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TIMCO ENGINEERING, Inc.

An IIA Company

FCC CFR 47 Part 95 F Test Report

APPLICANT	FIPLEX COMMUNICATIONS INC.
ADDRESS	2101 NW 79th Ave. MIAMI FL 33122 USA
FCC ID	P3TTXPA220
MODEL NUMBER	TXPA220
PRODUCT DESCRIPTION	MTA-PTC POWER AMPLIFIER
DATE SAMPLE RECEIVED	08/09/2018
FINAL TEST DATE	08/15/2018
TESTED BY	Franklin Rose
APPROVED BY	Tim Royer
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Report Version	Description	Issue Date
1229AUT18_95F_TestReport_	Rev1	Initial Issue	08/15/2018

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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	Franklin Rose, Project Manager / EMC Testing Technician
Date	08/15/2018

Reviewed and Approved by:

Name and Title	Tim Royer, Project Manager / EMC Testing Engineer
Date	08/15/2018

GENERAL INFORMATION

EUT Description	MTA-PTC POWER AMPLIFIER		
EUT Details	Power Amplifier for Part 95 F data radio, with receiver passthrough (non-amplified)		
FCC ID	P3TTXPA220		
Model Number	TXPA220		
Operating Frequency	218 – 219 MHz		
Test Frequencies	218.25 MHz, 218.5 MHz		
Type of Emission	F1D		
Modulation	FM		
EUT Power Source	☐ 110–120Vac, 50–60Hz	☒ DC Power	☐ Battery Operated
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	N Type		
Test Conditions	The temperature was 26ºC Relative humidity of 50%.		
Modification to the EUT	No Modification to EUT.		
Test Exercise	The EUT was operated in accordance with the service manual.		
Applicable Standards	TIA 603-E:2016, ANSI C63.26, FCC CFR 47 Part 2, Part 95, KDB 935210 D05 v01r02, section 4		
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070		

RESULTS SUMMARY

Governing Rule Part(s)	Test	Result
FCC PT. 95.1953	Test Frequencies	**PASS**
FCC Part 95.371(b)	Test Signals	**PASS**
KDB 935210 s.4.2	AGC Threshold	For Reporting Only
KDB 935210 s.4.3	Out-of-Band Rejection	For Reporting Only
FCC 95.1957(a), (b)(1), (d)	Input vs. Output Signal Comparison	**PASS**
FCC 95.1957(a), (b)(2)-(3), (d)	Emission Mask	**PASS**
FCC Pt. 2.1046(a), FCC Pt. 95.1955	RF Power Output	**PASS**
FCC Pt. 2.1033(c)(8)	Power Input to the Final Power Amplifier	For Reporting Only
FCC Part 95.1915	Adjacent Channel Power Ratio	For Reporting Only
KDB 935210 s.4.7.2	Intermodulation Spurious Emissions	**N/A**
FCC Part 2.1051(a), FCC Part 95.1957(b)(4), (c), (d)	Spurious Emissions at Antenna Terminals	**PASS**
FCC Part 2.1053(a), FCC Part 95.1957(b)(4), (c), (d)	Field Strength of Spurious Emissions	**PASS**

EUT DEFINITION

Rule Part No.: FCC PT. 95.1903

§95.1903 218-219 MHz Service description.

(a) The 218-219 MHz Service is authorized for system licensees to provide communication service to subscribers in a specific service area.

(b) The components of each 218-219 MHz Service system are its administrative apparatus, its response transmitter units (RTUs), and one or more cell transmitter stations (CTSs). RTUs may be used in any location within the service area. CTSs provide service from a fixed point, and certain CTSs must be individually licensed as part of a 218-219 MHz Service system. *See* §95.1911.

(c) Each 218-219 MHz Service system service area is one of the cellular system service areas as defined by the Commission, unless modified pursuant to §95.1923.

TEST FREQUENCIES

Rule Part No.: FCC PT. 95.1953

§95.1953 Frequency segments.

There are two frequency segments available for assignment to the 218-219 MHz Service in each service area. Frequency segment A is 218.000-218.500 MHz. Frequency segment B is 218.501-219.000 MHz.

Frequencies for Testing: ANSI C63.26-2015, FCC PT. 95.1957(c)

ANSI C63.26-2015
American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

Table 2—Number of frequencies to be tested

Frequency range over which EUT operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

§95.1957 Emission standards.

(c) When testing for certification, all measurements of unnecessary radiation are performed using a carrier frequency as close to the edge of the authorized frequency segment as the transmitter is designed to be capable of operating.

The EUT will utilize the bands: Transmit Band 218.0 – 218.5 MHz (Segment A); and
Receive Band 218.501 – 219.0 MHz (Segment B)

Therefore, the test frequencies shall be: **Transmit Band: 218.25, 218.50 MHz**

TEST SIGNALS

Rule Part No.: FCC Part 95.371(b)
Referring to KDB 935210 s.4.1 for guidance

§95.371 Emission types.

In general, Personal Radio Services stations may transmit any emission type that is appropriate for the permissible uses of the specific service, provided that it does not exceed the authorized bandwidth for that service and is in full compliance with the modulation limits (if any) and unwanted emission limits for the specific service.

(b) *Emission type designators.* Emission type designators are defined in §2.201 of this chapter. Designators for emissions commonly used in the Personal Radio Services are as follows:

Description	Designator
Data, FSK	F1D

Input Signal(s) for testing: Digitally modulated FM signal, carrying data only.

Peripheral Equipment used in testing: A representative transceiver typically used in the EUT's normal operation has been provided by the manufacturer. This transceiver was used to generate the necessary data signal to the EUT:

Manufacturer	GE
Model	TD220
Product Name	TD220MAX
Serial Number	2652873
Output Emission	Digitally Modulated FM Data

AGC THRESHOLD

Rule Part No.: Referring to KDB 935210 s.4.2 for guidance

Requirements: KDB 935210 s.4.2

Testing at and above the AGC threshold will be required.[6] The AGC threshold shall be determined by applying the procedure of 3.2, but with the signal generator configured to produce a test signal defined in Table 1, a CW input signal, or a digitally modulated signal, consistent with the discussion about signal types in 4.1.

[6] See footnote 1 about the terms and concepts AGC, ALC, OLC.

Test Procedure: KDB 935210 s.3.2

The AGC threshold is to be determined as follows.[3]

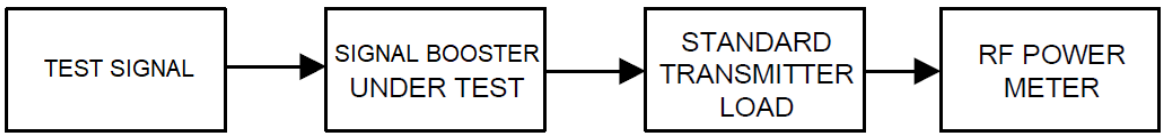
In the case of fiber-optic distribution systems, the RF input port of the equipment under test (EUT) refers to the RF input of the supporting equipment RF to optical convertor; see also descriptions and diagrams for typical DAS booster systems in KDB Publication 935210 D02 [R7].

Devices intended to be directly connected to an RF source (donor port) only need to be evaluated for any over-the-air transmit paths.

a) Connect a signal generator to the input of the EUT.
b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.
c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).
d) Set the signal generator frequency to the center frequency of the EUT operating band.
e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.
f) Record this level as the AGC threshold level.
g) Repeat the procedure with the remaining test signal.

[3] Consistent with for example TIA-156 [R10], for compliance testing purposes the terms automatic gain control (AGC), automatic level control (ALC), and output level control (OLC) are generally taken to be synonyms, which refer to a means by which gain or output power is electronically adjusted as a function of voltage or some other specified parameter(s).

Test Setup Block Diagram: KDB 935210 s.3.2



AGC THRESHOLD

Test Data: AGC Measurement Table

Frequency (MHz)	Input Level (dBm)	Output Level (dBm)	Rise in Level (dBm)	Remarks
218.25	33	42.22	0.01	Maximum Input
218.25	32	42.21	-0.01	
218.25	31	42.22	0.00	
218.25	30	42.22	0.00	
218.25	29	42.22	0.00	
218.25	28	42.22	0.02	
218.25	27	42.2	-0.04	
218.25	26	42.24	0.18	+3 dB AGC
218.25	25	42.06	0.68	
218.25	24	41.38	0.55	
218.25	23	40.83	0.77	AGC Level
218.25	22	40.06	0.89	
218.25	21	39.17	1.22	
218.25	20	37.95	0.89	-3 dB AGC
218.25	19	37.06	0.91	
218.25	18	36.15	0.98	
218.25	17	35.17	0.99	
218.25	16	34.18	n/a	

AGC LEVEL: 23 dBm

Note: All testing was done at maximum input (+33 dBm) in accordance with normal operation of the EUT.

OUT OF BAND REJECTION

Rule Part No.: Referring to KDB 935210 s.4.3 for guidance

Requirements: FCC PT. 95.1953

§95.1953 Frequency segments.

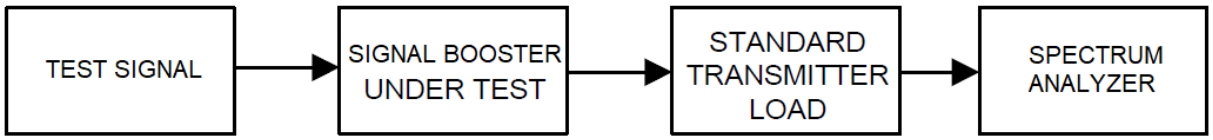
There are two frequency segments available for assignment to the 218-219 MHz Service in each service area. Frequency segment A is 218.000-218.500 MHz. Frequency segment B is 218.501-219.000 MHz.

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.

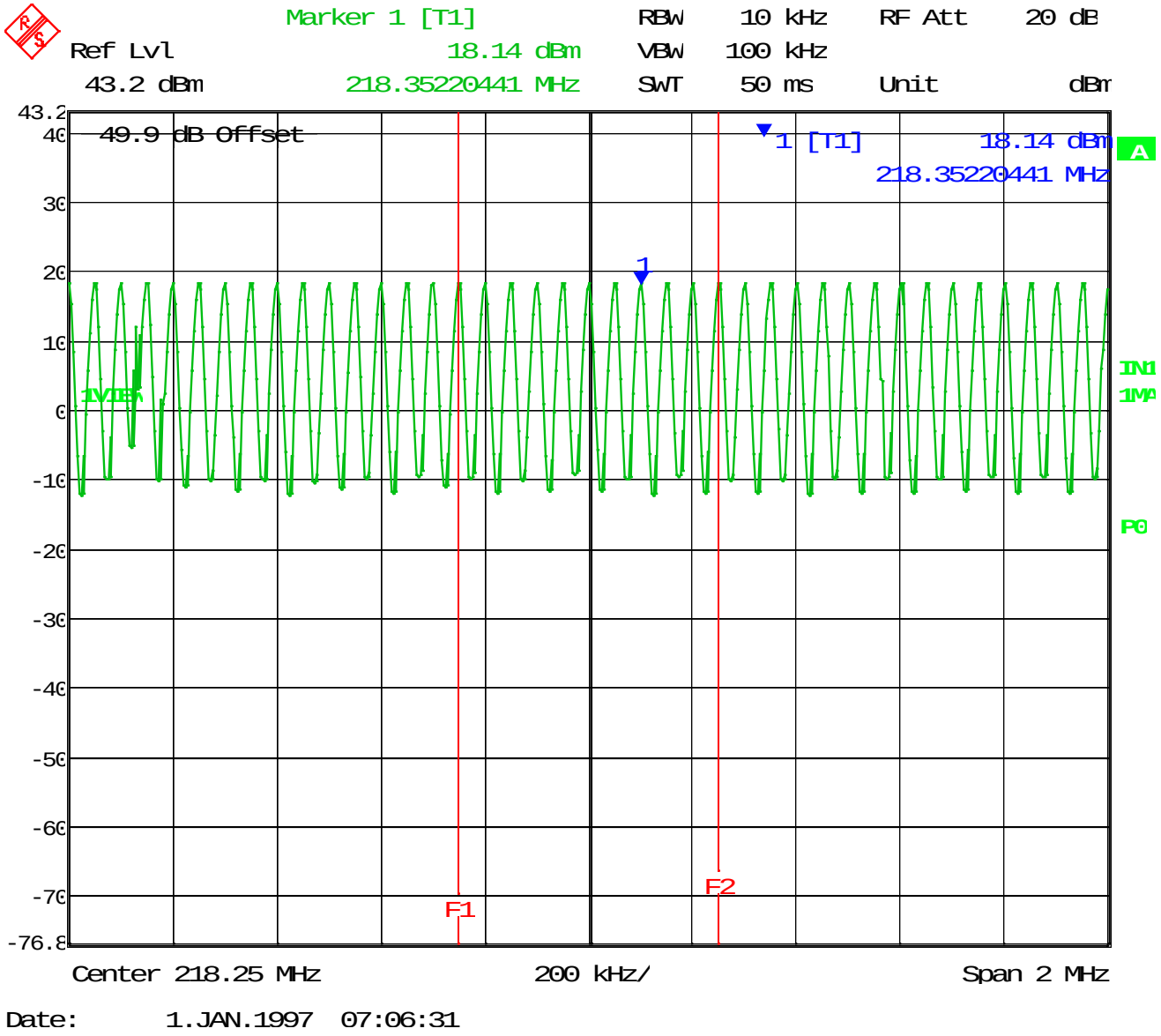
a) Connect a signal generator to the input of the EUT.
b) Configure a swept CW signal with the following parameters:
   1) Frequency range = ± 250 % of the manufacturer's specified pass band.
   2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold 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 × 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

Test Data: Passband

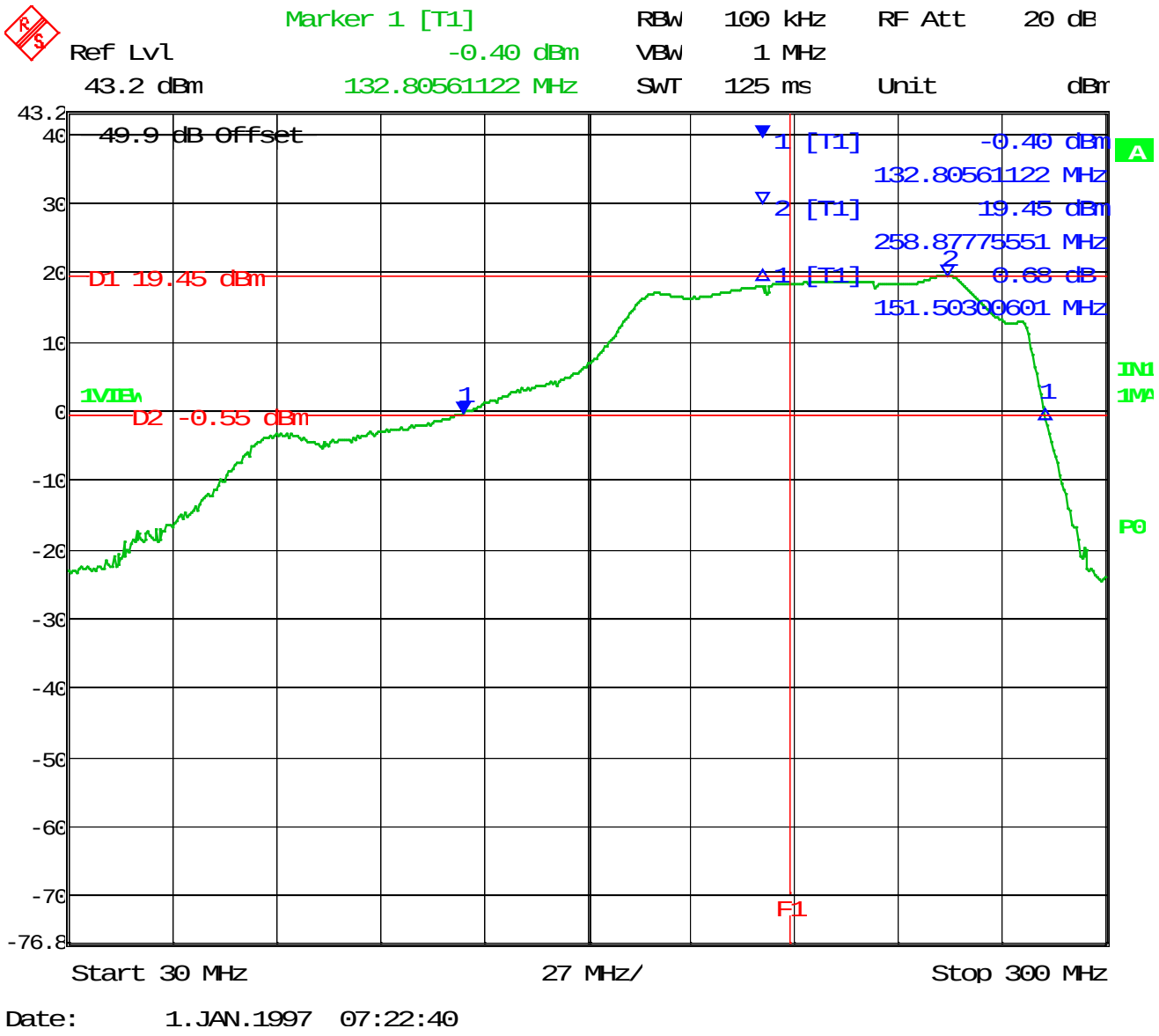


RESULT: N/A. EUT not intended to reject signals out-of-band.

***Note:** The EUT will be permanently connected to a FCC Part 95 certified transmitter during normal operation, and shall not transmit out-of-band.

OUT OF BAND REJECTION

Test Data: Operational Capability



RESULT: Device operational 20 dB band = 151.5 MHz

***Note:** The EUT will be permanently connected to a FCC Part 95 certified transmitter during normal operation, and shall not transmit out-of-band.

INPUT VS OUTPUT COMPARISON

Rule Part No.: FCC 95.1957(a), (b)(1), (d)
Referring to KDB 935210 s.4.4 for guidance

Compliance with the emission mask of the EUT output shall be measured for the public safety service signal types as specified in 4.1.

Refer to the applicable regulatory requirements (e.g., Section 90.210) for emission mask specifications.

Requirements: FCC 95.1957(a), (b)(1), (d)

§95.1957 Emission standards.

(a) All transmissions by each CTS and by each RTU shall use an emission type that complies with the following standard for unnecessary radiation.

(b) All spurious and out-of-band emissions shall be attenuated:

(1) Zero dB on any frequency within the authorized frequency segment.

(2) At least 28 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 250 kHz up to and including 750 kHz;

(3) At least 35 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 750 kHz up to and including 1250 kHz;

(4) At least 43 plus 10 log (base 10) (mean power in Watts) dB on any frequency removed from the midpoint of the assigned frequency segment by more than 1250 kHz.

(c) When testing for certification, all measurements of unnecessary radiation are performed using a carrier frequency as close to the edge of the authorized frequency segment as the transmitter is designed to be capable of operating.

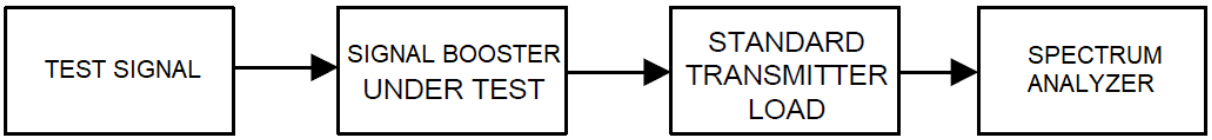
(d) The reference bandwidth of the instrumentation used to measure the emission power shall be 100 Hz for measuring emissions up to and including 250 kHz from the edge of the authorized frequency segment, and 10 kHz for measuring emissions more than 250 kHz from the edge of the authorized frequency segment. If a video filter is used, its bandwidth shall not be less than the reference bandwidth. The power level of the highest emission within the frequency segment, to which the attenuation is referenced, shall be remeasured for each change in reference bandwidth.

INPUT VS OUTPUT COMPARISON

Test Procedure: KDB 935210 s.4.4

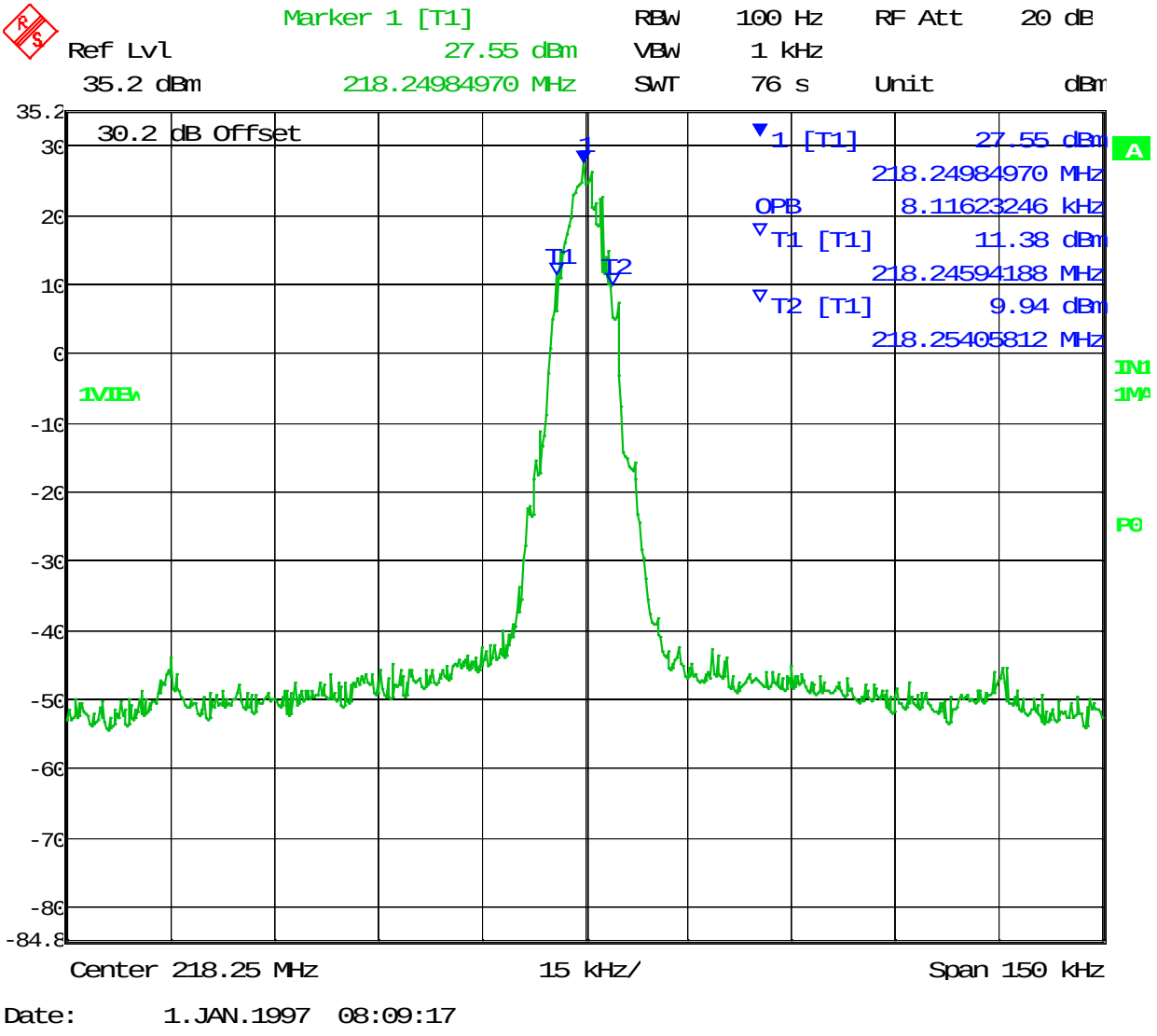
a) Connect a signal generator to the input of the EUT.
b) Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation (see Table 1).
c) Configure the signal level to be just below the AGC threshold (see results from 4.2).
d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
e) Set the spectrum analyzer center frequency to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between 2 times to 5 times the EBW (or OBW).
f) The nominal RBW shall be 300 Hz for 16K0F3E, and 100 Hz for all other emissions types.
g) Set the reference level of the spectrum analyzer to accommodate the maximum input amplitude level, i.e., the level at f_0 per 4.2.
h) Set spectrum analyzer detection mode to peak, and trace mode to max hold.
i) Allow the trace to fully stabilize.
j) Confirm that the signal is contained within the appropriate emissions mask.
k) Use the marker function to determine the maximum emission level and record the associated frequency as f_0.
l) Capture the emissions mask plot for inclusion in the test report (output signal spectra).
m) Measure the EUT input signal power (signal generator output signal) directly from the signal generator using power measurement guidance provided in KDB Publication 971168 [R8] (input signal spectra).
n) Compare the spectral plot of the output signal (determined in step k), to the input signal (determined in step l) to affirm they are similar (in passband and rolloff characteristic features and relative spectral locations).
o) Repeat steps d) to n) with the input signal amplitude set 3 dB above the AGC threshold.
p) Repeat steps b) to o) for all authorized operational bands and emissions types (see applicable regulatory specifications, e.g., Section 90.210).
q) Include all accumulated spectral plots depicting EUT input signal and EUT output signal in the test report, and note any observed dissimilarities.

Test Setup Block Diagram: KDB 935210 s.4.4



INPUT VS OUTPUT COMPARISON

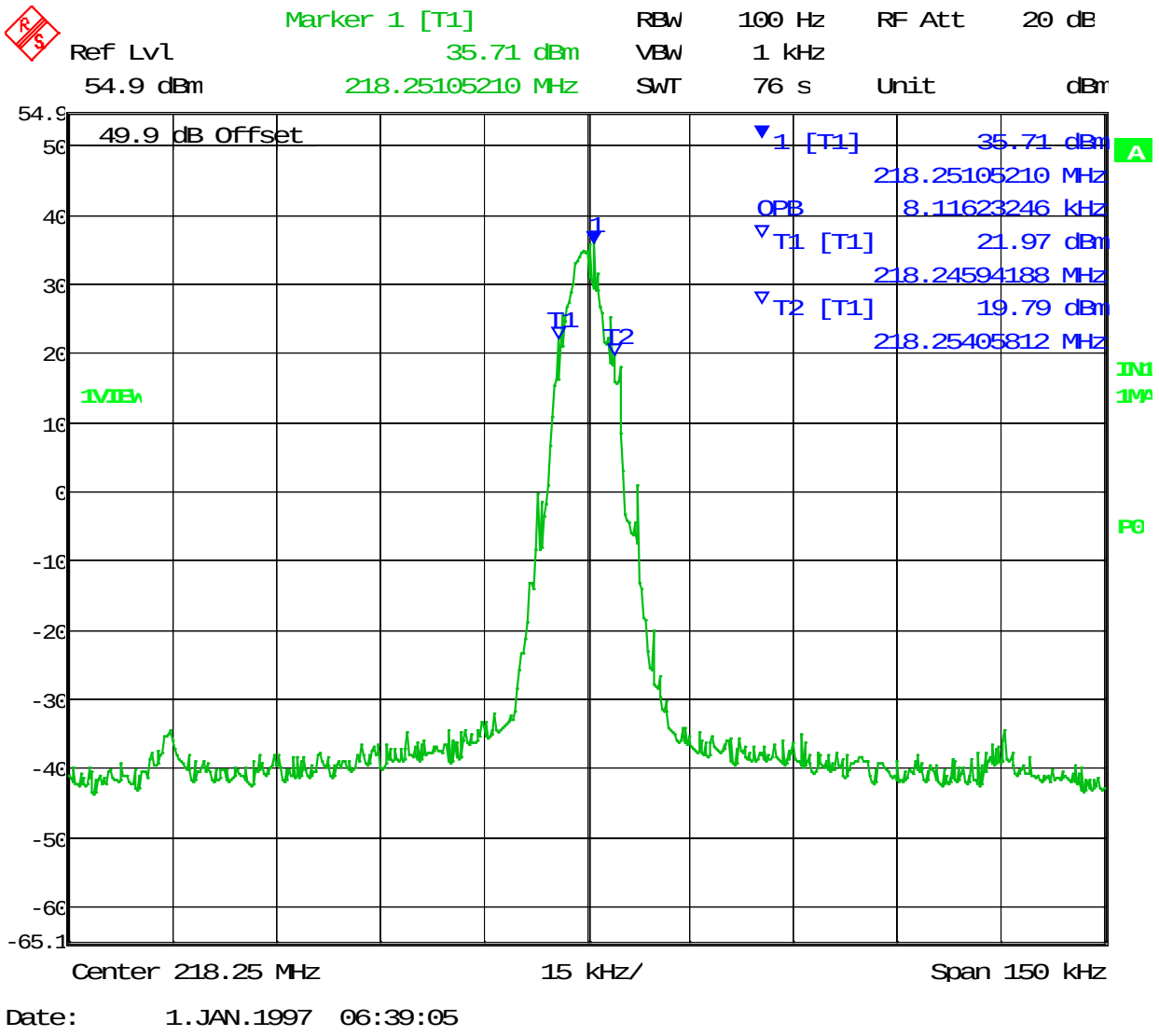
Test Data: 218.25 MHz, 8K12F1D Input Signal



RESULT: Input Signal 99% OBW = 8.116 kHz

INPUT VS OUTPUT COMPARISON

Test Data: 218.25 MHz, 8K12F1D Output Signal



RESULT: Output Signal 99% OBW = 8.116 kHz

EMISSION MASK

Rule Part No.: FCC 95.1957(a), (b)(2), (3), (d)
Referring to KDB 935210 s.4.4 for guidance

Compliance with the emission mask of the EUT output shall be measured for the public safety service signal types as specified in 4.1.

Refer to the applicable regulatory requirements (e.g., Section 90.210) for emission mask specifications.

Requirements: FCC 95.1957(a), (b)(2), (3), (d)

§95.1957 Emission standards.

(a) All transmissions by each CTS and by each RTU shall use an emission type that complies with the following standard for unnecessary radiation.

(b) All spurious and out-of-band emissions shall be attenuated:

(1) Zero dB on any frequency within the authorized frequency segment.

(2) At least 28 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 250 kHz up to and including 750 kHz;

(3) At least 35 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 750 kHz up to and including 1250 kHz;

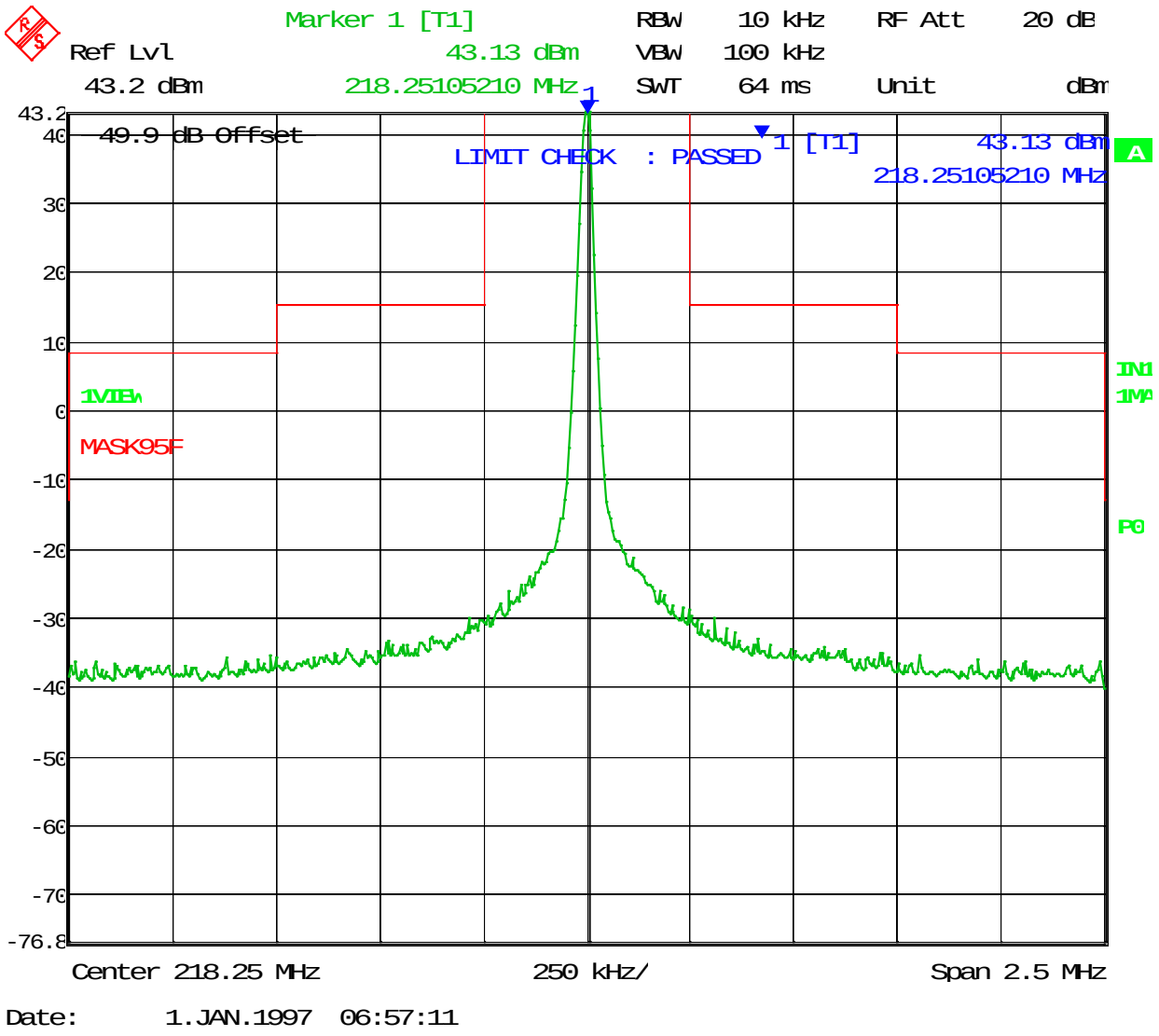
(4) At least 43 plus 10 log (base 10) (mean power in Watts) dB on any frequency removed from the midpoint of the assigned frequency segment by more than 1250 kHz.

(c) When testing for certification, all measurements of unnecessary radiation are performed using a carrier frequency as close to the edge of the authorized frequency segment as the transmitter is designed to be capable of operating.

(d) The reference bandwidth of the instrumentation used to measure the emission power shall be 100 Hz for measuring emissions up to and including 250 kHz from the edge of the authorized frequency segment, and 10 kHz for measuring emissions more than 250 kHz from the edge of the authorized frequency segment. If a video filter is used, its bandwidth shall not be less than the reference bandwidth. The power level of the highest emission within the frequency segment, to which the attenuation is referenced, shall be remeasured for each change in reference bandwidth.

EMISSION MASK

Test Data: 218.25 MHz, 8K12F1D Emission Mask



RESULT: Limit Check Passed

RF POWER OUTPUT

Rule Part No.: FCC Pt. 2.1046(a), FCC Pt. 95.1955
Referring to KDB 935210 s.4.5, 4.5.5 for guidance

Requirements: FCC Pt. 95.1955

§95.1955 Transmitter effective radiated power limitation.

The effective radiated power (ERP) of each CTS and RTU shall be limited to the minimum necessary for successful communications. No CTS or fixed RTU may transmit with an ERP exceeding 20 Watts. No mobile RTU may transmit with an ERP exceeding 4 Watts.

Test Procedure: KDB 935210 s.4.5, & 4.5.3, TIA 603-E

Adjust the internal gain control of the EUT to the maximum gain for which the equipment certification is being sought. Any EUT attenuation settings shall be set to their minimum value.

Input power levels (uplink and downlink) should be set to maximum input ratings, while confirming that the device is not capable of operating in saturation (non-linear mode) at the rated input levels, including during the performance of the input/output power measurements.

4.5.3 Power measurement Method 1: using a spectrum or signal analyzer

a) Set the frequency span to at least 1 MHz.
b) Set RBW = 100 kHz.
c) Set VBW ≥ 3 × RBW.
d) Set the detector to PEAK, and trace mode to MAX HOLD.
e) Place a marker on the peak of the signal, and record the value as the maximum power.
f) Repeat step e) but with the EUT in place.
g) EUT gain may be calculated as described in 4.5.5.

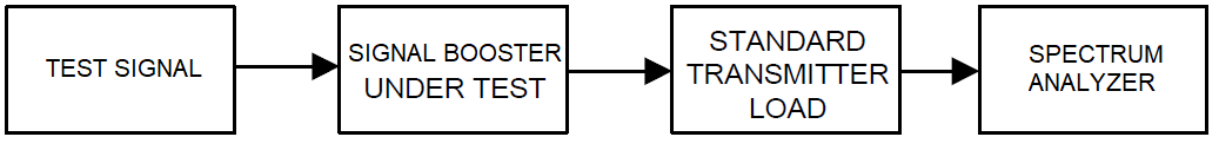
NOTE–Sections 90.219 and 2.1033(c) do not require gain test data; inclusion of industrial booster gain test data in test reports submitted for FCC equipment authorization is optional.

After the input and output power levels have been measured as described in the preceding subclauses, the gain of the EUT can be determined from:

Gain (dB) = output power (dBm) − input power (dBm).

Report the gain for each authorized operating frequency band, and each test signal stimulus.

Test Setup Block Diagram: KDB 935210 s.4.5



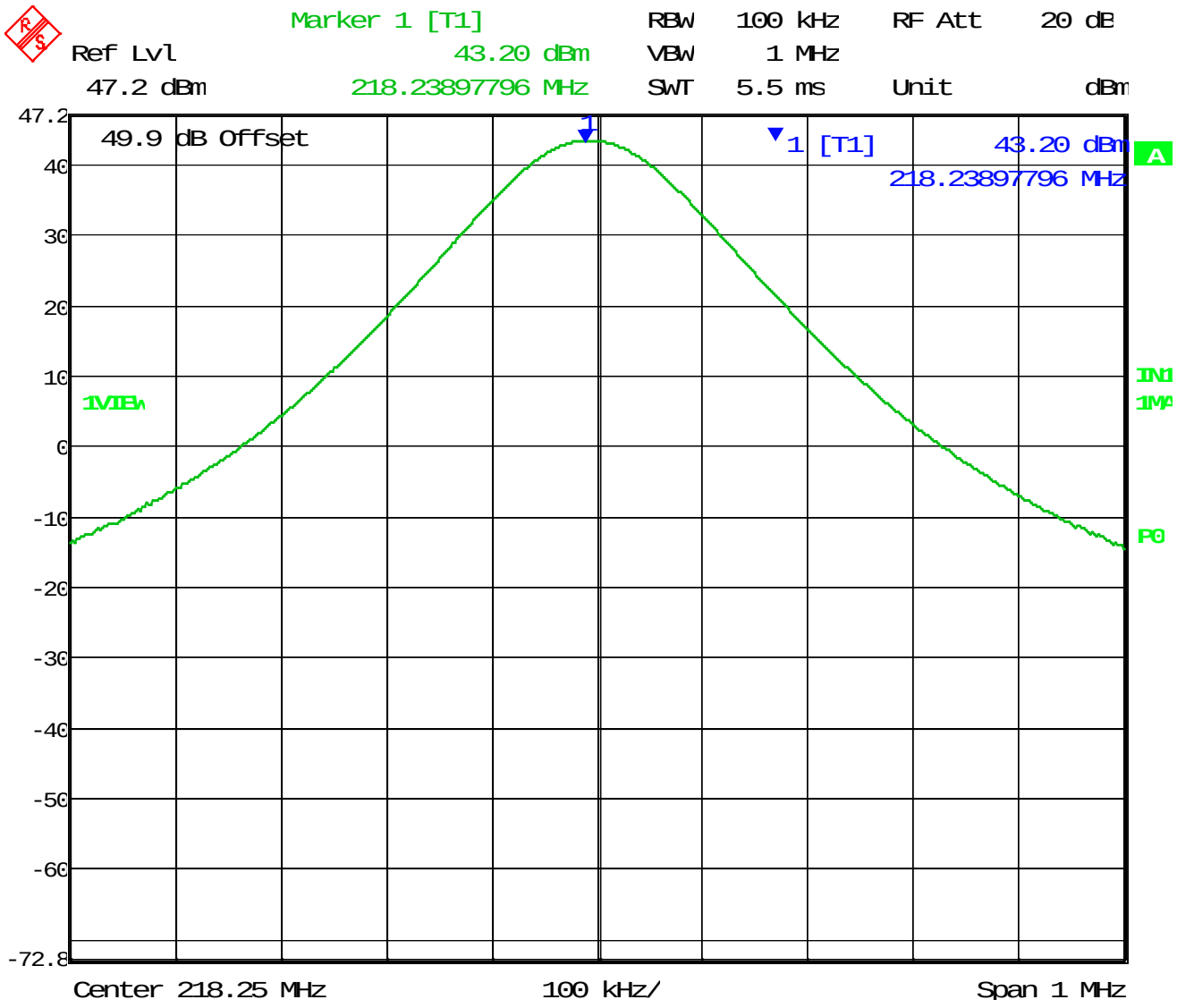
RF POWER OUTPUT

Test Data: Output Measurement Table

Input Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Final Gain (dB)	Antenna System Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	ERP (W)	ERP Limit (W)	Margin (W)
218.25	33.00	43.20	10.20	2.39	2.20	43.01	19.999	20	0.001

Note: An antenna gain of 2.2 dBi was specified by the Manufacturer.

Test Data: Output Measurement Plot



POWER TO FINAL AMPLIFIER

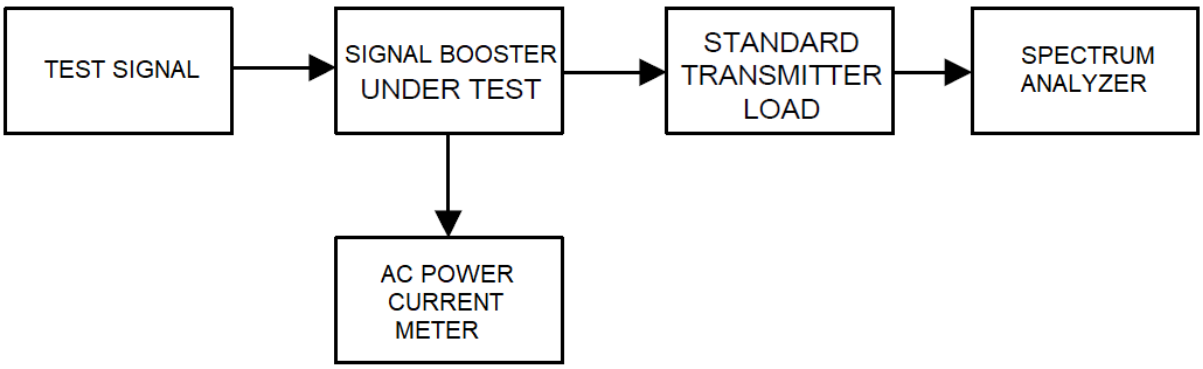
Rule Part No.: FCC Pt. 2.1033(c)(8)

Requirements:

(c) Applications for equipment other than that operating under parts 15, 11 and 18 of this chapter shall be accompanied by a technical report containing the following information:

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

Test Setup Block Diagram:



Test Data: Power to Final Amplifier Calculation

INPUT POWER: (13.8 VDC) (10.1 A) = **139.38 Watts Maximum**

ADJACENT CHANNEL POWER RATIO

Rule Part No.: FCC Part 95.1915

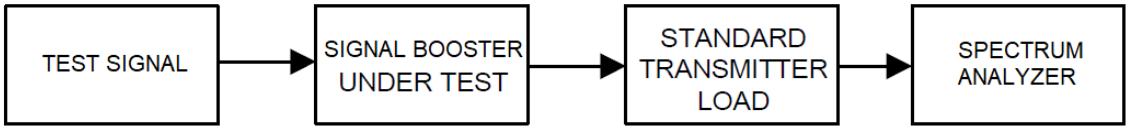
Requirements: For Reporting Only

§95.1915 License application.

(a) In addition to the requirements of part 1, subpart F of this chapter, each application for a 218-219 MHz Service system license must include a plan analyzing the co- and adjacent channel interference potential of the proposed system, identifying methods being used to minimize this interference, and showing how the proposed system will meet the service requirements set forth in §95.1931 of this part. This plan must be updated to reflect changes to the 218-219 MHz Service system design or construction.

Test Procedure: TIA-603-E, s.2.2.14

Test Setup Block Diagram: TIA-603-E, s.2.2.14



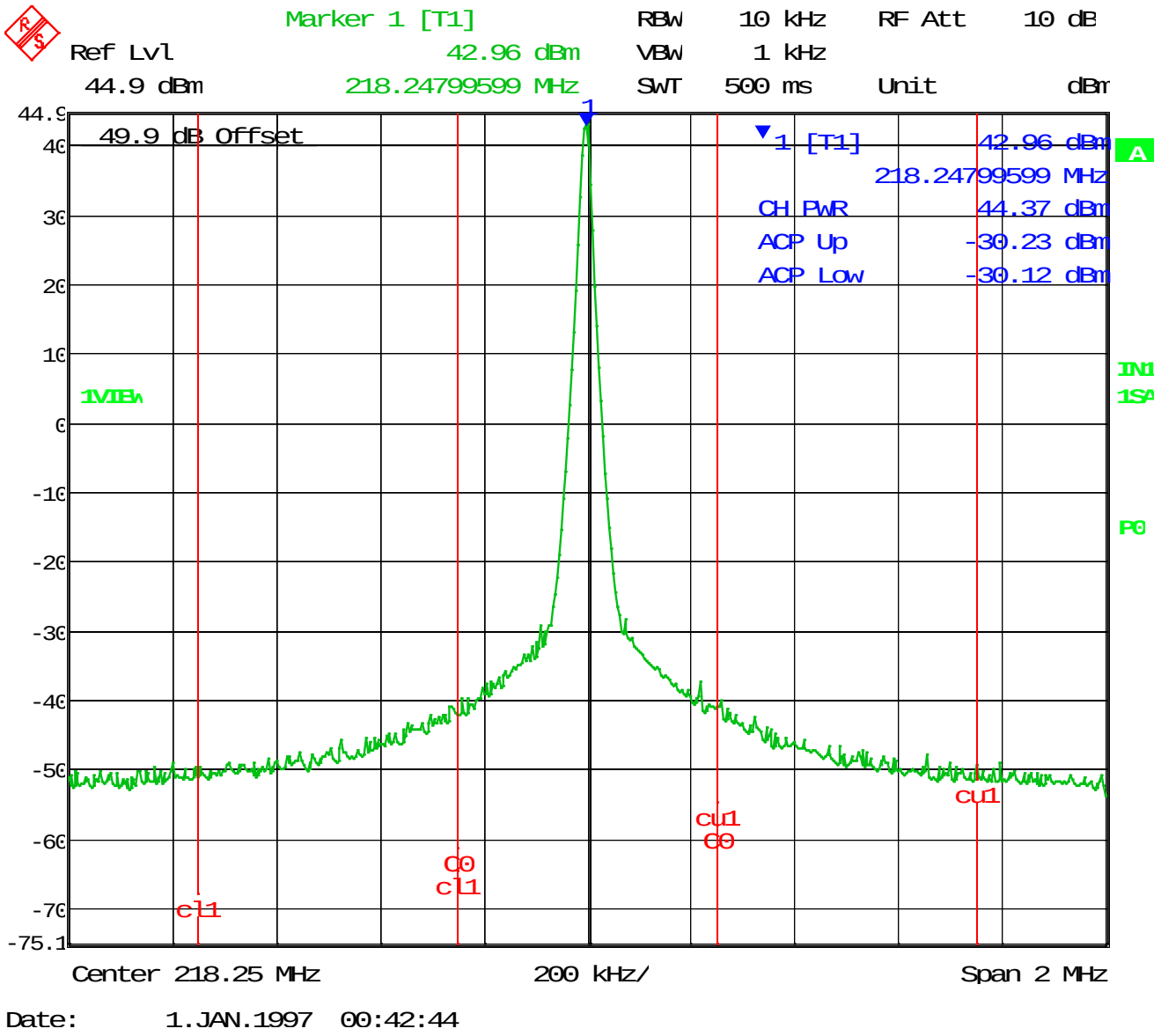
***Note**: The test setup is modified from the test setup appearing in TIA-603-E because the signal transmitter is digitally modulated, and the EUT is only a power amplifier.

Adjacent Channel Power Ratio Calculation:

RMS Channel Power (dBm) – RMS Adjacent Channel Power (dBm) = Adjacent Channel Power Ratio (dB)

ADJACENT CHANNEL POWER RATIO

Test Data: 218.25 MHz Adjacent Channel Power Plot



Date: 1.JAN.1997 00:42:44

RESULT:

Upper Adjacent Channel Power Ratio = 74.60 dB
Lower Adjacent Channel Power Ratio = 74.49 dB

INTERMODULATION SPURIOUS EMISSIONS

Rule Part No.: Referring to KDB 935210 s.4.7.2 for guidance

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:

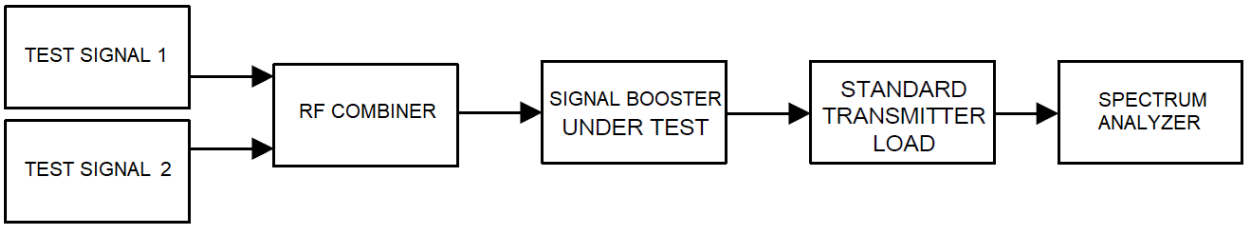
Test Procedure: KDB 935210 s.4.7.2, TIA 603-E

Intermodulation products shall be measured using two CW signals with all available channel spacings (e.g., 12.5 kHz and 6.25 kHz) with the center between these channels being equal to the center frequency f_0 as determined from 4.4.

NOTE—Intermodulation-product spurious emission measurements are not required for single-channel boosters that cannot accommodate two simultaneous signals within the passband.

a) Connect a signal generator to the input of the EUT.
   If the signal generator is not capable of producing two independent modulated carriers simultaneously, then two discrete signal generators can be connected, with an appropriate combining network to support the two-signal test.
b) Configure the two signal generators to produce CW on frequencies spaced consistent with 4.7.1, with amplitude levels set to just below the AGC threshold (see 4.2).
c) Connect a spectrum analyzer to the EUT output.
d) Set the span to 100 kHz.
e) Set RBW = 300 Hz with VBW ≥ 3 × RBW.
f) Set the detector to power averaging (rms).
g) Place a marker on highest intermodulation product amplitude.
h) Capture the plot for inclusion in the test report.
i) Repeat steps c) to h) with the composite input power level set to 3 dB above the AGC threshold.
j) Repeat steps b) to i) for all operational bands.

Test Setup Block Diagram: KDB 935210 s.4.7.2



Test Data: **N/A.** The EUT is a single-channel amplifier.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a), FCC Part 95.1957(b)(4), (c), (d)
Referring to KDB 935210 s.4.7.3 for guidance

Requirements: FCC Part 95.1957(b)(4), (c), (d)

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).

§95.1957 Emission standards.

(a) All transmissions by each CTS and by each RTU shall use an emission type that complies with the following standard for unnecessary radiation.

(b) All spurious and out-of-band emissions shall be attenuated:

(1) Zero dB on any frequency within the authorized frequency segment.

(2) At least 28 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 250 kHz up to and including 750 kHz;

(3) At least 35 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 750 kHz up to and including 1250 kHz;

(4) At least 43 plus 10 log (base 10) (mean power in Watts) dB on any frequency removed from the midpoint of the assigned frequency segment by more than 1250 kHz.

(c) When testing for certification, all measurements of unnecessary radiation are performed using a carrier frequency as close to the edge of the authorized frequency segment as the transmitter is designed to be capable of operating.

(d) The reference bandwidth of the instrumentation used to measure the emission power shall be 100 Hz for measuring emissions up to and including 250 kHz from the edge of the authorized frequency segment, and 10 kHz for measuring emissions more than 250 kHz from the edge of the authorized frequency segment. If a video filter is used, its bandwidth shall not be less than the reference bandwidth. The power level of the highest emission within the frequency segment, to which the attenuation is referenced, shall be remeasured for each change in reference bandwidth.

Limit Calculation: FCC Part 95.1957(b)(4)

43 + 10 * Log(20) = **56.01 dBc**

43.01 dBm – 56.01 dBm = **-13.0 dBm Limit**

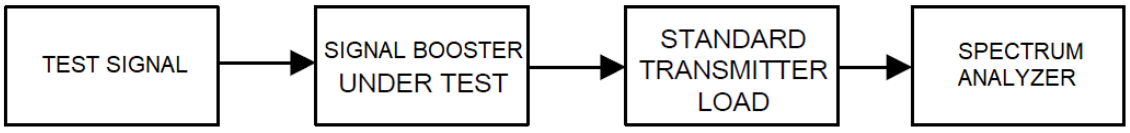
SPURIOUS EMISSIONS AT ANTENNA TERMINALS

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 × 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.

Test Setup Block Diagram: KDB 935210 s.4.7.3

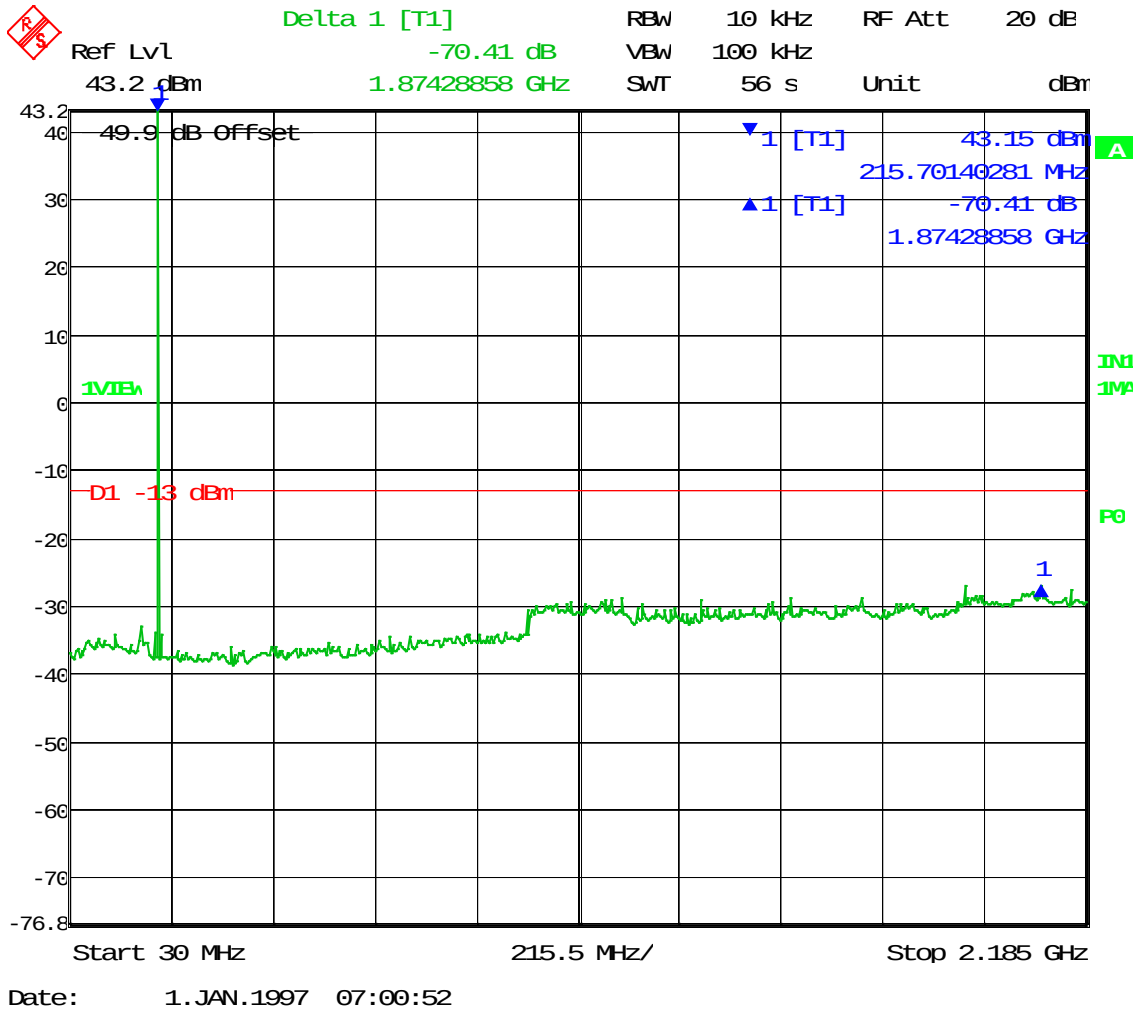


SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: Spurious Emissions Table

43+10*log(P) Limit (dBc)	Peak Spurious Emission (dBc)	Margin (dB)
56.01	70.41	14.40

Test Data: Spurious Emissions Plot



FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Part No.: FCC Part 2.1053(a), FCC Part 95.1957(b)(4), (c), (d)
Referring to KDB 935210 s.4.7.3 for guidance

Requirements: FCC Part 95.1957(b)(4), (c), (d)

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).

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(b) All spurious and out-of-band emissions shall be attenuated:

(1) Zero dB on any frequency within the authorized frequency segment.

(2) At least 28 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 250 kHz up to and including 750 kHz;

(3) At least 35 dB on any frequency removed from the midpoint of the assigned frequency segment by more than 750 kHz up to and including 1250 kHz;

(4) At least 43 plus 10 log (base 10) (mean power in Watts) dB on any frequency removed from the midpoint of the assigned frequency segment by more than 1250 kHz.

(c) When testing for certification, all measurements of unnecessary radiation are performed using a carrier frequency as close to the edge of the authorized frequency segment as the transmitter is designed to be capable of operating.

(d) The reference bandwidth of the instrumentation used to measure the emission power shall be 100 Hz for measuring emissions up to and including 250 kHz from the edge of the authorized frequency segment, and 10 kHz for measuring emissions more than 250 kHz from the edge of the authorized frequency segment. If a video filter is used, its bandwidth shall not be less than the reference bandwidth. The power level of the highest emission within the frequency segment, to which the attenuation is referenced, shall be remeasured for each change in reference bandwidth.

Limit Calculation: FCC Part 95.1957(b)(4)

43 + 10 * Log(20) = **56.01 dBc**

43.01 dBm – 56.01 dBm = **-13.0 dBm Limit**

FIELD STRENGTH OF SPURIOUS EMISSIONS

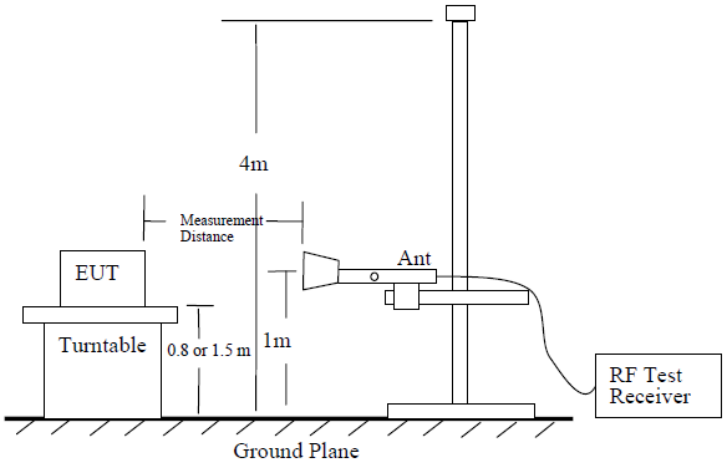
Test Procedure: KDB 935210 s.4.7.3, TIA 603-E

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.

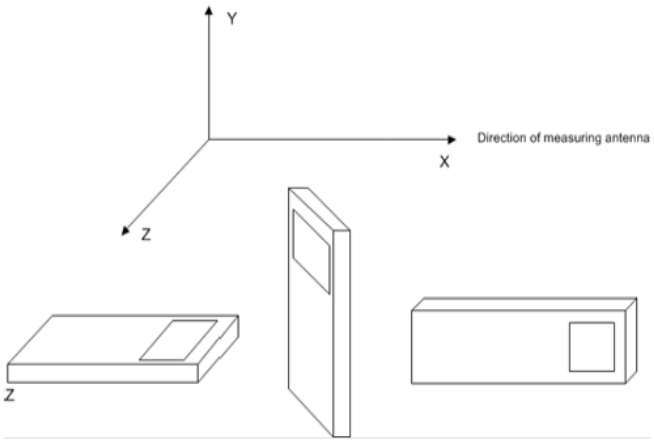
a) Connect a signal generator to the input of the EUT.
b) Configure the signal generator to produce a CW signal.
c) Set the frequency of the CW signal to the center channel of the EUT passband.
d) Set the output power level so that the resultant signal is just below the AGC threshold (see 4.2).
e) Connect 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 × 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. 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, but may have been included for informational purposes.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: Spurious Emissions Table

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 (dB)
218.5	79.40	23.75	H	1.07	8.28	3.00	33.10	-64.27	-13.00	51.27
218.5	107.00	24.66	V	1.19	10.40	3.00	36.25	-61.13	-13.00	48.13
218.5	437.00	39.60	H	2.39	16.40	3.00	58.39	-38.98	-13.00	25.98
218.5	437.00	36.06	V	2.39	16.40	3.00	54.85	-42.52	-13.00	29.52
218.5	655.50	48.47	H	2.98	19.60	3.00	71.05	-26.33	-13.00	13.33
218.5	655.50	44.86	V	2.98	19.60	3.00	67.44	-29.94	-13.00	16.94
218.5	874.00	41.22	H	3.53	22.50	3.00	67.25	-30.13	-13.00	17.13
218.5	874.00	36.82	V	3.53	22.50	3.00	62.85	-34.53	-13.00	21.53
218.5	1092.50	25.21	H	3.93	27.11	3.00	56.25	-41.13	-13.00	28.13
218.5	1092.50	22.24	V	3.93	27.11	3.00	53.28	-44.10	-13.00	31.10
218.5	1311.00	18.94	H	4.29	28.69	3.00	51.92	-45.46	-13.00	32.46
218.5	1311.00	14.37	V	4.29	28.69	3.00	47.35	-50.03	-13.00	37.03
218.5	1529.50	4.27	H	4.59	27.76	3.00	36.62	-60.76	-13.00	47.76
218.5	1529.50	4.47	V	4.59	27.76	3.00	36.82	-60.56	-13.00	47.56
218.5	1748.00	20.76	H	4.90	29.70	3.00	55.36	-42.02	-13.00	29.02
218.5	1748.00	19.47	V	4.90	29.70	3.00	54.07	-43.31	-13.00	30.31
218.5	1966.50	16.70	H	5.30	31.31	3.00	53.31	-44.06	-13.00	31.06
218.5	1966.50	15.12	V	5.30	31.31	3.00	51.73	-45.64	-13.00	32.64
218.5	2185.00	6.47	H	5.61	31.29	3.00	43.37	-54.00	-13.00	41.00
218.5	2185.00	11.16	V	5.61	31.29	3.00	48.06	-49.31	-13.00	36.31

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	Serial Number	Cal/Char Date	Due Date
Coaxial Cable - BMBM-0061-01 RG400	Pasternack	PE3582LF-24	BMBM-0061-01	01/31/17	01/31/19
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	07/11/18	07/11/20
Ant: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	01/30/17	01/30/19
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
EMI Test Receiver R & S ESIB 40	Rohde & Schwarz	ESIB 40	100274	08/18/16	08/18/18
Attenuator N 20dB 20W DC-12G	Narda	768-20-SP	155	07/10/17	07/10/19
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Terminator N 20W DC-18G	Narda	8205	#14	04/06/17	04/06/19
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#109	05/24/17	05/23/19
Coaxial Cable – NMNM-0180-00 Aqua	Micro-Coax	UFB311A-0-0720-50U50U	225362-001 (#100)	07/14/2018	07/14/2020

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT