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FCC

UHF PORTABLE PART 90

TEST REPORT

APPLICANT	DELUXE TELEPHONE SYSTEMS LTD.
	311 Consumer Road Toronto Ontario M2J 4G8 CANADA
FCC ID	2ACZRDTM25
MODEL NUMBER	DTM-25
PRODUCT DESCRIPTION	220-222 MHZ TRANSCEIVER
STANDARD APPLIED	CFR 47 Part 90
DATE SAMPLE RECEIVED	9/22/2014
DATE TESTED	9/22/2014
REPORT ISSUE DATE	12/22/2014
TESTED BY	Nam Nguyen
APPROVED BY	Sid Sanders
TIMCO REPORT NO.	1706UT14TestReport.docx
TEST RESULTS	☒ PASS ☐ FAIL

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:
☒ fulfill the general approval requirements as identified in this test report
☐ 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: 2005 requirements.

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669

Authorized Signatory Name:

Sid Sanders
Engineering Project Manager

Date: 12/22/2014

GENERAL INFORMATION

EUT Specification

EUT Description	220-222 MHZ TRANSCEIVER
FCC ID	2ACZRDTM25
Model Number	DTM-25
Operating Frequency	220-222MHz
Test Frequencies	220.607 & 221.607MHz
Type of Emission	8K10F1D
Modulation	3FSK
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☒ DC Power 12V
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable
Test Conditions	The temperature was 24-26ºC with a relative humidity of 50-65%.
Revision History to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-C:2004, FCC CFR 47 Part 90
Test Facility	Timco Engineering Inc. 849 NW State Road 45 Newberry, FL 32669 USA.

TEST PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-D:2010, using a 50uH LISN. Both lines were observed with the EUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

Radiation Interference: The test procedure used was ANSI/TIA 603-D:2010, using an Rohde & Schwarz – EMI test receiver. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

RF POWER OUTPUT

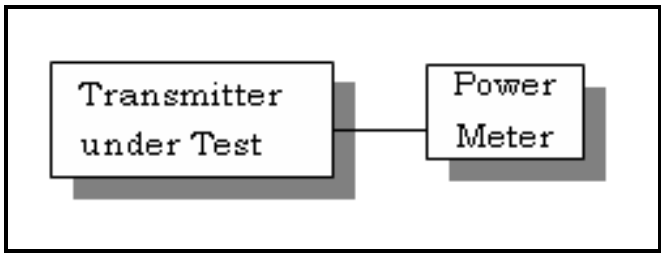
Rule Part No.: Part 2.1046(a), Part 90

Test Requirements: Manufacturer's Specification

Method of Measurement: RF power is measured by using a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage (if battery operated), or a properly adjusted power supply (if not battery operated), and the transmitter properly adjusted the RF output measures:

For the device with a fixed or integral antenna, the RF power is measured as ERP. The substitution method was used. The RF output measures:

Test Setup Diagram:



Test Data: RF power of the EUT can be set at 5W to 25W.

OUTPUT POWER:

	RF POWER High		RF POWER Low	
Tuned Frequency (MHz)	dBm	Watts	dBm	Watts
220.607	43.84	24.21	37.45	5.5
221.607	44.00	25.10	37.07	5.1

Part 2.1033 (C)(8) DC Input into the final amplifier

FOR LOW POWER SETTING INPUT POWER: (12.0V)(0.95A) = 11.4 Watts
FOR HIGH POWER SETTING INPUT POWER: (12.0V)(2.50A) = 30.0Watts

OCCUPIED BANDWIDTH

Part 2.1049(c) EMISSION BANDWIDTH:
Part 90.210(b) 25kHz Channel Spacing

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least 43 + 10log(P)dB.

Part 90.210(c) 25 kHz Channel Spacing Not Equipped with a Low Pass Filter

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz but not more than10 kHz: At least 83 log (fd/5) dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least 29 log(fd2/11)dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least 43+10 log(Po)dB.

Part 90.210(d) Emission Mask D - 12.5 kHz channel BW 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 f0 to 5.625 kHz removed from f0: Zero dB.
(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27 (fd - 2.88 kHz) dB.
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10log(P) dB or 70 dB, whichever is the lesser attenuation.

Part 90.210(e) Emission Mask E – 6.25 kHz channel BW equipment.

For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

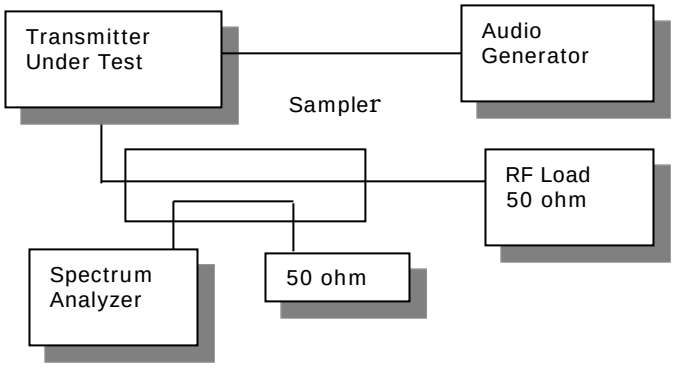
(1) On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.

(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd – 3.0 kHz) or 55 + 10 Log(P) or 65, whichever us the lesser attenuation.

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

Method of Measurement: ANSI/TIA 603-D: 2010

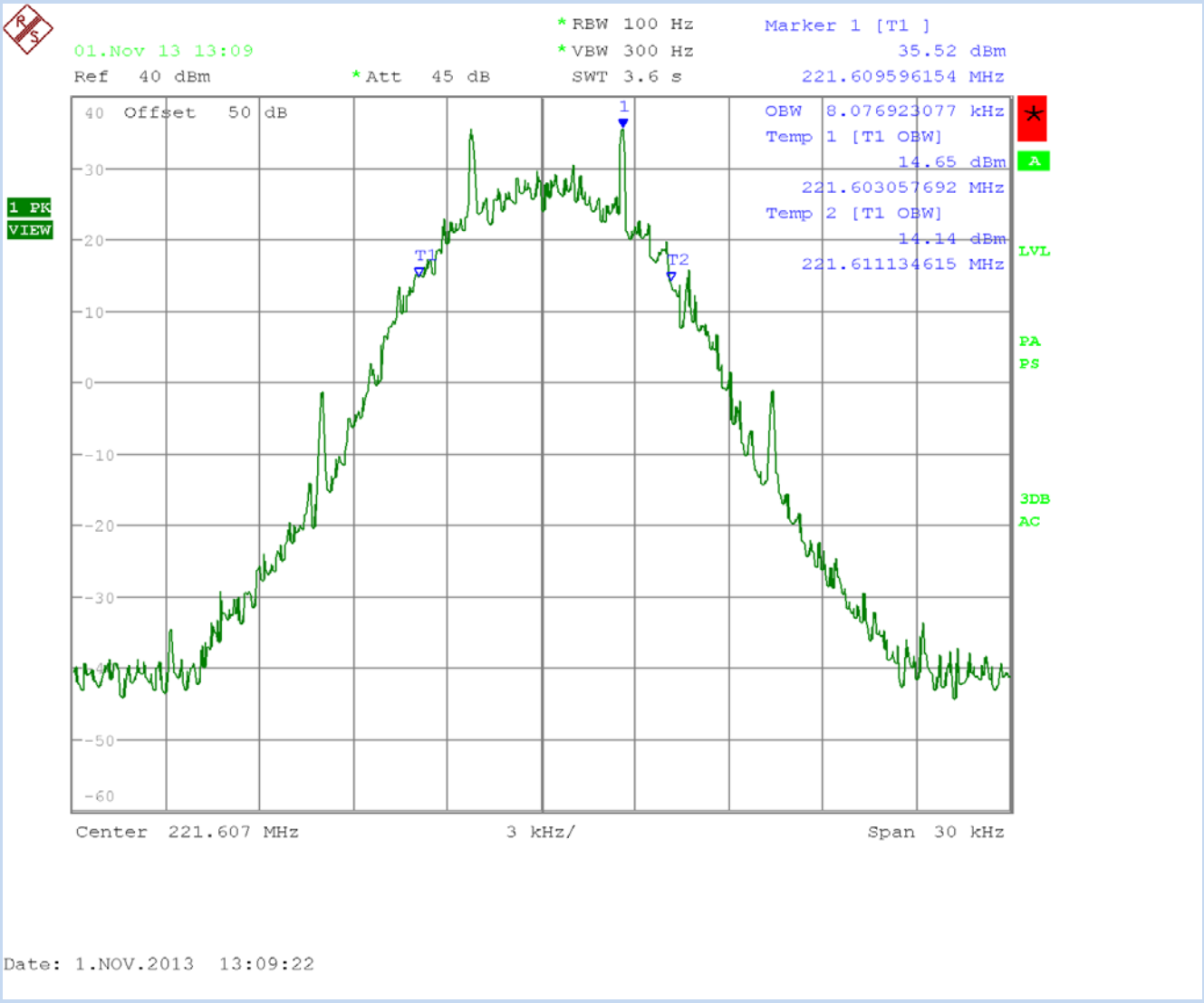
Test Setup Diagram:



Test Data: See the plots below

OCCUPIED BANDWIDTH PLOTS: ANALOG
Part 90.210(d) Emission Mask D - 12.5 kHz channel bandwidth - ANALOG

Occupied Bandwidth Plot



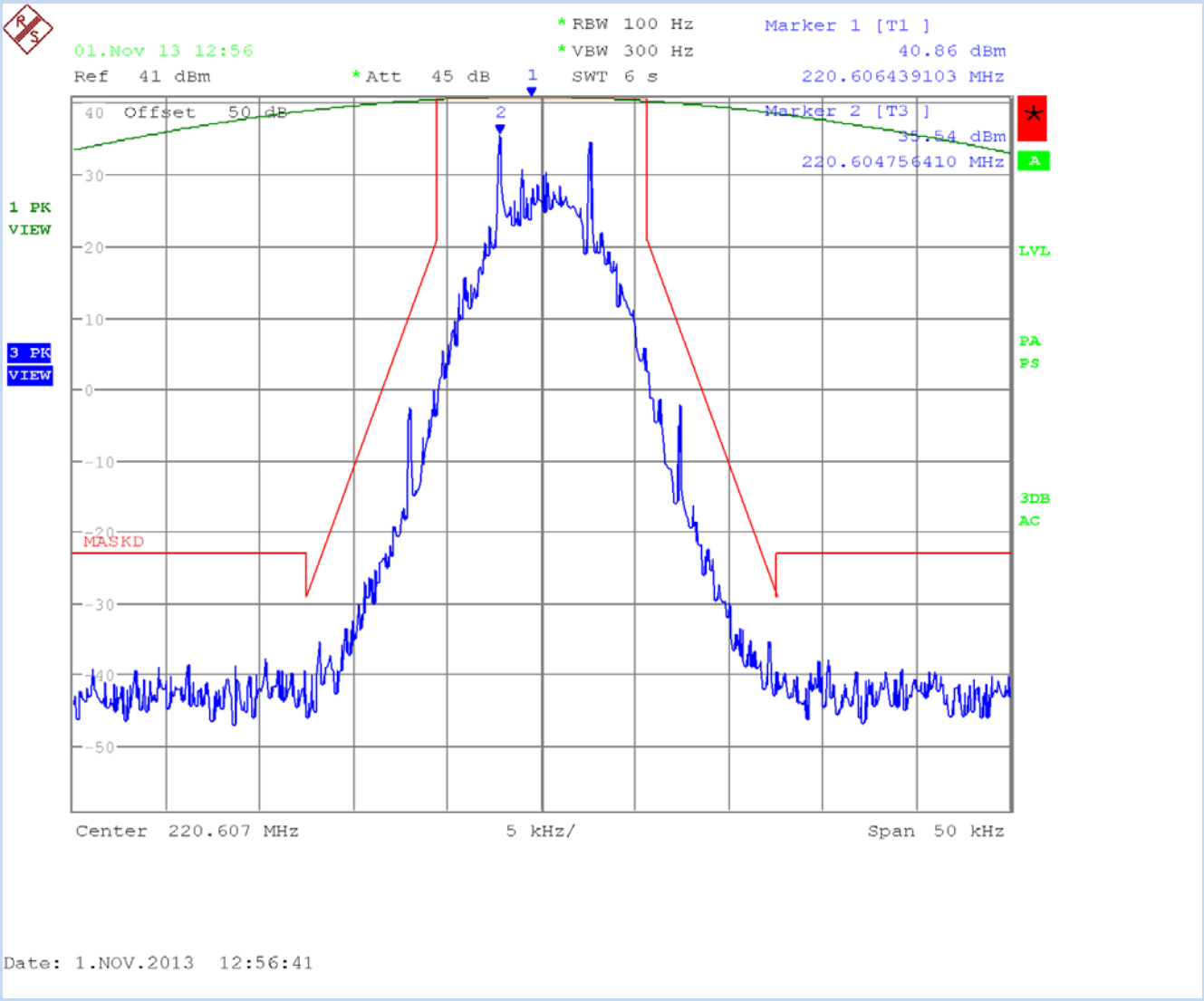
99.0% Power Occupied bandwidth = 8.07 kHz

Result Meets The Requirement

OCCUPIED BANDWIDTH PLOTS: ANALOG
Part 90.210(d) Emission Mask D - 12.5 kHz channel bandwidth - ANALOG

Occupied Bandwidth Plot

12.5kHz: DIGITAL



Result Meets The Requirement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

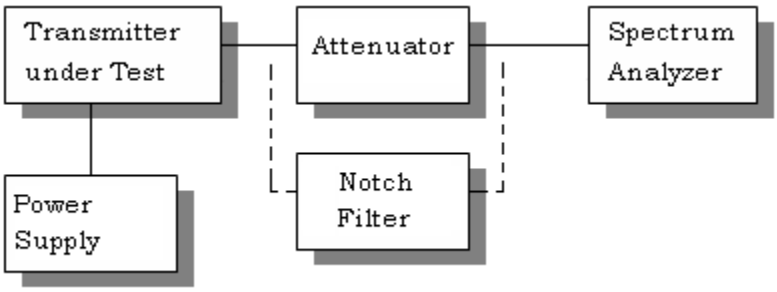
Rule Part No.: Part 2.1051(a)

Requirements:

12.5 kHz Channel Spacing = 50+10 log (25.0) = 64.0 dBc (high power)
12.5 kHz Channel Spacing = 50+10 log (5.0) = 57.0 dBc (low power)

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-D: 2010.

Method of Measuring Conducted Spurious Emissions



Test Data: High Power Low end of Band

Test Data:

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
220.61	441.21	69.8		220.61	441.21	70.1
	661.82	65.1			661.82	64.5
	882.43	69.3			882.43	69.2
	1103.04	79.9			1103.04	80.7
	1323.64	85.4			1323.64	82.1
	1544.25	80.7			1544.25	80.4
	1764.86	83.9			1764.86	80.1
	1985.46	82.9			1985.46	81.6
	2206.07	84.4			2206.07	80.7

RESULTS: MEET REQUIREMENTS

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: High Power Middle of Band

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
221.61	443.21	65.4		221.61	443.21	70.3
	664.82	66.1			664.82	64.5
	886.43	69.8			886.43	69.7
	1108.04	79.73			1108.04	82.5
	1329.64	84.18			1329.64	82.3
	1551.25	80.17			1551.25	79.9
	1772.86	83.22			1772.86	82
	1994.46	82.18			1994.46	82.9
	2216.07	83.72			2216.07	82.7

RESULTS: MEET REQUIREMENTS

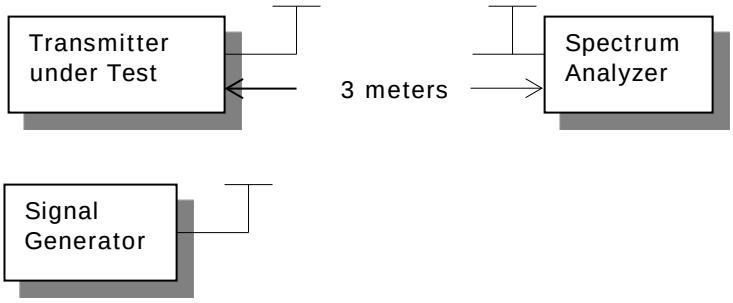
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

Requirements: 12.5kHz Channel Spacing = 50+10log(OP) = 64.0 dBc

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-D: 2010 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.

Test Setup Diagram:



Test Data: 50+10log(25W) = 64 dB

High Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
220.61	0	0
441.21	V	88.9
661.82	V	98.9
882.43	V	70.0
1103.04	H	85.8
1323.64	H	93.6
1544.25	V	94.5
1764.86	V	89.8
1985.46	V	96.4
2206.07	V	95.1

Low Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
220.61	0	0
441.21	V	90.2
661.82	V	79.2
882.43	V	71.4
1103.04	H	79.3
1323.64	V	75.6
1544.25	V	80.3
1764.86	H	85.5
1985.46	H	91.0
2206.07	V	83.7

RESULTS: MEET REQUIREMENTS

FIELD STRENGTH OF SPURIOUS EMISSIONS

High Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
221.61	0	0
443.21	V	88.1
664.82	V	98.2
886.43	V	69.8
1108.04	H	80.4
1329.64	H	99.1
1551.25	H	96.6
1772.86	H	93.4
1994.46	H	94.3
2216.07	H	93.0

Low Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
221.61	0	0
443.21	V	88.6
664.82	V	78.5
886.43	V	70.5
1108.04	H	83.2
1329.64	V	92.7
1551.25	H	93.0
1772.86	H	88.4
1994.46	H	90.5
2216.07	V	84.3

RESULTS: MEET REQUIREMENTS

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 90.213

Requirements: Temperature range requirements: -30 to +50º C.
Voltage Variation +, -15%
±2.5 PPM

Method of Measurements: ANSI/TIA 603-D: 2010.

Test Data:
Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		221.607651
Temperature (ºC)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-30	221.607545	-0.48
-20	221.607548	-0.46
-10	221.607568	-0.37
0	221.607595	-0.25
+10	221.607564	-0.39
+20	221.607642	-0.04
+30	221.607632	-0.09
+40	221.607581	-0.32
+50	221.607551	-0.45

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery (%)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-15%	221.607648	-0.01
	221.607651	0.00
+15%	221.607656	0.02

RESULTS: MEET REQUIREMENTS

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	06/05/13	06/05/15
Analyzer Silver Tower Preamplifier	HP	8449B	3008A00372	06/05/13	06/05/15
Analyzer Silver Tower RF Preselector	HP	85685A	2926A00983	06/05/13	06/05/15
Analyzer Silver Tower Quasi-Peak Adapter	HP	85650A	2811A01175	06/05/13	06/05/15
Power Meter	Boonton Electronics	4531	11793	1/9/13	1/9/15
Sensor	Boonton	51072A	34647	01/19/13	01/19/15
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Horn Antenna	ETS	3117	35923	12/7/11	12/7/13
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	152	11/01/13	11/01/15
DC Power Supply	HP	6264B	2032A04119	05/6/13	05/6/15
Hygro-Thermometer	Extech	445703	0602	06/15/13	06/15/15
Digital Multimeter	Fluke	77	35053830	06/20/13	06/20/15
EMI Receiver	Rohde & Schwarz	ESIB40	100274	8/12/14	8/12/16
Directional Coupler	HP	778D	1144A08107	5/6/13	5/6/15
Oscilloscope	Lecroy	LT364L	00543	6/15/13	6/15/15
Temperature Chamber	Tenney Engineering	TTRC	11717-7	8/19/14	8/19/16
Notch Filter	Microlab	HA-10N		5/7/13	5/7/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15