Test of AKELA ASTIR 3300

To: CFR 47 Part 90, DA 11-1870

Test Report Serial No.: AKEL02-U1 Rev B

TEST REPORT

FROM

Test of AKELA ASTIR 3300

To CFR 47 Part 90, DA 11-1870

Test Report Serial No.: AKEL02-U1 Rev B

This report supersedes: AKEL02-U1 Rev A

Manufacturer: AKELA, Inc
5551 Ekwill St, Suite A
Santa Barbara, California 93111
USA

Product Function: Standoff Through the Wall Imaging Radar (ASTIR)

Copy No: pdf **Issue Date:** 7th January 2013

This Test Report is Issued Under the Authority of;

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

ACCREDITED

TESTING CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard EN 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

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
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 EN ISO/IEC Guide 65. 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

USA Telecommunication Certification Body (TCB) - TCB Identifier – US0159

Industry Canada Certification Body - CAB Identifier – US0159

European Notified Body - Notified Body Identifier - 2280

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

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
A	17th September 2012	Initial Release
B	7th January 2013	MPE calculation revised per the requirements of KDB 447498.

1. TEST RESULT CERTIFICATE

Manufacturer:	AKELA, Inc 5551 Ekwill St, Suite A Santa Barbara, California 93111 USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Standoff Through the Wall Imaging Radar (ASTIR)	Telephone:	+1 925 462 0304
Model:	ASTIR 3300	Fax:	+1 925 462 0306
S/N:	R5C321T309		
Test Date(s):	7th to 8th August 2012	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
CFR 47 Part 90, DA 11-1870	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:

ACCREDITED
TESTING CERTIFICATE #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)	CFR 47 Part 90	2012	Code of Federal Regulations
(ii)	DA 11-1870	Nov 2011	FCC Grant of Waiver
(iii)	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
(iv)	CISPR 22	2008	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(v)	M 3003	Edition 2 Jan. 2007	Expression of Uncertainty and Confidence in Measurements
(vi)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(vii)	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
(viii)	A2LA P101	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 AKELA ASTIR 3300 to CFR 47 Part 90, DA 11-1870 regulations.
Applicant:	AKELA, Inc 5551 Ekwill St, Suite A Santa Barbara, California 93111 USA
Manufacturer:	As Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	AKEL02-U1 Rev B
Date EUT received:	7th August 2012
Dates of test (from - to):	7th to 8th August 2012
Standard(s) applied:	CFR 47 Part 90, DA 11-1870
No of Units Tested:	1
Type of Equipment:	AKELA Standaoff Throughwall Imaging Radar (ASTIR)
Model:	AR 500SC
Location for use:	Indoor/Outdoor
Installation Type:	Portable
Declared Frequency Range(s):	Transmit: 3101 - 3499 MHz Receiver: 3101 - 3499 MHz
Type of Modulation:	Stepped frequency continuous wave signal
Declared Maximum Output Power:	+6 dBm
ITU Emission Designator:	N0N
Transmit/Receive Operation:	Full Duplex
Software Revision:	61
Hardware Revision:	Revision C
Rated AC Input Voltage and Current:	Input: Nominal 117Vac 100 - 240Vac 50 -60Hz 0.1A
Rated DC Input Voltage and Current:	Input Nominal 12Vdc 10.5 -14Vdc 0.8A
Operating Temperature Range:	Client declared: -30ºC to +50ºC
Clock/Oscillator(s):	25 MHz; 32.768 MHz, 42.8 MHz; 100 MHz; 312.5 MHz
Frequency Stability:	±10 ppm /year
Equipment Dimensions:	50.8cm X 43.2cm X 22.9cm
Weight:	8.03 kgs
Primary function of equipment:	Standoff Throughwall Imaging Radar (ASTIR)

3.2. Scope of Test Program

The scope of the test program was to test the AKELA ASTIR 3300 for compliance against;-

CFR 47 Part 90 and the requirements specified in FCC DA 11-1870.

Product Description

AKELA developed the ASTIR through-the-wall radar imaging system for law enforcement and other first responder use. The ASTIR device steps through the frequency range 3101-3499 MHz at 2 MHz intervals. The timing and other characteristics are chosen to maximize the utility to law enforcement, weighed against battery life and the need to protect other users of the band. Processing of the returned signals determines the presence, location, and velocity of objects in front of the device, even if a wall intervenes. This enables the operator to detect and track the presence of both moving and stationary individuals within a building structure.

Unlike through-the-wall systems that must be placed in direct contact or in close proximity to a wall, AKELA's system allows a standoff distance up to 30 meters.

AKELA ASTIR 3300

AKELA ASTIR 3300

AKELA ASTIR 3300

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

EUT/ Support	Manufacturer	Equipment Description (Including Brand Name)	Model No.	Serial No.
EUT	Akela	AKELA Standoff Through the Wall Imaging Radar (ASTIR)	AR 500SC	R5C321T309
Support	IBM	Lagtop Computer	T60	L3MH607

3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.
Integral – Directional	10.8	A-INFOMW	WR229

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. RJ45 100 BT Ethernet
2. IEC AC Receptacle AC Mains Input
3. 5.5X2.5mm Socket 12Vdc power input

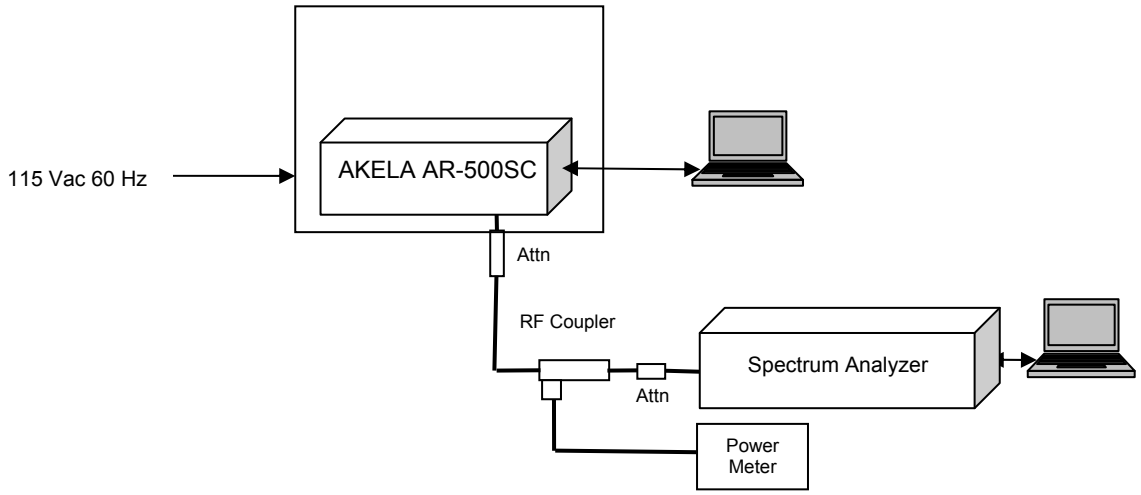
3.6. Test Configurations

Test Frequencies

Low (MHz)	Mid (MHz)	High (MHz)
3101	3300	3499

Test Set-Up

Test software was available to exercise the Subscriber Station and the equipment was tested using the following test configuration.



Test Set-Up

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. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **CFR47 Part 90** and **FCC Waiver DA 11-1870.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
90.213 **2.1055(a)(1)**	Frequency Stability	Includes temperature variations	Conducted	Complies	5.1.1
90.205 **2.1046**	EIRP Rated Power	Modulated Output Power	Conducted	Complies	5.1.2
90.210 **DA 11-1870**	Spectrum Mask	Emissions from the antenna port	Conducted	Complies	5.1.3
2.1051;	Spurious Emissions	Emissions from the antenna port	Conducted	Complies	5.1.4
90.210	Radiated Spurious Emissions	Spurious emissions	Radiated	Complies	5.1.5
1.1310	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Radiated	Calculation	5.1.6

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 3.7 'Equipment Modifications' highlight the equipment modifications that were required to bring the product into compliance with the above matrix*

5. TEST RESULTS

5.1. Device Characteristics

5.1.1. Frequency Stability; Temperature Variations

FCC 47 CFR Part 90.213

Test Procedure
The EUT was placed in an environmental chamber. The transmitter output was connected to a spectrum analyzer and the EUT was powered via 120Vac mains supply.

Frequency stability was measured in a Continuous Wave (CW) mode through the extremes of temperature range -30º C to +50ºC at intervals of 10º C at normal supply voltage on the low, mid and high channels. The environmental chamber was set to dwell on each temperature to allow the temperature of the EUT stabilize before measurements were made.

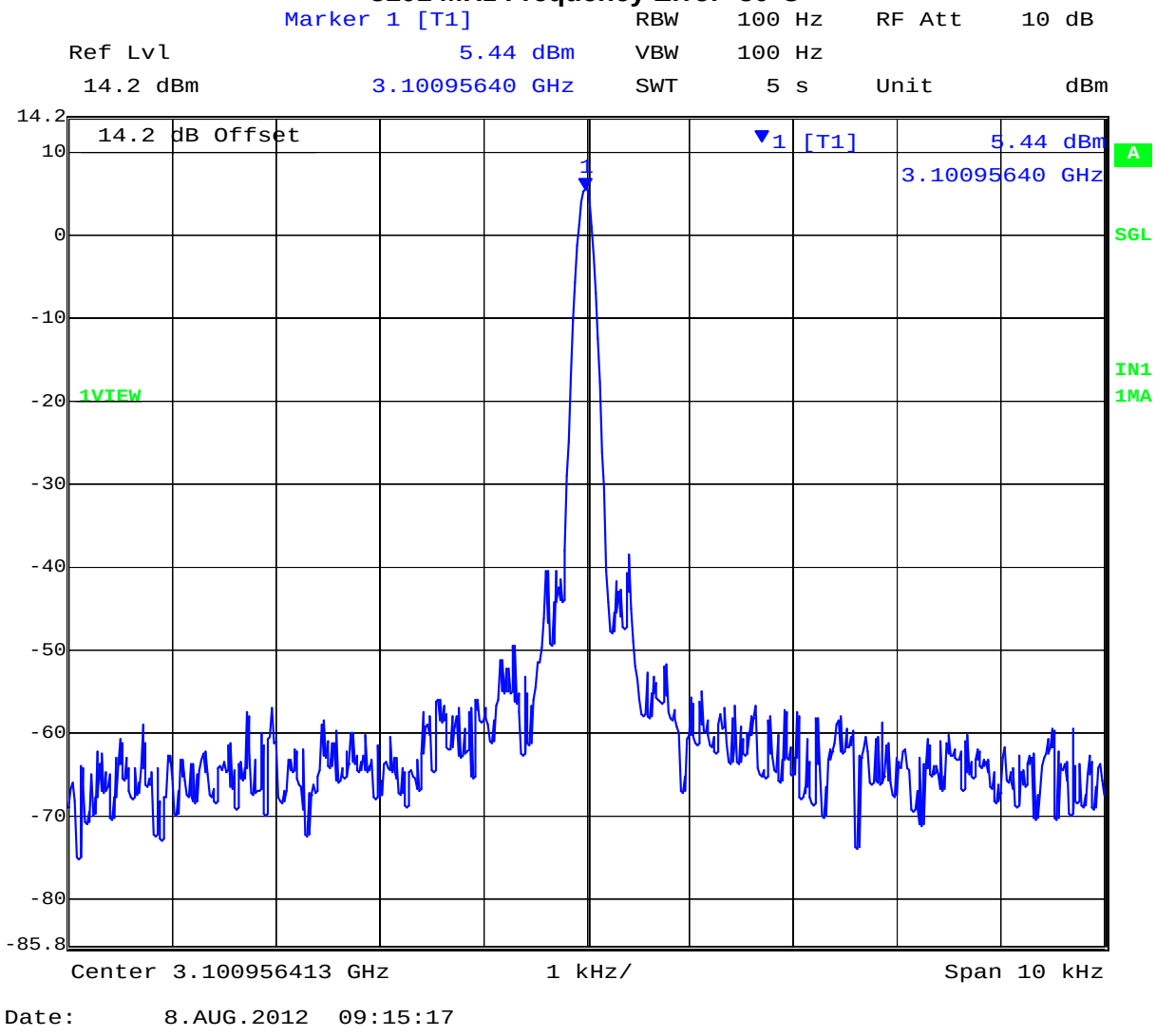
Test Set-up is shown in Section 3.6 Test Configuration

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS Frequency Stability –

Channel Frequency (MHz)	Temperature (°C)	Mains Voltage (Vac)	Center Frequency (MHz)	Delta (kHz)	ppm
3101	-30	120	3100.95640	-43.60	14.06
	-20	120	3100.97718	-22.82	7.36
	-10	120	3100.99186	-8.14	2.62
	+0	120	3100.99685	-3.15	1.02
	+10	120	3101.00074	+0.74	0.24
	+20	120	3100.99422	-5.78	1.86
	+30	120	3100.98228	-17.72	5.71
	+40	120	3100.96524	-34.76	11.21
	+50	120	3100.94624	-53.76	17.34
3300	-30	120	3299.95286	-47.14	14.28
	-20	120	3299.97618	-23.82	7.22
	-10	120	3299.99081	-9.19	2.78
	+0	120	3299.99800	-2.00	0.61
	+10	120	3300.00074	+0.74	0.22
	+20	120	3299.99336	-6.64	2.01
	+30	120	3299.98121	-18.79	5.69
	+40	120	3299.96257	-37.43	11.34
	+50	120	3299.94308	-56.92	17.25
3499	-30	120	3498.94991	-50.09	14.32
	-20	120	3498.97492	-25.08	7.17
	-10	120	3498.98960	-10.40	2.97
	+0	120	3498.99829	-1.71	0.49
	+10	120	3499.00072	+0.72	0.21
	+20	120	3498.99260	-7.40	2.11
	+30	120	3498.98017	-19.83	5.67
	+40	120	3498.96003	-39.97	11.42
	+50	120	3498.94031	-59.69	17.06
Maximum Frequency Drift with respect to the nominal frequency		-53.76 kHz, -17.34 ppm			

3101 MHz Frequency Error -30°C



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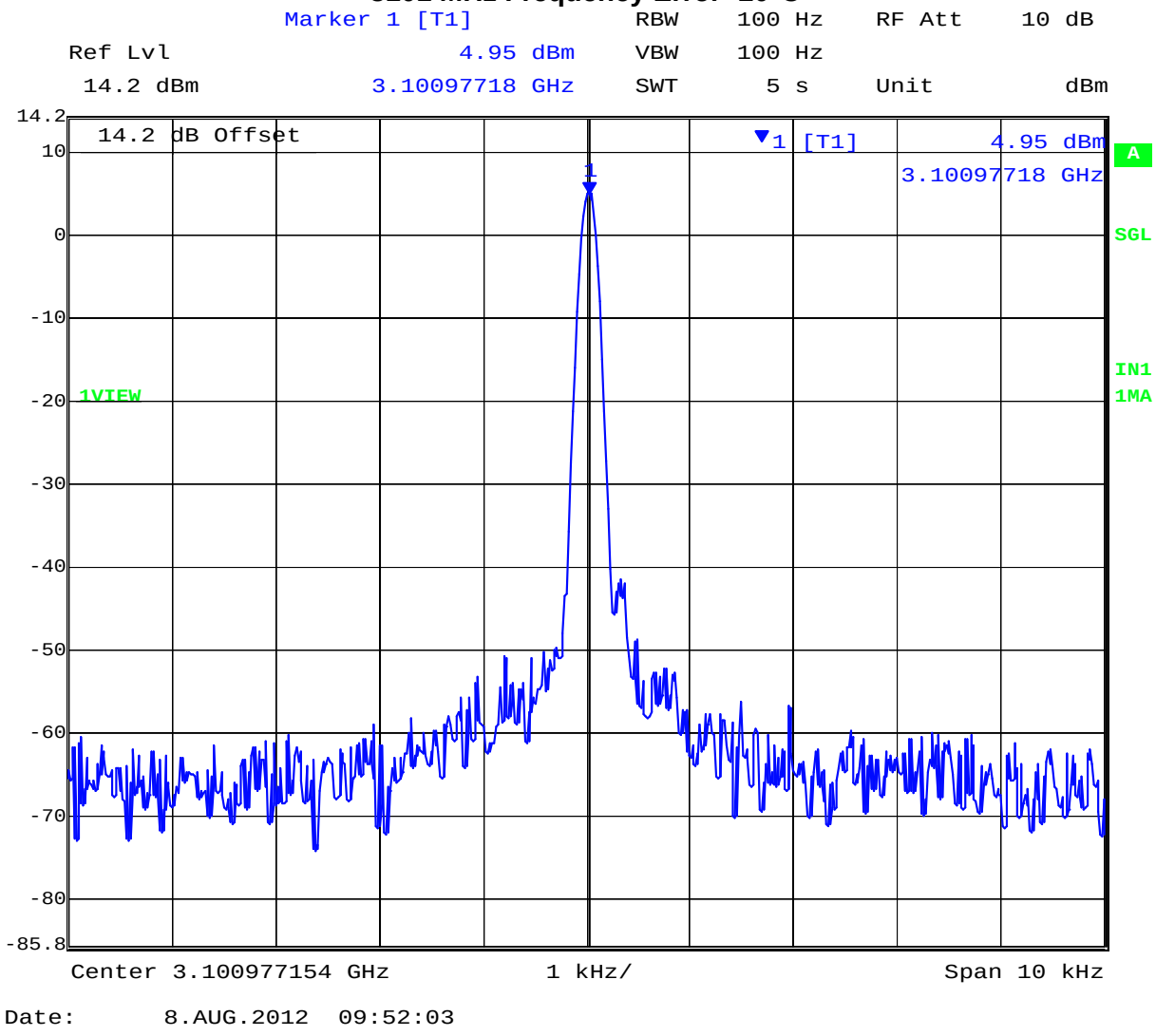

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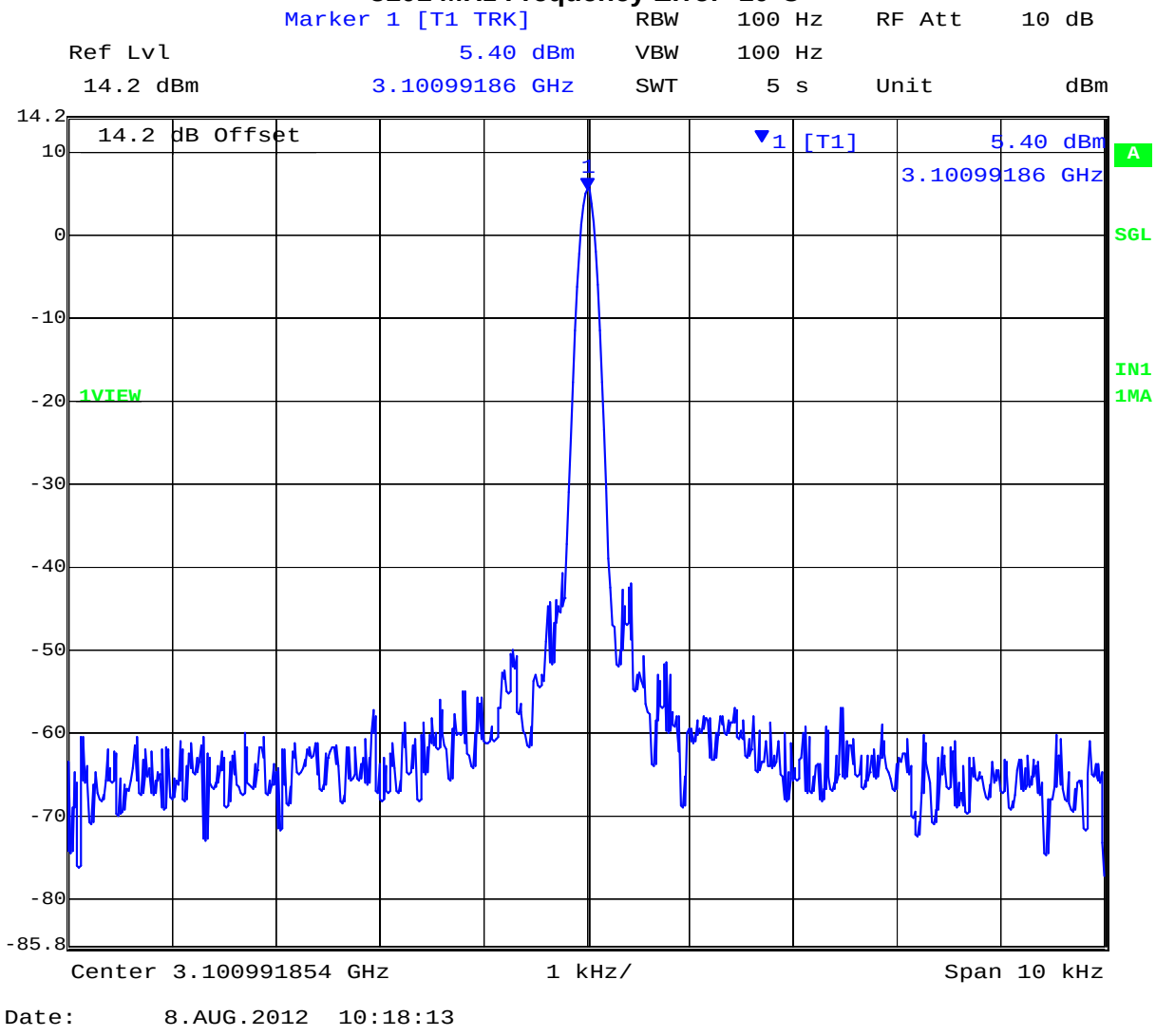

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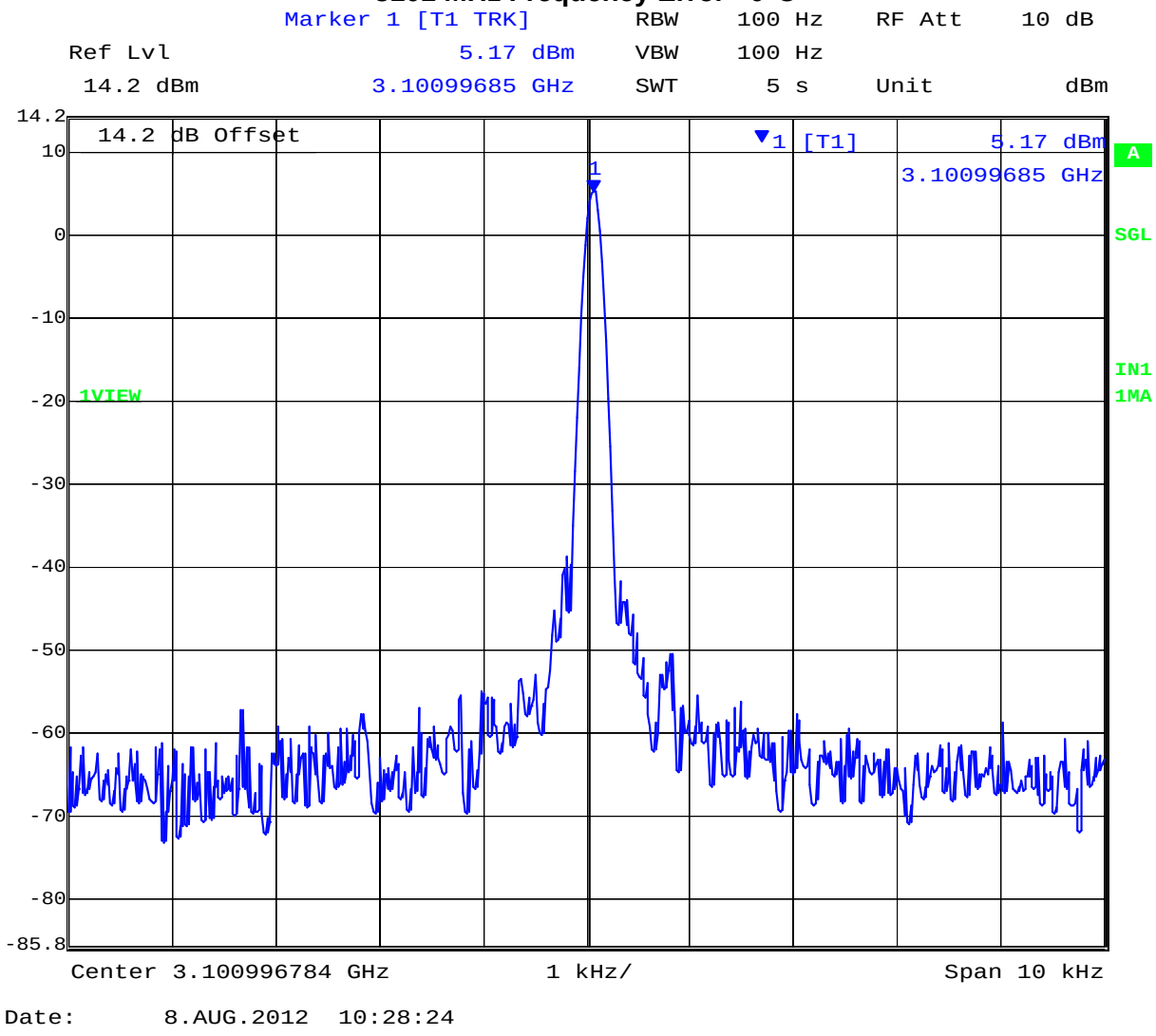

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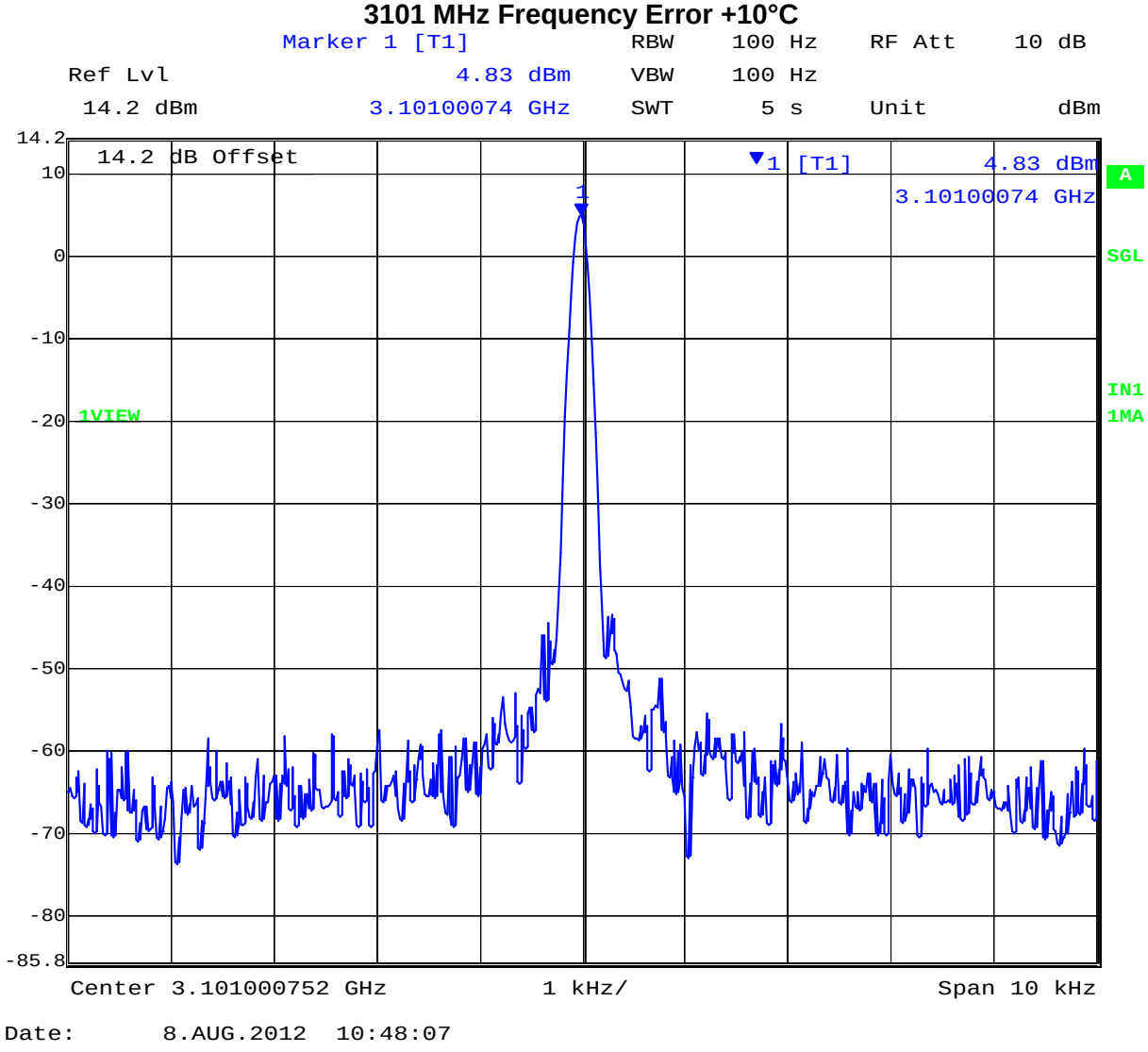

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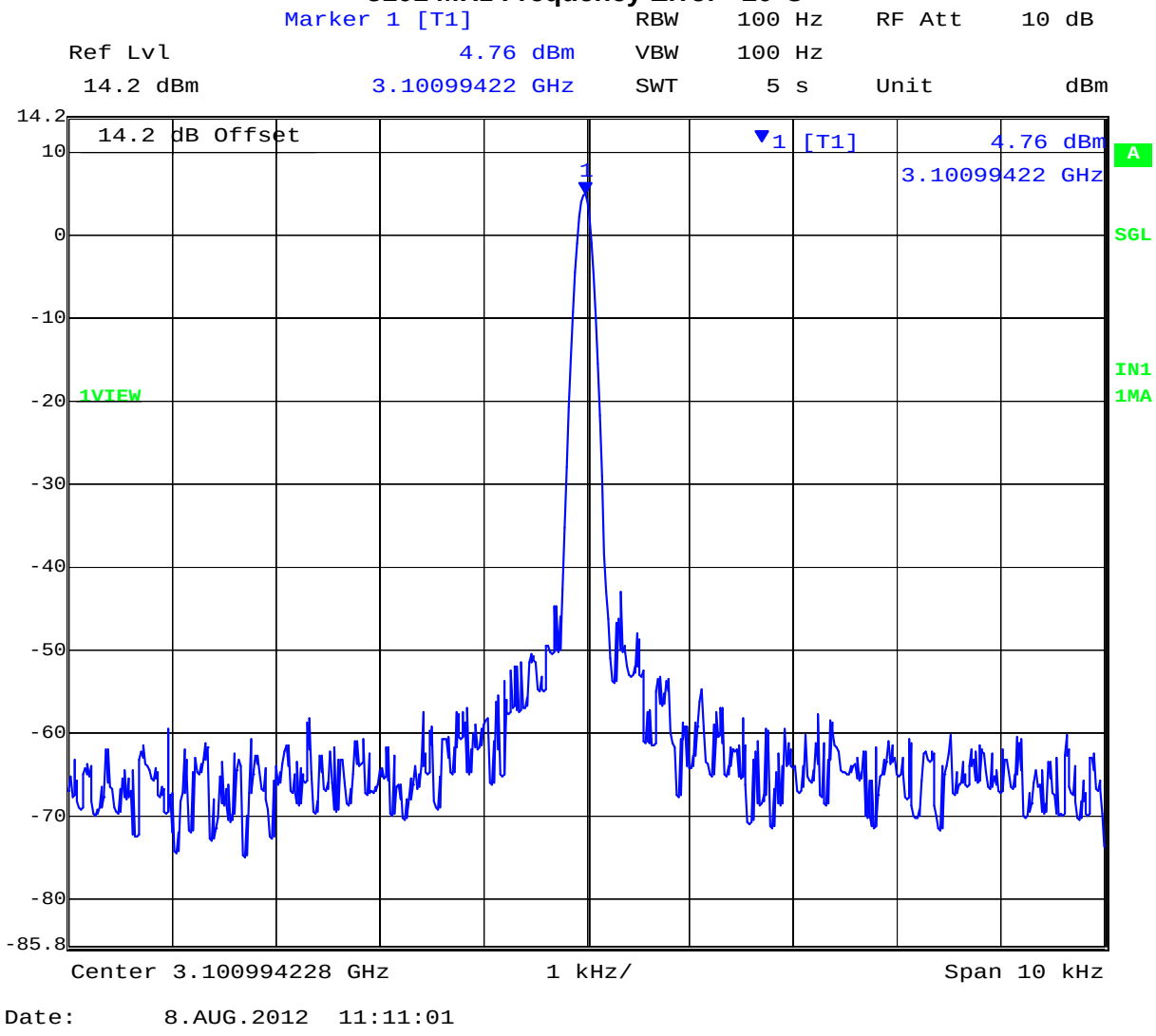

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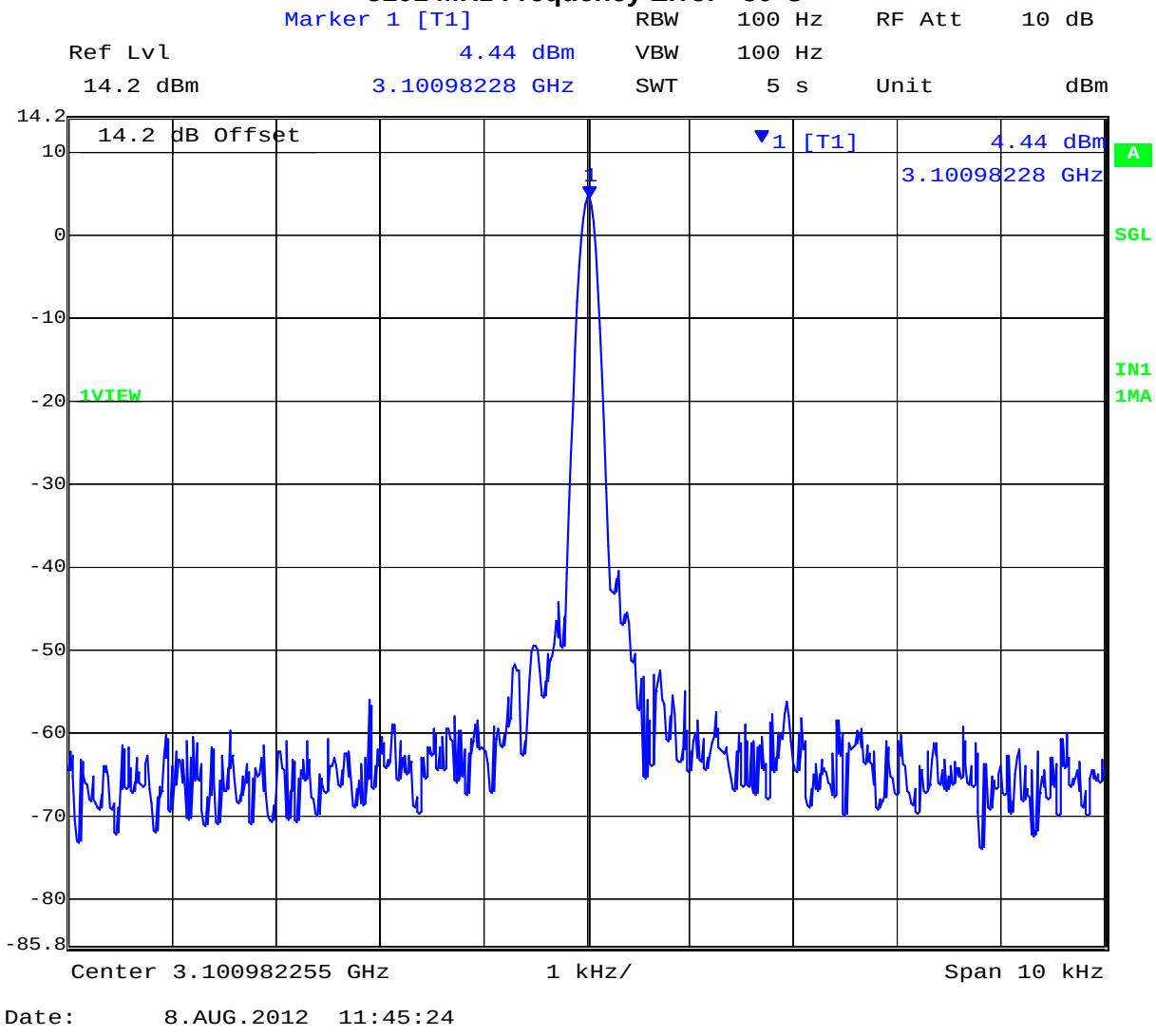

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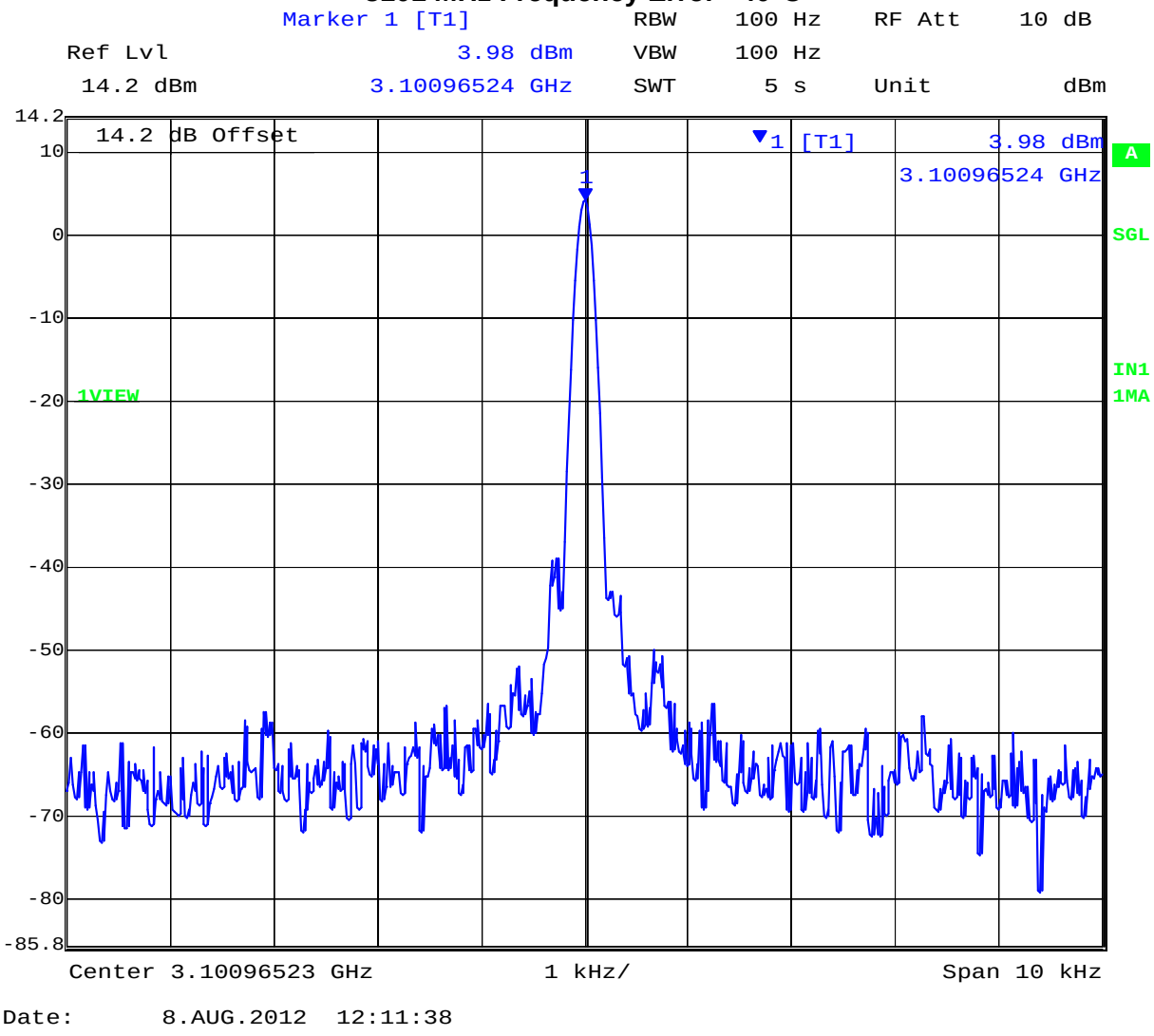

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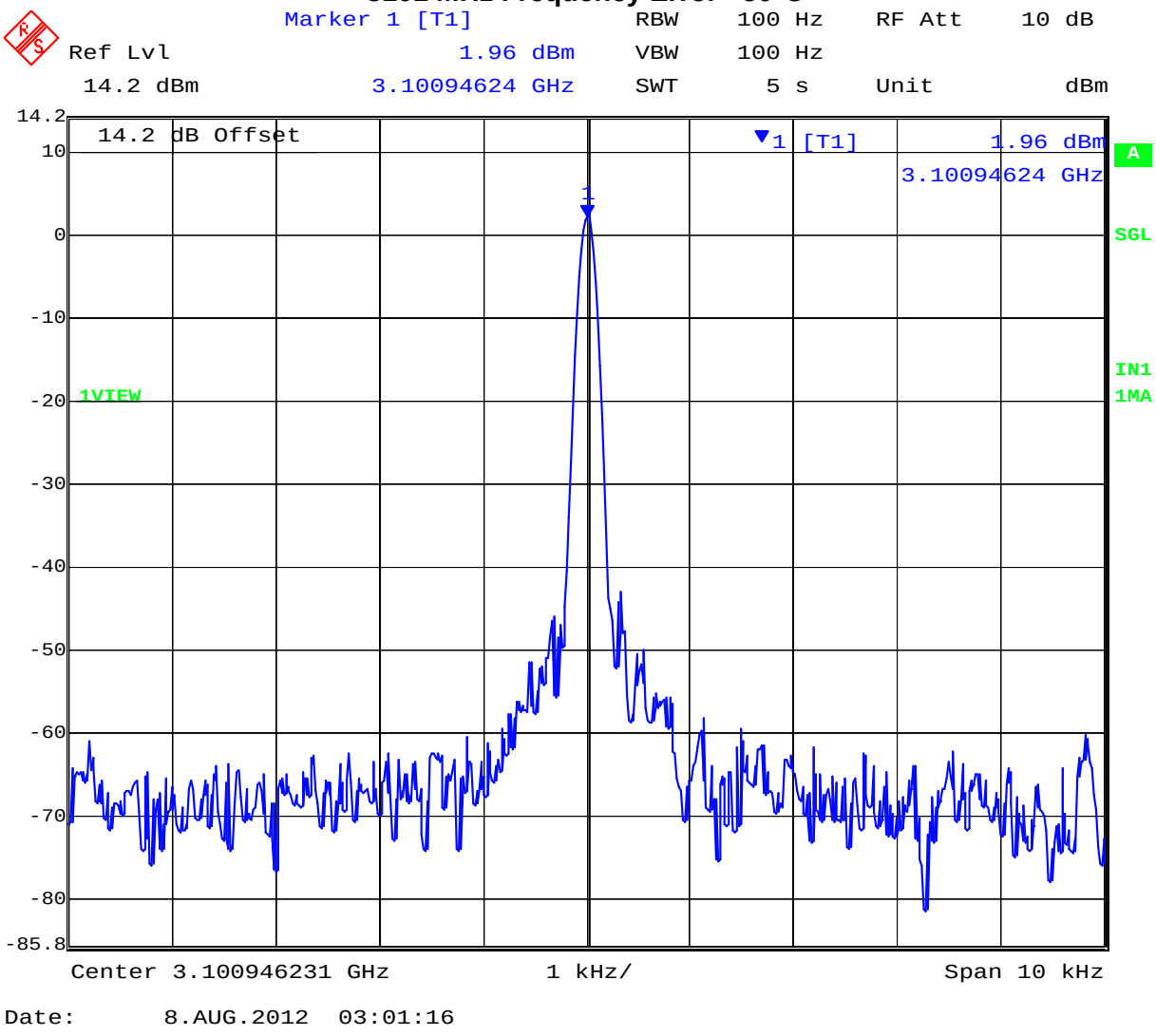

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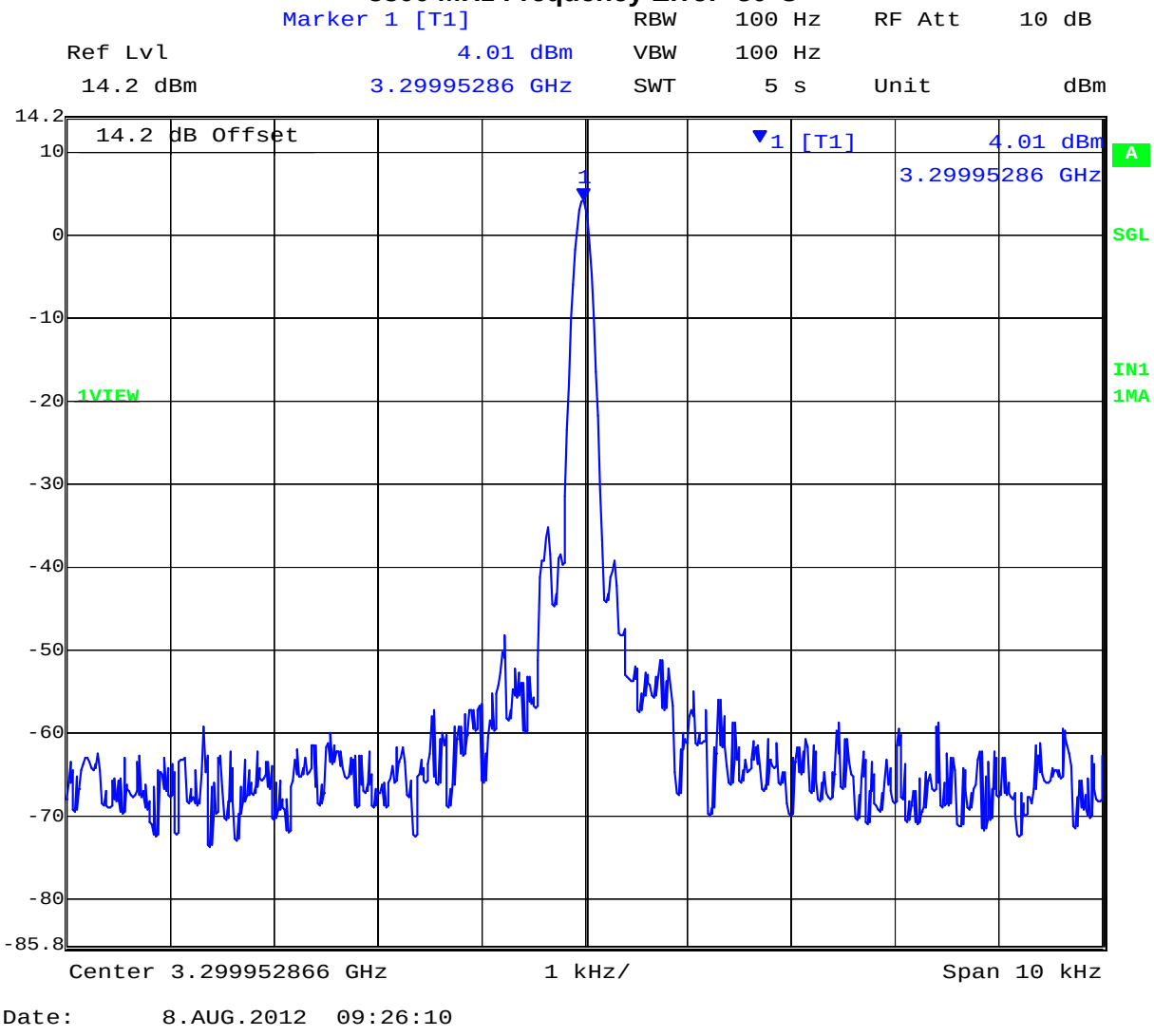

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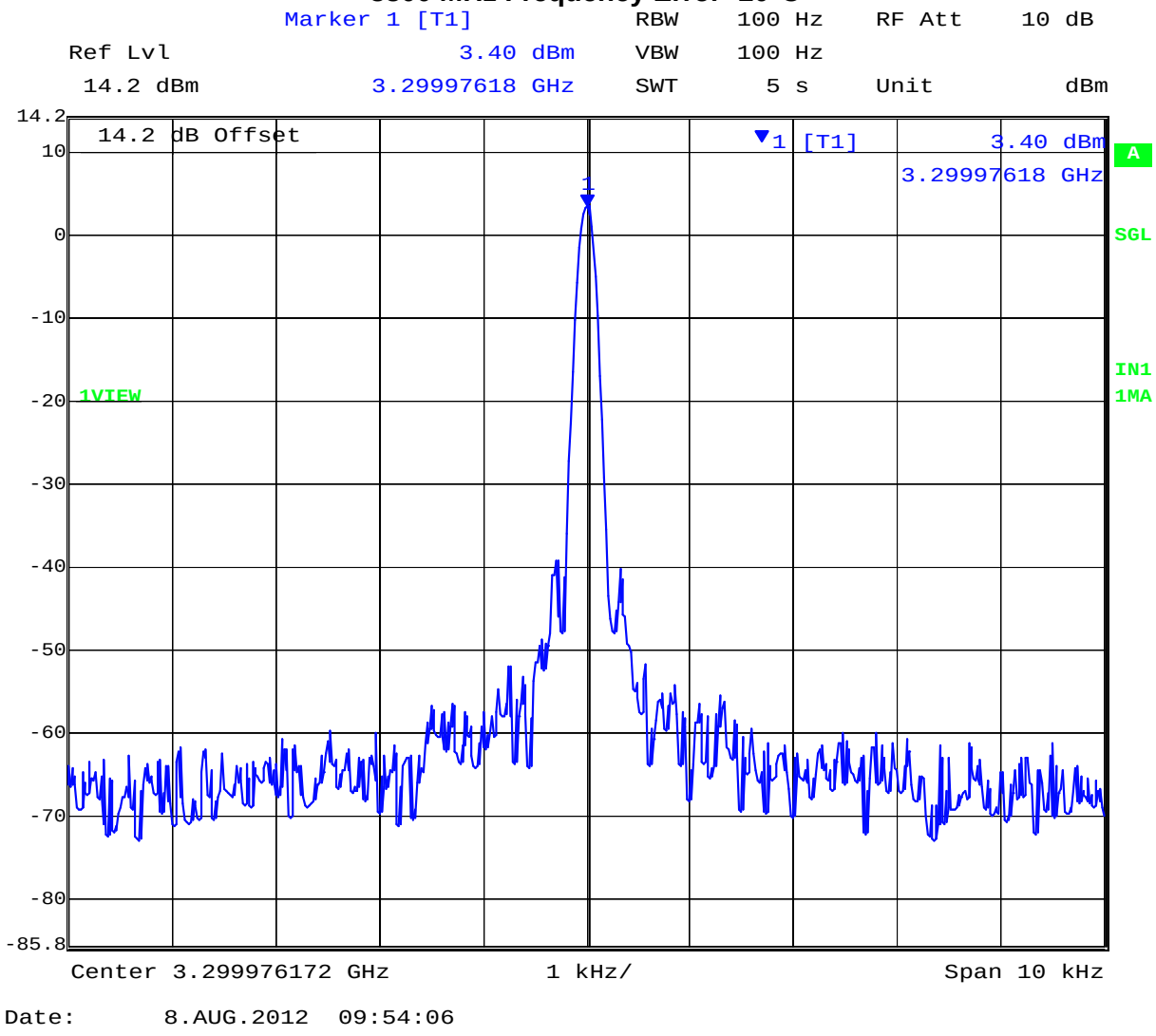

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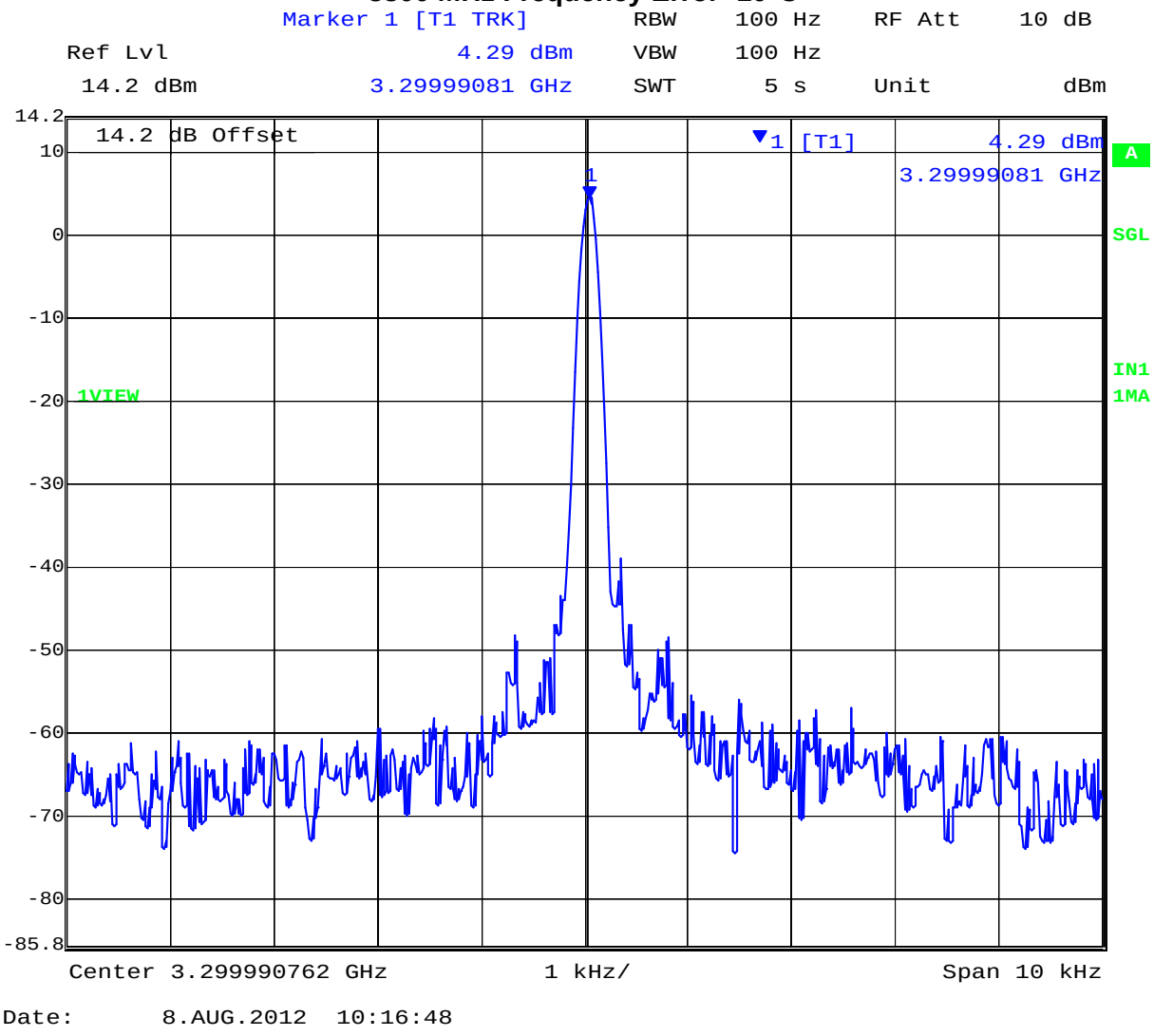

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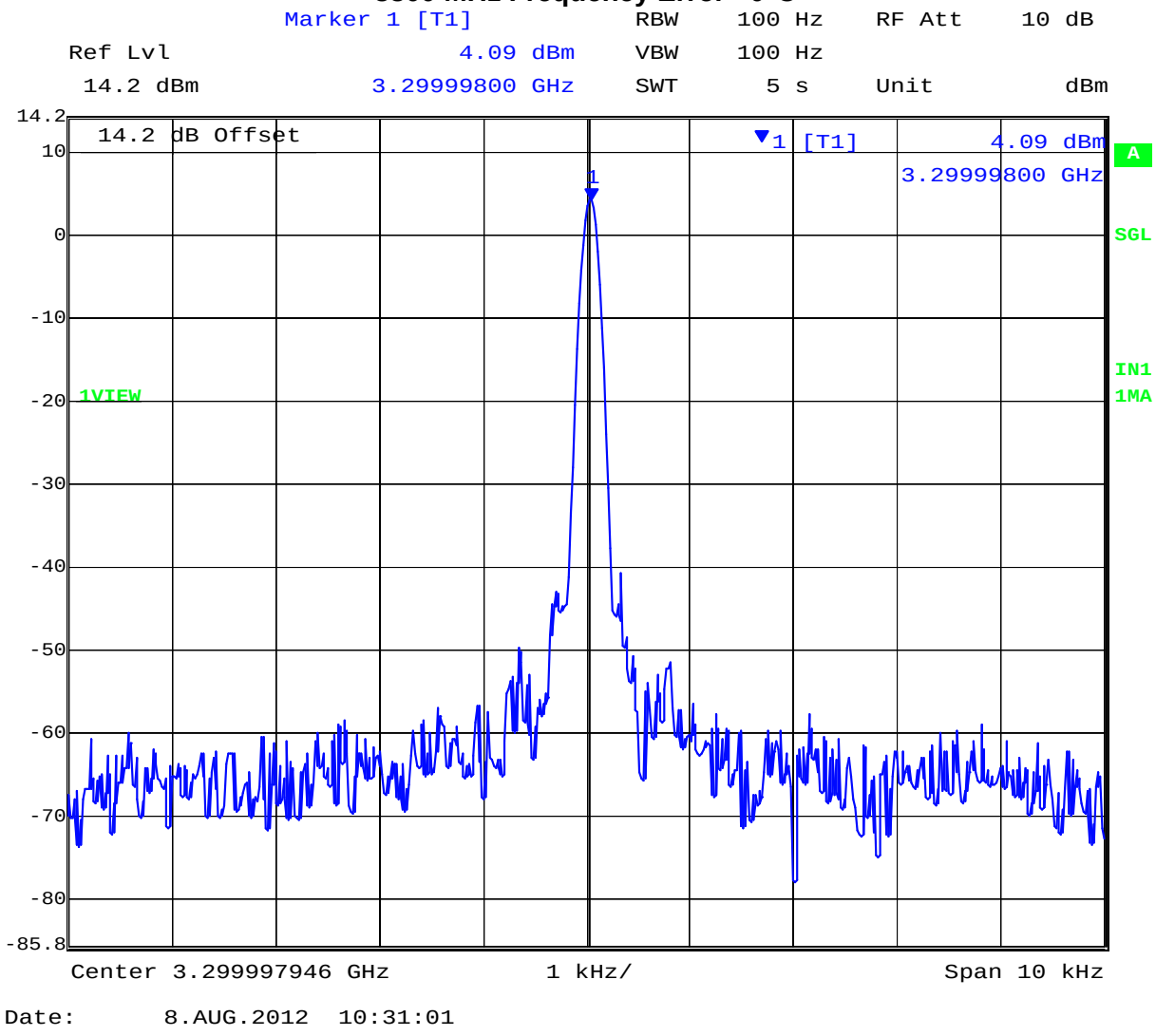

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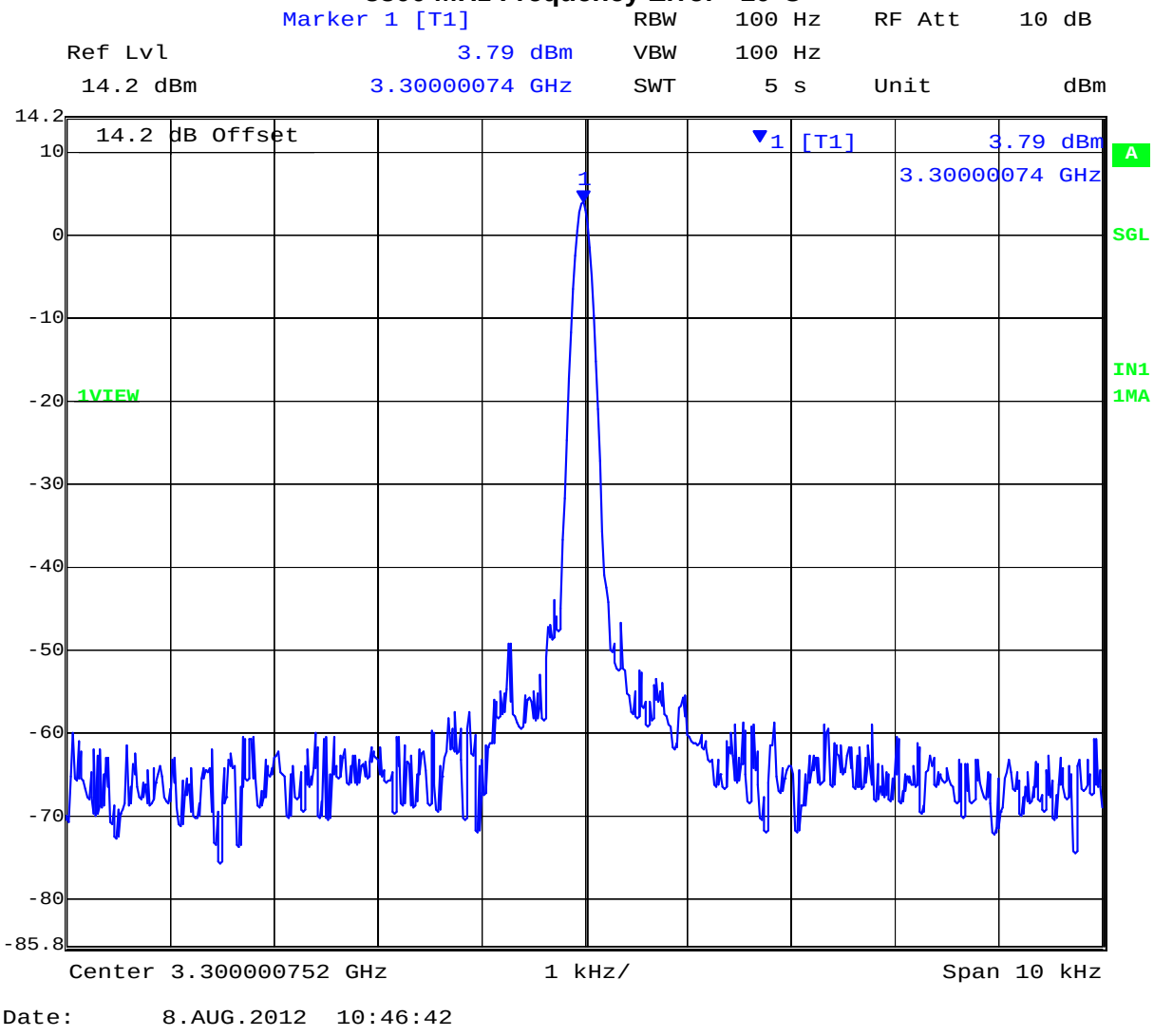

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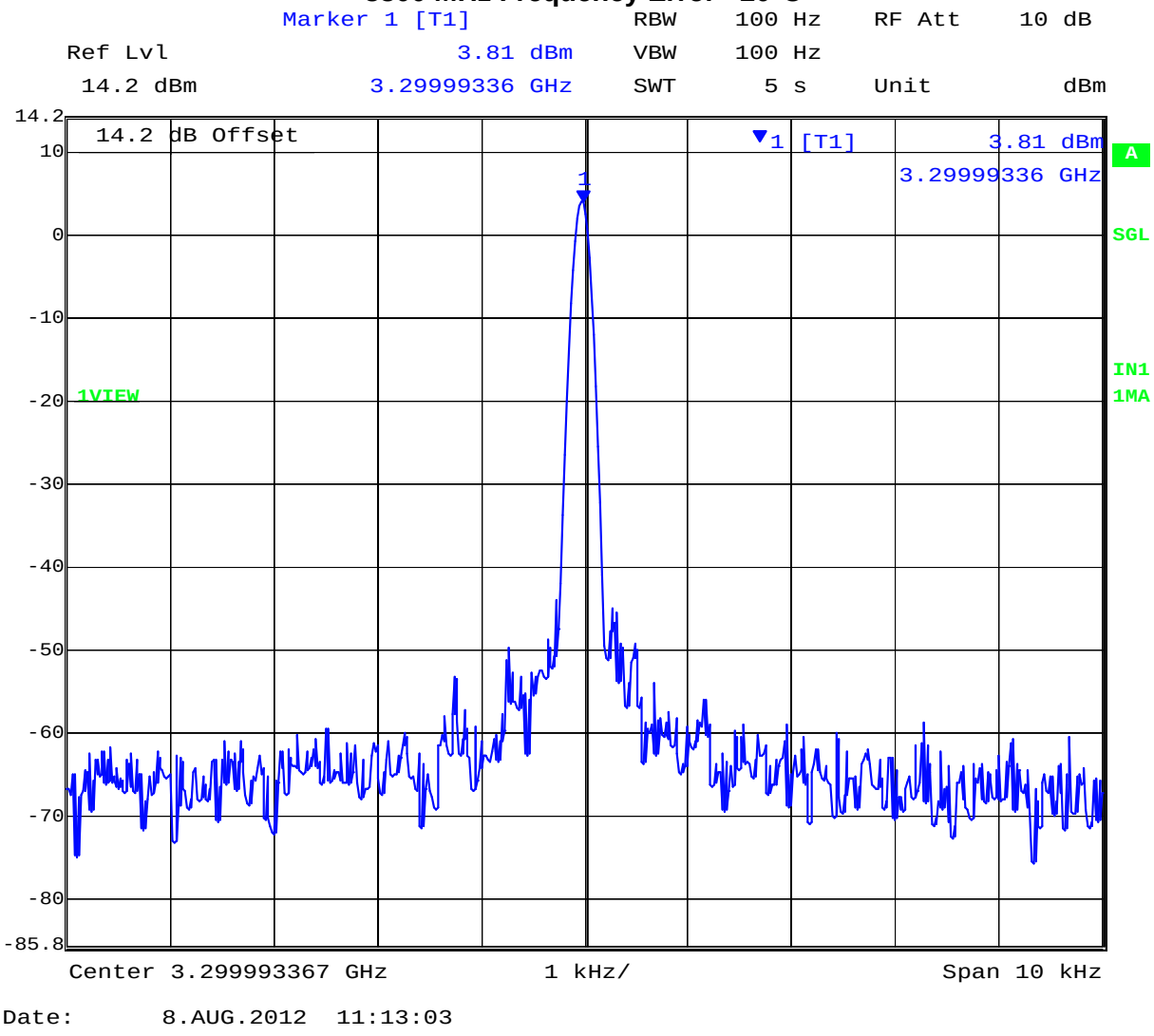

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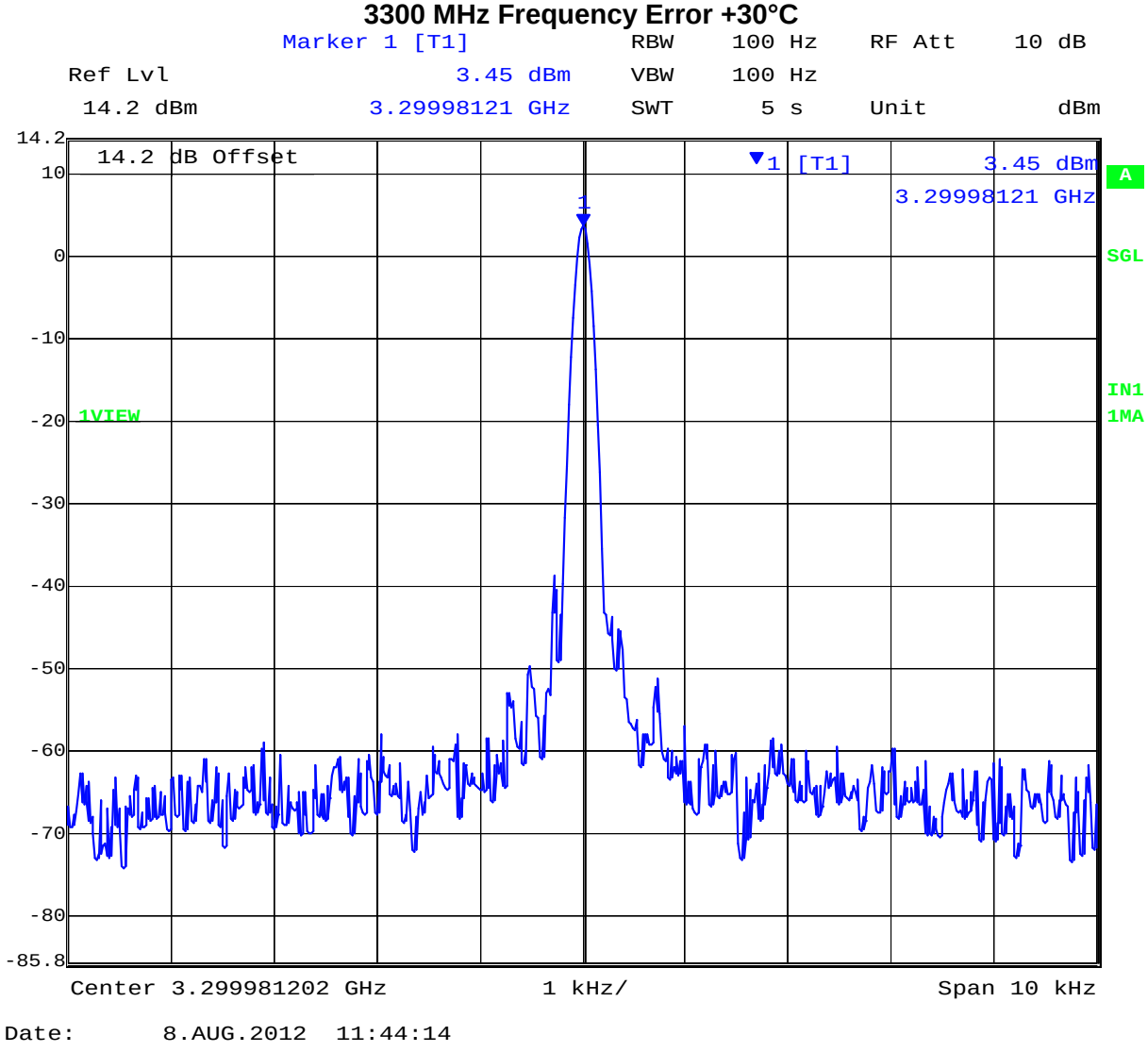

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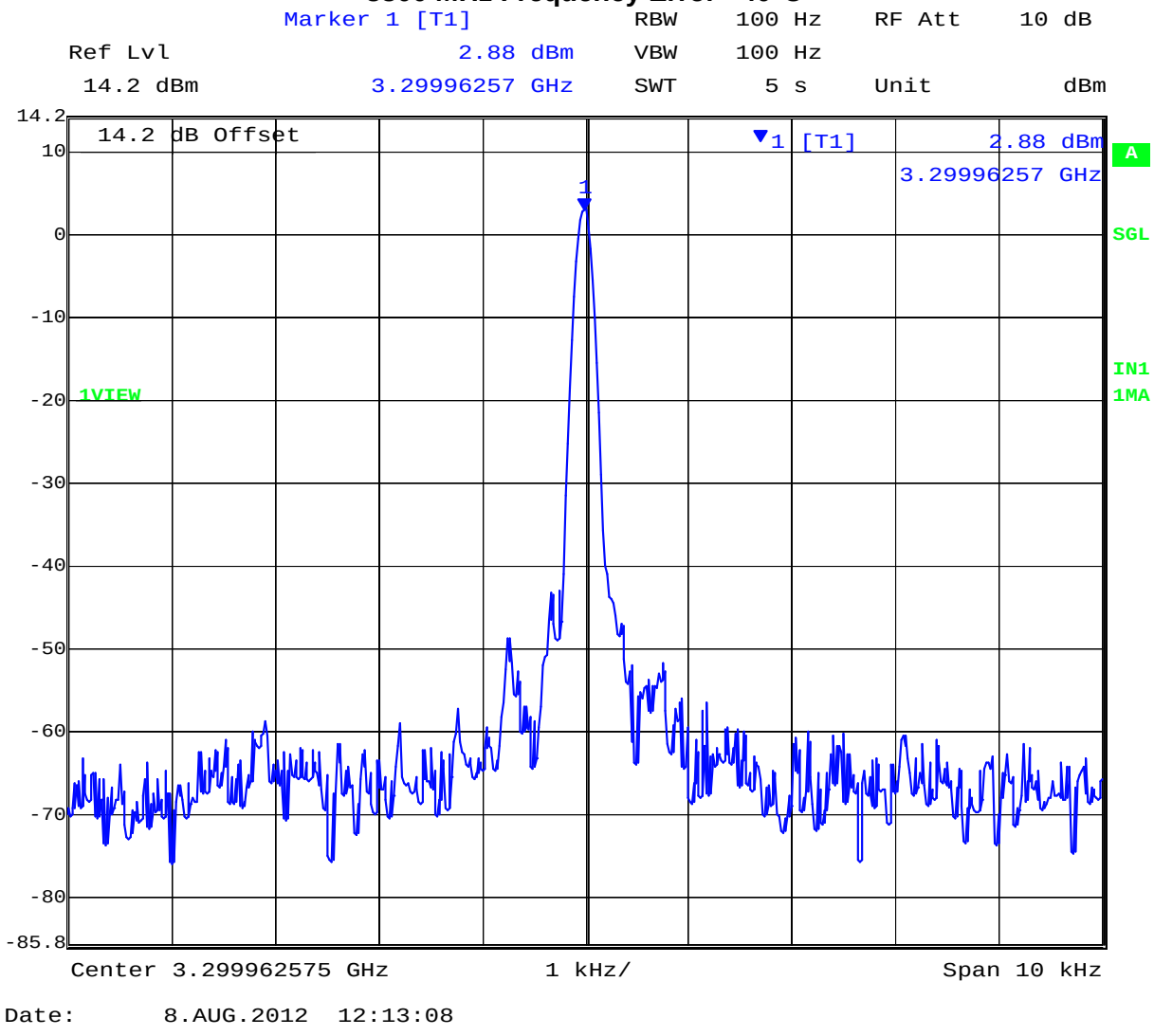

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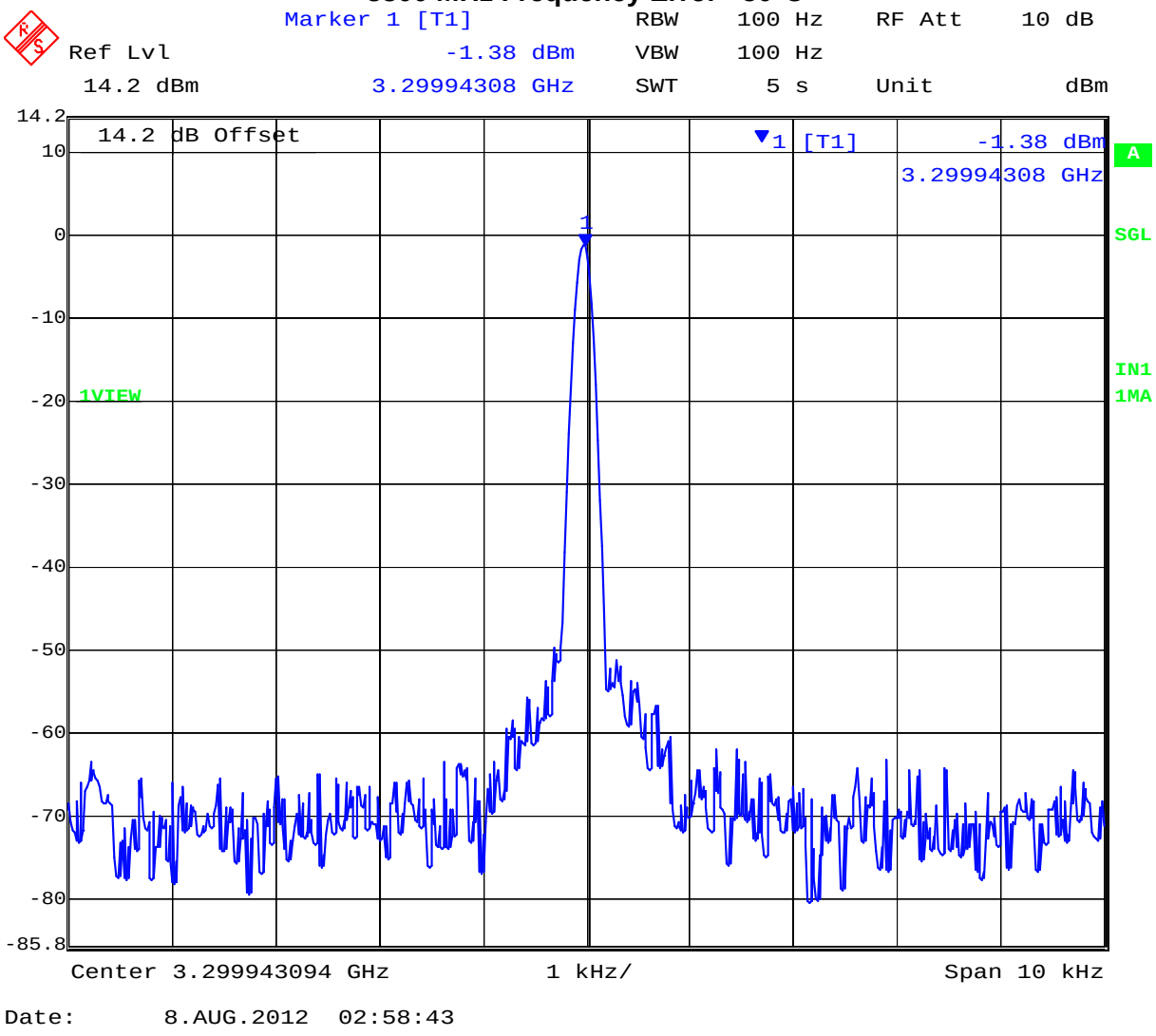

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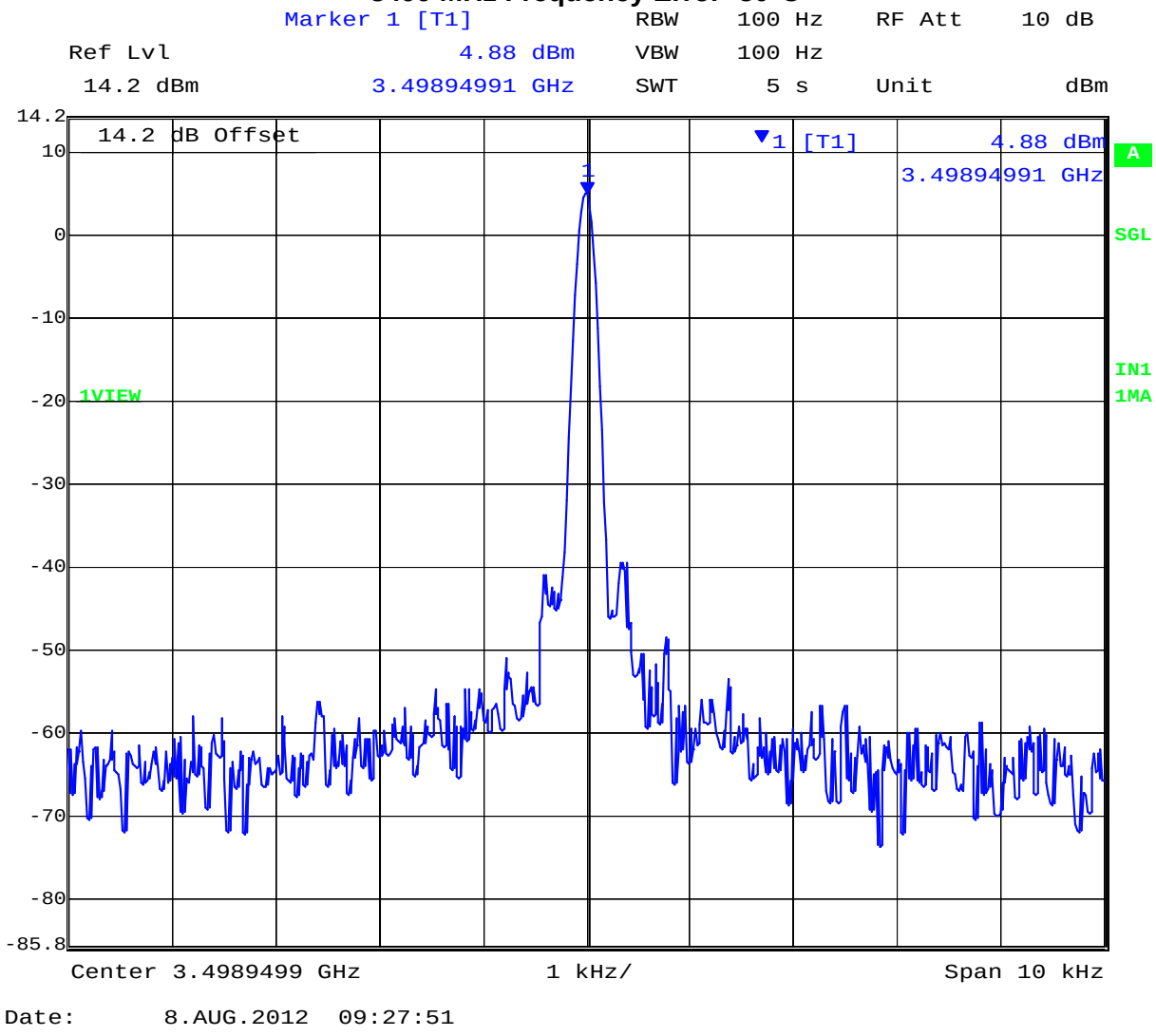

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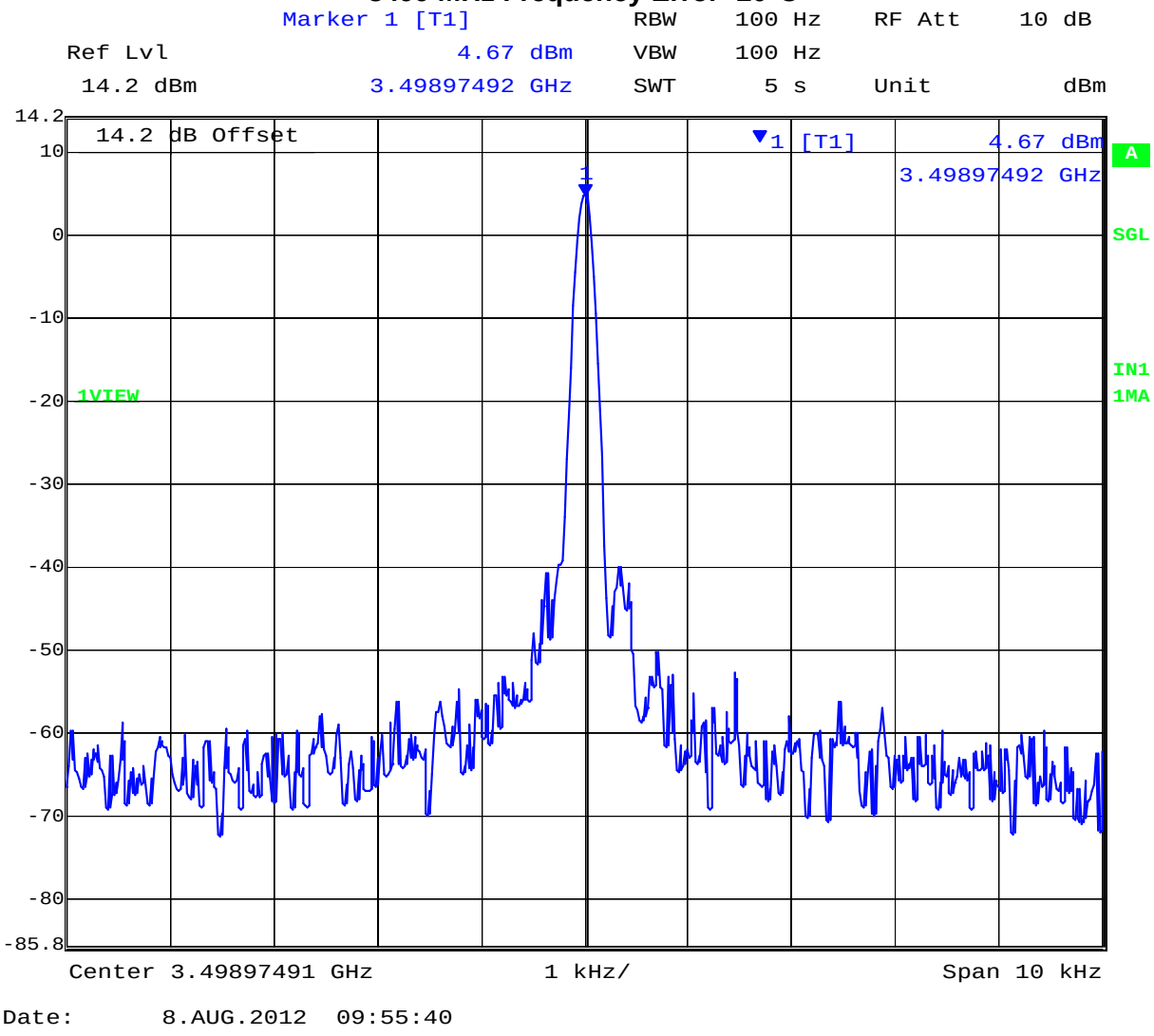

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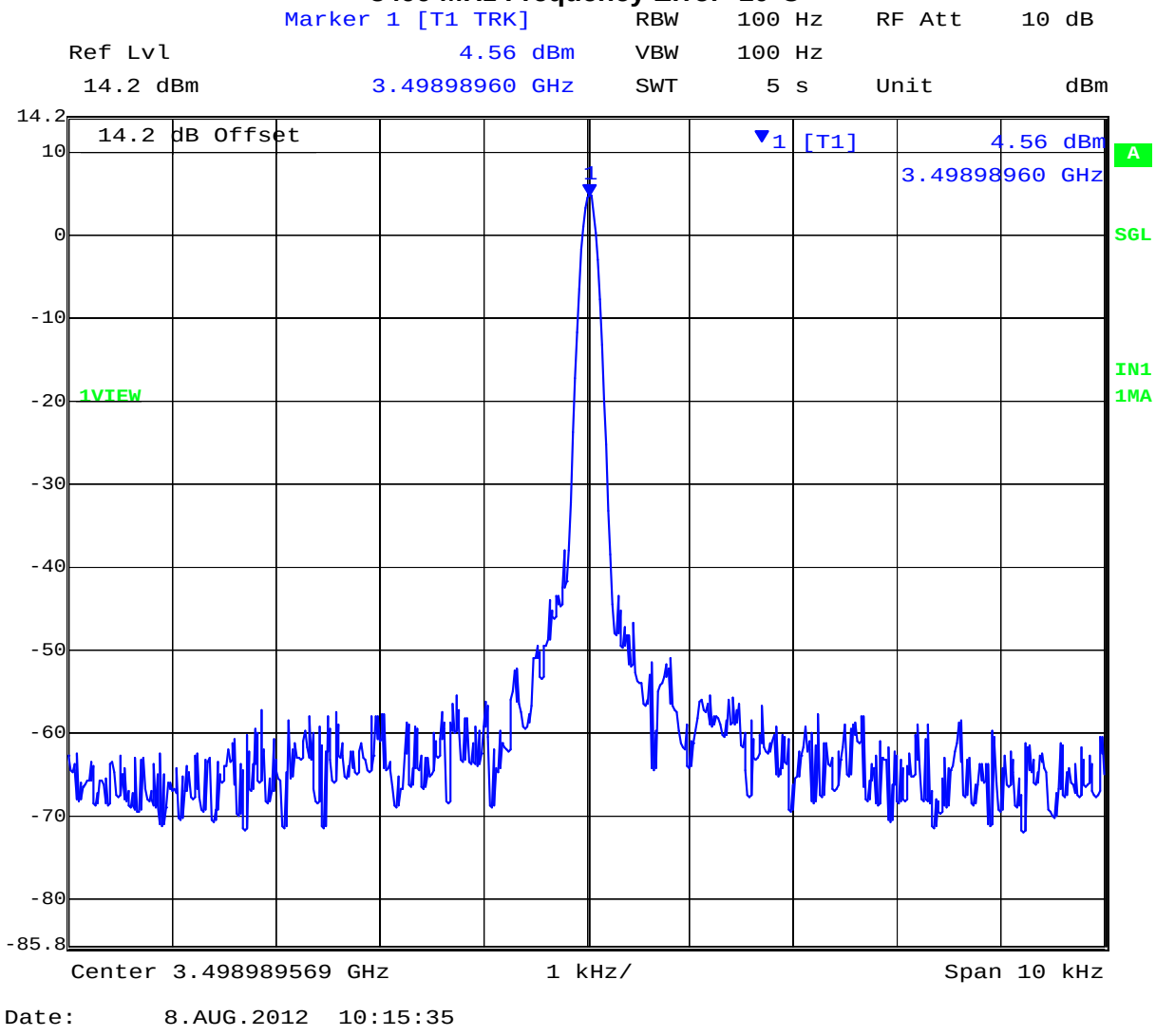

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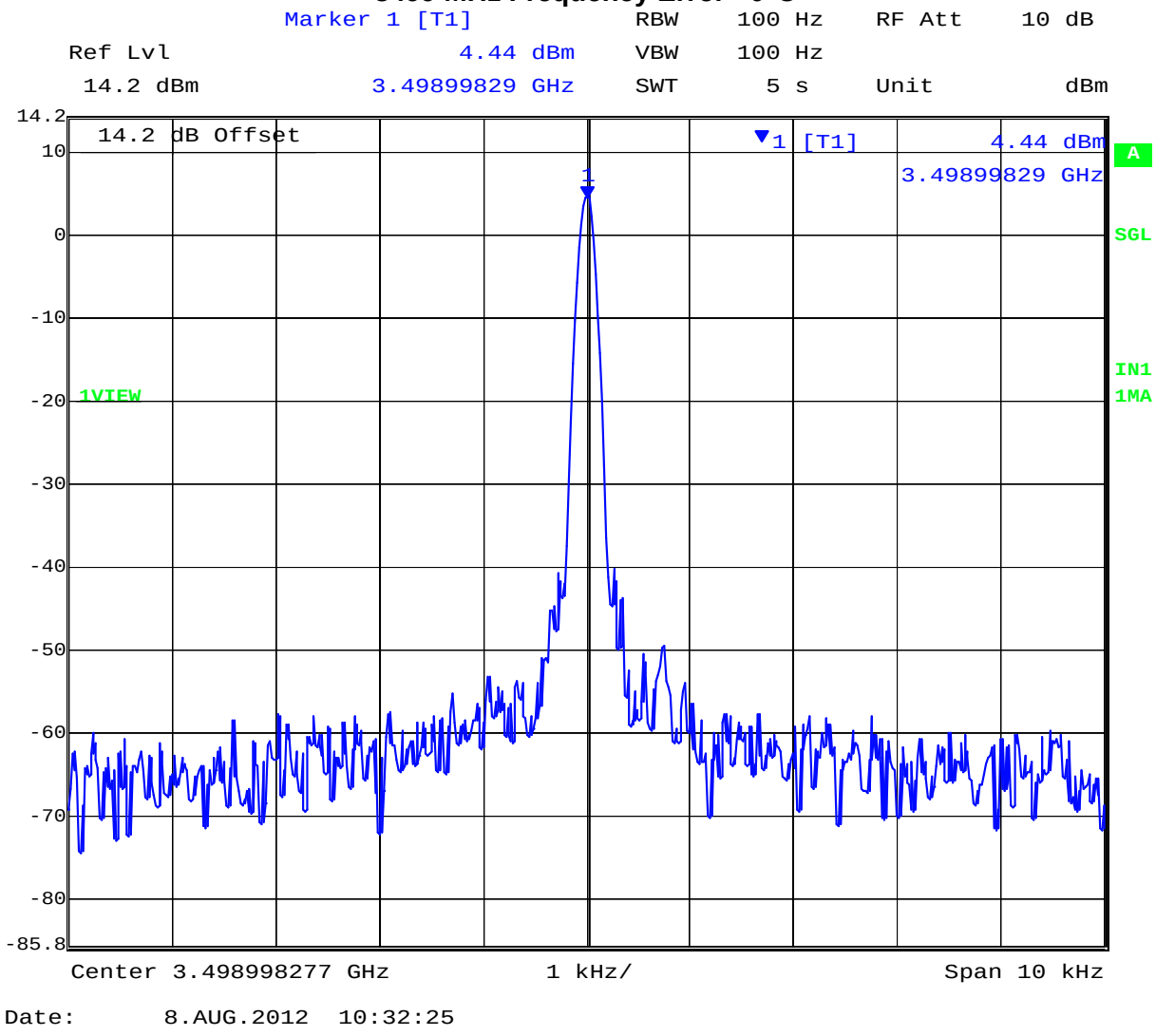

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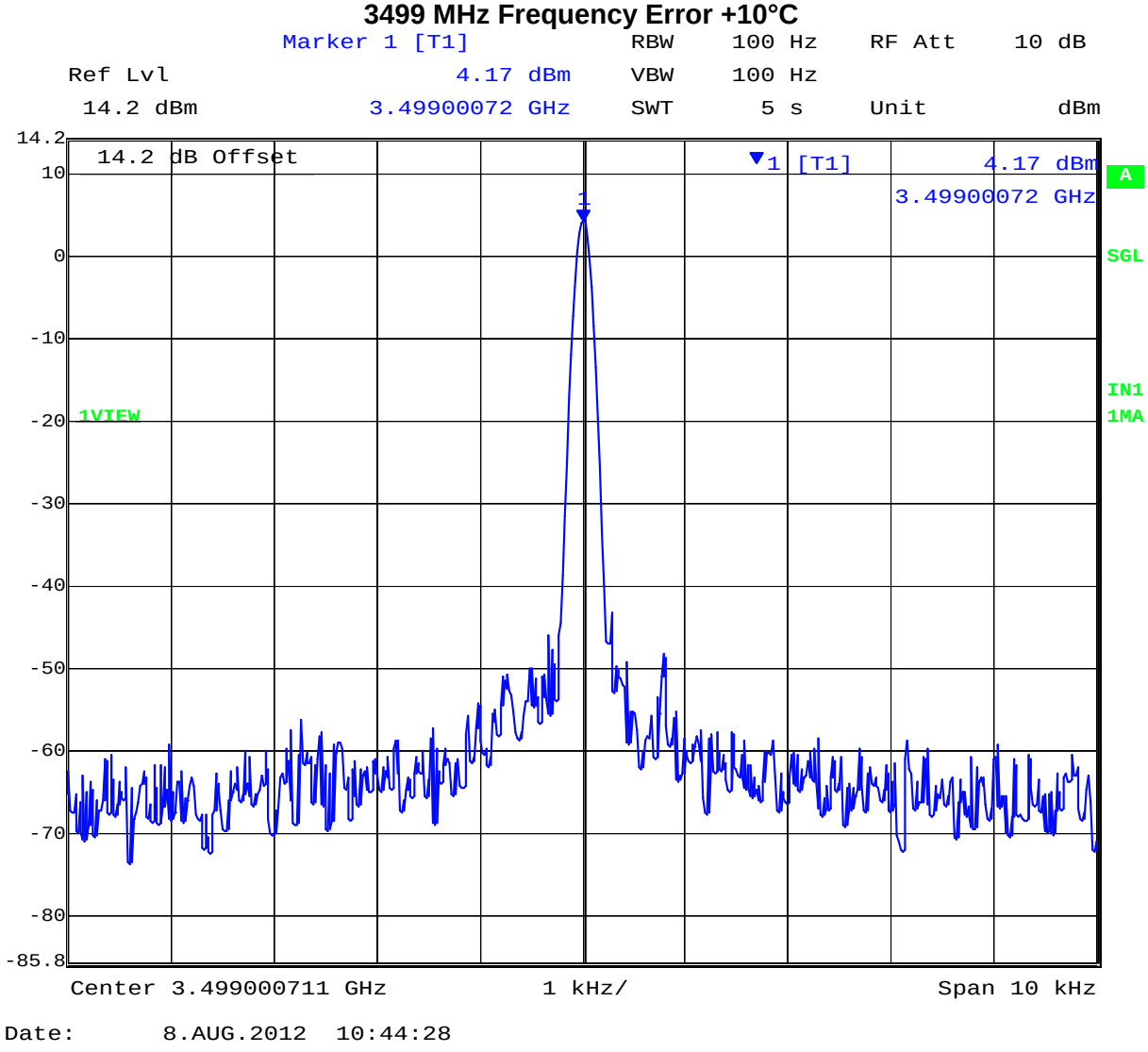

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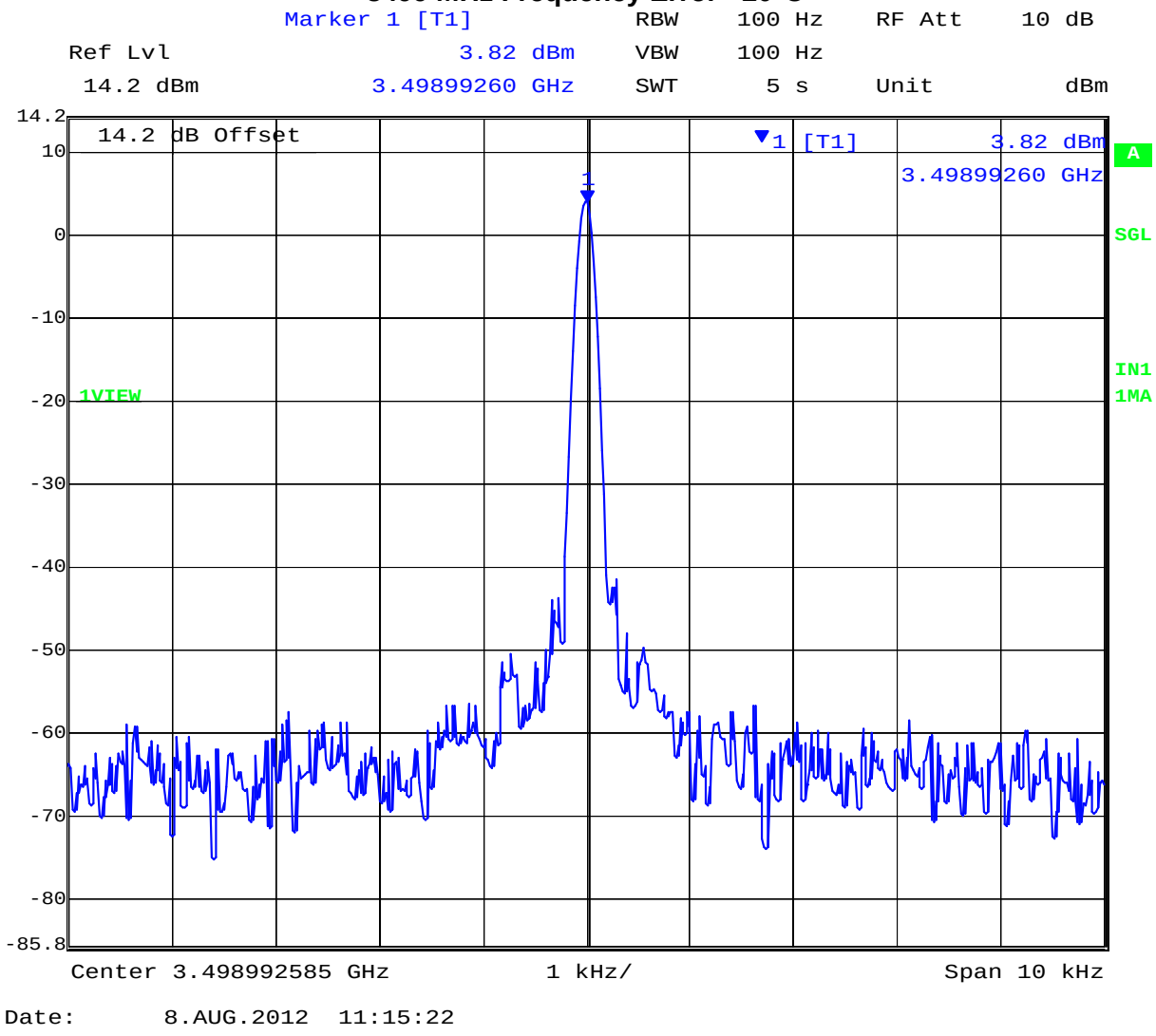

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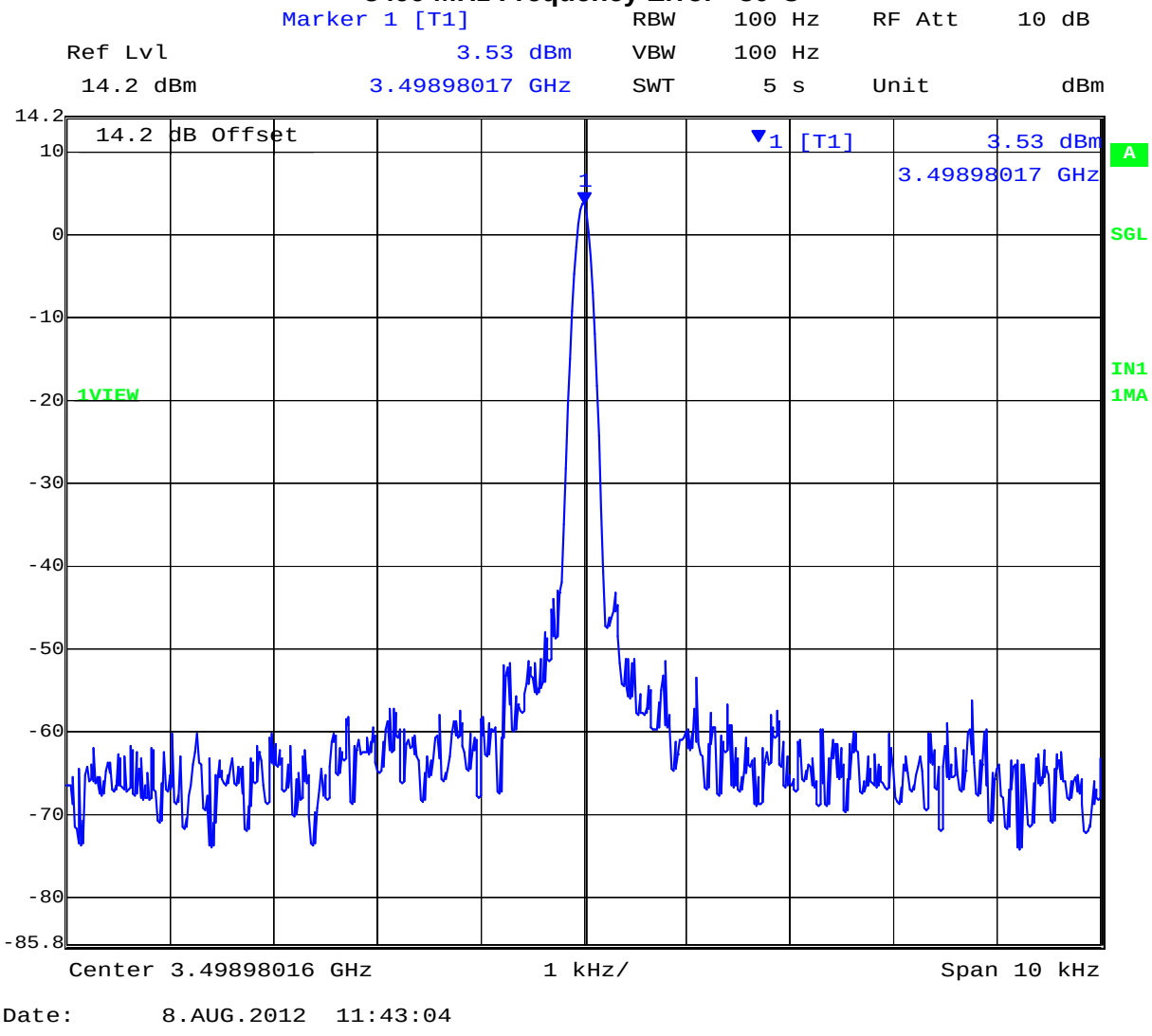

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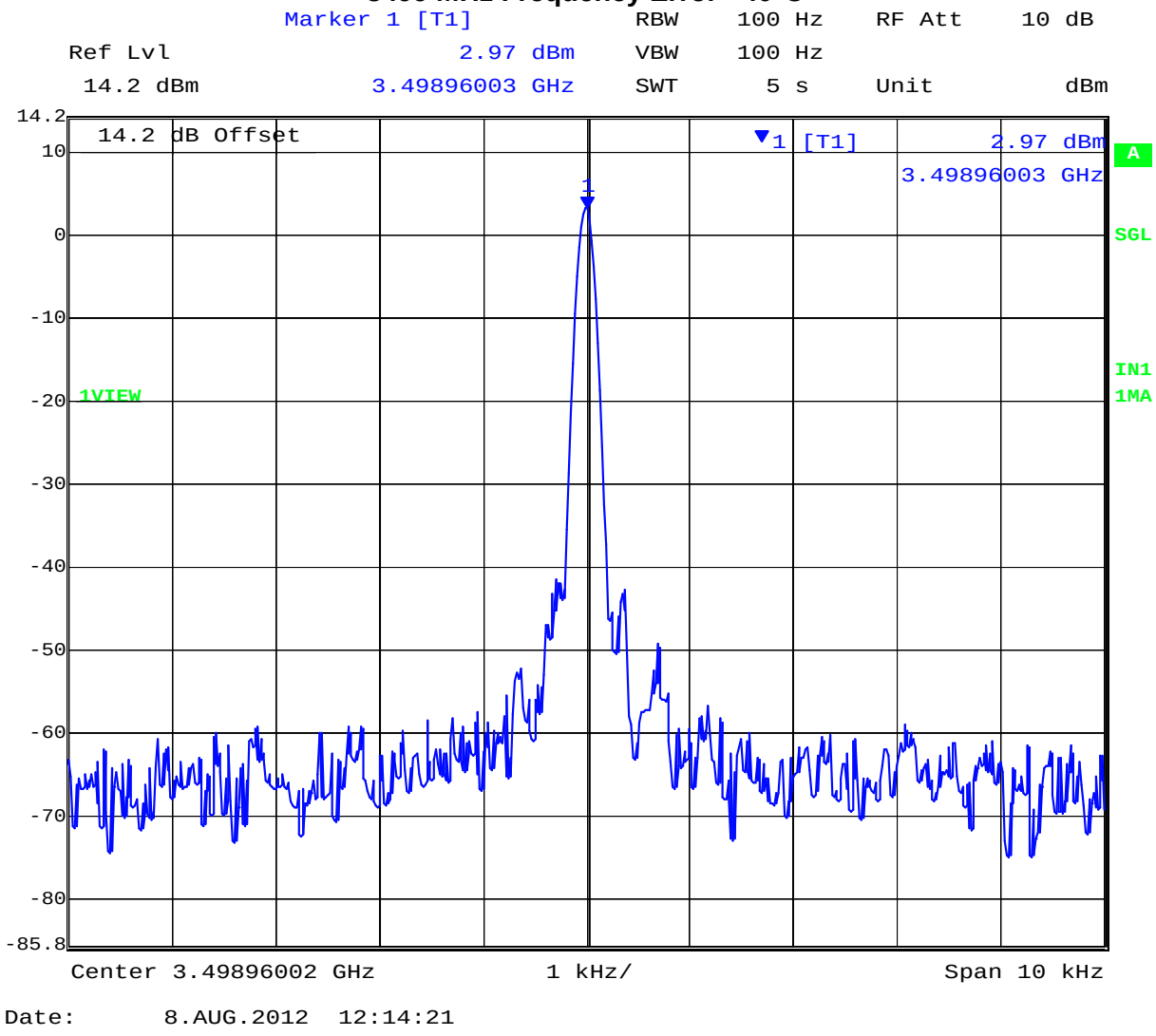

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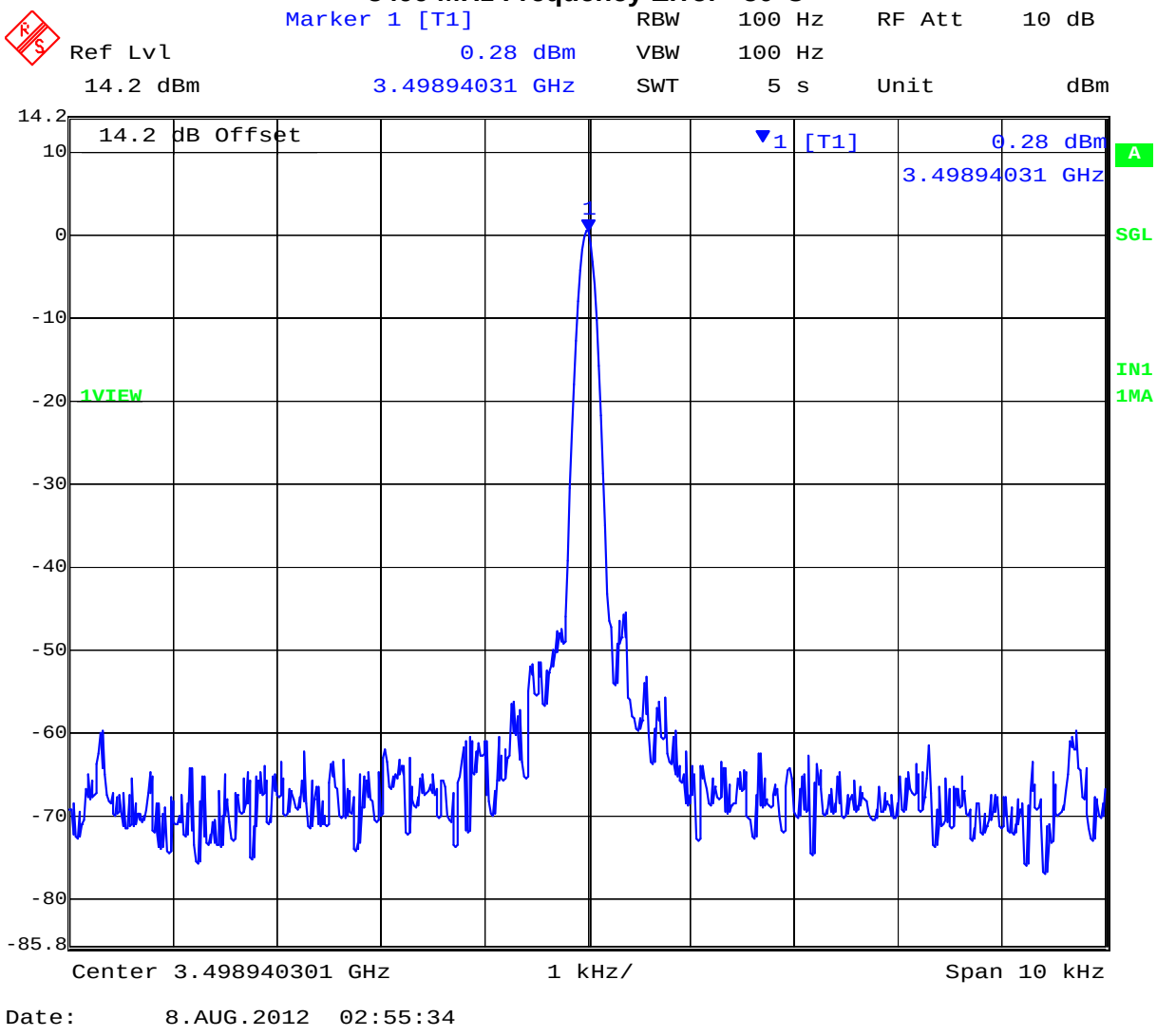


Specification

Limits

§ 90.213 Frequency stability.

Minimum Frequency Stability

[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3]100	100	200
25–50	20	20	50
72–76	5		50
150–174	[5,11]5	[6]5	[4,6]50
216–220	1.0		1.0
220–222[12]	0.1	1.5	1.5
421–512	[7,11,14]2.5	[8]5	[8]5
806–809	[14]1.0	1.5	1.5
809–824	[14]1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	[14]0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928[13]	2.5	2.5	2.5
929–930	1.5		
935–940	0.1	1.5	1.5
1427–1435	[9]300	300	300
Above 2450[10]			

[10]Except for DSRCS equipment in the 5850–5925 MHz band, frequency stability is to be specified in the station authorization. Frequency stability for DSRCS equipment in the 5850–5925 MHz band is specified in subpart M of this part.

Laboratory Measurement Uncertainty for Frequency Stability

Measurement uncertainty	±0.866 ppm

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement'	0070, 0116, 0158, 0193, 0252, 0313, 0314.

5.1.2. Peak Output Power

FCC 47 CFR Part 90.205
DA 11-1870

Test Procedure
The transmitter terminal of EUT was connected to the input of an average power meter. Measurements were made while EUT was operating in a continuous transmission mode i.e. 100 % duty cycle at the appropriate center frequency. All cable losses and offsets were taken into consideration in the measured result.

Test Set-up is shown in Section 3.6 Test Configuration

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Channel Frequency (MHz)	Output Power (dBm)	EIRP (dBm)
3101	4.68	15.48
3300	3.97	14.77
3499	3.74	14.54

Specification

Limits

§ 90.205 Power and Antenna Height Limits

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation. Except where otherwise specifically provided for, the maximum power that will be authorized to applicants whose license applications for new stations are filed after August 18, 1995 is as follows:

DA 11-1870 Note 3

The device may not be mounted on a fixed outdoor structure.
the ASTIR transmits with a peak instantaneous power of 31.6 milliwatts (+15dBm)

Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	±1.33 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Output Power'	0070, 0116, 0158, 0193, 0252, 0313, 0314.

5.1.3. Spectrum Mask

CFR 47Part 90, §90.210 ; DA 11-1870

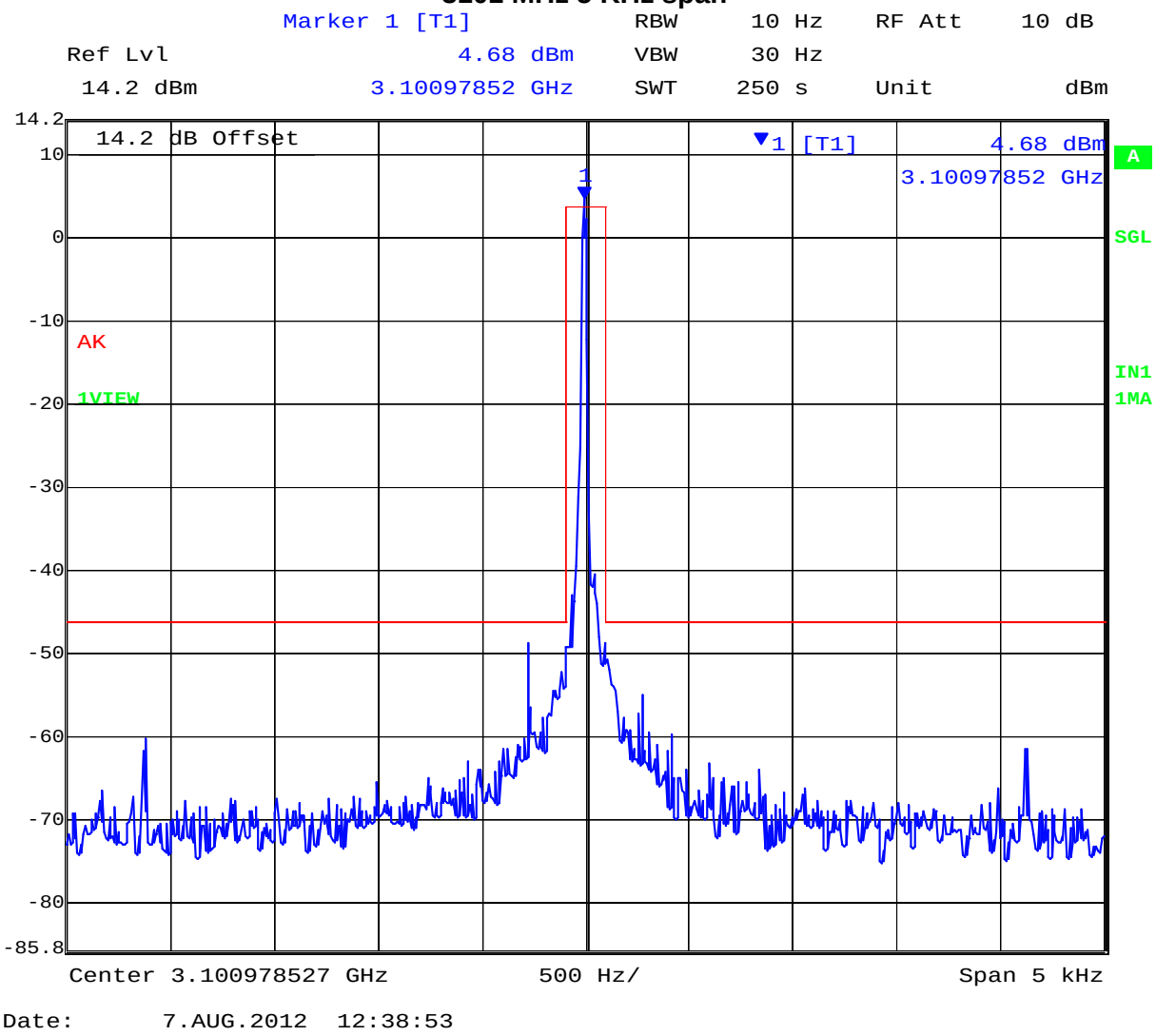
5.1.3.1. Spectrum Mask
Test Procedure

The transmitter spectrum mask was measured conductively at the antenna port for compliance with the limits as stated below. The EUT was set to transmit on low, mid and high channel frequencies and the spectrum MASK measured over 5 KHz and 21 KHz spans. Measurement were made while EUT was operating in an unmodulated(CW) transmit mode of operation, at the appropriate center frequency.

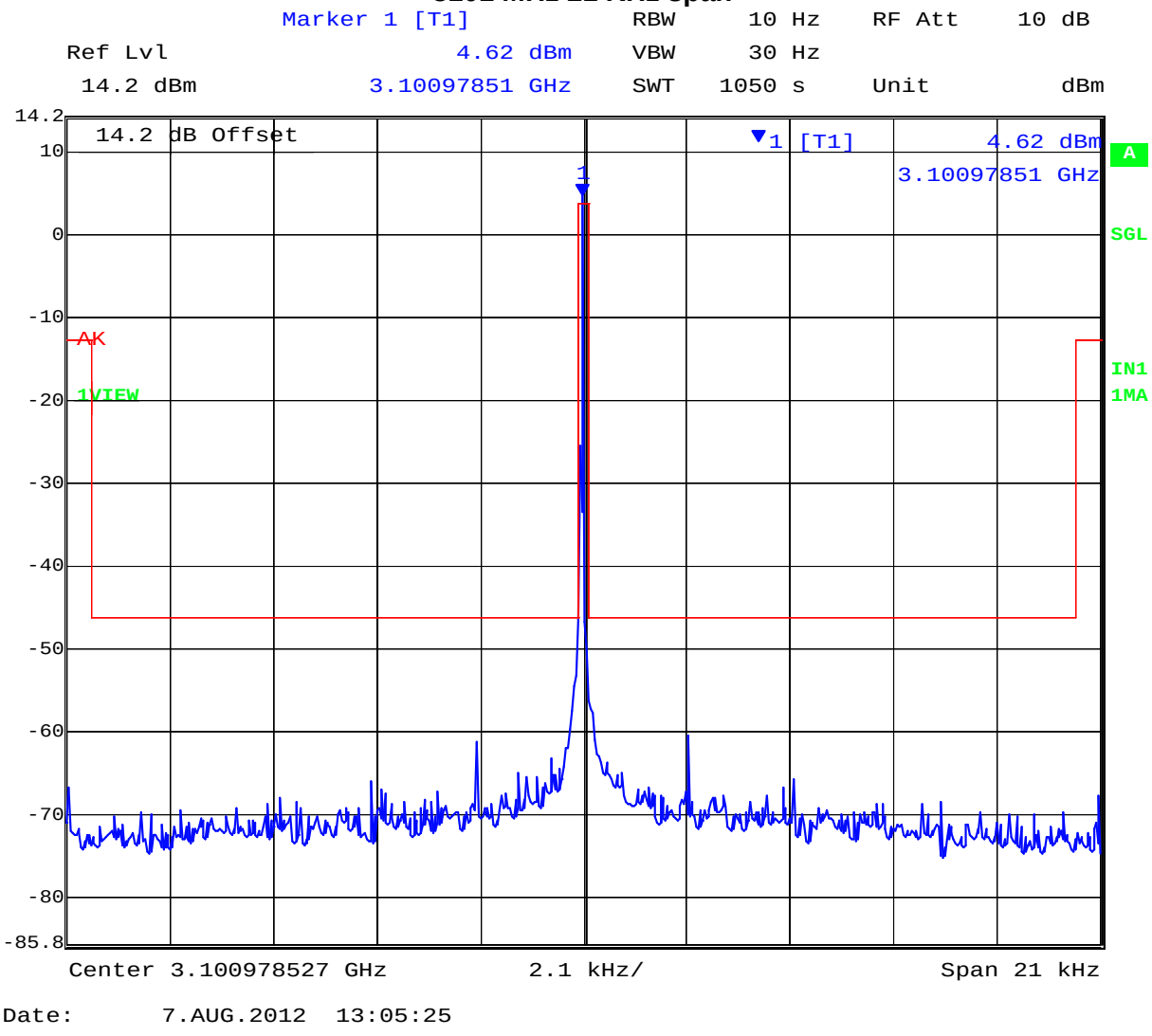
Test Set-up is shown in Section 3.6 Test Configuration

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

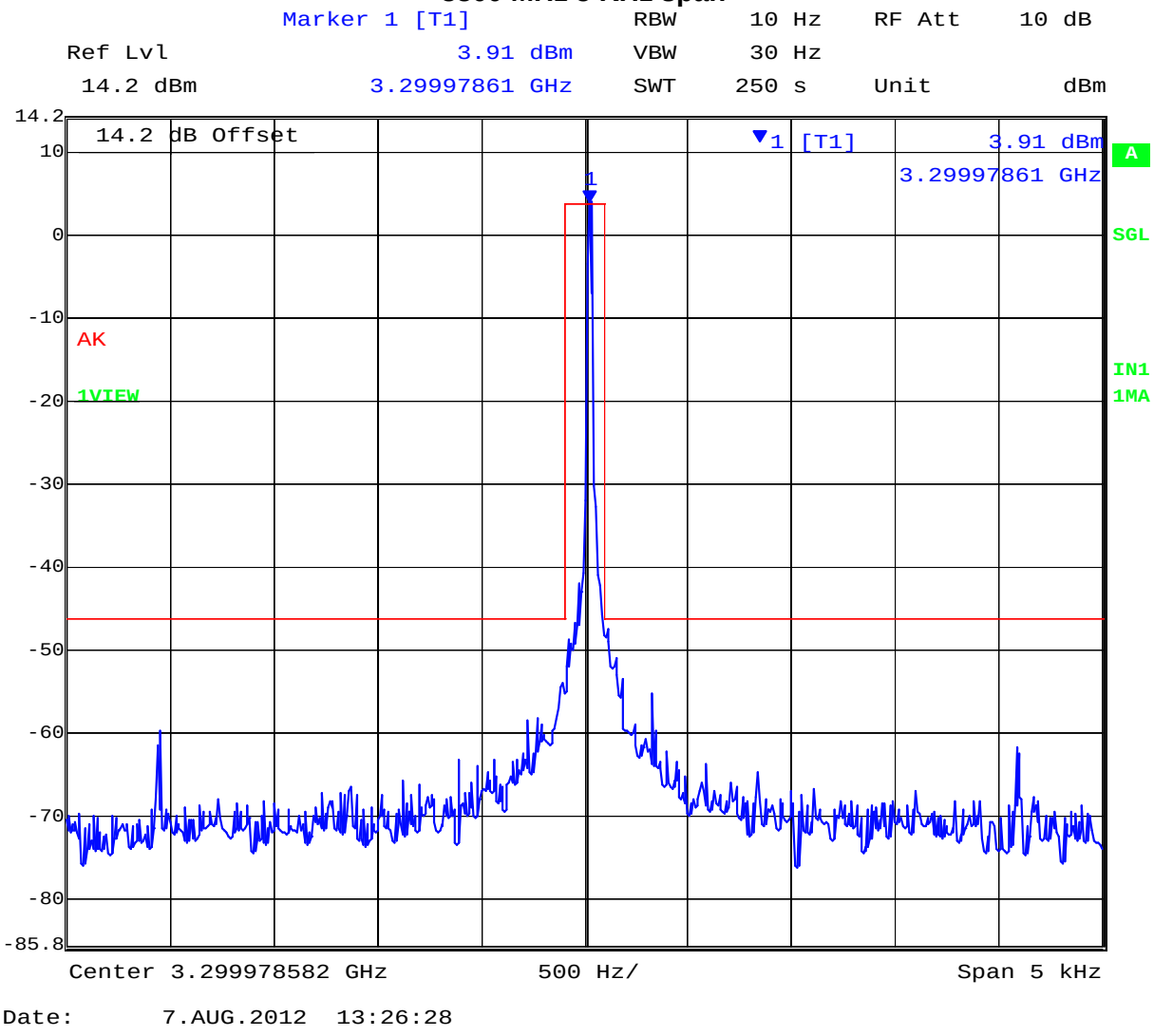
3101 MHz 5 KHz span



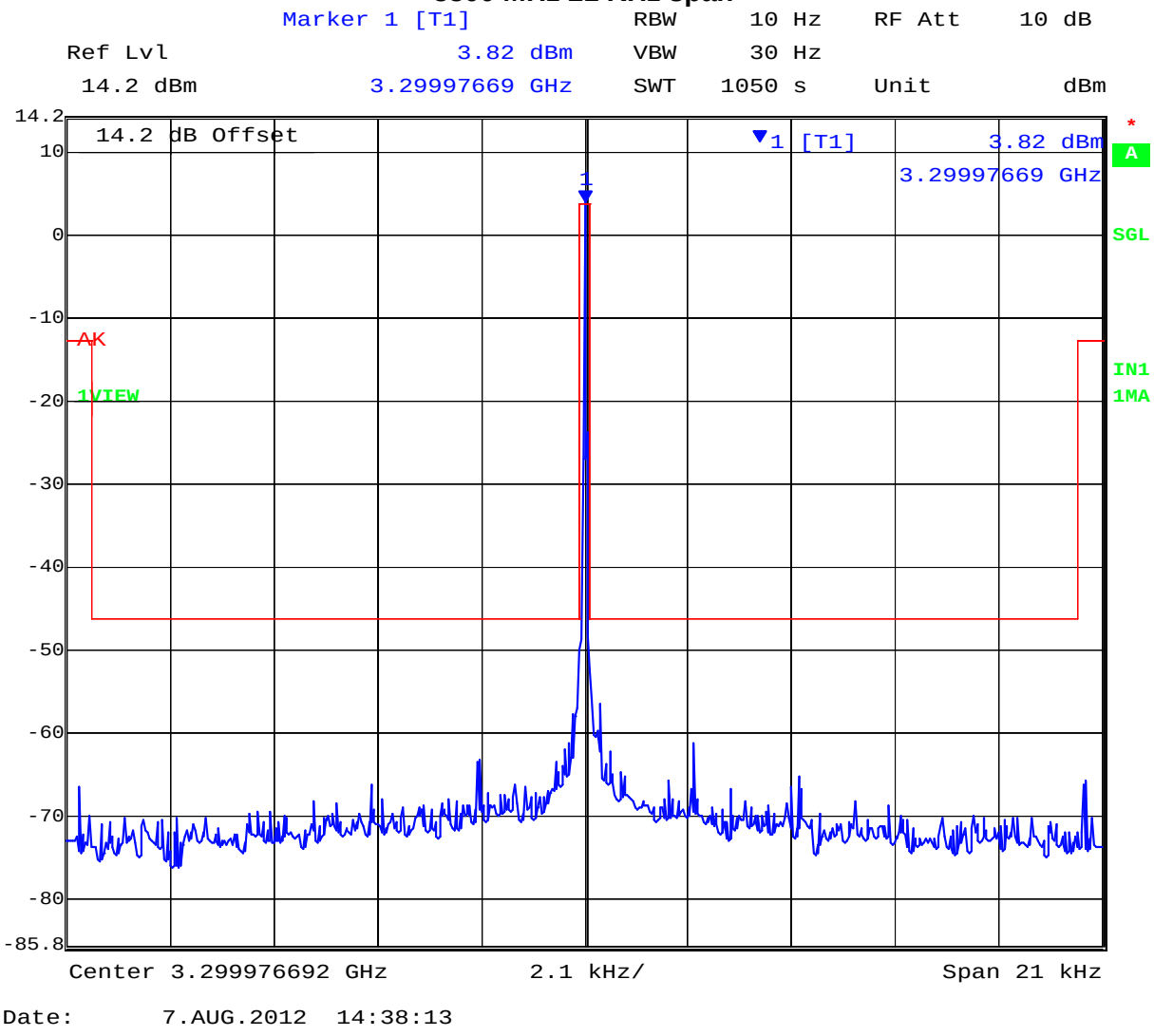
3101 MHz 21 KHz span



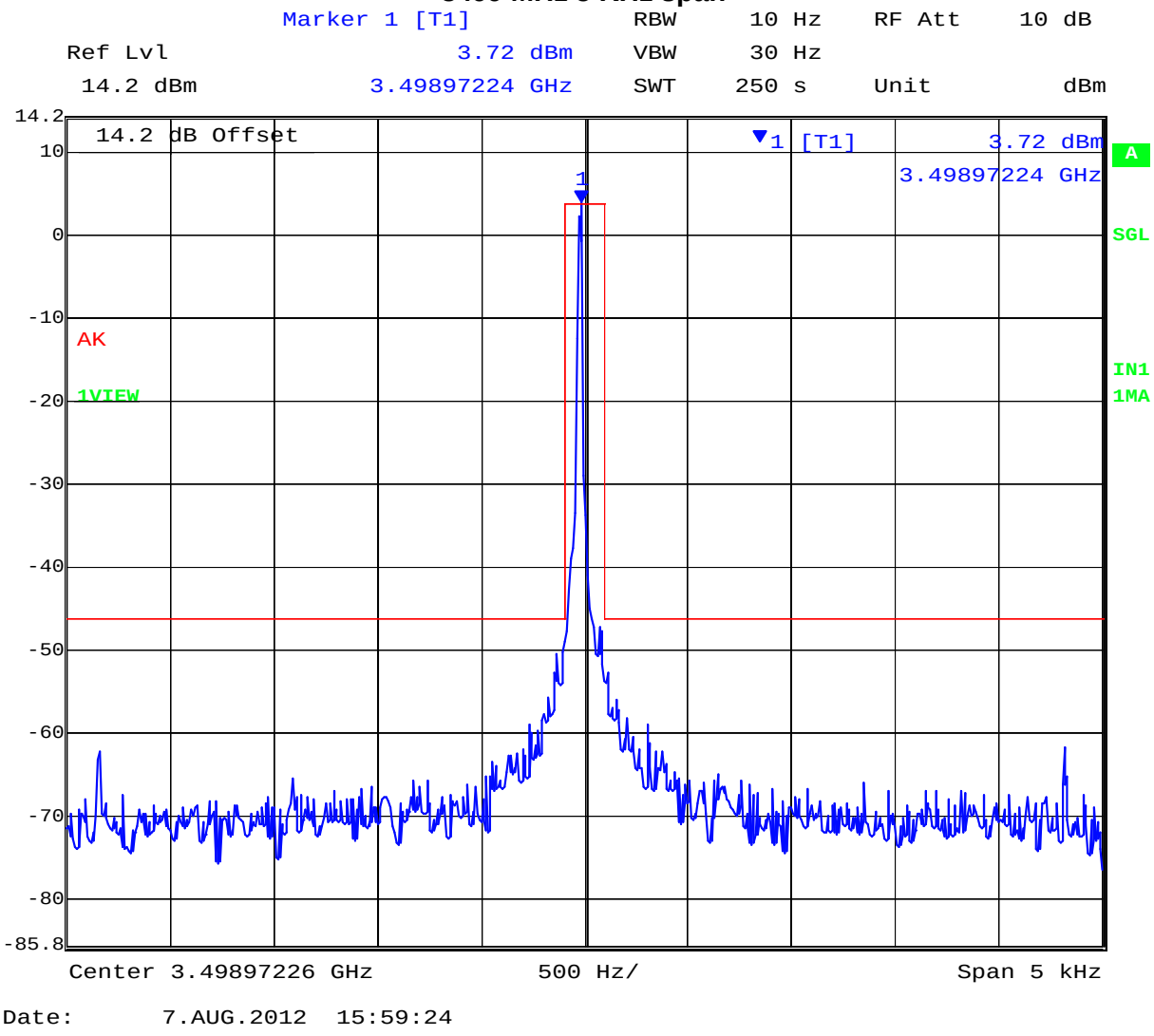
3300 MHz 5 KHz span



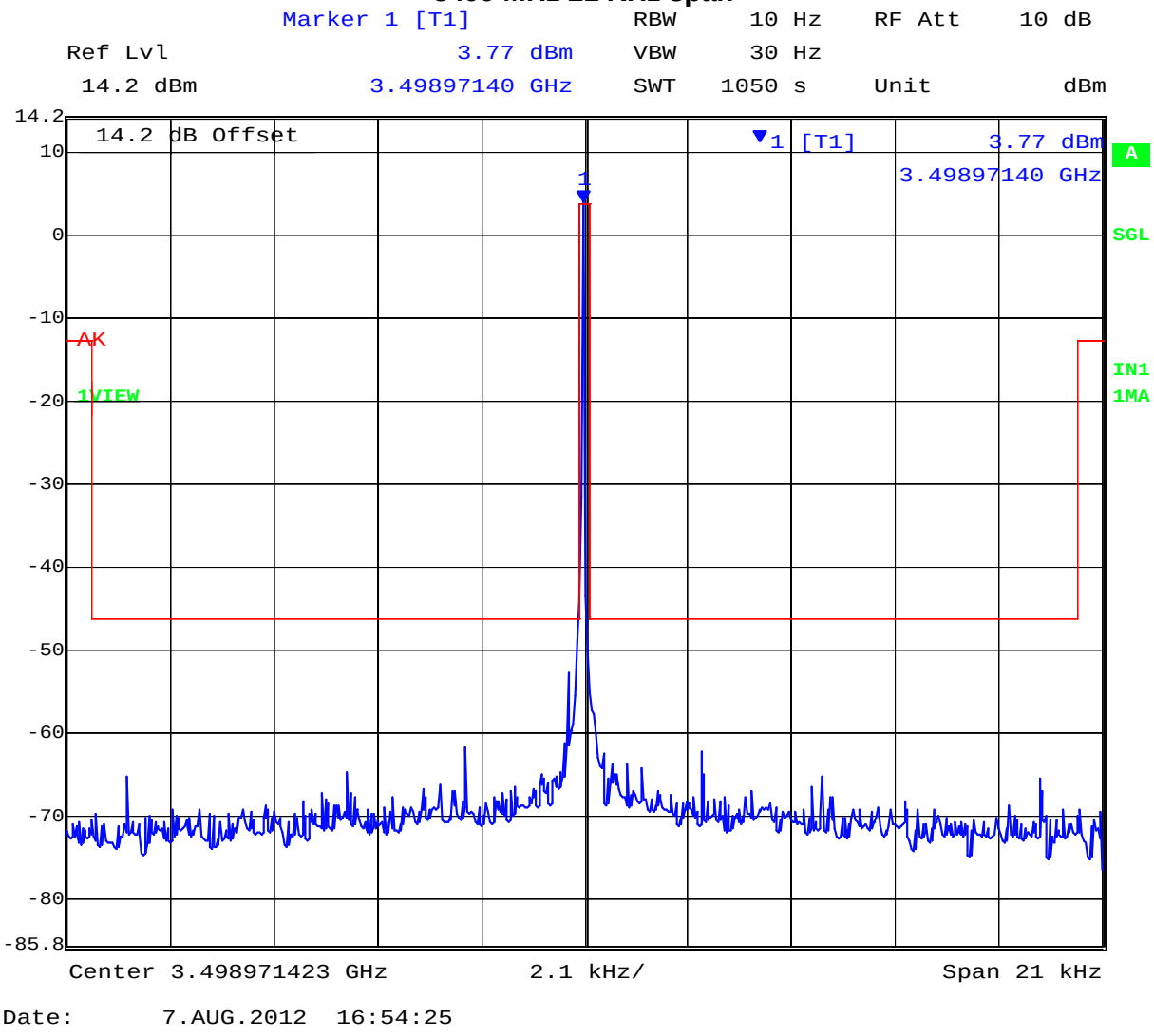
3300 MHz 21 KHz span



3499 MHz 5 KHz span



3499 MHz 21 KHz span



Specification

Limits

§ 90.210 Spectrum Masks (& Spurious Emissions).

(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd2 /11) dB or 50 dB, whichever is the lesser attenuation;

DA 11-1870

NOTE 4; The device transmits an unmodulated (CW) carrier (emission designator N0N). The emission must be attenuated 50 dB below the peak and average power on any frequency removed from the operating frequency from 100 Hz to 10 kHz, and comply with Section 90.210(c) on any frequency removed from the operating frequency by more than 10 kHz. The device must also meet the limits of Section 90.210(c) using peak and average limits.

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0070, 0116, 0158, 0088, 0252, 0313, 0314

5.1.4. Spurious Emissions at Antenna Terminal

CFR 47 § 2.1051 Spurious Emissions at antenna terminals

5.1.4.1. Transmitter Conducted Spurious Emissions (30 M- 40 GHz)

Test Procedure

Transmitter conducted spurious emissions were measured on the low, middle and high channels to prove compliance. Measurement were made while EUT was operating in a modulated transmit mode of operation, at the appropriate center frequency. Conducted spurious emissions were measured to 35 GHz in a peak hold mode.

Test Set-up is shown in Section 3.6 Test Configuration

Limit
§ 2.1051 Spurious Emissions at antenna terminals
The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

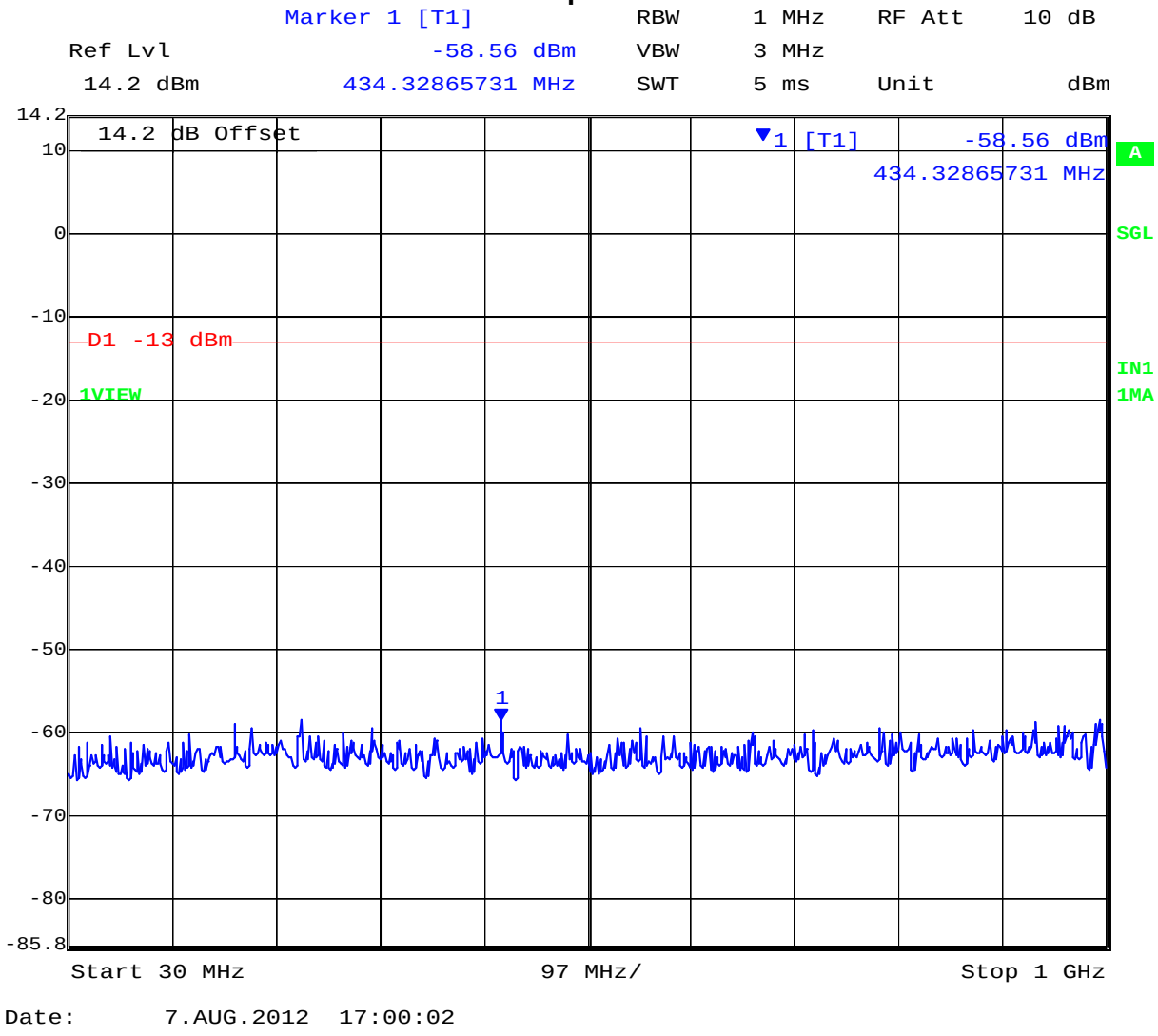
§ 90.210 Emission masks.
c) (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

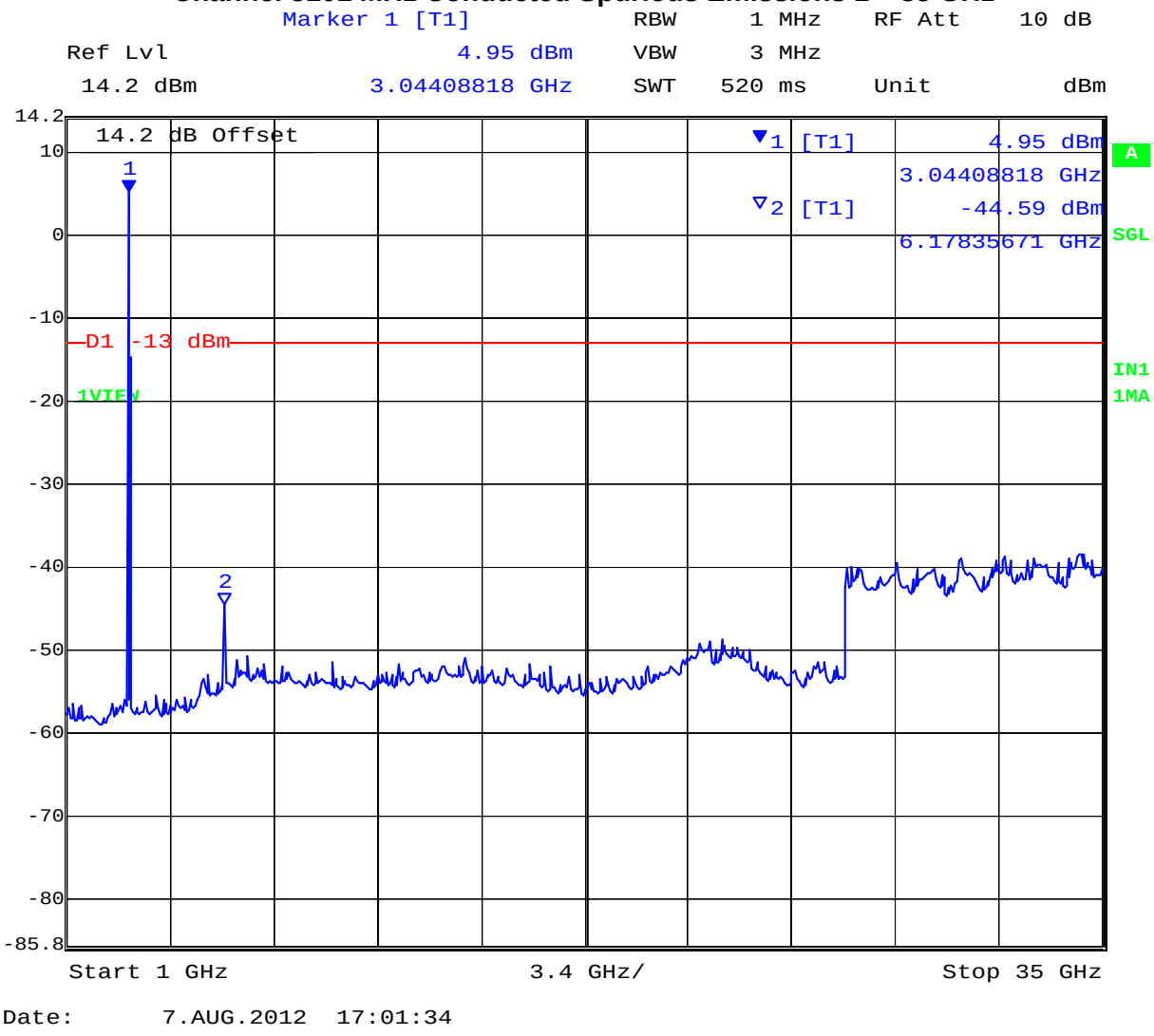
5.1.4.2. Transmitter Conducted Spurious Emissions (30 MHz- 35 GHz)

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3101	30	1,000	-58.56	-13.0	-45.56
	1,000	35,000	-44.59		-31.59

Channel 3101 MHz Conducted Spurious Emissions 30 MHz – 1 GHz

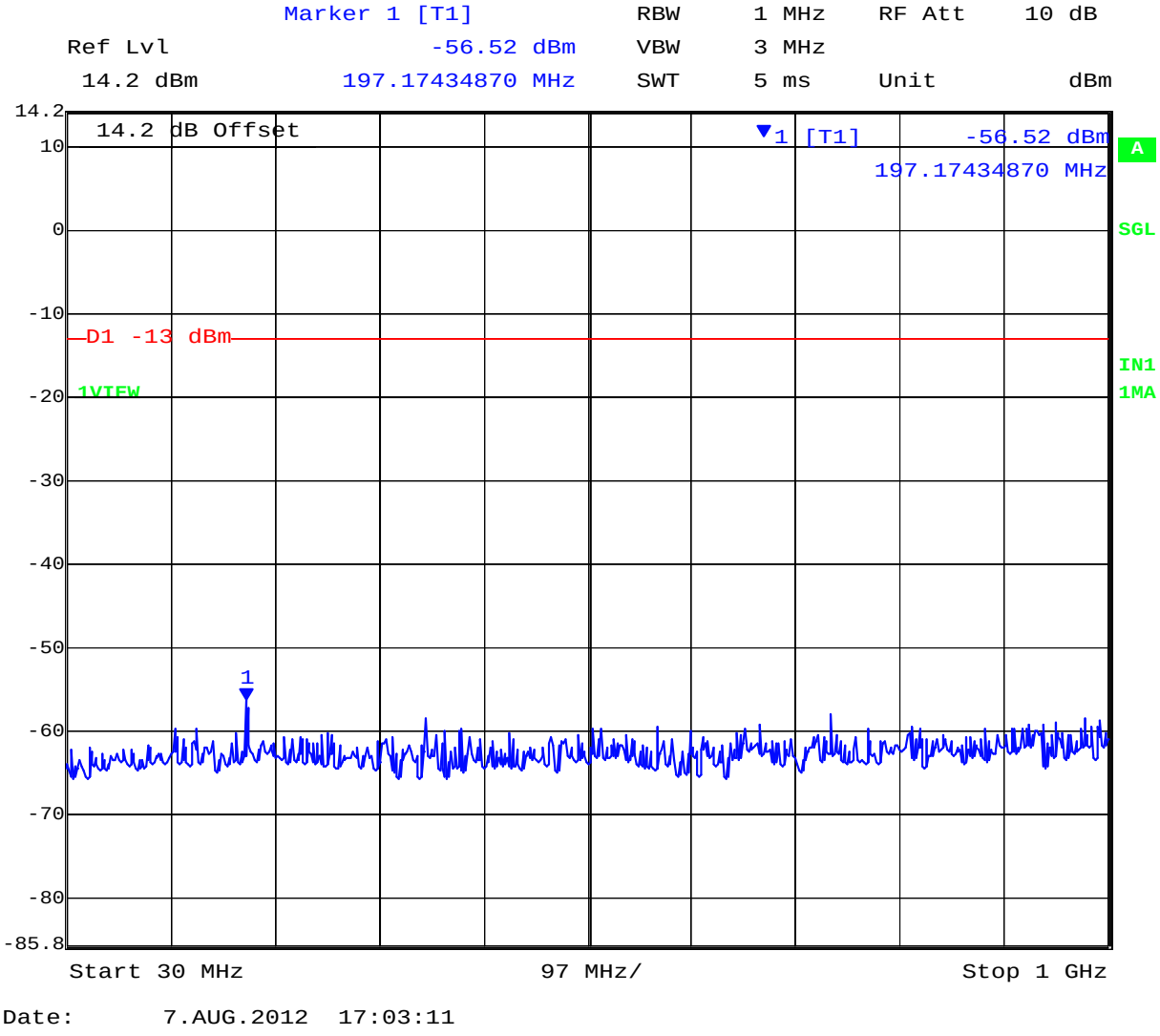


Channel 3101 MHz Conducted Spurious Emissions 1 – 35 GHz

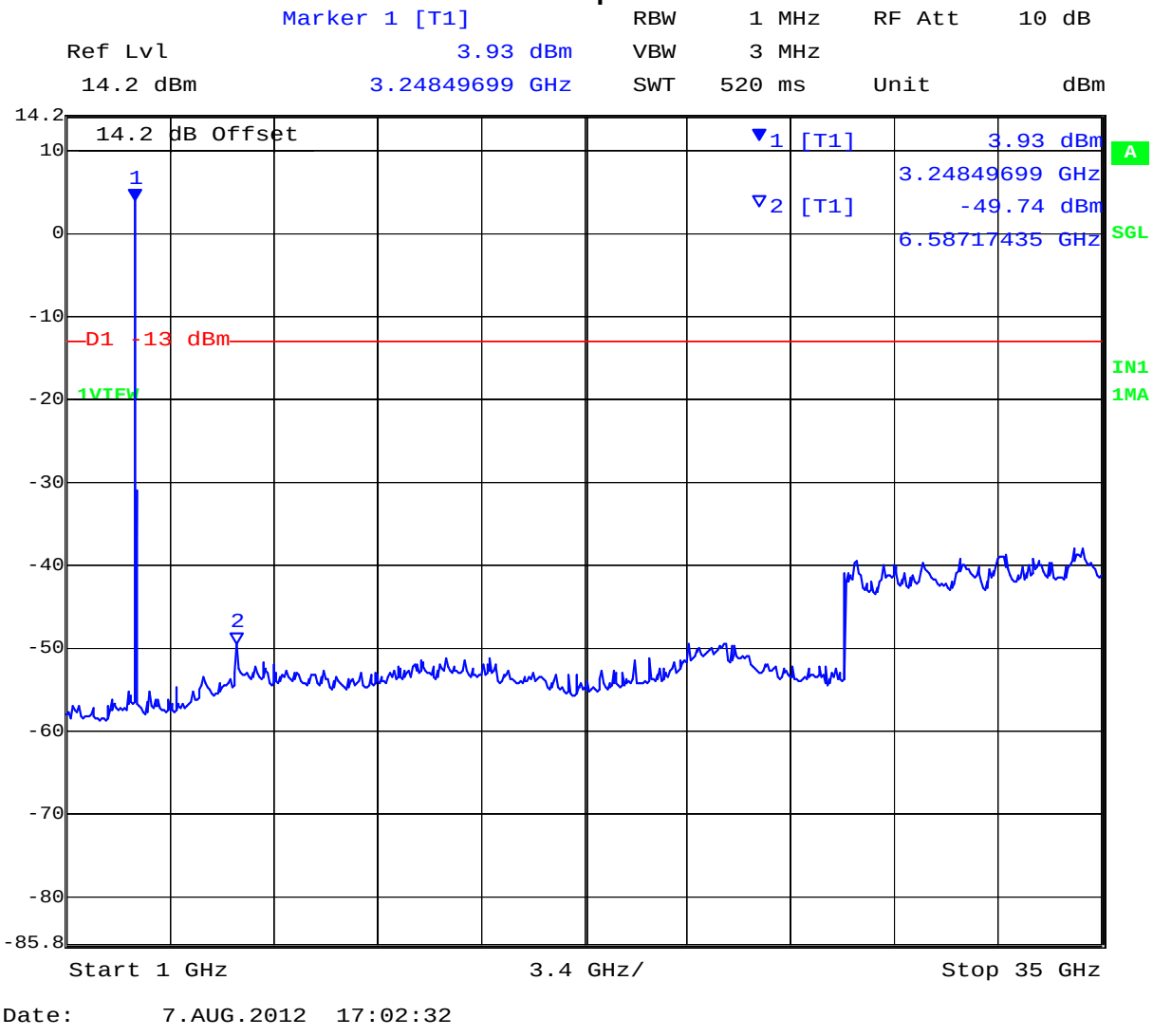


Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3300	30	1,000	-56.52	-13.0	-43.52
	1,000	35,000	-49.74		-36.74

Channel 3300 MHz Conducted Spurious Emissions 30 MHz – 1 GHz

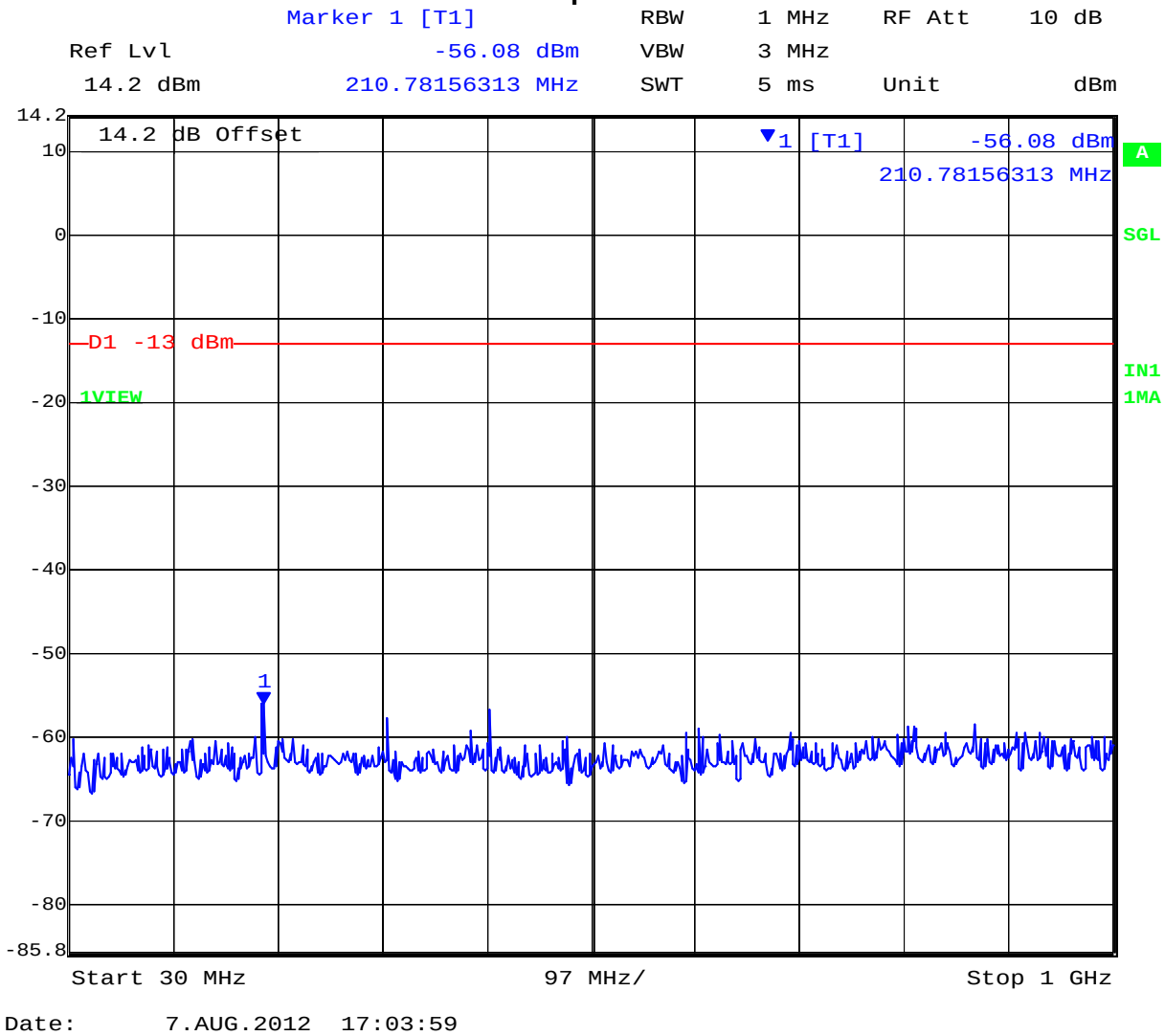


Channel 3300 MHz Conducted Spurious Emissions 1 – 35 GHz

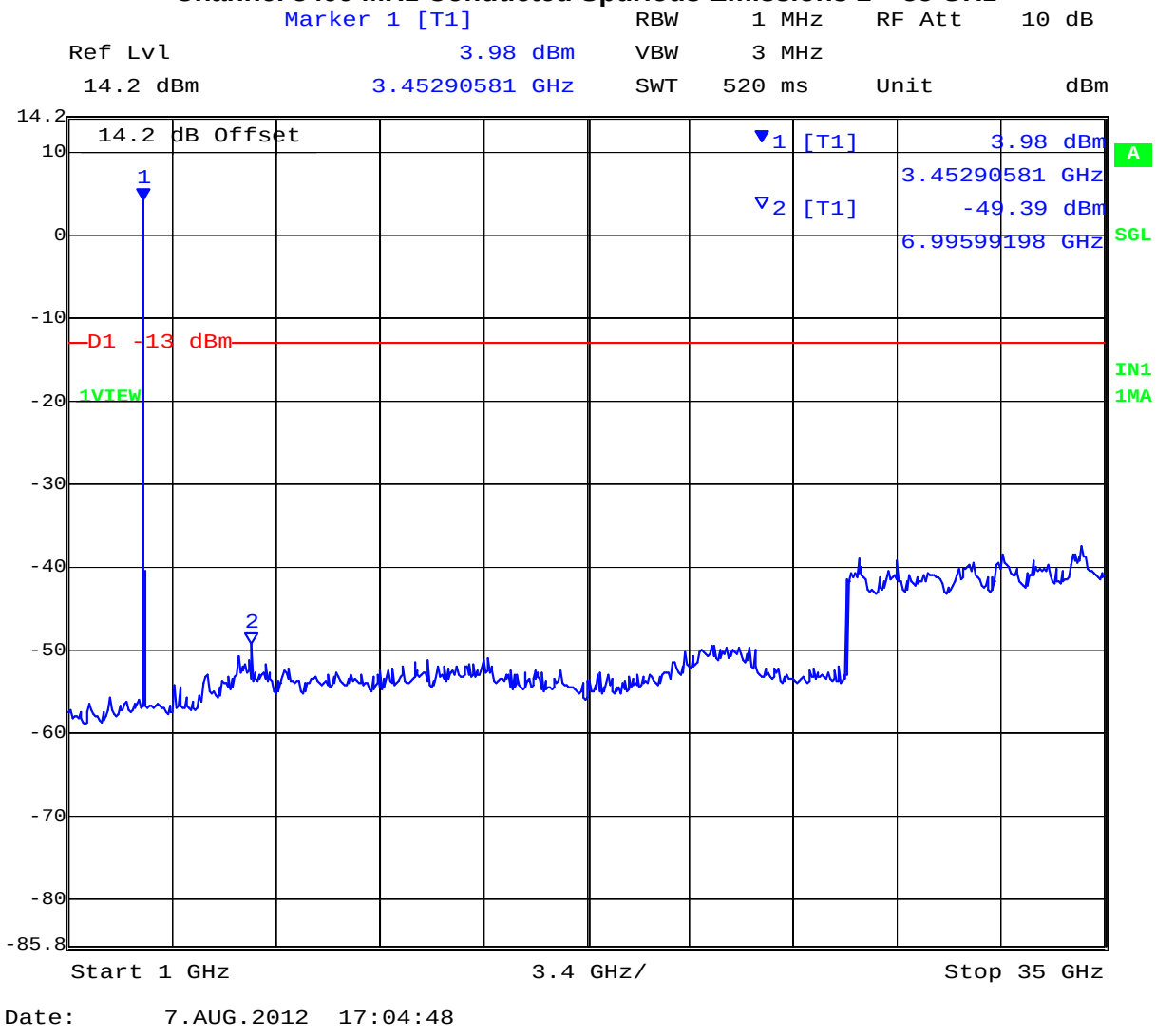


Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3499	30	1,000	-56.08	-13.0	-43.08
	1,000	35,000	-49.39		-36.39

Channel 3499 MHz Conducted Spurious Emissions 30 MHz – 1 GHz



Channel 3499 MHz Conducted Spurious Emissions 1 – 35 GHz



Specification

Limits

§ 2.1051 Spurious Emissions at antenna terminals

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0070, 0116, 0158, 0088, 0252, 0313, 0314

5.1.5. Radiated Spurious Emissions

5.1.5.1. Transmitter Radiated Emissions

FCC 47 CFR Part 90.210;

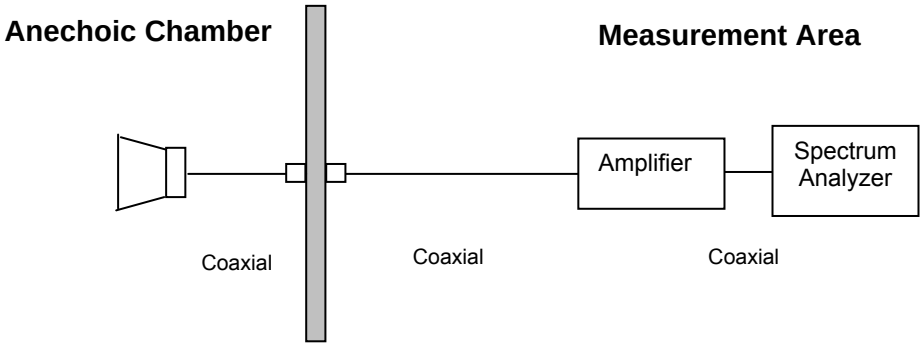
Test Procedure
Measurements were made while EUT was operating in a unmodulated(CW) transmit mode of operation, at the appropriate center frequency. Substitution was performed on any emissions observed. The antenna port was attenuated with a 50 Ω termination.

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.

Limit
§ 90.210 Spectrum Masks
(c) (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

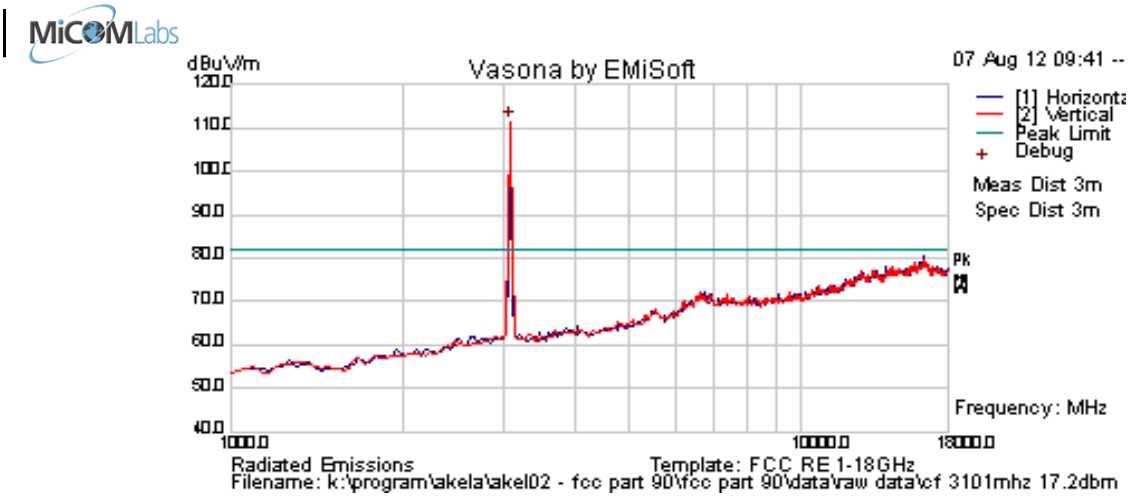
Test Measurement Set up



Measurement set up for Radiated Emission Test

No spurious emissions were witnessed above 1 GHz. Only the fundamental was present during testing.

Test Freq.	3101 MHz	**Engineer**	SB
Variant		**Temp (ºC)**	26
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	39
Power Setting	17.2 dBm EIRP	**Press. (mBars)**	1004
Antenna	Integral	**Duty Cycle (%)**	
Test Notes 1			
Test Notes 2			

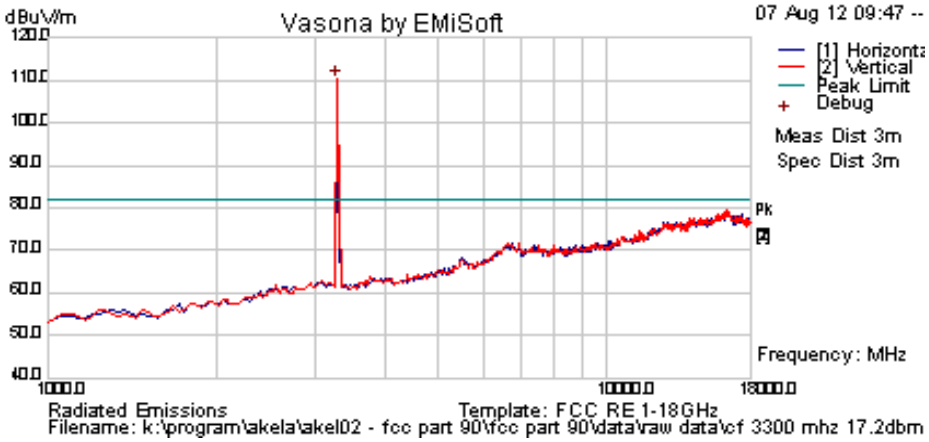


Formally measured emission peaks

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
3078.156	75.3	3.4	32.8	111.6	Peak [Scan]	V	100	0				FUND

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.	3300 MHz	**Engineer**	SB
Variant		**Temp (ºC)**	26
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	39
Power Setting	17.2 dBm EIRP	**Press. (mBars)**	1004
Antenna	Integral	**Duty Cycle (%)**	
Test Notes 1			
Test Notes 2			

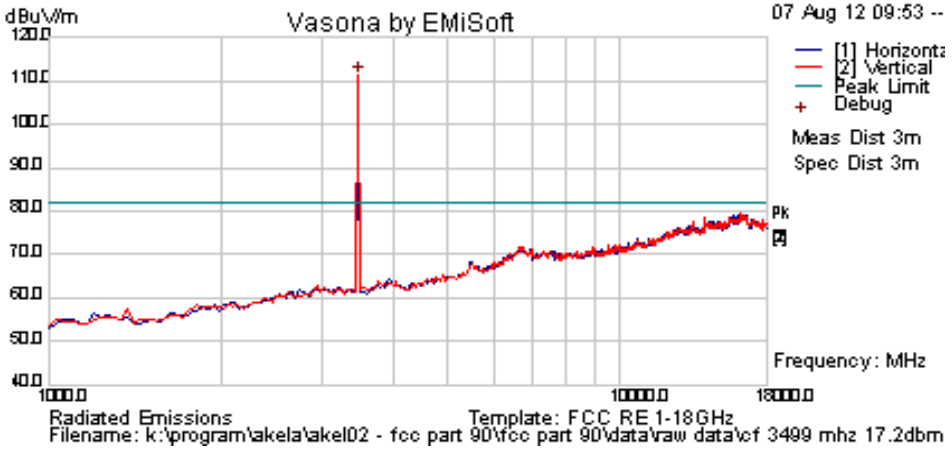


Formally measured emission peaks

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
3282.565	73.9	3.5	32.8	110.2	Peak [Scan]	V	150	0				FUND

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.	3499 MHz	**Engineer**	SB
Variant		**Temp (ºC)**	26
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	39
Power Setting	17.2 dBm EIRP	**Press. (mBars)**	1004
Antenna	Integral	**Duty Cycle (%)**	
Test Notes 1			
Test Notes 2			



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
3486.974	74.9	3.6	32.9	111.4	Peak [Scan]	V	100	0				

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

Limits

§ 90.210 Emission masks.

c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd2 /11) dB or 50 dB, whichever is the lesser attenuation;

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0104, 0158, 0134, 0310, 0312, Dipole.

5.1.6. Maximum Permissible Exposure

FCC§1.1310

Calculations for Maximum Permissible Exposure Levels

Power Density = Pd (mW/cm^2) = EIRP/(4πd^2)

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain = 10 ^ (G (dBi)/10)

The AKELA ASTIR3300 transmits on a single transmitter. The calculated safe distance is computed using the highest conducted power measured (+4.68 dBm) when used with the 10dBi antenna;

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm^2

Per KDB 447498 the maximum peak power value used takes account of the power variance of the device.

Freq. Band (GHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Max Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm^2 Limit(cm)	Minimum Separation Distance (cm)
3101	10.8	12.0	+6.00	3.98	2.0	20.0*

*Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if the calculations indicate the MPE distance to be lower.

Specification
Maximum Permissible Exposure Limits

§1.1310

Limit = 1mW / cm^2 from 1.310 Table 1

Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

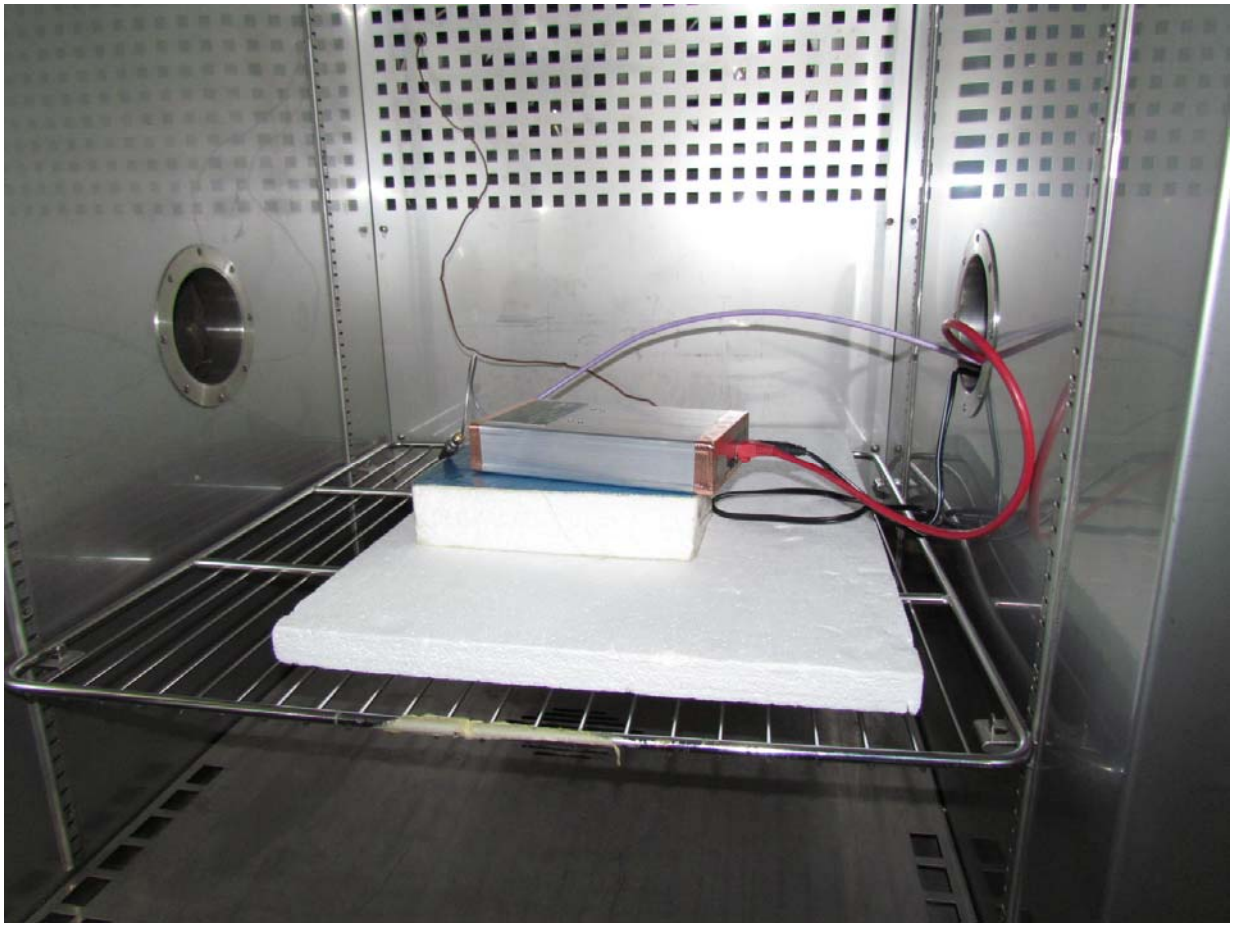
Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33dB

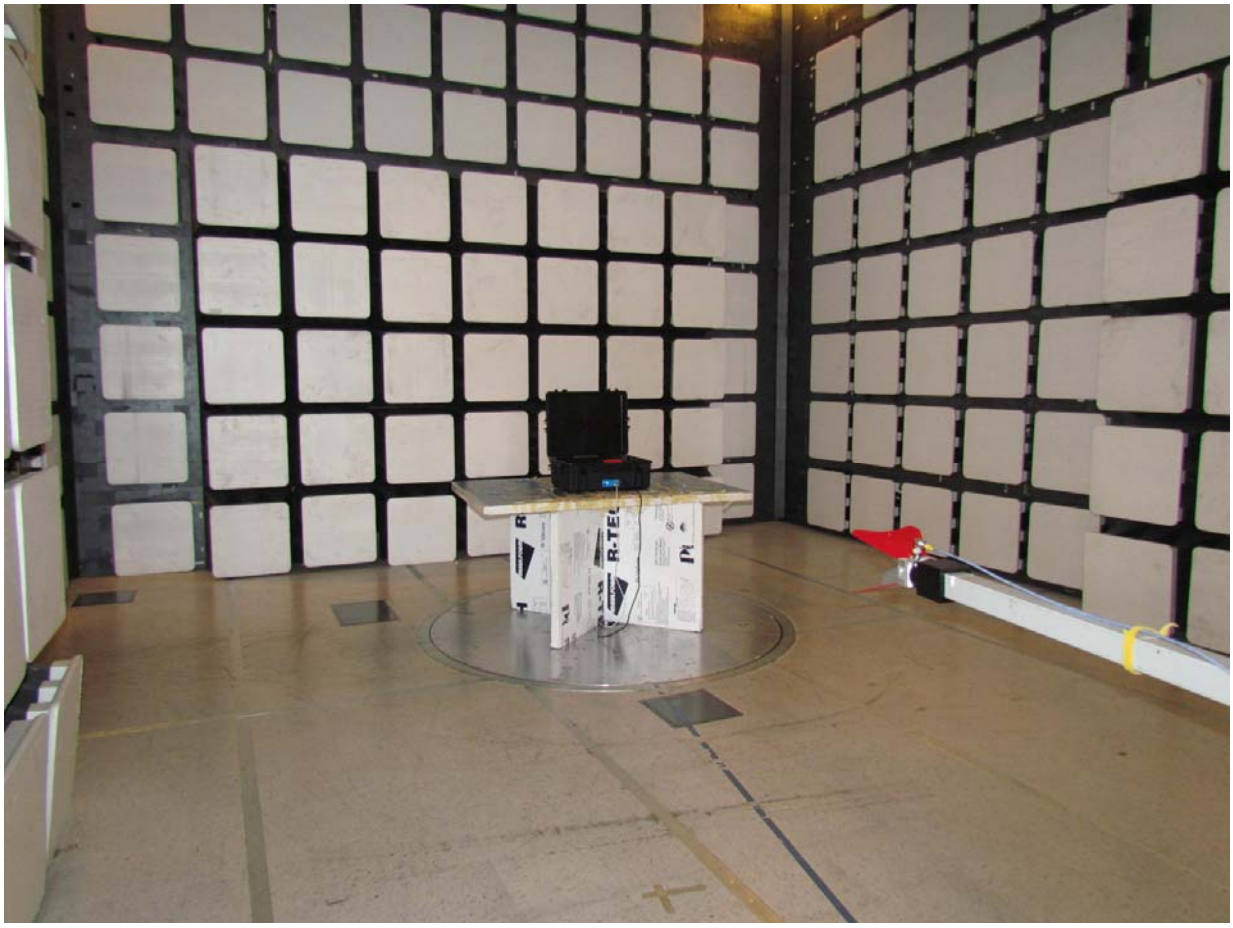
6. TEST SET-UP PHOTOGRAPHS

6.1. General Measurement Test Set-Up

6.2. Environmental Chamber Conducted RF Tested



6.3. Radiated Spurious Emissions above 1GHz



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #	Calibration Due Date
0070	Power Meter	Hewlett Packard	437B	3125U11552	28th Nov 12
0117	Power Sensor	Hewlett Packard	8487D	3318A00371	15th Nov 12
0223	Power Meter	Hewlett Packard	EPM-442A	US37480256	15th Nov 12
0374	Power Sensor	Hewlett Packard	8485A	3318A19694	29th Nov 12
0158	Barometer /Thermometer	Control Co.	4196	E2846	8th Dec 12
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007	2nd Dec 12
0287	EMI Receiver	Rhode & Schwartz	ESIB40	100201	16th Nov 12
0338	30 - 3000 MHz Antenna	Sunol	JB3	A052907	8th Nov 12
0335	1-18 GHz Horn Antenna	EMCO	3117	00066580	7th Nov 12
0252	SMA Cable	Megaphase	Sucoflex 104	None	N/A
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001	N/A
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002	N/A
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	N/A
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001	N/A
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623	N/A

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