



Engineering and Testing for EMC and Safety Compliance

CERTIFICATION APPLICATION REPORT FCC PART 90/INDUSTRY CANADA RSS-119

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FCC ID:	RXUSP510U2	FRN NUMBER:	0010534170
MODEL:	SP510 U2	RTL WORK ORDER NUMBER:	2004192
EQUIPMENT TYPE:	PTT UHF-H	RTL QUOTE NUMBER:	QRTL04-399
DATE OF TEST REPORT:	December 30, 2004		
FCC Classification:	☒ TNF – Licensed Non-Broadcast Transmitter Held to Face		
FCC Rule Part(s):	Part 90: Private Land Mobile Radio Services		
Industry Canada Standard:	RSS-119: Land Mobile and Fixed Radio Transmitters and Receivers, 27.41MHz to 960MHz		
Frequency Range (MHz)	Output Power (W)	Frequency Tolerance (PPM)	Emission Designator
440-470	6.2	3.05	16K0F3E
440-470	6.2	3.05	11K0F3E

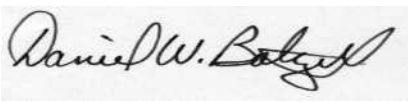
We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to or exclusions from the FCC Part 2, FCC Part 90, Industry Canada RSS-119, ANSI C63.2, ANSI/TIA-603-B-2002 and ANSI/TIA/EIA 603-1.

Signature: 

Date: December 30, 2004

Typed/Printed Name: Desmond A. Fraser

Position: President

Signature: 

Date: December 30, 2004

Typed/Printed Name: Daniel Baltzell

Position: Test Engineer

TABLE OF CONTENTS

1	GENERAL INFORMATION	5
1.1	SCOPE	5
1.2	TEST FACILITY	5
1.3	RELATED SUBMITTAL(S)/GRANT(S)	5
2	EQUIPMENT INFORMATION	6
2.1	TEST SYSTEM DETAILS	6
2.2	WORST CASE CONFIGURATION OF TESTED SYSTEM	7
3	DC VOLTAGES AND CURRENTS - FCC PART 2.1033(C)(8)	8
4	RF POWER OUTPUT - §2.1046, RSS-119 §6.2	9
4.1	ANSI/TIA/EIA-603-1992, SECTION 2.2.1 TEST PROCEDURE	9
4.2	RF POWER OUTPUT TEST EQUIPMENT	9
4.3	RF POWER OUTPUT TEST DATA	10
5	MODULATION CHARACTERISTICS - §2.1047 TEST PROCEDURE, RSS-119 §6.6	11
5.1	MODULATION CHARACTERISTICS TEST EQUIPMENT	11
6	MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE FCC PART 2 §2.1047(A)	11
6.1	TEST PROCEDURE	11
6.2	TEST DATA	12
7	MODULATION CHARACTERISTICS - AUDIO LOW PASS FILTER RESPONSE FCC PART 2 §2.1047(A)	13
7.1	TEST PROCEDURE	13
7.2	TEST DATA	13
8	MODULATION CHARACTERISTICS - MODULATION LIMITING; FCC PART 2 §2.1047(B)	14
8.1	TEST PROCEDURE	14
8.2	TEST DATA	14
9	OCCUPIED BANDWIDTH - §2.1049, RSS-119 §6.4	18
9.1	OCCUPIED BANDWIDTH - §2.1049 TEST PROCEDURE	18
9.2	OCCUPIED BANDWIDTH TEST EQUIPMENT	18
9.3	OCCUPIED BANDWIDTH TEST DATA	19
9.4	OCCUPIED BANDWIDTH TEST DATA	20
9.5	OCCUPIED BANDWIDTH TEST DATA	21
10	SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051, RSS-119 §6.3	22
10.1	SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051 TEST PROCEDURE	22
10.2	SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT	22
10.3	CONDUCTED SPURIOUS EMISSIONS TEST DATA	23
11	RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053, RSS-119 §6.3	26
11.1	RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053	26
11.2	RADIATED SPURIOUS TEST EQUIPMENT	27
11.3	RADIATED SPURIOUS EMISSIONS TEST DATA - §2.1053	28
12	FREQUENCY STABILITY / TEMPERATURE VARIATION - §2.1055, RSS-119 §7.0	29
12.1	MEASUREMENT METHOD:	29
12.2	TIME PERIOD AND PROCEDURE:	29
12.3	FREQUENCY TOLERANCE:	29
12.4	FREQUENCY STABILITY TEST EQUIPMENT	29
12.5	FREQUENCY STABILITY TEST DATA - §2.1055	30
13	TRANSIENT FREQUENCY BEHAVIOR - FCC PART 90 §90.214, RSS-119 §7.0	33
13.1	TRANSIENT FREQUENCY BEHAVIOR TEST PROCEDURE	33
13.2	TRANSIENT FREQUENCY BEHAVIOR LIMITS	33
13.3	TRANSIENT FREQUENCY BEHAVIOR TEST DATA	35
14	NECESSARY BANDWIDTH AND EMISSION BANDWIDTH - FCC PART 2.202	39
15	CONCLUSION	39

FIGURE INDEX

FIGURE 2-1:	WORST CASE CONFIGURATION OF SYSTEM UNDER TEST	7
FIGURE 4-1:	ILLUSTRATION OF HOW THE EQUIPMENT IS CONNECTED	9

TABLE INDEX

TABLE 2-1:	EQUIPMENT UNDER TEST (EUT)	6
TABLE 4-1:	RF POWER OUTPUT TEST EQUIPMENT	9
TABLE 4-2:	RF POWER OUTPUT TEST DATA HIGH POWER	10
TABLE 4-3:	RF POWER OUTPUT TEST DATA LOW POWER	10
TABLE 5-1:	MODULATION CHARACTERISTICS TEST EQUIPMENT	11
TABLE 9-1:	OCCUPIED BANDWIDTH TEST EQUIPMENT	18
TABLE 10-1:	SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT	22
TABLE 10-2:	CONDUCTED SPURIOUS EMISSIONS (CHANNEL 1 AT 440.0 MHZ)	23
TABLE 10-3:	CONDUCTED SPURIOUS EMISSIONS (CHANNEL 2 AT 455 MHZ)	24
TABLE 10-4:	CONDUCTED SPURIOUS EMISSIONS (CHANNEL 3 AT 470 MHZ)	25
TABLE 11-1:	RADIATED SPURIOUS TEST EQUIPMENT	27
TABLE 11-2:	RADIATED SPURIOUS EMISSIONS DATA §2.1053	28
TABLE 12-1:	FREQUENCY STABILITY TEST EQUIPMENT	29
TABLE 12-2:	FREQUENCY STABILITY DATA - §2.1055: TEMPERATURE	30
TABLE 12-3:	FREQUENCY STABILITY DATA - §2.1055: VOLTAGE	32
TABLE 13-1:	REQUIREMENTS FOR EUT WITH 25 KHZ CHANNEL SPACING	33
TABLE 13-2:	REQUIREMENTS FOR EUT WITH 12.5 KHZ CHANNEL SPACING	33
TABLE 13-3:	TRANSIENT FREQUENCY BEHAVIOR TEST EQUIPMENT	34

PLOT INDEX

PLOT 6-1:	AUDIO FREQUENCY RESPONSE CHANNEL 2 AT 455 MHZ	12
PLOT 7-1:	AUDIO LOW PASS FILTER RESPONSE (CHANNEL 2 AT 455 MHZ)	13
PLOT 8-1:	MODULATION LIMITING RESPONSE (POSITIVE PEAK), CH 5, 455 MHZ, NB	14
PLOT 8-2:	MODULATION LIMITING RESPONSE (NEGATIVE PEAK), CH 5, 455 MHZ, NB	15
PLOT 8-3:	MODULATION LIMITING RESPONSE (POSITIVE PEAK), CH 2, 455 MHZ, WB	16
PLOT 8-4:	MODULATION LIMITING RESPONSE (NEGATIVE PEAK), CH 2, 455 MHZ, WB	17
PLOT 9-1:	MASK D (455 MHZ; CH 5; NARROWBAND)	19
PLOT 9-2:	MASK B (455 MHZ; CH 2; WIDEBAND)	20
PLOT 9-3:	MASK D (455 MHZ; CH 8; DIGITAL)	21
PLOT 12-1:	TEMPERATURE FREQUENCY STABILITY - §2.1055	31
PLOT 12-2:	VOLTAGE FREQUENCY STABILITY - §2.1055	32
PLOT 13-1:	ON TIME – CHANNEL 5: 455 MHZ; 12.5 KHZ NARROWBAND	35
PLOT 13-2:	OFF TIME – CHANNEL 5: 455 MHZ; 12.5 KHZ NARROWBAND	36
PLOT 13-3:	ON TIME – CHANNEL 2: 455 MHZ; 25 KHZ WIDEBAND	37
PLOT 13-4:	OFF TIME – CHANNEL 2: 455 MHZ; 25 KHZ WIDEBAND	38

APPENDIX INDEX

APPENDIX A:	RF EXPOSURE	40
APPENDIX B:	AGENCY AUTHORIZATION LETTER	41
APPENDIX C:	CONFIDENTIALITY REQUEST LETTER	42
APPENDIX D:	ALIGNMENT PROCEDURE	43
APPENDIX E:	PRODUCT DESCRIPTION	44
APPENDIX F:	ANTENNA SPECIFICATION	45
APPENDIX G:	LABEL AND LABEL LOCATION	46
APPENDIX H:	BILL OF MATERIAL (PARTS LIST)	47
APPENDIX I:	SCHEMATICS	48
APPENDIX J:	BLOCK DIAGRAM	49
APPENDIX K:	USER'S MANUAL	50
APPENDIX L:	TEST PHOTOGRAPHS	51
APPENDIX M:	EXTERNAL PHOTOGRAPHS	53
APPENDIX N:	INTERNAL PHOTOGRAPHS	58

PHOTOGRAPH INDEX

PHOTOGRAPH 1:	FCC ID LABEL LOCATION; RF WARNING LABEL SAMPLE AND LOCATION	46
PHOTOGRAPH 2:	RADIATED FRONT VIEW	51
PHOTOGRAPH 3:	RADIATED BACK VIEW	52
PHOTOGRAPH 4:	TOP VIEW	53
PHOTOGRAPH 5:	BOTTOM VIEW	54
PHOTOGRAPH 6:	FRONT VIEW	55
PHOTOGRAPH 7:	LEFT SIDE VIEW	56
PHOTOGRAPH 9:	RIGHT SIDE VIEW	57
PHOTOGRAPH 10:	BACK WITH BATTERY REMOVED	58
PHOTOGRAPH 11:	DIGITAL PCB INSIDE BACK COVER	59
PHOTOGRAPH 12:	PCB FRONT	60
PHOTOGRAPH 13:	RF PCB BACK SIDE	61
PHOTOGRAPH 14:	RF PCB FRONT SIDE	62
PHOTOGRAPH 15:	RF PCB FRONT SIDE WITH SHIELDS REMOVED	63

1 GENERAL INFORMATION

1.1 SCOPE

FCC Rules Part 90 (Subpart K): This subpart sets forth special requirements applicable to the use of certain frequencies or frequency bands.

All measurements contained in this application were conducted in accordance with the FCC Rules and Regulations CFR47 Part 90, Industry Canada RSS-119 and ANSI/TIA/EIA603-B-2002 Land Mobile FM or PM Communications Equipment Measurement and Performance Standards. The measurement instrumentation conforms to the ANSI C63.2; standard for EMI and Field Strength Instrumentation. The Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.2 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.2).

1.3 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application for Certification. A DoC report is on file for the receiver section and digital interface for the EUT. The IF, LO and up to the 2nd LO were investigated.

2 EQUIPMENT INFORMATION

2.1 TEST SYSTEM DETAILS

The test sample was received on November 1, 2004. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system are:

TABLE 2-1: EQUIPMENT UNDER TEST (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
UHF Portable Radio	Maxon	SP510 U2	N/A	RXUSP510U2	N/A	16292
UHF Portable Radio	Maxon	SP510 U2	N/A	RXUSP510U2	N/A	16293
Antenna	Maxon	ACC-100	N/A	N/A	N/A	16196
Battery	Maxon	BTM100-01	N/A	N/A	N/A	16180
Battery	Maxon	BTM100-01	N/A	N/A	N/A	16186
Belt Clip	Maxon	N/A	N/A	N/A	N/A	16187
Belt Clip	Maxon	N/A	N/A	N/A	N/A	16188

2.2 WORST CASE CONFIGURATION OF TESTED SYSTEM

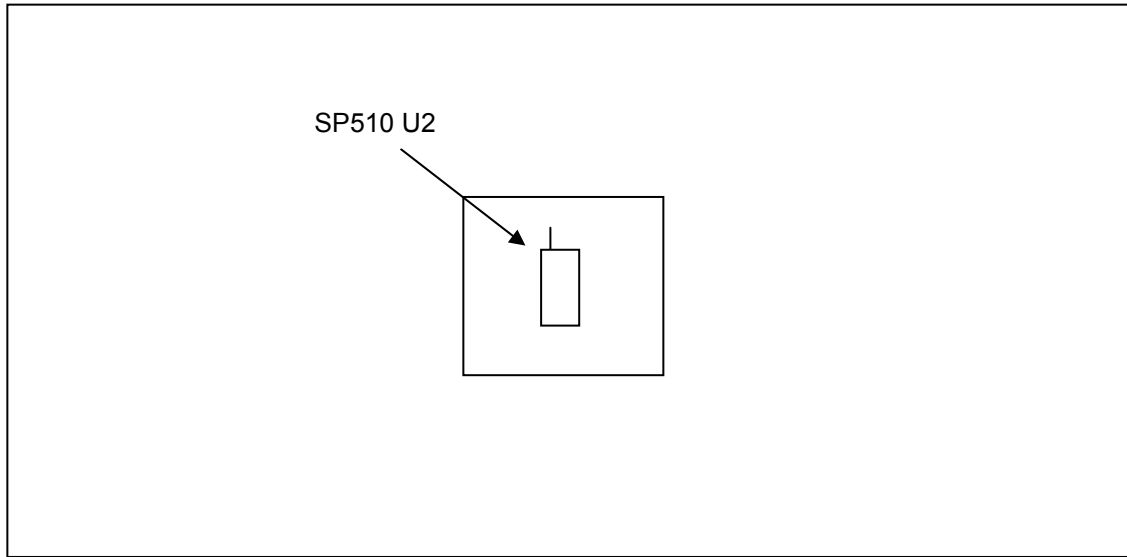


FIGURE 2-1: WORST CASE CONFIGURATION OF SYSTEM UNDER TEST

3 DC VOLTAGES AND CURRENTS - FCC PART 2.1033(C)(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 were:

7.5 volts @ 2.0A High Power 7.5 volts @ 0.84A Low Power
--

4 RF POWER OUTPUT - §2.1046, RSS-119 §6.2

4.1 ANSI/TIA/EIA-603-1992, SECTION 2.2.1 TEST PROCEDURE

Connect the equipment as illustrated below. Measure the transmitter output power during the defined duty cycle. The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

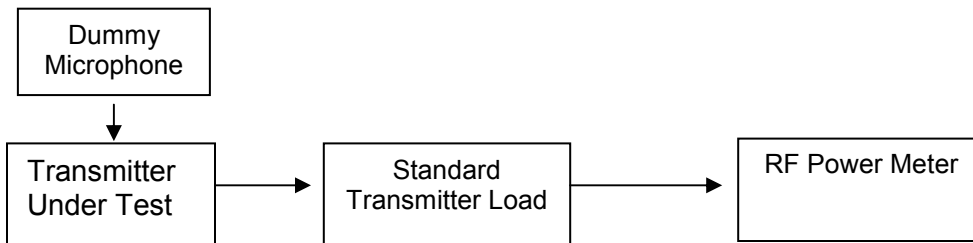


FIGURE 4-1: ILLUSTRATION OF HOW THE EQUIPMENT IS CONNECTED

4.2 RF POWER OUTPUT TEST EQUIPMENT

TABLE 4-1: RF POWER OUTPUT TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Cal Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	8/2/05
901186	Agilent Technologies	E9323A (50 MHz – 6 GHz)	Peak & Average Power Sensor	US40410380	8/2/05

4.3 RF POWER OUTPUT TEST DATA

TABLE 4-2: RF POWER OUTPUT TEST DATA HIGH POWER

Frequency (MHz)	Channel	Power Measured (dBm)	Power (Watt)
440	1	31.23	1.33
455	2	30.24	1.06
470	3	29.98	1.00

TABLE 4-3: RF POWER OUTPUT TEST DATA LOW POWER

Frequency (MHz)	Channel	Power Measured (dBm)	Power (Watt)
440	1	31.23	1.33
455	2	30.24	1.06
470	3	29.98	1.00

TEST PERSONNEL:

Dan Biggs
Test Engineer


Signature

November 19, 2004
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5 MODULATION CHARACTERISTICS - §2.1047 TEST PROCEDURE, RSS-119 §6.6

The modulation characteristic tests apply to analog modulation, and do not apply to digital modulation.

5.1 MODULATION CHARACTERISTICS TEST EQUIPMENT

TABLE 5-1: MODULATION CHARACTERISTICS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Cal Due Date
901118	Hewlett Packard	HP8901B	Modulation Analyzer	2406A00178	7/07/05
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	9/08/05
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892	9/08/05

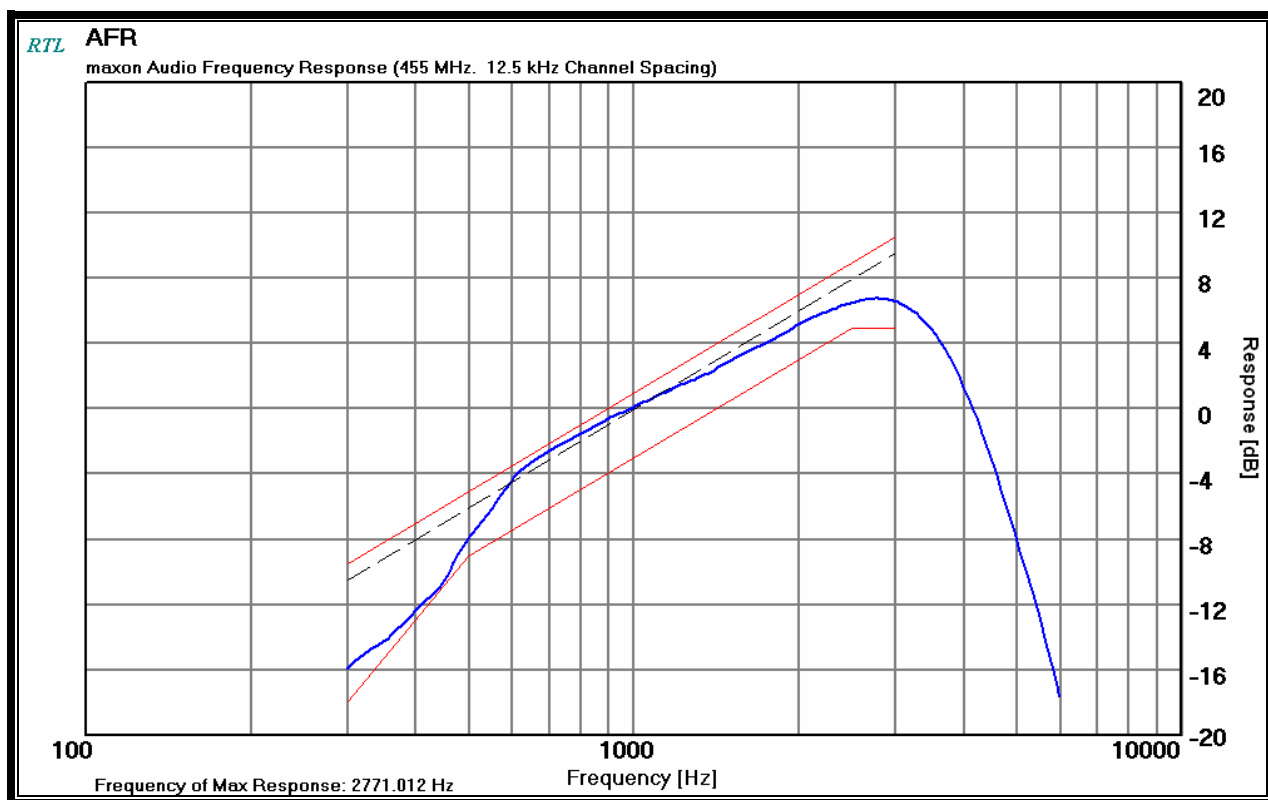
6 MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE FCC PART 2 §2.1047(A)

6.1 TEST PROCEDURE

ANSI/TIA-603-B-2002, section 2.2.6. The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic. The input audio level at 1000 Hz is set to produce 20% of the rated system deviation. This point is shown as the 0 dB reference level, noted DEVref. The audio signal generator was varied from 300 Hz to 5 kHz with the input level held constant. The deviation in kHz was recorded using a modulation analyzer as DEVfreq. The response in dB relative to 1 kHz was calculated as follows: Audio Frequency Response = 20 LOG (DEVfreq/DEVref)

6.2 TEST DATA

PLOT 6-1: AUDIO FREQUENCY RESPONSE CHANNEL 2 AT 455 MHZ



TEST PERSONNEL:

Dan Biggs

November 19, 2004

Test Engineer

Signature

Date Of Test

7 MODULATION CHARACTERISTICS - AUDIO LOW PASS FILTER RESPONSE FCC PART 2 §2.1047(A)

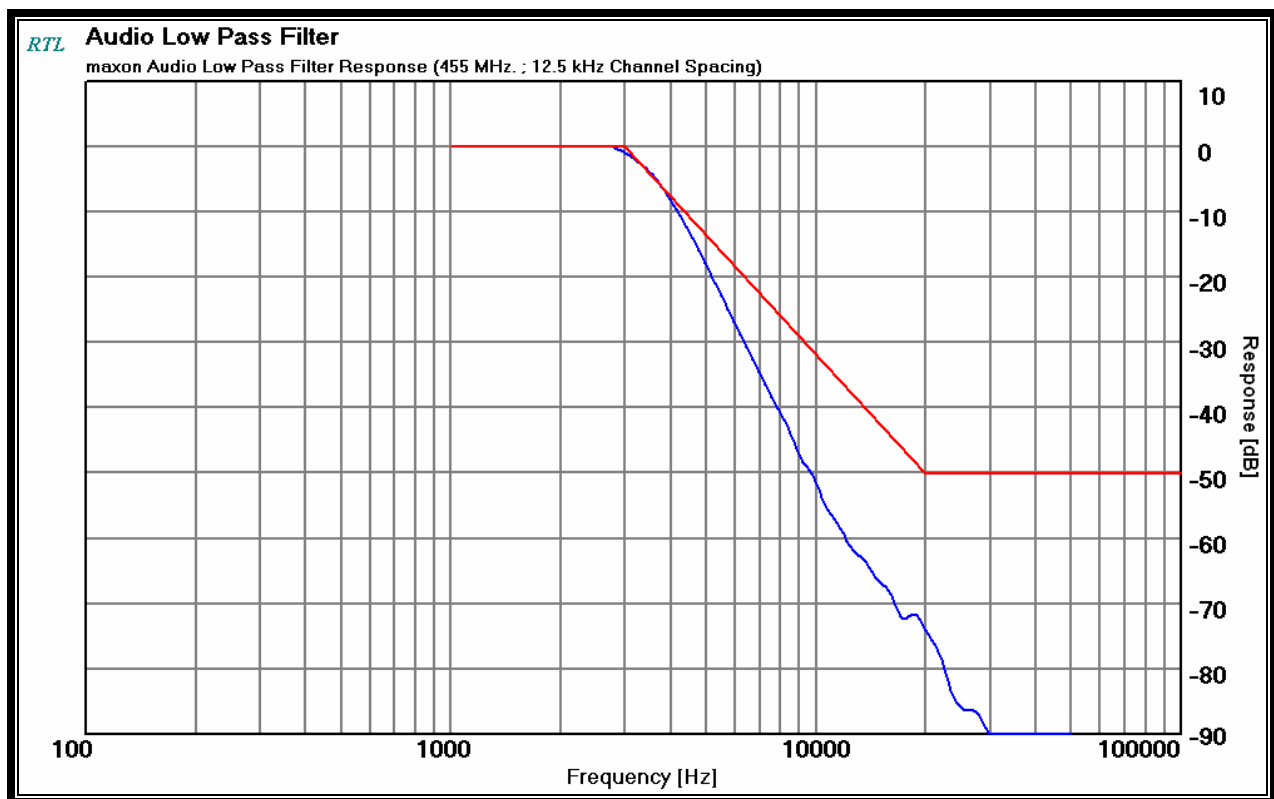
7.1 TEST PROCEDURE

ANSI/TIA-603-B-2002, 2.2.15

The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

7.2 TEST DATA

PLOT 7-1: AUDIO LOW PASS FILTER RESPONSE (CHANNEL 2 AT 455 MHZ)



TEST PERSONNEL:

Dan Biggs
Test Engineer

Daniel Biggs
Signature

November 19, 2004
Date Of Test

8 MODULATION CHARACTERISTICS - MODULATION LIMITING; FCC PART 2 §2.1047(B)

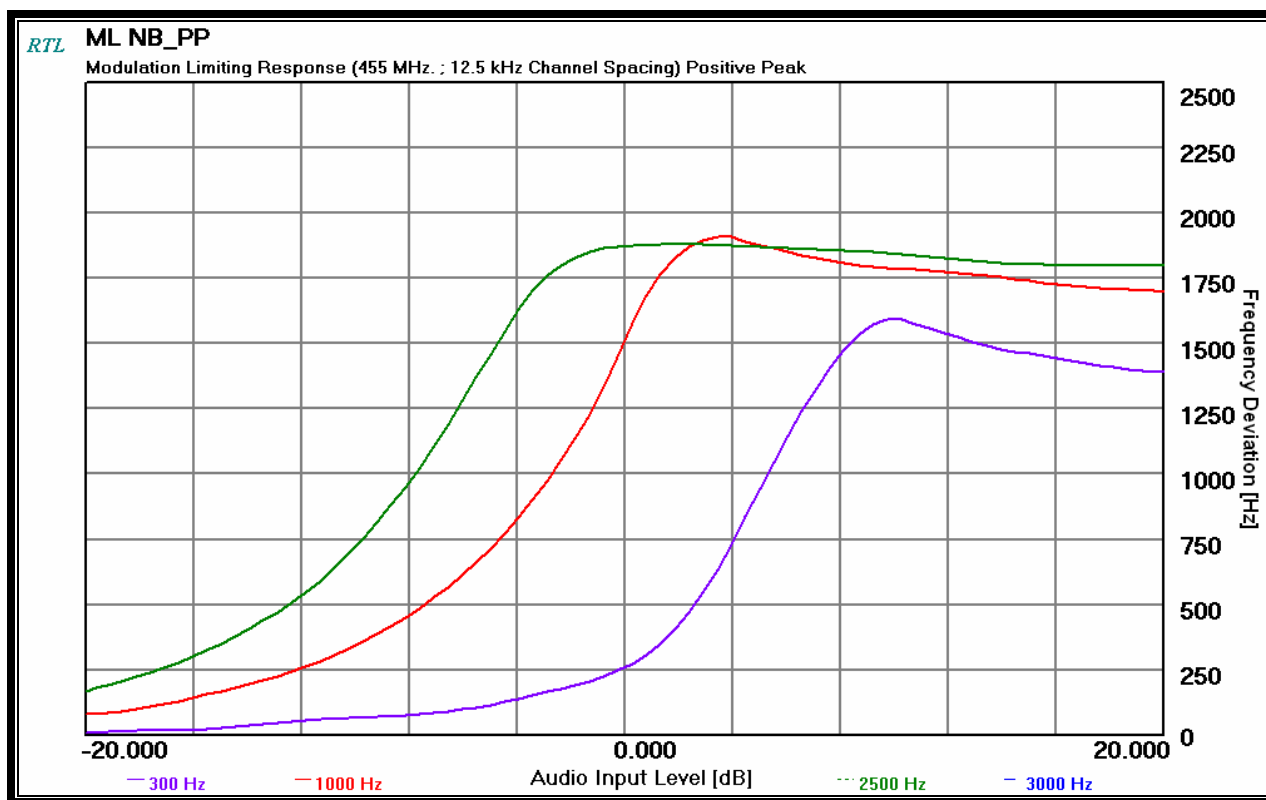
8.1 TEST PROCEDURE

ANSI/TIA-B-603-2002, section 2.2.3

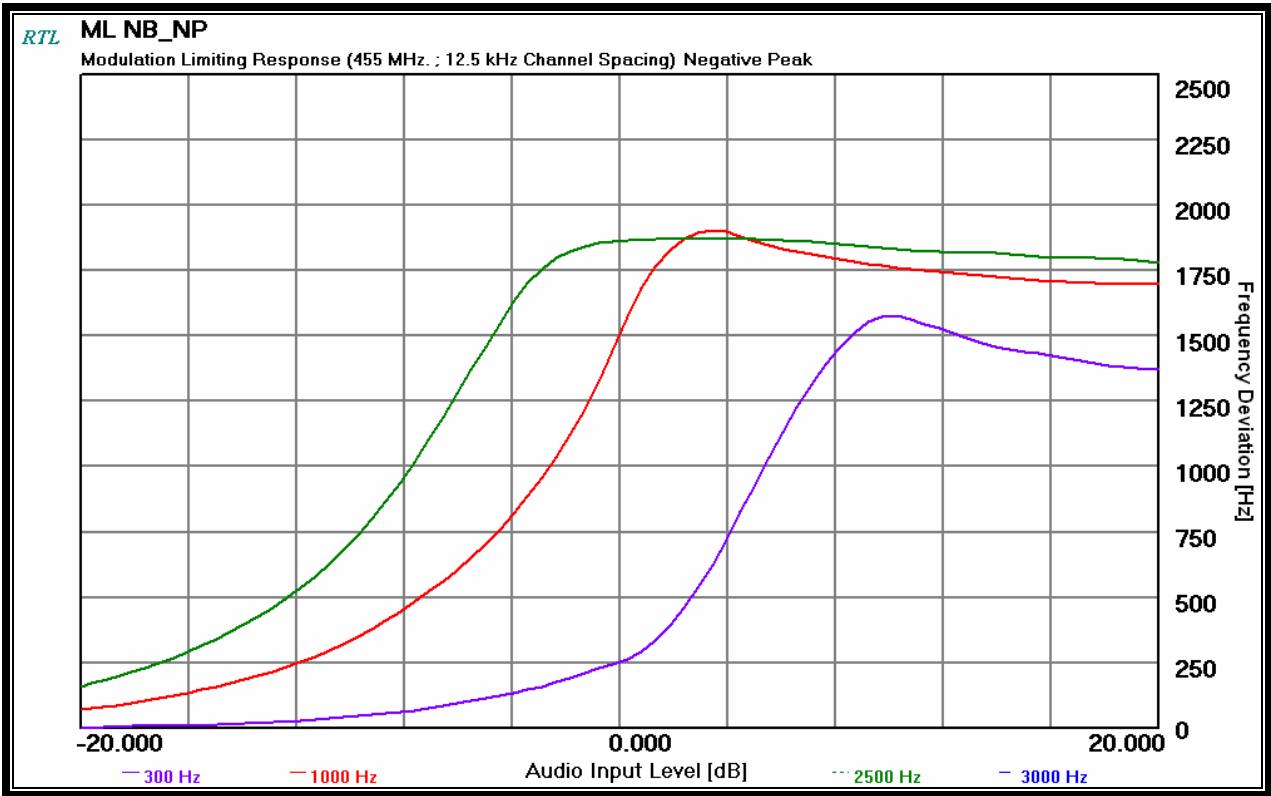
The transmitter is adjusted for full rated system deviation. The audio input level is adjusted for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0 dB) the audio input level is varied from the reference to a level +20 dB above it and -20 dB under it, for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500 Hz. The system deviation obtained as a function of the input level is recorded. Both Positive and Negative Peak deviations were recorded.

8.2 TEST DATA

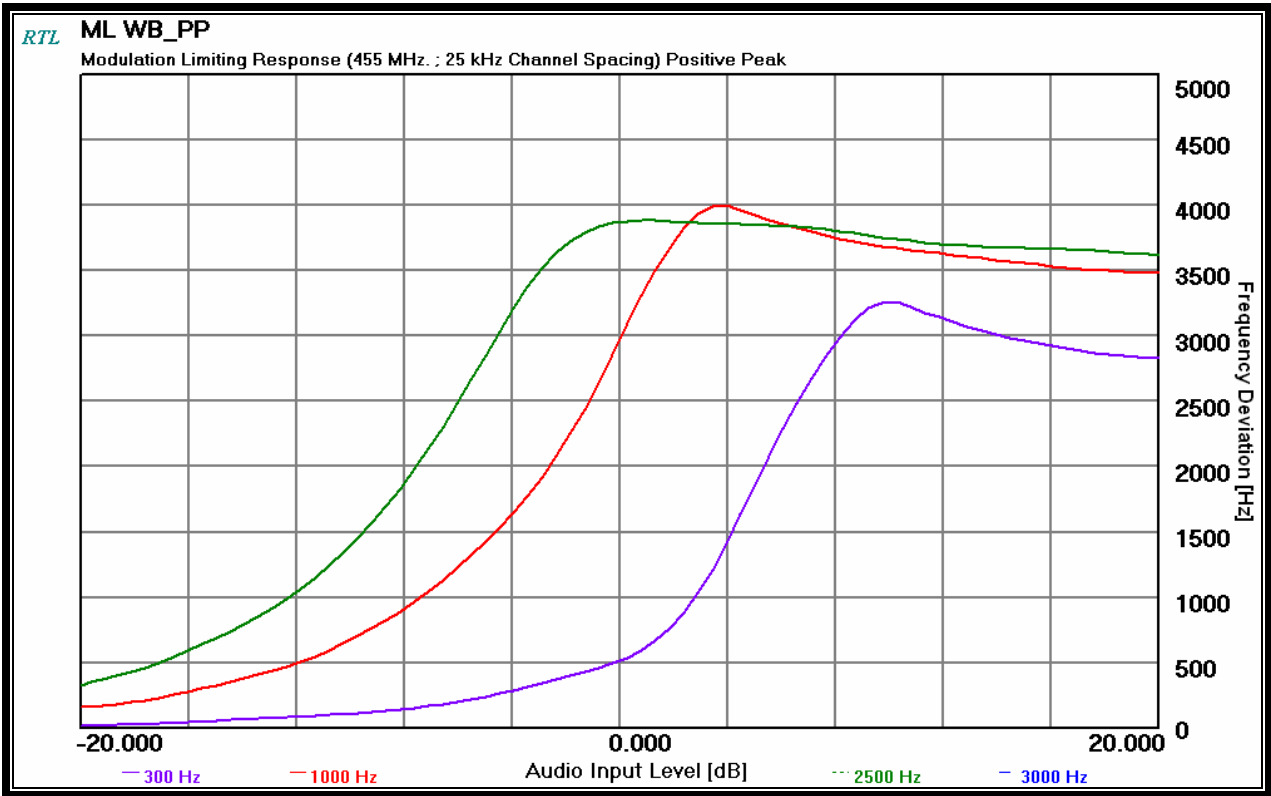
PLOT 8-1: MODULATION LIMITING RESPONSE (POSITIVE PEAK), CH 5, 455 MHZ, NB



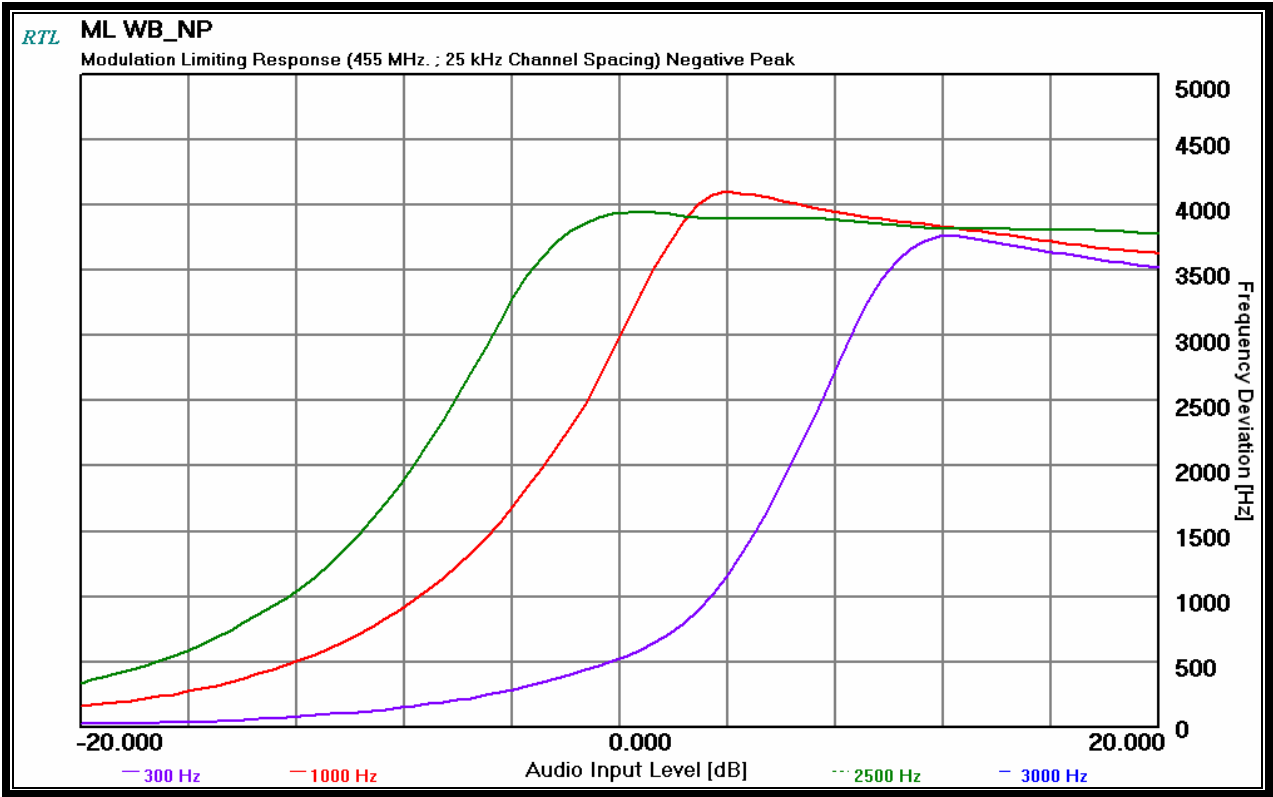
PLOT 8-2: MODULATION LIMITING RESPONSE (NEGATIVE PEAK), CH 5, 455 MHZ, NB



PLOT 8-3: MODULATION LIMITING RESPONSE (POSITIVE PEAK), CH 2, 455 MHZ, WB



PLOT 8-4: MODULATION LIMITING RESPONSE (NEGATIVE PEAK), CH 2, 455 MHZ, WB



TEST PERSONNEL:

Dan Biggs		November 19, 2004
Test Engineer	Signature	Date Of Test

9 OCCUPIED BANDWIDTH - §2.1049, RSS-119 §6.4

9.1 OCCUPIED BANDWIDTH - §2.1049 TEST PROCEDURE

The antenna output terminal of the EUT was connected to the input of a 50 ohm spectrum analyzer through a matched 10 dB attenuator. The radio transmitter was operating at maximum output power with and without internal data modulation. 100% of the in-band modulation was below the specified mask.

(b) *Emission Mask B.* For transmitters that are equipped with an audio low-pass filter pursuant to §90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

(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 $7.27(f_d - 2.88 \text{ kHz})$ 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.

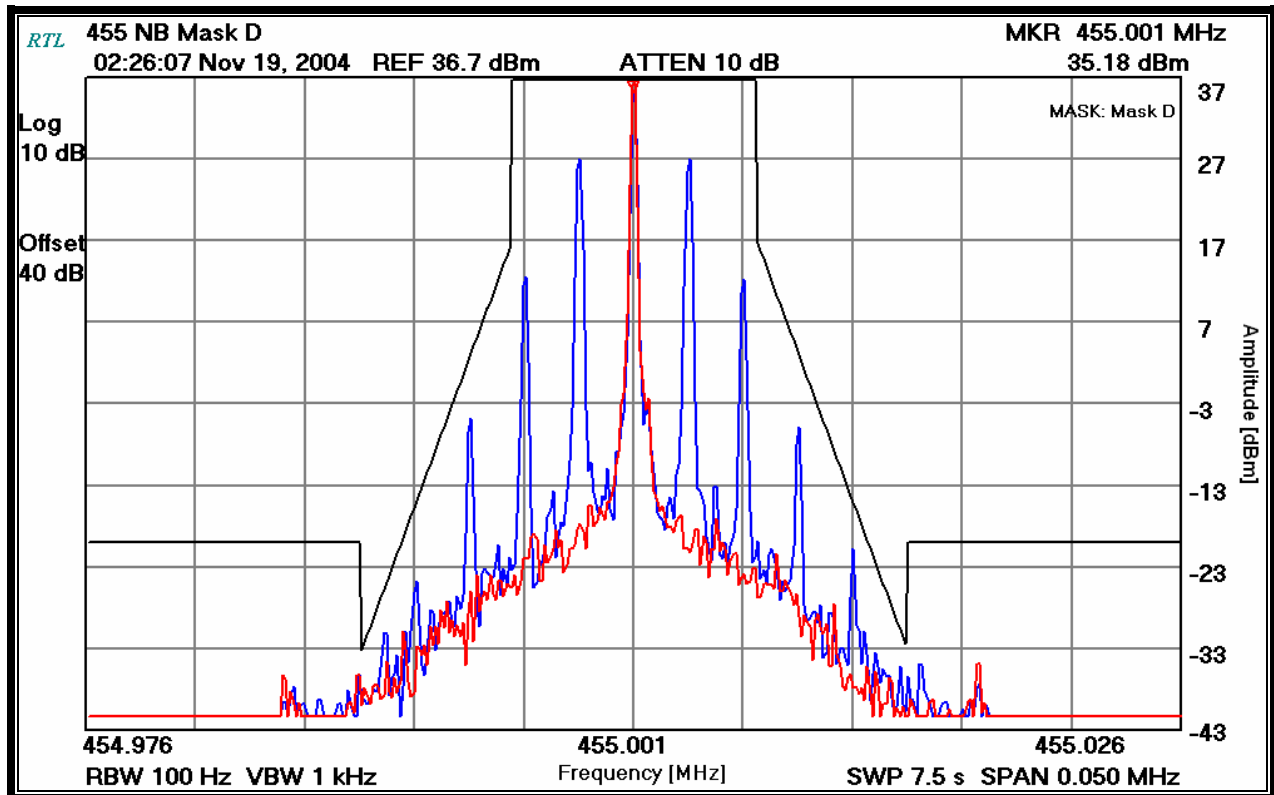
9.2 OCCUPIED BANDWIDTH TEST EQUIPMENT

TABLE 9-1: OCCUPIED BANDWIDTH TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Cal Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	6/23/05
901140	Weinschel Corp.	47-10-34 DC-18GHz	Attenuator, 50W 10dB	BK6203	5/13/05
900927	Tektronix	ASG 100	Audi Signal Generator	B03274 V2.3	3/3/05

9.3 OCCUPIED BANDWIDTH TEST DATA

PLOT 9-1: MASK D (455 MHZ; CH 5; NARROWBAND)



TEST PERSONNEL:

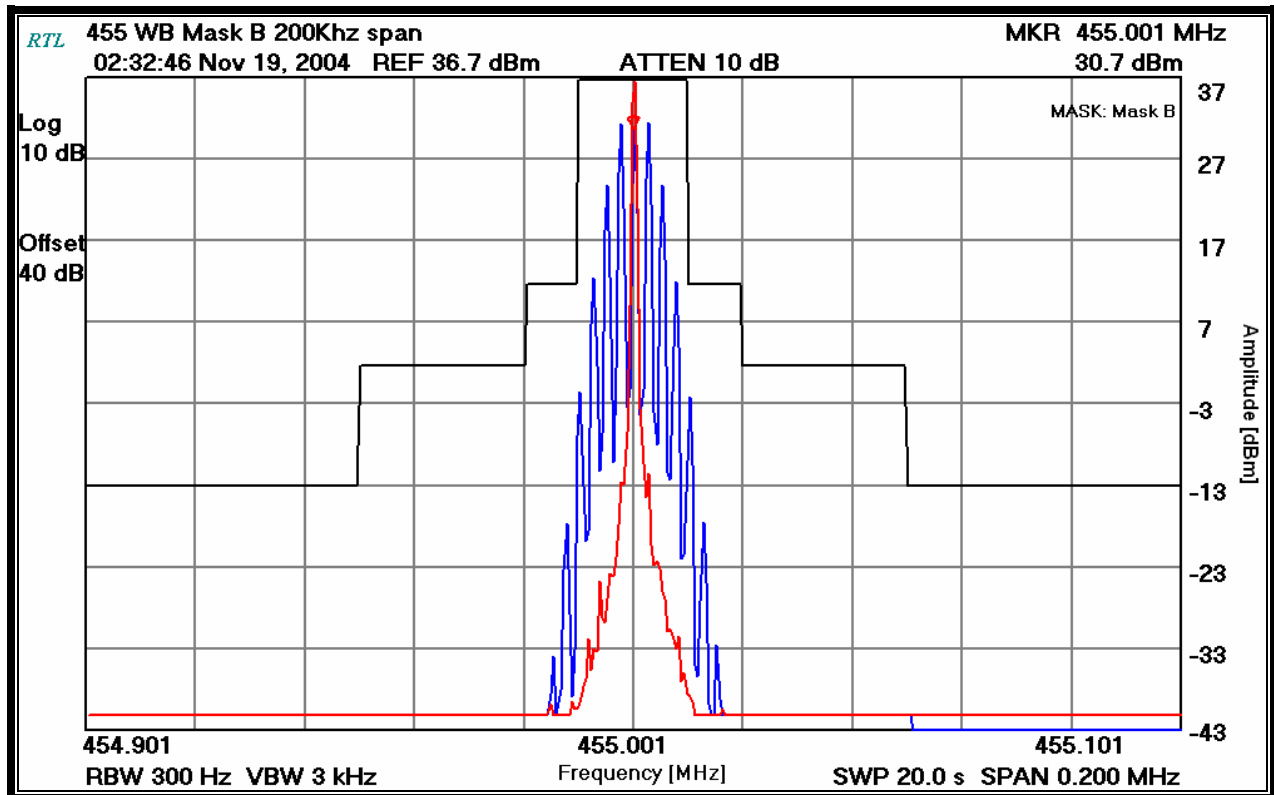
Dan Biggs
 Test Engineer

Daniel Biggs
 Signature

November 19, 2004
 Date Of Test

9.4 OCCUPIED BANDWIDTH TEST DATA

PLOT 9-2: MASK B (455 MHZ; CH 2; WIDEBAND)



TEST PERSONNEL:

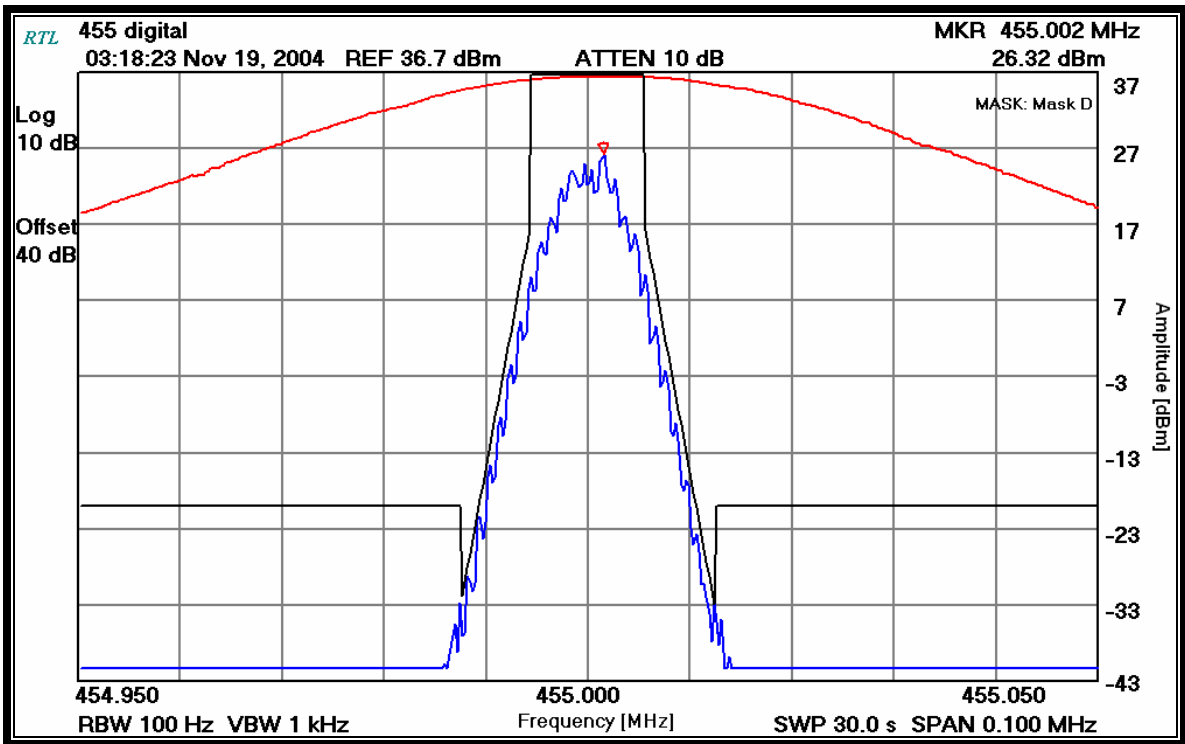
Dan Biggs
Test Engineer

Daniel Biggs
Signature

November 19, 2004
Date Of Test

9.5 OCCUPIED BANDWIDTH TEST DATA

PLOT 9-3: MASK D (455 MHZ; CH 8; DIGITAL)



TEST PERSONNEL:

Dan Biggs
Test Engineer

Daniel Biggs
Signature

November 19, 2004
Date Of Test

10 SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051, RSS-119 §6.3

10.1 SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051 TEST PROCEDURE

The level of the various conducted spurious frequencies was measured by means of a calibrated spectrum analyzer. The antenna output terminal of the EUT was connected to the input of a 50 Ω spectrum analyzer through a matched 10 dB attenuator and notch filter. The transmitter was operating at maximum power.

10.2 SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT

TABLE 10-1: SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Cal Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	6/23/05
901132	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	5/13/05

10.3 CONDUCTED SPURIOUS EMISSIONS TEST DATA

TABLE 10-2: CONDUCTED SPURIOUS EMISSIONS (CHANNEL 1 AT 440.0 MHZ)

Operating Frequency (MHz): 440.0
 Channel: 1
 Measured Conducted Power (dBm): 36.8
 Modulation: Analog
 Limit (dBc): 56.8 (50+10LogP)

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Spectrum Analyzer Level (dBc)	Margin (dB)
880.0	-48.8	0.9	84.7	-27.9
1320.0	-36.8	0.5	73.1	-16.3
1760.0	-52.5	0.4	88.9	-32.1
2200.0	-42.1	0.1	78.8	-22.1
2640.0	-46.9	0.0	83.6	-26.9
3080.0	-47.6	0.6	83.7	-26.9
3520.0	-40.7	0.3	77.2	-20.5
3960.0	-42.5	9.7	69.7	-12.9
4400.0	-39.6	0.5	75.9	-19.1

TEST PERSONNEL:

Dan Biggs
 Test Engineer


 Signature

November 19, 2004
 Date Of Test

TABLE 10-3: CONDUCTED SPURIOUS EMISSIONS (CHANNEL 2 AT 455 MHZ)

Operating Frequency (MHz): 455
 Channel: 2
 Measured Conducted Power (dBm): 36.8
 Modulation: Analog
 Limit (dBc): 56.8 (50+10LogP)

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Spectrum Analyzer Level (dBc)	Margin (dB)
910.0	-43.1	0.4	79.5	-22.7
1365.0	-37.1	0.4	73.5	-16.7
1820.0	-45.8	0.2	82.4	-25.6
2275.0	-48.3	0.2	84.9	-28.1
2730.0	-43.1	0.4	79.5	-22.8
3185.0	-43.6	0.3	80.0	-23.3
3640.0	-37.3	1.0	73.1	-16.3
4095.0	-44.5	1.9	79.3	-22.5
4550.0	-33.2	0.5	69.5	-12.7

TEST PERSONNEL:

Dan Biggs
 Test Engineer


 Signature

November 19, 2004
 Date Of Test

TABLE 10-4: CONDUCTED SPURIOUS EMISSIONS (CHANNEL 3 AT 470 MHZ)

Operating Frequency (MHz): 470
 Channel: 3
 Measured Conducted Power (dBm): 36.8
 Modulation: Analog
 Limit (dBc): 56.8 (50+10LogP)

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Notch Filter Insertion Loss (dB)	Corrected Spectrum Analyzer Level (dBc)	Margin (dB)
940.0	-37.2	0.6	73.4	-16.6
1410.0	-37.7	0.2	74.3	-17.5
1880.0	-37.7	0.5	74.0	-17.2
2350.0	-39.6	0.1	76.3	-19.5
2820.0	-44.1	0.2	80.7	-23.9
3290.0	-43.0	0.0	79.8	-23.0
3760.0	-34.8	0.6	71.0	-14.2
4230.0	-41.5	0.7	77.6	-20.8
4700.0	-34.2	0.3	70.7	-13.9

TEST PERSONNEL:

Dan Biggs



November 19, 2004

Test Engineer

Signature

Date Of Test

11 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053, RSS-119 §6.3

11.1 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

A receiving antenna located 3 meters from the turntable received any signal radiated from the transmitter and its operating accessories. The receiving antenna was varied from 1 to 4 meters

ERP Measurements by Substitution Method:

The EUT was placed on a turntable 3-meters from the receive antenna. The EUT was placed on the turntable with the transmitter transmitting into a non-radiating load. The field of maximum intensity was found by rotating the EUT 360 degrees in all 3 orthogonal axes, and changing the height of the receive antenna from 1 to 4 meters. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. An antenna was substituted in place of the EUT. This antenna was fed by a signal generator, and the input level adjusted to the same field strength level as the EUT. The conducted power from the signal generator was recorded. The level was checked at the antenna input using a splitter to verify no impedance mismatch and corrected. The signal generator level was further corrected by subtracting the connecting cable loss, and further corrected with the transmitting antenna gain referenced to a ½ wave dipole measurement.

The spectrum analyzer was set to the following settings: Quasi-peak below 1 GHz (120 kHz RBW/VBW); Average above 1 GHz (1MHz RBW/10 Hz VBW), sweep speed auto.

11.2 RADIATED SPURIOUS TEST EQUIPMENT

TABLE 11-1: RADIATED SPURIOUS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Cal Due Date
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz - 2 GHz)	2648	9/20/05
901215	Hewlett Packard	8596EM	EMC Analyzer (9kHz-12.8GHz)	3826A00144	9/8/05
900928	Hewlett Packard	83752A	Synthesized Sweeper (0.01 - 20 GHz)	3610A00866	9/5/05
900814	Electro-Metrics	EM-6961 (RGA-60)	Double Ridged Guide Antenna (1 - 18 GHz)	2310	2/17/06
900772	EMCO	3161-02	Horn antenna (2.0 - 4.0 GHz)	9804-1044	5/20/07
900321	EMCO	3161-03	Horn antenna (4.0 - 8.2 GHz)	9508-1020	5/20/07
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	5/5/05
900154	Compliance Design	Roberts Dipole	Adjustable Elements Dipole Antenna (30 – 1000 MHz)	N/A	10/6/05
900352	WERLATONE	C1795	Directional Coupler, 100 watt (1 - 1000 MHz)	4067	7/1/2005
901341	Narda Microwave Corp.	3003-20-40	Coaxial Directional Coupler (2 - 4 GHz)	2	7/1/2005
901342	Narda Microwave Corp.	3044-10	Coaxial Directional Coupler (4 - 8 GHz)	901	7/1/2005
901345	Narda Microwave Corp.	3002-30	Coaxial Directional Coupler (0.95 - 2 GHz)	20032	7/1/2005

11.3 RADIATED SPURIOUS EMISSIONS TEST DATA - §2.1053

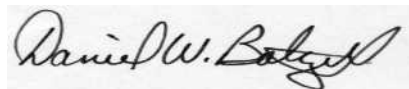
Operating Frequency (MHz): 455
 Channel: 2
 Measured Conducted Power (dBm): 36.8
 Modulation: Analog narrowband
 Distance (m): 3
 Limit (dBc): 56.8 (50+10LogP)

TABLE 11-2: RADIATED SPURIOUS EMISSIONS DATA §2.1053

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Margin (dB)
910.0	80.5	-37.8	3.6	-1.1	79.3	-22.5
1365.0	85.5	-31.3	4.6	3.4	69.3	-12.5
1820.0	69.8	-37.6	5.5	4.8	75.1	-18.3
2275.0	51.7	-41.6	6.4	5.0	79.8	-23.0
2730.0	51.3	-41.1	7.3	5.7	79.5	-22.7
3185.0	67.3	-23.3	7.8	6.1	61.8	-5.0
3640.0	56.7	-32.9	8.1	5.9	71.9	-15.1
4095.0	49.0	-37.9	8.4	6.1	77.0	-20.2
4550.0	57.5	-29.6	8.6	7.0	68.0	-11.2

TEST PERSONNEL:

Daniel Baltzell
 Test Engineer



Signature

November 19, 2004
 Date Of Test

12 FREQUENCY STABILITY / TEMPERATURE VARIATION - §2.1055, RSS-119 §7.0

12.1 MEASUREMENT METHOD:

The frequency stability of the transmitter was measured by:

1. Temperature: The temperature was varied from -30°C to +50°C at intervals no more than 10°C throughout the temperature range using an environmental chamber. A period of time sufficient to stabilize all of the components in the equipment shall be allowed prior to each frequency measurement.
2. Primary Supply Voltage: The primary supply voltage was varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied. The EUT was tested down to the battery endpoint.

12.2 TIME PERIOD AND PROCEDURE:

1. The carrier frequency of the transmitter was measured at room temperature (25°C to 27°C to provide a reference).
2. The equipment was subjected to a three hour "soak" at -30°C without any power applied.
3. After the "soak" at -30°C, the measurement of the carrier frequency of the transmitter was made within a three-minute interval after applying power to the transmitter.
4. Frequency measurements were made at 10°C intervals up to +50°C, then back to room temperature. A minimum period of one hour was provided to allow stabilization of the equipment at each temperature level.

12.3 FREQUENCY TOLERANCE:

The minimum frequency stability shall be +/- 5.0 ppm referenced to a received carrier frequency from a base station.

12.4 FREQUENCY STABILITY TEST EQUIPMENT

TABLE 12-1: FREQUENCY STABILITY TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Cal Due Date
900946	Tenney Engineering, Inc	TH65	Temperature Chamber with Humidity	11380	2/3/05
901247	Wavetek	DM25XT	Multimeter	40804098	3/3/05
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	8/11/05

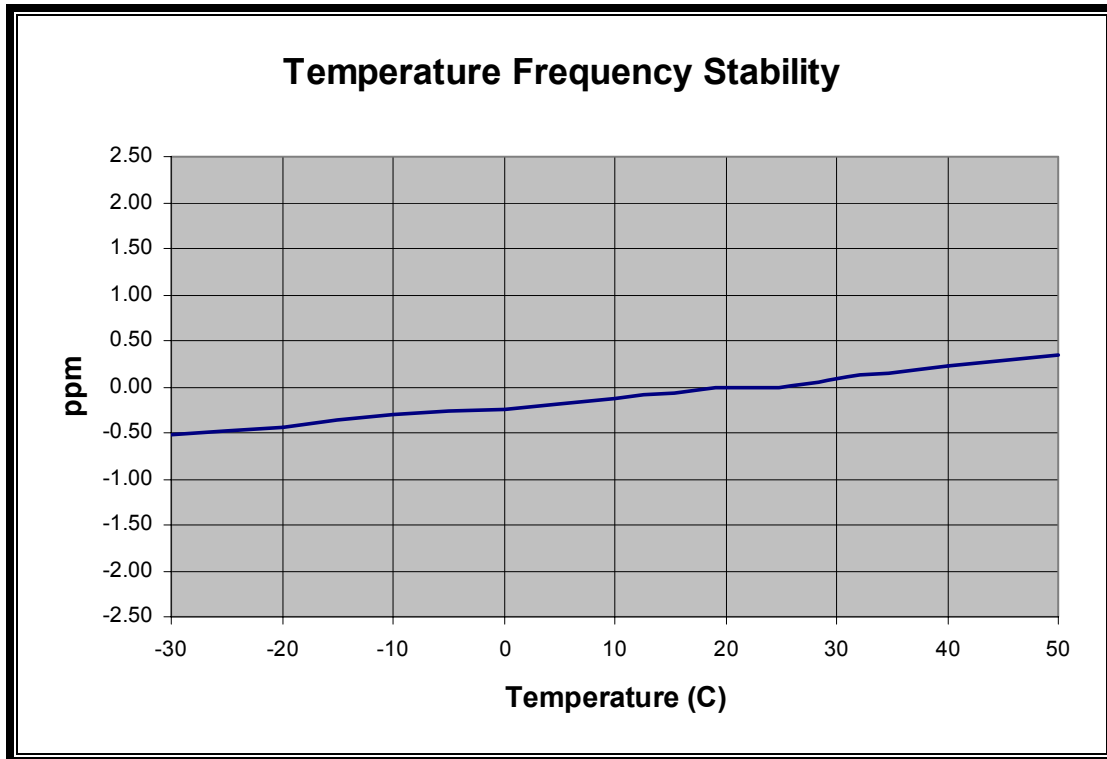
12.5 FREQUENCY STABILITY TEST DATA - §2.1055

Operating Frequency (MHz): 455
 Channel: 2
 Reference Voltage: 7.5 VDC
 Deviation Limit: 5.0 PPM

TABLE 12-2: FREQUENCY STABILITY DATA - §2.1055: TEMPERATURE

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	454.999765	-0.52
-20	454.999802	-0.44
-10	454.999860	-0.31
0	454.999890	-0.24
10	454.999945	-0.12
20	455.000000	0.00
24.8	455.000000	reference
30	455.000042	0.09
40	455.000104	0.23
50	455.000154	0.34

PLOT 12-1: TEMPERATURE FREQUENCY STABILITY - §2.1055



TEST PERSONNEL:

Dan Biggs
Test Engineer

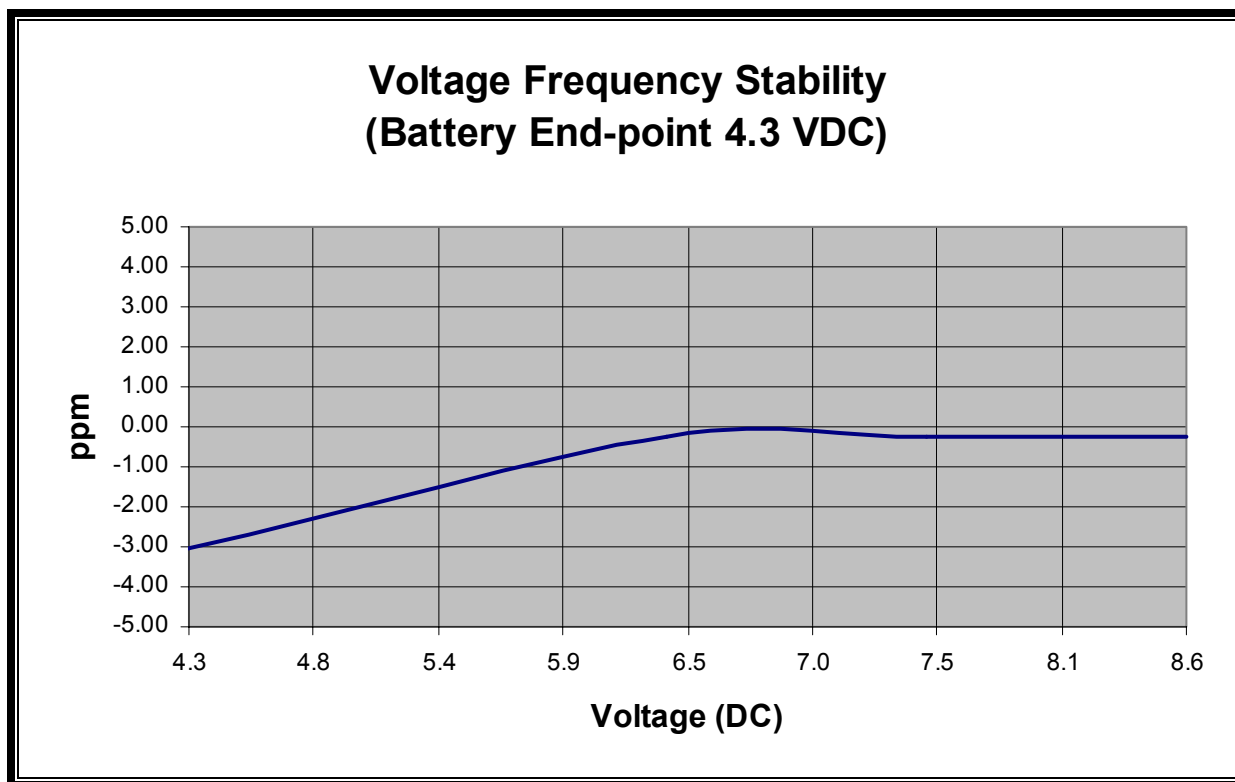
Dan Biggs
Signature

November 22, 2004
Date Of Test

TABLE 12-3: FREQUENCY STABILITY DATA - §2.1055: VOLTAGE

Voltage (DC)	Measured Frequency (MHz)	ppm
4.3 (battery end-point)	454.998613	-3.05
6.375	454.999889	-0.24
7.5	454.999887	-0.25
8.625	454.999884	-0.25

PLOT 12-2: VOLTAGE FREQUENCY STABILITY - §2.1055



TEST PERSONNEL:

Dan Baltzell
 Test Engineer

Signature

December 28, 2004
 Date Of Test

13 TRANSIENT FREQUENCY BEHAVIOR - FCC PART 90 §90.214, RSS-119 §7.0

13.1 TRANSIENT FREQUENCY BEHAVIOR TEST PROCEDURE

ANSI/TIA-603-B-2002 section 2.2.19

13.2 TRANSIENT FREQUENCY BEHAVIOR LIMITS

TABLE 13-1: REQUIREMENTS FOR EUT WITH 25 KHZ CHANNEL SPACING

Time Intervals (*)(**)	Maximum Frequency Difference (***)	150-174 MHz	421-512 MHz
t1(****)	± 25 kHz	5.0 mSec	10.0 mSec
t2	± 12.5 kHz	20.0 mSec	25.0 mSec
t3(****)	± 25 kHz	5.0 mSec	10.0 mSec

TABLE 13-2: REQUIREMENTS FOR EUT WITH 12.5 KHZ CHANNEL SPACING

Time Intervals (*)(**)	Maximum Frequency Difference(***)	150-174 MHz	421-512 MHz
t1(****)	± 12.5 kHz	5.0 mSec	10.0 mSec
t2	± 6.25 kHz	20.0 mSec	25.0 mSec
t3(****)	± 12.5 kHz	5.0 mSec	10.0 mSec

(*) t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing. t_1 is the time period immediately following t_{on} .

t_2 is the time period immediately following t_1 .

t_3 is the time period from the instant when the transmitter is turned off until t_{off} .

t_{off} is the instant when the 1 kHz test signal starts to rise.

(**) During the time from the end of t_2 to the beginning of t_3 , the frequency difference must not exceed the limits specified in §90.213.

(***) The difference between the actual transmitter frequency and the assigned transmitter frequency.

(****) If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

Maximum frequency difference between time T2 and T3: Calculation for Channel 5:

The frequency stability is required to be 5 PPM.

4 div. on scope represent 12.5 kHz for narrow band channel.

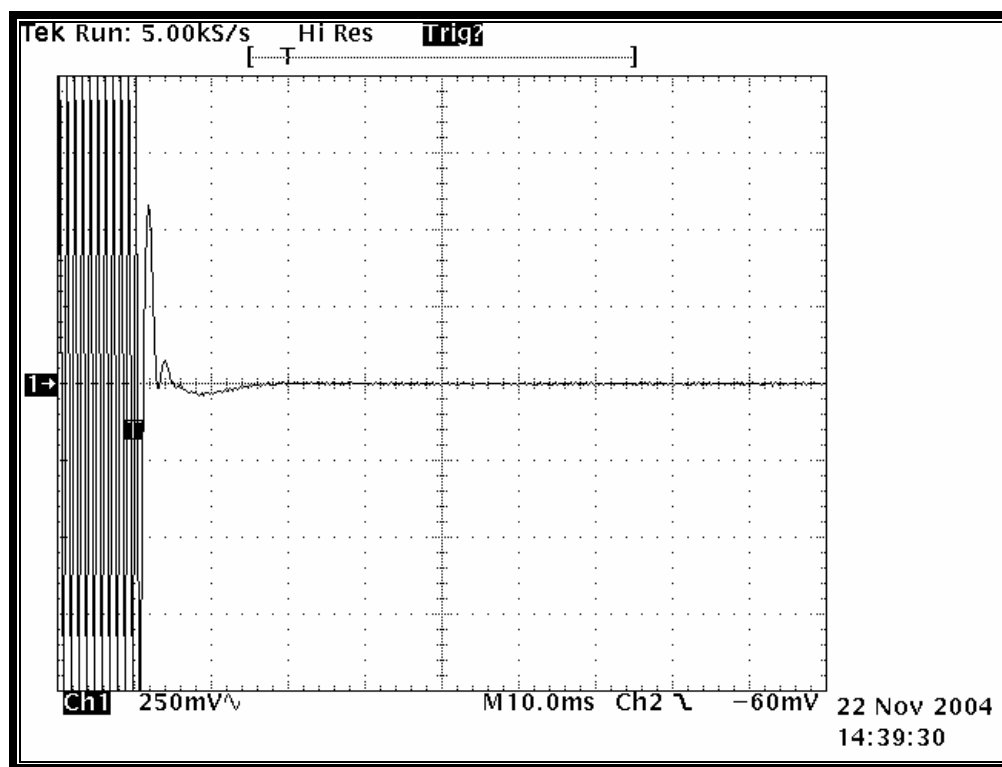
Therefore, 455 MHz times 5 PPM times +/- 4 Divisions divided by 12.5 kHz equals about +/-0.36 division.
0.36 Div. correspond to 1.138 kHz.

TABLE 13-3: TRANSIENT FREQUENCY BEHAVIOR TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Cal Due Date
900917	Hewlett Packard	8648C	Synthesized Signal Generator (9 kHz - 3200 MHz)	3537A01741	7/6/05
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz – 1300 MHz)	2406A00178	7/7/05
900561	Tektronix	TDS540A	Oscilloscope	B020129	3/25/05
901214	Hewlett Packard	HP8471D	Detector	2952A19822	5/13/05
900352	Werlatone	C1795	Directional Coupler, 100 watt (1 - 1000 MHz)	4067	7/1/2005
901138	Weinschel Corp.	48-40-34 DC- 18GHz	Attenuator, 100W 40dB	BK5883	5/13/05
901140	Weinschel Corp.	47-10-34 DC- 18GHz	Attenuator, 50W 10dB	BK6203	5/13/05

13.3 TRANSIENT FREQUENCY BEHAVIOR TEST DATA

PLOT 13-1: ON TIME – CHANNEL 5: 455 MHZ; 12.5 KHZ NARROWBAND



Carrier ON time:
 Power: 5 W rated
 Channel 5: 455 MHz NB (12.5 kHz)
 RF Signal Generator: Modulation 12.5 kHz deviation

Timebase: 10 ms/div
 Trigger: On negative edge of Ch 2, level -60mV
 Ch 1: 250mV/div, Probe 1.000:1
 Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz

TEST PERSONNEL:

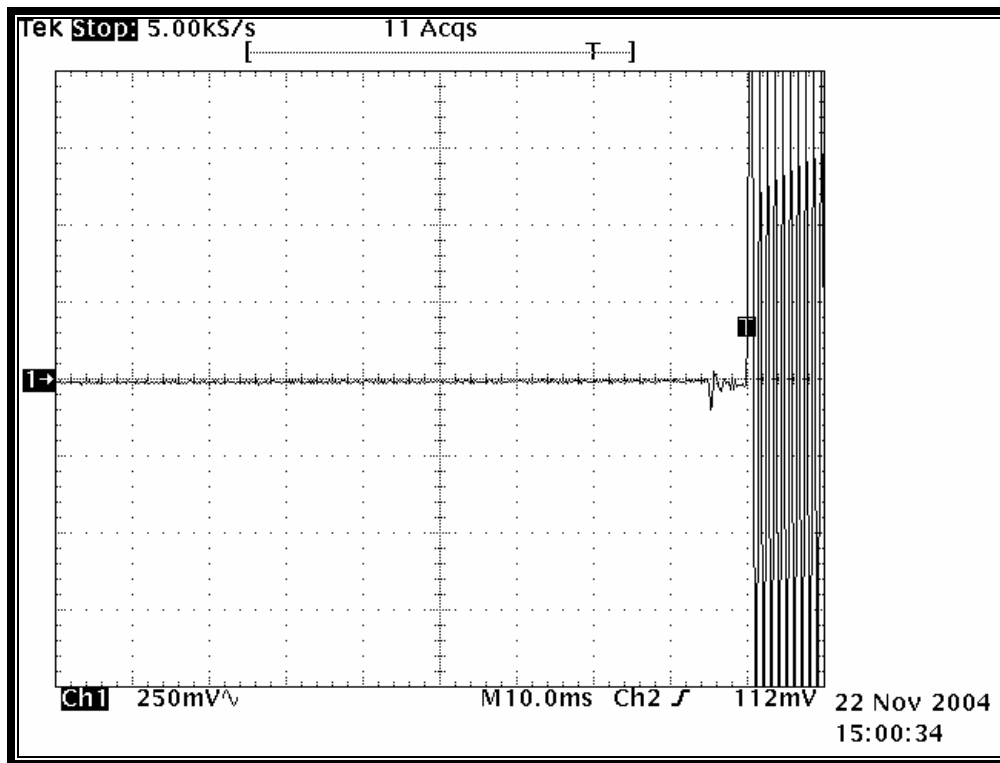
Daniel Baltzell
 Test Engineer

Daniel W. Baltzell

Signature

November 22, 2004
 Date Of Test

PLOT 13-2: OFF TIME – CHANNEL 5: 455 MHZ; 12.5 KHZ NARROWBAND



Carrier OFF time:
Power: 5 W rated
Channel 5: 455 MHz NB (12.5 kHz)
RF Signal Generator: Modulation 12.5 kHz deviation

Timebase: 10 ms/div
Trigger: On positive edge of Ch 2, level 112 mV
Ch 1: 250mV/div, Probe 1.000:1
Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz

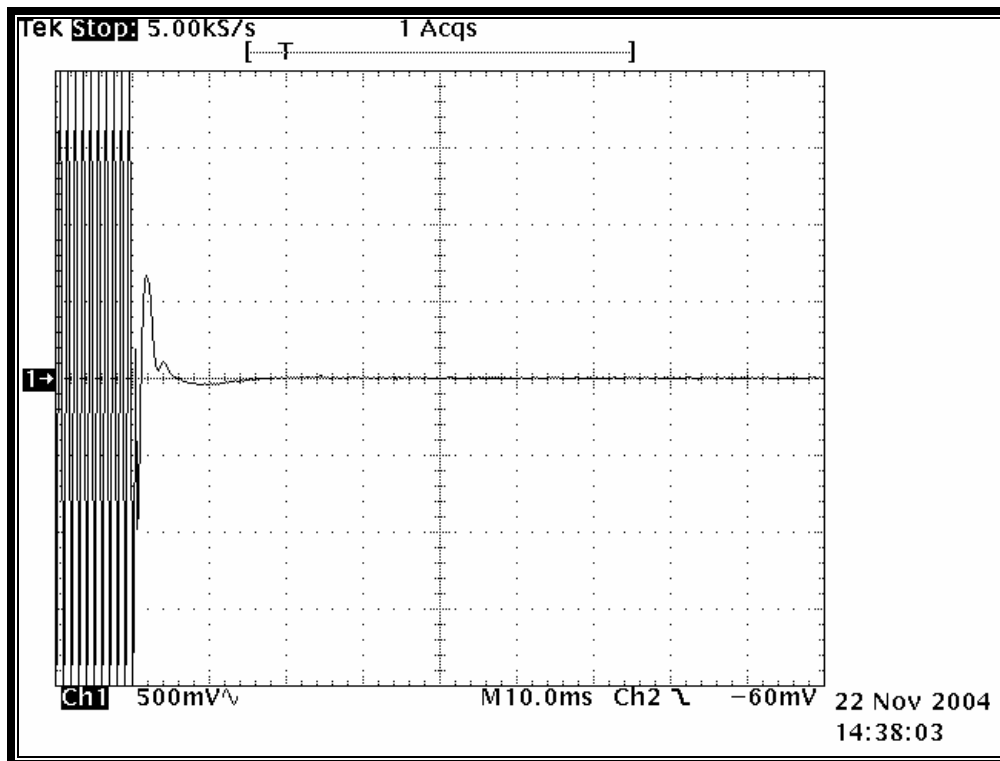
TEST PERSONNEL:

Daniel Baltzell
Test Engineer

Signature

November 22, 2004
Date Of Test

PLOT 13-3: ON TIME – CHANNEL 2: 455 MHZ; 25 KHZ WIDEBAND



Carrier ON time:
Power: 5 W rated
Channel 2: 455 MHz WB (25 kHz)
RF Signal Generator: Modulation 25 kHz deviation

Timebase: 10 ms/div
Trigger: On negative edge of Ch 2, level -60 mV
Ch 1: 500mV/div, Probe 1.000:1
Vertical scale: +/- 4 div. corresponds to +/- 25 kHz

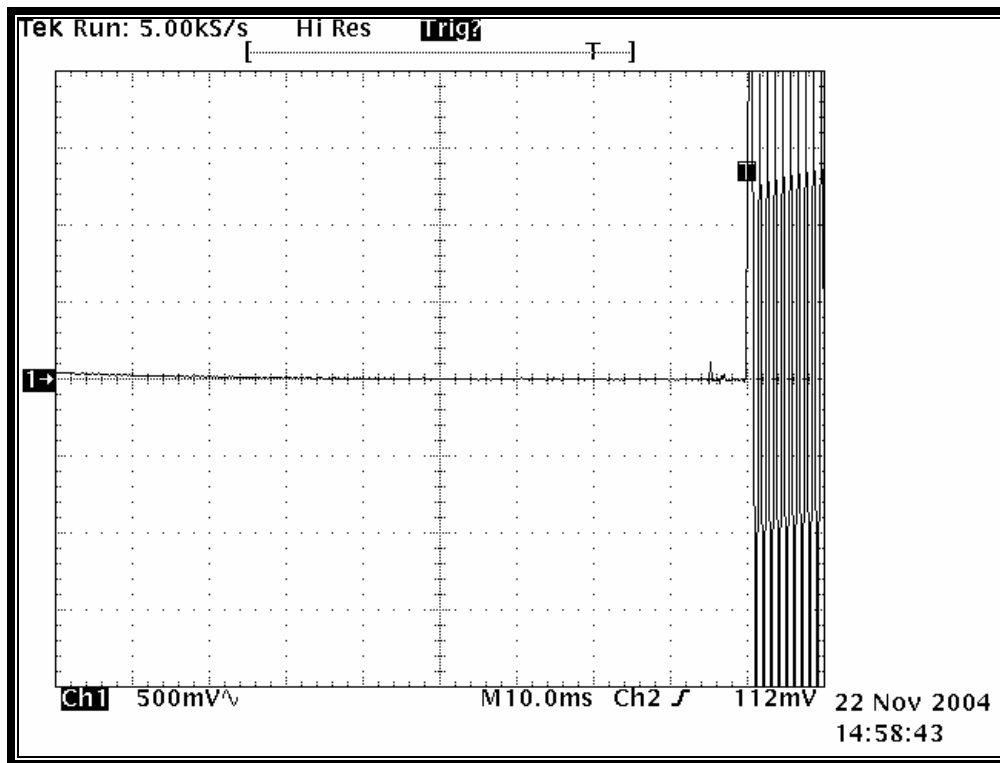
TEST PERSONNEL:

Daniel Baltzell
Test Engineer

Signature

November 22, 2004
Date Of Test

PLOT 13-4: OFF TIME – CHANNEL 2: 455 MHZ; 25 KHZ WIDEBAND



Carrier OFF time:
Power: 5 W rated
Channel 2: 455 MHz WB (25 kHz)
RF Signal Generator: Modulation 25 kHz deviation

Timebase: 10 ms/div
Trigger: On positive edge of Ch 2, level 112 mV
Ch 1: 500mV/div, Probe 1.000:1
Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz

TEST PERSONNEL:

Daniel Baltzell
Test Engineer

Signature

November 22, 2004
Date Of Test

14 NECESSARY BANDWIDTH AND EMISSION BANDWIDTH - FCC PART 2.202

Type of Emission: F3E

Necessary Bandwidth and Emission Bandwidth calculation

The 25 kHz Analog modulation necessary bandwidth: $B_n = 16K0F3E$

The 12.5 kHz Analog modulation bandwidth = $11K0F3E$

Calculation:

Max modulation (M) in kHz: 3

Max deviation (D) in kHz for (25 kHz channel spacing analog): 5

Max deviation for (D) in kHz for (12.5 kHz channel spacing): 2.5

Constant factor (K): 1

$$B_{n(25KHz \text{ analog})} = 2xM + 2xDK = (2x3) + (2x5x1) = 16 \text{ kHz}$$

$$B_{n(12.5KHz)} = 2xM + 2xDK = (2x3) + (2x2.5x1) = 11 \text{ kHz}$$

15 CONCLUSION

The data in this measurement report shows that the Maxon Telecom Co., Ltd. Model SP510 U2, FCC ID: RXUSP510U2, complies with all the requirements of Parts 2 and 90 of the FCC Rules, and Industry Canada RSS-119.