Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

M/A-COM, Inc.
221 Jefferson Ridge Parkway
Lynchburg, VA 28061
Daryl Popowitch
Phone: (434) 455-9527
E-Mail: Popowitda@tycoelectronics.com

MODEL: OpenSky M-803 V-TAC
(Vehicular Tactical Network) 800 MHz Mobile Radio

FCC ID: BV8VTAC800
IC ID: 3670A-VTAC

May 24, 2005

Standards Referenced for This Report	
Part 2: 2004	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 15: 2004	§15.109: Radiated Emissions Limits
Part 90: 2004	Private Land Mobile Radio Services
ANSI/TIA/EIA 603 - 2002	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA/EIA – 102.CAAA; 2002	Digital C4FM/CQPSK Transceiver Measurement Methods
Industry Canada	RSS-119: Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz

Frequency Range (MHz)	Output Power (W) Conducted Max measured	Frequency Tolerance Limit (ppm)	Emission Designator
806-824	24.55	1.5	17K6F7D (OTP)
851-869	24.55	1.5	17K6F7D (OTP/ORP)
806-824	24.55	1.5	17K6F7E (OTP)
851-869	24.55	1.5	17K6F7E (OTP/ORP)
806-821/851-866	24.55	1.5	16K0F3E (OCF SMR)
821-824/866-869	24.55	1.5	14K0F3E (OCF NPS)
806-824/851-869	24.55	1.5	8K4F1D/F1E (P25)

REPORT PREPARED BY TEST ENGINEER: DANIEL BIGGS

Document Number: 2005029/QRTL05-052

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1 GENERAL INFORMATION

The following certification report is prepared on behalf of **M/A-COM, Inc**. in accordance with the Federal Communications Commission Rules and Regulations. The Equipment Under Test (EUT) was the **OpenSky M-803 V-TAC (Vehicular Tactical Network) 800 MHz Mobile Radio; FCC ID: BV8VTAC800, IC: 3670A-VTAC**. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, Part 90, and ANSI/TIA/EIA 603-2002, Land Mobile FM or PM Communications Equipment Measurement and Performance Standards. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

Please note that portions of the EUT are subject to Part 15 DoC testing. A DoC report is on file for this product.

1.1 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is a new certification application.

1.3 DESCRIPTION OF CHANGE IN DEVICE

No changes were made to the EUT to achieve compliance.

1.4 PRODUCT DESCRIPTION

The M-803 Vehicular Tactical (V-TAC) unit is a voice and data radio designed for a mobile environment. It operates in the 800 MHz SMR and NPSPAC frequency bands. The rated RF output power is continuously variable between 0.25 – 24 W. The MAMROS0016 configuration, consisting of a trunk mount transceiver (VRM), vehicular repeater base (VRB), RF combiner, control head, and 10 dB power attenuator, was tested. OpenSky digital and conventional modulation software was provided for testing.

TABLE 1-1: PRODUCT DESCRIPTION

Trade Name	OpenSky V-TAC (Vehicular Tactical Network) 800 MHz Mobile Radio
Use of Product	Voice and data communication
FCC Identifier	BV8VTAC800
Type Modulation	GFSK, FM
Bit Rate	9600, 19200 bps
Baud Rate	9600
RF Output	Continuously variable between 0.25 - 24W
Frequency Range	806-824 MHz and 851-869 MHz
Max. Number of Channels	830 normal, 830 talkaround
Antenna Gain	3 dBd
External Input	Audio and digital

The M-803 Vehicular Tactical Unit (V-TAC) consists of a Full Duplex Trunk Mount M-803 Mobile Radio Unit (MRU) with GPS, an M-803 Vehicular Repeater Base Unit (VRB), and an 800 MHz RF Combiner; see Figure 1.

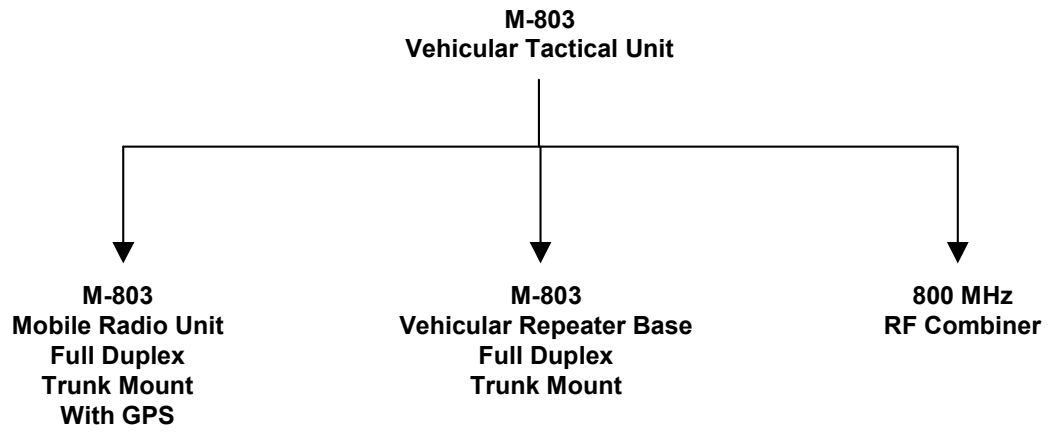

FIGURE 1-1: M-803 VEHICULAR TACTICAL UNIT (VTAC) MAJOR COMPONENTS

1.4.1 M-803 VTAC FREQUENCY RANGE

The M-803 VTAC can operate as a MRU, as a local base station in Scene of Incident (SOI) coverage, and as a Vehicular Repeater for Coverage Extension (CE). When the VTAC operates as a MRU, the frequency range is described in Table 1-2. When the VTAC operates in SOI or CE, the frequency range is described in Table 1-3.

TABLE 1-2: VTAC FREQUENCY RANGE (MRU)

Emission Protocol	OTP	OCF	TA (OCF & P25)	P25
Receive Range	851.0125 MHz to 868.9875 MHz	851.0125 MHz to 868.9875 MHz	851.0125 MHz to 868.9875 MHz	851.0125 MHz to 868.9875 MHz
Transmit Range	806.0125 MHz to 823.9875 MHz	806.0125 MHz to 823.9875 MHz	851.0125 MHz to 868.9875 MHz	806.0125 MHz to 823.9875 MHz
Receive to Transmit Offset Frequency	45 MHz	45 MHz	0 Hz	45 Hz
Number of Channels	830	830	830	830
Channel Spacing	25 kHz	25 kHz	25 kHz	25 kHz

TABLE 1-3: VTAC FREQUENCY RANGE (SOI OR CE)

Emission Protocol	OTP Scene of Incident	OTP/ORP Coverage Extension
Receive Range	806.0125 MHz to 823.9875 MHz	806.0125 MHz to 823.9875 MHz and 851.0125 MHz to 868.9875 MHz
Transmit Range	851.0125 MHz to 868.9875 MHz	806.0125 MHz to 823.9875 MHz and 851.0125 MHz to 868.9875 MHz
Receive to Transmit Offset Frequency	45 MHz	45 MHz
Number of Channels	830	830
Channel Spacing	25 kHz	25 kHz

1.4.2 M-803 VEHICULAR TACTICAL UNIT TYPES OF EMISSIONS

The M-803 VTAC can operate as a MRU, as a local base station in Scene of Incident (SOI) coverage, and as a Vehicular Repeater for Coverage Extension (CE). When the VTAC operates as a MRU, the emission types are OTP, OCF, TA and P25. When the VTAC operates in SOI or CE, the emission types are OTP and ORP. All emissions are listed in Table 1-4.

- **OpenSky® Trunked Protocol (OTP)**: OTP supports burst transfers of voice and data over a single channel. The information is transmitted through a 4 level Gaussian frequency shift keyed (GFSK) signal. The signal symbol rate is 9600 baud that corresponds to a 19.2 Kbps data rate. The symbols are Gaussian filtered with a BBT = 0.7 and then frequency modulated with a modulation index of 1/3.
- **OpenSky® Conventional FM (OCF)**: OCF is based on TIA/EIA-603, which provides standard FM radio capabilities over separate transmit and receive frequencies. The audio transmit path consists of a microphone level input which is audio leveled, high pass filtered, low pass filtered, and pre-emphasis. A CTCSS tone is added and the peak deviation limited. The resulting signal is then FM modulated.
- **Talk Around (TA)**: TA is based on TIA/EIA-603, which provides standard FM radio capabilities over the same transmit and receive frequency. The audio transmit path consists of a microphone level input which is audio leveled, high pass filtered, low pass filtered, and pre-emphasis. A CTCSS tone is added and the peak deviation limited. The resulting signal is then FM modulated.
- **P25® Common Air Interface (CAI)**: P25 supports continuous transfers of voice and data over a single frequency division multiplex channel (FDM). The information is transmitted through a 4 level Frequency shift keyed (FSK) signal where the symbol deviations are at 0.6KHz, 1.8KHz-0.6KHz-1.8KHz. The signal symbol rate is 4800 baud that corresponds to a 9.6 Kbps data rate. The symbols are Raised Cosine filtered with an excess bandwidth (alpha) of 0.2 to the frequency response specified in TSB1002.BAA. The filtered signal is then further shaped with an Inverse Sinc filter also to the frequency response described in TSB1002.BAA.
- **OpenSky® Trunked Protocol (OTP)**: When the VTAC is operating in SOI, the emission type will be the forward path of OTP. Forward path OTP supports continuous transmission for the transfers of voice and data over a single channel. The information is transmitted through a 4 level Gaussian frequency shift keyed (GFSK) signal. The signal symbol rate is 9600 baud that corresponds to a 19.2 Kbps data rate. The symbols are Gaussian filtered with a BBT = 0.7 and then frequency modulated with a modulation index of 1/3.
- **OpenSky® Repeater Protocol (ORP)**: When the VTAC is operating in CE, the emission type will be ORP that is a modified forward path OTP. ORP supports burst transmission of voice and data over a single channel. The information is transmitted through a 4 level Gaussian frequency shift keyed (GFSK) signal. The signal symbol rate is 9600 baud that corresponds to a 19.2 Kbps data rate. The symbols are Gaussian filtered with a BBT = 0.7 and then frequency modulated with a modulation index of 1/3.

TABLE 1-4: M-803 VTAC TYPES OF EMISSIONS

Emission Protocol	Type of Modulation	Nature of Signal	Type of Information
OTP	Frequency Modulation	A single channel burst transmission containing digital information without the use of a modulating sub-carrier.	• Data transmission, telemetry, telecommand • Telephony
OCF	Frequency Modulation	A single channel burst transmission containing analogue information	• Telephony
TA	Frequency Modulation	A single channel burst transmission containing analogue information	• Telephony
P25	Frequency Modulation	A single channel burst transmission containing digital information without the use of a modulating sub-carrier.	• Data transmission, telemetry, telecommand • Telephony
OTP (SOI)	Frequency Modulation	A single channel of continuous transmission containing digital information without the use of a modulating sub-carrier.	• Data transmission, telemetry, telecommand • Telephony
ORP (CE)	Frequency Modulation	Two channels of burst transmission containing digital information without the use of a modulating sub-carrier.	• Data transmission, telemetry, telecommand • Telephony

2 CONFORMANCE STATEMENT

Standards Referenced for This Report	
Part 2: 2004	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 15: 2004	§15.109: Radiated Emissions Limits
Part 90: 2004	Private Land Mobile Radio Services
ANSI/TIA/EIA 603 - 2002	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
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Frequency Range (MHz)	Output Power (W) Conducted Max measured	Frequency Tolerance Limit (ppm)	Emission Designator
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851-869	24.55	1.5	17K6F7D (OTP/ORP)
806-824	24.55	1.5	17K6F7E (OTP)
851-869	24.55	1.5	17K6F7E (OTP/ORP)
806-821/851-866	24.55	1.5	16K0F3E (OCF SMR)
821-824/866-869	24.55	1.5	14K0F3E (OCF NPS)
806-824/851-869	24.55	1.5	8K4F1D/F1E (P25)

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. 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 above standards for certification methodology.

Signature:  Date: May 24, 2005

Typed/Printed Name: Desmond Fraser Position: President

Signature:  Date: May 24, 2005

Typed/Printed Name: Daniel W. Biggs Position: Test Engineer

3 TESTED SYSTEM DETAILS

The EUT test sample was received on February 8, 2005. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

The system consists of an 800 MHz transceiver (VRM), a repeater (VRB), an RF combiner, and is controlled by a control head/microphone. The system was tested in a duplex operating mode.

The EUT consists of two transceivers that can transmit simultaneously, which connect to a single antenna through a combiner. Since both transceivers can transmit simultaneously, simultaneous transmission was determined to be the worst case mode of operation for power measurements and spurious measurements. During these tests, the power from one of the transceivers was investigated with the other transceiver set to the channel which generated the highest power.

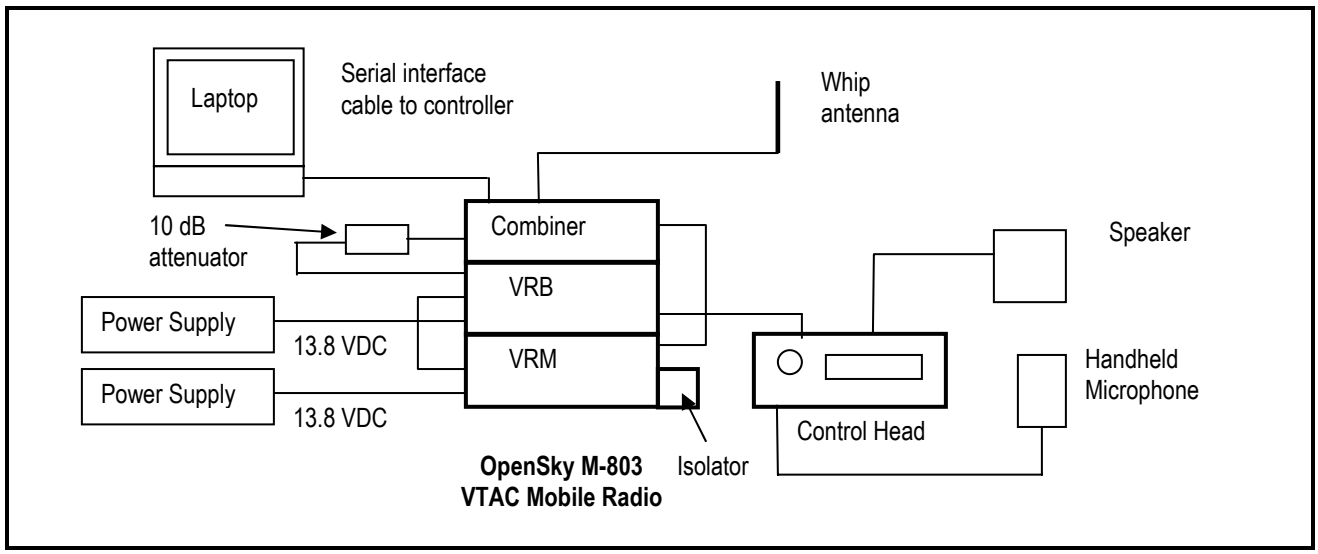
TABLE 3-1: EQUIPMENT UNDER TEST (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
800 MHz Transceiver	M/A-Com, Inc.	M-803 MAMROS0006	A4007116843F	BV8VTAC800	16534
Vehicular Repeater Base	M/A-Com, Inc.	M-803 MAMROS0007	A4008019A37B	BV8VTAC800	16534
Combiner	M/A-Com, Inc.	MAMROS0016	A400901918A0	N/A	16534
Isolator	M/A-Com, Inc.	MAMROS0106	N/A	N/A	16534
Control Head	M/A-Com, Inc.	MACDOS0003	A4000A16F69B	N/A	15486
Speaker	M/A-Com, Inc.	N/A	LS102824V10R1A	N/A	16481
Microphone	M/A-Com, Inc.	N/A	1000005928-0001	N/A	16490
DTMF Microphone	M/A-Com, Inc.	600L	MC103334V1	N/A	16501
Antenna	M/A-Com, Inc.	ASP-1860	N/A	N/A	N/A
Attenuator	M/A-Com, Inc.	Microline	766-10	N/A	N/A

TABLE 3-2: SUPPORT EQUIPMENT

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Notebook Computer	N/A	N/A	N/A	N/A	N/A
RS-232 Interface Cable	N/A	DB-9	N/A	N/A	16500
Power Supply	M/A-Com, Inc.	N/A	N/A	N/A	16498
Power Supply	M/A-Com, Inc.	N/A	N/A	N/A	16497

FIGURE 3-1: CONFIGURATION OF TESTED SYSTEM



4 FCC RULES AND REGULATIONS PART 2 §2.1033(C)(8) VOLTAGES AND CURRENTS THROUGH THE FINAL AMPLIFYING STAGE

Nominal DC Voltage: 13.8 VDC
Current: 4 Amps RX Mode; 12 Amps TX Mode

5 FCC RULES AND REGULATIONS PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED; RSS-119 §6.2: OUTPUT POWER TEST

5.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, Section 2.2.1.

The EUT was connected to a coaxial attenuator having a 50Ω load impedance. The EUT was tested with both the VRM and VRB units transmitting simultaneously on separate frequencies. The power measurements reported in Tables 5-1 and 5-2 are a combined power reading from the antenna RF port of the combiner.

5.2 TEST DATA

TABLE 5-1: RF POWER OUTPUT (VRM/VRB COMBINED – VRB HIGH POWER): CARRIER OUTPUT POWER (UNMODULATED)

Channel	Frequency (MHz)	RF Power Measured (Watt)*
001/001	806.0125/851.0125	24.55
001/830	806.0125/868.9875	24.55
830/001	823.9875/851.0125	23.44

*Measurement accuracy: +/- .02 dB (logarithmic mode)

TABLE 5-2: RF POWER OUTPUT (VRB – LOW POWER): CARRIER OUTPUT POWER (UNMODULATED)

Channel (VRB)	Frequency (MHz)	RF Power Measured (Watt)*
001	851.0125	0.265
600	865.9875	0.281
830	868.9875	0.267

* Measurement accuracy: +/- .02 dB (logarithmic mode)

TABLE 5-3: RF POWER OUTPUT (RATED POWER)

Rated Power (W)
24

TABLE 5-4: TEST EQUIPMENT FOR TESTING RF POWER OUTPUT - CONDUCTED

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901184/901186	Agilent	E4416A/E9323A	Power Meter/ Sensor	GB41050573/US420.52510380	08/02/05

TEST PERSONNEL:

Daniel Biggs		February 23, 2005
Test Technician/Engineer	Signature	Date Of Test

6 FCC RULES AND REGULATIONS PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS; RSS-119 §6.3: UNWANTED EMISSIONS

6.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, Section 2.2.13.

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 19,200 bps. The system was tested with both the VRM and VRB transmitting on separate frequencies. The plots represent the VRB set to a power of 39 dBm (high power) or 34 dBm (low power). The VRM was set to 41 dBm for all tests.

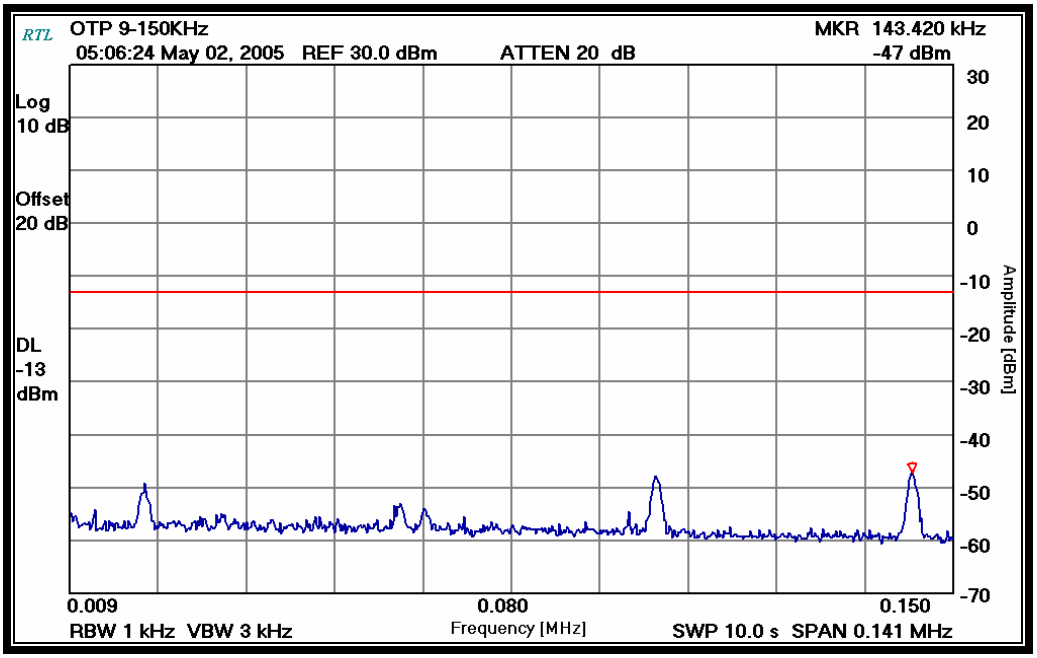
6.2 TEST DATA

Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc.

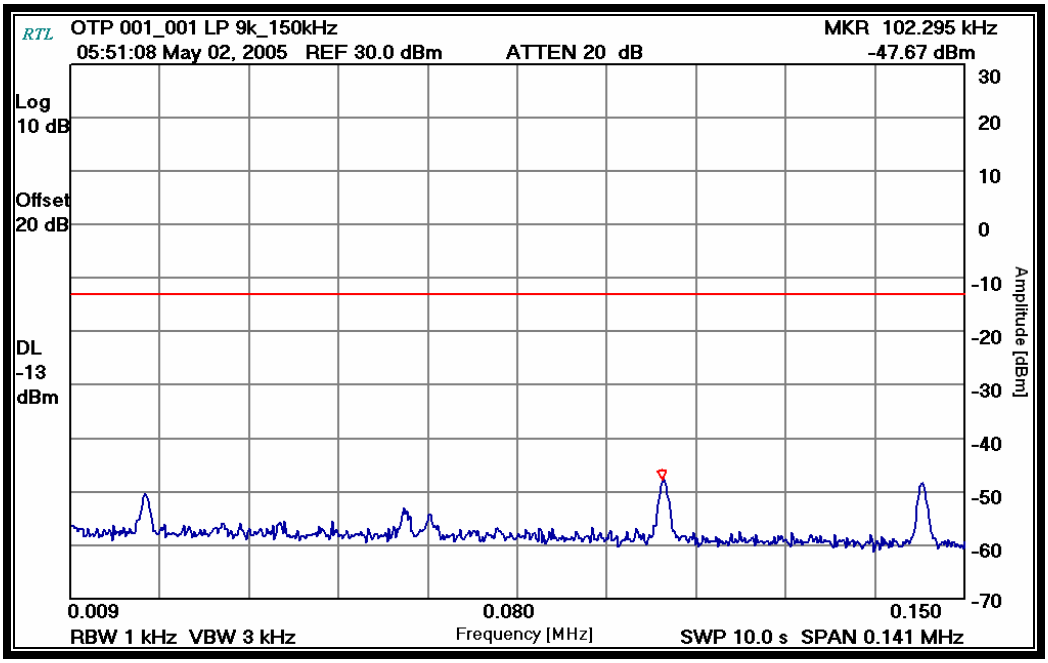
Limits: P(dBm) – (43 + 10xLOG P(W))

The worst case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

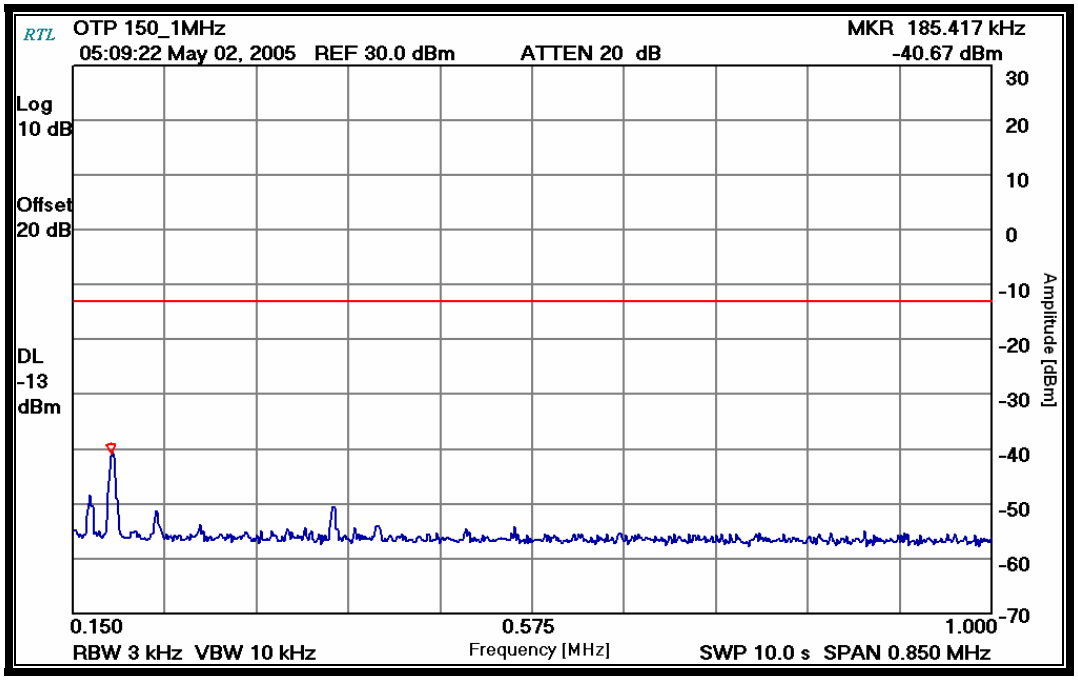
PLOT 6-1: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 MHZ (9 KHZ – 150 KHZ) – VRB HIGH POWER



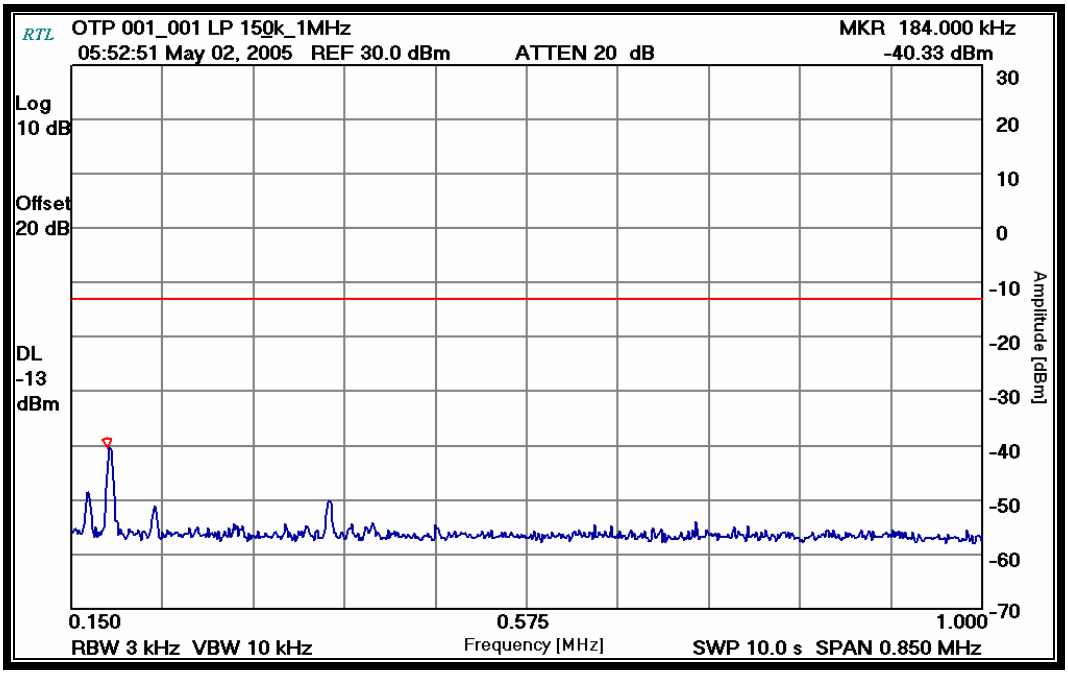
PLOT 6-2: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 MHZ (9 KHZ – 150 KHZ) – VRB LOW POWER



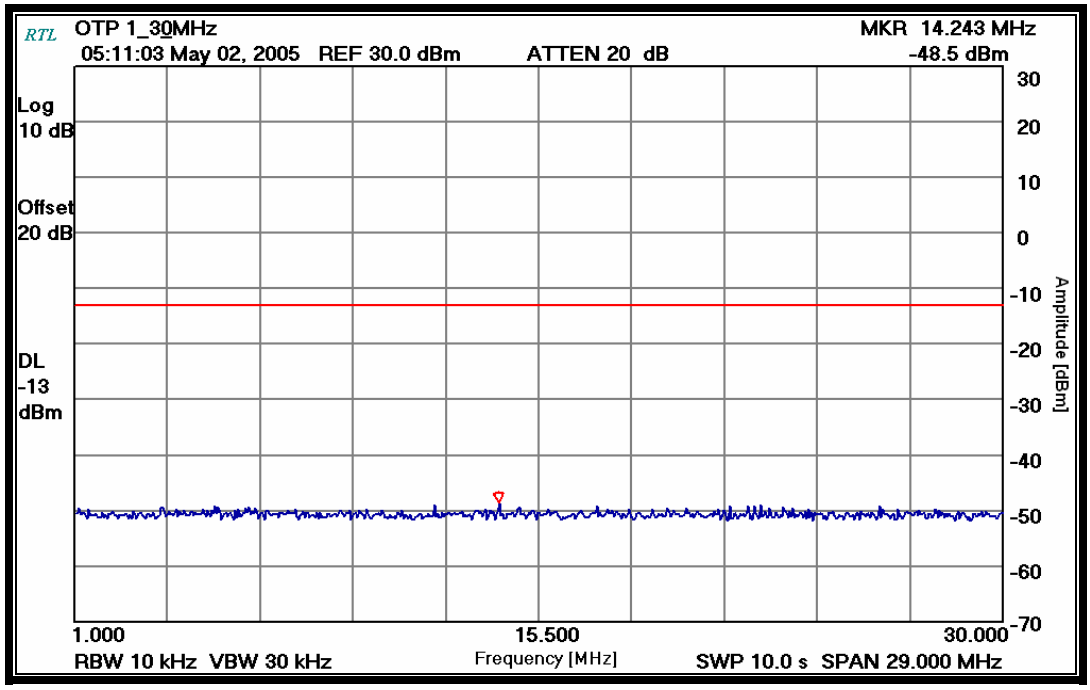
PLOT 6-3: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (150 KHZ – 1 MHZ) – VRB HIGH POWER



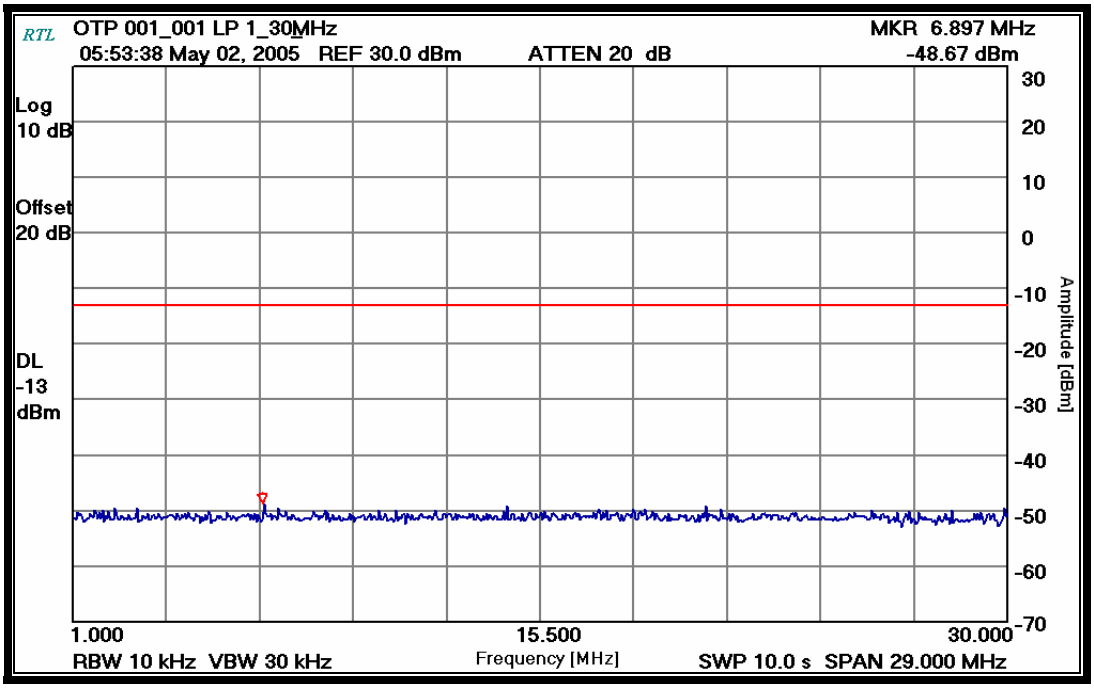
PLOT 6-4: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (150 KHZ – 1 MHZ) – VRB LOW POWER



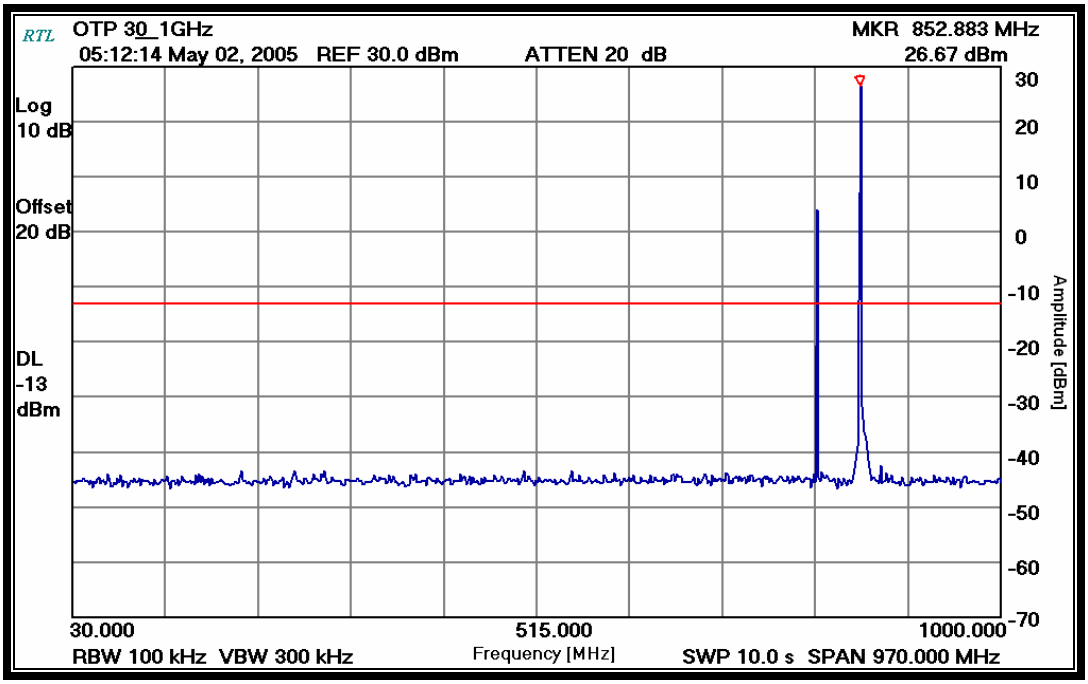
PLOT 6-5: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (1 MHZ – 30 MHZ) – VRB HIGH POWER



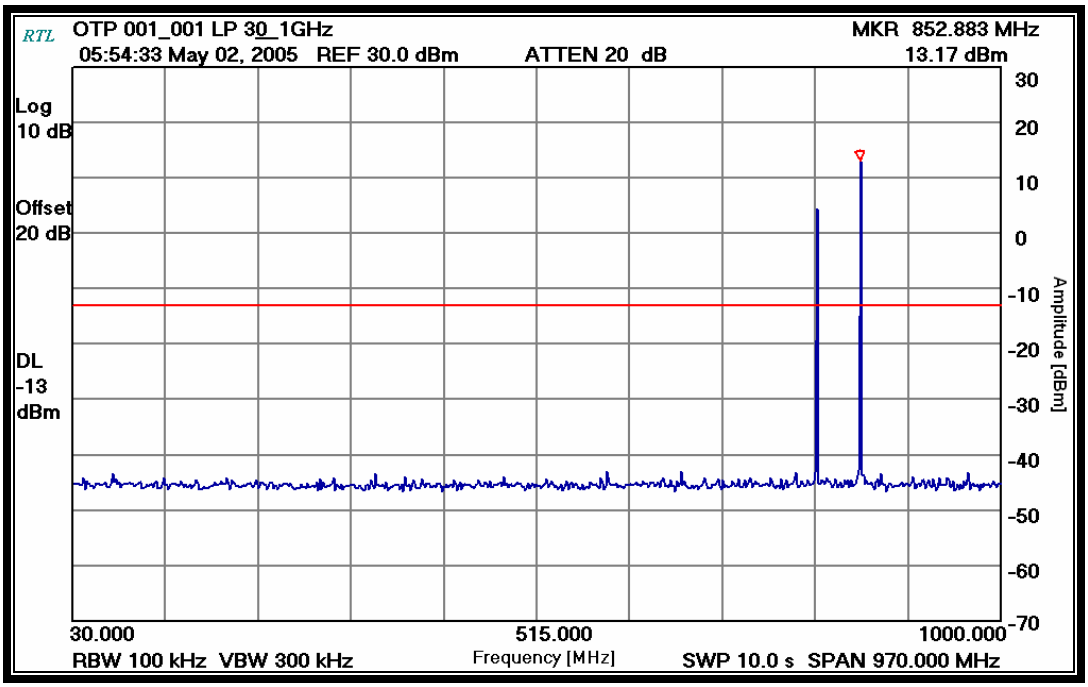
PLOT 6-6: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (1 MHZ – 30 MHZ) – VRB LOW POWER



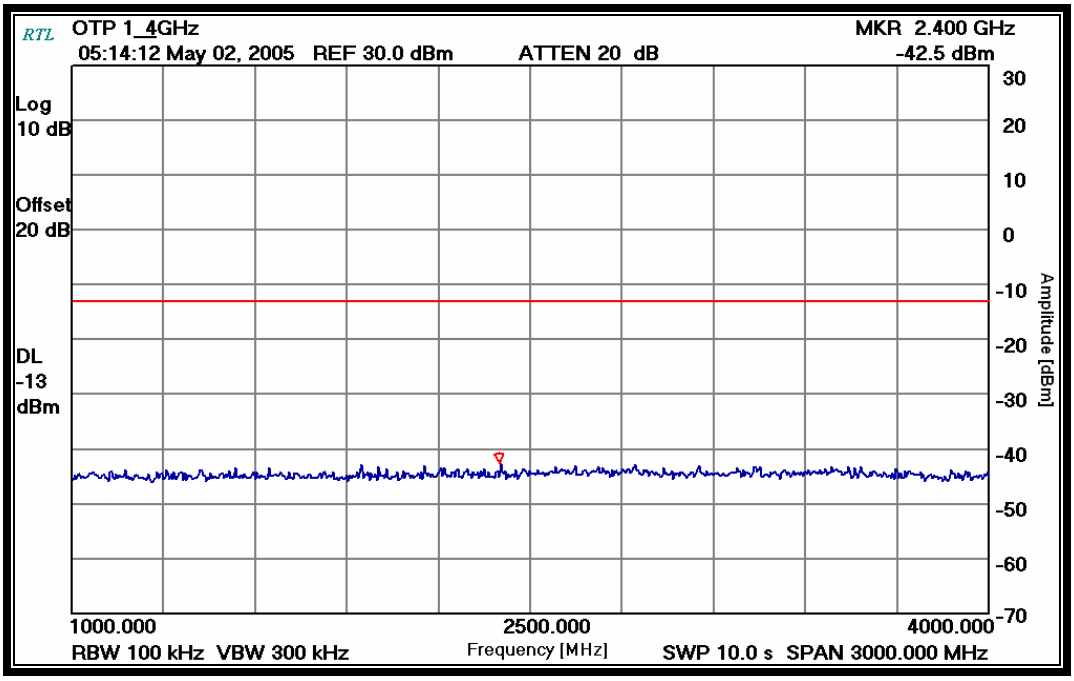
PLOT 6-7: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (30 MHZ – 1 GHZ) – VRB HIGH POWER



PLOT 6-8: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (30 MHZ – 1 GHZ) – VRB LOW POWER



PLOT 6-9: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (1 GHZ – 4 GHZ) – VRB HIGH POWER



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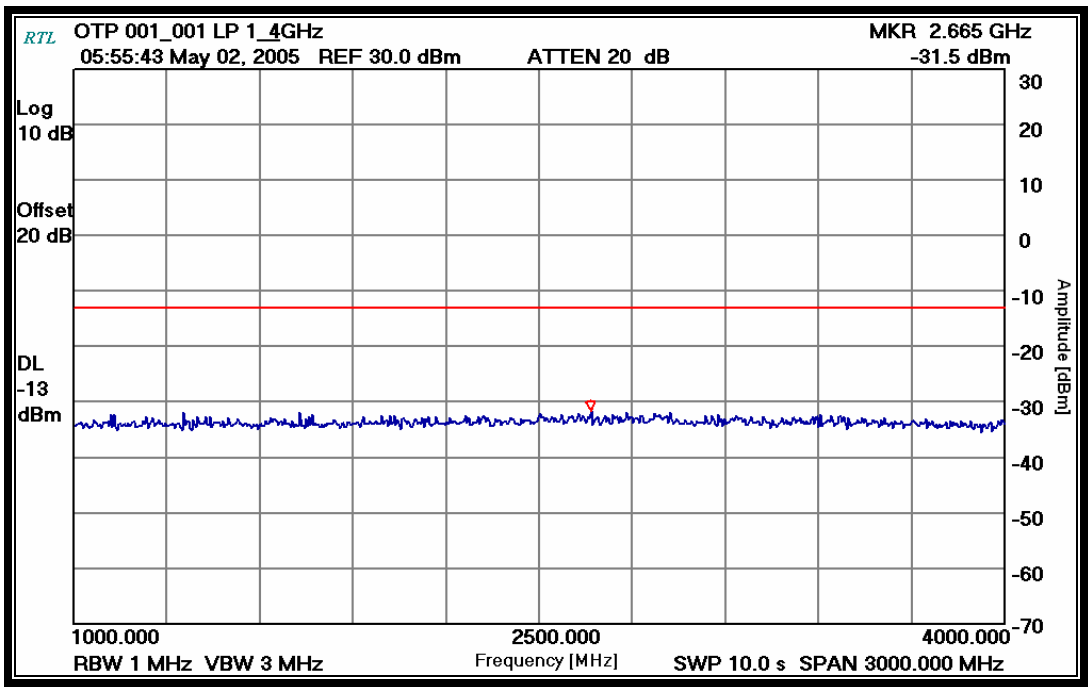
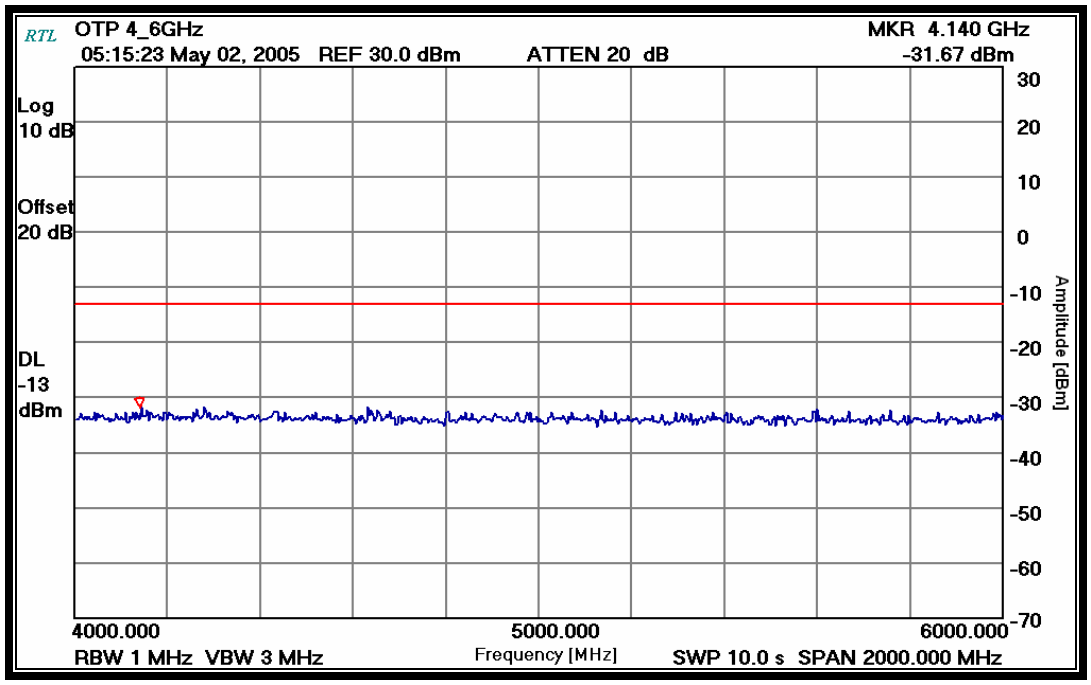
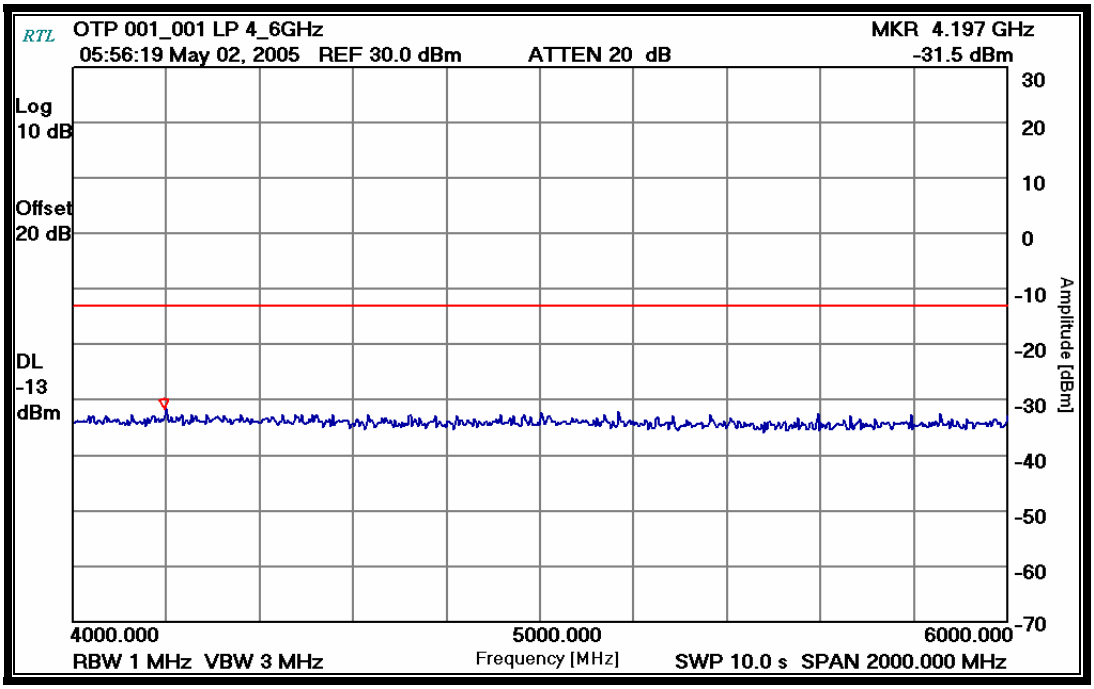
PLOT 6-10: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (1 GHZ – 4 GHZ) – VRB LOW POWER



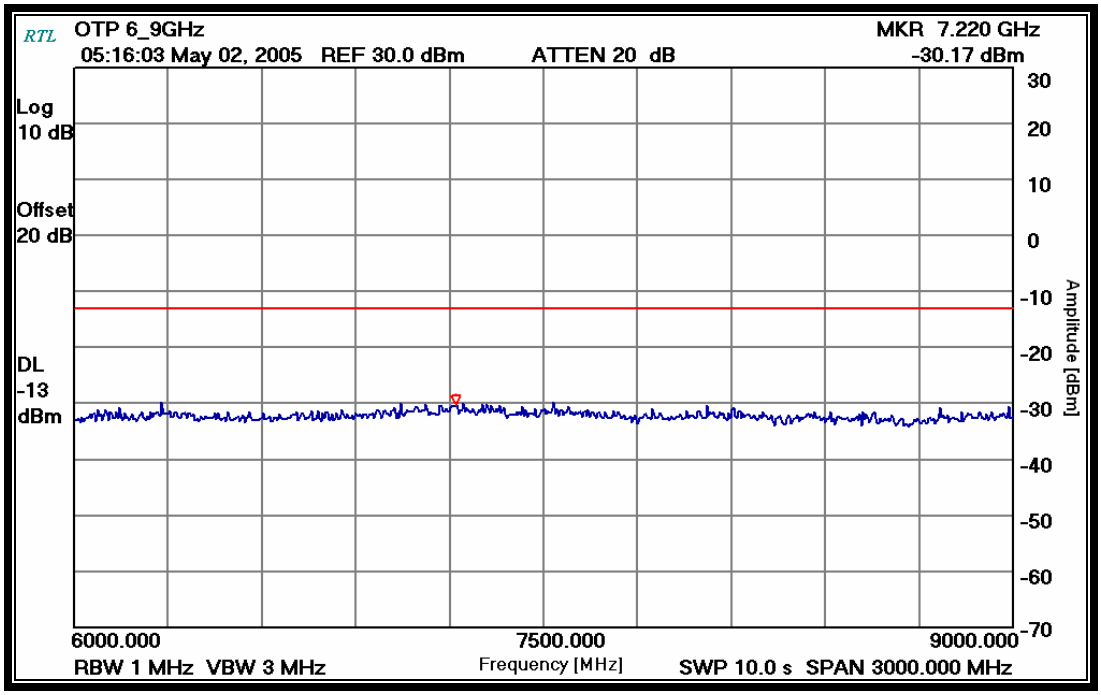
PLOT 6-11: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (4 GHZ – 6 GHZ) – VRB HIGH POWER



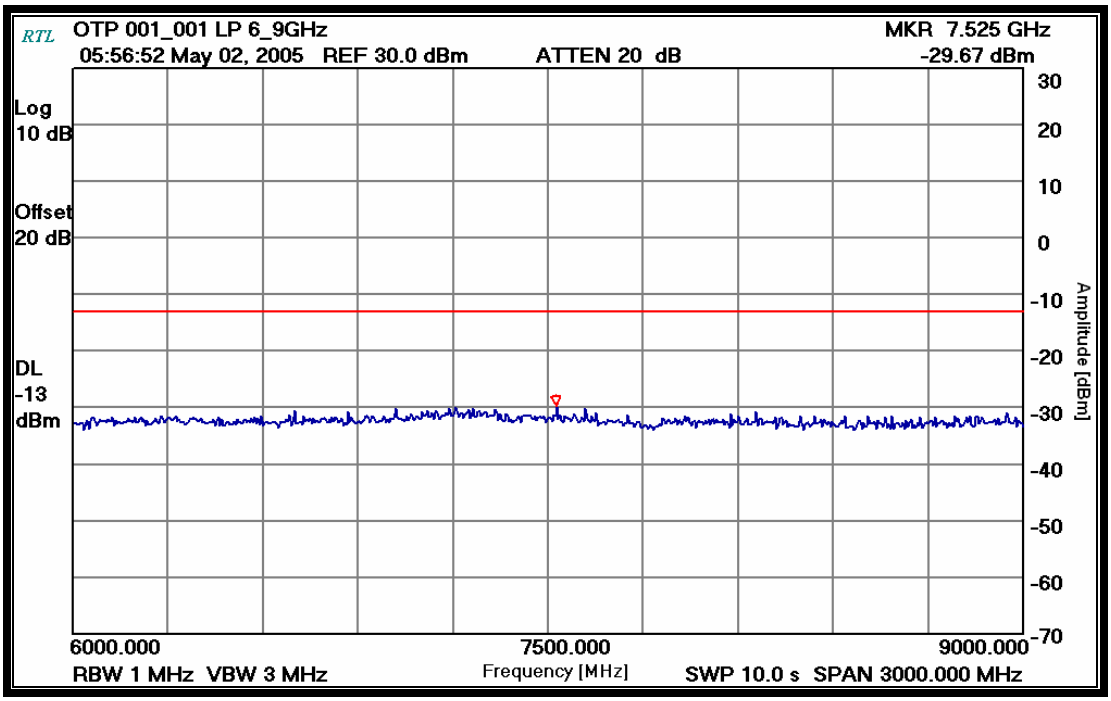
PLOT 6-12: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (4 GHZ – 6 GHZ) – VRB LOW POWER



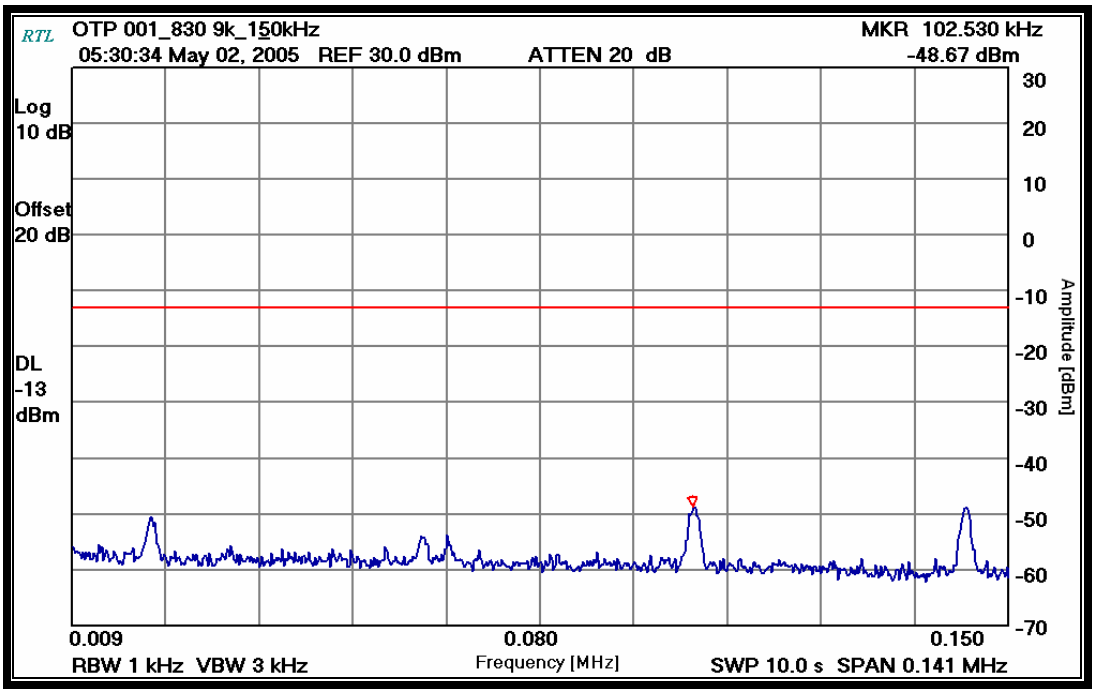
PLOT 6-13: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (6 GHZ – 9 GHZ) - VRB HIGH POWER



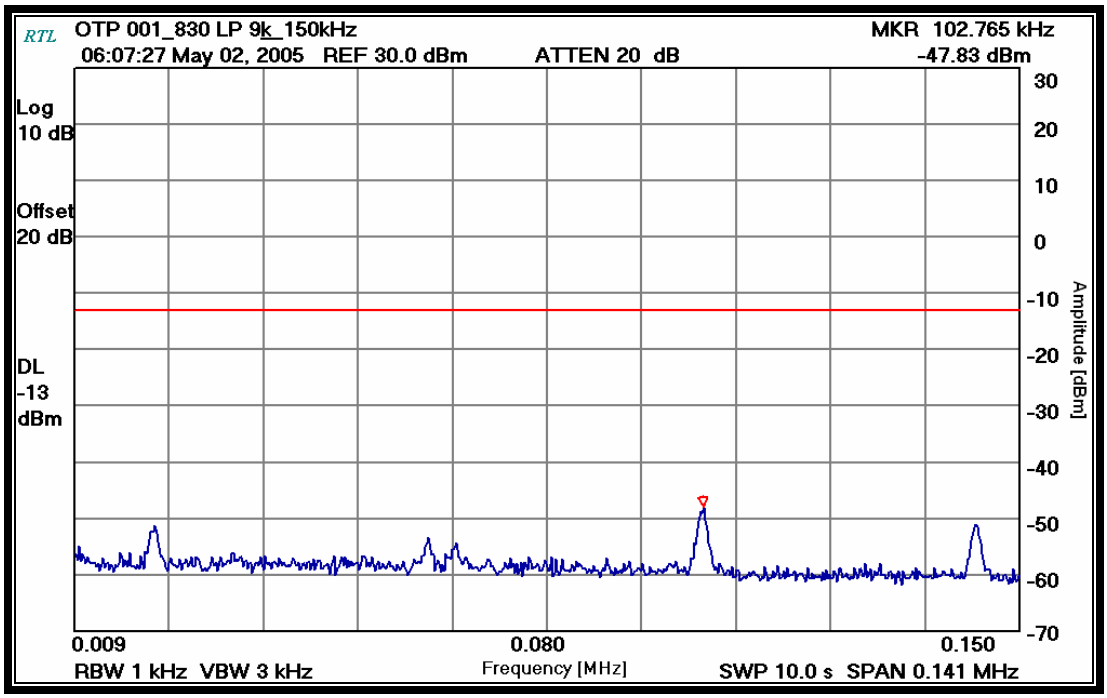
PLOT 6-14: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/001 – VRM-806.0125/VRB-851.0125 (6 GHZ – 9 GHZ) – VRB LOW POWER



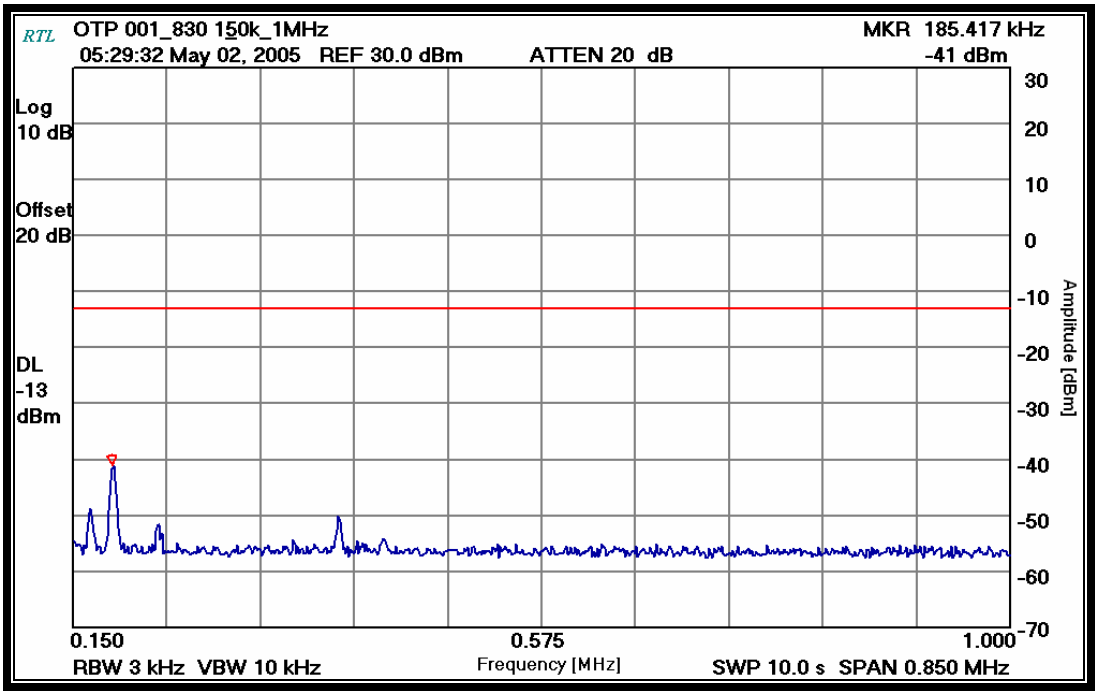
PLOT 6-15: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (9 KHZ – 150 KHZ) – VRB HIGH POWER



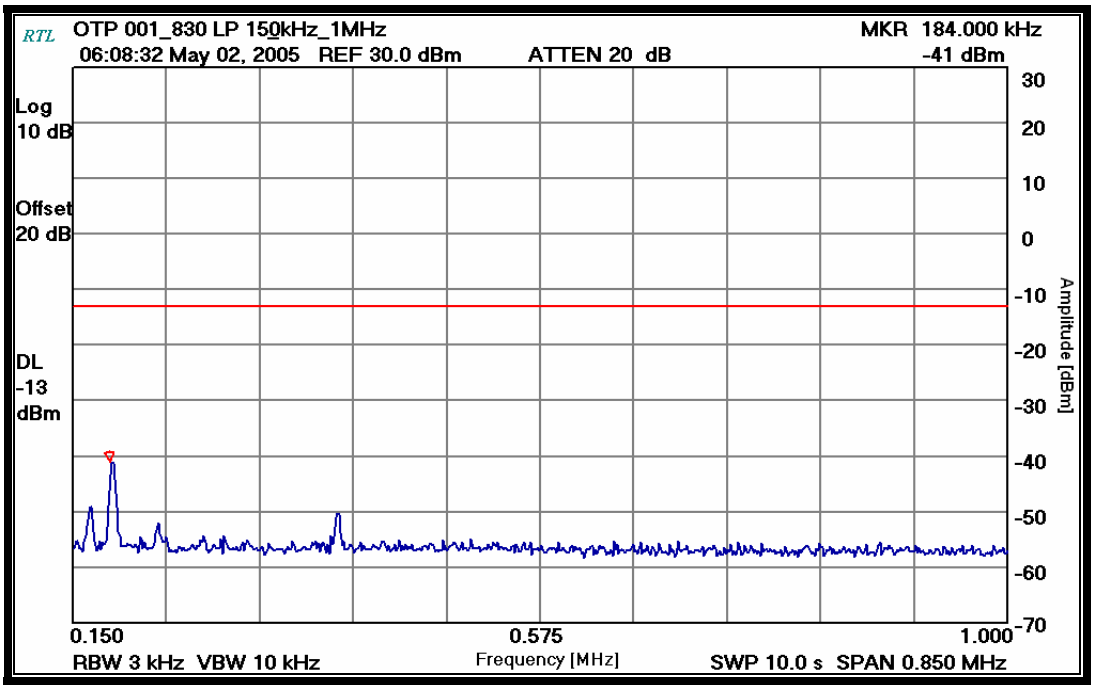
PLOT 6-16: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (9 KHZ – 150 KHZ) – VRB LOW POWER



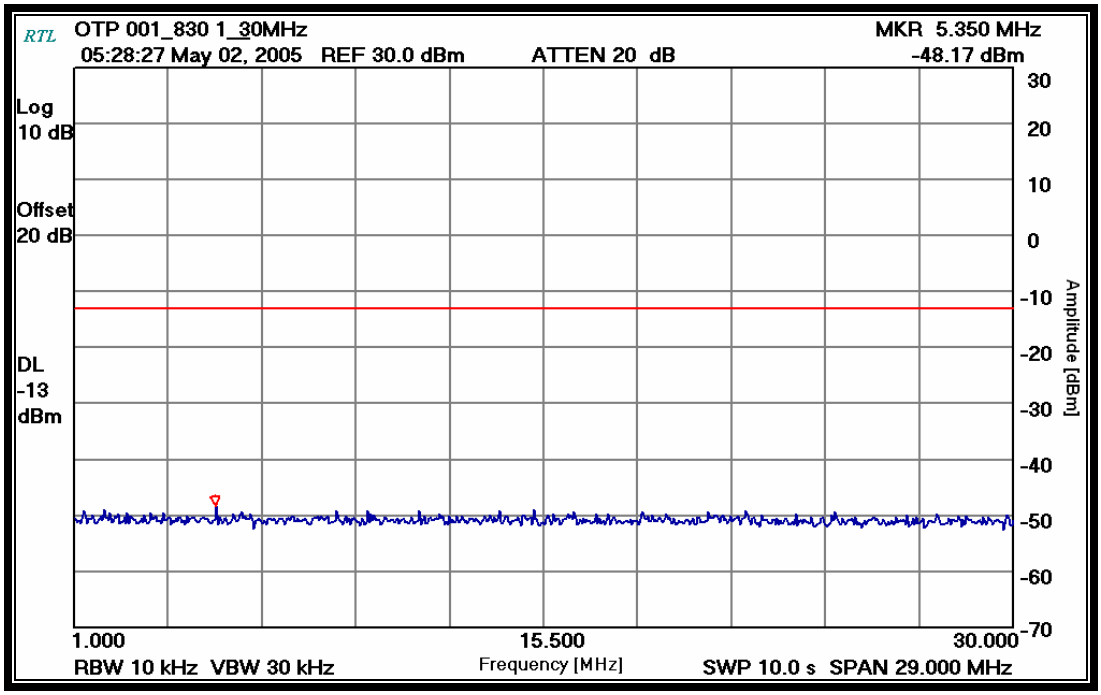
PLOT 6-17: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (150 KHZ – 1 MHZ) – VRB HIGH POWER



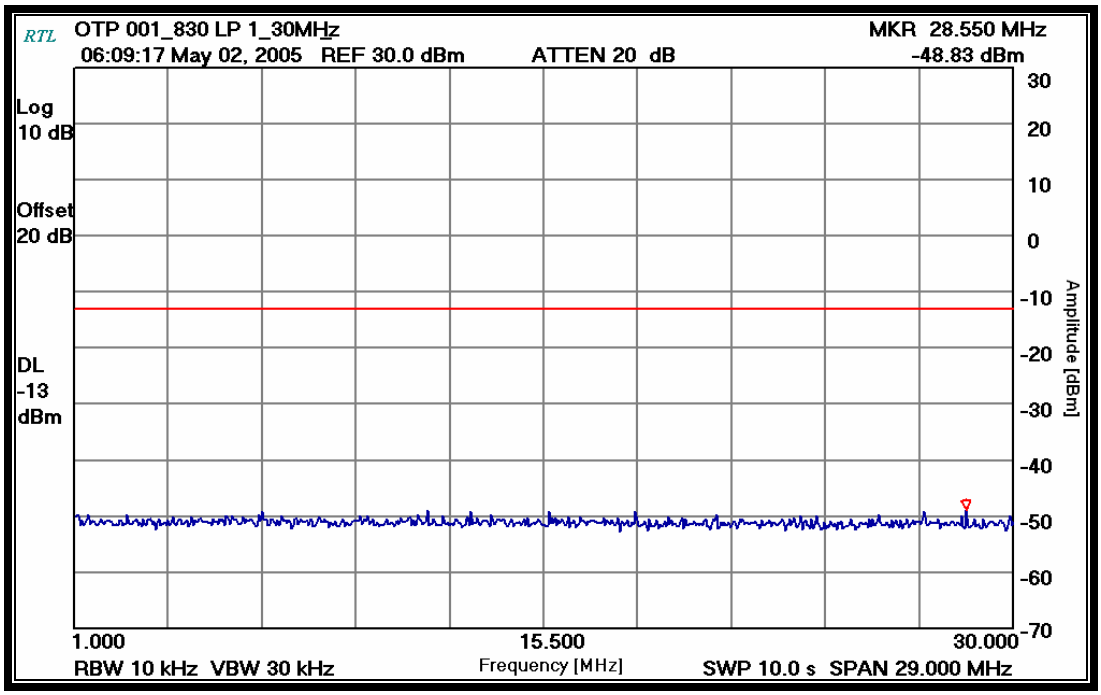
PLOT 6-18: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (150 KHZ – 1 MHZ) – VRB LOW POWER



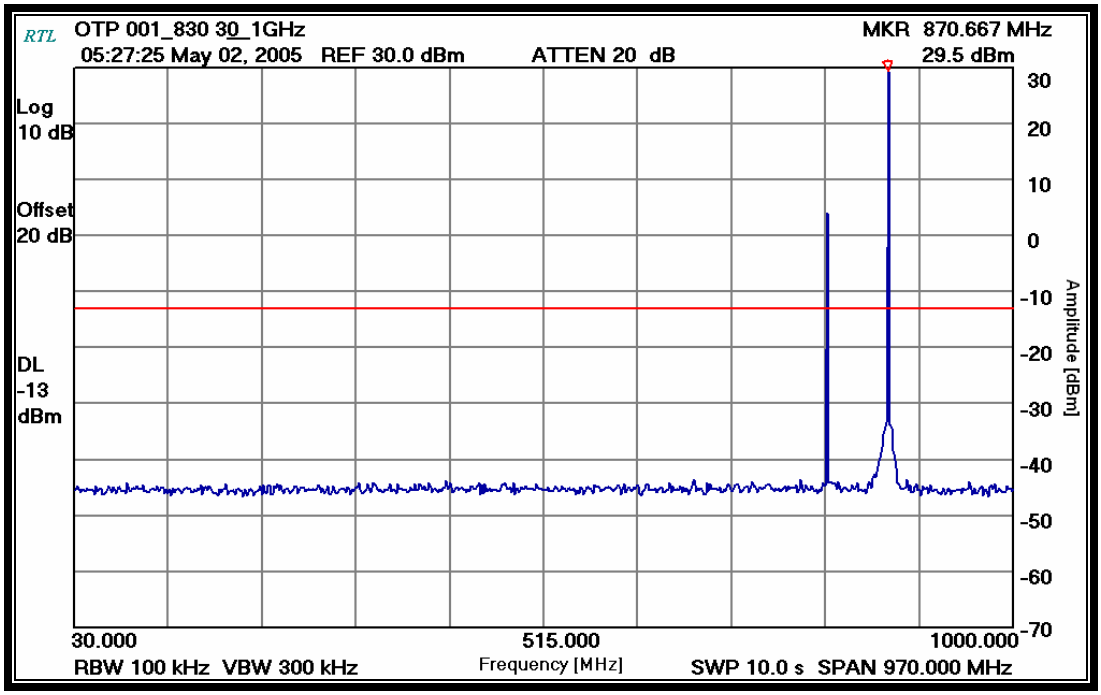
PLOT 6-19: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (1 MHZ – 30 MHZ) – VRB HIGH POWER



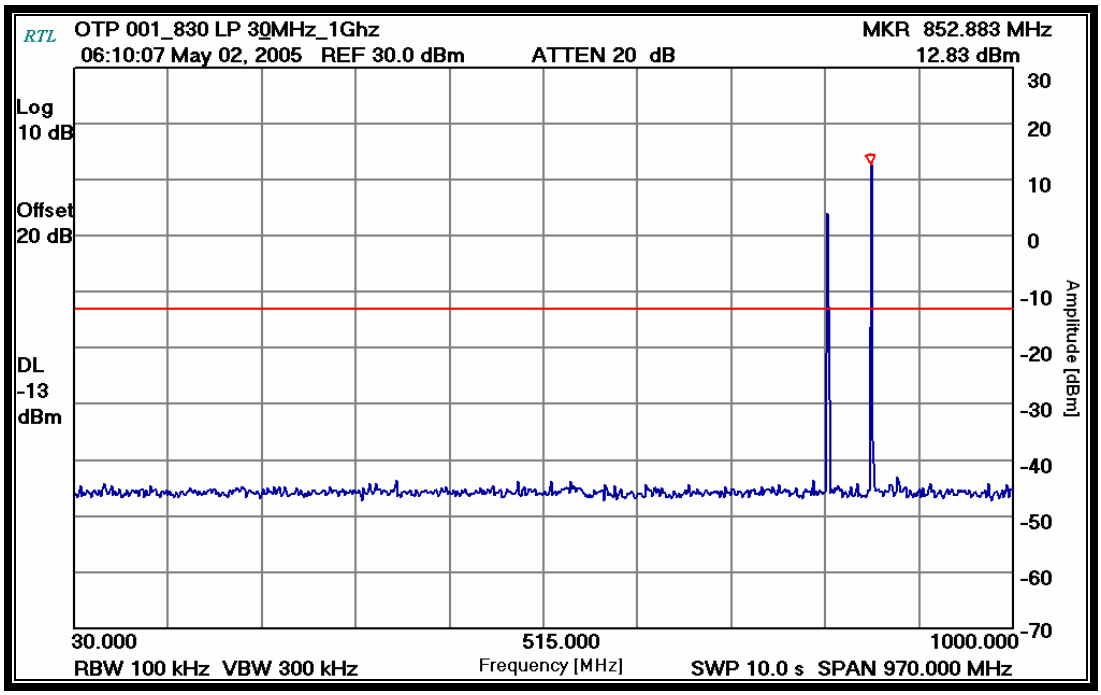
PLOT 6-20: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (1 MHZ – 30 MHZ) – VRB LOW POWER



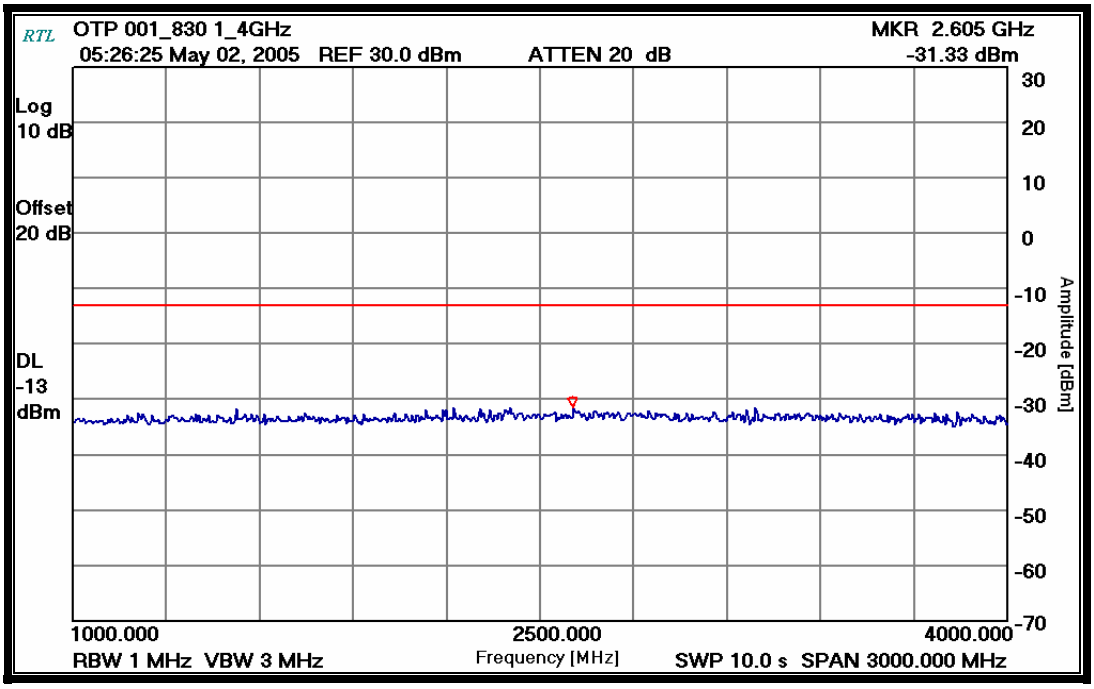
PLOT 6-21: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (30 MHZ – 1 GHZ) – VRB HIGH POWER



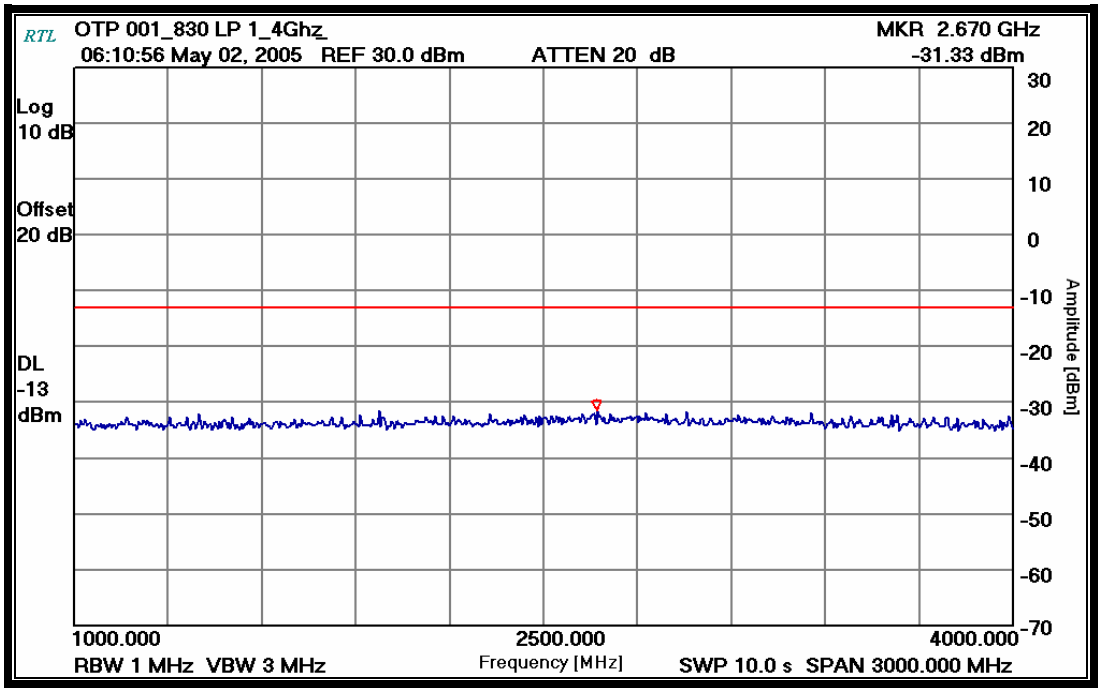
PLOT 6-22: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (30 MHZ – 1 GHZ) – VRB LOW POWER



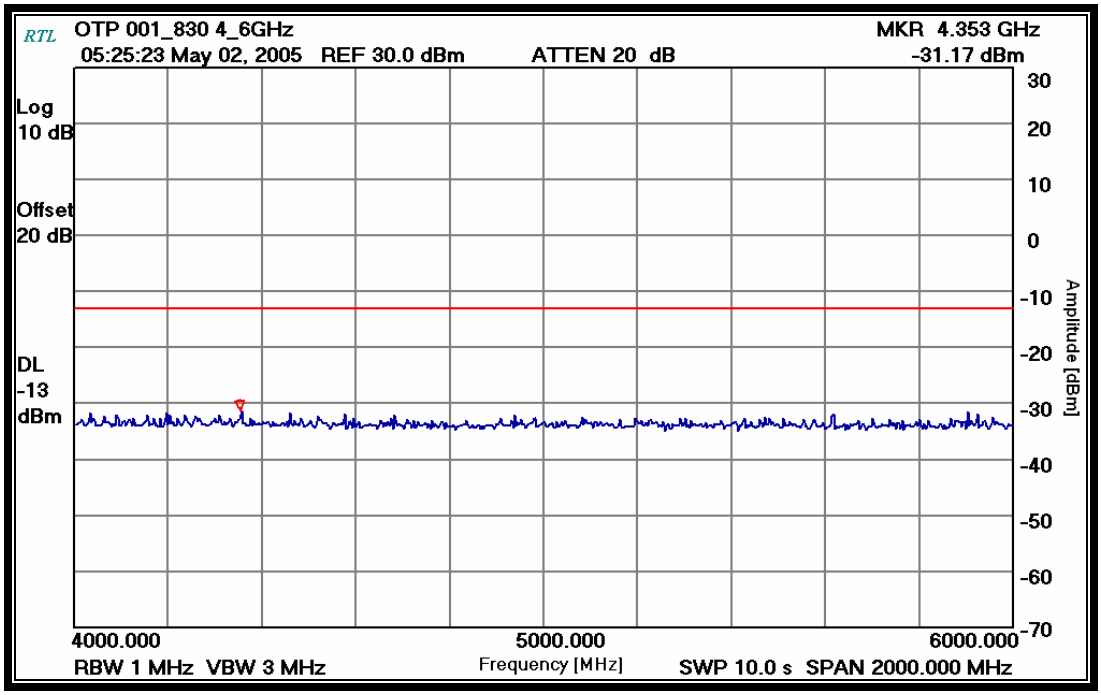
PLOT 6-23: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (1 GHZ – 4 GHZ) – VRB HIGH POWER



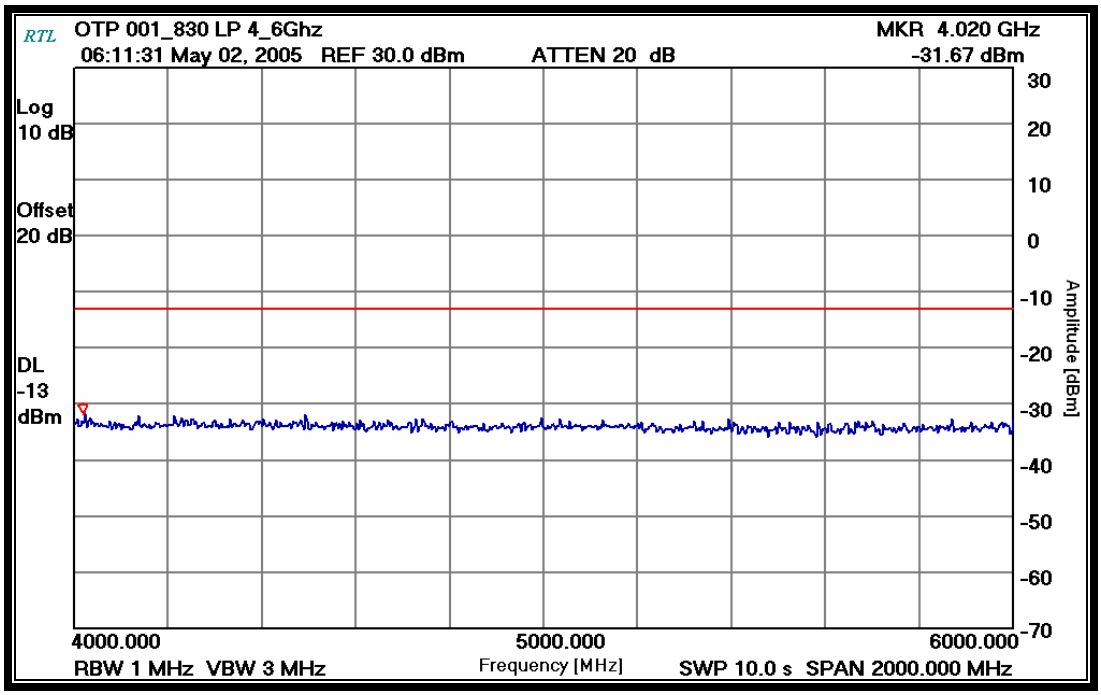
PLOT 6-24: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (1 GHZ – 4 GHZ) – VRB LOW POWER



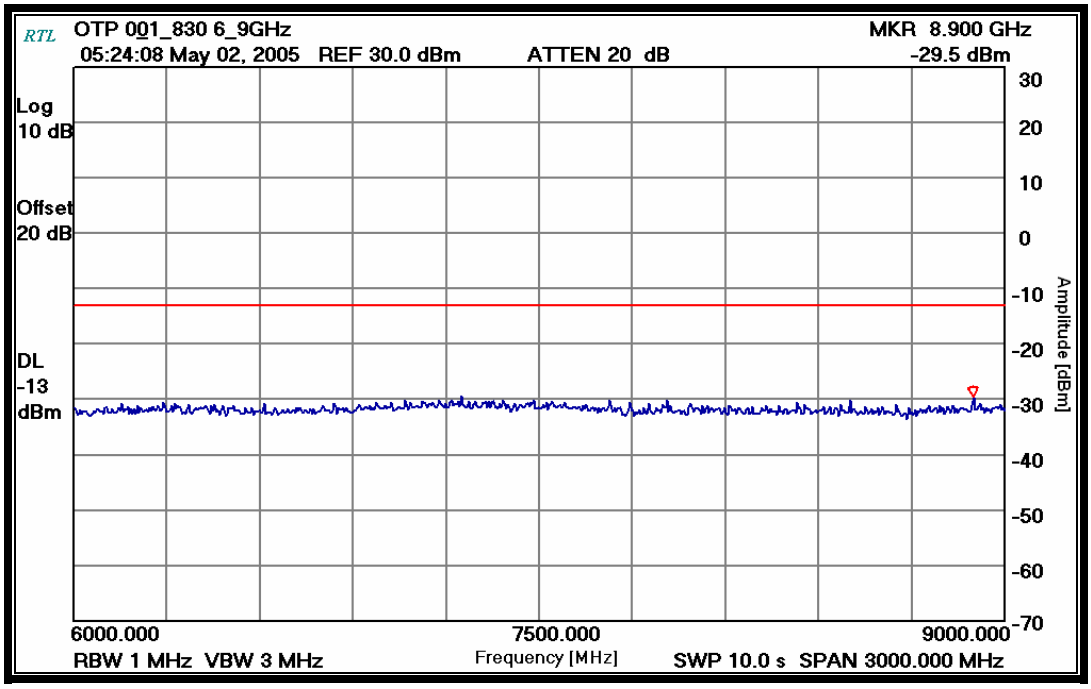
PLOT 6-25: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (4 GHZ – 6 GHZ) – VRB HIGH POWER



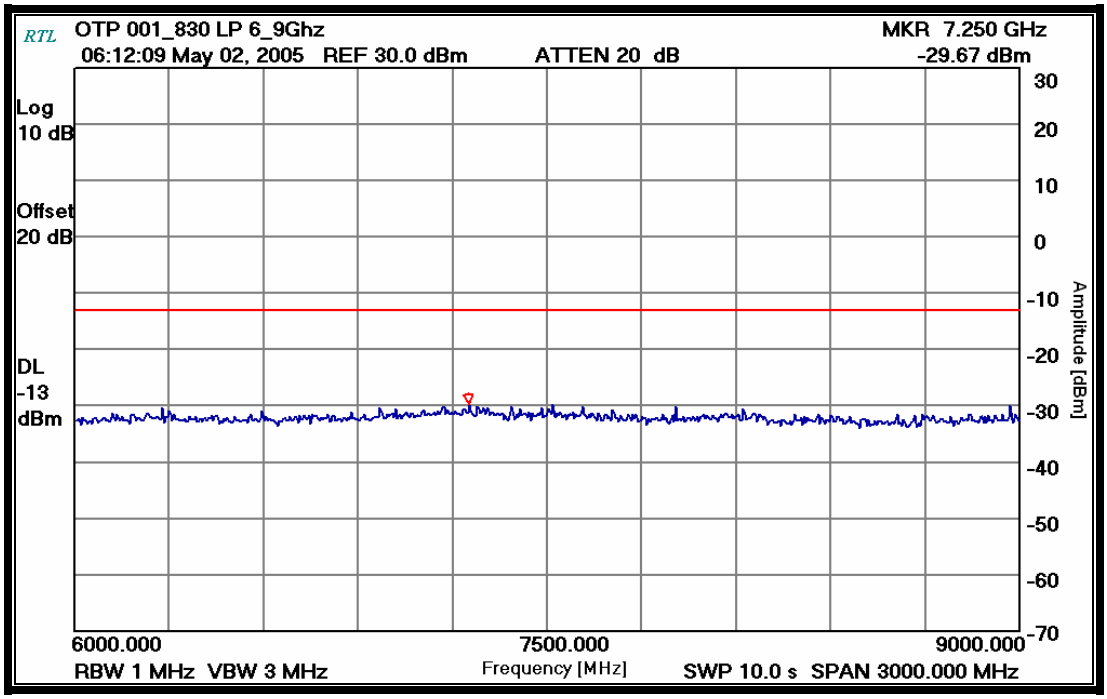
PLOT 6-26: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (4 GHZ – 6 GHZ) – VRB LOW POWER



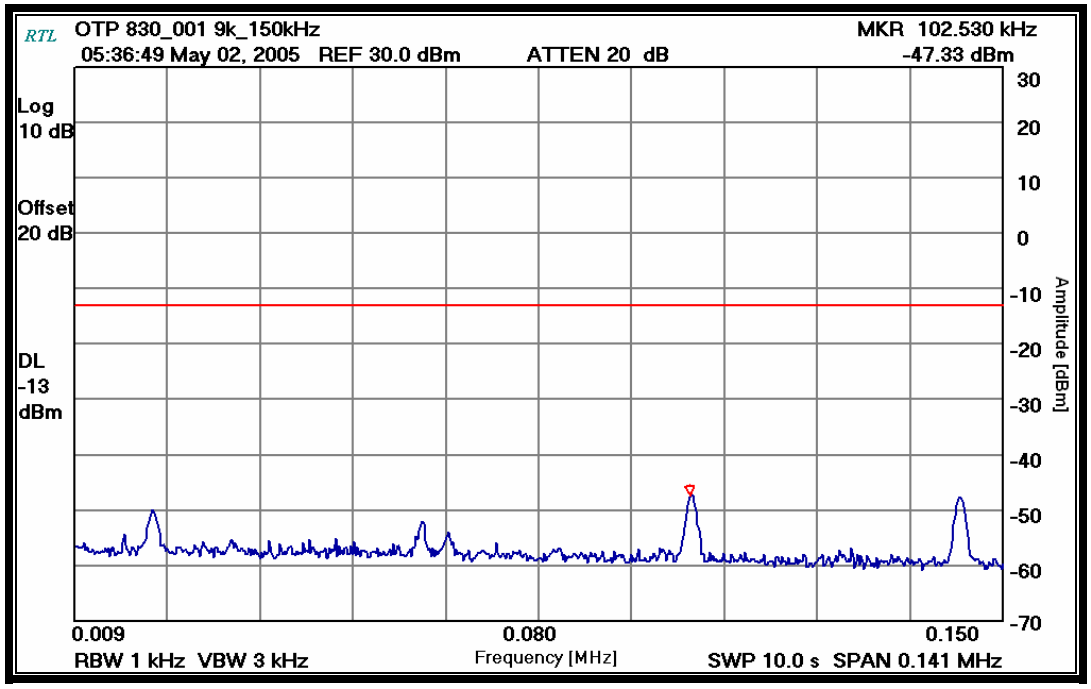
PLOT 6-27: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (6 GHZ – 9 GHZ) – VRB HIGH POWER



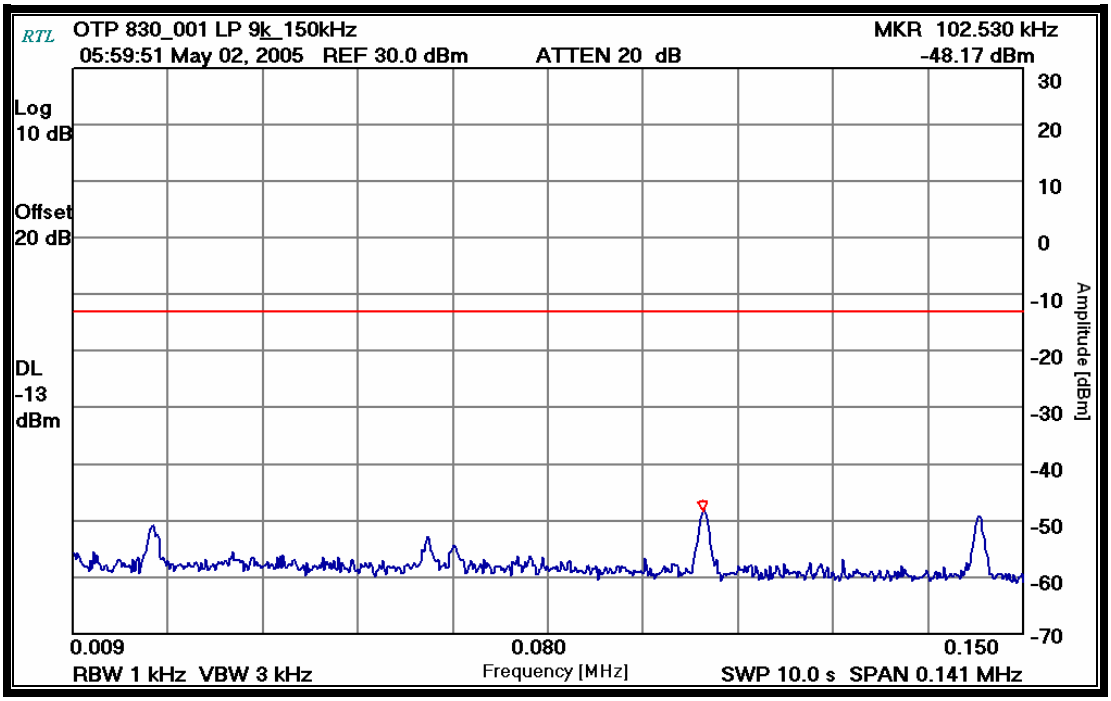
PLOT 6-28: CONDUCTED SPURIOUS EMISSIONS CHANNEL 001/830 – VRM-806.0125/VRB-868.9875 (6 GHZ – 9 GHZ) – VRB LOW POWER



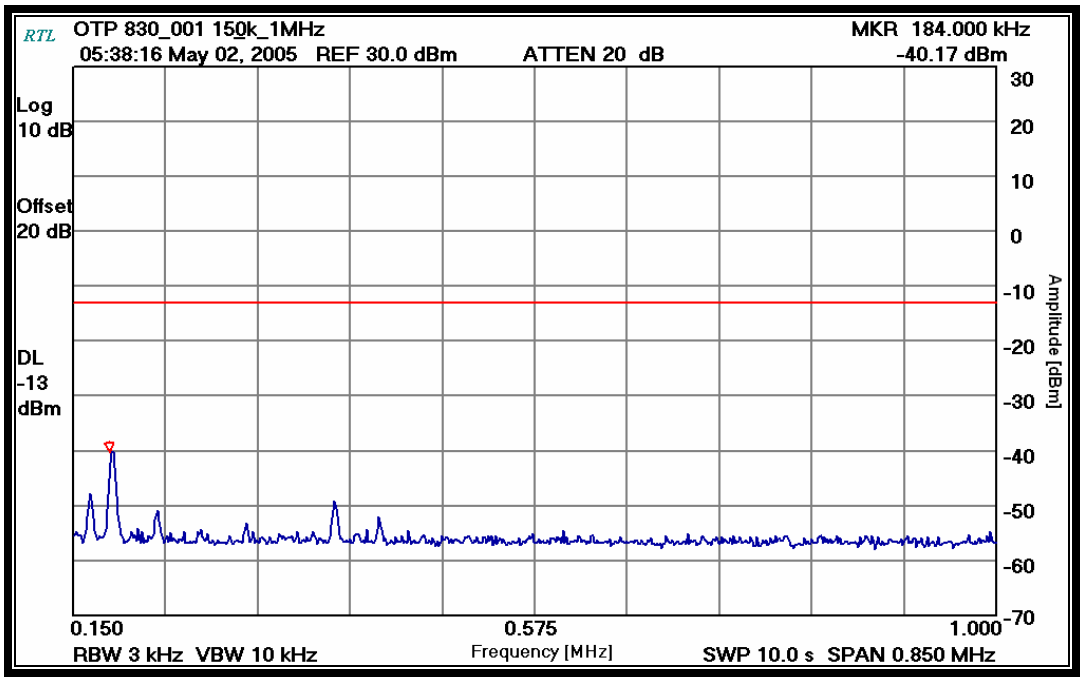
PLOT 6-29: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (9 KHZ – 150 KHZ) – VRB HIGH POWER



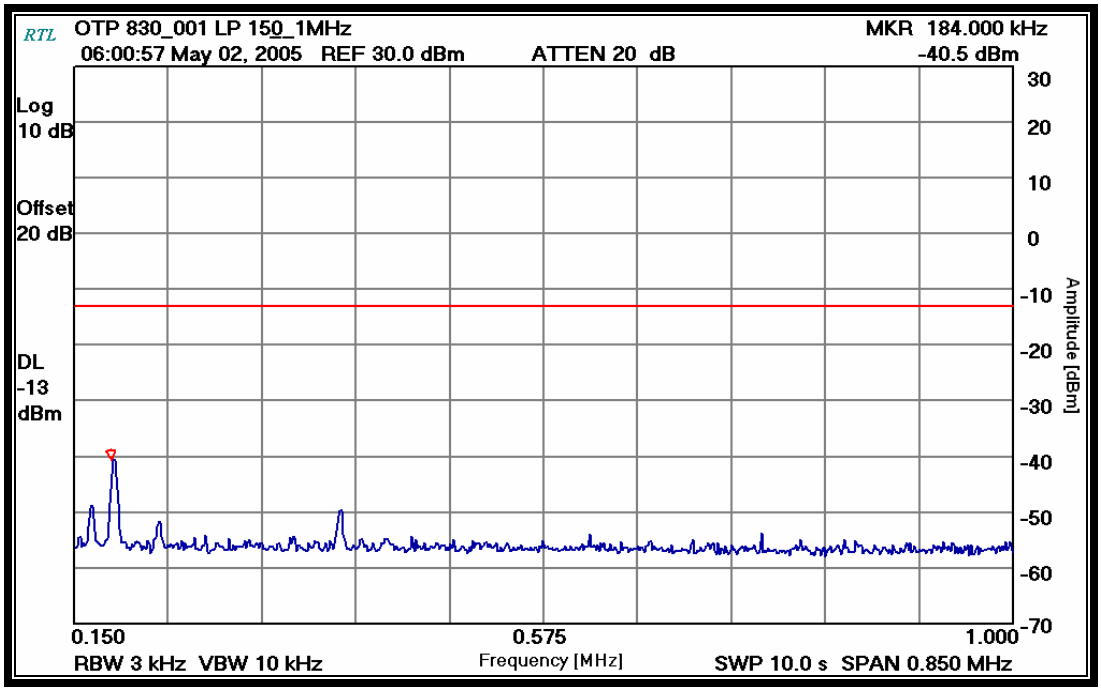
PLOT 6-30: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (9 KHZ – 150 KHZ) – VRB LOW POWER



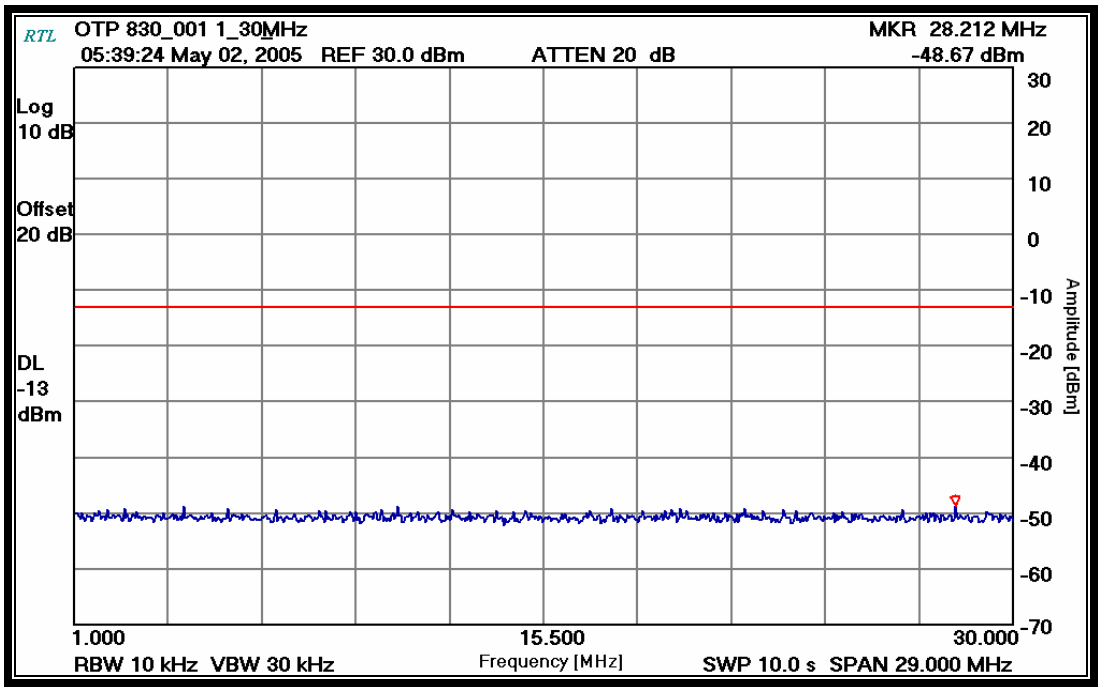
PLOT 6-31: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (150 KHZ – 1 MHZ) – VRB HIGH POWER



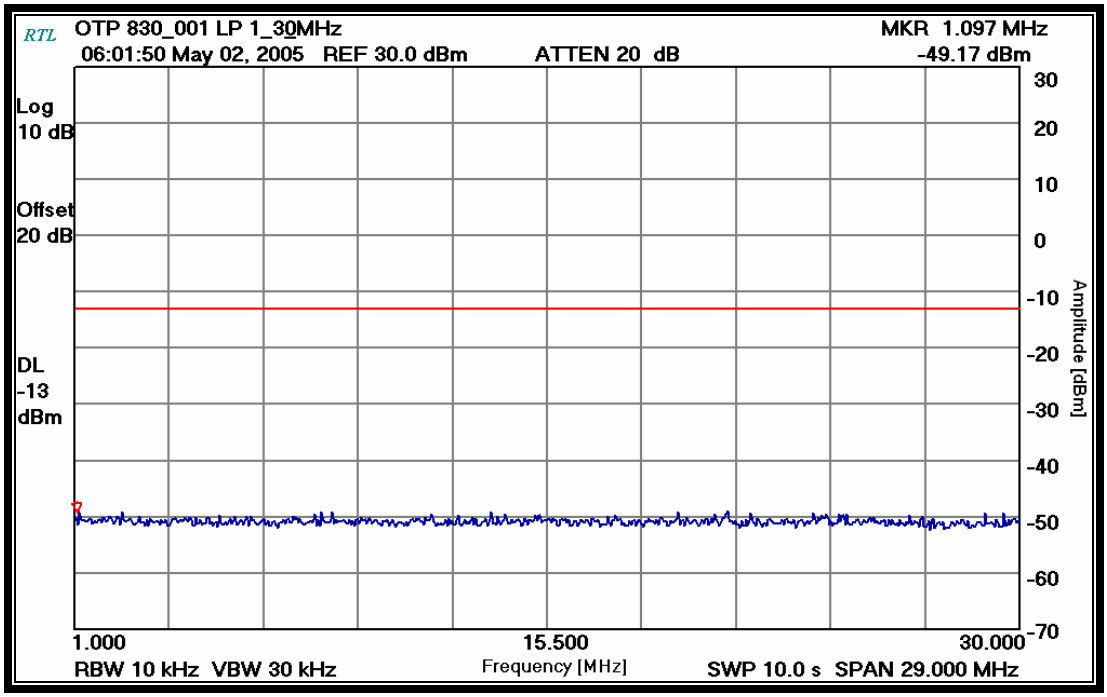
PLOT 6-32: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (150 KHZ – 1 MHZ) – VRB LOW POWER



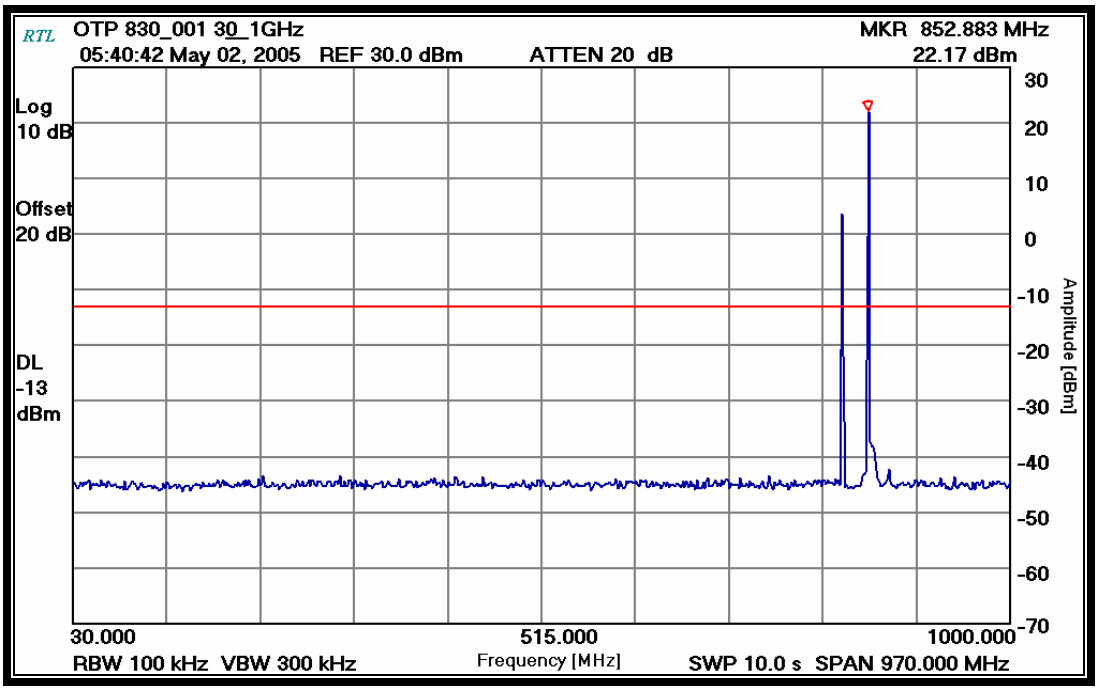
PLOT 6-33: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (1 MHZ – 30 MHZ) – VRB HIGH POWER



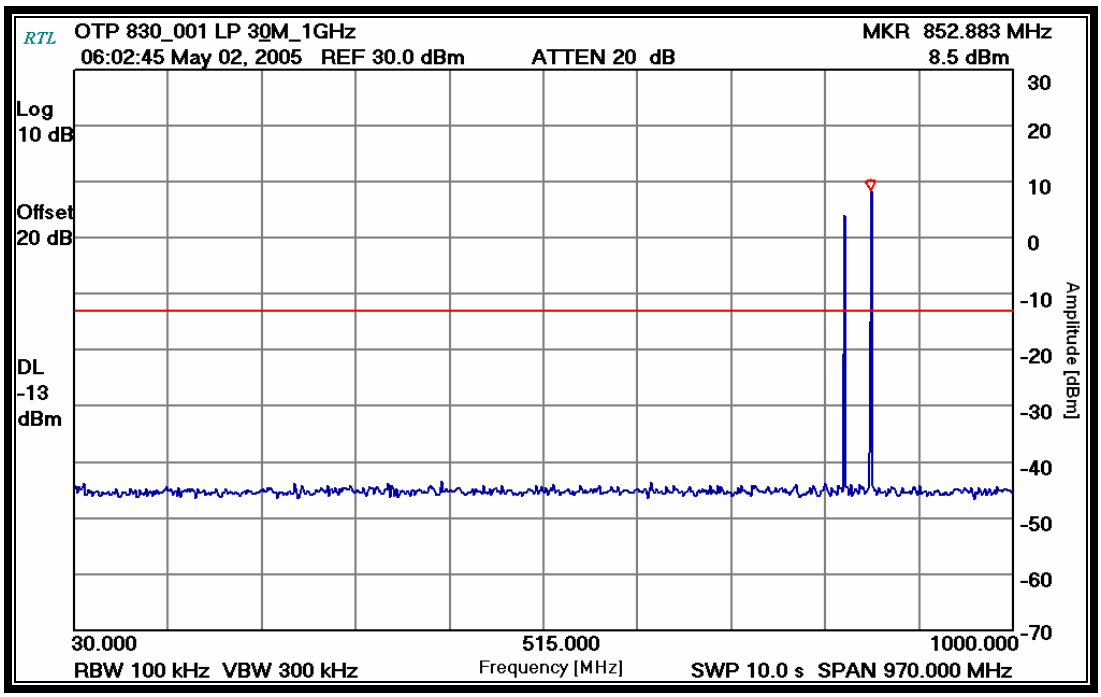
PLOT 6-34: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (1 MHZ – 30 MHZ) – VRB LOW POWER



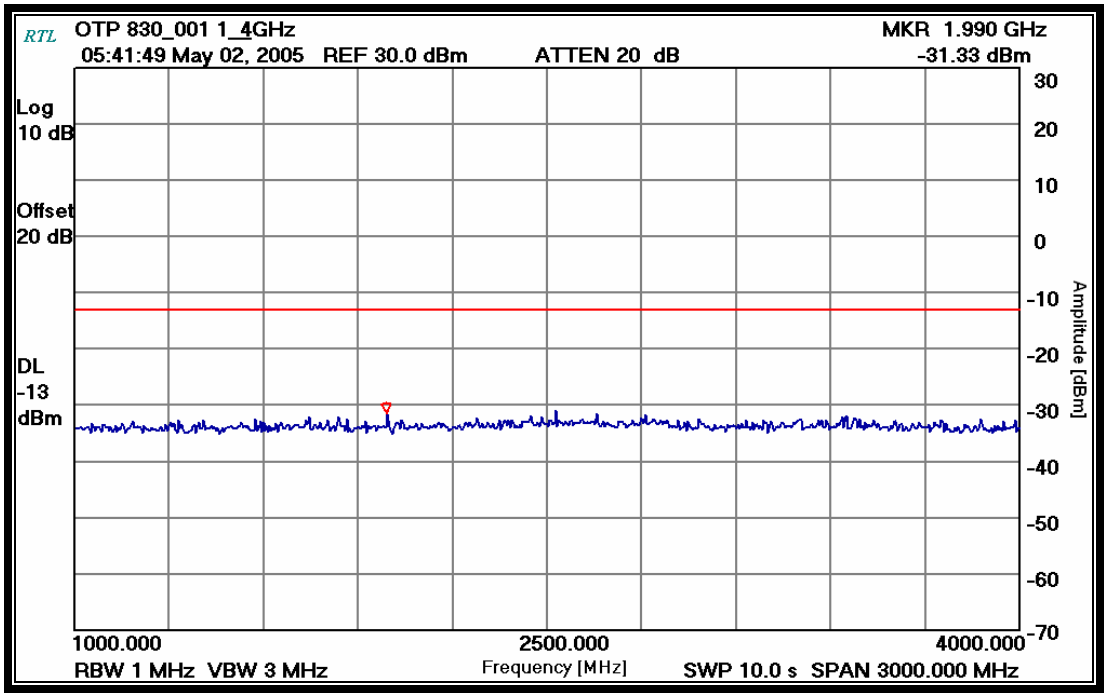
PLOT 6-35: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (30 MHZ – 1 GHZ) – VRB HIGH POWER



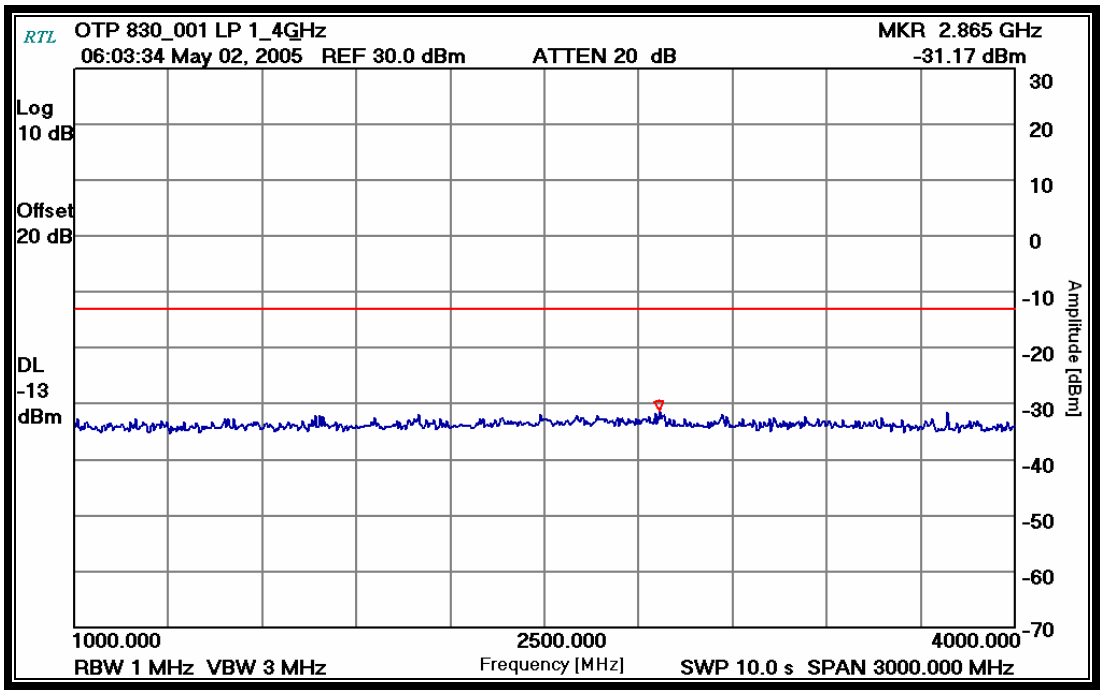
PLOT 6-36: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (30 MHZ – 1 GHZ) – VRB LOW POWER



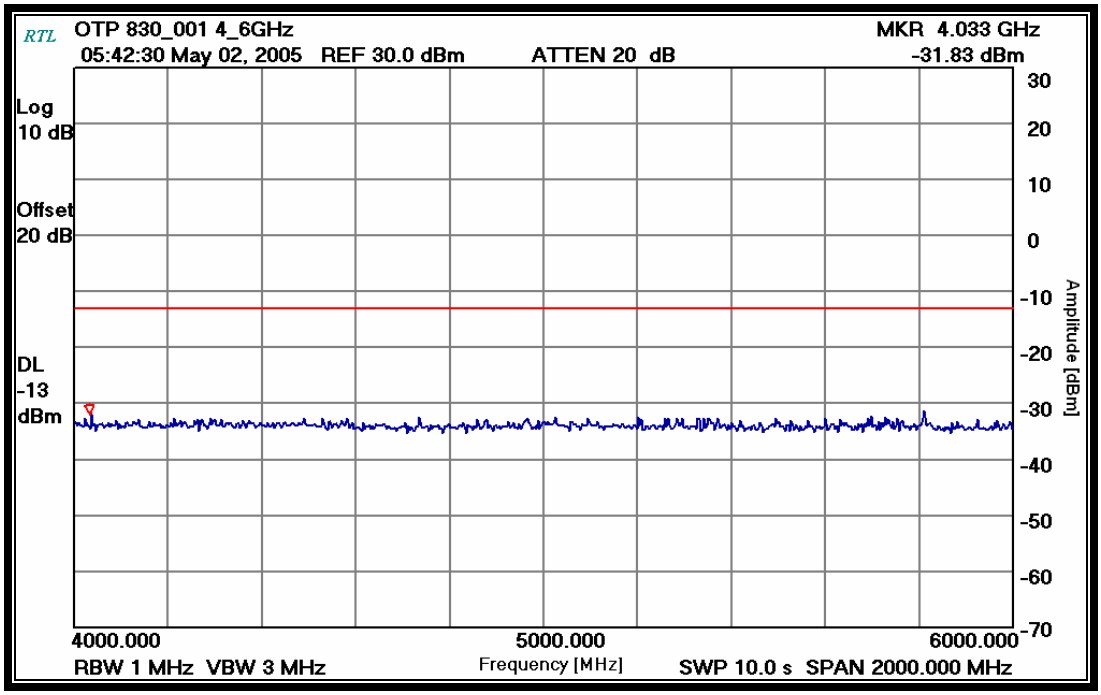
PLOT 6-37: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (1 GHZ – 4 GHZ) – VRB HIGH POWER



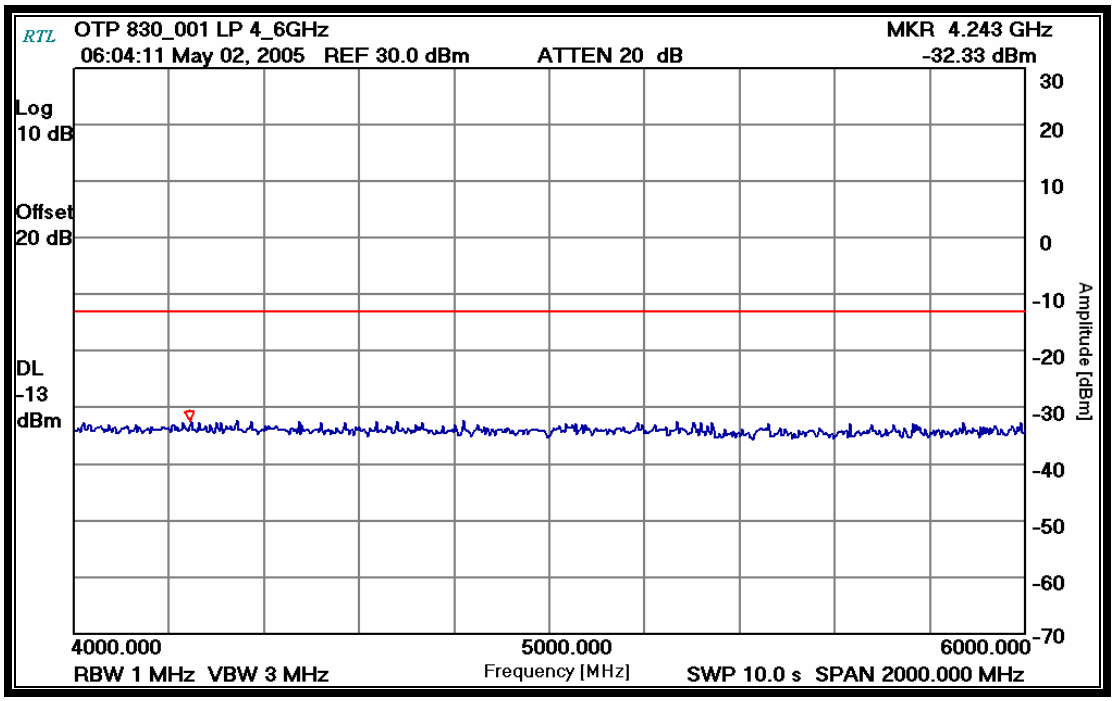
PLOT 6-38: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (1 GHZ – 4 GHZ) - VRB LOW POWER



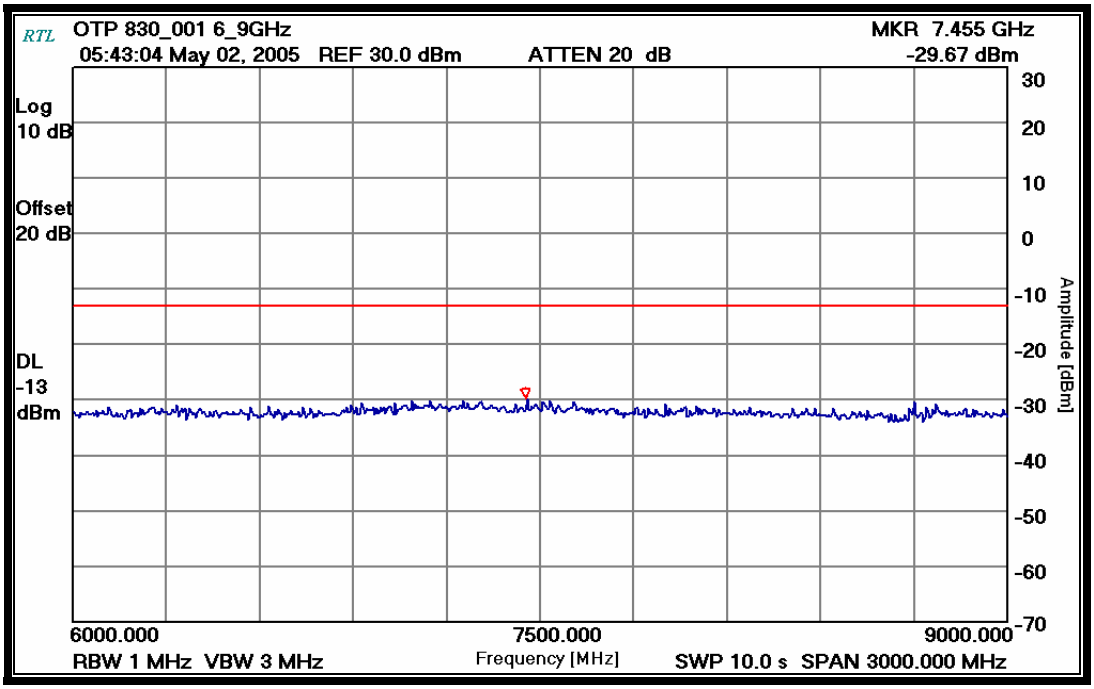
PLOT 6-39: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (4 GHZ – 6 GHZ) – VRB HIGH POWER



PLOT 6-40: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (4 GHZ – 6 GHZ) – VRB LOW POWER



PLOT 6-41: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (6 GHZ – 9 GHZ) – VRB HIGH POWER



PLOT 6-42: CONDUCTED SPURIOUS EMISSIONS CHANNEL 830/001 – VRM-823.9875 /VRB-851.0125 (6 GHZ – 9 GHZ) – VRB LOW POWER

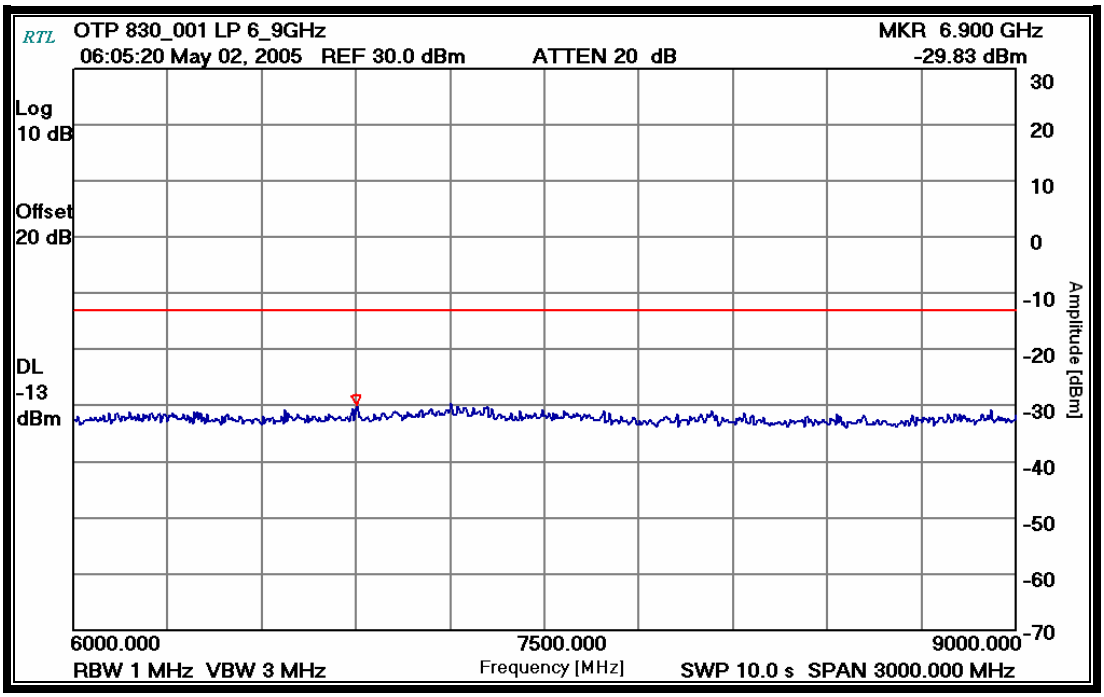
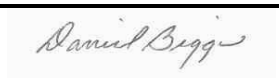


TABLE 6-1: TEST EQUIPMENT FOR TESTING CONDUCTED SPURIOUS EMISSIONS

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	09/08/05

TEST PERSONNEL:

Daniel Biggs		May 2, 2005
Test Technician/Engineer	Signature	Date Of Test

7 FCC RULES AND REGULATIONS PART 2 §2.1053 (A): FIELD STRENGTH OF SPURIOUS RADIATION; RSS-119 §6.3: UNWANTED EMISSIONS

7.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, Section 2.2.12.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 19,200 bps.

The spurious emissions levels were measured and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the antenna was further corrected to a half-wave dipole.

7.2 TEST DATA

7.2.1 CFR 47 PART 90.210 REQUIREMENTS

The worst-case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

The VRM power was set to 15W and the VRB was set to 8W. Both transmitters were transmitting simultaneously.

TABLE 7-1: FIELD STRENGTH OF SPURIOUS RADIATION CHANNEL 001/830 – 806.0125/868.9875 MHZ; HIGH POWER

Freq = 806.0125 MHz
Limit = 43 + 10 Log P = 54.8 dBc
Conducted Power = 41.8 dBm = 15.14 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1612.025	42.04	-34.45	0.60	4.94	73.77	-17.11
2418.038	42.44	-35.77	0.80	6.84	73.39	-16.73
3224.05	40.44	-37.10	1.20	7.44	74.52	-17.86
4030.063	58.55	-28.79	1.10	7.04	66.51	-9.85
4836.075	64.06	-24.68	1.20	7.24	62.30	-5.64
5642.088	48.18	-39.86	1.40	8.34	76.58	-19.92
6448.1	58.43	-32.18	1.60	8.84	68.60	-11.94
7254.113	52.40	-34.71	1.50	8.34	71.53	-14.87
8060.125	56.39	-29.22	2.00	7.34	67.54	-10.88

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Freq = 868.9875 MHz
Limit = 43 + 10 Log P = 51.72 dBc
Conducted Power = 38.72 dBm = 7.45 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1737.975	31.33	-43.15	0.80	4.84	82.77	-26.11
2606.963	41.29	-36.23	0.90	7.14	73.65	-16.99
3475.95	36.16	-39.10	1.20	7.54	76.42	-19.76
4344.938	46.38	-43.38	1.00	7.84	80.20	-23.54
5213.925	58.13	-30.19	1.20	7.64	67.41	-10.75
6082.913	62.20	-28.75	1.60	8.64	65.37	-8.71
6951.9	45.26	-43.20	1.60	8.14	80.32	-23.66
7820.888	45.18	-40.88	1.80	7.84	78.50	-21.84
8689.875	41.80	-41.77	1.80	8.49	78.74	-22.08

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

TABLE 7-2: FIELD STRENGTH OF SPURIOUS RADIATION CHANNEL 830/001 – 823.9875/851.0125 MHZ; HIGH POWER

Freq = 823.9875 MHz
Limit = 43 + 10 Log P = 54.62 dBc
Conducted Power = 41.62 dBm = 14.52 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1647.975	45.07	-30.28	0.70	4.94	70.29	-13.04
2471.963	42.08	-35.76	0.90	6.84	74.07	-16.82
3295.95	44.92	-30.62	1.00	7.34	68.53	-11.28
4119.938	52.71	-34.53	1.10	7.14	72.74	-15.49
4943.925	63.01	-26.47	1.30	7.34	64.68	-7.43
5767.913	49.80	-39.14	1.20	8.39	76.20	-18.95
6591.9	58.10	-32.14	1.90	8.74	69.55	-12.30
7415.888	48.74	-38.92	1.70	8.54	76.33	-19.08
8239.875	55.66	-26.09	2.10	7.64	64.80	-7.55

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Freq = 851.0125 MHz
Limit = 43 + 10 Log P = 51.81 dBc
Conducted Power = 38.81 dBm = 7.6 W

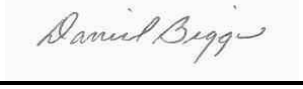
Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
1702.025	34.45	-40.44	0.80	4.94	79.79	-26.81
2553.038	40.59	-37.10	1.00	6.84	74.75	-19.88
3404.05	35.65	-39.42	1.20	7.54	76.57	-20.35
4255.063	36.42	78.91	1.40	7.84	89.54	-33.05
5106.075	51.65	77.72	1.90	7.74	73.72	-17.23
5957.088	47.51	80.51	1.40	8.64	79.25	-22.76
6808.1	45.70	-43.14	1.60	8.24	79.99	-23.50
7659.113	43.20	-42.15	2.10	8.74	79.00	-22.51
8510.125	43.41	-40.31	2.40	8.44	77.76	-21.27

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

TABLE 7-3: TEST EQUIPMENT FOR TESTING FIELD STRENGTH OF SPURIOUS RADIATION

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	09/20/05
900814	Electro-Metrics	EM-6961 (RGA-60)	Double Ridge Guide Antenna (1 - 18 GHz)	2310	2/17/06
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	N/A
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	08/11/05
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 - 20 GHz)	3610A00866	09/05/05

TEST PERSONNEL:

Daniel Biggs		March 16, 2005
Test Technician/Engineer	Signature	Date Of Test

8 FCC RULES AND REGULATIONS PART 2 §2.1049 (C) (1): OCCUPIED BANDWIDTH; PART 90 §90.210 EMISSIONS MASKS; RSS-119 §6.4: EMISSIONS MASKS

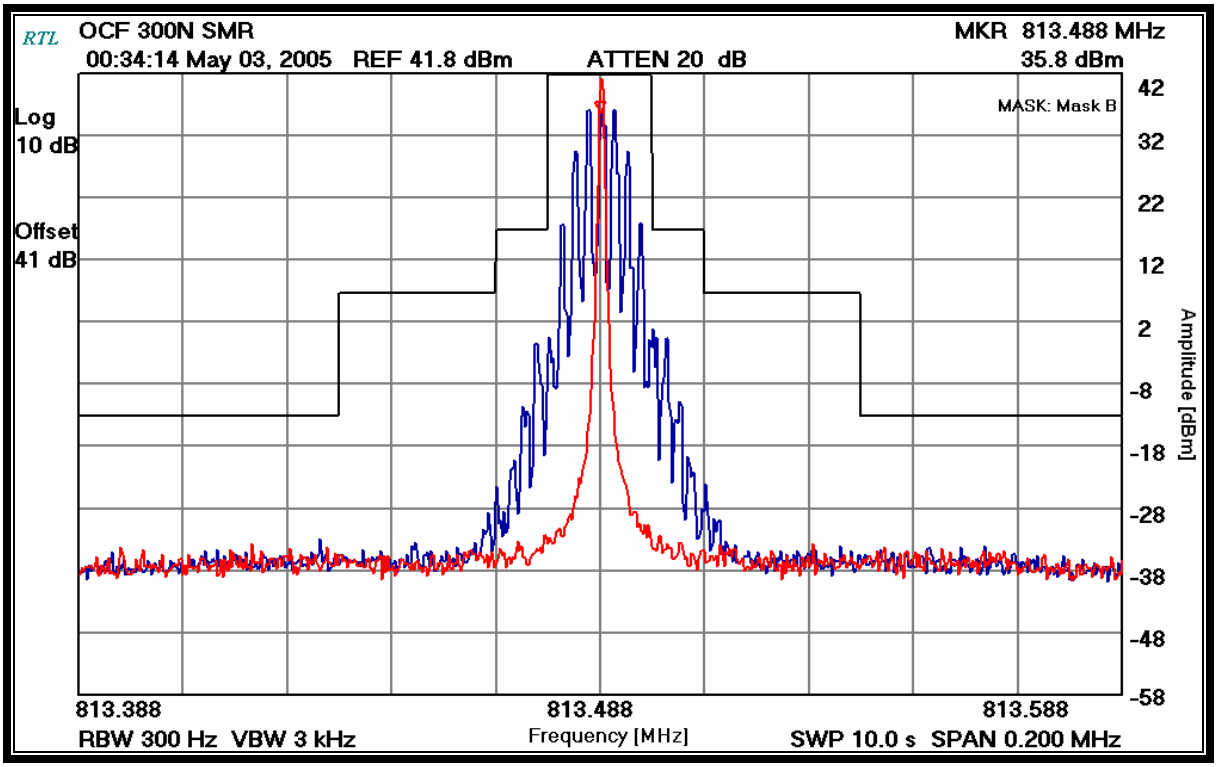
8.1 TEST PROCEDURE

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 19,200 bps.

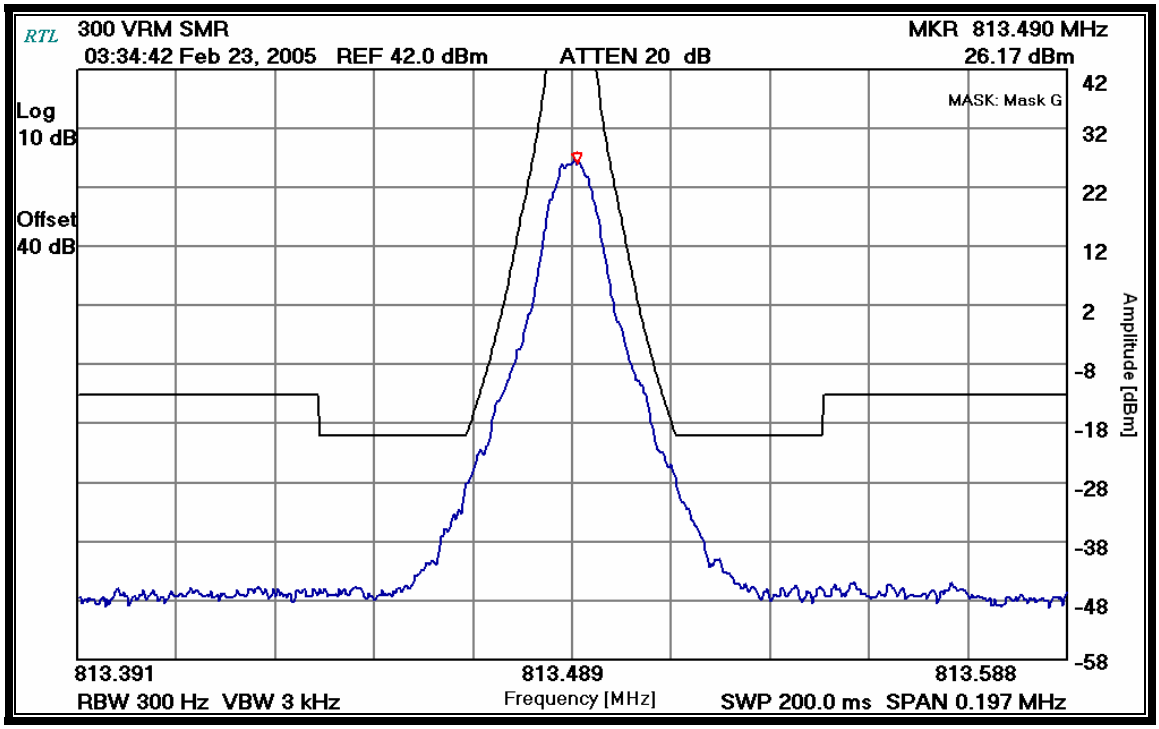
ANSI/TIA/EIA-603-2002, Section 2.2.11.

8.2 TEST DATA

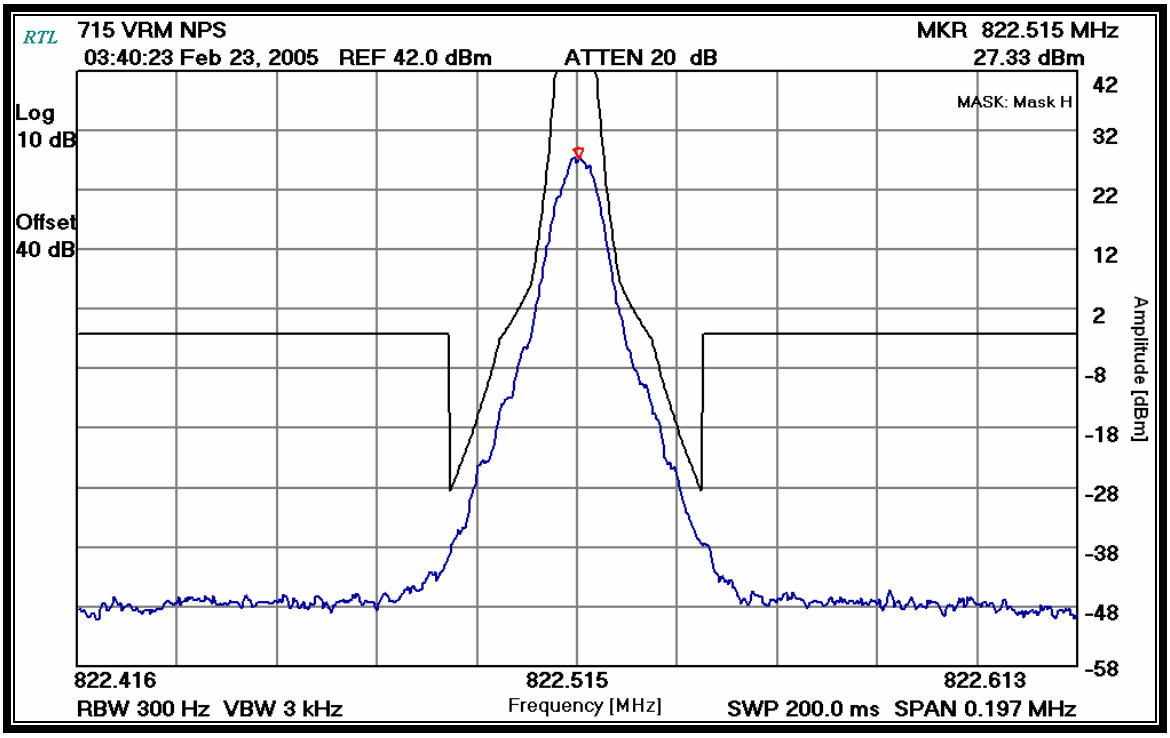
PLOT 8-1: EMISSIONS MASKS; VRM; SMR; OCF; CHANNEL 300N



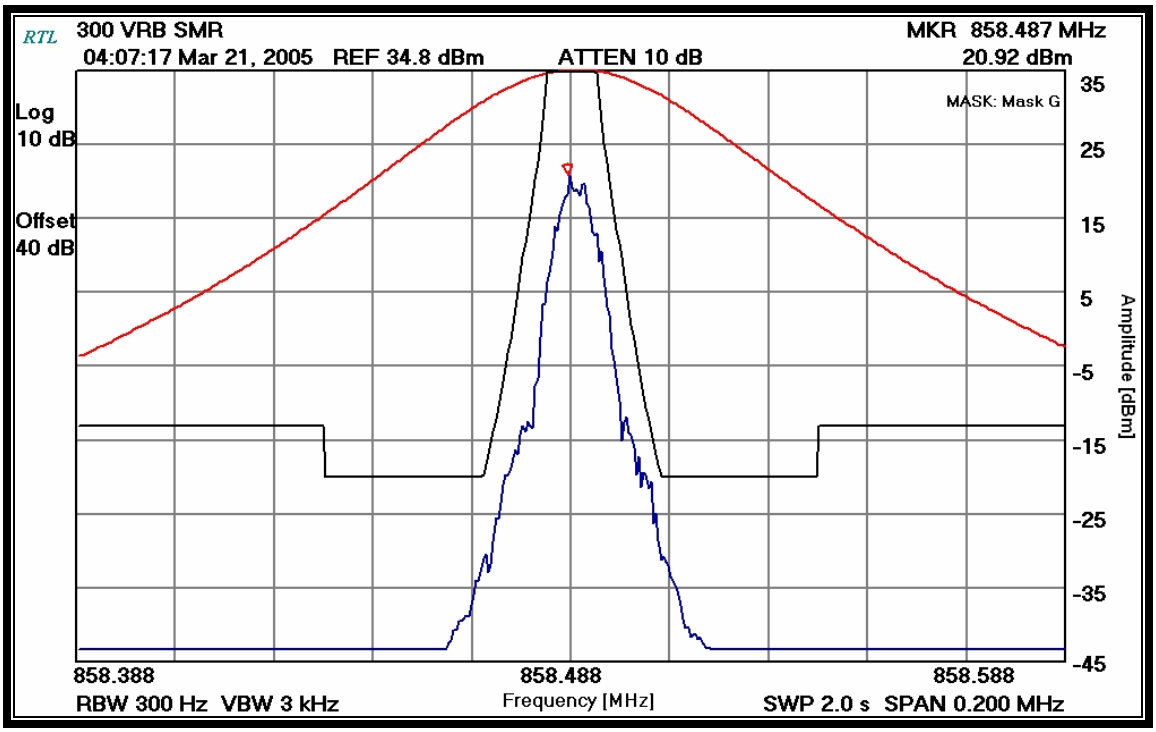
PLOT 8-2: EMISSIONS MASKS; VRM; SMR; OTP; CHANNEL 300N



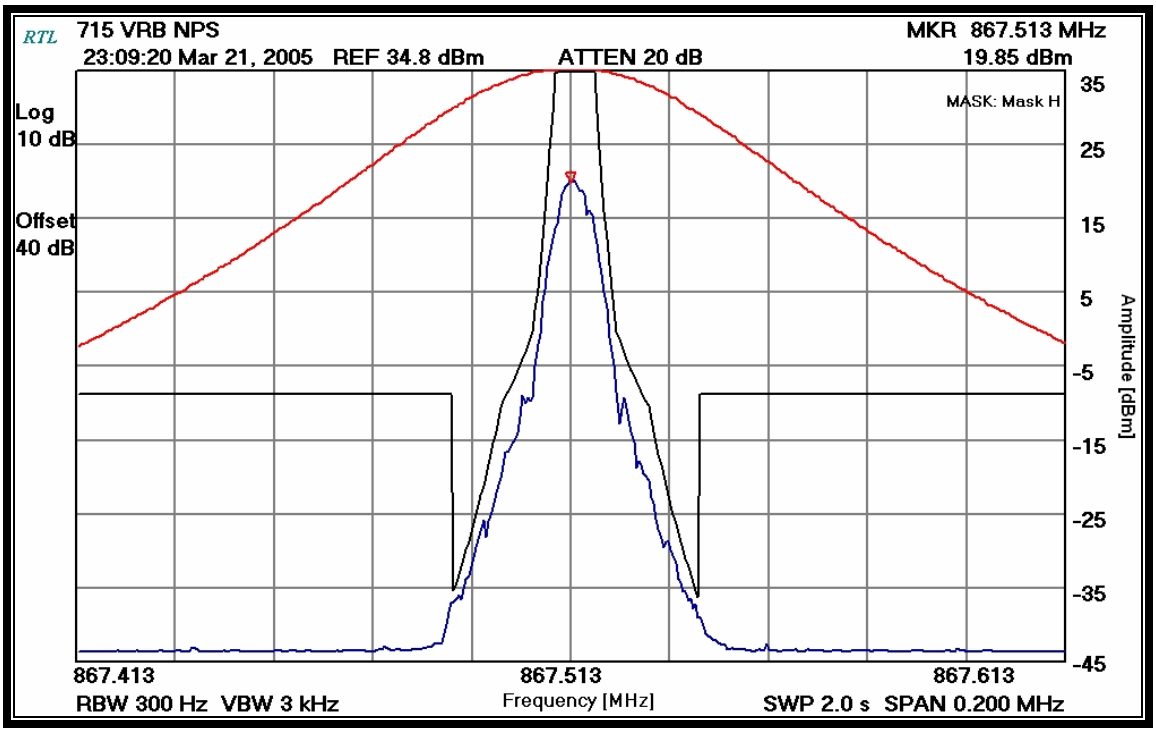
PLOT 8-3: EMISSIONS MASKS; VRM NPS; OTP; CHANNEL 715N



PLOT 8-4: EMISSIONS MASKS; VRB SMR; ORP; CHANNEL 300N



PLOT 8-5: EMISSIONS MASKS; VRB NPS; ORP; CHANNEL 715N



PLOT 8-6: EMISSIONS MASKS; VRM NPS; P25; CHANNEL 715T

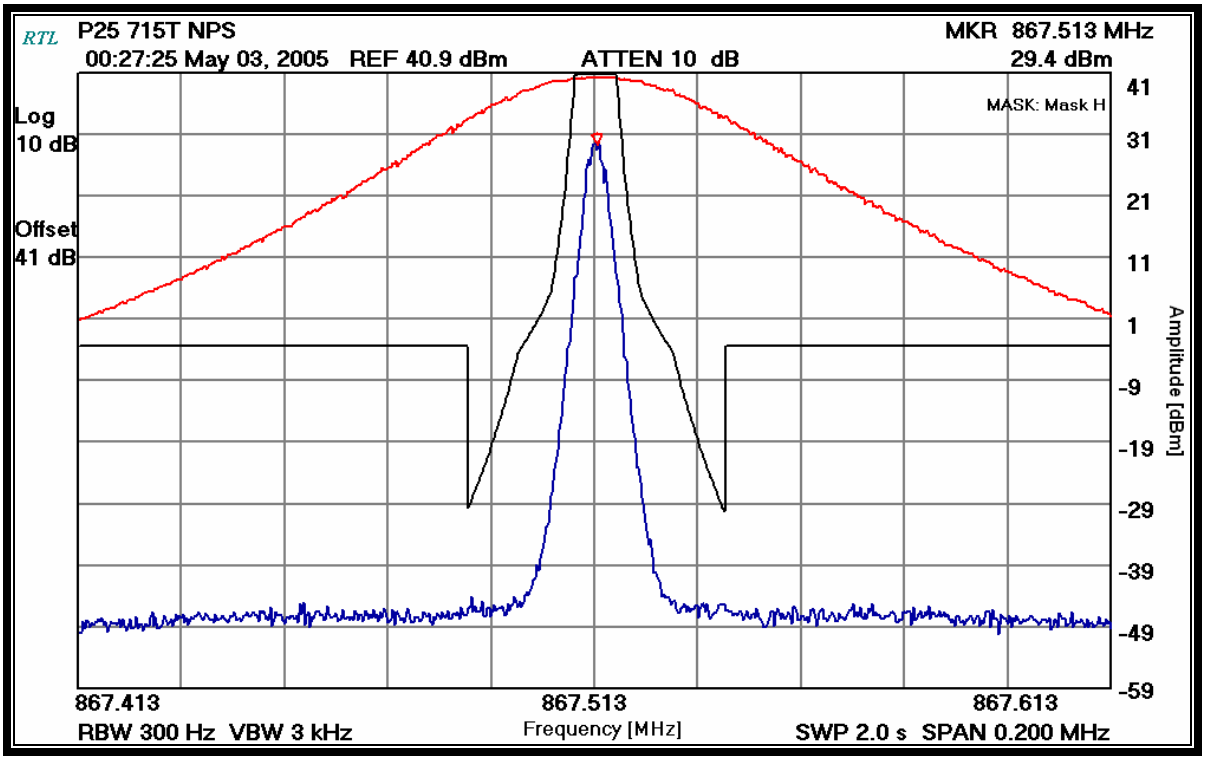


TABLE 8-1: TEST EQUIPMENT FOR TESTING OCCUPIED BANDWIDTH

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	09/08/05

TEST PERSONNEL:

Daniel Biggs	Daniel Biggs	February 23/March 21/May 3, 2005
Test Technician/Engineer	Signature	Dates Of Tests

9 FCC RULES AND REGULATION PART 2 §2.1055: FREQUENCY STABILITY; PART 90 §90.213: FREQUENCY STABILITY; RSS-119 §7: FREQUENCY STABILITY

9.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.2.

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +60°C.

The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½ hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage.

The worst-case test data are shown below in Table 9-1 and Table 9-3.

9.2 TEST DATA

9.2.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

Limit is 1.5 ppm for a mobile device from 821-824 MHz. Worst-case deviation was found to be -.89 ppm at -10°C.

PLOT 9-1: TEMPERATURE FREQUENCY STABILITY – VRM UNIT - CHANNEL 601, 821.0125 MHZ

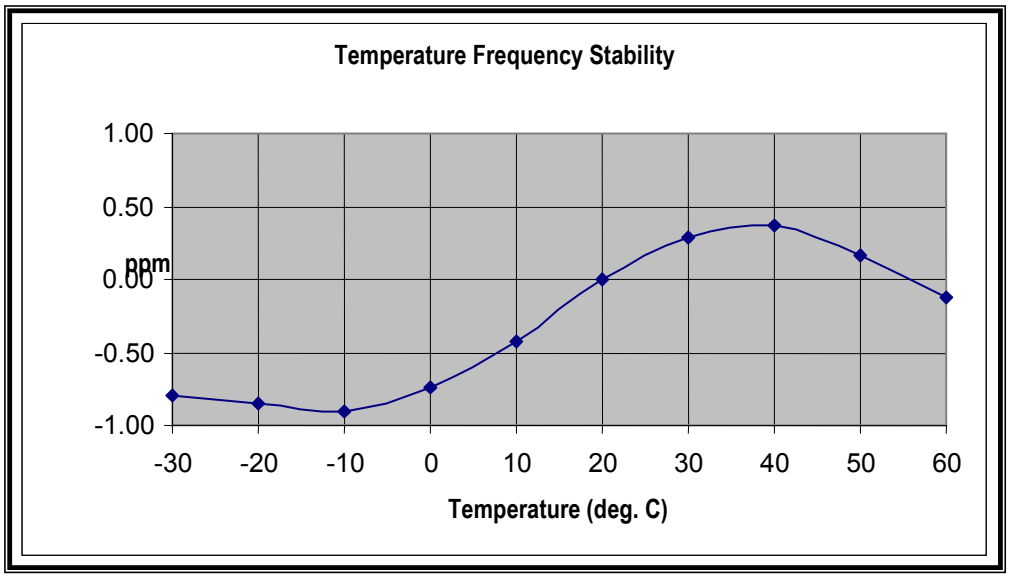


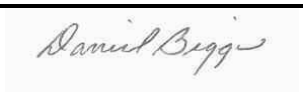
TABLE 9-1: FREQUENCY STABILITY/TEMPERATURE VARIATION - CHANNEL 601, 821.0125 MHZ

Temperature (C)	Measured Frequency (MHz)	ppm
-30	821.0123	-0.79
-20	821.012258	-0.84
-10	821.012213	-0.89
0	821.01235	-0.72
10	821.012598	-0.42
20	821.012945	0.00
30	821.013173	0.28
40	821.01324	0.36
50	821.013083	0.17
60	821.012845	-0.12

TABLE 9-2: TEST EQUIPMENT FOR TESTING FREQUENCY STABILITY/TEMPERATURE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	02/04/06
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	09/08/05

TEST PERSONNEL:

Daniel Biggs		March 21, 2005
Test Technician/Engineer	Signature	Date Of Test

9.2.2 FREQUENCY STABILITY/VOLTAGE VARIATION

Worst-case variation is -.10 ppm.

PLOT 9-2: VOLTAGE FREQUENCY STABILITY VRM UNIT - CHANNEL 601, 821.0125 MHZ

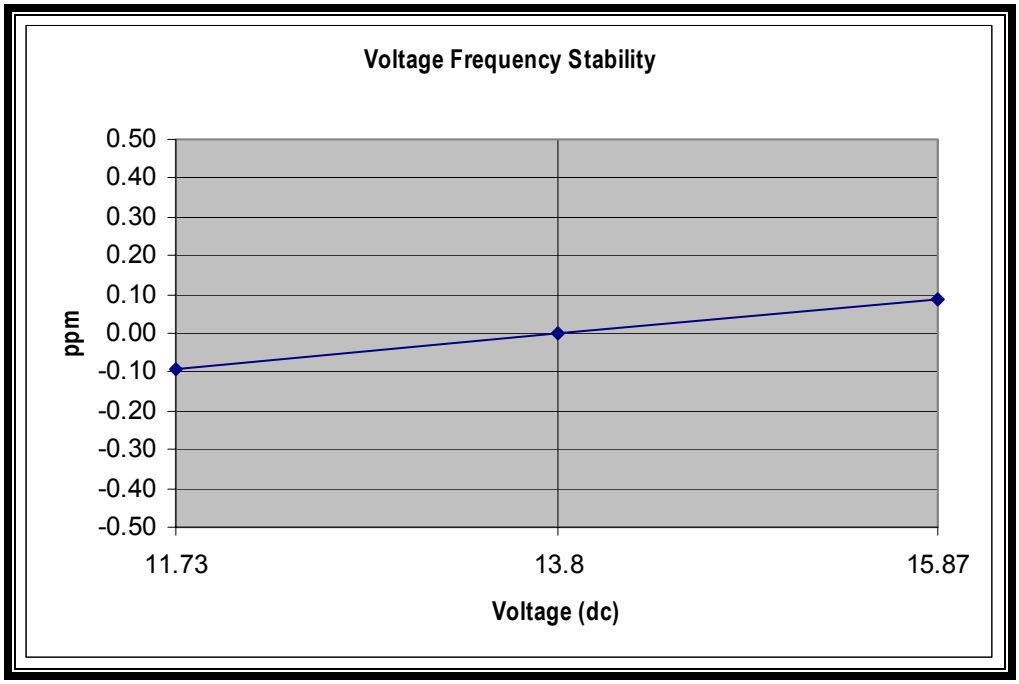


TABLE 9-3: FREQUENCY STABILITY/VOLTAGE VARIATION - CHANNEL 601, 821.0125 MHZ

Voltage (VDC)	Measured Frequency (MHz)	ppm
11.73	821.01285	-0.10
13.8	821.012928	0.00
15.87	821.013	0.09

TABLE 9-4: TEST EQUIPMENT FOR TESTING FREQUENCY STABILITY/VOLTAGE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	02/04/06
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	09/08/05

TEST PERSONNEL:

Daniel Biggs	Daniel Biggs	March 21, 2005
Test Technician/Engineer	Signature	Date Of Test

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

10.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.6

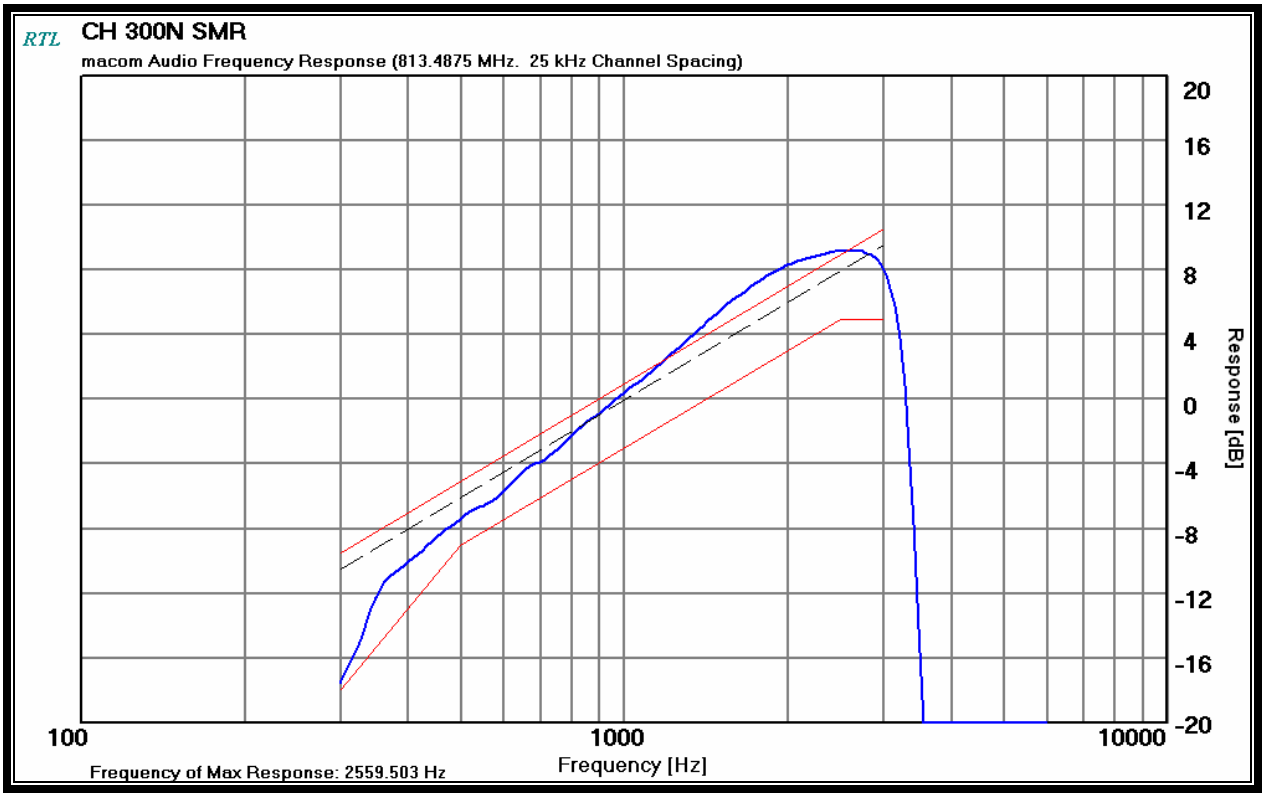
The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

The input audio level at 1000 Hz was 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 100 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)

10.2 TEST DATA

PLOT 10-1: MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE – SMR; 300N



PLOT 10-2: MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE – NPS; 715T

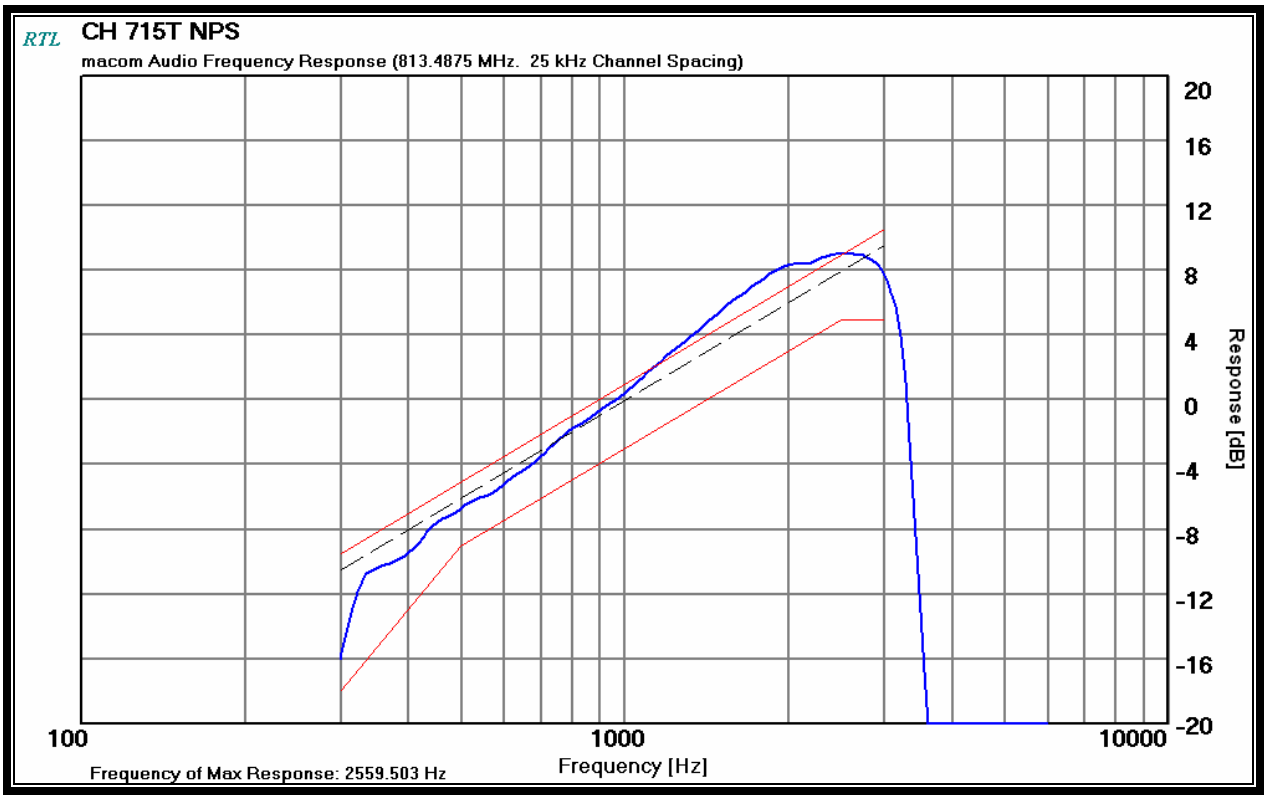


TABLE 10-1: TEST EQUIPMENT FOR TESTING AUDIO FREQUENCY RESPONSE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	09/08/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	09/08/05

TEST PERSONNEL:

Daniel Biggs	Daniel Biggs	May 3, 2005
Test Technician/Engineer	Signature	Date Of Test

11 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS – AUDIO LOW PASS FILTER; RSS-119 §6.6: AUDIO LOW-PASS FILTER

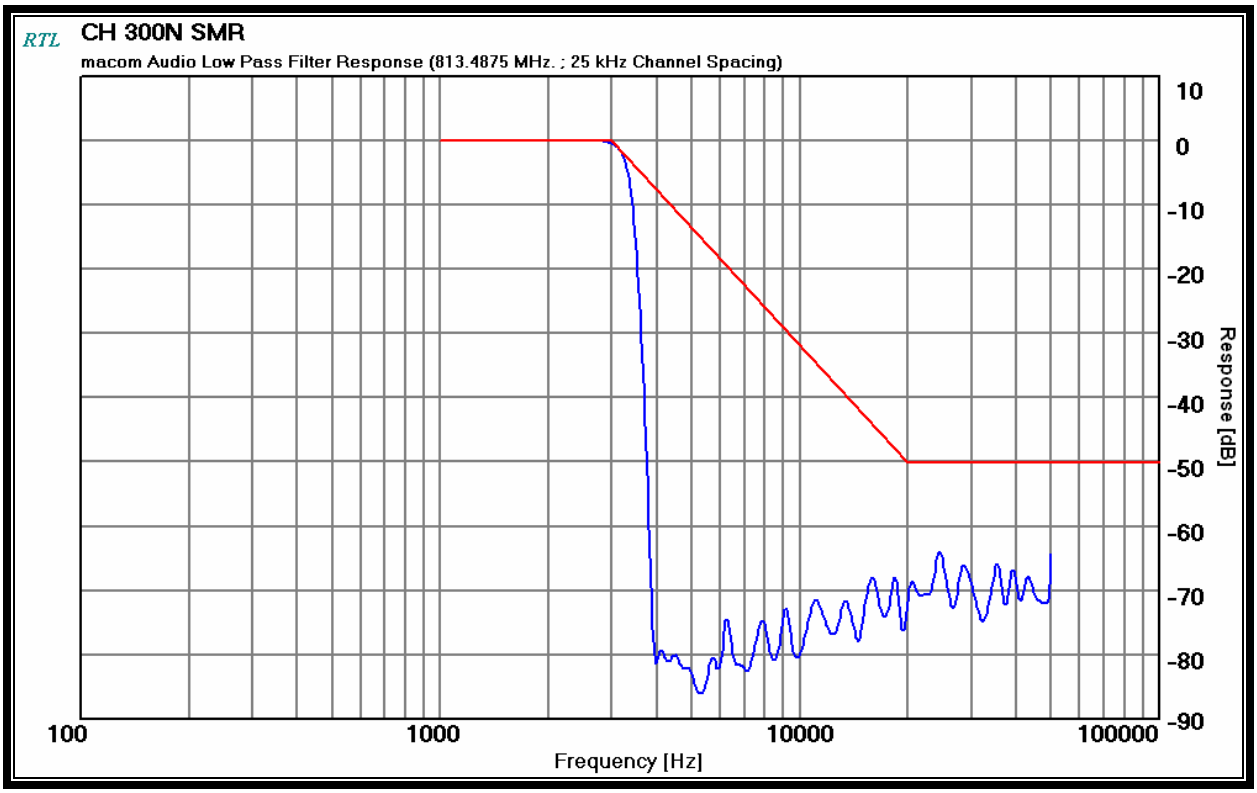
11.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, 2.2.15

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

11.2 TEST DATA

PLOT 11-1: MODULATION CHARACTERISTICS – AUDIO LOW PASS FILTER – 300N SMR



PLOT 11-2: MODULATION CHARACTERISTICS – AUDIO LOW PASS FILTER – 715T NPS

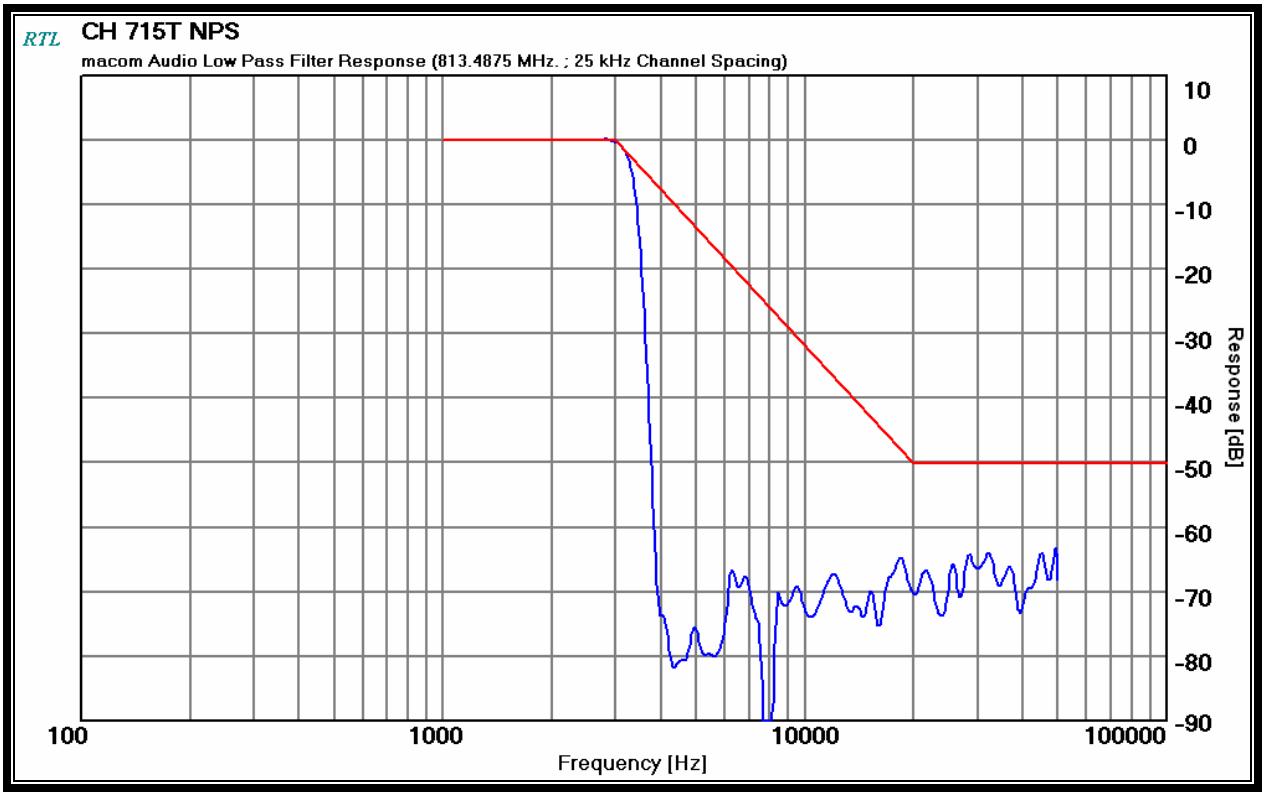


TABLE 11-1: TEST EQUIPMENT FOR TESTING AUDIO LOW PASS FILTER RESPONSE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	09/08/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	09/08/05

TEST PERSONNEL:

Daniel Biggs	Daniel Biggs	May 3, 2005
Test Technician/Engineer	Signature	Date Of Test

12 FCC RULES AND REGULATIONS PART 2 §2.1047 (B): MODULATION CHARACTERISTICS - MODULATION LIMITING; RSS-119 §6.6: FM MODULATION LIMITING AND AUDIO LOW-PASS FILTER

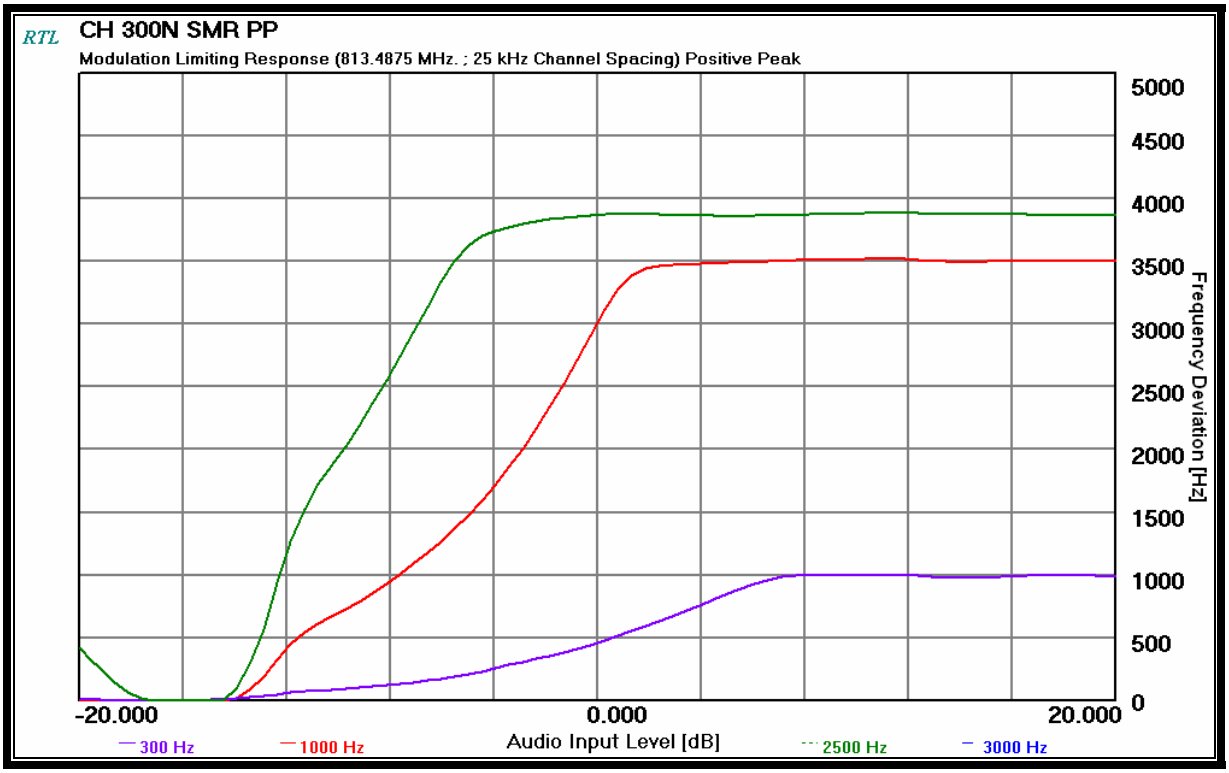
12.1 TEST PROCEDURE

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

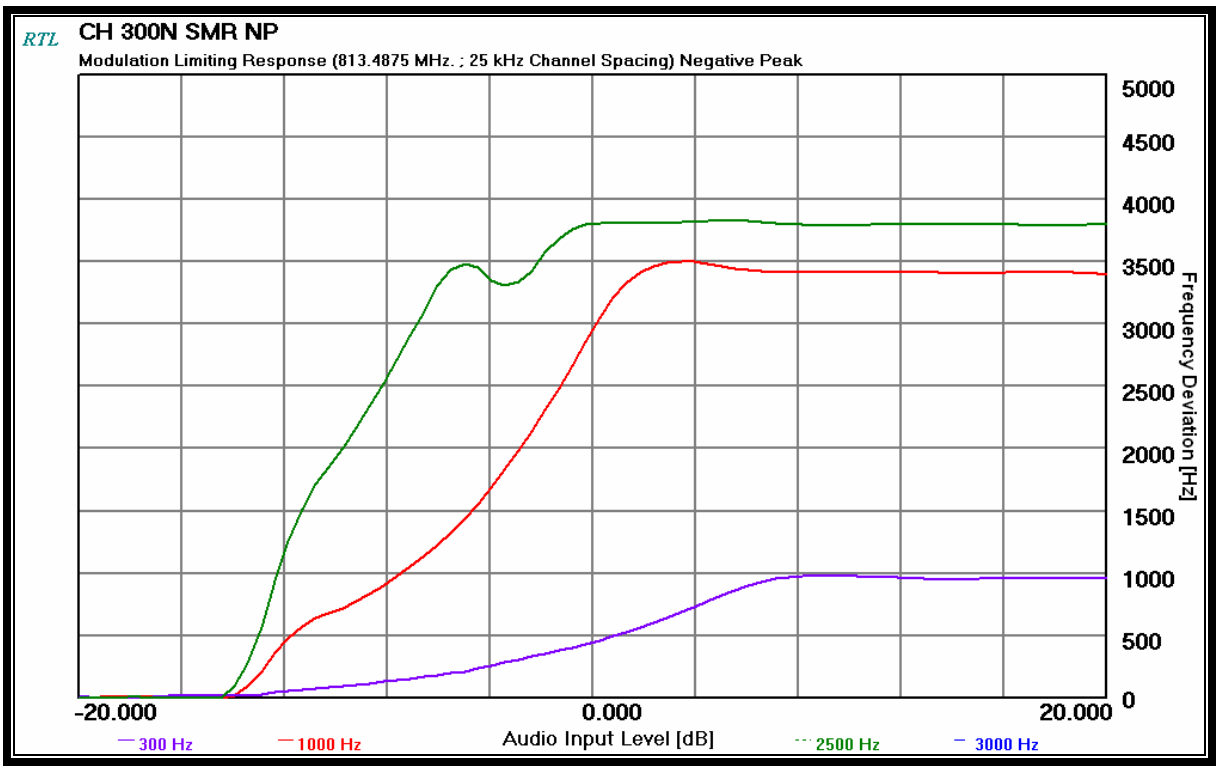
The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0dB) the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500 Hz. The system deviation obtained as a function of the input level was recorded. Both positive and negative peak deviations were recorded.

12.2 TEST DATA

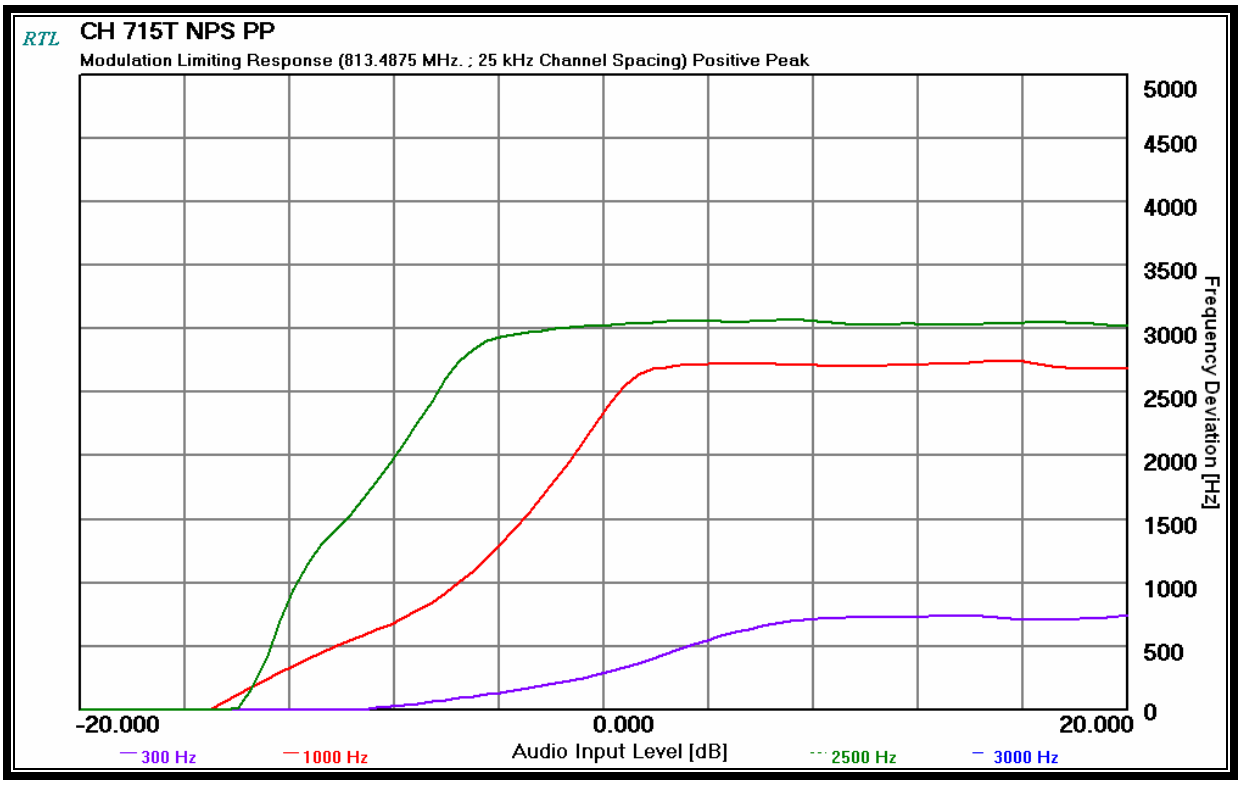
PLOT 12-1: MODULATION CHARACTERISTICS – MODULATION LIMITING: SMR; 300N; POSITIVE PEAK



PLOT 12-2: MODULATION CHARACTERISTICS – MODULATION LIMITING: SMR; 300N; NEGATIVE PEAK



PLOT 12-3: MODULATION CHARACTERISTICS – MODULATION LIMITING: NPS; 715T; POSITIVE PEAK



PLOT 12-4: MODULATION CHARACTERISTICS – MODULATION LIMITING: NPS; 715T; NEGATIVE PEAK

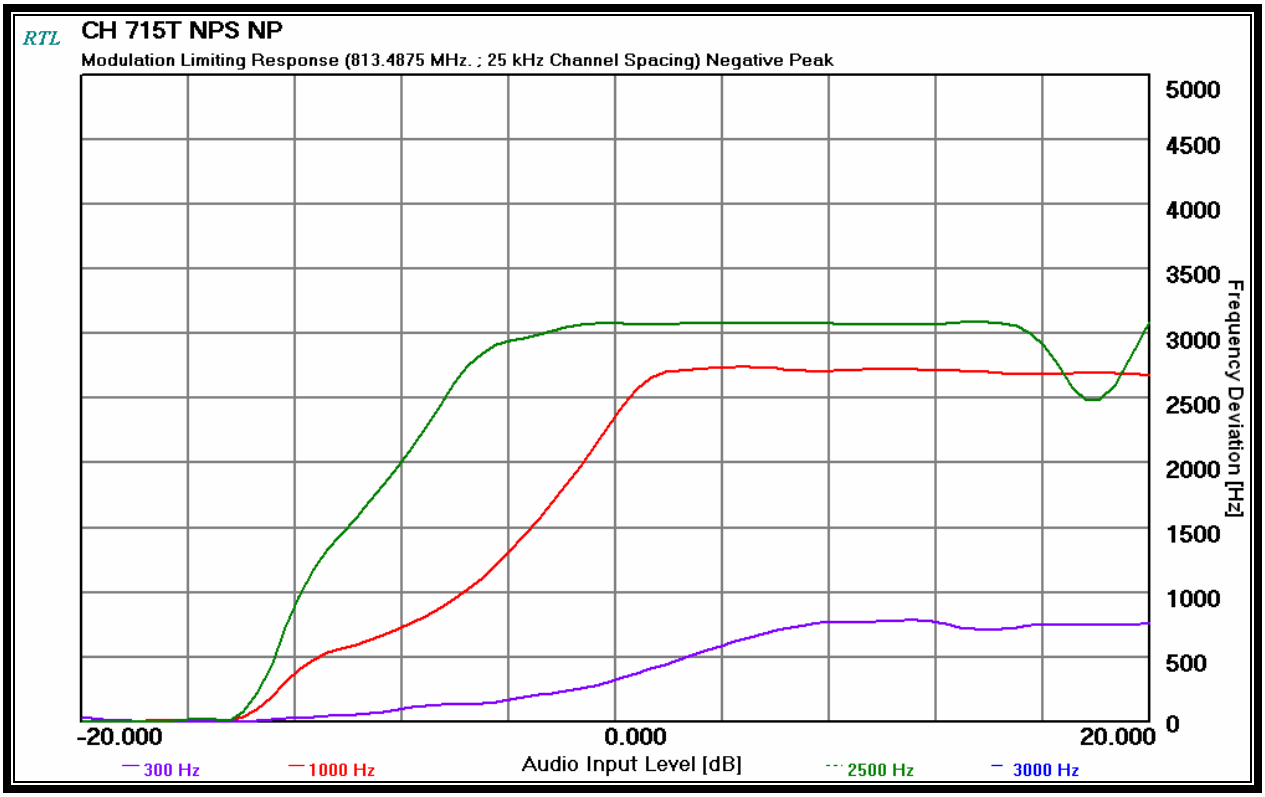


TABLE 12-1: TEST EQUIPMENT FOR TESTING MODULATION LIMITING

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	09/08/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	09/08/05

TEST PERSONNEL:

Daniel Biggs	Daniel Biggs	May 3, 2005
Test Technician/Engineer	Signature	Date Of Test

13 FCC RULES AND REGULATIONS PART 2 §2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH; PART 90 §2.210: TYPES OF EMISSIONS

Type of Emission: F3E, F7D, F7E

Voice – SMR - 25 kHz channel separation
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 5.0
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 16.0 kHz
Emission designator: 16K0F3E

Voice – NPSPAC - 25 kHz channel separation
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 4.0
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 14.0 kHz
Emission designator: 14K0F3E

OTP/ORP – SMR - 19200 bps
Calculation:
Data rate in bps (R) = 19200
Peak deviation of carrier (D) = 4000 Hz
Bn = $[R/\log_2(4) + 2\ (D)\ (1)]$ = 17.6 kHz
Emission designator: 17K6F7D, 17K6F7E

OTP/ORP – NPSPAC - 19200 bps
Calculation:
Data rate in bps (R) = 19200
Peak deviation of carrier (D) = 4000 Hz
Bn = $[R/\log_2(4) + 2\ (D)\ (1)]$ = 17.6 kHz
Emission designator: 17K6F7D, 17K6F7E

P25 – SMR - 9600 bps
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800 Hz
Bn = $[R/\log_2(4) + 2\ (D)\ (1)]$ = 8.4 kHz
Emission designator: 8K4F1D, 8K4F1E

P25 – NPSPAC - 9600 bps
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800 Hz
Bn = $[R/\log_2(4) + 2\ (D)\ (1)]$ = 8.4 kHz
Emission designator: 8K4F1D, 8K4F1E

14 CONCLUSION

The data in this measurement report shows that the **M/A-COM, Inc**. Model **OpenSky M-803 V-TAC Mobile Radio; FCC ID: BV8VTAC800, IC: 3670A-VTAC,** complies with the applicable requirements of Parts 90 and 2 of the FCC Rules, and Industry Canada RSS-119.