Company: Rockwell Collins

Test of: IMS-6010
To:
FCC CFR 47 Part 15.247 (DTS) & IC RSS 210

Report No.: ROCK05-U3 Rev A

TEST REPORT

TEST REPORT

FROM

MiCOM Labs
opening wireless markets

Test of: Rockwell Collins IMS-6010
to

To: FCC CFR 47 Part 15.247 (DTS) & IC RSS 210

Test Report Serial No.: ROCK05-U3 Rev A

This report supersedes: None

Applicant:	Rockwell Collins 400 Collins Rd NE Cedar Rapids Iowa 52498, USA
Product Function:	Wireless connectivity for aircraft systems
Issue Date:	12th March 2015

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
575 Boulder Court
Pleasanton California 94566
USA
Phone: +1 (925) 462-0304
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www.micomlabs.com

A2LA ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

Table of Contents

ACCREDITATION, LISTINGS & RECOGNITION

TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf


American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 28th day of February 2014.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2015

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

RECOGNITION

MiCOM Labs, Inc has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

EU MRA – European Union Mutual Recognition Agreement.
NB – Notified Body
APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification

PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf


American Association for Laboratory Accreditation

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 - *Requirements for bodies certifying products, processes and services*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 28th day of February 2014.

President & CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2015

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation

United States of America – Telecommunication Certification Body (TCB)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	Initial release	12th March 2015
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In the above table the latest report revision will replace all earlier versions.

TEST RESULT CERTIFICATE

Manufacturer:	Rockwell Collins 400 Collins Rd NE Cedar Rapids Iowa 52498, USA	**Tested By:**	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
EUT:	Wireless connectivity for aircraft	**Telephone:**	+1 925 462 0304
Model:	IMS-6010	**Fax:**	+1 925 462 0306
S/N's:	40RMHC		
Test Date(s):	From 29th Jan to 18th Feb 2015	**Website:**	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC CFR 47 Part 15 Subpart C 15.247 (DTS) & IC RSS 210	**EQUIPMENT COMPLIES**

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

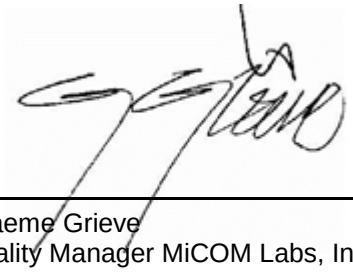
1. This document reports conditions under which testing was conducted and the results of testing performed.

2. Details of test methods used have been recorded and kept on file by the laboratory.

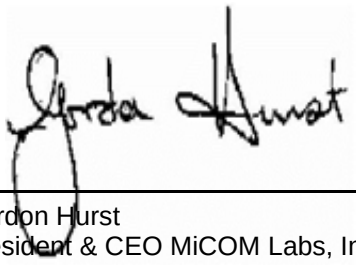
3. Test results apply only to the item(s) tested.

ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:



Graeme Grieve
Quality Manager MiCOM Labs, Inc.



Gordon Hurst
President & CEO MiCOM Labs, Inc.

1. REFERENCES AND MEASUREMENT UNCERTAINTY

1.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	KDB 644545 D01 v01r02	Oct 31 2013	Guidance for IEEE 802.11ac Old rules.
II	662911	Oct 31 2013	Guidance for measurement of output emission of devices that employ single transmitter with multiple outputs or systems with multiple transmitters operating simultaneously in the same frequency band
III	558074 D01	June 6,2014	DTS Meas Guidance v03r02 Guidance for performing compliance measurements on Digital Transmission Systems (DTS) operating under section 15.247.
IV	558074 D02	June 5,2014	DTS Part 15.247 Old Rule. Guidance for performing compliance measurements on Digital Transmission Systems (DTS) operating under section 15.247.
V	A2LA	April 2014	Reference to A2LA Accreditation Status – A2LA Advertising Policy
VI	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
VII	CISPR 22	2008	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
VIII	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
IX	FCC 47 CFR Part 15.247	2014	CFR Title 47 Part 15.247 – Radio Frequency Devices; Subpart C – Intentional Radiators
X	ICES-003	Issue 5 2012	Spectrum Management and Telecommunications; Interference-Causing Equipment Standard. Information Technology Equipment (ITE) – Limits and methods of measurement.
XI	LAB34	Edition 1 August 2002	The expression of uncertainty in EMC Testing
XII	M 3003	Edition 3 Nov. 2012	Expression of Uncertainty and Confidence in Measurements
XIII	RSS-210 Annex 8	2010	Radio Standards Specification 210; License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
XIV	RSS-Gen	2010	General Requirements and Information for the Certification of Radiocommunication Equipment
XV	KDB 644545 D02 v01	June 7th 2012	Alternative Guidance for IEEE 802.11ac and pre-ac Device emissions testing, old rules.
XVI	KDB 644545 D03	August 14th 2014	Guidance for IEEE 802.11ac New Rules v01
XVII	FCC 47 CFR Part 2.1033	2014	FCC requirements and rules regarding photographs and test setup diagrams.

1.2. Test And Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

2. PRODUCT DETAILS AND TEST CONFIGURATIONS

2.1. Technical Details

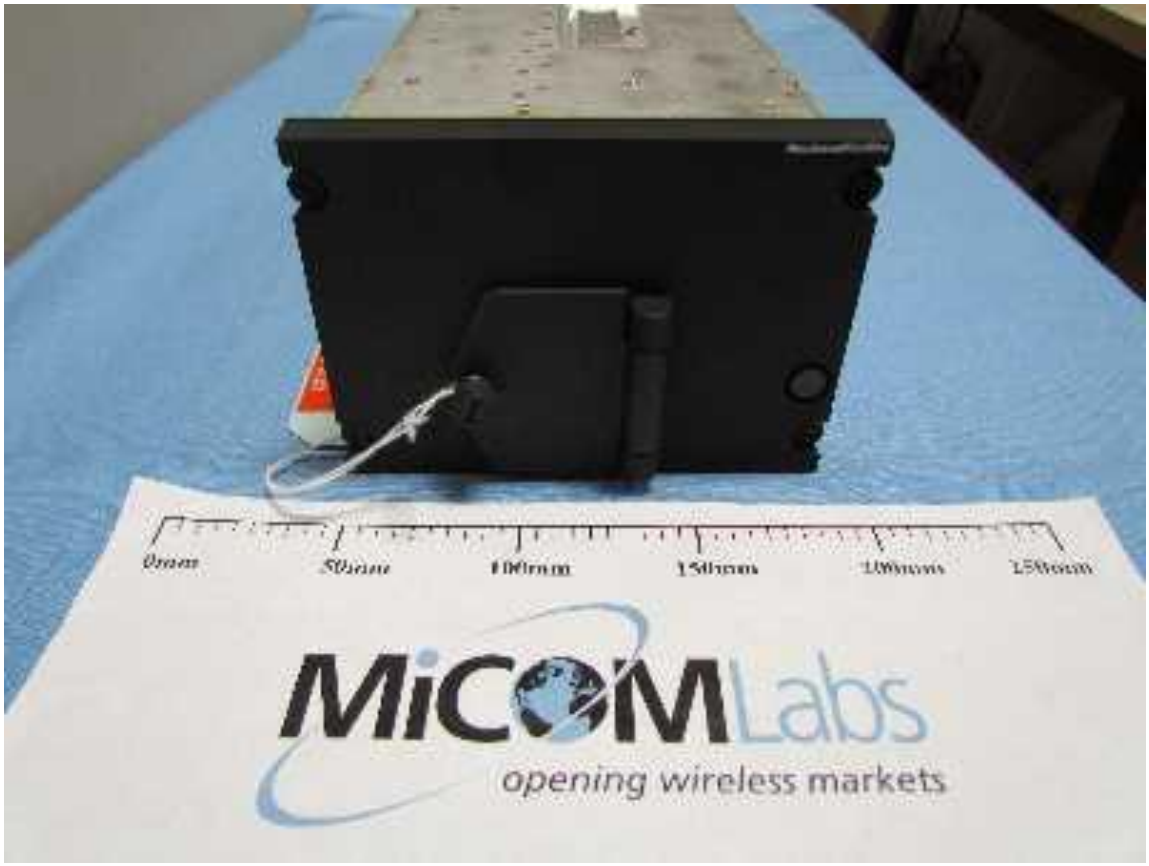
Details	Description
Purpose:	Test of the Rockwell Collins IMS-6010 to FCC CFR 47 Part 15 Subpart C 15.247 (DTS) and Industry Canada RSS-210 regulations.
Applicant:	Rockwell Collins 400 Collins Rd NE Cedar Rapids Iowa 52498, USA
Manufacturer:	As Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	ROCK05-U5
Date EUT received:	26th January 2015
Standard(s) applied:	FCC CFR 47 Part 15 Subpart C 15.247 (DTS) & IC RSS 210
Dates of test (from - to):	29th January to 18th February 2015
No of Units Tested:	1
Type of Equipment:	802.11a/b Wireless connectivity for aircraft systems
Product Trade Name:	Rockwell Collins
Model(s):	IMS-6010
Location for use:	Indoor
Declared Frequency Range(s):	2400 - 2483.5 MHz;
Hardware Rev	822-3132-931
Software Rev	IMSOS - 810-0334-XXX IMSA - 810-0331-XXX
Type of Modulation:	Per 802.11 –CCK, BPSK, QPSK, DSSS, OFDM
EUT Modes of Operation:	2400 - 2483.5 MHz: 802.11b; 802.11g;
Declared Nominal Output Power (Ave):	2400 - 2483.5 MHz: Not Declared: 802.11b; 802.11g;
Transmit/Receive Operation:	Transceiver - Simplex
System Beam Forming:	This device has no beam-forming capability
Rated Input Voltage and Current:	DC only (Battery operated / external supply) 28.0Vdc
Operating Temperature Range:	Declared Range -20C to 60C
ITU Emission Designator:	11b – 16M0G1D 11g - 18M8D1D
Equipment Dimensions:	5.7 x 8.928 x 4.125 (in)
Weight:	6 lbs
Primary function of equipment:	On ground Wireless connectivity for aircraft systems
Secondary function of equipment:	None

2.2. Scope Of Test Program

Rockwell Collins IMS-6010

The scope of the test program was to test the Rockwell Collins IMS-6010 in the frequency ranges 2400 - 2483.5 MHz; for compliance against FCC CFR 47 Part 15 Subpart C 15.247 (DTS) and Industry Canada RSS-210 specifications.

Rockwell Collins IMS-6010



2.3. Equipment Model(s) and Serial Number(s)

Model / Description	Serial no.	Hardware ver.	SoftWare ver.
IMS-6010	40RMHC	822-3132-931	IMSOS - 810-0334-00x IMSA - 810-0331-00x

2.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
External	Sensor Systems Inc.	865-5366-715	Dipole	0.0	-	360	-	2400 - 2483.5
External	Sensor Systems Inc.	865-5366-71S	Dipole	4.8	-	360	-	2400 - 2483.5

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth

2.5. Cabling and I/O Ports

Number and type of I/O ports

Port Type	Max Cable Length	# Of Ports	Screened	Conn Type	Data Type
Ethernet	100m	8	Y	Aircraft Specific	Aircraft Specific
USB	15m	1	N	USB	USB
Antenna	>10m	!	Y	TNC	RF

2.6. Test Configurations

Testing was performed to determine the highest power level versus bit rate. The variant with the highest power was used to exercise the product.

Operational Mode(s) (802.11a/b/g/n/ac)	Data Rate with Highest Power MBit/s	Channel Frequency (MHz)		
		Low	Mid	High
2400 - 2483.5 MHz				
802.11b	1	2,412.00	2,437.00	2,462.00
802.11g	6	2,412.00	2,437.00	2,462.00

Legacy – data rates for 802.11abg products

Radiated emissions testing was performed for the two antennas in worst case mode (mode with the highest spectral density)

2,400 – 2483.5 MHz

15.247	
802.11b,g,	SE 2412
	SE 2437
	SE 2462
	BE 2390
	BE 2483.5

KEY;-

SE – Spurious Emission
BE – Band-Edge

Results for the above configurations are provided in this report

2.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

Conducted Testing
11g mode power setting reduced from 21.0 to 19.5 to comply with the conducted band edge requirements.

Radiated testing
During radiated band-edge emission testing with antennas the EUT output power was reduced in order to comply with the Restricted Band limit criteria.

The following tables summarize the final power setting required on the IMS-6010 with each antenna model to comply with all requirements of the standard.

Antenna: Sensor Systems 865-5366-715 0 dBi (RC Type MAA-6000)

Mode	Transmit Channel		
	2412 MHz	2437 MHz	2462 MHz
11b	19.0	21.0	21.0
11g	18.0	19.5	17.0

Antenna: Sensor Systems 865-5366-71S 4.8 dBi (RC Type MAA-2000)

Mode	Transmit Channel		
	2412 MHz	2437 MHz	2462 MHz
11b	20.0	21.0	21.0
11g	17.5	19.5	17.5

2.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

3. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247** and **Industry Canada RSS-210** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(2) **A8.2(1)** **4.4**	6 dB and 99 % Bandwidths	≥500 kHz	Conducted	Complies	6.1
15.247(b)(3) **15.31(e)** **A8.4(4)**	Peak Output Power Voltage Variation	Shall not exceed 1W Variation of supply voltage 85 % -115 %	Conducted	Complies	6.2
15.247(e) **A8.2**	Peak Power Spectral Density	Shall not be greater than +8 dBm in any 3 kHz band	Conducted	Complies	6.3
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **4.7**	Spurious Emissions (30MHz - 26 GHz b/g and 30 MHz – 40 GHz a)	The radiated emission in any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density	Conducted	Complies	6.4

List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247, Industry Canada RSS-210,** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **2.6** **4.7**	Radiated Emissions	Restricted Bands	Radiated	Complies	6.5
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	
	Radiated Band Edge	Band-edge results Peak Emissions		Complies	
15.205 / **15.209** **2.2**	Radiated Spurious Emissions	Emissions <1 GHz (30M-1 GHz)	Radiated	Complies	6.6
15.207 **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Not Applicable – EUT is dc powered	6.7

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*
Note 3: *Section 2.7 Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix*

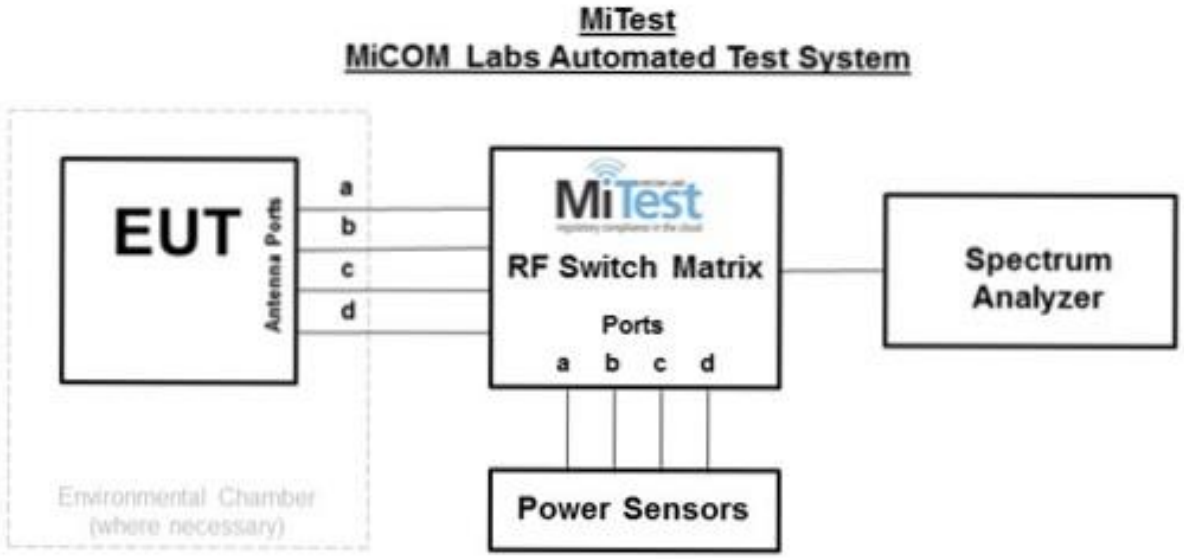
4. TEST EQUIPMENT CONFIGURATION(S)

Conducted

Conducted RF Emission Test Set-up(s) with Environmental Chamber
The following tests were performed using the conducted test set-up shown in the diagram below.

1. RF Output Power*
2. Power Spectral Density
3. Occupied Channel Bandwidth
4. Transmitter Unwanted Emissions in the Out-of-Band Domain*
5. Transmitter Unwanted Emissions in the Spurious Domain (Conducted)
6. Receiver Spurious Emissions (Conducted)

*environmental chamber utilized



Conducted Test Measurement Setup

A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2015
249	Resistance Thermometer	Thermotronics	GR2105-02	9340 #2	30 Oct 2015
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	31 Jul 2015
361	Desktop for RF#1, Labview Software installed	Dell	Vostro 220	WS RF#1	Not Required
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	17 Jul 2015
380	4x4 RF Switch Box	MiCOM Labs	MiTest RF Switch Box	MIC001	30 Jun 2015
390	USB Power Head 50MHz - 24GHz -60 to +20dBm	Agilent	U2002A	MY50000103	17 Oct 2015
398	Test Software	MiCOM	MiTest ATS	Version 1.9	Not Required
405	DC Power Supply 0-60V	Agilent	6654A	MY4001826	Cal when used
408	USB to GPIB interface	National Instruments	GPIB-USB HS	14C0DE9	Not Required
440	USB Wideband Power Sensor	Boonton	55006	9178	25 Sep 2015
441	USB Wideband Power Sensor	Boonton	55006	9179	25 Sep 2015
442	USB Wideband Power Sensor	Boonton	55006	9181	25 Sep 2015
445	PoE Injector	D-Link	DPE-101GL	QTAH1E2000625	Not Required
75	Environmental Chamber	Thermatron	SE-300-2-2	27946	28 Nov 2015
RF#1 GPIB#1	GPIB cable to Power Supply	HP	GPIB	None	Not Required
RF#1 SMA#1	EUT to Mitest box port 1	Flexco	SMA Cable port1	None	30 Jun 2015
RF#1 SMA#2	EUT to Mitest box port 2	Flexco	SMA Cable port2	None	30 Jun 2015
RF#1 SMA#3	EUT to Mitest box port 3	Flexco	SMA Cable port3	None	30 Jun 2015
RF#1 SMA#4	EUT to Mitest box port 4	Flexco	SMA Cable port4	None	30 Jun 2015
RF#1 SMA#SA	Mitest box to SA	Flexco	SMA Cable SA	None	30 Jun 2015
RF#1 USB#1	USB Cable to Mitest Box	Dynex	USB Cable	None	Not Required

5. Measurement and Presentation of Test Data

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

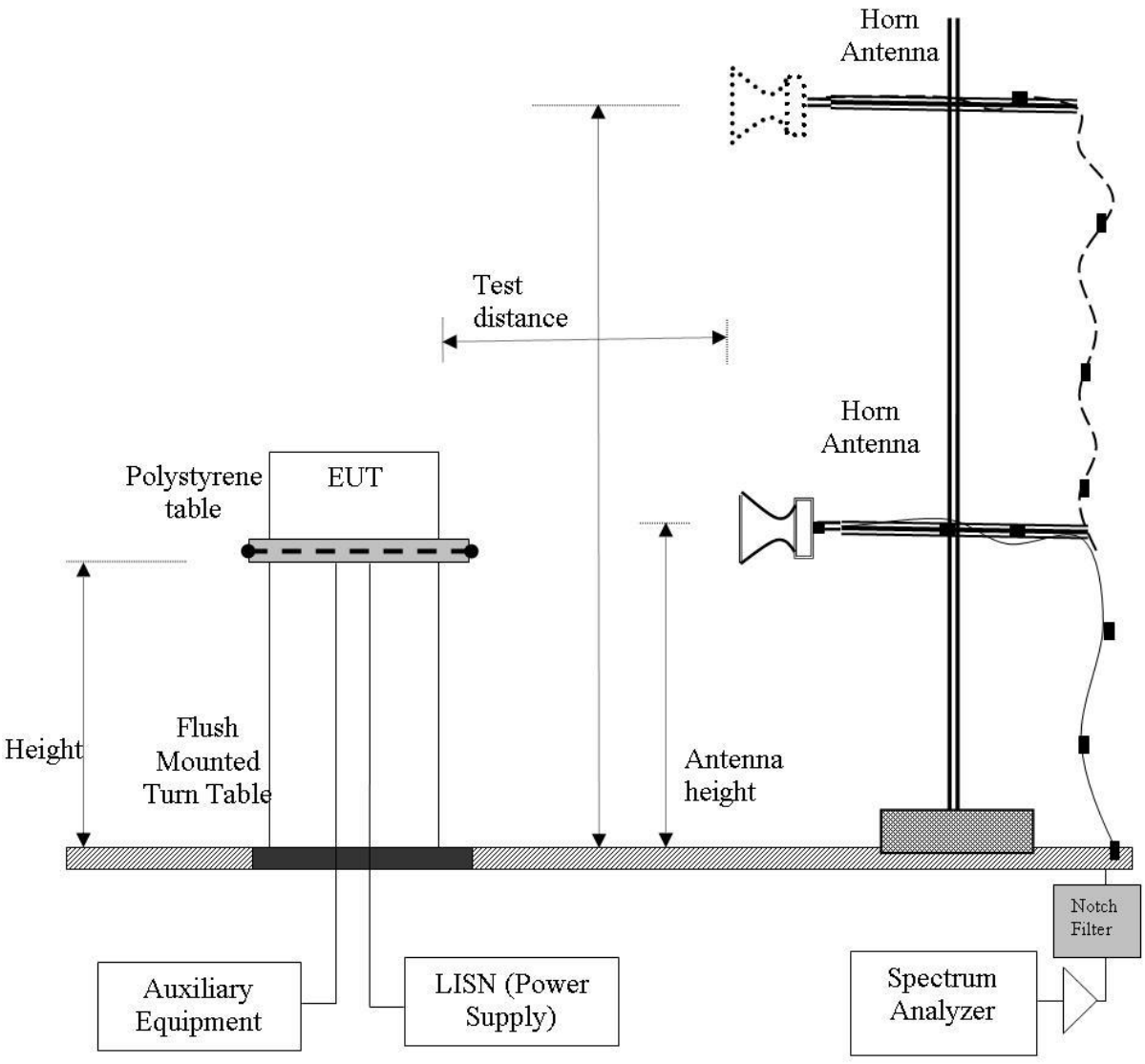
Test and report automation was performed by MiTest. MiTest is an automated test system developed by MiCOM Labs. MiTest is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.

The MiCOM Labs "MiTest" Automated Test System" (Patent Pending)

5.1. Radiated Spurious Emission Test Set-up > 1 GHz

The following tests were performed using the conducted test set-up shown in the diagram below.

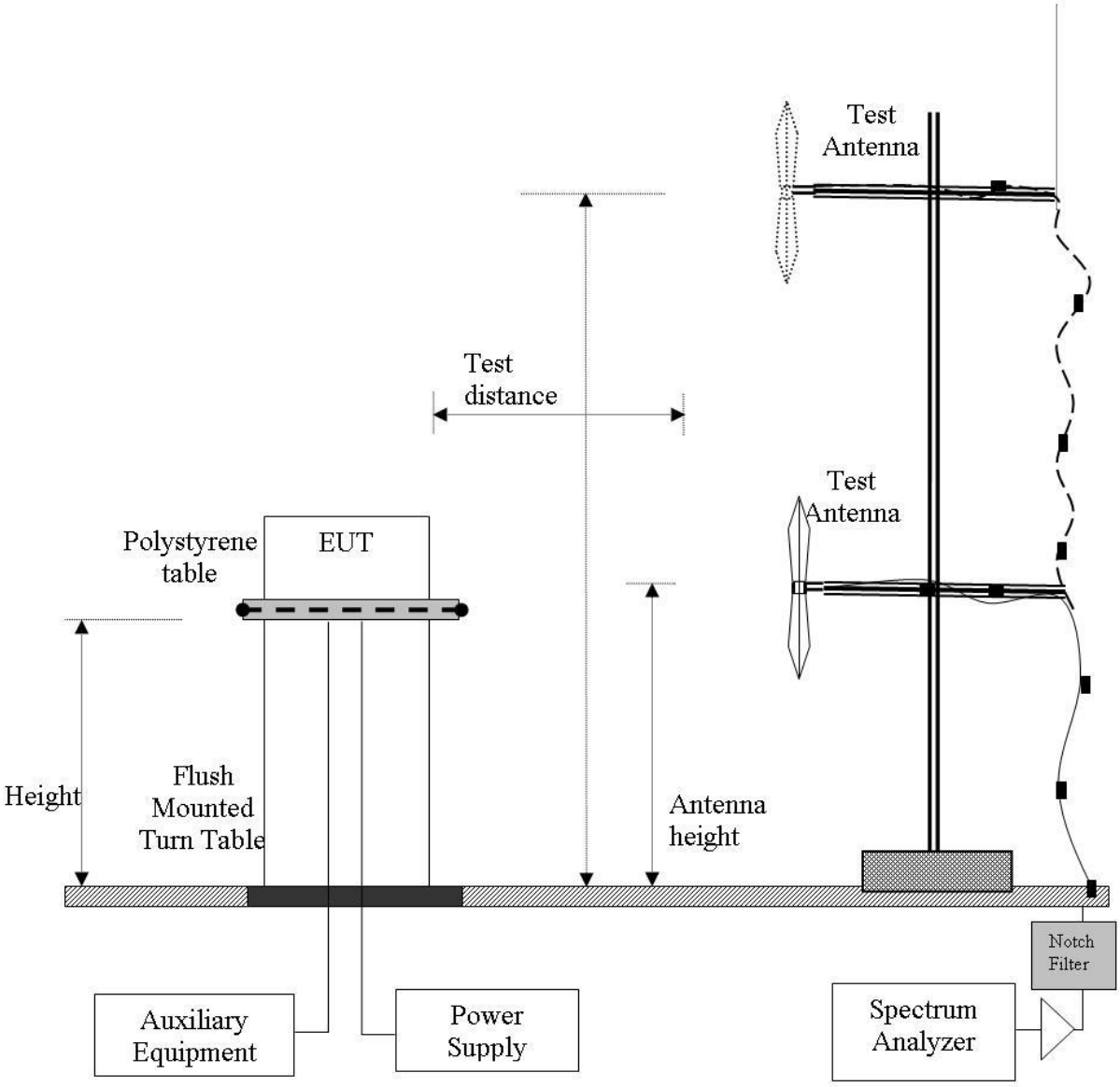
Radiated Emission Measurement Setup – Above 1 GHz



5.2. Digital Emissions Test Set-up (0.03 – 1 GHz)

The following tests were performed using the conducted test set-up shown in the diagram below.

Digital Emission Measurement Setup – Below 1 GHz



Traceability of Test Equipment Utilized for Radiated Emission Testing

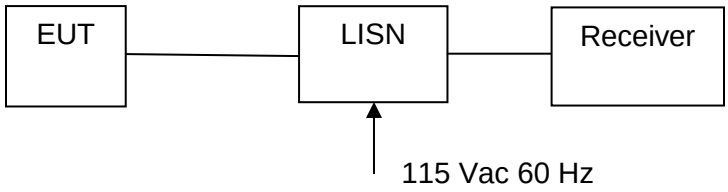
Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2015
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CY101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	31 Jul 2015
301	5470 to 5725 MHz Notch Filter	Microtronics	RBC50704	001	08 Oct 2015
302	5150 to 5350 MHz Notch Filter	Microtronics	BRC50703	002	08 Oct 2015
303	5725 to 5875 MHz Notch filter	Microtronics	BRC50705	003	08 Oct 2015
310	SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	30 Oct 2015
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	14 Aug 2015
342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1	08 Oct 2015
377	Band Rejection Filter 5150 to 5880MHz	Microtronics	BRM50716	034	08 Oct 2015
396	2.4 GHz Notch Filter	Microtronics	BRM50701	001	07 Oct 2015
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	23 Oct 2015
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Oct 2015
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	30 May 2015
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
502	Test Software for Radiated Emissions	EMISoft	Vasona	Version 5 Build 59	Not Required
87	Uninterruptible Power Supply	Falcon Electric	ED2000-1/2LC	F3471 02/01	Cal when used

5.3. AC Wireline Emission Test Set-up

The following tests were performed using the conducted test set-up shown in the diagram below.

1. AC Wireline Conducted Emissions

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

Traceability of Test Equipment Utilized for ac Wireline Emission Testing

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2015
184	Pulse Limiter	Rhode & Schwarz	ESH3Z2	357.8810.52	Cal when used
190	LISN (two-line V-network)	Rhode & Schwarz	ESH3Z5	836679/006	12 Sep 2015
193	Receiver 20 Hz to 7 GHz	Rhode & Schwarz	ESI 7	838496/007	14 Jan 2015
307	BNC-CABLE	Megaphase	1689 1GVT4	15F50B002	Cal when used
316	Dell desktop computer workstation with Vasona	Dell	Desktop	WS04	Not Required

6. TEST RESULTS

6.1. 6 dB & 99% Bandwidth

Conducted Test Conditions for 6 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	6 dB and 99 % Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(2)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 558074 - D01 DTS Measurement Guidance v01: Section 5.1 Emission Bandwidth		

Test Procedure for 6 dB and 99% Bandwidth Measurement
The bandwidth at 6 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

Equipment Configuration for 6 dB & 99% Bandwidth			
Variant:	802.11b	**Duty Cycle (%):**	100
Data Rate:	1 MBit/s	**Antenna Gain (dBi):**	0
Modulation:	CCK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 6 dB Bandwidth (MHz) Port(s)				6 dB Bandwidth (MHz)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	KHz	MHz
2412.0	12.585				12.585	12.585	≥500.0	-12.09
2437.0	12.104				12.104	12.104	≥500.0	-11.60
2462.0	12.585				12.585	12.585	≥500.0	-12.09

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				Maximum 99% Bandwidth (MHz)		
MHz	a	b	c	d			
2412.0	15.952				15.952		
2437.0	15.872				15.872		
2462.0	15.872				15.872		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 6 dB & 99% Bandwidth

Variant:	802.11g	**Duty Cycle (%):**	100
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	0
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 6 dB Bandwidth (MHz) Port(s)				6 dB Bandwidth (MHz)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	KHz	MHz
2412.0	16.353				16.353	16.353	≥500.0	-15.85
2437.0	16.353				16.353	16.353	≥500.0	-15.85
2462.0	16.353				16.353	16.353	≥500.0	-15.85

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				Maximum 99% Bandwidth (MHz)		
MHz	a	b	c	d			
2412.0	18.758				18.758		
2437.0	16.994				16.994		
2462.0	16.994				16.994		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Specification

Limits

§15.247 (a)(2) & RSS-210 §A8.2(1)
The minimum 6 dB bandwidth shall be at least 500 kHz.

§ IC RSS-Gen 4.4.1 Occupied Bandwidth When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

§ IC RSS-Gen 4.4.2 6 dB Bandwidth Where indicated, the 6 dB bandwidth is measured at the points when the spectral density of the signal is 6 dB down from the in –band spectral density of the modulated signal, with the transmitter modulated by a representative signal.

6.2. Conducted Output Power

Conducted Test Conditions for Fundamental Emission Output Power			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Emission Output Power	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(2)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 558074 - D01 DTS Measurement Guidance v01: Section 5.2 Fundamental Emission Output Power KDB 662911 was implemented for In-band power measurements. The measure and sum technique was implemented in all cases.		

Test Procedure for Fundamental Emission Output Power Measurement
The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure peak power. The resolution filter bandwidth was set to 6 dB, peak detector selected and the analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Supporting Information
Calculated Power = A + G + 10 log (1/x) dBm
A = Total Power [10 Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)], G = Antenna Gain,
x = Duty Cycle

Equipment Configuration for Average Output Power

Variant:	802.11b	**Duty Cycle (%):**	100.0
Data Rate:	1 MBit/s	**Antenna Gain (dBi):**	0.0
Modulation:	CCK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Output Power (dBm)				Calculated Total Power Σ Port(s) + DCCF (+0 dB)	Limit	Margin	EUT Power Setting
	Port(s)							
MHz	a	b	c	d	dBm	dBm	dB	
2412.0	19.65				19.65	30.00	-10.35	21.00
2437.0	19.44				19.44	30.00	-10.56	21.00
2462.0	18.81				18.81	30.00	-11.19	21.00

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

DCCF - Duty Cycle Correction Factor

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Average Output Power

Variant:	802.11g	**Duty Cycle (%):**	100.0
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	0.0
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	Tx power reduced to comply with the conducted band edge requirements. See Sect 2.7		

Test Measurement Results

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s) + DCCF (+0 dB)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dB	
2412.0	18.37				18.37	30.00	-11.63	19.50
2437.0	17.61				17.61	30.00	-12.39	19.50
2462.0	16.99				16.99	30.00	-13.01	19.50

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

DCCF - Duty Cycle Correction Factor

Note: click the links in the above matrix to view the graphical image (plot).

Specification

Limits

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1.0 watt.

15.247 (b) (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

15.247 (c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

§15.31 (e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

§ RSS-210 A8.4(4) For systems employing digital modulation techniques operating in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands the maximum peak conducted power shall not exceed 1 watt.

6.3. Power Spectral Density

Conducted Test Conditions for Power Spectral Density			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Power Spectral Density	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (e)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 558074 - D01 DTS Measurement Guidance v01: Section 5.3 Maximum Power Spectral Density Level in the Emission Bandwidth		

Test Procedure for Power Spectral Density

The transmitter output was connected to a spectrum analyzer and the maximum level in a 3 kHz bandwidth was measured. A peak value was found over the full emission bandwidth and the frequency span reduced to obtain enhanced resolution. Sweep time ≥ span / 3 kHz with video averaging turned off. The Peak Power Spectral Density is the highest level found across the emission in a 3 kHz resolution bandwidth.

Supporting Information

Calculated Power = A + 10 log (1/x) dBm

A = Total Power Spectral Density [10 Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)]

x = Duty Cycle

Limit Line: KDB 662911 was implemented for In-band power spectral density (PSD) measurements - Option (2) measure and subtract 10 log (N) dB from the limit for devices with multiple RF ports

Equipment Configuration for Power Spectral Density - Average			
Variant:	802.11b	**Duty Cycle (%):**	100.0
Data Rate:	1 MBit/s	**Antenna Gain (dBi):**	0.00
Modulation:	CCK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/3KHz)				Amplitude Summation + DCCF (+0 dB)	Limit	Margin
MHz	a	b	c	d	dBm/3KHz	dBm/3KHz	dB
2412.0	-13.663				-13.663	8.0	-21.7
2437.0	-14.057				-14.057	8.0	-22.1
2462.0	-14.816				-14.816	8.0	-22.8

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

DCCF - Duty Cycle Correction Factor

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Power Spectral Density - Average			
Variant:	802.11g	**Duty Cycle (%):**	100.0
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	0.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/3KHz)				Amplitude Summation + DCCF (+0 dB)	Limit	Margin
MHz	a	b	c	d	dBm/3KHz	dBm/3KHz	dB
2412.0	-15.695				-15.695	8.0	-23.7
2437.0	-17.836				-17.836	8.0	-25.8
2462.0	-17.816				-17.816	8.0	-25.8

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

DCCF - Duty Cycle Correction Factor

Note: click the links in the above matrix to view the graphical image (plot).

Specification
Peak Power Spectral Density Limits

§15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission

RSS-210 §**A8.2(2)** The transmitter power spectral density (into the antenna) shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0 second duration.

6.4. Conducted Emissions

Conducted Band-Edge Emissions

Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Max Unwanted Emission Levels	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (d)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 558074 - D01 DTS Measurement Guidance v01: Section 5.4 Maximum Unwanted Emission Levels		

Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement
Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Equipment Configuration for Conducted Low Band-Edge Emissions - Average			
Variant:	802.11b	**Duty Cycle (%):**	100
Data Rate:	1 MBit/s	**Antenna Gain (dBi):**	0
Modulation:	CCK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2412.0 MHz					
Band-Edge Frequency:	2400.0 MHz					
Test Frequency Range:	2350.0 - 2422.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-42.60	-30.00	2401.80			-1.800

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted Low Band-Edge Emissions - Average			
Variant:	802.11g	**Duty Cycle (%):**	100
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	0
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2412.0 MHz						
Band-Edge Frequency:	2400.0 MHz						
Test Frequency Range:	2350.0 - 2422.0 MHz						
Port(s)	**Band-Edge Markers and Limit**			**Band-Edge Revised Limit**			**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**Plot Limit (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-30.39	-32.00	2397.90	-30.39	-30.00	2400.10	-0.100

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted High Band-Edge Emissions - Average			
Variant:	802.11b	**Duty Cycle (%):**	100
Data Rate:	1 MBit/s	**Antenna Gain (dBi):**	0
Modulation:	CCK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2462.0 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2452.0 - 2524.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-55.57	-30.00	2471.90			-11.600

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted High Band-Edge Emissions - Average			
Variant:	802.11g	**Duty Cycle (%):**	100
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	0
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	Tx power reduced to comply with the conducted band edge requirements. See Sect 2.7		

Test Measurement Results

Channel Frequency:	2462.0 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2452.0 - 2524.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-45.46	-33.00	2474.50			-9.000

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Conducted Spurious Emissions

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	802.11b	**Duty Cycle (%):**	100
Data Rate:	1 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	CCK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Frequency Range	Transmitter Conducted Spurious Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
2412.0	30.0 - 26000.0	-61.483	-43.00						
2437.0	30.0 - 26000.0	-61.483	-42.00						
2462.0	30.0 - 26000.0	-61.483	-43.00						

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	802.11g	**Duty Cycle (%):**	100
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Frequency Range	Transmitter Conducted Spurious Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
2412.0	30.0 - 26000.0	-59.545	-42.00						
2437.0	30.0 - 26000.0	-61.483	-43.00						
2462.0	30.0 - 26000.0	-61.483	-44.00						

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Specification

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
2,400 MHz	2,483.5 MHz	≥ 20 dB
5725 MHz	5850 MHz	

§15.247(d) and RSS-210 §A8.5 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

§15.247(d)
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

RSS-210 §A8.5 If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

RSS-Gen §4.7
The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz , whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

6.5. Radiated Emission Testing

Transmitter Radiated Spurious Emissions (above 1 GHz); Peak Field Strength Measurements; and Radiated Band Edge Measurements – Restricted Bands

FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2, §2.6
Industry Canada RSS-Gen §4.7

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Operational Modes

Operational mode(s) tested for spurious emissions were the modes which delivered maximum spectral density.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

FS = R + AF + CORR - FO

where: FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

For example:
Given receiver input reading of 51.5 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

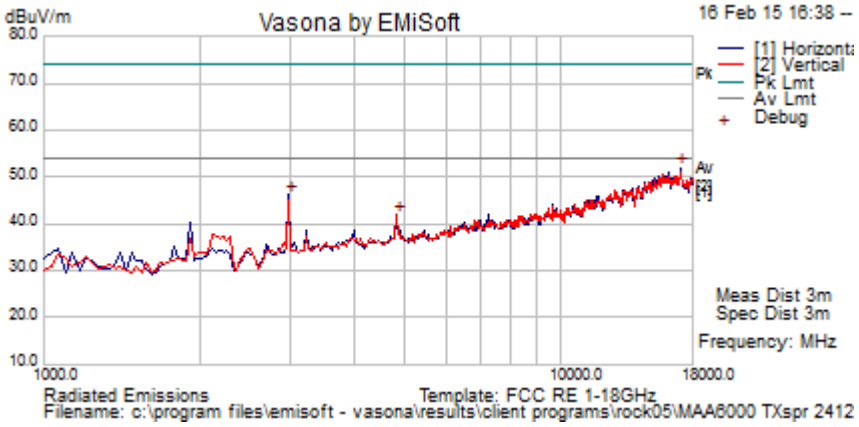
40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

NOTE: KDB 662911 was implemented for Out-of-Band measurements. Where necessary Option (2) Measure and add 10 log (N) dB was implemented

Antenna-Sensor Systems 865-5366-715 0 dBi (RC Type MAA-6000)

Antenna Spurious and Band-Edge Emissions

Test Freq.	2412 MHz	**Engineer**	JMH
Variant	802.11b; 1 Mbs	**Temp (ºC)**	19
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	40
Power Setting	21	**Press. (mBars)**	1004
Antenna	MAA-6000	**Duty Cycle (%)**	100
Test Notes 1	EUT model IMS-6010, SN# 40RMHC		
Test Notes 2	28 V DC		

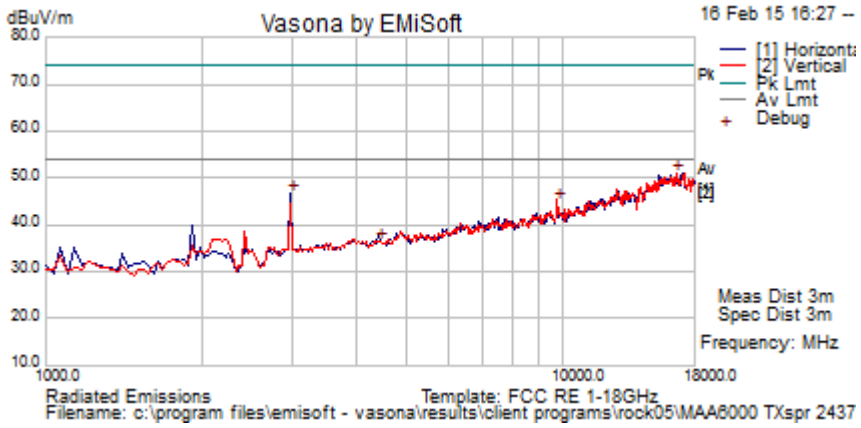


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
17046.092	38.8	12.4	0.8	52.0	Peak [Scan]	H						NRB
4823.978	47.4	5.7	-11.2	41.9	Peak [Scan]	V	98	-1	54.0	-12.1	Pass	RB
3000.041	52.6	4.4	-11.0	46.0	Peak [Scan]	H						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2437 MHz	**Engineer**	JMH
Variant	802.11b; 1 Mbs	**Temp (ºC)**	19
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	40
Power Setting	21	**Press. (mBars)**	1004
Antenna	MAA-6000	**Duty Cycle (%)**	100
Test Notes 1	EUT model IMS-6010, SN# 40RMHC		
Test Notes 2	28 V DC		

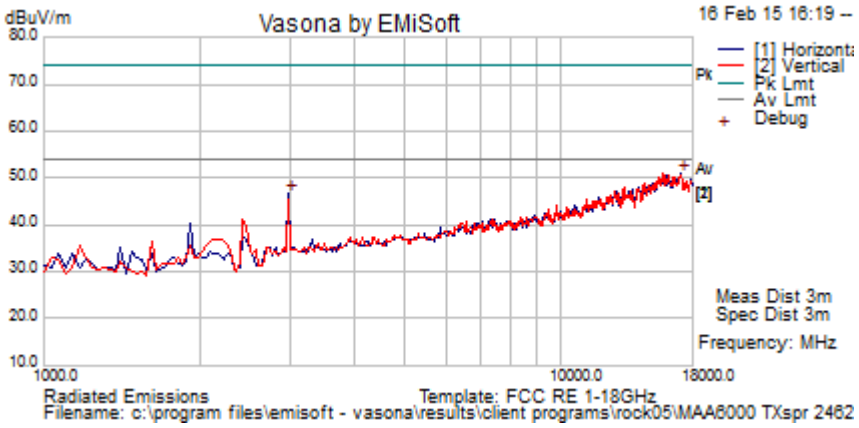


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
16569.138	37.5	11.9	1.6	51.0	Peak [Scan]	V						Noise
3000.060	53.1	4.4	-11.0	46.5	Peak [Scan]	H						NRB
9759.86	42.6	8.6	-6.2	44.9	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2462 MHz	**Engineer**	JMH
Variant	802.11b; 1 Mbs	**Temp (ºC)**	19
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	40
Power Setting	21	**Press. (mBars)**	1004
Antenna	MAA-6000	**Duty Cycle (%)**	100
Test Notes 1	EUT model IMS-6010, SN# 40RMHC		
Test Notes 2	28 V DC		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
17114.228	38.0	12.5	0.5	50.9	Peak [Scan]	H						NRB
3000.054	53.0	4.4	-11.0	46.4	Peak [Scan]	H						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

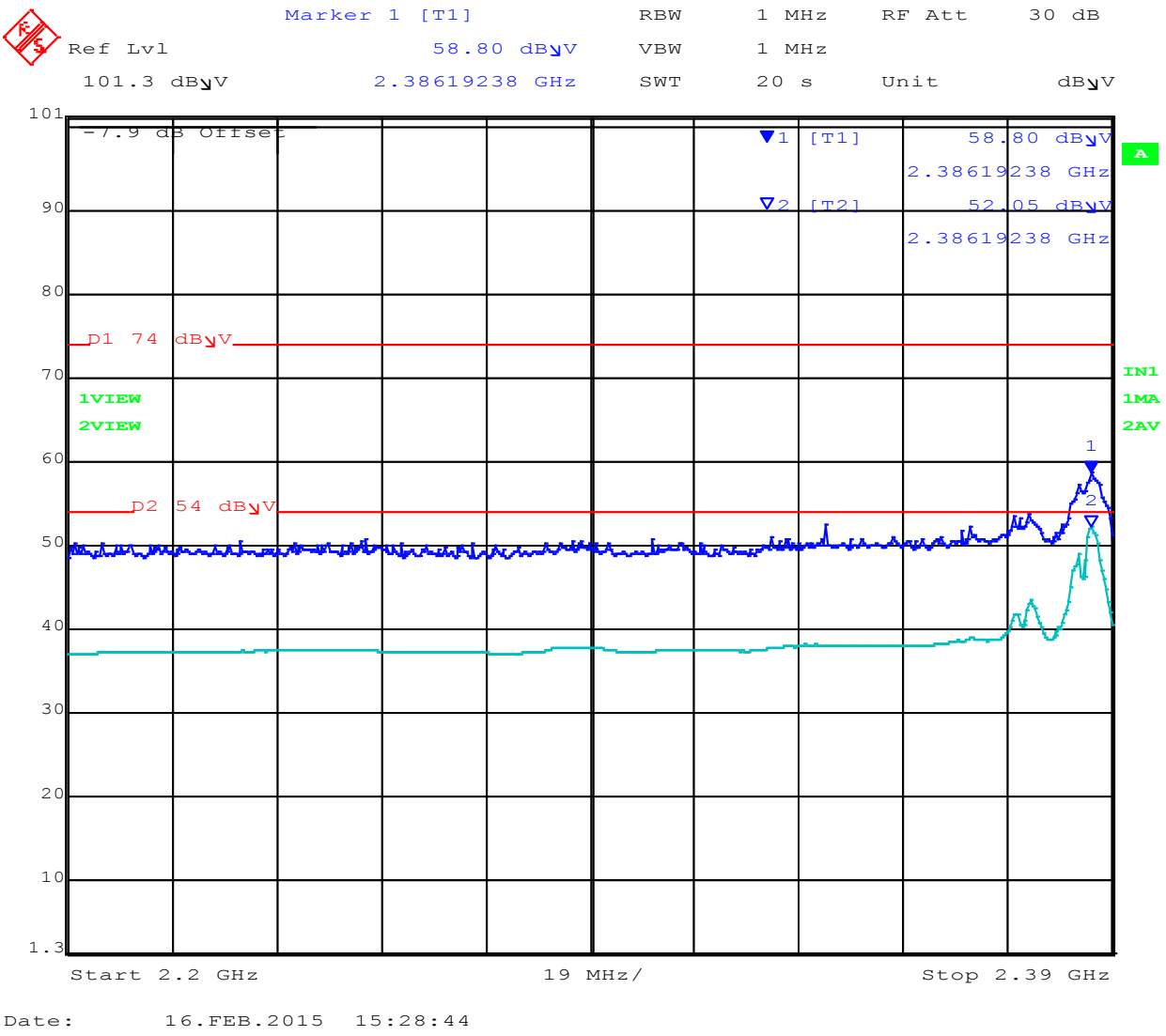
Band-Edge - Antenna Sensor Systems 865-5366-715 0 dBi (RC Type MAA-6000)

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

2.4 GHz Frequency Band

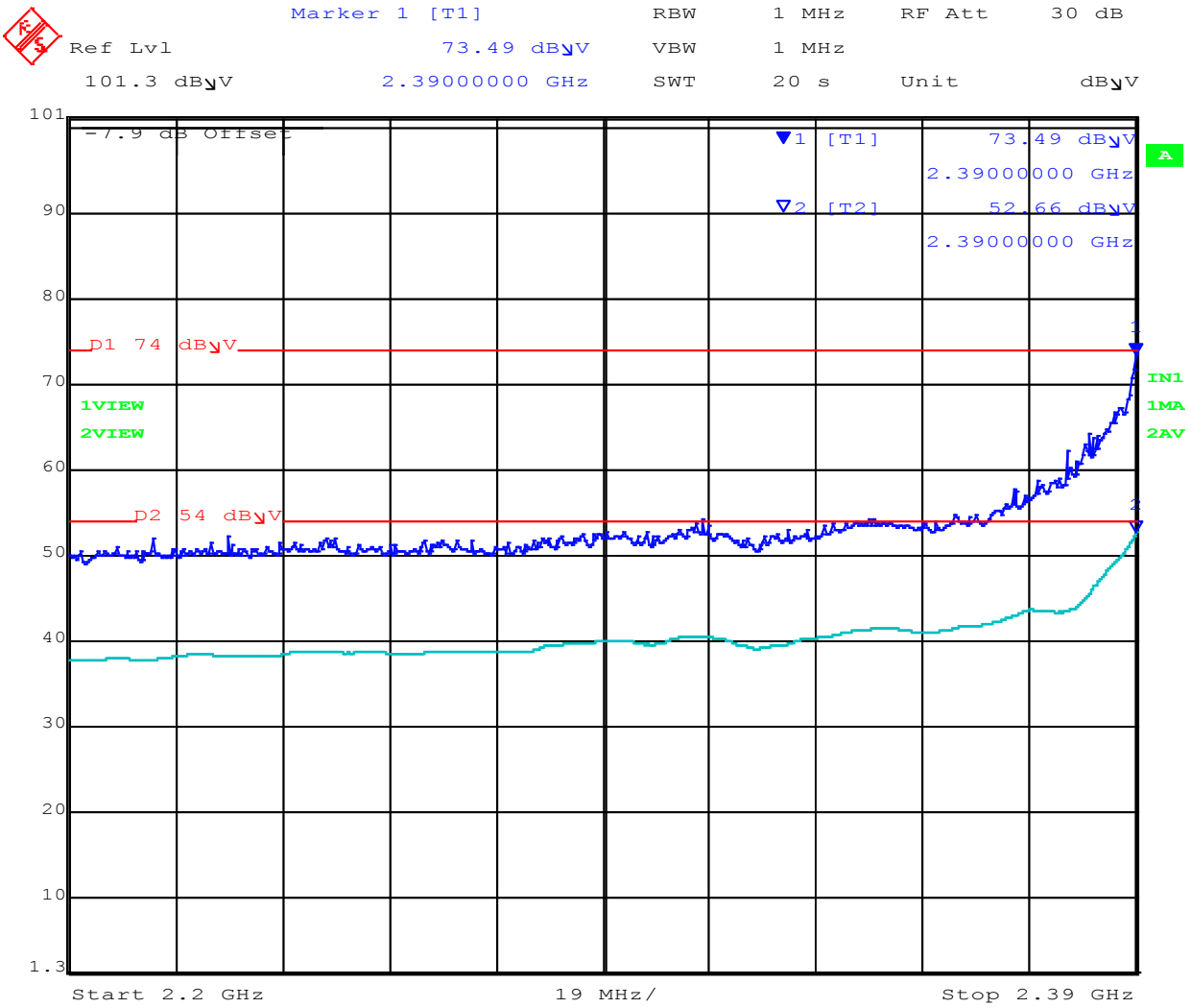
	2390 MHz			2483.5 MHz		
	dBµV		Power Setting	dBµV		Power Setting
Operational Mode	Peak	Average		Peak	Average	
b	58..80	53.05	19.0	58.06	50.92	21.0
g	73.49	53.66	18.0	72.69	52.12	17.0

802.11b Radiated Band-Edge @ 2390 MHz



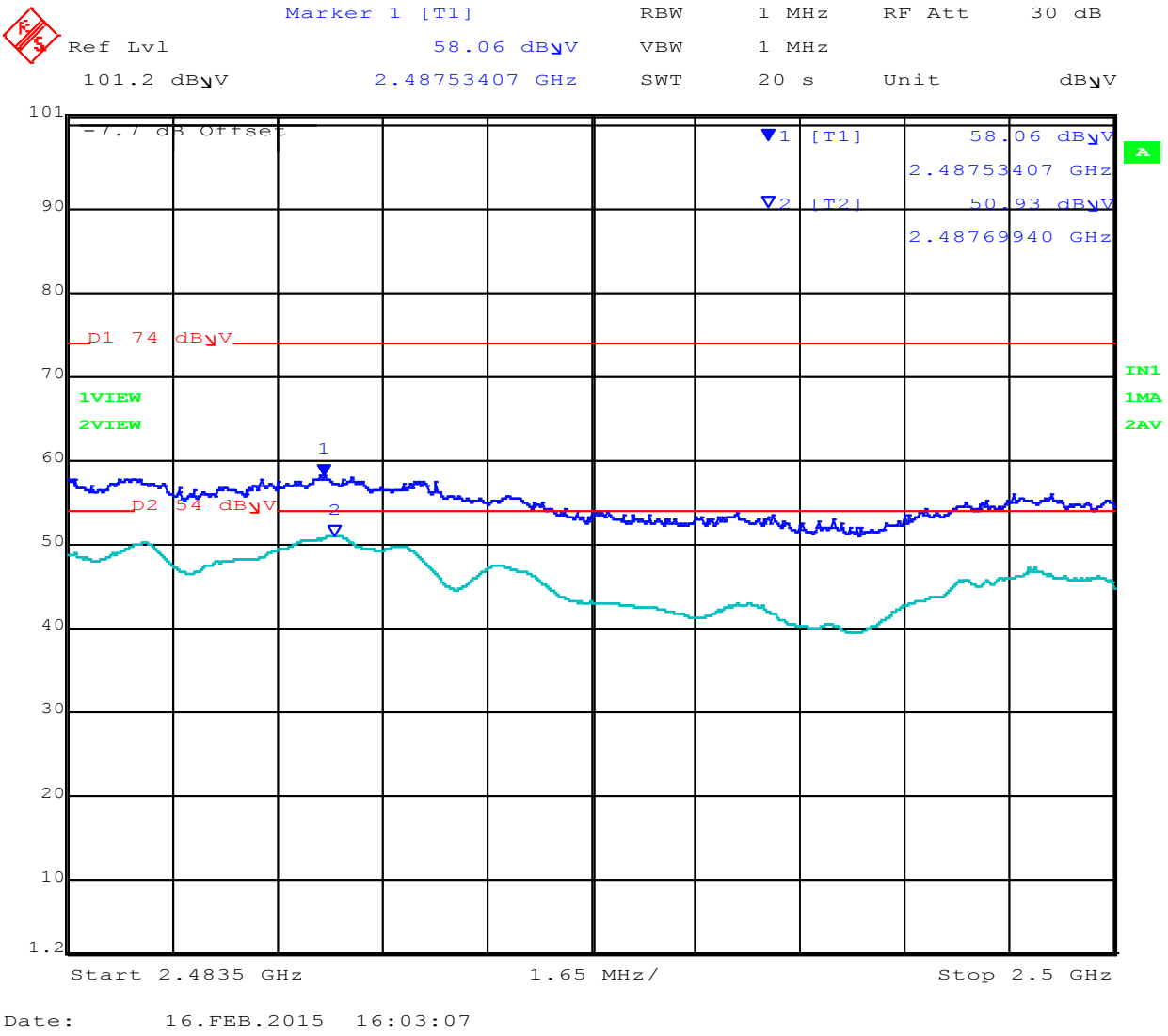
Date: 16.FEB.2015 15:28:44

802.11g Radiated Band-Edge @ 2390 MHz

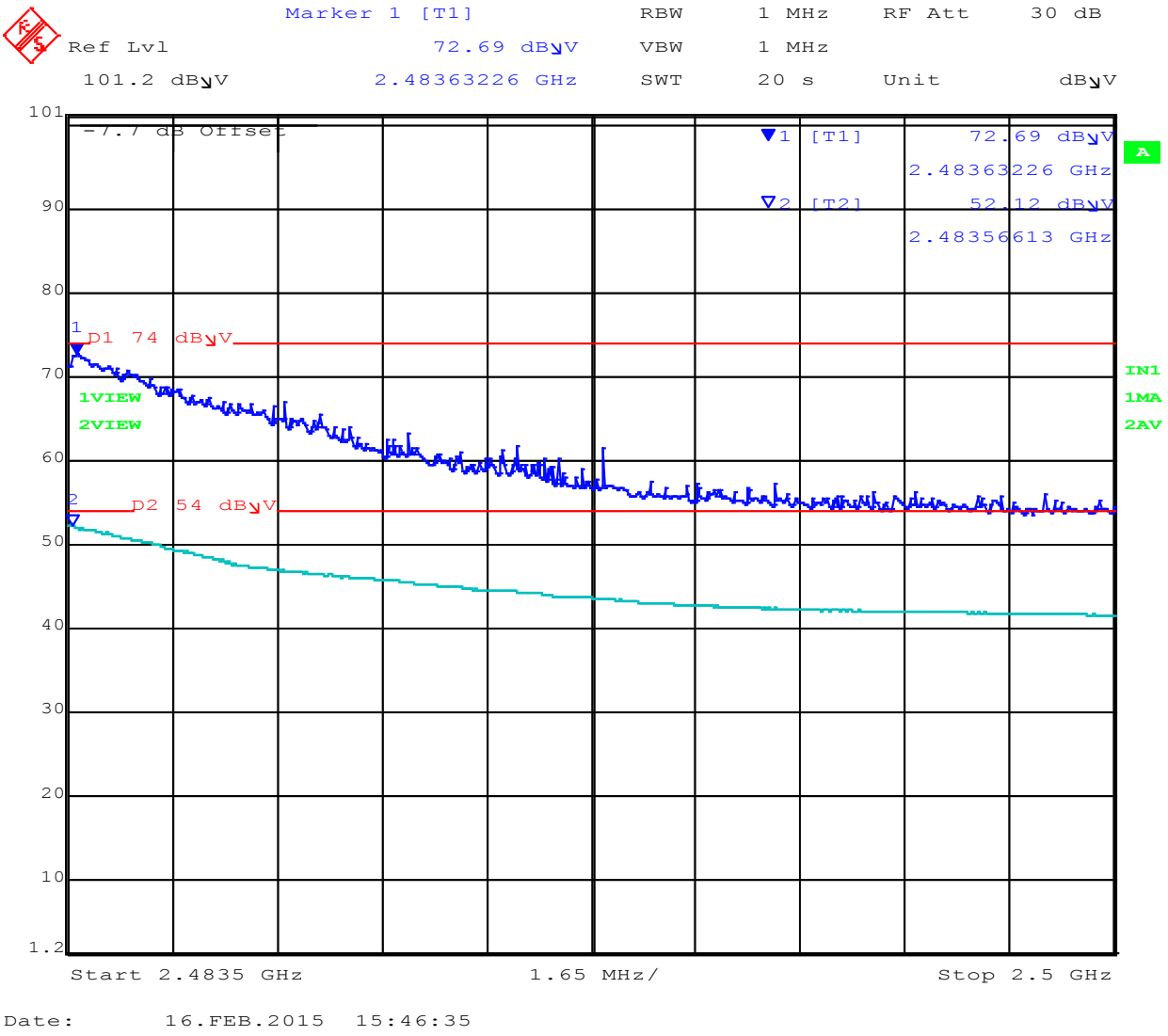


Date: 16.FEB.2015 15:34:25

802.11b Radiated Band-Edge @ 2483.5 MHz



802.11g Radiated Band-Edge @ 2483.5 MHz



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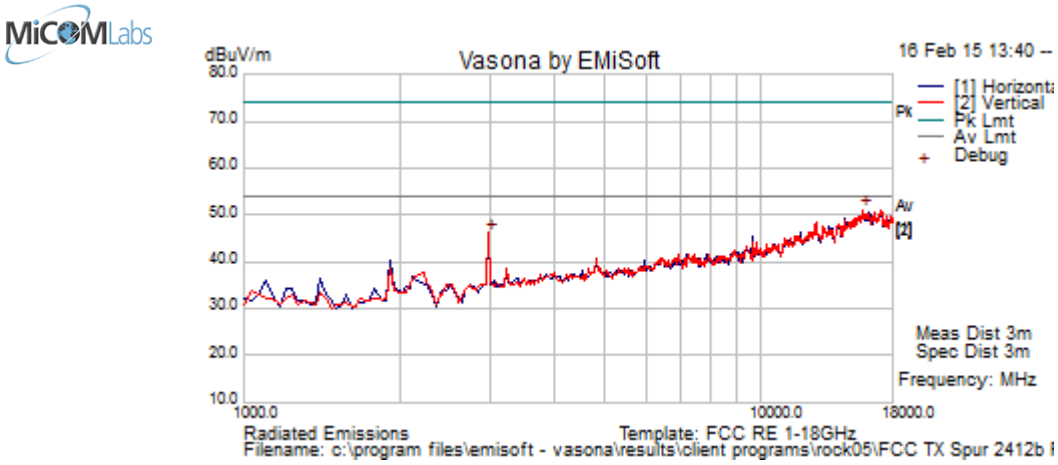
Antenna- Sensor Systems 865-5366-71S 4.8 dBi antenna (RC Type MAA-2000)

Spurious and Band-Edge Emissions

Test Freq.	2412 MHz	**Engineer**	JMH
Variant	802.11b; 1 Mbs	**Temp (ºC)**	19
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	40
Power Setting	21	**Press. (mBars)**	1004
Antenna	MAA-2000	**Duty Cycle (%)**	100
Test Notes 1	EUT model IMS-6010, SN# 40RMHC		
Test Notes 2	28 V DC		

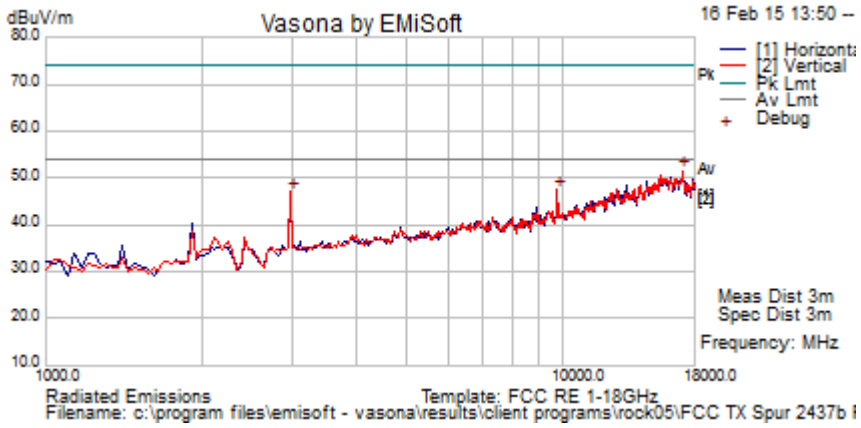


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
3000.077	52.8	4.4	-11.0	46.2	Peak [Scan]	V						NRB
15819.639	39.3	11.7	0.0	51.1	Peak [Scan]	V	100	0	54.0	-2.9	Pass	Noise

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2437 MHz	**Engineer**	JMH
Variant	802.11b; 1 Mbs	**Temp (ºC)**	19
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	40
Power Setting	21	**Press. (mBars)**	1004
Antenna	MAA-2000	**Duty Cycle (%)**	100
Test Notes 1	EUT model IMS-6010, SN# 40RMHC		
Test Notes 2	28 V DC		

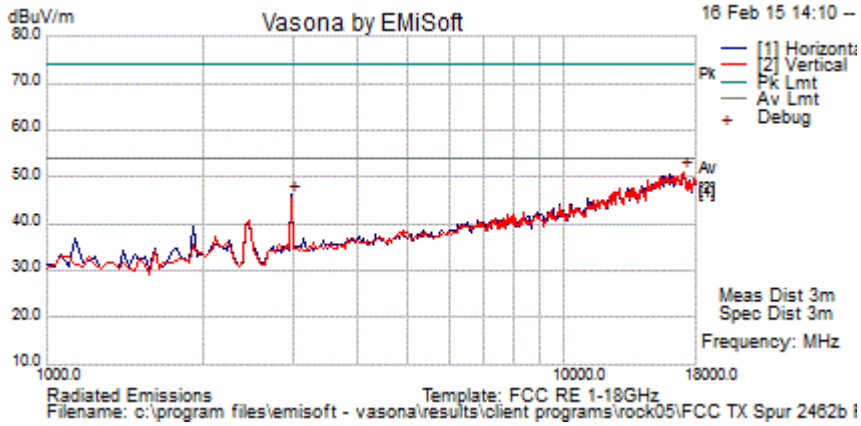


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
17080.160	38.4	12.5	0.6	51.5	Peak [Scan]	V						NRB
3000.064	53.7	4.4	-11.0	47.1	Peak [Scan]	V						NRB
9755.602	45.0	8.6	-6.2	47.4	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2462 MHz	**Engineer**	JMH
Variant	802.11b; 1 Mbs	**Temp (ºC)**	19
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	40
Power Setting	21	**Press. (mBars)**	1004
Antenna	MAA-2000	**Duty Cycle (%)**	100
Test Notes 1	EUT model IMS-6010, SN# 40RMHC		
Test Notes 2	28 V DC		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
17114.228	38.1	12.5	0.5	51.0	Peak [Scan]	V	200					NRB
3000.009	52.8	4.4	-11.0	46.3	Peak [Scan]	H	100					NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

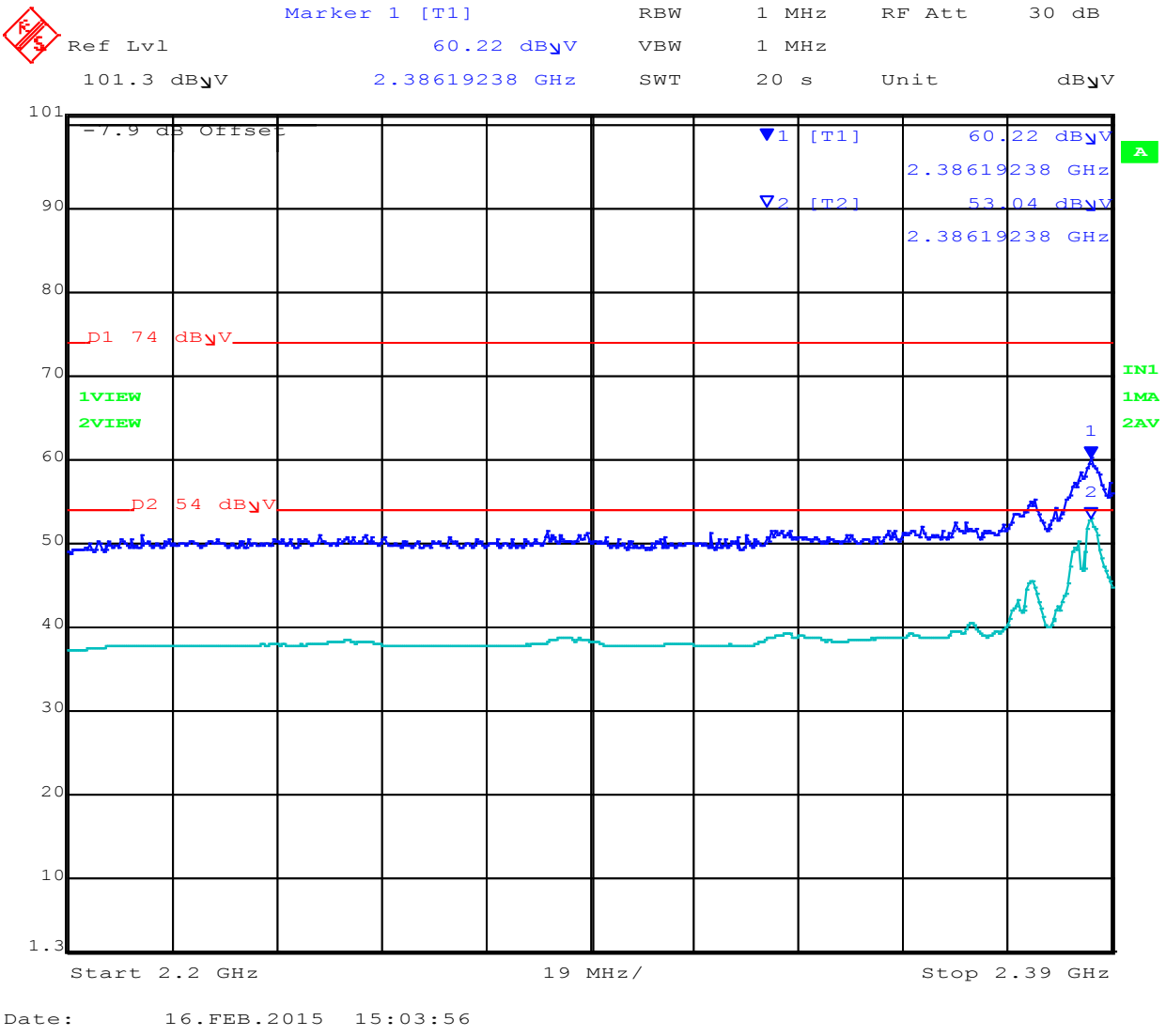
Band-Edge - Antenna Sensor Systems 865-5366-71S 4.8 dBi (RC Type MAA-2000)

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

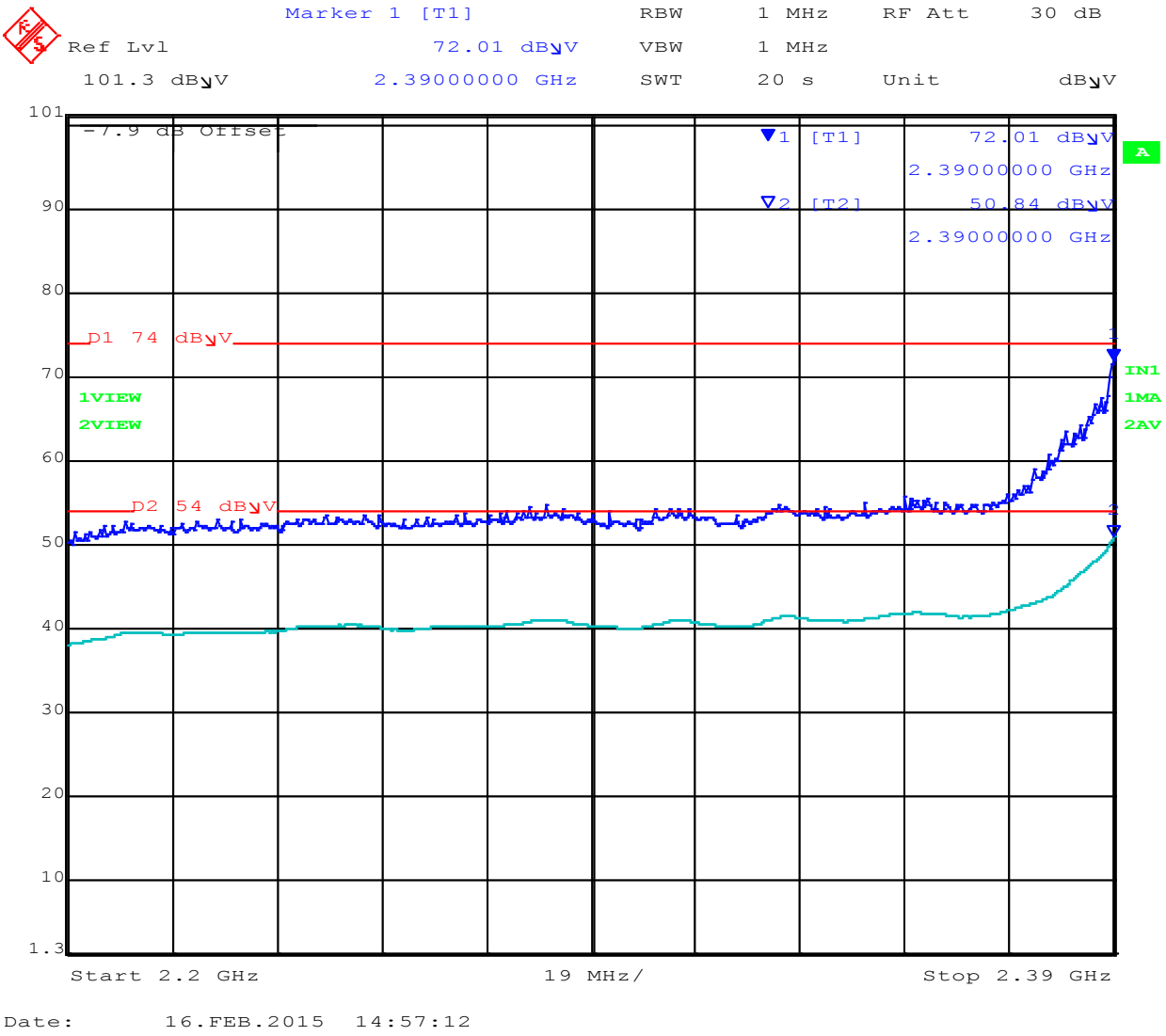
2.4 GHz Frequency Band

	2390 MHz			2483.5 MHz		
	dBµV		Power Setting	dBµV		Power Setting
Operational Mode	Peak	Average		Peak	Average	
b	60.22	53.04	20.0	58.68	51.39	21.0
g	72.01	50.04	17.5	72.24	50.14	17.5

802.11b Radiated Band-Edge @ 2390 MHz



802.11g Radiated Band-Edge @ 2390 MHz



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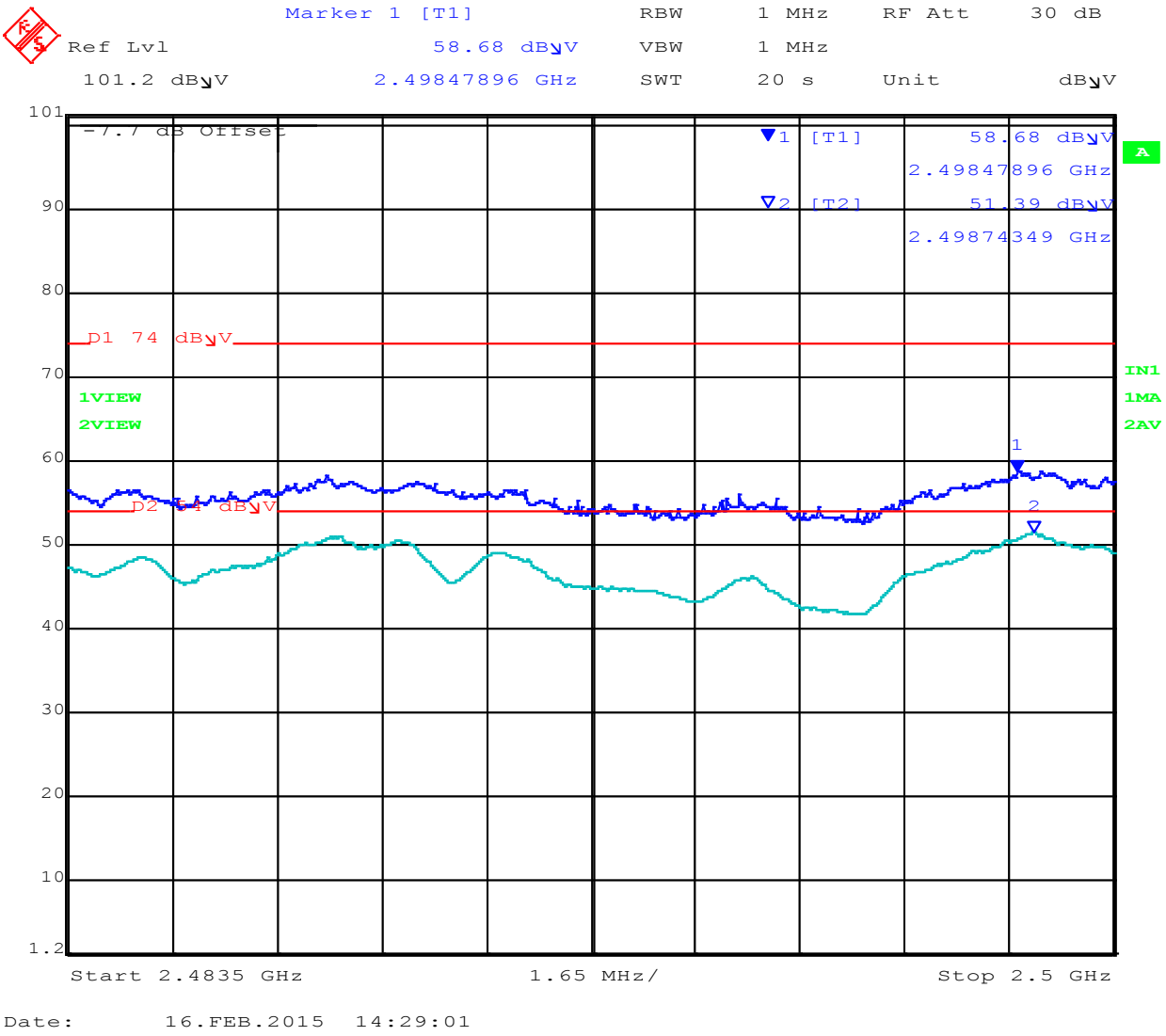
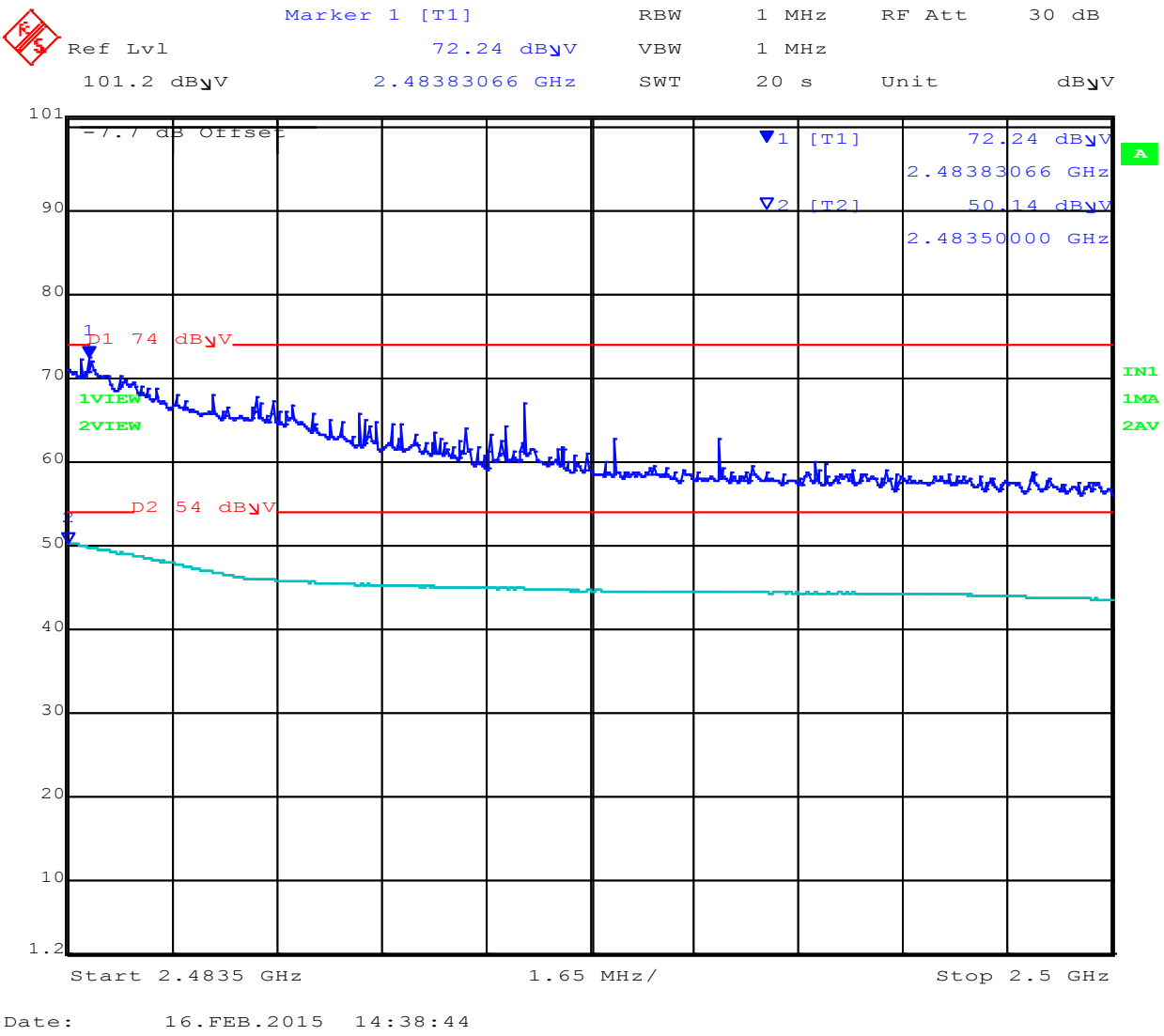
802.11b Radiated Band-Edge @ 2483.5 MHz



802.11g Radiated Band-Edge @ 2483.5 MHz



Specification Limits

FCC §15.247(d) and RSS-210 §A8.5 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

FCC §15.247(d)
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

IC RSS-210 §A8.5 If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

IC RSS-Gen §4.7
The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz , whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

FCC §15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) Limit Matrix

Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

6.6. Digital Emissions (0.03-1 GHz)

FCC, Part 15 Subpart C §15.205/ §15.209
Industry Canada RSS-210 §2.2

Test Procedure

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 7 Test Set-Up Photographs.

The EUT had two methods of powering on ac/dc converter and Power over Ethernet (POE). Both modes were tested for emissions below 1GHz.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

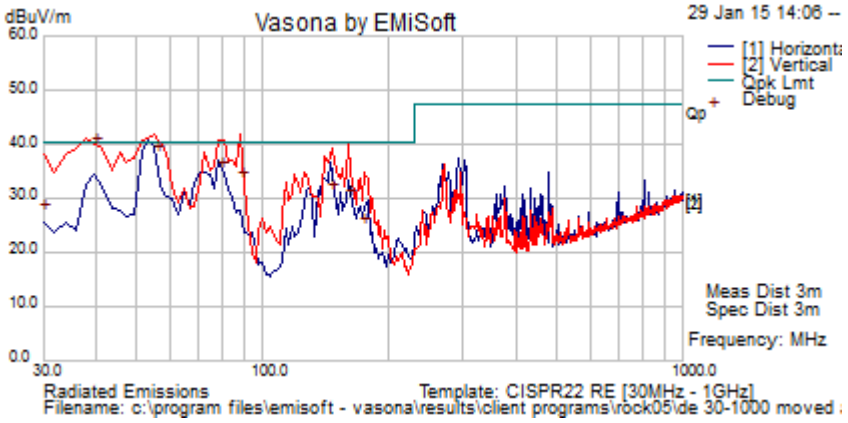
$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 dB\mu V/m$$

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

$$Level\ (dB\mu V/m) = 20 * Log\ (level\ (\mu V/m))$$

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

Test Freq.	NA	**Engineer**	JMH
Variant	Digital Emissions	**Temp (ºC)**	18
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	33
Power Setting	NA	**Press. (mBars)**	1000
Antenna	NA		
Test Notes 1	Monitor Keyboard and Mouse Disconnected, front panel closed		
Test Notes 2	EUT model IMS-6010, SN# 40RMHC, 28V DC		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
55.815	58.3	3.7	-23.8	38.200	Quasi Max	V	100	308	40.5	-2.3	Pass	
39.786	53.0	3.6	-17.0	39.5	Quasi Max	V	102	24	40.5	-1.0	Pass	
80.125	54.5	3.9	-23.2	35.2	Quasi Max	V	119	255	40.5	-5.3	Pass	
88.552	53.2	3.9	-23.7	33.4	Quasi Max	V	113	-1	40.5	-7.1	Pass	
30.165	33.6	3.5	-9.6	27.5	Quasi Max	V	99	272	40.5	-13.0	Pass	
160.145	44.0	4.3	-18.3	30.0	Quasi Max	V	110	8	40.5	-10.5	Pass	
146.398	45.2	4.2	-18.4	31.1	Quasi Max	V	121	26	40.5	-9.4	Pass	
173.973	39.7	4.4	-19.5	24.5	Quasi Max	V	123	222	40.5	-16.0	Pass	

Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

Specification

Limits

§15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

§15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) and **RSS-Gen §2.2** Limit Matrix

Frequency(MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

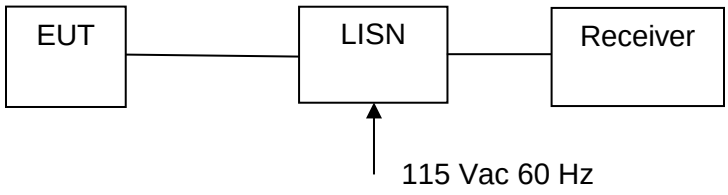
6.7. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §7.2.2

Not Applicable – the Rockwell Collins IMS-6010 is dc powered only.

Test Procedure
The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)

Ambient conditions.
Temperature: 19°C Relative humidity:38 % Pressure: 1004 mbar

Specification

Limit

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

RSS-Gen §7.2.2
The radio frequency voltage that is conducted back into the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The tighter limit applies at the frequency range boundaries.

§15.207 (a) and **RSS-Gen §7.2.2** Limit Matrix
The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

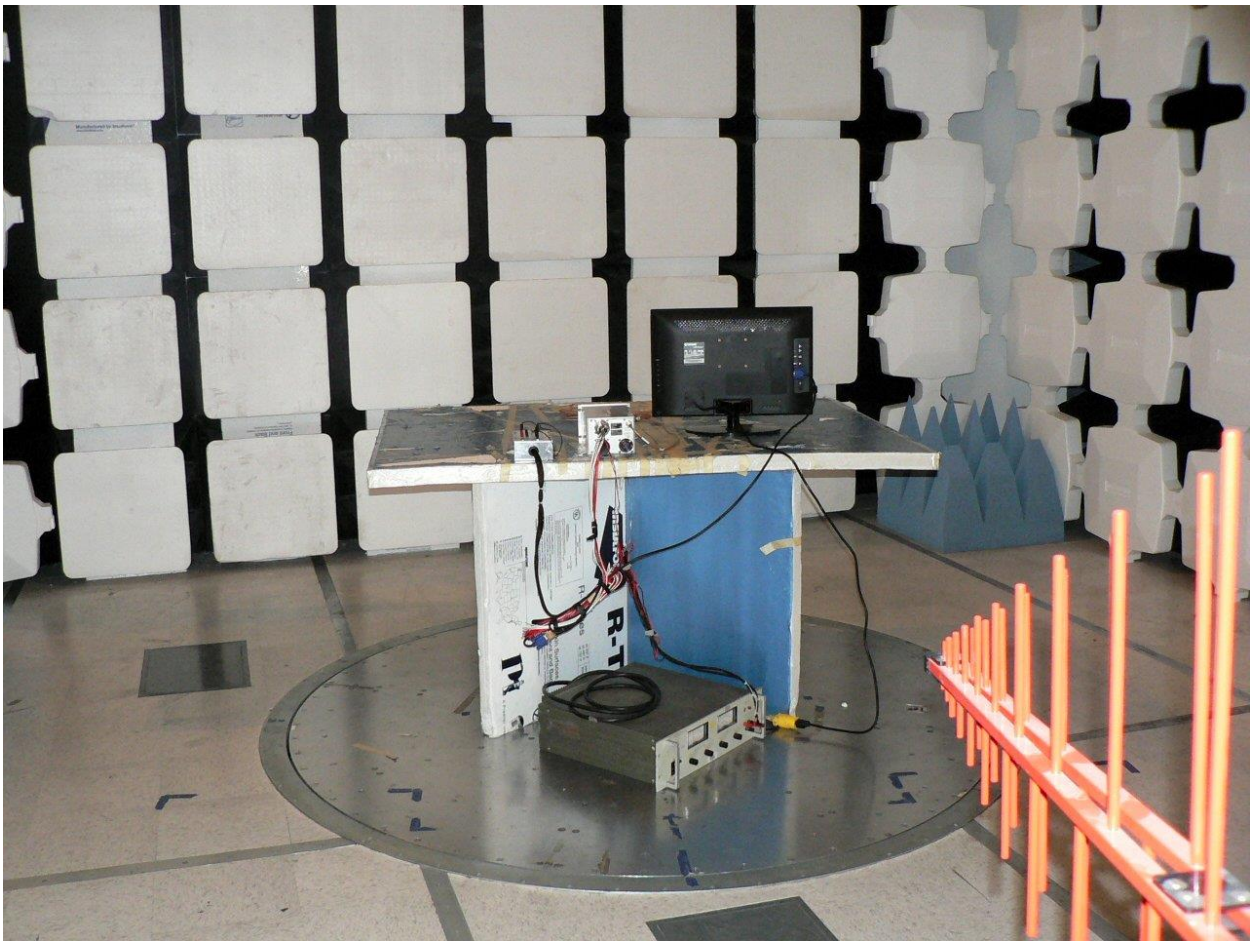
Laboratory Measurement Uncertainty for Conducted Emissions

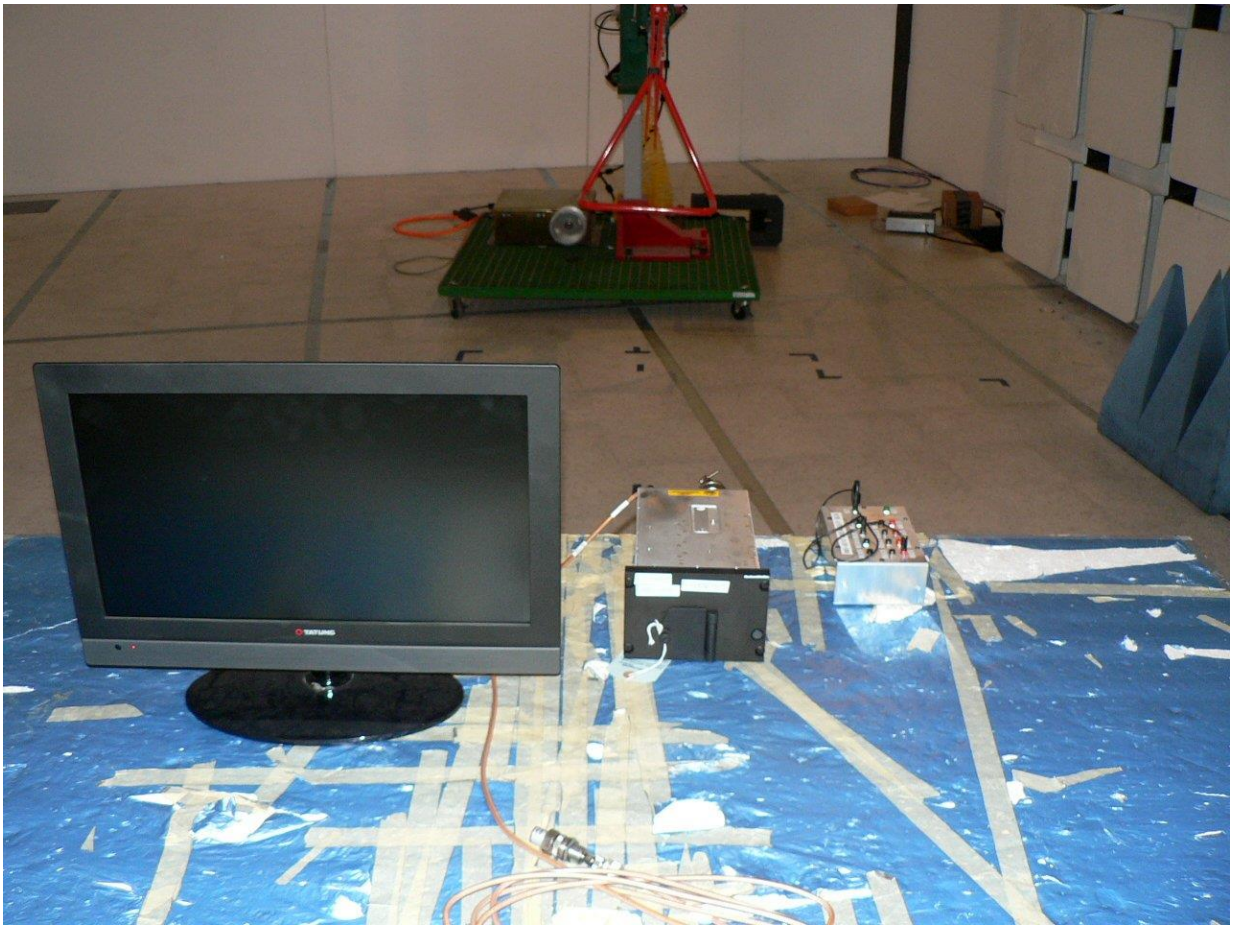
Measurement uncertainty	±2.64 dB

7. PHOTOGRAPHS

7.1. Conducted Test Setup

1.1. Radiated Emissions Test Setup <1 GHz



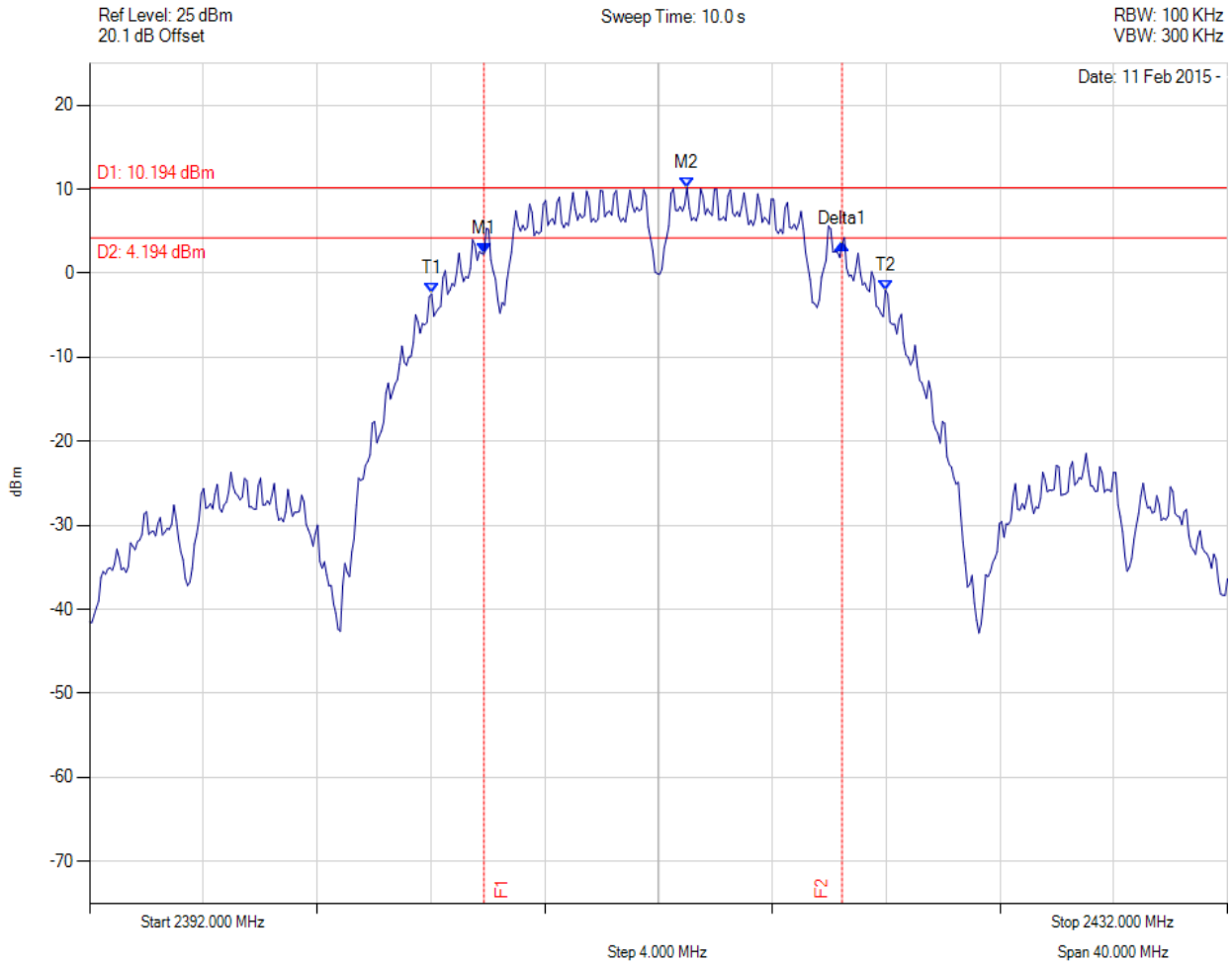


8. APPENDIX- SUPPORTING INFORMATION

8.1. 6 dB & 99% Bandwidth

6 dB & 99% BANDWIDTH

Variant: 802.11b, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc

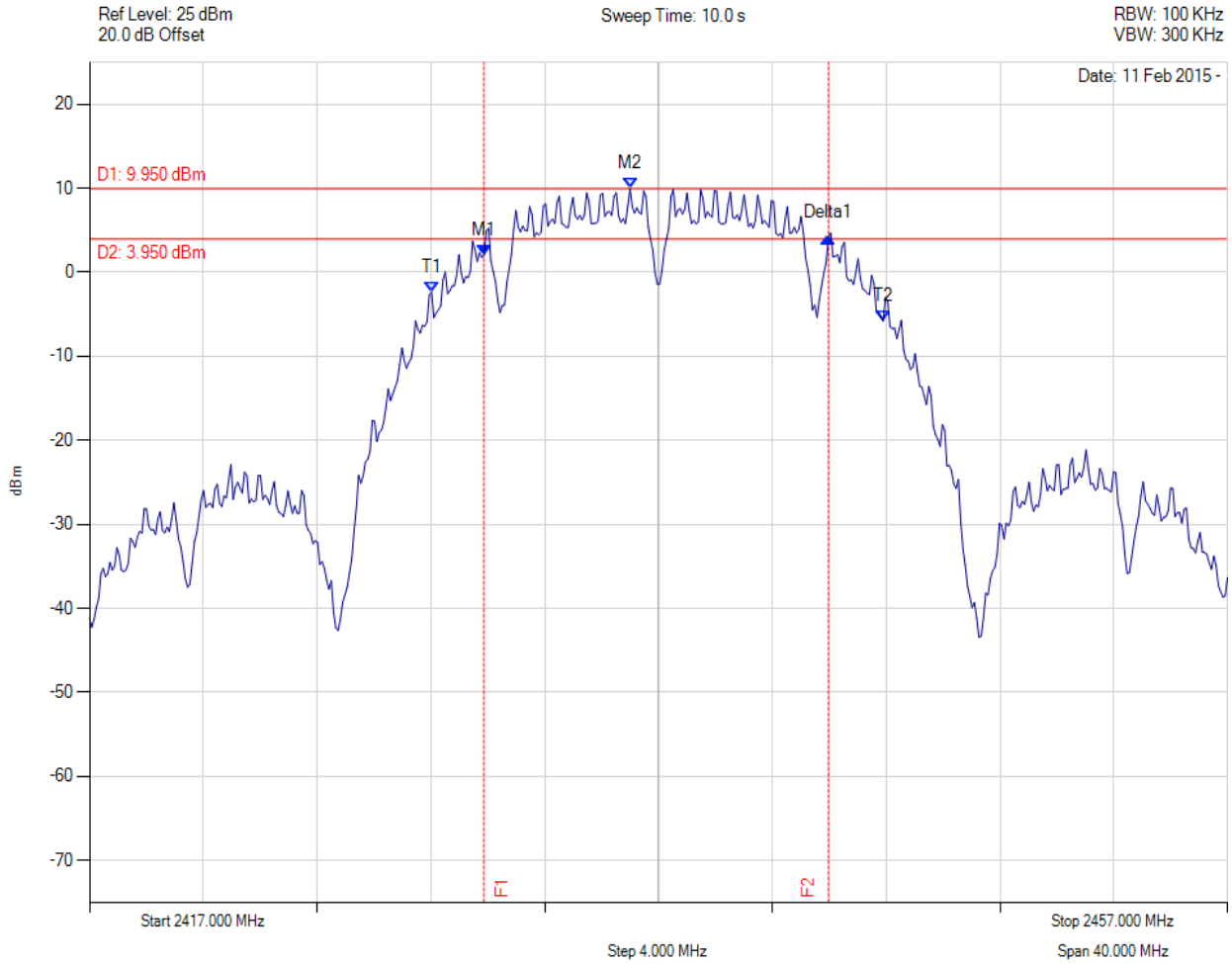


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2405.868 MHz : 2.295 dBm M2 : 2413.002 MHz : 10.194 dBm Delta1 : 12.585 MHz : 1.194 dB T1 : 2404.024 MHz : -2.439 dBm T2 : 2419.976 MHz : -2.006 dBm OBW : 15.952 MHz	Measured 6 dB Bandwidth: 12.585 MHz Limit: ≥500.0 kHz Margin: -12.09 MHz

Back to Matrix

6 dB & 99% BANDWIDTH

Variant: 802.11b, Channel: 2437.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc

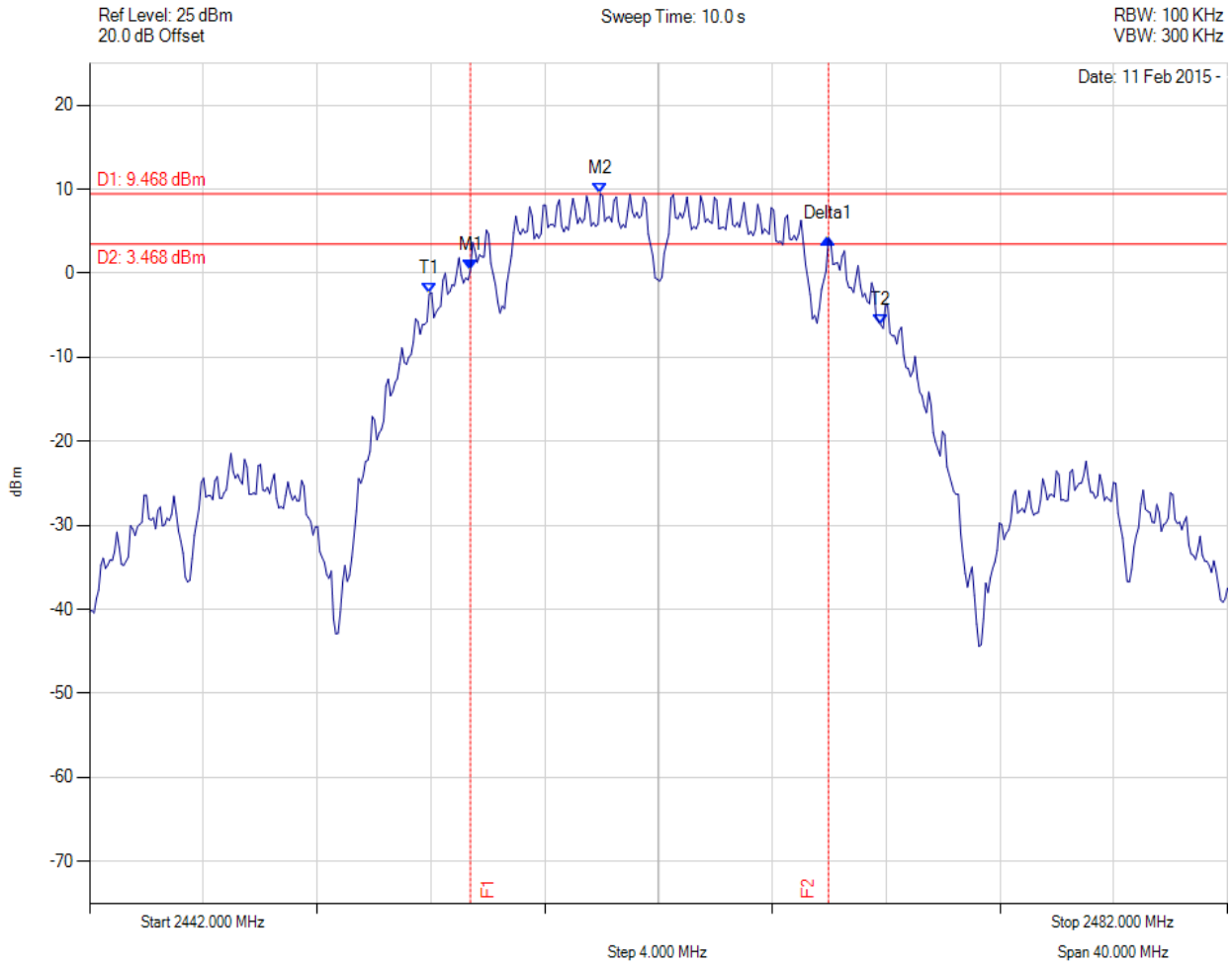


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2430.868 MHz : 2.023 dBm M2 : 2435.998 MHz : 9.950 dBm Delta1 : 12.104 MHz : 2.135 dB T1 : 2429.024 MHz : -2.360 dBm T2 : 2444.896 MHz : -5.807 dBm OBW : 15.872 MHz	Measured 6 dB Bandwidth: 12.104 MHz Limit: ≥500.0 kHz Margin: -11.60 MHz

Back to Matrix

6 dB & 99% BANDWIDTH

Variant: 802.11b, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc

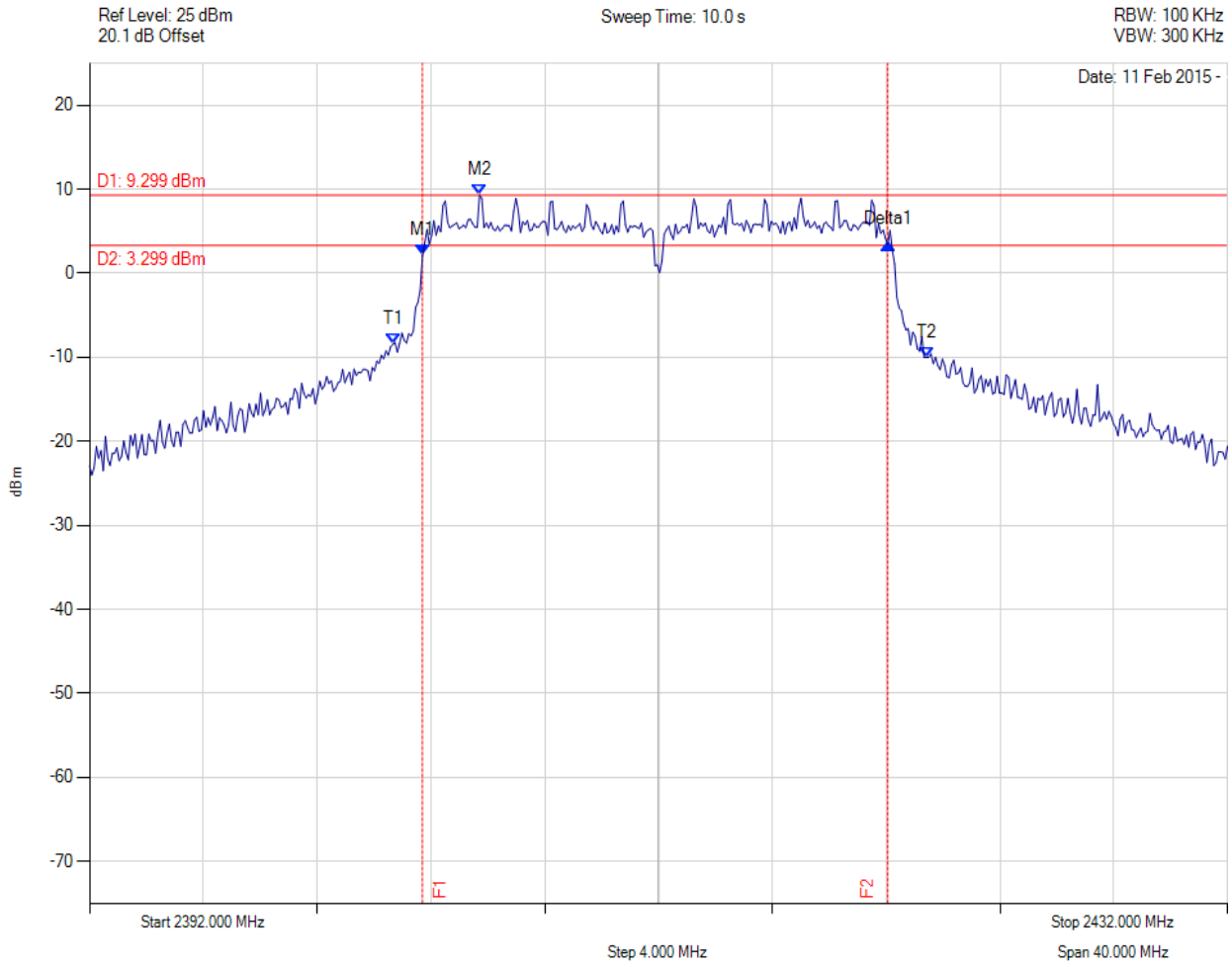


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2455.387 MHz : 0.357 dBm M2 : 2459.956 MHz : 9.468 dBm Delta1 : 12.585 MHz : 3.773 dB T1 : 2453.944 MHz : -2.433 dBm T2 : 2469.816 MHz : -6.151 dBm OBW : 15.872 MHz	Measured 6 dB Bandwidth: 12.585 MHz Limit: ≥500.0 kHz Margin: -12.09 MHz

Back to Matrix

6 dB & 99% BANDWIDTH

Variant: 802.11g, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc

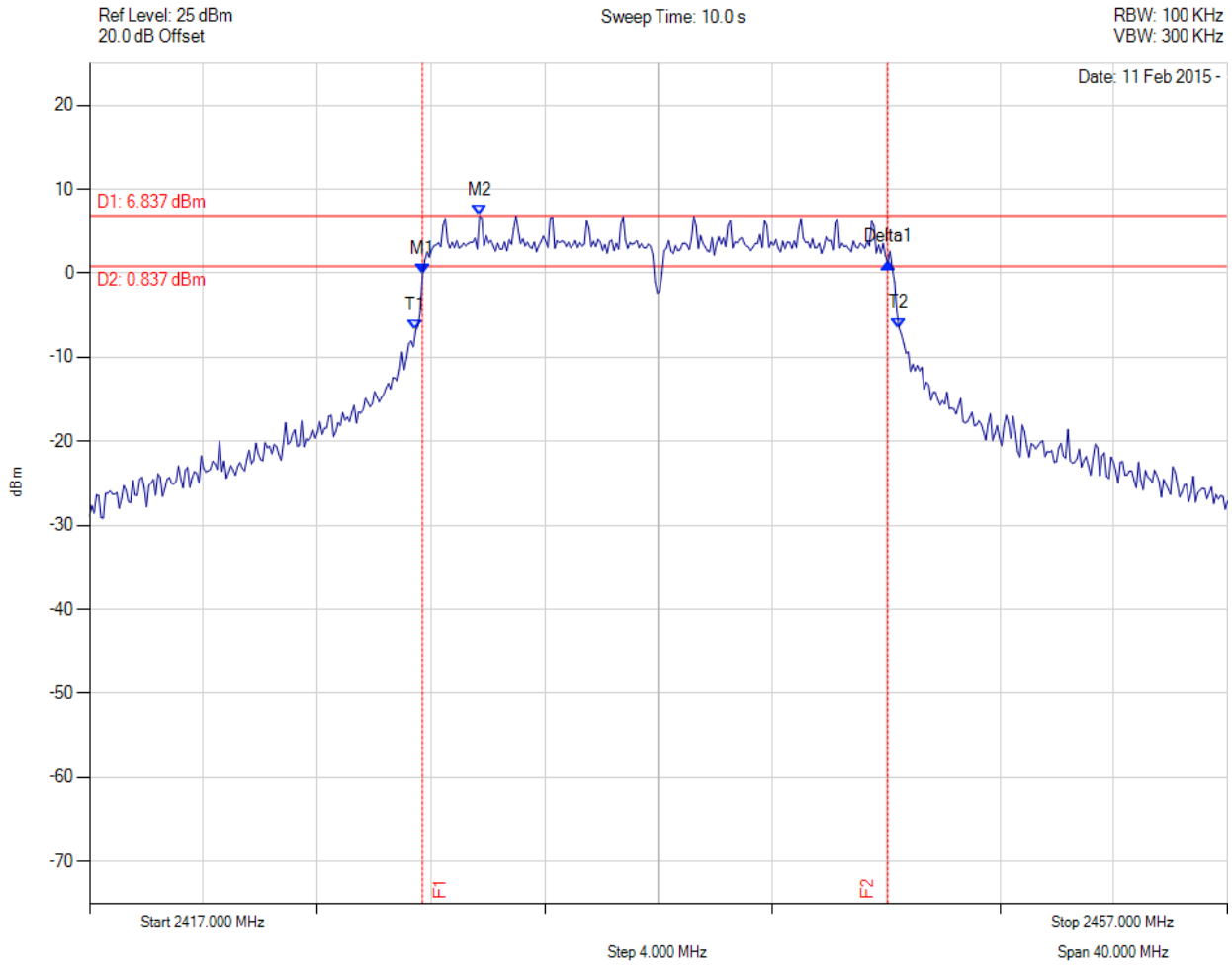


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2403.703 MHz : 2.112 dBm M2 : 2405.707 MHz : 9.299 dBm Delta1 : 16.353 MHz : 1.336 dB T1 : 2402.661 MHz : -8.459 dBm T2 : 2421.419 MHz : -10.021 dBm OBW : 18.758 MHz	Measured 6 dB Bandwidth: 16.353 MHz Limit: ≥500.0 kHz Margin: -15.85 MHz

Back to Matrix

6 dB & 99% BANDWIDTH

Variant: 802.11g, Channel: 2437.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2428.703 MHz : -0.064 dBm M2 : 2430.707 MHz : 6.837 dBm Delta1 : 16.353 MHz : 1.350 dB T1 : 2428.463 MHz : -6.828 dBm T2 : 2445.457 MHz : -6.533 dBm OBW : 16.994 MHz	Measured 6 dB Bandwidth: 16.353 MHz Limit: ≥500.0 kHz Margin: -15.85 MHz

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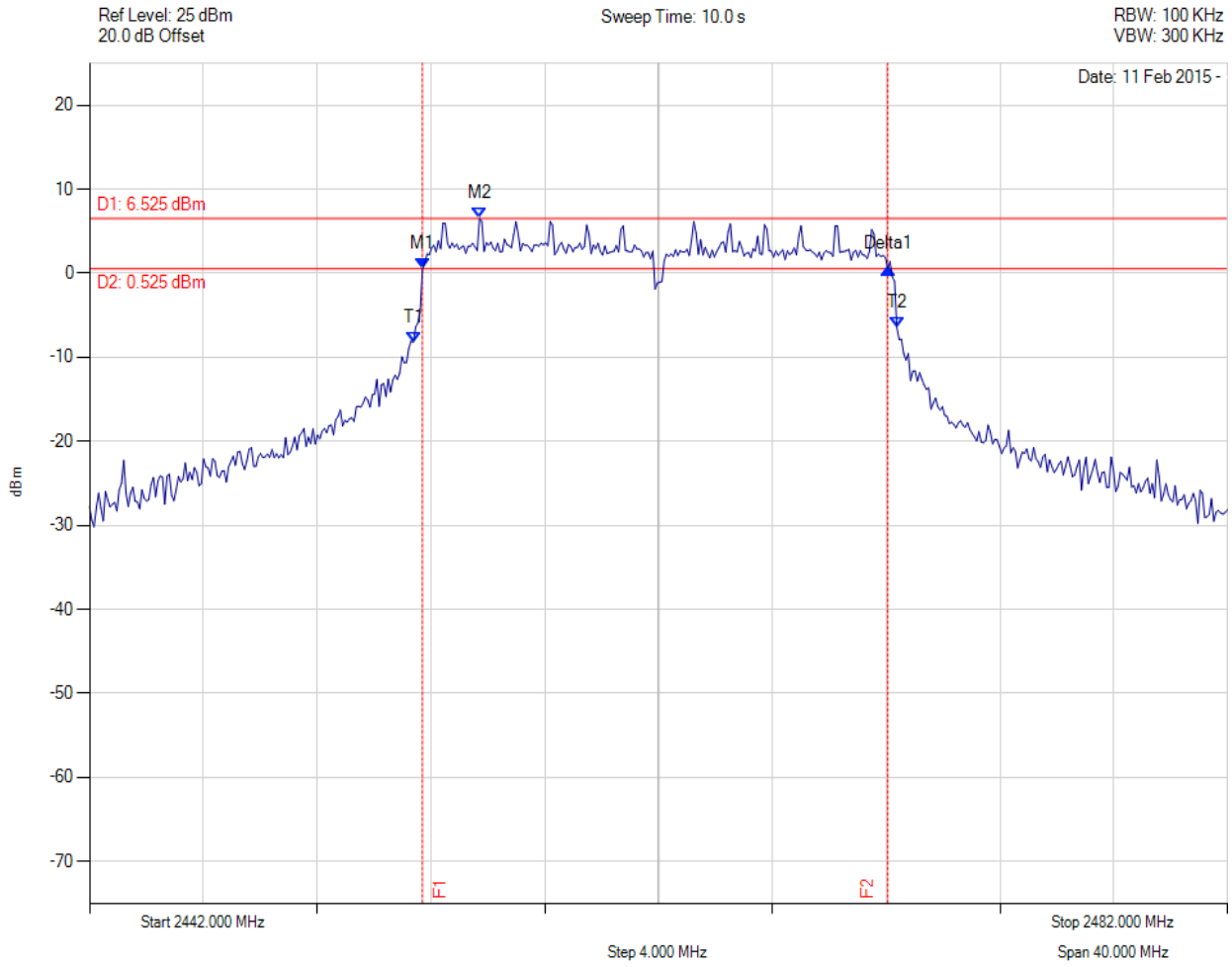
6 dB & 99% BANDWIDTH

Variant: 802.11g, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2453.703 MHz : 0.512 dBm M2 : 2455.707 MHz : 6.525 dBm Delta1 : 16.353 MHz : 0.059 dB T1 : 2453.383 MHz : -8.195 dBm T2 : 2470.377 MHz : -6.458 dBm OBW : 16.994 MHz	Measured 6 dB Bandwidth: 16.353 MHz Limit: ≥500.0 kHz Margin: -15.85 MHz

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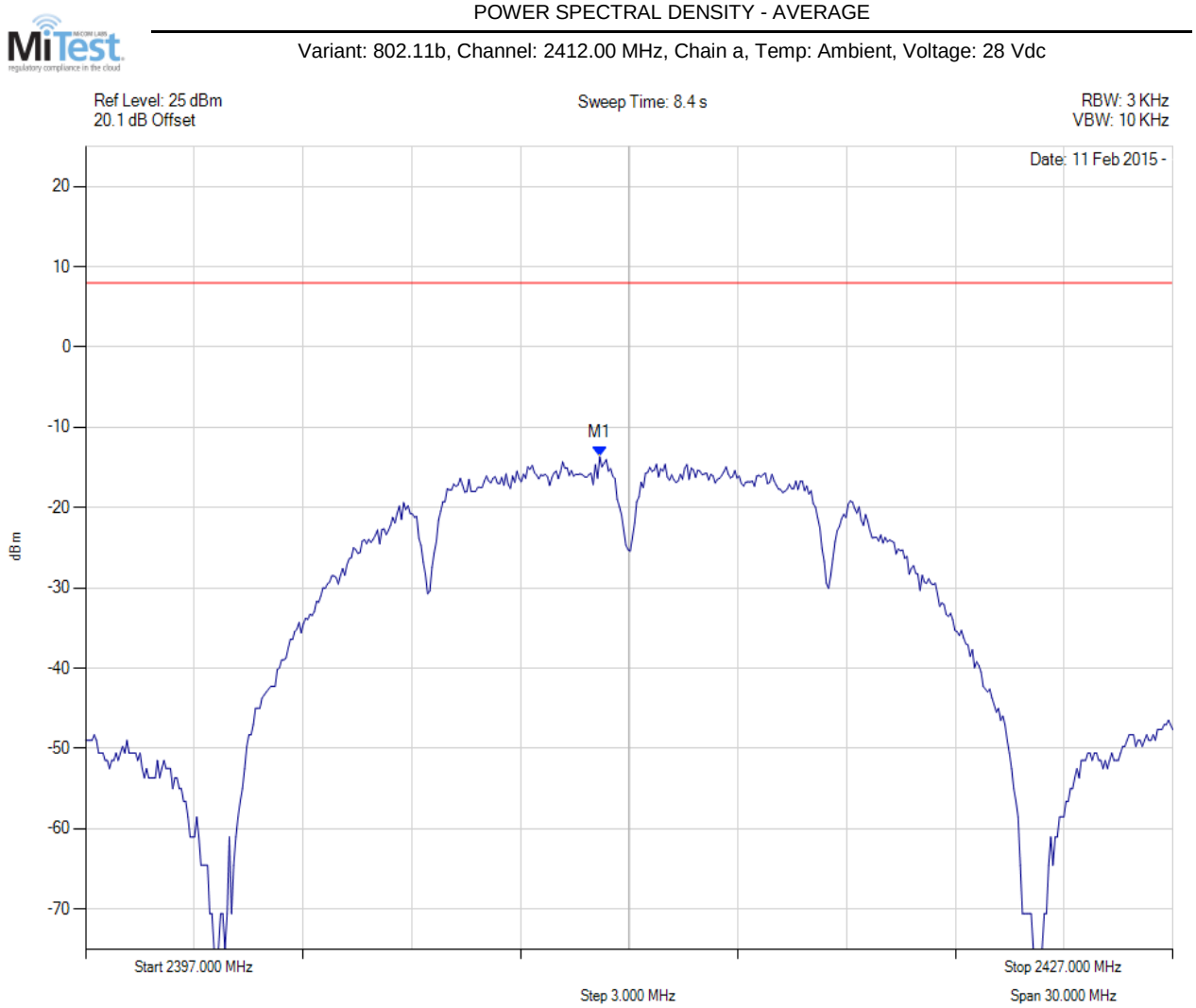
8.2. Power Spectral Density



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2411.188 MHz : -13.663 dBm	Limit: ≤ 8.000 dBm

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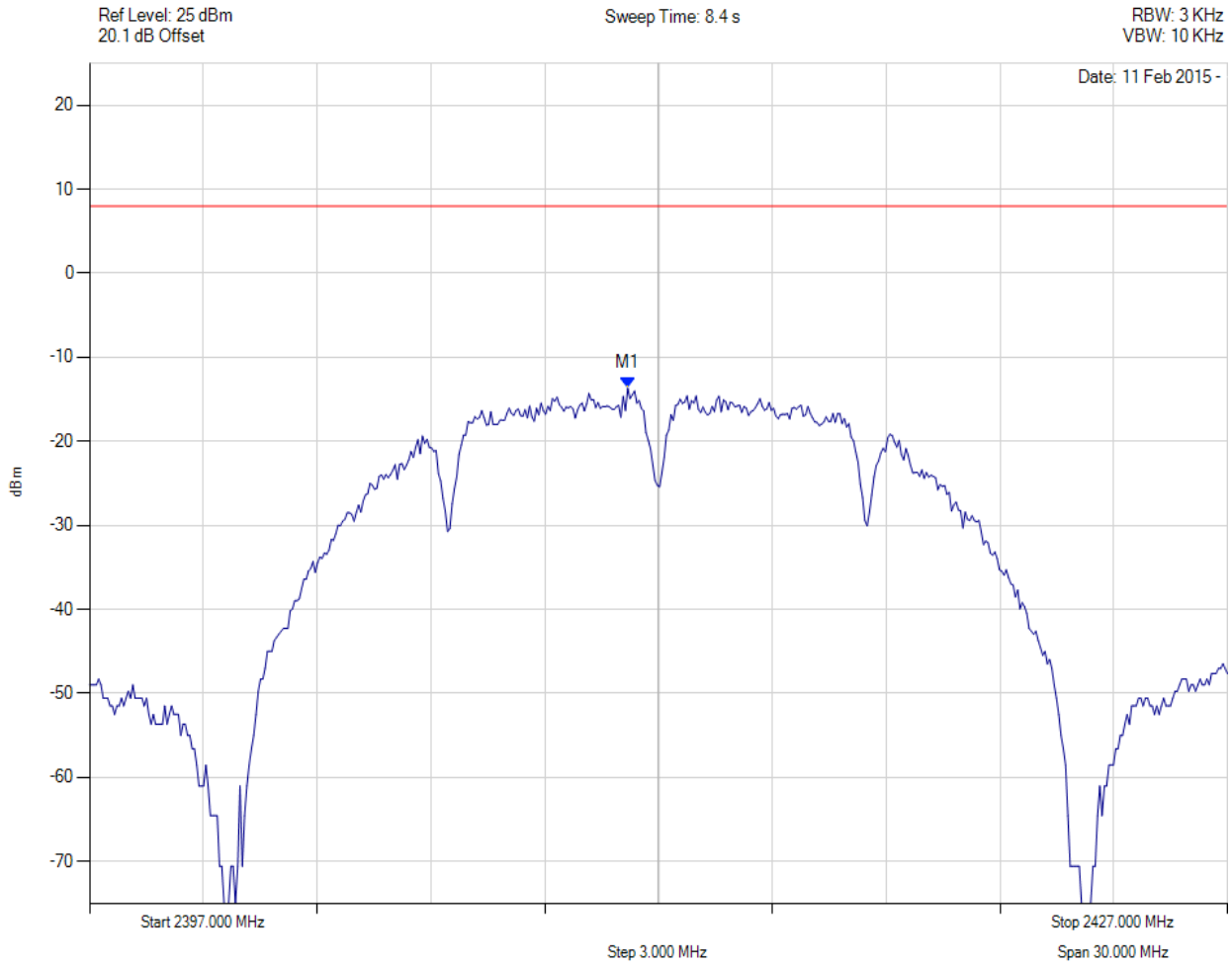
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11b, Channel: 2412.00 MHz, SUM, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2411.200 MHz : -13.663 dBm M1 + DCCF : 2411.200 MHz : -13.663 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 8.0 dBm Margin: -21.7 dB

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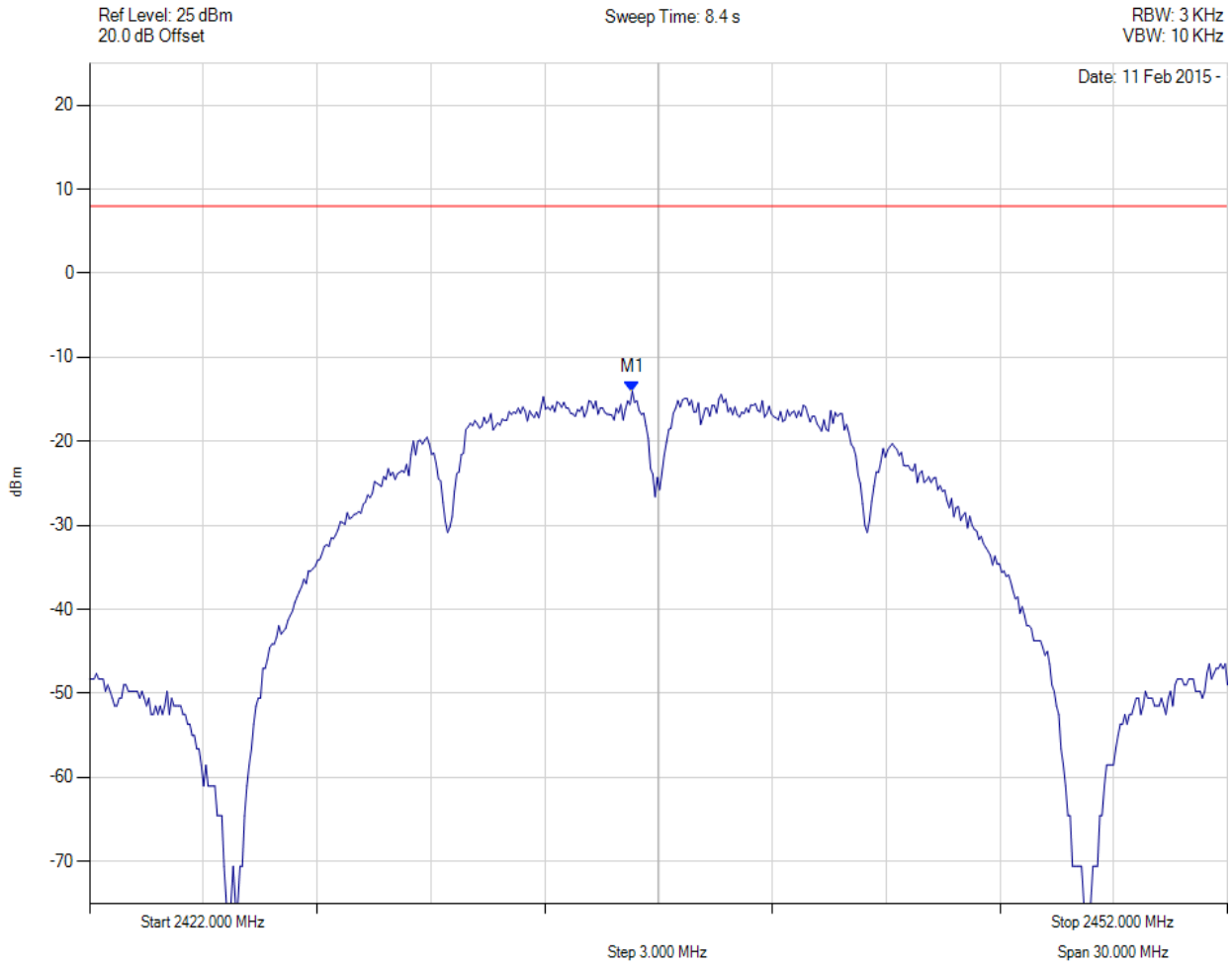
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11b, Channel: 2437.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2436.309 MHz : -14.057 dBm	Limit: ≤ 8.000 dBm

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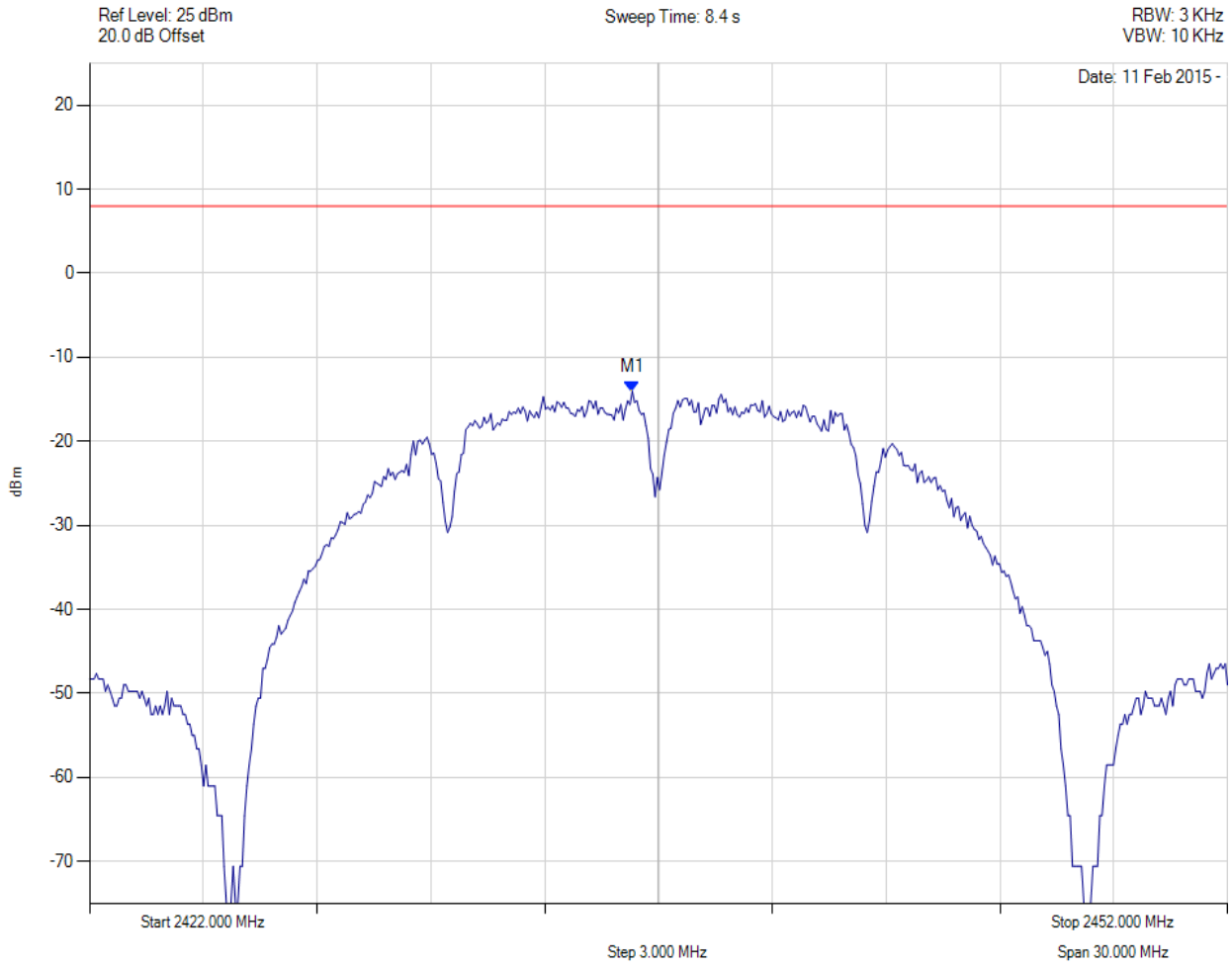
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11b, Channel: 2437.00 MHz, SUM, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2436.300 MHz : -14.057 dBm M1 + DCCF : 2436.300 MHz : -14.057 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 8.0 dBm Margin: -22.1 dB

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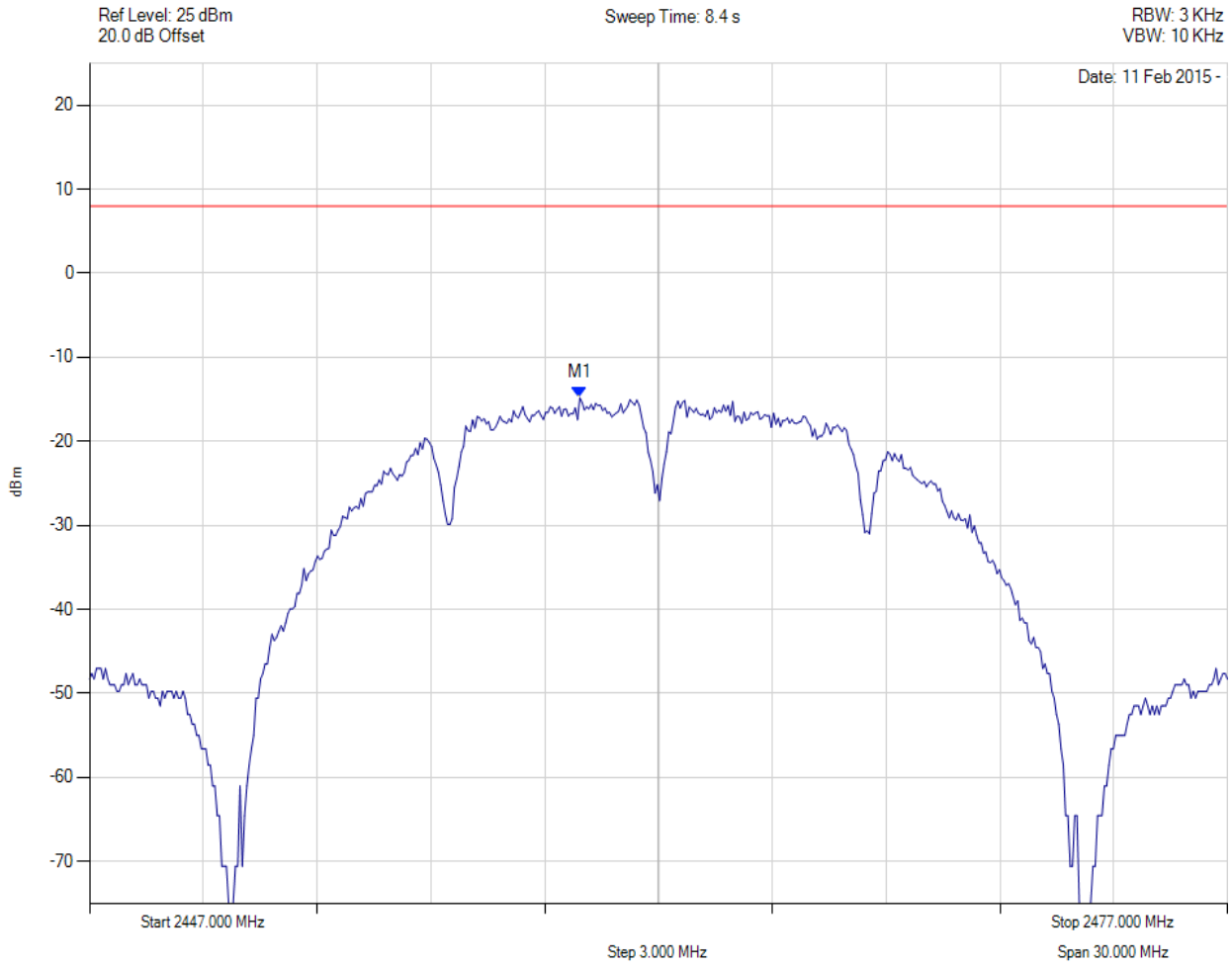
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11b, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2459.926 MHz : -14.816 dBm	Limit: ≤ 8.000 dBm

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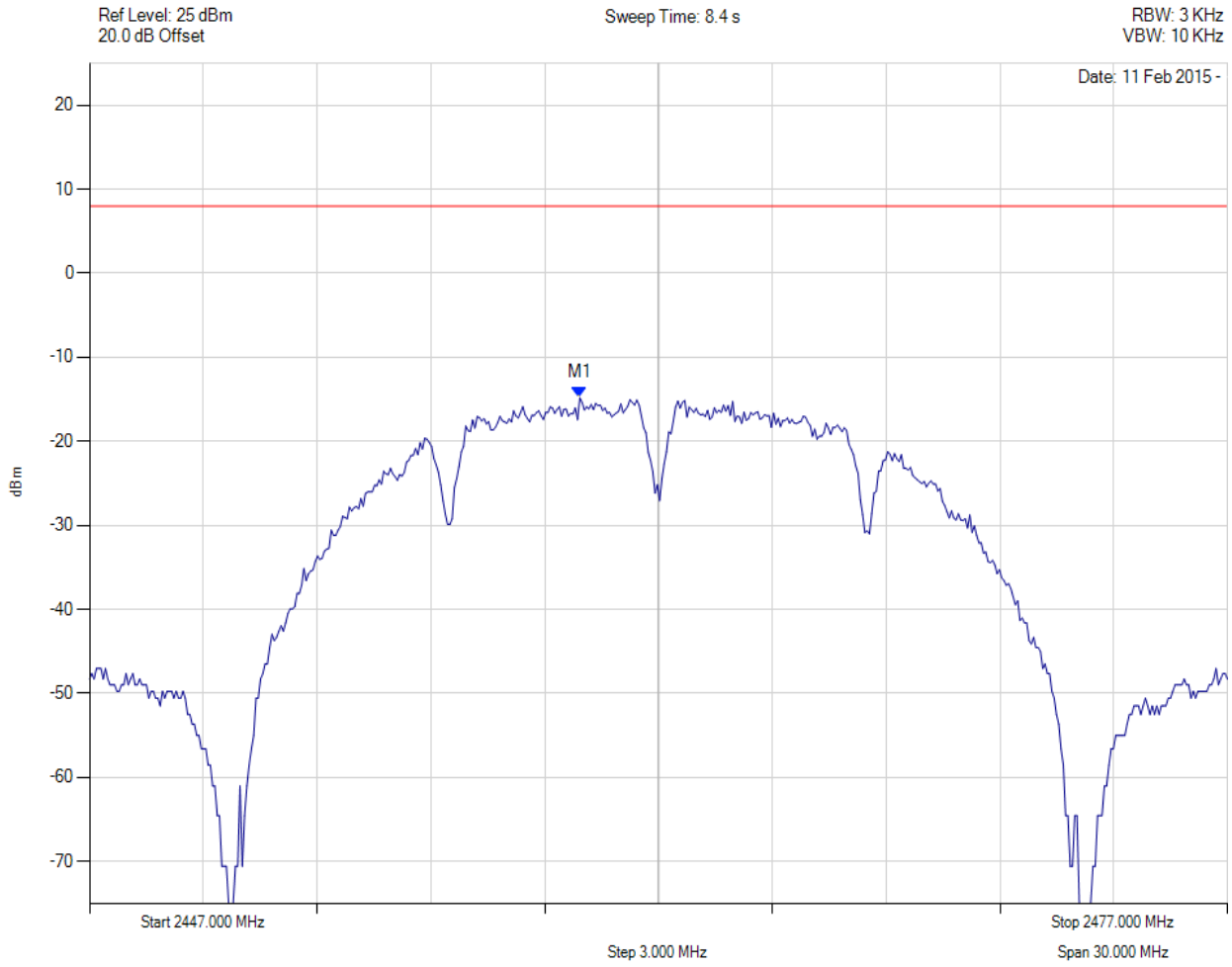
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11b, Channel: 2462.00 MHz, SUM, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2459.900 MHz : -14.816 dBm M1 + DCCF : 2459.900 MHz : -14.816 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 8.0 dBm Margin: -22.8 dB

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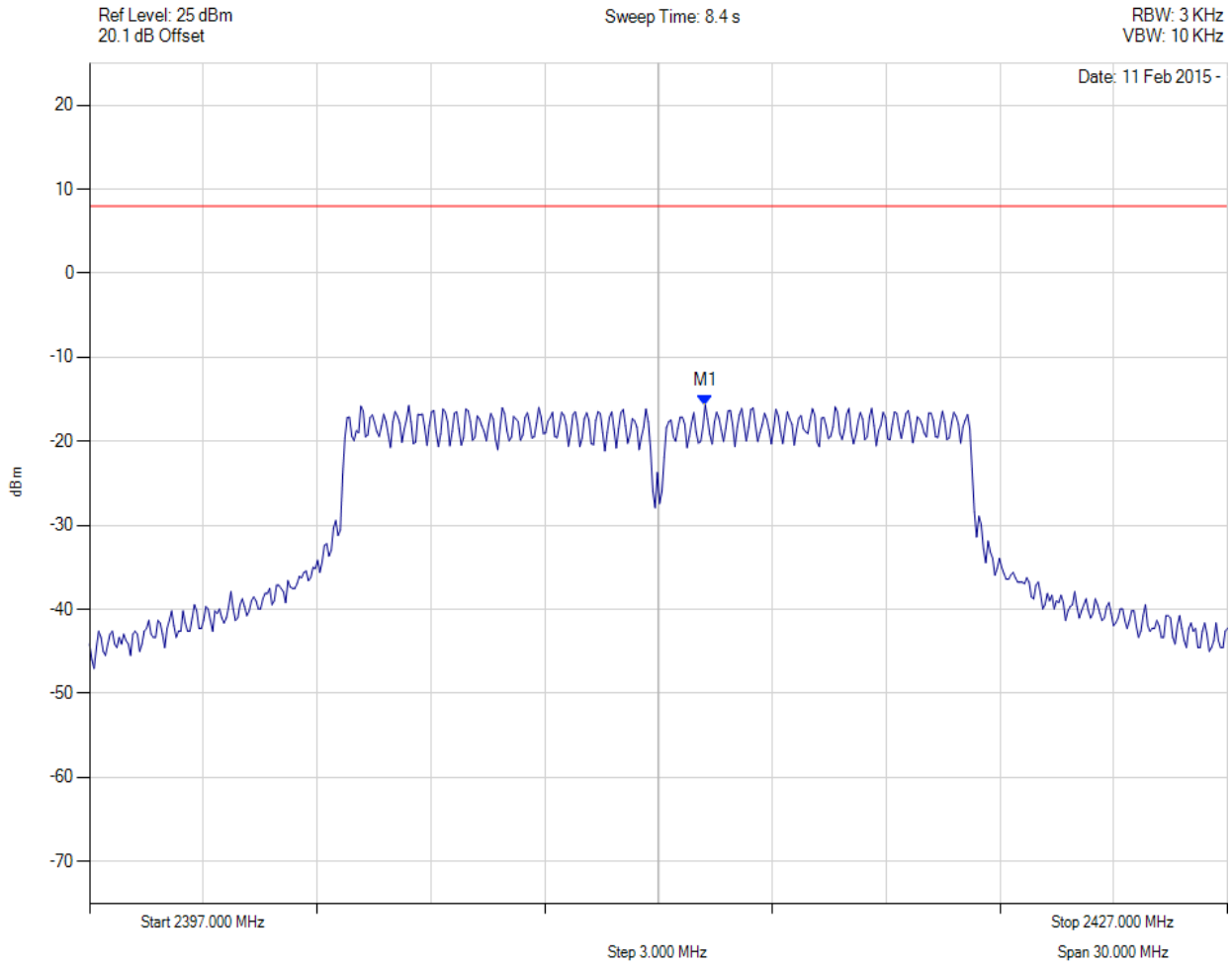
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11g, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2413.232 MHz : -15.695 dBm	Limit: ≤ 8.000 dBm

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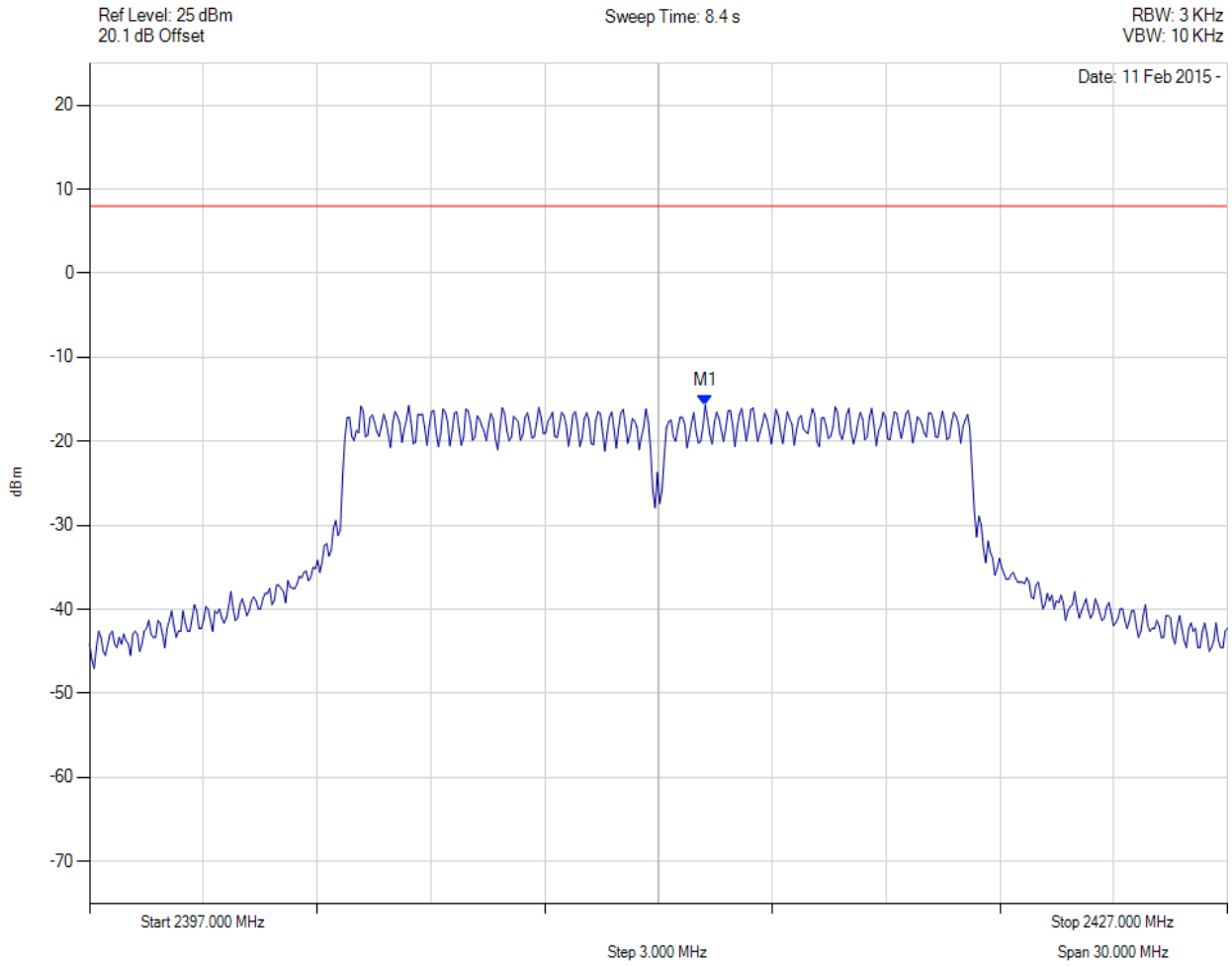
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11g, Channel: 2412.00 MHz, SUM, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2413.200 MHz : -15.695 dBm M1 + DCCF : 2413.200 MHz : -15.695 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 8.0 dBm Margin: -23.7 dB

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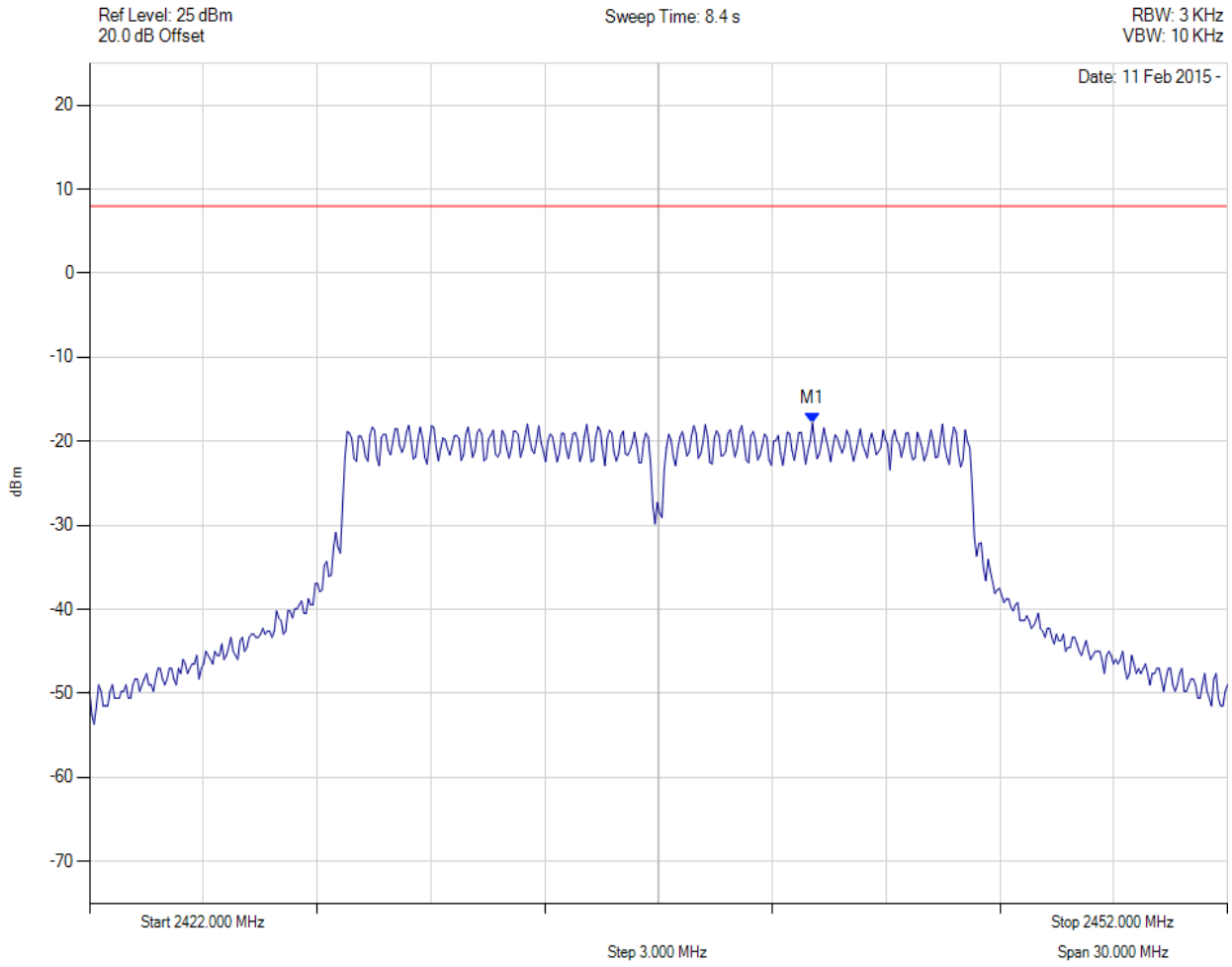
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11g, Channel: 2437.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.058 MHz : -17.836 dBm	Limit: ≤ 8.000 dBm

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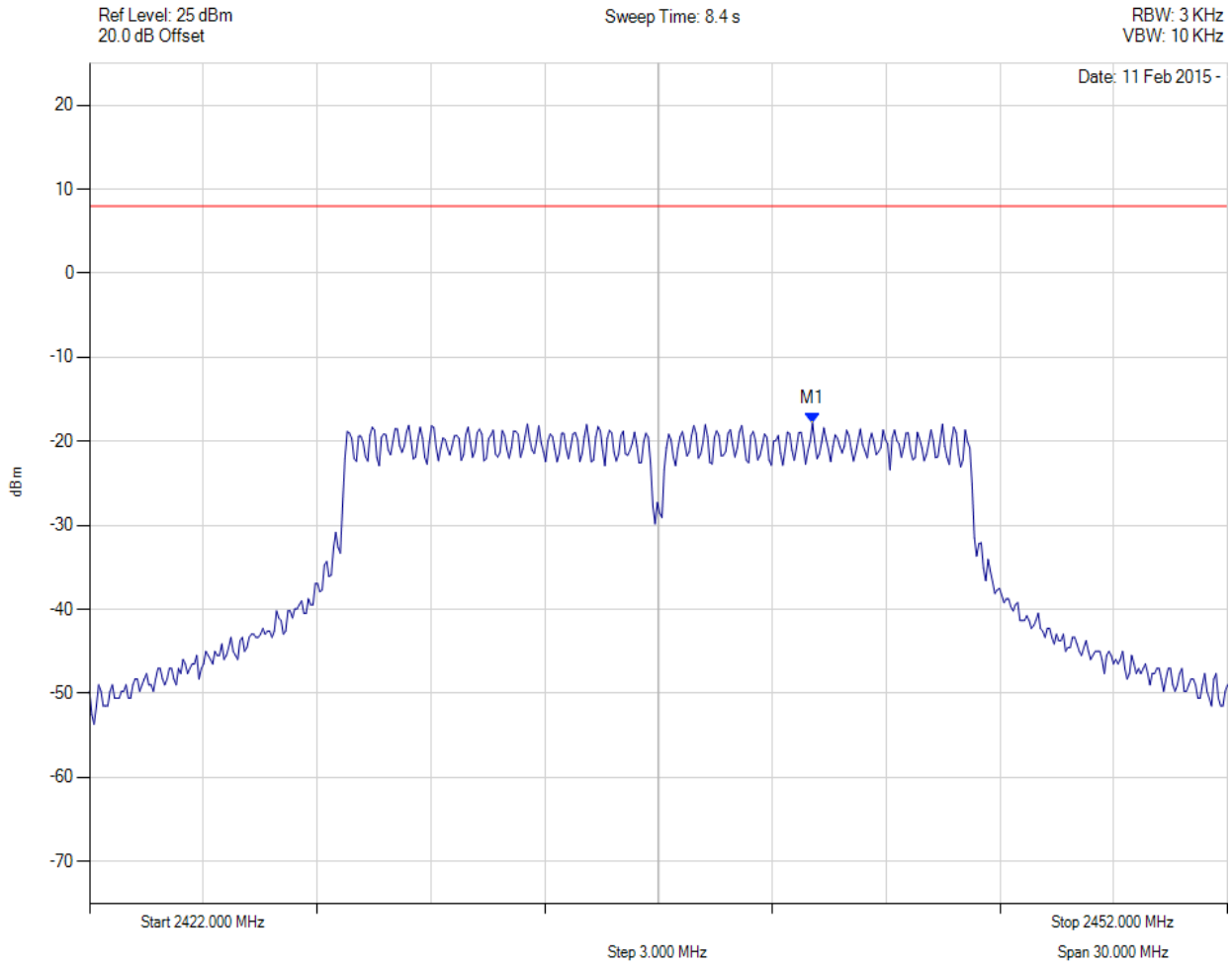
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11g, Channel: 2437.00 MHz, SUM, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.100 MHz : -17.836 dBm M1 + DCCF : 2441.100 MHz : -17.836 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 8.0 dBm Margin: -25.8 dB

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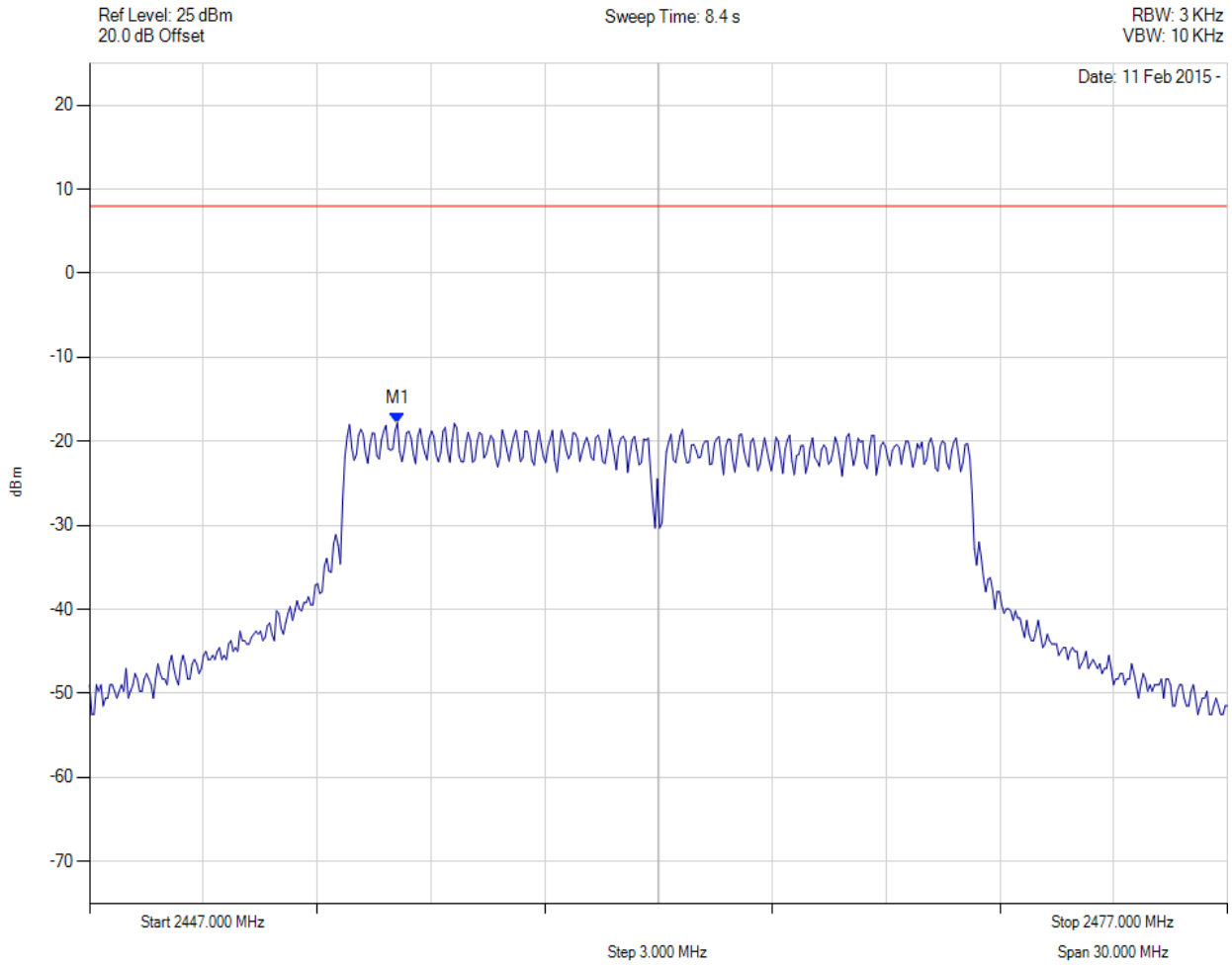
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11g, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2455.116 MHz : -17.816 dBm	Limit: ≤ 8.000 dBm

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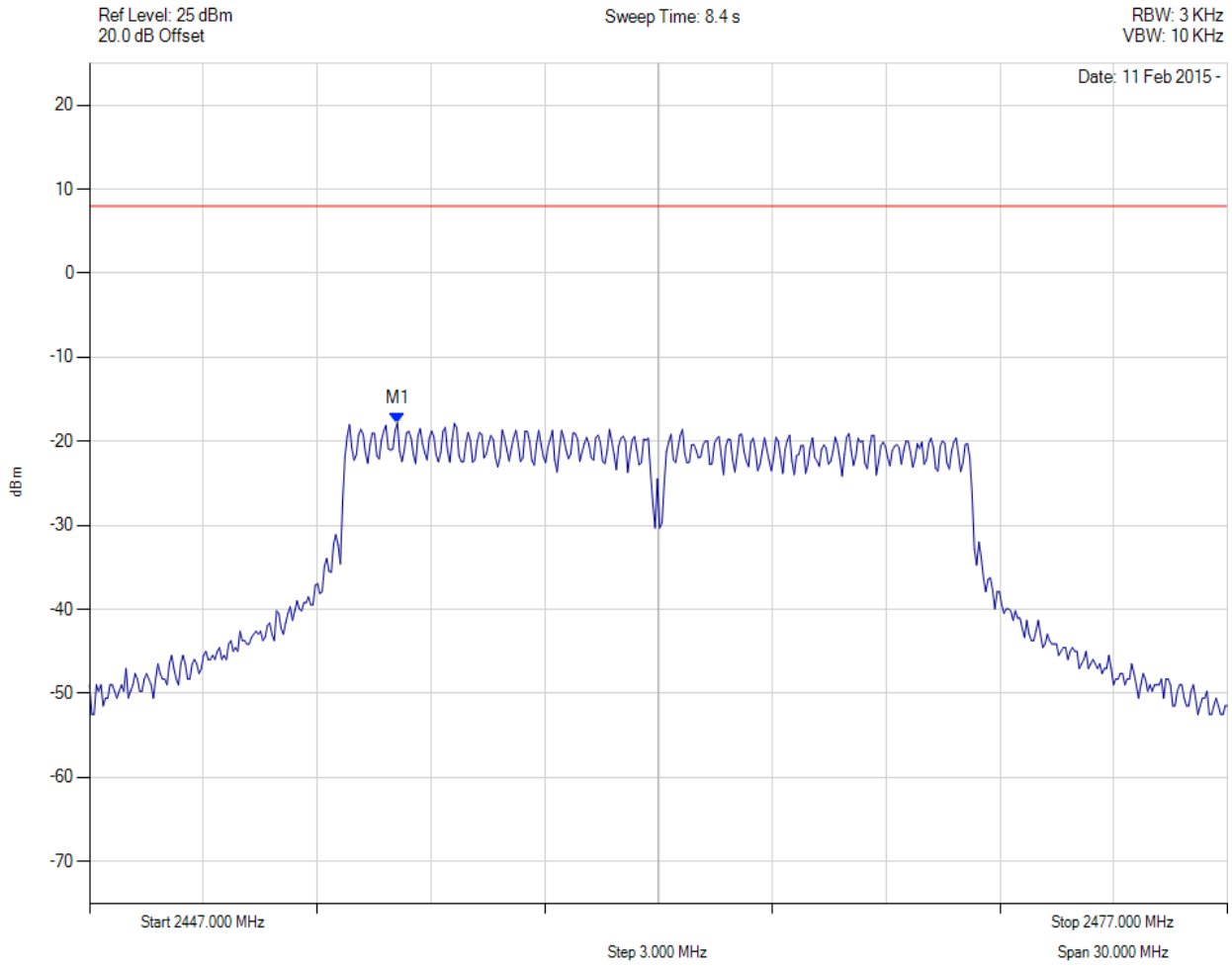
POWER SPECTRAL DENSITY - AVERAGE

Variant: 802.11g, Channel: 2462.00 MHz, SUM, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2455.100 MHz : -17.816 dBm M1 + DCCF : 2455.100 MHz : -17.816 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 8.0 dBm Margin: -25.8 dB

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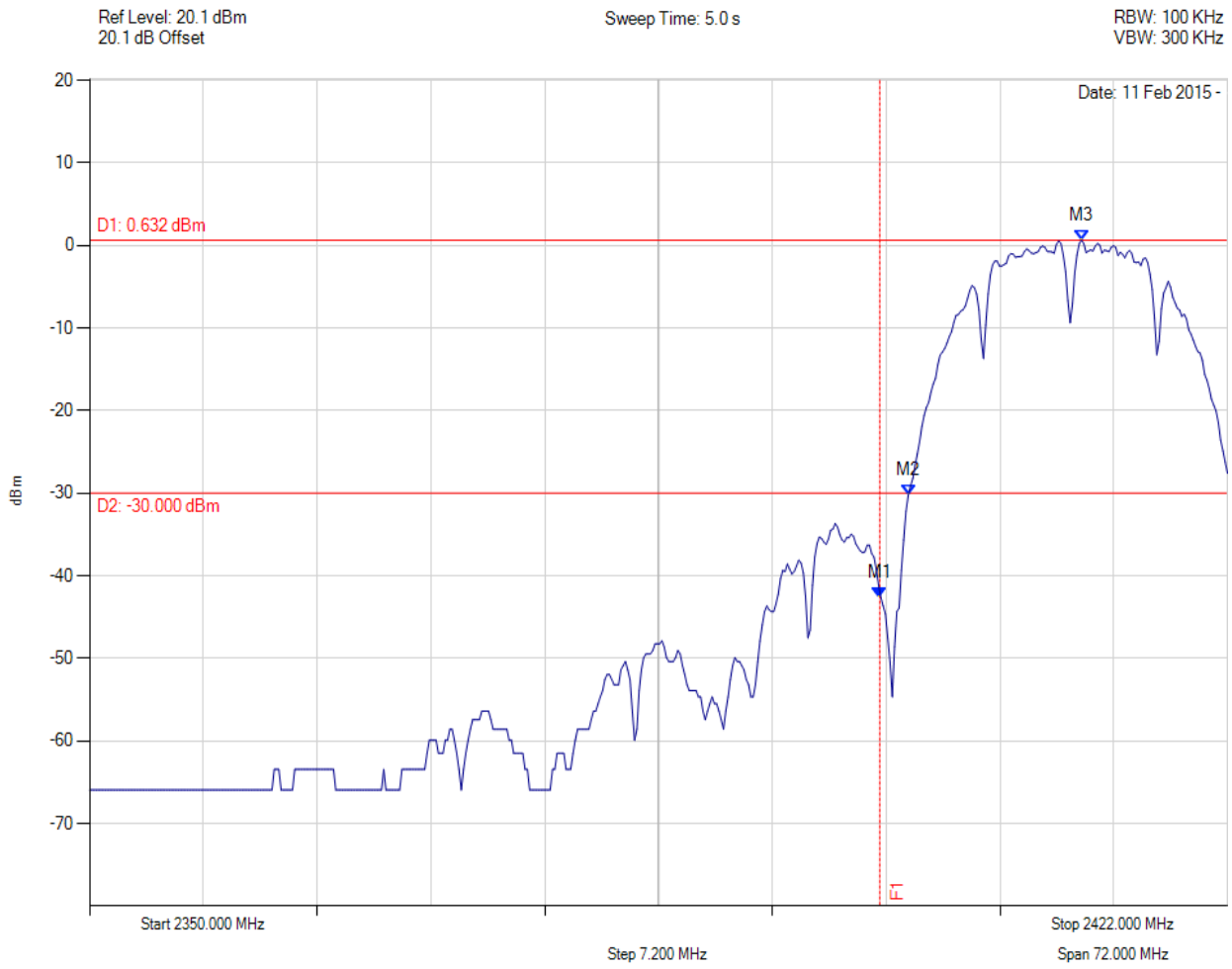
8.3. Conducted Emissions

8.3.1. Conducted Band-Edge Emissions

CONDUCTED LOW BAND-EDGE EMISSIONS - AVERAGE

Variant: 802.11b, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2400.000 MHz : -42.596 dBm M2 : 2401.800 MHz : -30.216 dBm M3 : 2412.766 MHz : 0.632 dBm	Channel Frequency: 2412.00 MHz

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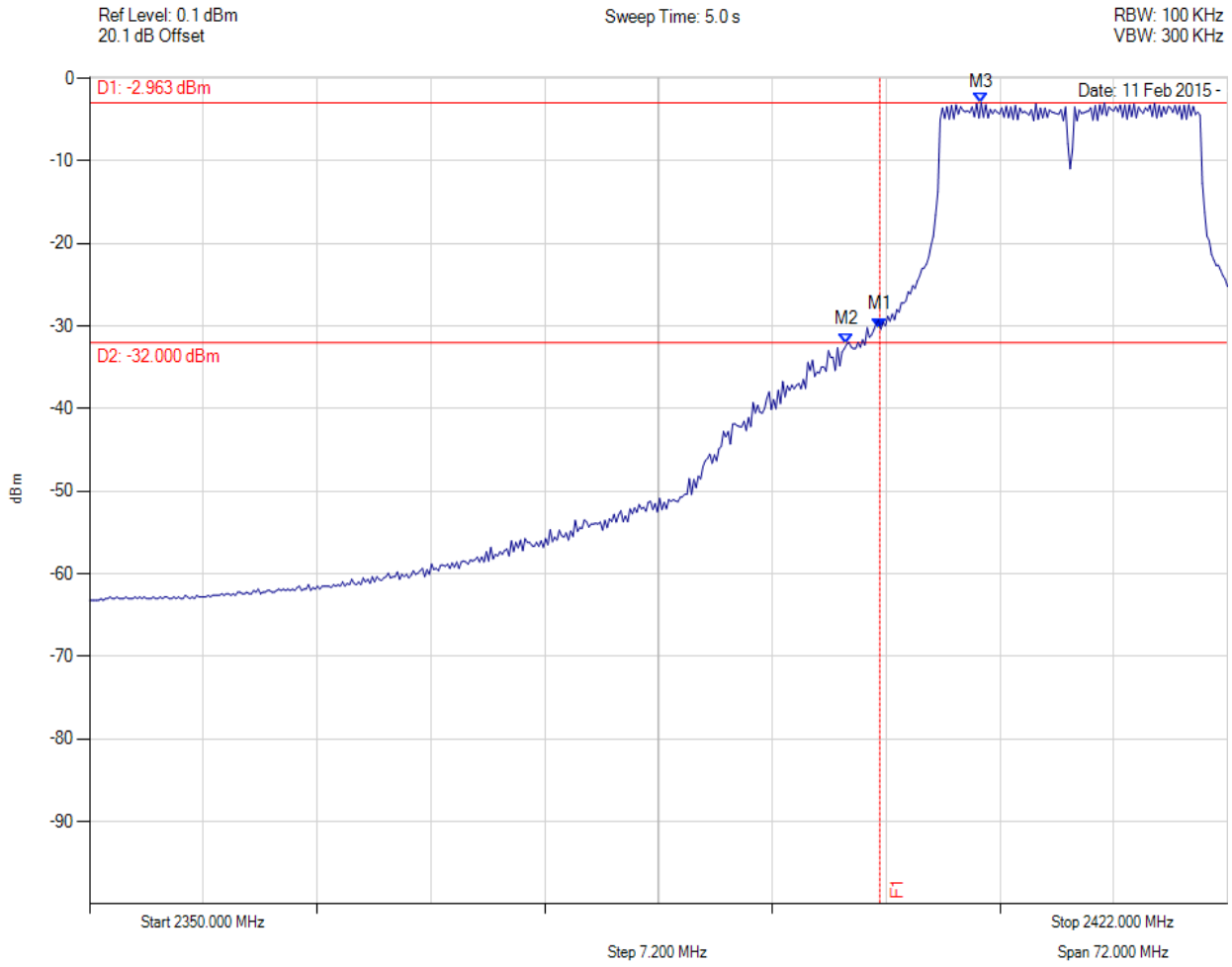
CONDUCTED LOW BAND-EDGE EMISSIONS - AVERAGE

Variant: 802.11g, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2400.000 MHz : -30.394 dBm M2 : 2397.904 MHz : -32.232 dBm M3 : 2406.417 MHz : -2.963 dBm	Channel Frequency: 2412.00 MHz

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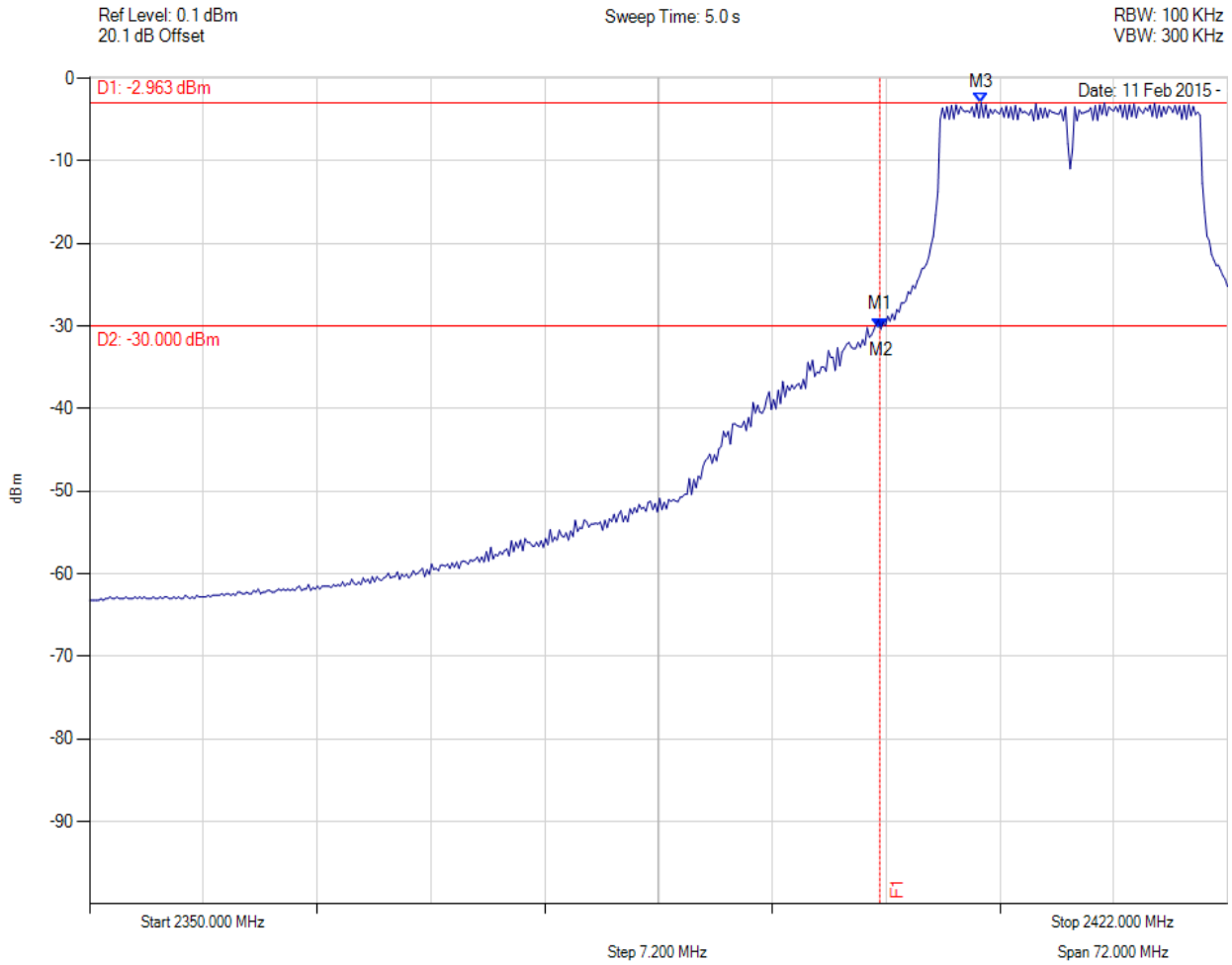
Revised CONDUCTED LOW BAND-EDGE EMISSIONS - AVERAGE

Variant: 802.11g, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2400.000 MHz : -30.394 dBm M2 : 2400.068 MHz : -30.394 dBm M3 : 2406.417 MHz : -2.963 dBm	Channel Frequency: 2412.00 MHz

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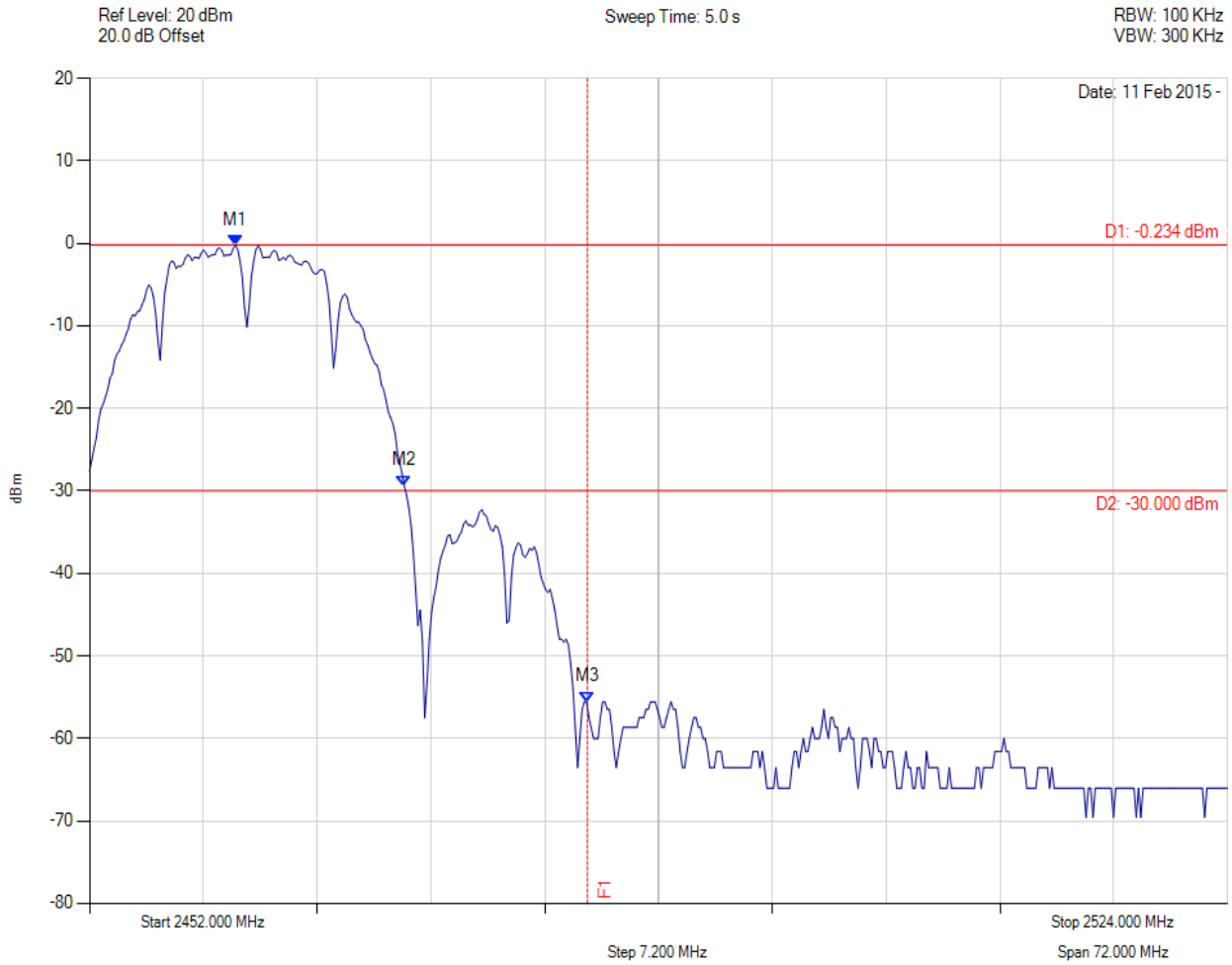
CONDUCTED HIGH BAND-EDGE EMISSIONS - AVERAGE

Variant: 802.11b, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2461.234 MHz : -0.234 dBm M2 : 2471.912 MHz : -29.373 dBm M3 : 2483.500 MHz : -55.565 dBm	Channel Frequency: 2462.00 MHz

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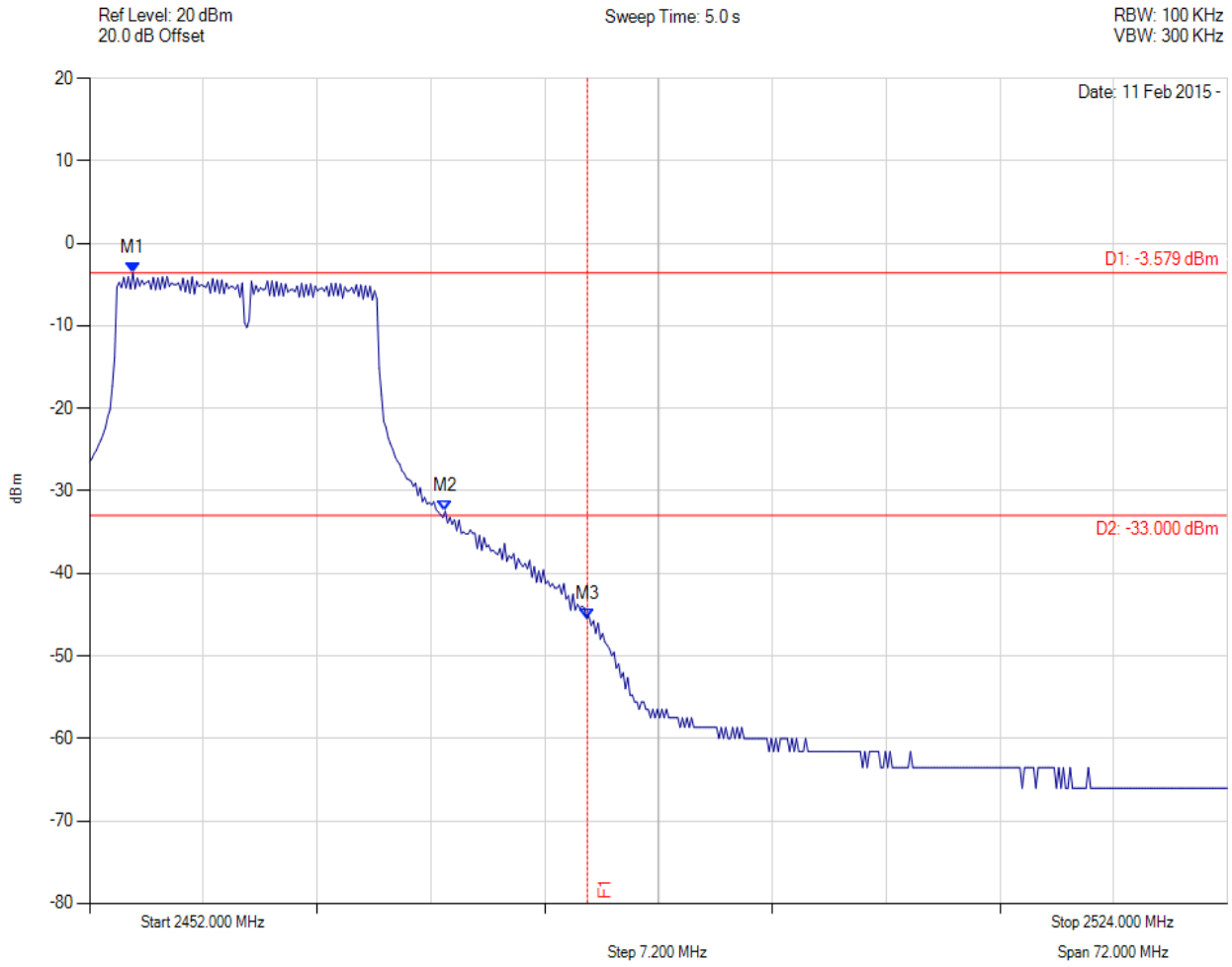
CONDUCTED HIGH BAND-EDGE EMISSIONS - AVERAGE

Variant: 802.11g, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2454.741 MHz : -3.579 dBm M2 : 2474.509 MHz : -32.459 dBm M3 : 2483.500 MHz : -45.462 dBm	Channel Frequency: 2462.00 MHz

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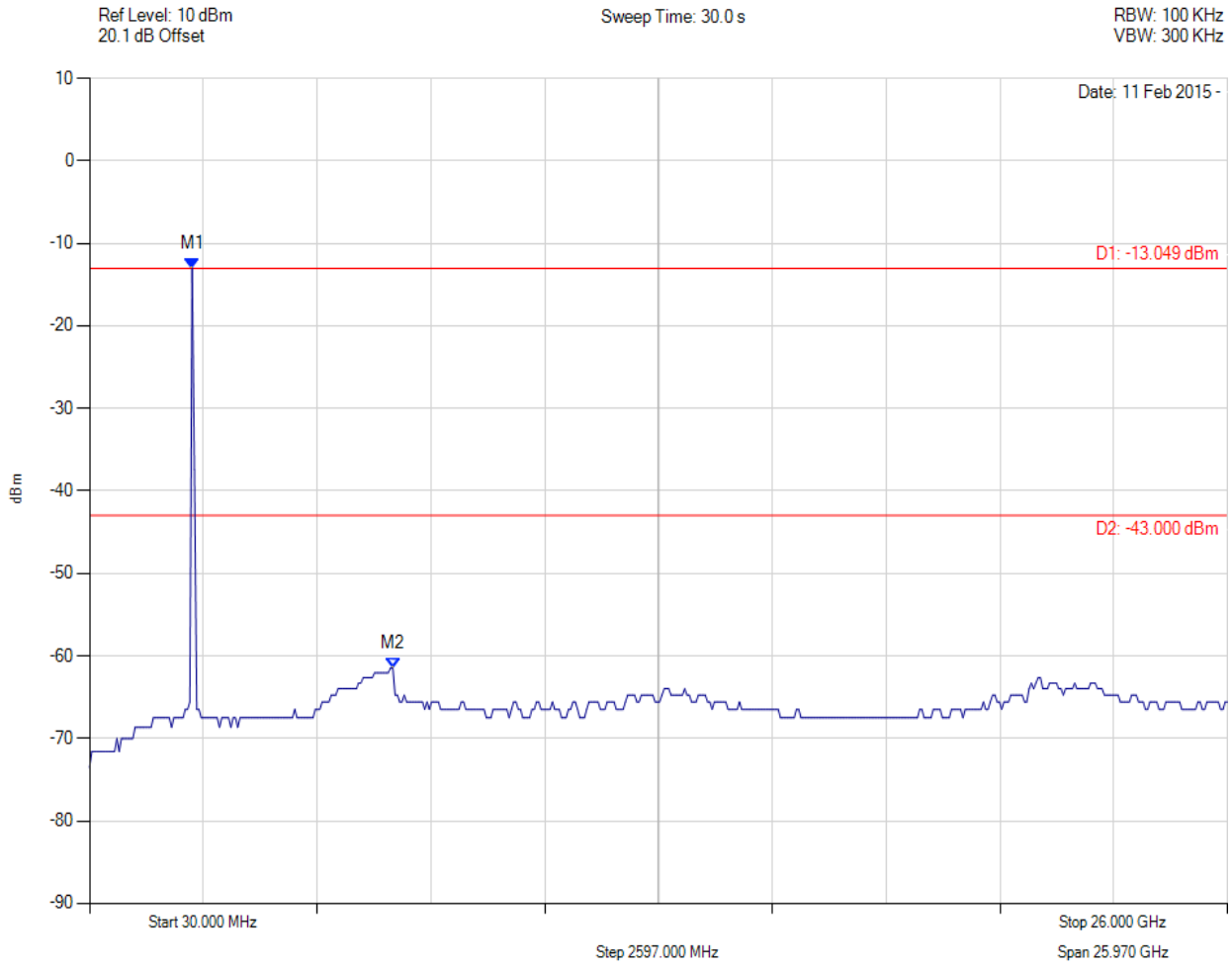
8.3.2. Conducted Spurious Emissions

CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 802.11b, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2371.984 MHz : -13.049 dBm M2 : 6951.864 MHz : -61.483 dBm	Limit: -43.00 dBm Margin: -18.48 dB

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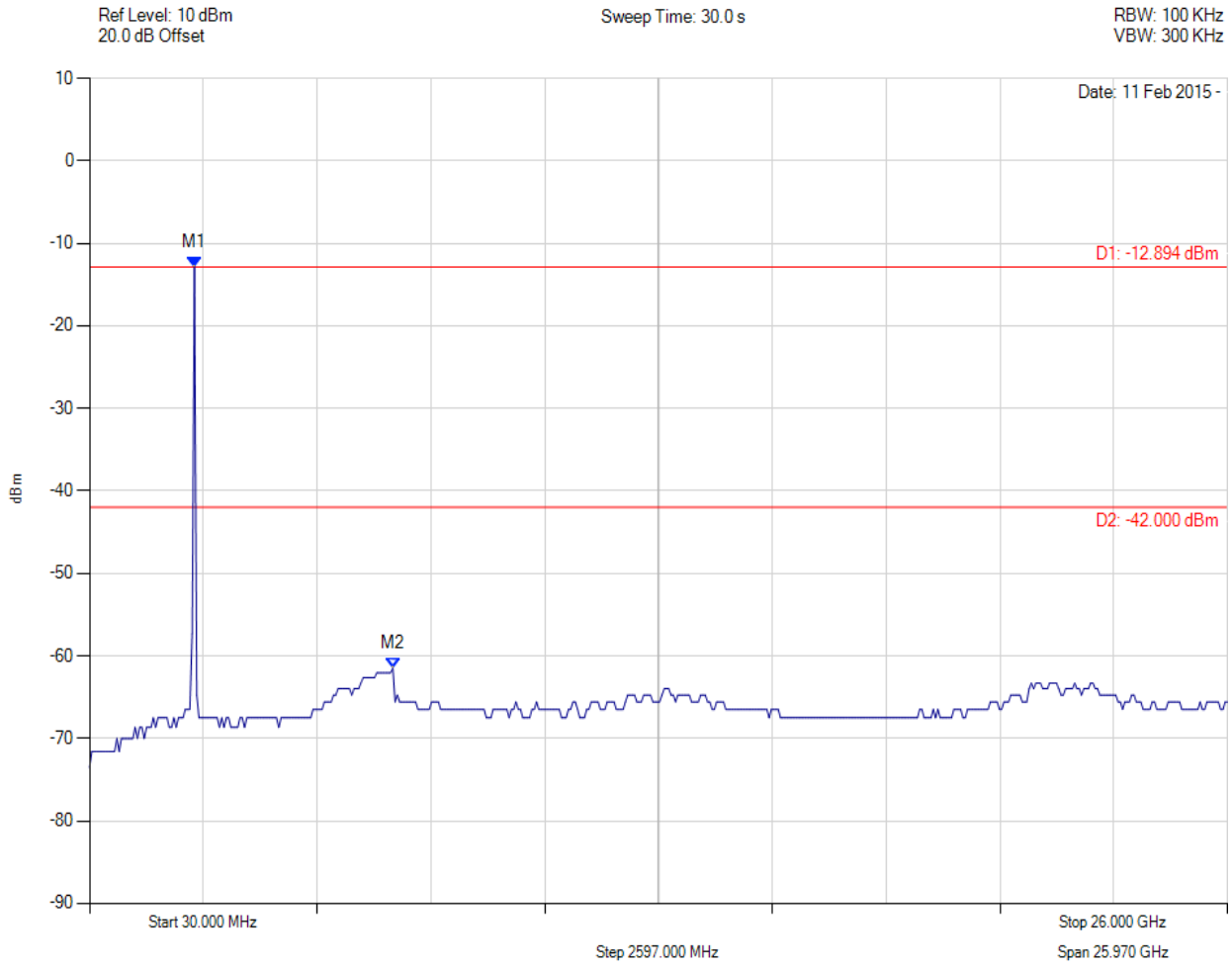
CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 802.11b, Channel: 2437.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2424.028 MHz : -12.894 dBm M2 : 6951.864 MHz : -61.483 dBm	Limit: -42.00 dBm Margin: -19.48 dB

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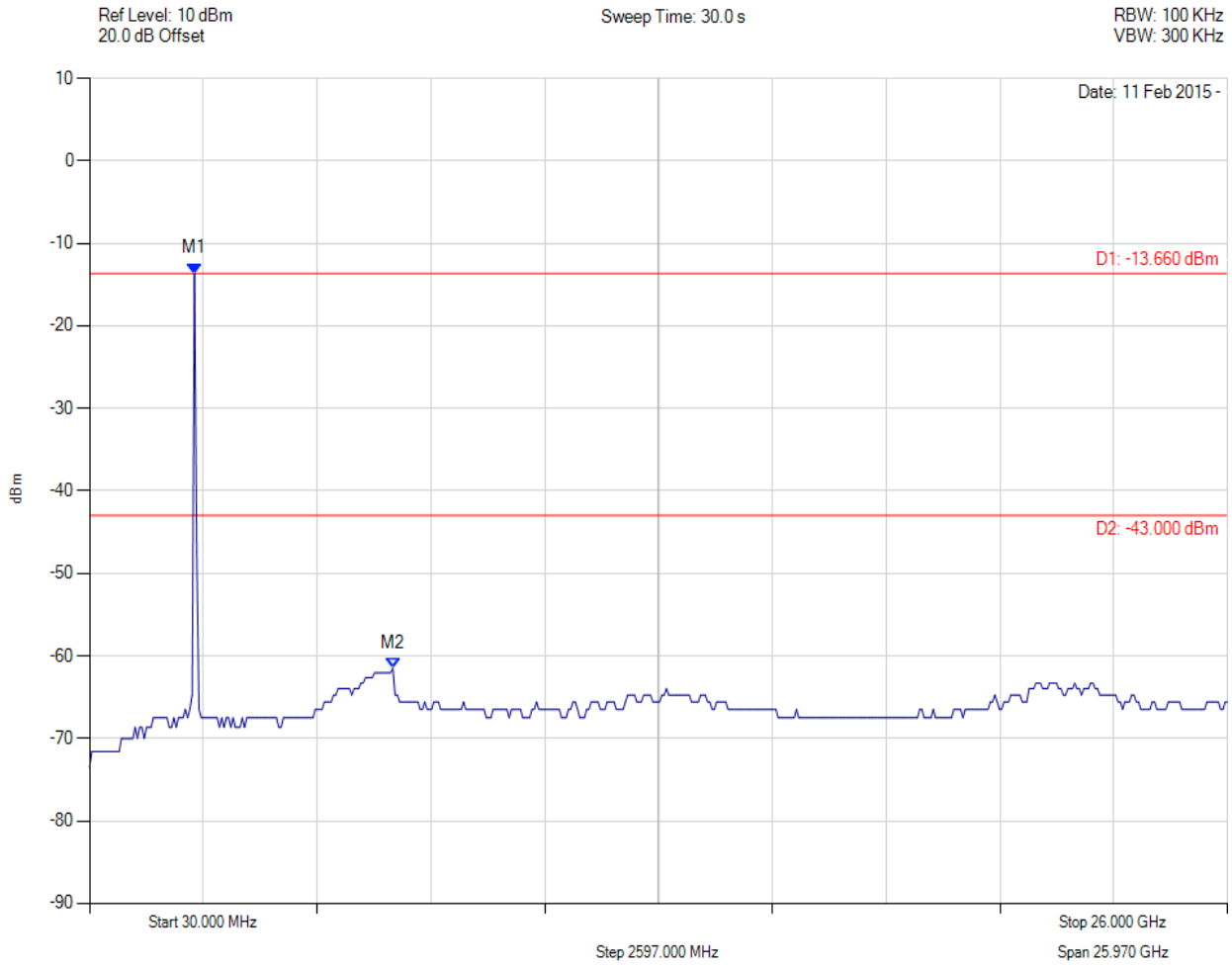
CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 802.11b, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2424.028 MHz : -13.660 dBm M2 : 6951.864 MHz : -61.483 dBm	Limit: -43.00 dBm Margin: -18.48 dB

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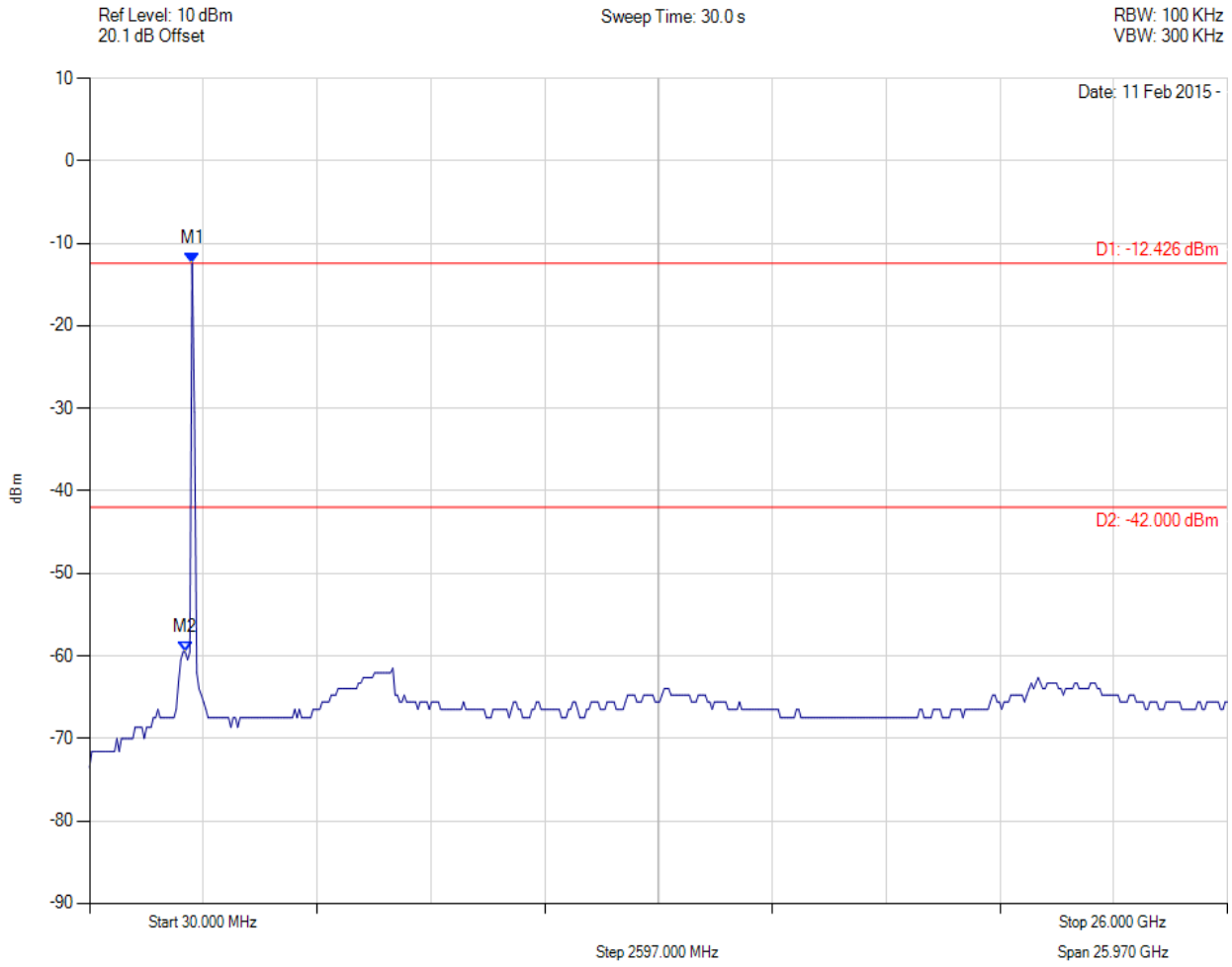
CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 802.11g, Channel: 2412.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2371.984 MHz : -12.426 dBm M2 : 2215.852 MHz : -59.545 dBm	Limit: -42.00 dBm Margin: -17.55 dB

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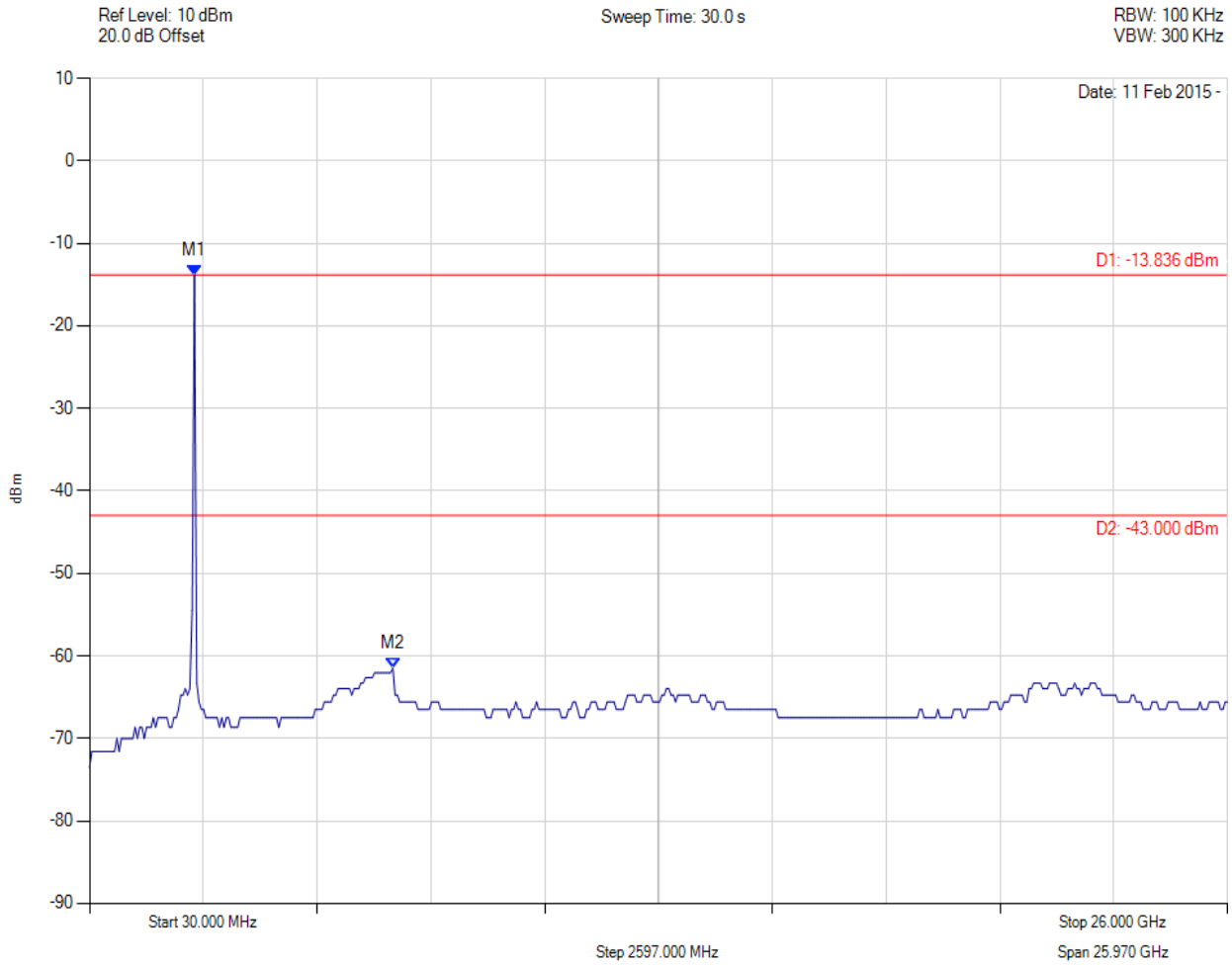
CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 802.11g, Channel: 2437.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2424.028 MHz : -13.836 dBm M2 : 6951.864 MHz : -61.483 dBm	Limit: -43.00 dBm Margin: -18.48 dB

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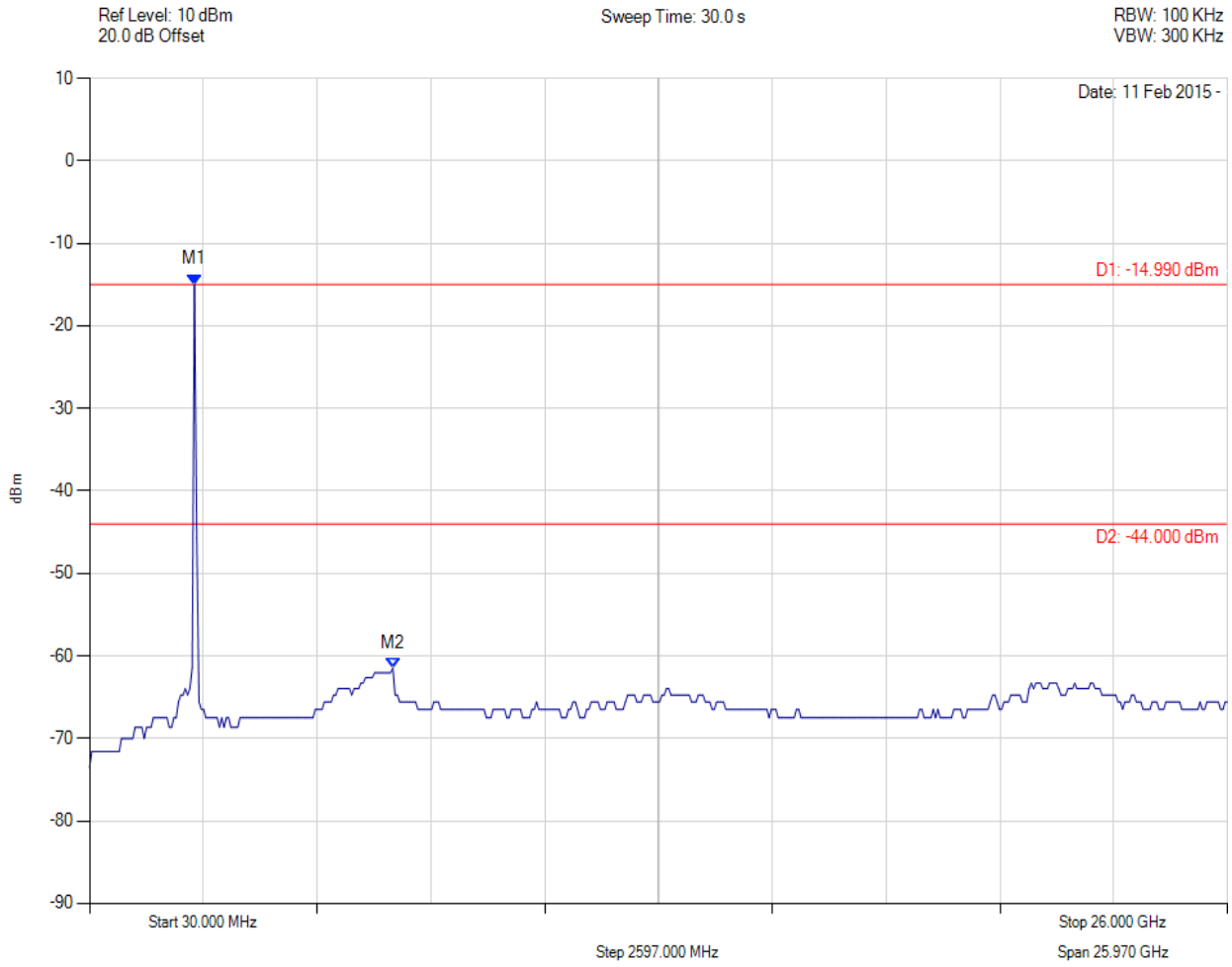
CONDUCTED SPURIOUS EMISSIONS - AVERAGE

Variant: 802.11g, Channel: 2462.00 MHz, Chain a, Temp: Ambient, Voltage: 28 Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = AVERAGE Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2424.028 MHz : -14.990 dBm M2 : 6951.864 MHz : -61.483 dBm	Limit: -44.00 dBm Margin: -17.48 dB

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