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FCC PART 90 AND IC RSS-119, RSS-GEN TEST REPORT

APPLICANT	NEPTUNE TECHNOLOGY GROUP INC.
ADDRESS	1600 ALABAMA HIGHWAY 229 TALLASSEE AL 36078 USA
FCC ID	FCC ID: P2S450MC
IC CERTIFICATION	IC: 4171B-450MC
MODEL NUMBER	450MC
PRODUCT DESCRIPTION	Mini Collector
DATE SAMPLE RECEIVED	1/11/2010
DATE TESTED	1/14/2010
TESTED BY	Joe Scoglio
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	52AUT9TestReport.pdf
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

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



Certificate # 0955-01



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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.



Testing Certificate # 0955-01

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:

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

DUT SPECIFICATION

DUT Description	MINI COLLECTOR
FCC ID	FCC ID: P2S450MC
IC Certification	IC: 4171B-450MC
Model Number	450MC
Serial Number	N/A
Type of Emission	Frequency Shift Keying 12k0F1D
DUT Power Source	<input checked="" type="checkbox"/> 110-120Vac/50- 60Hz
	<input type="checkbox"/> DC Power 12V
	<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

TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C: 2004 using a 50uH LISN. Both lines were observed with the DUT 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-C: 2004 using an Agilent spectrum receiver with pre-selector. 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 micro volt at the output of the antenna.

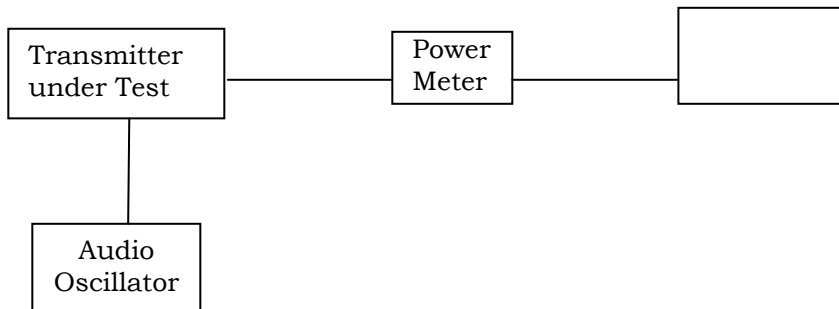
RF POWER OUTPUT

Rule Part No.: FCC Part 2.1046(a), IC RSS-119 4.1 and 5.4, RSS-GEN 4.8

Test Requirements: FCC Part 2.1046(a), IC RSS-119 4.1 and 5.4, RSS-GEN 4.8

Method of Measurement: RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage and the transmitter properly adjusted the RF output measured:

Test Setup Diagram:



Test Data:

OUTPUT POWER: HIGH – 5 watts
 LOW - 1 watt

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

FOR LOW POWER SETTING INPUT POWER: (12.0V)(0.8A) = 9.6 Watts
 FOR HIGH POWER SETTING INPUT POWER: (12.0V)(1.2A) = 14.4 Watts



MODULATION CHARACTERISTICS

Rule Part No.: FCC Pt 2.1033(c), Part 2.1033(c) (4), FCC Part 90.209, IC RSS-119 5.5
FCC Part 90.207

Requirements: FCC Pt 2.1033(c), Part 2.1033(c) (4), FCC Part 90.209, IC RSS-119 5.5
FCC Part 90.207

Data:

Type of Emission: 11K2F1D , 11K2F2D

Type of Emission: 11K2F2D, F1D

$$B_n = 2M + 2DK$$

$$M = B/2 = 9600/2 = 4800$$

$$D = 800$$

$$K=1$$

$$B_n = 2(4800) + 2(800) = 11.2k$$

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AUDIO FREQUENCY RESPONSE

Rule Part No.: FCC Part 2.1047(a)(b), IC RSS-119 5.2

Test Requirements: FCC Part 2.1047(a)(b), IC RSS-119 5.2

Method of Measurement:

The audio frequency response was measured in accordance with ANSI/TIA 603-C:2004. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted. The audio frequency response curve is shown below.

AUDIO FREQUENCY RESPONSE PLOT

The radio only transmits digital information.



AUDIO LOW PASS FILTER

VOICE MODULATED COMMUNICATION EQUIPMENT

Part 2.1047(a) Voice modulated communication equipment: For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

AUDIO LOW PASS FILTER

The radio only transmits digital information.



AUDIO INPUT VERSUS MODULATION

Rule Part No.: FCC Part 2.1047(b) & 90, IC RSS-119 5.2

Test Requirements: FCC Part 2.1047(b) & 90, IC RSS-119 5.2

Method of Measurement: **Modulation cannot exceed 100%**, The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C:2004. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz.

Test data:

Modulation Limiting Plot

The radio only transmits digital information.

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OCCUPIED BANDWIDTH

Rule Part No.: FCC Part 2.1049(c), RSS-GEN 4.6

Requirements:

FCC Part 90.210(b) RSS-119 4.2 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 $43 + 10\log(P)$ dB.

Part 90.210(c) 12.5kHz 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 (f_d in kHz) of more than 5 kHz but not more than 10 kHz: At least $83 \log(f_d/5)$ dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least $29 \log(f_d/11)$ 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 $43 + 10 \log(P_o)$ 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 f_0 to 5.625 kHz removed from f_0 : Zero dB.
- (2) On any frequency 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.

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

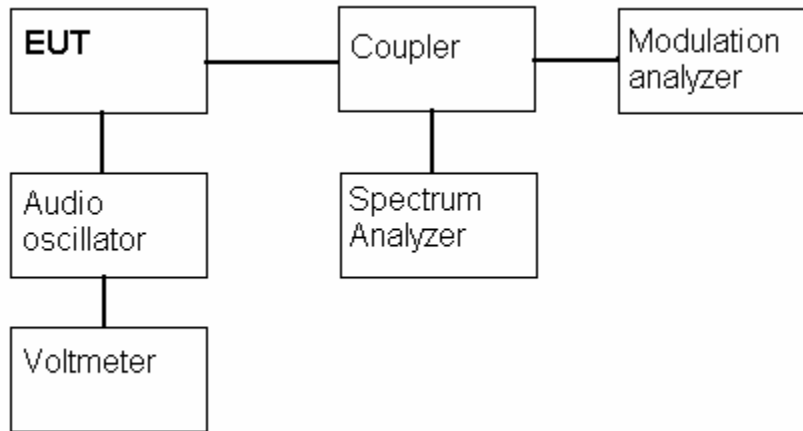
For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.
- (2) On any frequency 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 $30 + 16.67(f_d - 3.0)$ kHz) or $55 + 10 \log(P)$ or 65, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6kHz: At least $55 + 10\log(P)$ dB or 65 dB, whichever is the lesser attenuation.

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Test Setup Diagram:

OCCUPIED BANDWIDTH MEASUREMENT

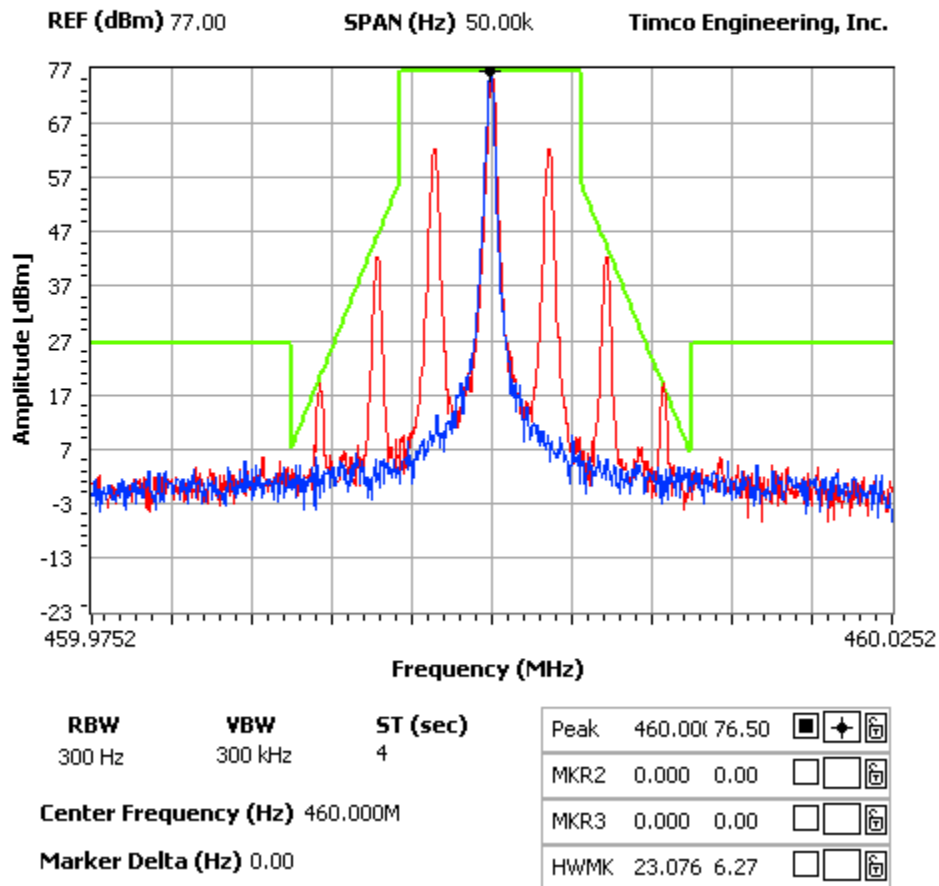


Test Data: See the plots below

12.5 kHz – DIGITAL

NOTES:

FCC 90.210 Mask D



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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a), RSS-GEN 7.1.4

Requirements: 25 kHz Channel Spacing = $43+10\log(P_o) = 50$ dBc
 12.5 kHz Spacing = $50+10\log(P_o) = 57$ dBc

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-C:2004.

FCC Limit for:

Test Data:

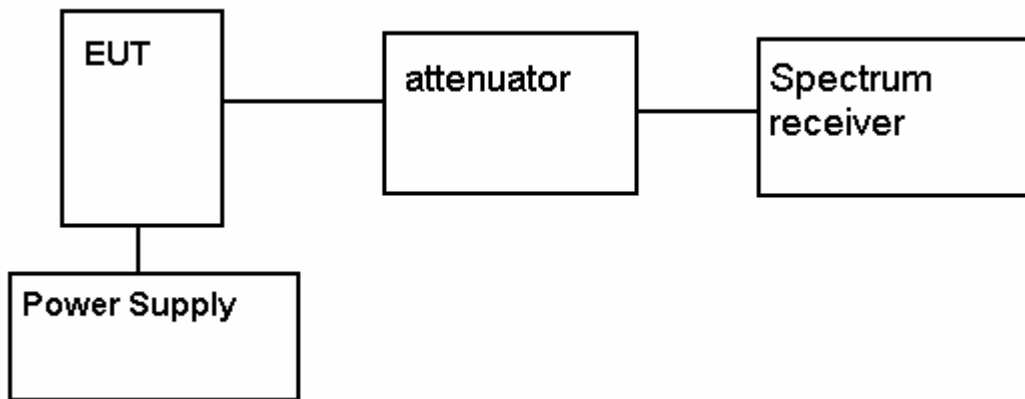
TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
450	450	0		450	450	0
	900	71.3			900	75.9
	1350	80.9			1350	86.9
	1800	89.6			1800	88.7
	2250	100.6			2250	104.1
	2700	102.9			2700	103.7
	3150	102			3150	105.5
	3600	89			3600	91.9
	4050	91.3			4050	95.2
	4500	113.7			4500	110

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
460	460	0		460	460	0
	920	71.3			920	80.6
	1380	76.7			1380	93
	1840	93			1840	100.4
	2300	98.2			2300	106.9
	2760	101.4			2760	105.1
	3220	108.8			3220	104.6
	3680	88			3680	90.4
	4140	99.9			4140	103.5
	4600	117.4			4600	111.7

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TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
470	470	0		470	470	0
	940	70.8			940	81
	1410	73.6			1410	86.3
	1880	90.3			1880	97.5
	2350	99.3			2350	105.3
	2820	103.9			2820	105.9
	3290	90.6			3290	101.5
	3760	88.9			3760	87.8
	4320	102			4320	107.7
	4700	113			4700	111.1

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA 603-C: 2004.

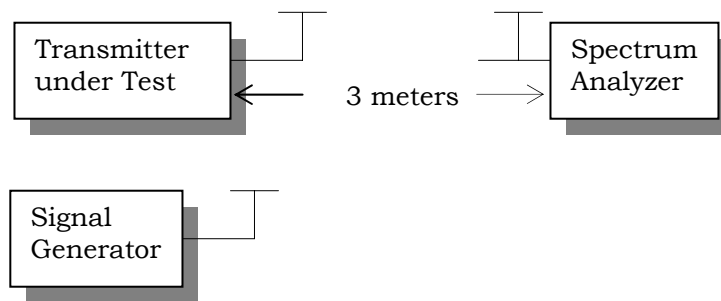
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053, RSS-GEN 4.9

Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

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-C:2004 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:

HI POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
450.00	V	0
900.00	V	86.76

LOW POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
450.00	V	0
900.00	V	86.56

HI POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
460.00	V	0
920.00	V	86.50

LOW POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
460.00	V	0
920.00	V	78.80

HI POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
470.00	V	0
940.00	V	74.68
3290.00	V	91.22

LOW POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
470.00	V	0
940.00	H	79.48

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RECEIVER RADIATED SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 15.109, RSS-GEN 4.10, 6

Requirements: 30-88 MHz 40.0 dB μ V/m measured at 3 meters
 88-216 MHz 43.5 dB μ V/m
 216-960 MHz 46.0 dB μ V/m
 ABOVE 960 MHz 54.0 dB μ V/m

TEST DATA:

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB μ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dB μ V/m	Margin dB
450.0	502.90	20.0	H	1.31	18.16	39.47	6.53
450.0	502.90	25.1	V	1.31	18.07	44.48	1.52
450.0	1,005.90	16.5	H	2.10	27.60	46.20	7.80
450.0	1,005.90	17.5	V	2.10	27.60	47.20	6.80
450.0	2,011.80	9.0	H	2.91	31.23	43.14	10.86
450.0	2,011.80	9.2	V	2.91	31.23	43.34	10.66
460.0	512.90	17.0	H	1.34	18.83	37.17	8.83
460.0	512.90	17.8	V	1.34	18.44	37.58	8.42
460.0	1,025.90	15.1	H	2.12	27.62	44.84	9.16
460.0	1,025.90	17.6	V	2.12	27.62	47.34	6.66
460.0	2,051.80	10.6	H	2.94	31.33	44.87	9.13
460.0	2,051.80	11.7	V	2.94	31.33	45.97	8.03
470.0	522.90	18.3	H	1.37	18.78	38.45	7.55
470.0	522.90	22.5	V	1.37	18.13	42.00	4.00
470.0	1,045.90	13.3	V	2.14	27.64	43.08	10.92
470.0	2,091.80	11.1	H	2.96	31.44	45.50	8.50
470.0	2,091.80	12.6	V	2.96	31.44	47.00	7.00

FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 90.213, RSS-119 5.3, RSS-GEN 7.2.4

Requirements: Temperature range requirements: -30 to +50° C.
 Voltage Variation +, -15%
 ±1.5 PPM

Method of Measurements: ANSI/TIA 603-C: 2004

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	460.000001	0.61
-20	460.000075	0.77
-10	459.999956	0.51
0	459.999825	0.23
+10	459.999732	0.03
+20	459.999662	-0.13
+30	459.9995	-0.48
+40	459.999429	-0.63
+50	459.99945	-0.59

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery (%)	Frequency (MHz)	Frequency Stability (PPM)
-15%	459.999694	-0.06
0	459.999720	0
+15%	459.999707	-0.03

TRANSIENT FREQUENCY BEHAVIOR

Rule Part No.: FCC Part 2.1055(a)(1), FCC Part 90.214, IC RSS-119 5.8

Requirements: Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz

Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels

t ₁ ⁴	±25.0 kHz	5.0 ms	10.0 ms
t ₂	±12.5 kHz	20.0 ms	25.0 ms
t ₃ ⁴	±25.0 kHz	5.0 ms	10.0 ms

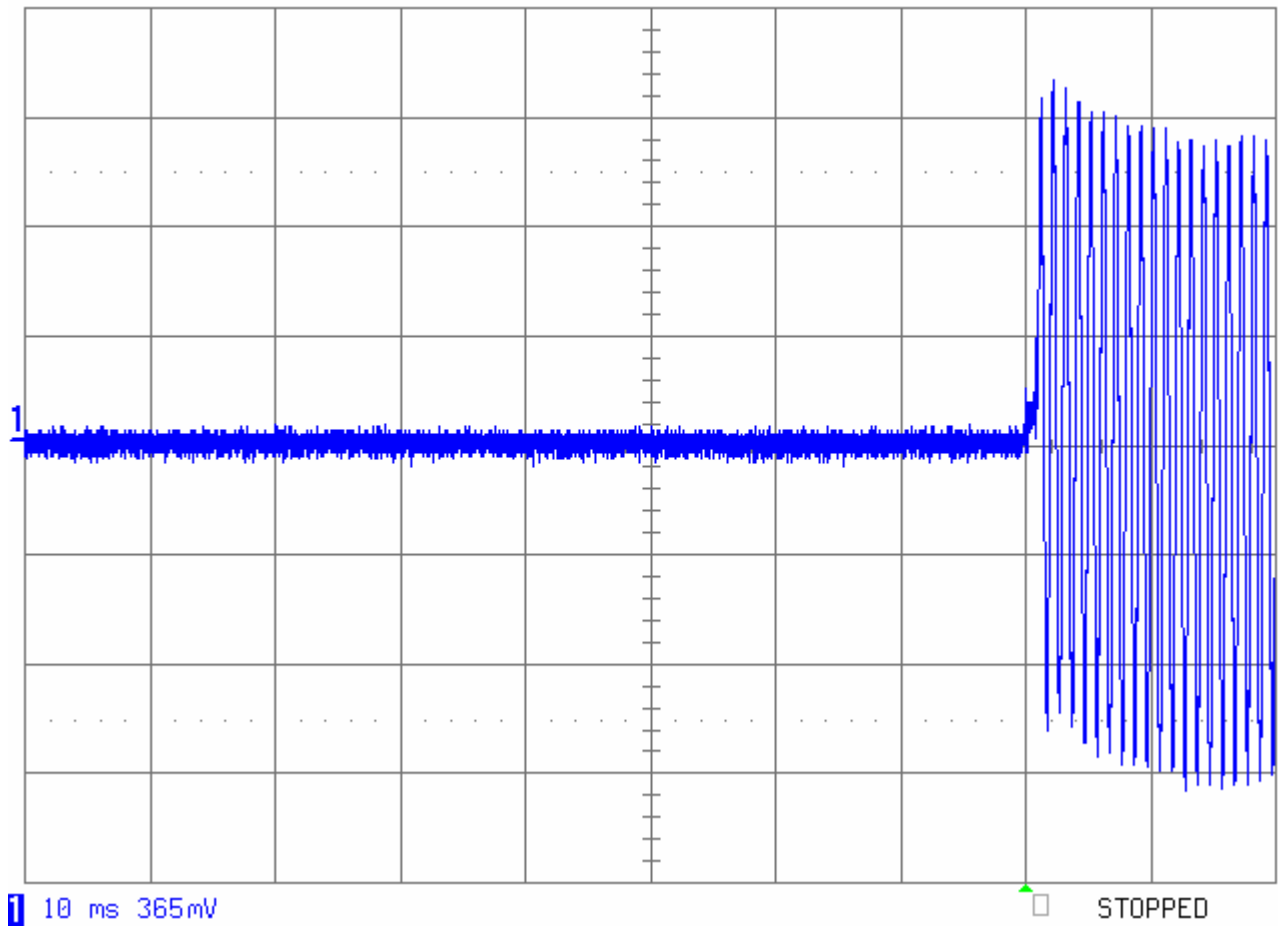
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

t ₁ ⁴	±12.5 kHz	5.0 ms	10.0 ms
t ₂	±6.25 kHz	20.0 ms	25.0 ms
t ₃ ⁴	±12.5 kHz	5.0 ms	10.0 ms

Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels

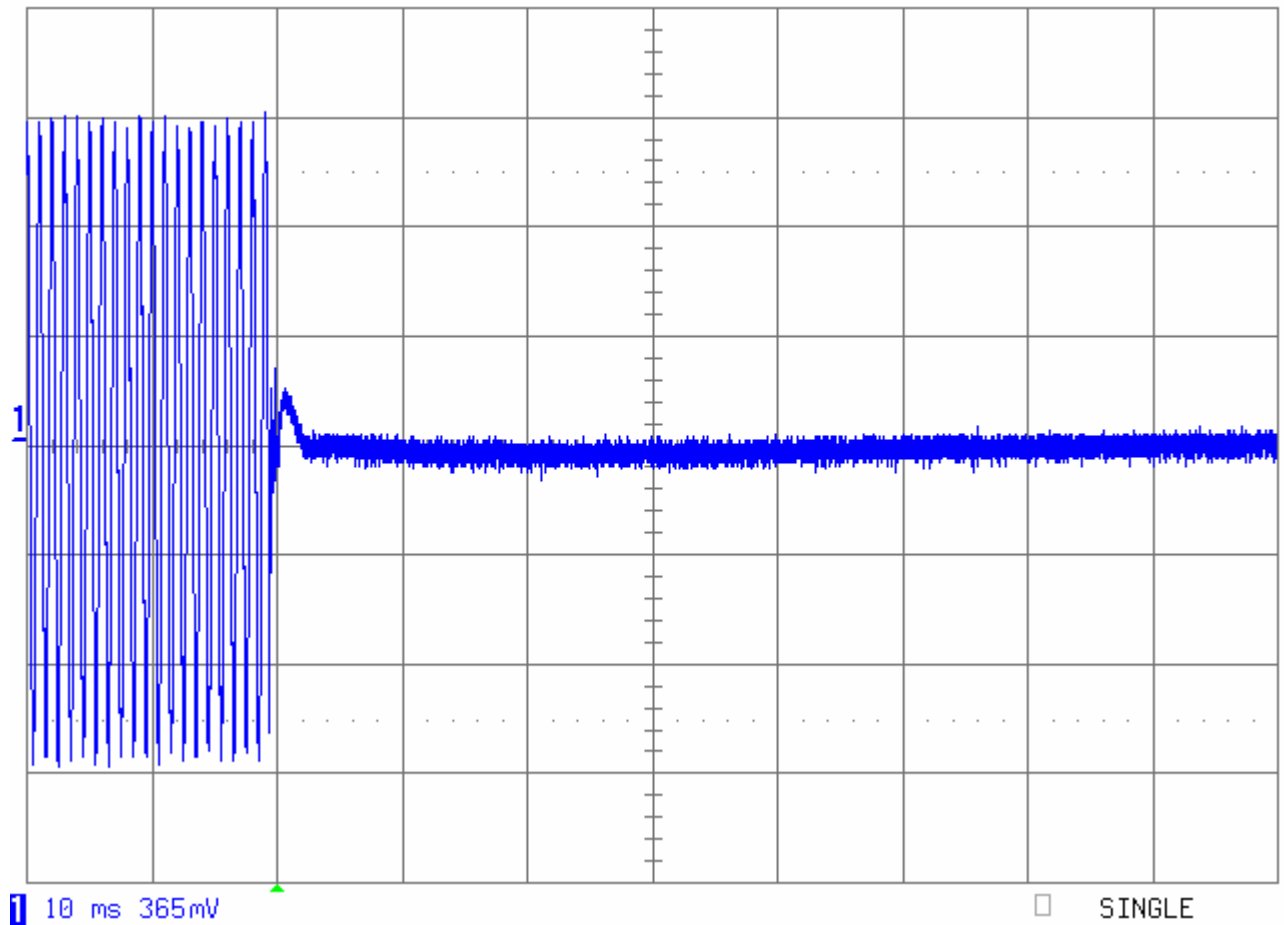
t ₁ ⁴	±6.25 kHz	5.0 ms	10.0 ms
t ₂	±3.125 kHz	20.0 ms	25.0 ms
t ₃ ⁴	±6.25 kHz	5.0 ms	10.0 ms

TRANSIENT FREQUENCY RESPONSE OFF (12.5 kHz channel)
Reading Floppy Disk Drive



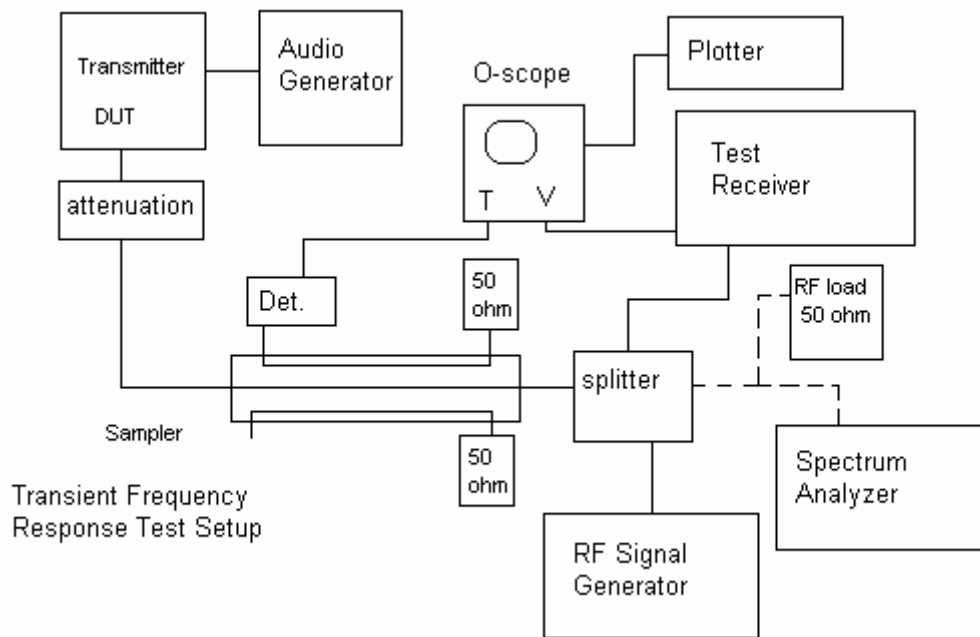
TRANSIENT FREQUENCY RESPONSE ON (12.5 kHz channel)

Reading Floppy Disk Drive



TEST PROCEDURE: ANSI/TIA 603-C:2004 PARA 2.2.19

1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.
3. Reduce the attenuation between the transmitter and the RF detector by 30 dB. With the levels set as above the transient frequency behavior was observed & recorded.

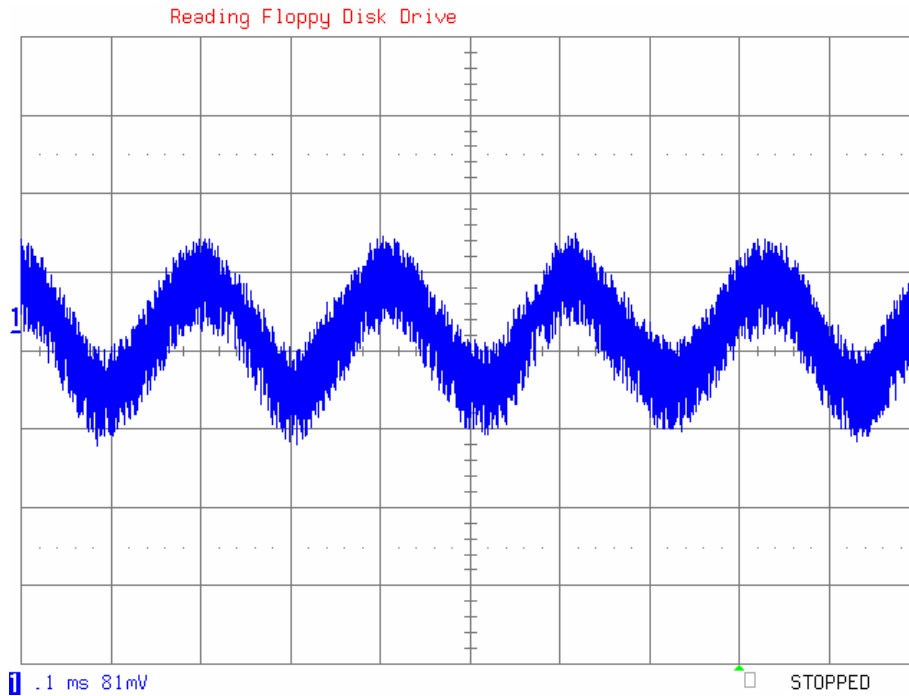


SPECTRAL EFFICIENCY

Rule Part No.: FCC Part 90.203, IC RSS-119

Requirements:

The plot below is demodulated 9600 baud data.





EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/11/07	5/11/10
AC Voltmeter	HP	400FL	2213A14499	CAL 3/23/09	3/23/10
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/22/09	11/22/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/21/09	11/21/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/24/09	11/24/11
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/21/09	11/21/11
Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 3/30/09	3/30/11
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/3/09	3/3/12
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 4/5/09	4/5/12
Hygro-Thermometer	Extech	445703	0602	CAL 1/30/09	1/30/11
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/9/09	5/9/11
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/14/09	5/14/11
System One	Audio Precision	System One	SYS1-45868	CHAR 2/27/08	2/27/10
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/08	4/25/10

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