GENERAL DYNAMICS
C4 Systems

Exhibit 6 – Test Report

General Dynamics C4 Systems

CM-350 (V2) VHF Digital Transmitter (VDT)

FCC ID: MIJCM350V2

Model No. CM-350 (V2) VDT

1.0 Identification (Nameplate) Information

Equipment Applicant:	**General Dynamics C4 Systems** **8220 E. Roosevelt St.** **Scottsdale, Arizona 85257**
Tests Conducted By:	**General Dynamics C4 Systems** **EMC Test Facility** **8201 E. McDowell Rd.** **Scottsdale, Arizona 85257**
Test Summary:	**Complies with FCC Part 87, Aviation Services**

The General Dynamics EMC Laboratory
is accredited through the

NVLAP®

NVLAP Lab Code 100405-0

APPLICATION		REVISION HISTORY			
NEXT ASSY	USED ON	REV	DESCRIPTION	DATE	APPROVED
	CM-350 (V2)	-	INTIAL RELEASE	YY-MM-DD	CCB

ALL SHEETS ARE THE SAME REVISION LEVEL

CONTR XXXXXX-XX-X-XXXX	**GENERAL DYNAMICS** SCOTTSDALE, ARIZONA 85257
ISS X. XXXXXXXX YY-MM-DD	
APPROVALS	TITLE
DWN X. XXXXXXXX YY-MM-DD	**CM-350 (V2) VDT FCC Certification Report**
CHKR X. XXXXXXXX YY-MM-DD	
QA X. XXXXXXXX YY-MM-DD	
MATL X. XXXXXXXX YY-MM-DD	
MFG X. XXXXXXXX YY-MM-DD	SIZE: **A** · CAGE CODE: **1VPW8** · DWG NO: **12-P57599R**
ENG X. XXXXXXXX YY-MM-DD	
	SCALE: NONE · SHEET 1 OF 68

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Test Summary Table

Specification : 47 CFR Parts 2 & 87 Test Procedure : 12-P57247R		Test Sample : CM-350 (V2) VDT SN : 2V5000001		
No.	Test	CFR Reference	Data Section	Test Result
1	Occupied Bandwidth	87.135	4.1	COMPLIANT
2	Spectrum Mask	87.135	4.2	COMPLIANT
3	Spurious Emissions, Antenna Terminal	87.139	4.3	COMPLIANT
4	Spurious Emissions, Radiated Chassis	87.139	4.4	COMPLIANT
5	Modulation Characteristics	87.141	4.5	COMPLIANT
6	Frequency Stability	87.133	4.6	COMPLIANT
7	RF Power Output	2.1046	4.7	N/A (Required Information Provided)

Administrative Data

Purpose of Test:	To measure specific transmitter characteristics of the NEXCOM II CM-350 (V2) VHF Digital Transmitter (VDT) and compare those results to the applicable requirements specified in the Code of Federal Regulations (CFR), Title 47, Parts 2 and 87 for FCC Certification.
Manufacturer:	General Dynamics C4 Systems 8201 E McDowell Rd. Scottsdale, Arizona 85257
Unit Identification:	CM-350 (V2) VDT S/N: 2V5000001 CM-350 (V2) VDT S/N: 2V5000005 CM-350 (V2) VDT S/N: 2V5000007 CM-350 (V2) VDT S/N: 2V5000107
Test Conducted By:	General Dynamics C4 Systems EMC/TEMPEST Test Facility
Test Period:	04/24/2013 to 05/29/2013
Disposition of Unit:	Returned to Project
Abstract:	This document contains the measurement data required for FCC certification of the CM-350 (V2) VDT. Included is a description of the test sample, test setups, and test equipment used. Test setup photos are included in a separate exhibit of the FCC filing package.

1.0 GENERAL INFORMATION

1.1 Applicable Documents

47 CFR Part 2	Code of Federal Regulations, Title 47, Part 2, “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
47 CFR Part 87	Code of Federal Regulations, Title 47, Part 87, “Aviation Services”
ANSI C63.4-2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
12-P57247R	FCC Test Procedure for the NEXCOM II CM-300/350 (V2) VHF Digital Transmitters (VDT)

1.2 Test Requirements

The CM-350 (V2) VDT is subject to the requirements in 47 CFR Parts 2 and 87 for FCC certification of Aviation Service transmitters used in the United States. The tests shown in Table 1.2-1 as defined in Parts 2 and 87 were performed on the CM-350 (V2) VDT.

Table 1.2-1 FCC Certification Technical Data Requirements

Test Name	Media	Test Range	47 CFR Parts 2 and 87 Requirements
Bandwidth of Emissions (Occupied Bandwidth)	RF Output	99% Mean Power	87.135 2.1049
Emission Limitations (Antenna Terminal)	RF Output	25 dBc @ 50-100% 35 dBc @ 100-250% 43+10LogP > 250%	87.139 2.1051
Emission Limitations (Radiated with output terminated)	Chassis – E-Field	30MHz – 1.4 GHz	87.139 2.1053
Modulation Characteristics	RF Output	Audio Frequency Response 100 Hz – 5 kHz	87.141 2.1047
Frequency Stability	RF Output Carrier	-30°C to +50°C 85 to 115% VAC/DC	87.133 2.1055
RF Power Output	RF Output	Carrier	87.131 2.1046

2.0 TEST SAMPLE

2.1 Description

The NEXCOM II Air Traffic Control (ATC) Transmitters and Receivers are designed to meet the dynamic mission requirements of air traffic control centers, commercial airports, military air stations and range installations. The radio equipment is designed to be rack mounted and includes the following units:

CM-300 (V2) VDR	VHF Receiver
CM-300 (V2) VDT	VHF Low Power Transmitter 12 Watts
CM-350 (V2) VDT	VHF High Power Transmitter 35 Watts

The receiver is a superheterodyne double conversion designs with internal cosite cavity filters. They share a common architecture and operate from a common field upgradable software load. Control is provided by a General Purpose Processor and digital demodulation is implemented in a dedicated real time Digital Signal Processor (DSP). The receivers are remotely controllable and support Voice over IP (VoIP).

The receiver includes voice A3E AM operating mode with 8.33 kHz channels and 25 kHz channels. The Receiver also includes local or remote control operation. The local mode has a built-in display and keypad. Remote control is via Ethernet using a personal computer (PC) or the remote interface connector.

The transmitters are on-channel synthesized designs with Cartesian feedback power amplifiers and internal cosite cavity filters. A General Purpose Processor provides local and remote control of the transmitter and implements the VoIP, Ethernet, and serial interfaces. These transmitters produce high quality, low distortion Amplitude Modulation (AM) signals while minimizing out of band emissions, back intermodulation products, and adjacent channel noise.

2.2 Equipment Under Test (EUT)

This particular EMC test report is for the CM-350 (V2) VDT, S/N 2V5000001, CM-350 (V2) VDT, S/N 2V5000005, CM-350 (V2) VDT, S/N 2V5000007 and CM-350 (V2) VDT, S/N 2V5000107.

2.3 Power Requirements

The CM-350 (V2) VDT was operated from an AC power source for the majority of the testing except for frequency stability which was also performed with a +24 VDC power supply. The radio equipment includes automatic AC/24 VDC switching in the event of AC voltage failures or brown-outs.

2.4 Atmospheric Conditions

During testing, the room temperature, relative humidity and atmospheric pressure were monitored and measured using the equipment in Table 2.4-1. Typical values during testing in the GDC4S EMC/TEMPEST Laboratory were as follows: 1) room temperature of 25^{o}C and 2) relative humidity of 28%. The atmospheric pressure in the EMC/TEMPEST Laboratory measured about 96.6 kPa.

The final Radiated Emissions measurements performed on the Open Area Test Site (OATS) were recorded on the data sheet as follows: 1) 32^{o}C, 2) relative humidity of 10%, and 3)92.6 kPA atmospheric pressure.

Table 2.4-1 Atmospheric Test Equipment

MODEL	DESCRIPTION	MFG.	ASSET #	UN-CERT.	LAST CAL.	DUE CAL.
3310-40	Hygrometer & Temp. Indicator	Sufft	T47785	± 5.0%	13-Nov-12	30-Nov-13
Nimbus	Barometer, Digital	Sensor Instruments Co., Inc.	T53728	± 0.1%	03-Oct-12	31-Oct-13

2.5 Test Equipment

The EMI test equipment used for these measurements is listed below as Table 2.5-1. Equipment calibration is traceable to NIST. The calibration dates shown are those in effect at the time this test report was generated. In some cases, the "last" calibration date indicates that the equipment was calibrated after the date on which the test was actually performed. However, all test equipment had current calibrations at the time the testing was performed. Support Test Equipment (STE) is listed in Table 2.5-2.

Table 2.5-1 EMI Laboratory Test Equipment List

MODEL	DESCRIPTION	MFG.	ASSET #	UN-CERT.	LAST CAL.	DUE CAL.
			Antennas			
2070-2	Antenna Mast, 6 meter	EMCO	G72315	N/A	NCR	NCR
3142B	Antenna, BiConiLog	EMCO	T47085	± 2.0 dB	18-Mar-13	31-Mar-14
3142B	Antenna, BiConiLog	EMCO	T47086	± 2.0 dB	18-Mar-13	31-Mar-14
			Controllers			
2090	Controller, Multi-Device	EMCO	G72315.1	N/A	NCR	NCR
			LISNs			
8028-50-TS-24-BNC	LISN, 50µH, FCC	Solar	T36676	± 2.0 dB	11-Mar-13	31-Mar-14
8028-50-TS-24-BNC	LISN, 50µH, FCC	Solar	T41319	± 2.0 dB	11-Mar-13	31-Mar-14
8012-50-R-24	LISN, Dual 50µH, FCC	Solar	T52419	± 2.0 dB	20-Feb-13	28-Feb-14
			Receivers			
ESI-7	Receiver, 20Hz-7GHz	Rohde & Schwarz	G71791	± 2.0 dB	05-Apr-13	30-Apr-14
ESI-7	Receiver BIOS Firmware 3.3	Rohde & Schwarz	G71791.1	N/A	NCR	NCR
ESI-7	Receiver Analyzer Firmware 4.01	Rohde & Schwarz	G71791.2	N/A	NCR	NCR
ES-K1.60	Receiver Software, EMI Controller(1999), Service Pack 2	Rohde & Schwarz	G71791.3	N/A	NCR	NCR
ESU40	Receiver, 20Hz-40GHz	Rohde & Schwarz	100295	± 2.0 dB	12-Sep-12	12-Sep-13

Table 2.5-2 STE Test Equipment

MODEL	DESCRIPTION	MFG.	ASSET #	UN-CERT.	LAST CAL.	DUE CAL.
8903A	Audio Analyzer	Hewlett Packard	G20851	N/A	26-Dec-12	31-Dec-13
8901A	Modulation Analyzer	Hewlett Packard	G24131	N/A	04-Feb-13	28-Feb-15
R2670	Digital Communications System Analyzer	General Dynamics	G78047	N/A	06-Jul-12	31-Jul-13
778D	Coupler, Directional, 20dB, 0.1-2.0 GHz, 50 Watt	Hewlett Packard	T37492	± 1.5 dB	VBU	VBU
E6400	MDT Lattitude Laptop	Dell	X74905	N/A	NCR	NCR

2.6 Setup Requirements

2.6.1 General

A standard, commercial, 3-conductor AC power cord was used for testing of the equipment. A special DC power cable with a "D" Subminiature (D-Sub) connector was used for DC power mode testing while receiving +24 VDC power from an external power supply. Both power cables were unshielded.

A 37 pin, D-Sub style connector, was used for the remote interface including audio and discrete I/O on the VHF transmitter. A double shielded CAT 5E Ethernet cable was used for communications with the Maintenance Data Terminal (MDT) located outside the chamber. The RF coaxial cables were Huber+Suhner Enviroflex_142 Type used for both interfacing to the STE and also for the cavity filter interconnects.

The part numbers for the cables used during FCC testing are provided below:

- 37 pin remote interface cable is an L-Com P/N CS2N37MF-15
- Ethernet cable is L-Com P/N TRD855DSZ-15
- RF Cables were double-shielded Huber+Suhner Enviroflex _142 Type

2.6.2 Modes of Operation

The CM-350 (V2) VDT was placed in a typical operating mode using Support Test Equipment (STE). The CM-350 (V2) VDT transmitter was adjusted to the rated continuous wave (CW) output power level of 35 Watts, after cavity filter and ATR losses. The transmitter was set for continuous transmit mode via the Push-To-Talk (PTT) toggle switch on the remote breakout box. The normal PTT timeout was disabled through the Maintenance Data Terminal (MDT) interface.

Where required, the VHF transmitter was tested at three (3) frequencies across the ATC FCC certifiable operating range of 117.975 to 136.975 MHz. For other testing requiring only a single transmit frequency, the measurements were taken at the mid-band frequency of 131.35 MHz. The specific operating frequency settings shown in Table 2.6-1 placed the radio in a 25 kHz channel spacing mode.

Table 2.6-1 VDT Operating Frequency Settings for 25 kHz Channel Mode

Low	Mid	High
119.000 MHz	131.350 MHz	135.500 MHz

Additional measurements with the radio in a 8.33 kHz channel spacing mode were performed for the Occupied Bandwidth and Spectral Mask measurements. The frequency settings for the 8.33 kHz channel spacing mode are shown in Table 2.6-2 below.

Table 2.6-2   VDT Operating Frequency Settings for 8.33 kHz Channel Mode

Low	Mid	High
119.005 MHz	131.355 MHz	135.505 MHz

The carrier was modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

A general test setup diagram is shown as Figure 2.6-1.   The indication of a chamber wall between the CM-350 (V2) VDT and the STE is only applicable for the radiated emission pre-scans that were performed in a shielded enclosure.

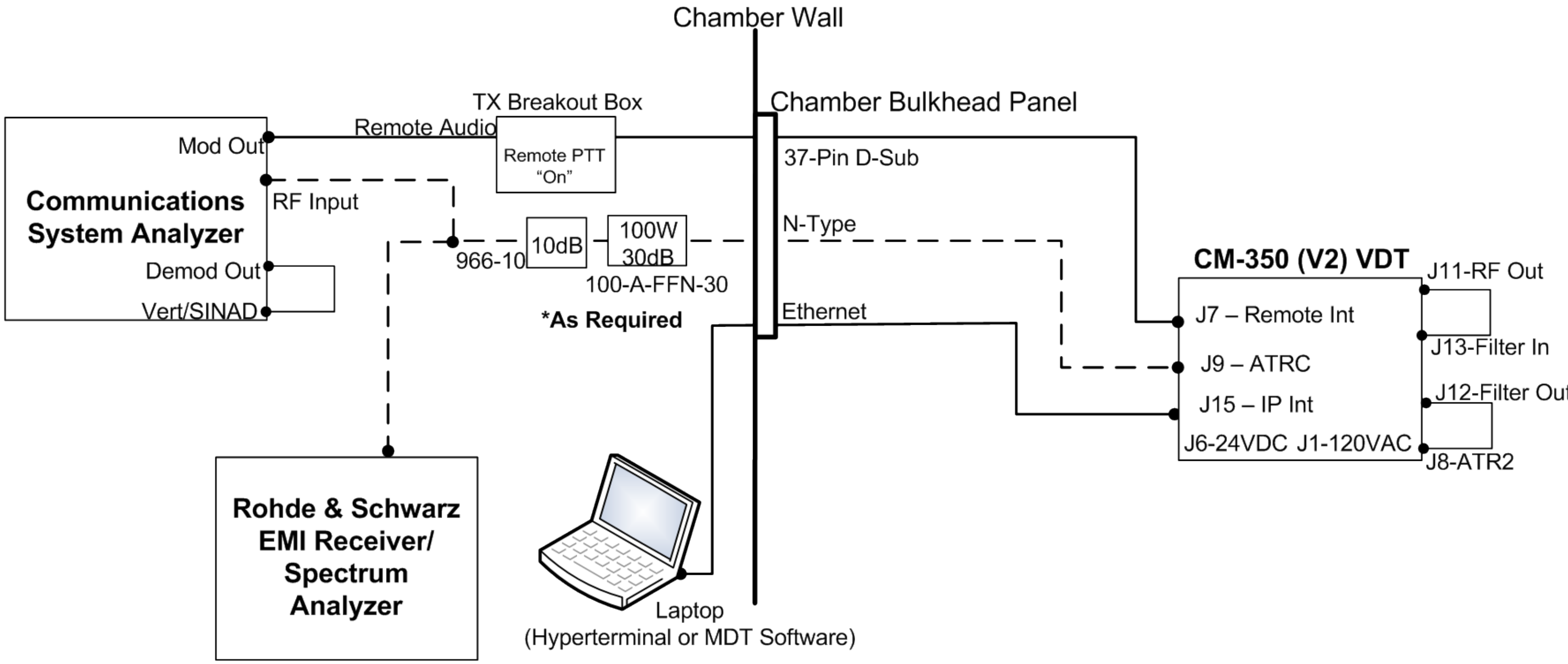

Figure 2.6-1 CM-350 (V2) VDT to STE Interconnect Diagram

3.0 TEST FACILITY

3.1 Facility Description

The FCC certification testing on the CM-350 (V2) VDT was performed by General Dynamics C4 Systems (GDC4S), EMC/TEMPEST Test Laboratory which is located in the southeast wing of the Hayden building at 8201 E. McDowell Road, Scottsdale, AZ.

The GDC4S EMC test facility includes an accredited three-meter and ten-meter Open Area Test Site (OATS) and several shielded enclosures. The facility has been found to be in compliance with the requirements of Section 2.948 of the FCC rules, per Registration Number 90811, dated July 27, 2010. The facility has also been issued a Certificate of Accreditation through the National Voluntary Laboratory Accreditation Program (NVLAP) by NIST. This is under NVLAP Code: 100405-0 and is effective through September 30, 2013. The facility is in compliance with all CISPR 16 requirements.

In order to properly identify radiated emissions in an ambient free environment prior to final measurements on the Open Area Test Site (OATS), preliminary radiated emissions measurements were performed in a solid wall shielded enclosure.

All other RF front end measurements associated with the transmitter certification process were performed outside of a shielded enclosure in the GDC4S EMC/TEMPEST Laboratory.

3.2 Quality System

The GDC4S EMI/TEMPEST Test Laboratory maintains a Group Operating Manual that describes the quality assurance program of the EMC/TEMPEST Facility to set forth procedures covering all quality assurance functions. This manual has been constructed to reflect a quality program in compliance with the requirements of the following:

- National Institute of Standards & Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP)
- NIST Handbook 150 NVLAP Procedures and General Requirements
- NVLAP EMC and Telecommunications FCC Methods Handbook 150-11
- ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

4.0 MEASUREMENT RESULTS

4.1 Occupied Bandwidth

The occupied bandwidth measurements for the CM-350 (V2) VDT are illustrated in Figures 4.1-1 and 4.1-2. These measurements were performed on the ATRC RF output on the unit with the transmitter operating in a normal mode at rated output power. The unit was modulated with an audio frequency of 2500 Hz. The audio tone level was first set to an amplitude that resulted in 50% modulation depth. The audio level was then increased by 16dB. The Rohde & Schwarz Spectrum Analyzer was set for a measurement of 99% Occupied Bandwidth.

Radio Model Number:	CM-350 (V2) VDT			
Radio Serial Number	2V5000001			
Radio Hardware Version	Pilot			
Radio Software Version	Micro	1.38	SBV	1.37
	Boot	4.05	Web	5.05
	CPLD	F00V009		

The requirements of 2.1049(c)(1) and 87.137 specify 25 kHz (6K00A3E) and 8.33 kHz (5K6A3E) when tuned to an 8.33 kHz channel. These requirements were met in both cases.

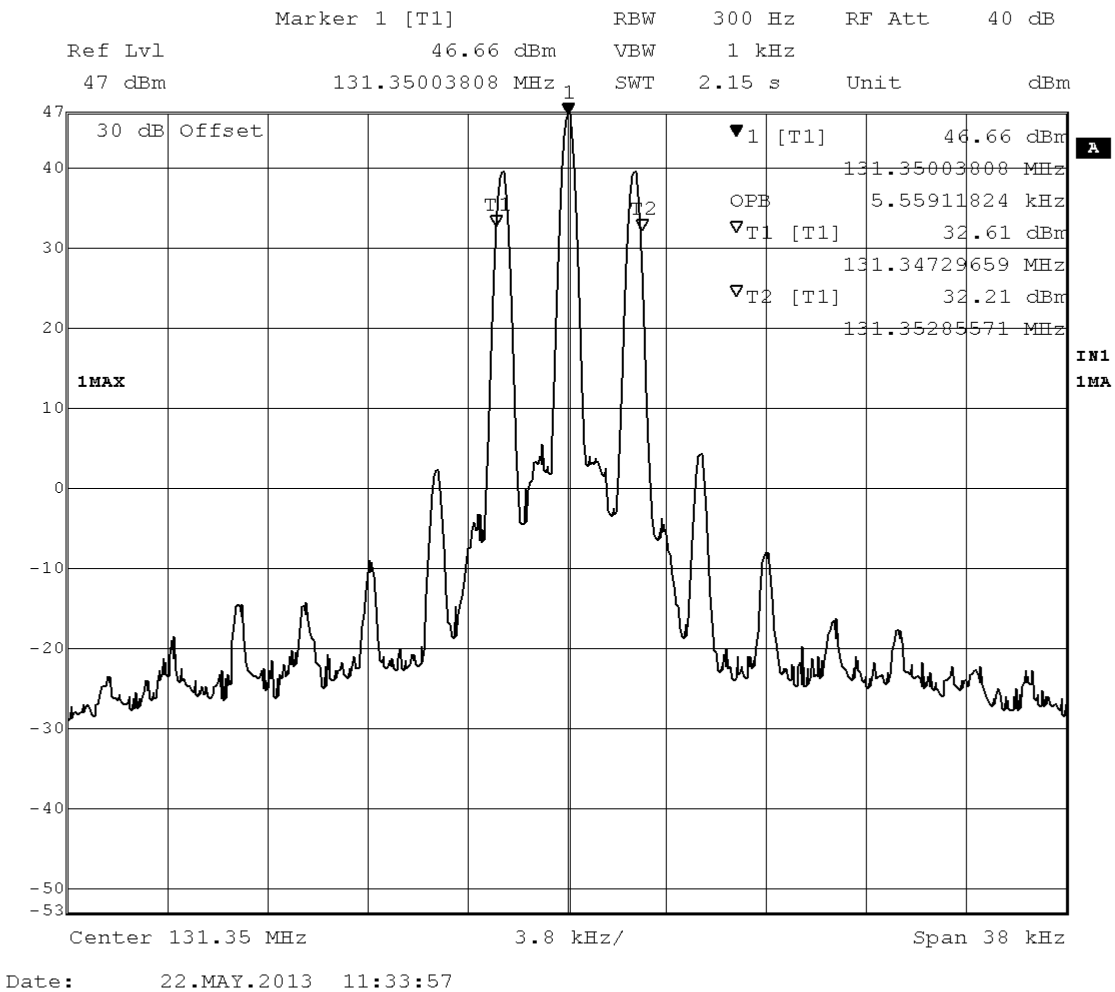

Figure 4.1-1 CM-350 (V2) VDT Occupied Bandwidth, 25 kHz Channel

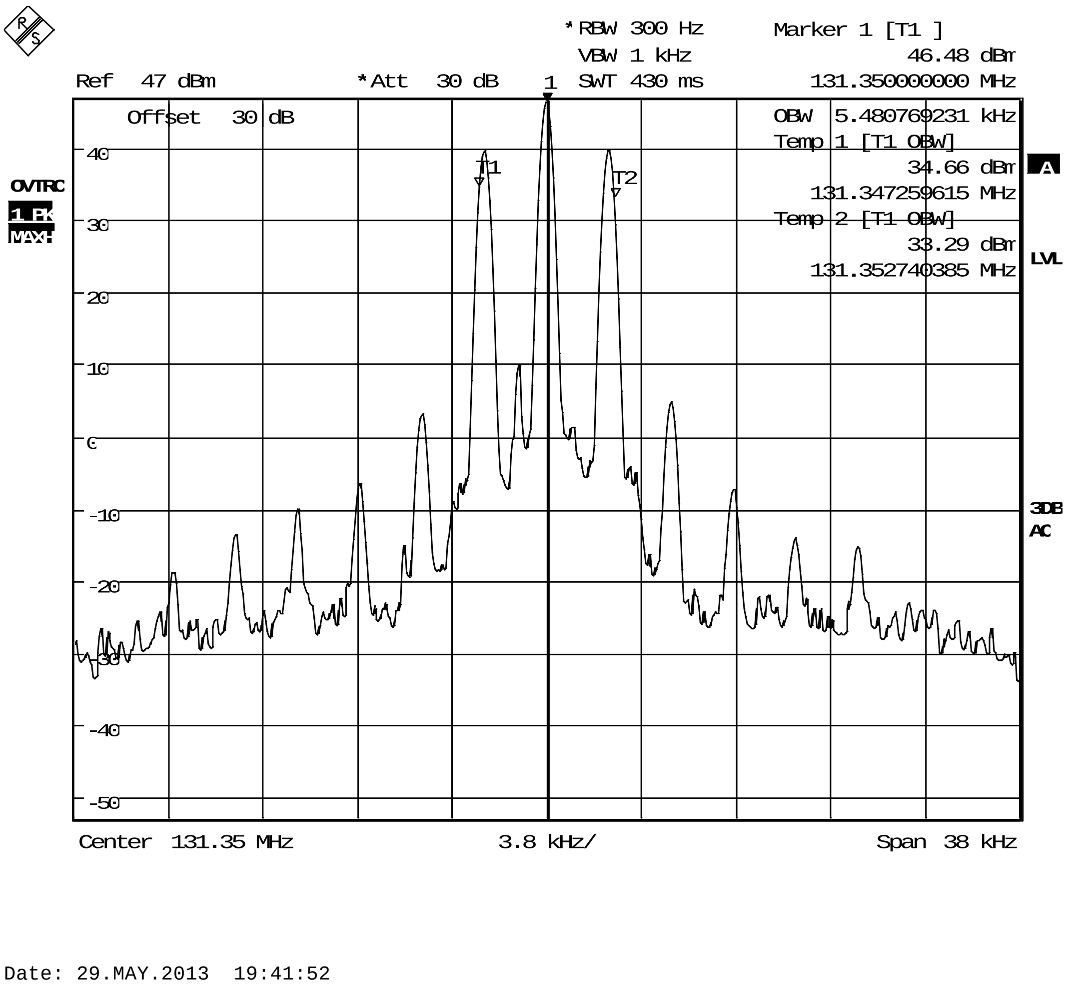

Figure 4.1-2 CM-350 (V2) VDT Occupied Bandwidth, 8.33 kHz Channel

4.2 Spectral Mask

The spectral mask was measured at frequencies ± 250% of the allocated bandwidth centered at the low, mid, and high operating frequencies of 119.000 MHz, 131.350 MHz, and 135.500 MHz.

The requirements of 2.1051 and 87.139 specify the following:

-25 dBc @ 50 to 100% removed from Carrier
-35 dBc @ 100 to 250% removed from Carrier
-58.5 dBc @ >250% removed from Carrier
(43+10LogP)

The spectral mask limits are further defined in Table 4.2-1 for the 35W VHF transmitter.

Table 4.2-1 Spectral Mask Emission Limits

Power	*25 dBc limit*	*35 dBc limit*	*43 + 10Log P (W) limit*
35W (+45.5 dBm)	+20.5 dBm	+10.5 dBm	-13 dBm

The same modulation scheme that was used for the Occupied Bandwidth measurement was used for the Spectral Mask measurements. The measurements were also repeated for the 8.33 kHz channel settings of 119.005 MHz, 131.355 MHz, and 135.505 MHz.

All modulated carriers were within their spectral mask requirements and the data plots are shown in Figures 4.2-1 through 4.2-6.

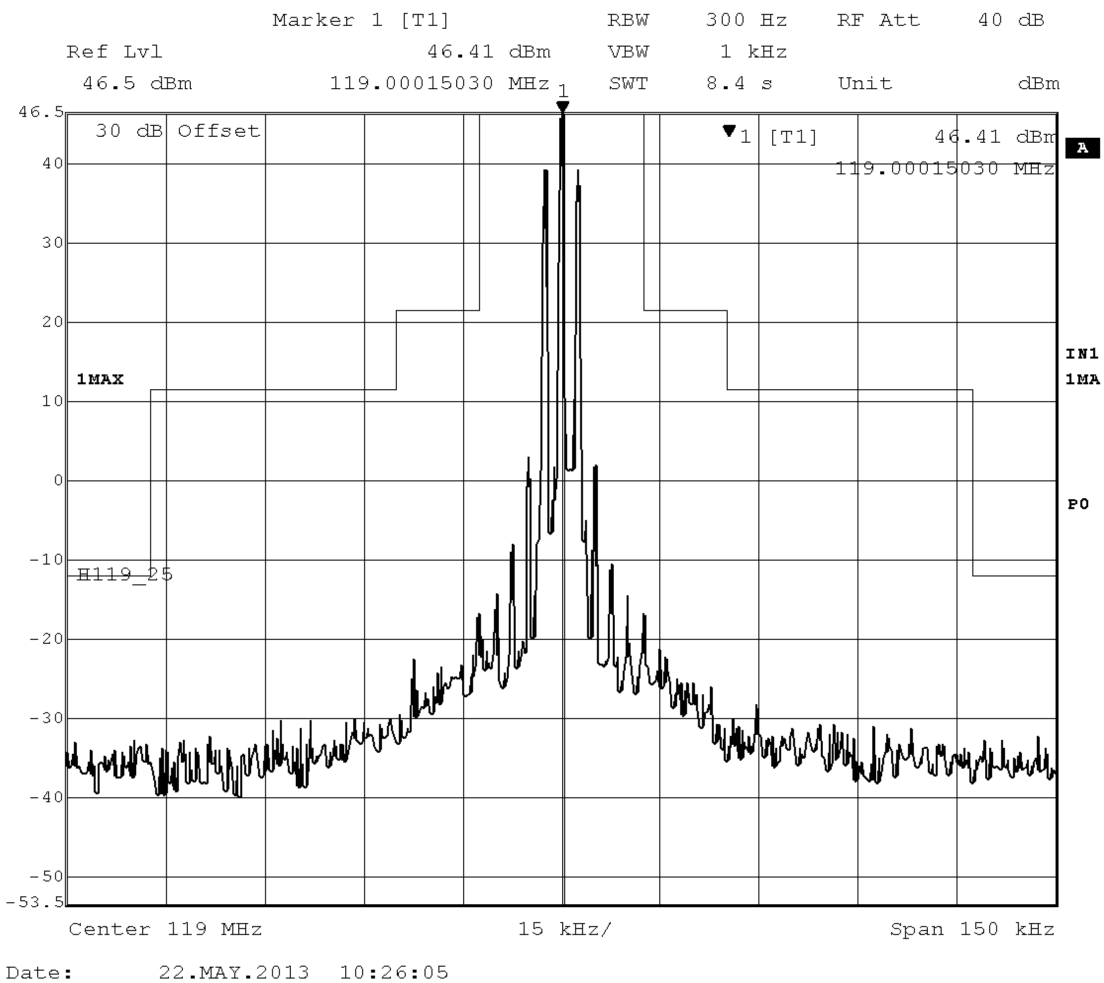

Figure 4.2-1 Spectral Mask, 25 kHz Channel @ 119.000 MHz

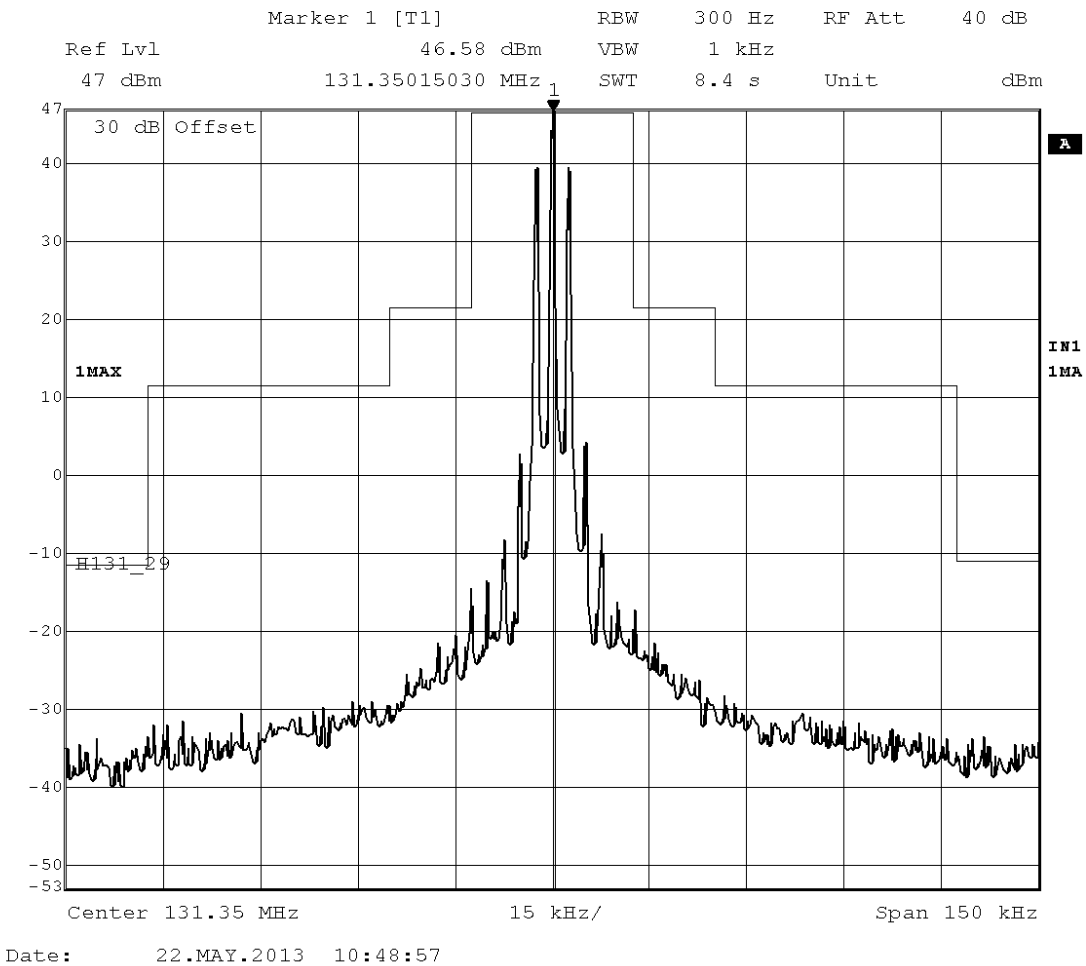

Figure 4.2-2 Spectral Mask, 25 kHz Channel @ 131.350 MHz

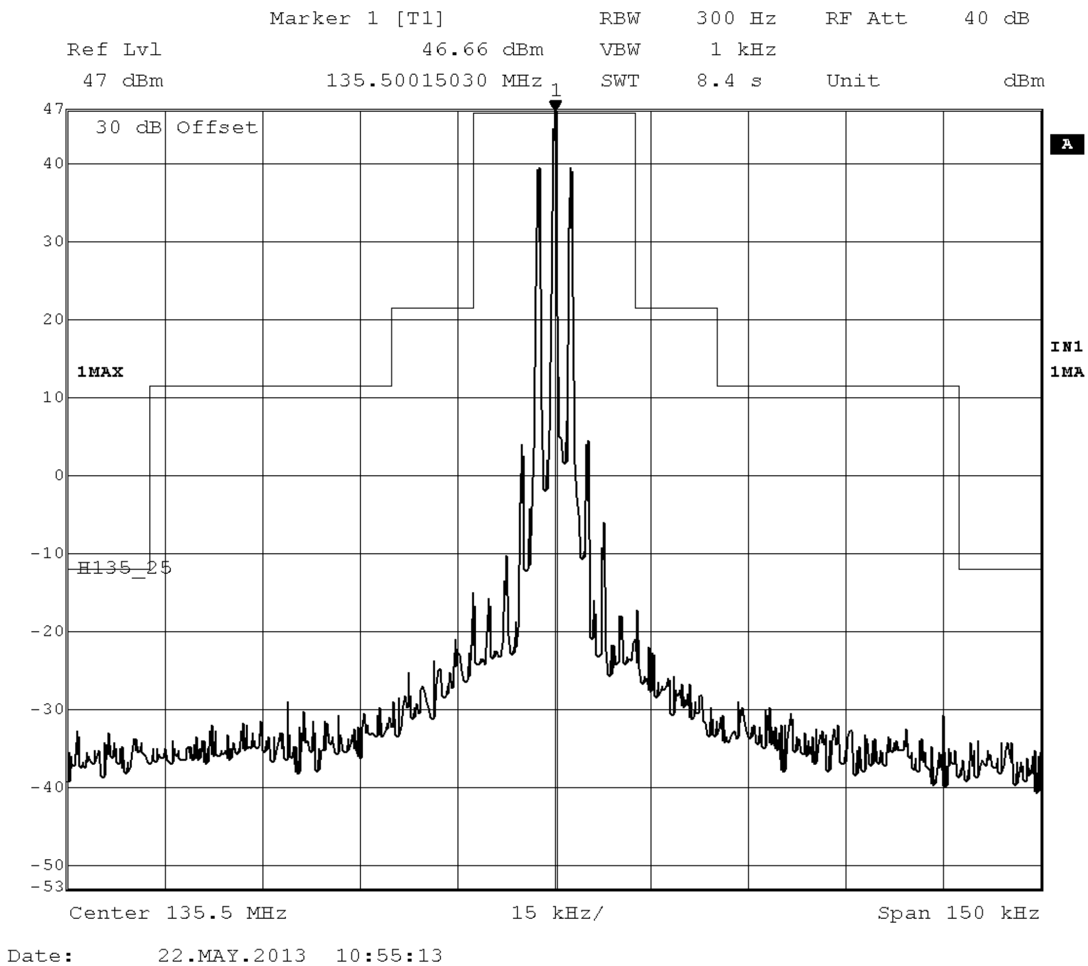

Figure 4.2-3 Spectral Mask, 25 kHz Channel @ 135.500 MHz

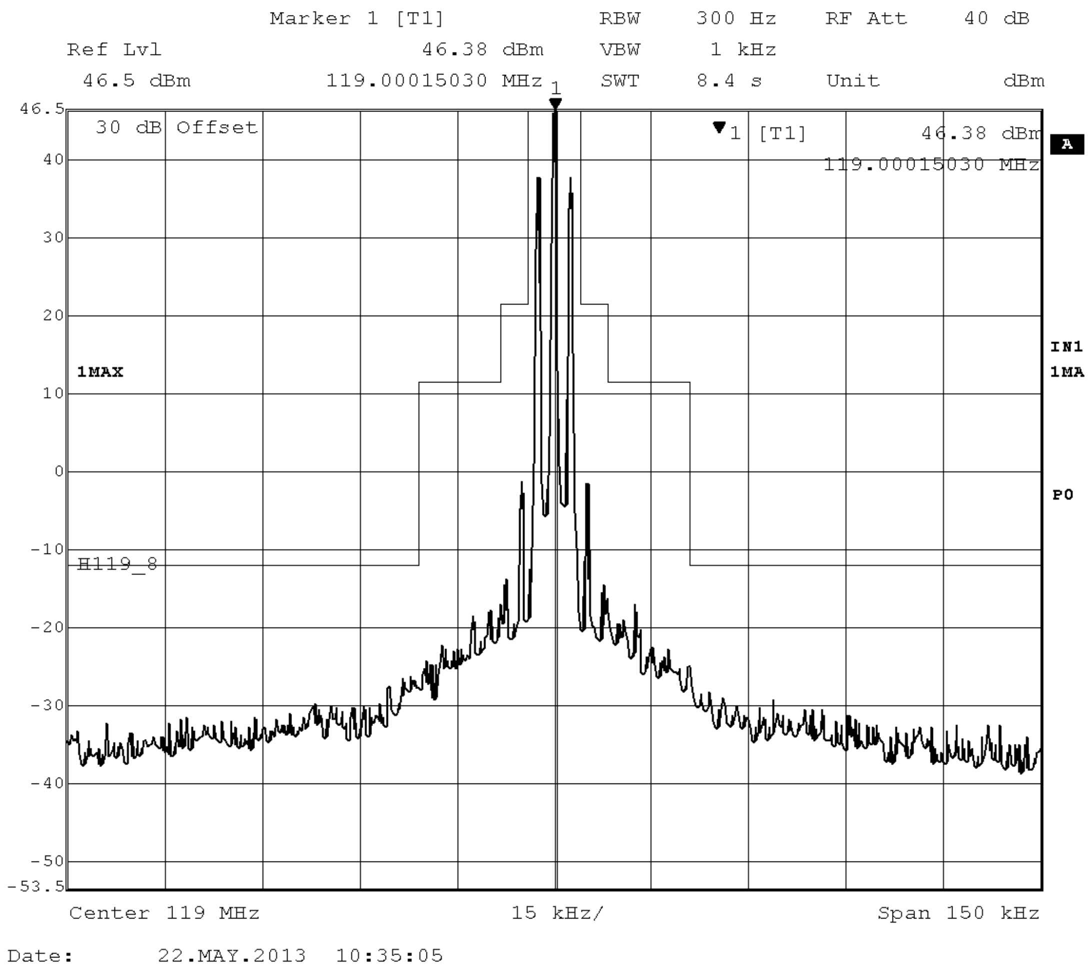

Figure 4.2-4 Spectral Mask, 8.33 kHz Channel @ 119.005 MHz

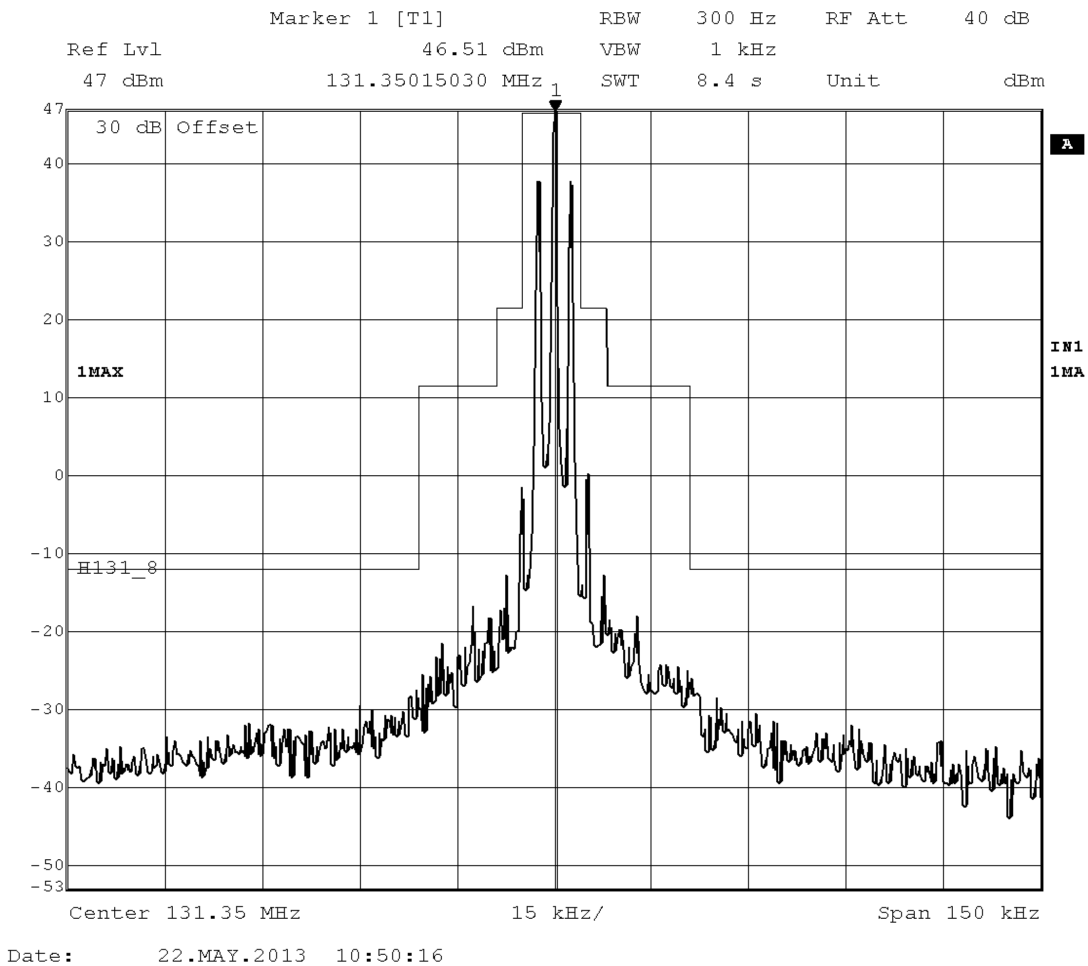

Figure 4.2-5 Spectral Mask, 8.33 kHz Channel @ 131.355 MHz

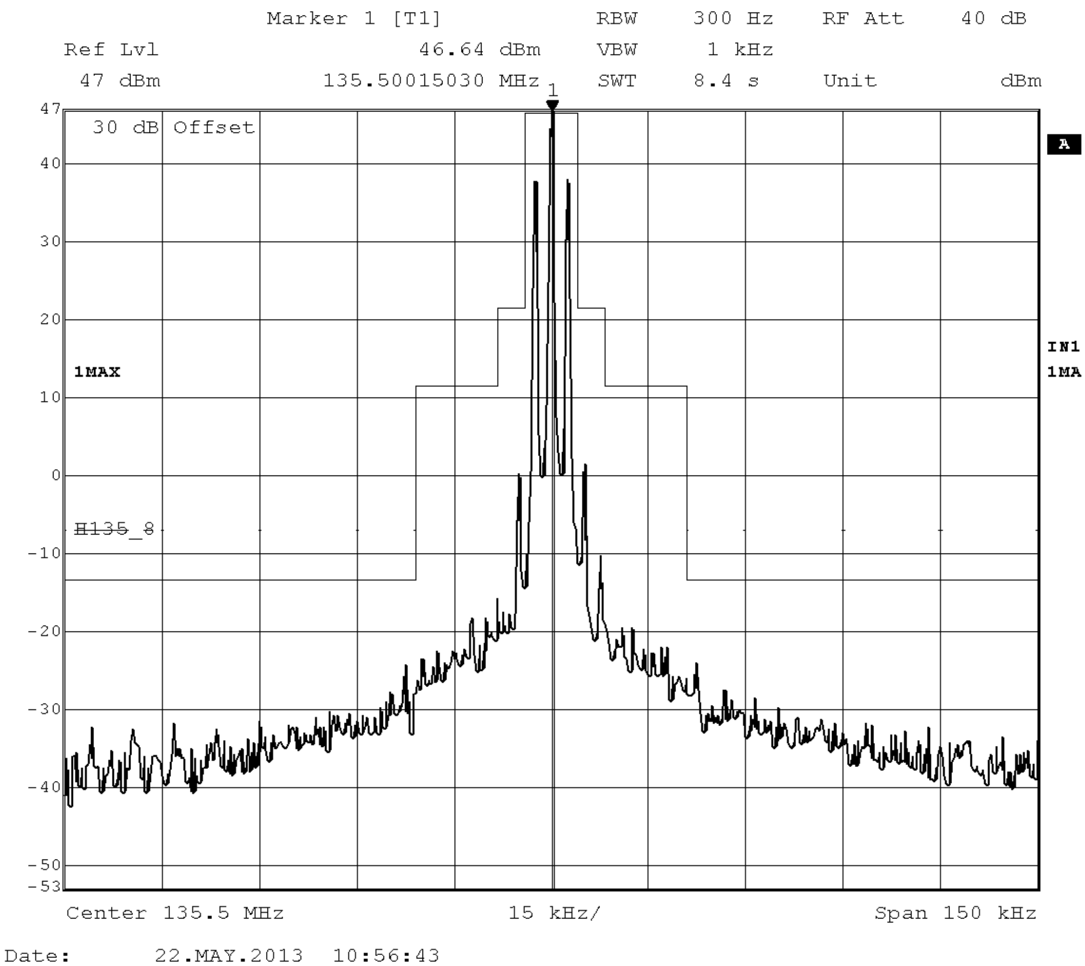

Figure 4.2-6 Spectral Mask, 8.33 kHz Channel @ 135.505 MHz

4.3 Conducted Spurious Emissions

The following measurement data illustrates the out-of-band conducted spurious emissions measured between 30 MHz and 2 GHz. The test requirement limit specified at >250% frequency offset from the carrier frequency is -58.5 dBc (43+10Log P) or approximately -13 dBm for a 35W transmitter.

All conducted spurious emissions on the CM-350 (V2) VDT were well below the specified limit.

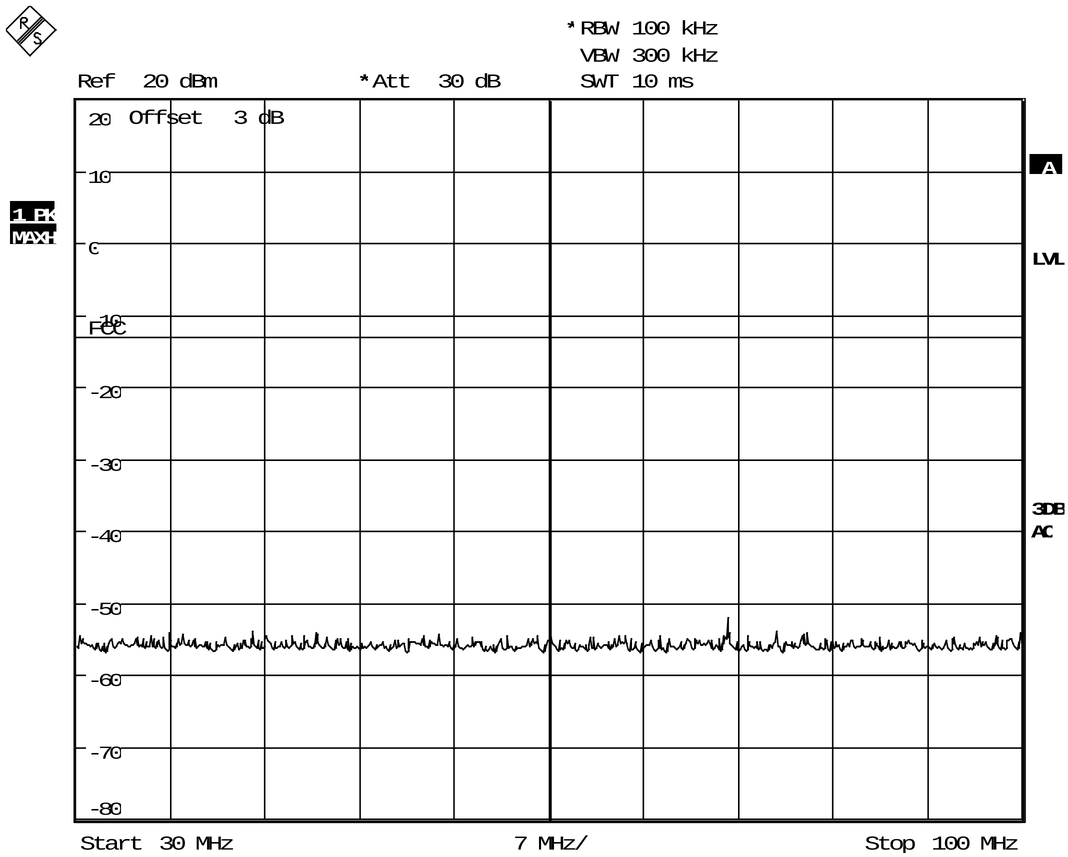

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Figure 4.3-1 Conducted Spurious Emissions, 30MHz – 100MHz (Fo=119MHz)

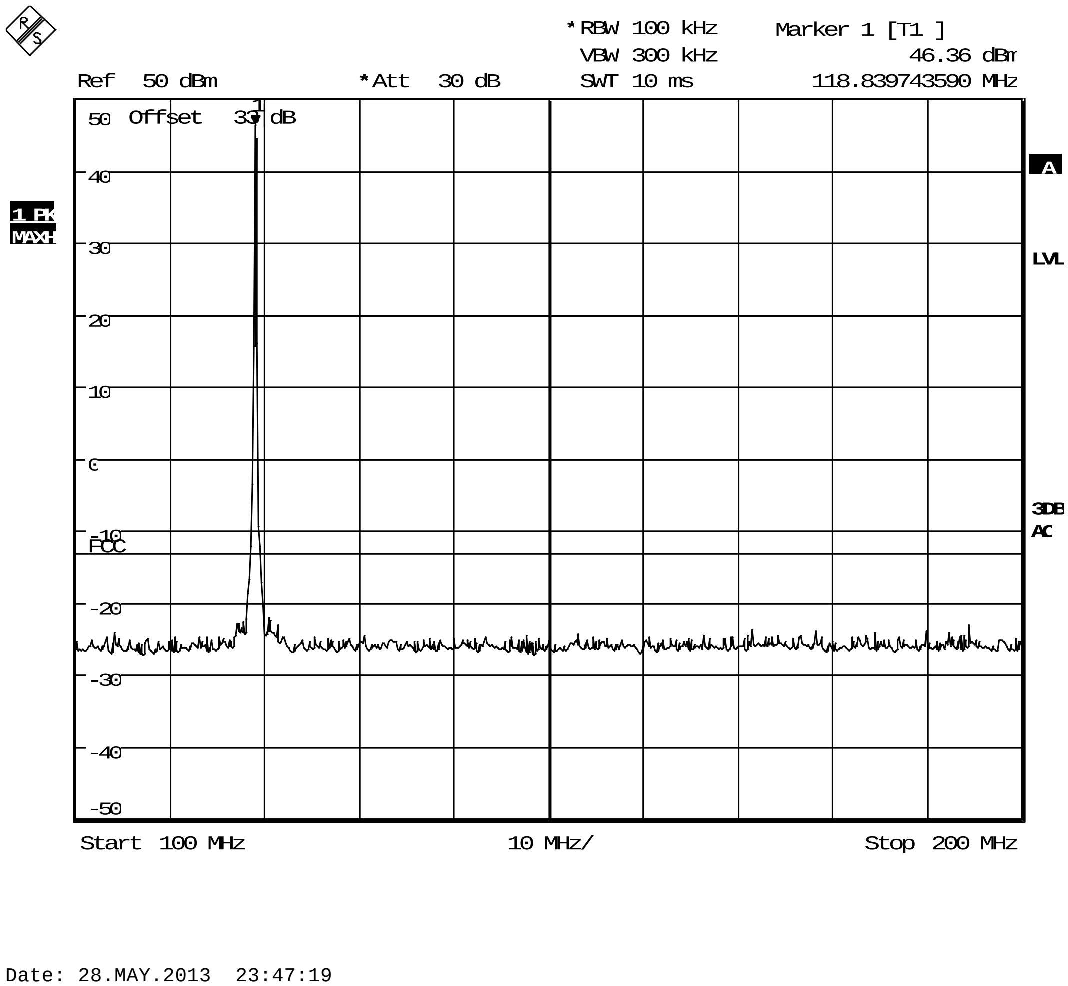

Figure 4.3-2 Conducted Spurious Emissions, 100MHz – 200MHz (Fo=119MHz)

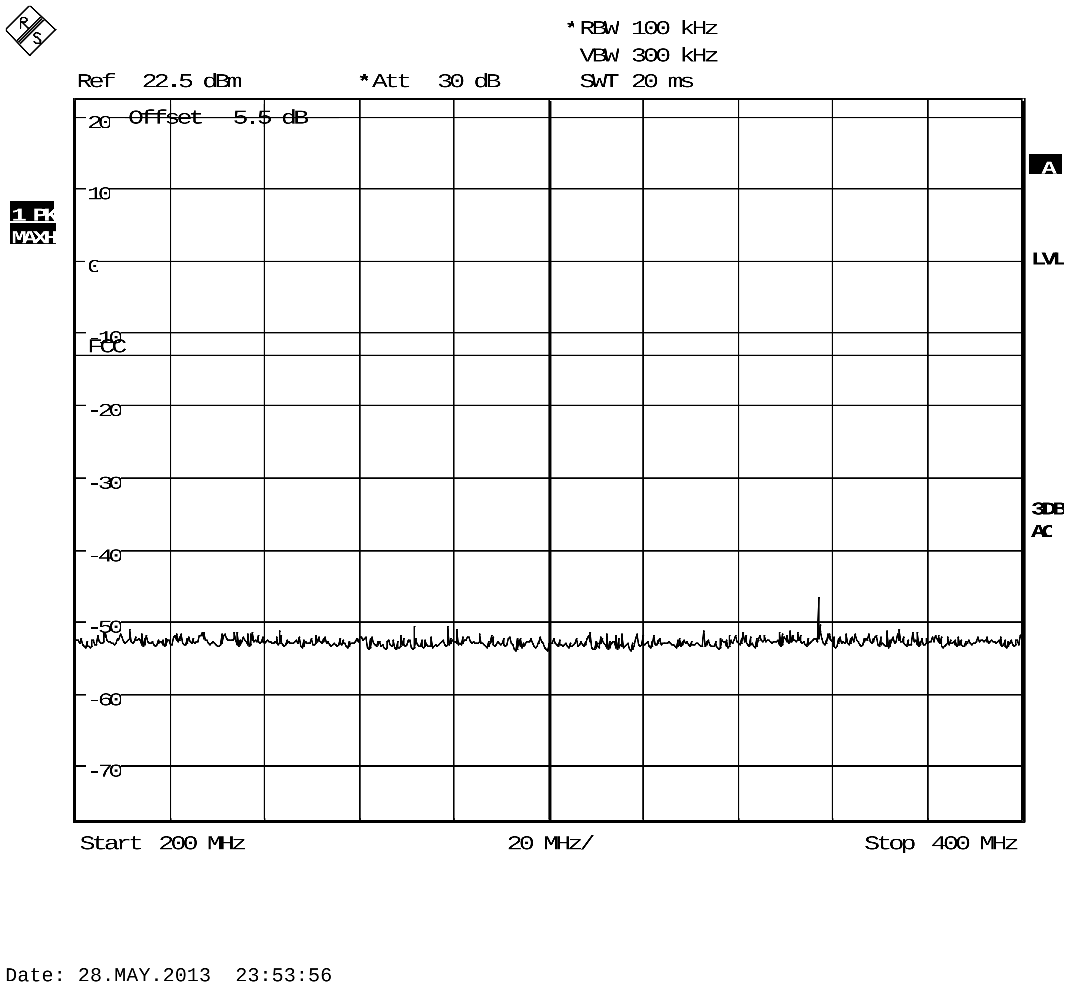

Figure 4.3-3 Conducted Spurious Emissions, 200MHz – 400MHz (Fo=119MHz)

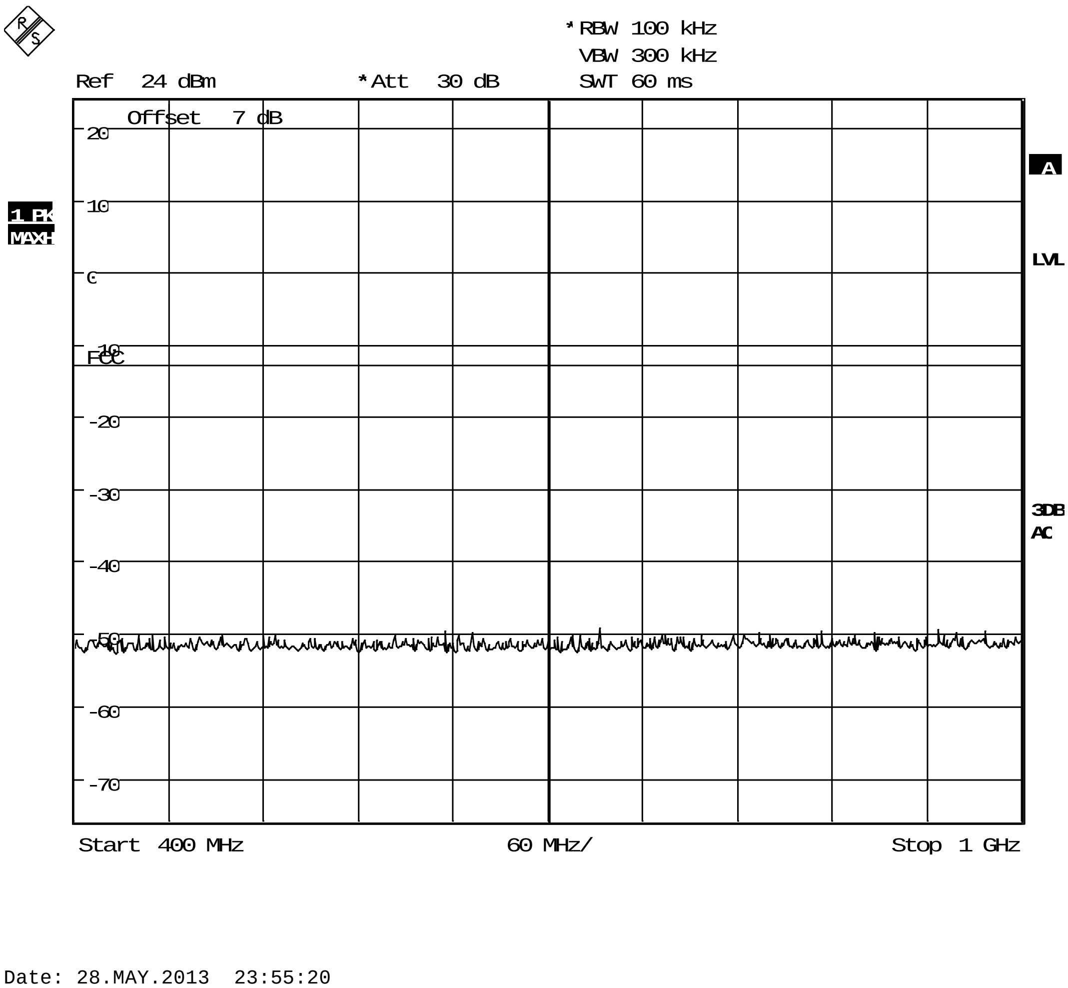

Figure 4.3-4 Conducted Spurious Emissions, 400MHz – 1GHz (Fo=119MHz)

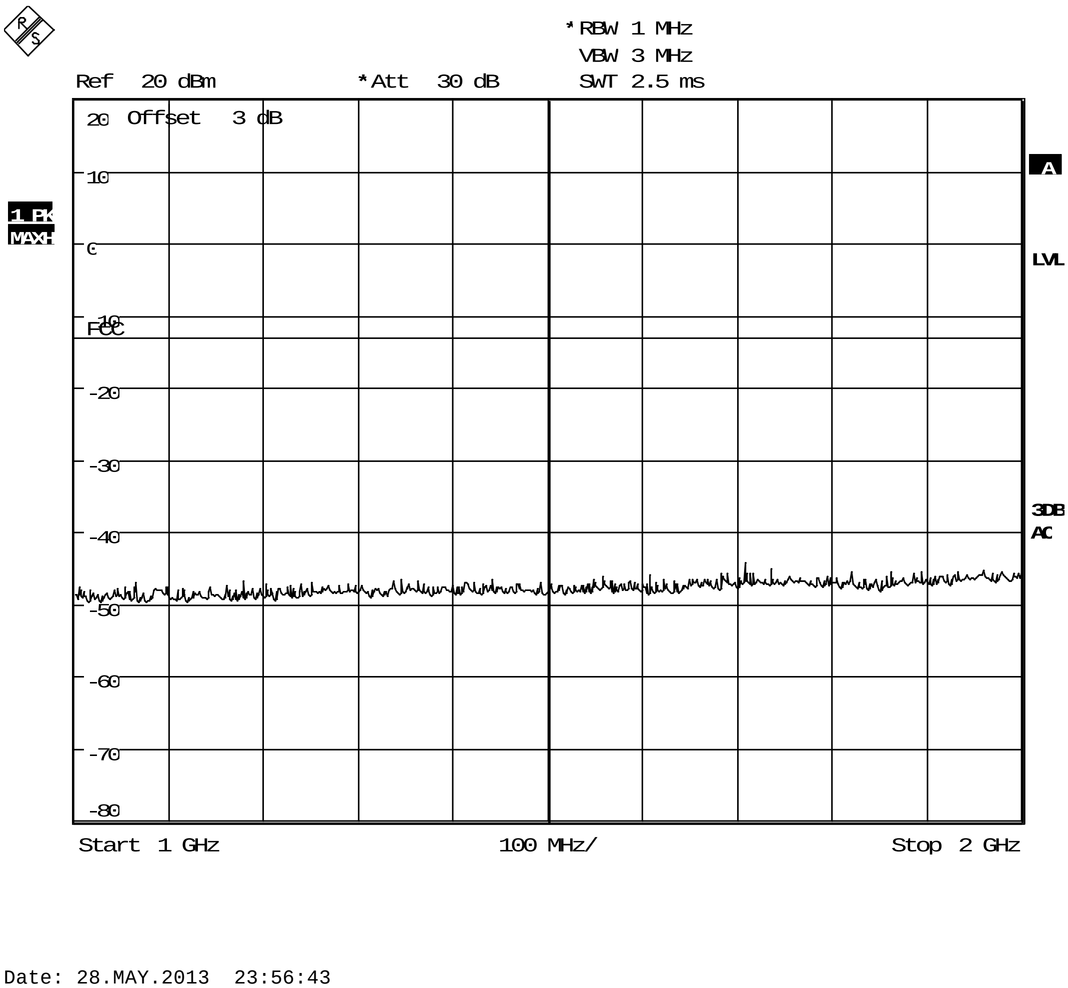

Figure 4.3-5 Conducted Spurious Emissions, 1GHz – 2GHz (Fo=119MHz)

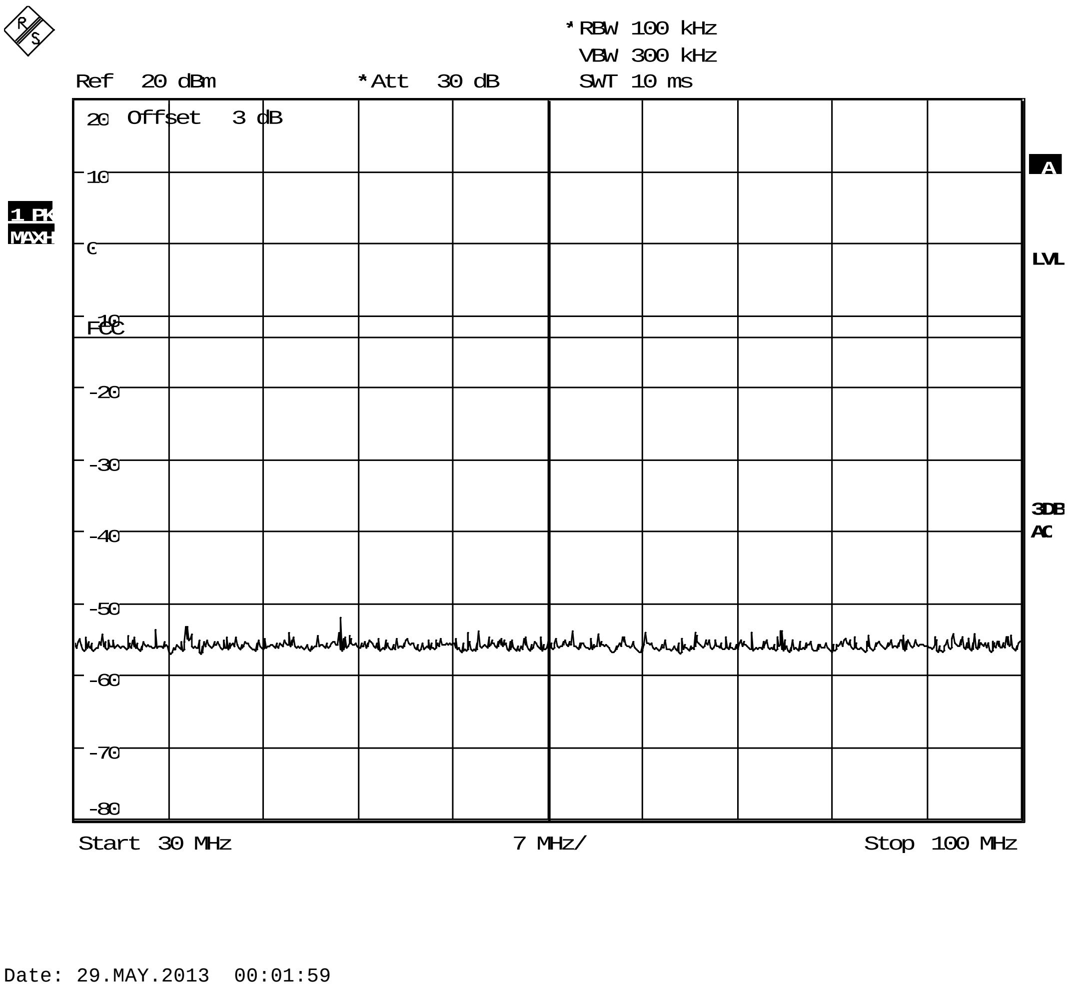

Figure 4.3-6 Conducted Spurious Emissions, 30MHz – 100MHz (Fo=131.35MHz)

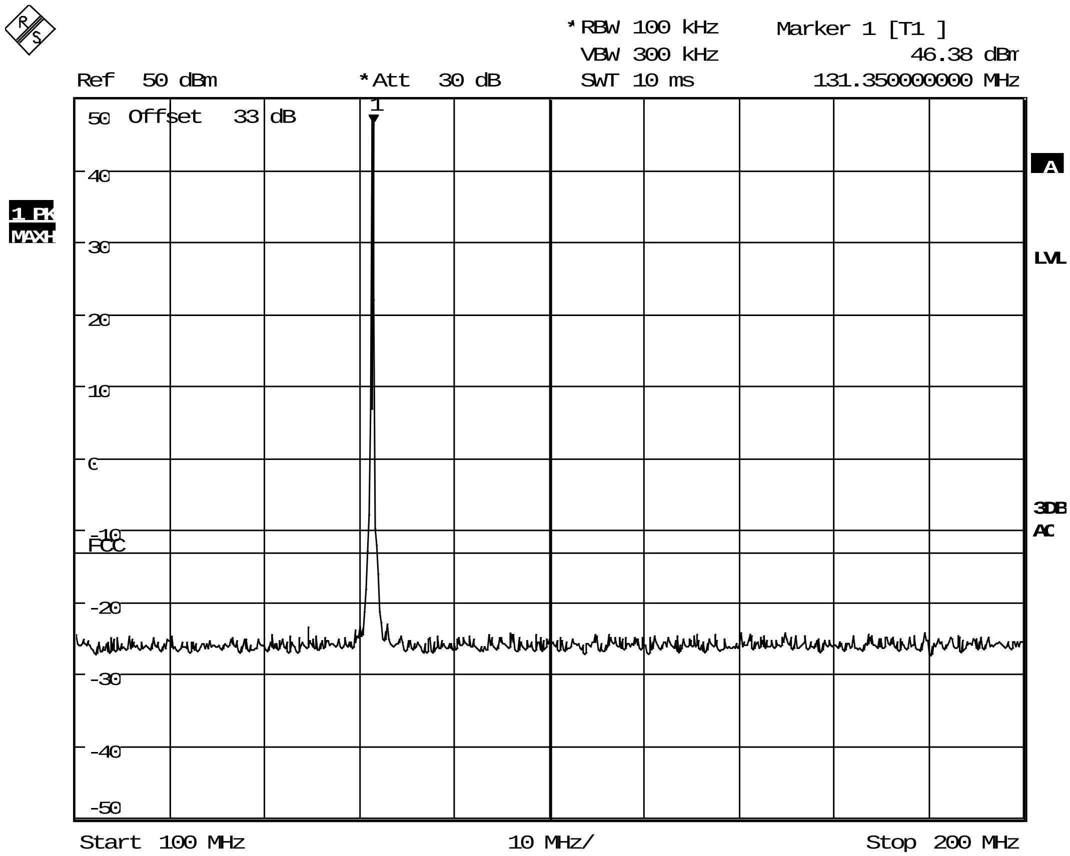

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Figure 4.3-7 Conducted Spurious Emissions, 100MHz – 200MHz (Fo=131.35MHz)

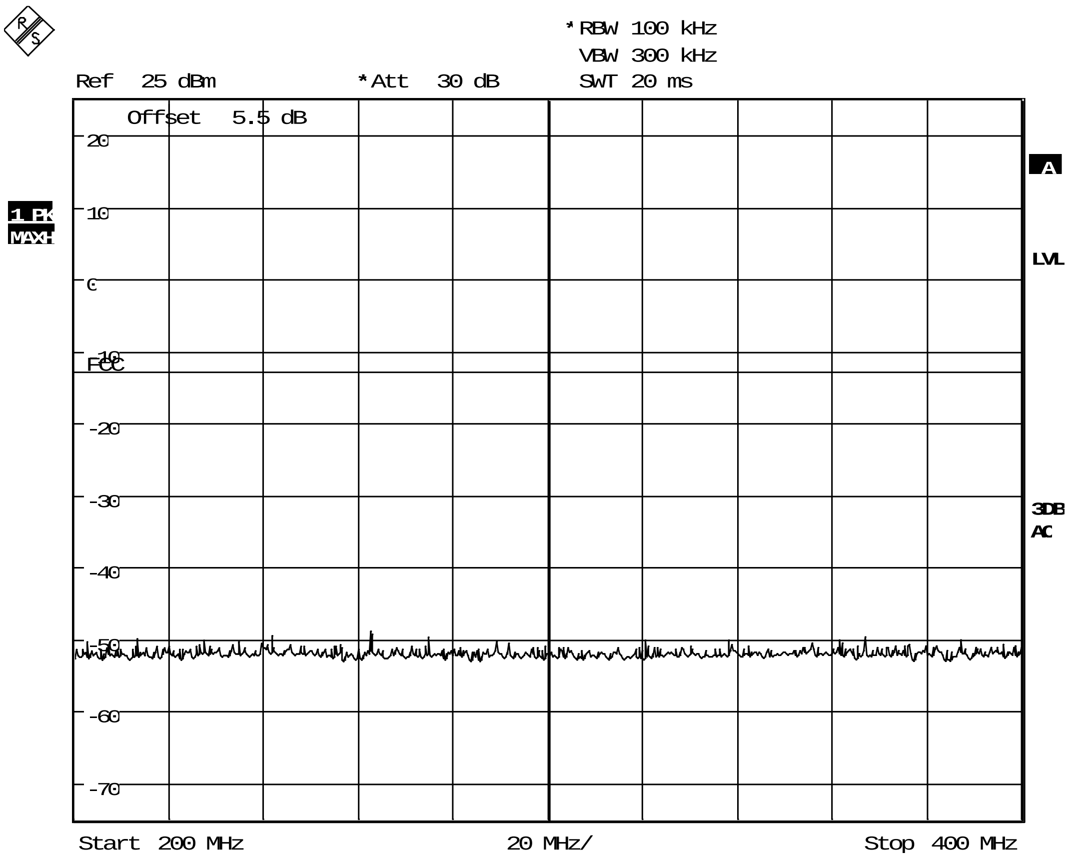

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Figure 4.3-8 Conducted Spurious Emissions, 200MHz – 400MHz (Fo=131.35MHz)

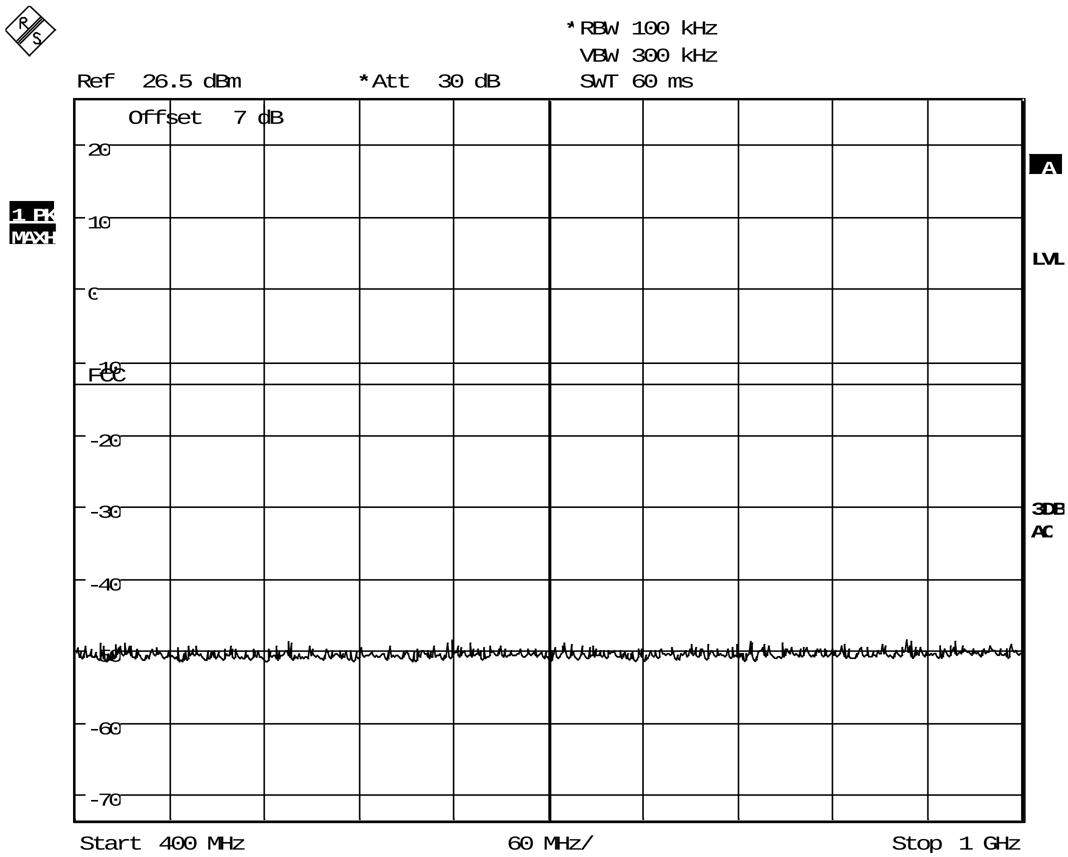

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Figure 4.3-9 Conducted Spurious Emissions, 400MHz – 1GHz (Fo=131.35MHz)

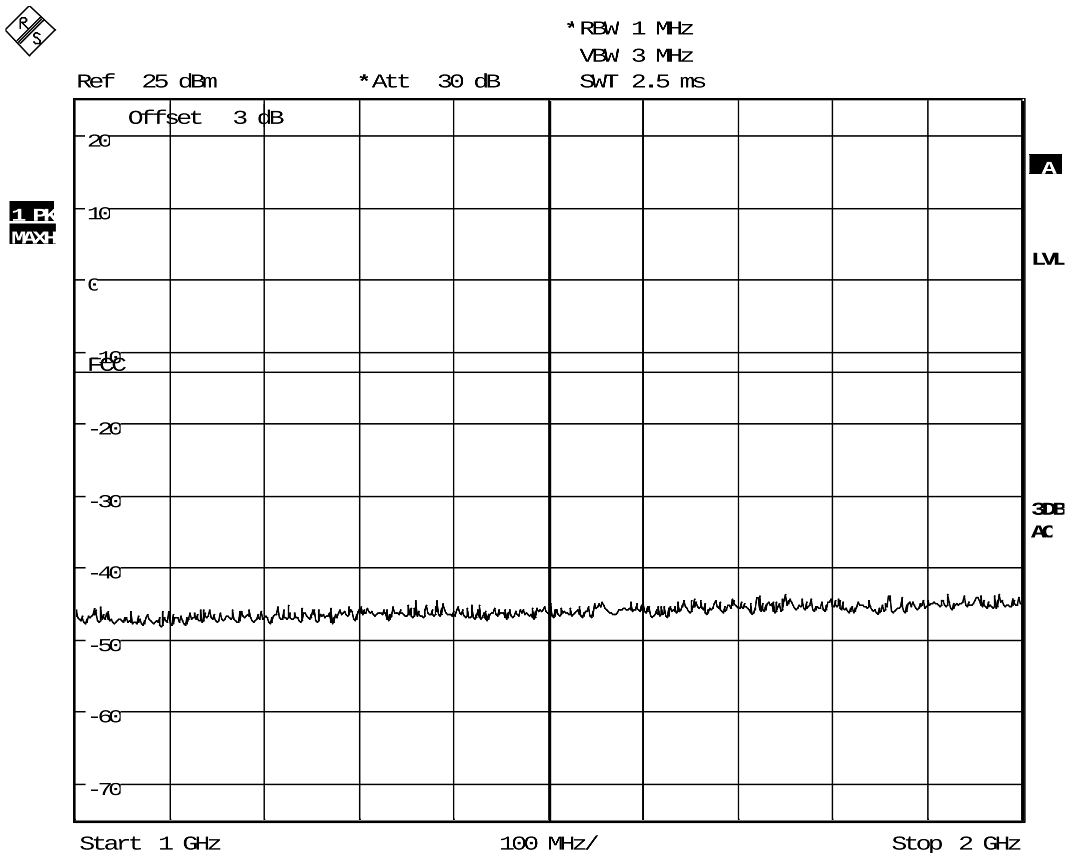

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Figure 4.3-10 Conducted Spurious Emissions, 1GHz – 2GHz (Fo=131.35MHz)

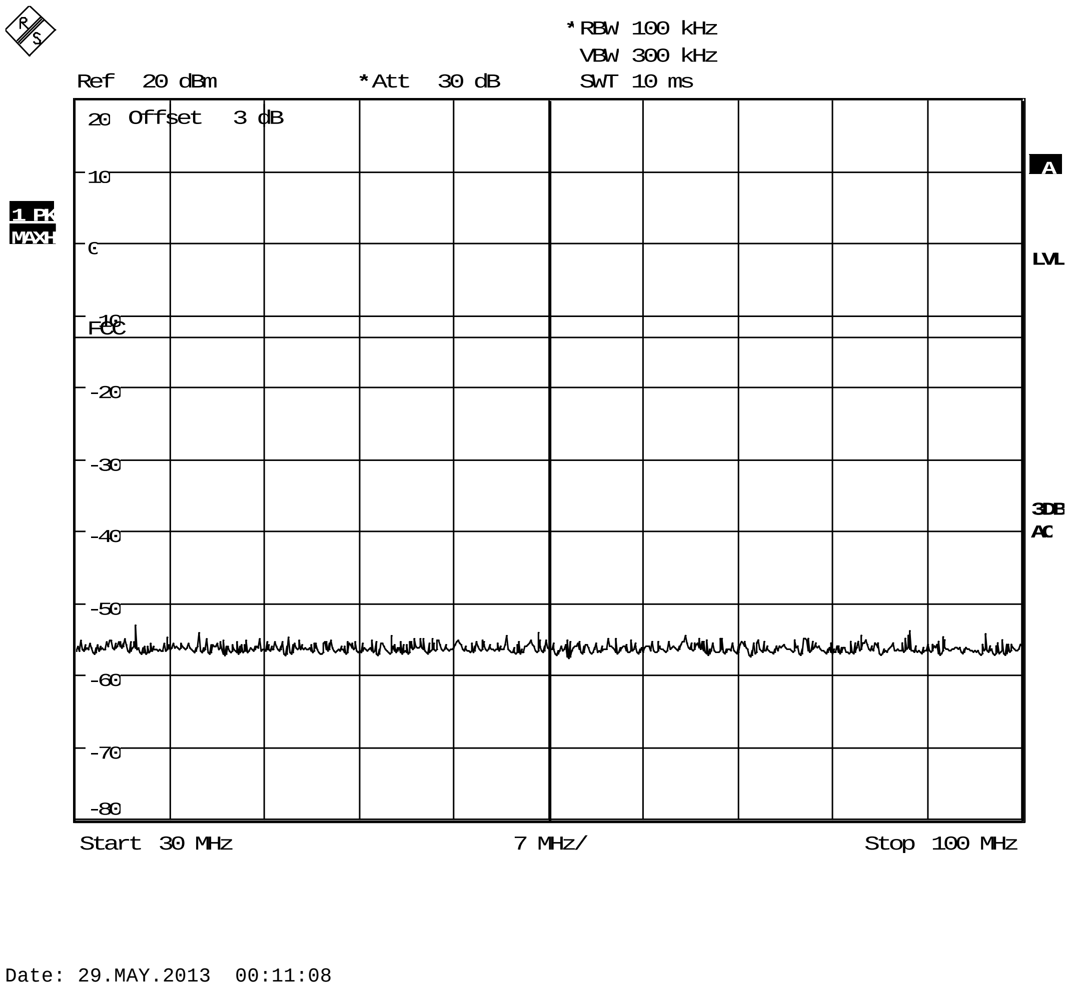

Figure 4.3-11 Conducted Spurious Emissions, 30MHz – 100MHz (Fo=135.5MHz)

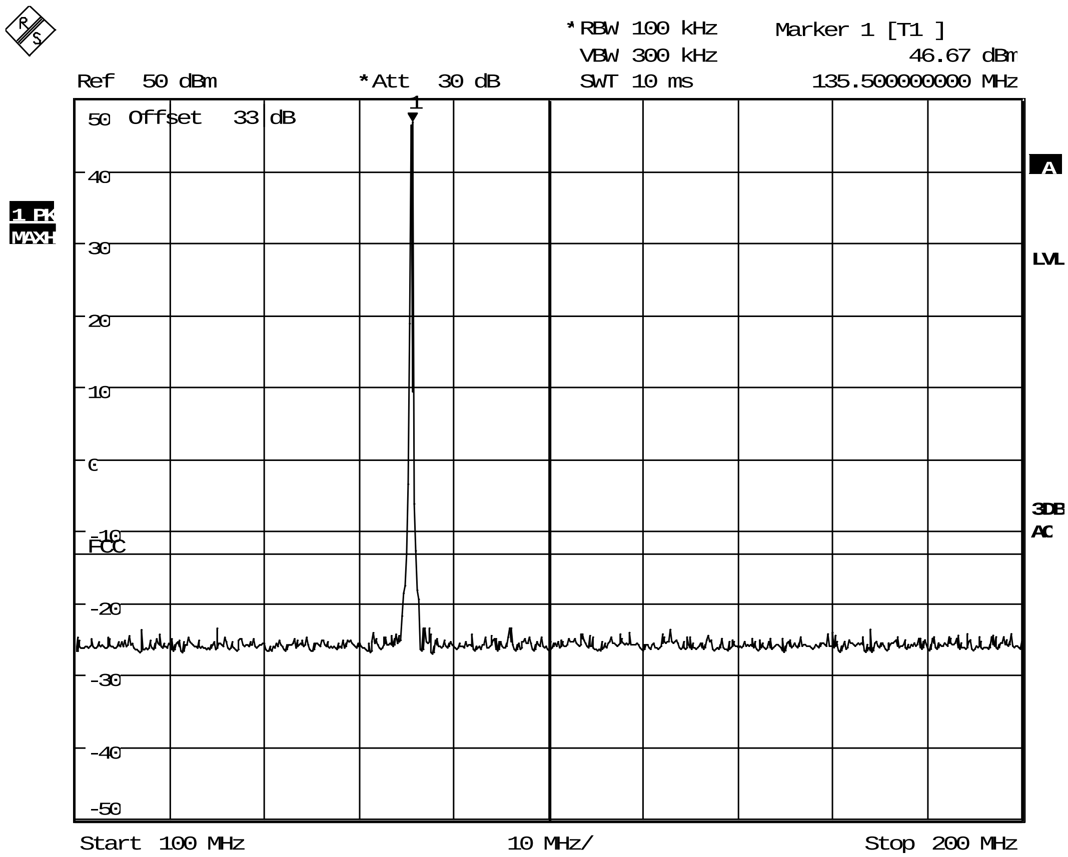

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Figure 4.3-12 Conducted Spurious Emissions, 100MHz – 200MHz (Fo=135.5MHz)

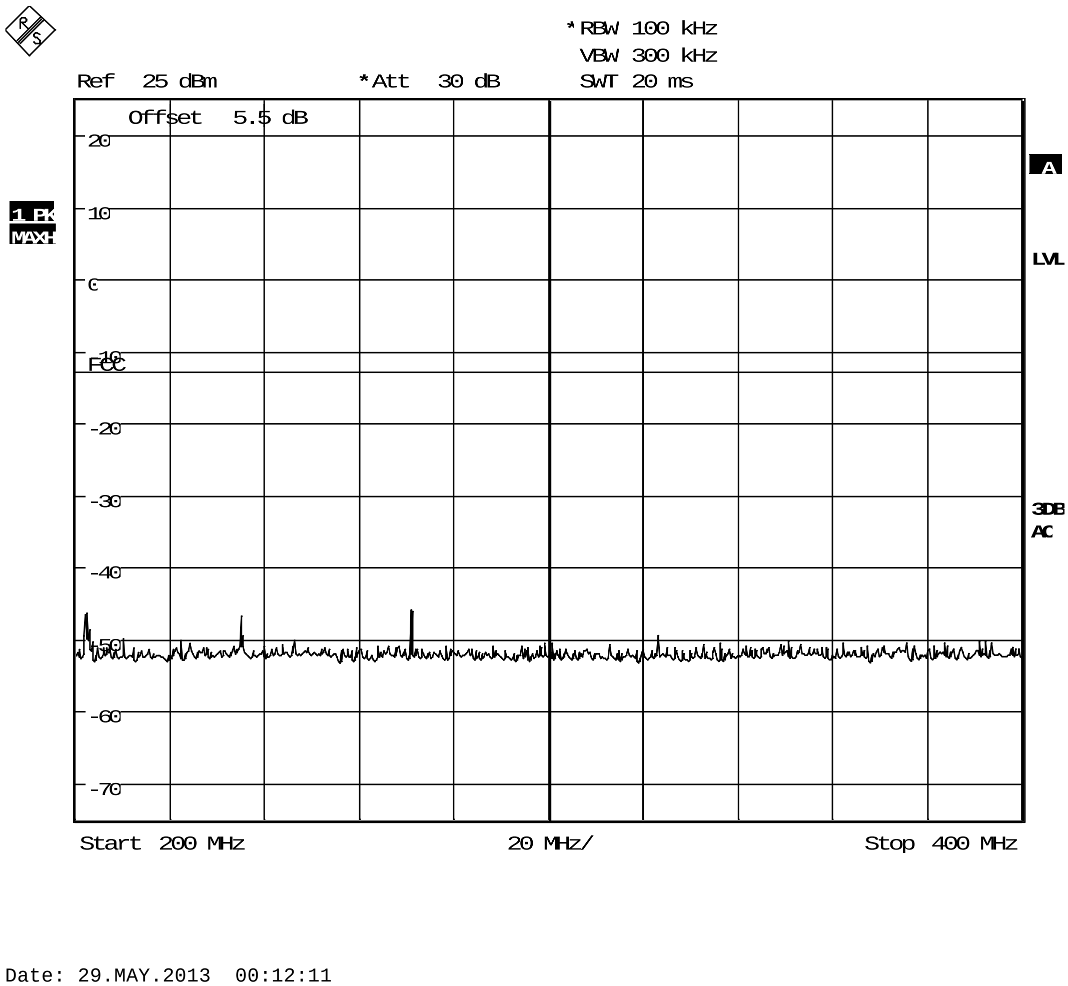


Figure 4.3-13 Conducted Spurious Emissions, 200MHz – 400MHz (Fo=135.5MHz)

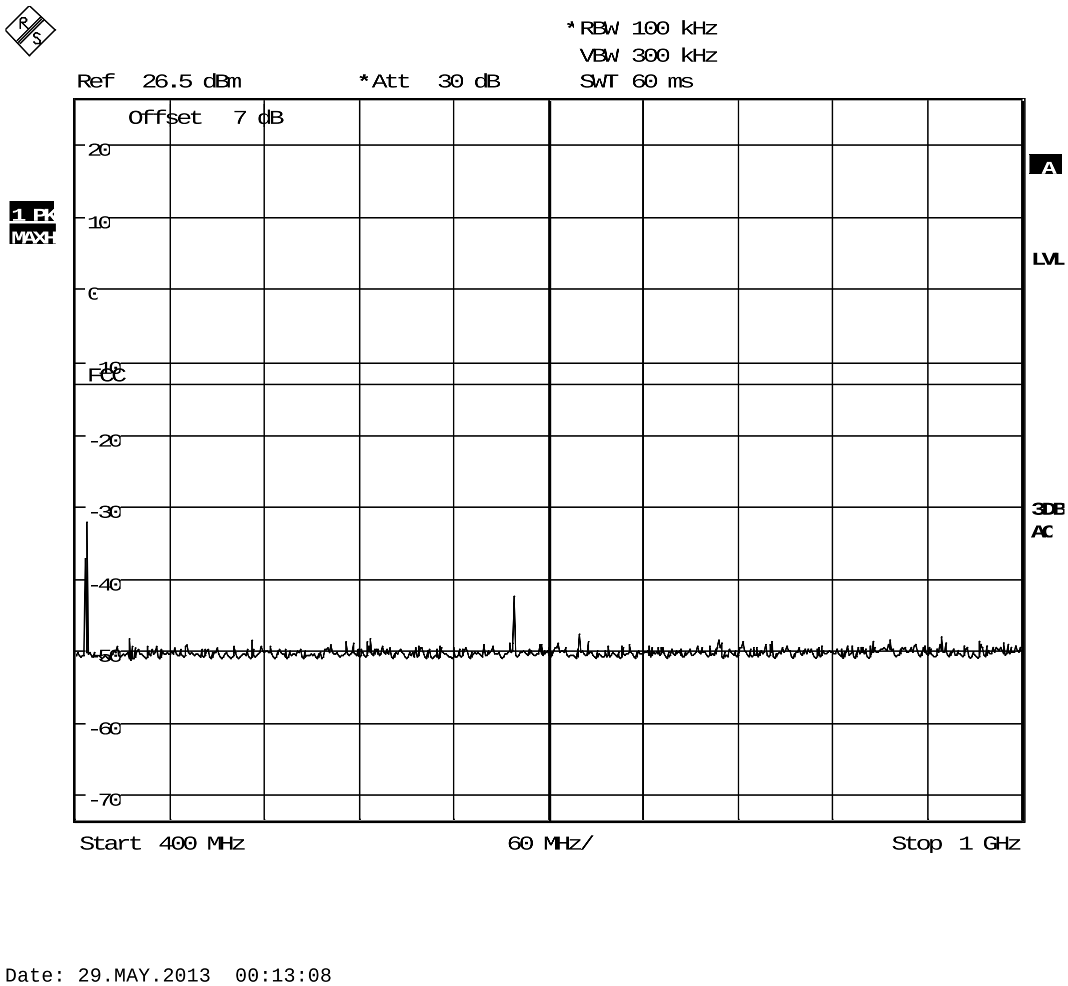
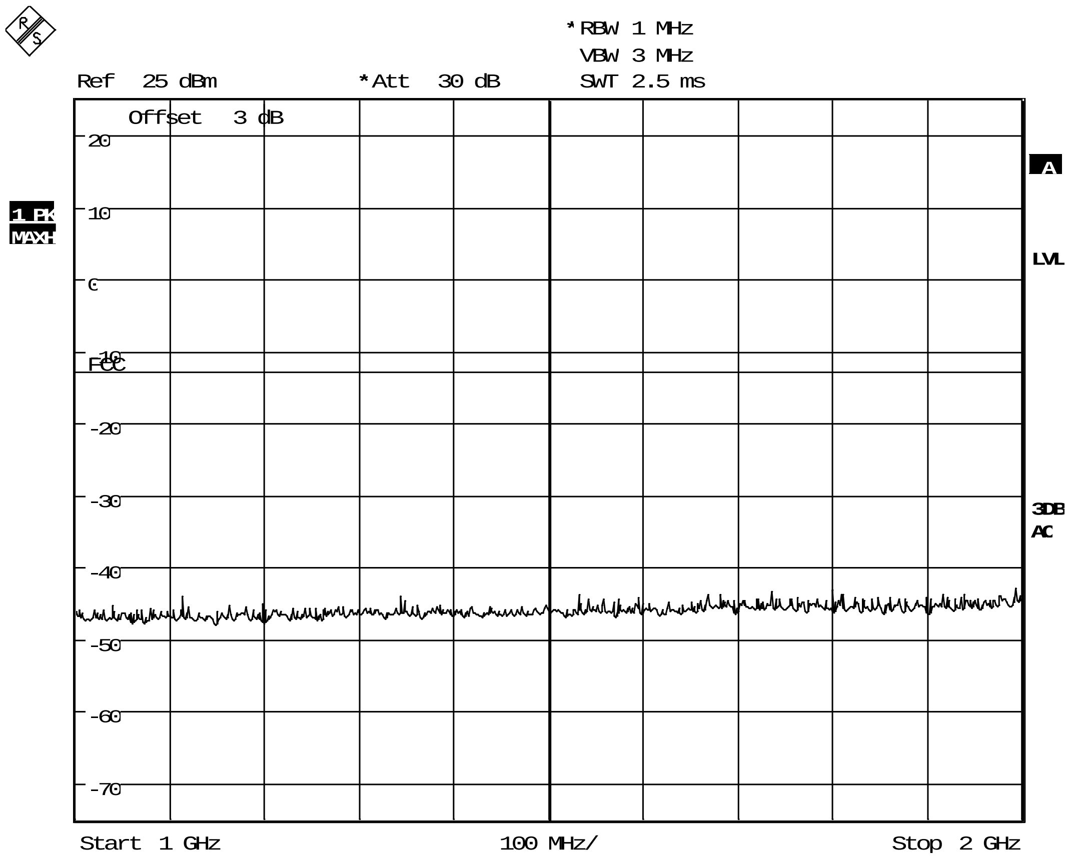


Figure 4.3-14 Conducted Spurious Emissions, 400MHz – 1GHz (Fo=135.5MHz)



Date: 29.MAY.2013 00:14:09

Figure 4.3-15 Conducted Spurious Emissions, 1GHz – 2GHz (Fo=135.5MHz)

4.4 Radiated Spurious Emissions

Radiated spurious emissions were measured over the frequency range of 30 MHz to 2 GHz with a 50 Ohm termination on the antenna port. The carrier signal field strength at maximum output power (35W) was calculated to be approximately 132.4 dBuV/m at a 10 meter distance using the following formula.

$$E\ (V/m) = \sqrt{(30 * P_t G_n)}/d = \sqrt{(30*35*1.64)}/10 = 4.15\ V/m$$
$$E\ (dBuV/m) = 20*Log\ (4.15e06) = 132.4\ dBuV/m$$

This reference level was calculated with the assumption that all emissions are radiated from half wave dipole antennas (G_n = 1.64). Therefore, the radiated emissions requirement limit was calculated to be approximately -58.4 dBc (i.e. 43 +10*Log (35)) or 74 dBuV/m.

As illustrated in the pre-scan data provided in the following pages, all radiated emissions from the cabinet and/or associated cables were well below (>30dB) the requirement limit. The final amplitude levels of the transmitter harmonics were still re-measured on the OATS and the data sheet is included as Table 4.4-1.

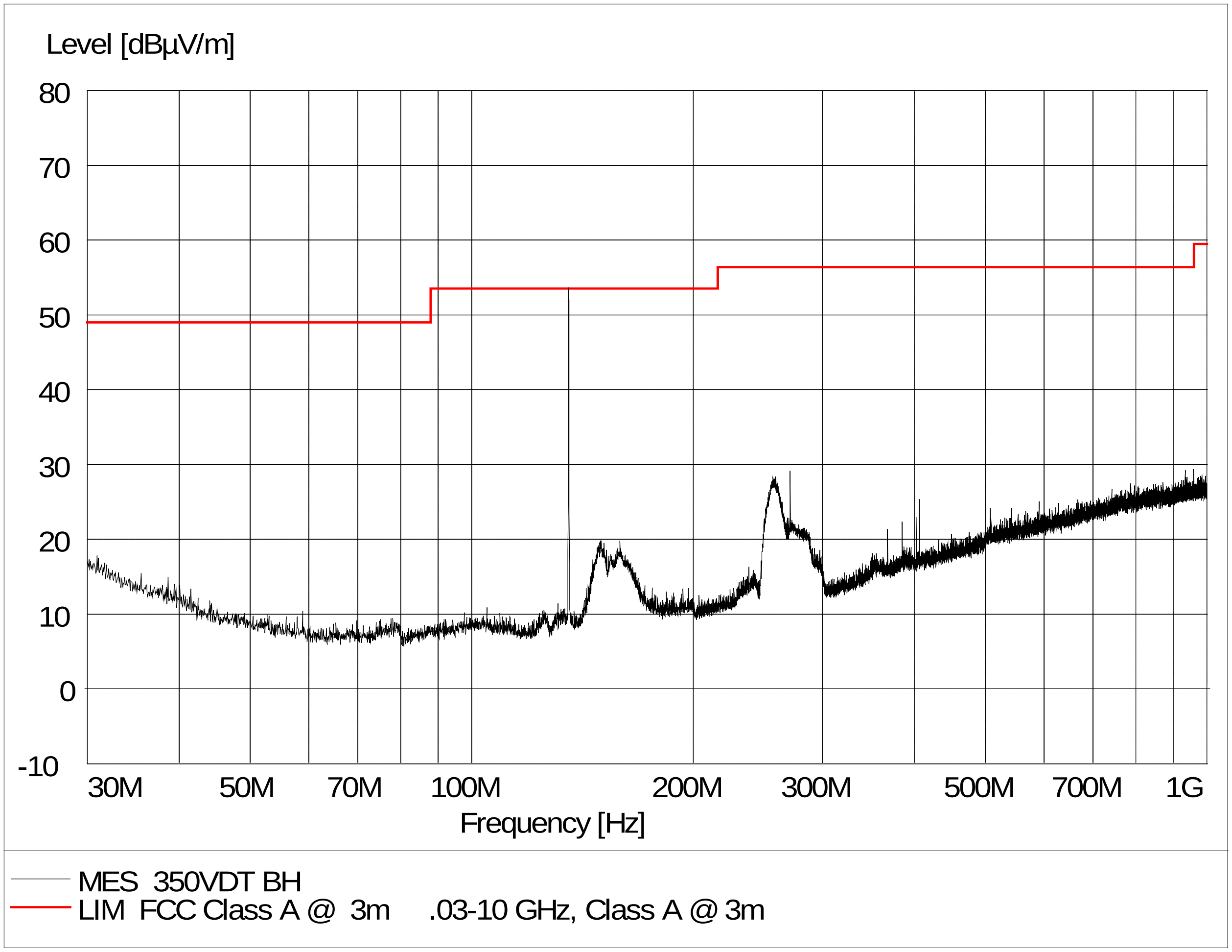


Figure 4.4-1 Radiated spurious emissions, Horizontal Polarization, 30 MHz – 1 GHz (Rear)

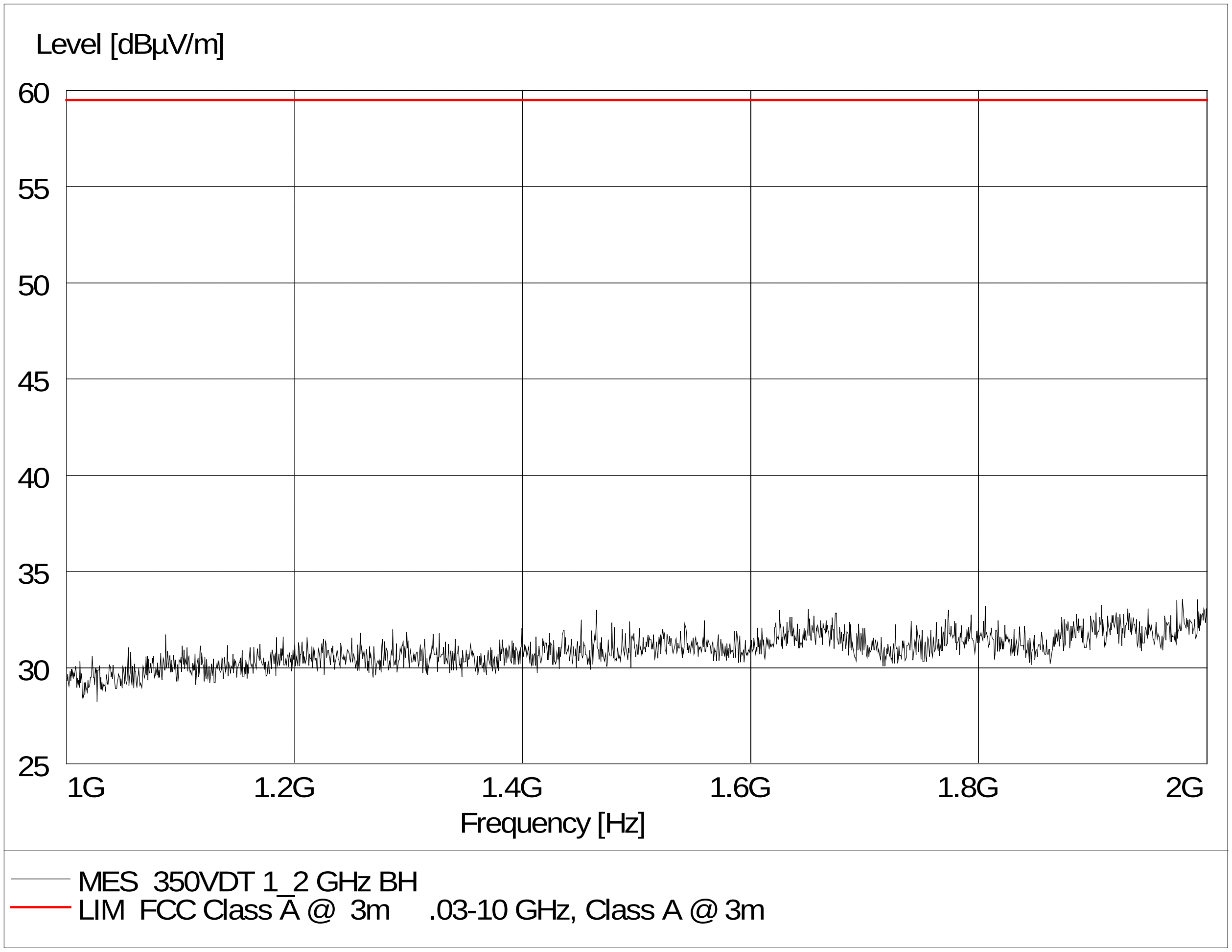


Figure 4.4-2 Radiated spurious emissions, Horizontal Polarization, 1 – 2 GHz (Rear)

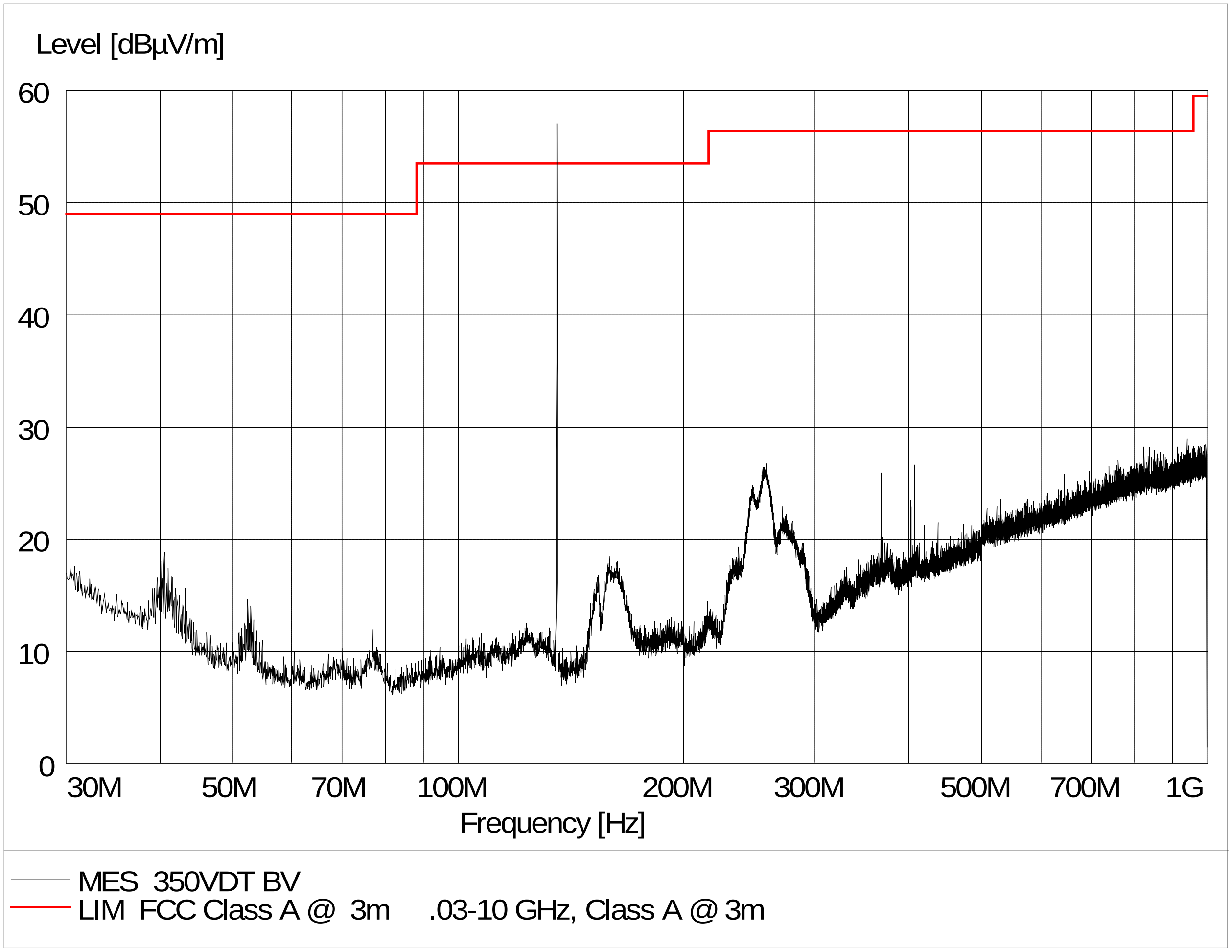


Figure 4.4-3 Radiated spurious emissions, Vertical Polarization, 30 MHz – 1 GHz (Rear)

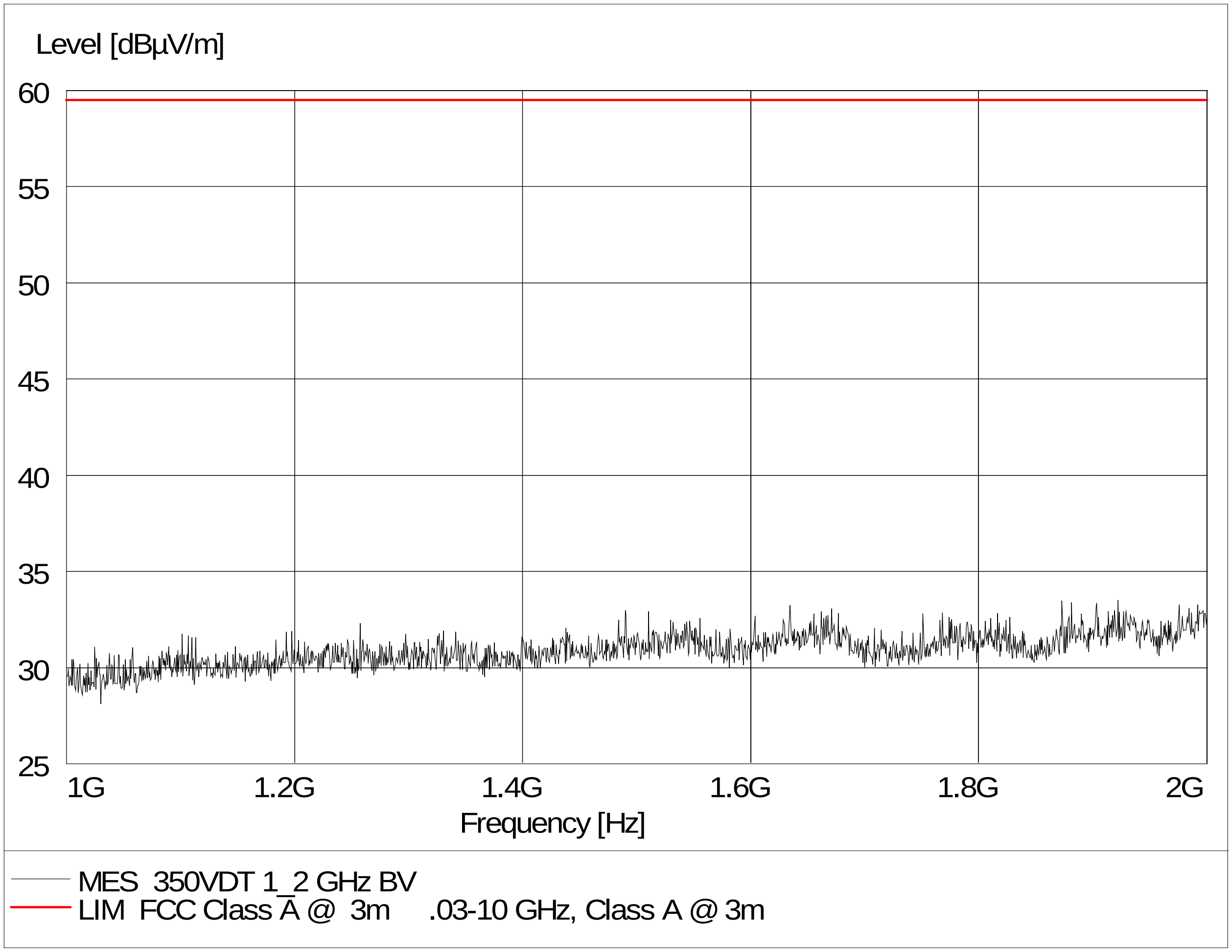


Figure 4.4-4 Radiated spurious emissions, Vertical Polarization, 1 - 2GHz (Rear)

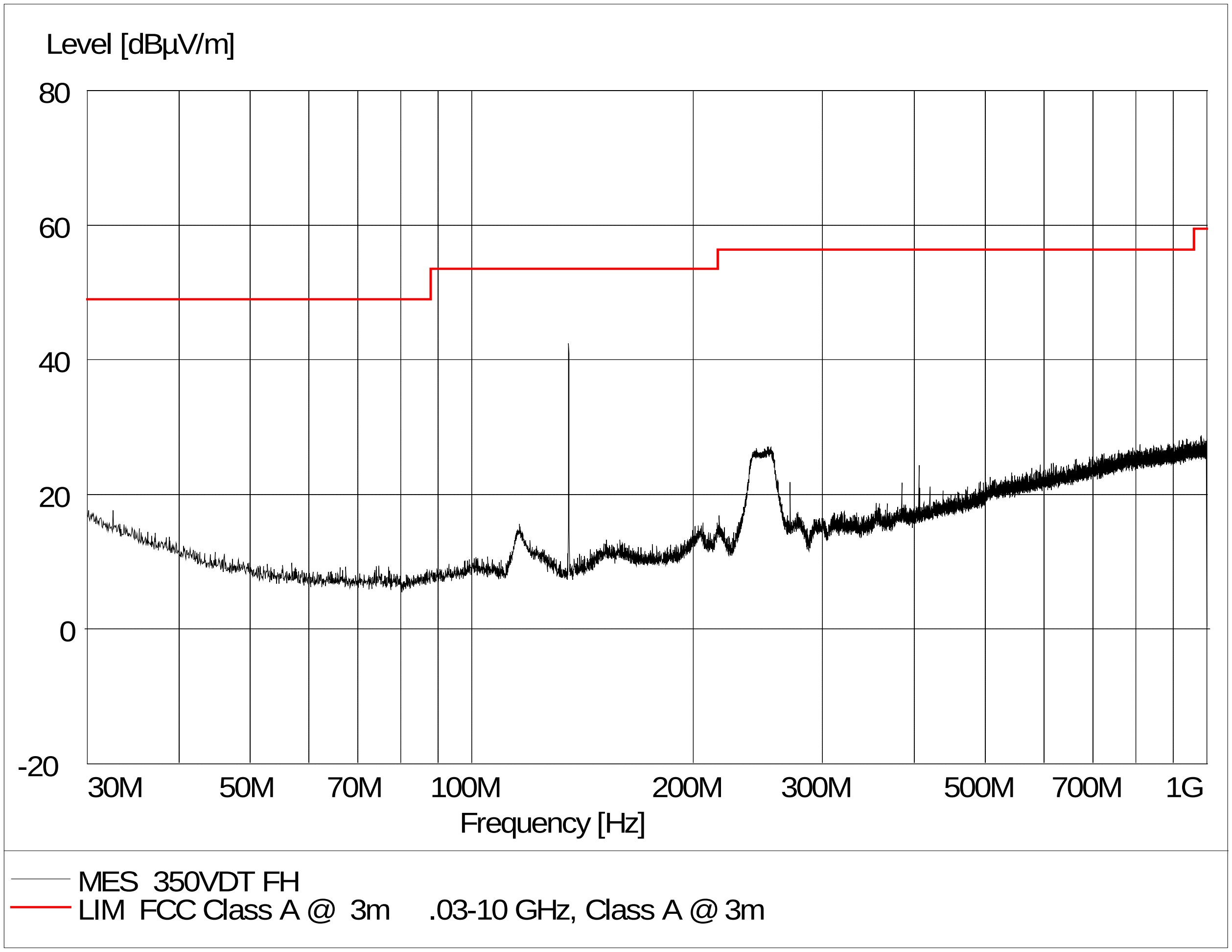


Figure 4.4-5 Radiated spurious emissions, Horizontal Polarization, 30MHz-1GHz (Front)

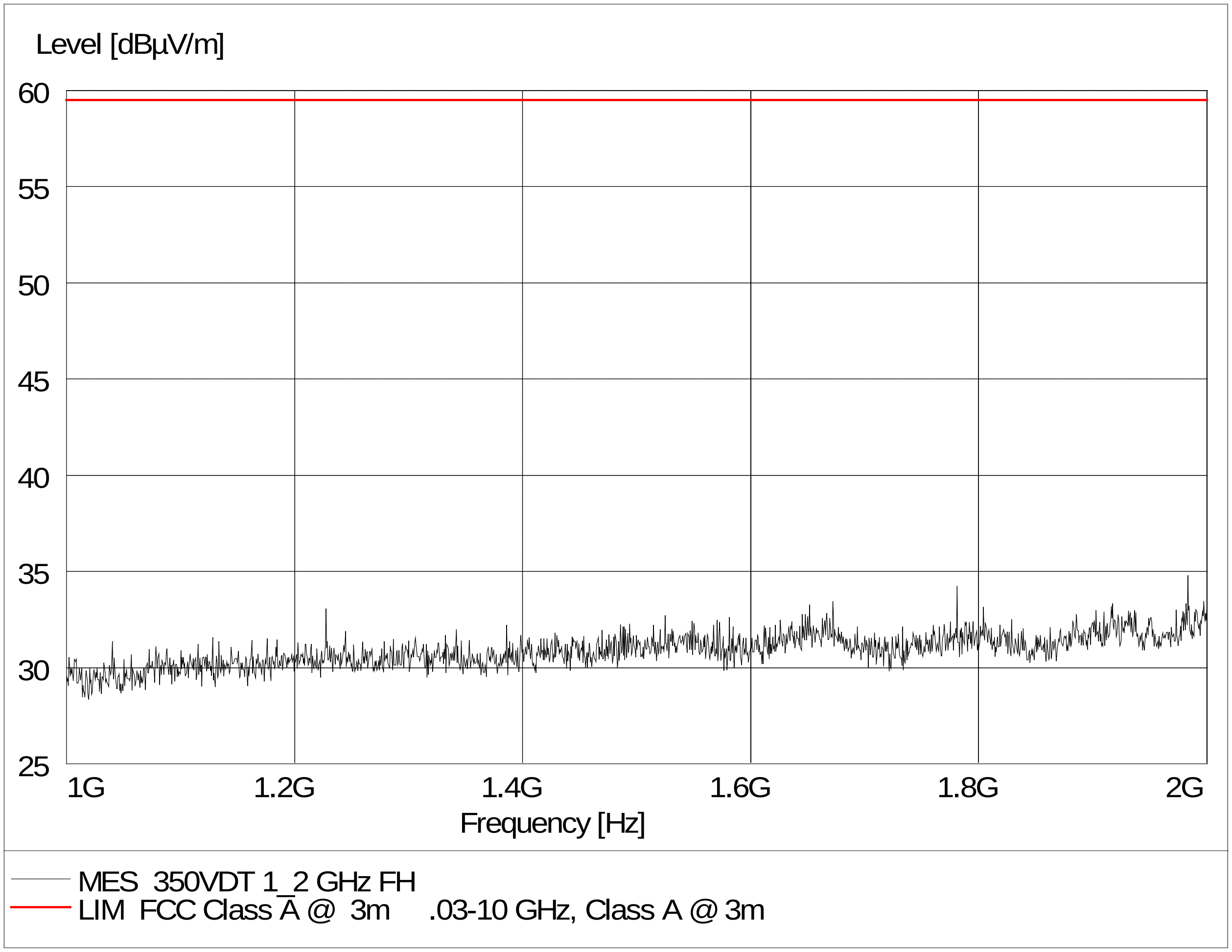


Figure 4.4-6 Radiated spurious emissions, Horizontal Polarization, 1 - 2GHz (Front)

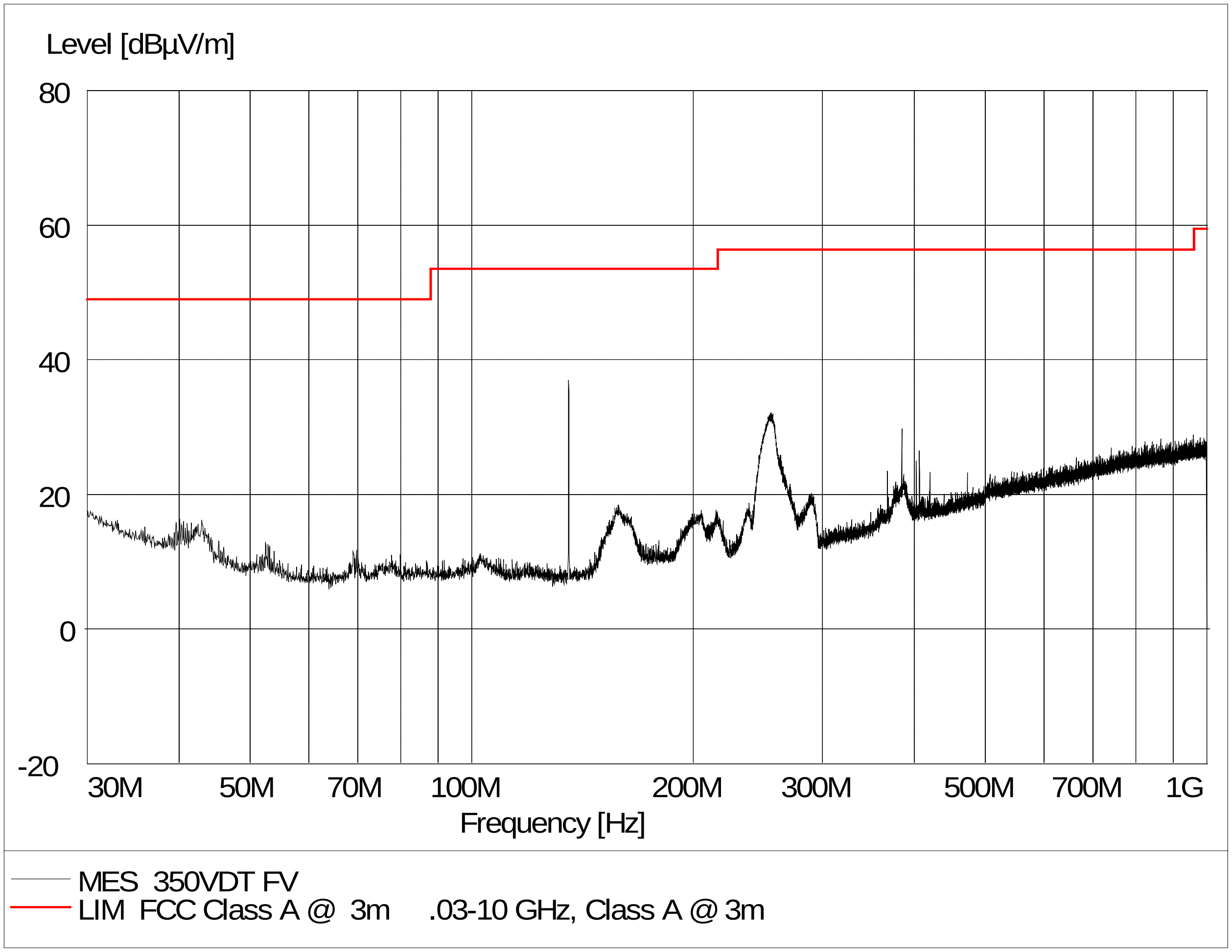


Figure 4.4-7 Radiated spurious emissions, Vertical Polarization, 30MHz - 1GHz (Front)

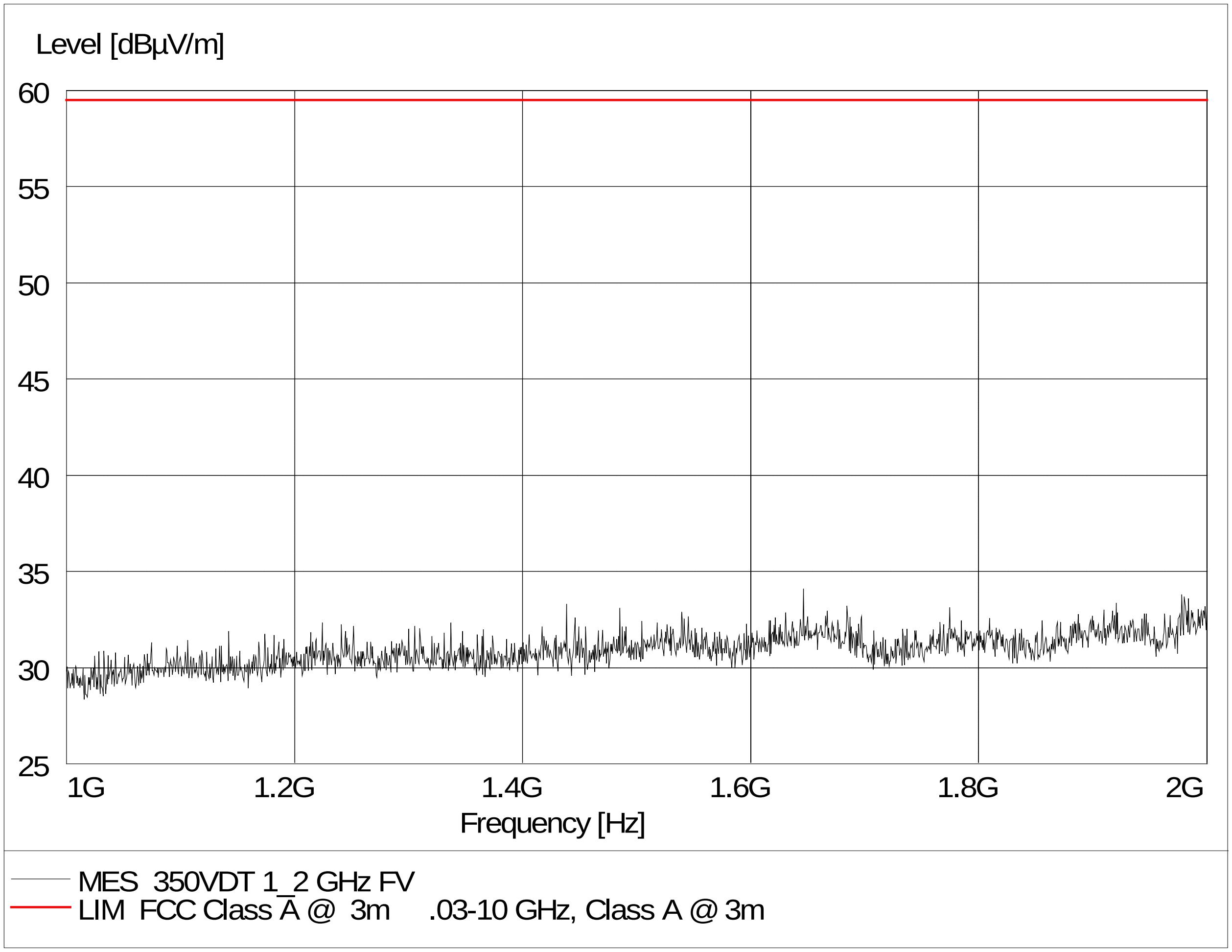


Figure 4.4-8 Radiated spurious emissions, Vertical Polarization, 1 - 2GHz (Front)

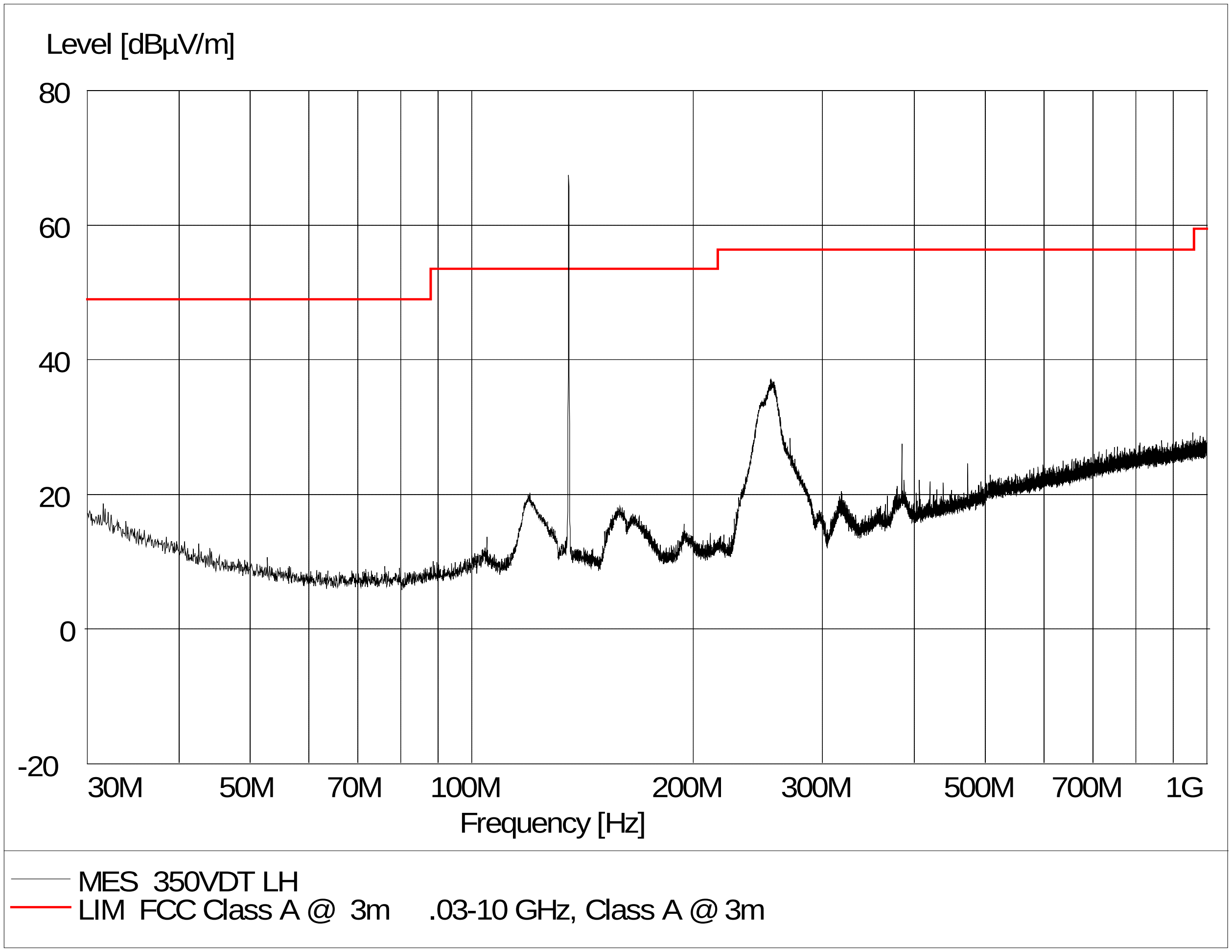


Figure 4.4-9 Radiated spurious emissions, Horizontal Polarization, 30MHz - 1GHz (Left)

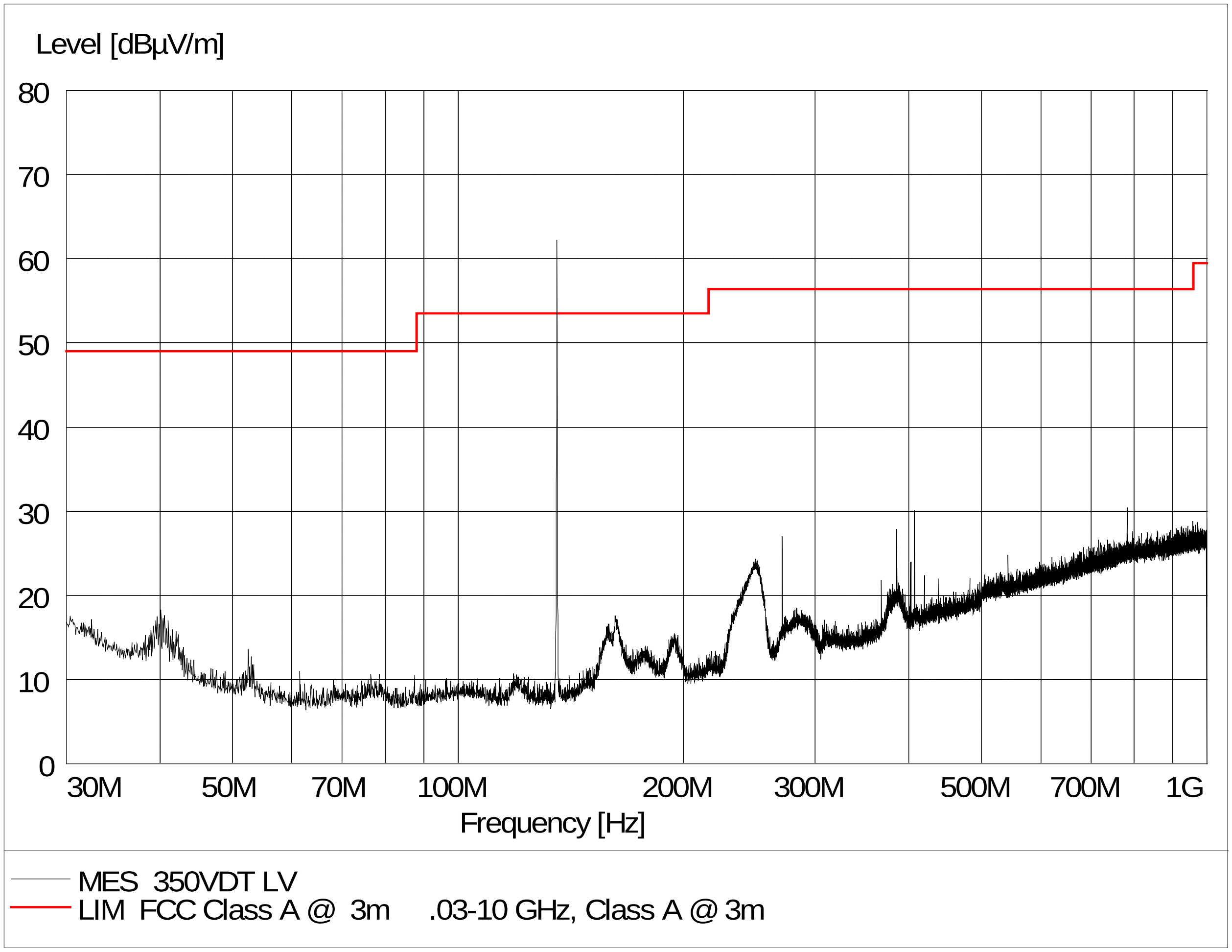


Figure 4.4-10 Radiated spurious emissions, Vertical Polarization, 30MHz - 1GHz (Left)

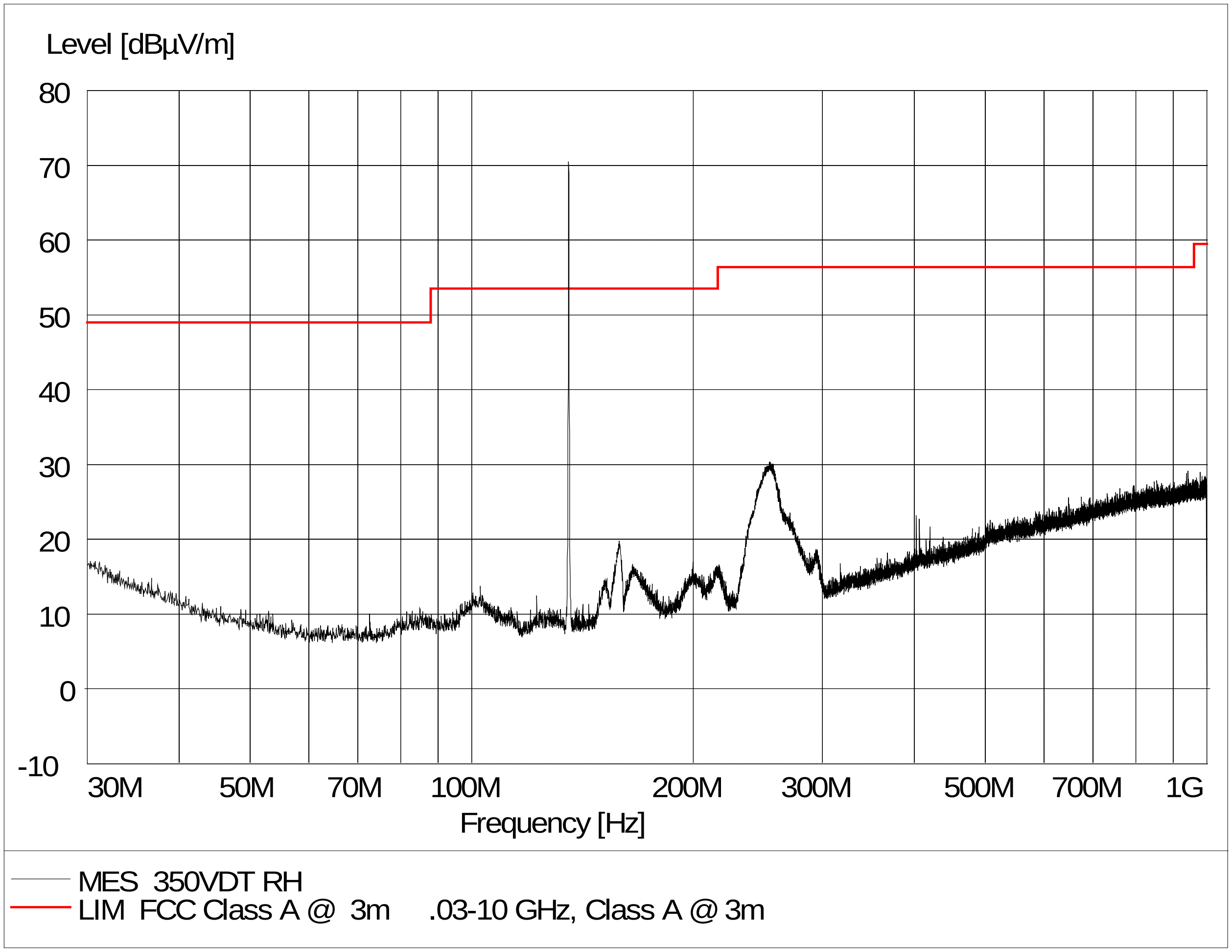


Figure 4.4-11 Radiated spurious emissions, Horizontal Polarization, 30MHz - 1GHz (Right)

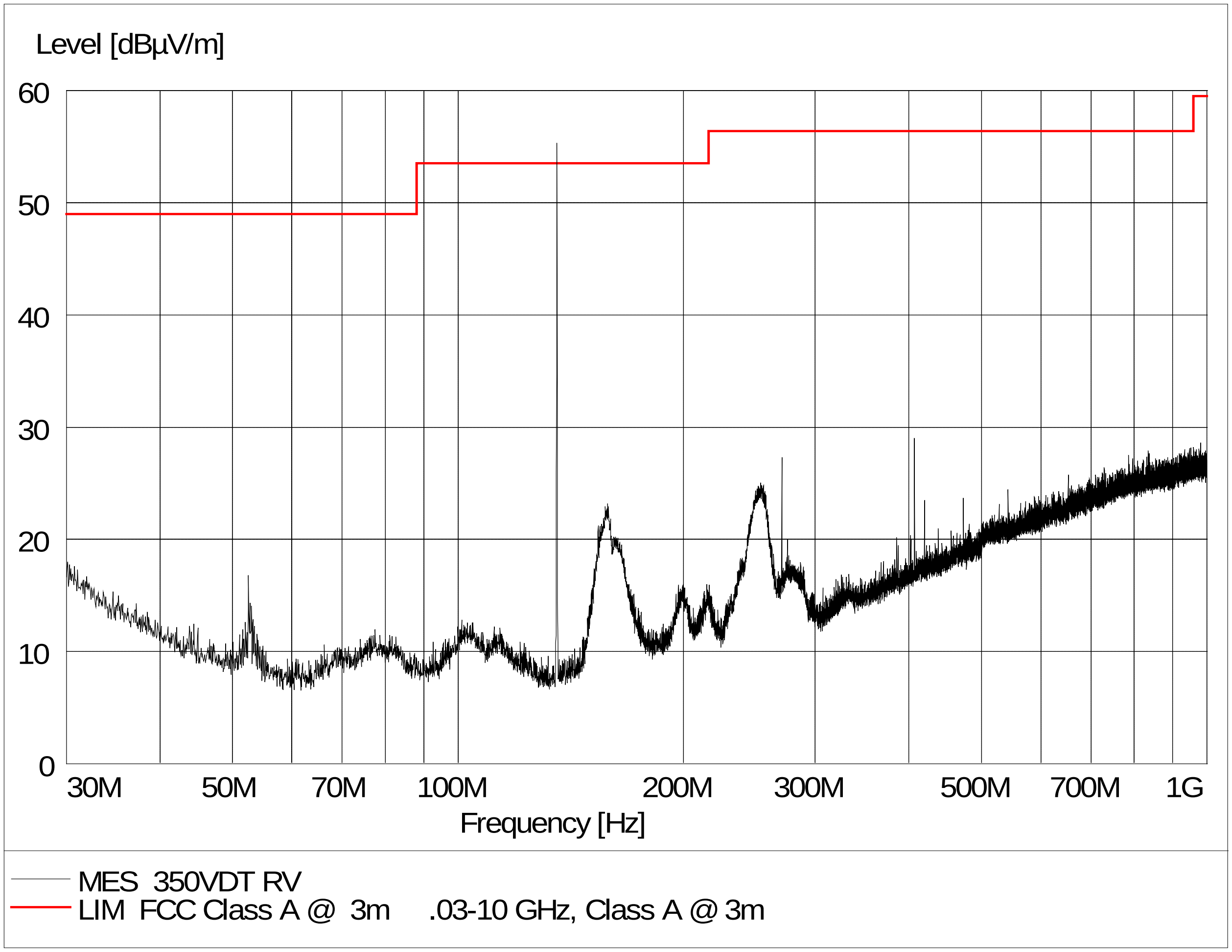


Figure 4.4-12 Radiated spurious emissions, Vertical Polarization, 30MHz - 1GHz (Right)

Table 4.1-1 Radiated Spurious Emission, OATS Measurements

GENERAL DYNAMICS
C4 Systems

FCC Radiated Test Results

Equip.	CM-350 VHF Digital Transmitter	Test Date:	5/20/2013
Mode:	Transmit	Test Technician:	R.Johnston
Model#:	CM-350 (V2) VDT	Measurement Distance (m)	10
Serial #:	2V5000001	Equipment Class	
		32°C	10%R.H. BP 92.6 kpa

Frequency MHz	SA Reading (dBuV)	Az	Ht cm	Pol	Antenna Factor	Cable/Attn. Loss	Pre Amp dB	Emission (dBuV/m)	Spec Limit (dBuV/m)	Pass/ Fail	Comments:
Fo = 135.5											
271.000	12.4	FR	100.00	V	12.8	10.5	0.0	35.7	74.0	PASS	2nd Harmonic
406.500	10.0	FR	100.00	V	15.8	11.4	0.0	37.2	74.0	PASS	3rd Harmonic
542.000	32.0	F	100.00	V	18.8	12.5	0.0	63.3	74.0	PASS	4th in Ambient
542.000	15.0	F	100.00	V	18.8	12.5	0.0	46.3	74.0	PASS	10kHz BW
Fo = 131.35											
262.7	11.0	F	100.00	V	12.4	10.4	0.0	33.8	74.0	PASS	2nd @ Noise Floor
394.05	13.0	B	282.00	V	19.7	12.5	0.0	45.2	74.0	PASS	3rd @ Noise Floor
525.4	32.0	B	217.00	H	19.7	12.5	0.0	64.2	74.0	PASS	4th in Ambient
Fo = 119											
238.00	16.0	BL	100.00	V	15.5	11.0	0.0	42.5	74.0	PASS	2nd @ Noise Floor
357.00	15.0	B	310.00	V	18.0	12.2	0.0	45.2	74.0	PASS	3rd @ Noise Floor
476.00	40.0	B	303.00	H	18.0	12.2	0.0	70.2	74.0	PASS	4th in Ambient

4.5 Modulation Characteristics

Figure 4.5-1 illustrates the test setup used for measuring the audio response of the modulator with respect to the requirements of 47 CFR Part 2.1047 (a). Data was taken and recorded with the HP 4195A audio network analyzer. The graphs recorded, Figures 4.5-2 and 4.5-3, illustrate the audio frequency response of the modulator for both 25 kHz and 8.33 kHz channel spacing. These measurements were performed by project personnel on CM-350 (V2) VDT S/N 2V5000005.

Radio Model Number:	CM-350 (V2) VDT			
Radio Serial Number	2V5000005			
Radio Hardware Version	Pilot			
Radio Software Version	Micro	1.39	SBV	1.38
	Boot	4.05	Web	5.05
	CPLD	F00V009		

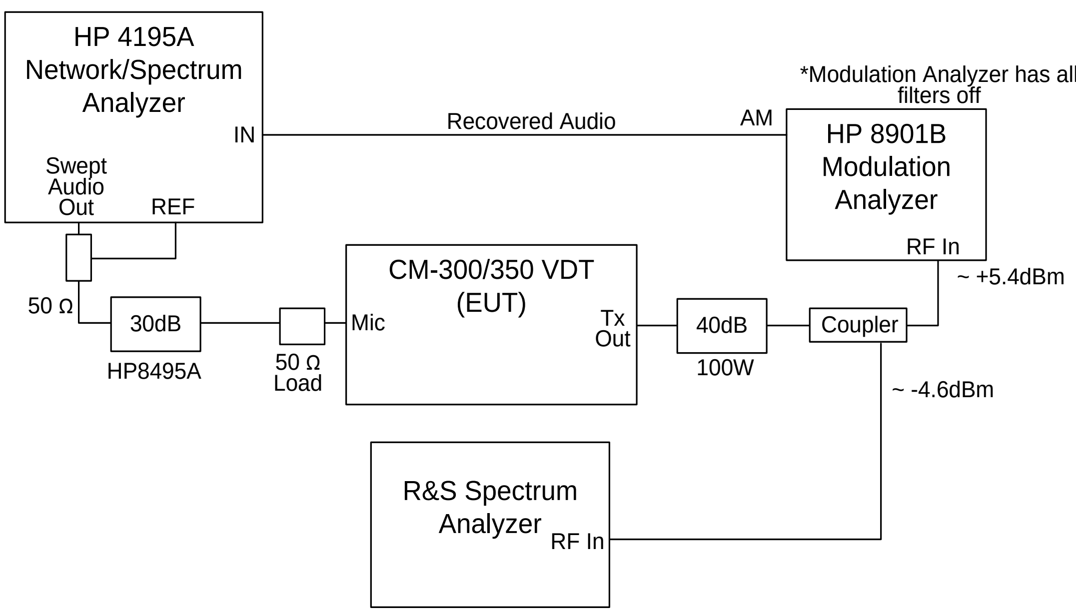


Figure 4.5-1 Audio Frequency Response Test Setup Diagram

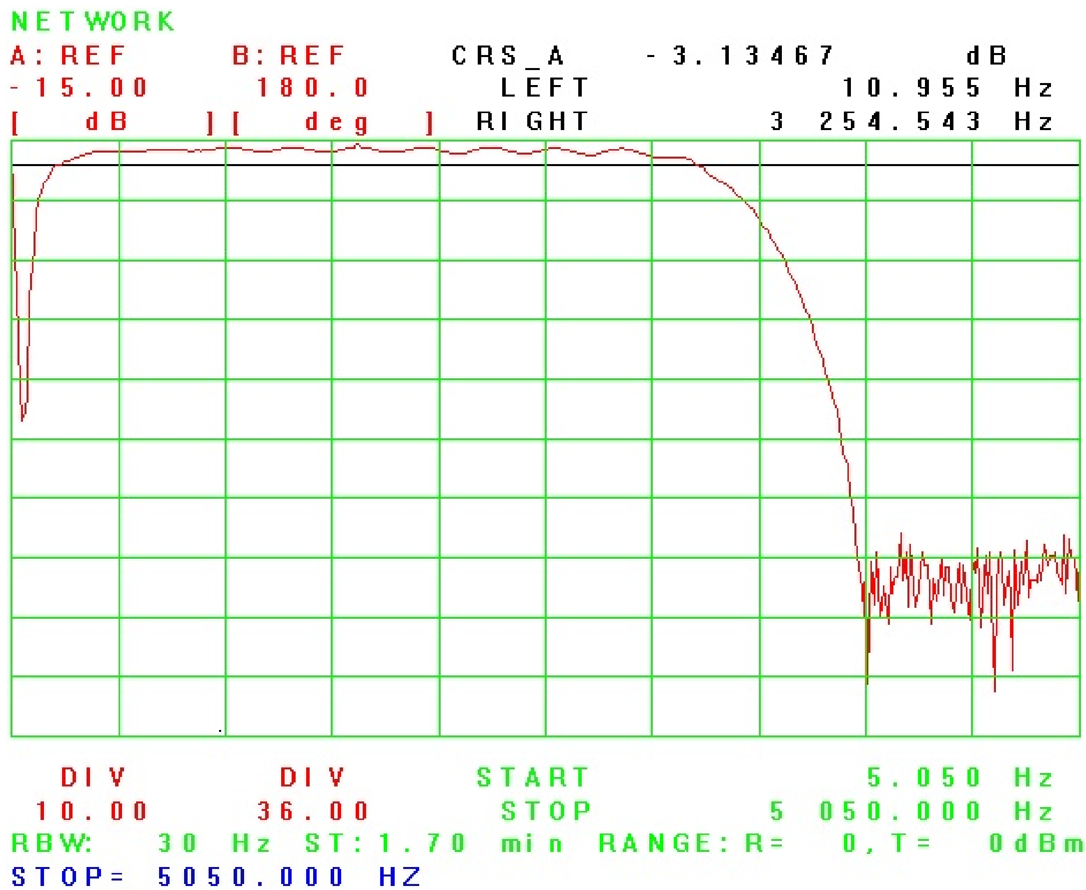


Figure 4.5-2 Audio Frequency Response Curve, 25 kHz Channel Spacing

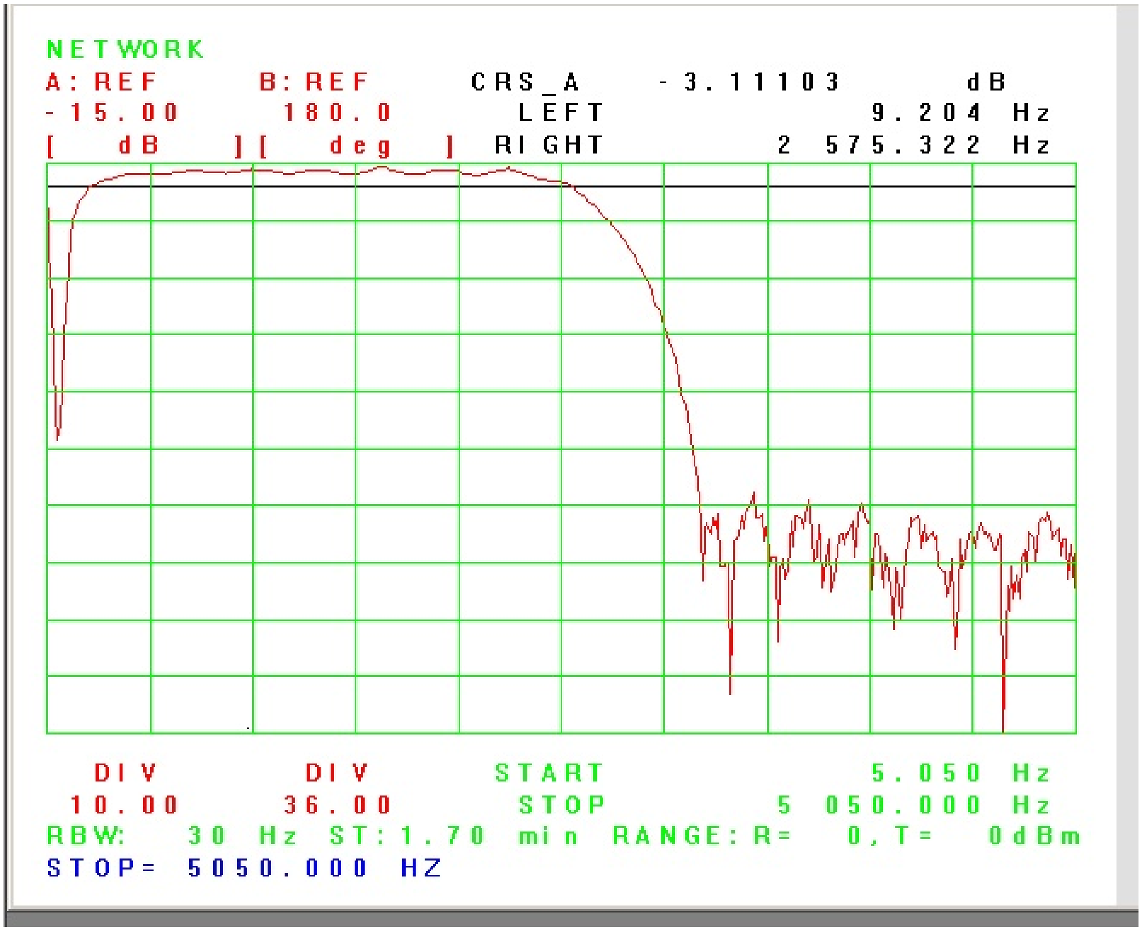


Figure 4.5-3 Audio Frequency Response Curve, 8.33 kHz Channel Spacing

Data was also taken to illustrate the percentage of modulation versus the modulation input voltage in accordance with 47 CFR Part 2.1047 (b). The requirements of 47 CFR Part 87.141 also applies to the CM-350 (V2) VDT specifying that, when A3E emission is used, the modulation percentage must not exceed 100 percent.

This data was taken while holding the audio frequency at 500 Hz, 1 kHz and 2 kHz and a peak frequency taken from the audio frequency response results, into the CM-350 (V2) VDT.

Figure 4.5-4 shows the modulation response for each of three tones while the input voltage was varied. The frequency is held constant and the modulation is read from an HP 8901B modulation analyzer. These measurements were performed by project personnel on CM-350 (V2) VDT S/N 2V5000107.

Radio Model Number:	CM-350 (V2) VDT			
Radio Serial Number	2V5000107			
Radio Hardware Version	FAT			
Radio Software Version	Micro	1.39	SBV	1.38
	Boot	4.05	Web	5.05
	CPLD	F00V009		

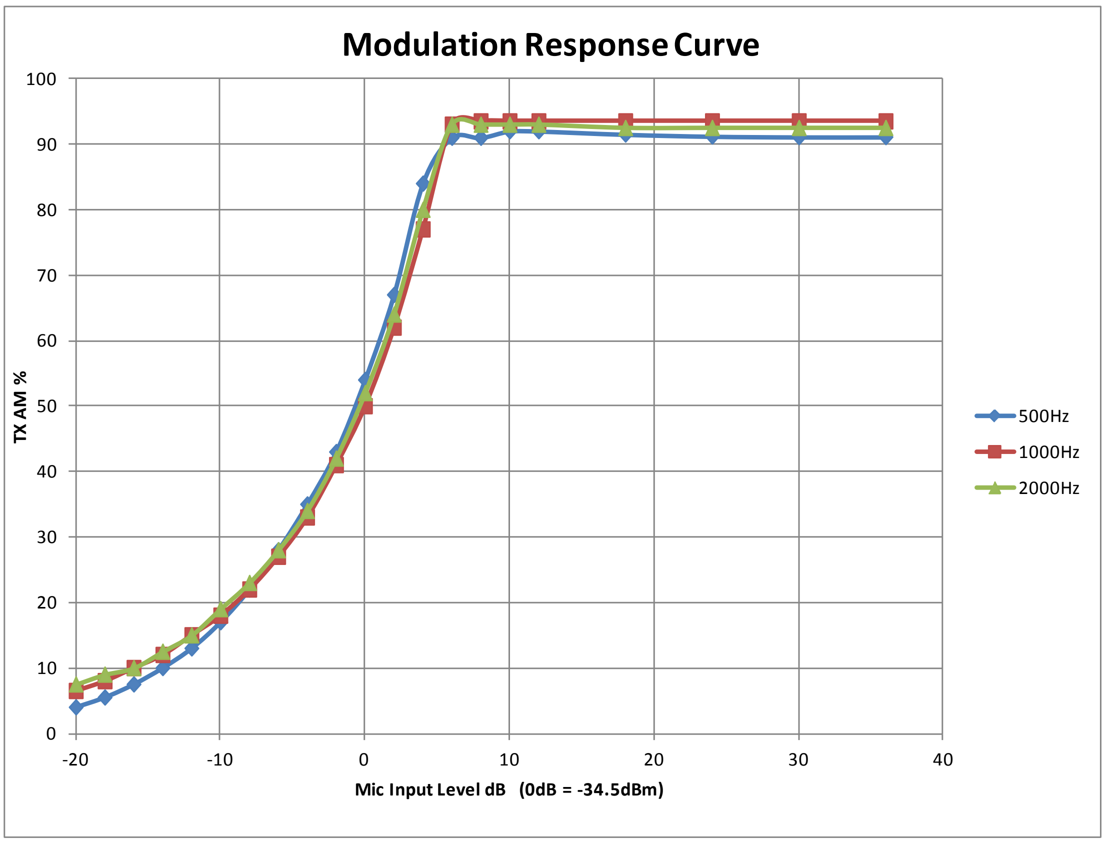


Figure 4.5-4 Modulation Response

4.6 Frequency Stability

The CM-350 (V2) VDT was tested for frequency stability in accordance with the requirements of 47 CFR Part 2.1055 when operated in a CW mode at maximum rated power over the temperature range of -30°C to +50°C in 10°C steps. This included testing at three (3) operating frequencies (119 MHz, 131.35 MHz, and 135.5 MHz). The stability requirement specified in 47 CFR Part 87.133 is 20 parts per million (ppm).

Frequency stability was also measured over an input power voltage range of 85% to 115% for AC power and for DC power battery backup operation. These voltage settings are shown in Table 4.6-1.

Table 4.6-1 Frequency Stability Input Voltage Settings

Nominal Power	85%	115%
120 VAC	102 VAC	138 VAC
24 VDC	20.4 VDC	27.6 VDC

The CM-350 (V2) VDT is only rated to operate at 24 VDC, -10%/+20% VDC, i.e. 21.6 VDC to 28.8 VDC. The testing indicates that the unit continues to meet the 20ppm requirement to a minimum voltage level of approximately 21.3 VDC, at which point the unit automatically shuts down. Although the 85% minimum level (+20.4VDC) was not reached, frequency stability below 21.3 VDC is a non-issue since the radio shuts off.

The frequency stability data is illustrated below and was performed by project personnel on the CM-350 (V2) VDT S/Ns 2V5000007 and 2V500005. The radio met the 20ppm frequency stability requirement across the specified temperature and voltage ranges.

Radio Model Number:	CM-350 (V2) VDT			
Radio Serial Number	2V5000005			
Radio Hardware Version	Pilot			
Radio Software Version	Micro	1.39	SBV	1.38
	Boot	4.05	Web	5.05
	CPLD	F00V009		
Radio Model Number:	CM-350 (V2) VDT			
Radio Serial Number	2V5000007			
Radio Hardware Version	Pilot			
Radio Software Version	Micro	1.39	SBV	1.38
	Boot	4.05	Web	5.05
	CPLD	F00V009		

Temperature vs. Frequency Stability

-30 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000018	119000018	119000018	119000017
Offset	18	18	18	17
PPM	.151	.151	.151	.142
RF Power CW	31.62	31.62	31.62	31.62

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131.350032	131.350032	131350029	131350025
Offset	32	32	29	25
PPM	.243	.243	.220	.190
RF Power CW	30.90	30.90	31.62	32.35

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135500026	135500025	135500023	135500021
Offset	26	25	23	21
PPM	.191	.184	.169	.154
RF Power CW	32.35	32.35	33.11	33.11

-20 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000018	119000018	119000018	119000017
Offset	18	18	18	17
PPM	.151	.151	.151	.142
RF Power CW	30.19	30.90	30.90	31.62

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131350019	131350019	131350019	131350019
Offset	19	19	19	19
PPM	.144	.144	.144	.144
RF Power CW	33.11	33.11	33.11	33.11

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135500019	135500020	135500020	135500020
Offset	19	20	20	20
PPM	.140	.147	.147	.147
RF Power CW	33.88	33.88	33.88	33.88

-10 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000002	119000001	119000000	119000000
Offset	2	1	0	0
PPM	.016	.008	0	0
RF Power CW	33.35	32.35	32.35	32.35

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131350010	131350009	131350005	131350002
Offset	10	9	5	2
PPM	.076	.068	.038	.015
RF Power CW	33.88	33.88	33.88	33.88

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135500014	135500015	135500014	135500011
Offset	14	15	14	11
PPM	.103	.110	.103	.081
RF Power CW	32.35	32.35	32.35	33.88

0 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000002	118999998	118999994	118999994
Offset	2	2	6	6
PPM	.016	.016	.050	.050
RF Power CW	31.62	31.62	32.35	33.11

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131349993	131349993	1313499995	1313499996
Offset	7	7	5	4
PPM	.053	.053	.038	.30
RF Power CW	33.88	34.67	34.67	34.67

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135499996	135499997	135499998	135499999
Offset	4	3	2	1
PPM	.029	.022	.014	.007
RF Power CW	34.67	34.67	34.67	35.48

+10 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000004	119000004	119000004	119000005
Offset	4	4	4	5
PPM	.033	.033	.033	.042
RF Power CW	33.88	33.88	33.88	33.88

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131350002	131350002	131350003	131350004
Offset	2	2	3	4
PPM	.015	.015	.022	.030
RF Power CW	35.48	35.48	35.48	35.48

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135499997	135499998	135500000	135500001
Offset	3	2	0	1
PPM	.022	.014	0	.007
RF Power CW	33.88	33.88	34.67	35.48

+20 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000006	119000006	119000005	119000004
Offset	6	6	5	4
PPM	.050	.050	.042	.033
RF Power CW	33.11	33.11	33.88	34.67

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131350004	131500003	131350002	131350002
Offset	4	3	2	2
PPM	.030	.022	.015	.015
RF Power CW	36.30	36.30	37.15	37.15

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135500002	135500001	135500001	135500000
Offset	2	1	1	0
PPM	.014	.007	.007	0
RF Power CW	37.15	37.15	37.15	37.15

+30 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000001	119000001	119000002	119000003
Offset	1	1	2	3
PPM	.008	.008	.016	.025
RF Power CW	35.48	35.48	35.48	35.48

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131349999	131350000	131350000	131349999
Offset	1	0	0	1
PPM	.007	0	0	.007
RF Power CW	37.15	37.15	37.15	37.15

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135499997	135499998	135499998	135500000
Offset	3	2	2	0
PPM	.022	.014	.014	0
RF Power CW	34.67	36.30	36.30	37.15

+40 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000009	119000009	119000010	119000010
Offset	9	9	10	10
PPM	.075	.075	.073	.073
RF Power CW	33.88	34.67	35.48	35.48

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	1313500011	1313500011	1313500012	
Offset	11	11	12	12
PPM	.083	.083	.091	.091
RF Power CW	38.01	38.01	38.01	38.90

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135500012	135500013	135500013	135500013
Offset	12	13	13	13
PPM	.088	.095	.095	.095
RF Power CW	38.01	38.01	38.01	38.90

+50 C **SN 2V5000007**

Set Frequency (MHz)	119.000 MHz	119.000 MHz	119.000 MHz	119.000 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	119000004	119000005	119000005	119000008
Offset	4	5	5	8
PPM	.033	.042	.042	.067
RF Power CW	38.01	38.01	38.01	38.01

Set Frequency (MHz)	131.350 MHz	131.350 MHz	131.350 MHz	131.350 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	131349998	131350000	131349998	131350004
Offset	2	0	2	4
PPM	.015	0	.015	.030
RF Power CW	39.81	39.81	39.81	39.81

Set Frequency (MHz)	135.500 MHz	135.500 MHz	135.500 MHz	135.500 MHz
Time	0 minutes	2 minutes	5 minutes	10 minutes
Measured Frequency	135499989	135499989	135499991	135499997
Offset	11	11	9	3
PPM	.081	.081	.066	.022
RF Power CW	37.15	38.01	38.01	39.81

FCC Freq Stab vs Input Voltage					**DATE: 4/24-4/25**			**Tested By: K.Wagstaff**	
		UUT SN: 2V500005			Model: CM-350 (V2) VHF Transmitter				
	* Alert LED ON		** Fail LED ON						
		Freq: 119.000 MHz							
		2 MIN			5 MIN			10 MIN	
Input Voltage	AC / DC PWR	Frequency Counter Reading	ppm from Nom	AC / DC PWR	Frequency Counter Reading	ppm from Nom	AC / DC PWR	Frequency Counter Reading	ppm from Nom
20.40	UUT Shuts off at Voltages Lower than ~21.3 Volts								
21.40	21.33	119000012	-0.10	21.39	119000013	-0.11	21.41	119000015	-0.13
24.00	24.10	119000007	-0.06	24.08	119000009	-0.08	24.00	119000011	-0.09
27.60	27.65	118999999	0.01	27.68	119000005	-0.04	27.76	119000014	-0.12
102	102.08	119000015	-0.13	102.08	119000017	-0.14	102.08	119000022	-0.18
120	120.10	119000024	-0.20	120.10	119000027	-0.23	120.10	119000030	-0.25
138	137.95	119000050	-0.42	137.94	119000049	-0.41	137.94	119000048	-0.40
		Freq: 131.350 MHz							
		2 MIN			5 MIN			10 MIN	
Input Voltage	AC / DC PWR	Frequency Counter Reading	ppm from Nom	AC / DC PWR	Frequency Counter Reading	ppm from Nom	AC / DC PWR	Frequency Counter Reading	ppm from Nom
20.4	UUT Shuts off at Voltages Lower than ~21.3 Volts								
21.40	21.36	131350019	-0.14	21.32	131350019	-0.14	21.36	131350023	-0.18
24.00	23.99	131350051	-0.39	24.01	131350052	-0.40	24.09	131350054	-0.41
27.60	27.73	131350020	-0.15	27.68	131350025	-0.19	27.76	131350031	-0.24
102	102.08	131350011	-0.08	102.08	131350012	-0.09	102.08	131350015	-0.11
120	120.10	131350035	-0.27	120.10	131350035	-0.27	120.10	131350035	-0.27
138	137.94	131350049	-0.37	137.95	131350056	-0.43	137.95	131350057	-0.43
		Freq: 135.500 MHz							
		2 MIN			5 MIN			10 MIN	
Input Voltage	AC / DC PWR	Frequency Counter Reading	ppm from Nom	AC / DC PWR	Frequency Counter Reading	ppm from Nom	AC / DC PWR	Frequency Counter Reading	ppm from Nom
20.4	UUT Shuts off at Voltages Lower than ~21.3 Volts								
21.40	21.41	135500025	-0.18	21.32	135500026	-0.19	21.36	135500029	-0.21
24.00	24.05	135500046	-0.34	24.01	135500046	-0.34	24.09	135500049	-0.36
27.60	27.72	135500035	-0.26	27.68	135500039	-0.29	27.76	135500044	-0.32
102	102.08	135500026	-0.19	102.08	135500028	-0.21	102.08	135500031	-0.23
120	120.10	135500037	-0.27	120.10	135500038	-0.28	120.10	135500039	-0.29
138	137.95	135500047	-0.35	137.95	135500048	-0.35	137.95	135500050	-0.37

4.7 RF Output Power and Final Amplifier Voltage/Current

The RF output power was measured at the output terminals of the transmitter and provided below:

119.000 MHz	+46.6 dBm
131.35 MHz	+46.9 dBm
135.5 MHz	+46.8 dBm

Paragraph 2.1033(c)(8) indicates that the DC voltage and DC current applied into the final radio frequency amplifying device shall be specified for normal operation over the power range. These measurement readings are provided below:

1) DC Voltage into Final RF Amplifier: 28 Volts DC, nominal
2) DC Current in the Final RF Amplifier: 11.0 Amps (@35W output power)

5.0 CONCLUSIONS

The NEXCOM II CM-350 (V2) VHF Digital Transmitter (VDT) complies with the applicable sections of 47 CFR Parts 2 and 87 required for FCC certification.