



FCC CFR 47 Part 90 Test Report

| | |
|-----------------------------|--|
| APPLICANT | KP ELECTRONIC SYSTEMS LTD. |
| ADDRESS | P.O. BOX 42 TEFEN INDUSTRIAL PARK, 24959 ISRAEL |
| FCC ID | H78KPMATUDI |
| MODEL NUMBER | MATU-DI |
| PRODUCT DESCRIPTION | MINI ALARM TRANSMITTER |
| DATE SAMPLE RECEIVED | 08/09/2019 |
| FINAL TEST DATE | 08/09/2019 |
| TESTED BY | Tim Royer |
| APPROVED BY | Franklin Rose |
| TEST RESULTS | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL |

| Report Number | Report Version | Description | Issue Date |
|-------------------------------|----------------|----------------|------------|
| 2050AUT19 PT90_TestReport_ | Rev1 | Initial Report | 08/09/2019 |
| 2050AUT19 PT90_TestReport_ | Rev2 | Updated FCC ID | 09/10/2019 |

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



Sr. EMC Engineer
 EMC-003838-NE



Name and Title Tim Royer, Project Manager/Testing Engineer

Date 08/09/2019

Reviewed and Approved by:



Name and Title Franklin Rose, Project Manager / EMC Testing Technician

Date 08/20/2019

GENERAL INFORMATION

| | |
|--------------------------------|--|
| EUT Description | MINI ALARM TRANSMITTER |
| FCC ID | H78KPMATUDI |
| Model Number | MATU-DI |
| Operating Frequency | 430.0-470.275 MHz |
| Test Frequencies | 430, 450, 470.275 MHz |
| Type of Emission | 2K34F1D (Narrowband Digital FM) |
| Modulation | FM |
| EUT Power Source | <input type="checkbox"/> 110–120Vac/50– 60Hz |
| | <input checked="" type="checkbox"/> DC Power (13.8 V) |
| | <input type="checkbox"/> Battery Operated Exclusively |
| Test Item | <input type="checkbox"/> Prototype |
| | <input checked="" type="checkbox"/> Pre-Production |
| | <input type="checkbox"/> Production |
| Type of Equipment | <input checked="" type="checkbox"/> Fixed |
| | <input type="checkbox"/> Mobile |
| | <input type="checkbox"/> Portable |
| Antenna Connector | BNC |
| Test Conditions | The temperature was 26°C 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 | ANSI/TIA 603-E:2016, ANSI C63.26 (2015), FCC CFR 47 Part 2, Part 90 |
| Test Facility | Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070 |

RESULTS SUMMARY

| Rule Part No. | Test Item | Results |
|--------------------------------|---|-------------|
| 2.1046(a), 90.205(g), (h), (i) | RF Power Output | PASS |
| 2.1033(c)(4), 90.209(b)(5) | Modulation Characteristics | N/A |
| 2.1047(a) | Audio Frequency Response and Low Filter | N/A |
| 2.1047(b) | Modulation Limiting | N/A |
| 2.1049 (c) | Occupied Bandwidth | PASS |
| 90.210(d)(1), (2) | Emission Masks | PASS |
| 2.1051(a), 90.210(d)(3) | Spurious Emissions at Antenna Terminals | PASS |
| 2.1053(a), 90.210(d)(3) | Field Strength of Spurious Emissions | PASS |
| 2.1055(a)(2), 90.213 | Frequency Stability < 5 ppm | PASS |
| 90.214 | Transient Frequency Response | N/A |

RF POWER OUTPUT

FCC Rule Parts: FCC Part 2.1046(a), 90.205(g), (h), (i)

(g) 421-430 MHz. Limitations on power and antenna heights are specified in §90.279.

(a) Base station authorizations in the 421-430 MHz band will be subject to Effective Radiated Power (ERP) and Effective Antenna Height (EAH) limitations as shown in the table below. ERP is defined as the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction. EAH is calculated by subtracting the Assumed Average Terrain Elevation (AATE) as listed in table 7 of §90.619 from the antenna height above mean sea level.

LIMITS OF EFFECTIVE RADIATED POWER (ERP) CORRESPONDING TO EFFECTIVE ANTENNA HEIGHTS (EAH) OF BASE STATIONS IN THE 421-430 MHz BAND

| Effective antenna height (EAH) in meters (feet) | Maximum effective radiated power (ERP) (watts) |
|---|--|
| 0-152 (0-500) | 250 |
| Above 152-305 (above 500-1000) | 150 |
| Above 305-457 (above 1000-1500) | 75 |
| Above 457-610 (above 1500-2000) | 40 |
| Above 610-762 (above 2000-2500) | 20 |
| Above 762-914 (above 2500-3000) | 15 |
| Above 914-1219 (above 3000-4000) | 10 |
| Above 1219 (above 4000) | 5 |

RF POWER OUTPUT

(h) 450-470 MHz. (1) The maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2. Applicants requesting an ERP in excess of that listed in table 2 must submit an engineering analysis based upon generally accepted engineering practices and standards that includes coverage contours to demonstrate that the requested station parameters will not produce coverage in excess of that which the applicant requires.

(2) Applications for stations where special circumstances exist that make it necessary to deviate from the ERP and antenna heights in Table 2 will be submitted to the frequency coordinator accompanied by a technical analysis, based upon generally accepted engineering practices and standards, that demonstrates that the requested station parameters will not produce a signal strength in excess of 39 dBu at any point along the edge of the requested service area. The coordinator may then recommend any ERP appropriate to meet this condition.

(3) An applicant for a station with a service area radius greater than 32 km (20 mi) must justify the requested service area radius, which may be authorized only in accordance with table 2, note 4. For base stations with service areas greater than 80 km, all operations 80 km or less from the base station will be on a primary basis and all operations outside of 80 km from the base station will be on a secondary basis and will be entitled to no protection from primary operations.

TABLE 2—450-470 MHz—MAXIMUM ERP/REFERENCE HAAT FOR A SPECIFIC SERVICE AREA RADIUS

| | Service area radius (km) | | | | | | | | | |
|---------------------------------------|--------------------------|-----|------|------|------|------|-----------------|-----------------|-----------------|-----------------|
| | 3 | 8 | 13 | 16 | 24 | 32 | 40 ⁴ | 48 ⁴ | 64 ⁴ | 80 ⁴ |
| Maximum ERP (w) ¹ | 2 | 100 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| Up to reference HAAT (m) ³ | 15 | 15 | 15 | 27 | 63 | 125 | 250 | 410 | 950 | 2700 |

¹Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig. 29 (See §73.699, Fig. 10 b).

²Maximum ERP of 500 watts allowed. Signal strength at the service area contour may be less than 39 dBu.

³When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation: $ERP_{allow} = ERP_{max} \times (HAAT_{ref} / HAAT_{actual})^2$.

⁴Applications for this service area radius may be granted upon specific request with justification and must include a technical demonstration that the signal strength at the edge of the service area does not exceed 39 dBu.

(i) 470-512 MHz. Power and height limitations are specified in §§90.307 and 90.309.

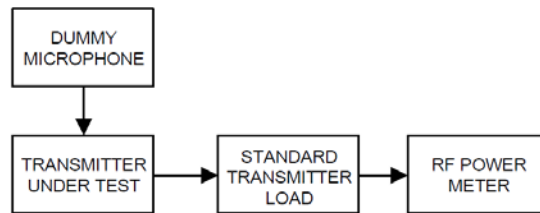
§90.307 Protection criteria.

The tables and figures listed in §90.309 shall be used to determine the effective radiated power (ERP) and antenna height of the proposed land mobile base station and the ERP for the associated control station (control station antenna height shall not exceed 31 meters (100 feet) above average terrain (AAT)).

(c) Mobile units and control stations operating on the frequencies available for land mobile use in any given urbanized area shall afford protection to co-channel and adjacent channel television stations in accordance with the values set forth in table C in §90.309 and paragraph (d) of this section except for channel 15 in New York, NY, and Cleveland, OH, and channel 16 in Detroit, MI, where protection will be in accordance with the values set forth in table D in §90.309 and paragraph (d) of this section.

RF POWER OUTPUT

Method of Measurement: TIA-603-E, 2.2.1



Test Data: Power Measurement Table

| Peak Power Output | |
|-------------------|-------|
| Frequency (MHz) | dBm |
| 430.00 | 31.63 |
| 450 | 32.22 |
| 470.275 | 34.78 |

Part 2.1033 (c) (8) DC Input into Final Amplifier

INPUT POWER: (12 V) (0.45 A) = **5.625 Watts**

Result: Meets Requirements

OCCUPIED BANDWIDTH

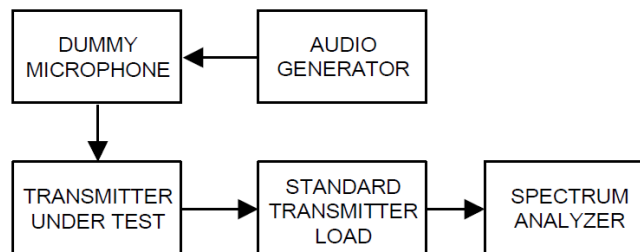
FCC Rule Parts: 2.1049 (c)

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10 dB greater than that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

Method of Measurement: ANSI C63.26, 5.4.4 (using Test Setup from TIA 603-E 2.2.11, below)

Note: The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to ANSI C63.26, 5.4.4, Step e).

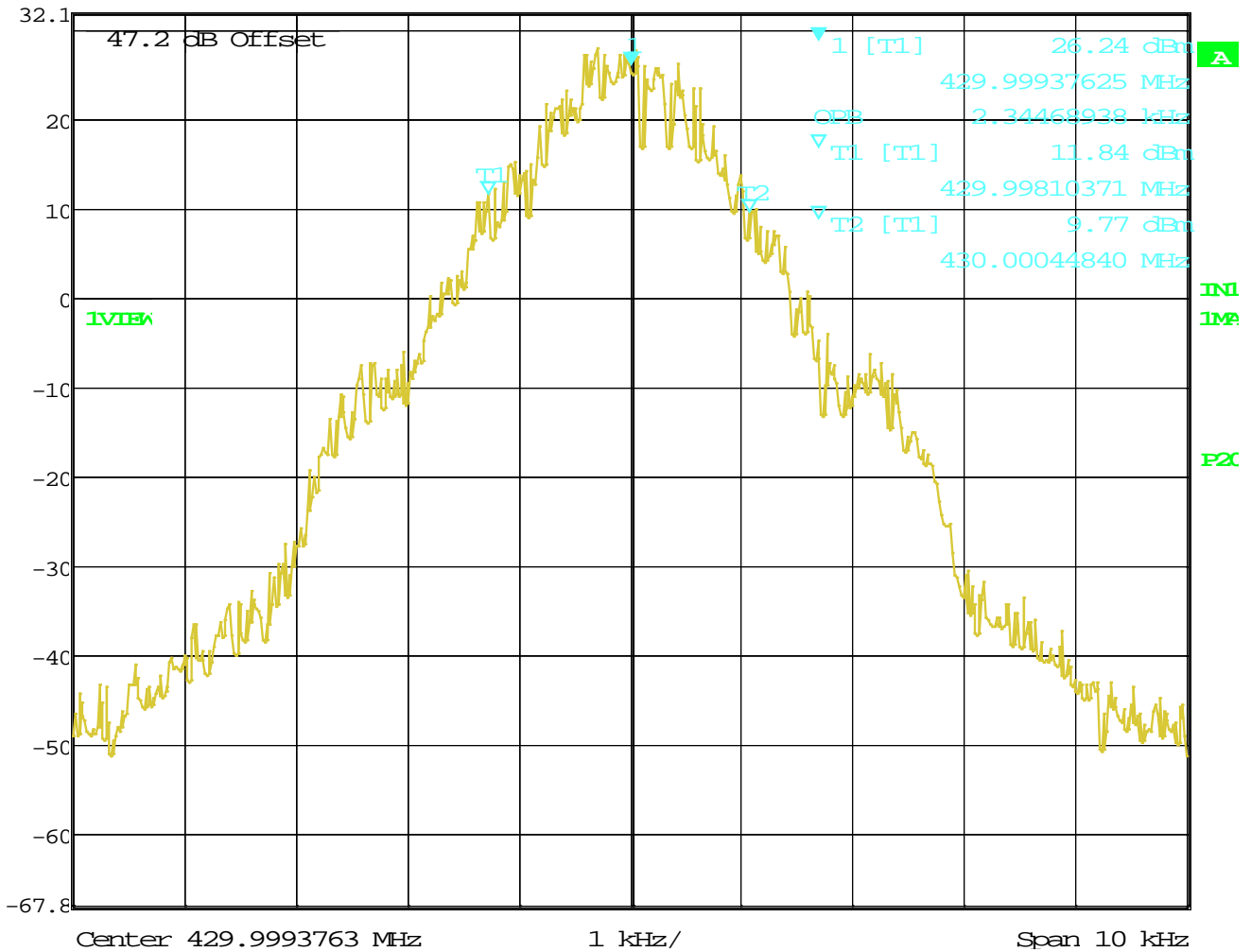


OCCUPIED BANDWIDTH 99%

Test Data: 2K34F1D



| | | | | | |
|----------|------------------|-----|--------|--------|-------|
| Ref Lvl | Marker 1 [T1] | RBW | 100 Hz | RF Att | 30 dB |
| 32.1 dBm | 26.24 dBm | VBW | 5 kHz | | |
| | 429.99937625 MHz | SWT | 5 s | Unit | dBm |



Date: 1.JAN.1997 06:29:51

99% OBW = 2.34 kHz

OCCUPIED BANDWIDTH 99%

EMISSION MASKS

FCC Rule Parts: 90.210(d)(1), (2)

APPLICABLE EMISSION MASKS

| Frequency band (MHz) | Mask for equipment with audio low pass filter | Mask for equipment without audio low pass filter |
|------------------------|---|--|
| 421-512 ^{2,5} | B, D, or E | C, D, or E |

²Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.

⁵Equipment may alternatively meet the Adjacent Channel Power limits of §90.221.

Requirements:

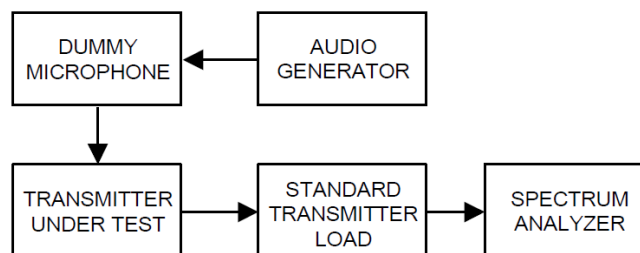
(e) *Emission Mask E—6.25 kHz or less channel bandwidth equipment.* For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3 \text{ kHz})$ or $55 + 10 \log(P)$ or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least $55 + 10 \log(P)$ or 65 dB, whichever is the lesser attenuation.

Method of Measurement: ANSI C63.26, 5.4.4 (using Test Setup from TIA 603-E 2.2.11, below)

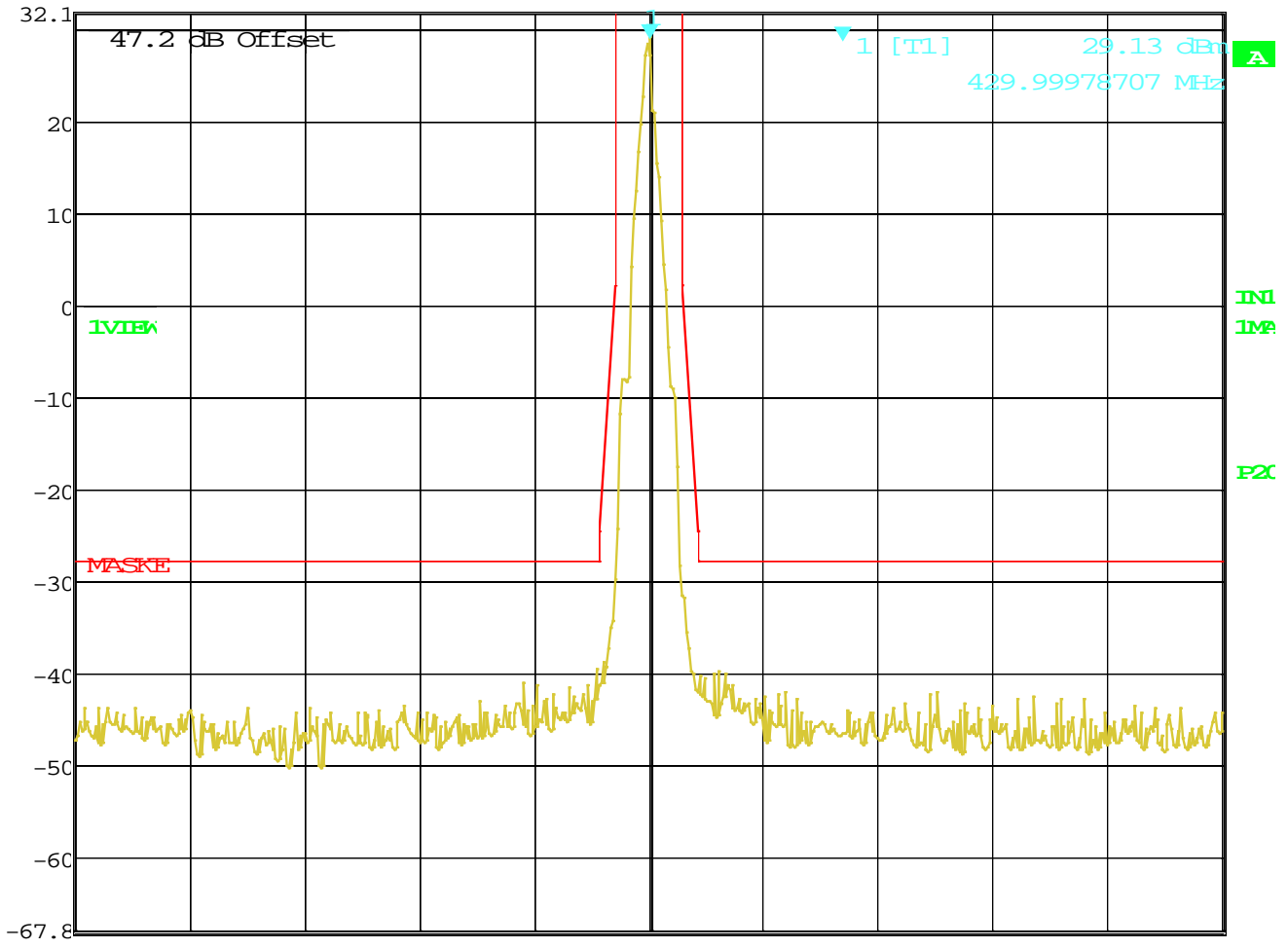


EMISSION MASK E - NARROWBAND FM (6.25 kHz)

Test Data: 430 MHz



| | | | | | |
|----------|------------------|-----|--------|--------|-------|
| Ref Lvl | Marker 1 [T1] | RBW | 100 Hz | RF Att | 30 dB |
| 32.1 dBm | 29.13 dBm | VBW | 5 kHz | | |
| | 429.99978707 MHz | SWT | 54 s | Unit | dBm |



Center 429.9997871 MHz 10.625 kHz/ Span 106.25 kHz

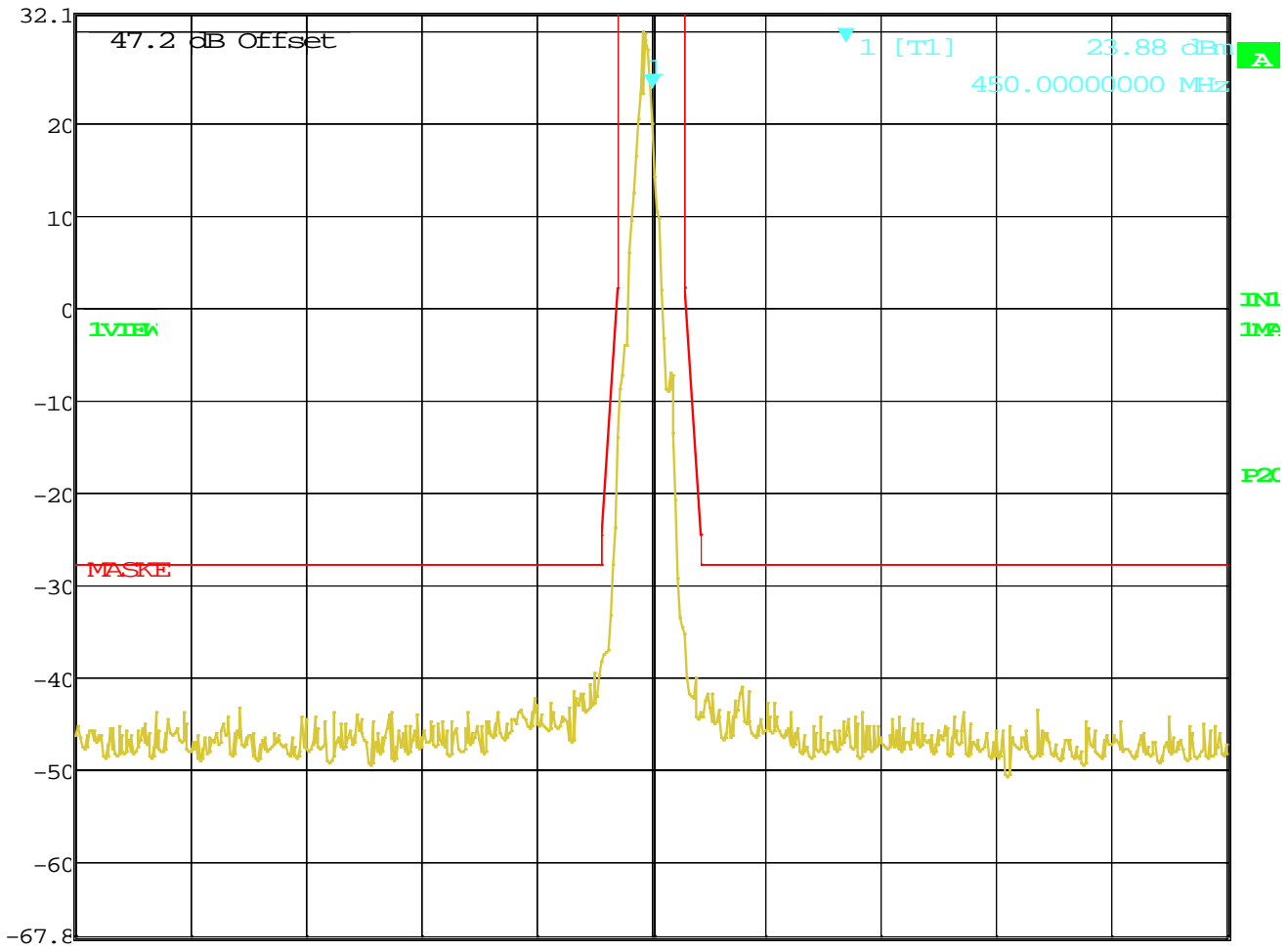
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EMISSION MASK E

Test Data: 450 MHz



| | | | | | |
|----------|-----------------|-----|--------|--------|-------|
| Ref Lvl | Marker 1 [T1] | RBW | 100 Hz | RF Att | 30 dB |
| 32.1 dBm | 23.88 dBm | VBW | 5 kHz | | |
| | 450.0000000 MHz | SWT | 54 s | Unit | dBm |



Center 450 MHz 10.625 kHz/ Span 106.25 kHz

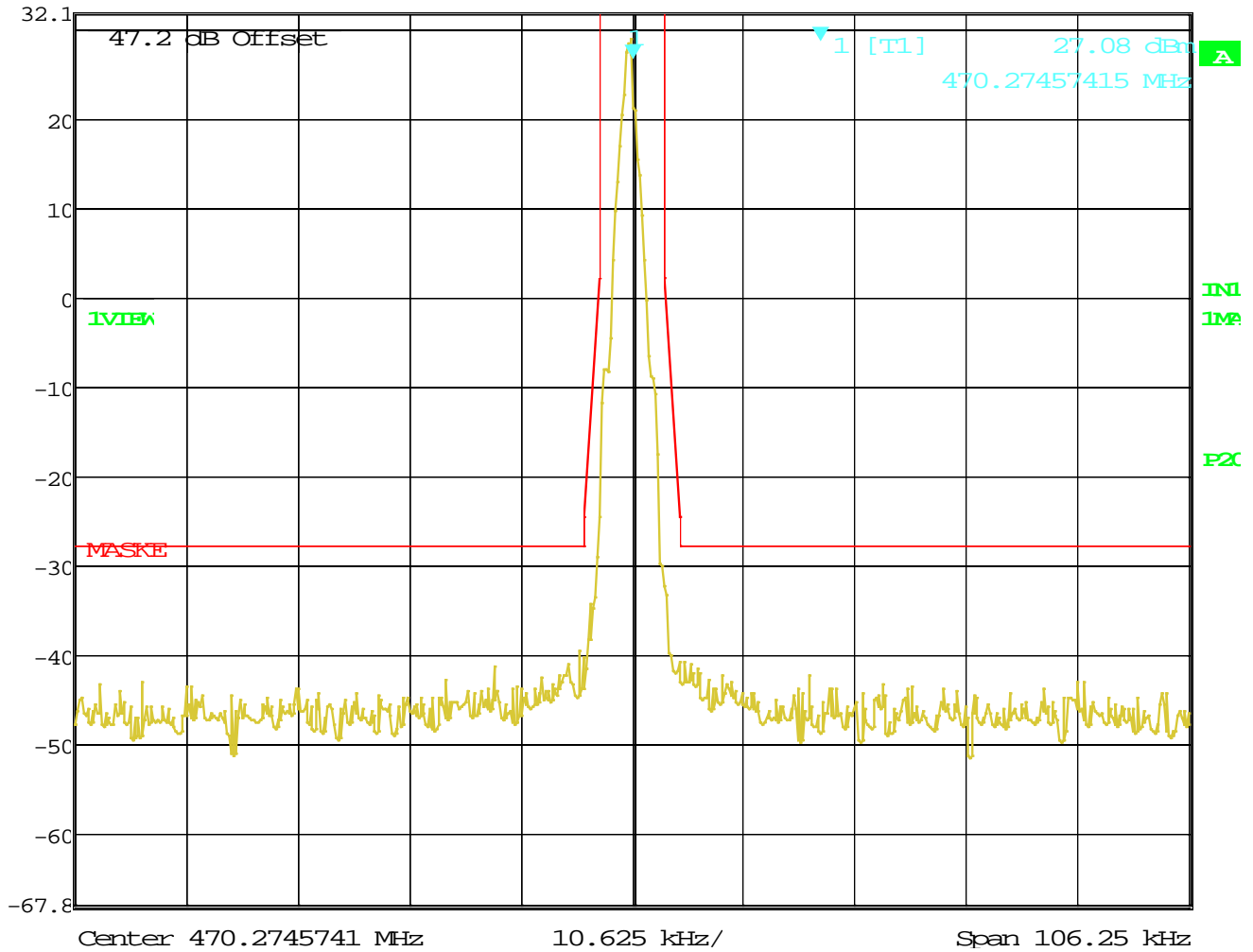
Date: 1.JAN.1997 04:08:39

EMISSION MASK E

Test Data: 470.275 MHz



| | | | | | | | |
|---------|----------|---------------|------------------|-----|--------|--------|-------|
| Ref Lvl | 32.1 dBm | Marker 1 [T1] | 27.08 dBm | RBW | 100 Hz | RF Att | 30 dB |
| | | | 470.27457415 MHz | VBW | 5 kHz | Unit | dBm |
| | | | | SWT | 54 s | | |



Date: 1.JAN.1997 03:59:59

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

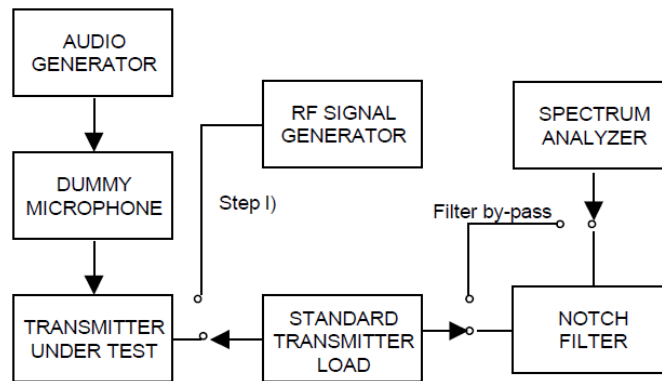
FCC Rule Parts: FCC Part 2.1051(a), 90.210(d)(3)

Requirements:

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

Method of Measurement: ANSI/TIA-603-E

Test Procedure: TIA 603-E, 2.2.13



SPURIOUS EMISSIONS - NARROWBAND FM

Test Data: 430 MHz

| Spurious Conducted Emissions, Narrowband FM (6.25 kHz), Mask E Limit ($\geq 250\%$ Authorized BW) | | High Power | |
|--|------------|-------------|--------------|
| | | dBm | 31.63 |
| | | Watts | 1.46 |
| | | Limit (dBm) | -20 |
| Frequency (MHz) | Peak (dBm) | Margin (dB) | |
| Fundamental | 430.0000 | 31.63 | 0.00 |
| 2nd Harmonic | 860.0000 | -30.91 | 10.91 |
| 3rd Harmonic | 1290.0000 | -55.12 | 35.12 |
| 4th Harmonic | 1720.0000 | -54.06 | 34.06 |
| 5th Harmonic | 2150.0000 | -37.22 | 17.22 |
| 6th Harmonic | 2580.0000 | -44.17 | 24.17 |
| 7th Harmonic | 3010.0000 | -37.91 | 17.91 |
| 8th Harmonic | 3440.0000 | -46.18 | 26.18 |
| 9th Harmonic | 3870.0000 | -42.92 | 22.92 |
| 10th Harmonic | 4300.0000 | -37.78 | 17.78 |

* Indicates Noise Floor of Measurement

Result: Meets Requirement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 450 MHz

| | | |
|---|--------------------|--------------------|
| Spurious Conducted Emissions, Narrowband FM (6.25 kHz), Mask E Limit (≥250% Authorized BW) | dBm | 32.22 |
| | Watts | 1.67 |
| | Limit (dBm) | -20 |
| Frequency (MHz) | Peak (dBm) | Margin (dB) |
| Fundamental 450.0000 | 32.22 | 0.00 |
| 2nd Harmonic 900.0000 | -41.86 | 21.86 |
| 3rd Harmonic 1350.0000 | -47.85 | 27.85 |
| 4th Harmonic 1800.0000 | -53.11 | 33.11 |
| 5th Harmonic 2250.0000 | -47.66 | 27.66 |
| 6th Harmonic 2700.0000 | -42.17 | 22.17 |
| 7th Harmonic 3150.0000 | -44.89 | 24.89 |
| 8th Harmonic 3600.0000 | -48.08 | 28.08 |
| 9th Harmonic 4050.0000 | -40.59 | 20.59 |
| 10th Harmonic 4500.0000 | -41.32 | 21.32 |

* Indicates Noise Floor of Measurement

Result: Meets Requirement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 470.275 MHz

| | | |
|---|--------------------|--------------------|
| Spurious Conducted Emissions, Narrowband FM (6.25 kHz), Mask E Limit (≥250% Authorized BW) | dBm | 34.78 |
| | Watts | 3.01 |
| | Limit (dBm) | -20 |
| Frequency (MHz) | Peak (dBm) | Margin (dB) |
| Fundamental 470.2750 | 34.78 | 0.00 |
| 2nd Harmonic 940.5500 | -46.68 | 26.68 |
| 3rd Harmonic 1410.8250 | -37.78 | 17.78 |
| 4th Harmonic 1881.1000 | -45.41 | 25.41 |
| 5th Harmonic 2351.3750 | -55.56 | 35.56 |
| 6th Harmonic 2821.6500 | -44.14 | 24.14 |
| 7th Harmonic 3291.9250 | -52.38 | 32.38 |
| 8th Harmonic 3762.2000 | -50.85 | 30.85 |
| 9th Harmonic 4232.4750 | -47.09 | 27.09 |
| 10th Harmonic 4702.7500 | -44.86 | 24.86 |

* Indicates Noise Floor of Measurement

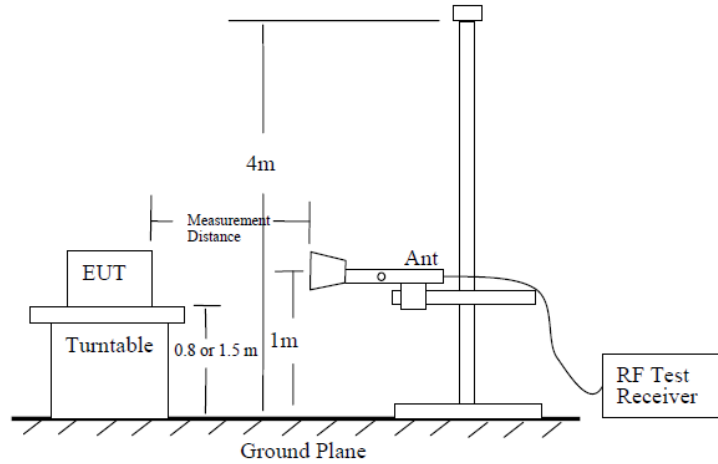
Result: Meets Requirement

FIELD STRENGTH OF SPURIOUS EMISSIONS

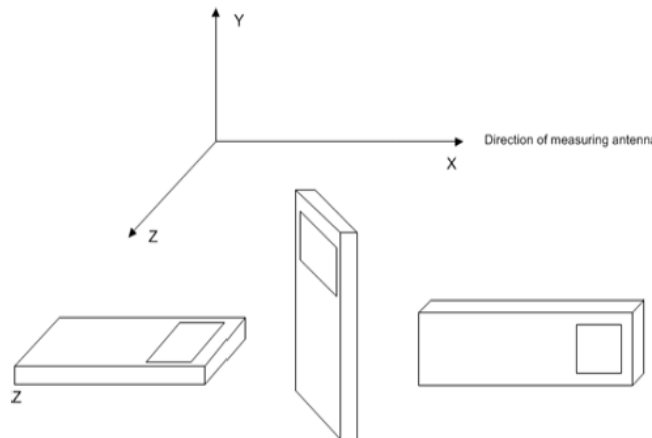
FCC Rule Parts: FCC Part 2.1053(a), 90.210(d)(3)

Method of Measurement: ANSI C63.26, 5.5.4

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: 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: 430 MHz

| Power Output | | Limit | | | | | | | | |
|--------------|-------|-------|--------|--|--|--|--|--|--|--|
| dBm | Watts | dBc | dBm | | | | | | | |
| 34.78 | 3.01 | 54.78 | -20.00 | | | | | | | |

| 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) |
|-----------------------|--------------------------|----------------------|------------------|----------------|--------------------------|-------------------------|--------------|-------------------------|-----------|-------------|
| 430.00 | 860.00 | 14.07 | V | 3.49 | 22.20 | 39.76 | 3.000 | 39.760 | -57.617 | 37.62 |
| 430.00 | 860.00 | 12.66 | H | 3.49 | 22.20 | 38.35 | 3.000 | 38.350 | -59.027 | 39.03 |
| 430.00 | 1290.00 | 20.45 | H | 4.10 | 28.63 | 53.18 | 3.000 | 53.176 | -44.201 | 24.20 |
| 430.00 | 1290.00 | 19.36 | V | 4.10 | 28.63 | 52.09 | 3.000 | 52.086 | -45.291 | 25.29 |
| 430.00 | 1720.00 | 21.30 | V | 4.81 | 29.33 | 55.44 | 3.000 | 55.436 | -41.941 | 21.94 |
| 430.00 | 1720.00 | 16.61 | H | 4.81 | 29.33 | 50.75 | 3.000 | 50.746 | -46.631 | 26.63 |
| 430.00 | 2150.00 | 17.45 | H | 5.36 | 31.24 | 54.05 | 3.000 | 54.054 | -43.323 | 23.32 |
| 430.00 | 2150.00 | 13.56 | V | 5.36 | 31.24 | 50.16 | 3.000 | 50.164 | -47.213 | 27.21 |
| 430.00 | 2580.00 | 13.70 | V | 5.76 | 32.49 | 51.95 | 3.000 | 51.951 | -45.426 | 25.43 |
| 430.00 | 2580.00 | 14.10 | H | 5.76 | 32.49 | 52.35 | 3.000 | 52.351 | -45.026 | 25.03 |
| 430.00 | 3010.00 | 15.86 | H | 6.33 | 32.55 | 54.74 | 3.000 | 54.741 | -42.636 | 22.64 |
| 430.00 | 3010.00 | 16.14 | V | 6.33 | 32.55 | 55.02 | 3.000 | 55.021 | -42.356 | 22.36 |
| 430.00 | 3440.00 | 15.00 | V | 6.82 | 32.61 | 54.43 | 3.000 | 54.434 | -42.944 | 22.94 |
| 430.00 | 3440.00 | 14.52 | H | 6.82 | 32.61 | 53.95 | 3.000 | 53.954 | -43.424 | 23.42 |
| 430.00 | 3870.00 | 15.75 | H | 6.82 | 33.21 | 55.78 | 3.000 | 55.779 | -41.598 | 21.60 |
| 430.00 | 3870.00 | 14.39 | V | 6.82 | 33.21 | 54.42 | 3.000 | 54.419 | -42.958 | 22.96 |
| 430.00 | 4300.00 | 15.74 | V | 7.23 | 33.46 | 56.43 | 3.000 | 56.432 | -40.945 | 20.95 |
| 430.00 | 4300.00 | 16.31 | H | 7.23 | 33.46 | 57.00 | 3.000 | 57.002 | -40.375 | 20.38 |

Result: Meets Requirement

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 450 MHz

| Power Output | | Limit | | | | | | | | |
|-----------------------|--------------------------|----------------------|------------------|----------------|--------------------------|-------------------------|--------------|-------------------------|-----------|-------------|
| dBm | Watts | dBc | dBm | | | | | | | |
| 34.78 | 3.01 | 54.78 | -20.00 | | | | | | | |
| 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) |
| 450.00 | 900.00 | 21.94 | H | 3.54 | 21.70 | 47.18 | 3.000 | 47.180 | -50.197 | 30.20 |
| 450.00 | 900.00 | 24.46 | V | 3.54 | 21.70 | 49.70 | 3.000 | 49.700 | -47.677 | 27.68 |
| 450.00 | 900.00 | 22.75 | V | 3.54 | 21.70 | 47.99 | 3.000 | 47.990 | -49.387 | 29.39 |
| 450.00 | 900.00 | 20.50 | H | 3.54 | 21.70 | 45.74 | 3.000 | 45.740 | -51.637 | 31.64 |
| 450.00 | 1350.00 | 19.32 | H | 4.24 | 28.76 | 52.32 | 3.000 | 52.320 | -45.057 | 25.06 |
| 450.00 | 1350.00 | 26.03 | V | 4.24 | 28.76 | 59.03 | 3.000 | 59.030 | -38.347 | 18.35 |
| 450.00 | 1800.00 | 18.34 | V | 4.91 | 30.29 | 53.54 | 3.000 | 53.542 | -43.835 | 23.84 |
| 450.00 | 1800.00 | 17.50 | H | 4.91 | 30.29 | 52.70 | 3.000 | 52.702 | -44.675 | 24.68 |
| 450.00 | 2250.00 | 13.92 | H | 5.42 | 31.23 | 50.57 | 3.000 | 50.570 | -46.807 | 26.81 |
| 450.00 | 2250.00 | 17.12 | V | 5.42 | 31.23 | 53.77 | 3.000 | 53.770 | -43.607 | 23.61 |
| 450.00 | 2700.00 | 18.42 | V | 5.99 | 32.51 | 56.92 | 3.000 | 56.920 | -40.457 | 20.46 |
| 450.00 | 2700.00 | 15.09 | H | 5.99 | 32.51 | 53.59 | 3.000 | 53.590 | -43.787 | 23.79 |
| 450.00 | 3150.00 | 15.18 | H | 6.50 | 32.78 | 54.46 | 3.000 | 54.458 | -42.919 | 22.92 |
| 450.00 | 3150.00 | 15.09 | V | 6.50 | 32.78 | 54.37 | 3.000 | 54.368 | -43.009 | 23.01 |
| 450.00 | 3600.00 | 15.35 | V | 6.67 | 33.11 | 55.13 | 3.000 | 55.130 | -42.247 | 22.25 |
| 450.00 | 3600.00 | 13.40 | H | 6.67 | 33.11 | 53.18 | 3.000 | 53.180 | -44.197 | 24.20 |
| 450.00 | 4050.00 | 16.21 | H | 7.18 | 33.38 | 56.77 | 3.000 | 56.774 | -40.603 | 20.60 |
| 450.00 | 4050.00 | 14.54 | V | 7.18 | 33.38 | 55.10 | 3.000 | 55.104 | -42.273 | 22.27 |
| 450.00 | 4500.00 | 16.99 | V | 7.32 | 33.89 | 58.20 | 3.000 | 58.200 | -39.177 | 19.18 |
| 450.00 | 4500.00 | 14.59 | H | 7.32 | 33.89 | 55.80 | 3.000 | 55.800 | -41.577 | 21.58 |

Result: Meets Requirement

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 470.275 MHz

| Power Output | | Limit | | | | | | | | |
|-----------------------|--------------------------|----------------------|------------------|----------------|--------------------------|-------------------------|--------------|-------------------------|-----------|-------------|
| dBm | Watts | dBc | dBm | | | | | | | |
| 34.78 | 3.01 | 54.78 | -20.00 | | | | | | | |
| 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) |
| 470.28 | 940.60 | 20.96 | H | 3.59 | 22.60 | 47.15 | 3,000 | 47.151 | -50.226 | 30.23 |
| 470.28 | 940.60 | 22.21 | V | 3.59 | 22.60 | 48.40 | 3,000 | 48.401 | -48.976 | 28.98 |
| 470.28 | 1410.80 | 19.17 | H | 4.35 | 28.38 | 51.90 | 3,000 | 51.904 | -45.473 | 25.47 |
| 470.28 | 1410.80 | 16.93 | V | 4.35 | 28.38 | 49.66 | 3,000 | 49.664 | -47.713 | 27.71 |
| 470.28 | 1881.10 | 14.39 | V | 5.03 | 30.95 | 50.37 | 3,000 | 50.367 | -47.010 | 27.01 |
| 470.28 | 1881.10 | 16.50 | H | 5.03 | 30.95 | 52.48 | 3,000 | 52.477 | -44.900 | 24.90 |
| 470.28 | 2351.40 | 17.23 | H | 5.58 | 31.92 | 54.73 | 3,000 | 54.732 | -42.645 | 22.64 |
| 470.28 | 2351.40 | 13.82 | V | 5.58 | 31.92 | 51.32 | 3,000 | 51.322 | -46.055 | 26.05 |
| 470.28 | 2821.70 | 18.52 | V | 6.15 | 32.42 | 57.09 | 3,000 | 57.093 | -40.284 | 20.28 |
| 470.28 | 2821.70 | 13.28 | H | 6.15 | 32.42 | 51.85 | 3,000 | 51.853 | -45.524 | 25.52 |
| 470.28 | 3291.90 | 15.12 | H | 6.68 | 32.63 | 54.43 | 3,000 | 54.427 | -42.950 | 22.95 |
| 470.28 | 3291.90 | 13.32 | V | 6.68 | 32.63 | 52.63 | 3,000 | 52.627 | -44.750 | 24.75 |
| 470.28 | 3762.20 | 14.40 | V | 8.73 | 33.13 | 56.26 | 3,000 | 56.263 | -41.114 | 21.11 |
| 470.28 | 3762.20 | 13.79 | H | 8.73 | 33.13 | 55.65 | 3,000 | 55.653 | -41.724 | 21.72 |
| 470.28 | 4232.50 | 13.45 | H | 7.16 | 33.33 | 53.94 | 3,000 | 53.945 | -43.433 | 23.43 |
| 470.28 | 4232.50 | 13.75 | V | 7.16 | 33.33 | 54.24 | 3,000 | 54.245 | -43.133 | 23.13 |
| 470.28 | 4702.80 | 14.80 | V | 7.17 | 33.88 | 55.85 | 3,000 | 55.848 | -41.529 | 21.53 |
| 470.28 | 4702.80 | 14.62 | H | 7.17 | 33.88 | 55.67 | 3,000 | 55.668 | -41.709 | 21.71 |

Result: Meets Requirement

FREQUENCY STABILITY

FCC Rule Parts: FCC Part 2.1055(a)(2), 90.213

MINIMUM FREQUENCY STABILITY

[Parts per million (ppm)]

| Frequency range (MHz) | Fixed and base stations | Mobile stations | |
|-----------------------|-------------------------|---------------------------|------------------------------|
| | | Over 2 watts output power | 2 watts or less output power |
| 421-512 | 7 11 14 _{2,5} | 8 ₅ | 8 ₅ |

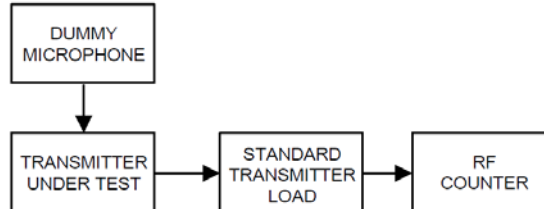
⁷In the 421-512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm.

⁸In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

¹¹Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.

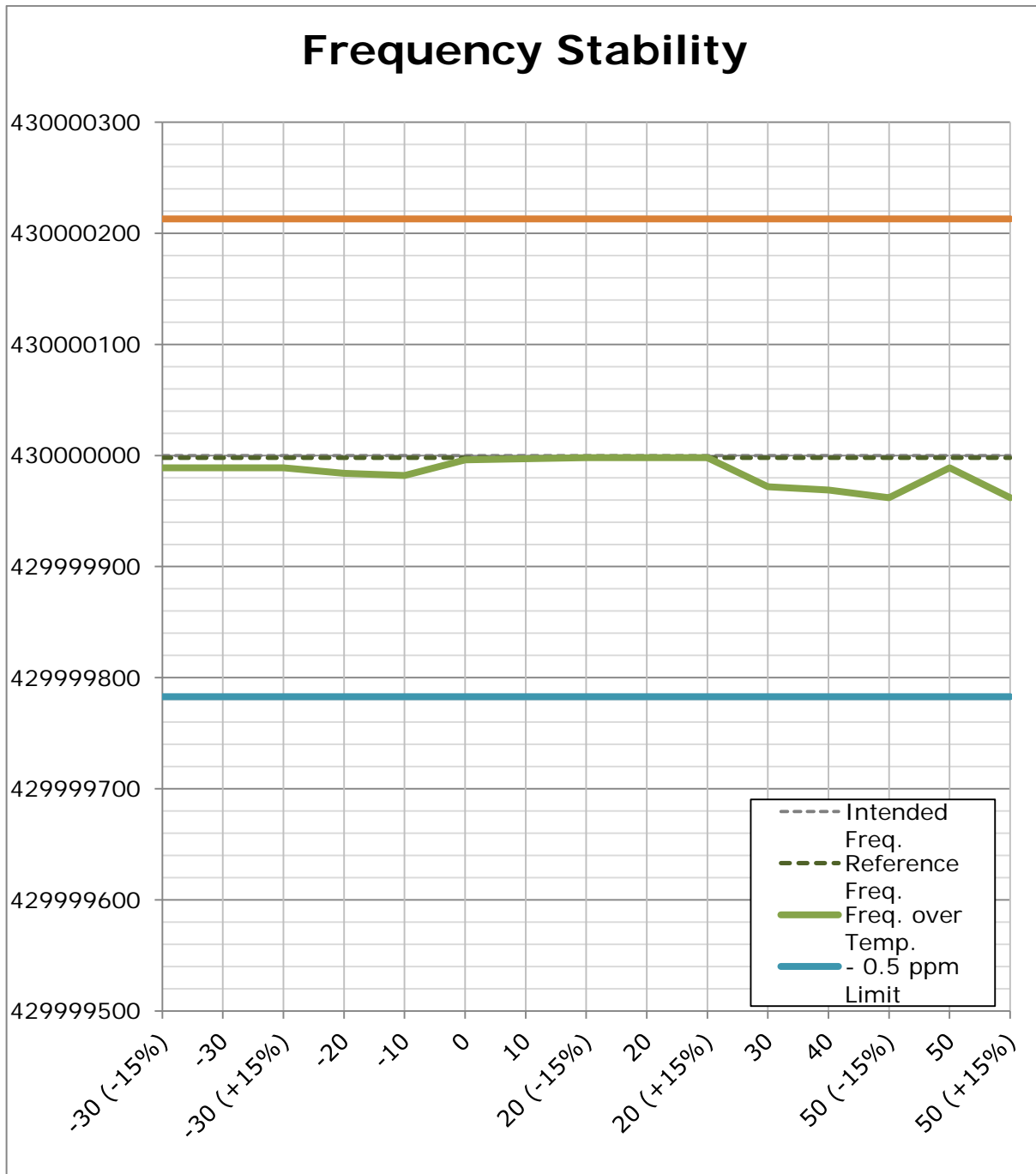
¹⁴Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

Method of Measurements: TIA 603-E, 2.2.2



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Plot



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Table

| 430 MHz | | | | |
|----------------------|------------------------|-------------------------|-----------------------------------|----------------|
| Limit: | | 0.5 | ppm | |
| Temperature (°C) | Supplied Voltage (VDC) | Intended Frequency (Hz) | Measured Reference Frequency (Hz) | Deviation (Hz) |
| 20°C (reference) | 12 | 430000000 | 429999998 | 2 |
| @ 20°C (reference) | | | | |
| Supplied Voltage (%) | Supplied Voltage (VDC) | Frequency (Hz) | Deviation (Hz) | PPM |
| -15% | 10.20 | 429999998 | 0 | 0.000 |
| 15% | 13.80 | 429999998 | 0 | 0.000 |
| @ -30°C | | | | |
| Supplied Voltage (%) | Supplied Voltage (VDC) | Frequency (Hz) | Deviation (Hz) | PPM |
| -15% | 10.20 | 429999989 | 9 | 0.021 |
| 15% | 13.80 | 429999989 | 9 | 0.021 |
| @ 50°C | | | | |
| Supplied Voltage (%) | Supplied Voltage (VDC) | Frequency (Hz) | Deviation (Hz) | PPM |
| -15% | 10.20 | 429999962 | 36 | 0.084 |
| 15% | 13.80 | 429999962 | 36 | 0.084 |
| Temperature (°C) | Supplied Voltage (VDC) | Frequency (Hz) | Deviation (Hz) | PPM |
| 50 | 12 | 429999962 | 36.00000 | 0.084 |
| 40 | 12 | 429999969 | 29.00000 | 0.067 |
| 30 | 12 | 429999972 | 26.00000 | 0.060 |
| 20 | 12 | 429999998 | 0.00000 | 0.000 |
| 10 | 12 | 429999997 | 1.00000 | 0.002 |
| 0 | 12 | 429999996 | 2.00000 | 0.005 |
| -10 | 12 | 429999982 | 16.00000 | 0.037 |
| -20 | 12 | 429999984 | 14.00000 | 0.033 |
| -30 | 12 | 429999989 | 9.00000 | 0.021 |

RESULT: Meets 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. | ±1.88% | |
| Within 6kHz and 25kHz of audio Freq. | ±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-0065-01 Black DC-2G | Belden | | BMBM-0065-01 | 07/18/18 | 07/18/20 |
| Antenna: Biconical 1057 | Eaton | 94455-1 | 1057 | 12/13/17 | 12/13/19 |
| Antenna: Log-Periodic 1122 | Electro-Metrics | LPA-25 | 1122 | 08/26/17 | 08/26/19 |
| Temperature Chamber LARGE | Tenney Engineering | TTRC | 11717-7 | N/A | N/A |
| Frequency Counter Small Chamber | HP | 5385A | 3242A07460 | 08/22/17 | 08/22/19 |
| 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 | 12/31/17 | 12/31/19 |
| Antenna: Double-Ridged Horn/ETS Horn 2 | ETS-Lindgren | 3117 | 00041534 | 03/01/17 | 03/01/20 |
| Software: Field Strength Program | Timco | N/A | Version 4.10.7.0 | N/A | N/A |
| Type K J Thermometer | Martel | 303 | 080504494 | 11/02/17 | 11/02/19 |
| EMI Test Receiver R & S ESIB 40 | Rohde & Schwarz | ESIB 40 | 100274 | 08/18/16 | 08/18/19 |
| EMI Test Receiver R & S ESU 40 | Rohde & Schwarz | ESU 40 | 100320 | 04/01/16 | 04/01/20 |
| Bore-sight Antenna Positioning Tower | Sunol Sciences | TLT2 | N/A | N/A | N/A |
| Tunable Notch Filter 250-850 MHz | Eagle | TNF-200 | 250-850 MHz (#19) | 11/19/17 | 11/19/19 |
| Terminator N 20W DC-18G | Narda | 8205 | #14 | 04/06/17 | 04/06/20 |
| DC Power Supply | HP | 6286A | 1744A03842 | N/A | N/A |

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT