

TEST REPORT
of the accredited test laboratory

TÜV Nr.:M/FG-02/104

Geschäftsbereich
Medizintechnik,
Nachrichtentechnik
und EMV

Prüfstelle für
Nachrichtentechnik
und EMV

Prüfzentrum Wien
A - 1230 Wien
Deutschstraße 10

Tel: +43-1-61091-0
Fax: DW 6505
Mail: office@tuev.or.at

Applicant: Siemens AG Österreich
Erdberger Lände 26
A-1030 Wien

Tested Product: Siemens Bluetooth™ Module SieMo

Type: SieMo-S50037

Manufacturer: Siemens AG Österreich
A-1030 Wien; Erdberger Lände 26

Output power / field strength: 0 dBm nom. power supply: 3,3 VDC
4 dBm max.
according to bluetooth power class 2

Frequency range: 2400 – 2483,5 MHz Channel separation: 1 MHz

Standard: FCC: 47 CFR 15.247

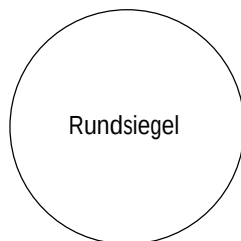
Akkreditierte Prüf-,
Überwachungs-,
Zertifizierungs- und
Kalibrierstelle

Notified Body 0408

TÜV Österreich
Test laboratory for EMC

Deputy supervisor of EMC-
laboratory:

Ing. Wilhelm Seier



12. 3. 2002

checked by:

Ing. Klaus Röttsch

Copy Nbr.: _____

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The results of this test report only refer to the provided equipment.

LIST OF MEASUREMENTS

The complete list of measurements called for in 47 CFR 15.247 is given below.

SUBCLAUSE	PARAMETER TO BE MEASURED	PAGE
	Intentional Radiators	
	Test object data	3
15.247 a	Channel carrier frequency separation	4
15.247 a	Number of hopping channels	5
15.247 a	20 dB Bandwidth	6-11
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15.247 c	Spurious emissions	16-26
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15.209	Radiated emissions	29

TEST OBJECT DATA

General EUT Description

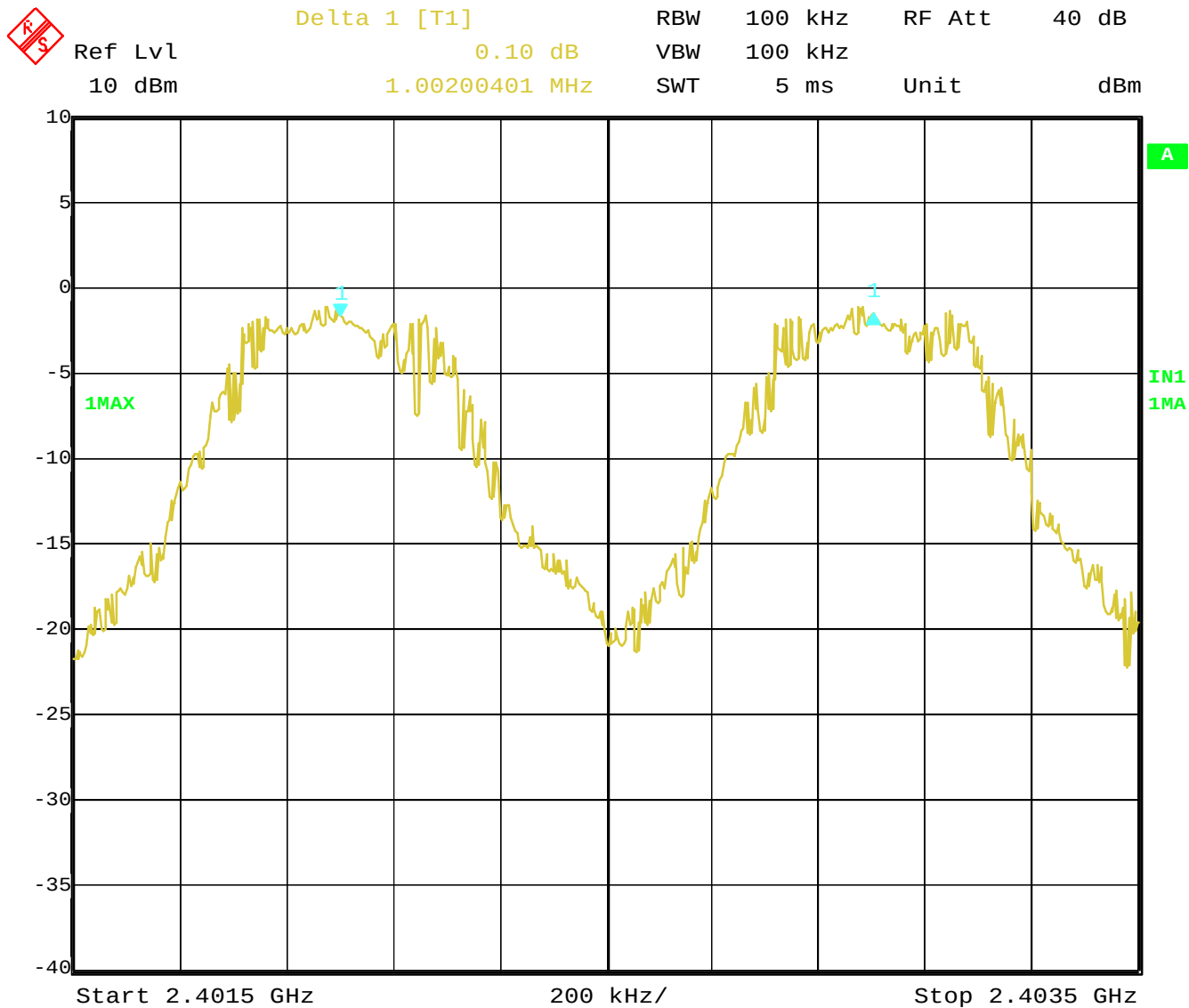
Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices.

Bluetooth operates in the unlicensed ISM Band at 2,4 GHz. in the US a band of 83,5 MHz width is available. In this band, 79 RF channels spaced 1 MHz apart are defined. The channel is represented by a pseudo-random hopping sequence through the 79 channels. The channel is divided into time slots, with a nominal slot length of 625µs, where each slot corresponds to different RF hop frequencies. The nominal hop rate is 1600 hops/s. All frequencies are equally used. The average time of occupancy is 0,3797 s within a 30 second period. The symbol rate on the channel is 1 Ms/s.

The most parameters were measured conducted (on a test board), while the radiated emissions were measured with the „blue2net“ Bluetooth LAN Access Point.

CHANNEL CARRIER FREQUENCY

§ 15.247/a



Date: 21. JAN. 2002 08:50:54

The channel separation is defined as 1 MHz in bluetooth specifications.

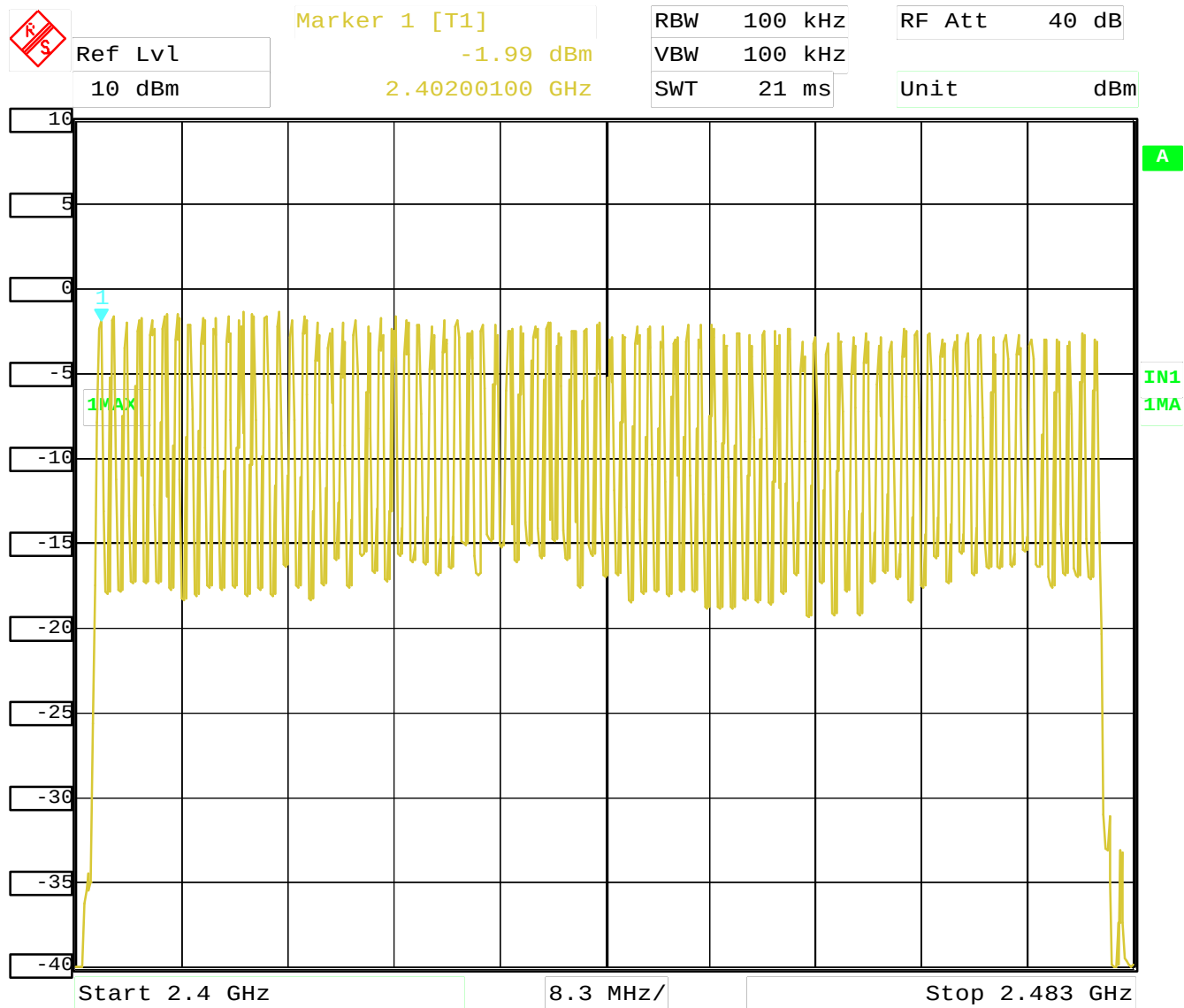
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

NUMBER OF HOPPING CHANNELS

§ 15.247/a



Date: 21. JAN. 2002 08:56:19

The number of hopping channels is defined as 79 in bluetooth specifications.

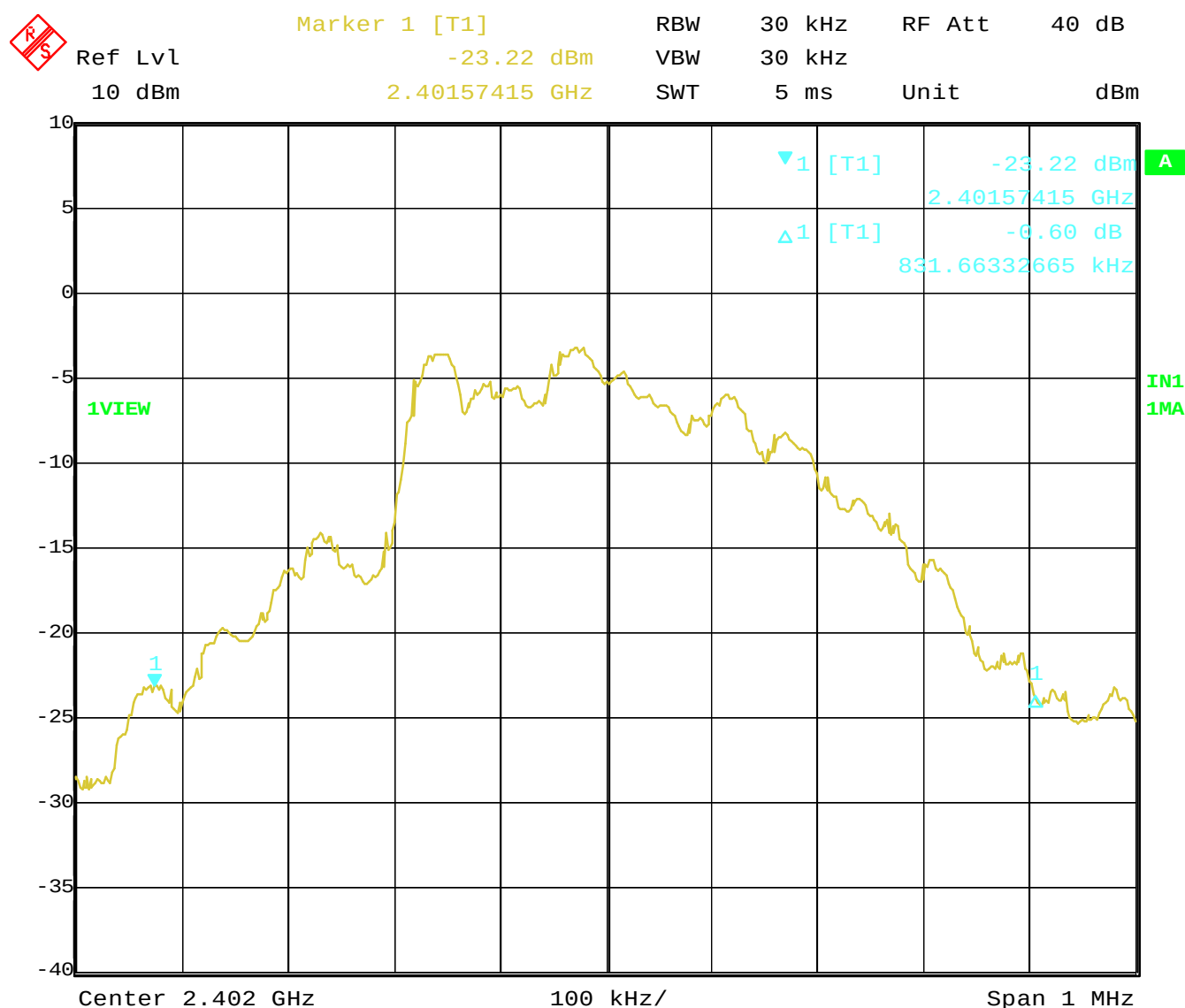
20 dB BANDWIDTH

§ 15.247/a

Measurements were made on the lowest and highest hopping channel frequency (channel 0; 2402 MHz and channel 78; 2480 MHz) with hopping disabled.

The measurements were carried out in 3 operating modes:

1. Data TX, mode DH1 (2 timeslots, one used)
2. Data TX, mode DH3 (4 timeslots, three used)
3. Data TX, mode DH5 (6 timeslots, five used)



Date: 21. JAN. 2002 09:27:09

channel 0, mode DH1

Bandwidth: 831,66 kHz

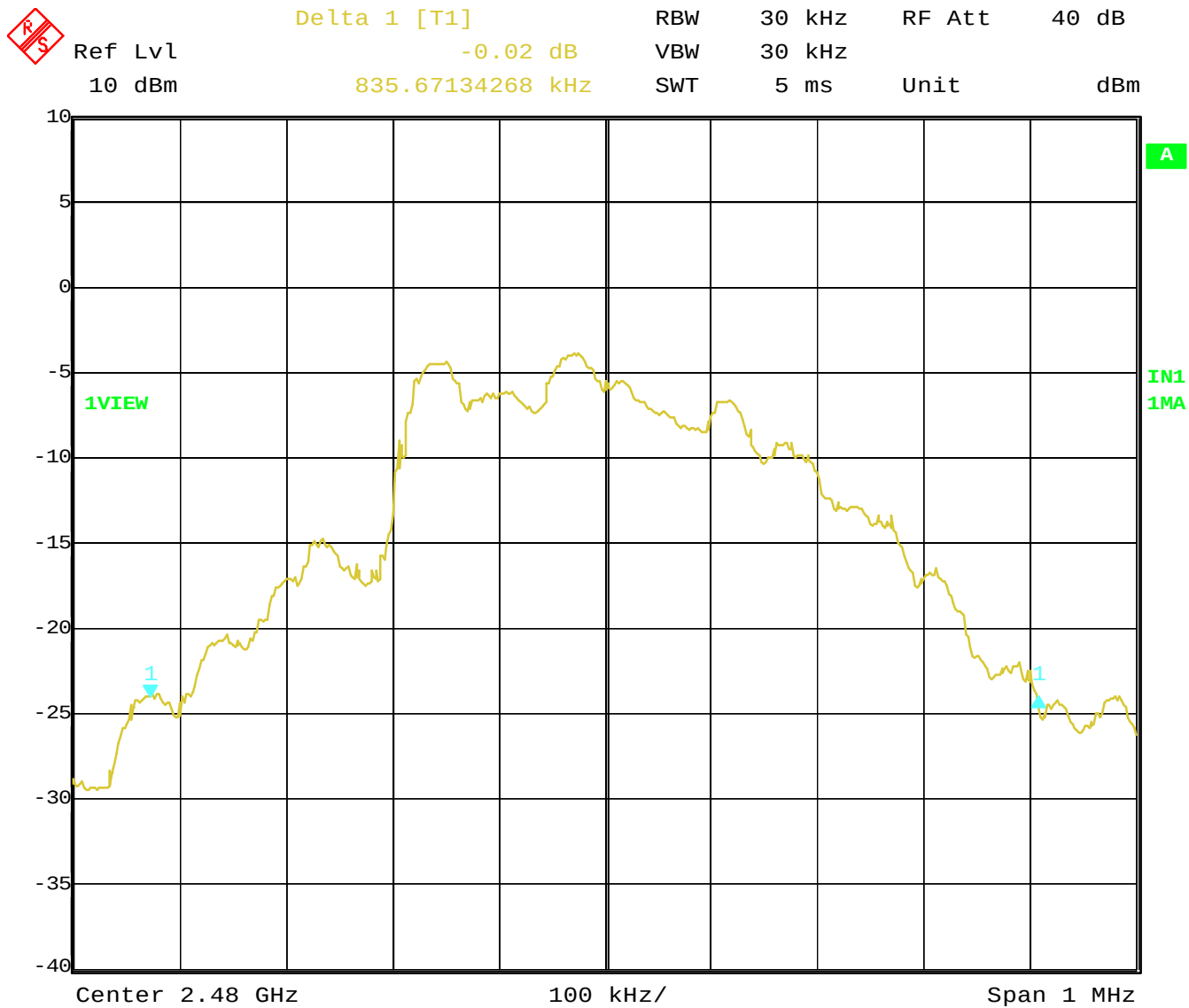
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

20 dB BANDWIDTH

§ 15.247/a



Date: 21. JAN. 2002 09:37:02

channel 78, mode DH1

Bandwidth: 835,67 kHz

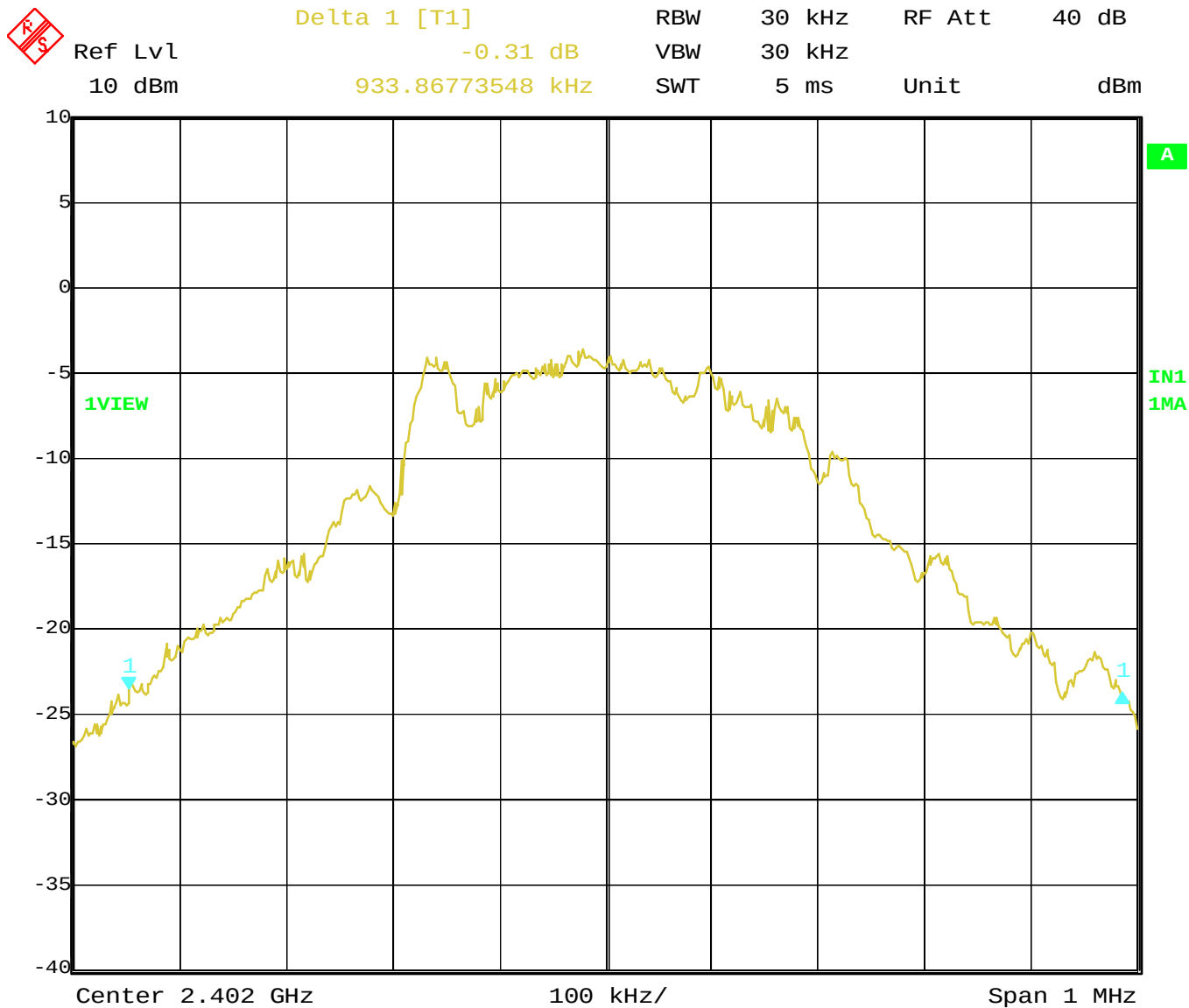
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

20 dB BANDWIDTH

§ 15.247/a



Date: 21. JAN. 2002 09:29:47

channel 0, mode DH3

Bandwidth: 933,87 kHz

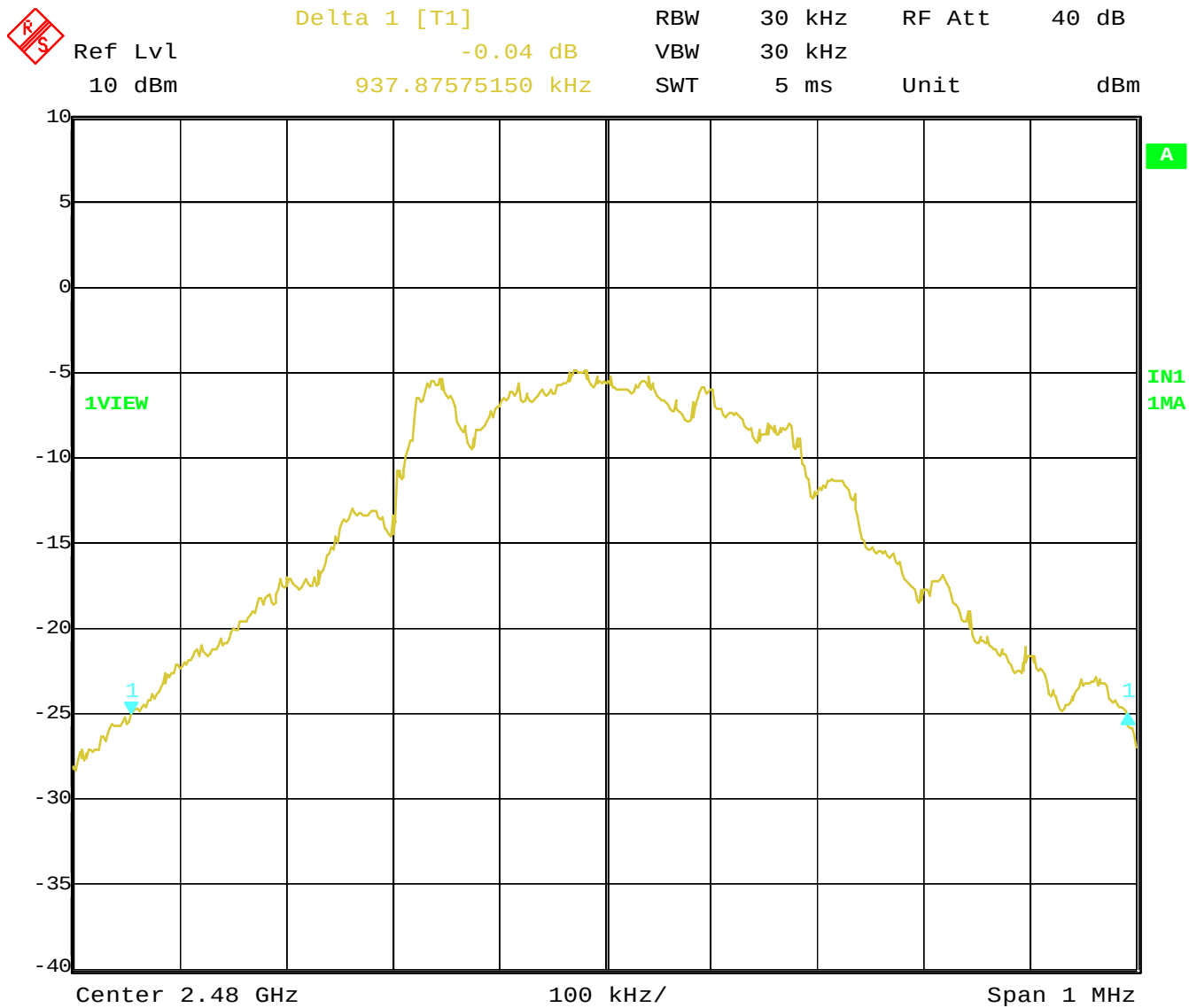
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

20 dB BANDWIDTH

§ 15.247/a



Date: 21. JAN. 2002 09:40:02

channel 78, mode DH3

Bandwidth: 937,88 kHz

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

20 dB BANDWIDTH

§ 15.247/a



Ref Lvl
10 dBm

Delta 1 [T1]

0.22 dB

933.86773548 kHz

RBW

30 kHz

RF Att

40 dB

VBW

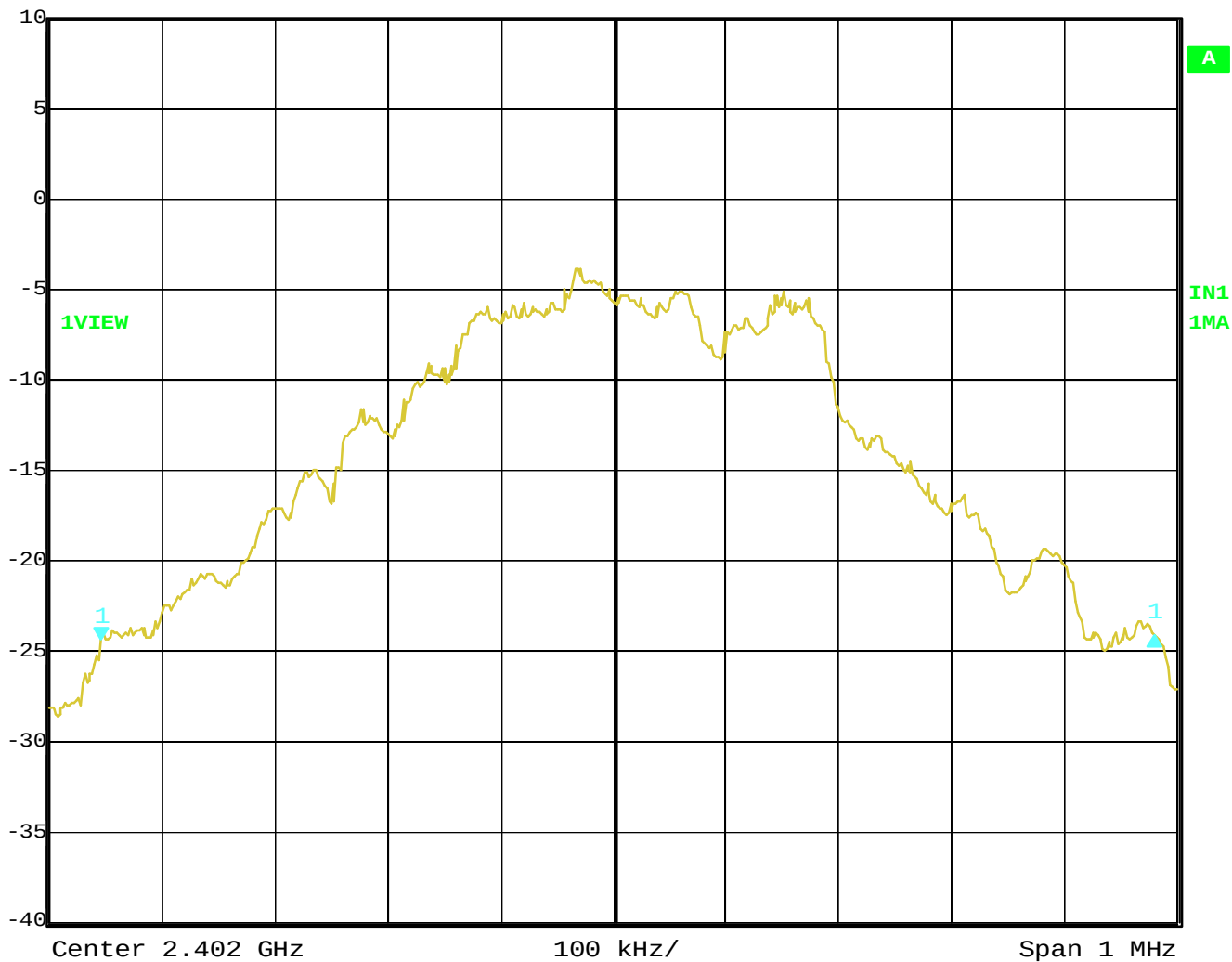
30 kHz

SWT

5 ms

Unit

dBm



Date: 21. JAN. 2002 09:32:06

channel 0, mode DH5

Bandwidth: 933,87 kHz

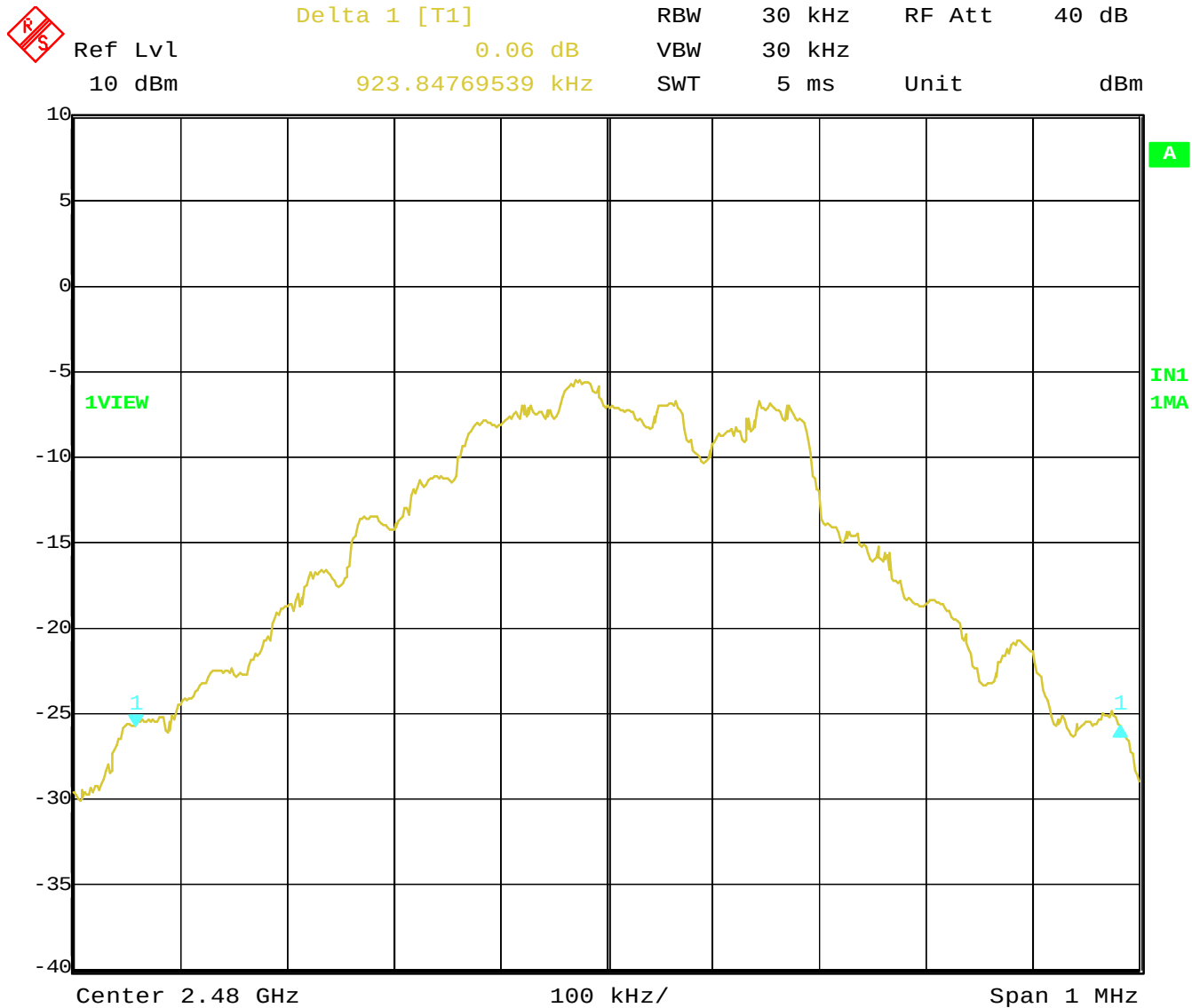
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

20 dB BANDWIDTH

§ 15.247/a



Date: 21.JAN.2002 09:43:00

channel 78, mode DH5

Bandwidth: 923,85 kHz

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

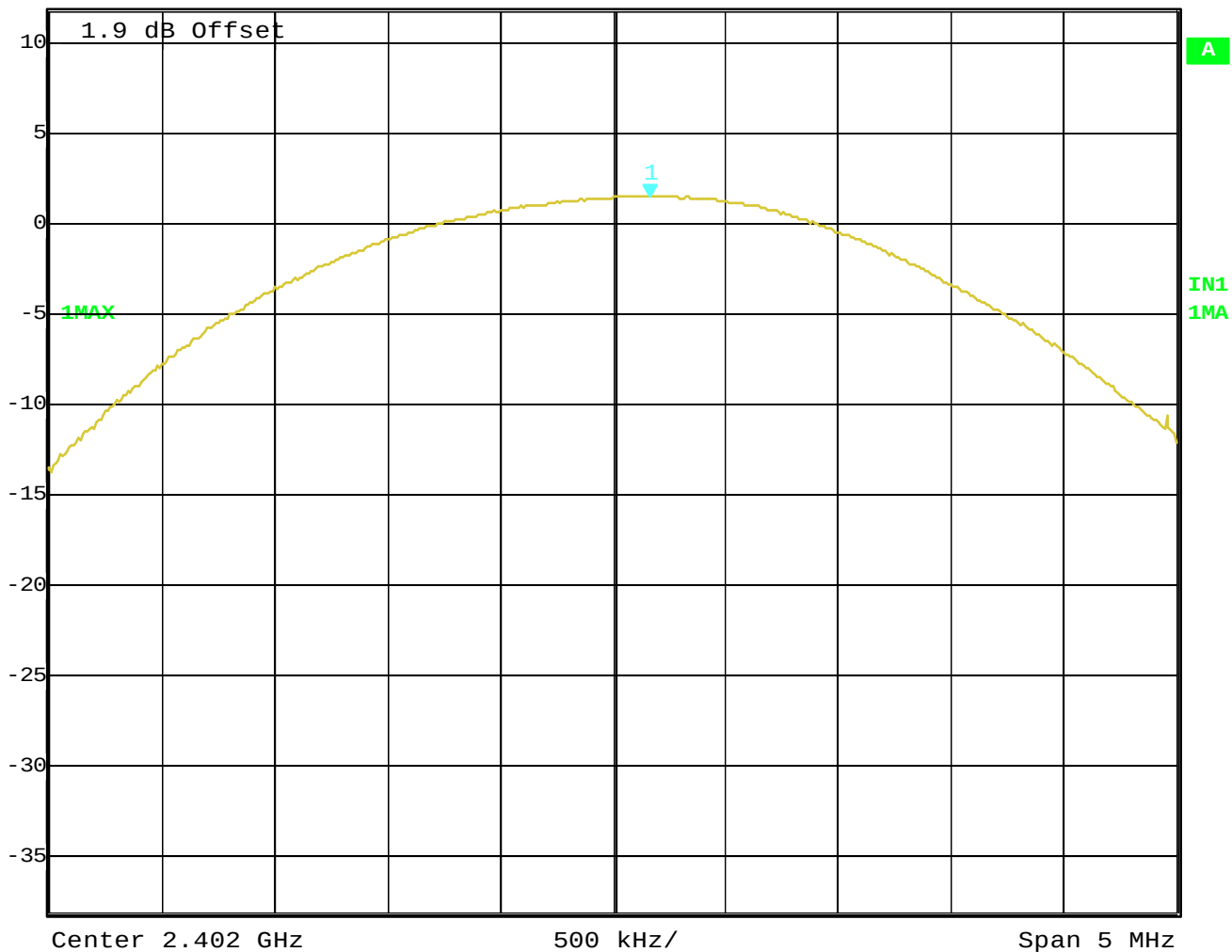
Relative humidity: 58%

MAXIMUM PEAK OUTPUT POWER

§ 15.247/b



Ref Lvl 11.9 dBm
Marker 1 [T1] 1.43 dBm
2.40216533 GHz
RBW 2 MHz
VBW 2 MHz
SWT 5 ms
RF Att 40 dB
Unit dBm



Date: 21. JAN. 2002 10:06:32

channel 0

Peak output power 1,43 dBm

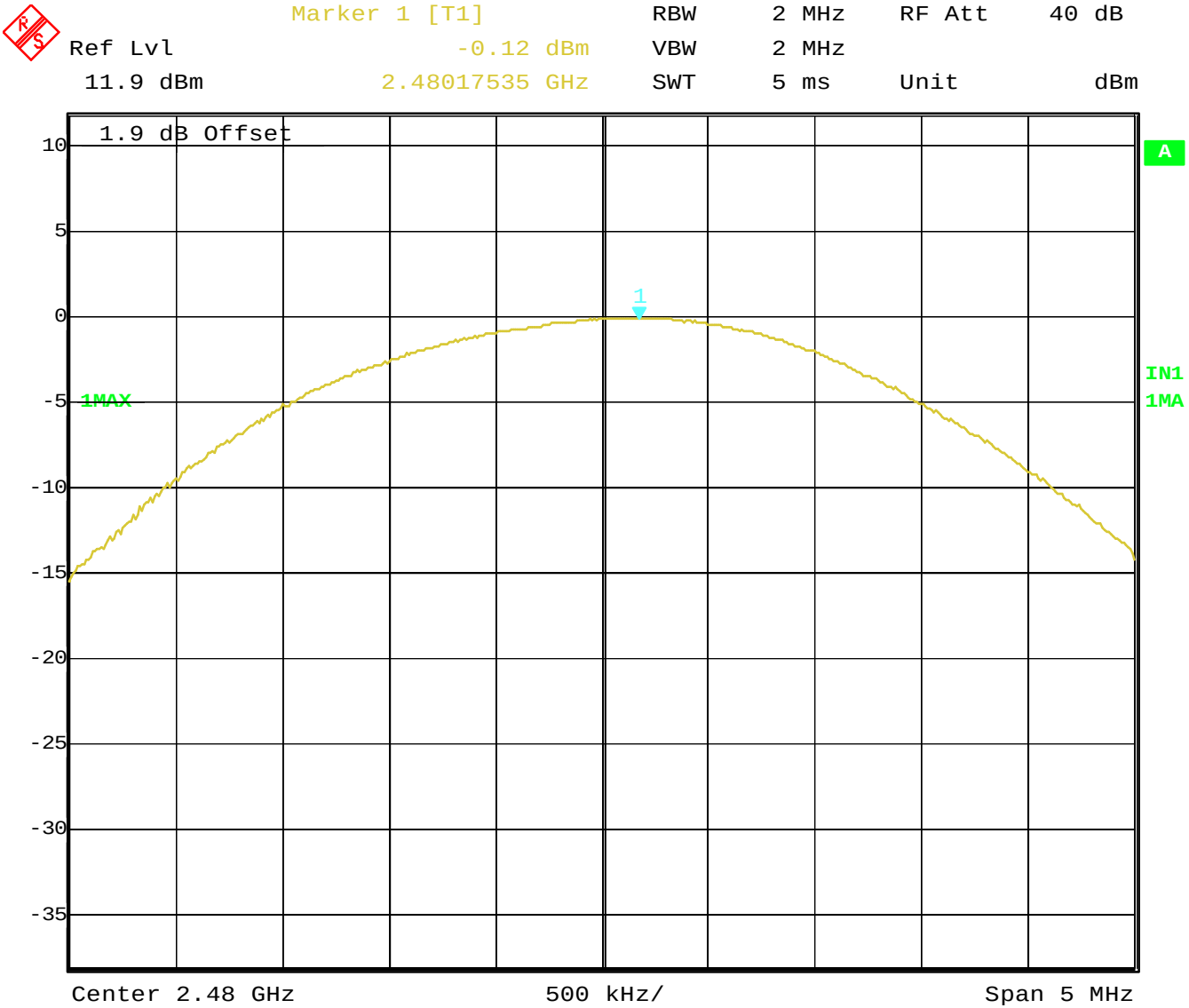
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

MAXIMUM PEAK OUTPUT POWER

§ 15.247/b



Date: 21. JAN. 2002 10:03:59

channel 78

Peak output power -0,12 dBm

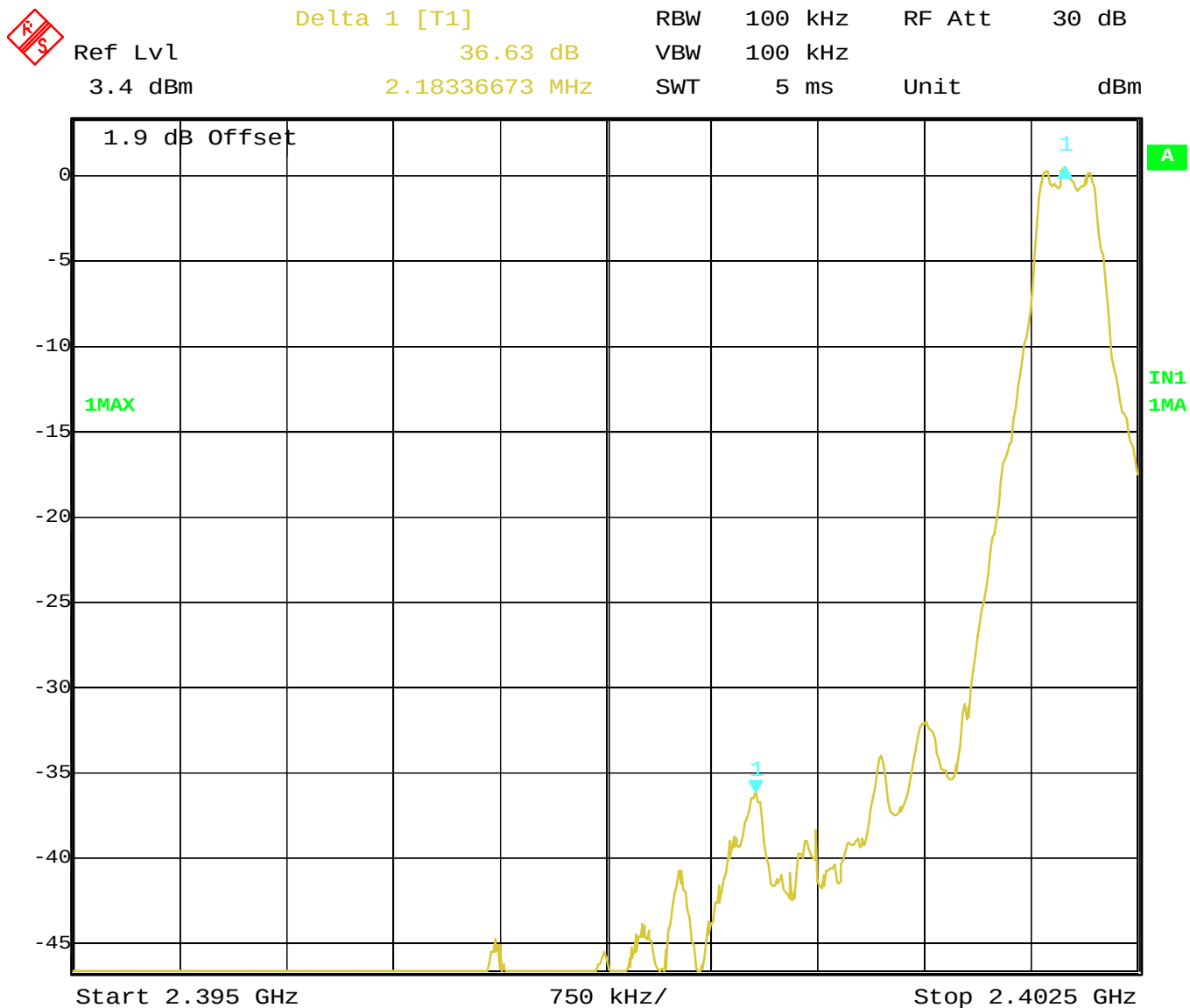
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

BAND EDGE REQUIREMENTS

§ 15.247/c



Date: 21.JAN.2002 10:11:46

Peak power at the band edge or at the highest emission outside the band on channel 0: -36,63 dBc

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

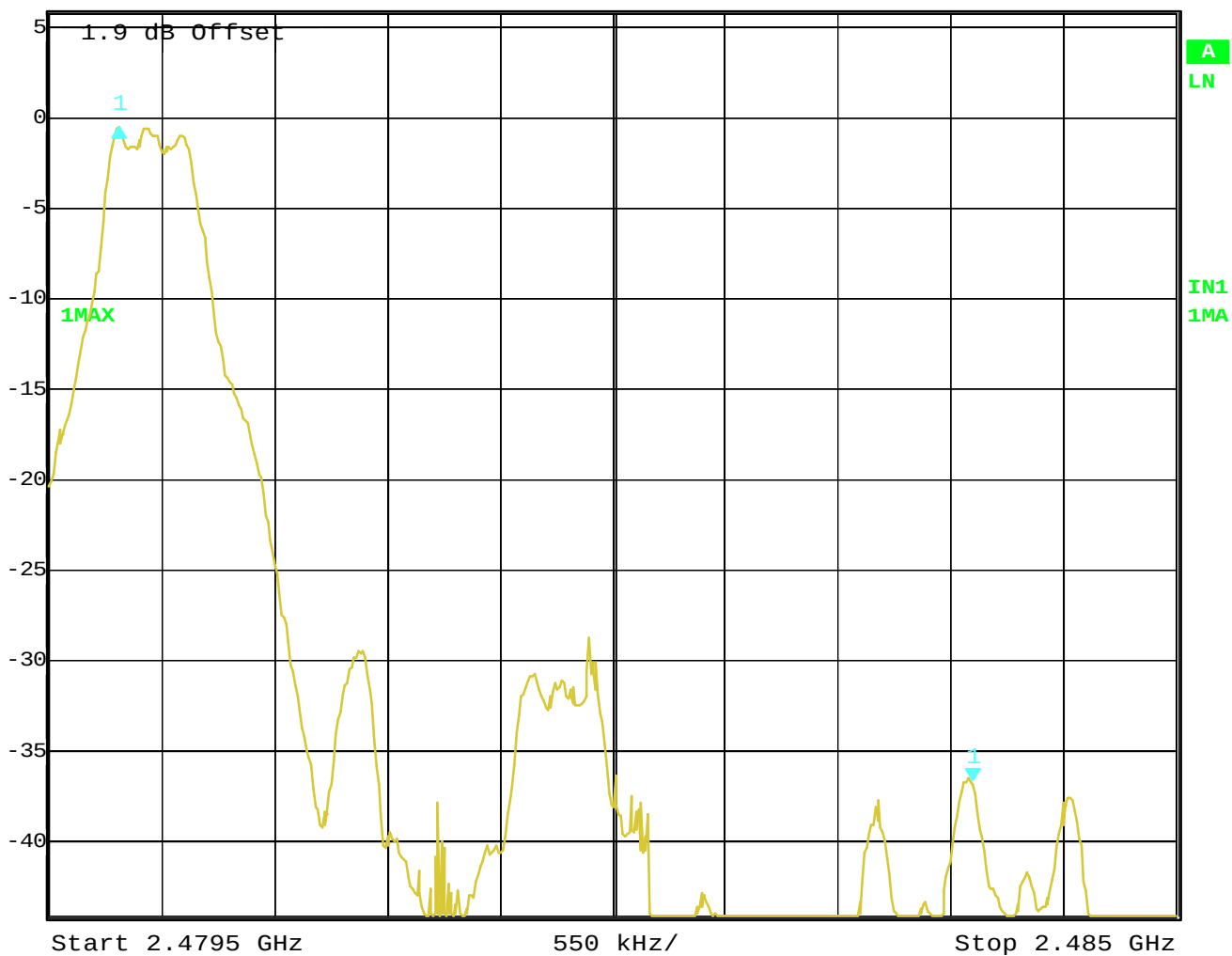
Relative humidity: 58%

BAND EDGE REQUIREMENTS

§ 15.247/c



Ref Lvl	Delta 1 [T1]	RBW	100 kHz	RF Att	20 dB
5.9 dBm	36.07 dB	VBW	100 kHz	Mixer	-20 dBm
	-4.17034068 MHz	SWT	5 ms	Unit	dBm



Date: 21. JAN. 2002 10:32:29

Peak power at the band edge or at the highest emission outside the band on channel 78: -36,07 dBc

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

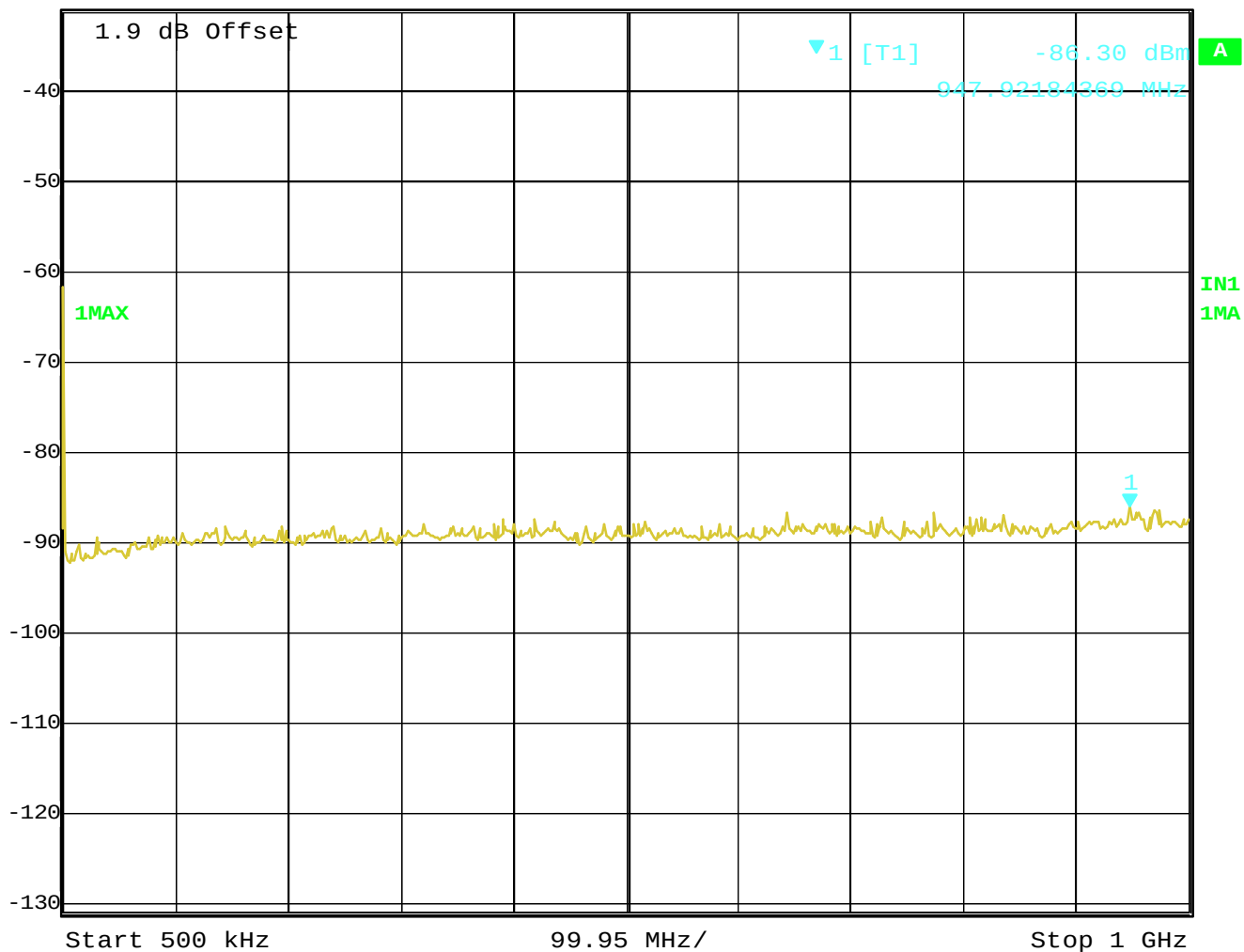
Relative humidity: 58%

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl -31.1 dBm
Marker 1 [T1] -86.30 dBm
947.92184369 MHz
RBW 100 kHz
VBW 100 kHz
SWT 250 ms
RF Att 0 dB
Mixer -20 dBm
Unit dBm

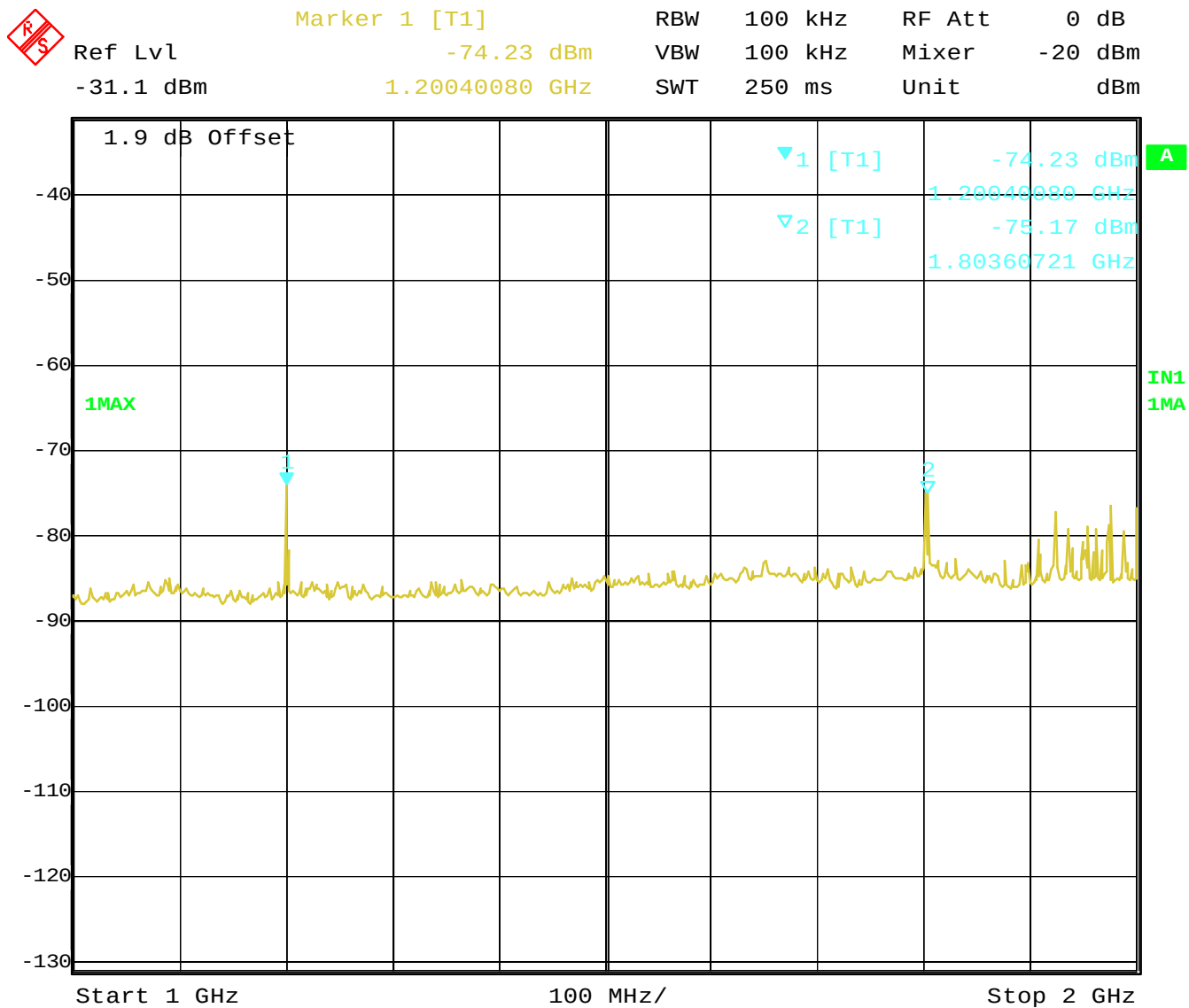


Date: 21.JAN.2002 10:57:14

Emissions in the frequency range 500 kHz to 1 GHz operated on channel 0.

SPURIOUS EMISSIONS

§ 15.247/c



Date: 21.JAN.2002 10:56:23

Emissions in the frequency range 1 GHz to 2 GHz operated on channel 0.

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

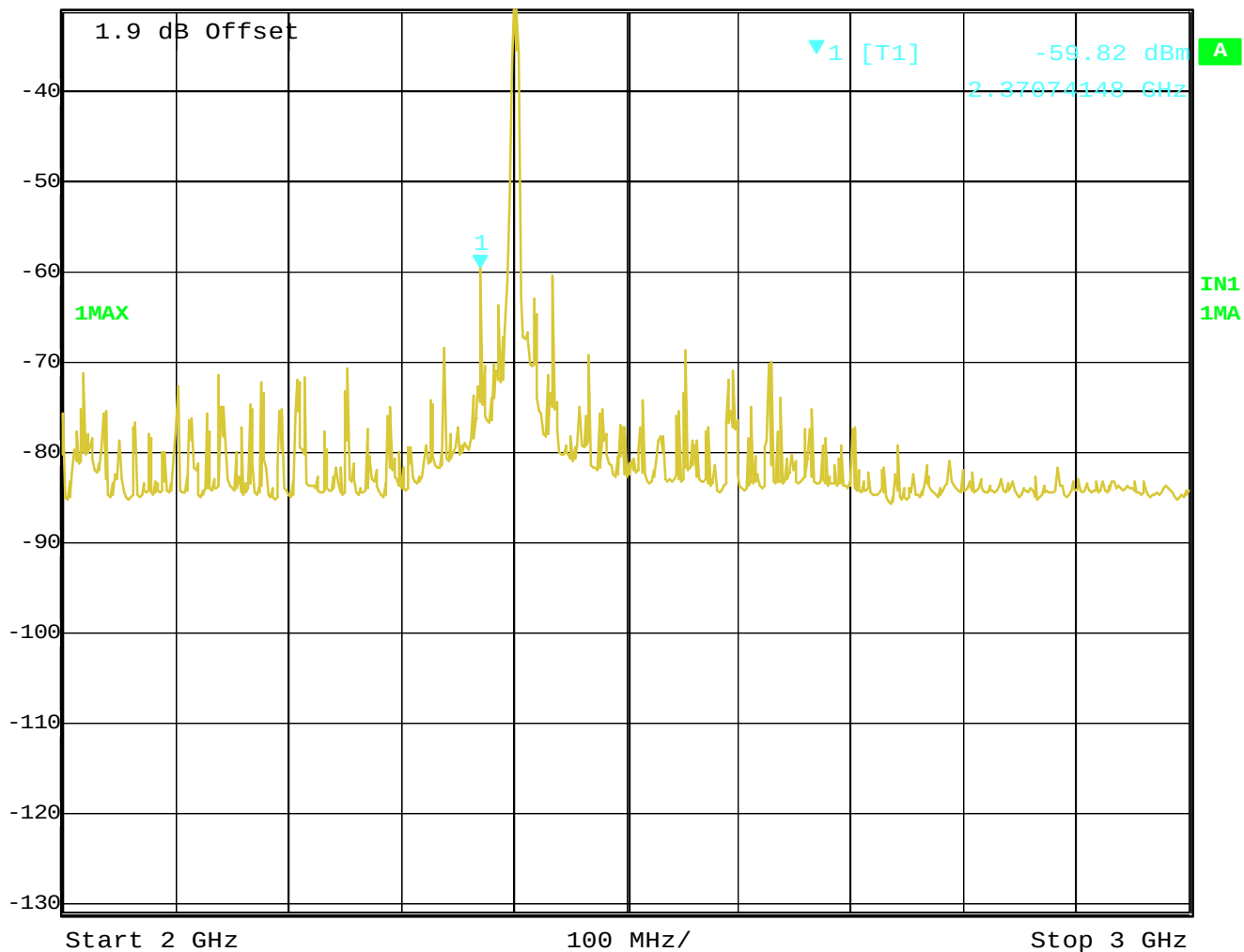
Relative humidity: 58%

SPURIOUS EMISSIONS

§ 15.247/c



Marker 1 [T1]
Ref Lvl -31.1 dBm
-59.82 dBm
2.37074148 GHz
RBW 100 kHz
VBW 100 kHz
SWT 250 ms
RF Att 0 dB
Mixer -20 dBm
Unit dBm



Date: 21.JAN.2002 10:55:08

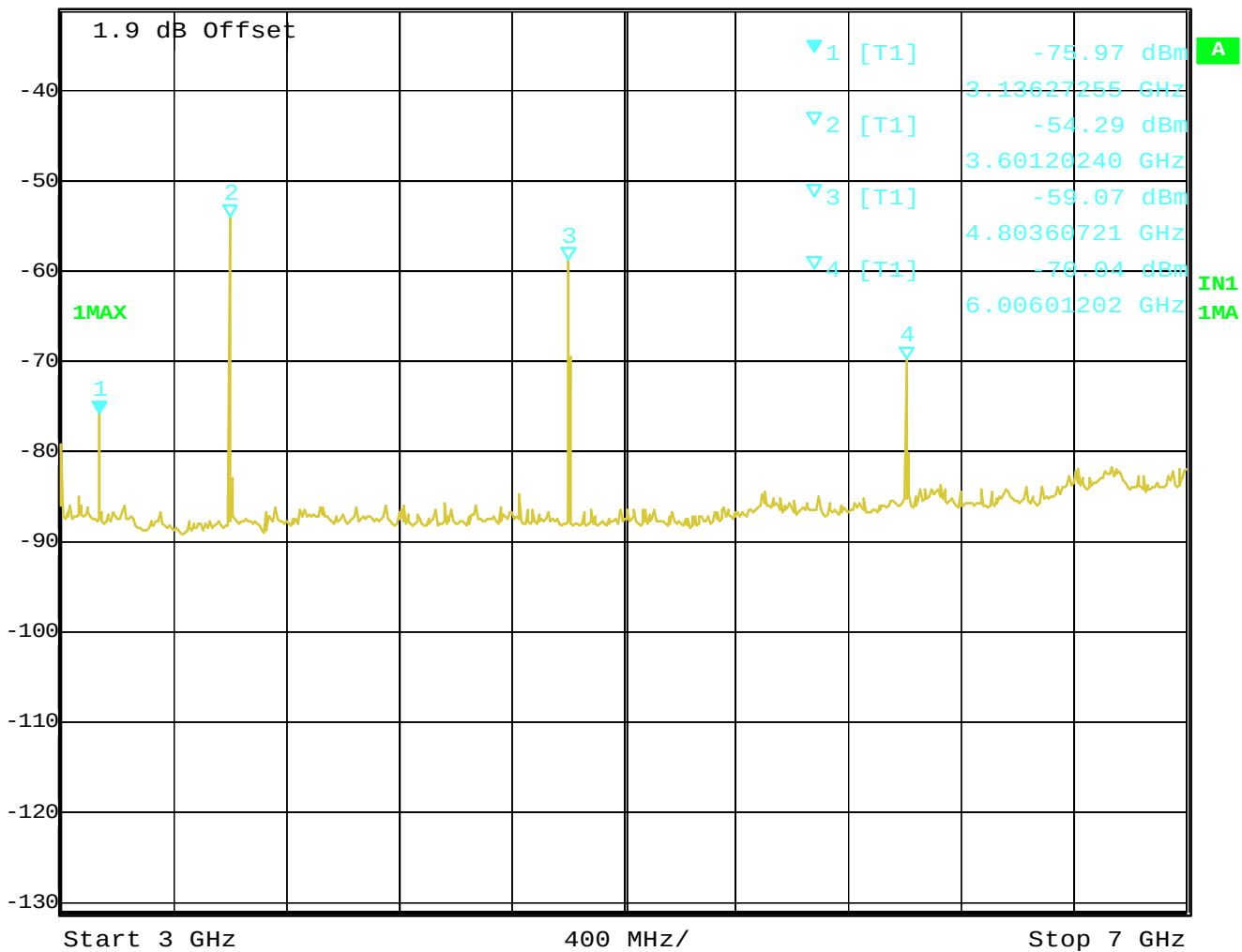
Emissions in the frequency range 2 GHz to 3 GHz operated on channel 0.

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl -31.1 dBm
Marker 1 [T1] -75.97 dBm
3.13627255 GHz
RBW 100 kHz
VBW 100 kHz
SWT 1 s
RF Att 0 dB
Mixer -20 dBm
Unit dBm



Date: 21. JAN. 2002 10:47:55

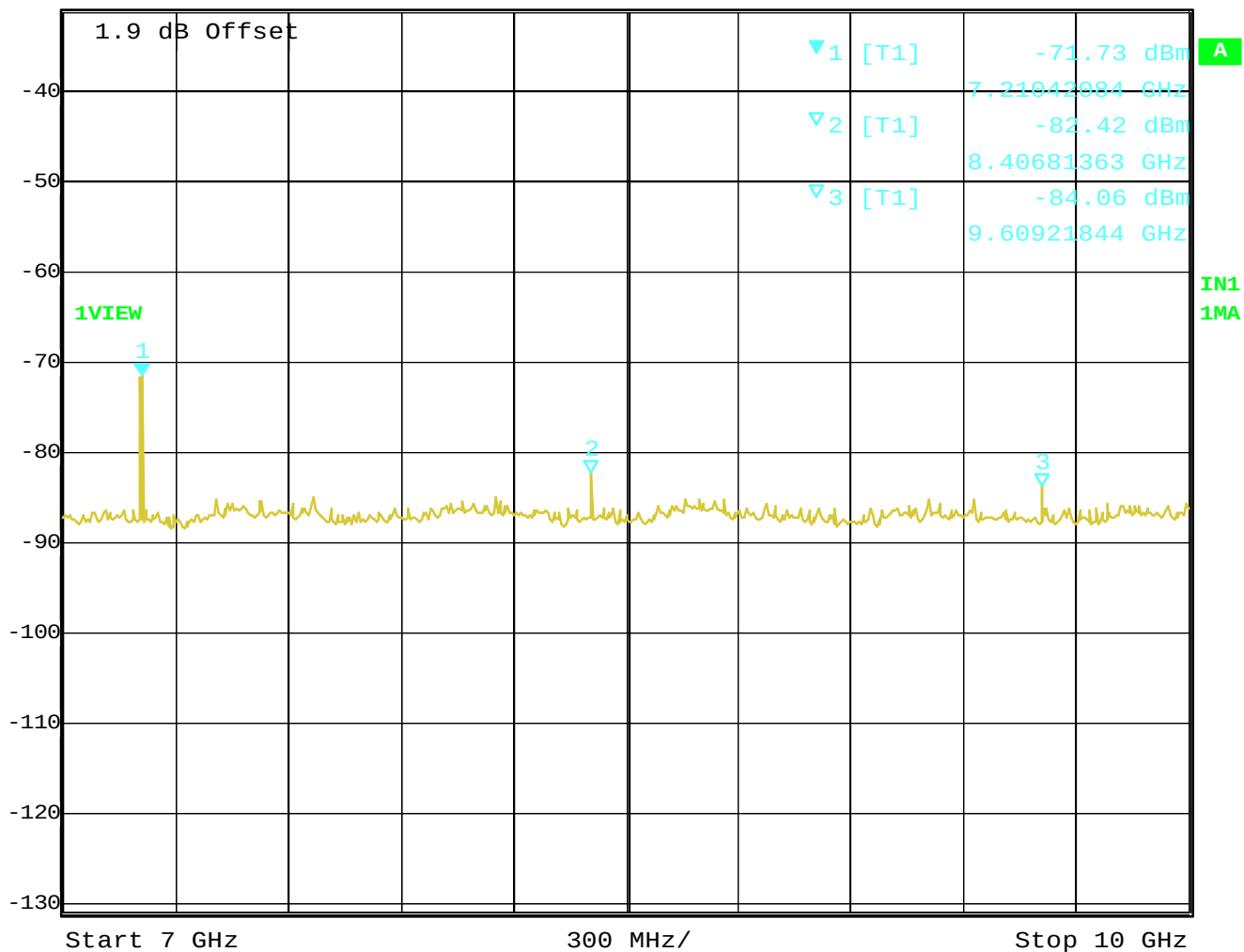
Emissions in the frequency range 3 GHz to 7 GHz operated on channel 0.

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl -31.1 dBm
Marker 1 [T1] -71.73 dBm
7.21042084 GHz
RBW 100 kHz
VBW 100 kHz
SWT 760 ms
RF Att 0 dB
Mixer -20 dBm
Unit dBm



Date: 21. JAN. 2002 10:53:29

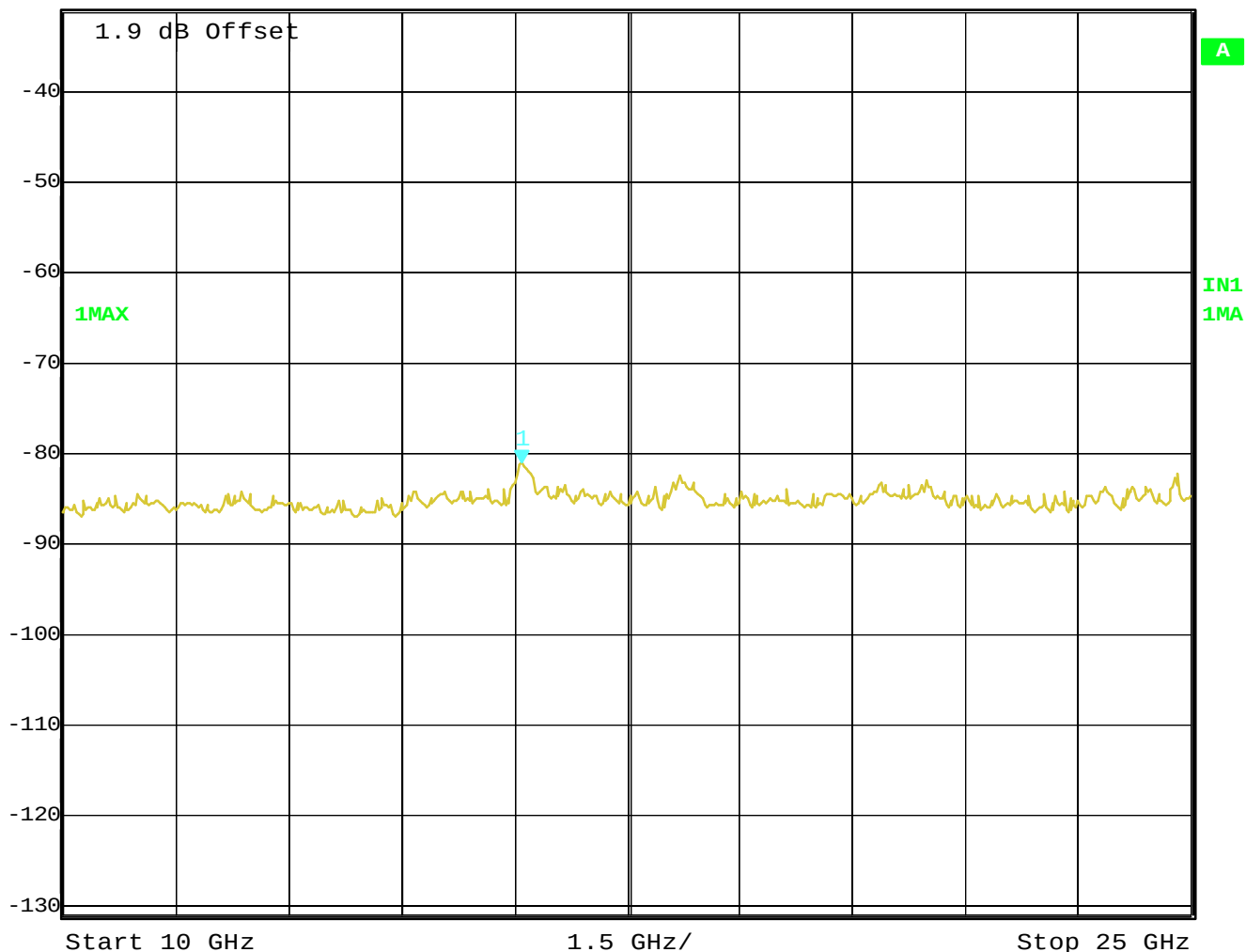
Emissions in the frequency range 7 GHz to 10 GHz operated on channel 0.

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl	Marker 1 [T1]	RBW	100 kHz	RF Att	0 dB
-31.1 dBm	-81.13 dBm	VBW	100 kHz	Mixer	-20 dBm
	16.10220441 GHz	SWT	3.8 s	Unit	dBm



Date: 21.JAN.2002 10:46:01

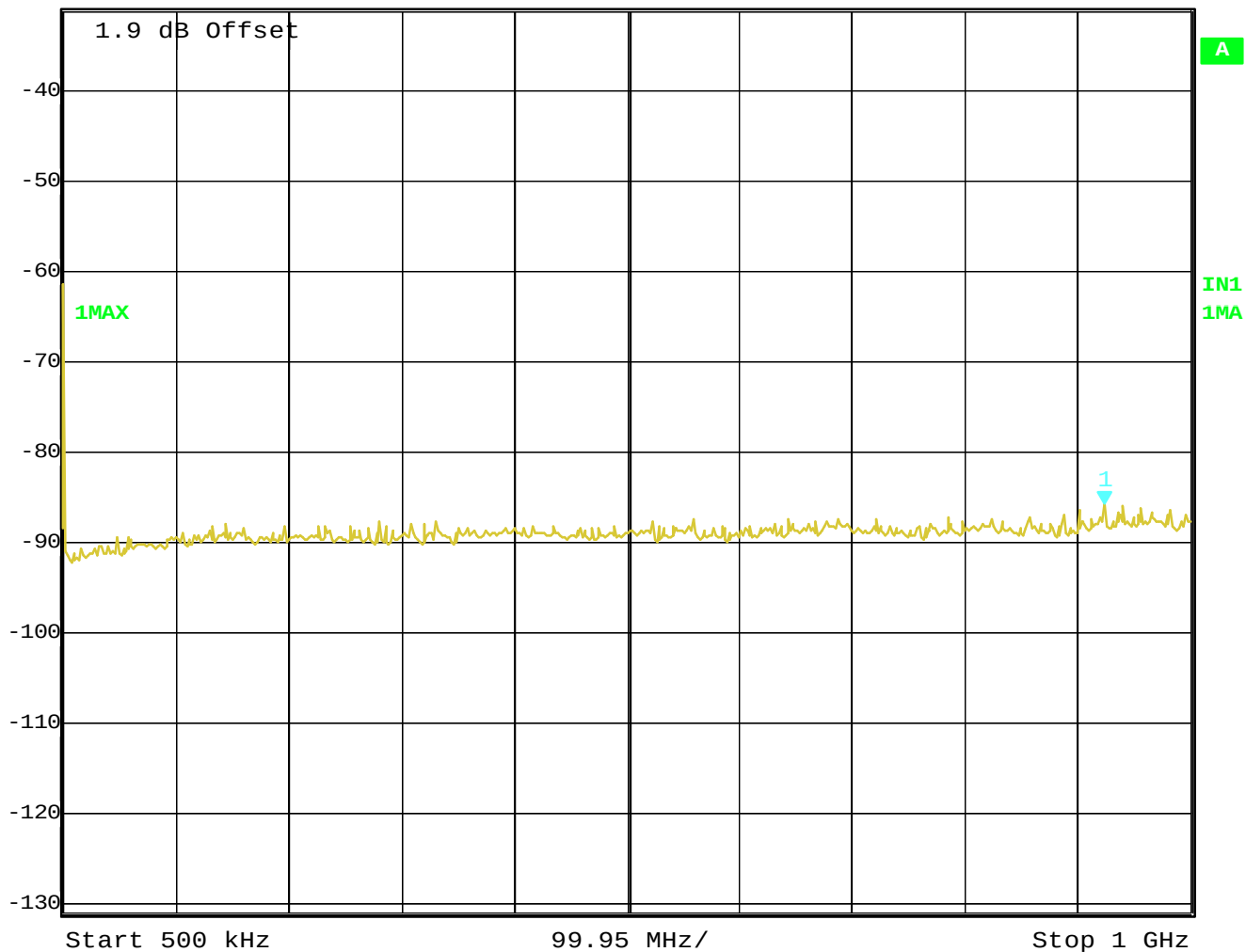
Emissions in the frequency range 10 GHz to 25 GHz operated on channel 0.

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl	Marker 1 [T1]	RBW	100 kHz	RF Att	0 dB
-31.1 dBm	-85.88 dBm	VBW	100 kHz	Mixer	-20 dBm
	923.88577154 MHz	SWT	250 ms	Unit	dBm



Date: 21. JAN. 2002 10:35:29

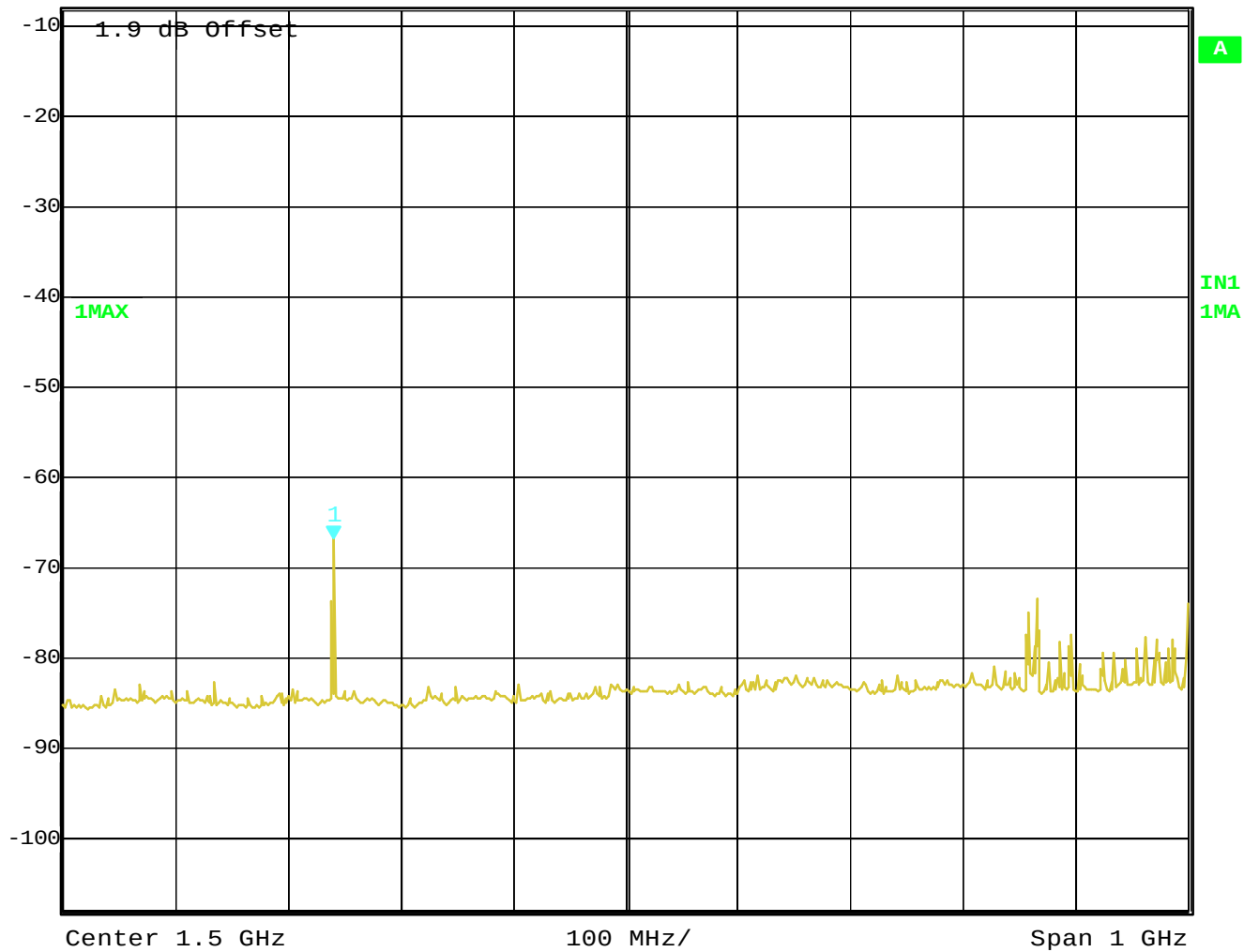
Emissions in the frequency range 500 kHz to 1 GHz operated on channel 78.

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl -8.1 dBm
Marker 1 [T1] -66.87 dBm
1.24048096 GHz
RBW 100 kHz
VBW 100 kHz
SWT 250 ms
RF Att 0 dB
Unit dBm



Date: 21. JAN. 2002 10:27:20

Emissions in the frequency range 1 GHz to 2 GHz operated on channel 78.

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

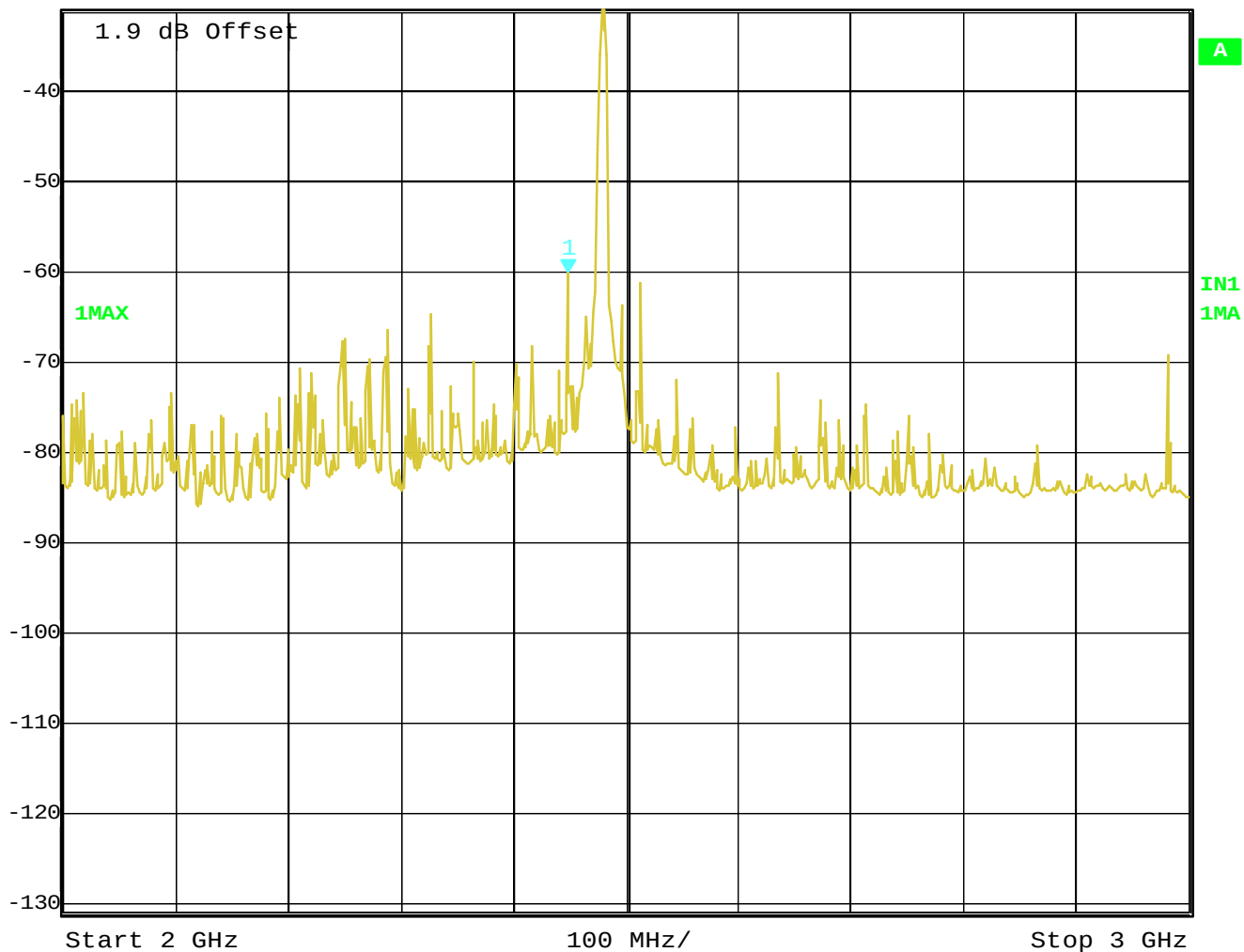
Relative humidity: 58%

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl	Marker 1 [T1]	RBW	100 kHz	RF Att	0 dB
-31.1 dBm	-60.14 dBm	VBW	100 kHz	Mixer	-20 dBm
	2.44889780 GHz	SWT	250 ms	Unit	dBm



Date: 21.JAN.2002 10:38:09

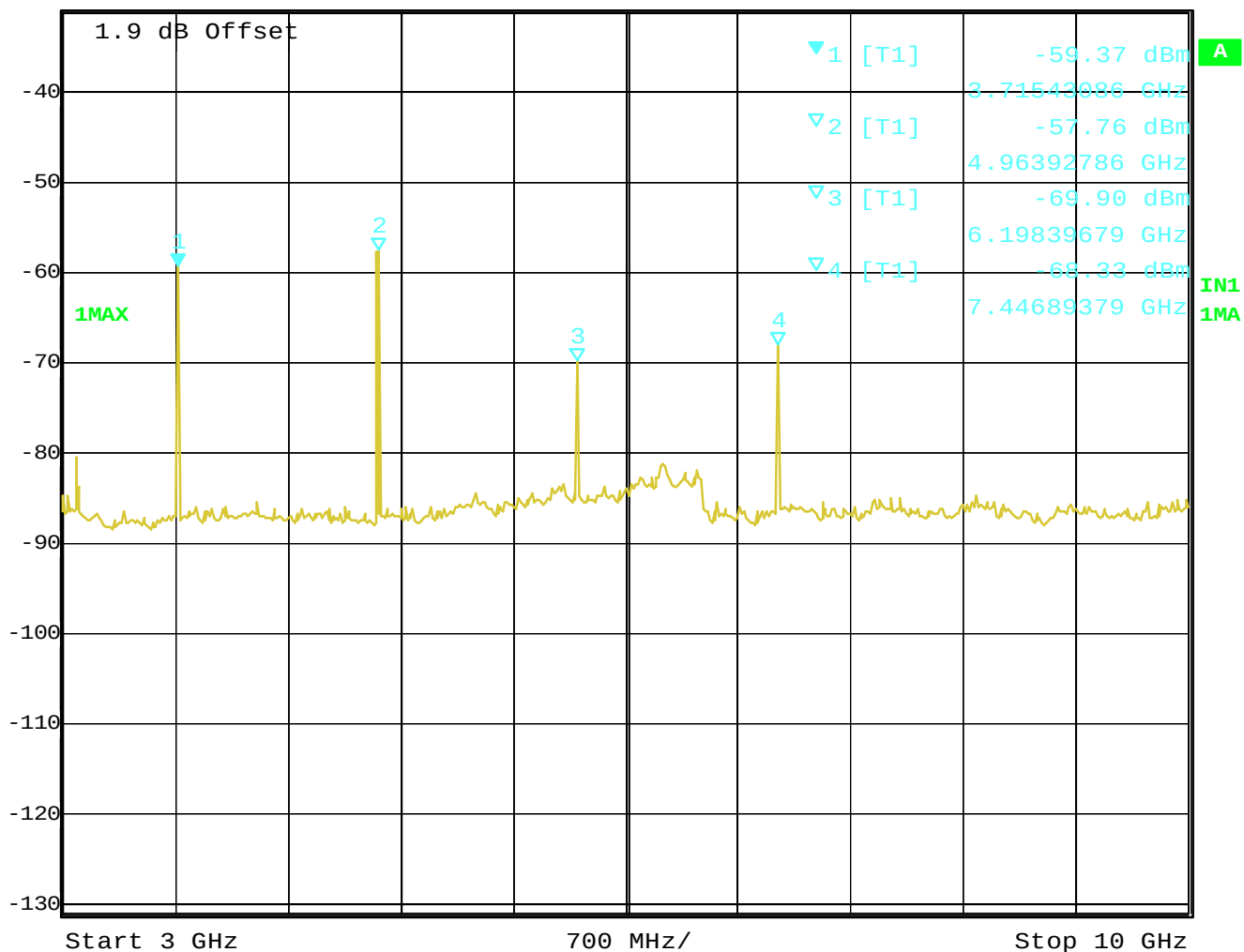
Emissions in the frequency range 2 GHz to 3 GHz operated on channel 78.

SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl -31.1 dBm Marker 1 [T1] -59.37 dBm RBW 100 kHz RF Att 0 dB
VBW 100 kHz Mixer -20 dBm
SWT 1.75 s Unit dBm



Date: 21.JAN.2002 10:42:22

Emissions in the frequency range 3 GHz to 10 GHz operated on channel 78.

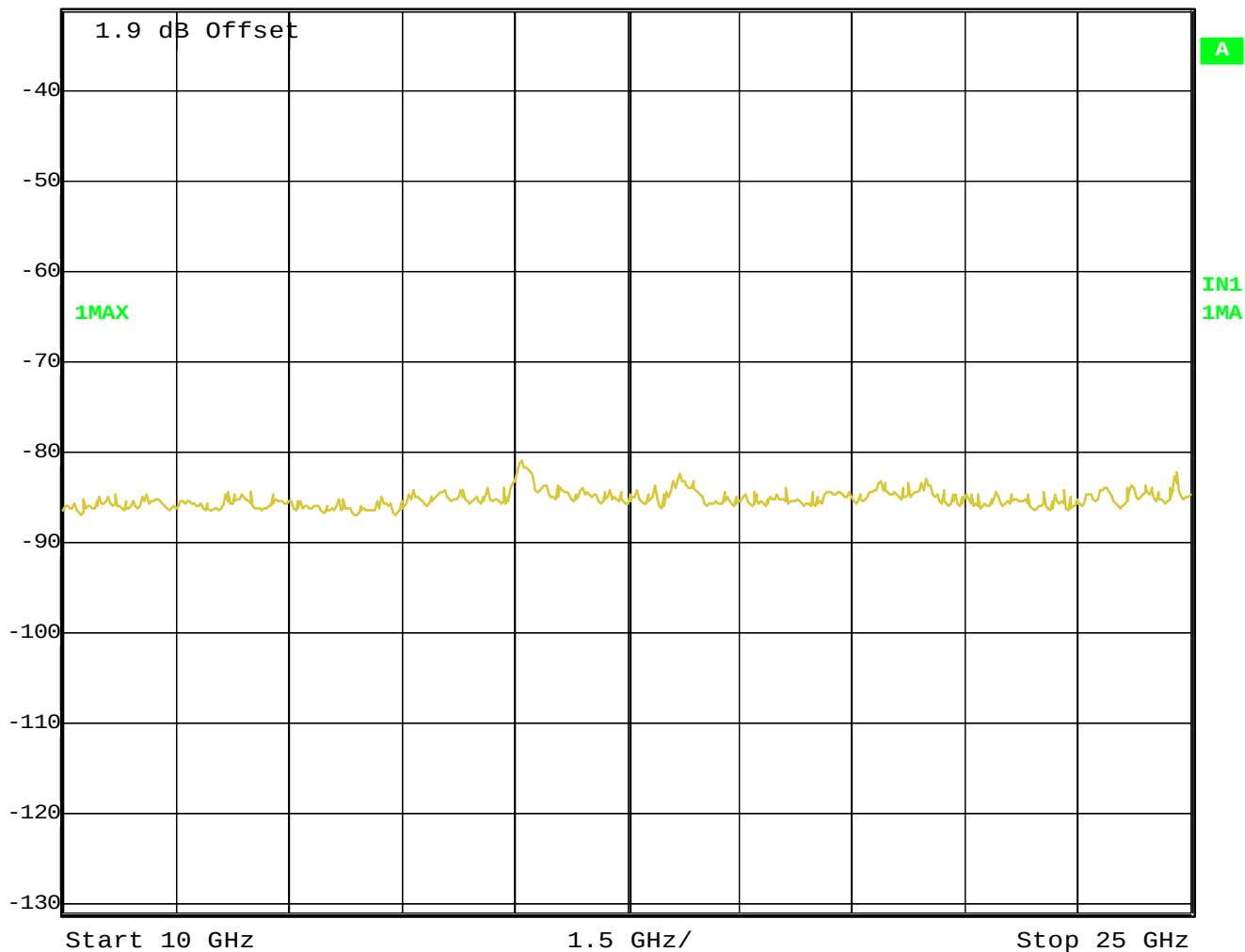
SPURIOUS EMISSIONS

§ 15.247/c



Ref Lvl
-31.1 dBm

RBW	100 kHz	RF Att	0 dB
VBW	100 kHz	Mixer	-20 dBm
SWT	3.8 s	Unit	dBm



Date: 21. JAN. 2002 10:45:39

Emissions in the frequency range 10 GHz to 25 GHz operated on channel 78.

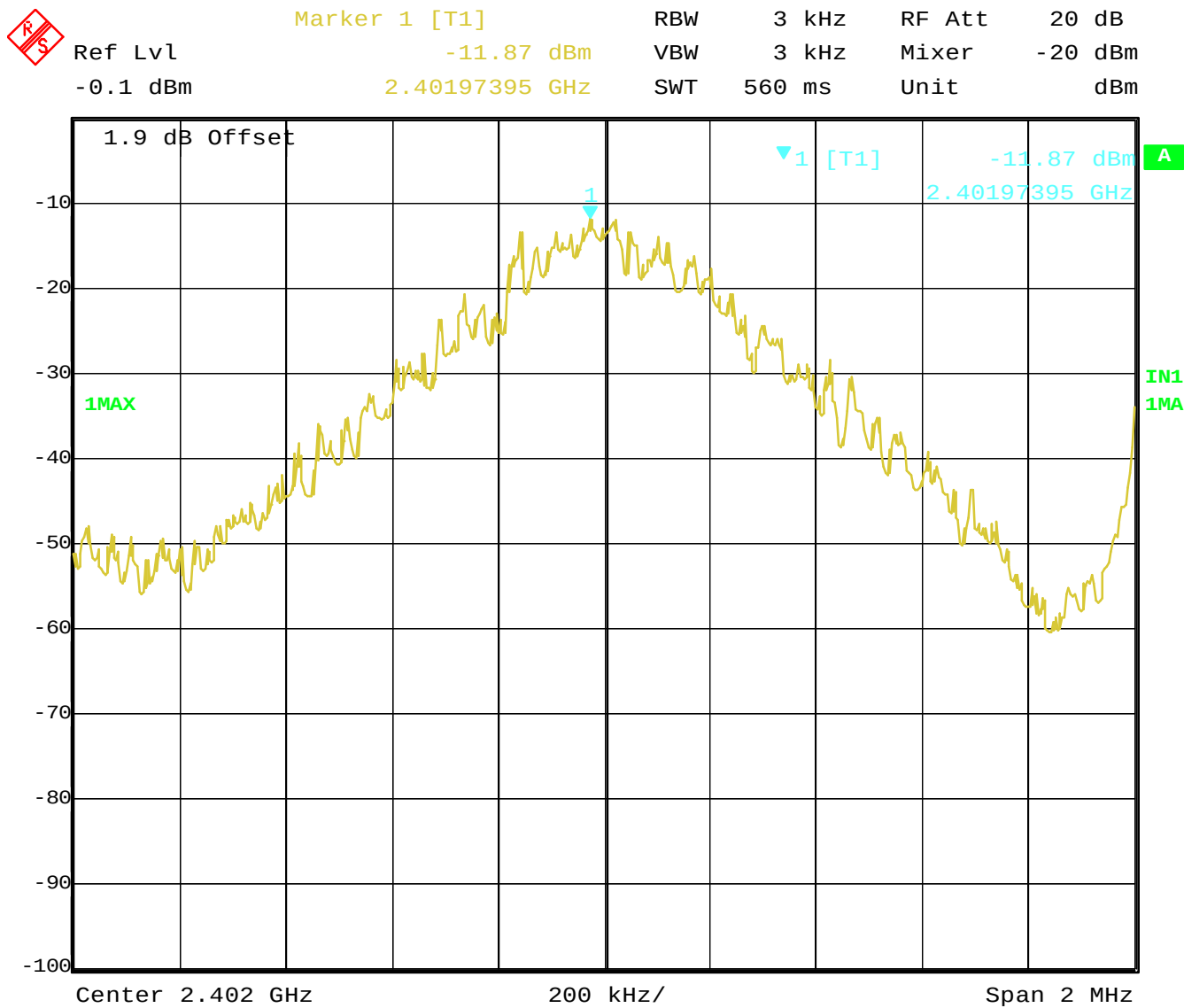
Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

POWER SPECTRAL DENSITY

§ 15.247/f (d)



Date: 21. JAN. 2002 11:17:19

channel 0

Power density: -11.87 dBm

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

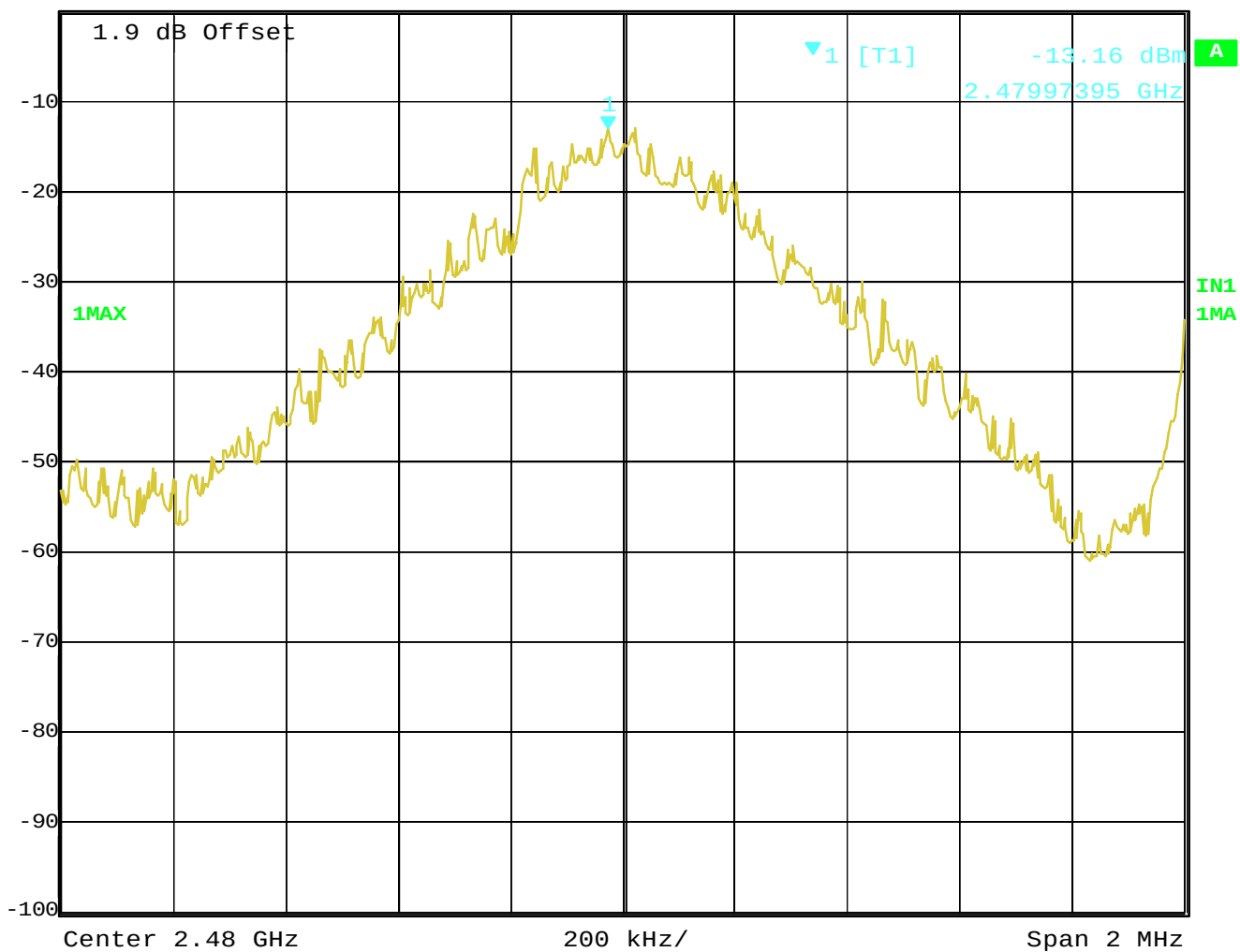
Relative humidity: 58%

POWER SPECTRAL DENSITY

§ 15.247/f (d)



Ref Lvl -0.1 dBm
Marker 1 [T1] -13.16 dBm
2.47997395 GHz
RBW 3 kHz
VBW 3 kHz
SWT 560 ms
RF Att 20 dB
Mixer -20 dBm
Unit dBm



Date: 21. JAN. 2002 11:23:35

channel 78

Power density: -13,16 dBm

Test Report Reference:
M/FG-02/104

Ambient temperature: 22°C

Relative humidity: 58%

RADIATED EMISSIONS (Intentional Radiator)

§ 15.209/a

The radiated emission test was made with the equipment BT-LAP (CasSi), which was the former inofficial name for the Bluetooth LAN Access Point „blue2net“. For details see test report number: M/EMV-01/260.

Appendix 1

Test equipment used

☐ Anechoic Chamber with 3m measurement distance	NT-100	☐ ESPC - Test receiver 9 kHz - 2,5 GHz	NT-203
☐ MA 240 - Antenna mast 1 - 4 m height	NT-110	☒ ESI26 – Test receiver 20 Hz – 26,5 GHz	NT-207
☐ DS 412 - Turntable 0 - 400 ° Azimuth	NT-111	☐ Digital Radio Tester CTS55	NT-208
☐ HD 100 Controller Mast+Turntable	NT-112	☐ Noise-gen., ITU-R 559-2 20 Hz – 20 kHz	NT-209
☐ HUF-Z2 - Bicon. Antennna 20 - 300 MHz	NT-120	☐ CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz	NT-210
☐ HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz	NT-121	☐ 3271 - Spectrum analyzer 100 Hz - 26,5 GHz	NT-211
☐ HFH-Z2 - Loop Antenna. 9 kHz - 30 MHz	NT-122	☐ Radiocommunicationanalyzer Marconi 2945A	NT-212
☐ HFH-Z6 - Rod Antenna 9 kHz - 30 MHz	NT-123	☐ 2855S - Communication analyzer	NT-213
☐ 3121C - Dipole Antenna 28 - 1000 MHz	NT-124	☐ Mixer M28HW 26,5 GHz - 40 GHz	NT-214
☐ 3115 - Horn Antenna 1 - 18 GHz	NT-125	☐ Diode Detector 0,01 GHz - 26,5 GHz	NT-215
☐ 3116 - Horn Antenna 18 - 40 GHz	NT-126	☐ 3160-10 Horn Antenna 26,5 GHz - 40 GHz	NT-216
☐ SAS-200/543 - Bicon. Ant. 20 MHz - 300 MHz	NT-127	☐ Radiocommunicationanalyzer SWR 1180 MD	NT-217
☐ AT-1080 - Log. Per. Ant. 80 - 1000 MHz	NT-128	☐ Mixer M19HWD 40 GHz – 60 GHz	NT-218
☐ HK-116 - bicon. Ant. 20 MHz - 300 MHz	NT-129	☐ Mixer M12HWD 60 GHz – 90 GHz	NT-219
☐ HK-116 - bicon. Ant. 20 MHz - 300 MHz	NT-130	☐ TDS - 540 DSO Digital scope	NT-220
☐ 3146 - Log. Per. Ant. 200 - 1000MHz	NT-131	☐ PM97 Scopemeter	NT-221
☐ Loop Antenna H-Field	NT-132	☐ B9-DSP-IS Digital Analyzer for voltage fluctuations	NT-230
☐ Horn Antenna 500 MHz - 2900 MHz	NT-133	☐ DFT 555 - Power and harmonics analyzer	NT-231
☐ Log. per. Antenna 800 MHz - 2500 MHz	NT-134	☐ EFA-3 H-field- / E-field probe	NT-243
☐ Log. per. Antenna 800 MHz - 2500 MHz	NT-135	☐ E-field measuring instrument EMR-200; 100 kHz – 3 GHz	NT-244
☐ BiConiLog Antenna 26 MHz – 2000 MHz	NT-137	☐ E-field probe (for use with EMR-200)	NT-245
☐ Conical Dipol Antenna PCD8250	NT-138	☐ Magneticfield-Sensor 300 kHz – 30 MHz	NT-246
☐ HZ-1 Antenna tripod	NT-150	☐ MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250
☐ BN 1500 Antenna tripod	NT-151	☐ FCC-203I EM Injection clamp	NT-251
☐ ESVP - Test receiver 20 - 1000 MHz	NT-201	☐ FCC-203I-DCN Ferrite decoupling network	NT-252
☐ Switchbox	NT-202	☐ PR50 Current Probe	NT-253

Medizintechnik/
Nachrichtentechnik/EMV

Department: FG

Test report number:
M/FG-02/104

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Appendix 1 (continued)

Test equipment used

☐ Model 2000 Digital Multimeter	NT-261	☐ Preamplifier 1 GHz - 4 GHz	NT-335
☐ Fluke 97 Digital Multimeter	NT-262	☐ 2-97201 Electronic load	NT-341
☐ Fluke 97 Digital Multimeter	NT-263	☐ TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-344
☐ ESH2-Z5 Artificial mains network 4x25A	NT-300	☐ TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-345
☐ ESH3-Z5 Artificial mains network 2x10A	NT-301	☐ VDS 200 Mobil-impuls-generator	NT-350
☐ ESH3-Z6 Artificial mains network 1x100A	NT-302	☐ LD 200 Mobil-impuls-generator	NT-351
☐ ESH3-Z4 T-Artificial network	NT-303	☐ MPG 200 Mobil-Impuls-Generators	NT-352
☐ PHE 4500/B Power amplifier	NT-304	☐ EFT 200 Mobil-impuls-generator	NT-353
☐ EZ10 T-Artificial network	NT-305	☐ FP 16/3-1 3 ph. Coupling filter (Burst)	NT-400
☐ MidiStar Telephone exchange	NT-306	☐ PHE 4500 - Mains impedance network	NT-401
☐ SMG - Signal generator 0,1 - 1000 MHz	NT-310	☐ FP-SURGE 32.1 3 ph. Coupling filter (Surge)	NT-402
☐ PM 5518 TXVPS Video generator	NT-311	☐ IP 6.2 Coupling filter for data lines (Surge)	NT-403
☐ RefRad Reference generator	NT-312	☐ ESH2-Z3 - Probe 9 kHz - 30 MHz	NT-410
☐ SMP 02 Signal generator 10 MHz - 20 GHz	NT-313	☐ IP 4 - Capacitive clamp (Burst)	NT-411
☐ PEFT - Burst generator up to 4 kV	NT-320	☐ HV-Attenuator 54,5 dB (Burst)	NT-420
☐ PSD - ESD generator up to 25 kV	NT-321	☒ RF-Attenuator 20 dB 0,1 - 1000 MHz / 25 W	NT-421
☐ ESD-Pistol	NT-322	☐ RF-Attenuator 10 dB 0,1 - 1000 MHz / 20 W	NT-422
☐ Vacuum-Relais up to 8 kV	NT-323	☐ RF-Attenuator 30 dB 0,1 - 1000 MHz / 1 W	NT-423
☐ PSURGE 4.1 Surge generator	NT-324	☐ RF-Attenuator 30 dB	NT-424
☐ TRANSIENT 1000 Immunity test system	NT-325	☐ RF-Attenuator 6 dB 0,1 - 1000 MHz / 1 W	NT-425
☐ VCS 500-M6 Surge-Generator	NT-326	☐ RF-Attenuator 6 dB 0,1 - 1000 MHz / 1 W	NT-426
☐ BTA-250 - RF-Amplifier 9 kHz - 220 MHz / 250 W	NT-330	☐ Voltage-divider 1:100	NT-427
☐ 500W1000M7 - RF-Amplifier 80 - 1000 MHz / 500 W	NT-332	☐ RF-Attenuator 6 dB	NT-428
☐ AS0102-65R - RF-Amplifier 1 GHz - 2 GHz	NT-333	☐ RF-Attenuator 0 dB - 81 dB	NT-429
☐ APA01 - RF-Amplifier 0,5 GHz - 2,5 GHz	NT-334	☐ WRU 27 - Band blocking 27 MHz	NT-430

Medizintechnik/
Nachrichtentechnik/EMV

Department: FG

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Appendix 1 (continued)

Test equipment used

☐ WHJ450C9 AA - High pass 450 MHz	NT-431	☐ SPS_PHE - Test software voltage fluctuations/harmonics	NT-525
☐ WHJ250C9 AA - High pass 250 MHz	NT-432	☐ SPS_EM - Test software for PHE 4500/B	NT-527
☐ RF-Load 150 W	NT-433	☐ Noise power test apparatus according to EN 55014	NT-530
☐ Impedance transducer 50 Ohm – 800 Ohm	NT-435	☐ Vertical coupling plane (ESD)	NT-531
☐ I+P 7780 Directional coupler 100 - 2000 MHz	NT-440	☐ Equipment for ESD-pulse verification.	NT-532
☐ ESH3-Z2 - Pulse limiter 9 kHz - 30 MHz	NT-441	☐ TEM-Zelle	NT-533
☐ Power Divider 6 dB/1 W/50 Ohm	NT-443	☐ ESV-24 Plotter adapter	NT-540
☐ Directional coupler 0,1 MHz – 70 MHz	NT-444	☒ Test cables	NT-550
☐ Directional coupler 0,1 MHz – 70 MHz	NT-445	☐ Test cable #4 for EN 61000-4-6	NT-553
☐ Tube imitations according to EN 55015	NT-450	☐ Test cable #3 for conducted emission	NT-554
☐ FCC-801-M5-25 Coupling decoupling network	NT-460	☐ Test cable #5 ESD-cable (2x470k)	NT-555
☐ FCC-801-AF10 Coupling decoupling network	NT-461	☐ Test cable #6 ESD-cable (2x470k)	NT-556
☐ FCC-801-S25 Coupling decoupling network	NT-462	☐ Serial data - fiber optic link	NT-557
☐ FCC-801-T4 Coupling decoupling network	NT-463	☐ Test cable #8 Sucoflex 104EA	NT-559
☐ FCC-801-C1 Coupling decoupling network	NT-464	☐ Test cable #9 (for outdoor measurements)	NT-580
☐ F-16A - Current probe 1kHz - 70MHz	NT-465	☐ Test cable #10 (for outdoor measurements)	NT-581
☒ PC P450 - Test computer	NT-500	☐ Test cable #13 PBA-33PBC-10	NT-584
☐ SE 284 GPIB - Plotter	NT 502	☐ Shield chamber	NT-600
☐ PC P133 Test computer #2	NT-504	☐ Climatic chamber -55°C to +180°C	M-512
☐ PC P200 MMX Notebook	NT-505	☐ Control and simulation equipment for EUT	---
☐ PC PIII 933 MHz Notebook	NT-506		
☐ 7110 - Controlling device for E-Field probe	NT-510		
☐ Monitoring camera with Monitor	NT-511		
☐ BSR-V1 - Video transmission system (optical fiber link)	NT-512		
☐ ES-K1 Test software	NT-520		
☐ ESPC-K1 Test software	NT-521		

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