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TIMCO ENGINEERING, Inc.

An IIA Company

C2PC Test Report

APPLICANT	RADIO ACTIVITY S.R.L
ADDRESS	VIA PRIVATA CASCIA, 11 MILANO 20128 ITALY
FCC ID	Y9M-KA160
MODEL NUMBER	KA-160
PRODUCT DESCRIPTION	VHF BASE STATION
DATE SAMPLE RECEIVED	12/04/2018
FINAL TEST DATE	12/06/2018
TESTED BY	Tim Royer
APPROVED BY	Franklin Rose
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Report Version	Description	Issue Date
2059UT18_C2PC TestReport_	Rev0	Initial Issue	12/06/2018
	Rev1	Initial Issue with updates	01/04/2019

TABLE OF CONTENTS

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

Test

Sr. EMC Engineer
EMC-003838-NE

Name and Title	Tim Royer, Project Manager / EMC Testing Engineer
Date	12/6/2018

Reviewed and Approved by:

Name and Title	Franklin Rose, Project Manager / EMC Testing Technician
Date	12/10/2018

GENERAL INFORMATION

EUT Description	VHF BASE STATION
FCC ID	Y9M-KA160
Model Number	KA-160
Operating Frequency	150 – 174 MHz
Type of Emission	7K60FXE/FXD, 8K10F1E/F1D
Modulation	Digital
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☒ DC Power (12 V)
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable
Antenna Connector	BNC
Test Conditions	The temperature was 26ºC Relative humidity of 50%.
Modification to the EUT	None.
Test Exercise	The EUT was operated according to the User Manual.
Applicable Standards	ANSI C63.10; Referencing ANSI C63.26, TIA 603-E:2016, Part 2, Part 90
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070; IC Test Site: 2056-A

RESULTS SUMMARY

Applied Rule Part	Test Description	Result
2.1049 (c)	Occupied Bandwidth	**PASS**
90.210(b)(1), (2); (d)(1), (2)	Emission Mask	**PASS**
2.1053(a), 90.210(e)(3); (d)(3)	Spurious Emissions at Antenna Terminals	**PASS**

MODULATION CHARACTERISTICS, P25 & DMR SIGNALS

FCC Rule Parts: Part 2.1033(c)(4), 90.209(b)(5)

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
150-174	[1]7.5	[1 3]20/11.25/6

[1]For stations authorized on or after August 18, 1995.

[2]Bandwidths for radiolocation stations in the 420-450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis.

[3]Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of §90.203(j)(3).

[6]Operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the Adjacent Channel Power limits of §90.221.

8K10F1E/F1D (P25) Bandwidth Calculation

$Bn = (R/\log_2 S) + 2DK$
$Bn = (9600/\log_2(4)) + 2(1800)(0.916)$
$Bn = 4800 + 3298$
$Bn = 8.10$ kHz

Where:

R (data rate) = 9600 bps
D (peak deviation) = 1800 Hz
S (symbols) = 4
K (constant) = 0.916

Necessary Bandwidth for 8K10F1E/F1D = **8.10 kHz**

RESULT: 90.209(b)(5) Necessary Bandwidth for 8K10F1E/F1D = 8.10 kHz

MODULATION CHARACTERISTICS, P25 & DMR SIGNALS

7K60FXE/FXD (DMR) Bandwidth Calculation

Bn = (R/log2S) + 2DK
Bn = (9600/log2(4)) + 2(1800)(0.905)
Bn = (4800 + 3600) * 0.905
Bn = 7.602 kHz

Where:

R = baud rate (9600)
D = deviation kHz (1800 Hz)
S = signaling states (4)
K = constant (0.905)

RESULT: 90.209(b)(5) Necessary Bandwidth for 7K60FXE/FXD = 7.60 kHz

OCCUPIED BANDWIDTH

Rule Part: RSS-119 5.5, 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.

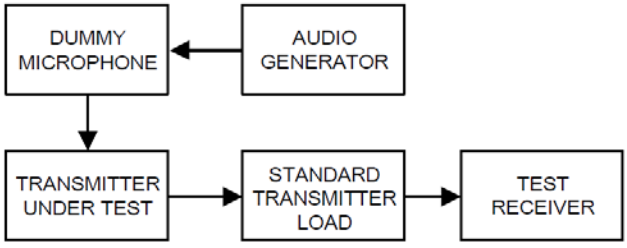
(2) Single sideband transmitters in A3A or A3J emission modes—when modulated by two tones at frequencies of 400 Hz and 1800 Hz (for 3.0 kHz authorized bandwidth), or 500 Hz and 2100 Hz (for 3.5 kHz authorized bandwidth), or 500 Hz and 2400 Hz (for 4.0 kHz authorized bandwidth), applied simultaneously. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(3) Single sideband transmitters in the A3H emission mode—when modulated by one tone at a frequency of 1500 Hz (for 3.0 kHz authorized bandwidth), or 1700 Hz (for 3.5 kHz authorized bandwidth), or 1900 Hz (for 4.0 kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency signal component equal in magnitude to the magnitude of the carrier in this mode.

(4) As an alternative to paragraphs (c) (2) and (3) of this section, other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However, any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the −25 dB step of the emission bandwidth limitation curve, the seventh and ninth order products must fall within the −35 dB step of the referenced curve and the eleventh and all higher order products must fall beyond the −35 dB step of the referenced curve.

(5) Independent sideband transmitters having two channels—when modulated by 1700 Hz tones applied simultaneously to both channels. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

Test Procedure: ANSI C63.10 s 6.9.3 (using test setup from TIA 603-E 2.2.11)



Note: The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to ANSI C63.10 s 6.9.3, step g.

Measurement Parameter Calculation:

99% OBW (kHz)	Min RBW (kHz)	Max RBW (kHz)	Min Span (kHz)	Max Span (kHz)
8.110	0.081	0.406	16.220	40.550

Test Data: **99% Occupied Bandwidth Table** (P25)

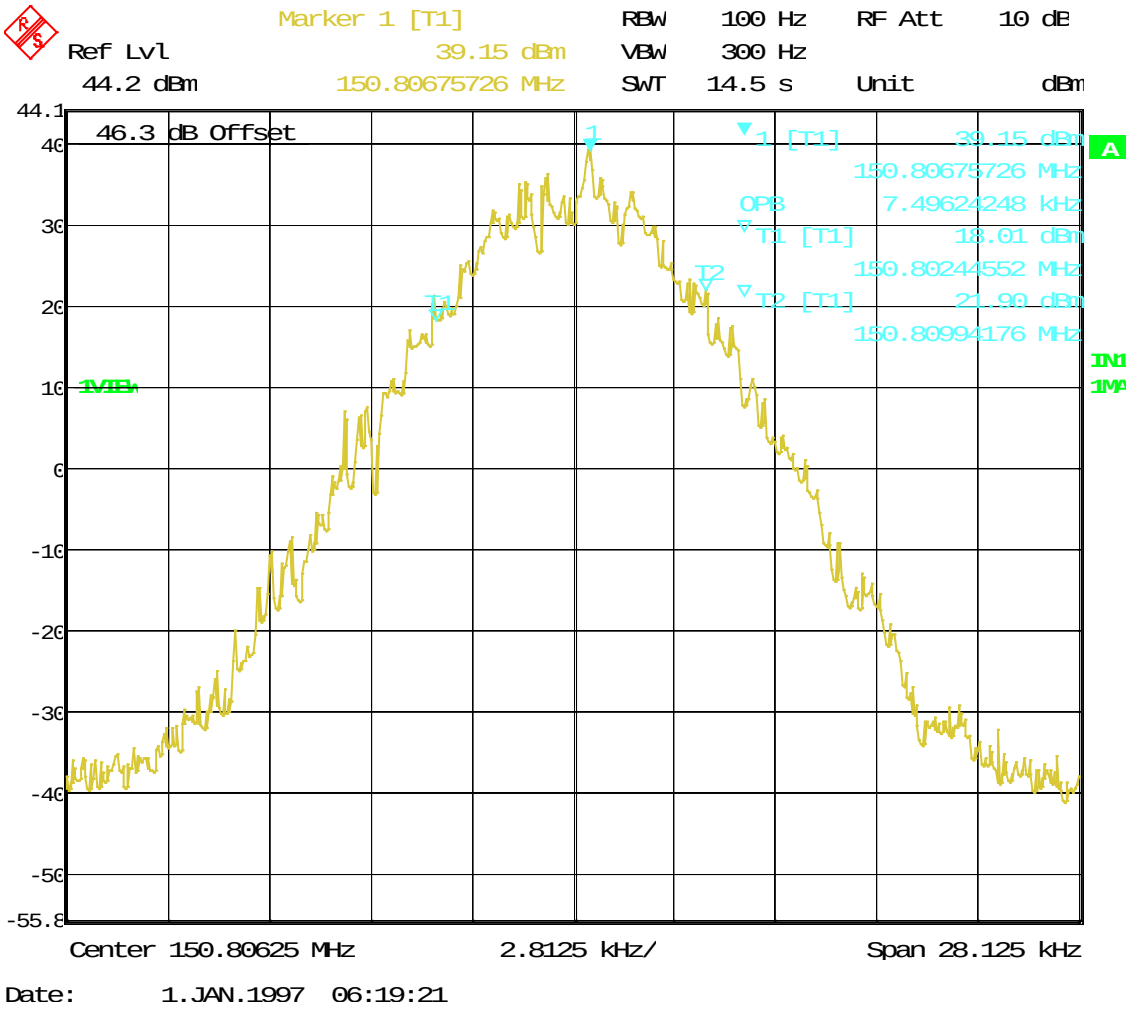
Frequency (MHz)	99% OBW (kHz)	Limit (kHz)	Margin (kHz)
150.8063	7.49	11.3	3.76
162.0000	7.11	11.3	4.14
173.9938	8.81	11.3	2.44

Test Data: **99% Occupied Bandwidth Table** (DMR)

Frequency (MHz)	99% OBW (kHz)	Limit (kHz)	Margin (kHz)
150.8063	8.17	11.3	3.08
162.0000	8.01	11.3	3.24
173.9938	7.96	11.3	3.29

OCCUPIED BANDWIDTH

Test Data: C4FM, 150.80625 MHz

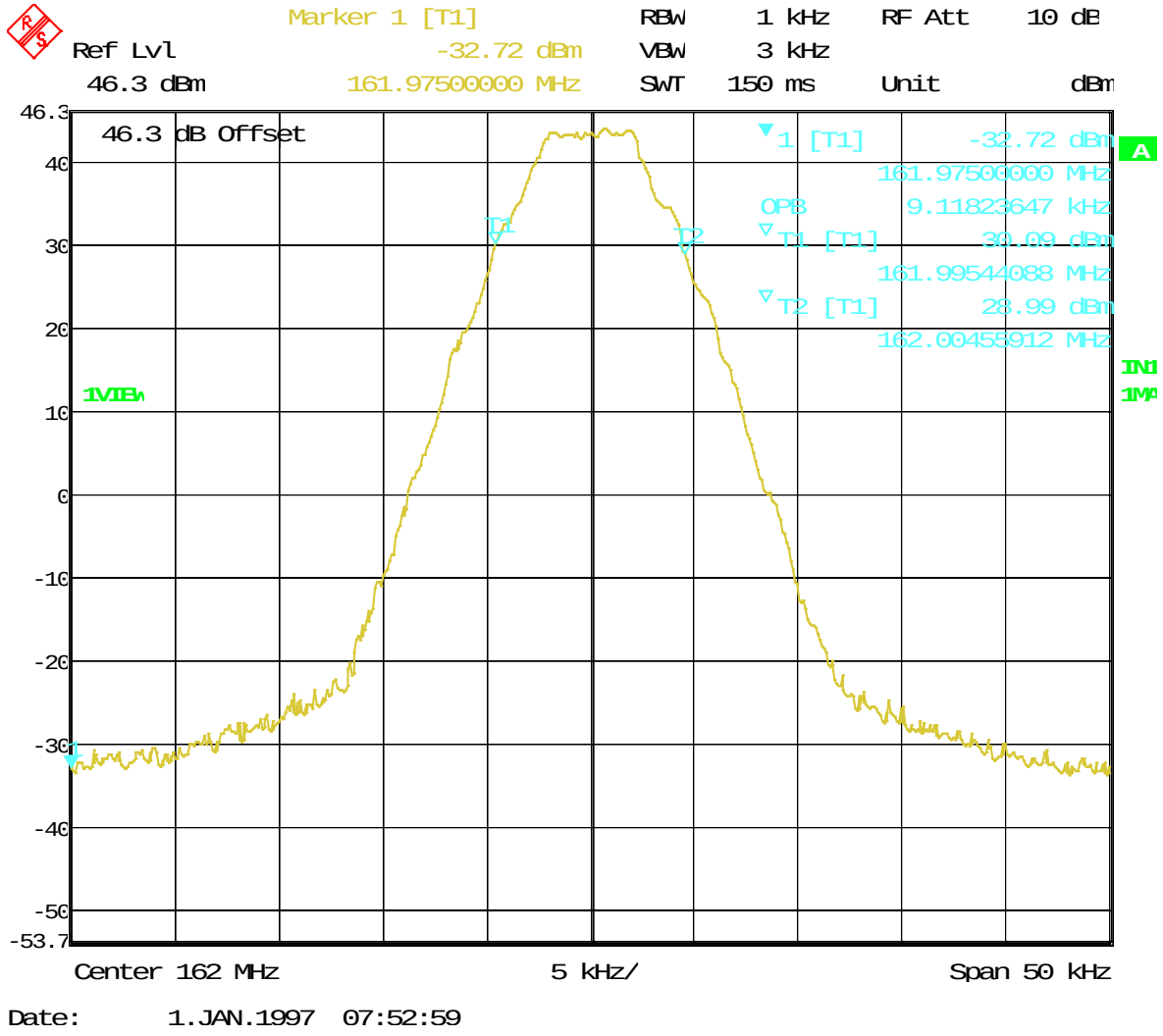


Result: 99% OBW = 7.49 kHz

Result: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: C4FM, 162.00000 MHz

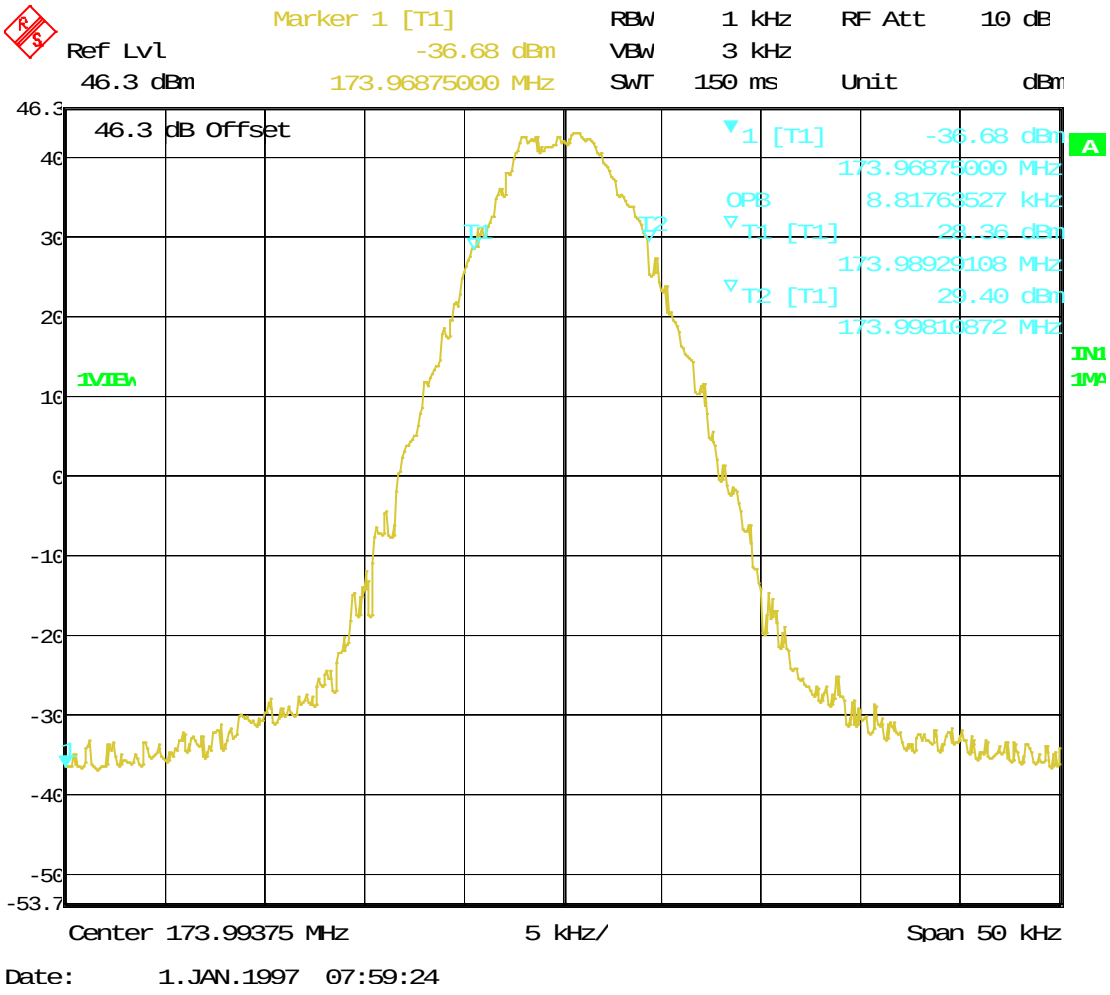


Result: 99% OBW = 9.11 kHz

Result: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: C4FM, 173.99375 MHz

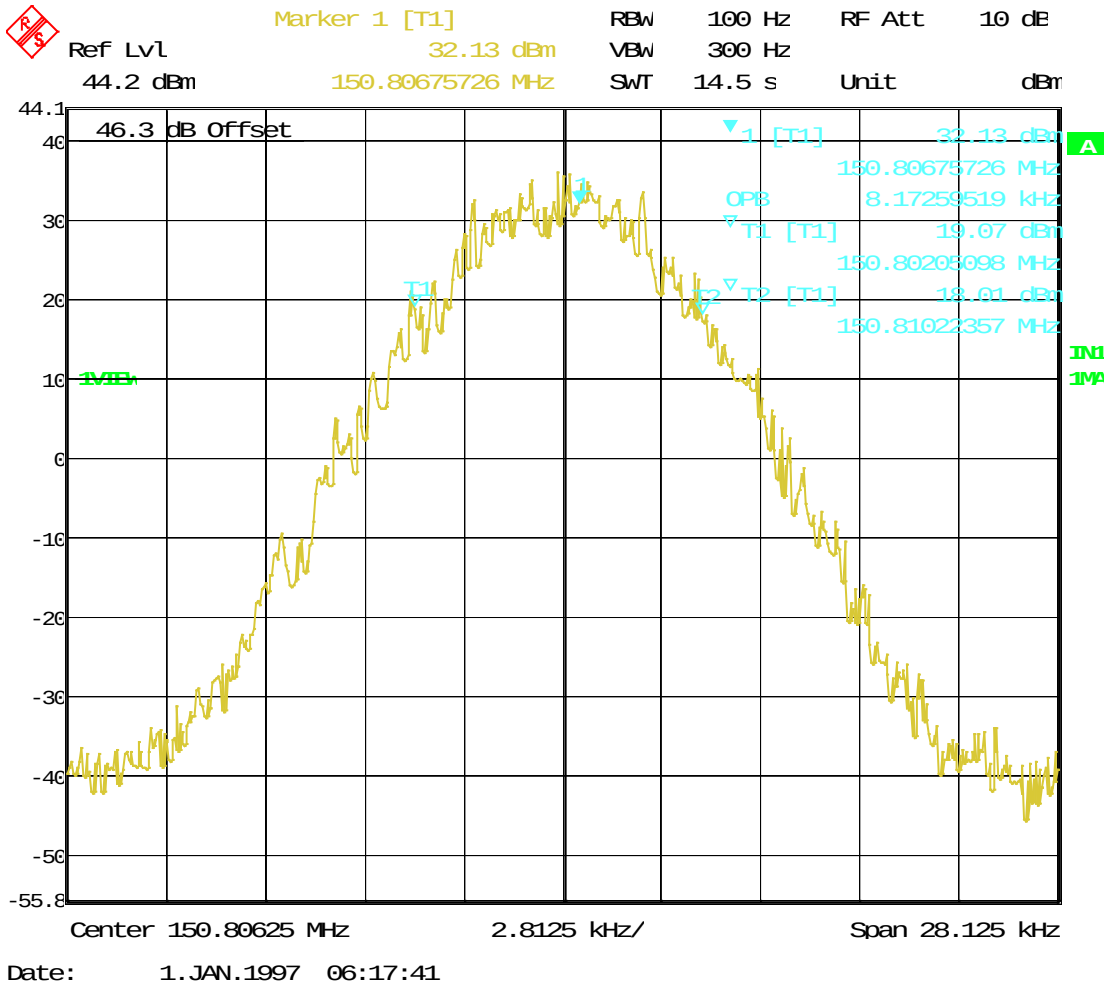


Result: 99% OBW = 8.81 kHz

Result: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: DMR, 150.80625 MHz

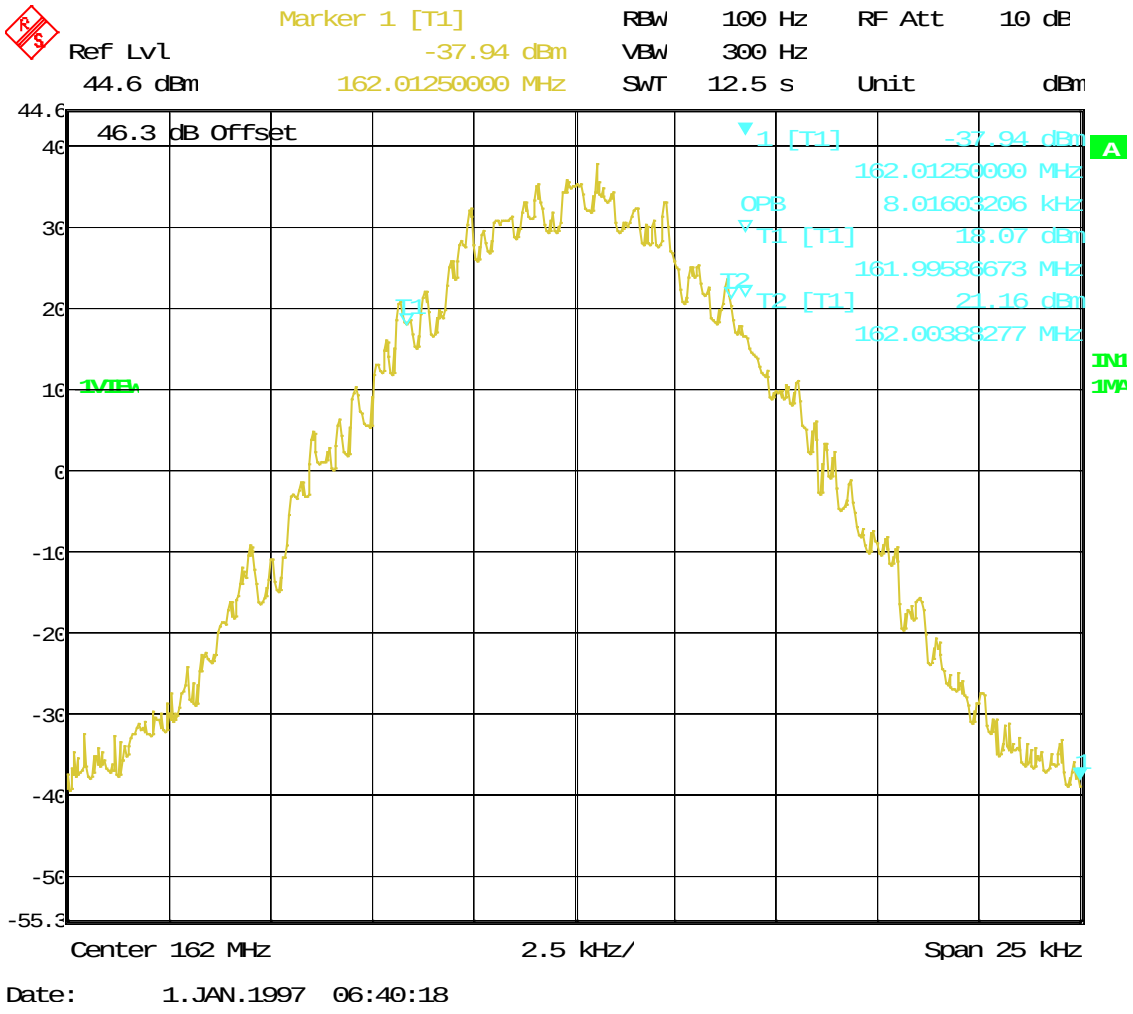


Result: 99% OBW = 8.17 kHz

Result: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: DMR, 162.00000 MHz

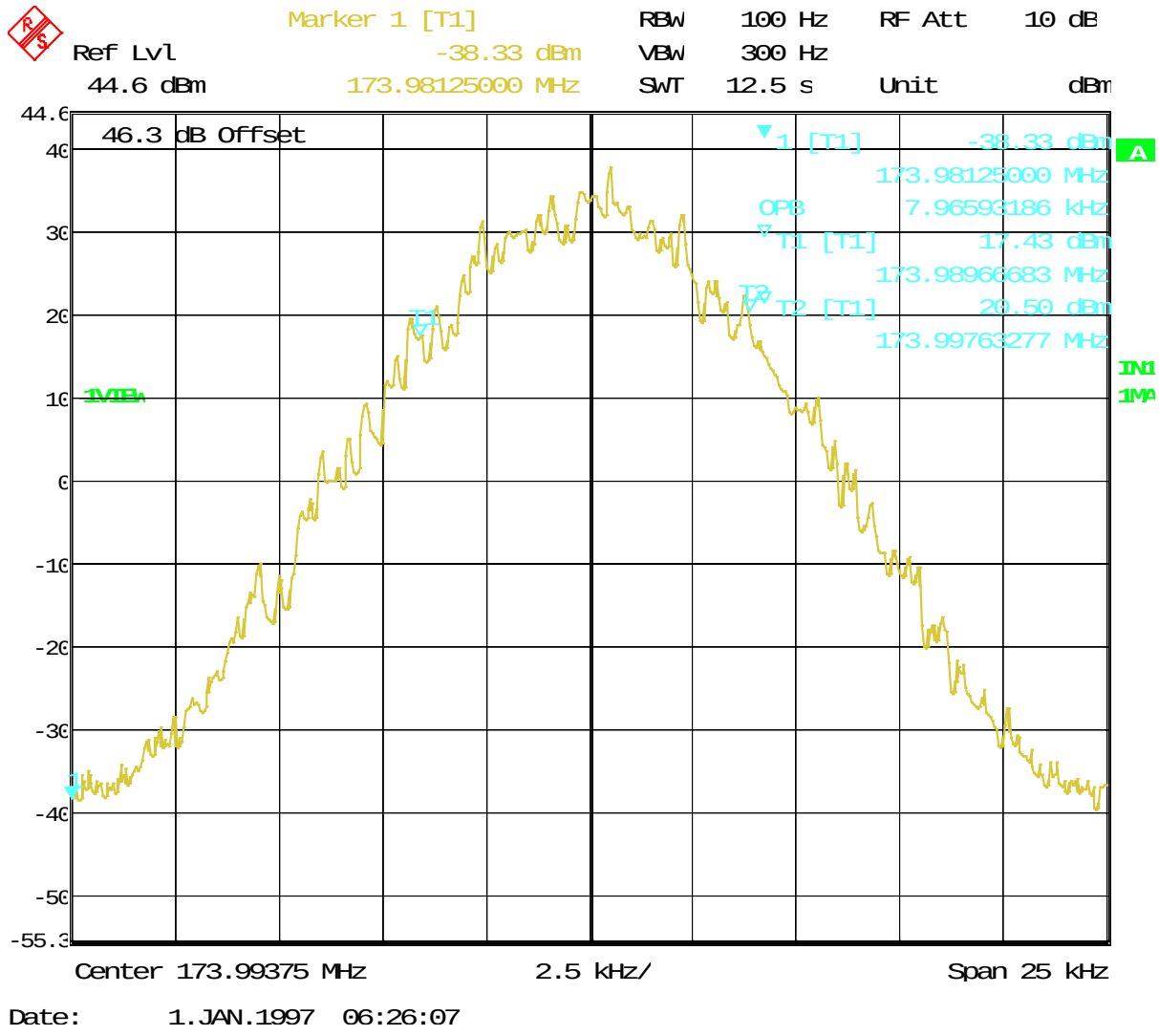


Result: 99% OBW = 8.01 kHz

Result: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: DMR, 173.99375 MHz



Result: 99% OBW = 7.96 kHz

Result: Meets Requirements

EMISSION MASK

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

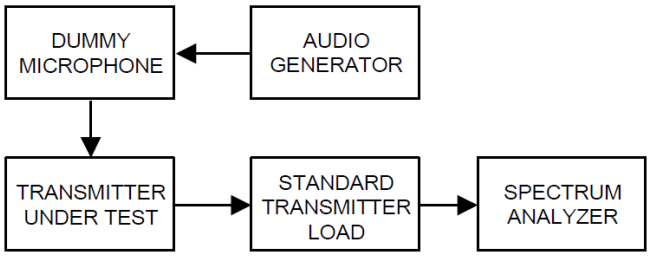
(d) *Emission Mask D—12.5 kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 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 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88$ kHz) dB.

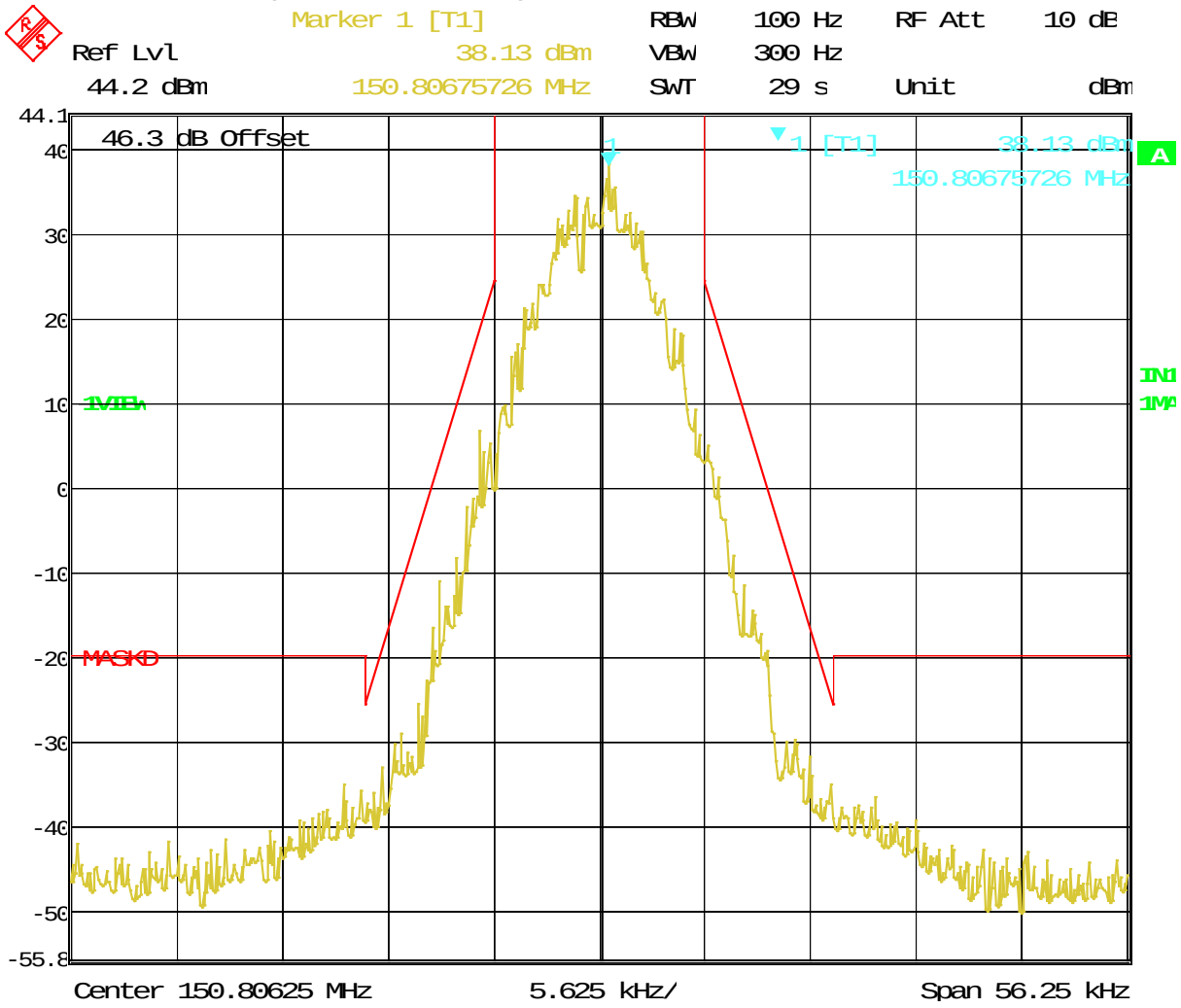
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

Test Procedure: ANSI C63.10, referencing TIA 603-E 2.2.11



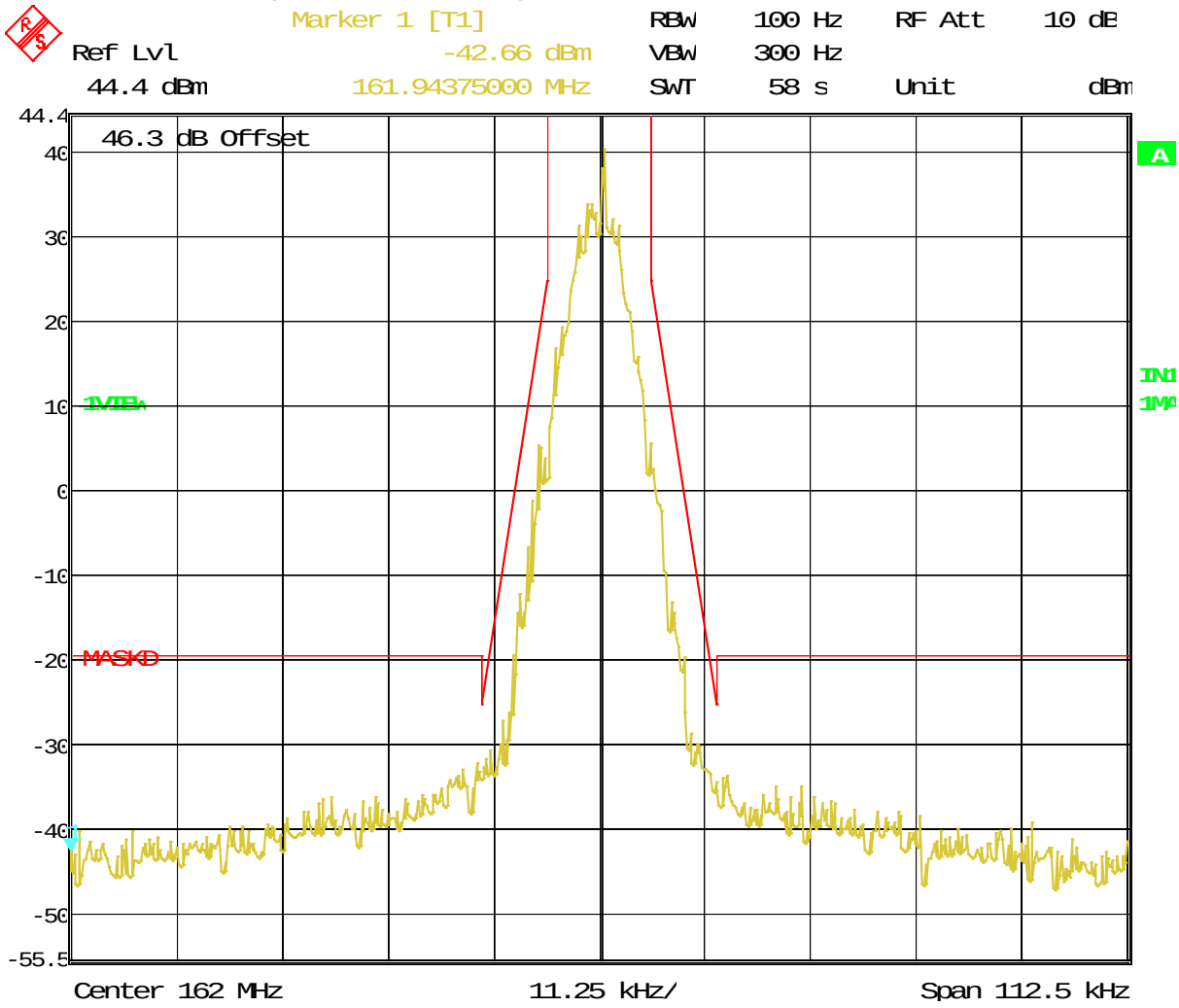
EMISSION MASK

Test Data: C4FM, 150.80625 MHz, 90.210 Mask D



EMISSION MASK

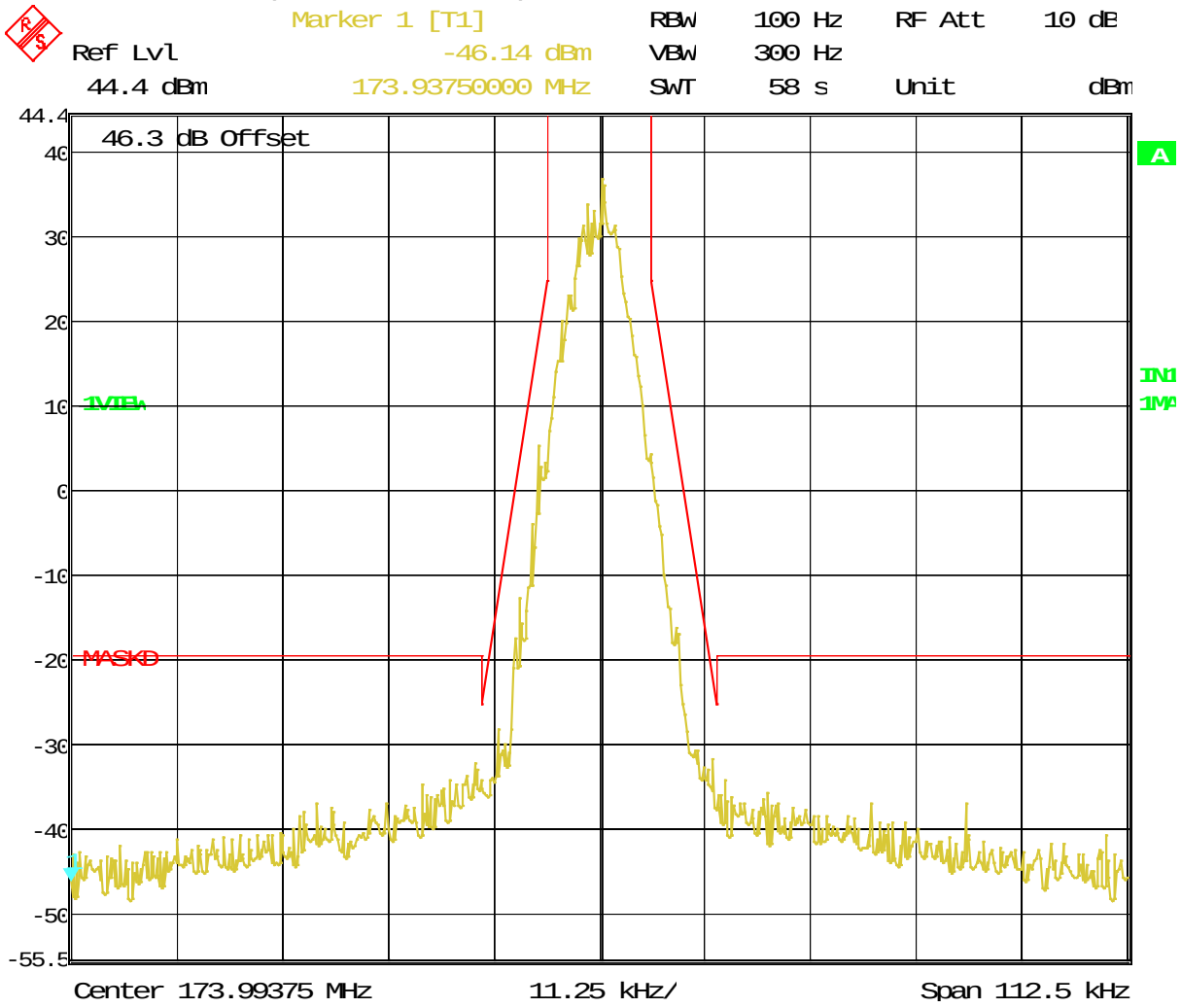
Test Data: C4FM, 162.00000 MHz, 90.210 Mask D



Date: 1.JAN.1997 07:00:14

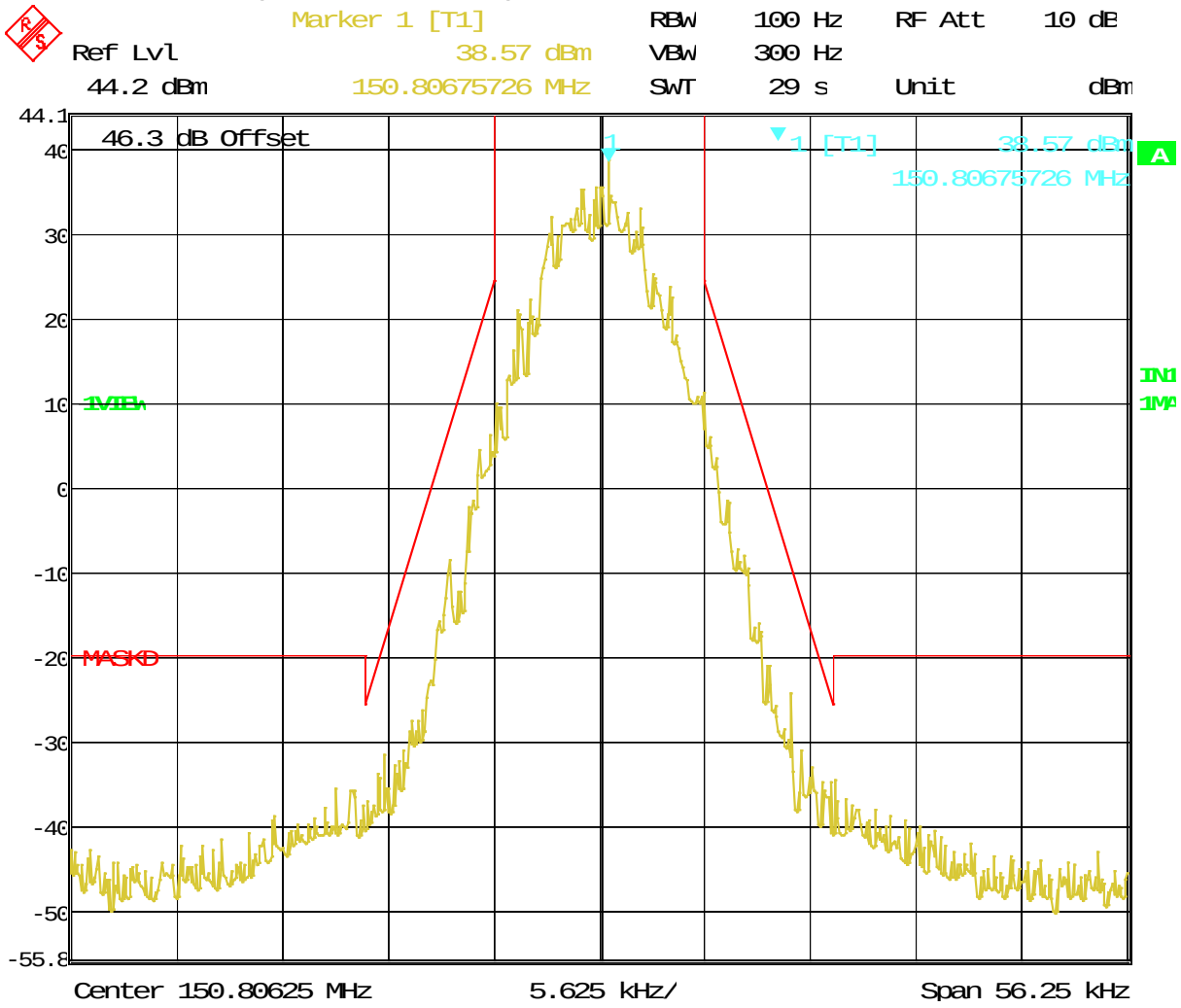
EMISSION MASK

Test Data: C4FM, 173.99375 MHz, 90.210 Mask D



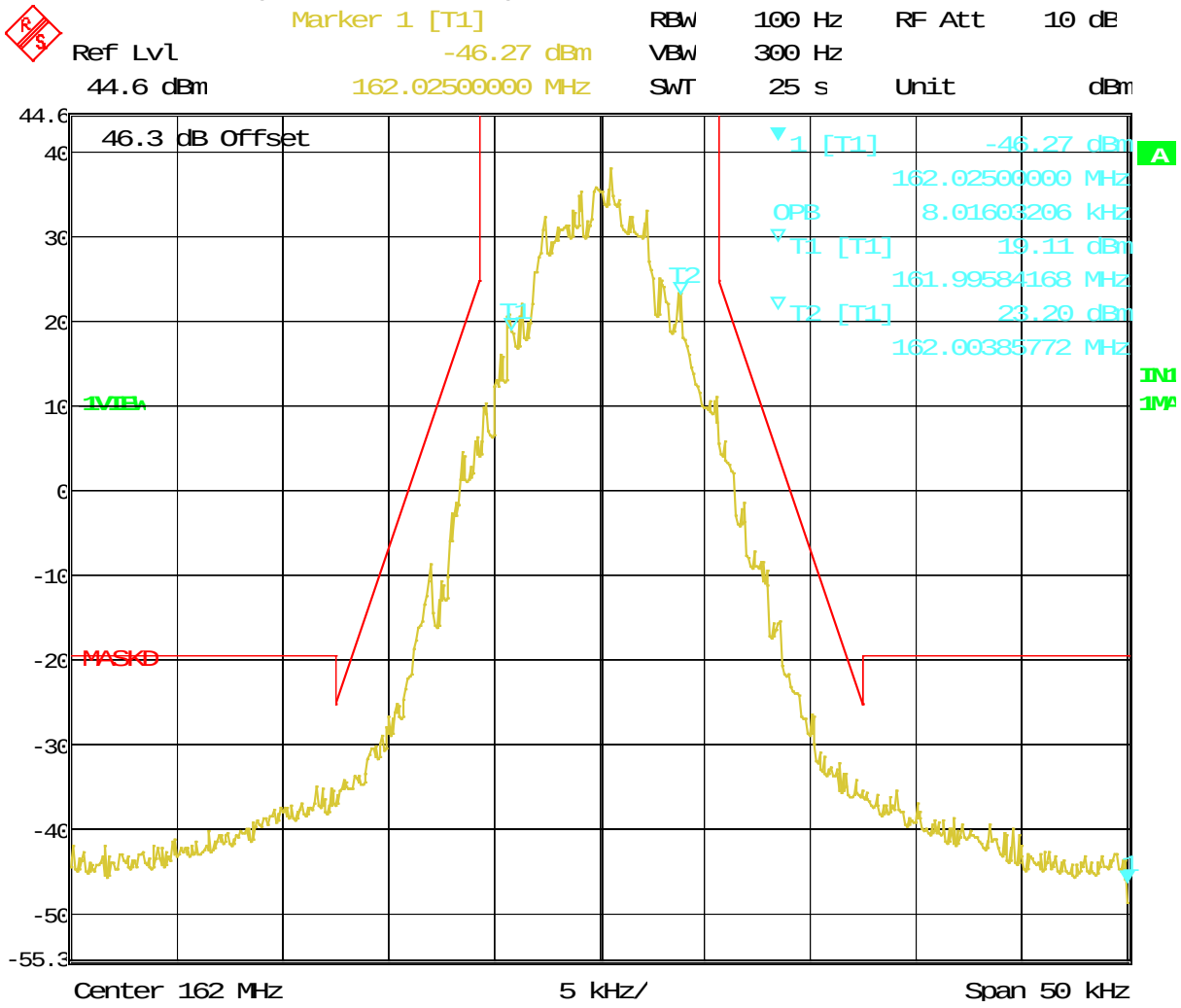
EMISSION MASK

Test Data: DMR, 150.80625 MHz, 90.210 Mask D



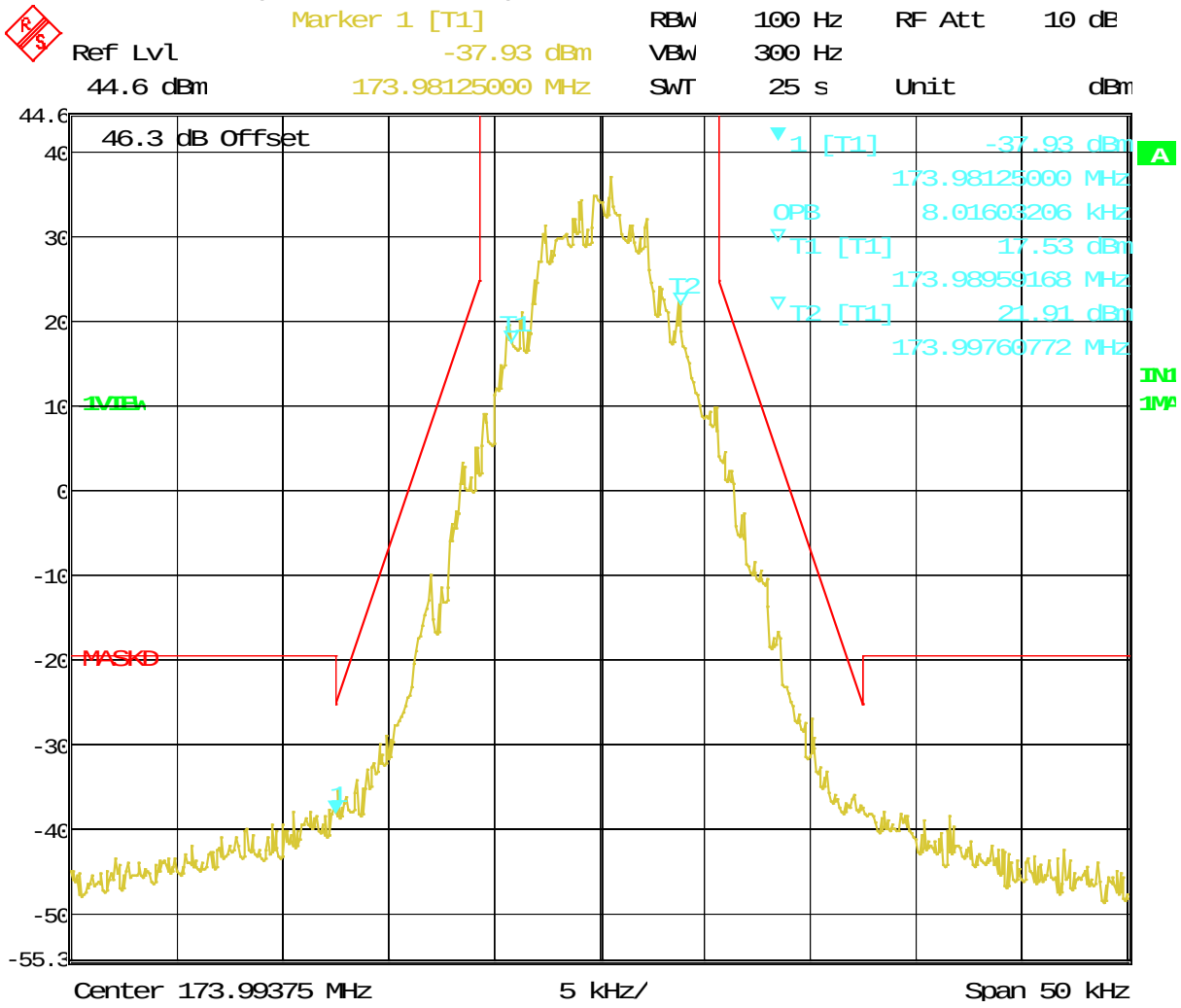
EMISSION MASK

Test Data: DMR, 162.00000 MHz, 90.210 Mask D



EMISSION MASK

Test Data: DMR, 173.99375 MHz, 90.210 Mask D



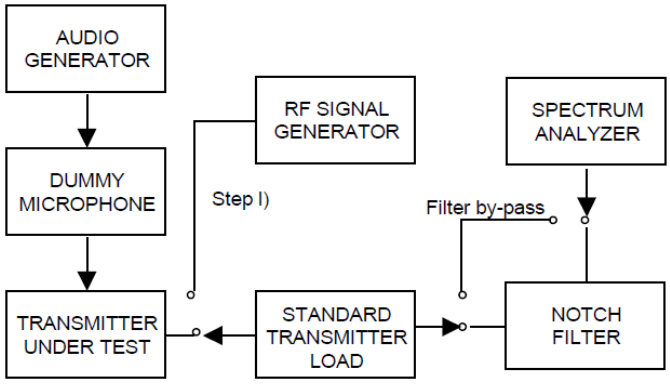
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part: 90.210(d)(3)

(d) *Emission Mask D—12.5 kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(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.

Test Procedure: ANSI C63.10, referencing TIA 603-E s 2.2.13



SPURIOUS EMISSIONS AT ANTENNA TERMINALS

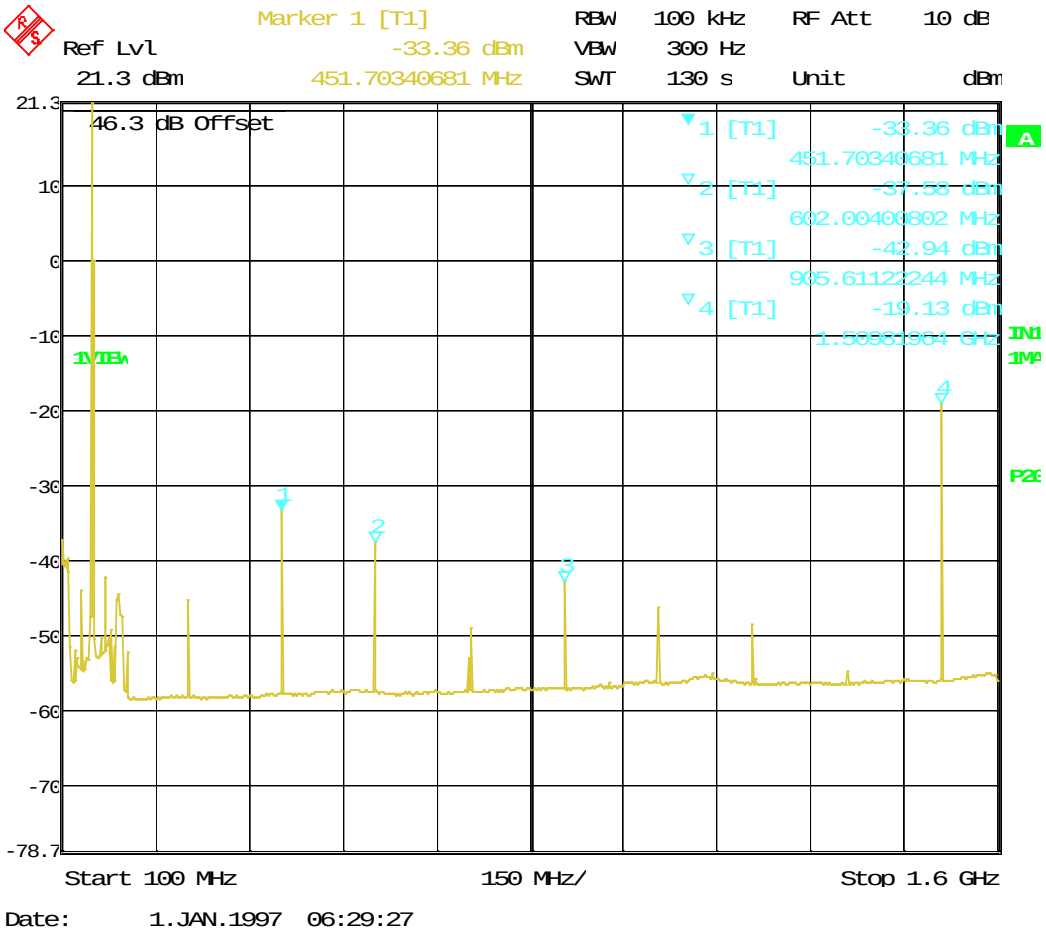
Limit Calculation:

Frequency (MHz)	Channel Type	Power Output (dBm)	50 + 10 * log(W) (dBc)	(dBc) to (dBm)
162.0000	Digital	44.000	64.000	-20.000

Note: A notch filter was used to attenuate the fundamental frequency of the EUT. TIA 603-E s. 2.2.13 was referenced for this Test Procedure. Digital emissions (P25 & DMR) were determined and generated via software.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 150.80625 MHz



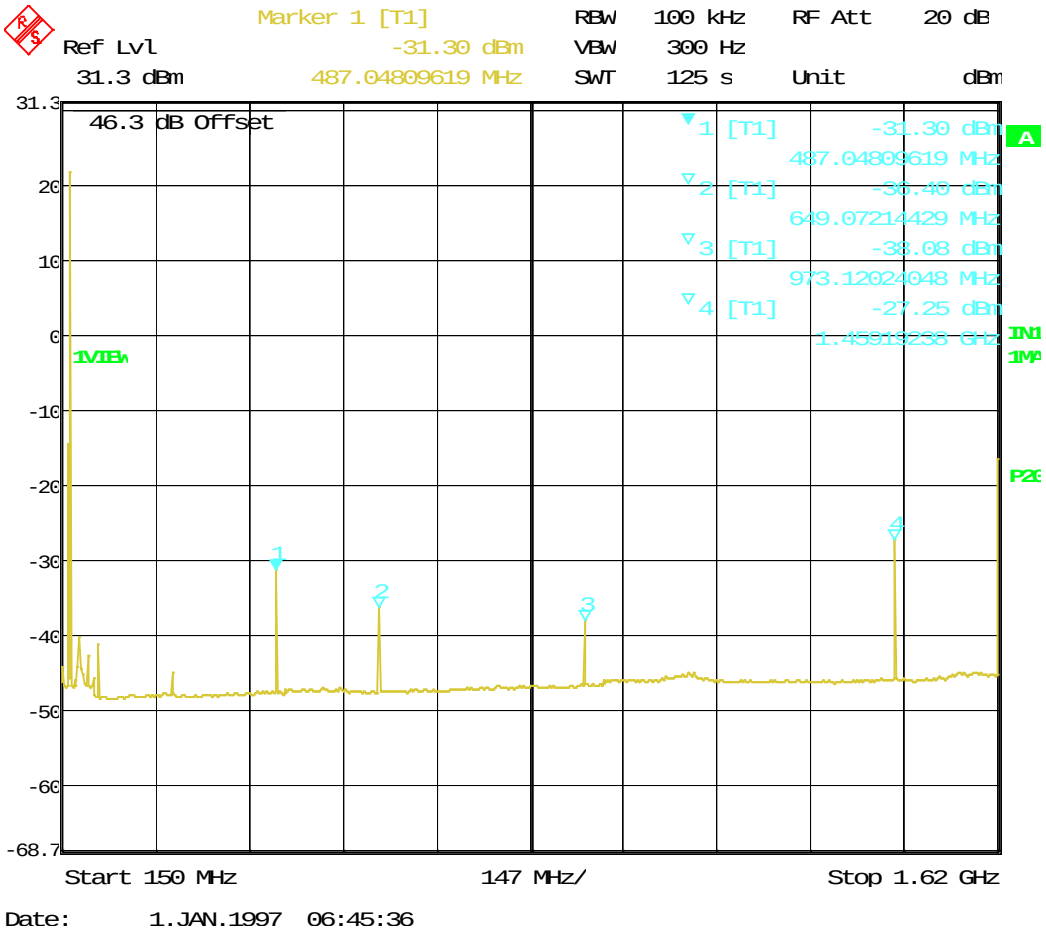
Spurious Emission Calculation:

Marker	Frequency (MHz)	Measured Level (dBm)	Substitution Level (dBm)	Limit (dBm)	Margin (dB)
1	451.70	-79.66	-48.38	-20.00	28.380
2	602.00	-83.88	-52.60	-20.00	32.600
3	905.61	-89.24	-57.96	-20.00	37.960
4	1509.80	-65.43	-34.15	-20.00	14.150

Result: Meets Requirements

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 162.00000 MHz



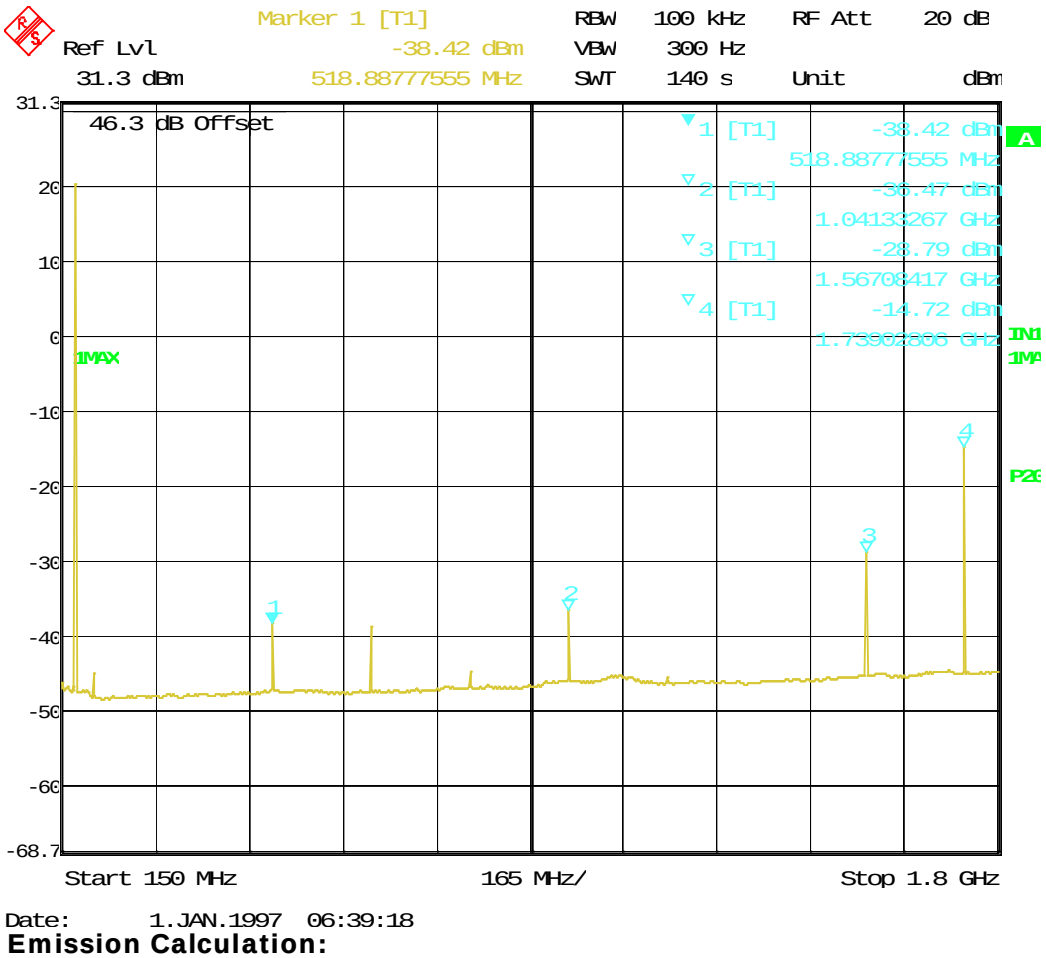
Spurious Emission Calculation:

Marker	Frequency (MHz)	Measured Level (dBm)	Substitution Level (dBm)	Limit (dBm)	Margin (dB)
1	487.04	-77.60	-46.32	-20.00	26.320
2	649.07	-82.70	-51.42	-20.00	31.420
3	973.12	-73.55	-42.27	-20.00	22.270
4	1459.90	-73.55	-42.27	-20.00	22.270

Result: Meets Requirements

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 173.99375 MHz



Spurious Emission Calculation:

Marker	Frequency (MHz)	Measured Level (dBm)	Substitution Level (dBm)	Limit (dBm)	Margin (dB)
1	518.88	-84.72	-53.44	-20.00	33.440
2	1041.30	-82.77	-51.49	-20.00	31.490
3	1567.00	-75.09	-43.81	-20.00	23.810
4	1739.00	-61.02	-29.74	-20.00	9.740

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%	
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%	

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-0072-00 Black	Times Wire	N/A	BMBM-0072-00	02/16/17	02/16/19
Coaxial Cable - BMBM-0061-01 RG400	Pasternack	PE3582LF-24	BMBM-0061-01	01/31/17	01/31/19
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	09/07/18	09/07/20
Attenuator BNC 10dB DC-2G	MiniCircuits	HAT-10+	#54	07/14/17	07/14/19
Tunable Notch Filter 54-210 MHz	Eagle	TNF-200	54-210 MHz	11/19/17	11/19/19
Attenuator BNC 6dB 50Ohm DC-2G	Mini-Circuits	HAT-6+	#53	07/14/17	07/14/19
DC Power Supply	HP	6286A	1744A03842	N/A	N/A
Attenuator N 30dB 100W DC-6G	PASTERNACK	PE7214-30	#109	5/24/17	5/24/19

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT