88	27.27	3.00	48.81	-48.57	-25.00	23.57
161.56875	1292.60	16.06	H	4.10	28.64	3.00	48.80	-48.57	-25.00	23.57
161.56875	1454.10	15.05	H	4.42	28.06	3.00	47.53	-49.85	-25.00	24.85
161.56875	1454.10	14.15	V	4.42	28.06	3.00	46.63	-50.75	-25.00	25.75

Result: Maximum Spurious Level @ 2nd Harmonic of 156.24 MHz, -43.34 dBm ERP

VHF Band Radiated Spurious Emissions FCC ID P3THRHU1444S-B

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
156.24	312.50	3.01	V	2.08	14.75	3.00	19.84	-77.53	-25.00	52.53
156.24	312.50	3.16	H	2.08	14.75	3.00	19.99	-77.38	-25.00	52.38
156.24	468.70	10.85	H	2.52	16.62	3.00	29.99	-67.38	-25.00	42.38
156.24	468.70	5.68	V	2.52	16.62	3.00	24.82	-72.55	-25.00	47.55
156.24	625.00	3.98	V	2.91	18.80	3.00	25.69	-71.69	-25.00	46.69
156.24	625.00	0.19	H	2.91	18.80	3.00	21.90	-75.48	-25.00	50.48
156.24	781.20	-2.95	H	3.30	21.90	3.00	22.25	-75.13	-25.00	50.13
156.24	781.20	-1.74	V	3.30	21.90	3.00	23.46	-73.92	-25.00	48.92
156.24	937.40	-0.13	V	3.59	22.60	3.00	26.06	-71.32	-25.00	46.32
156.24	937.40	-0.63	H	3.59	22.60	3.00	25.56	-71.82	-25.00	46.82
156.24	1093.70	12.37	H	3.83	27.12	3.00	43.32	-54.06	-25.00	29.06
156.24	1093.70	11.62	V	3.83	27.12	3.00	42.57	-54.81	-25.00	29.81
156.24	1249.90	9.93	H	4.00	28.42	3.00	42.35	-55.03	-25.00	30.03
156.24	1249.90	11.98	V	4.00	28.42	3.00	44.40	-52.98	-25.00	27.98
156.24	1406.20	10.09	V	4.35	28.42	3.00	42.86	-54.52	-25.00	29.52
156.24	1406.20	12.28	H	4.35	28.42	3.00	45.05	-52.33	-25.00	27.33
156.24	1562.40	10.45	H	4.59	27.84	3.00	42.88	-54.49	-25.00	29.49
156.24	1562.40	12.20	V	4.59	27.84	3.00	44.63	-52.74	-25.00	27.74

Result: Maximum Spurious Level @ 3rd Harmonic of 156.24 MHz, -52.98 dBm ERP

Note: More precautions were taken during the testing of FCC ID P3THRHU1444S-B to ensure the cabinet was electrically sealed. This contributed to the superior results during this test.

FIELD STRENGTH OF SPURIOUS EMISSIONS

UHF Low Band Radiated Spurious Emissions, Part 90, FCC ID P3THRHU1444S

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
453	906.00	27.47	V	3.55	22.28	3.00	53.30	-44.08	-25.00	19.08
453	1812.00	16.84	H	4.93	30.43	3.00	52.20	-45.18	-25.00	20.18
453	2718.00	14.83	V	6.03	32.46	3.00	53.32	-44.06	-25.00	19.06
453	2718.00	14.37	H	6.03	32.46	3.00	52.86	-44.52	-25.00	19.52
453	3171.00	13.08	H	6.53	32.73	3.00	52.34	-45.04	-25.00	20.04
453	3171.00	12.55	V	6.53	32.73	3.00	51.81	-45.57	-25.00	20.57
461	1844.00	17.04	H	4.98	30.81	3.00	52.83	-44.55	-25.00	19.55
461	2305.00	17.52	H	5.51	31.56	3.00	54.59	-42.79	-25.00	17.79
461	2305.00	17.41	V	5.51	31.56	3.00	54.48	-42.90	-25.00	17.90
461	2766.00	14.22	V	6.10	32.42	3.00	52.74	-44.63	-25.00	19.63
461	3227.00	14.13	V	6.62	32.68	3.00	53.43	-43.95	-25.00	18.95
461	3227.00	13.01	H	6.62	32.68	3.00	52.31	-45.07	-25.00	20.07

Result: Maximum Spurious Level @ 5th Harmonic of 461.0 MHz, -42.79 dBm ERP

UHF Low Band Radiated Spurious Emissions, Part 90, FCC ID P3THRHU1444S-B

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
461.00	922.00	1.43	H	3.55	22.28	3.00	27.26	-70.12	-25.00	45.12
461.00	922.00	-1.54	V	3.55	22.28	3.00	24.29	-73.09	-25.00	48.09
461.00	1383.00	12.30	H	4.26	28.70	3.00	45.26	-52.12	-25.00	27.12
461.00	1383.00	10.26	V	4.26	28.70	3.00	43.22	-54.16	-25.00	29.16
461.00	1844.00	10.70	V	4.93	30.43	3.00	46.06	-51.32	-25.00	26.32
461.00	1844.00	12.61	H	4.93	30.43	3.00	47.97	-49.41	-25.00	24.41
461.00	2305.00	11.03	H	5.44	31.32	3.00	47.79	-49.58	-25.00	24.58
461.00	2305.00	10.92	V	5.44	31.32	3.00	47.68	-49.69	-25.00	24.69
461.00	2766.00	11.70	V	6.03	32.46	3.00	50.19	-47.19	-25.00	22.19
461.00	2766.00	11.39	H	6.03	32.46	3.00	49.88	-47.50	-25.00	22.50
461.00	3227.00	11.82	H	6.53	32.73	3.00	51.08	-46.30	-25.00	21.30
461.00	3227.00	11.20	V	6.53	32.73	3.00	50.46	-46.92	-25.00	21.92
461.00	3688.00	9.89	V	6.61	33.15	3.00	49.65	-47.72	-25.00	22.72
461.00	3688.00	10.44	H	6.61	33.15	3.00	50.20	-47.17	-25.00	22.17
461.00	4149.00	10.54	H	7.14	33.39	3.00	51.07	-46.30	-25.00	21.30
461.00	4149.00	12.87	V	7.14	33.39	3.00	53.40	-43.97	-25.00	18.97
461.00	4610.00	9.88	V	7.38	33.95	3.00	51.21	-46.17	-25.00	21.17
461.00	4610.00	10.30	H	7.38	33.95	3.00	51.63	-45.75	-25.00	20.75

Result: Maximum Spurious Level @ 9th Harmonic of 461.0 MHz, -43.97 dBm ERP

FIELD STRENGTH OF SPURIOUS EMISSIONS

UHF Low Band Radiated Spurious Emissions, Part 22, FCC ID P3THRHU1444S

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
454.5	2272.50	15.52	V	5.46	31.36	3.00	52.34	-45.04	-25.00	20.04
454.5	2727.00	15.82	V	6.04	32.44	3.00	54.30	-43.07	-25.00	18.07
454.5	2727.00	13.95	H	6.04	32.44	3.00	52.43	-44.94	-25.00	19.94
454.5	3181.50	13.43	H	6.55	32.71	3.00	52.69	-44.69	-25.00	19.69
454.5	3181.50	13.33	V	6.55	32.71	3.00	52.59	-44.79	-25.00	19.79
454.5	4545.00	11.22	V	7.41	33.99	3.00	52.62	-44.76	-25.00	19.76

Result: Maximum Spurious Level @ 5th Harmonic of 454.5 MHz, -43.07 dBm ERP

UHF Low Band Radiated Spurious Emissions, Part 22, FCC ID P3THRHU1444S-B

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
454.50	909.00	0.41	V	3.55	22.52	3.00	26.48	-70.90	-25.00	45.90
454.50	909.00	-0.59	H	3.55	22.52	3.00	25.48	-71.90	-25.00	46.90
454.50	1363.50	12.98	H	4.27	28.68	3.00	45.93	-51.44	-25.00	26.44
454.50	1363.50	10.97	V	4.27	28.68	3.00	43.92	-53.45	-25.00	28.45
454.50	1818.00	10.16	V	4.94	30.50	3.00	45.60	-51.78	-25.00	26.78
454.50	1818.00	11.91	H	4.94	30.50	3.00	47.35	-50.03	-25.00	25.03
454.50	2272.50	12.22	H	5.46	31.36	3.00	49.04	-48.34	-25.00	23.34
454.50	2272.50	11.61	V	5.46	31.36	3.00	48.43	-48.95	-25.00	23.95
454.50	2727.00	11.62	V	6.04	32.44	3.00	50.10	-47.27	-25.00	22.27
454.50	2727.00	12.71	H	6.04	32.44	3.00	51.19	-46.18	-25.00	21.18
454.50	3181.50	10.96	H	6.55	32.71	3.00	50.22	-47.16	-25.00	22.16
454.50	3181.50	10.83	V	6.55	32.71	3.00	50.09	-47.29	-25.00	22.29
454.50	3636.00	10.90	V	6.60	33.17	3.00	50.67	-46.71	-25.00	21.71
454.50	3636.00	10.14	H	6.60	33.17	3.00	49.91	-47.47	-25.00	22.47
454.50	4090.50	9.15	H	7.12	33.40	3.00	49.67	-47.70	-25.00	22.70
454.50	4090.50	11.29	V	7.12	33.40	3.00	51.81	-45.56	-25.00	20.56
454.50	4545.00	11.86	V	7.41	33.99	3.00	53.26	-44.12	-25.00	19.12
454.50	4545.00	10.60	H	7.41	33.99	3.00	52.00	-45.38	-25.00	20.38

Result: Maximum Spurious Level @ 10th Harmonic of 454.5 MHz, -44.12 dBm ERP

FIELD STRENGTH OF SPURIOUS EMISSIONS

UHF Mid Band Radiated Spurious Emissions, FCC ID P3THRHU1444S

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
483	1932.00	17.73	H	5.09	31.19	3.00	54.01	-43.37	-25.00	18.37
483	2415.00	18.05	V	5.62	31.87	3.00	55.54	-41.84	-25.00	16.84
483	2898.00	15.15	V	6.22	32.21	3.00	53.58	-43.80	-25.00	18.80
483	2898.00	13.62	H	6.22	32.21	3.00	52.05	-45.33	-25.00	20.33
483	3381.00	12.74	V	6.74	32.65	3.00	52.13	-45.25	-25.00	20.25
483	3381.00	12.72	H	6.74	32.65	3.00	52.11	-45.27	-25.00	20.27

Result: Maximum Spurious Level @ 5th Harmonic of 483.0 MHz, -41.84 dBm ERP

UHF Mid Band Radiated Spurious Emissions, FCC ID P3THRHU1444S-B

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
483.00	966.00	0.86	H	3.65	22.96	3.00	27.47	-69.91	-25.00	44.91
483.00	966.00	-0.69	V	3.65	22.96	3.00	25.92	-71.46	-25.00	46.46
483.00	1449.00	12.82	H	4.41	28.09	3.00	45.32	-52.05	-25.00	27.05
483.00	1449.00	11.03	V	4.41	28.09	3.00	43.53	-53.84	-25.00	28.84
483.00	1932.00	13.87	V	5.09	31.19	3.00	50.15	-47.23	-25.00	22.23
483.00	1932.00	13.87	H	5.09	31.19	3.00	50.15	-47.23	-25.00	22.23
483.00	2415.00	12.80	H	5.62	31.87	3.00	50.29	-47.09	-25.00	22.09
483.00	2415.00	11.34	V	5.62	31.87	3.00	48.83	-48.55	-25.00	23.55
483.00	2898.00	11.34	V	6.22	32.21	3.00	49.77	-47.61	-25.00	22.61
483.00	2898.00	12.80	H	6.22	32.21	3.00	51.23	-46.15	-25.00	21.15
483.00	3381.00	11.87	H	6.74	32.65	3.00	51.26	-46.12	-25.00	21.12
483.00	3381.00	11.72	V	6.74	32.65	3.00	51.11	-46.27	-25.00	21.27
483.00	3864.00	10.03	V	6.93	33.21	3.00	50.17	-47.21	-25.00	22.21
483.00	3864.00	10.03	H	6.93	33.21	3.00	50.17	-47.21	-25.00	22.21
483.00	4347.00	12.17	H	7.28	33.57	3.00	53.02	-44.36	-25.00	19.36
483.00	4347.00	11.95	V	7.28	33.57	3.00	52.80	-44.58	-25.00	19.58
483.00	4830.00	10.28	V	7.15	33.94	3.00	51.37	-46.00	-25.00	21.00
483.00	4830.00	10.24	H	7.15	33.94	3.00	51.33	-46.04	-25.00	21.04

Result: Maximum Spurious Level @ 9th Harmonic of 454.5 MHz, -44.36 dBm ERP

FIELD STRENGTH OF SPURIOUS EMISSIONS

UHF High Band Radiated Spurious Emissions, FCC ID P3THRHU1444S

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
507	2028.00	17.14	H	5.21	31.13	3.00	53.48	-43.90	-25.00	18.90
507	2535.00	18.06	V	5.68	32.51	3.00	56.25	-41.13	-25.00	16.13
507	3042.00	14.81	H	6.37	32.61	3.00	53.79	-43.59	-25.00	18.59
507	3549.00	14.29	H	6.79	32.95	3.00	54.03	-43.34	-25.00	18.34
507	3549.00	13.95	V	6.79	32.95	3.00	53.69	-43.68	-25.00	18.68
507	4563.00	13.33	H	7.44	34.01	3.00	54.78	-42.60	-25.00	17.60

Result: Maximum Spurious Level @ 5th Harmonic of 507.0 MHz, -41.13 dBm ERP

UHF High Band Radiated Spurious Emissions, FCC ID P3THRHU1444S-B

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
507.00	1014.00	11.78	V	3.72	27.01	3.00	42.51	-54.87	-25.00	29.87
507.00	1014.00	10.52	H	3.72	27.01	3.00	41.25	-56.13	-25.00	31.13
507.00	1521.00	11.14	H	4.53	27.76	3.00	43.43	-53.95	-25.00	28.95
507.00	1521.00	9.97	V	4.53	27.76	3.00	42.26	-55.12	-25.00	30.12
507.00	2028.00	11.57	V	5.21	31.13	3.00	47.91	-49.47	-25.00	24.47
507.00	2028.00	11.57	H	5.21	31.13	3.00	47.91	-49.47	-25.00	24.47
507.00	2535.00	12.92	H	5.68	32.51	3.00	51.11	-46.27	-25.00	21.27
507.00	2535.00	13.15	V	5.68	32.51	3.00	51.34	-46.04	-25.00	21.04
507.00	3042.00	16.88	V	6.37	32.61	3.00	55.86	-41.52	-25.00	16.52
507.00	3042.00	14.16	H	6.37	32.61	3.00	53.14	-44.24	-25.00	19.24
507.00	3549.00	15.39	H	6.79	32.95	3.00	55.13	-42.24	-25.00	17.24
507.00	3549.00	12.77	V	6.79	32.95	3.00	52.51	-44.86	-25.00	19.86
507.00	4056.00	10.71	V	7.17	33.38	3.00	51.26	-46.11	-25.00	21.11
507.00	4056.00	11.65	H	7.17	33.38	3.00	52.20	-45.17	-25.00	20.17
507.00	4563.00	12.87	H	7.44	34.01	3.00	54.32	-43.06	-25.00	18.06
507.00	4563.00	10.28	V	7.44	34.01	3.00	51.73	-45.65	-25.00	20.65
507.00	5070.00	10.40	V	7.69	34.08	3.00	52.17	-45.21	-25.00	20.21
507.00	5070.00	9.88	H	7.69	34.08	3.00	51.65	-45.73	-25.00	20.73

Result: Maximum Spurious Level @ 6th Harmonic of 507.0 MHz, -41.52 dBm ERP

FIELD STRENGTH OF SPURIOUS EMISSIONS

800 MHz Band Radiated Spurious Emissions, FCC ID P3THRHU1444S

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
851.00625	5957.00	10.57	V	8.58	35.05	3.00	54.20	-43.18	-13.00	30.18
851.00625	6808.10	9.86	H	9.18	35.86	3.00	54.90	-42.48	-13.00	29.48
851.00625	7659.00	8.26	V	10.03	35.93	3.00	54.22	-43.16	-13.00	30.16
851.00625	7659.10	9.19	H	10.03	35.93	3.00	55.15	-42.23	-13.00	29.23
851.00625	8510.00	8.82	V	10.22	35.94	3.00	54.98	-42.40	-13.00	29.40
851.00625	8510.10	9.26	H	10.22	35.94	3.00	55.42	-41.96	-13.00	28.96
860	2580.00	16.73	V	5.76	32.49	3.00	54.98	-42.40	-13.00	29.40
860	6880.00	9.11	V	9.22	35.90	3.00	54.23	-43.15	-13.00	30.15
860	6880.00	8.97	H	9.22	35.90	3.00	54.09	-43.29	-13.00	30.29
860	7740.00	10.84	H	10.11	35.87	3.00	56.82	-40.56	-13.00	27.56
860	8600.00	9.01	V	10.18	36.04	3.00	55.23	-42.15	-13.00	29.15
860	8600.00	8.80	H	10.18	36.04	3.00	55.02	-42.36	-13.00	29.36
868.99375	6952.00	9.56	H	9.24	36.12	3.00	54.92	-42.46	-13.00	29.46
868.99375	6952.00	9.53	V	9.24	36.12	3.00	54.89	-42.49	-13.00	29.49
868.99375	7820.90	10.00	H	10.16	35.86	3.00	56.02	-41.36	-13.00	28.36
868.99375	7820.90	9.82	V	10.16	35.86	3.00	55.84	-41.54	-13.00	28.54
868.99375	8689.90	9.97	H	10.35	35.98	3.00	56.30	-41.08	-13.00	28.08
868.99375	8689.90	9.49	V	10.35	35.98	3.00	55.82	-41.56	-13.00	28.56

Result: Maximum Spurious Level @ 9th Harmonic of 860.0 MHz, -40.56 dBm ERP

800 MHz Band Radiated Spurious Emissions, FCC ID P3THRHU1444S-B

Tuned Frequency (MHz)	Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dBm)
860.00	1720.00	12.68	V	4.81	29.33	3.00	46.82	-50.56	-13.00	37.56
860.00	1720.00	10.90	H	4.81	29.33	3.00	45.04	-52.34	-13.00	39.34
860.00	2580.00	12.14	H	5.76	32.49	3.00	50.39	-46.99	-13.00	33.99
860.00	2580.00	14.71	V	5.76	32.49	3.00	52.96	-44.42	-13.00	31.42
860.00	3440.00	12.33	V	6.82	32.61	3.00	51.76	-45.61	-13.00	32.61
860.00	3440.00	12.10	H	6.82	32.61	3.00	51.53	-45.84	-13.00	32.84
860.00	4300.00	10.09	V	7.23	33.46	3.00	50.78	-46.60	-13.00	33.60
860.00	4300.00	10.49	H	7.23	33.46	3.00	51.18	-46.20	-13.00	33.20
860.00	5160.00	10.40	H	7.82	34.11	3.00	52.33	-45.05	-13.00	32.05
860.00	5160.00	10.62	V	7.82	34.11	3.00	52.55	-44.83	-13.00	31.83
860.00	6020.00	10.79	V	8.65	35.15	3.00	54.59	-42.79	-13.00	29.79
860.00	6020.00	9.01	H	8.65	35.15	3.00	52.81	-44.57	-13.00	31.57
860.00	6880.00	10.14	H	9.22	35.90	3.00	55.26	-42.12	-13.00	29.12
860.00	6880.00	11.14	V	9.22	35.90	3.00	56.26	-41.12	-13.00	28.12
860.00	7740.00	10.23	V	10.11	35.87	3.00	56.21	-41.17	-13.00	28.17
860.00	7740.00	10.22	H	10.11	35.87	3.00	56.20	-41.18	-13.00	28.18
860.00	8600.00	9.83	H	10.18	36.04	3.00	56.05	-41.33	-13.00	28.33
860.00	8600.00	7.85	V	10.18	36.04	3.00	54.07	-43.31	-13.00	30.31

Result: Maximum Spurious Level @ 8th Harmonic of 860.0 MHz, -41.12 dBm ERP

Reference Section (KDB 484596 Section 3 d)

A matrix has been provided to disambiguate the source data for each frequency band, rule part, and emission designator, as required by KDB 484596:

Rule Part	Equipment Class	Frequency Range	Emission Designator(s)	Source Data FCC ID	Exhibit Name(s)
90	B9A	150.8 – 156.2475 MHz	4K00F3E 11K2F3E 4K00F1E 4K00F1D 4K00F1W 8K30F1E 8K30F1D 8K30F1W 4K00F2D 8K30F2D 7K60FXE 7K60FXD 8K10F1E 8K10F1D 8K10F1W 9K80F1E 9K80F1D	FCC ID P3THRHU1444S	1118AUT19_TestReport_Rev1.pdf 1119AUT19 MPE_Rev2.pdf C – Block Diagram.pdf D – Schematics.pdf F – Part List.pdf J – Internal photos.pdf Operational Description 2.pdf
90	B9A	157.1875 – 161.575 MHz			
90	B9A	453.0 – 454.0 MHz			
90	B9A	456.0 – 461.0 MHz			
90	B9A	482.5 – 484.2 MHz			
90	B9A	506.4 – 507.3 MHz			
90	B9A	851.0 – 869.0 MHz			
22	B2I	454.0 – 455.0 MHz			

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	± 0.93 dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	± 1.86 dB	
Occupied Bandwidth	± 2.65 %	
Radiated RF Power	± 1.4 dB	
Rad Emissions Sub Meth up to 26.5GHz	± 2.14 dB	
Adjacent channel power	± 0.93 dB	(1)

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	Serial Number	Cal/Char Date	Due Date
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 KMKM-0670-01 KFKF-0197-00	N/A	N/A
CHAMBER	Panashield	3M	N/A	03/05/19	03/05/21
Ant: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	01/30/17	01/30/20
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
EMI Test Receiver R & S ESU 40	Rohde & Schwarz	ESU 40	100320	08/06/18	08/06/20
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#109	05/24/17	05/23/19
Attenuator N 3dB 20W DC-4G	Narda	766-3	#5	07/10/17	07/10/19
Coaxial Cable – NMNM-0180-00 Aqua	Micro-Coax	UFB311A-0-0720-50U50U	225362-001 (#100)	07/14/2016	07/14/19
Coaxial Cable – NMNM-0180-01 Aqua	Micro-Coax	UFB311A-0-0720-50U50U	225362-002 (#101)	07/14/2016	07/14/19
Coaxial Cable - BMBM-0122-01 RG400	Pasternack	PE3582LF-48	BMBM-0122-01	05/06/19	05/06/21
Coaxial Cable - BMBM-0122-02 RG400	Pasternack	PE3582LF-48	BMBM-0122-02	05/06/19	05/06/21
Coaxial Cable - BMBM-0183-01 RG400	Pasternack	PE3582LF-72	BMBM-0183-01	05/06/19	05/06/21
Terminator N 20W DC-18G	Narda	8205	#14	05/06/19	05/06/21
Terminator N 50OHM DC-18GHz	Narda	370BNM	#63	05/06/19	05/06/21
Terminator N 20W DC-18G	Narda	5W	#48	05/06/19	05/06/21

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT