Test of: Axxcelera Broadband Wireless AxxceLTE

To: FCC 47 CFR Part 27

Test Report Serial No.: AXXC20-U3 Rev A

TEST REPORT

FROM

Test of: Axxcelera Broadband Wireless AxxceLTE

to

To: FCC 47 CFR Part 27

Test Report Serial No.: AXXC20-U3 Rev A

This report supersedes: NONE

Applicant: Axxcelera Broadband Wireless
82 Coromar Drive
Santa Barbara, California 93117
USA

Product Function: LTE eNodeB

Copy No: pdf Issue Date: 6th November 2015

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
575 Boulder Court,
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

TESTING CERT # 2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

This page has been left intentionally blank

TABLE OF CONTENTS

ACCREDITATION, LISTINGS & RECOGNITION

ACCREDITATION - TESTING

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025. 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

ilac-MRA

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 Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

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	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a 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
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065. 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)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)
RCB Identifier - 210

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft	28th October 2015	
Draft #2	1st November 2015	
Rev A	6th November 2015	Initial Release

1. TEST RESULT SUMMARY

Applicant:	Axxcelera Broadband Wireless 82 Coromar Drive Santa Barbara, California 93117 USA	Tested by:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California, 94566, USA
EUT:	LTE eNodeB	Tel:	+1 925 462 0304
Model:	AEN-114141-01	Fax:	+1 925 462 0306
S/N:	SCE1539001		
Test Date(s):	7th to 9th October 2015	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 27 & IC RSS-199	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.

Approved & Released for MiCOM Labs, Inc. by:

A2LA ACCREDITED
TESTING CERT # 2381.01

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 27	2012	Code of Federal Regulations
(ii)	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(iii)	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(iv)	M 3003	Edition 2 Jan. 2007	Expression of Uncertainty and Confidence in Measurements
(v)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(vi)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(vii)	A2LA	July 2012	Reference to A2LA Accreditation Status – A2LA Advertising Policy

2.2. Test and Uncertainty Procedures

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.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the Axxcelera Broadband Wireless AxxceLTE in the frequency range 2500-2690 to FCC Part 27 regulations.
Applicant:	Axxcelera Broadband Wireless 82 Coromar Drive Santa Barbara, California 93117 USA
Manufacturer:	As Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court, Pleasanton, 94566 California USA
Test report reference number:	AXXC20-U3 Rev A
Date EUT received:	7th October 2015
Standard(s) applied:	FCC 47 CFR Part 27
Dates of test (from - to):	7th to 9th October 2015
No of Units Tested:	One
Type of Equipment:	LTE eNodeB
Model(s):	4x4: AEN-114141-01 2x2: AEN-114100-01
Location for use:	Outdoor only
Declared Frequency Range(s):	2496 - 2690 MHz
Hardware Rev	4x4: 020-55026-1741-1 2x2: 020-55012-1741-1
Software Rev	EN11-A00
EUT Modes of Operation:	5, 10, 15, 20 MHz Channel Spacing
Type of Modulation:	QPSK, 16 QAM, 64 QAM
Transmit/Receive Operation:	Time Division Duplex
System Beam Forming:	Antenna beam forming is not implemented in this device
Rated Input Voltage and Current:	Nominal (4x4): -48 Vdc, 6.0 A Nominal (2x2): -48 Vdc, 5.0 A Maximum -60 Vdc Minimum -40 Vdc
Operating Temperature Range:	Declared range -40 to +55ºC
ITU Emission Designator:	5 MHz: 4M5D1D 10 MHz: 9M0D1D 15 MHz: 13M5D1D 20 MHz: 18M0D1D
Equipment Dimensions:	19 x 14 x 8.5 inches
Weight:	4x4: 50 lbs (22.75 kgs) 2x2: 47 lbs (21.50 kgs)
Primary function of equipment:	LTE eNodeB

3.2. Scope of Test Program

Axxcelera Broadband Wireless AxxceLTE RF Testing

The scope of the test program was to test the Axxcelera Broadband Wireless AxxceLTE, in the frequency range 2500 - 2690 MHz for compliance against FCC 47 CFR Part 27 specification.

FCC CFR 47 Part 27, 2496– 2690 MHz (LTE Band 41)
Subpart M - Broadband Radio Service and Educational Broadband Service

Axxcelera AxxceLTE
The Axxcelera AxxceLTE is an LTE base station radio transmission and reception device.

AEN-114141-01 (4x4)
The AxxceLTE product is a complete LTE eNodeB, including both the digital network and RF radio interfaces. It operates in LTE Band 41, which is defined as a TDD band from 2496 - 2690MHz. The model AEN-114141-01 contains (2) transceiver ICs supporting a total of (4) transmit and (4) receive channels.

Each transmit path contains a PA capable of supporting a 5-watt output signal level at the antenna port.
The unit is designed to run either:

- Single 4x4 sector at a single frequency channel in the band, or
- Dual 2x2 sectors each running at separate frequency channels in the band.

Axxcelera Broadband Wireless AxxceLTE eNodeB

Axxcelera Broadband Wireless AxxceLTE eNodeB – Connectors

Axxcelera Broadband Wireless AxxceLTE eNodeB – Label

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	LTE eNodeB	Axxcelera	AEN-114141-01	SCE1539001
Support	Laptop PC	IBM	Unknown	None

3.4. Antenna Details

Type	Manufacturer	Model Number	Azimuth/Elevation	Antenna Gain (dBi)
				2496 - 2690 MHz
External	Alpha Wireless	AW3286 (2 port)	65° / 5.5°	17.7 (10 @ 0-tilt)
External	Alpha Wireless	AW3193 (4 port)	65° / 5.5°	17.7 (18 @ 0-tilt)

3.5. Cabling and I/O Ports

Number and type of I/O ports

Port Type	Max Cable Length	# Of Ports	Screened	Conn Type	Data Type
Sync I/O	10m	2	Y	TNC	Digital
GPS Antenna	3m	1	Y	SMA	RF Port
Ethernet SPF	--	2	N/A	SFP	Optical
Ethernet	100m	1	Y	RJ-45	Packet
CPRI SFP	--	4	N/A	SFP	Optical
RF Antenna	Unknown	4 (4x4)	Y	N-Type	RF Port
RF Antenna	Unknown	2 (2x2)	Y	N-Type	RF Port

3.6. 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.

Matrix of test configurations

Operational Mode(s)	Variant	Data Rates with Highest Power	Test Frequencies (MHz)
5 MHz Bandwidth	QPSK + 64 QAM	Setting 5	2498.5 2593.0 2685.7
10 MHz Bandwidth		Setting 5	
15 MHz Bandwidth		Setting 5	
20 MHz Bandwidth		Setting 5	

3.7. Equipment Modifications

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

1. NONE

3.8. Deviations from the Test Standard

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

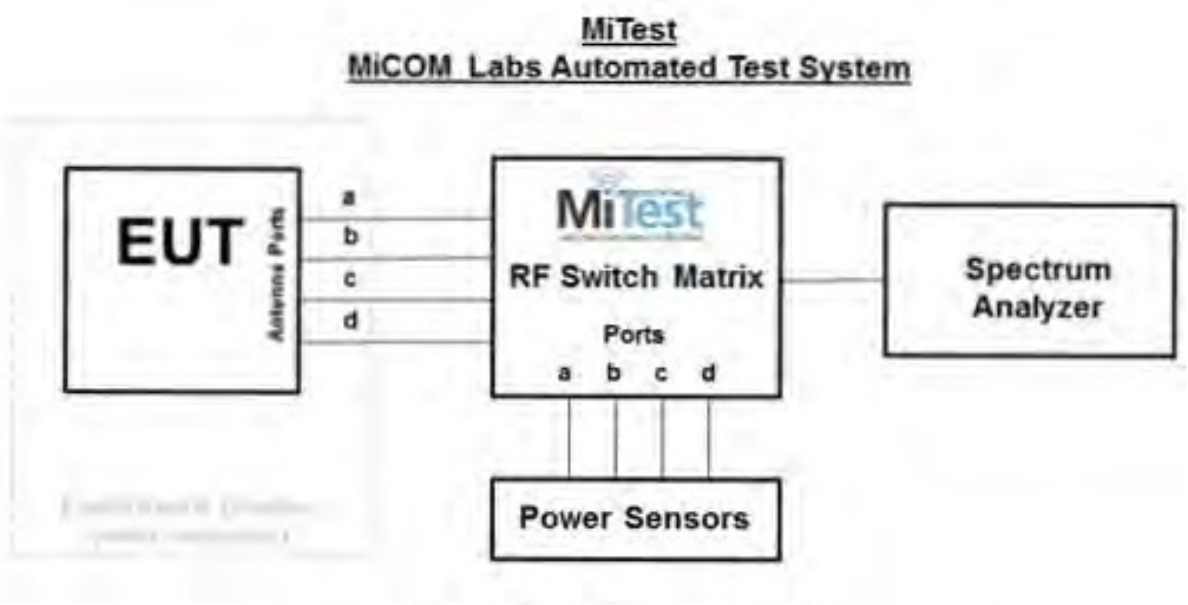
1. NONE

4. TESTING EQUIPMENT CONFIGURATION(S)

4.1. Conducted RF Emission Test Set-up

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

1. Section 6.1.1.2 Occupied Bandwidth
2. Section 6.1.1.4. Maximum Conducted Output Power
3. Section 6.1.1.5 Conducted Spurious Emissions
4. Section 6.1.1.5 Band-Edge Spurious Emissions



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.

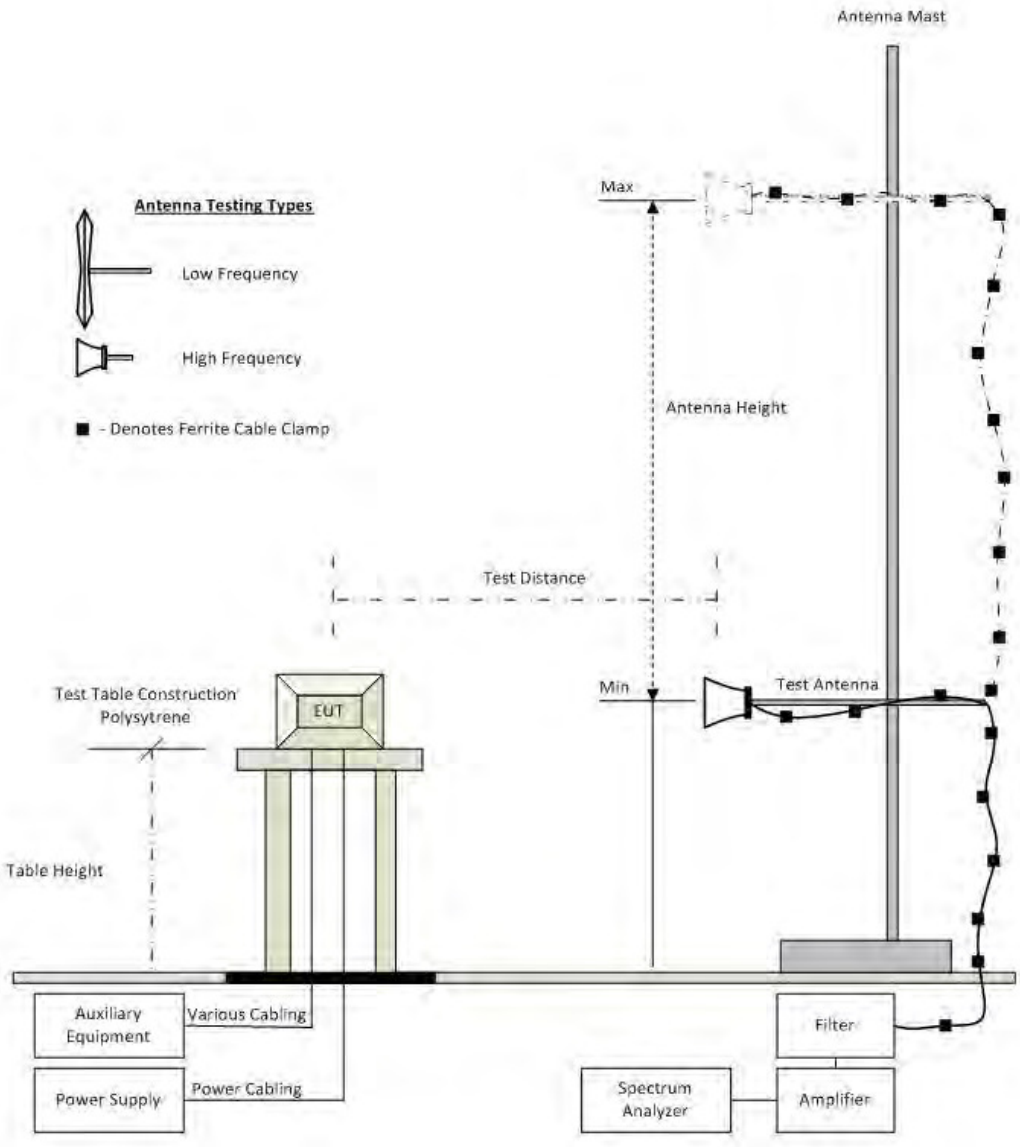
Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2015
249	Resistance Thermometer	Thermotronics	GR2105-02	9340 #2	30 Oct 2015
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	27 Aug 2016
361	Desktop for RF#1, Labview Software installed	Dell	Vostro 220	WS RF#1	Not Required
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	04 Aug 2016
380	4x4 RF Switch Box	MiCOM Labs	MiTest RF Switch Box	MIC001	20 Dec 2015
390	USB Power Head 50MHz - 24GHz -60 to +20dBm	Agilent	U2002A	MY50000103	17 Oct 2016
398	Test Software	MiCOM	MiTest ATS	Version 3.0.0.16	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
436	USB Wideband Power Sensor	Boonton	55006	8731	31 Jul 2016
437	USB Wideband Power Sensor	Boonton	55006	8759	31 Jul 2016
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 SA #452	Precision SMA Male RG-402 Spectrun Analyzer	Fairview Microwave	Precision SMA Male RG 402 coax	None	20 Dec 2015
RF#1 SMA#1	EUT to Mitest box port 1	Flexco	SMA Cable port1	None	20 Dec 2015
RF#1 SMA#2	EUT to Mitest box port 2	Flexco	SMA Cable port2	None	20 Dec 2015
RF#1 SMA#3	EUT to Mitest box port 3	Flexco	SMA Cable port3	None	20 Dec 2015
RF#1 SMA#4	EUT to Mitest box port 4	Flexco	SMA Cable port4	None	20 Dec 2015
RF#1 USB#1	USB Cable to Mitest Box	Dynex	USB Cable	None	Not Required

4.2. Radiated Spurious Emission Test Set-up

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

1. Spurious Emissions

Radiated Emission Measurement Setup – Above 1 GHz



Radiated Emission Test 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
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CY101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	27 Aug 2016
310	SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	30 Oct 2015
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	15 Aug 2016
393	DC - 1050 MHz Low Pass Filter	Microcircuits	VLFX-1050	N/A	08 Oct 2016
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	24 Feb 2016
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Nov 2015
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	28 May 2016
410	Desktop Computer	Dell	Inspiron 620	WS38	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
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	Rad Emissions Test Software	MiCOM	Software Ver. 1.0.73	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	25 Feb 2016
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	25 Feb 2016
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	25 Feb 2016
480	Cable - Bulkhead to Amp	SRC Haverhill	157-157-3050360	480	11 Aug 2016
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-151-3050787	481	11 Aug 2016
482	Cable - Amp to Antenna	SRC Haverhill	157-157-3051574	482	11 Aug 2016

5. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 27** and **Industry Canada RSS-199**, **Industry Canada RSS-Gen** **and GL-07.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
2.1033(c) **4.1**	Type of Modulation	Modulation type	Conducted	Complies	6.1.1.1
2.1033(c) **4.2**	Channel Bandwidth	99% Emission bandwidth	Conducted	Complies	6.1.1.2
2.1055, 27.54 **4.3**	Transmitter Frequency Stability	Frequency contained within band of interest	Conducted	Complies GPS Locked	6.1.1.3
2.1046 **5.2.1** **4.4**	Transmitter Output Power & EIRP	Power Measurement	Conducted	Complies	6.1.1.4
2.1051, 27.53(m) **4.5**	Transmitter Unwanted Emissions	Transmitter Spurious Emissions	Conducted	Complies	6.1.1.5

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

List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 27** and **Industry Canada RSS-199** and **Industry Canada RSS-Gen**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
2.1051, 27.53(m) **4.5**	Radiated Emissions		Radiated	Complies	6.1.2.1
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz			
	Radiated Band Edge	Band edge results			
	Receiver Spurious Emissions	Emissions above 1 GHz			
2.1051, 27.53(m) **4.5**	Digital Emissions	Emissions <1 GHz (30M-1 GHz)		Complies	6.1.2.2
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Not Tested*	6.1.3

*Device is powered by -48 Vdc

6. TEST RESULTS

6.1. Device Characteristics

6.1.1. Conducted Testing

6.1.1.1. Type of Modulation

Conducted Test Conditions for Type of Modulation			
Standard:	FCC CFR 47:Part 27	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Type of Modulation	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	2.1033(c)	**Pressure (mBars):**	999 - 1001
Reference Document(s):			

Test Procedure for Type of Modulation

The type of a digital modulation employed for the Axxcelera AxxceLTE is QPSK, 16 QAM, 64 QAM.

Requirement

Equipment certified under the standard shall employ digital modulation

6.1.1.2. Channel Bandwidth

Conducted Test Conditions for Occupied Bandwidth			
Standard:	FCC CFR 47:Part 27	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Occupied Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	2.1033(c)	**Pressure (mBars):**	999 - 1001
Reference Document(s):			

Test Procedure for Channel Bandwidth Measurement

The 99 % channel bandwidth is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The Resolution Bandwidth was set to approximately 1% of the emission bandwidth.

Limits

The channel bandwidth shall be equal to or greater than 1 MHz and shall be reported by the certification applicant. Based on the channel bandwidth, the channel edge shall be used as reference point in the measurement of the transmitter unwanted emission power.

Measurement Results for 99 % Operational Bandwidth

Equipment Configuration for 99% Occupied Bandwidth			
Variant:	5 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results								
Test Frequency	**Measured 99% Bandwidth (MHz)**							
	Port(s)							
MHz	**a**	**b**	**c**	**d**				
2593	4.50	4.50	4.50	4.50				

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 99% Occupied Bandwidth			
Variant:	5 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	QPSK	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)							
MHz	**a**	**b**	**c**	**d**				
2593	4.50	4.50	4.48	4.50				

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 99% Occupied Bandwidth			
Variant:	20 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results								
Test Frequency	**Measured 99% Bandwidth (MHz)**							
	Port(s)							
MHz	**a**	**b**	**c**	**d**				
2593	17.95	18.03	17.87	17.95				

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 99% Occupied Bandwidth			
Variant:	20 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	QPSK	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results								
Test Frequency	**Measured 99% Bandwidth (MHz)**							
	Port(s)							
MHz	**a**	**b**	**c**	**d**				
2593	17.87	17.87	17.95	17.87				

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 99% Occupied Bandwidth			
Variant:	10 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results								
Test Frequency	**Measured 99% Bandwidth (MHz)**							
	Port(s)							
MHz	**a**	**b**	**c**	**d**				
2593	9.01	8.97	8.97	9.01				

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).

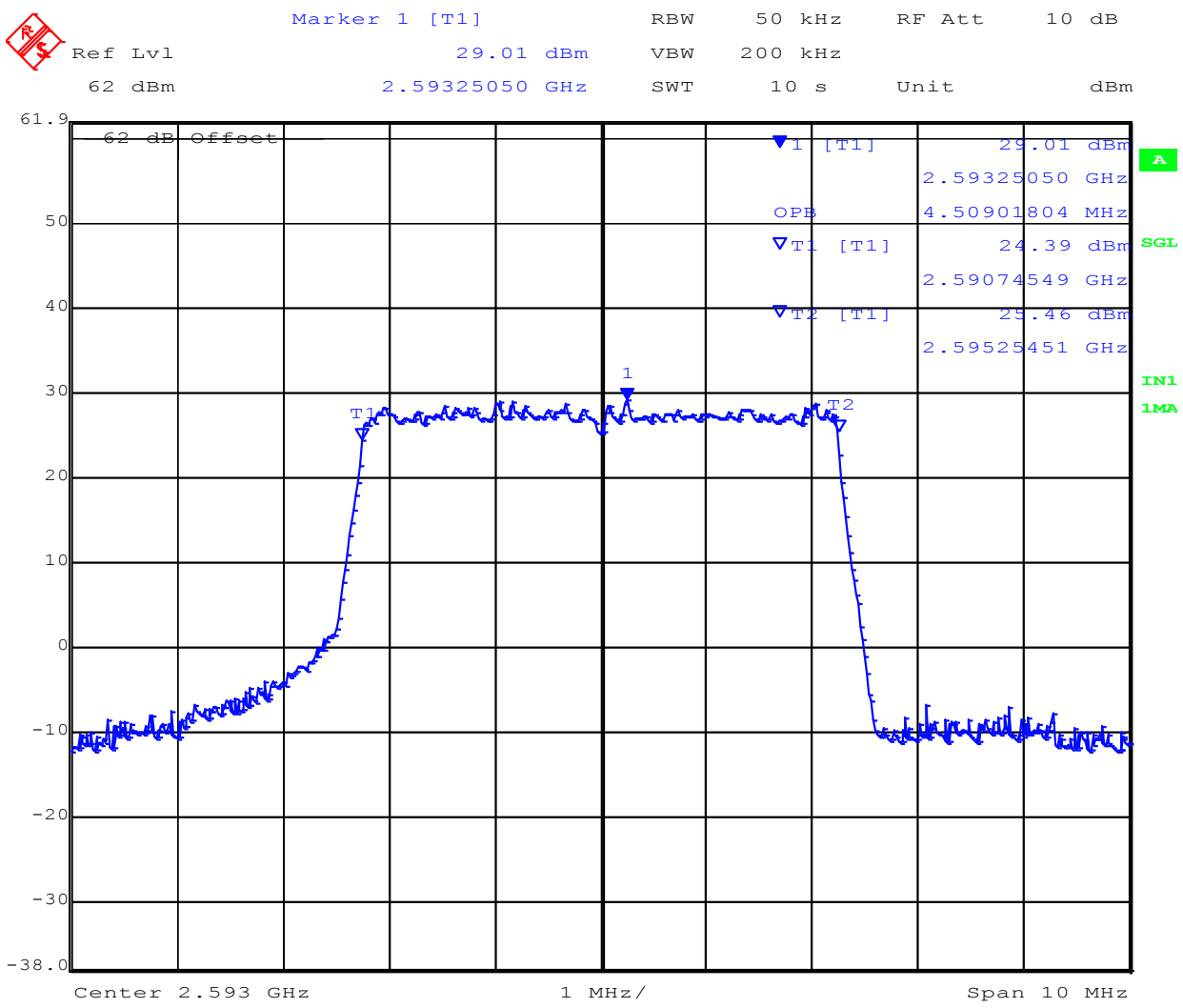
Equipment Configuration for 99% Occupied Bandwidth			
Variant:	15 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results								
Test Frequency	**Measured 99% Bandwidth (MHz)**							
	Port(s)							
MHz	**a**	**b**	**c**	**d**				
2593	13.46	13.46	13.46	13.46				

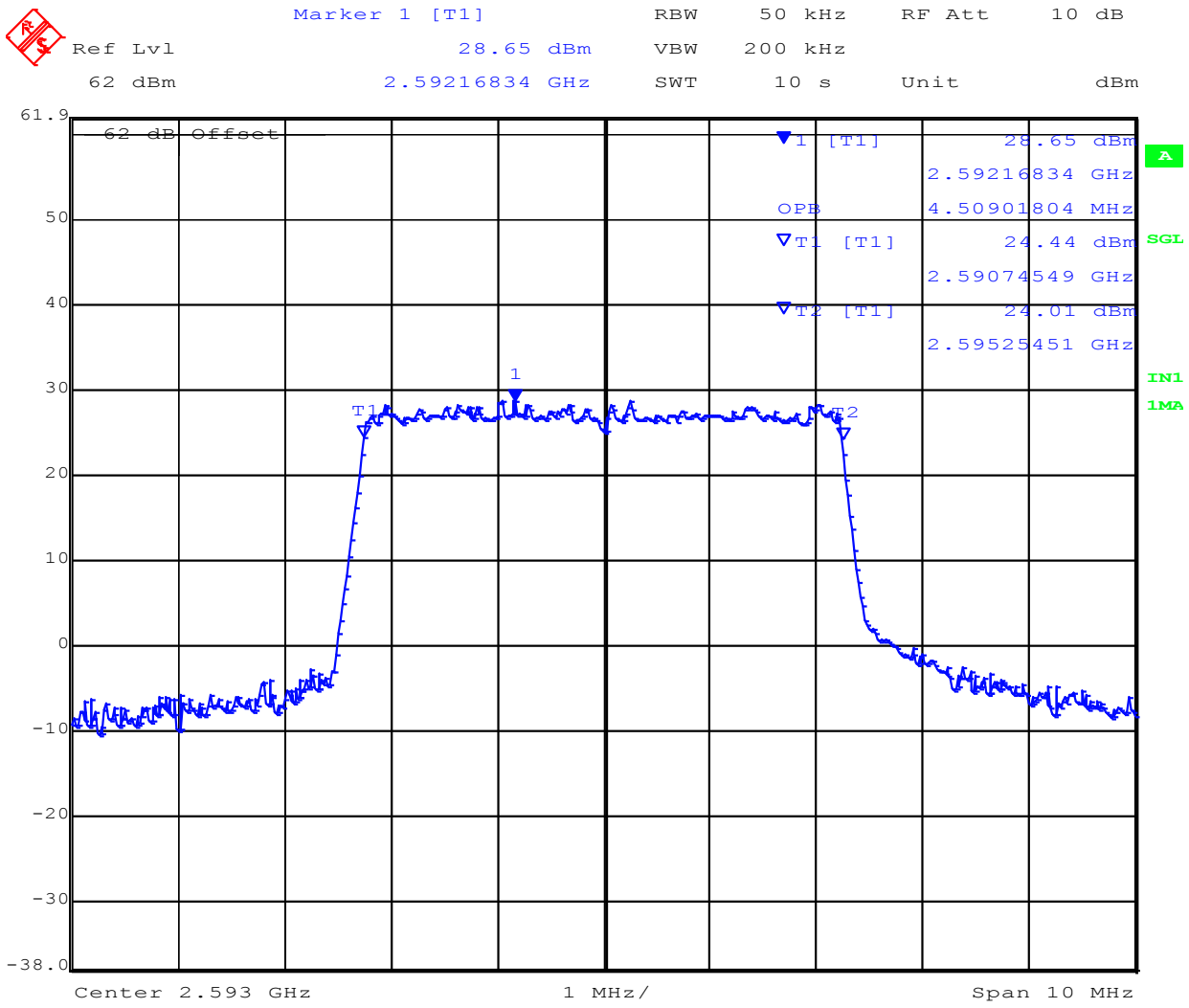
Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

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

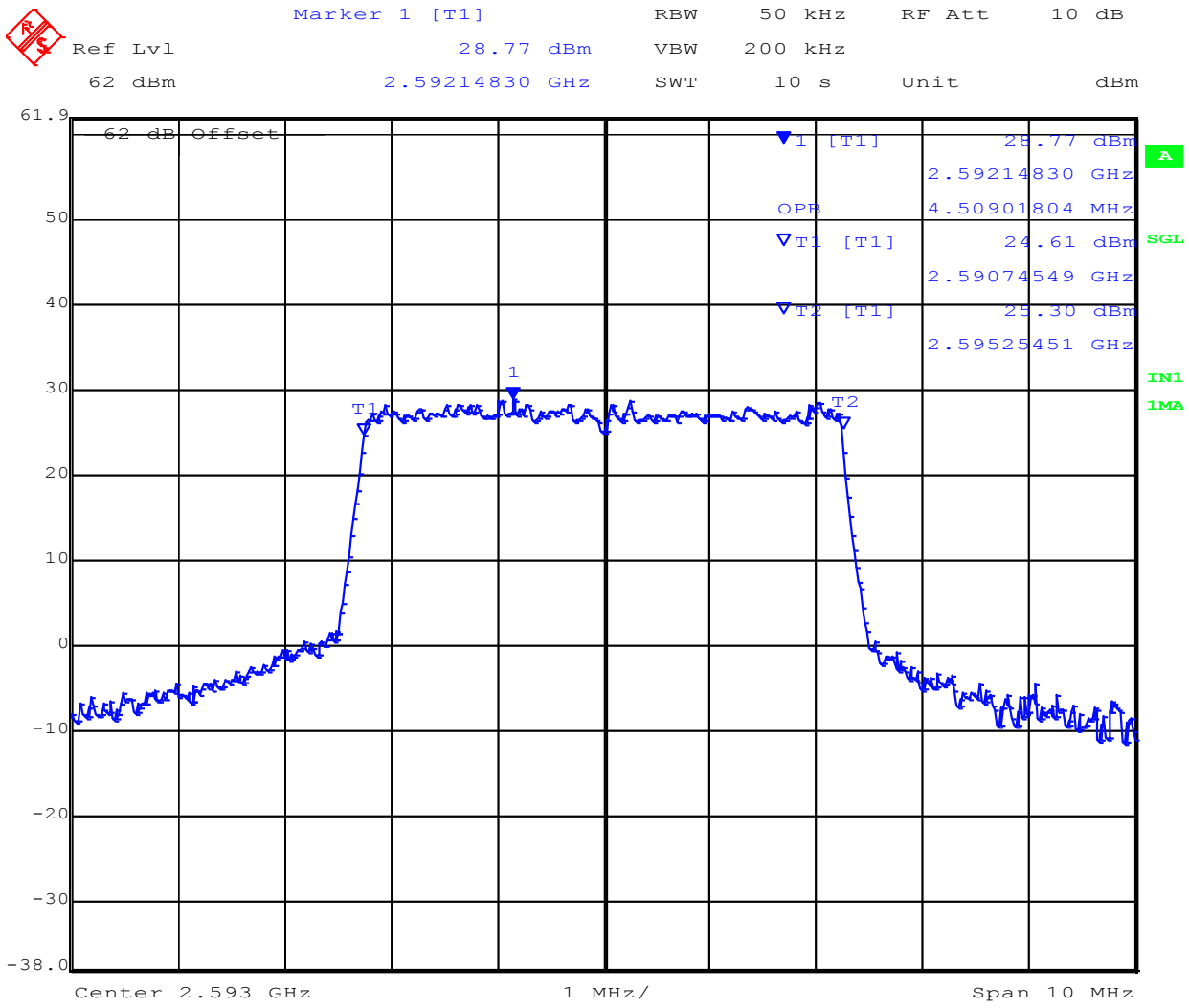
5 MHz Chain A 64 QAM



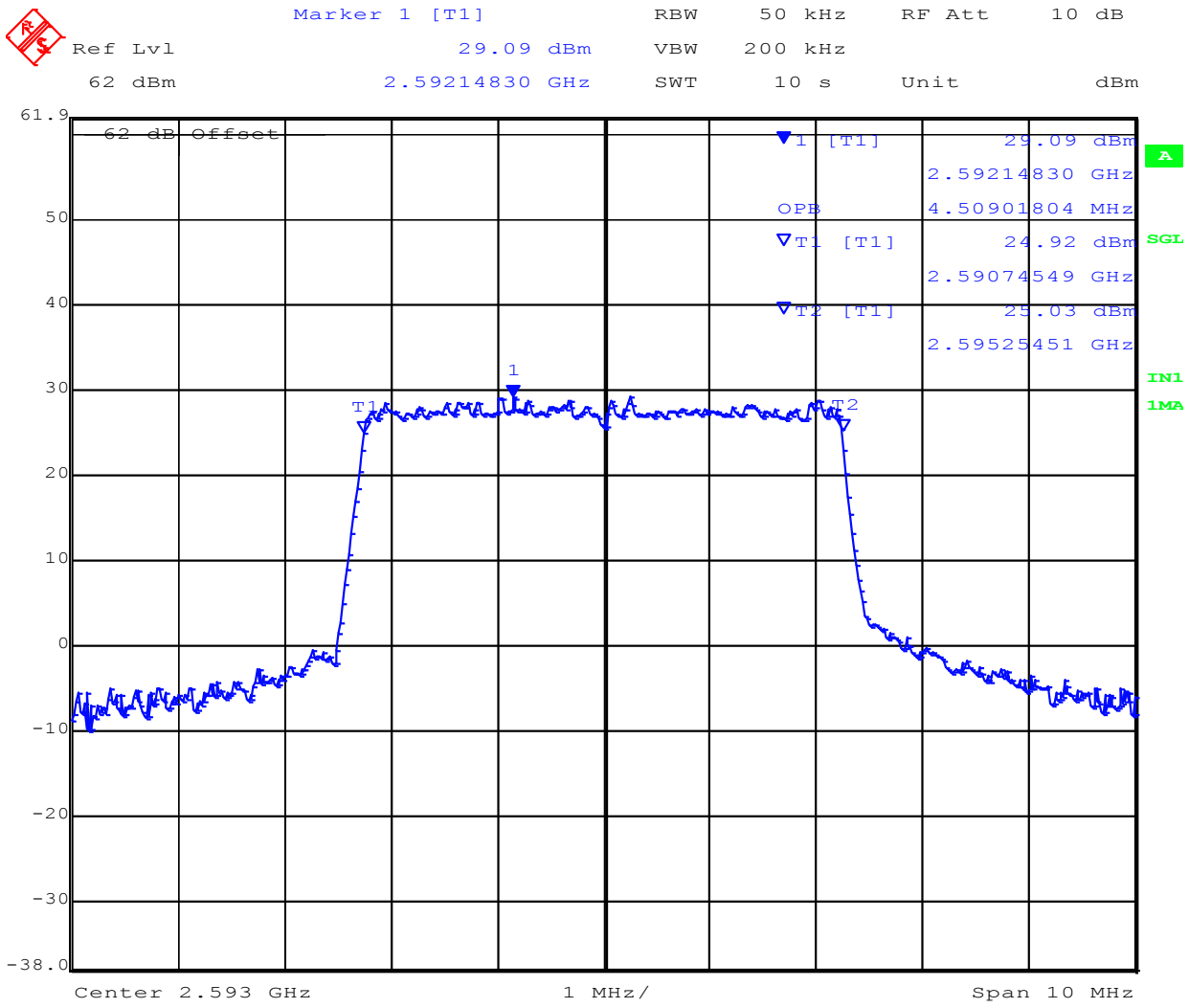
5 MHz Chain B 64 QAM



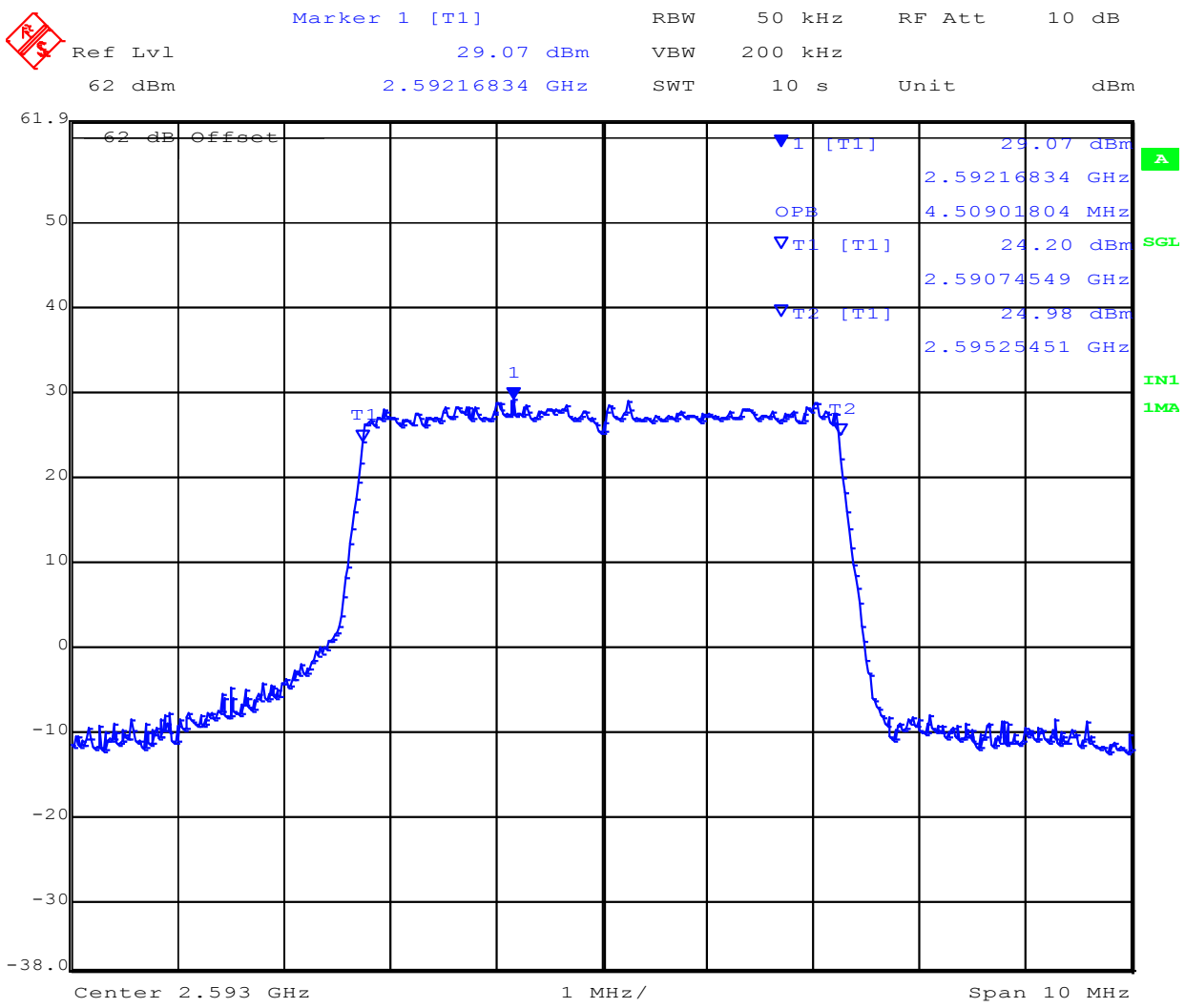
5 MHz Chain C 64 QAM



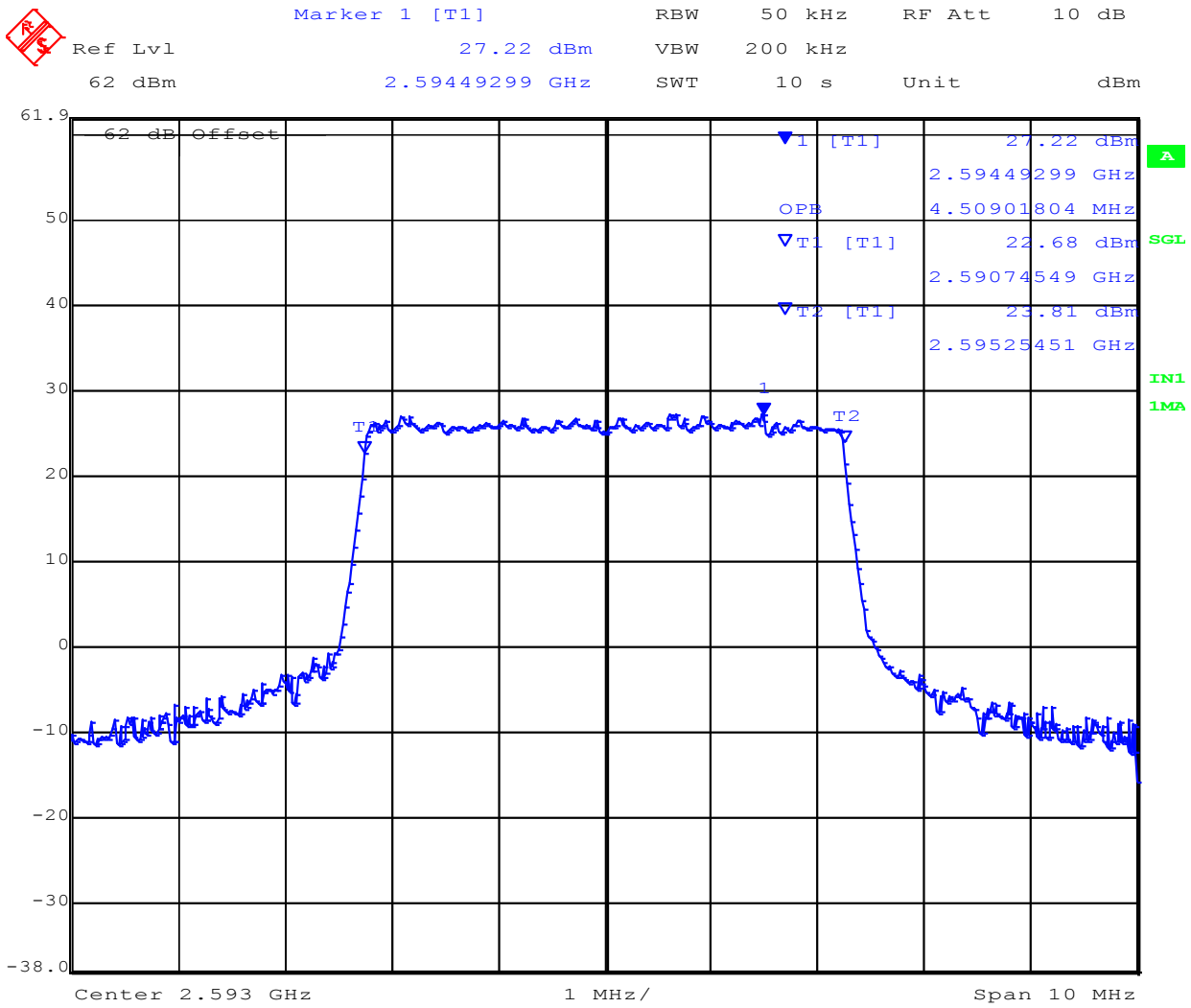
5 MHz Chain D 64 QAM



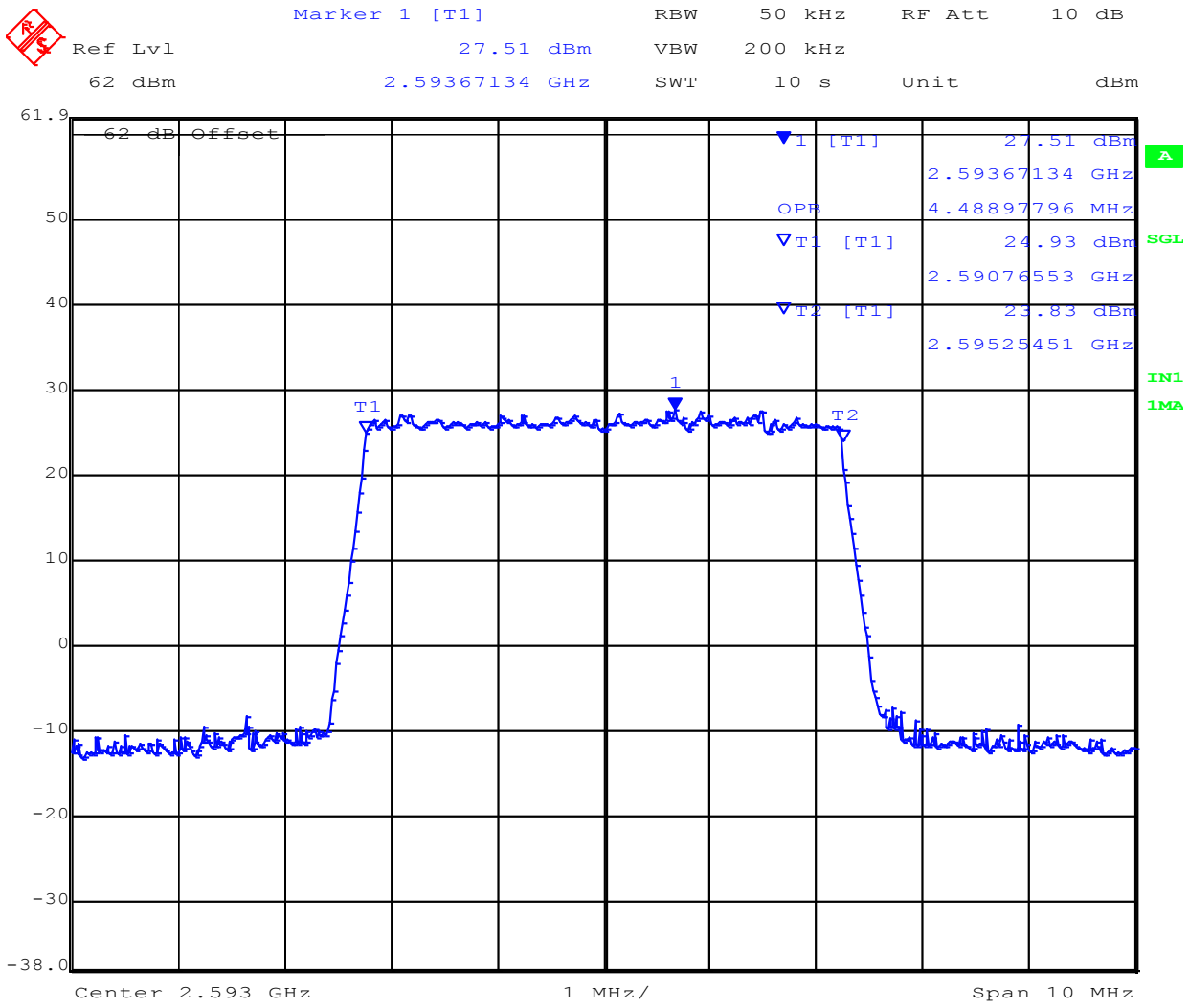
5 MHz Chain A QPSK



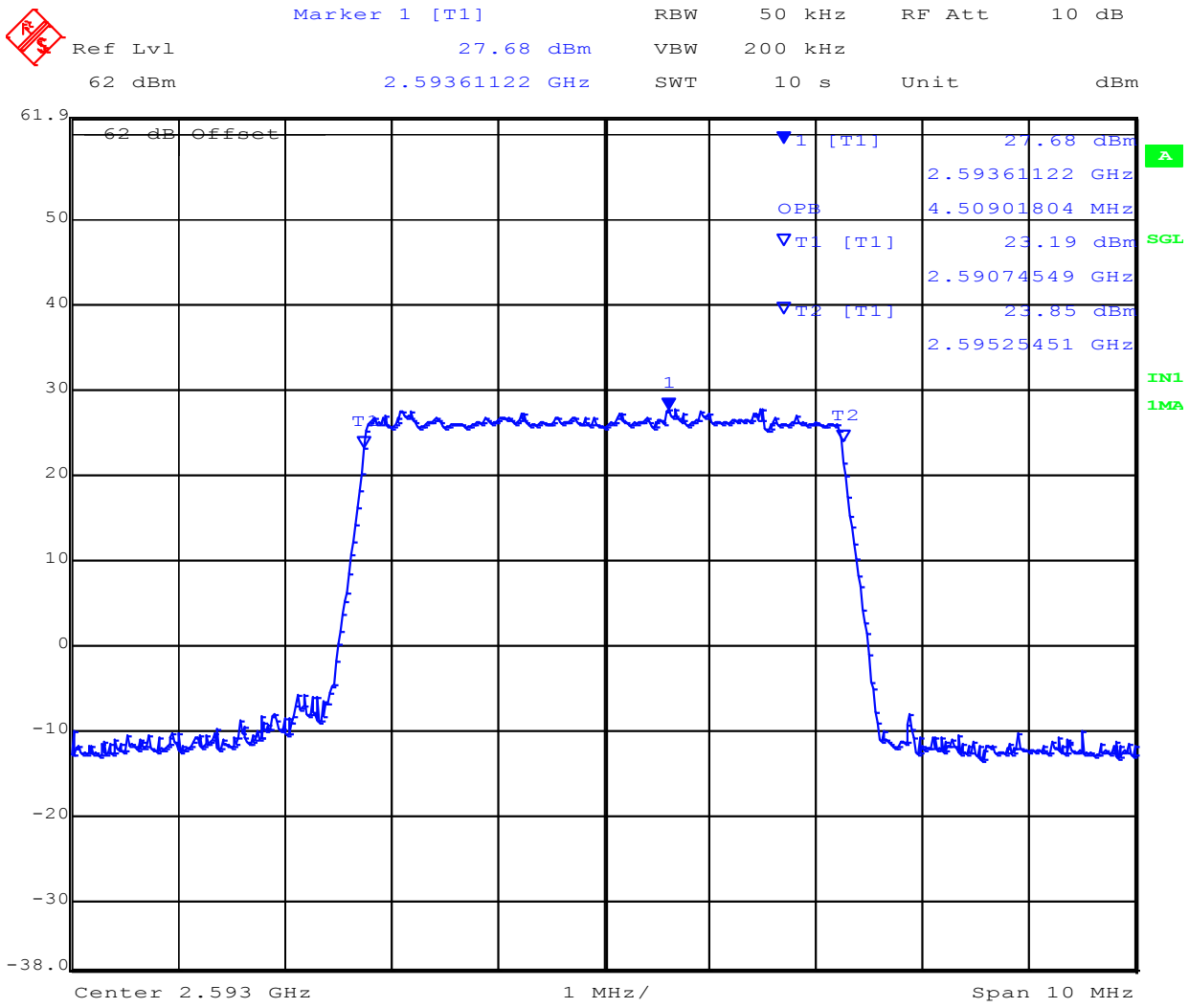
5 MHz Chain B QPSK



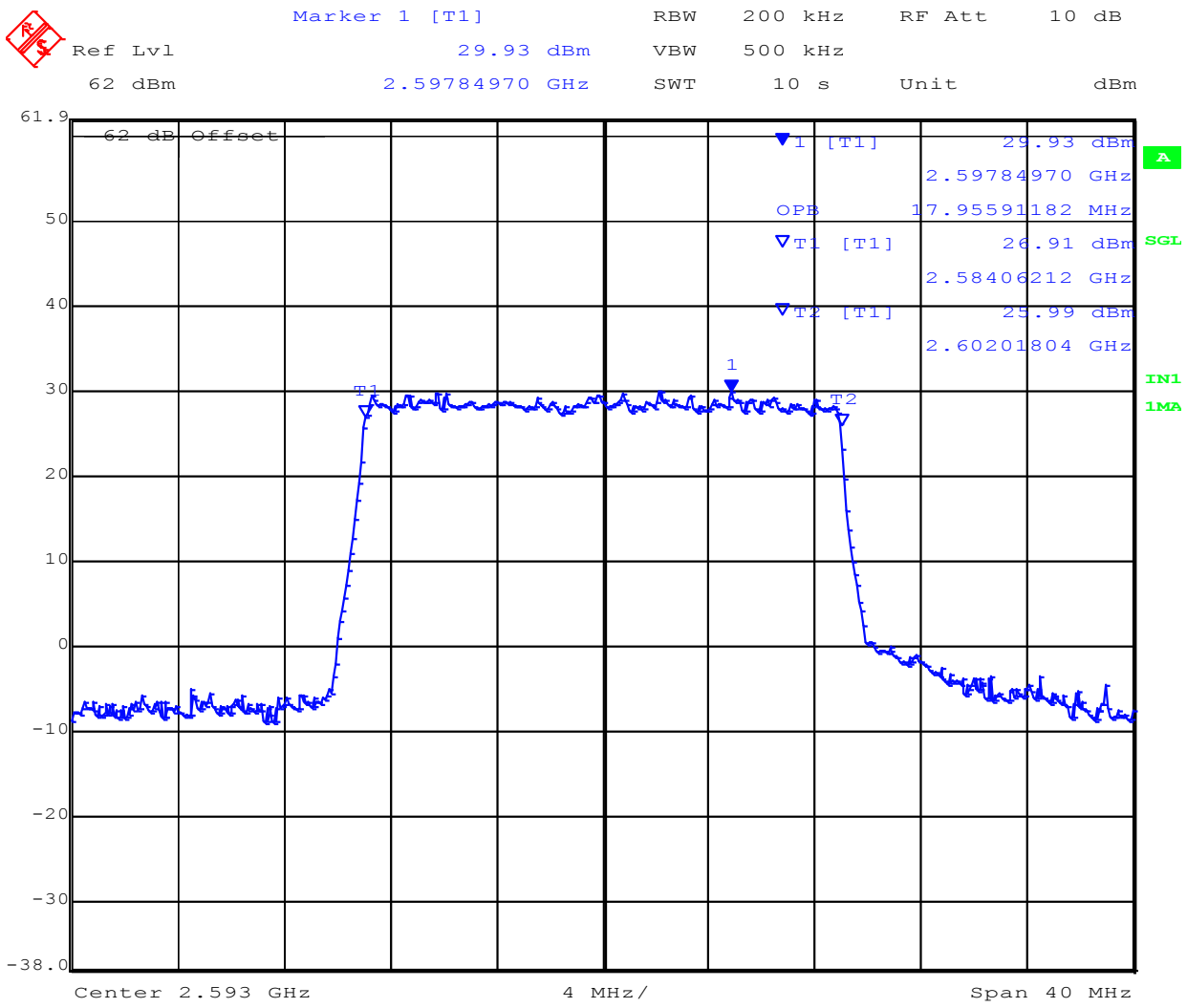
5 MHz Chain C QPSK



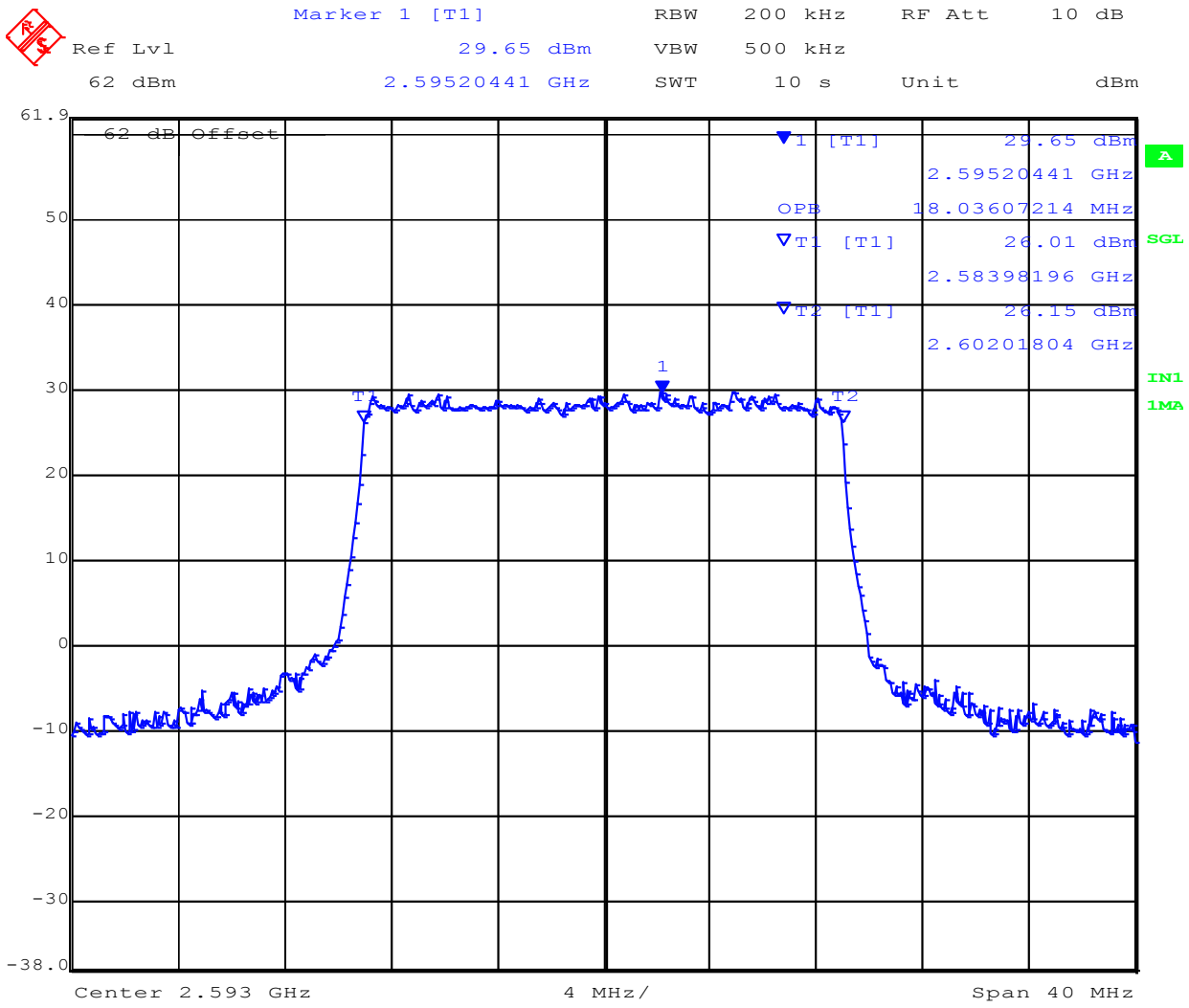
5 MHz Chain D QPSK



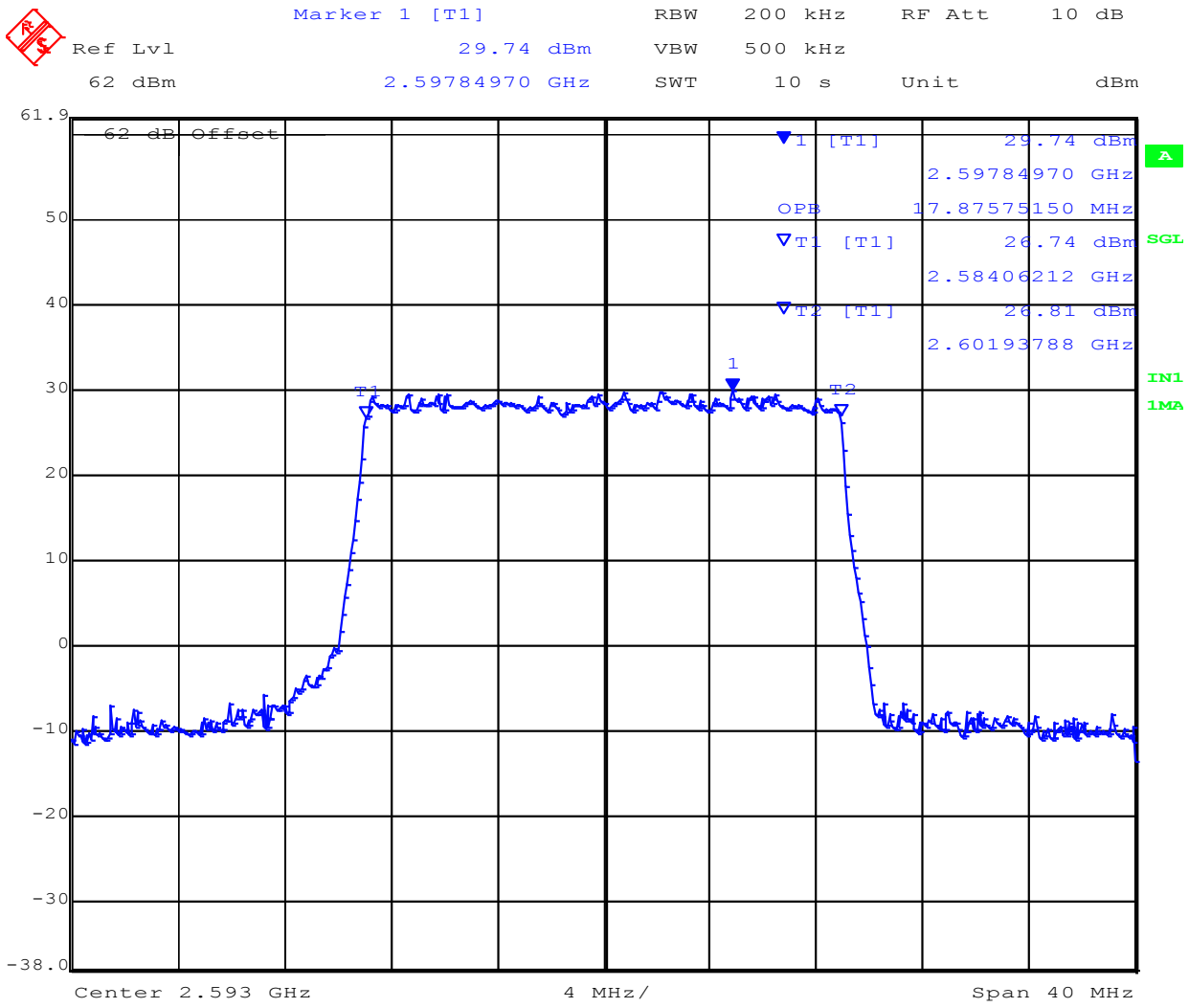
20 MHz Chain A 64 QAM



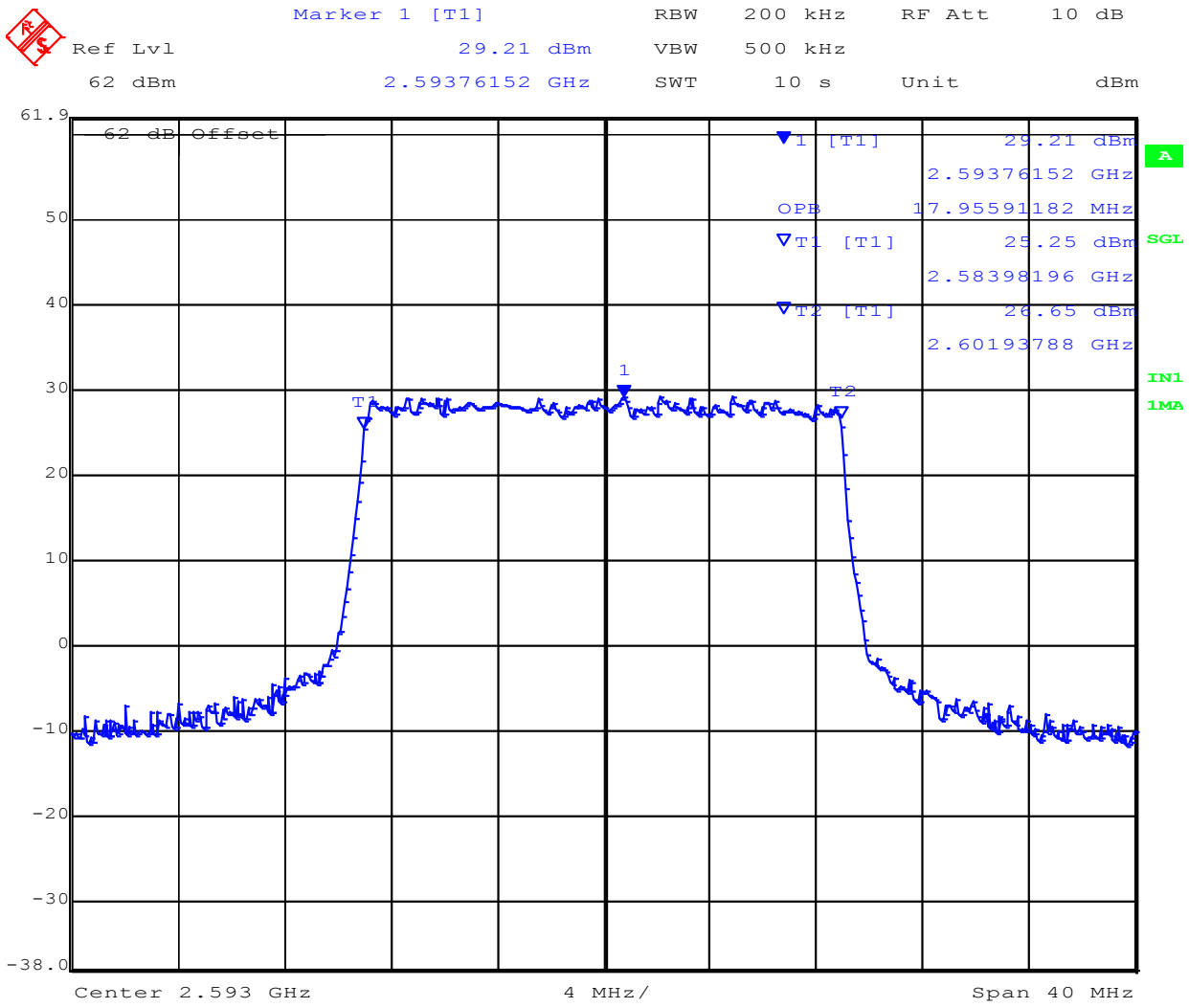
20 MHz Chain B 64 QAM



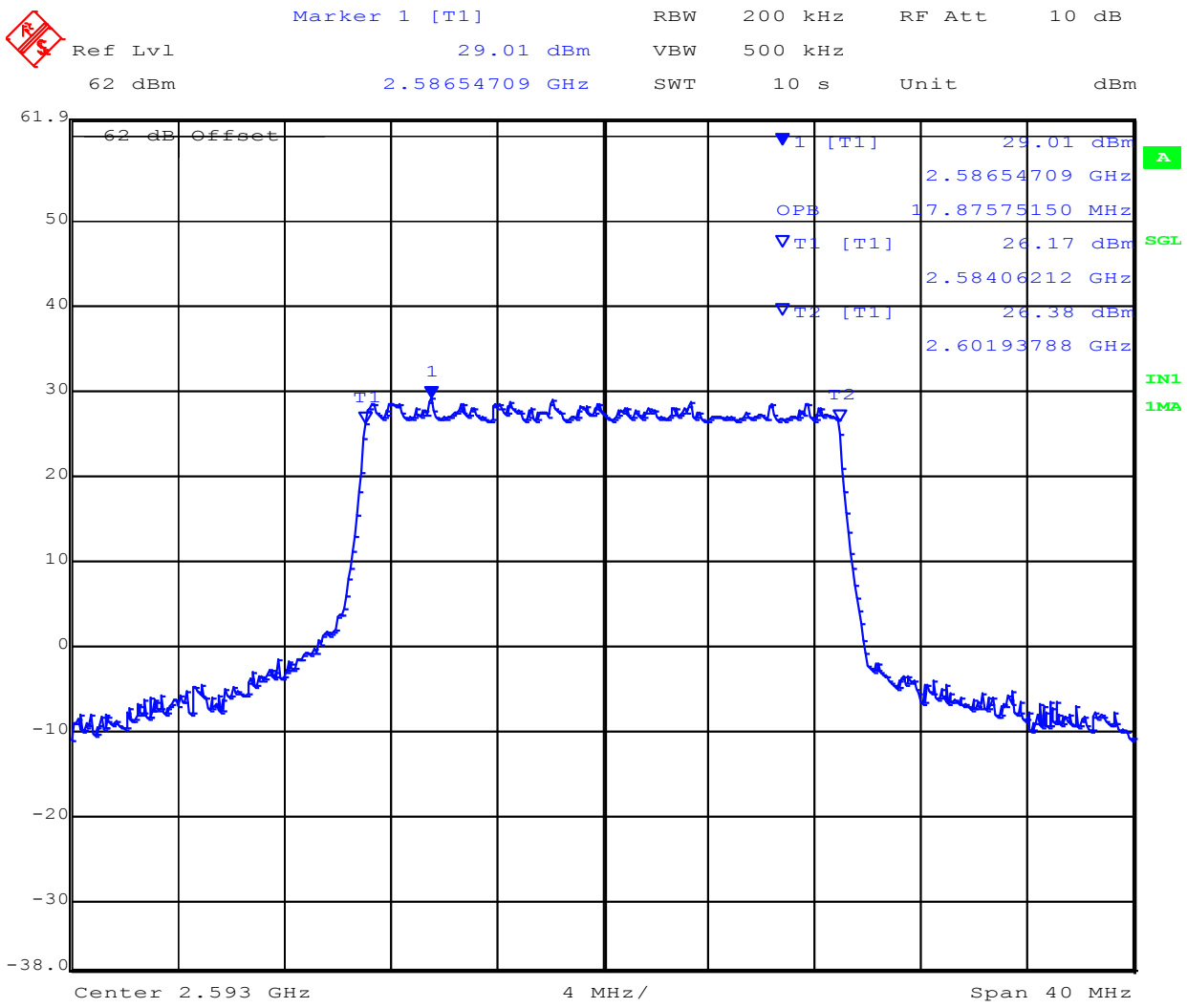
20 MHz Chain C 64 QAM



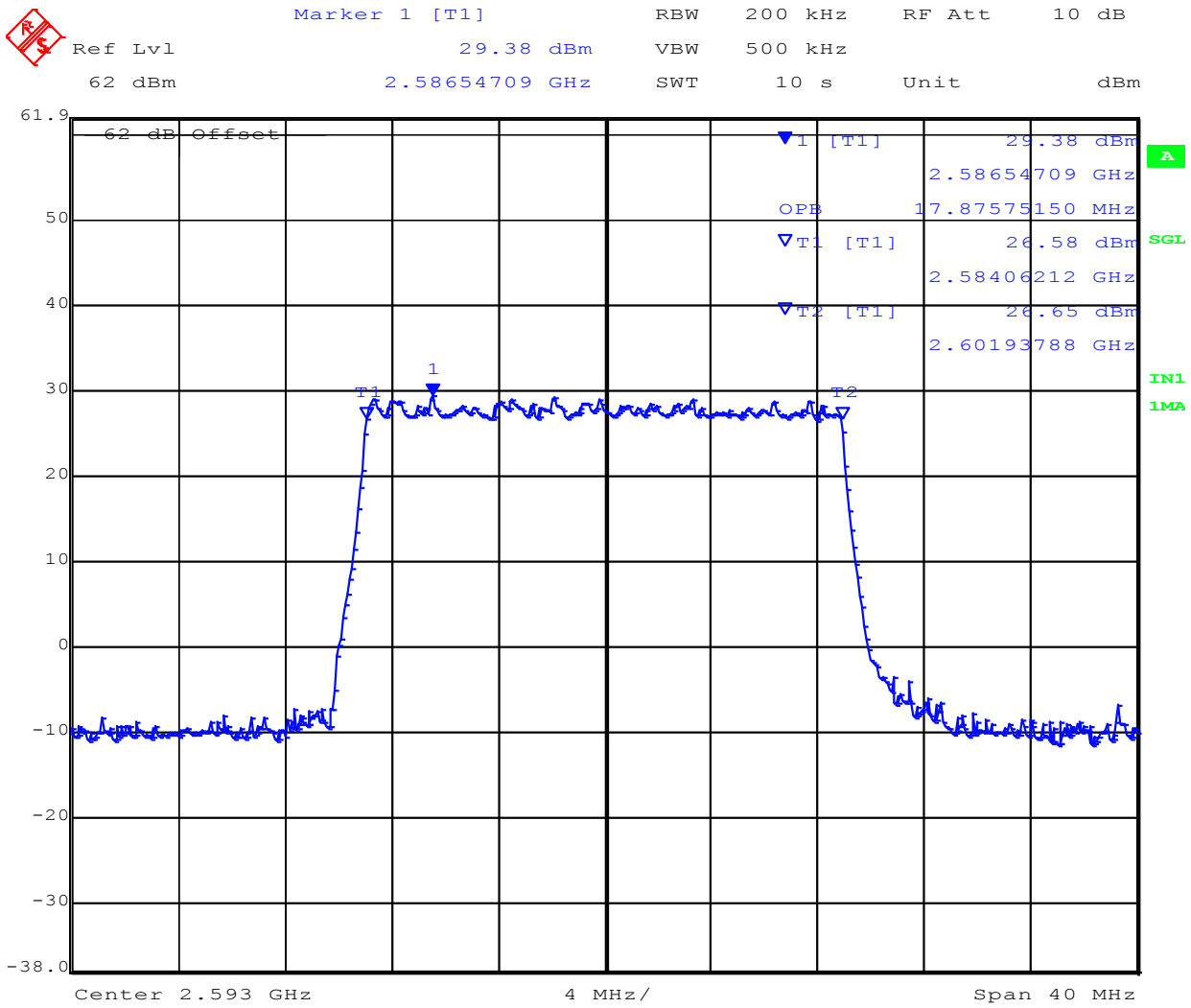
20 MHz Chain D 64 QAM



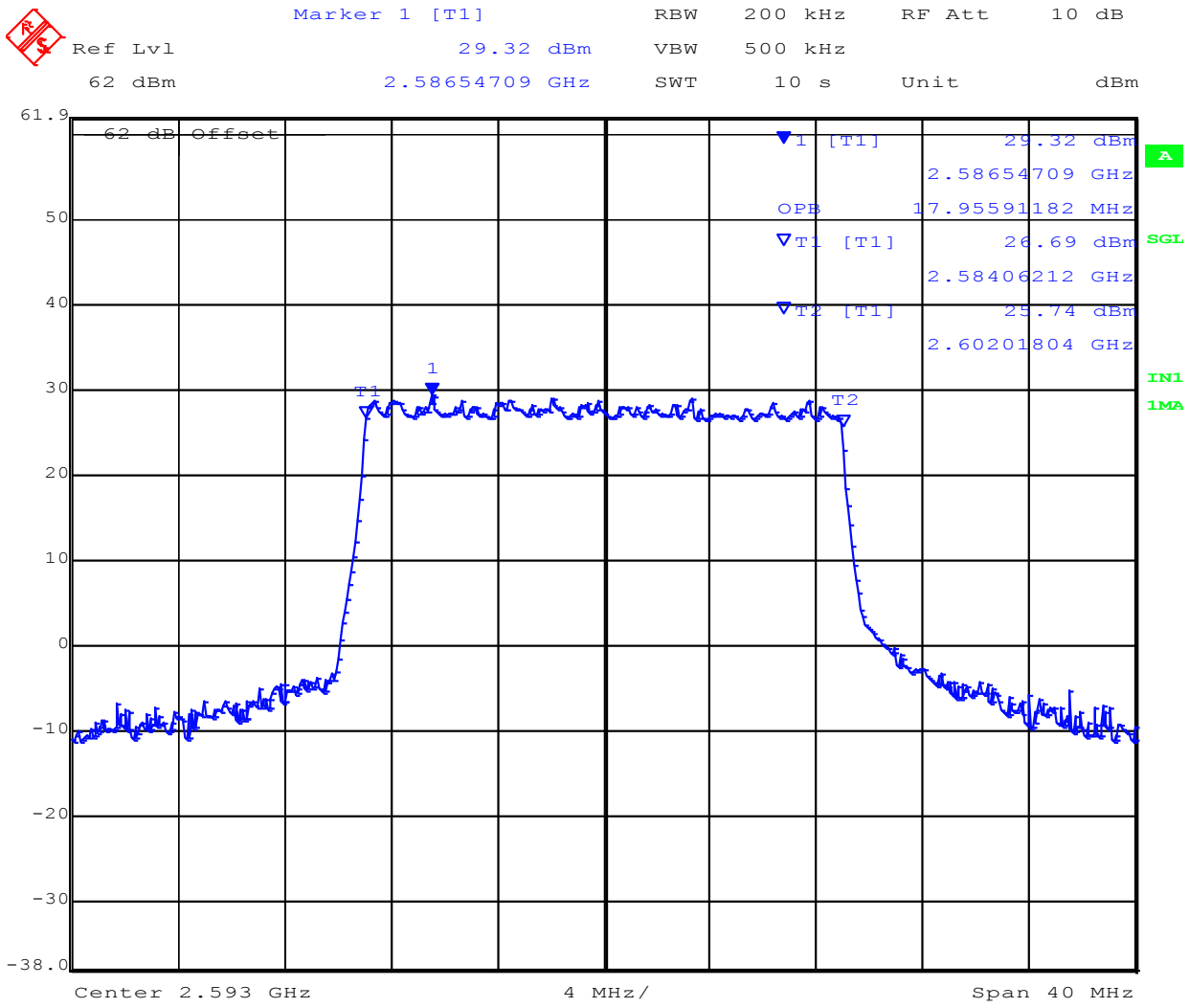
20 MHz Chain A QPSK



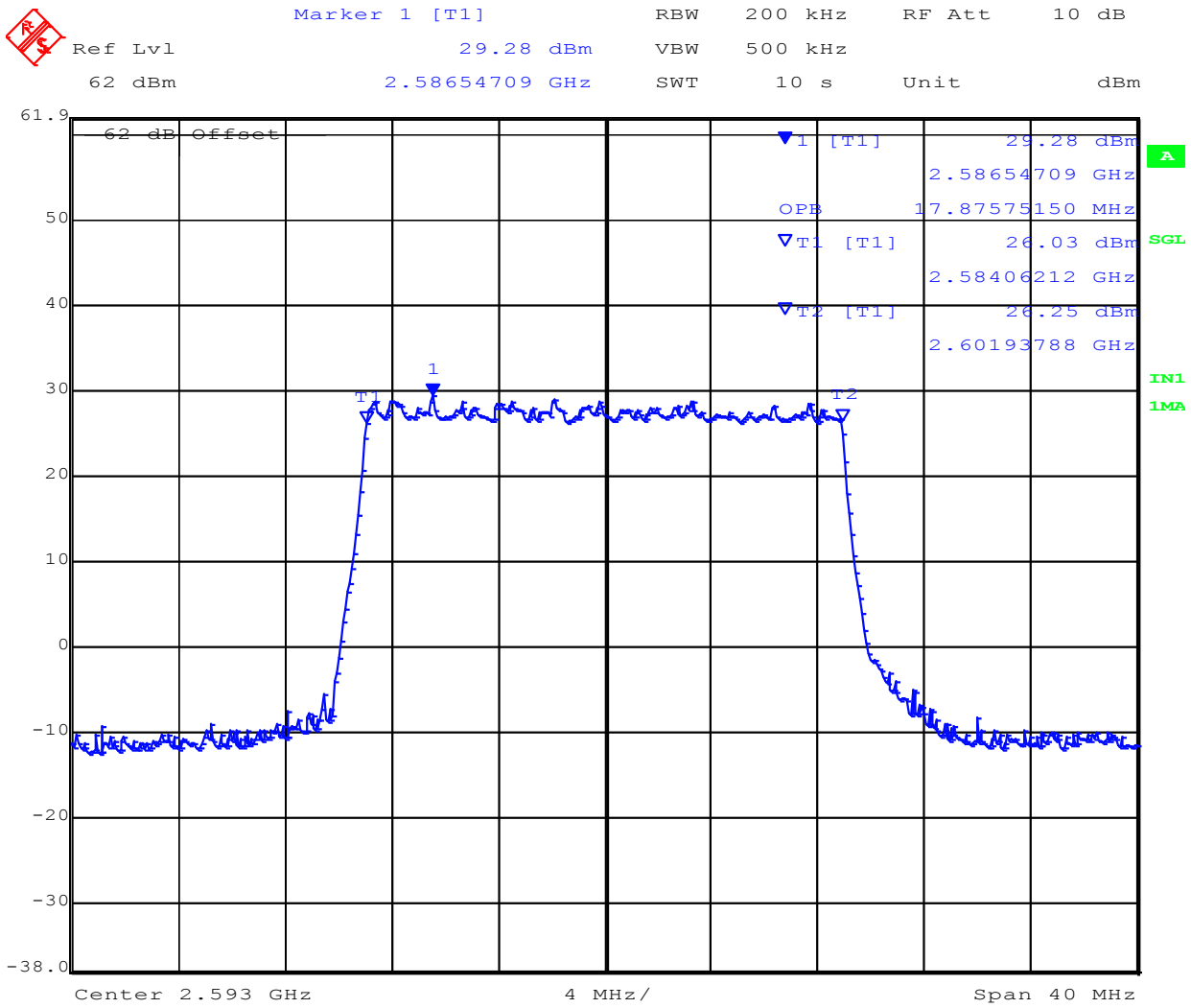
20 MHz Chain B QPSK



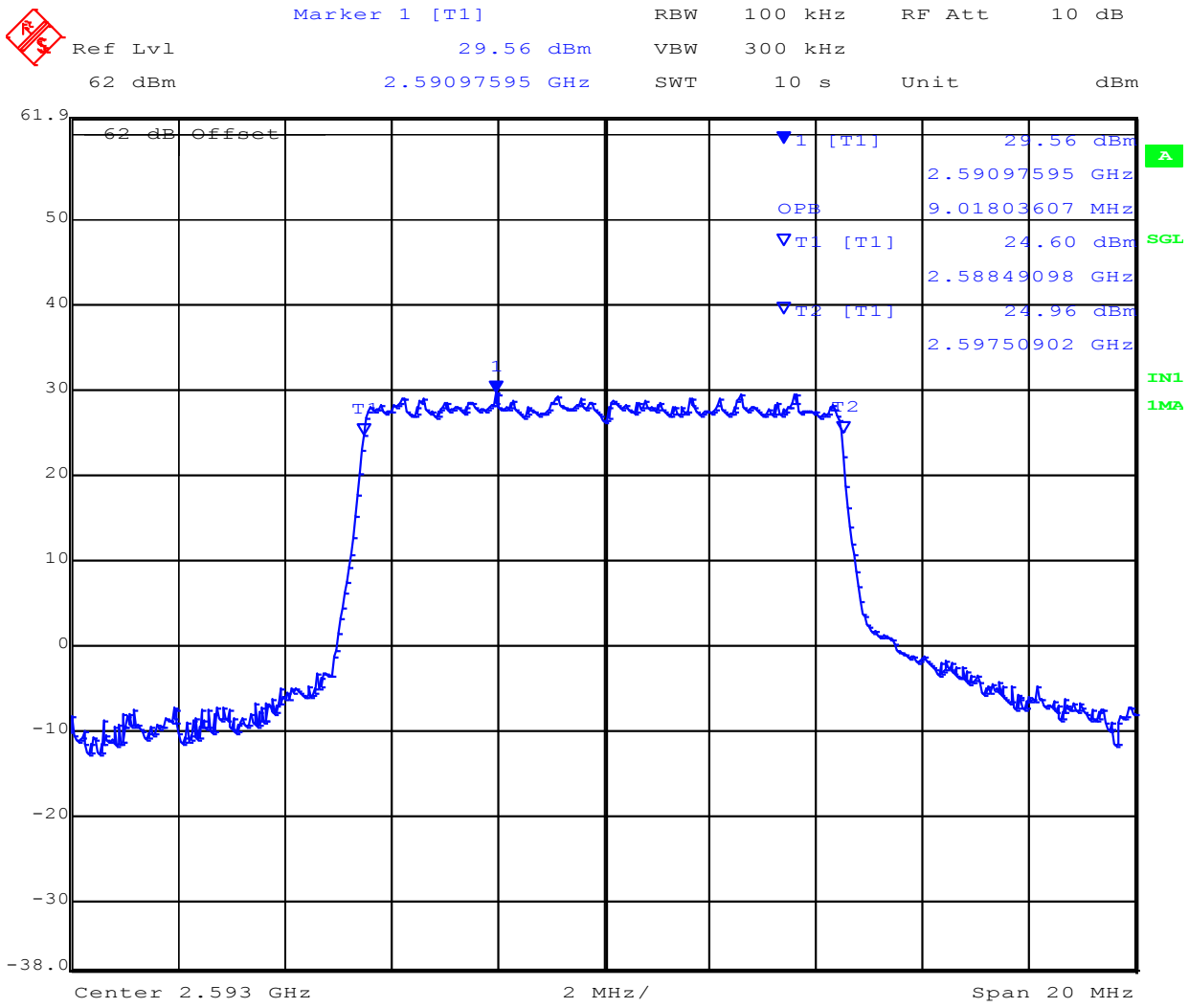
20 MHz Chain C QPSK



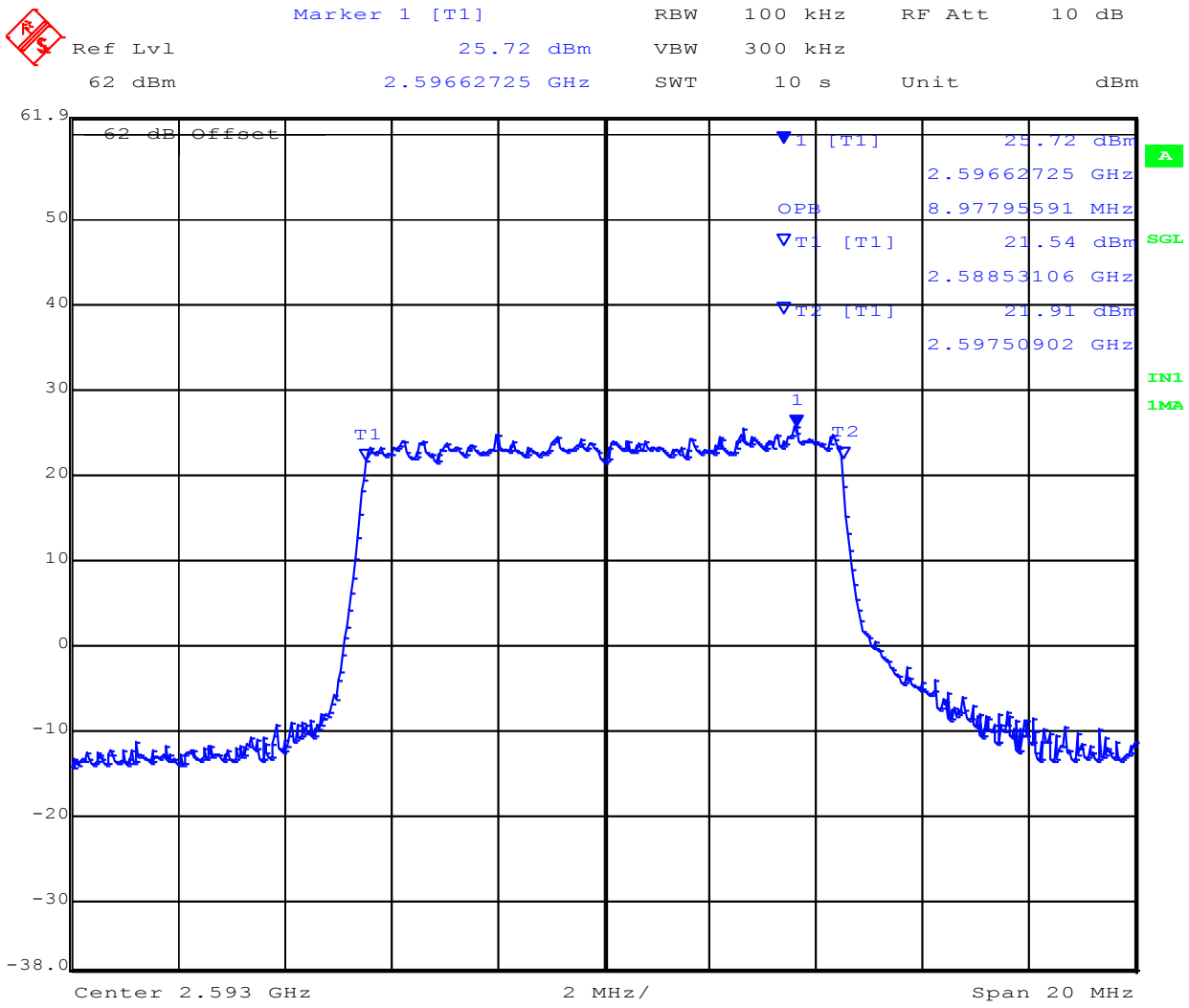
20 MHz Chain D QPSK



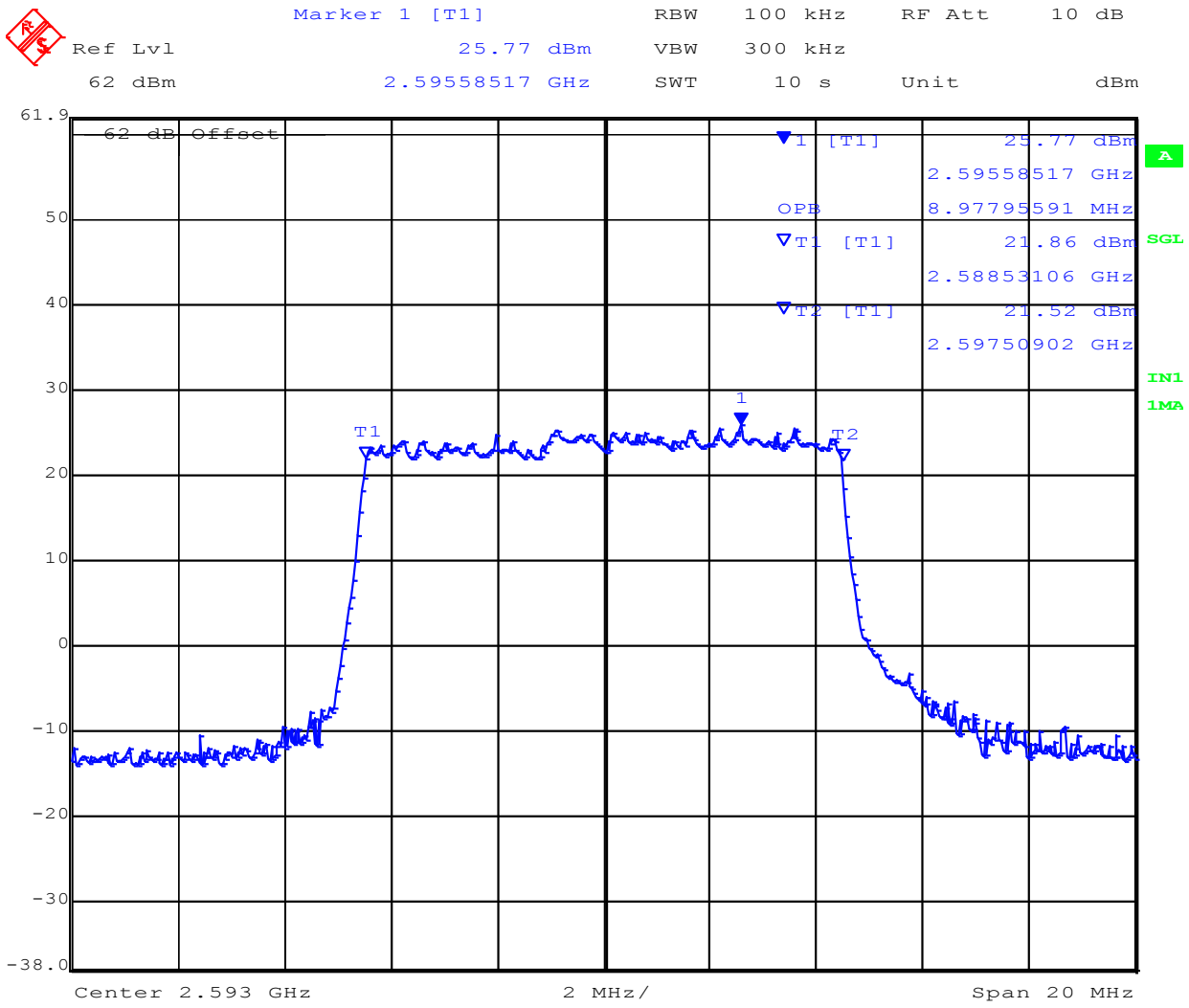
10 MHz Chain A 64 QAM



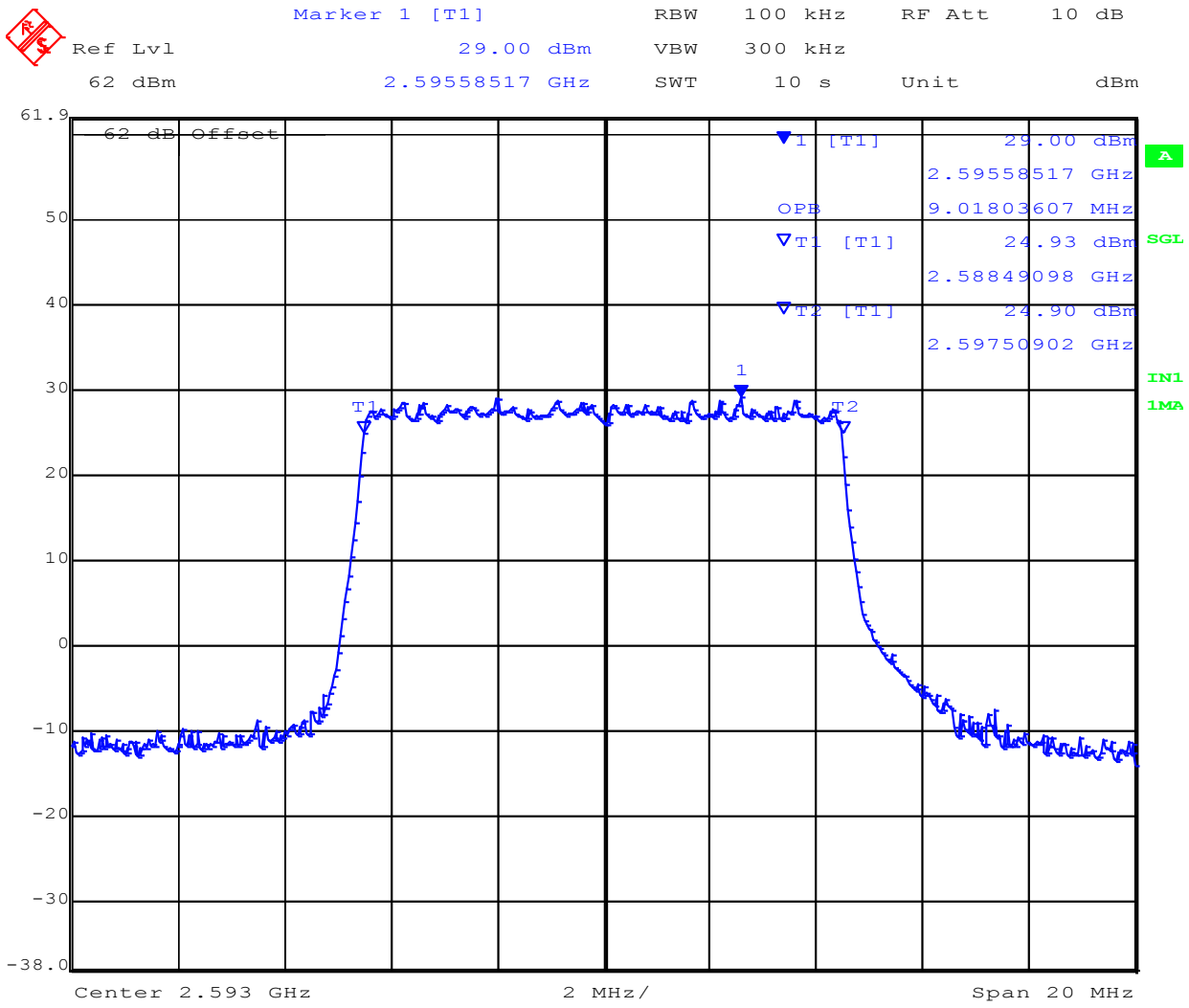
10 MHz Chain B 64 QAM



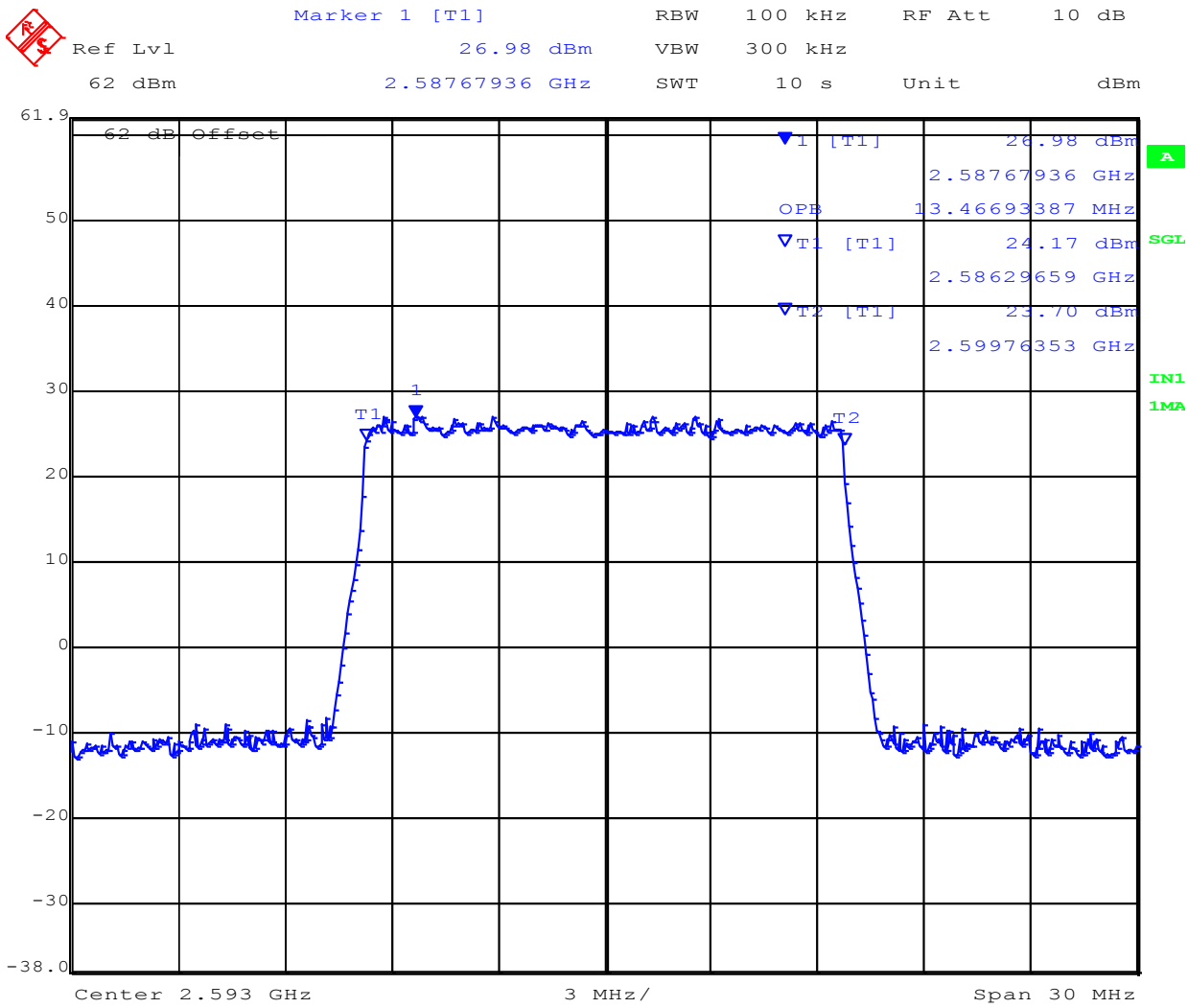
10 MHz Chain C 64 QAM



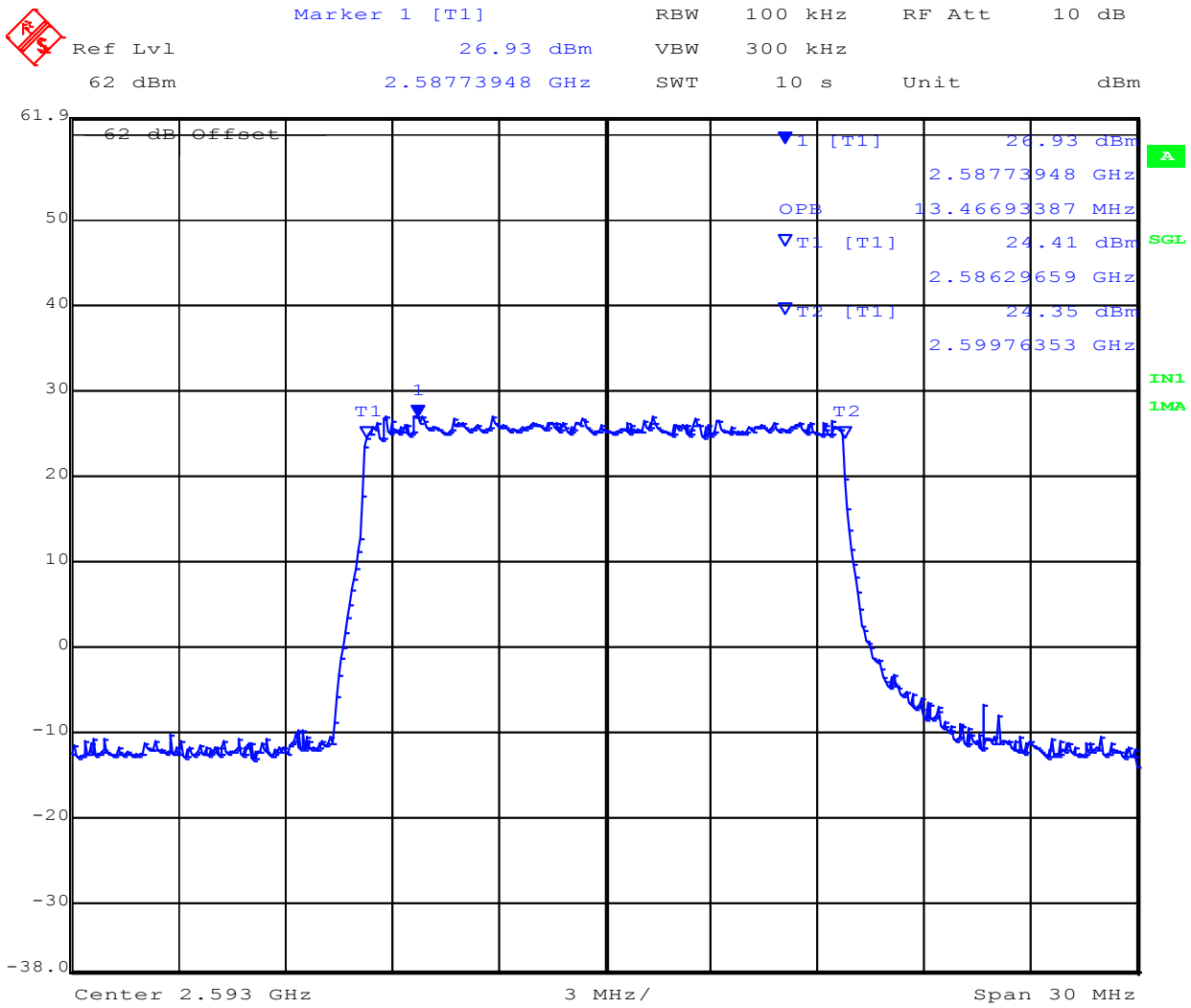
10 MHz Chain D 64 QAM



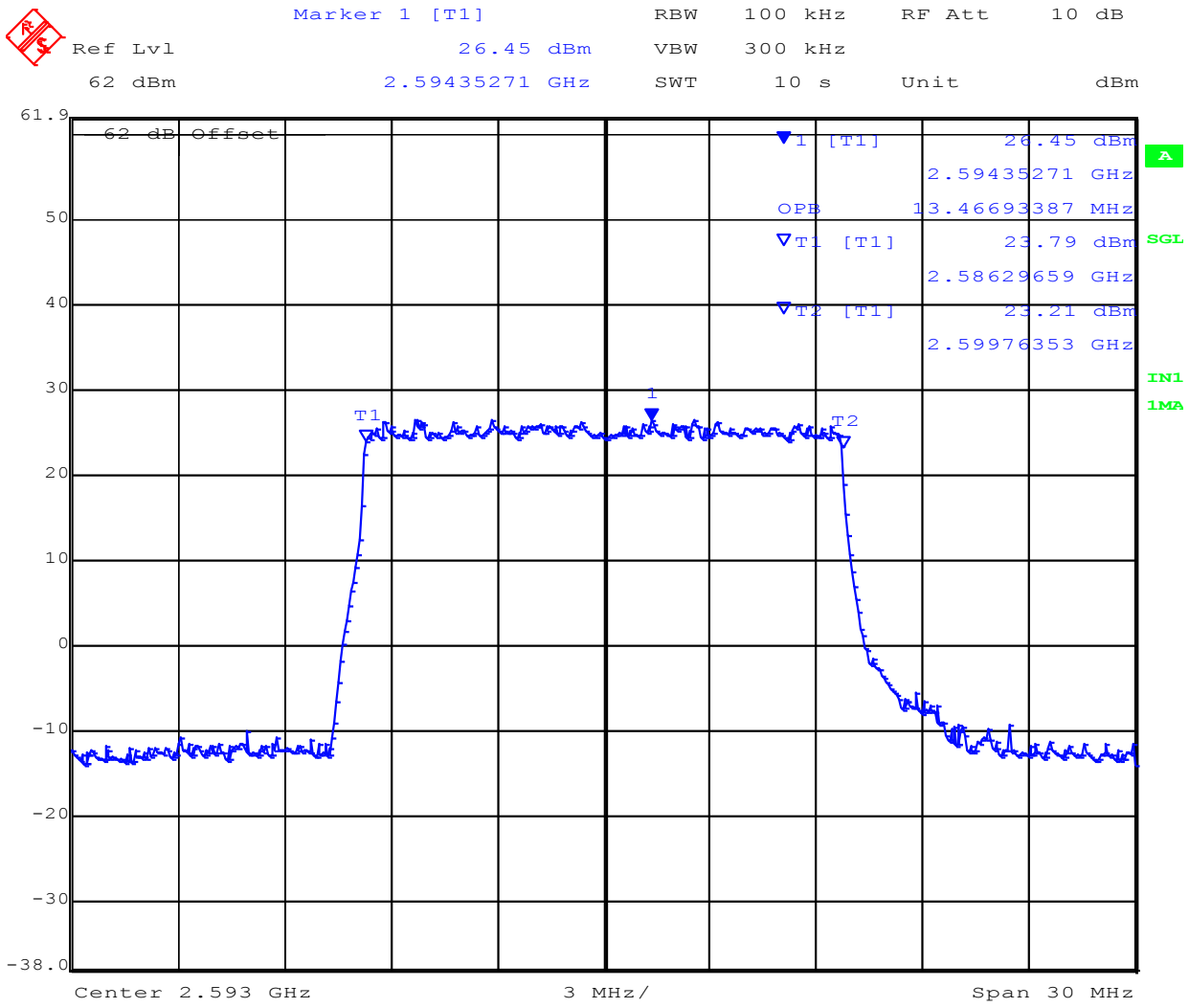
15 MHz Chain A 64 QAM



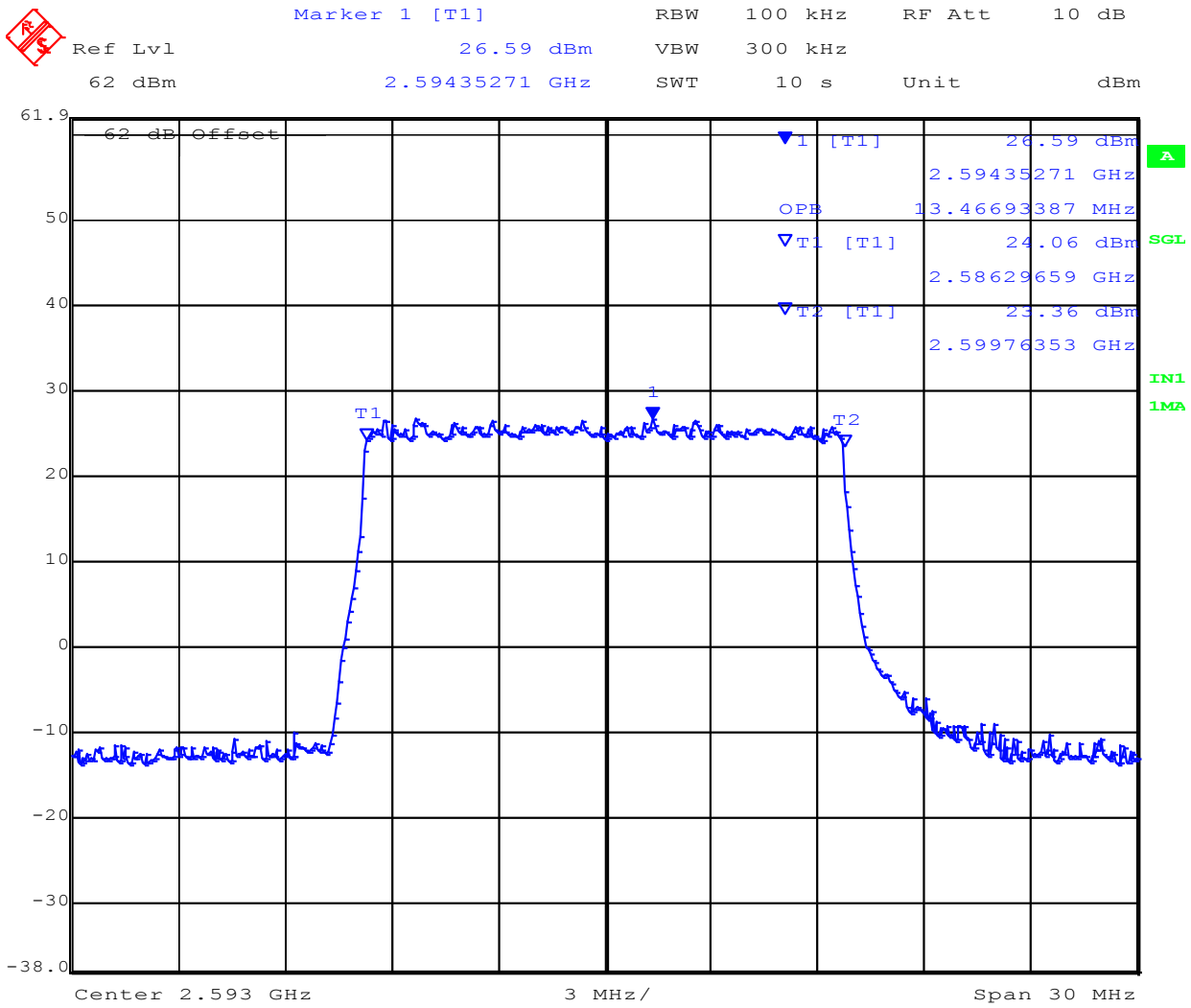
15 MHz Chain B 64 QAM



15 MHz Chain C 64 QAM



15 MHz Chain D 64 QAM



6.1.1.3. Transmitter Frequency Stability

Conducted Test Conditions for Maximum Conducted Output Power EIRP			
Standard:	FCC CFR 47 Part 27, RSS-199	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Transmitter Frequency Stability	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	FCC 2.1055, 27.54; IC RSS-Gen 4.3	**Pressure (mBars):**	999 - 1001
Reference Document(s):			

Test Procedure for Transmitter Frequency Stability
Transmitter Frequency Stability testing was performed over nominal voltage and ambient temperature and results reported are for a single antenna port (should the device have multiple ports i.e. MIMO device).

Definition
The center frequency is the center of the channel declared by the manufacturer as part of the declared channel plan(s).

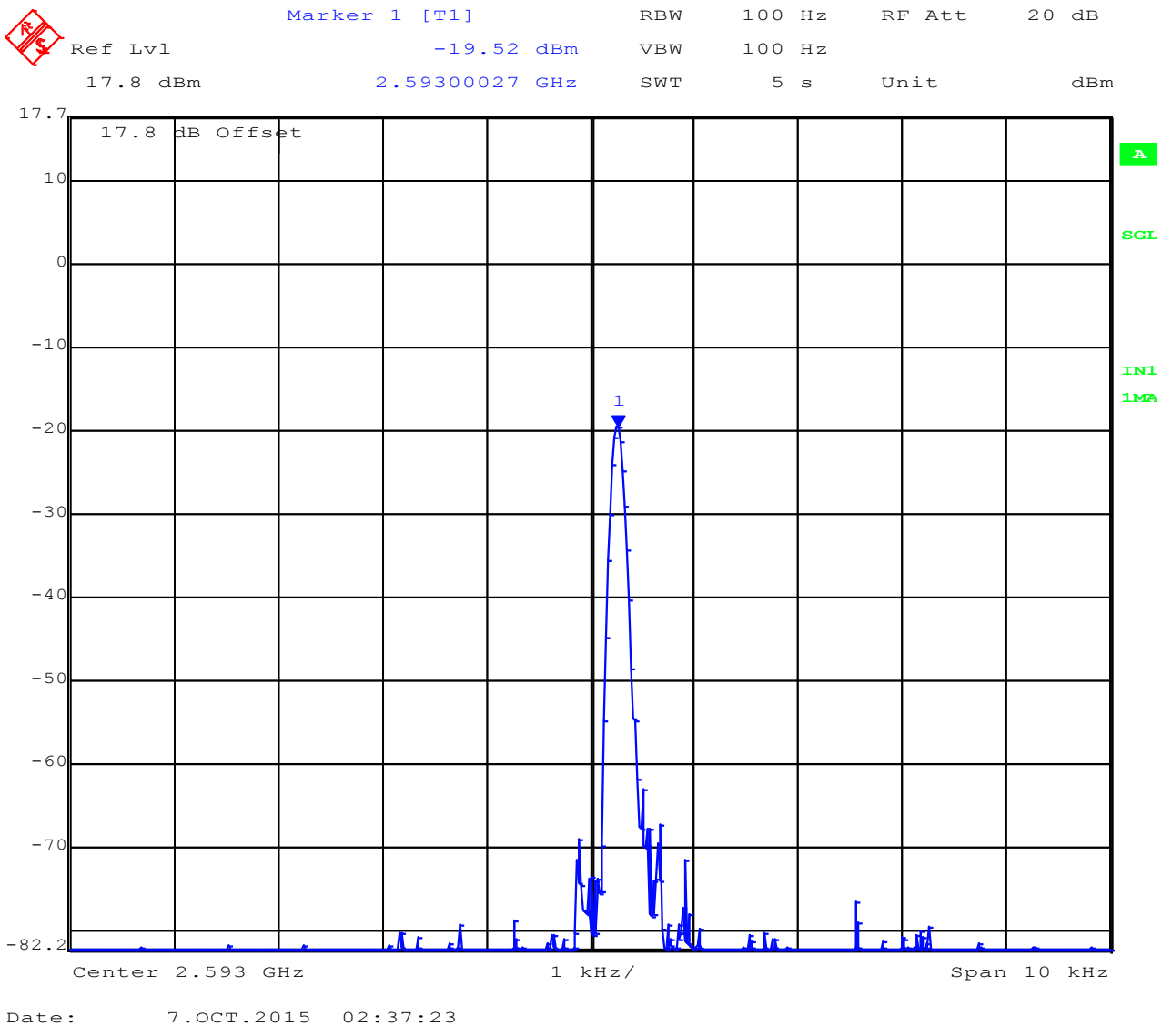
Limits
The applicant shall ensure frequency stability by showing that fundamental emissions are maintained within the frequency band of operation when tested at the temperature and supply voltage variations specified in the relevant standard FCC Part 2.1055, 27.54 and RSS-199 4.3

Test Type: Modulated, carrier breakthrough was used for measurement purposes

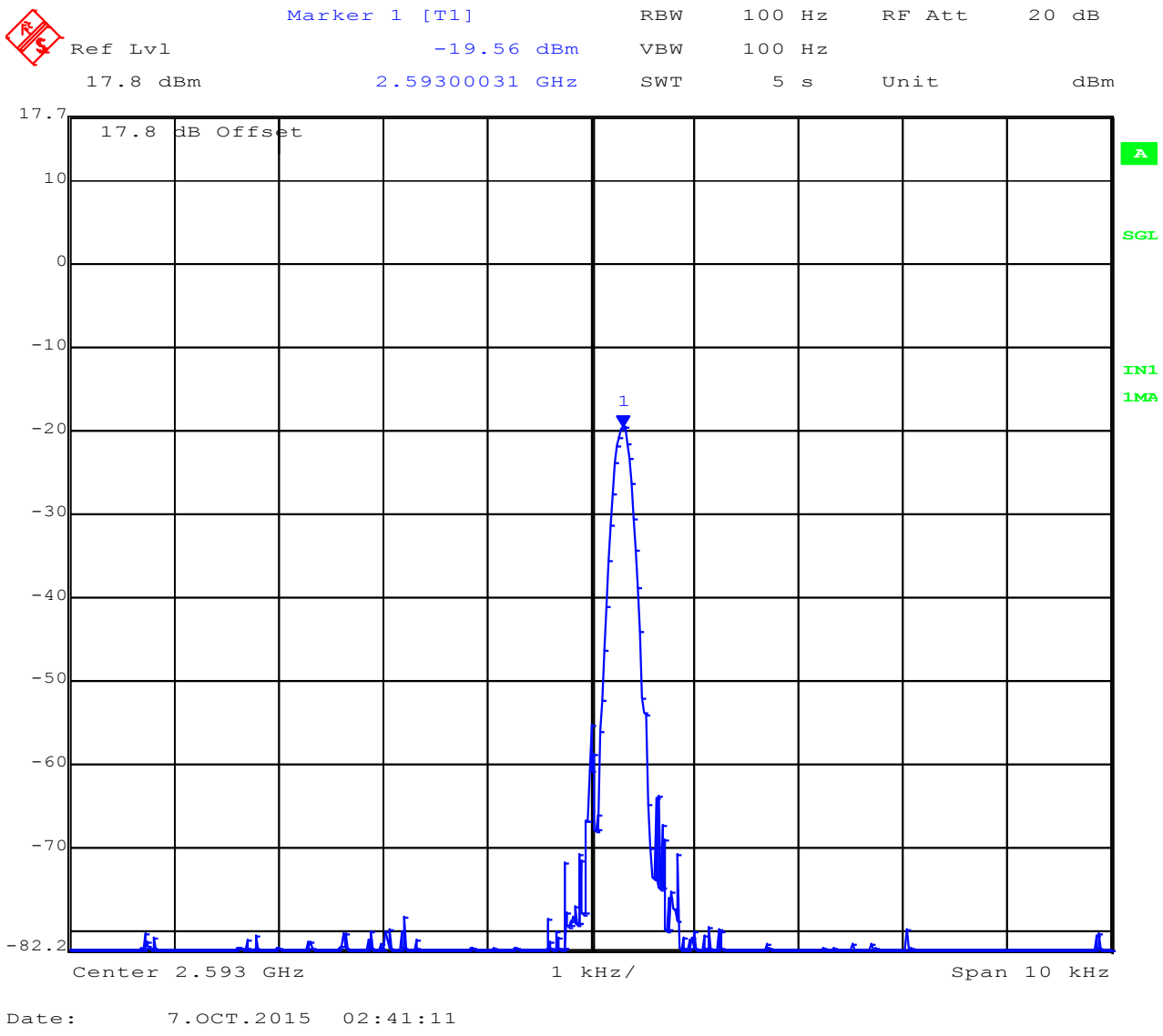
Measurement Results for Transmitter Frequency Stability

Test frequency	2593 MHz	Measured Frequency	Frequency Error	
Temperature	**Voltage**	**Hz**	**KHz**	**PPM**
20 °C	48 VDC	2593000270.0	0.27	0.104
20 °C	40 VDC	2593000310.0	0.31	0.120
20 °C	60 VDC	2593000410.0	0.41	0.158
-40 °C	48 VDC	2593000250.0	0.25	0.096
-30 °C	48 VDC	2593000130.0	0.13	0.050
-20 °C	48 VDC	2593000270.0	0.27	0.104
-10 °C	48 VDC	2593000350.0	0.35	0.135
0 °C	48 VDC	2593000250.0	0.25	0.096
+10 °C	48 VDC	2593000250.0	0.25	0.096
+25 °C	48 VDC	2593000370.0	0.37	0.143
+35 °C	48 VDC	2593000290.0	0.29	0.112
+45 °C	48 VDC	2593000330.0	0.33	0.127
+55 °C	48 VDC	2593000310.0	0.31	0.120

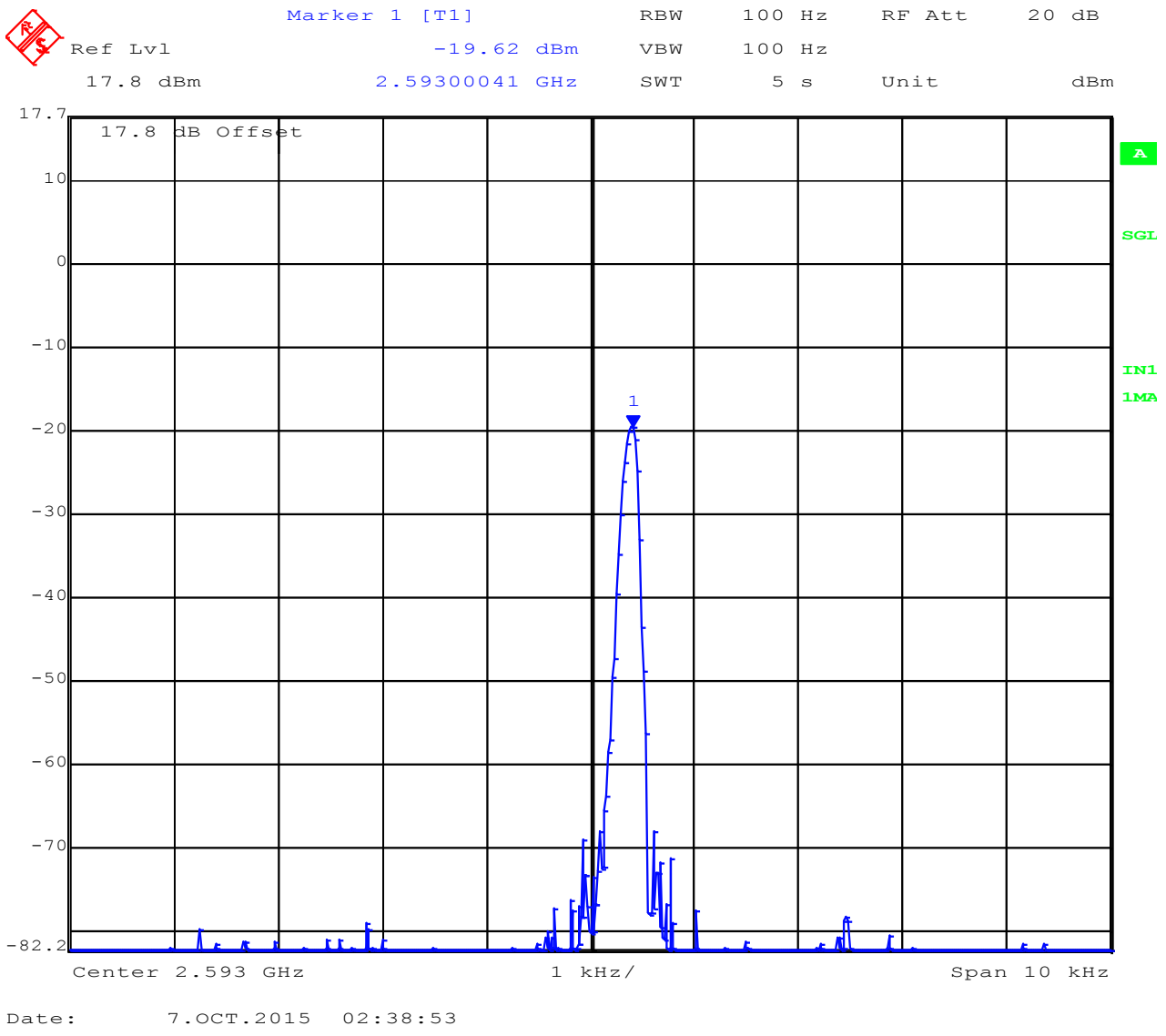
Frequency Stability -48 Vdc, +20°C



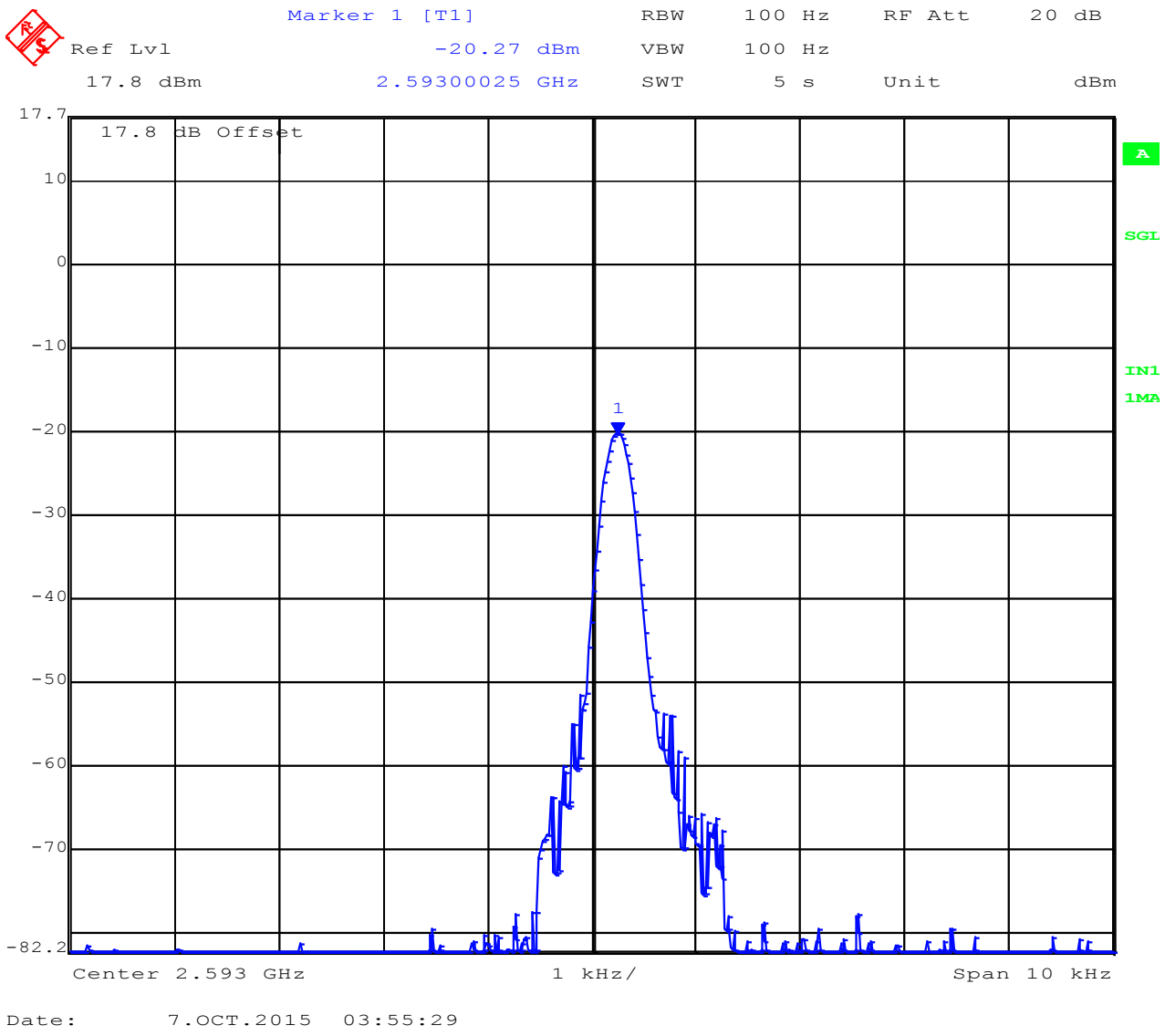
Frequency Stability -40 Vdc, +20°C



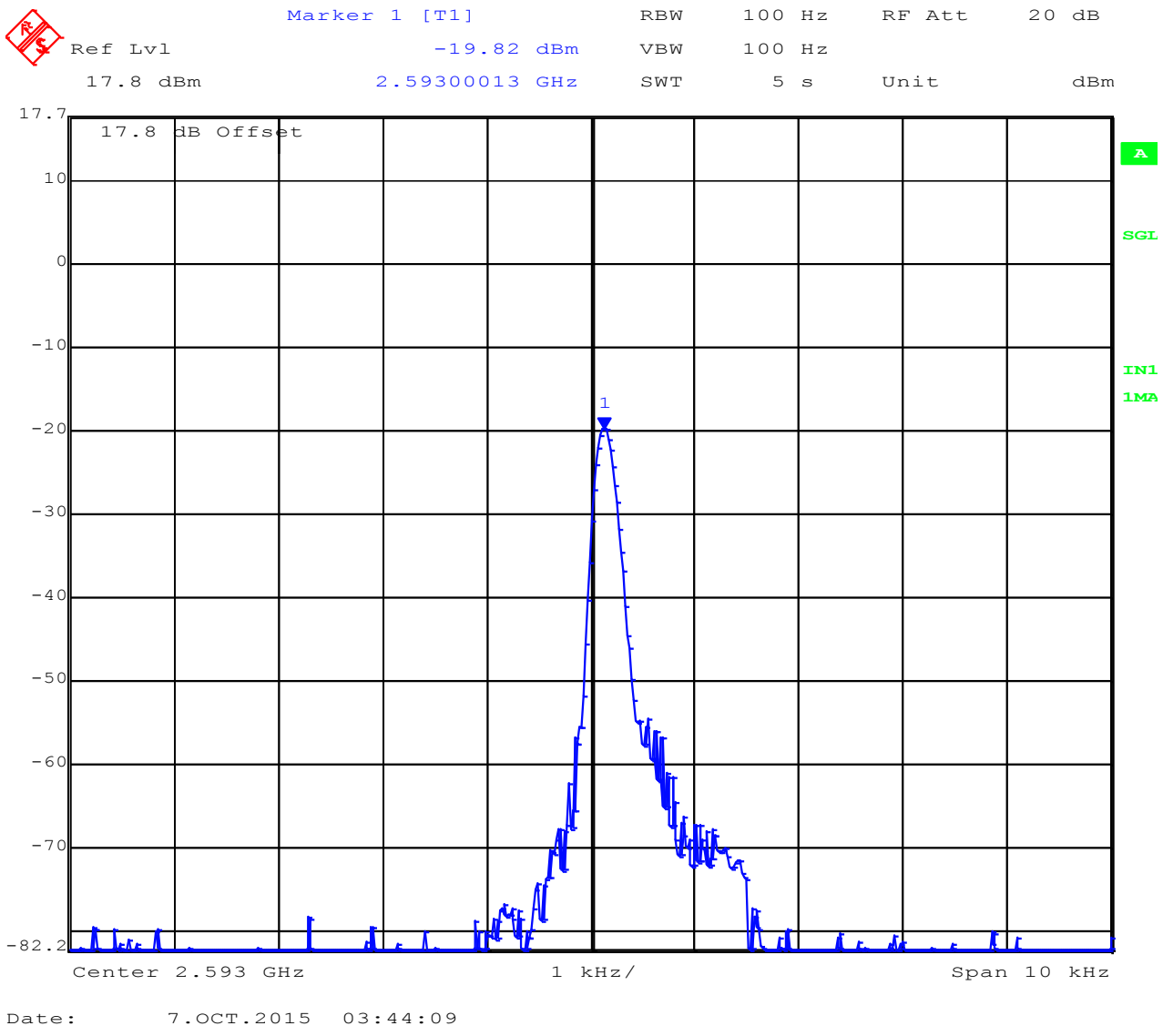
Frequency Stability -60 Vdc, +20°C



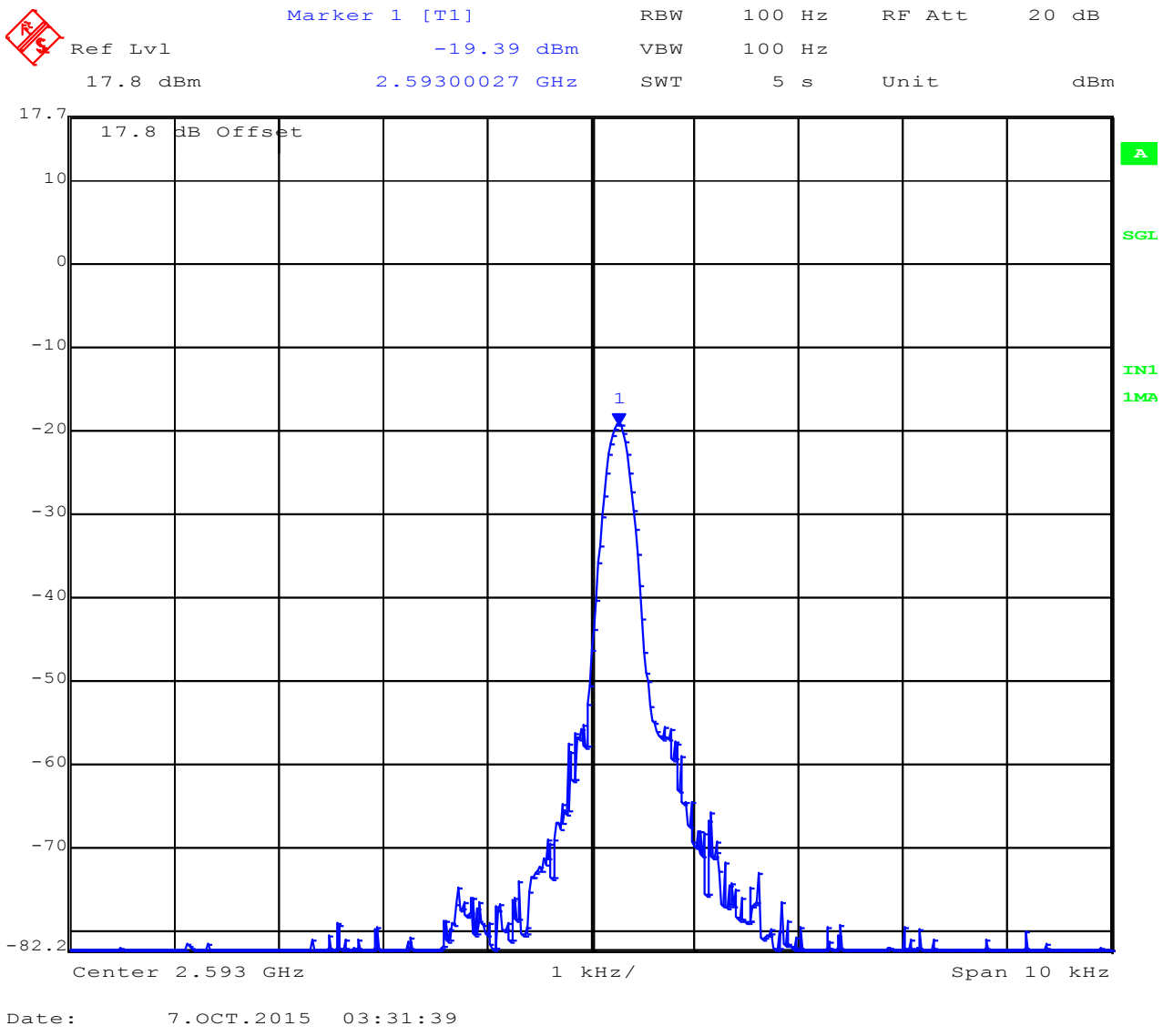
Frequency Stability -48 Vdc, -40°C



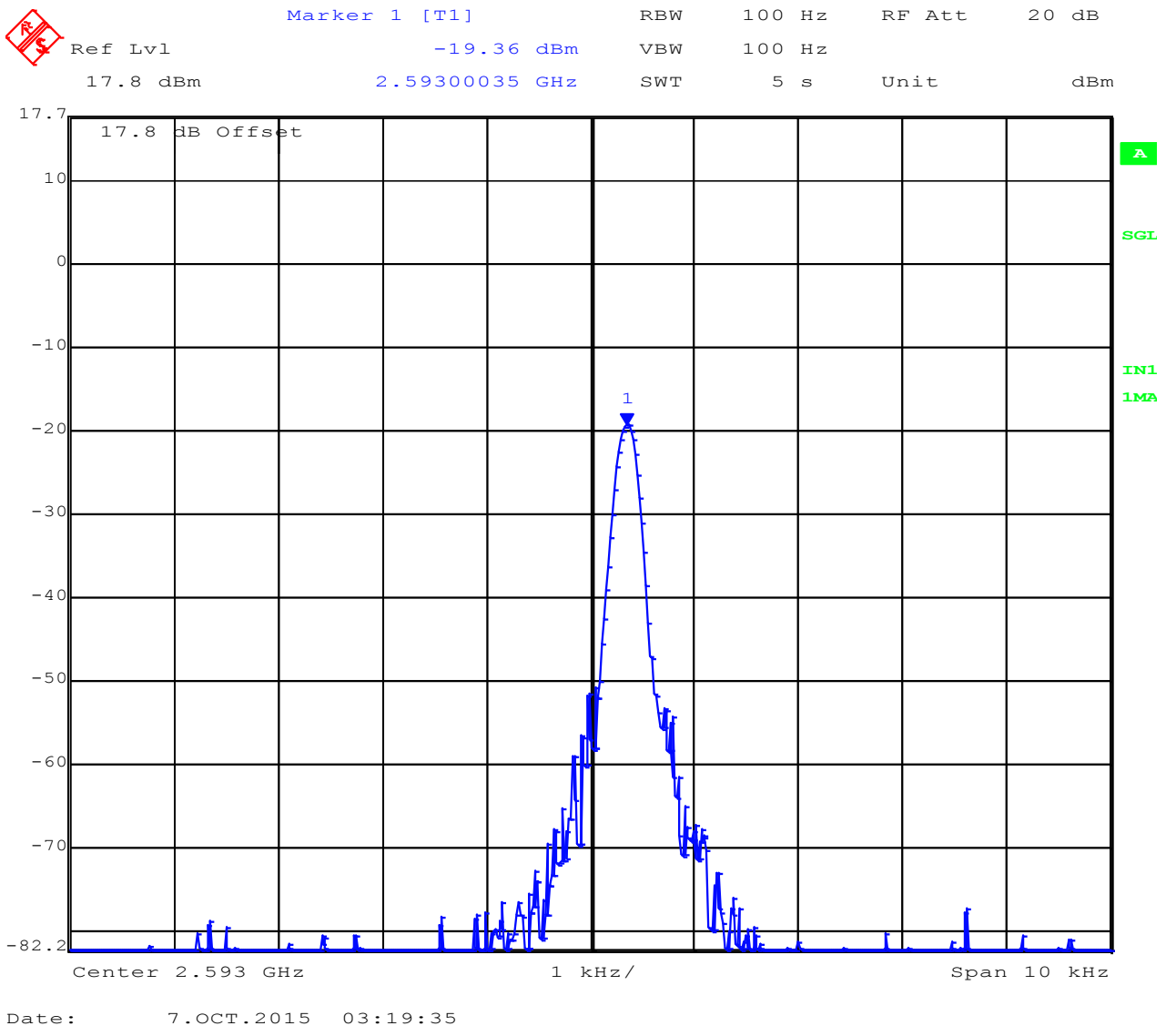
Frequency Stability -48 Vdc, -30°C



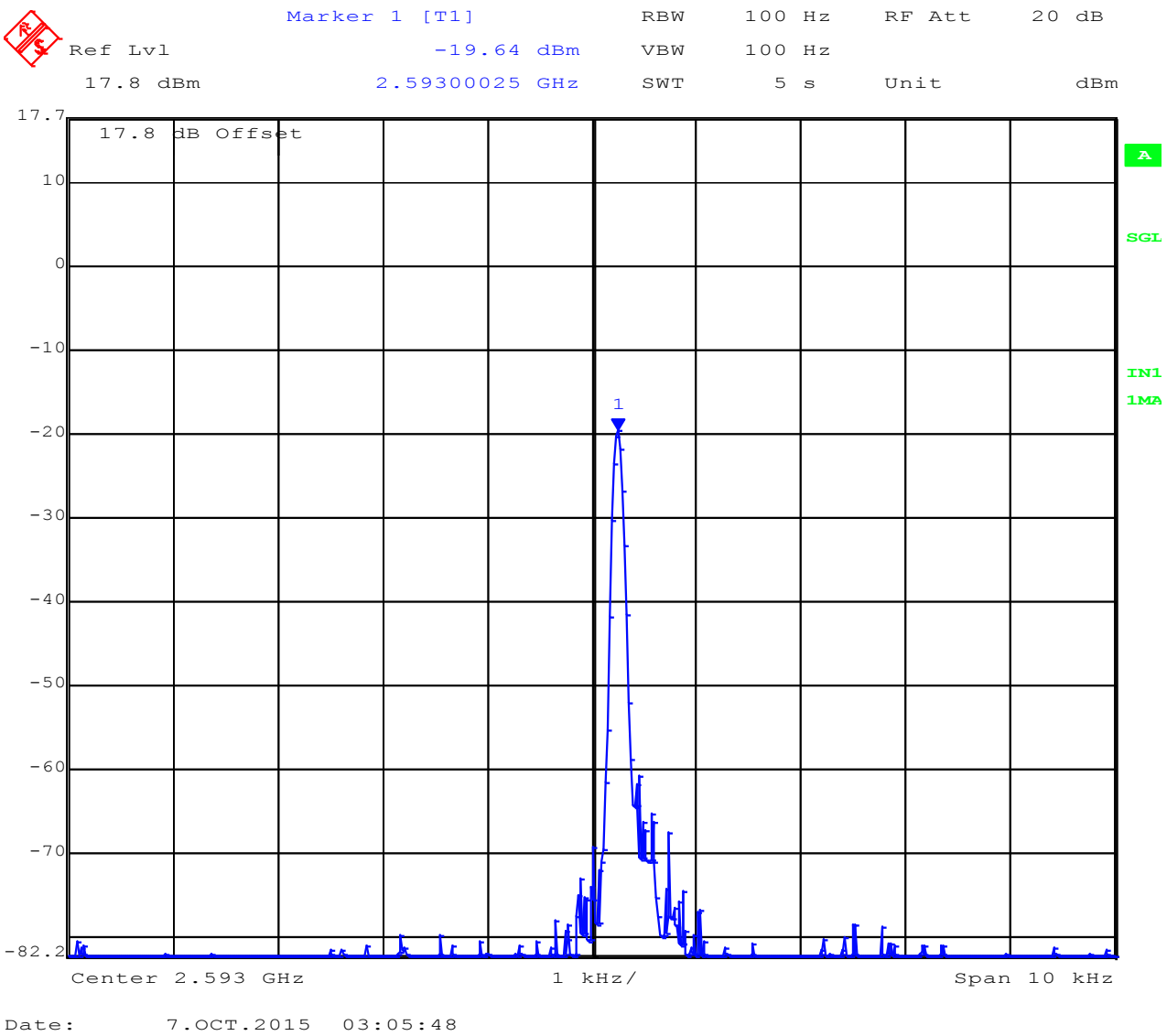
Frequency Stability -48 Vdc, -20°C



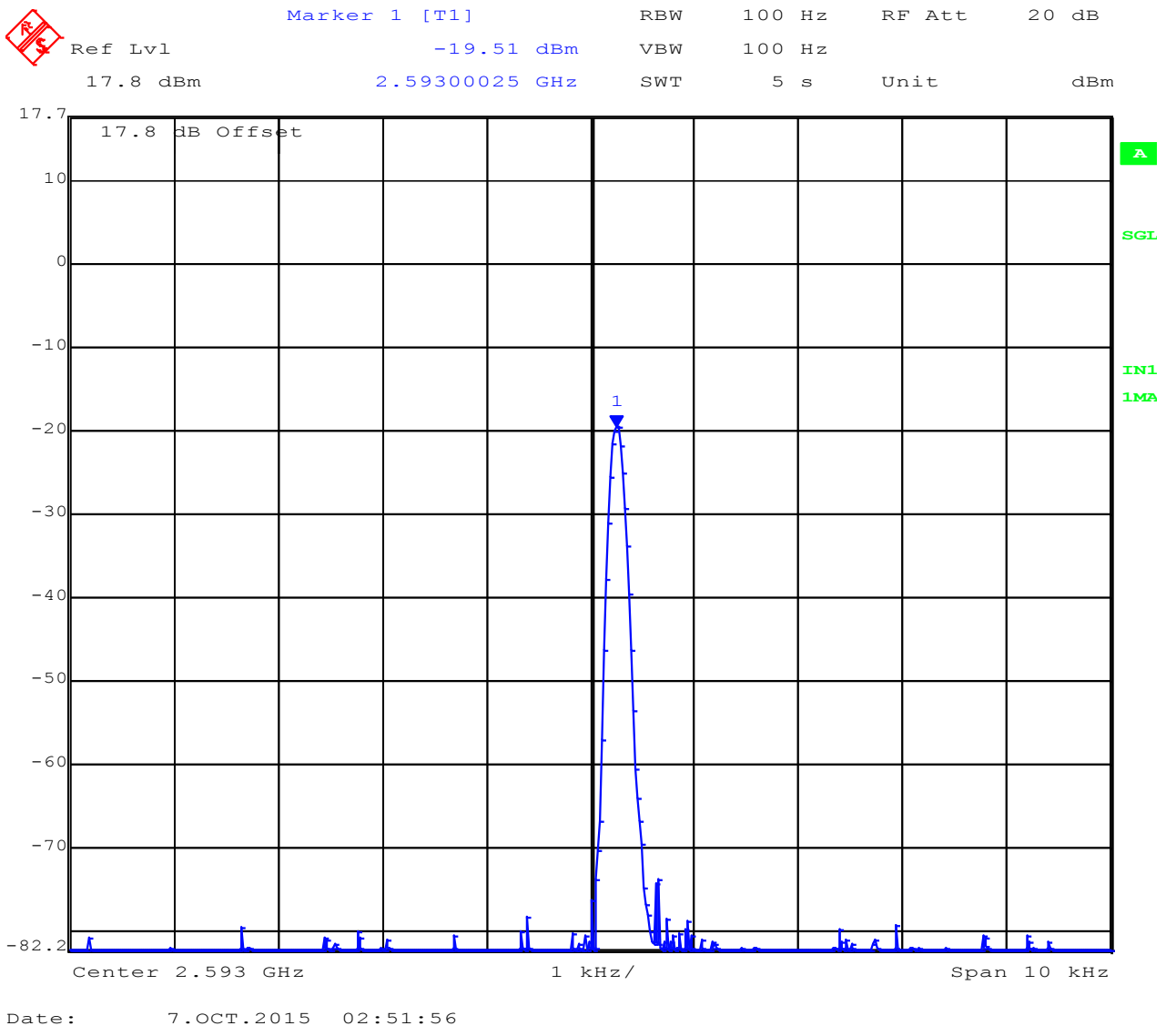
Frequency Stability -48 Vdc, -10°C



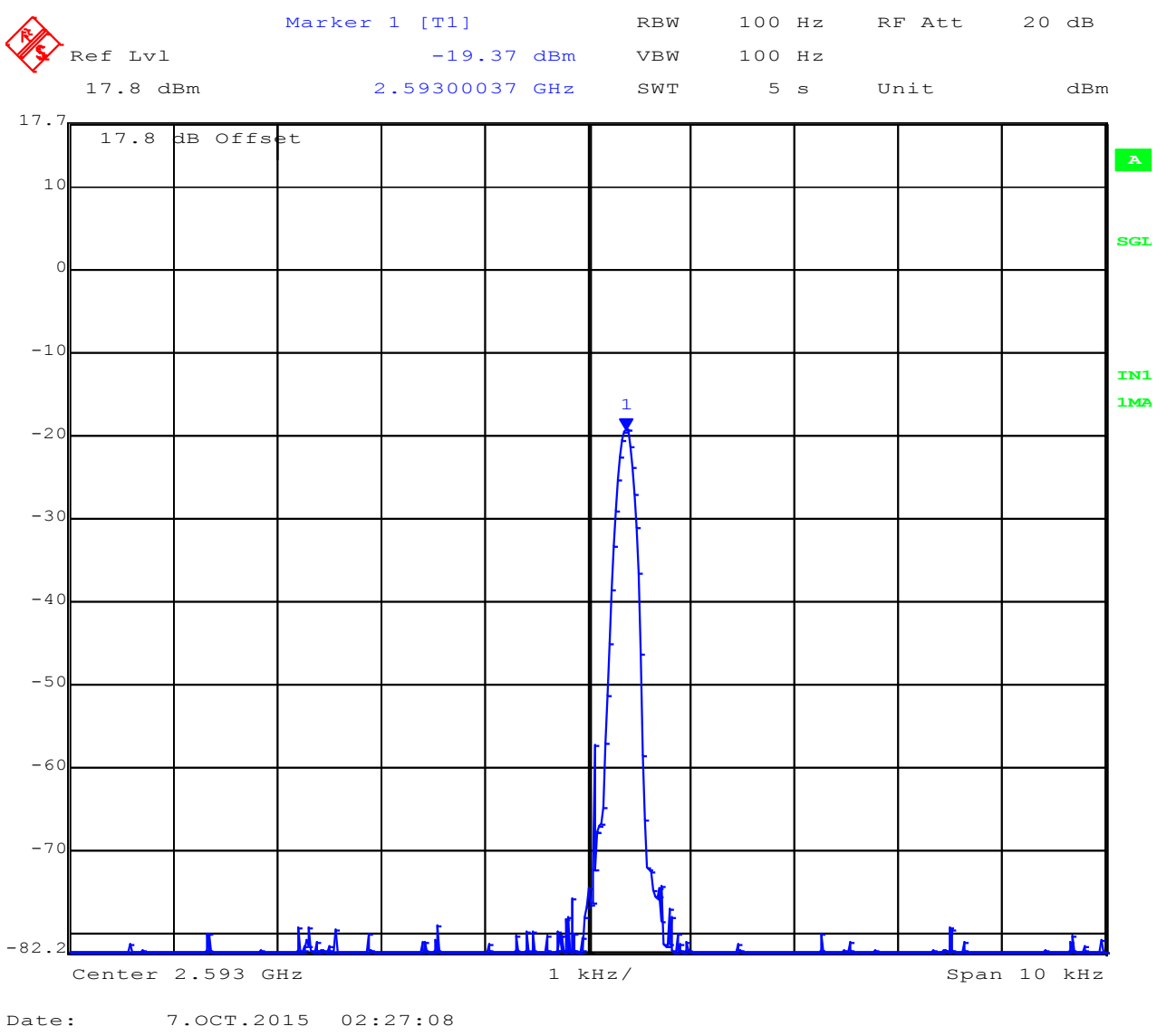
Frequency Stability -48 Vdc, +0°C



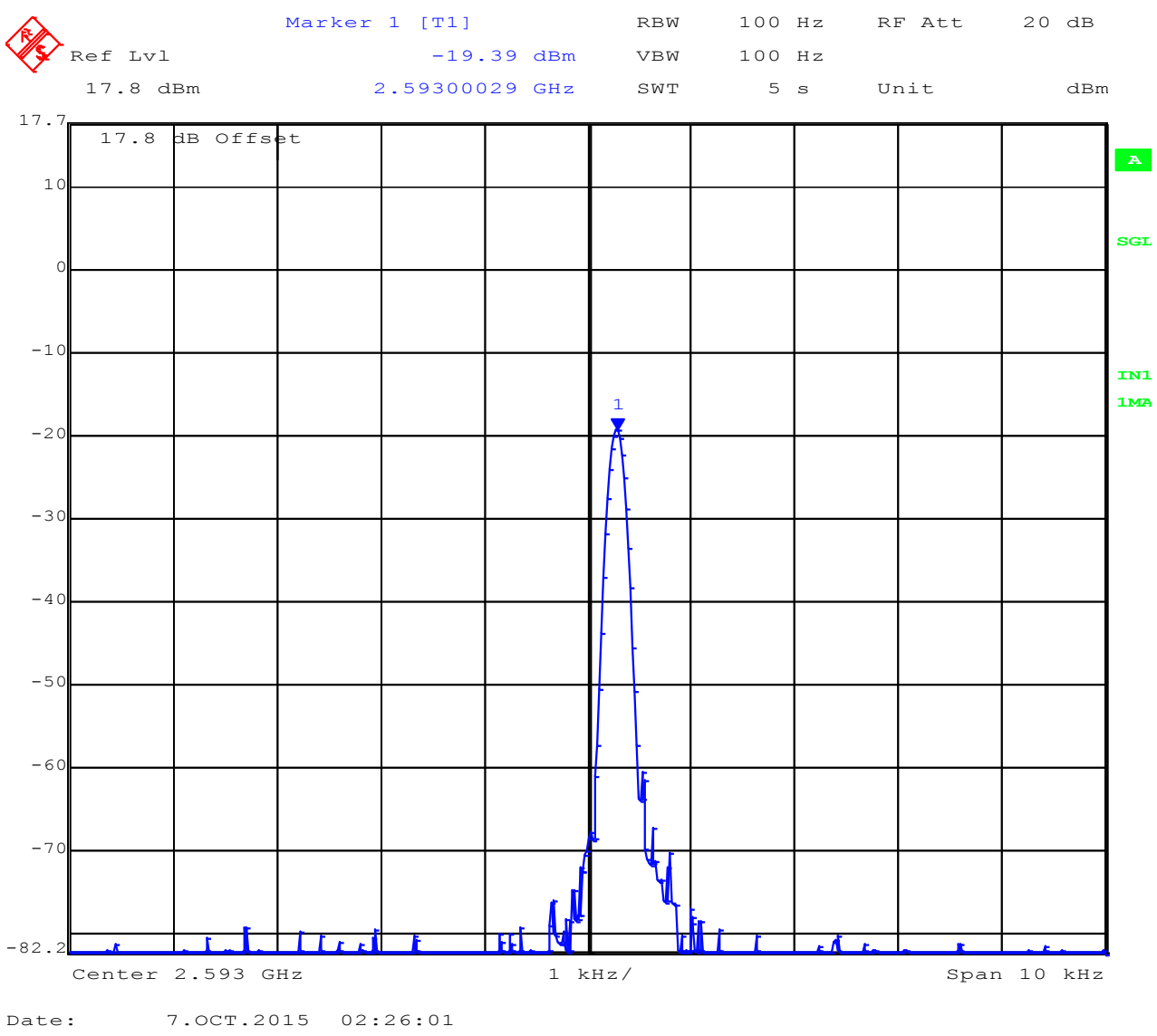
Frequency Stability -48 Vdc, +10°C



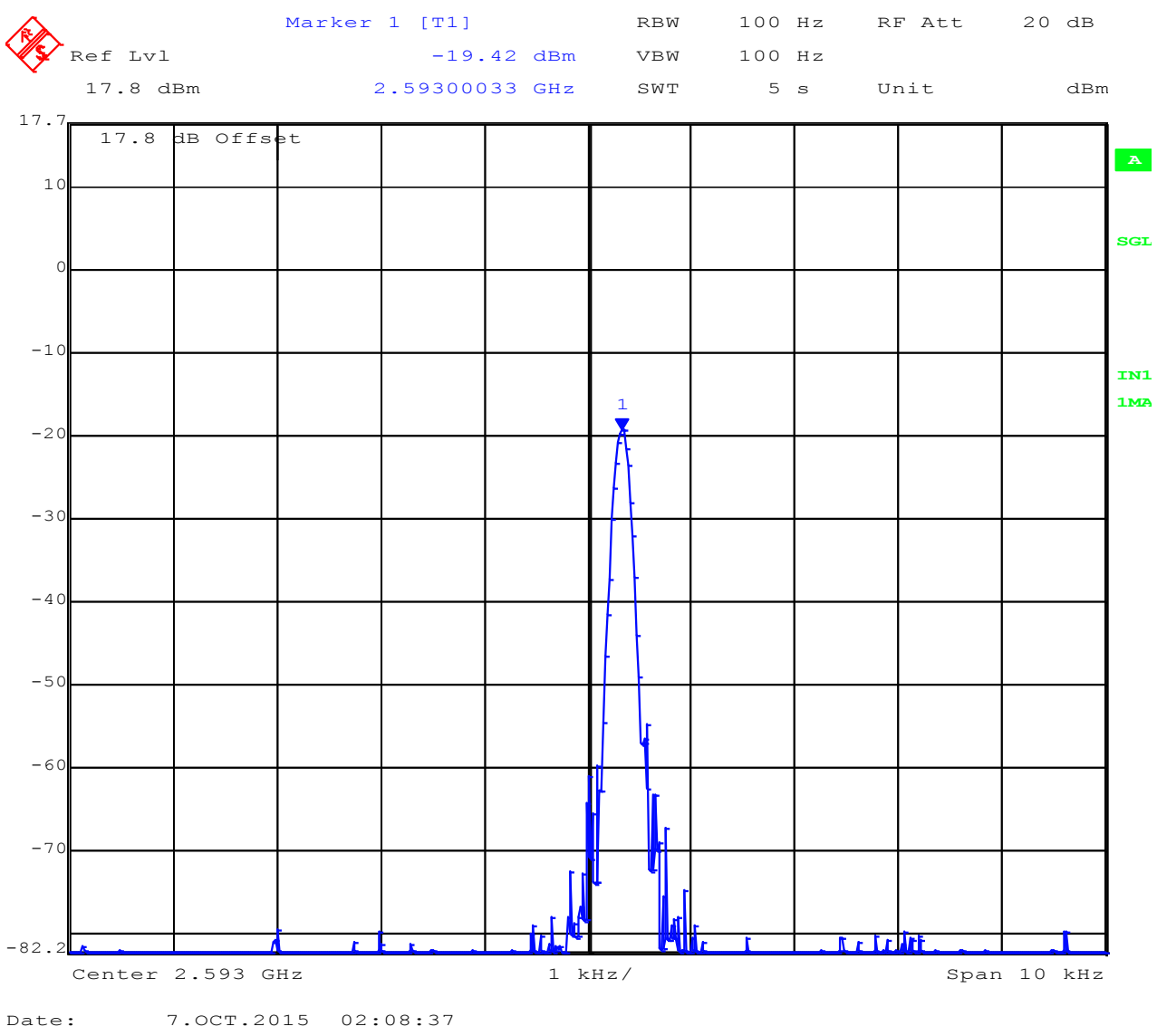
Frequency Stability -48 Vdc, +25°C



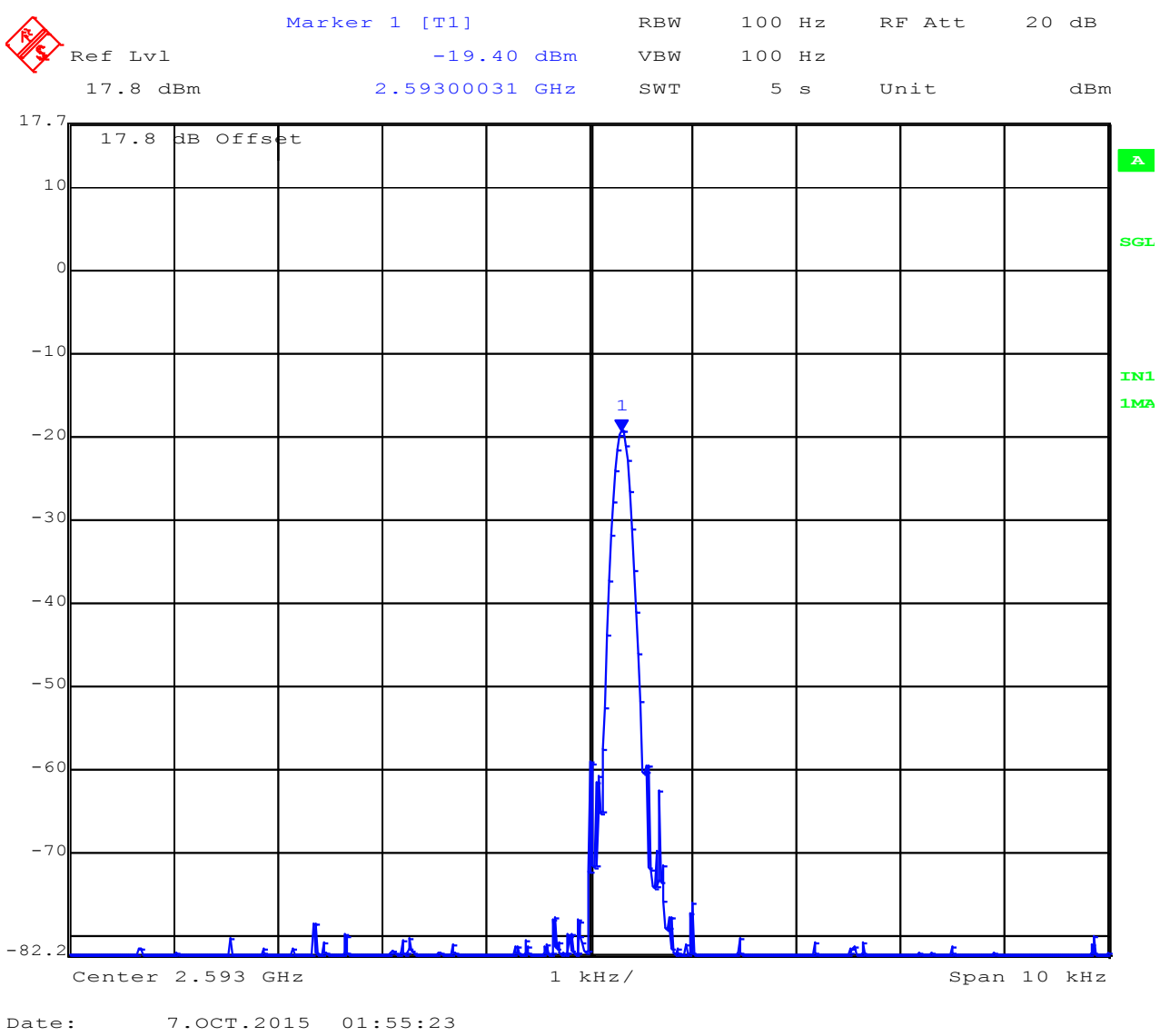
Frequency Stability -48 Vdc, +35°C



Frequency Stability -48 Vdc, +45°C



Frequency Stability -48 Vdc, +55°C



6.1.1.4. Maximum Conducted Output Power

Conducted Test Conditions for Maximum Conducted Output Power EIRP			
Standard:	FCC CFR 47 Part 27, RSS-199	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Maximum Conducted Output Power	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	FCC 2.1046, IC GL-07 5.2.1	**Pressure (mBars):**	999 - 1001
Reference Document(s):			

Test Procedure for Maximum Conducted Output Power Measurement (EIRP)

Test methodology used a wideband average power meter. Measurements were made while the EUT was operating in a continuous transmission mode (100% duty cycle) at the appropriate centre frequency. All cable losses and offsets were taken into consideration in the measured result. All operational modes and frequency bands were measured independently and the resultant power calculated. For multiple outputs, the measurements were made simultaneously on each output port and summed in a linear fashion. This technique was used in order to prove compliance.

Power Settings
Power settings for each of the eight antenna ports could be individually set through software control. Power measurements were made from each antenna port and the power setting logged for each measurement.

Limits
Base stations are limited to less than 33.3 W maximum equivalent isotropically radiated power (e.i.r.p.) in any 100 kHz segment.

Operational Bandwidths and maximum permitted EIRP values
Maximum EIRP = 33.3 W + increased power due to all 100 kHz segments in maximum bandwidth for each operational bandwidth
33.3W = 45.22 dBm

5 MHz: Maximum measured 99% Occupied Bandwidth = 4.50 MHz
Maximum EIRP = 33.3 W + increased power due to all 100 kHz segments in 4.50 MHz
Maximum EIRP = 45.22 + 10 * Log (4.5 MHz/0.1 MHz) = 45.22 + 16.5 = 61.72 dBm

10 MHz: Maximum measured 99% Occupied Bandwidth = 9.01 MHz
Maximum EIRP = 33.3 W + increased power due to all 100 kHz segments in 9.01 MHz
Maximum EIRP = 45.22 + 10 * Log (9.01 MHz/0.1 MHz) = 45.22 + 19.5 = 64.72 dBm

15 MHz: Maximum measured 99% Occupied Bandwidth = 13.46 MHz
Maximum EIRP = 33.3 W + increased power due to all 100 kHz segments in 13.46 MHz
Maximum EIRP = 45.22 + 10 * Log (13.46 MHz/0.1 MHz) = 45.22 + 21.3 = 66.52 dBm

20 MHz: Maximum measured 99% Occupied Bandwidth = 18.03 MHz
Maximum EIRP = 33.3 W + increased power due to all 100 kHz segments in 18.03 MHz
Maximum EIRP = 45.22 + 10 * Log (18.03 MHz/0.1 MHz) = 45.22 + 22.6 = 67.82 dBm

Measurement Results for Maximum Conducted Output Power

Equipment Configuration for Peak Transmit Power

Variant:	5 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				∑ Conducted power	EIRP	EIRP Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	dB	
2498.5	36.71	36.71	36.71	36.71	42.73	52.73	61.72	-8.99	37
2593.0	36.70	36.60	36.55	36.72	42.66	52.66	61.72	-9.06	37
2685.7	36.80	36.80	36.80	36.80	42.82	42.82	61.72	-8.90	37

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

Note: maximum power was found on Chain d

Offset for duty cycle is included in the measurement of chain power

Margin indicates that an antenna with a maximum gain of 18.0 dBi can be installed as part of the system. Antenna's with a gain higher than 18.0 dBi must reduce the output power 1 dB for every dB greater than 18.0 dBi.

Equipment Configuration for Peak Transmit Power			
Variant:	10 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm)				∑ Conducted power	EIRP	EIRP Limit	Margin	EUT Power Setting
	Port(s)								
MHz	a	b	c	d	dBm	dBm	dBm	dB	
2501.0	36.75	36.75	36.75	36.75	42.77	52.77	64.72	-11.95	37
2593.0	36.75	36.75	36.75	36.75	42.77	52.77	64.72	-11.95	37
2680.0	36.77	36.77	36.77	36.77	42.79	52.79	64.72	-11.93	37

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

Note: maximum power was found on Chain d

Offset for duty cycle is included in the measurement of chain power

Margin indicates that an antenna with a maximum gain of 18.0 dBi can be installed as part of the system. Antenna's with a gain higher than 18.0 dBi must reduce the output power 1 dB for every dB greater than 18.0 dBi.

Equipment Configuration for Peak Transmit Power			
Variant:	15 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				∑ Conducted power	EIRP	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	dB	
2503.0	36.72	36.72	36.72	36.72	42.74	52.74	66.52	-13.78	37
2593.0	36.89	36.89	36.89	36.89	42.91	52.91	66.52	-13.61	37
2683.5	36.59	36.59	36.59	36.59	42.61	52.61	66.52	-13.91	37

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

Note: maximum power was found on Chain d

Offset for duty cycle is included in the measurement of chain power

Margin indicates that an antenna with a maximum gain of 18.0 dBi can be installed as part of the system. Antenna's with a gain higher than 18.0 dBi must reduce the output power 1 dB for every dB greater than 18.0 dBi.

Equipment Configuration for Peak Transmit Power			
Variant:	20 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				∑ Conducted power	EIRP	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	dB	
2503.0	36.76	36.76	36.76	36.76	42.78	52.78	67.82	-15.04	37
2593.0	36.58	36.71	36.63	36.76	42.69	52.69	67.82	-15.13	37
2683.5	36.59	36.59	36.59	36.59	42.61	52.61	67.82	-15.21	37

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

Note: maximum power was found on Chain d

Offset for duty cycle is included in the measurement of chain power

Margin indicates that an antenna with a maximum gain of 18.0 dBi can be installed as part of the system. Antenna's with a gain higher than 18.0 dBi must reduce the output power 1 dB for every dB greater than 18.0 dBi.

6.1.1.5. Transmitter Unwanted Emissions

Conducted Test Conditions for Transmitter Unwanted Emissions			
Standard:	FCC CFR 47: Part 27, RSS-199	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Transmitter Unwanted Emissions	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	FCC 2.1051, 27.53(m), IC 4.5	**Pressure (mBars):**	999 - 1001
Reference Document(s):			

Test Procedure for Transmitter Unwanted Emissions

The Transmitter Unwanted Emissions were measurement conductively. Testing was performed on individual antenna ports and limits applied to each plot respectively.

Limits

The power of any unwanted emissions measured from the channel edge of the equipment shall be attenuated below the transmitter power, P (dBW), as follows:

(a) for base station and subscriber equipment, other than mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \text{ Log}_{10}$ (p), dB;

Maximum chain output power found = +36.89 dBm (4.89 W) (15 MHz bandwidth, channel 2593.0 MHz)

Limit = 43 + 10 Log (P) = 43 + 10 * Log (P) = 43 + 6.89 = 49.89 dB

Limit = 36.89 – 49.89 = -13.0 dBm

Change to Transmitter Unwanted Emission Limits

Although the Axxcelera Broadband Wireless Axxcel LTE has four antenna ports they do not transmit on the same channel frequency. Two ports are dedicated to each channel frequency within the frequency band. As a result the limits for transmitter spurious emissions are modified where testing occurs on a single chain at any given time;

Limit single chain = -13 dBm

Limit single chain (2 port) = -13 – 10 * log (n) [where n=2) = -13 – 3 = -16 dBm

6.1.1.5.1 Conducted Emissions

Equipment Configuration for 99% Occupied Bandwidth

Variant:	5 MHz	**Duty Cycle (%):**	88
Data Rate:	5	**Antenna Gain (dBi):**	10
Modulation:	64 QAM	**Beam Forming Gain (Y)(dB):**	None
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

CHAIN A

Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2498.1 MHz	9 - 150 KHz	-20.06	37.53	-16.0	-4.06
	0.15 - 30 MHz	-35.71	150.00	-16.0	-19.71
	30 - 1000 MHz	-33.49	860.04	-16.0	-17.49
	1000 - 26000 MHz	-20.01	22993.987	-16.0	-4.01

CHAIN B

Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2498.1 MHz	9 - 150 KHz	-21.48	73.707	-16.0	-5.48
	0.15 - 30 MHz	-34.17	150.00	-16.0	-18.17
	30 - 1000 MHz	-33.87	955.29	-16.0	-17.87
	1000 - 26000 MHz	-20.80	22987.713	-16.0	-4.80

CHAIN C

Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2498.1 MHz	9 - 150 KHz	-21.43	73.707	-16.0	-5.43
	0.15 - 30 MHz	-34.78	150.00	-16.0	-18.78
	30 - 1000 MHz	-33.77	817.27	-16.0	-17.77
	1000 - 26000 MHz	-20.71	22735.191	-16.0	-4.71

CHAIN D

Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2498.1 MHz	9 - 150 KHz	-21.74	73.89	-16.0	-5.74
	0.15 - 30 MHz	-34.96	150.00	-16.0	-18.96
	30 - 1000 MHz	-33.13	865.87	-16.0	-17.13
	1000 - 26000 MHz	-20.87	22893.102	-16.0	-4.87

Click on the link to view the plot

CHAIN A					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2593 MHz	9 - 150 KHz	-21.43	30.75	-16.0	-5.43
	0.15 - 30 MHz	-33.97	150.00	-16.0	-17.97
	30 - 1000 MHz	-32.97	788.11	-16.0	-16.97
	1000 - 26000 MHz	-21.81	22638.123	-16.0	-5.81

CHAIN B					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2593 MHz	9 - 150 KHz	-21.66	73.70	-16.0	-5.66
	0.15 - 30 MHz	-34.23	150.00	-16.0	-18.23
	30 - 1000 MHz	-33.23	939.73	-16.0	-17.23
	1000 - 26000 MHz	-20.81	21979.944	-16.0	-4.81

CHAIN C					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2593 MHz	9 - 150 KHz	-21.61	73.98	-16.0	-5.61
	0.15 - 30 MHz	-34.17	150.00	-16.0	-18.17
	30 - 1000 MHz	-33.91	836.71	-16.0	-17.91
	1000 - 26000 MHz	-20.17	22715.911	-16.0	-4.17

CHAIN D					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2593 MHz	9 - 150 KHz	-21.64	73.98	-16.0	-5.64
	0.15 - 30 MHz	-33.60	150.00	-16.0	-17.6
	30 - 1000 MHz	-32.82	939.73	-16.0	-16.82
	1000 - 26000 MHz	-20.81	22571.576	-16.0	-4.81

Click on the link to view the plot

CHAIN A					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2687.5 MHz	9 - 150 KHz	-18.27	32.73	-16.0	-2.27
	0.15 - 30 MHz	-35.06	150.00	-16.0	-19.06
	30 - 1000 MHz	-32.96	937.79	-16.0	-16.96
	1000 - 26000 MHz	-20.09	22519.110	-16.0	-4.09

CHAIN B					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2687.5 MHz	9 - 150 KHz	-21.42	37.53	-16.0	-5.42
	0.15 - 30 MHz	-33.81	150.00	-16.0	-17.81
	30 - 1000 MHz	-33.09	918.35	-16.0	-17.09
	1000 - 26000 MHz	-20.78	22917.432	-16.0	-4.78

CHAIN C					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2687.5 MHz	9 - 150 KHz	-21.92	73.70	-16.0	-5.92
	0.15 - 30 MHz	-34.55	150.00	-16.0	-18.55
	30 - 1000 MHz	-33.00	970.84	-16.0	-17.00
	1000 - 26000 MHz	-20.31	22716.351	-16.0	-4.31

CHAIN D					
Temperature	20.0 °C	Maximum Observed Spurious Emission		Limit	Margin
Voltage	24.00 Vdc	Amplitude	Emission Frequency		
Test Frequency	Frequency Range	dBm	MHz	dBm	dB
2687.5 MHz	9 - 150 KHz	-21.71	73.98	-16.0	-5.71
	0.15 - 30 MHz	-34.36	150.00	-16.0	-18.36
	30 - 1000 MHz	-33.23	982.50	-16.0	-17.23
	1000 - 26000 MHz	-19.81	22918.909	-16.0	-3.81

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

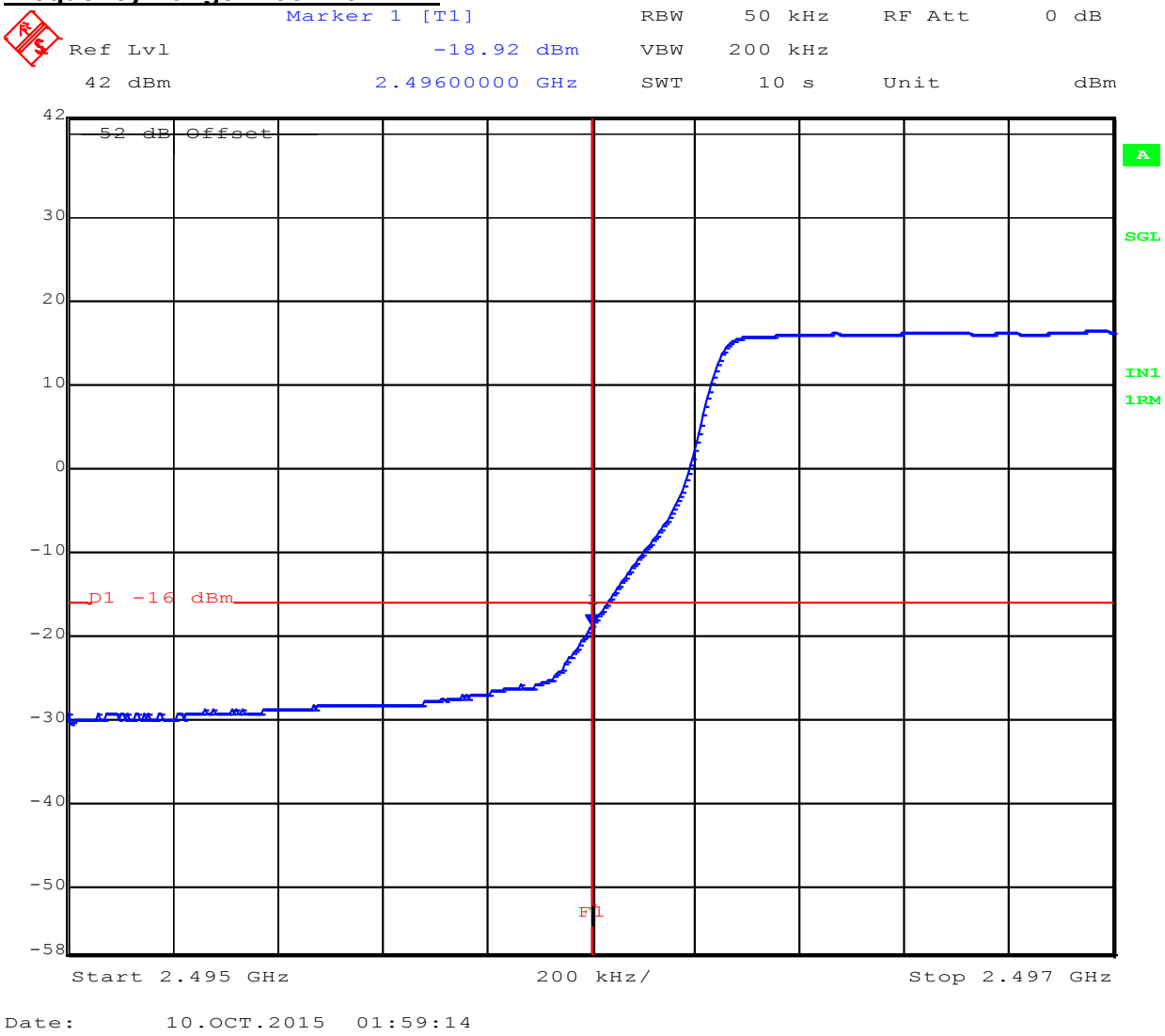
Click on the link to view the plot

6.1.1.5.2 Conducted Band-Edge Emissions

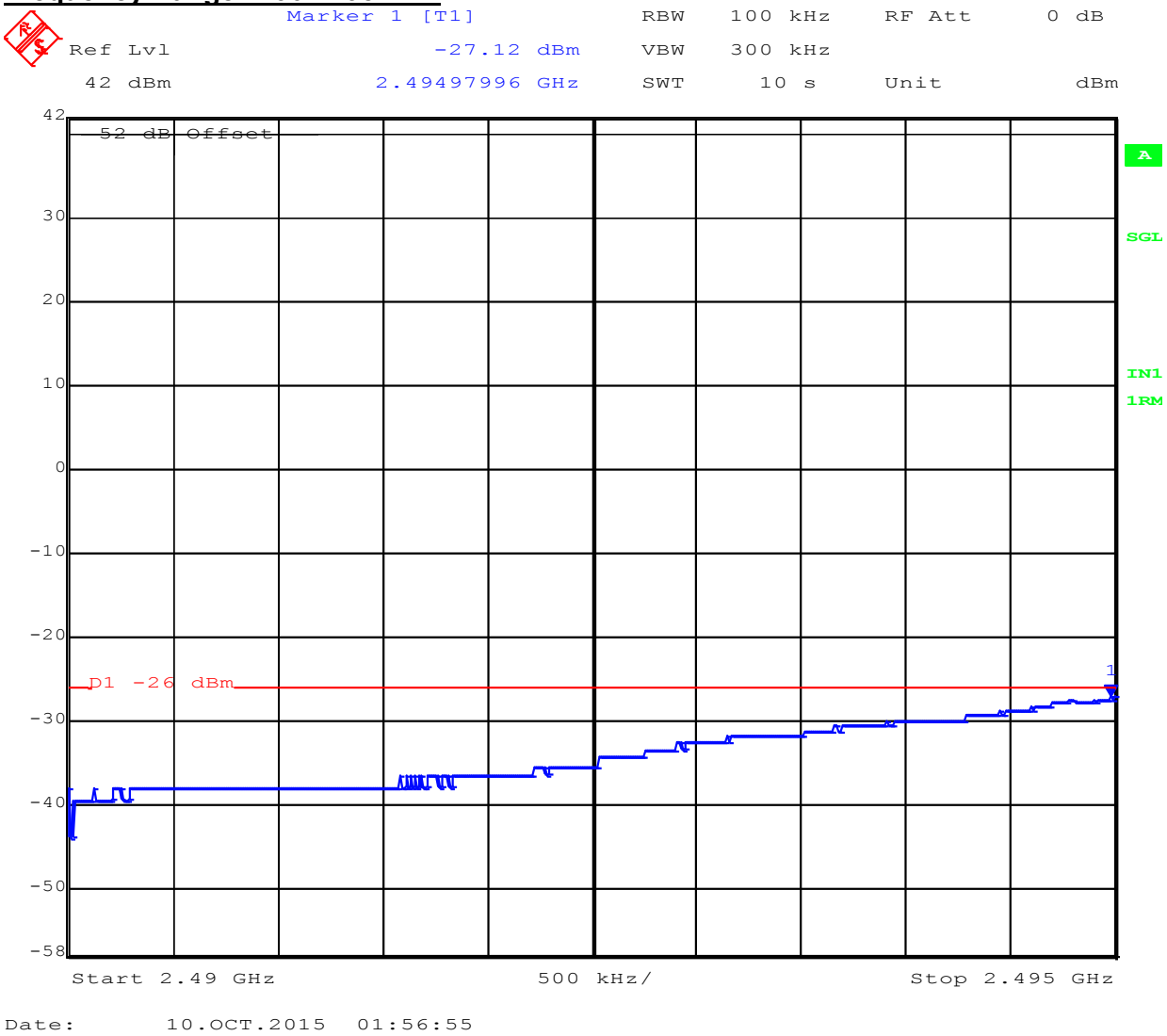
RESULTS SUMMARY FOR CONDUCTED BAND-EDGE EMISSIONS

Port D		Bandwidth	Band-Edge Freq	Peak (Limit -16 dBm)	Power Setting
Operational Mode	Channel Freq MHz	MHz	MHz	dBm	
64 QAM	2498.5	5	2496	-18.92	37
64 QAM	2501.0	10	2496	-21.97	37
64 QAM	2503.0	15	2496	-20.70	37
64 QAM	2503.0	20	2496	-23.74	37
64 QAM	2687.5	5	2690	-19.94	37
64 QAM	2680.1	10	2690	-21.97	37
64 QAM	2683.5	15	2690	-20.90	37
64 QAM	2683.5	20	2690	-24.02	37

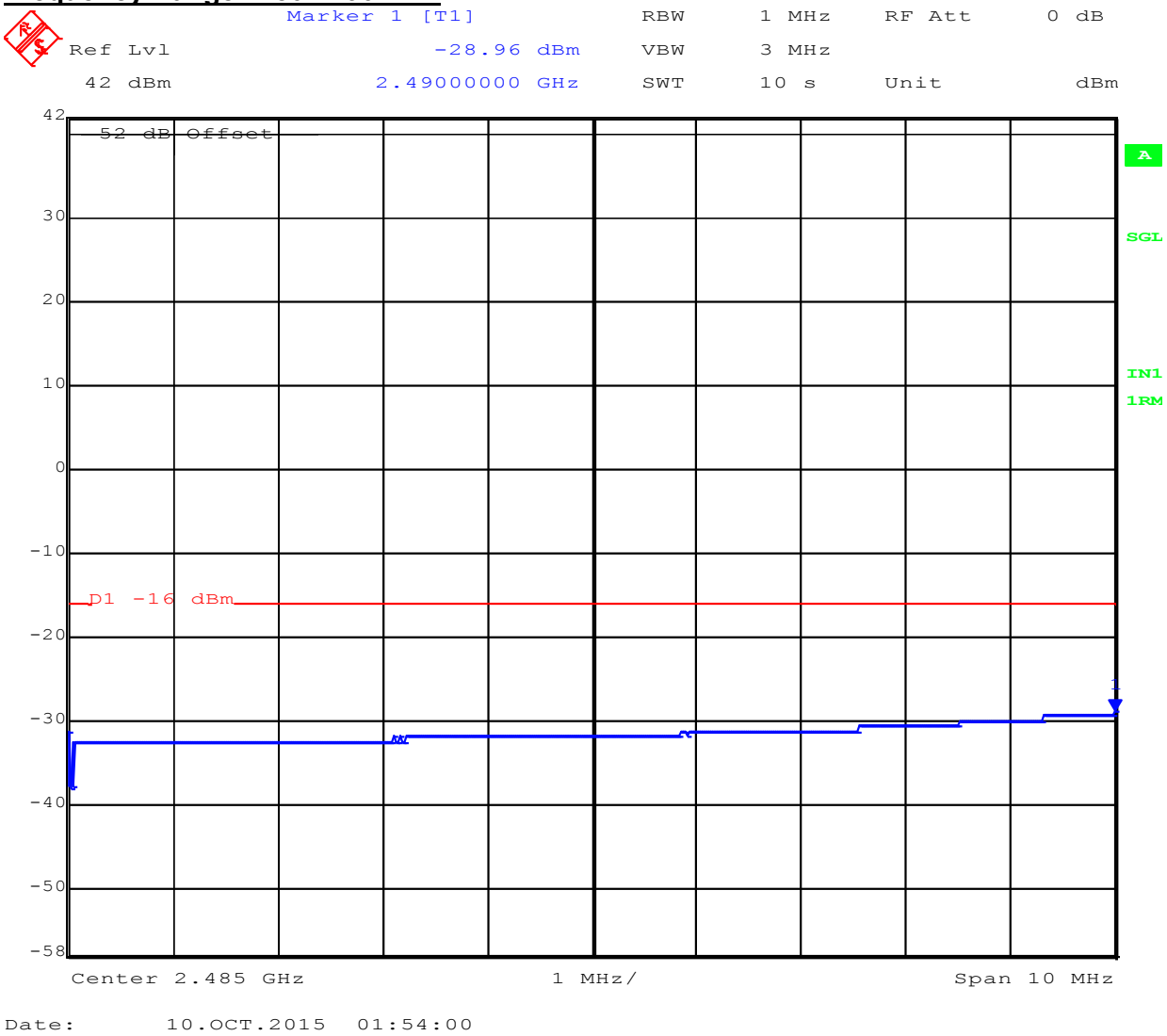
2498.1 MHz 5 MHz Bandwidth
Frequency Range 2495-2497 MHz



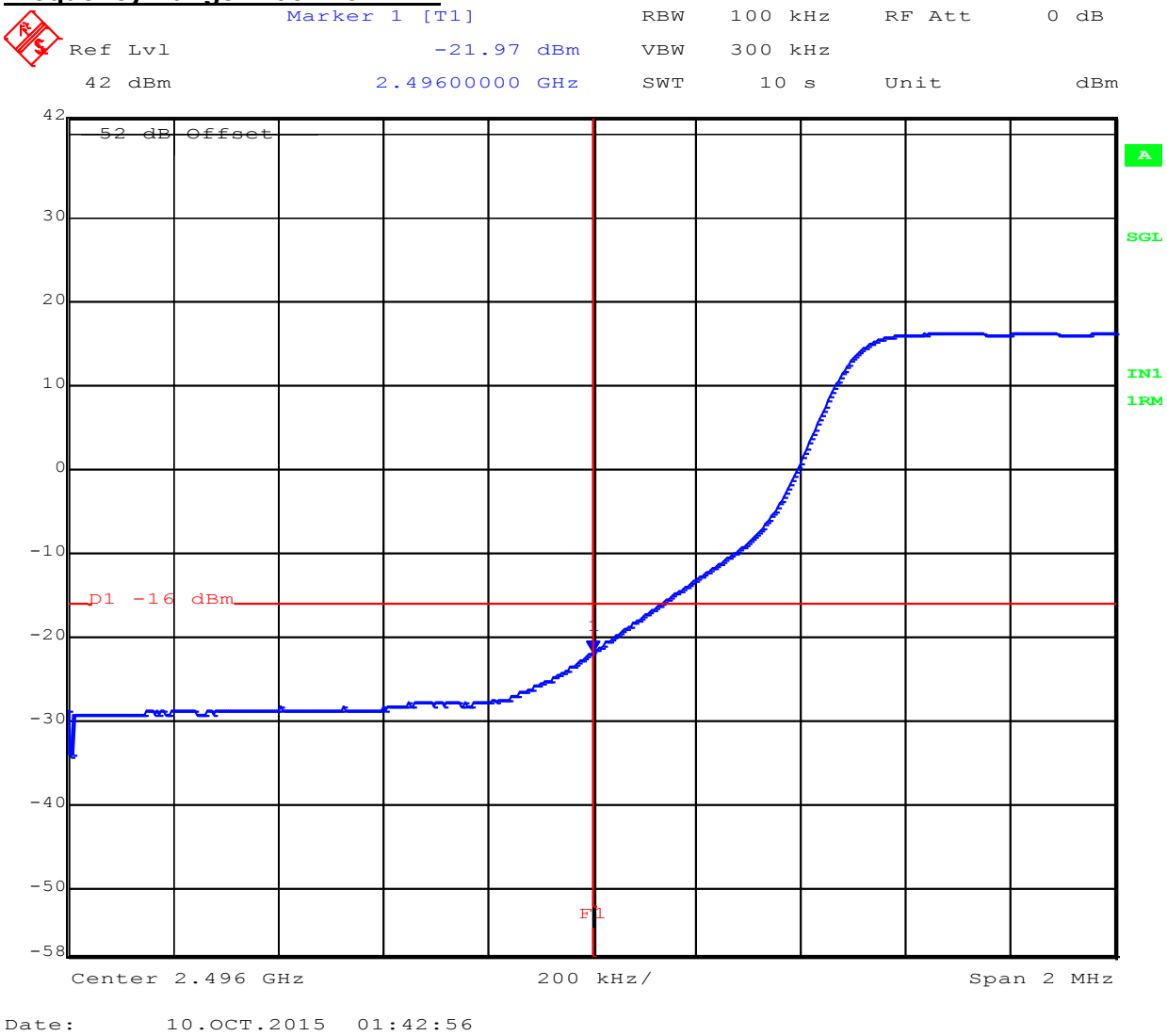
2498.1 MHz 5 MHz Bandwidth
Frequency Range 2490-2495 MHz



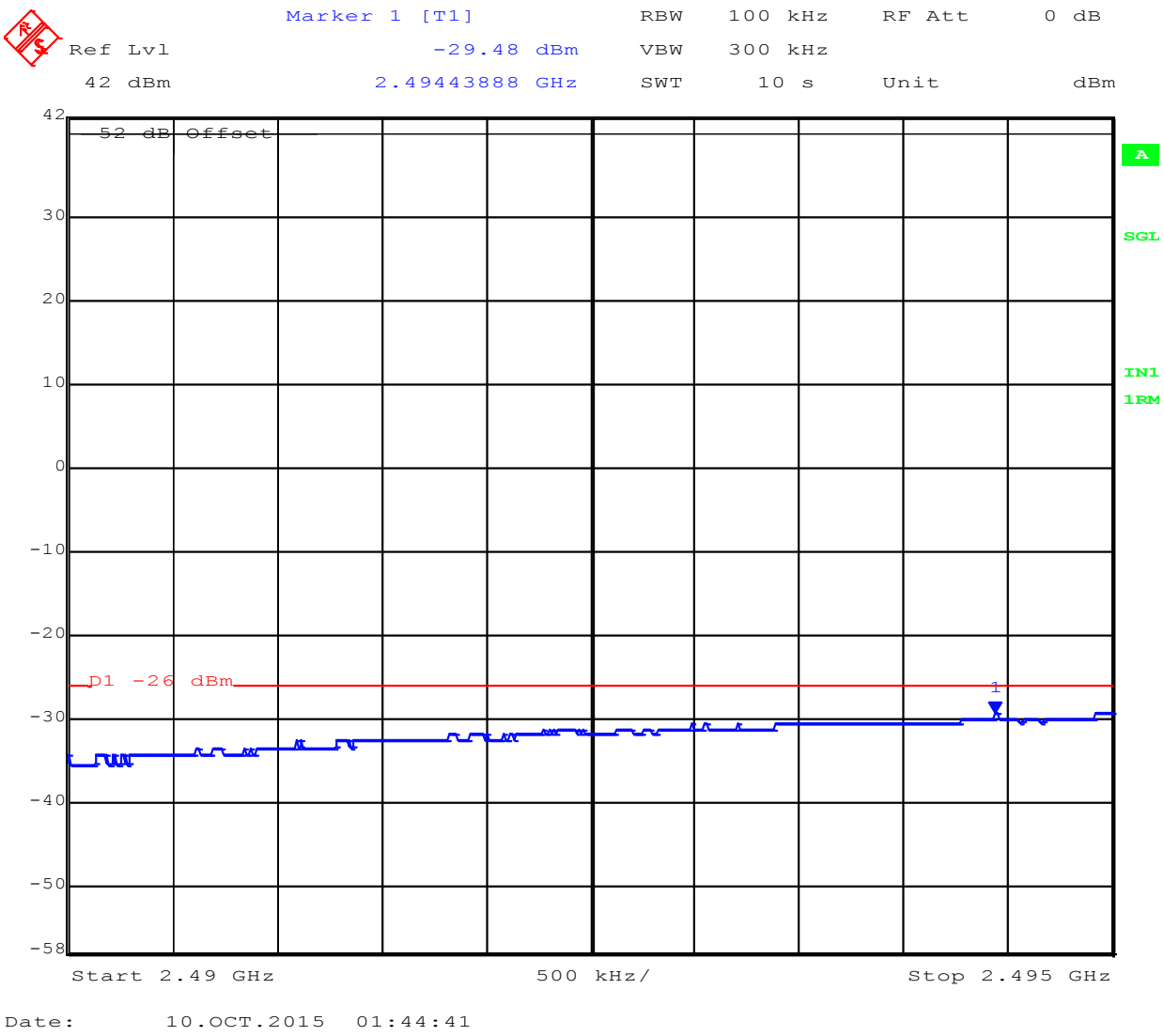
2498.1 MHz 5 MHz Bandwidth
Frequency Range 2480-2490 MHz



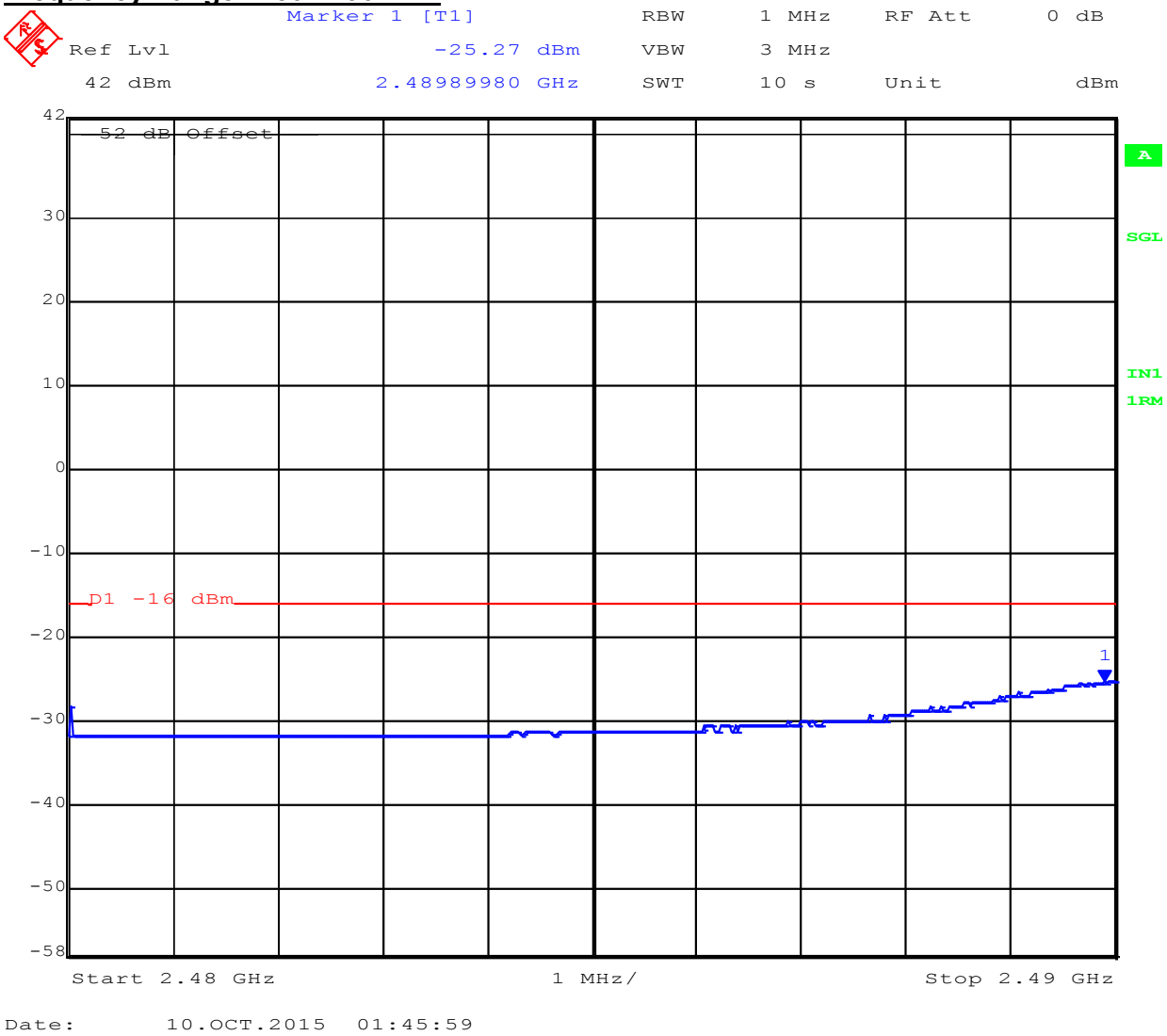
2501 MHz 10 MHz Bandwidth
Frequency Range 2495-2497 MHz



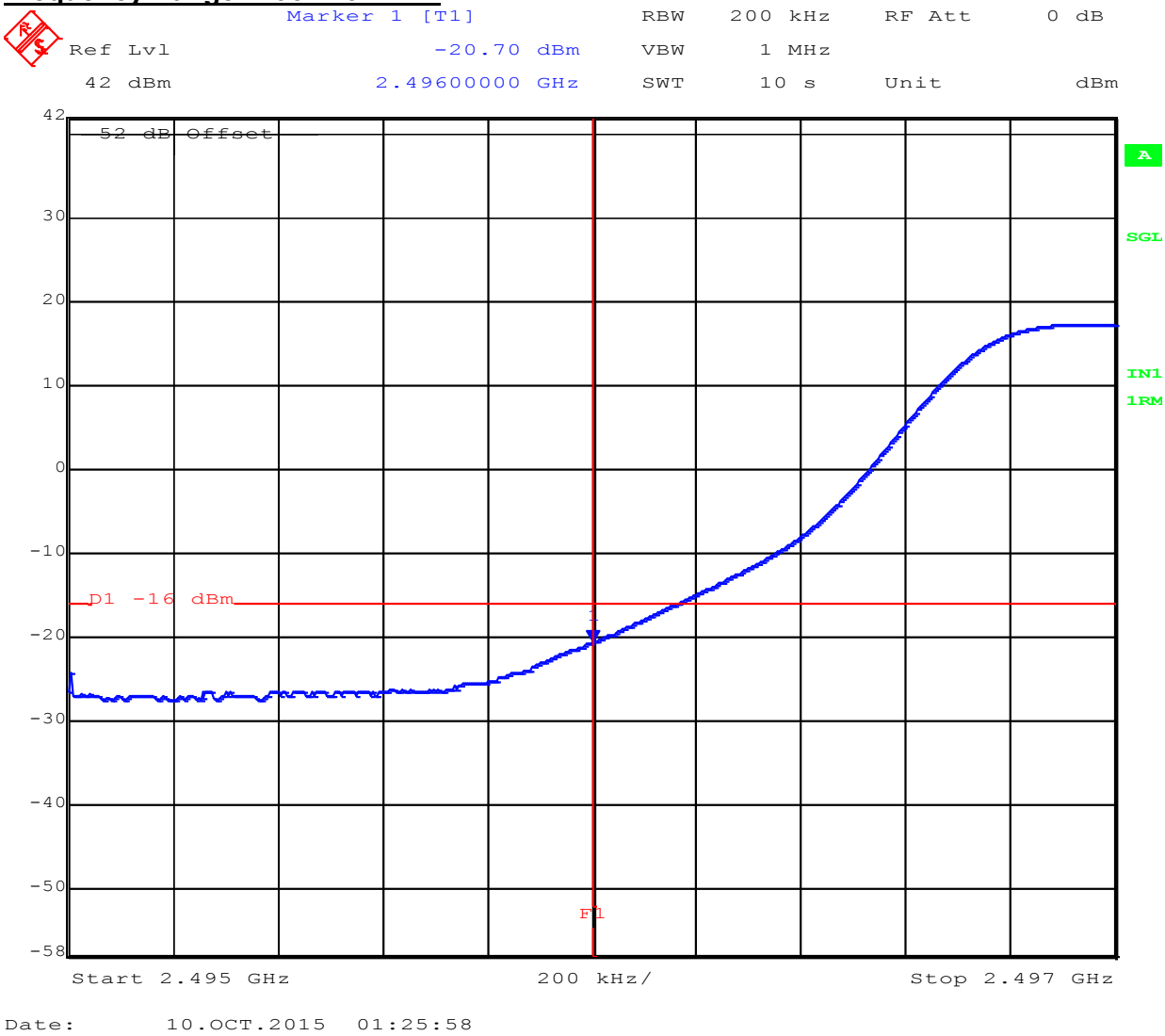
2501 MHz 10 MHz Bandwidth
Frequency Range 2490-2495 MHz



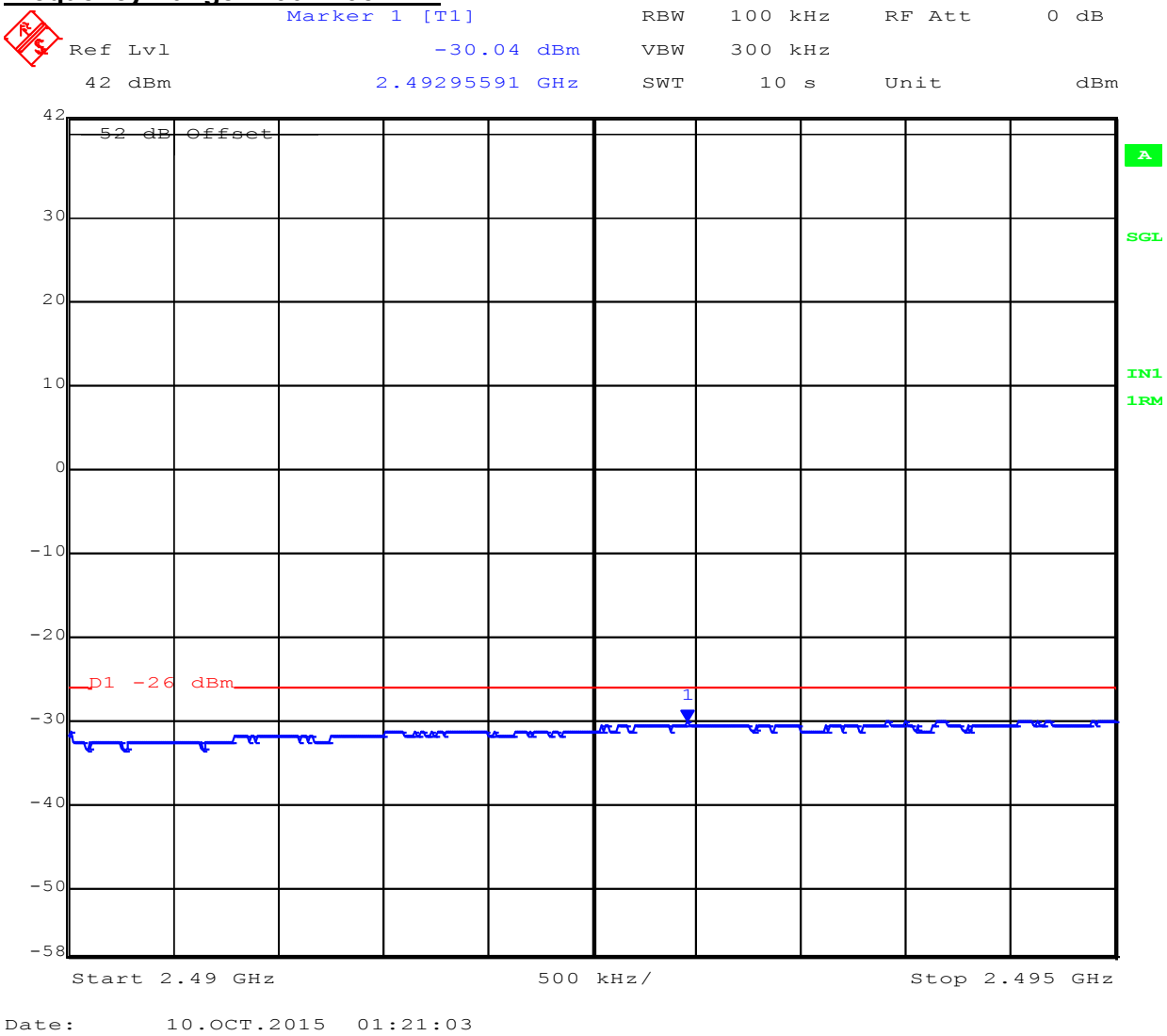
2501 MHz 10 MHz Bandwidth
Frequency Range 2480-2490 MHz



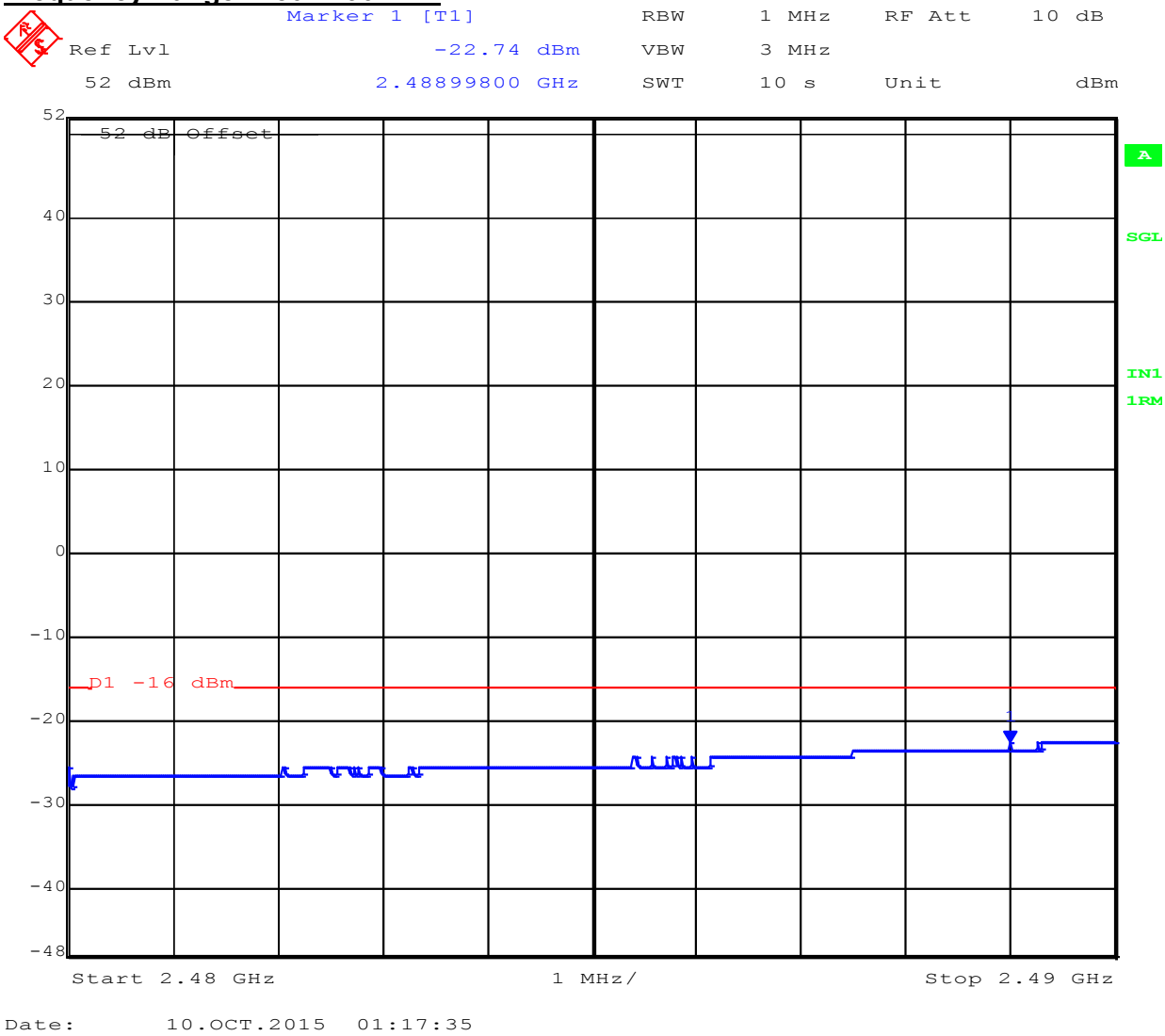
2503.5 MHz 15 MHz Bandwidth
Frequency Range 2495-2497 MHz



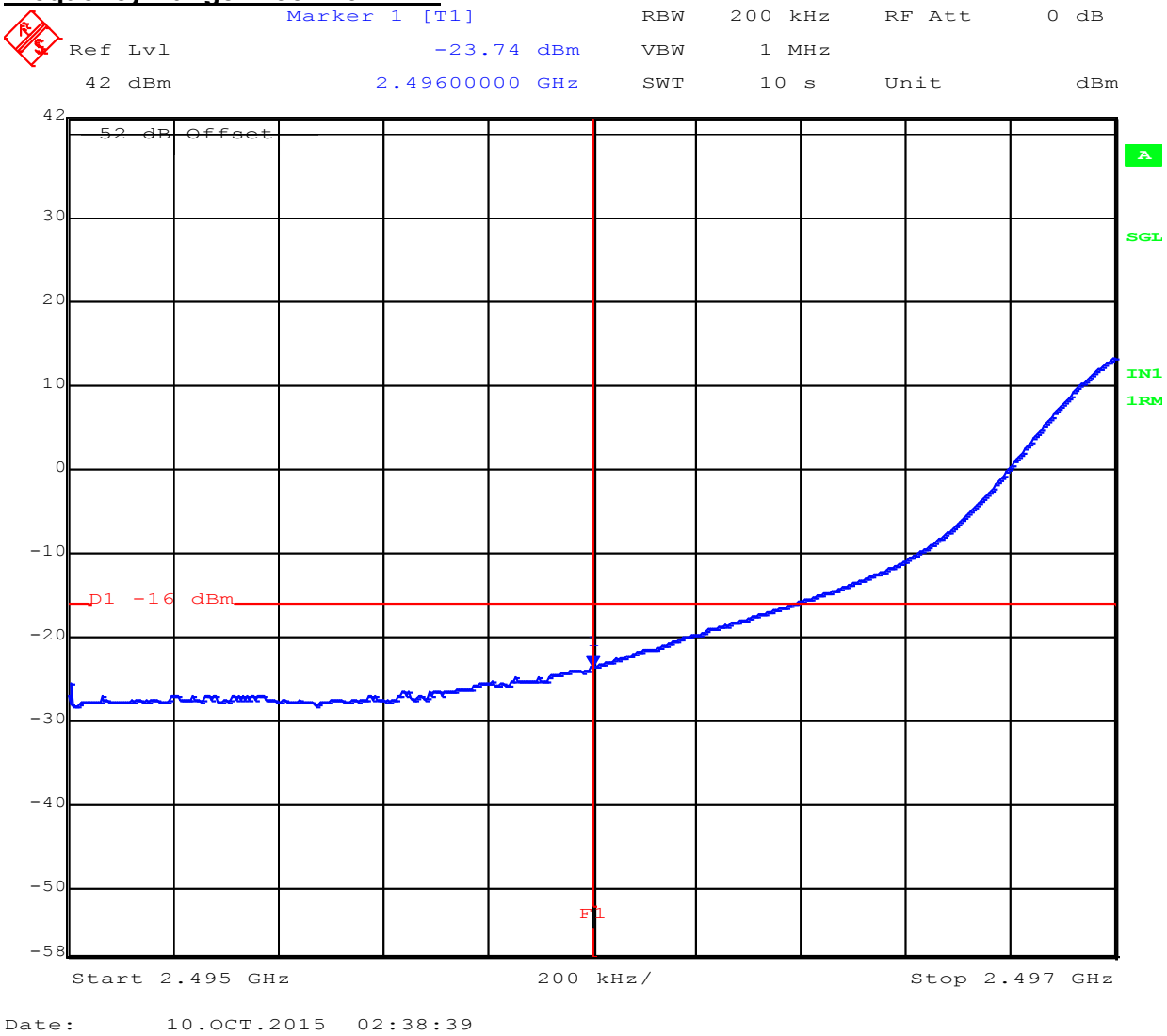
2503.5 MHz 15 MHz Bandwidth
Frequency Range 2490-2495 MHz



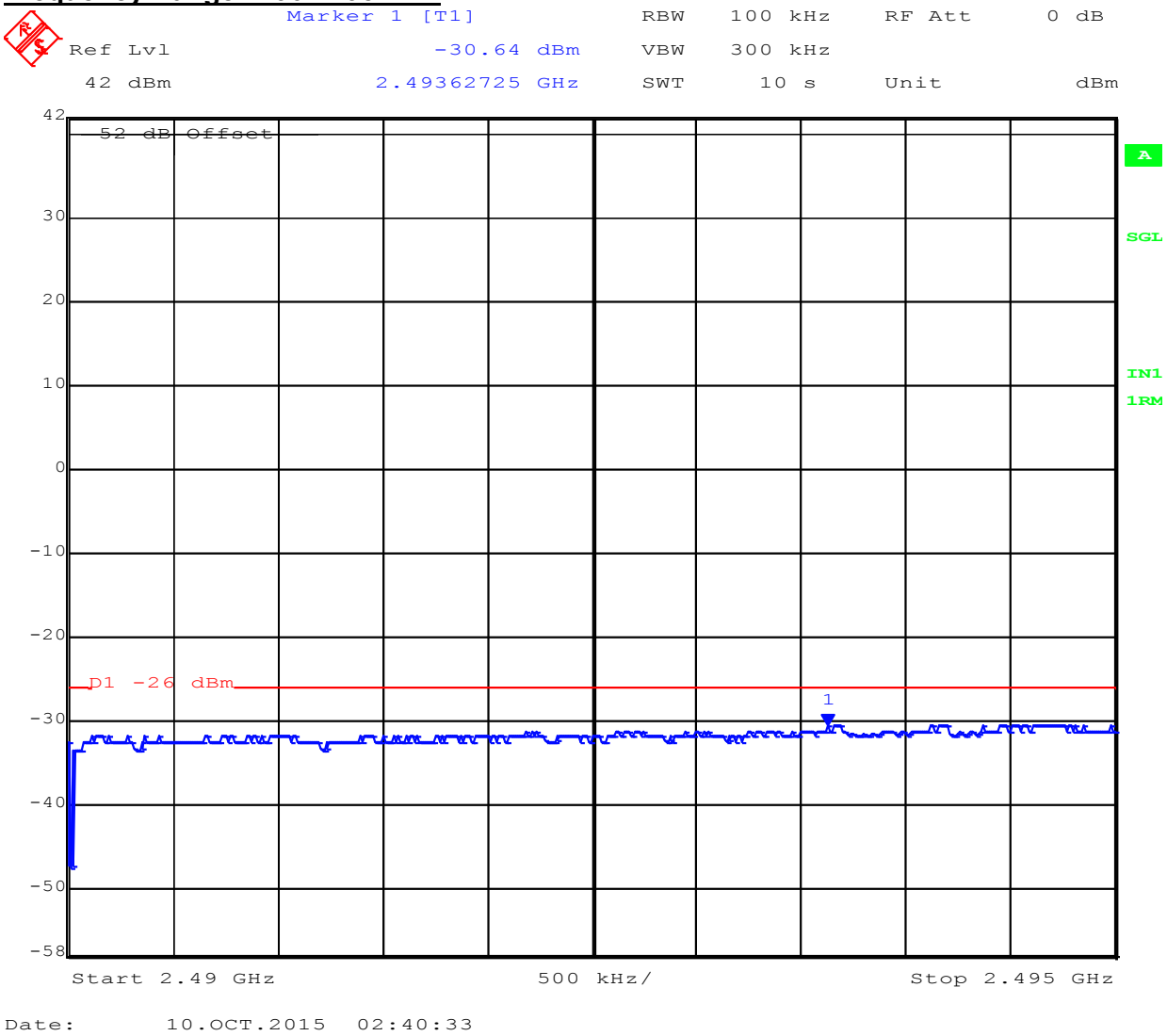
2503.5 MHz 15 MHz Bandwidth
Frequency Range 2480-2490 MHz



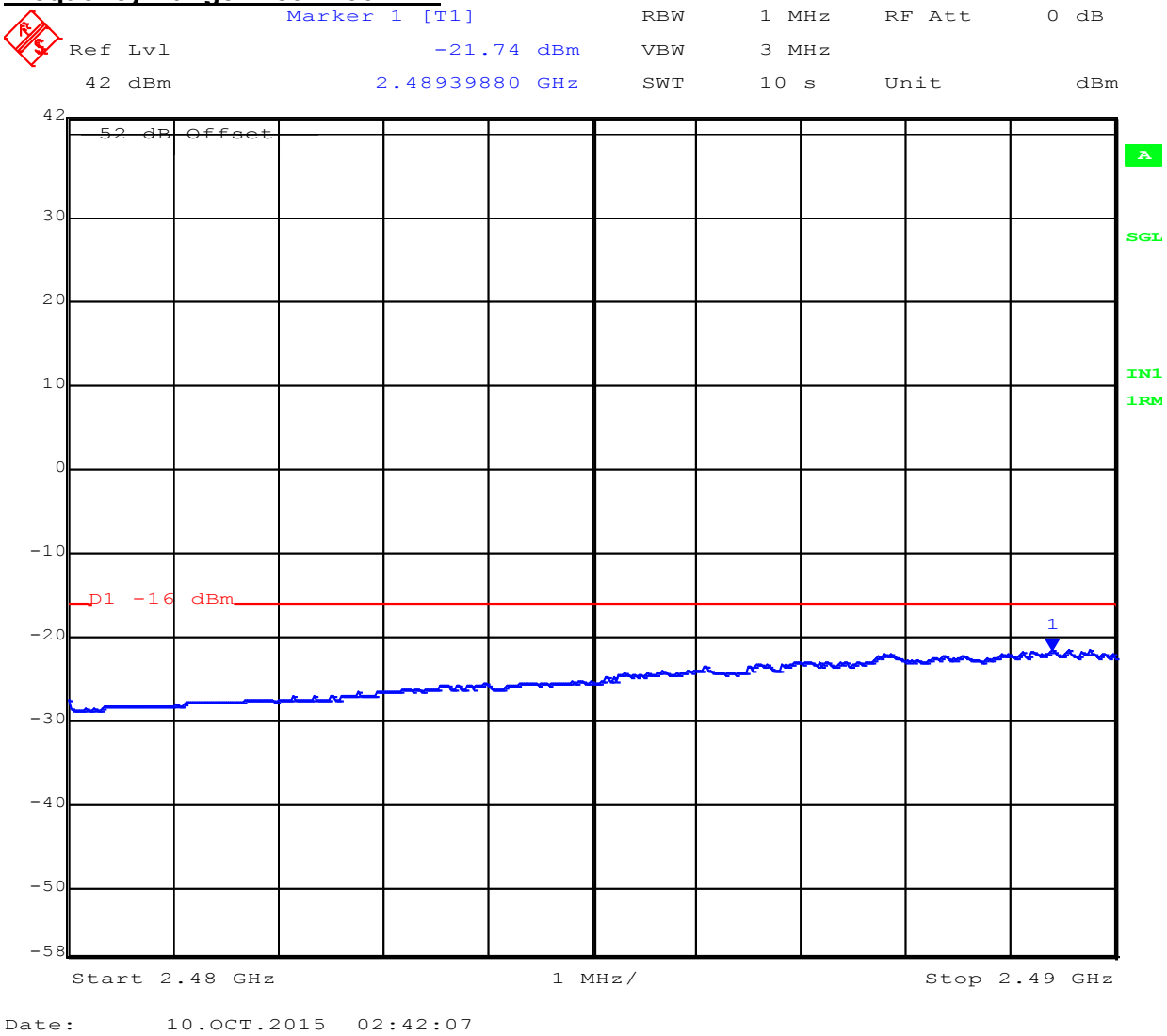
2506 MHz 20 MHz Bandwidth
Frequency Range 2495-2497 MHz



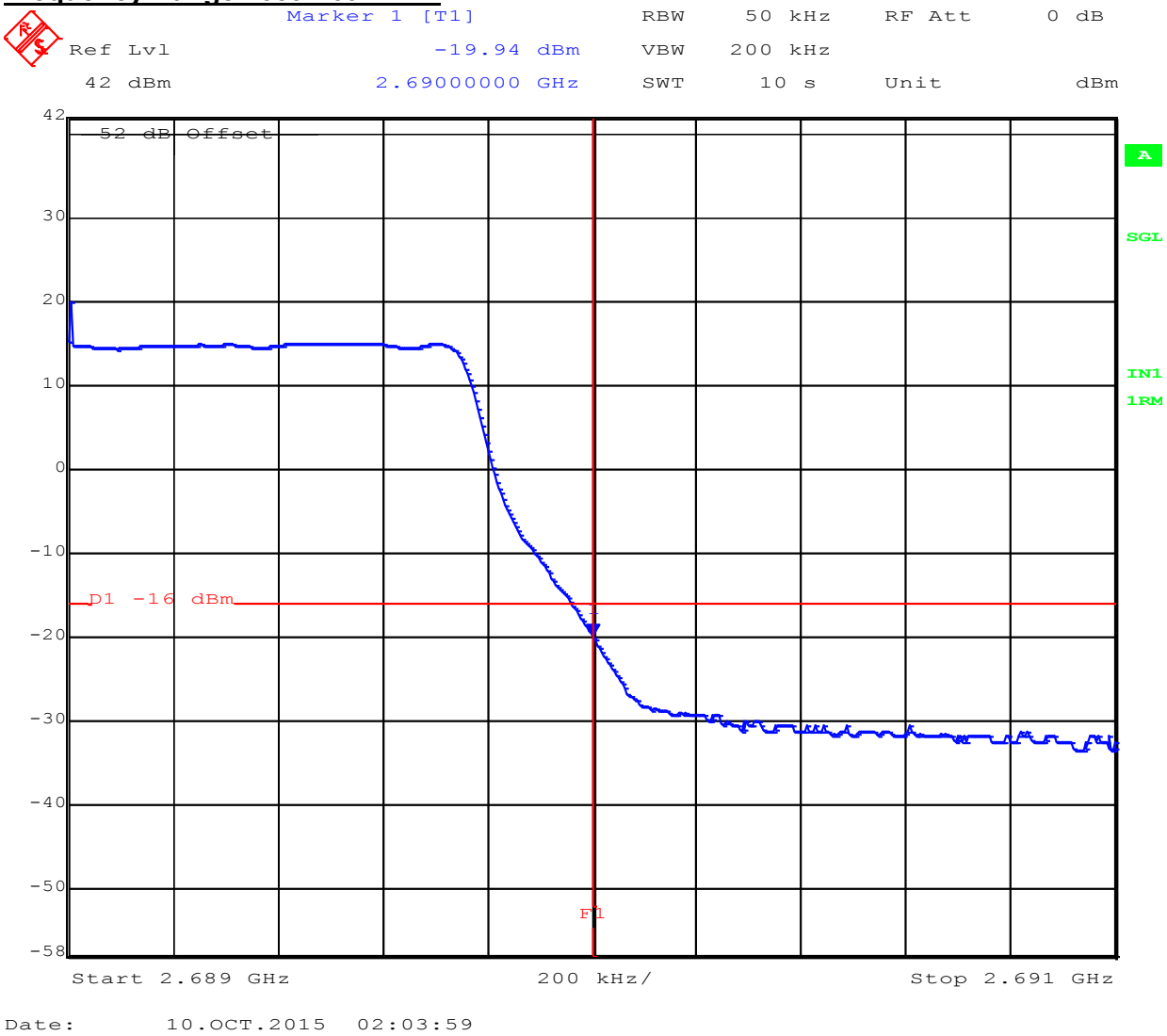
2506 MHz 20 MHz Bandwidth
Frequency Range 2490-2495 MHz



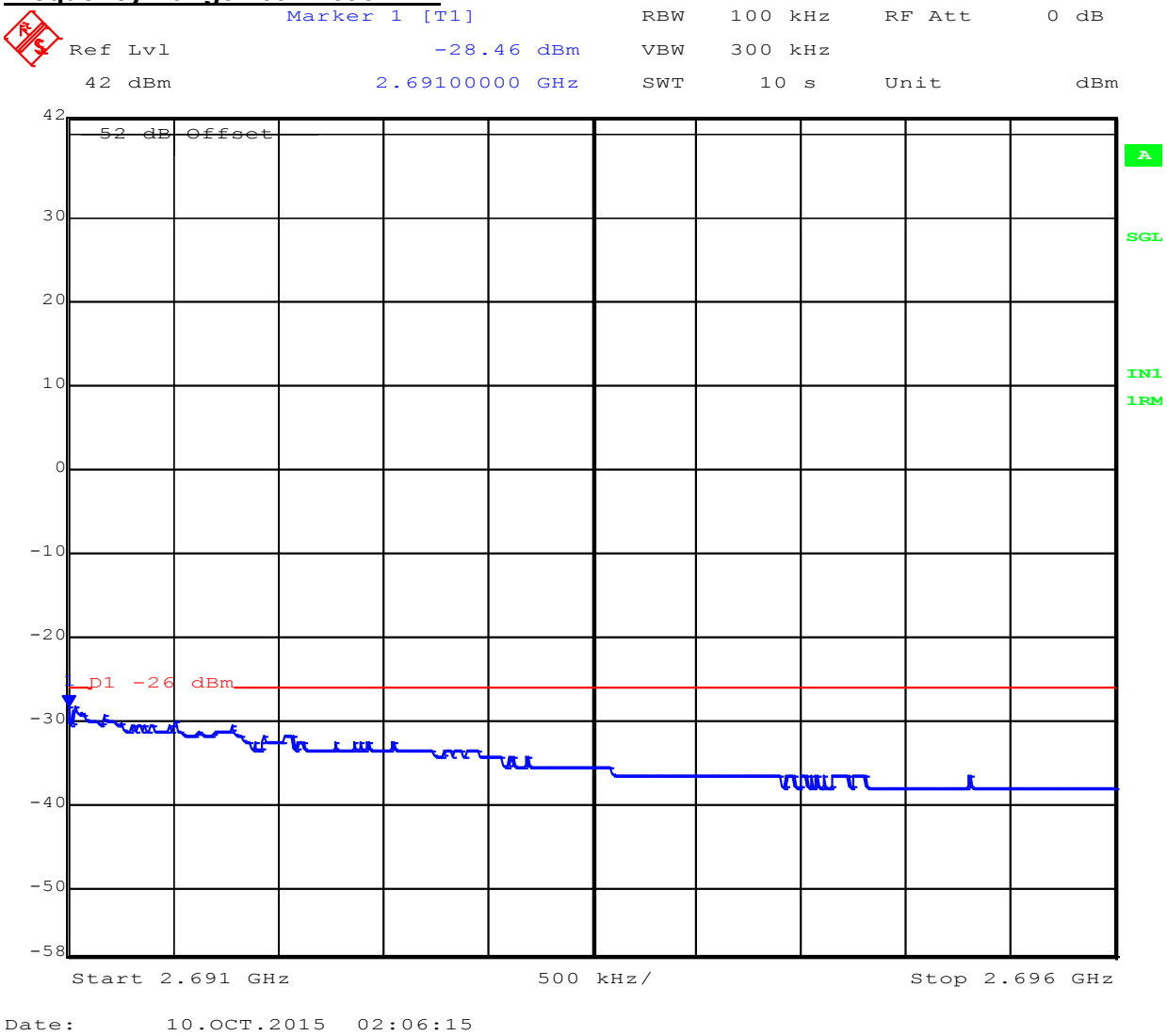
2506 MHz 20 MHz Bandwidth
Frequency Range 2480-2490 MHz



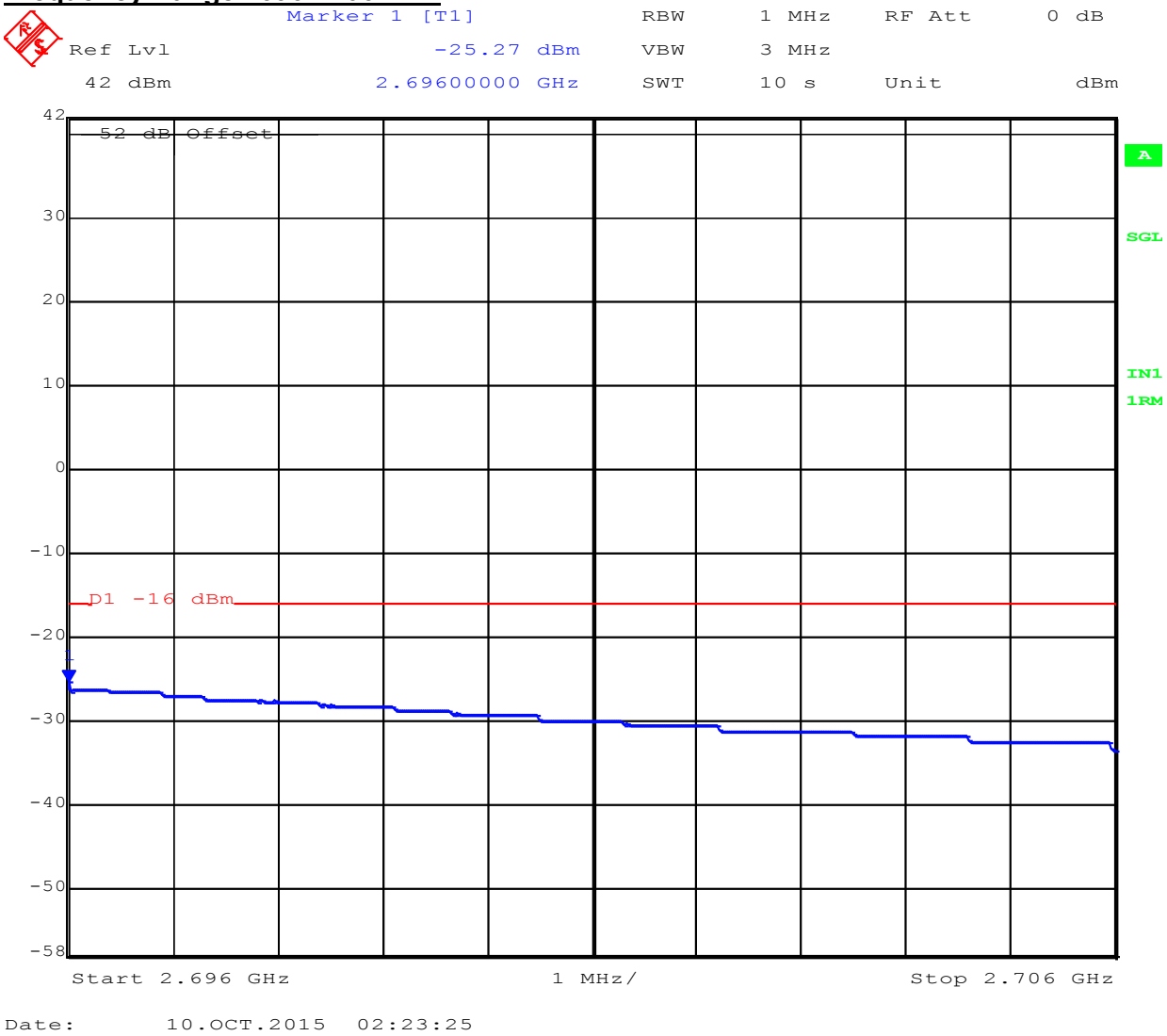
2687.5 MHz 5 MHz Bandwidth
Frequency Range 2689-2691 MHz



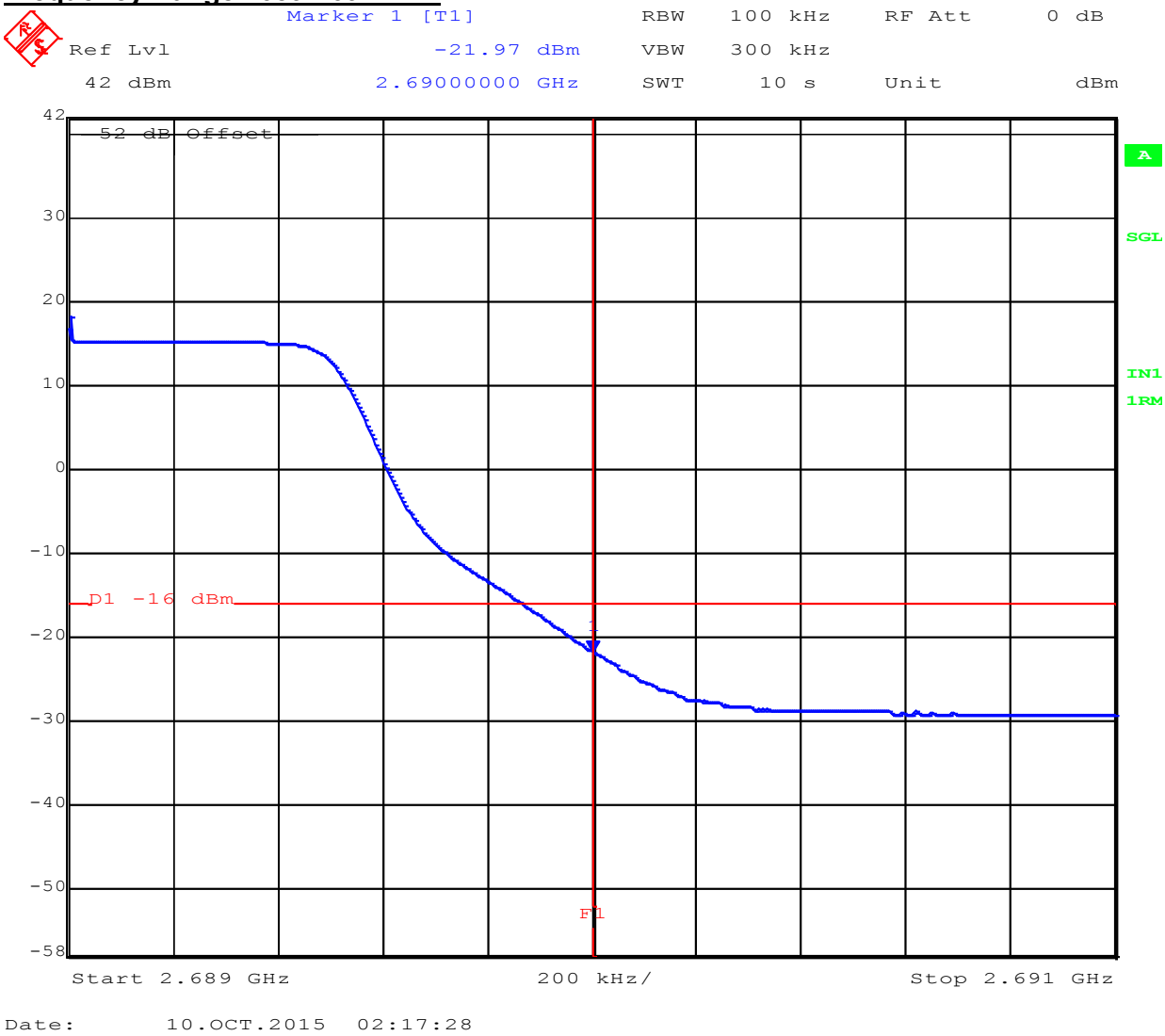
2687.5 MHz 5 MHz Bandwidth
Frequency Range 2691-2696 MHz



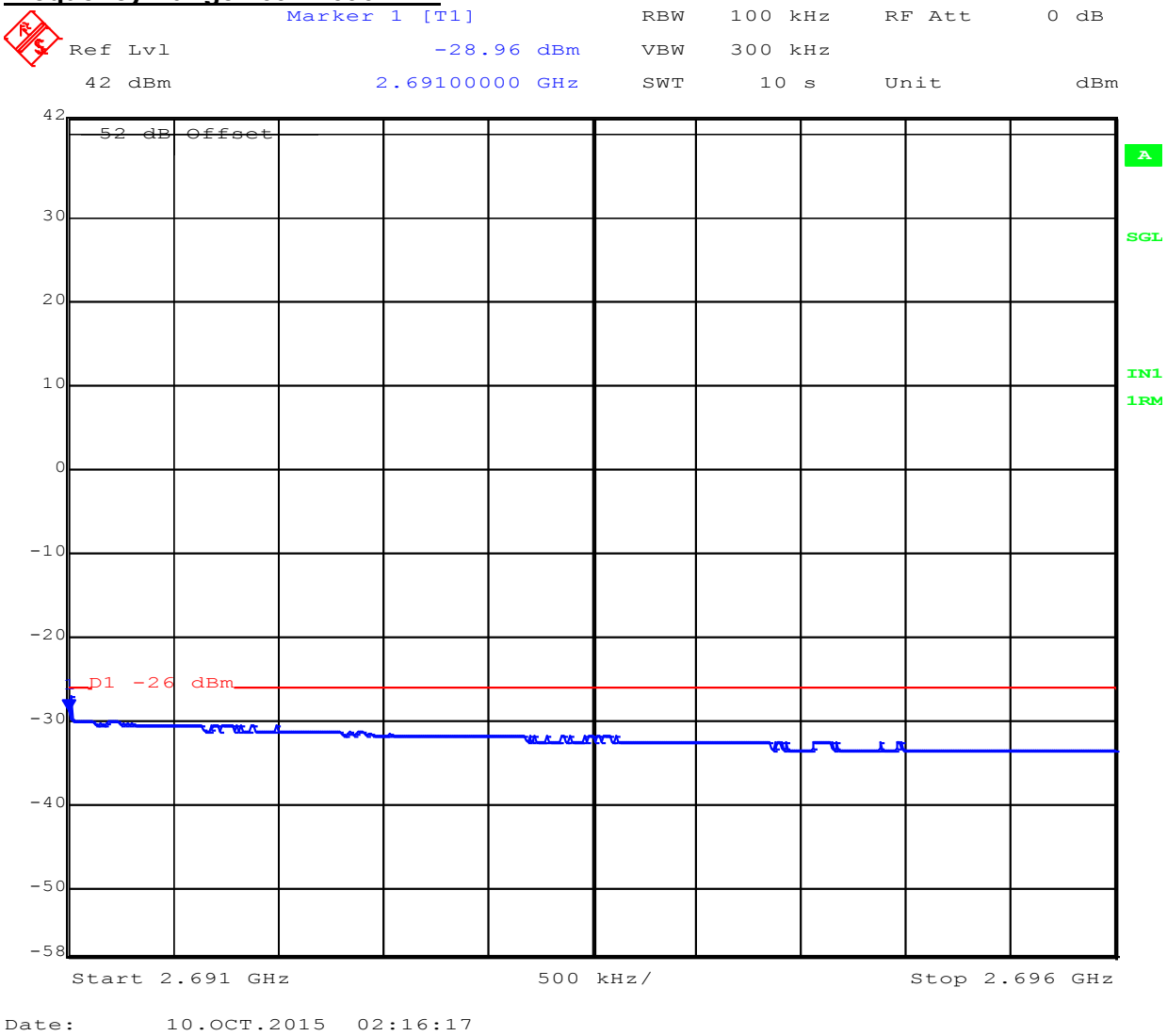
2687.5 MHz 5 MHz Bandwidth
Frequency Range 2696-2706 MHz



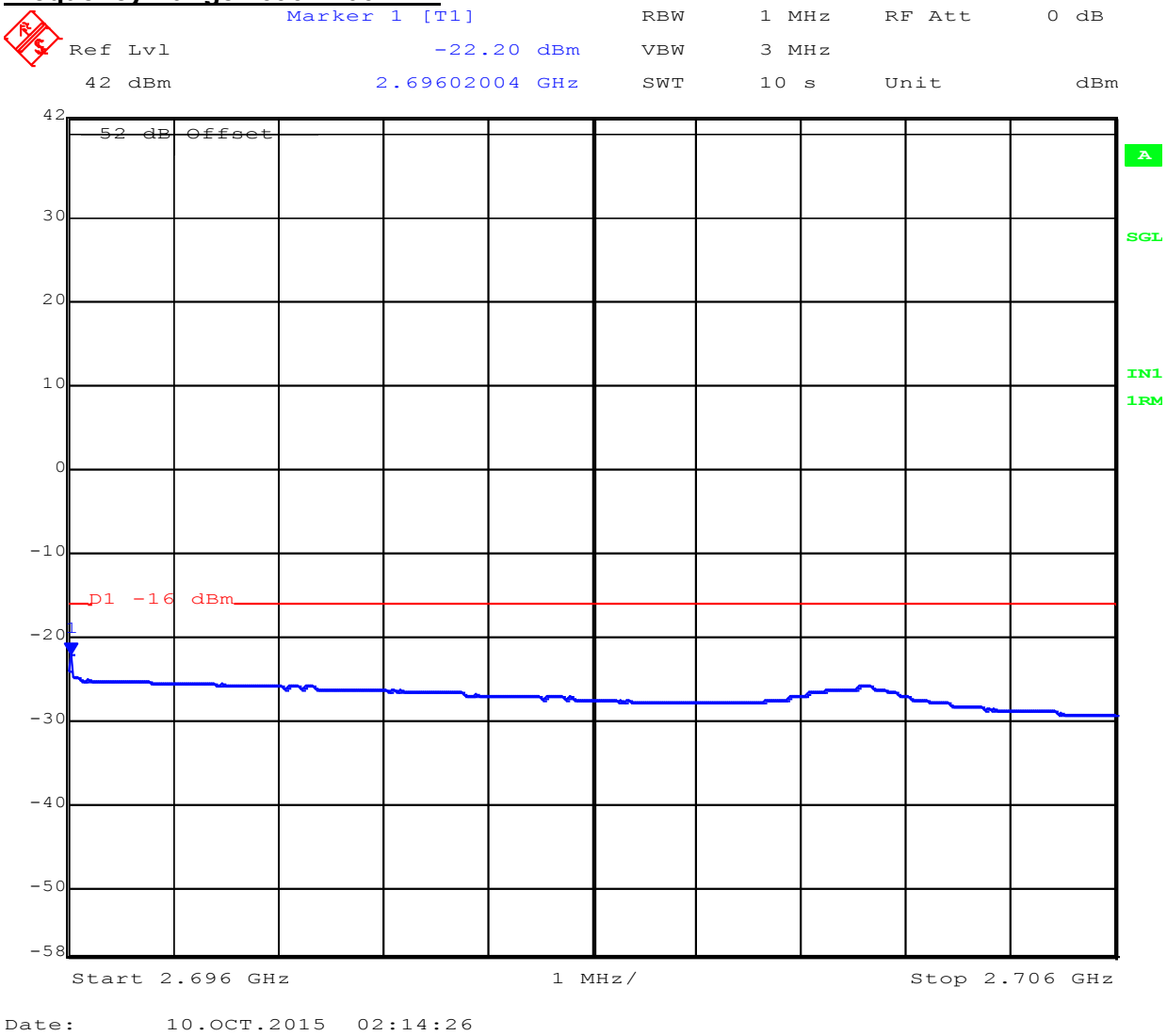
2685 MHz 10 MHz Bandwidth
Frequency Range 2689-2691 MHz



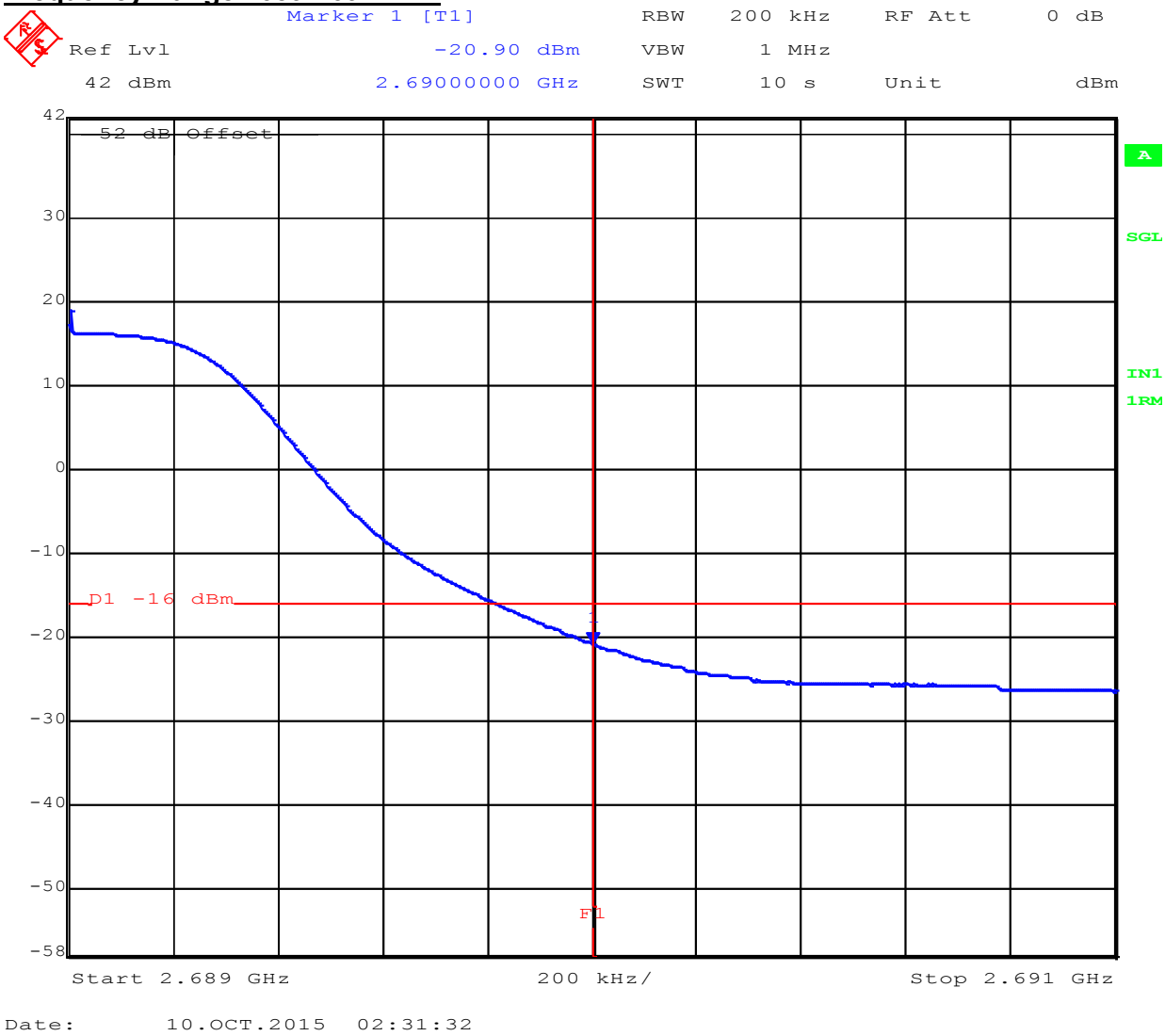
2685 MHz 10 MHz Bandwidth
Frequency Range 2691-2696 MHz



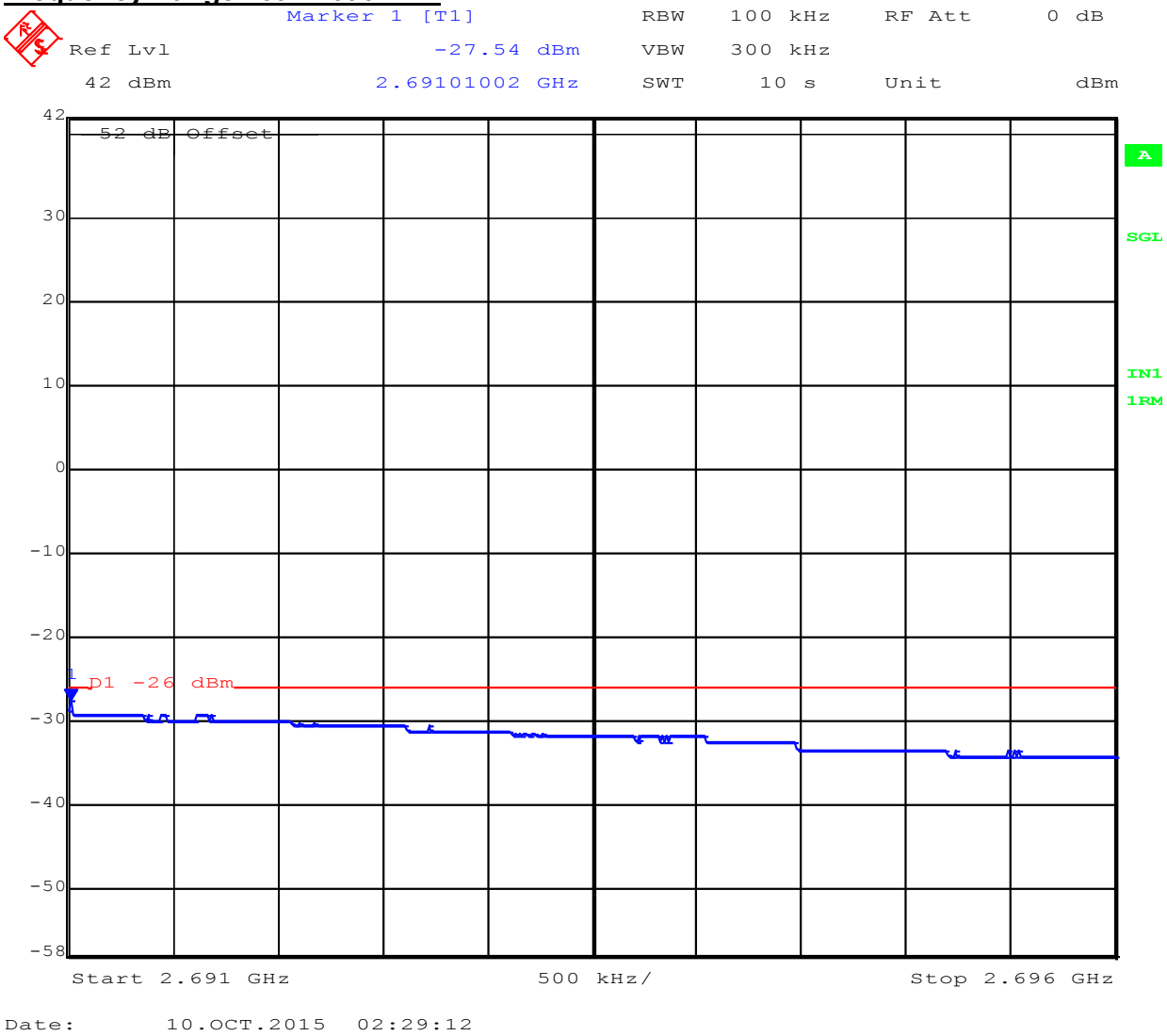
2685 MHz 10 MHz Bandwidth
Frequency Range 2696-2706 MHz



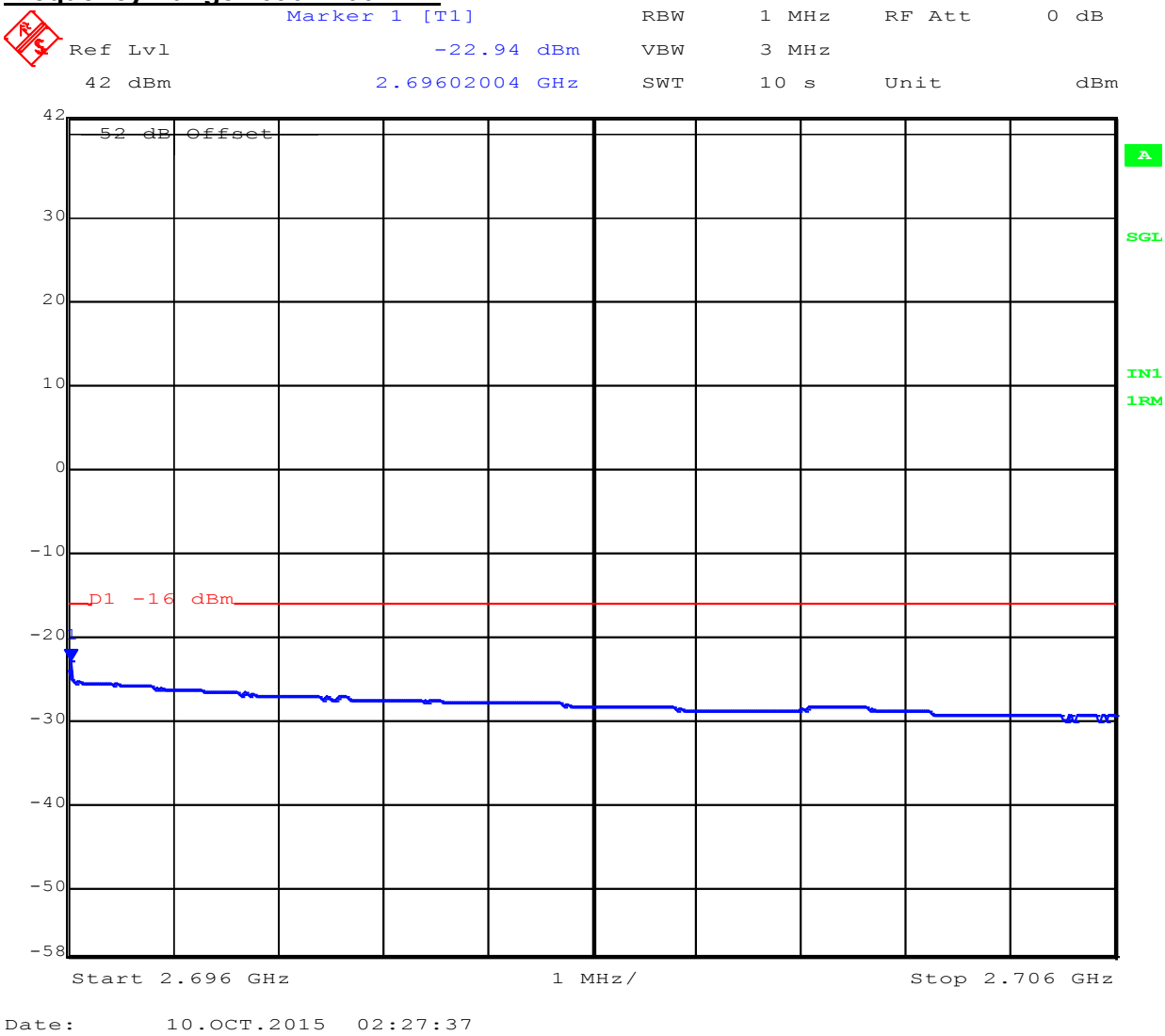
2682.5 MHz 15 MHz Bandwidth
Frequency Range 2689-2691 MHz



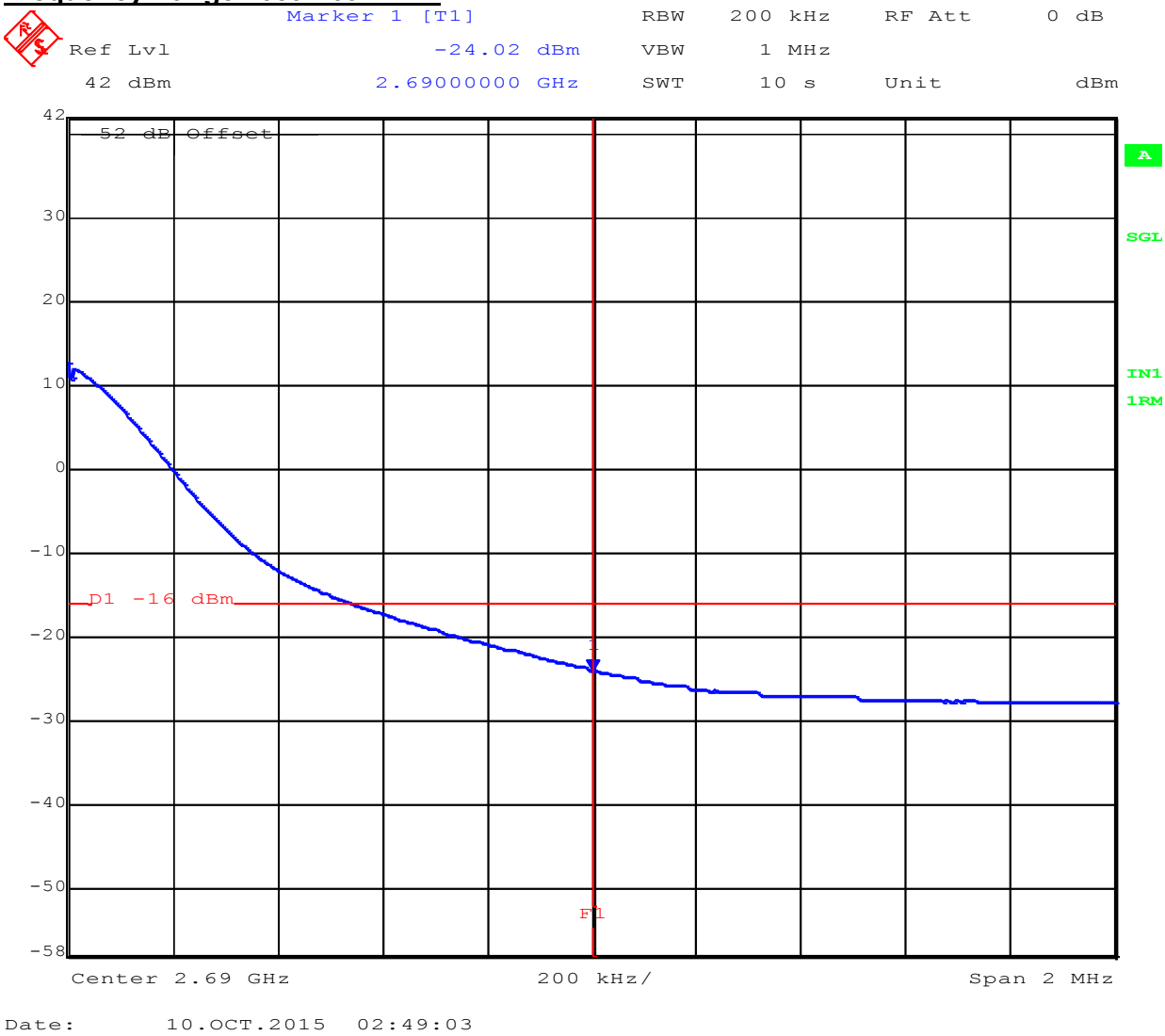
2682.5 MHz 15 MHz Bandwidth
Frequency Range 2691-2696 MHz



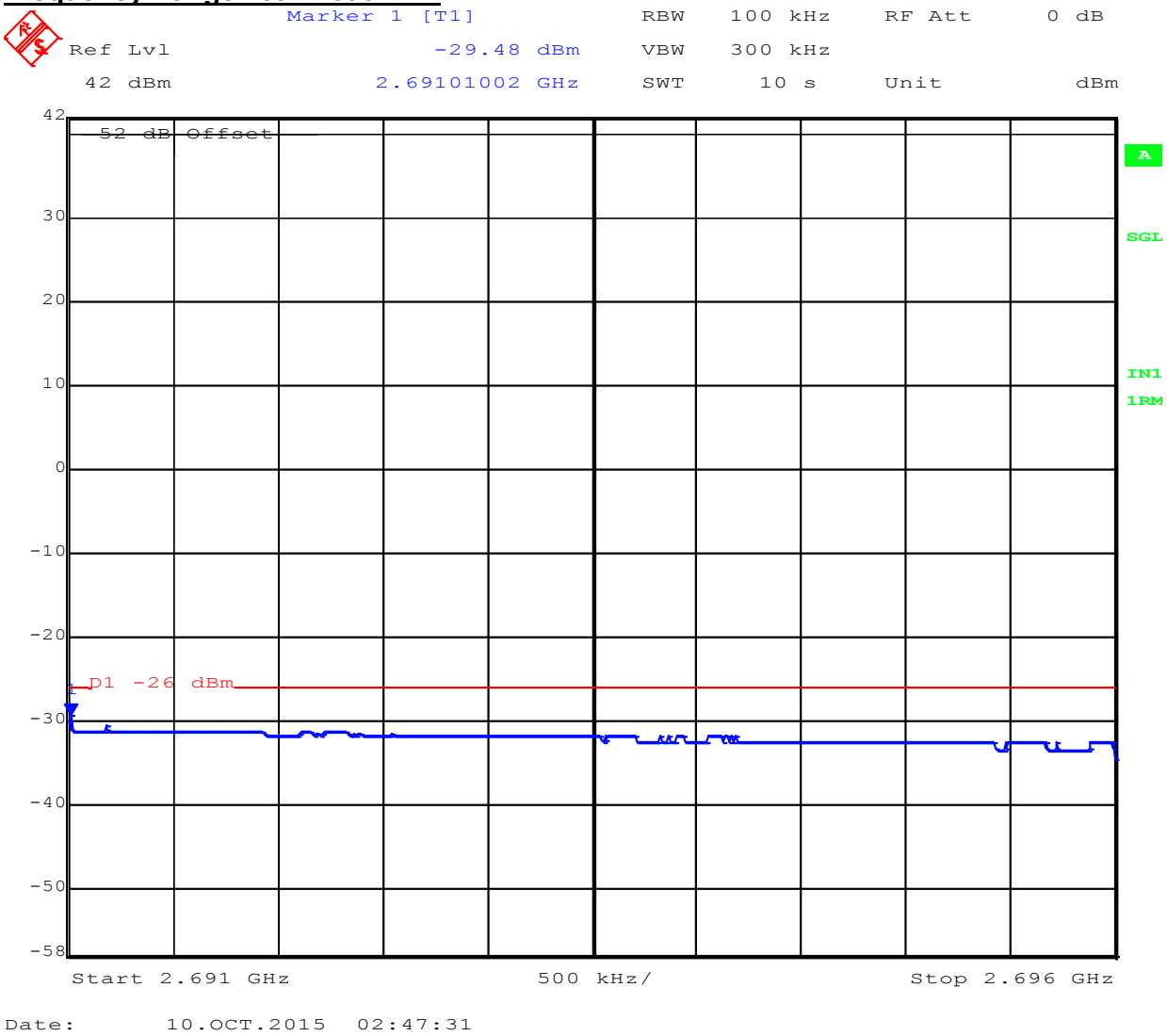
2682.5 MHz 15 MHz Bandwidth
Frequency Range 2696-2706 MHz



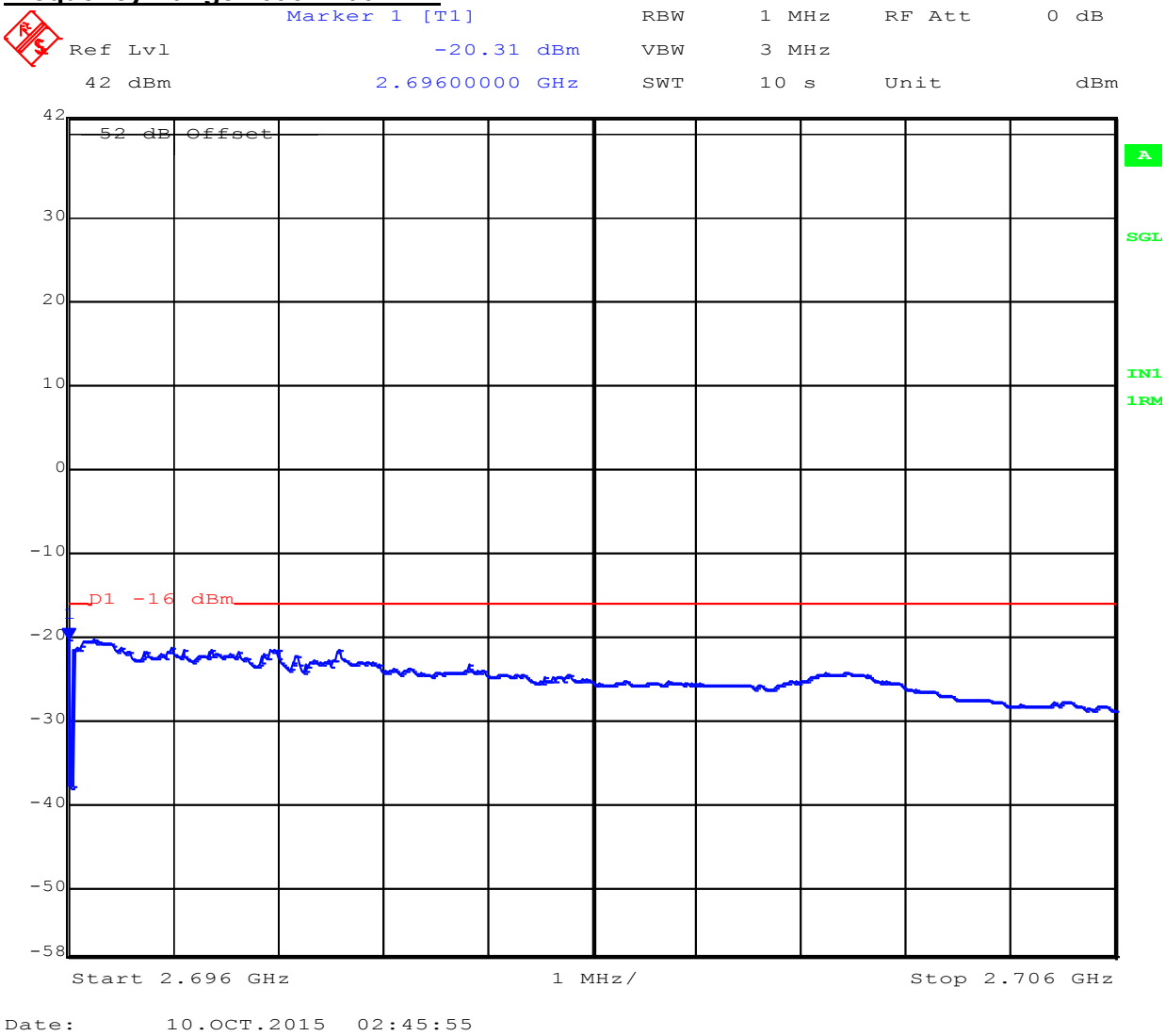
2680 MHz 20 MHz Bandwidth
Frequency Range 2689-2691 MHz



2680 MHz 20 MHz Bandwidth
Frequency Range 2691-2696 MHz



2680 MHz 20 MHz Bandwidth
Frequency Range 2696-2706 MHz



6.1.2. Radiated Testing

ANSI/TIA-603

Test Procedure
Measurements were made while EUT was operating in modulated mode of operation at the appropriate center frequency. Substitution was performed on any emissions observed. The antenna port was attenuated with a 50 Ω termination.

The measurement equipment was set to measure in peak hold mode. The emissions were 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.

The highest emissions relative to the limit are listed for each frequency band measured.

Limits
The power of any unwanted emissions measured from the channel edge of the equipment shall be attenuated below the transmitter power, P (dBW), as follows:

For base station and subscriber equipment, other than mobile subscriber equipment, the attenuation shall not be less than 43 + 10 Log10 (P), dB;

Maximum chain output power found = +36.89 dBm (4.89 W) (15 MHz bandwidth, channel 2593.0 MHz)

Limit = 43 + 10 Log (P) = 43 + 10 * Log (P) = 43 + 6.89 = 49.89 dB

Limit = 36.89 – 49.89 = -13.0 dBm

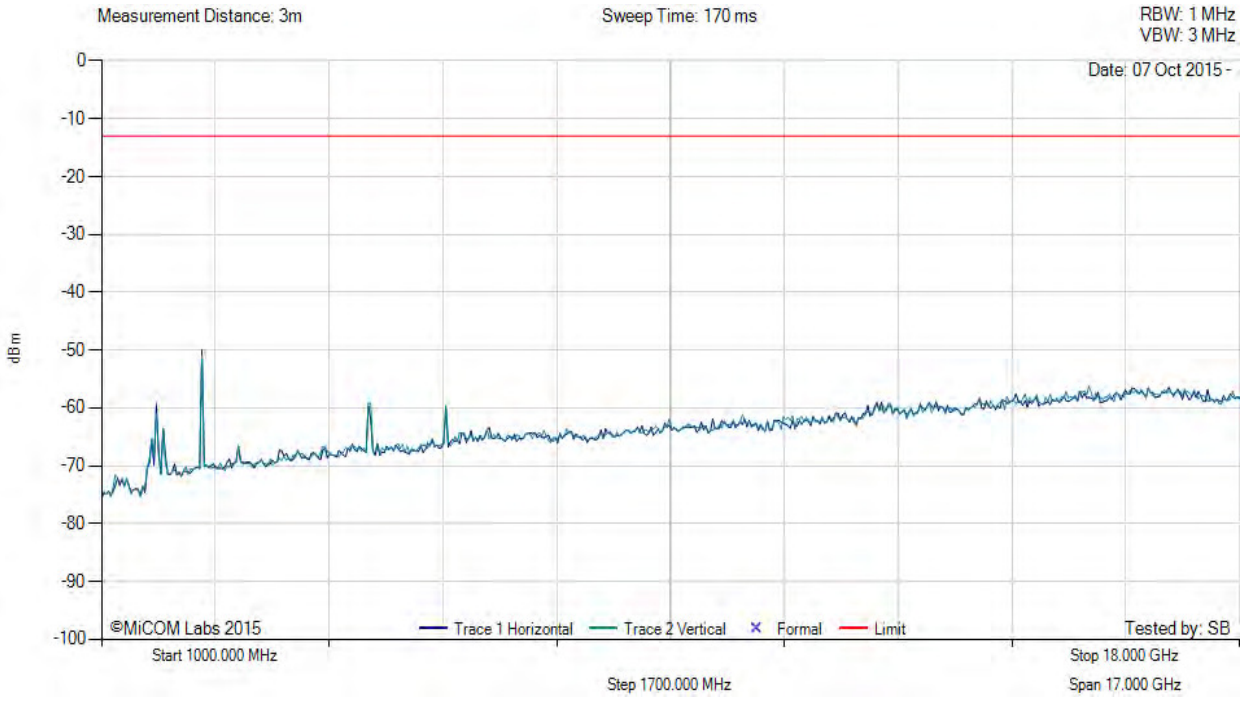
TIA/EIA 603 Compliance
For measurement purposes the antenna ports were terminated in 50 ohm's in accordance with TIA/EIA 603 measurement procedure.

6.1.2.1. Radiated Spurious Emissions

Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Terminated in 50 Ohms	**Variant:**	5 MHz
Antenna Gain (dBi):	Not Applicable	**Modulation:**	QAM 64
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	88
Channel Frequency (MHz):	2506.00	**Data Rate:**	5
Power Setting:	37	**Tested By:**	SB

Test Measurement Results

Variant: , Test Freq: 2506.00 MHz, Antenna: terminated, Power Setting: 37

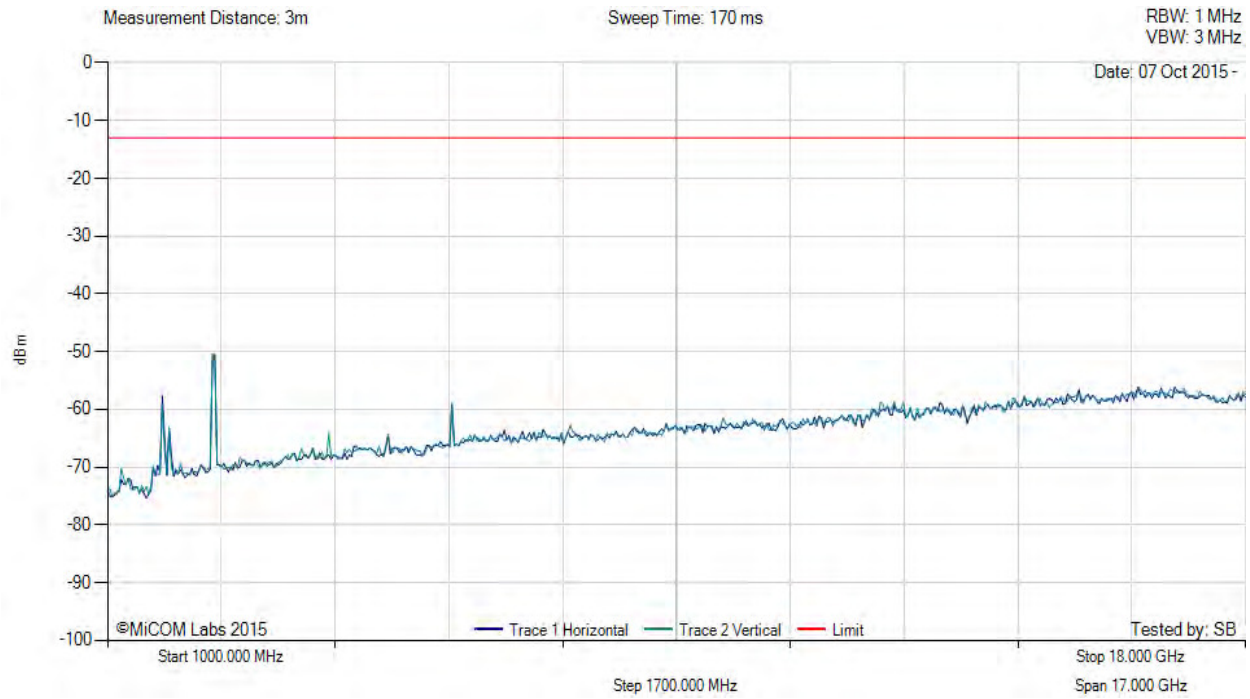


Num	Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
1	1839.51	-49.49	2.45	-13.49	-60.53	Peak (Scan)	Horizontal	100	236	-13	-47.5	Pass
2	5008.29	-45.67	3.63	-11.55	-53.59	Max Peak	Horizontal	162	211	-13	-20.6	Pass
3	6143.96	-48.53	3.86	-9.24	-53.91	Max Peak	Horizontal	114	163	-13	-20.9	Pass

Test Notes: 50 ohm termination heads on antenna ports

Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Terminated in 50 Ohms	**Variant:**	5 MHz
Antenna Gain (dBi):	Not Applicable	**Modulation:**	QAM 64
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	88
Channel Frequency (MHz):	2593.00	**Data Rate:**	5
Power Setting:	37	**Tested By:**	SB

Variant: , Test Freq: 2593.00 MHz, Antenna: terminated, Power Setting: 37



There are no emissions found within 6dB of the limit line.

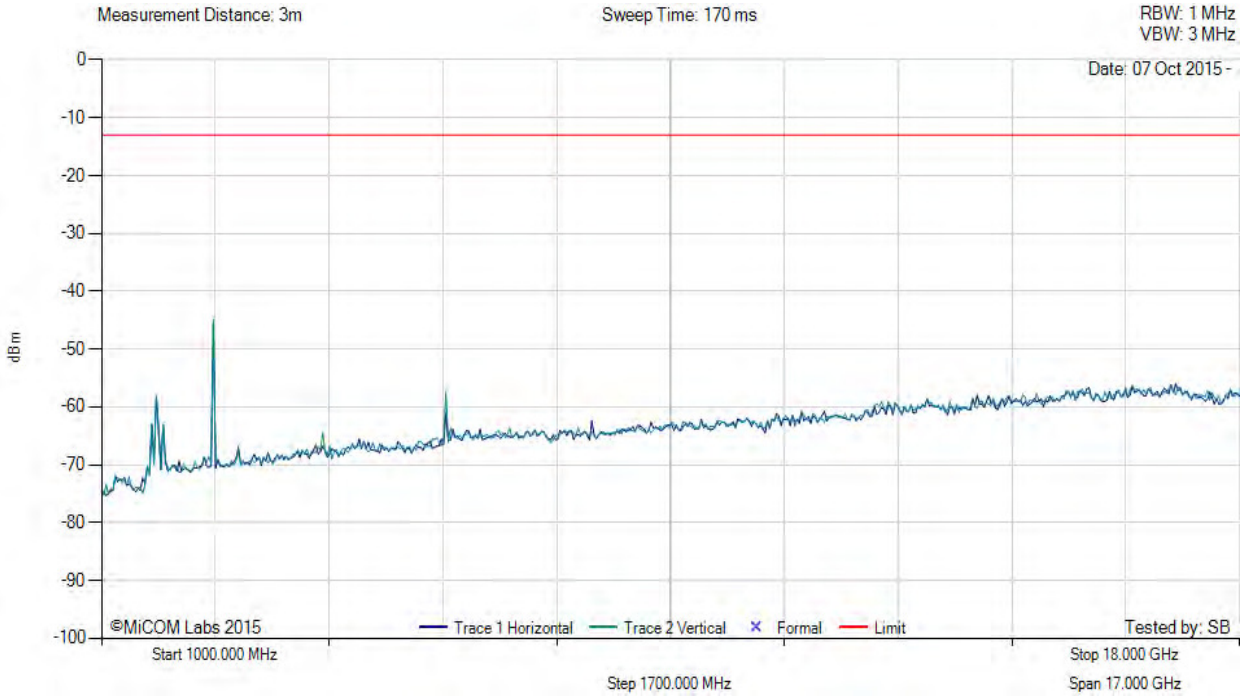
Test Notes: 50 ohm termination heads on antenna ports

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

Antenna:	Terminated in 50 Ohms	**Variant:**	5 MHz
Antenna Gain (dBi):	Not Applicable	**Modulation:**	QAM 64
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	88
Channel Frequency (MHz):	2680.00	**Data Rate:**	5
Power Setting:	37	**Tested By:**	SB

Test Measurement Results

Variant: , Test Freq: 2680.00 MHz, Antenna: terminated, Power Setting: 37



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	6144.09	-48.79	3.86	-9.24	-54.17	Max Peak	Vertical	102	179	-13	-21.2	Pass

Test Notes: 50 ohm termination heads on antenna ports

6.1.2.2. Digital Emissions

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 6 Test Set-Up Photographs.

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 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:

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

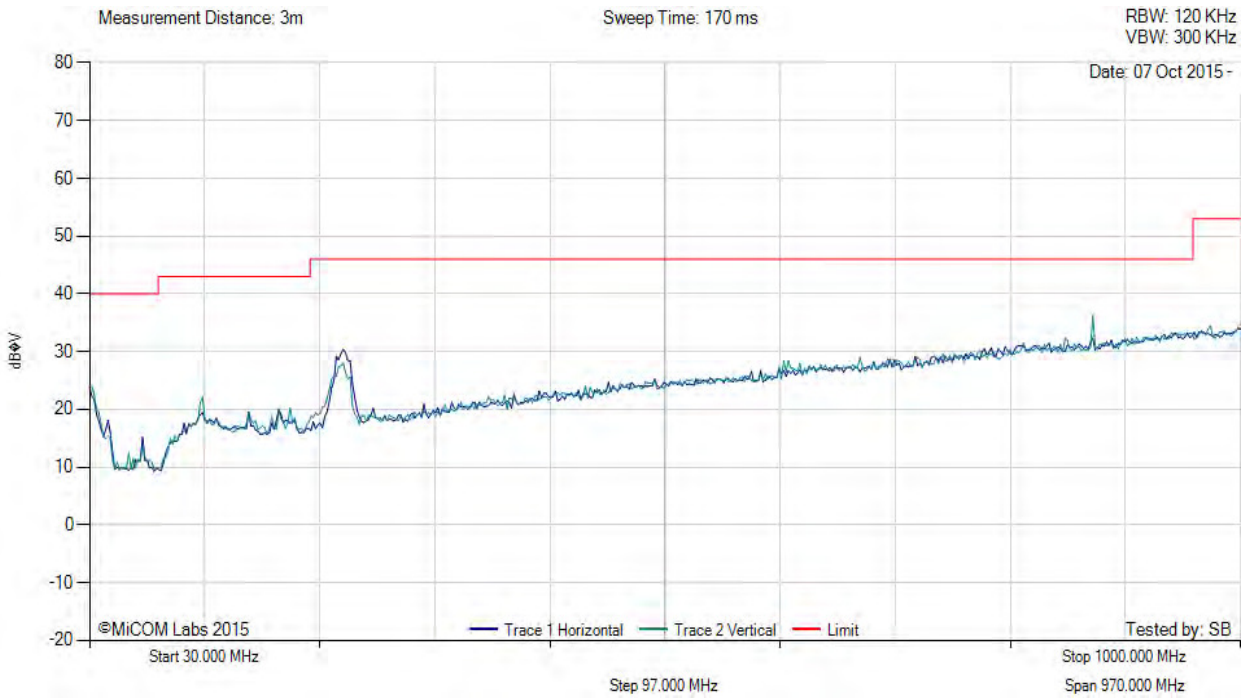
Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

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

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

Equipment Configuration for Digital Emissions			
Antenna:	Terminated in 50 Ohms	**Variant:**	5 MHz
Antenna Gain (dBi):	Not Applicable	**Modulation:**	QAM 64
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	88
Channel Frequency (MHz):	2680.00	**Data Rate:**	5
Power Setting:	37	**Tested By:**	SB

Variant: , Test Freq: 2680.00 MHz, Antenna: terminated, Power Setting: 37



There are no emissions found within 6dB of the limit line.

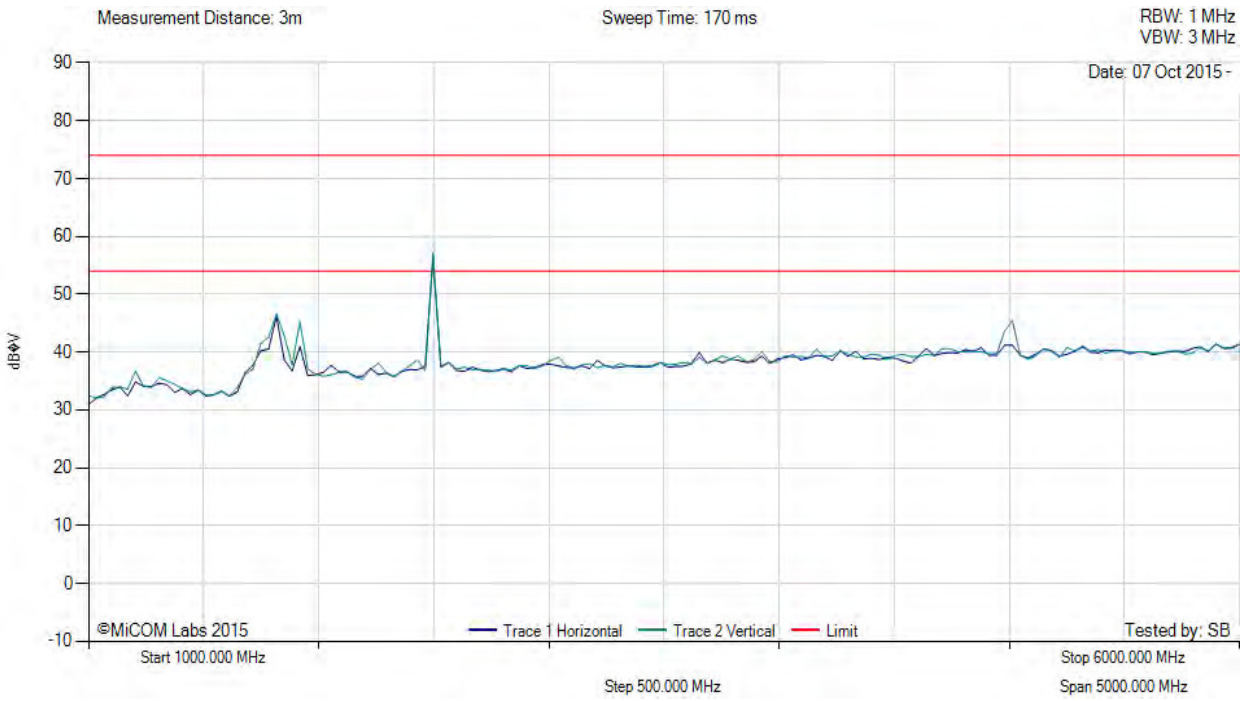
Test Notes: 50 ohm termination heads on antenna ports. Unit was positioned in a worst case orientation for the above digital emission plot. Data for the other orientation is kept on file.

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

Antenna:	Terminated in 50 Ohms	**Variant:**	5 MHz
Antenna Gain (dBi):	Not Applicable	**Modulation:**	QAM 64
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	88
Channel Frequency (MHz):	2680.00	**Data Rate:**	5
Power Setting:	37	**Tested By:**	SB

Test Measurement Results

Variant: , Test Freq: 2680.00 MHz, Antenna: terminated, Power Setting: 37



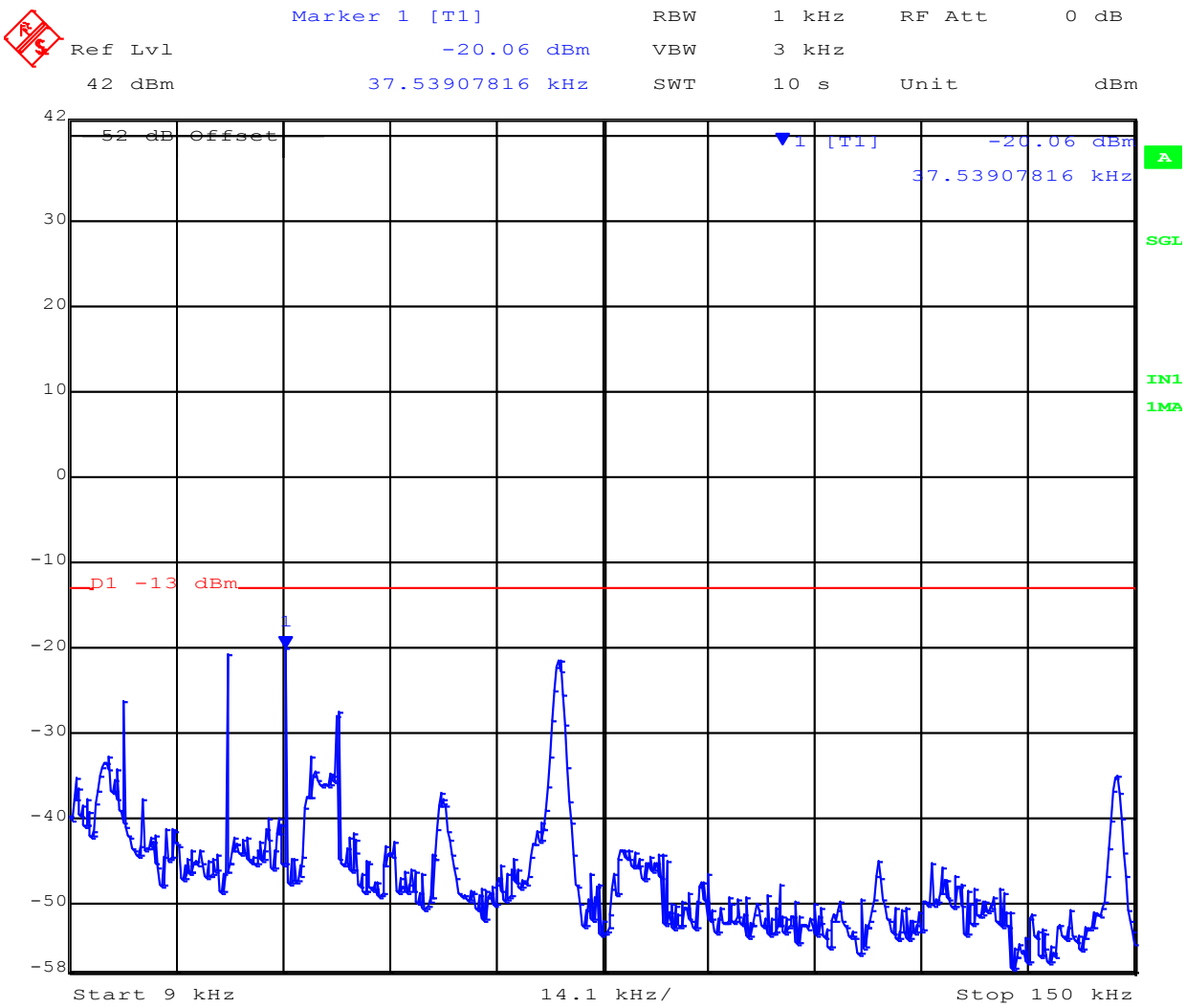
Num	Frequency MHz	Raw dBuv/m	Cable Loss	AF dB	Level dBuv/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuv/m	Margin dB	
#1	2668.99	56.20	2.45	-13.49	46.47	Peak (Scan)	Horizontal	100	-	-	--	FUND-
Test Notes: 50 ohm termination heads on antenna ports												

Test Notes: 50 ohm termination heads on antenna ports. Emission at 2668.99 MHz is the fundamental frequency

A. GRAPHICAL IMAGES

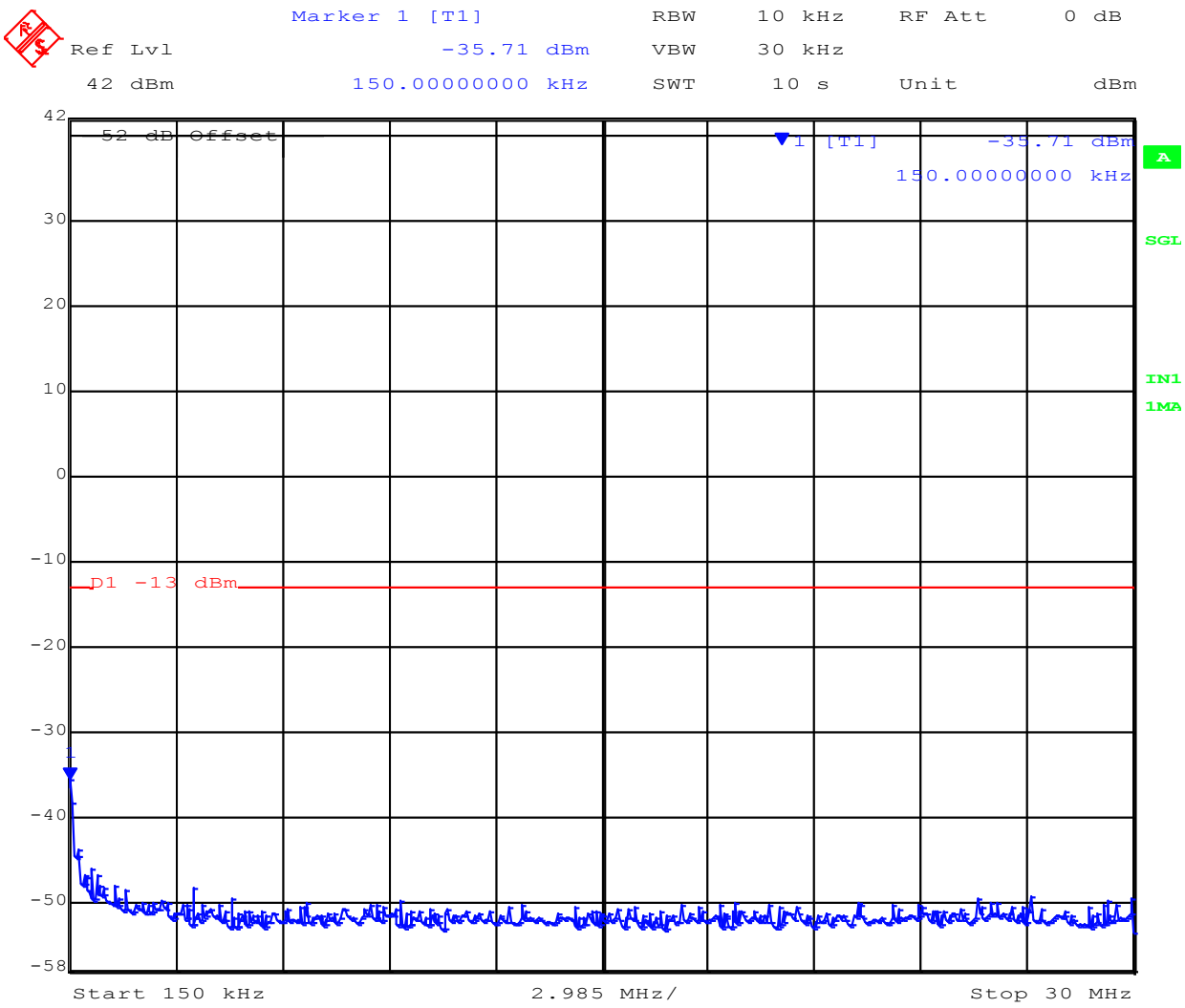
A.1 Transmitter Unwanted Spurious (Conducted)

2498.1MHz 9KHz – 150KHz Chain A



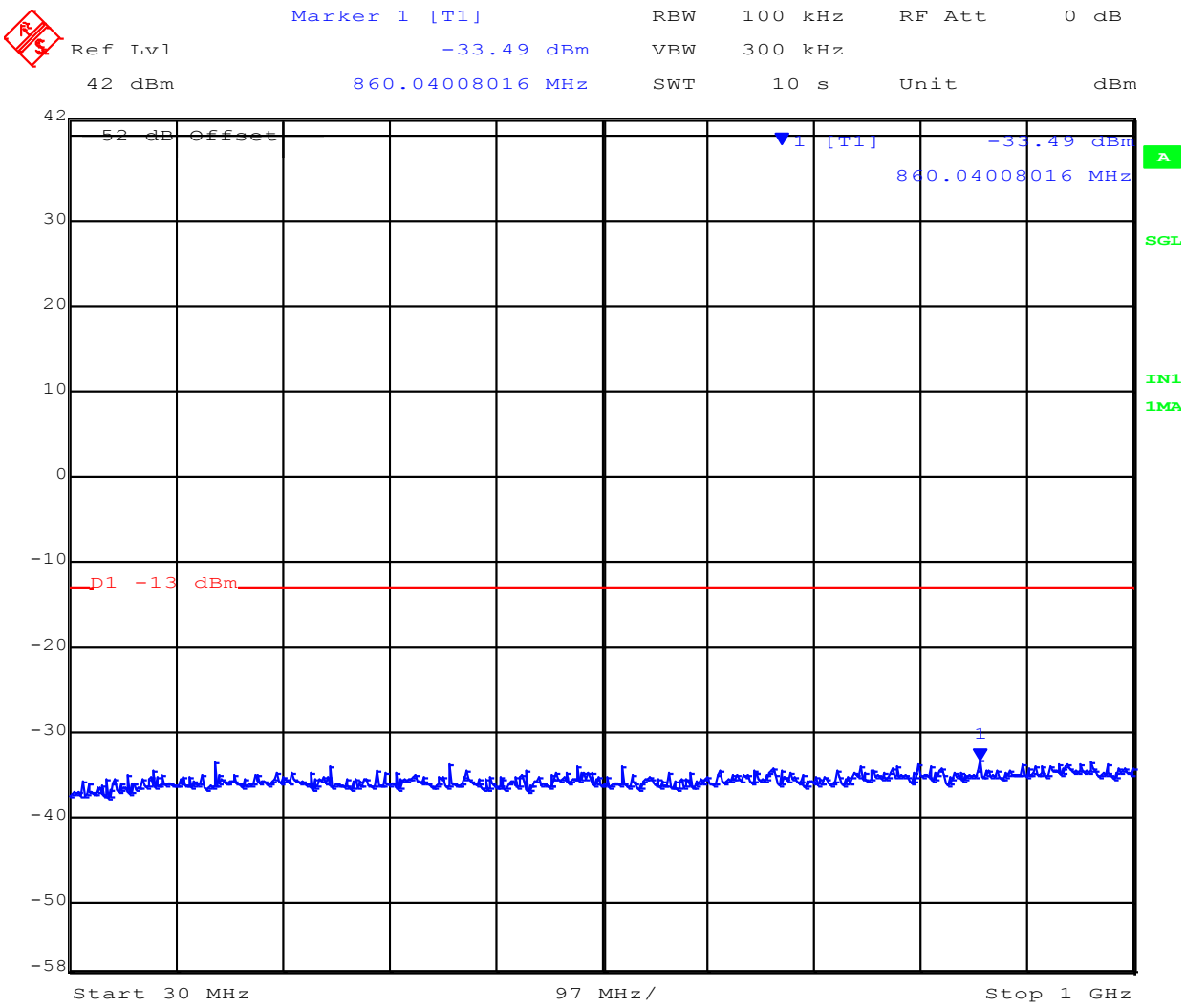
Back to Matrix

2498.1MHz 150KHz – 30MHz Chain A



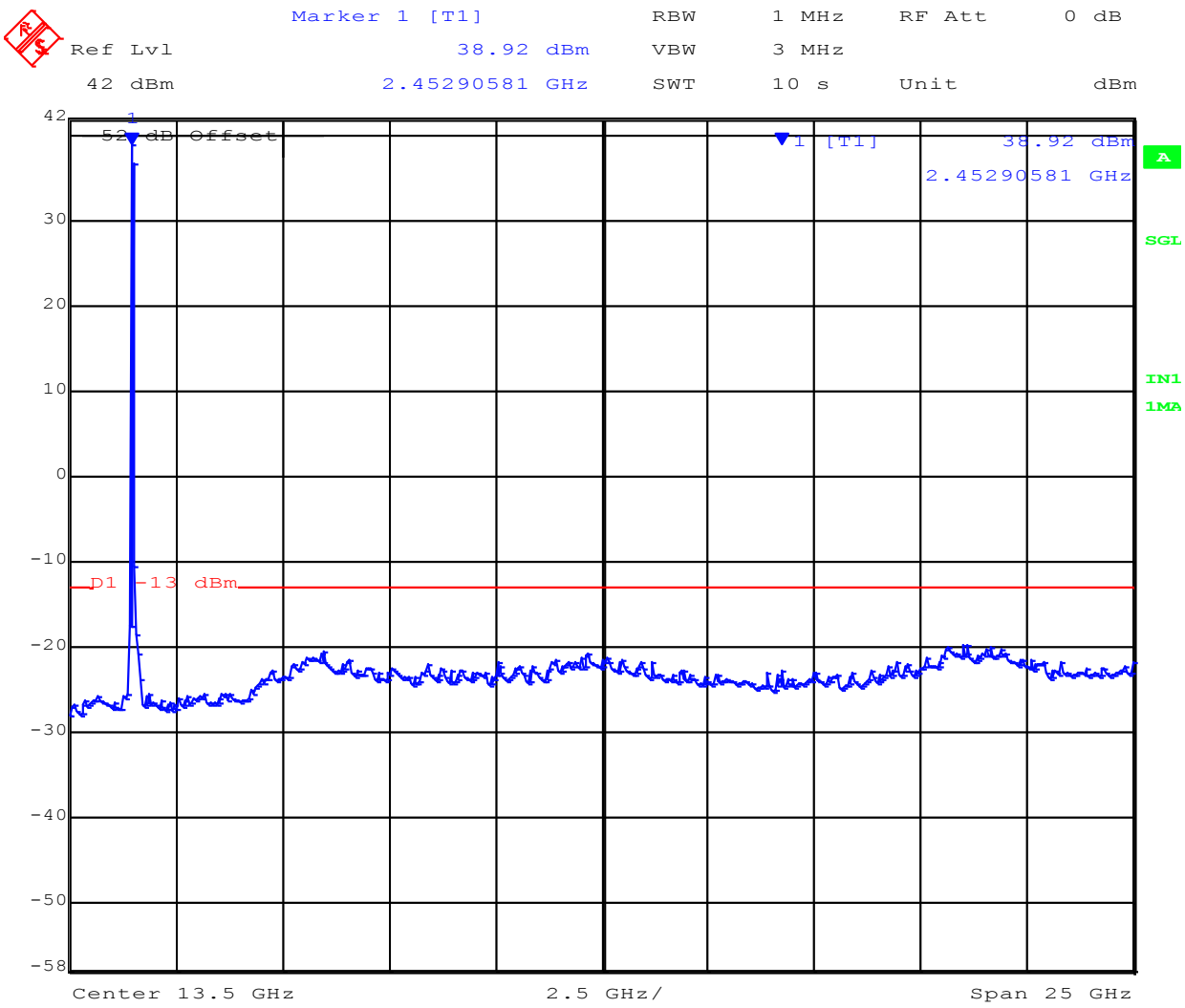
Back to Matrix

2498.1MHz 30MHz – 1GHz Chain A



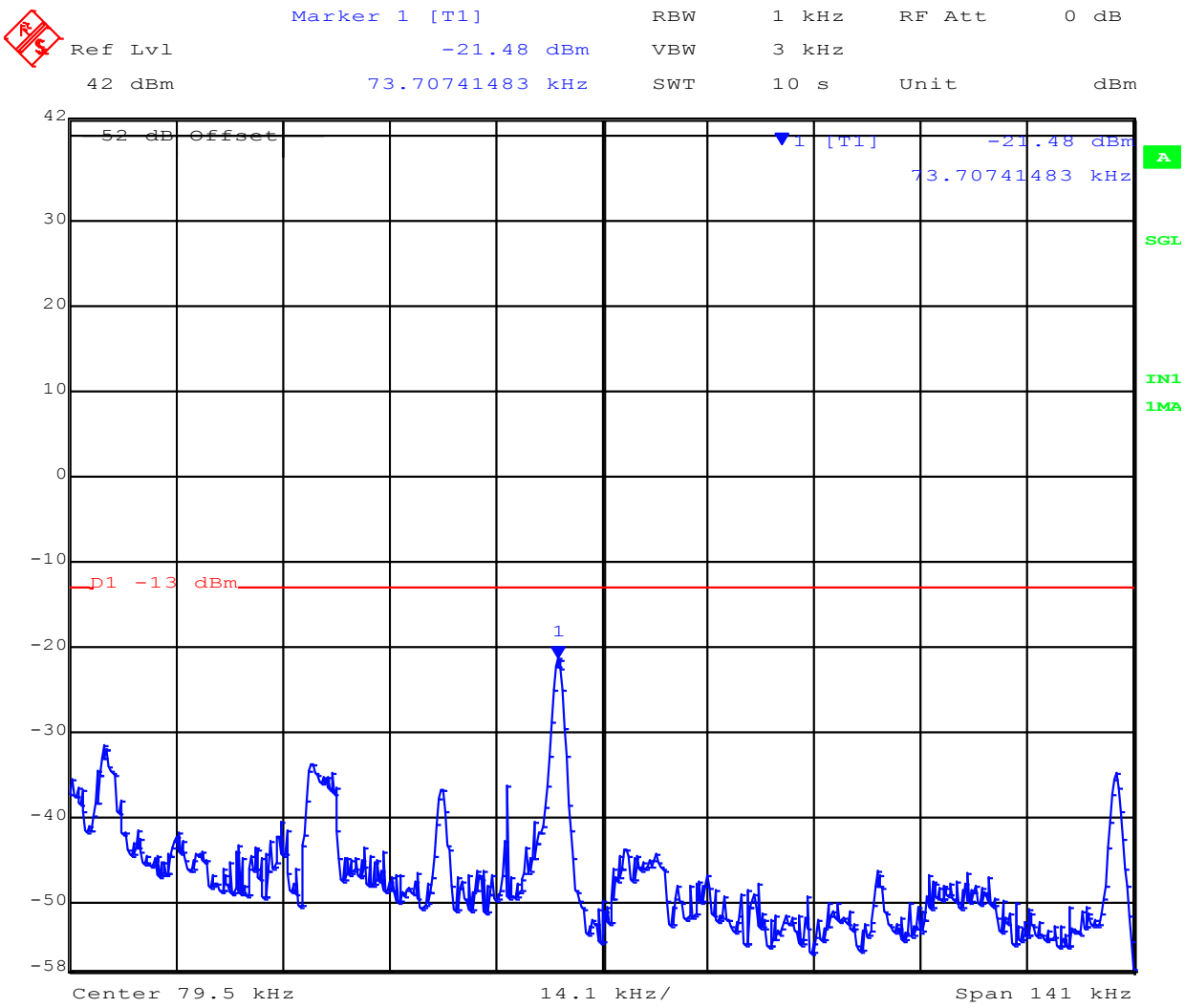
Back to Matrix

2498.1MHz 1GHz – 26GHz Chain A



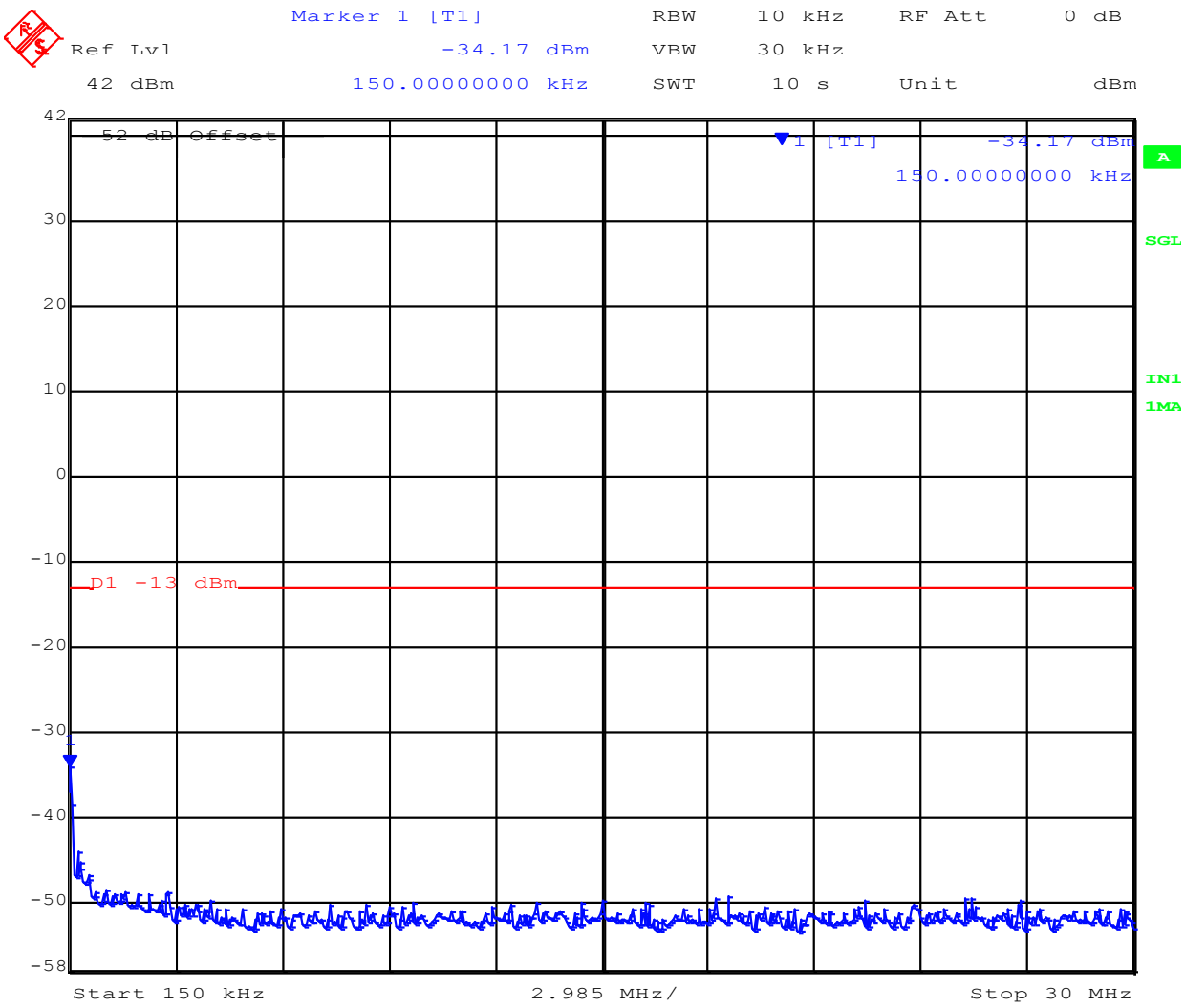
Back to Matrix

2498.1MHz 9KHz – 150KHz Chain B



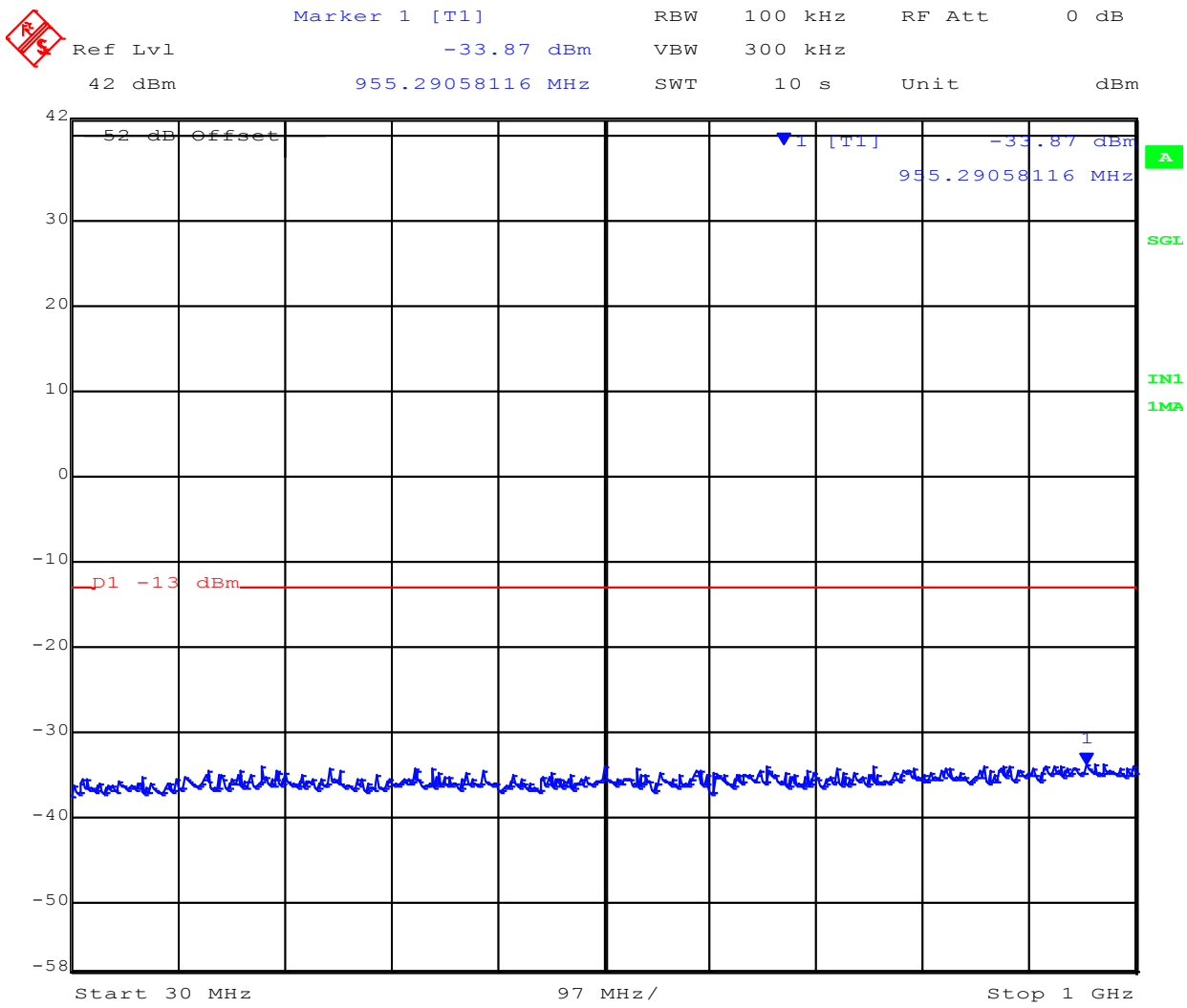
Back to Matrix

2498.1MHz 150KHz – 30MHz Chain B



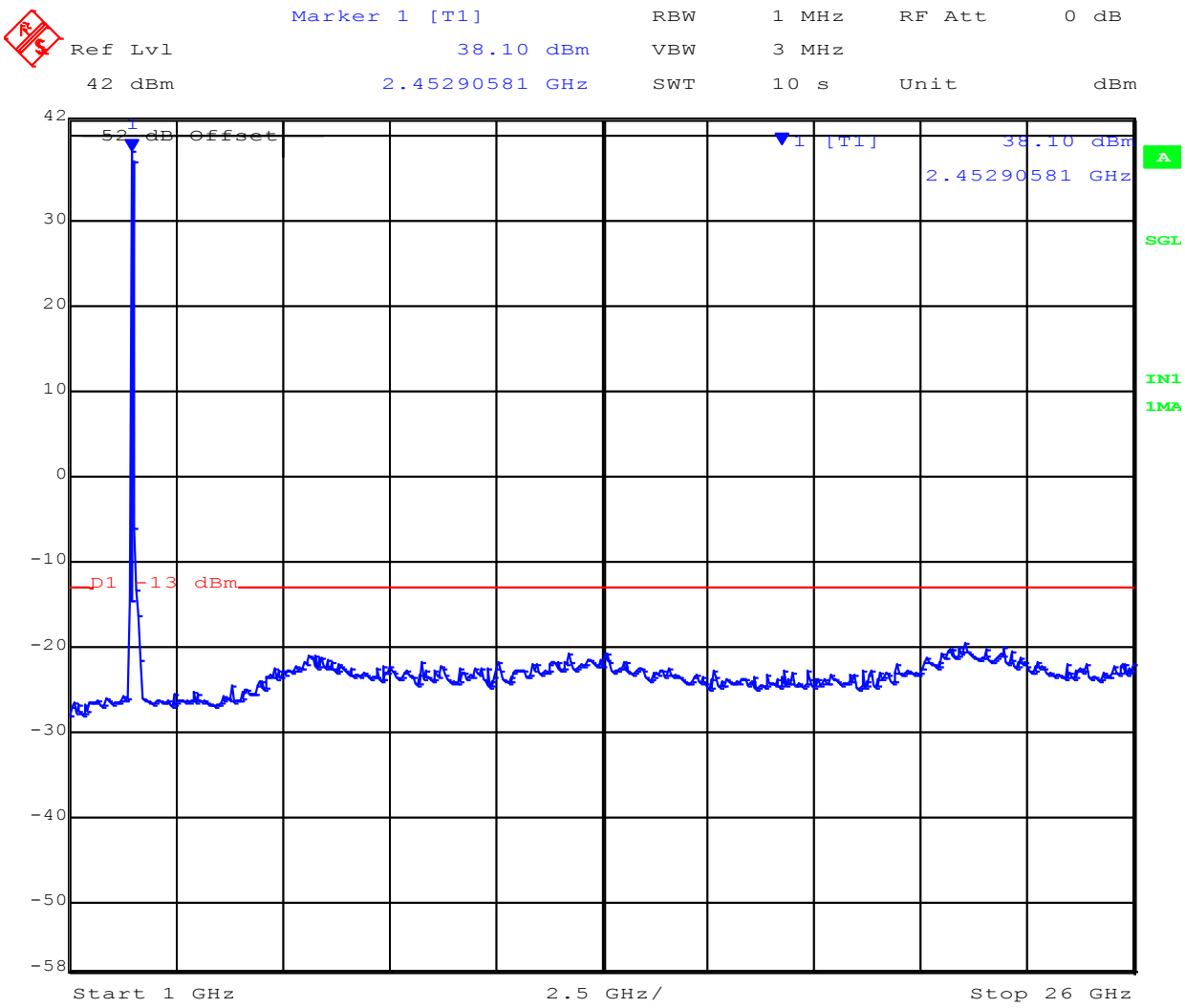
Back to Matrix

2498.1MHz 30MHz – 1GHz Chain B



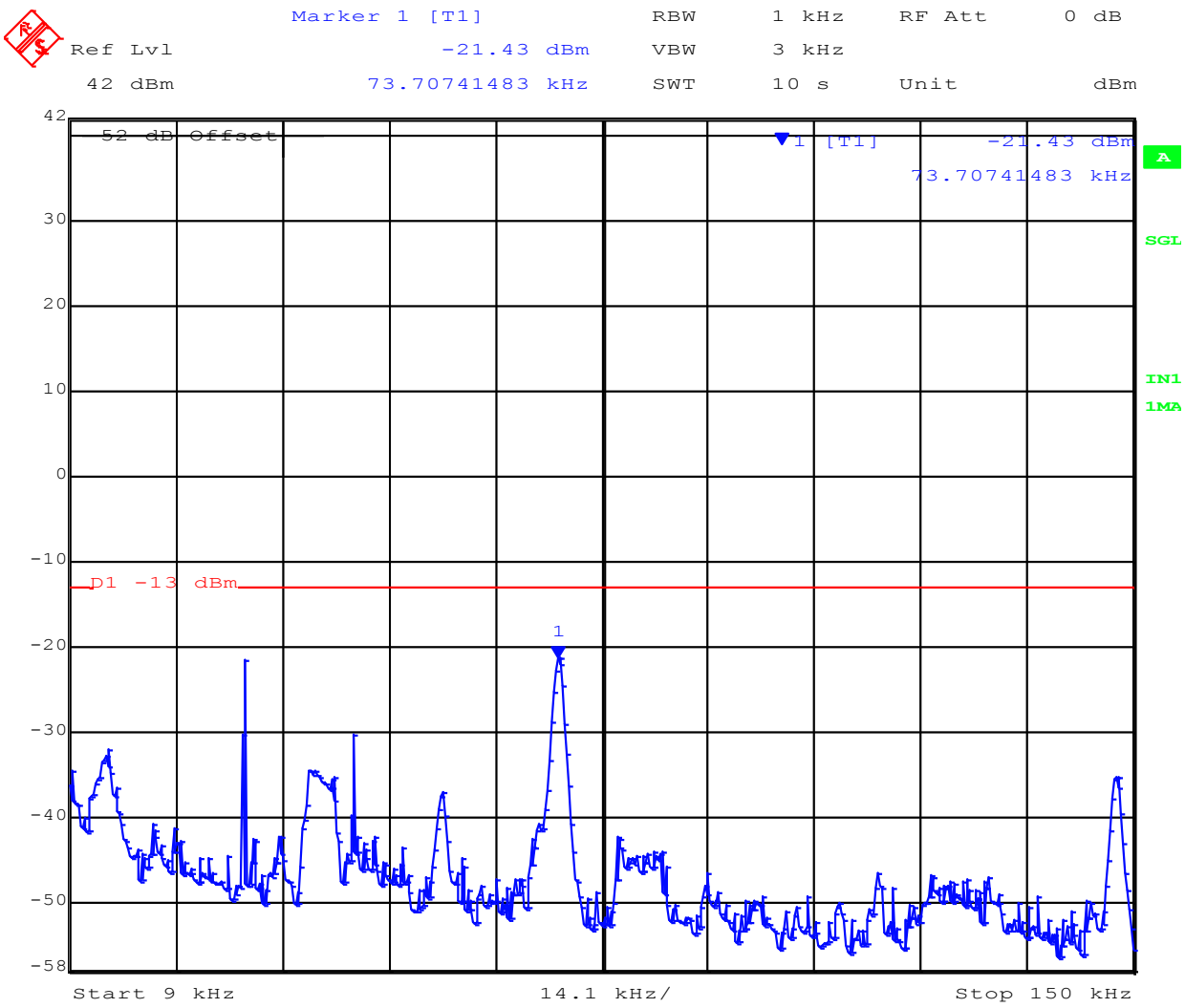
Back to Matrix

2498.1MHz 1GHz – 26GHz Chain B



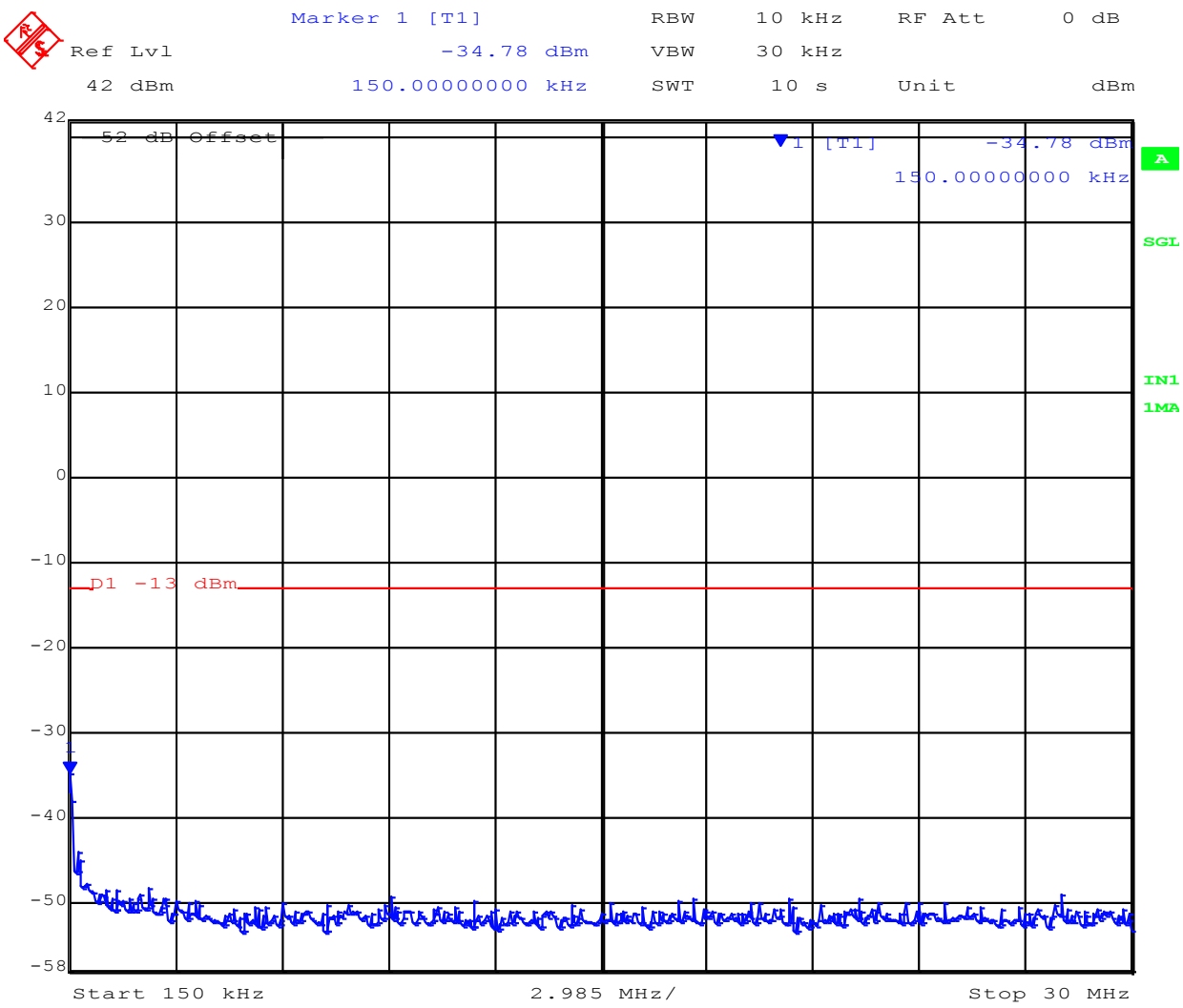
Back to Matrix

2498.1MHz 9KHz – 150KHz Chain C



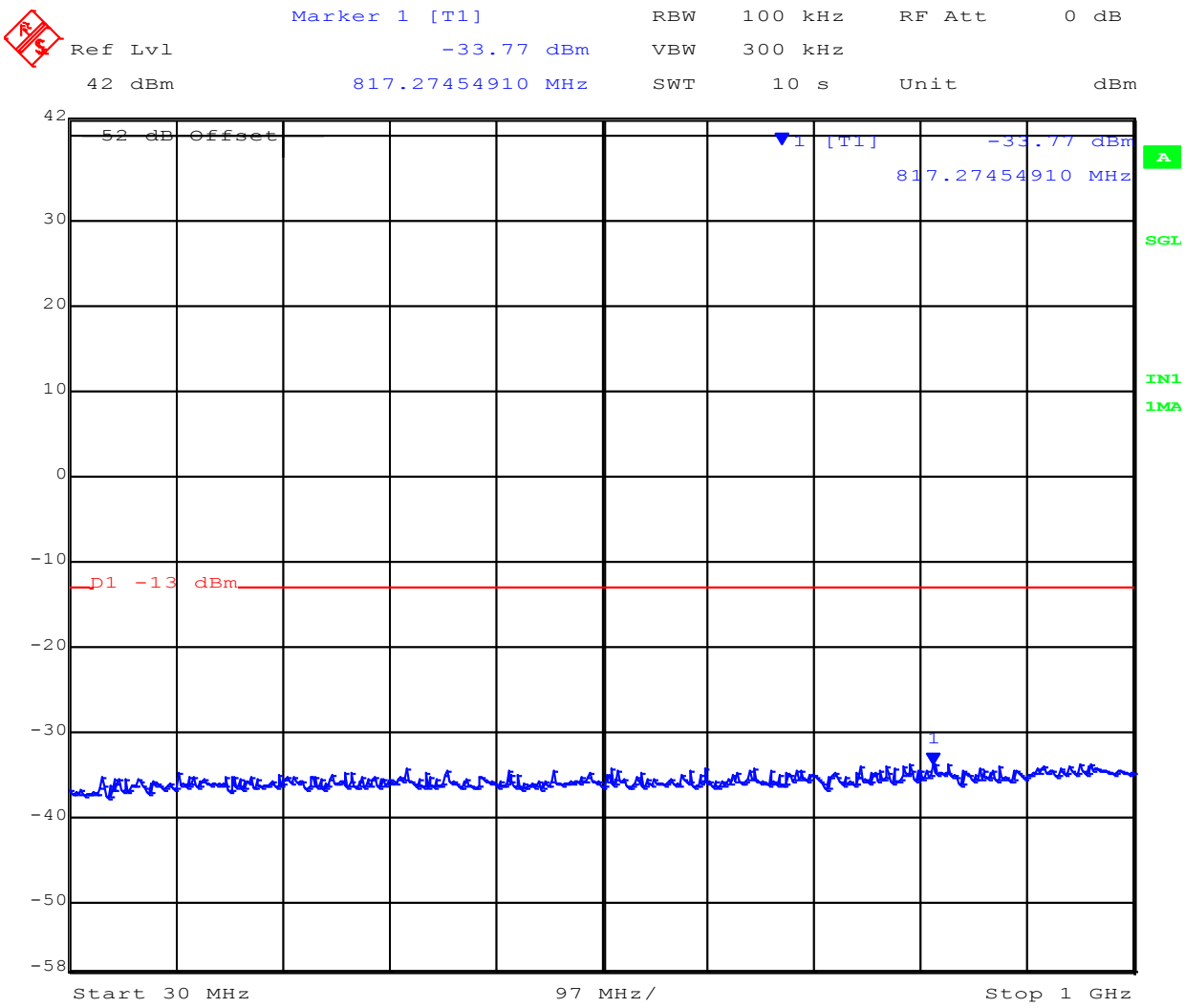
Back to Matrix

2498.1MHz 150KHz – 30MHz Chain C



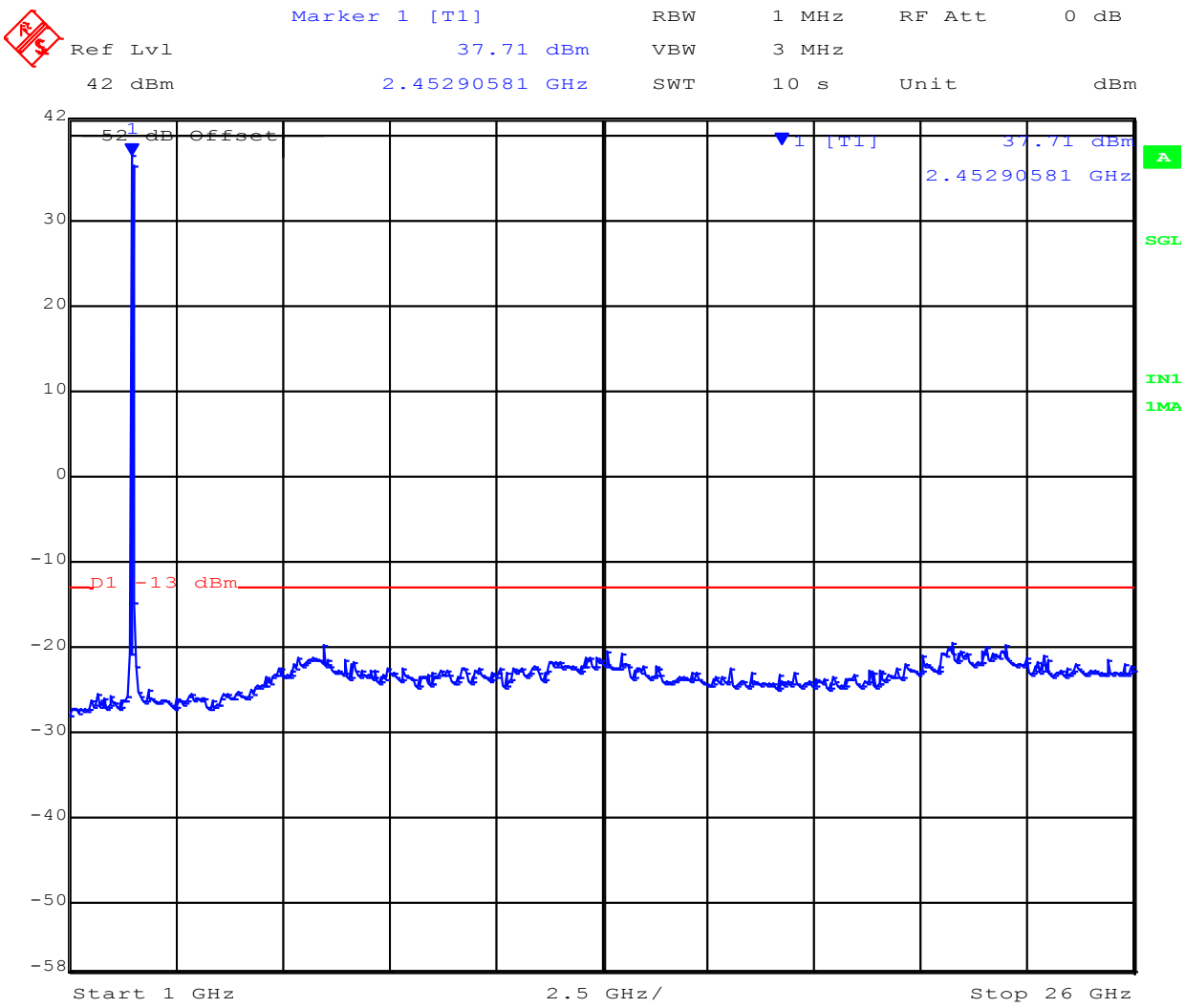
Back to Matrix

2498.1MHz 30MHz – 1GHz Chain C



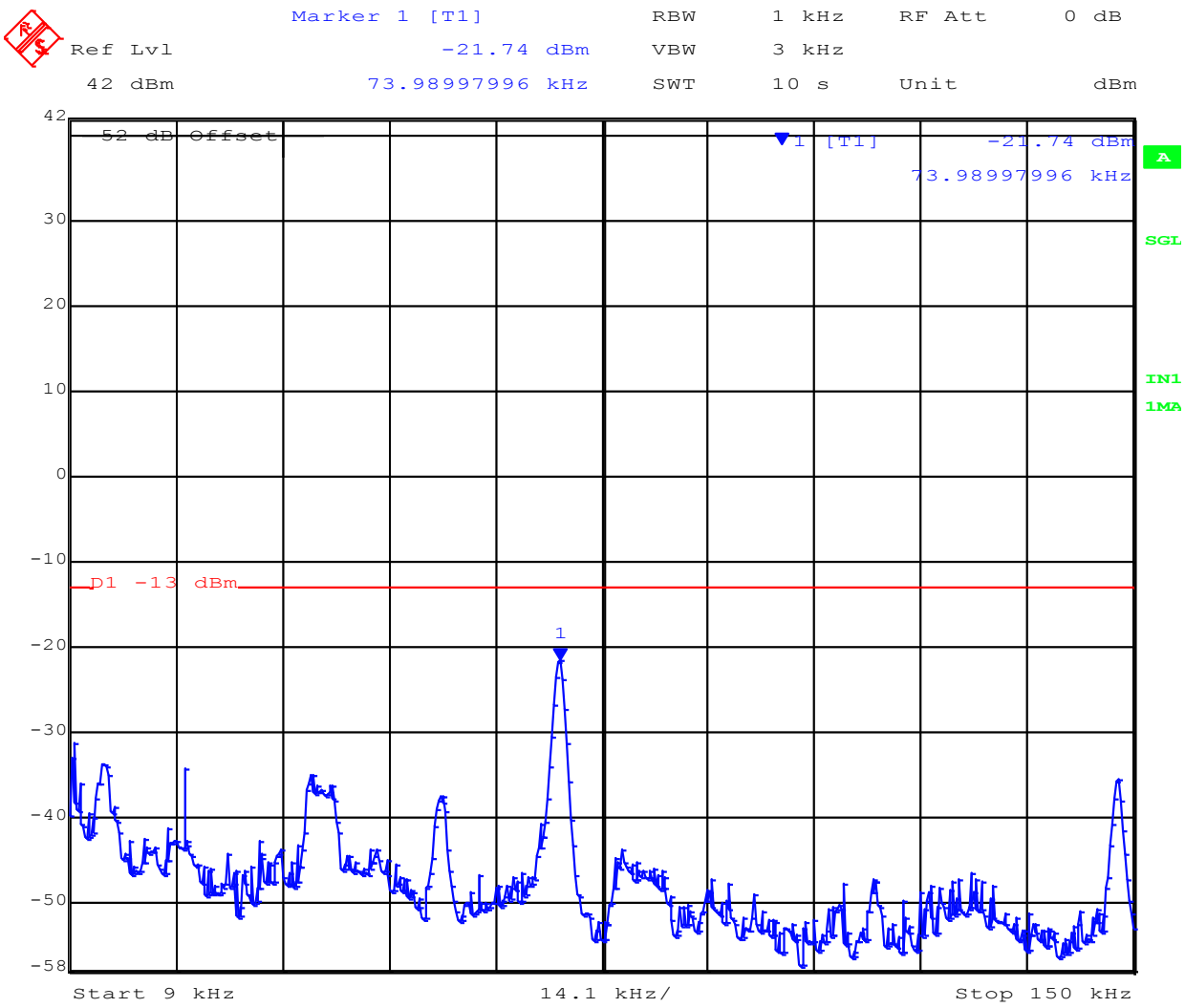
Back to Matrix

2498.1MHz 1GHz – 26GHz Chain C



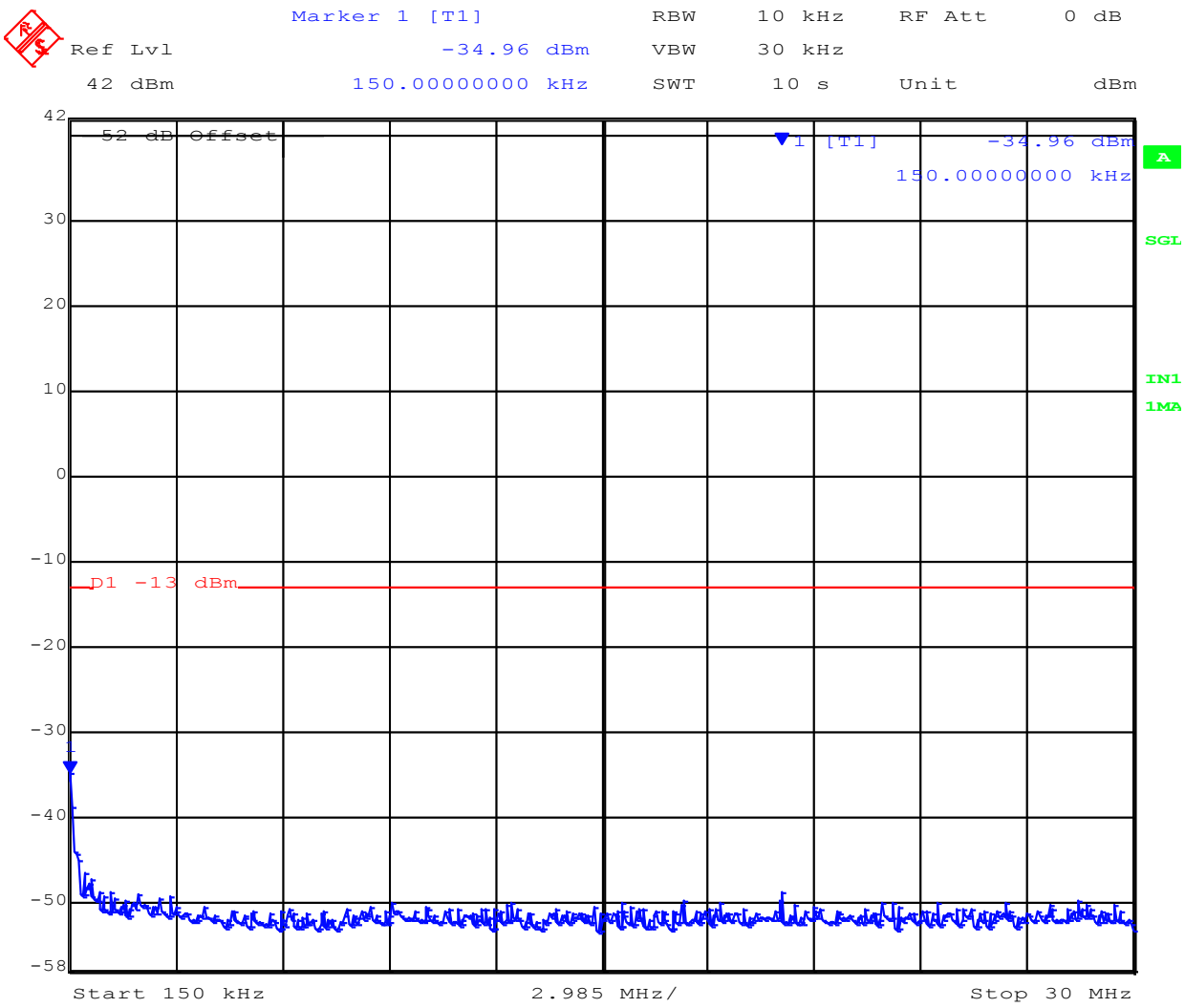
Back to Matrix

2498.1MHz 9KHz – 150KHz Chain D



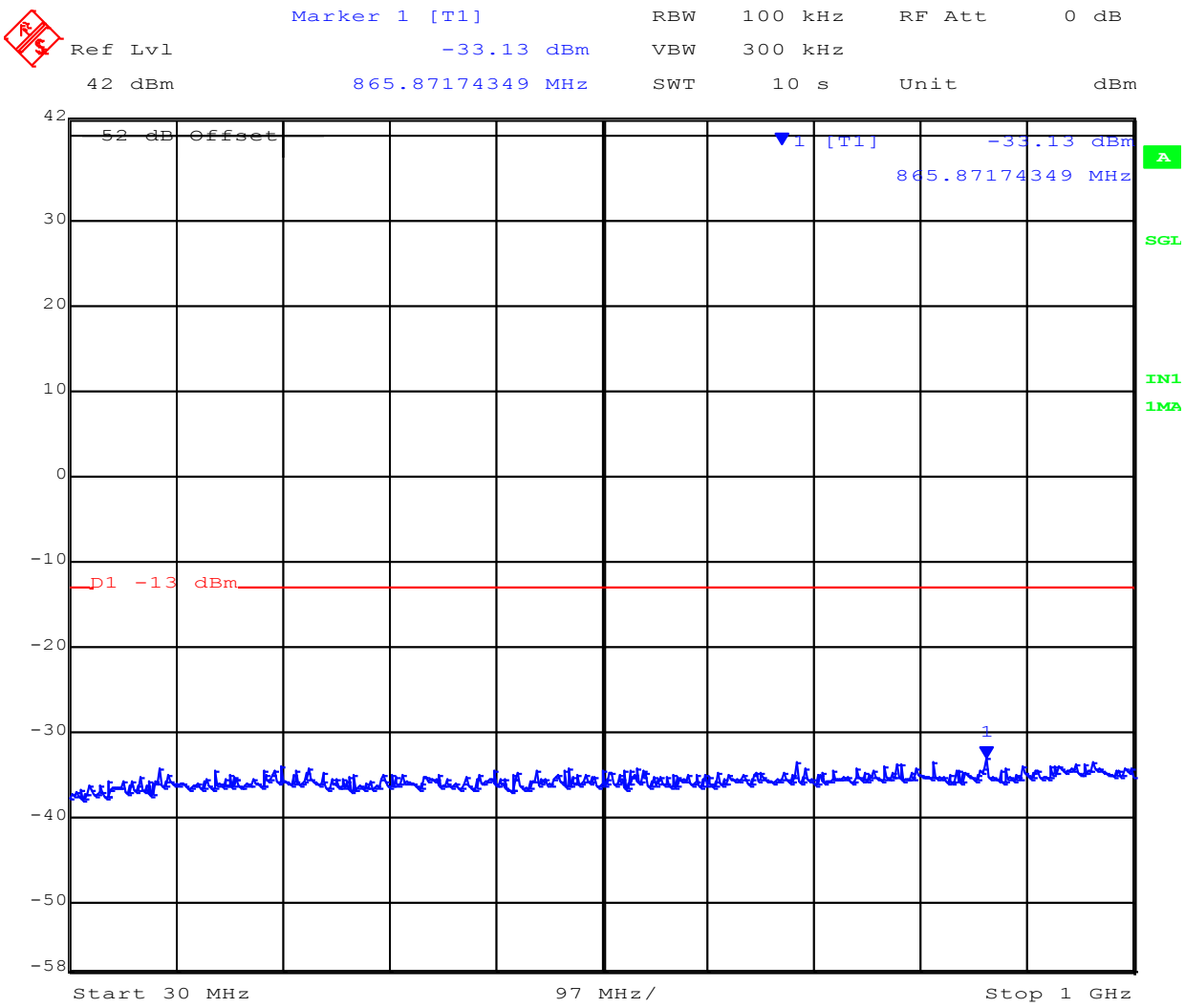
Back to Matrix

2498.1MHz 150KHz – 30MHz Chain D



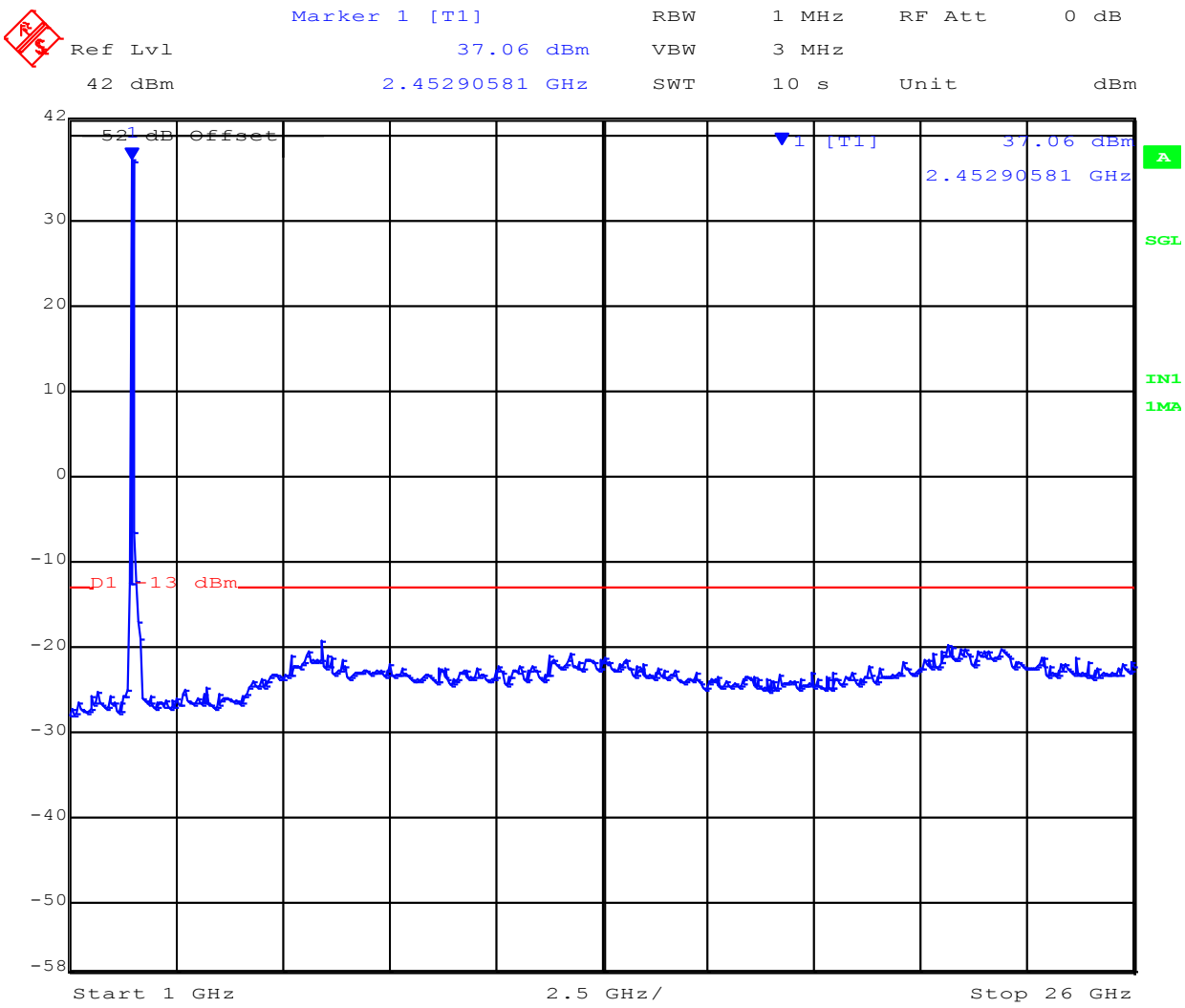
Back to Matrix

2498.1MHz 30MHz – 1GHz Chain D



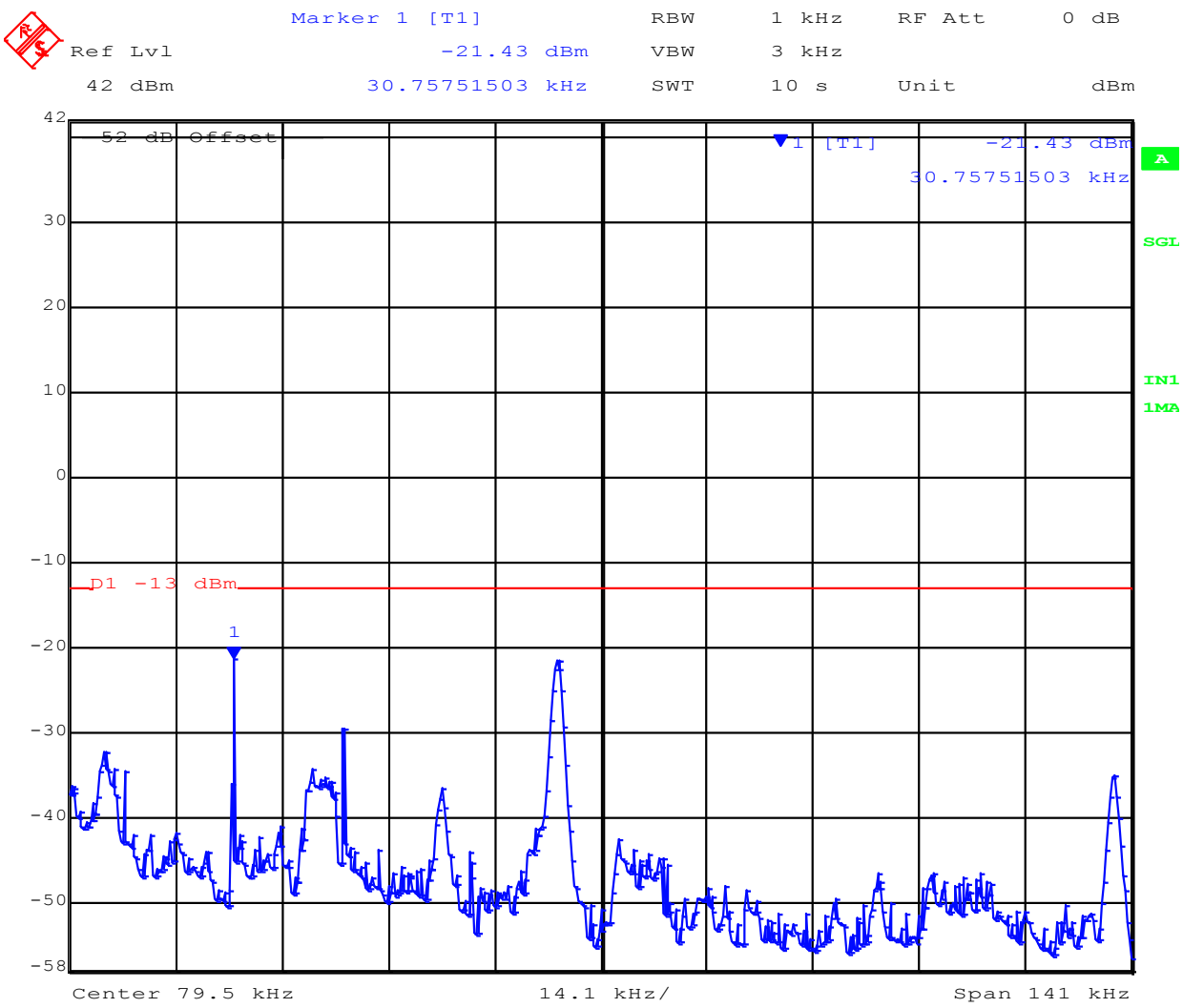
Back to Matrix

2498.1MHz 1GHz – 26GHz Chain D



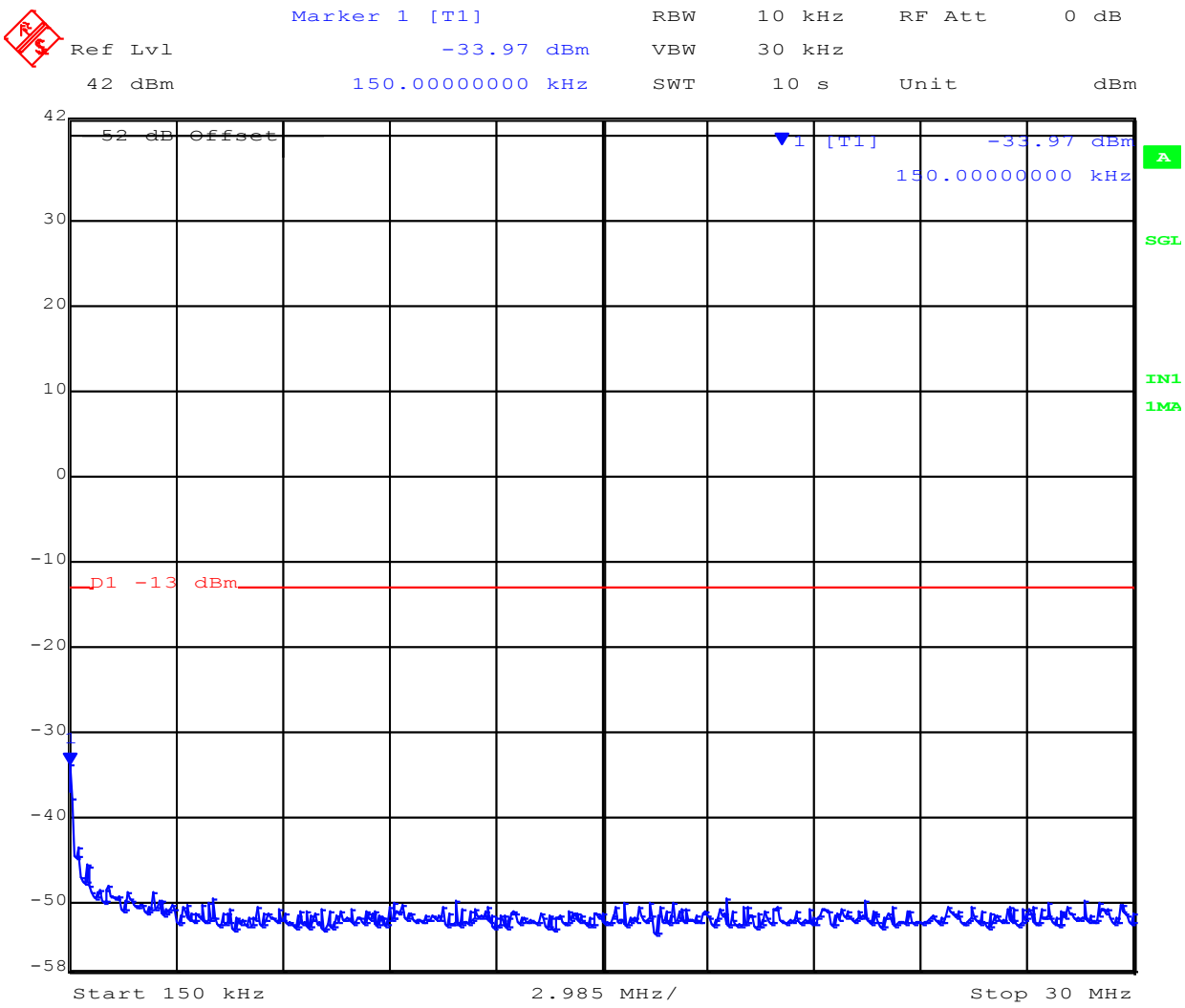
Back to Matrix

2593MHz 9KHz – 150KHz Chain A



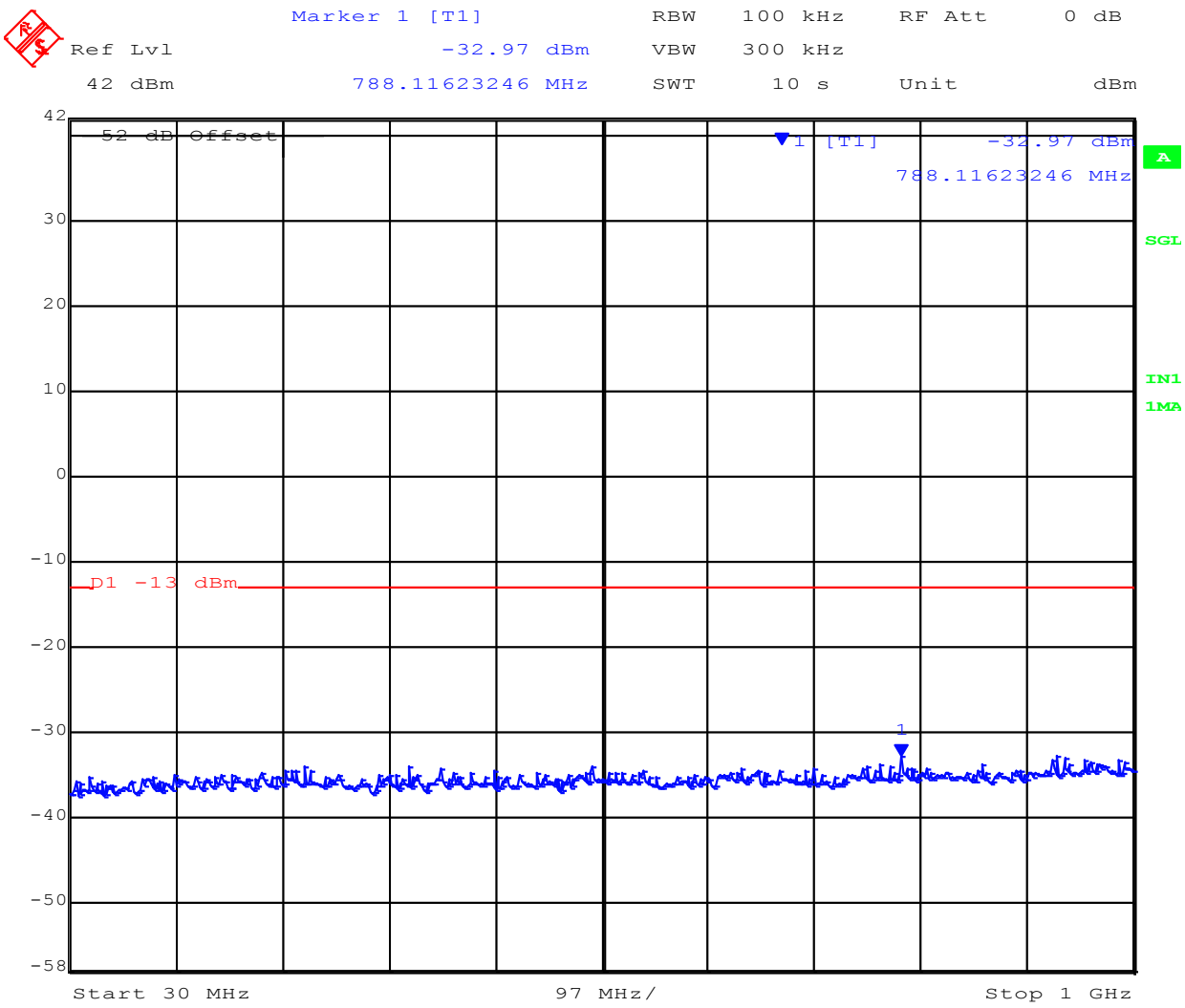
Back to Matrix

2593MHz 150KHz – 30MHz Chain A



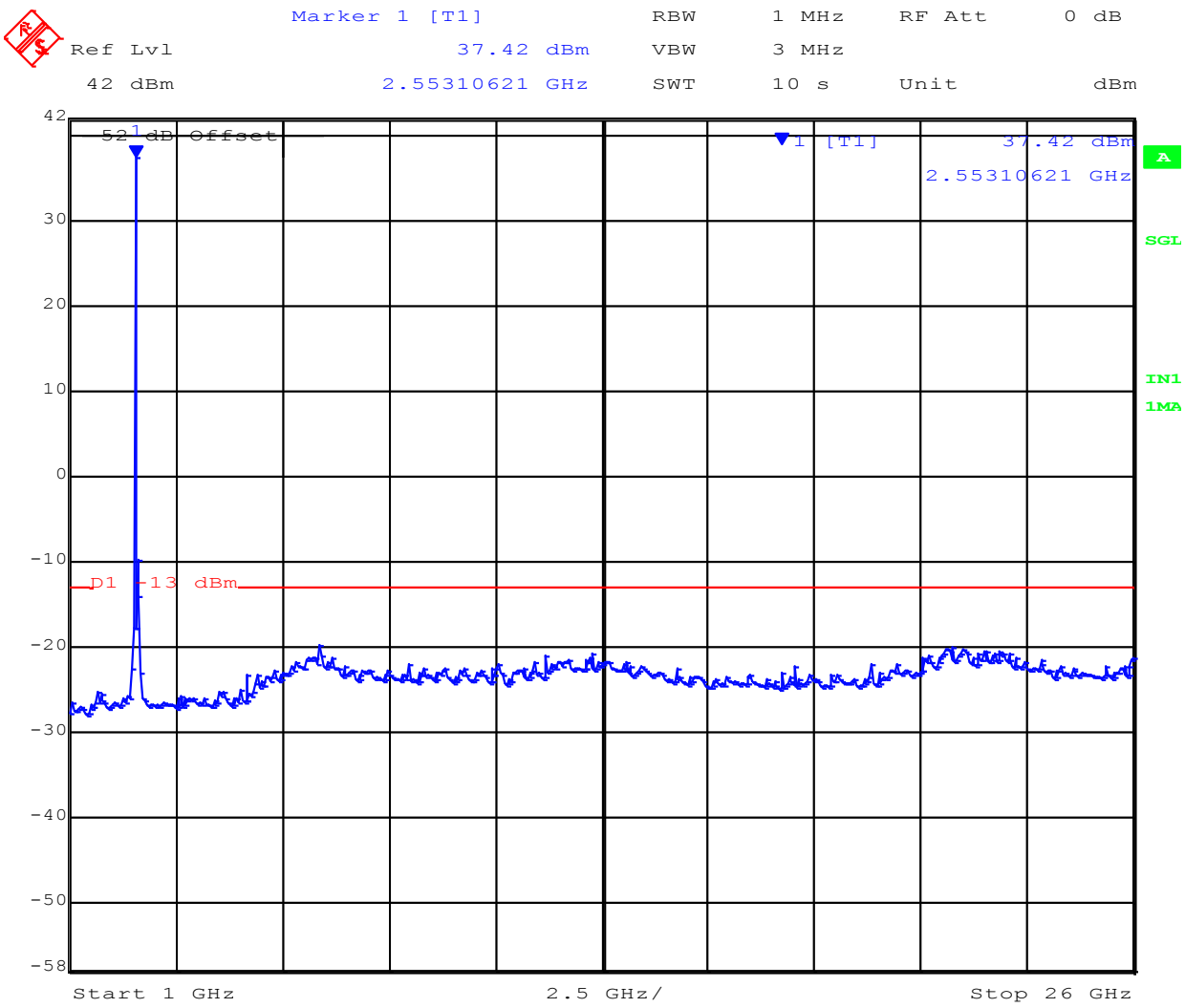
Back to Matrix

2593MHz 30MHz – 1GHz Chain A



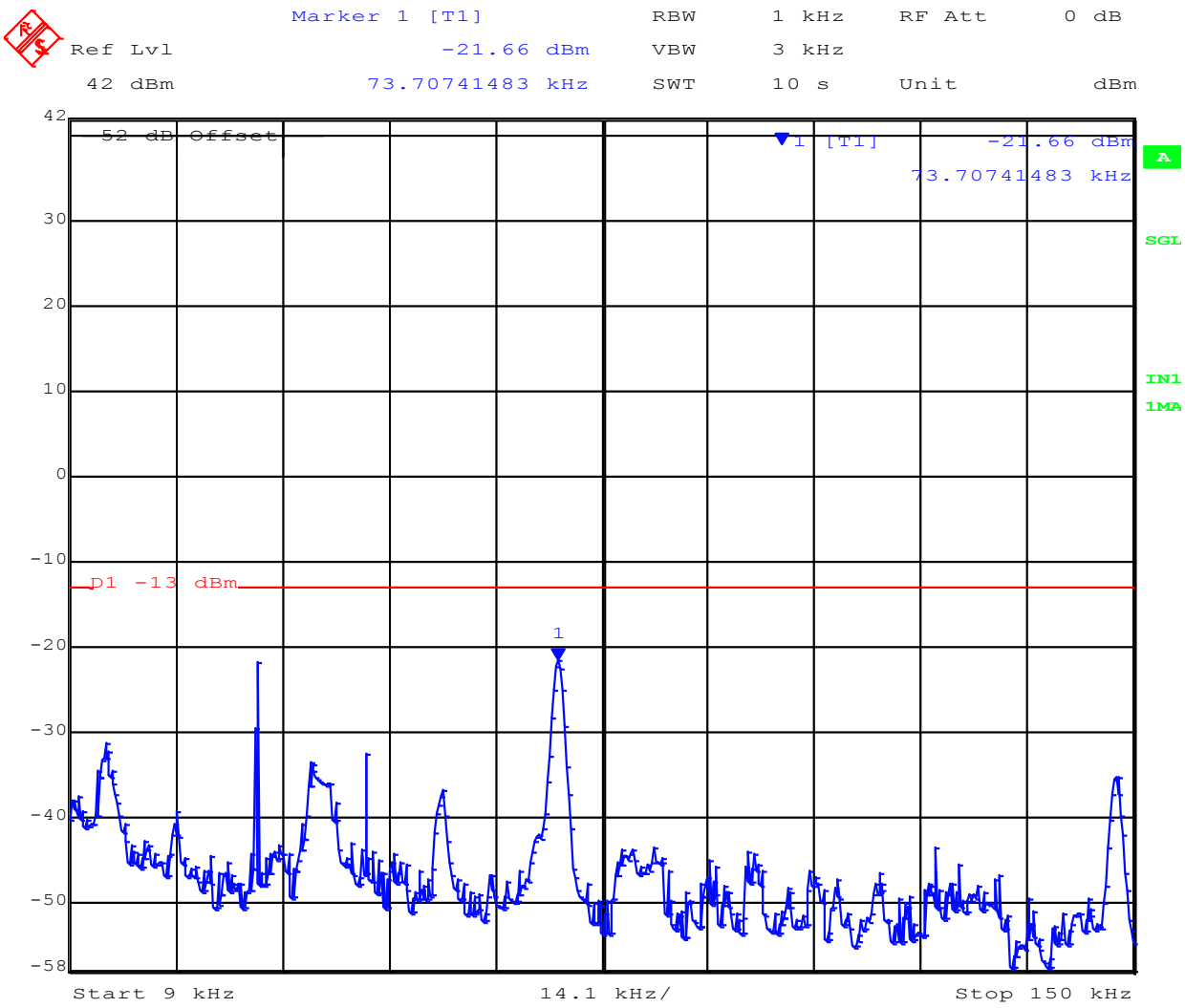
Back to Matrix

2593MHz 1GHz – 26GHz Chain A



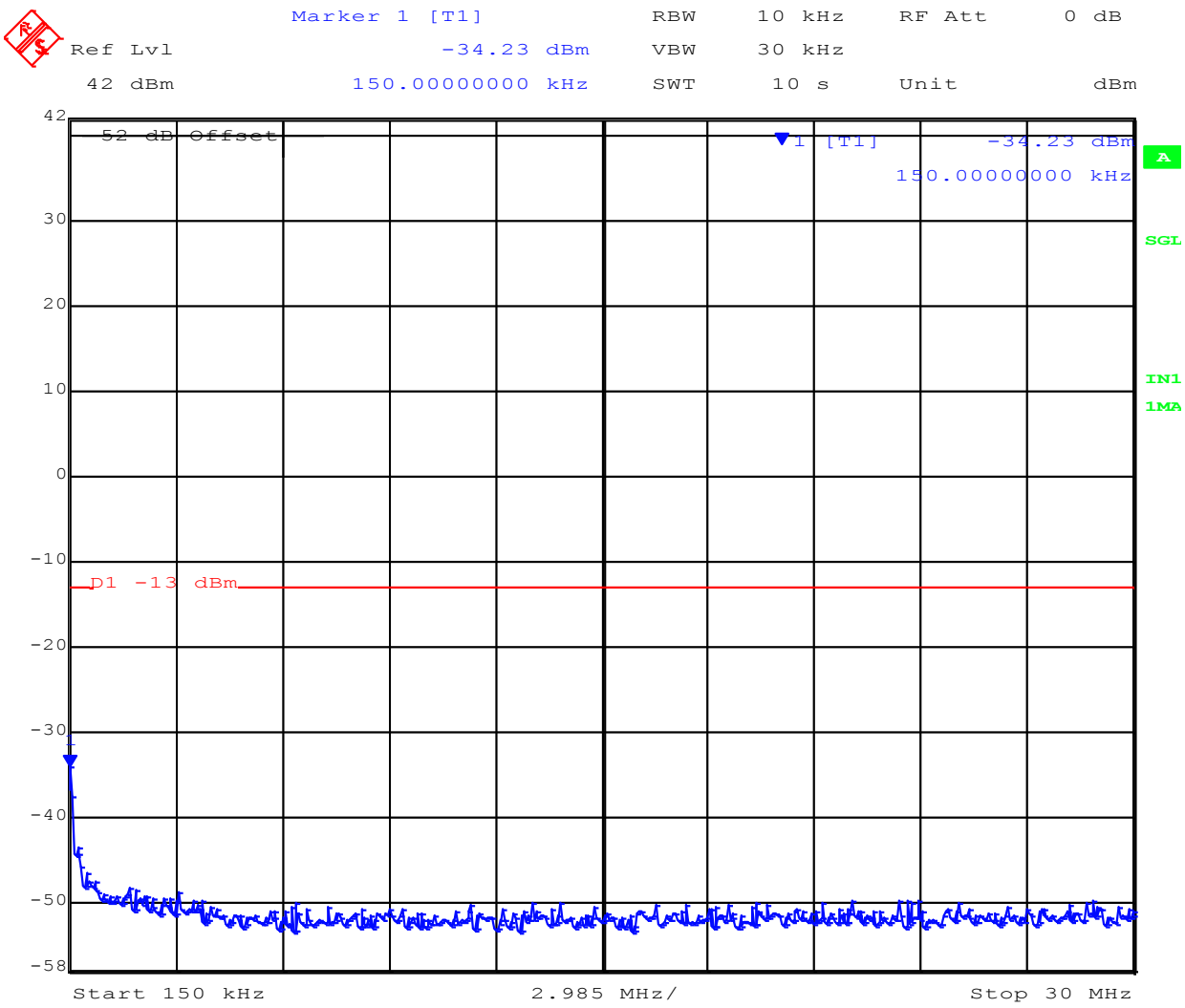
Back to Matrix

2593MHz 9KHz – 150KHz Chain B



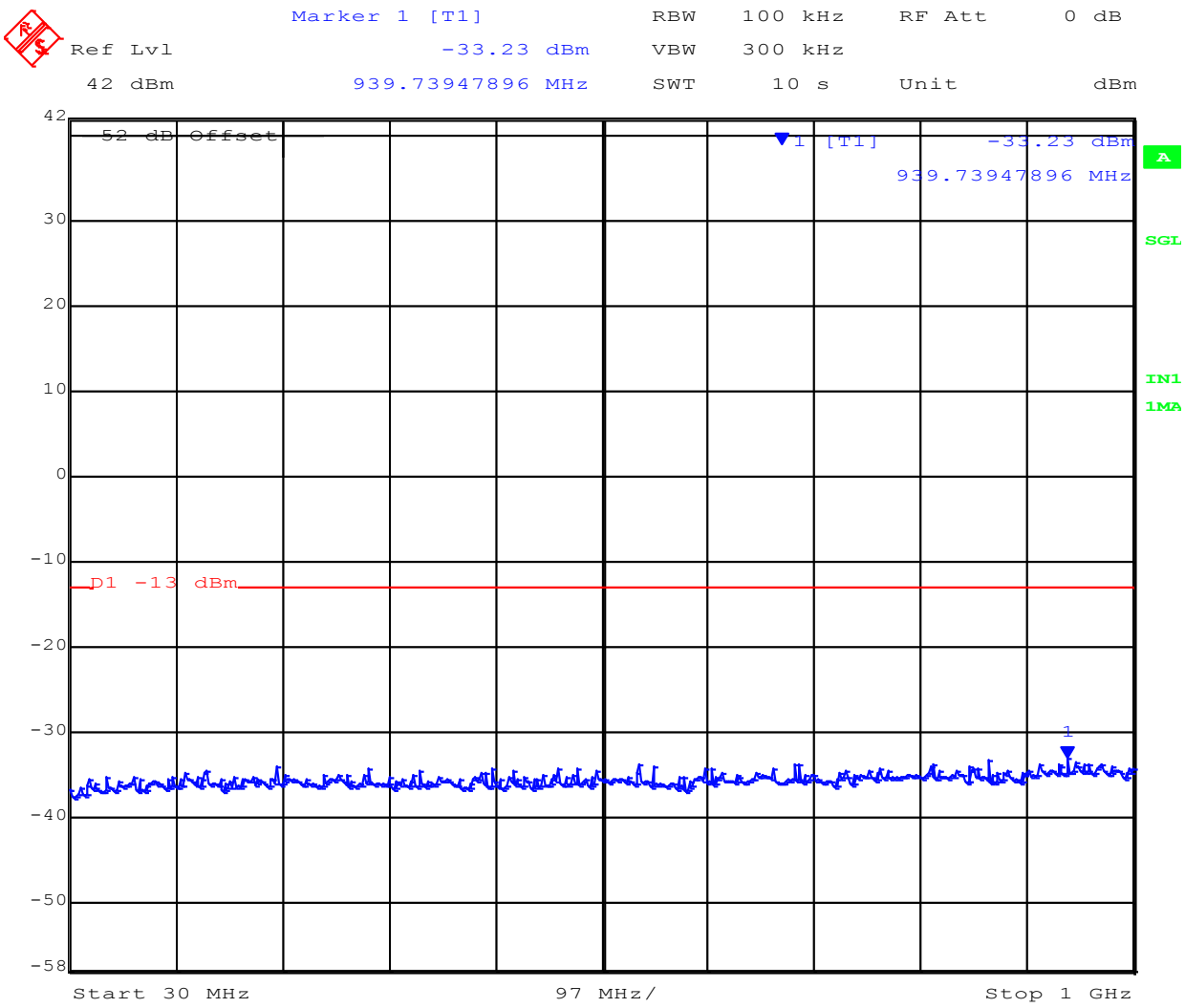
Back to Matrix

2593MHz 150KHz – 30MHz Chain B



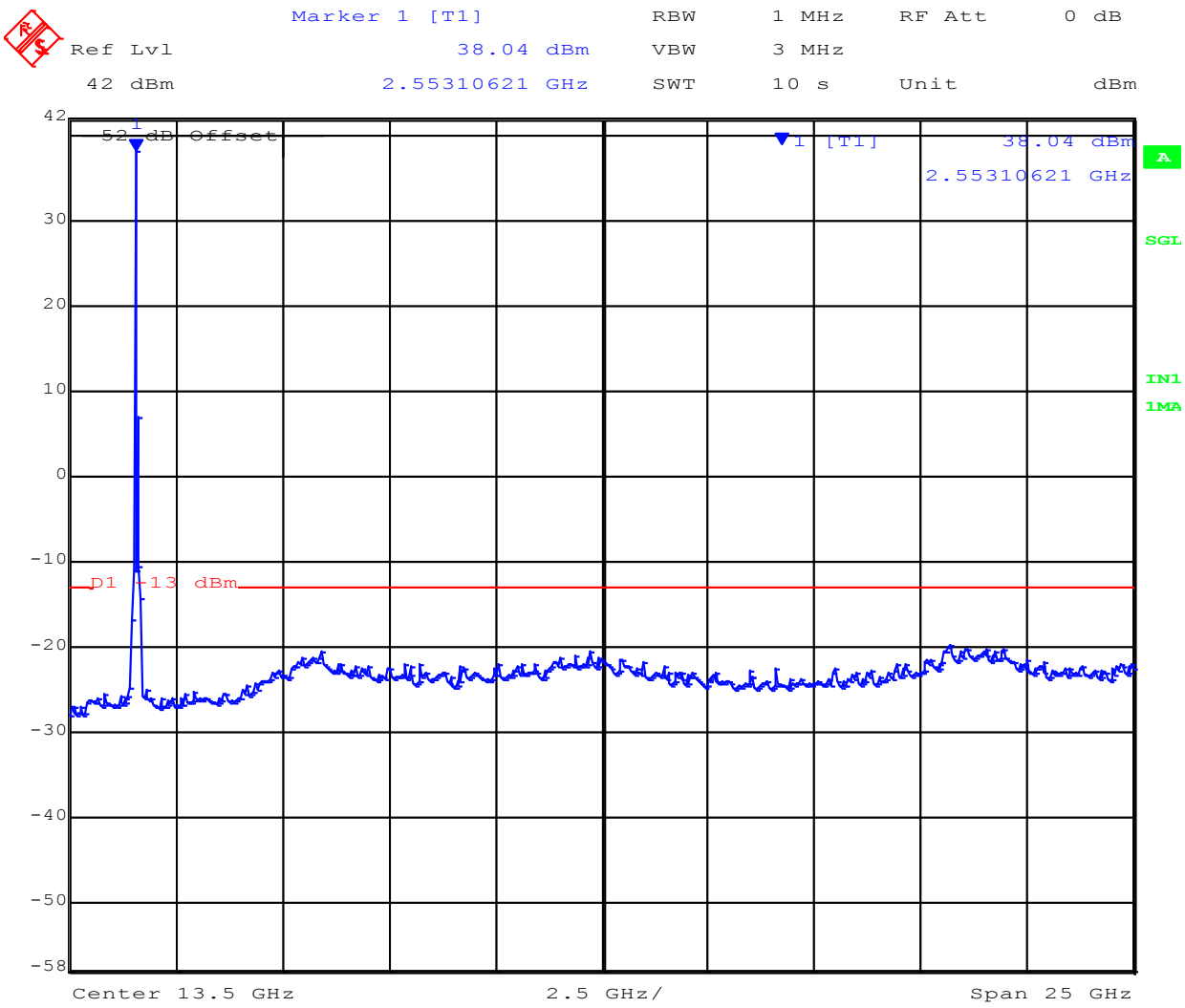
Back to Matrix

2593MHz 30MHz – 1GHz Chain B



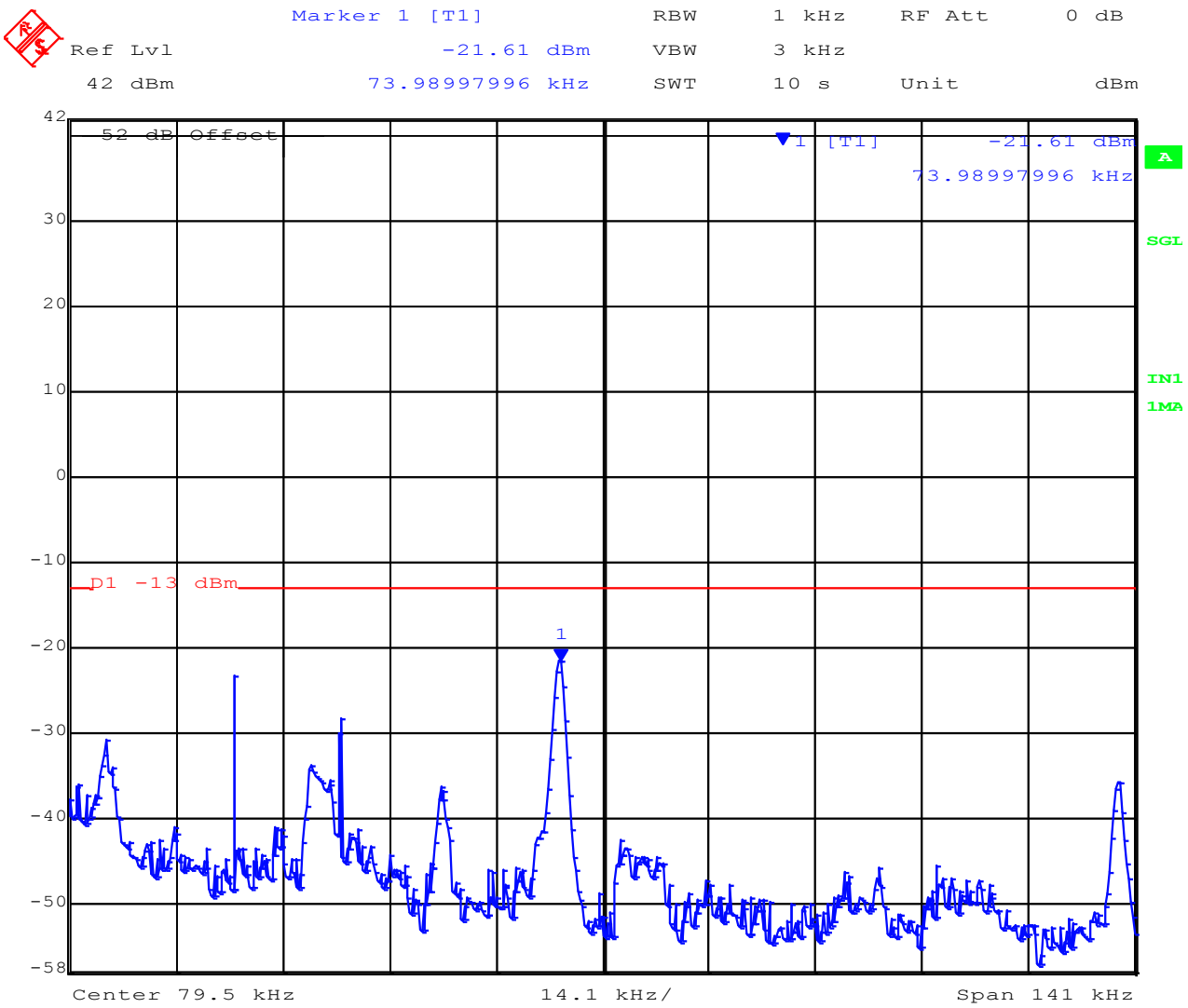
Back to Matrix

2593MHz 1GHz – 26GHz Chain B



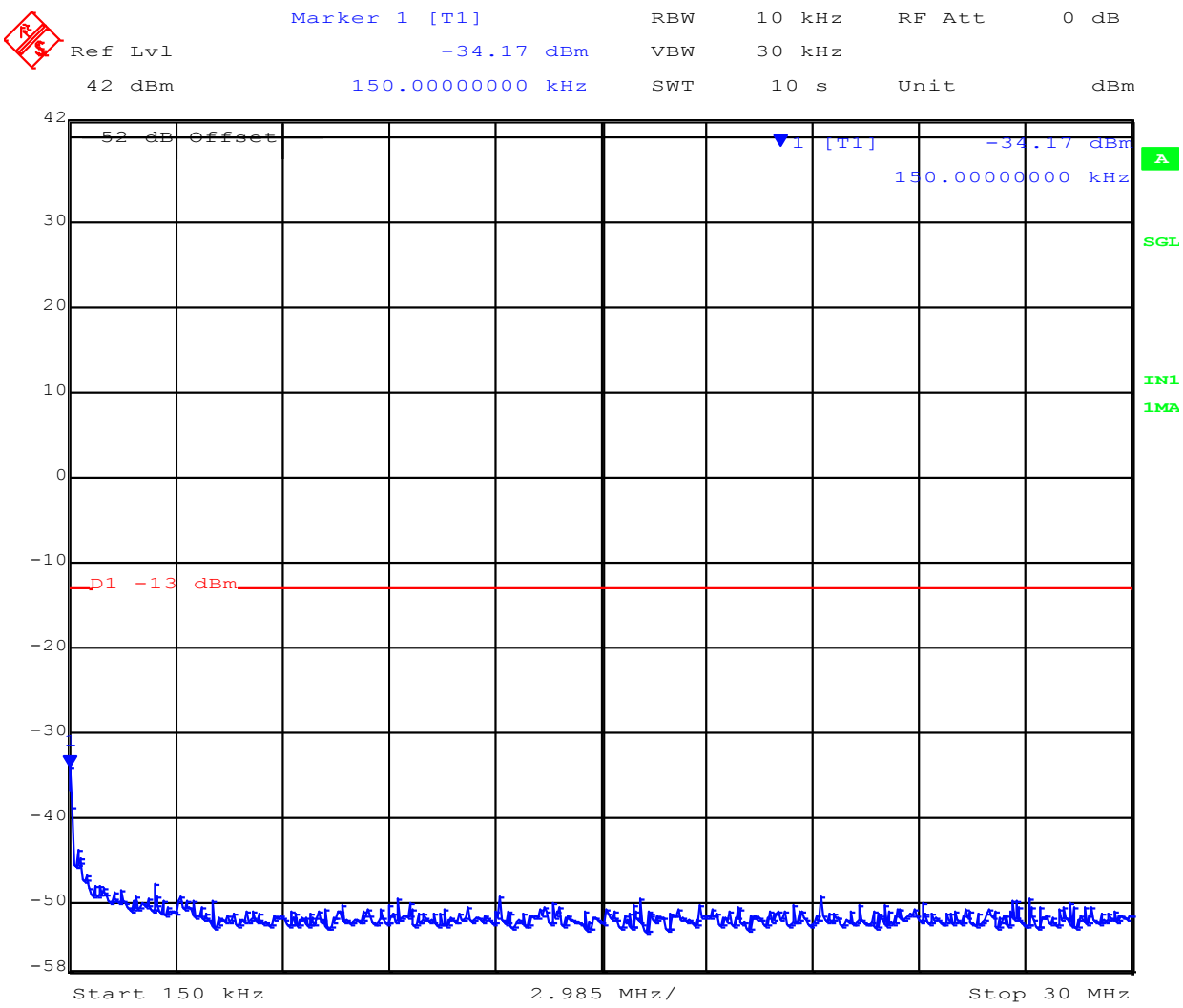
Back to Matrix

2593MHz 9KHz – 150KHz Chain C



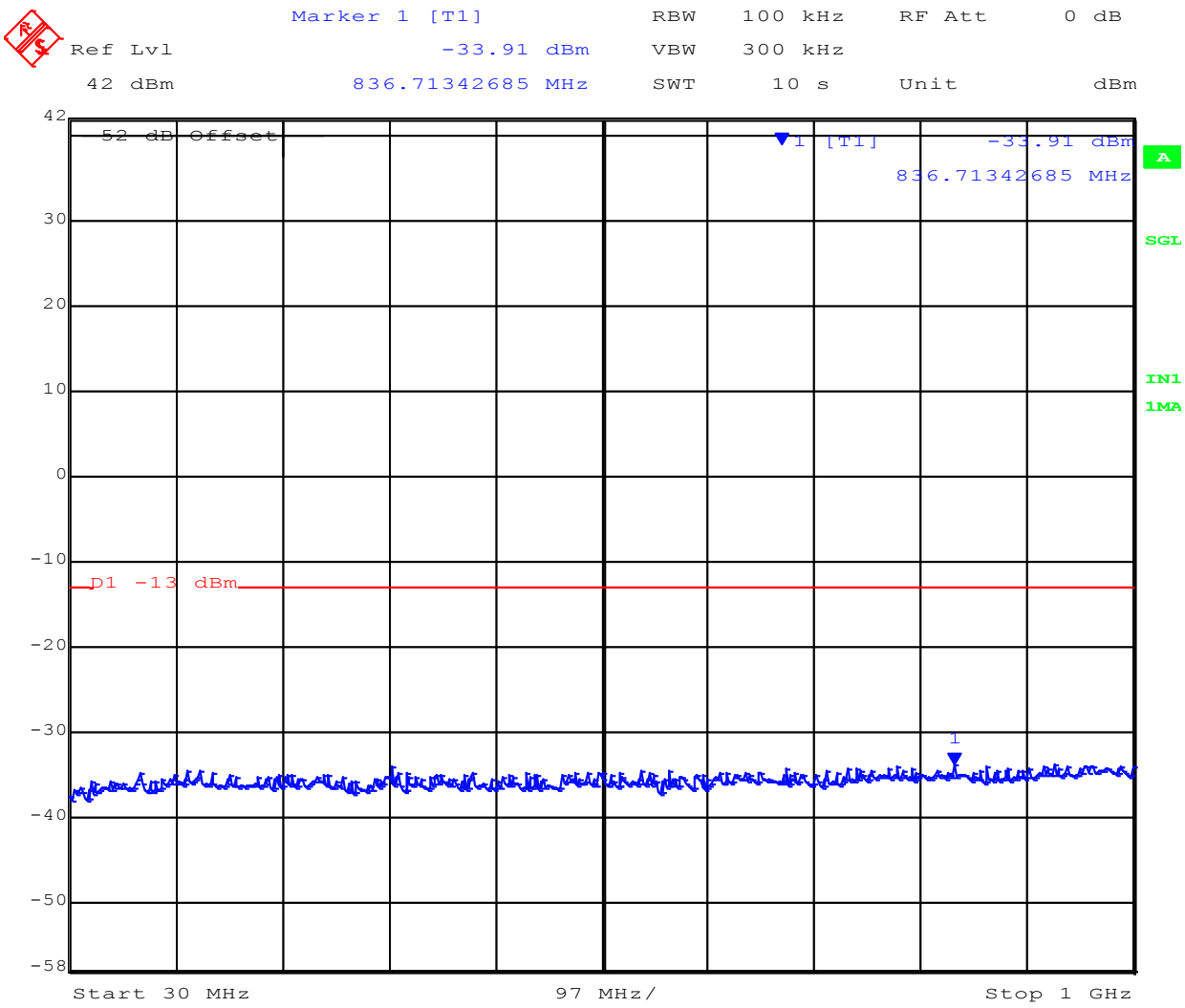
Back to Matrix

2593MHz 150KHz – 30MHz Chain C



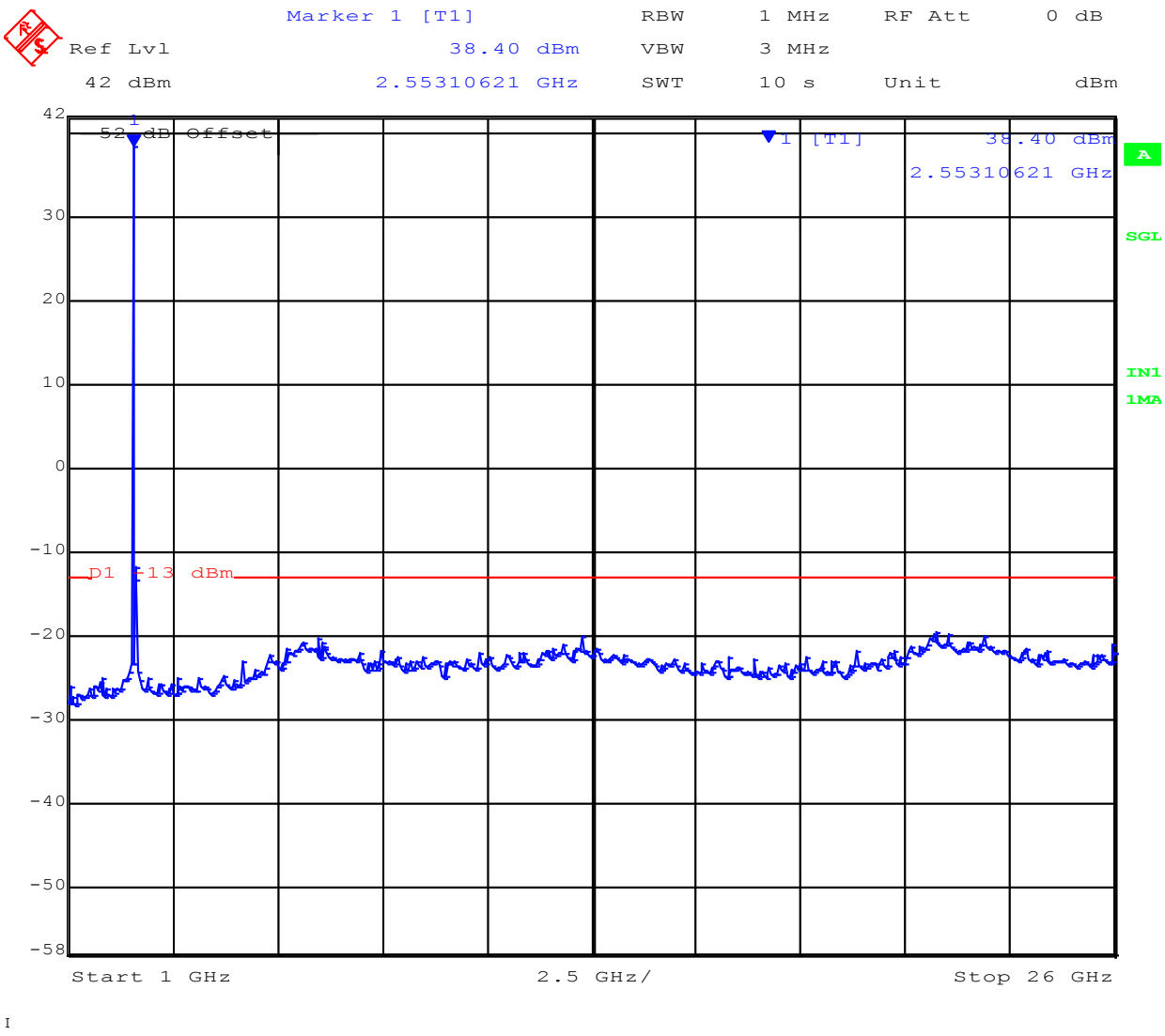
Back to Matrix

2593MHz 30MHz – 1GHz Chain C



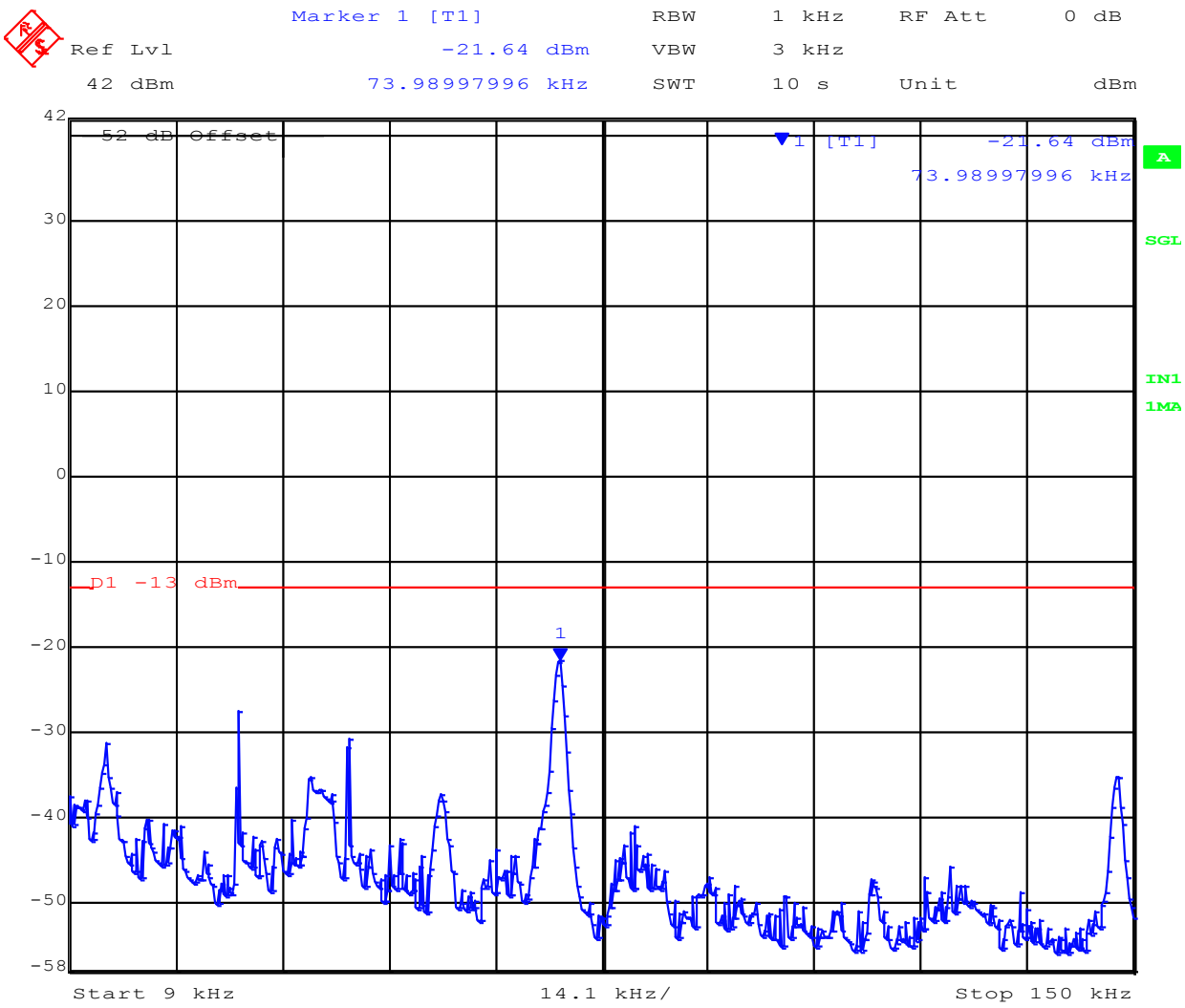
Back to Matrix

2593MHz 1GHz – 26GHz Chain C



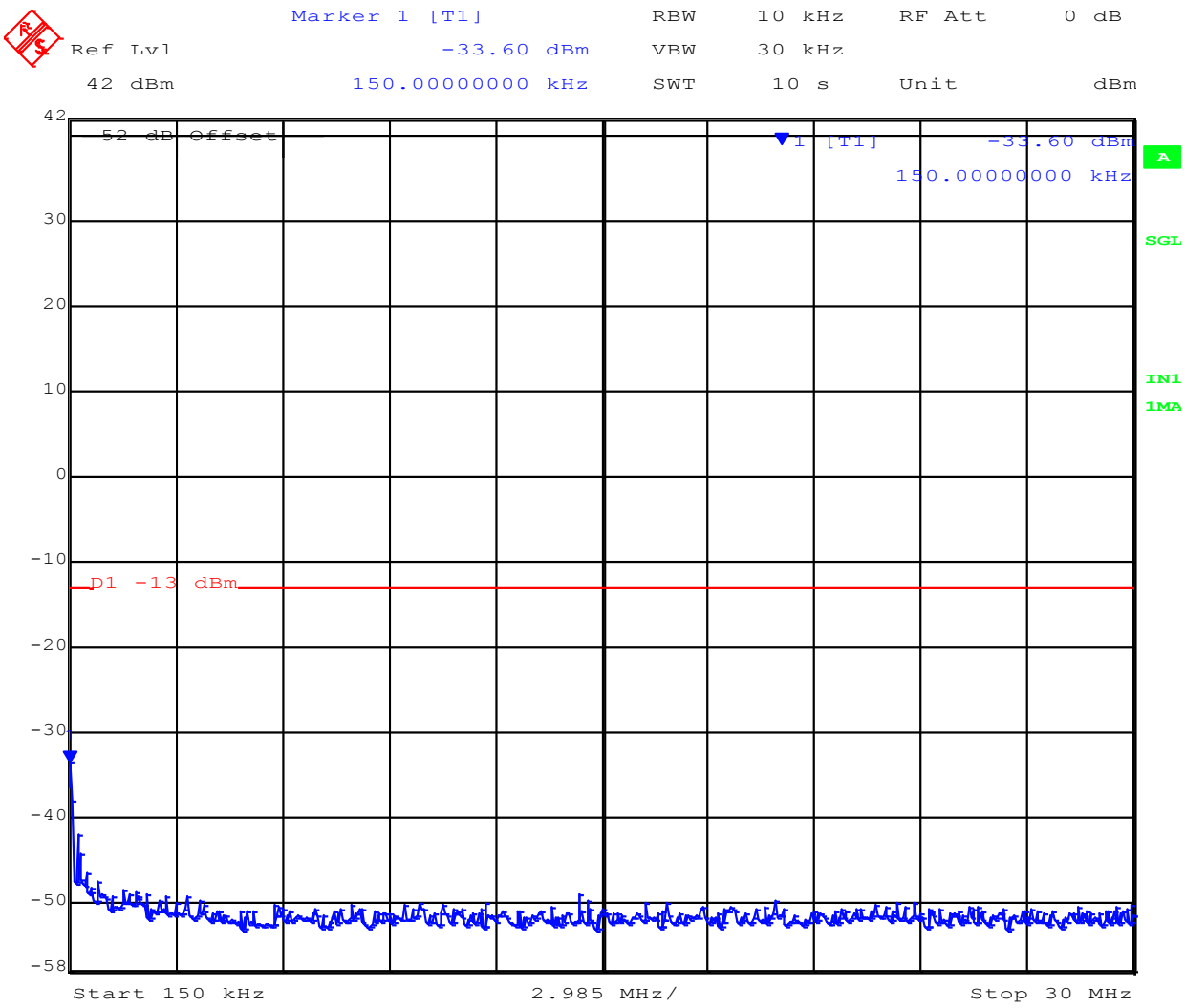
[Back to Matrix]

2593MHz 9KHz – 150KHz Chain D



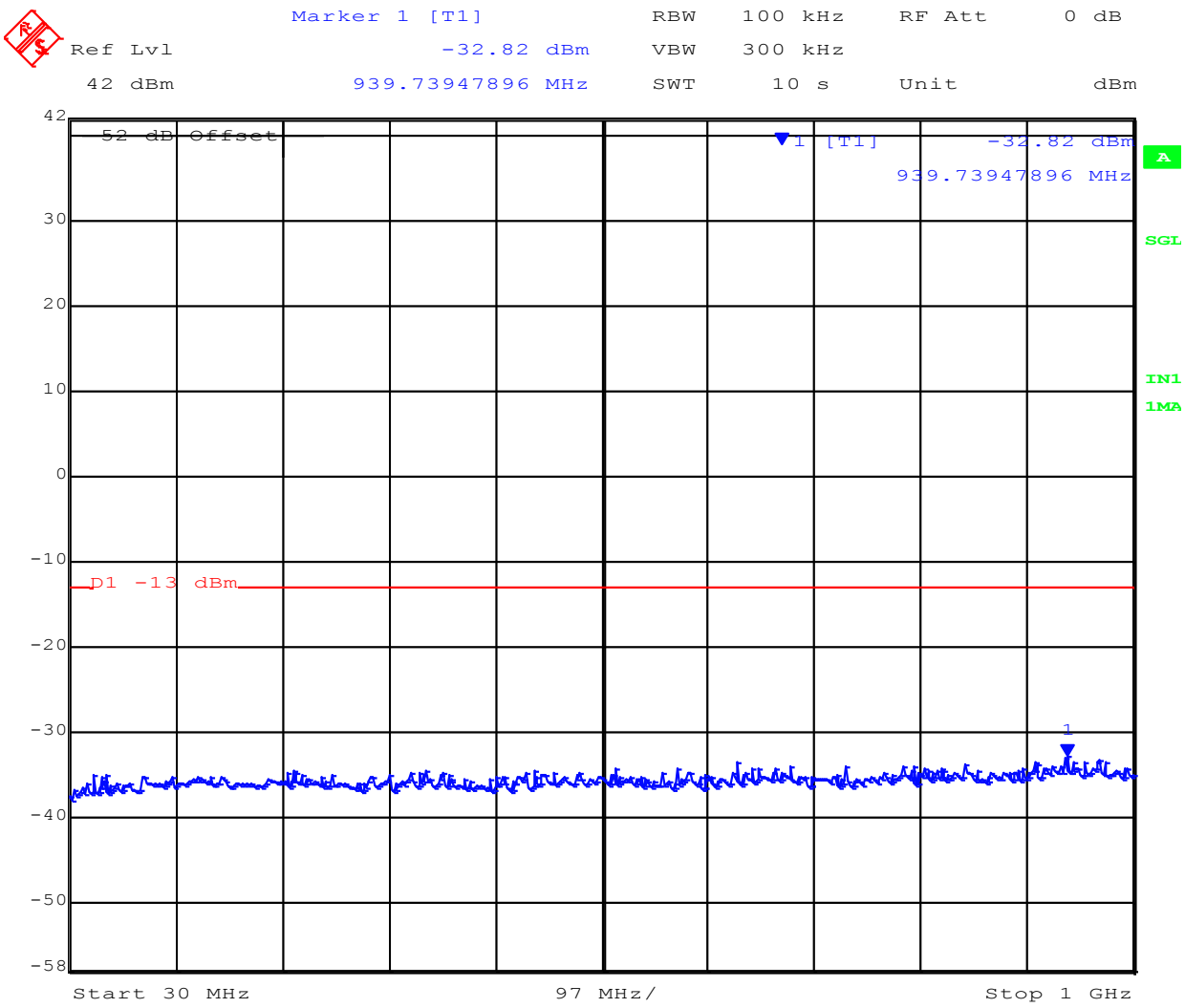
Back to Matrix

2593MHz 150KHz – 30MHz Chain D



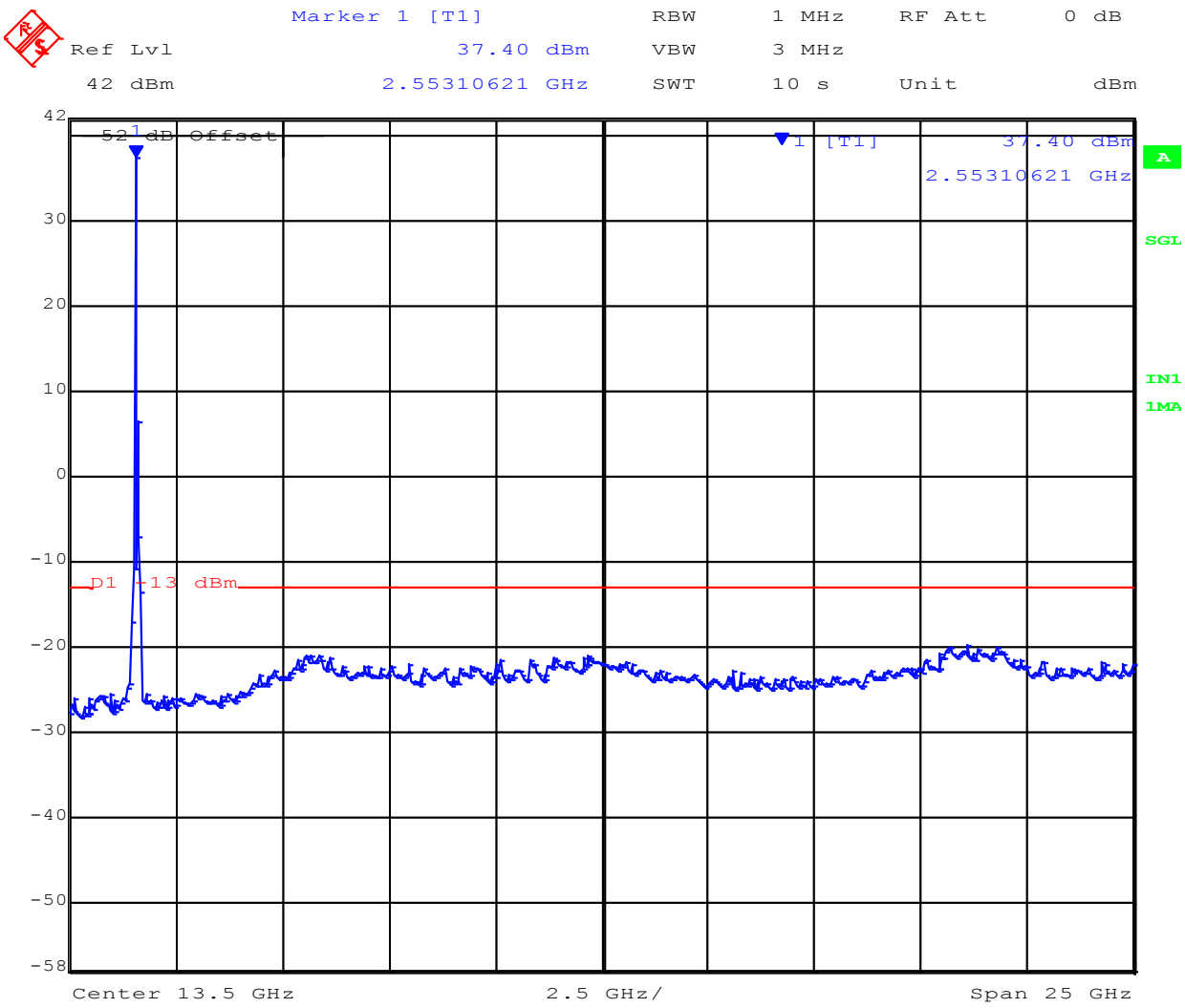
Back to Matrix

2593MHz 30MHz – 1GHz Chain D



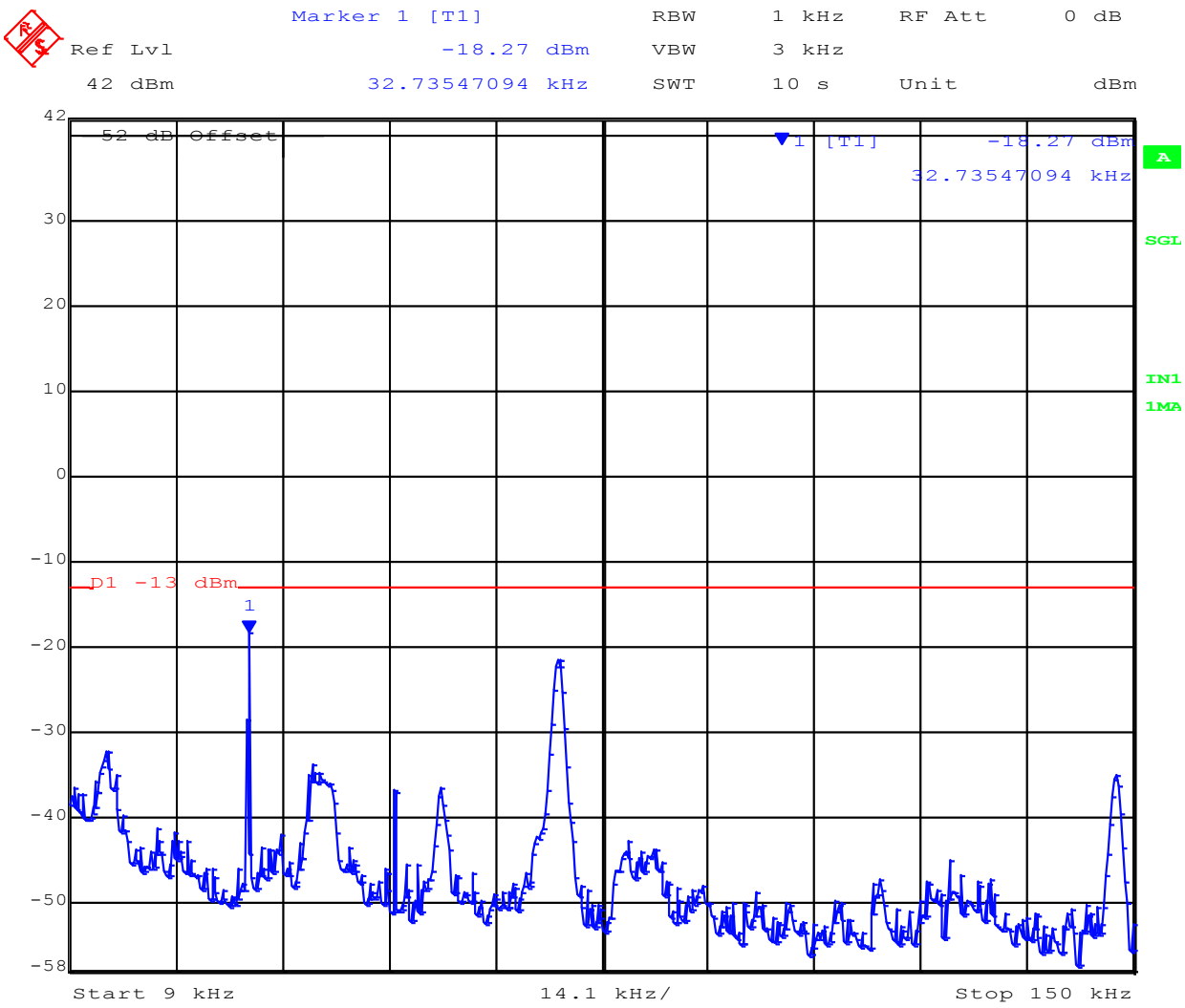
Back to Matrix

2593MHz 1GHz – 26GHz Chain D



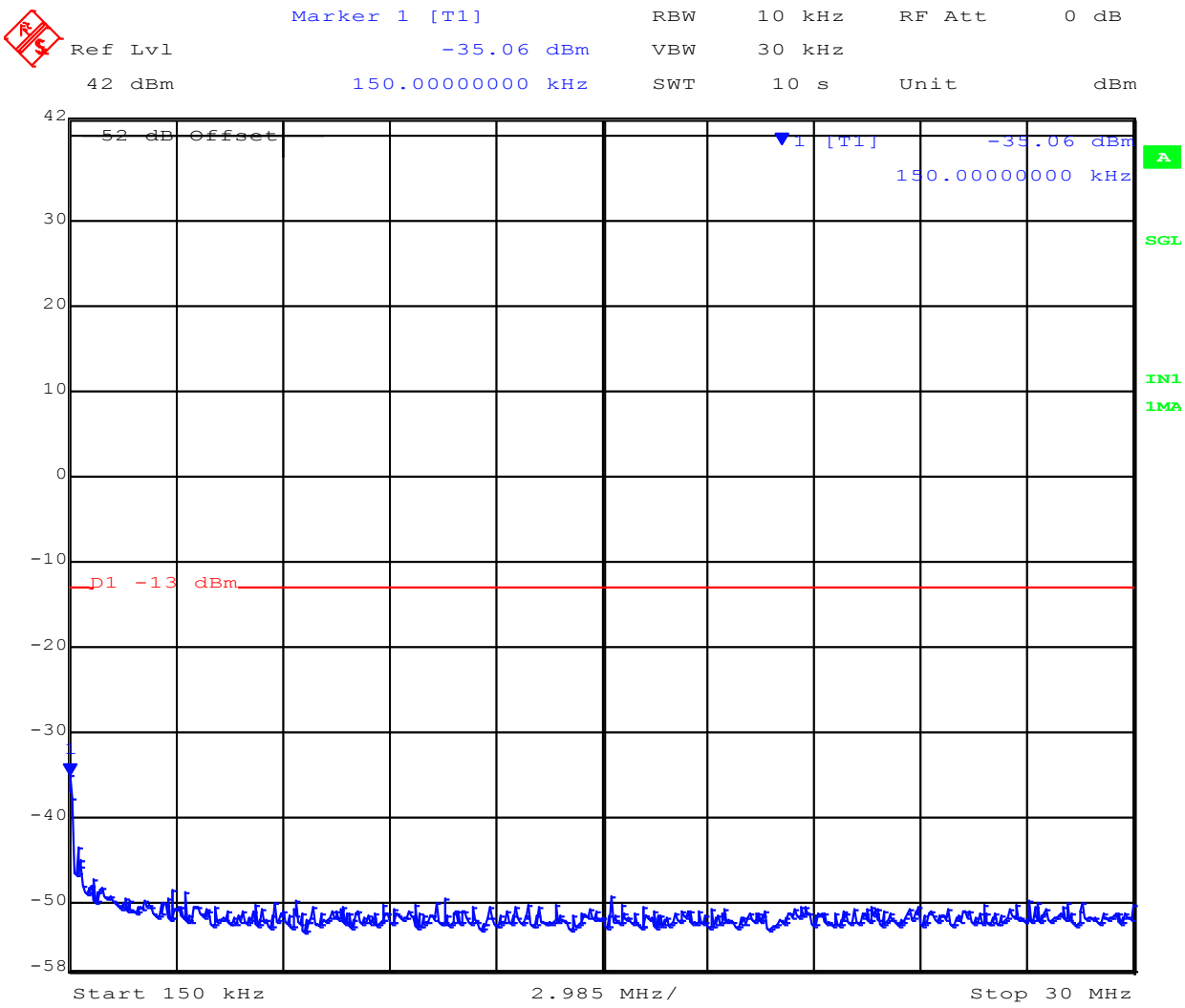
Back to Matrix

2687.5MHz 9KHz – 150KHz Chain A



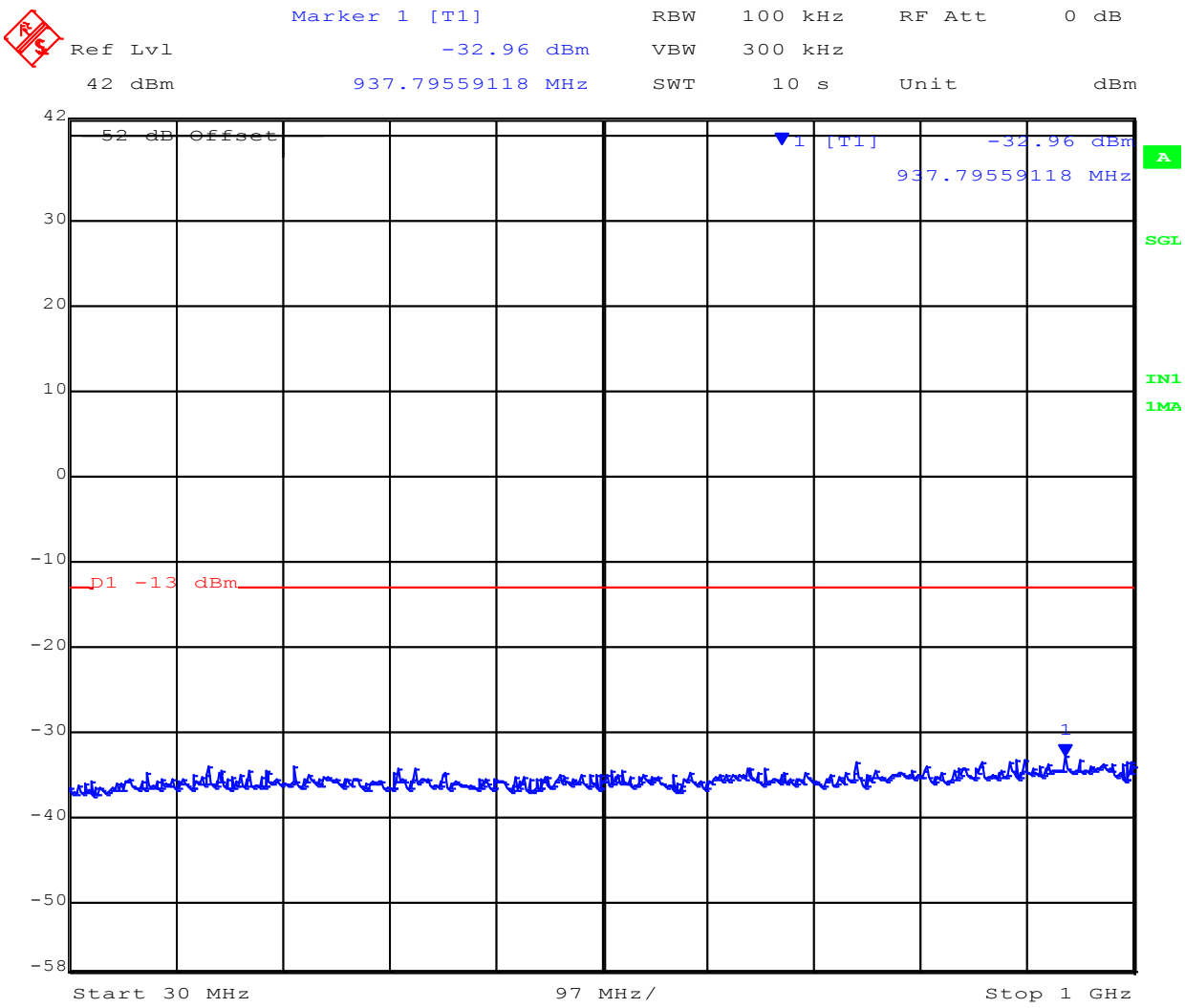
Back to Matrix

2687.5MHz 150KHz – 30MHz Chain A



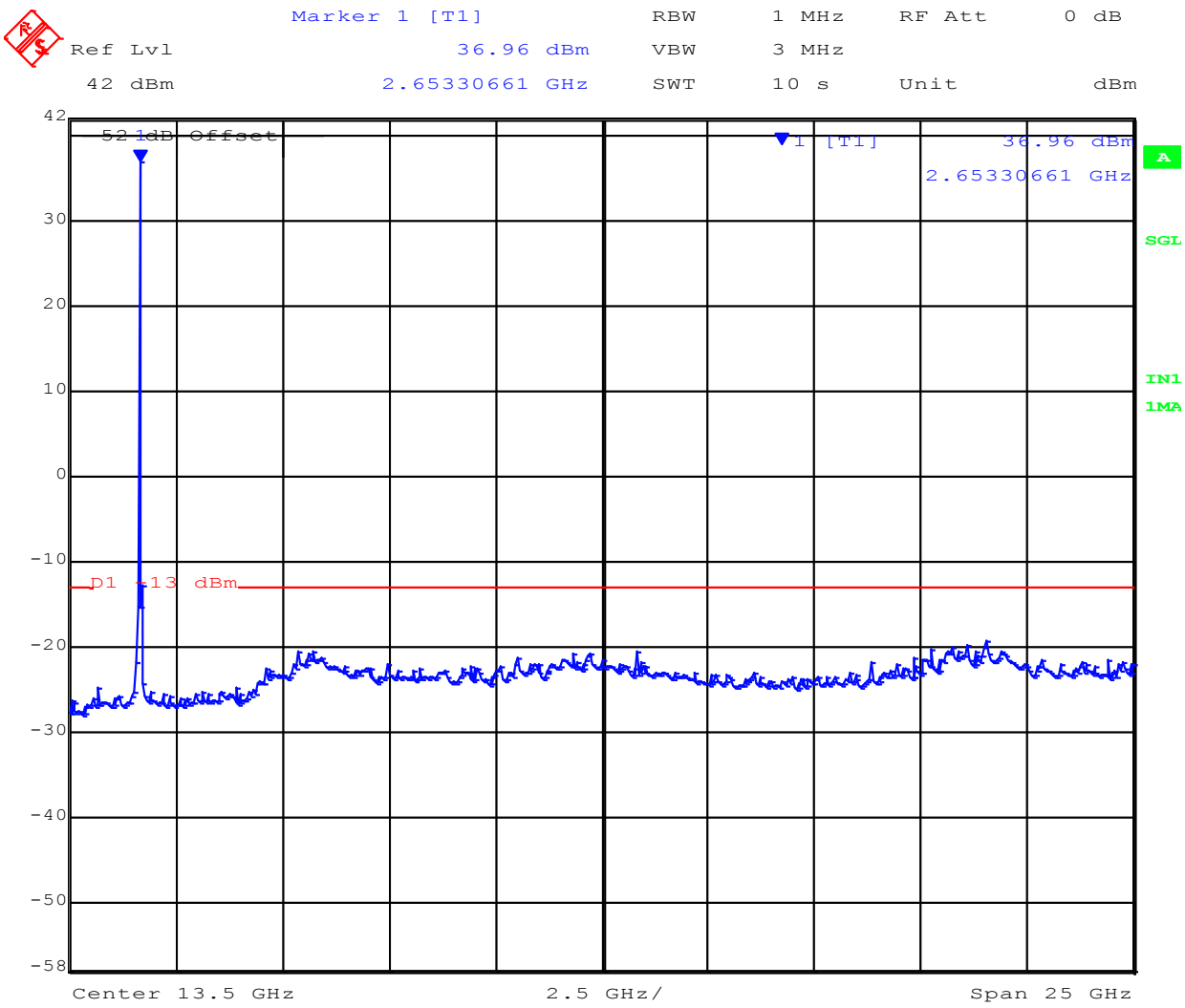
Back to Matrix

2687.5MHz 30MHz – 1GHz Chain A



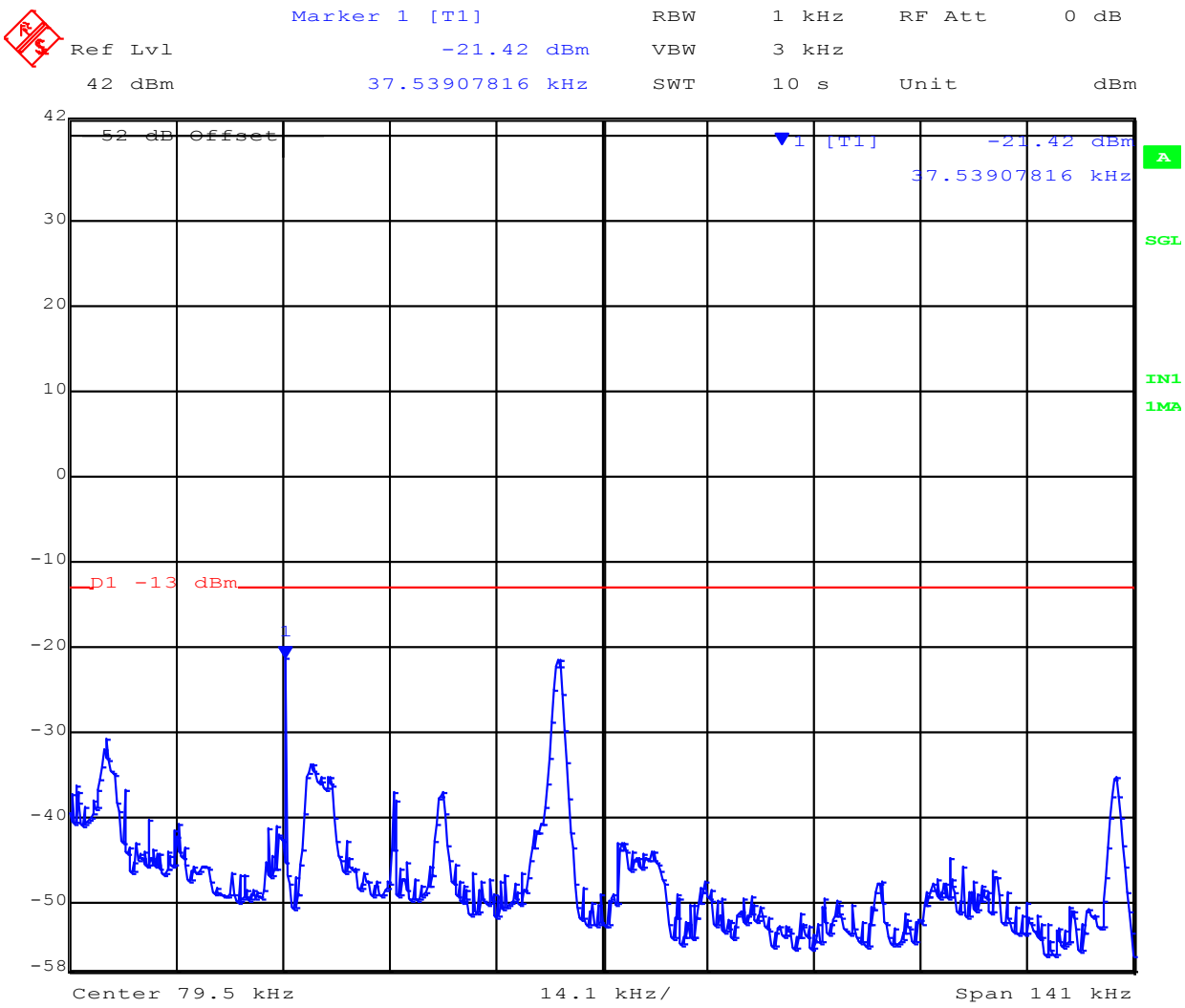
Back to Matrix

2687.5MHz 1GHz – 26GHz Chain A



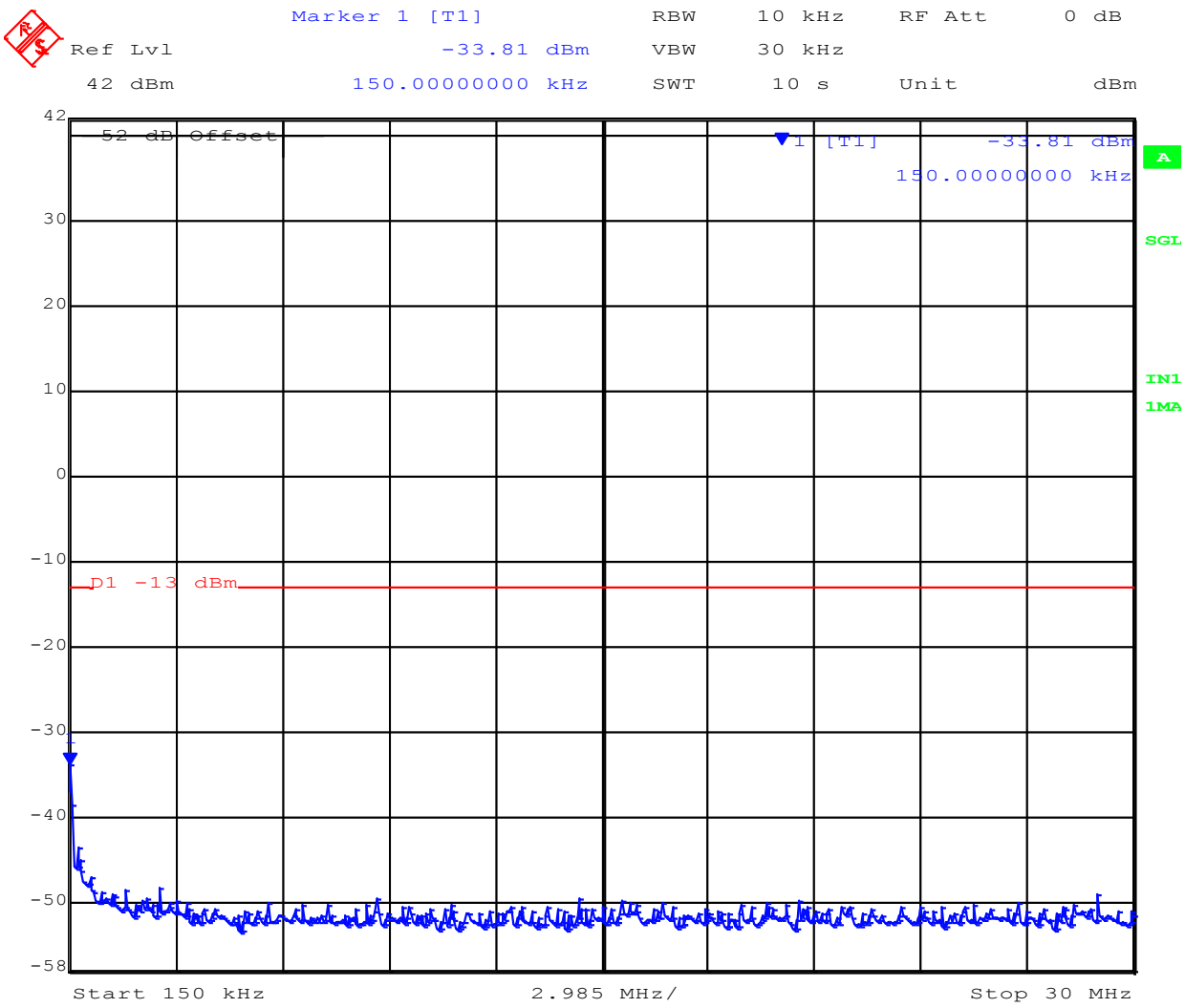
Back to Matrix

2687.5MHz 9KHz – 150KHz Chain B



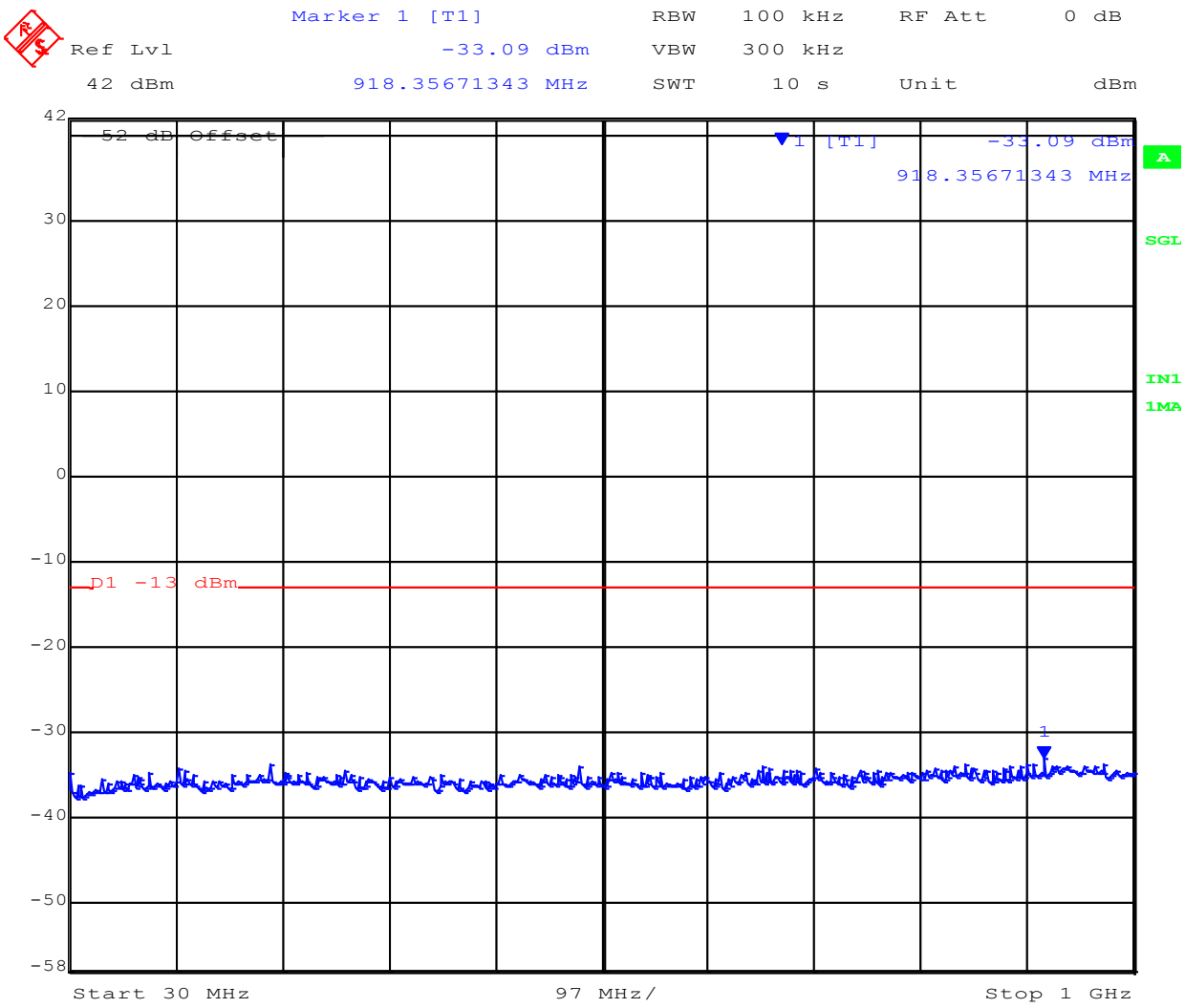
Back to Matrix

2687.5MHz 150KHz – 30MHz Chain B



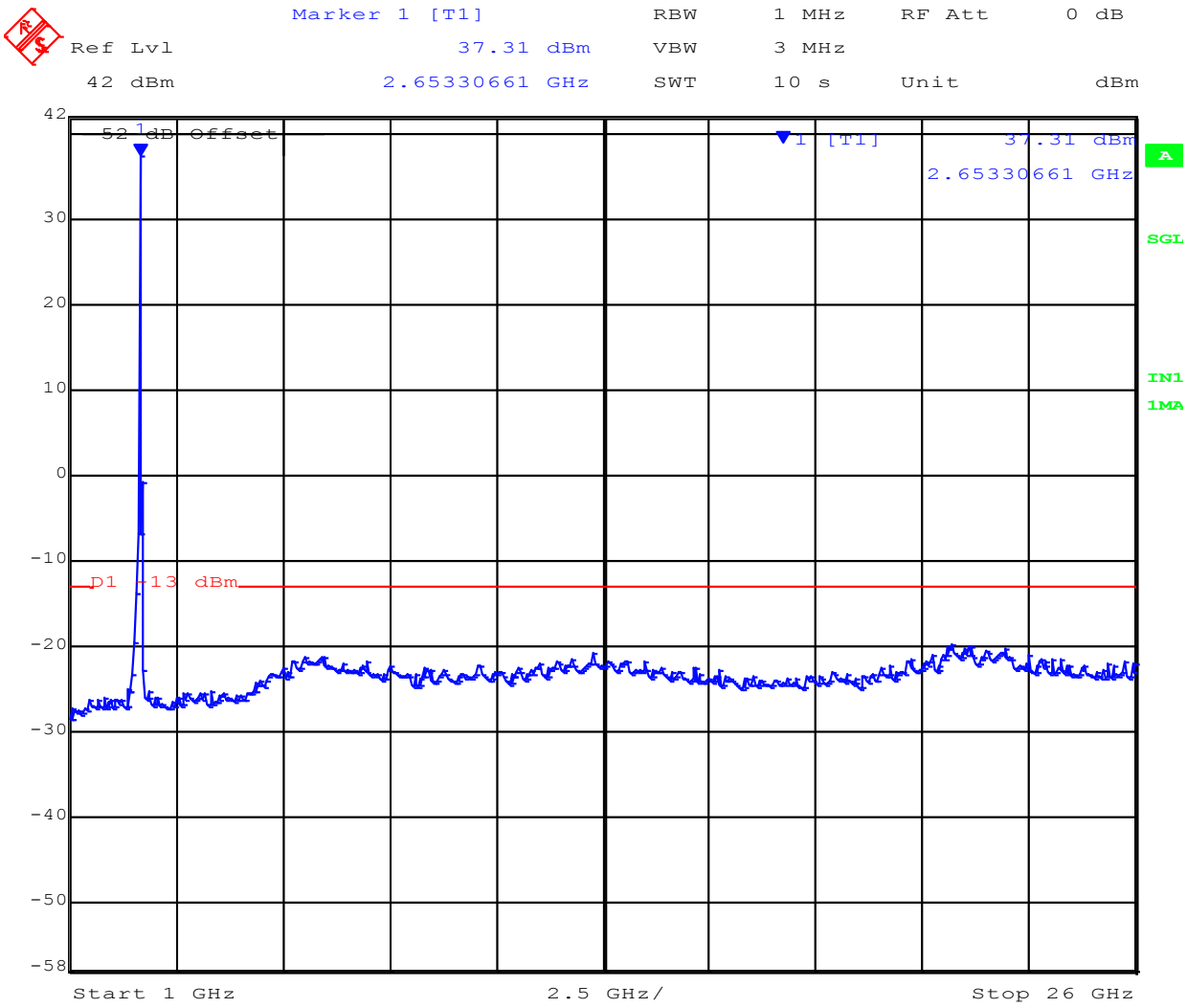
Back to Matrix

2687.5MHz 30MHz – 1GHz Chain B



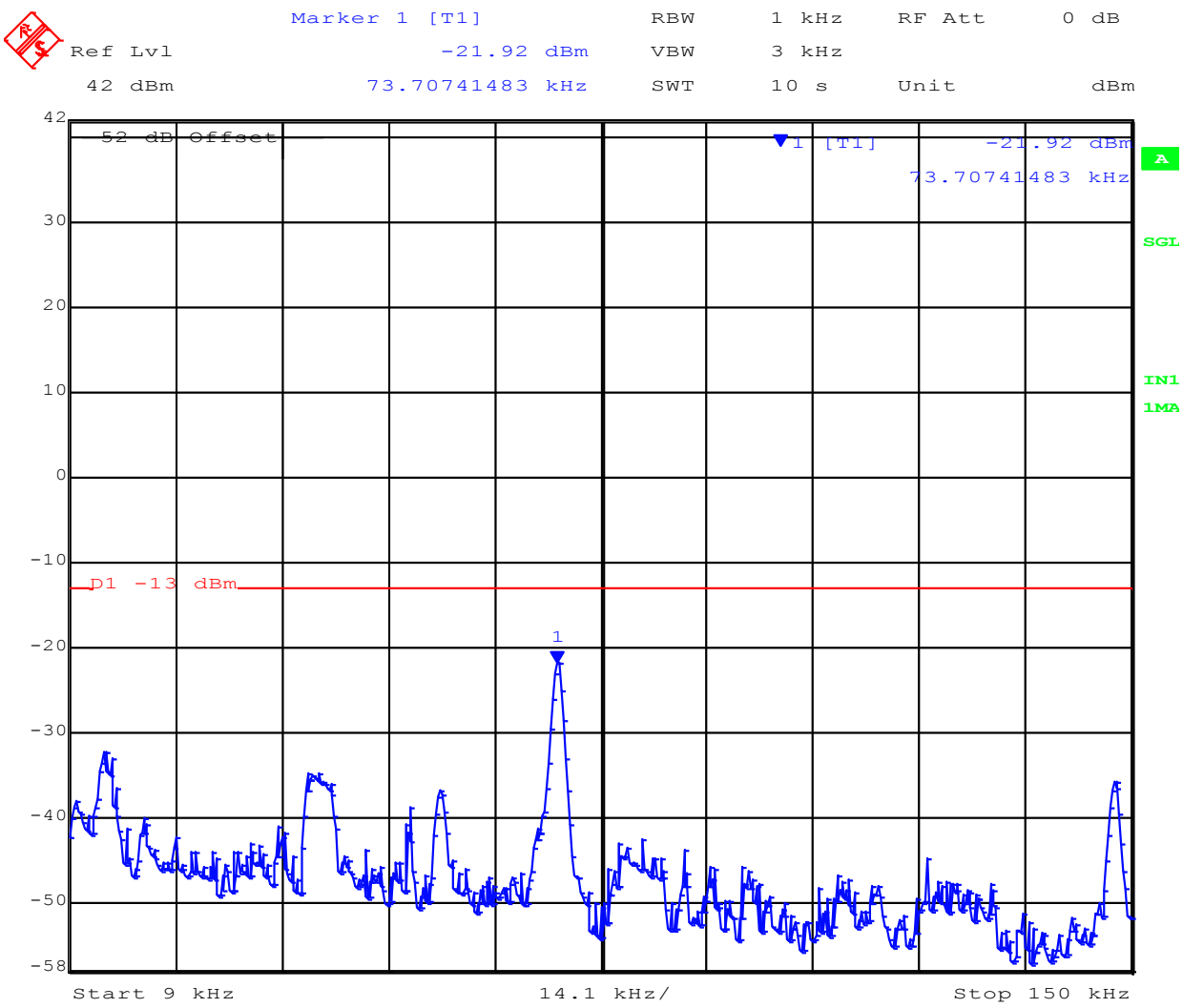
Back to Matrix

2687.5MHz 1GHz – 26GHz Chain B



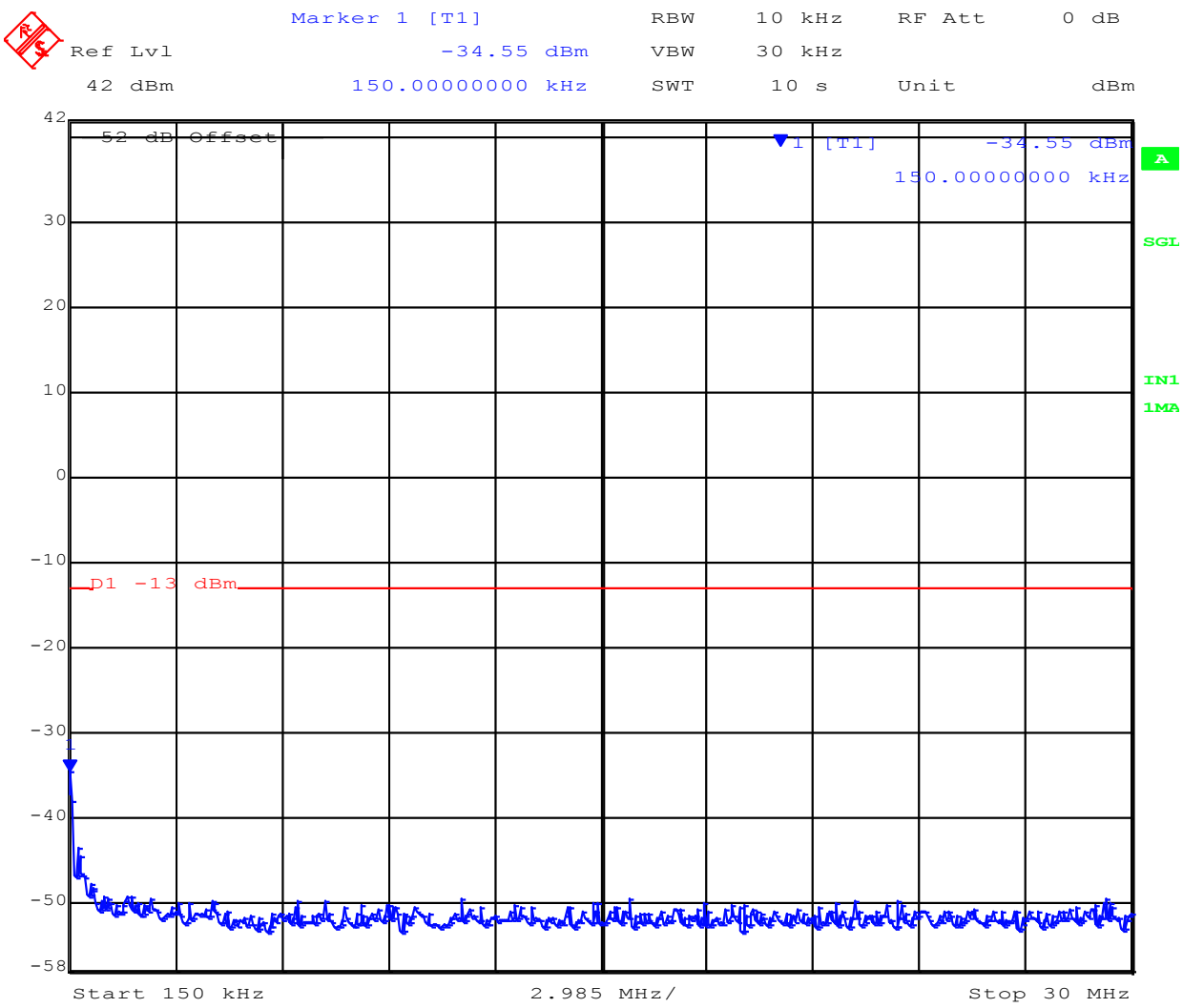
Back to Matrix

2687.5MHz 9KHz – 150KHz Chain C



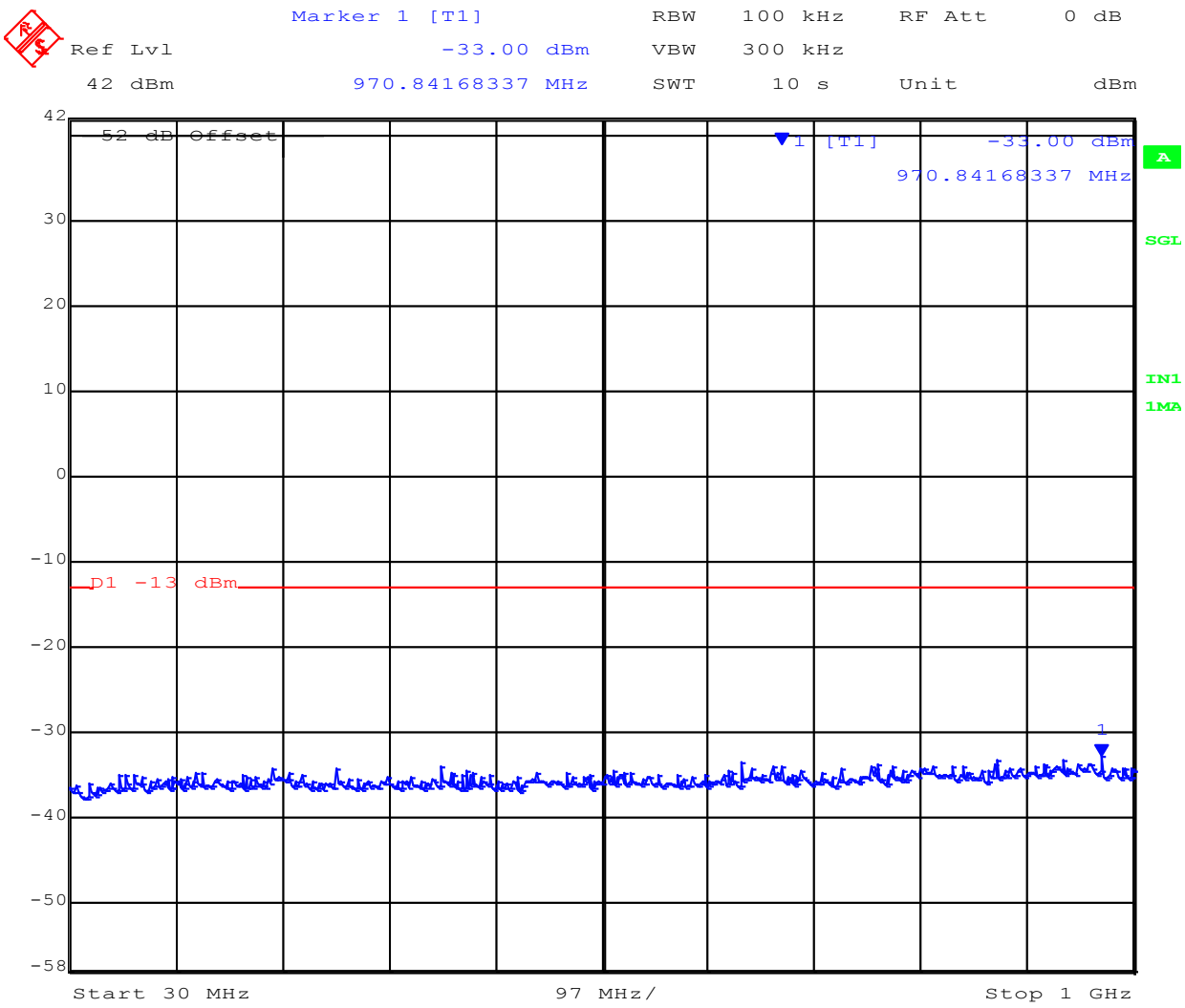
Back to Matrix

2687.5MHz 150KHz – 30MHz Chain C



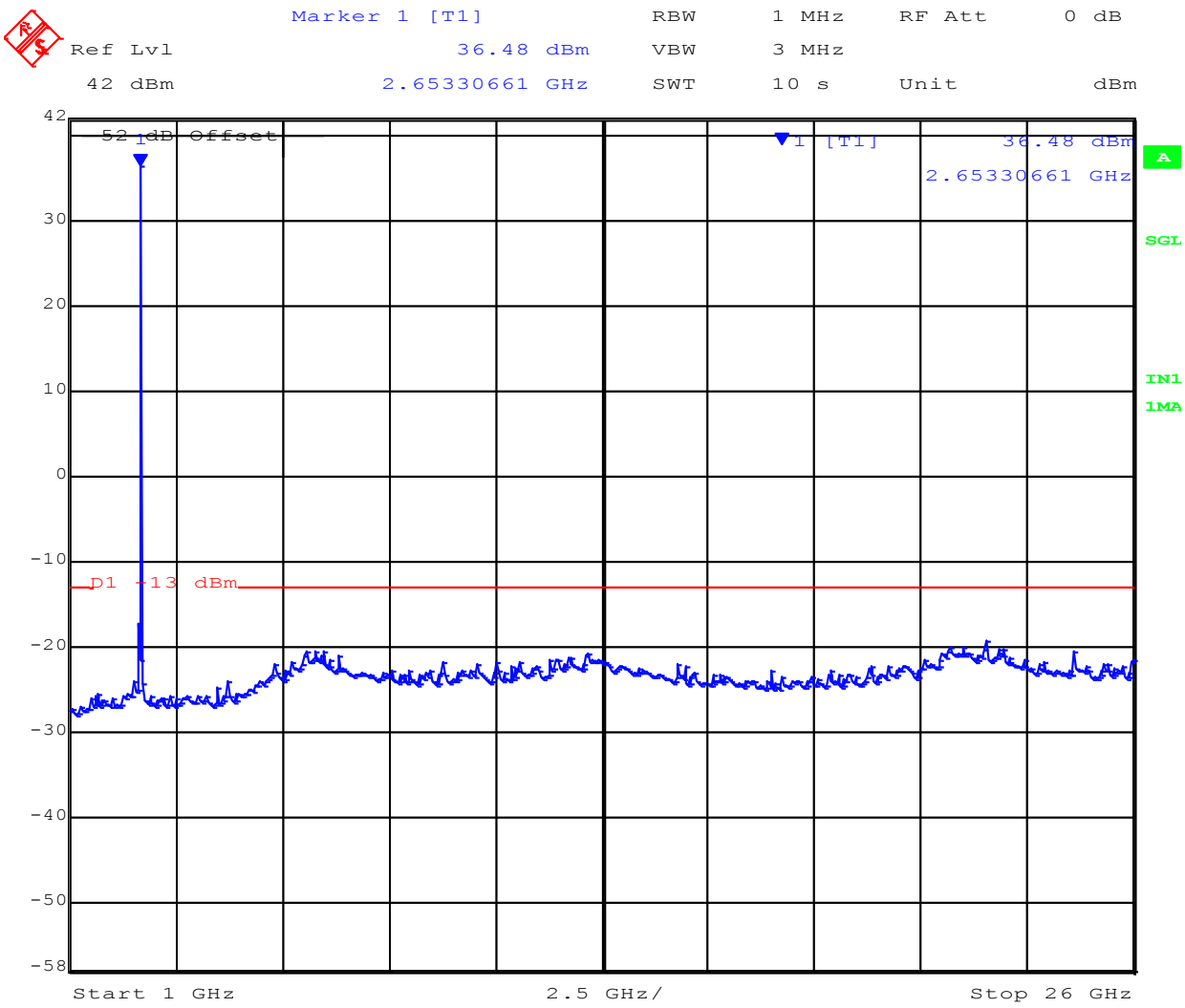
Back to Matrix

2687.5MHz 30MHz – 1GHz Chain C

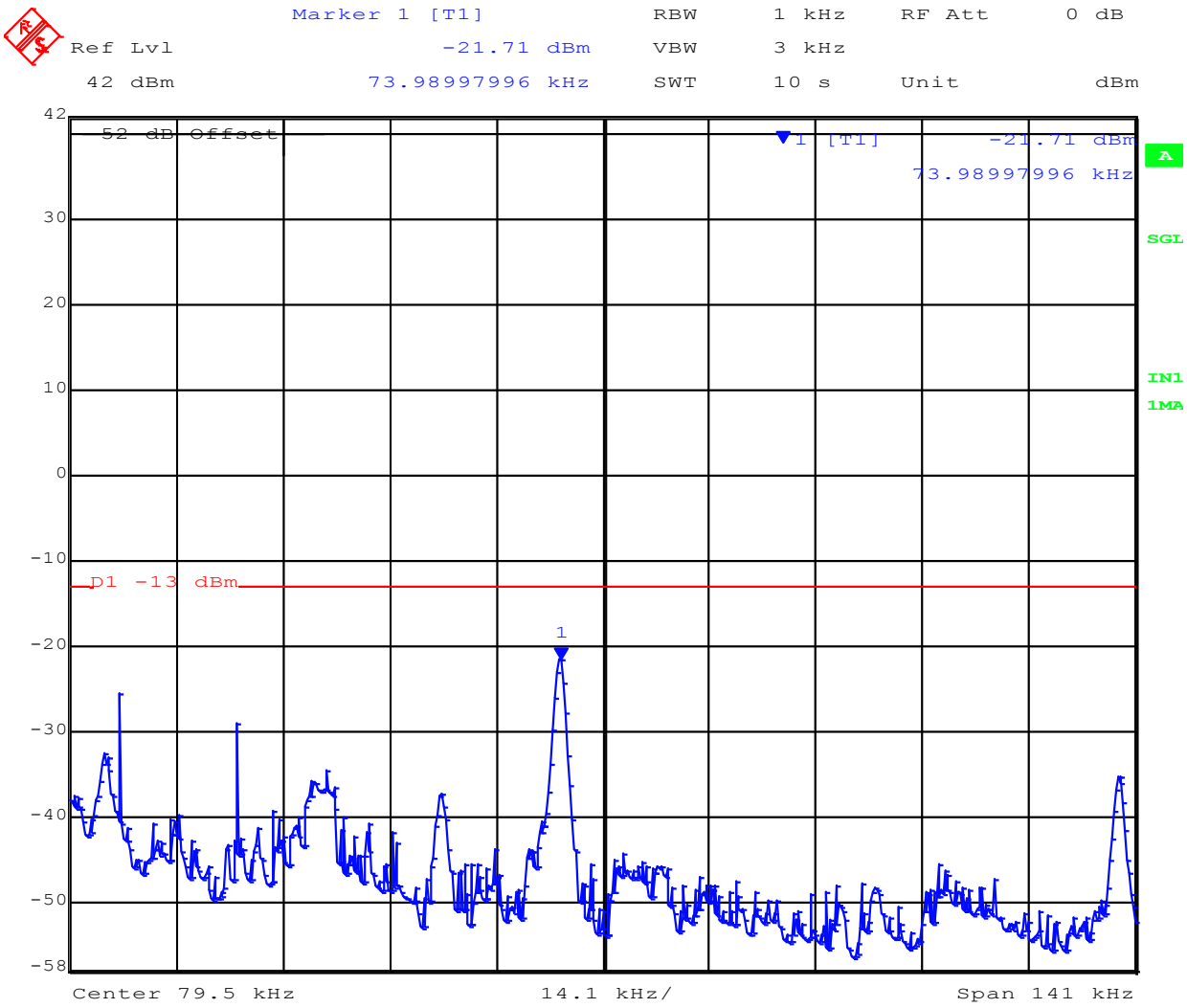


Back to Matrix

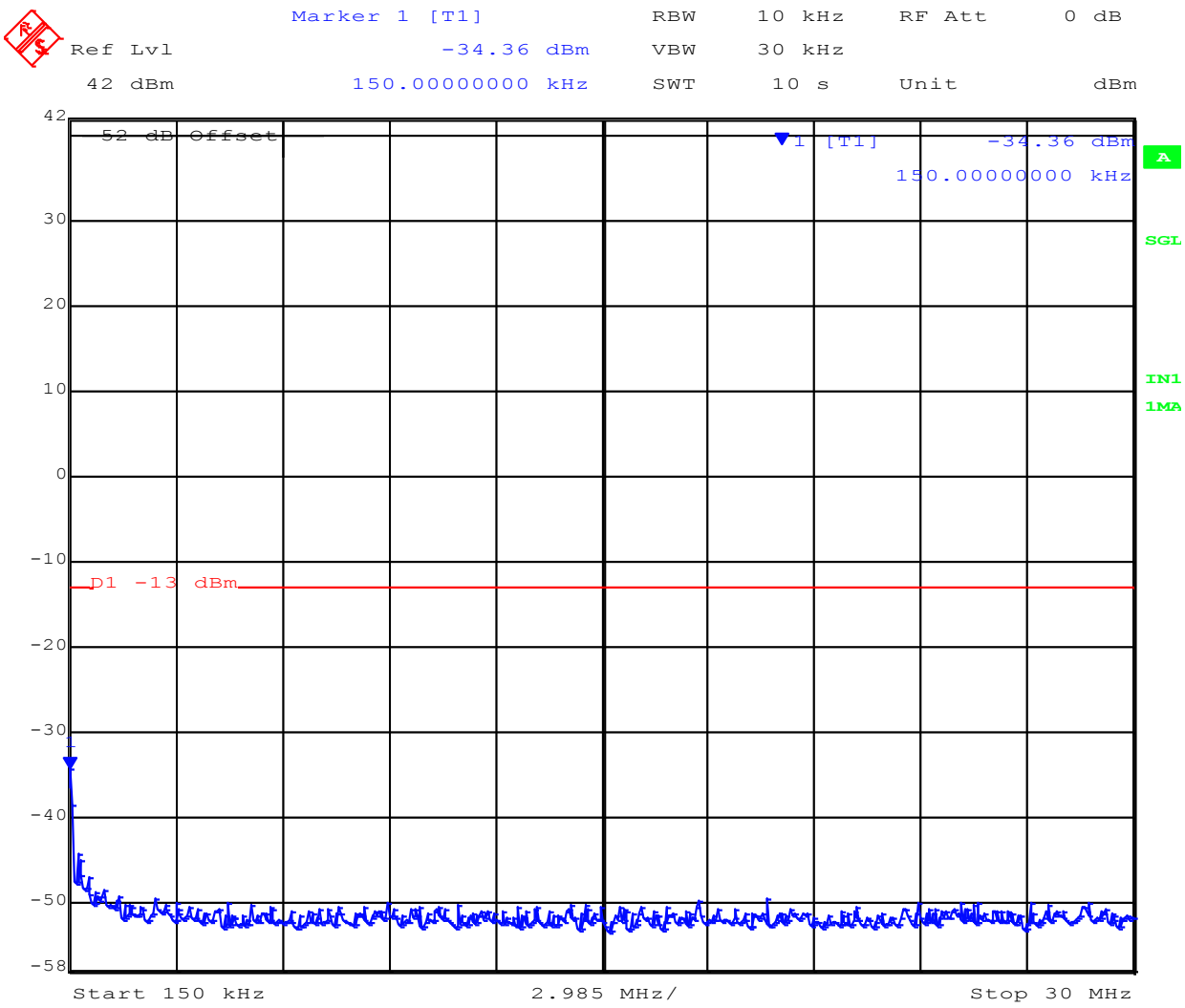
2687.5MHz 1GHz – 26GHz Chain C



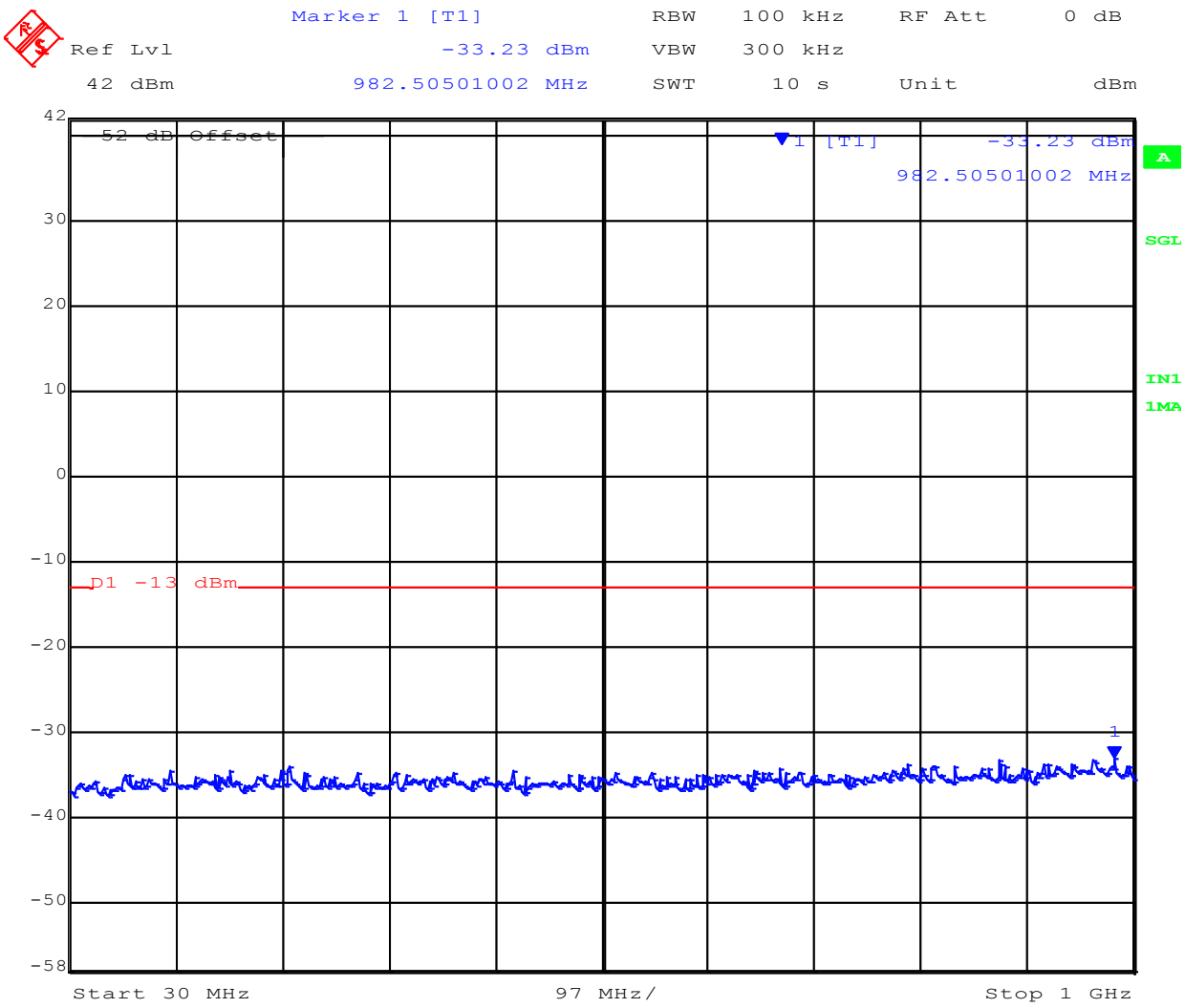
2687.5MHz 9KHz – 150KHz Chain D



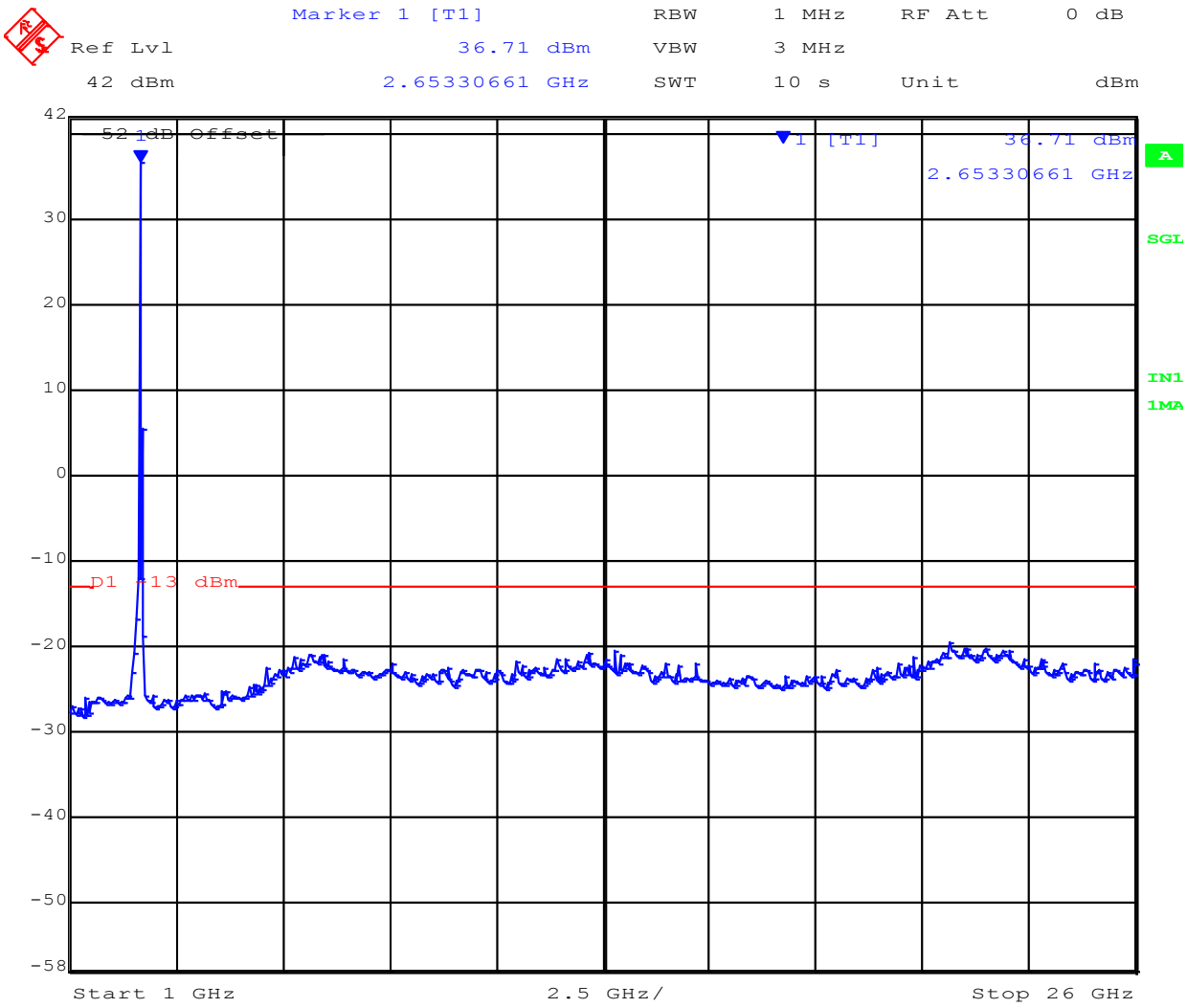
2687.5MHz 150KHz – 30MHz Chain D



2687.5MHz 30MHz – 1GHz Chain D



2687.5MHz 1GHz – 26GHz Chain D



575 Boulder Court,
Pleasanton, California 94566, USA
Tel: 1.925.462.0304
Fax: 1.925.462.0306
www.micomlabs.com