

Prüfbericht - Nr.:

14004957 001

Seite 1 von 20
 Page 1 of 20

Test Report No.

Auftraggeber:

Gigawavetech Pte Ltd.

Client:

1 Jalan Kilang Timor

#07-02 Pacific Tech Centre

Singapore

Gegenstand der Prüfung:

Bluetooth Headset

Test item:

Bezeichnung: GWT-BTH1

Serien-Nr.:

Engineering sample

Identification: **FCCID: QXZGWTBTH1**

Serial No.

Wareneingangs-Nr.: 031208012

Eingangsdatum: 08.12.2003

Receipt No.:

Date of receipt:

Prüfort:

Refer to section 4.1

Testing location:

Prüfgrundlage:

FCC Part 15, Subpart C

Test specification:

ANSI C63.4-1992

CISPR 22:1997

Prüfergebnis:

Der vorstehend beschriebene Prüfgegenstand wurde geprüft und entspricht oben genannter Prüfgrundlage.

Test Result

The a. m. test item passed.

geprüft / tested by:

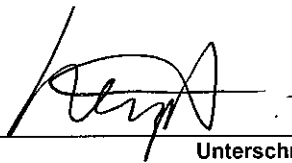
kontrolliert / reviewed by

Hugo Wan

Stephan Wald

10.12.2003

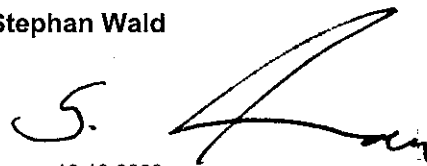
Datum
Date



Unterschrift
Signature

10.12.2003

Datum
Date



Unterschrift
Signature

Sonstiges / Other Aspects:

Abkürzungen:

OK, Pass = entspricht Prüfgrundlage
 Fail = entspricht nicht Prüfgrundlage
 N/A = nicht anwendbar

Abbreviations:

OK, Pass = passed
 Fail = failed
 N/A = not applicable

Dieser Prüfbericht bezieht sich nur auf den o.g. Prüfgegenstand und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.

This test report relates to the a. m. test item. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark on this or similar products.

Authorized format 16.12.1996, R.M.

1 Test Summary

7.1.1 ANTENNA CONNECTOR SUBCLAUSE 15.203

7.1.2 ANTENNA TYPE SUBCLAUSE 15.204

7.1.3 DISTURBANCE VOLTAGE ON AC MAINS SUBCLAUSE 15.207(A)

RESULT: Pass

Limit Subclause 15.207(a)

7.1.4 CARRIER FREQUENCY SEPERATION SUBCLAUSE 15.247(A)(1)

RESULT: Pass

Limit Subclause 15.247(a)(1)

7.1.5 DWELL TIME SUBCLAUSE 15.247(A)(1)(III)

RESULT: Pass

Limit Subclause 15.247(a)(1)(iii)

7.1.6 20dB BANDWIDTH SUBCLAUSE 15.247(A)(1)

7.1.7 HOPPING SEQUENCE SUBCLAUSE 15.247(A)(1)

7.1.8 RECEIVER INPUT BANDWIDTH SUBCLAUSE 15.247(A)(1)

7.1.9 PEAK OUTPUT POWER SUBCLAUSE 15.247(B)(1)

RESULT: Pass

Limit Subclause 15.247(b)(1)

7.1.10 BAND EDGE COMPLIANCE SUBCLAUSE 15.247(C)

RESULT: Pass

Limit Subclause 15.247(c)

7.1.11 SPURIOUS CONDUCTED EMISSIONS SUBCLAUSE 15.247(C)

RESULT: Pass

Limit Subclause 15.247(c)

7.1.12 SPURIOUS RADIATED EMISSIONS SUBCLAUSE 15.247(C)

RESULT: Pass

Limit Subclause 15.247(c)

2 Contents

1	TEST SUMMARY	2
2	CONTENTS	3
3	GENERAL REMARKS	4
3.1	COMPLEMENTARY MATERIALS.....	4
4	TEST SITES	4
4.1	TEST FACILITIES	4
4.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS	5
5	GENERAL PRODUCT INFORMATION	6
5.1	PRODUCT FUNCTION AND INTENDED USE	6
5.2	RATINGS AND SYSTEM DETAILS	6
5.3	INDEPENDENT OPERATION MODES	6
5.4	SUBMITTED DOCUMENTS	7
6	TEST SET-UP AND OPERATION MODE	7
6.1	PRINCIPLE OF CONFIGURATION SELECTION	7
6.2	TEST OPERATION AND TEST SOFTWARE.....	7
6.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	7
7	TEST RESULTS.....	8
7.1.1	<i>Antenna connector Subclause 15.203</i>	<i>8</i>
7.1.2	<i>Antenna type Subclause 15.204.....</i>	<i>8</i>
7.1.3	<i>Disturbance voltage on AC mains Subclause 15.207(a).....</i>	<i>9</i>
7.1.4	<i>Carrier frequency seperation Subclause 15.247(a)(1).....</i>	<i>11</i>
7.1.5	<i>Dwell time Subclause 15.247(a)(1)(iii).....</i>	<i>12</i>
7.1.6	<i>20dB bandwidth Subclause 15.247(a)(1)</i>	<i>13</i>
7.1.7	<i>Hopping sequence Subclause 15.247(a)(1).....</i>	<i>14</i>
7.1.8	<i>Receiver input bandwidth Subclause 15.247(a)(1)</i>	<i>15</i>
7.1.9	<i>Peak output power Subclause 15.247(b)(1)</i>	<i>16</i>
7.1.10	<i>Band edge compliance Subclause 15.247(c)</i>	<i>17</i>
7.1.11	<i>Spurious conducted emissions Subclause 15.247(c)</i>	<i>18</i>
7.1.12	<i>Spurious radiated emissions Subclause 15.247(c)</i>	<i>19</i>

3 General Remarks

3.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix 1: Test Results

Appendix 2: Test Setup

Appendix 3: EUT Photos

Appendix 4: FCCID Label, Block Diagram, Schematics and User Manual

4 Test Sites

4.1 Test Facilities

Hong Kong Productivity Council
HKPC Building
78 Tat Chee Avenue
Kowloon
Hong Kong

4.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

	Kind of Equipment	Manufacturer	Type	S/N
☒	Test Receiver	Rohde & Schwarz	ESHS30	847115/005
☒	L/I/S/N	Rohde & Schwarz	ESH 3-Z5	849876/026
☐	Oscilloscope	HP	54713B	US34510455
☐	Test Receiver	Rohde & Schwarz	ESVP	882402/033
☐	Absorbing Clamp	Rohde & Schwarz	MDS-21	979 3/4
☒	Test Receiver 20 – 1000MHz	Rohde & Schwarz	ESVS30	842807/009
☒	Biconical Antenna	Rohde & Schwarz	HK116	841489/015
☒	Log.-Periodic Antenna	Rohde & Schwarz	HL223	841516/017
☐	Universal Power Analyzer	Voltech	PM3000A	9915
☐	Reference Impedance Network	Voltech	IEC 555 Standard	9946
☐	AC Power Source	California Instr.	4500L	HK51895
☐	Trip-Loop Antenna	Chase	LLA6142	1019
☒	Double Ridge Horn Antenna	EMCO	3115	9002-3351
☒	Double Ridge Horn Antenna	EMCO	3116	9002-3347
☐	RF Comms Test Set	HP	8920B	US36492628
☐	Spectrum Analyser + Tracking Gen.	HP	8596E	3639A00758
☐	Signal Generator	Rohde & Schwarz	SMY 01	844146/024
☐	Signal Generator	Rohde & Schwarz	SMY 01	844146/023
☐	BiLog Antenna	EMCO	3143	9607-1287
☐	Isotropic Field Probe	Holladay	HI-4422	90956
☐	Power Amplifier	Kalmus	757-LC	7620-1
☐	Power Amplifier	Kalmus	122-FC	7620-2
☐	Coupling Clamp	Schaffner	CDN 126	312
☐	Couple Device Network	Fischer	CDN-M2	9604
☒	Spectrum Analyzer	Rohde & Schwarz	FSP30	1093.4495K30
☐	Temperature Chamber	Binder	MK 240	9020-0028
☐	EFT,ESD,SURGE, DIPS tester	Schaffner	Best 96	IN3796-011

5 General Product Information

5.1 Product Function and Intended Use

The submitted sample is a wireless headset based on the Bluetooth technology.

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 1MHz 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. The symbol rate on the channel is 1 Ms/s.

5.2 Ratings and System Details

	Receiver	Transmitter
Frequency range	: 2402 - 2480MHz	2402 - 2480MHz
Number of channels	: 79	79
Channel separation	: 1MHz	1MHz
Type of antenna	: Metal strip PIFA antenna	Metal strip PIFA antenna
Power supply	: 3.7V Lithium Battery supply	3.7V Lithium Battery supply

5.3 Independent Operation Modes

- a) Inquiry scan
- b) Page scan
- c) Connection state:
 - ACL link
 - SCO link

For further information, please refer to the user manual.

5.4 Submitted Documents

Schematics
Block Diagram
PCB Layout
User manual

6 Test Set-up and Operation Mode

6.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

6.2 Test Operation and Test Software

Refer to Test set-up in chapter 7.

6.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessory:

1. Nokia 8910i
Serial number: 351103/40/005161/8

7 Test Results

7.1.1 Antenna connector

Subclause 15.203

The antenna is permanently attached on the PCB.

7.1.2 Antenna type

Subclause 15.204

The EUT has a Metal strip PIFA antenna soldered to the circuit board. The antenna gain is 0dBi.

7.1.3 Disturbance voltage on AC mains

Subclause 15.207(a)

RESULT:

Pass

Test Specification : CISPR 22: 1997
 Mode of operation : Charging only / Normal use during charging
 Port of testing : AC power port of the charger of the EUT
 Supply voltage : AC 110V
 Temperature : 26°C
 Humidity : 57%

Operation mode: Charging only
 For Live measurement

Frequency	QP reading	QP limit	Av reading	Av limit
MHz	dB μ V	dB μ V	dB μ V	dB μ V
0.306	18.5	66 – 56*	0.1	56 – 46*
0.498	17.3	66 – 56*	0.1	56 – 46*

For Neutral measurement

Frequency	QP reading	QP limit	Av reading	Av limit
MHz	dB μ V	dB μ V	dB μ V	dB μ V
0.396	22.5	66 – 56*	0.1	56 – 46*
28.632	4.8	66 – 56*	0.1	56 – 46*

Operation mode: Normal use during charging
 For Live measurement

Frequency	QP reading	QP limit	Av reading	Av limit
MHz	dB μ V	dB μ V	dB μ V	dB μ V
0.492	19.4	66 – 56*	0.1	56 – 46*
24.267	17.6	66 – 56*	12.6	56 – 46*

For Neutral measurement

Frequency	QP reading	QP limit	Av reading	Av limit
MHz	dB μ V	dB μ V	dB μ V	dB μ V
0.396	23.8	66 – 56*	0.1	56 – 46*
24.261	21.3	66 – 56*	16.2	56 – 46*

* Decreases with the logarithm of the frequency.

The radio frequency voltage conducted back onto the Live and the Neutral power lines complies with the limits.

For test results refer to Appendix 1, page 1-5

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 10 von 20
Page 10 of 20

Limit

Subclause 15.207(a)

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

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

* Decreases with the logarithm of the frequency.

7.1.4 Carrier frequency separation

Subclause 15.247(a)(1)

RESULT:

Pass

Test specification	:	FCC § 15.31
Mode of operation	:	Tx mode (hopping on), DH1 packet
Port of testing	:	Temporary antenna port
Detector	:	PK
RBW/VBW	:	100kHz/300kHz
Supply voltage	:	3.7V Lithium Battery supply
Temperature	:	26°C
Humidity	:	57%

The centre frequencies of the hopping channels are separated by more than the 20dB bandwidth.
For test results refer to Appendix 1, page 6

Limit

Subclause 15.247(a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

7.1.5 Dwell time

Subclause 15.247(a)(1)(iii)

RESULT:

Pass

Test specification	:	FCC § 15.31
Mode of operation	:	Tx mode (2441MHz), DH5 packet
Port of testing	:	Temporary antenna port
Detector	:	PK
RBW/VBW	:	1MHz/3MHz
Supply voltage	:	3.7V Lithium Battery supply
Temperature	:	26°C
Humidity	:	57%

The screenshot in Appendix1 P.8 shows the occurrence of a channel in a 12.8s time period. In inquiry and page scan mode Bluetooth is using 32 hopping channels only. The frequency was used 27 times. The dwell time for the longest supported packet type is about 3ms. As a result the average time of occupancy will not be greater than 400ms.

i.e. Time period calculation:
 $0.4 \times 32 = 12.8s$

Limit calculation:
 $27 \times 2.944 \times 10^{-3} = 79.490 \times 10^{-3} s$
 $\leq 400 \times 10^{-3} s$

For test results please refer to Appendix 1, page 7-8.

Limit

Subclause 15.247(a)(1)(iii)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

7.1.6 20dB bandwidth

Subclause 15.247(a)(1)

Test specification : FCC § 15.31
Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH5 packet
Port of testing : Temporary antenna port
Detector : PK
RBW/VBW : 30kHz/100kHz
Supply voltage : 3.7V Lithium Battery supply
Temperature : 26°C
Humidity : 57%

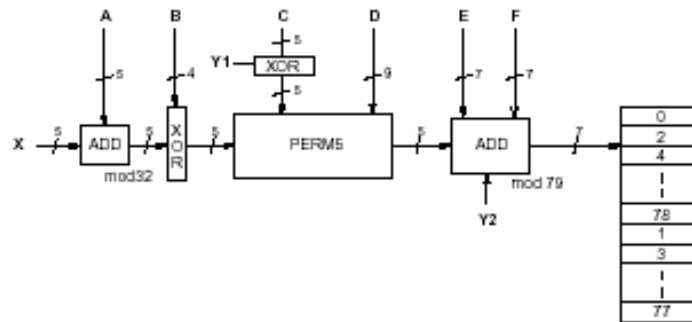
20dB bandwidth (MHz)		
2402	2441	2480
(0.468)-(-0.456) = 0.924	(0.456)-(-0.456) = 0.912	(0.456)-(-0.452) = 0.908

For test results refer to Appendix 1, page 9-11.

7.1.7 Hopping sequence

Subclause 15.247(a)(1)

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master. The X input determines the phase in the 32-hop segment, whereas Y1 and Y2 selects between master-to-slave and slave-to-master transmission. The inputs A to D determine the ordering within the segment, the inputs E and F determine the mapping onto the hop frequencies.



Example data:

Hop sequence {k} for CONNECTION STATE:
CLK start: 0x0000010
ULAP: 0x00000000

#ticks: 00 02 | 04 06 | 08 0a | 0c 0e | 10 12 | 14 16 | 18 1a | 1c 1e |

0x0000010:	08 66	10 70	12 19	14 23	16 01	18 05	20 33	22 37
0x0000030:	24 03	26 07	28 35	30 39	32 72	34 76	36 25	38 29
0x0000050:	40 74	42 78	44 27	46 31	48 09	50 13	52 41	54 45
0x0000070:	56 11	58 15	60 43	62 47	32 17	36 19	34 49	38 51
0x0000090:	40 21	44 23	42 53	46 55	48 33	52 35	50 65	54 67
0x00000b0:	56 37	60 39	58 69	62 71	64 25	68 27	66 57	70 59
0x00000d0:	72 29	76 31	74 61	78 63	01 41	05 43	03 73	07 75
0x00000f0:	09 45	13 47	11 77	15 00	64 49	66 53	68 02	70 06
0x0000110:	01 51	03 55	05 04	07 08	72 57	74 61	76 10	78 14
0x0000130:	09 59	11 63	13 12	15 16	17 65	19 69	21 18	23 22
0x0000150:	33 67	35 71	37 20	39 24	25 73	27 77	29 26	31 30
0x0000170:	41 75	43 00	45 28	47 32	17 02	21 04	19 34	23 36
0x0000190:	33 06	37 08	35 38	39 40	25 10	29 12	27 42	31 44
0x00001b0:	41 14	45 16	43 46	47 48	49 18	53 20	51 50	55 52
0x00001d0:	65 22	69 24	67 54	71 56	57 26	61 28	59 58	63 60
0x00001f0:	73 30	77 32	75 62	00 64	49 34	51 42	57 66	59 74
0x0000210:	53 36	55 44	61 68	63 76	65 50	67 58	73 03	75 11
0x0000230:	69 52	71 60	77 05	00 13	02 38	04 46	10 70	12 78
0x0000250:	06 40	08 48	14 72	16 01	18 54	20 62	26 07	28 15
0x0000270:	22 56	24 64	30 09	32 17	02 66	06 74	10 19	14 27
0x0000290:	04 70	08 78	12 23	16 31	18 03	22 11	26 35	30 43
0x00002b0:	20 07	24 15	28 39	32 47	34 68	38 76	42 21	46 29
0x00002d0:	36 72	40 01	44 25	48 33	50 05	54 13	58 37	62 45
0x00002f0:	52 09	56 17	60 41	64 49	34 19	36 35	50 51	52 67
0x0000310:	38 21	40 37	54 53	56 69	42 27	44 43	58 59	60 75
0x0000330:	46 29	48 45	62 61	64 77	66 23	68 39	03 55	05 71
0x0000350:	70 25	72 41	07 57	09 73	74 31	76 47	11 63	13 00
0x0000370:	78 33	01 49	15 65	17 02	66 51	70 67	03 04	07 20
0x0000390:	68 55	72 71	05 08	09 24	74 59	78 75	11 12	15 28
0x00003b0:	76 63	01 00	13 16	17 32	19 53	23 69	35 06	39 22
0x00003d0:	21 57	25 73	37 10	41 26	27 61	31 77	43 14	47 30
0x00003f0:	29 65	33 02	45 18	49 34	19 04	21 08	23 20	25 24

7.1.8 Receiver input bandwidth

Subclause 15.247(a)(1)

The receiver bandwidth is equal to the receiver bandwidth in the 79 hopping channel mode, which is 1 MHz. The receiver bandwidth is indirectly verified during Bluetooth RF conformance testing.

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 16 von 20
 Page 16 of 20

7.1.9 Peak output power

Subclause 15.247(b)(1)

RESULT:

Pass

Test specification : FCC § 15.31
 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
 Port of testing : Temporary antenna port
 Detector : PK
 RBW/VBW : 1MHz/3MHz
 Supply voltage : 3.7V Lithium Battery supply
 Temperature : 26°C
 Humidity : 57%

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Actual value (dBm)
2402	-0.79	4.30	3.51
2441	-1.09	4.15	3.06
2480	-1.43	4.50	3.07

All three transmit frequency modes comply with the maximum peak output power limit.
 For test results refer to Appendix 1, page 12-14

Limit

Subclause 15.247(b)(1)

Frequency range	RF output power
2.400-2.483,5MHz	0.125W (21.0dBm)

7.1.10 Band edge compliance

Subclause 15.247(c)

RESULT:

Pass

Test specification	:	FCC § 15.31
Mode of operation	:	Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
Port of testing	:	Temporary antenna port
Detector	:	PK
RBW/VBW	:	300kHz/1.0MHz
Supply voltage	:	3.7V Lithium Battery supply
Temperature	:	26°C
Humidity	:	57%

There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(c).

For test results refer to Appendix 1, page 15-17.

Limit

Subclause 15.247(c)

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Prüfbericht - Nr.:

14004957 001

Test Report No.

Seite 18 von 20

Page 18 of 20

7.1.11 Spurious conducted emissions

Subclause 15.247(c)

RESULT:

Pass

Test specification : FCC § 15.31
 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
 Port of testing : Temporary antenna port
 Detector : PK
 RBW/VBW : 100kHz/300kHz
 Supply voltage : 3.7V Lithium Battery supply
 Temperature : 26°C
 Humidity : 57%

Operating frequency : 2402MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)
No Peak Found	-	-	-

Operating frequency : 2441MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)
No Peak Found	-	-	-

Operating frequency : 2480MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)
No Peak Found	-	-	-

All three transmit frequency modes comply with the 20dB limit stated in subclause 15.247(c).
 For test results refer to Appendix 1, page 18-27.

Limit

Subclause 15.247(c)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 19 von 20
Page 19 of 20

7.1.12 Spurious radiated emissions

Subclause 15.247(c)

RESULT:

Pass

Test specification : ANSI C63.4 - 1992
Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
Port of testing : Enclosure
Measurement Location: 10m Semi Anechoic Chamber
Measurement Distance: 3m
Measurement BW : 1 MHz
Supply voltage : 3.7V Lithium Battery supply

Tx frequency 2402MHz, Polarization Vertical

Freq	Reading	AF	Cable att.	Pre -amp	Filter att.	Level	Limit/ Detector
MHz	dBuV	dB(1/m)	dB	dB	dB	dBuV/m	dBuV/m
-	-	-	-	-	-	-	-

Tx frequency 2402MHz, Polarization Horizontal

Freq	Reading	AF	Cable att.	Pre -amp	Filter att.	Level	Limit/ Detector
MHz	dBuV	dB(1/m)	dB	dB	dB	dBuV/m	dBuV/m
1200.500	47.78	24.40	1.52	37.10	1.87	38.47	74.0 / P

Tx frequency 2441MHz, Polarization Vertical

Freq	Reading	AF	Cable att.	Pre -amp	Filter att.	Level	Limit/ Detector
MHz	dBuV	dB(1/m)	dB	dB	dB	dBuV/m	dBuV/m
1220.000	45.07	24.40	1.52	37.10	1.87	35.76	74.0 / P

Tx frequency 2441MHz, Polarization Horizontal

Freq	Reading	AF	Cable att.	Pre -amp	Filter att.	Level	Limit/ Detector
MHz	dBuV	dB(1/m)	dB	dB	dB	dBuV/m	dBuV/m
1219.980	38.60	24.40	1.52	37.10	1.87	29.29	74.0 / P

Tx frequency 2480MHz, Polarization Vertical

Freq	Reading	AF	Cable att.	Pre -amp	Filter att.	Level	Limit/ Detector
MHz	dBuV	dB(1/m)	dB	dB	dB	dBuV/m	dBuV/m
1239.500	41.66	24.40	1.52	37.10	1.87	32.35	74.0 / P

Tx frequency 2480MHz, Polarization Horizontal

Freq	Reading	AF	Cable att.	Pre -amp	Filter att.	Level	Limit/ Detector
MHz	dBuV	dB(1/m)	dB	dB	dB	dBuV/m	dBuV/m
1239.500	47.72	24.40	1.52	37.10	1.87	38.41	74.0 / P

All three transmit frequency modes comply with the field strength within the restricted bands.
For test results refer to Appendix 1, page 28-63.

Limit

Subclause 15.247(c)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Field strength limits within the restricted bands using average detector:

Frequency (MHz)	Field strength (microvolts/meter)	Field strength (dB μ V/m)	Measurement distance (meters)
30-88	100	$20 \cdot \log(100) = 40.0$	3
88-216	150	$20 \cdot \log(150) = 43.5$	3
216-960	200	$20 \cdot \log(200) = 46.0$	3
960-2500	500	$20 \cdot \log(500) = 54.0$	3

According to section 15.35(b), on any frequency or frequencies above 1000 MHz the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in this part, including emission measurements below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated.

Prüfbericht - Nr.:

14004957 001

Seite 1 von 63
 Page 1 of 63

Test Report No.

Disturbance Voltage on AC Mains

Date: 2 Dec 2003
 EUT: GWT-BTH1
 Company: Gigawavetech Pte Ltd.
 Humidity: 57%
 Temperature: 26°C
 Voltage supply: 110V
 Test by: Hugo Wan

Operation mode: Charging only

Live measurement

Frequency (MHz)	QP reading (dBμV)	Av reading (dBμV)	Results
0.306	18.5	0.1	Pass
0.498	17.3	0.1	Pass

Neutral measurement

Frequency (MHz)	QP reading (dBμV)	Av reading (dBμV)	Results
0.396	22.5	0.1	Pass
28.632	4.8	0.1	Pass

Operation mode: Normal use during charging

Live measurement

Frequency (MHz)	QP reading (dBμV)	Av reading (dBμV)	Results
0.492	19.4	0.1	Pass
24.267	17.6	12.6	Pass

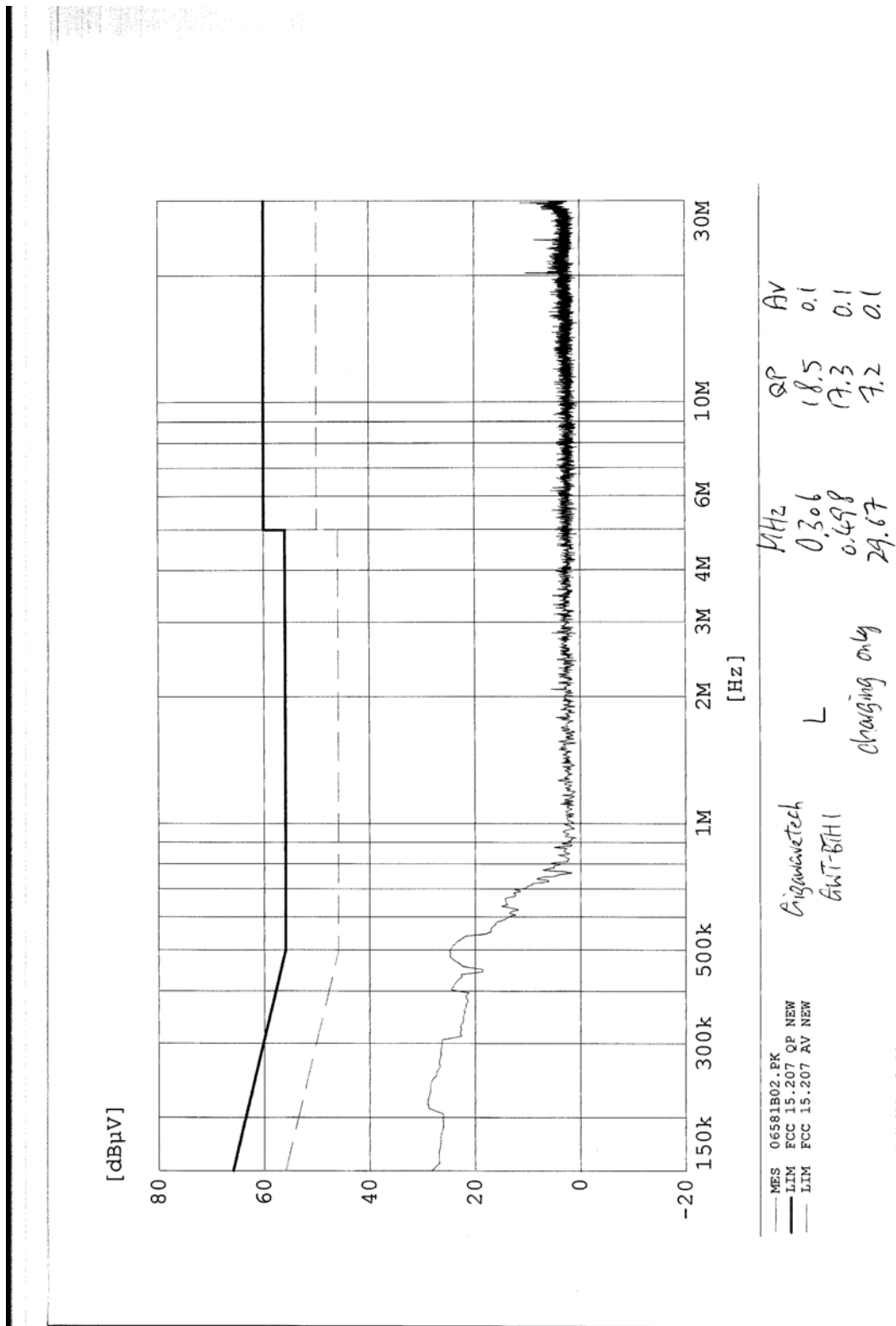
Neutral measurement

Frequency (MHz)	QP reading (dBμV)	Av reading (dBμV)	Results
0.396	23.8	0.1	Pass
24.261	21.3	16.2	Pass

Prüfbericht - Nr.:
Test Report No.

14004957 001

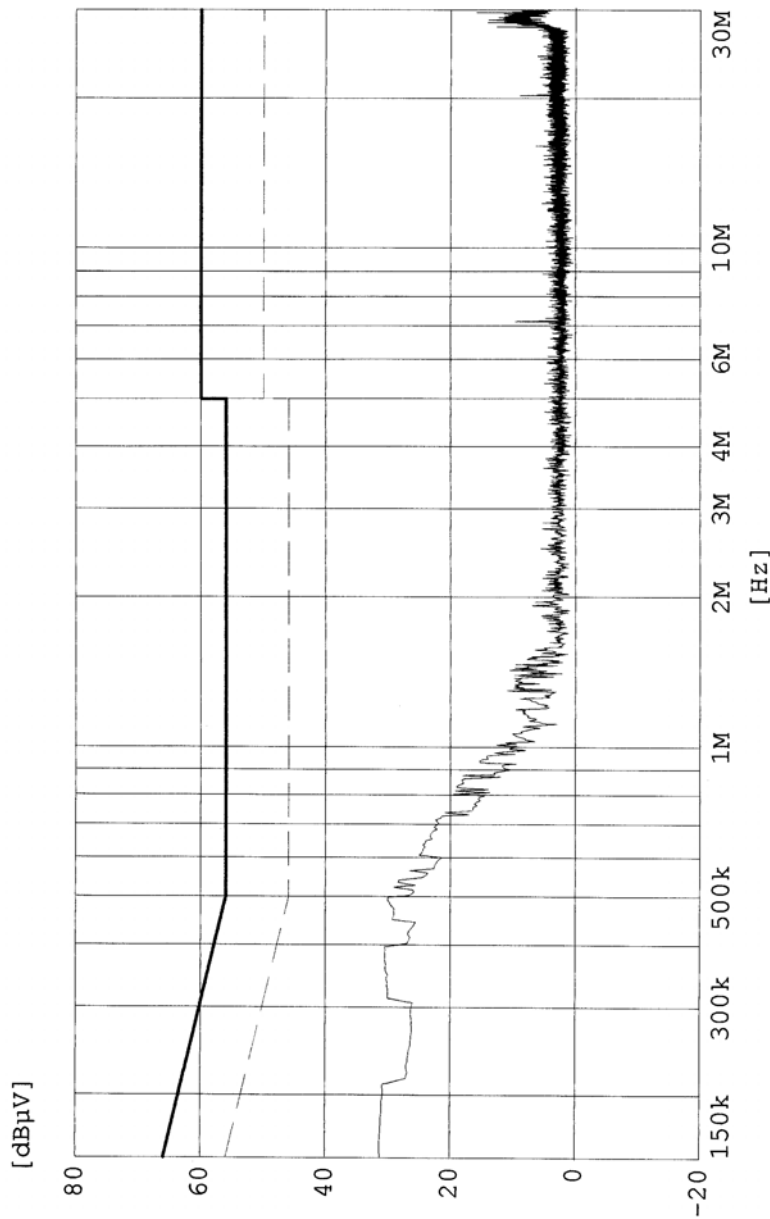
Seite 2 von 63
Page 2 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 3 von 63
 Page 3 of 63



MES 06581B01.PK
 LIM FCC 15.207 QP NEW
 LIM FCC 15.207 AV NEW

ErgebnisTech
 GWT-BTH1

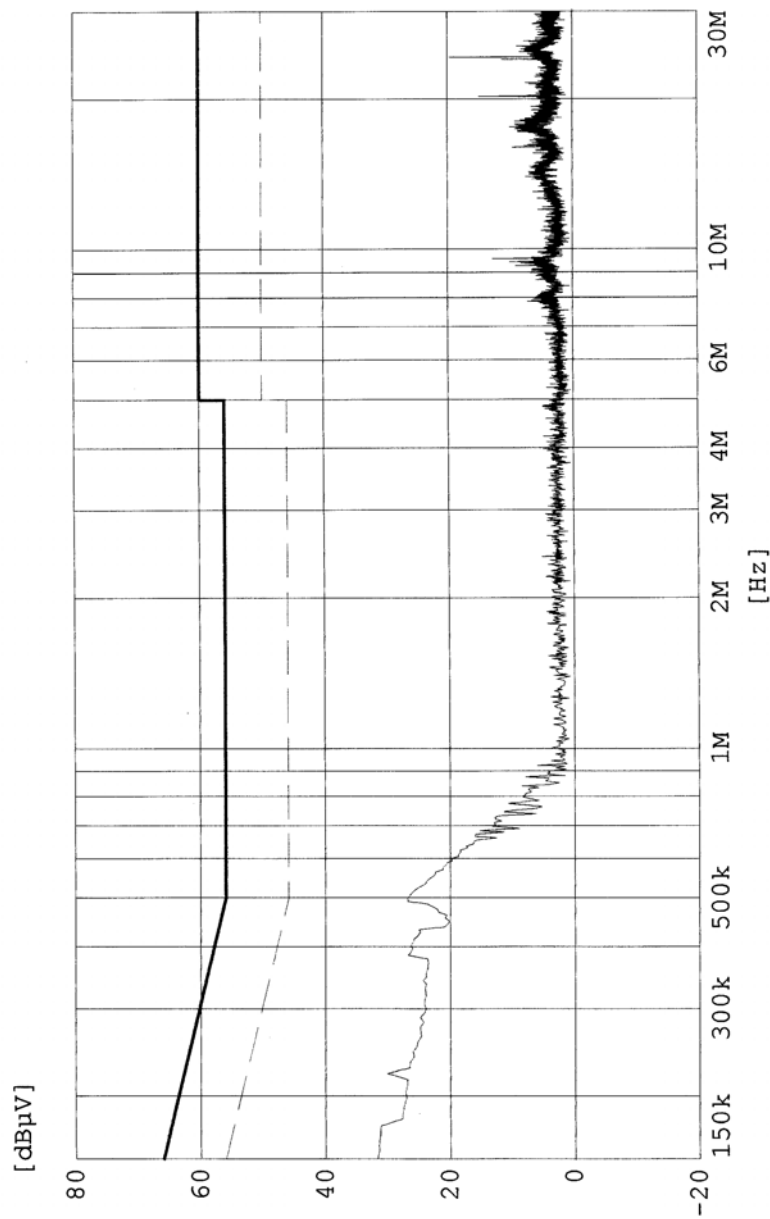
N
 charging only
 MHz 0.396
 28.632

QP 22.5
 4.8
 AV 0.1
 0.1

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 4 von 63
 Page 4 of 63

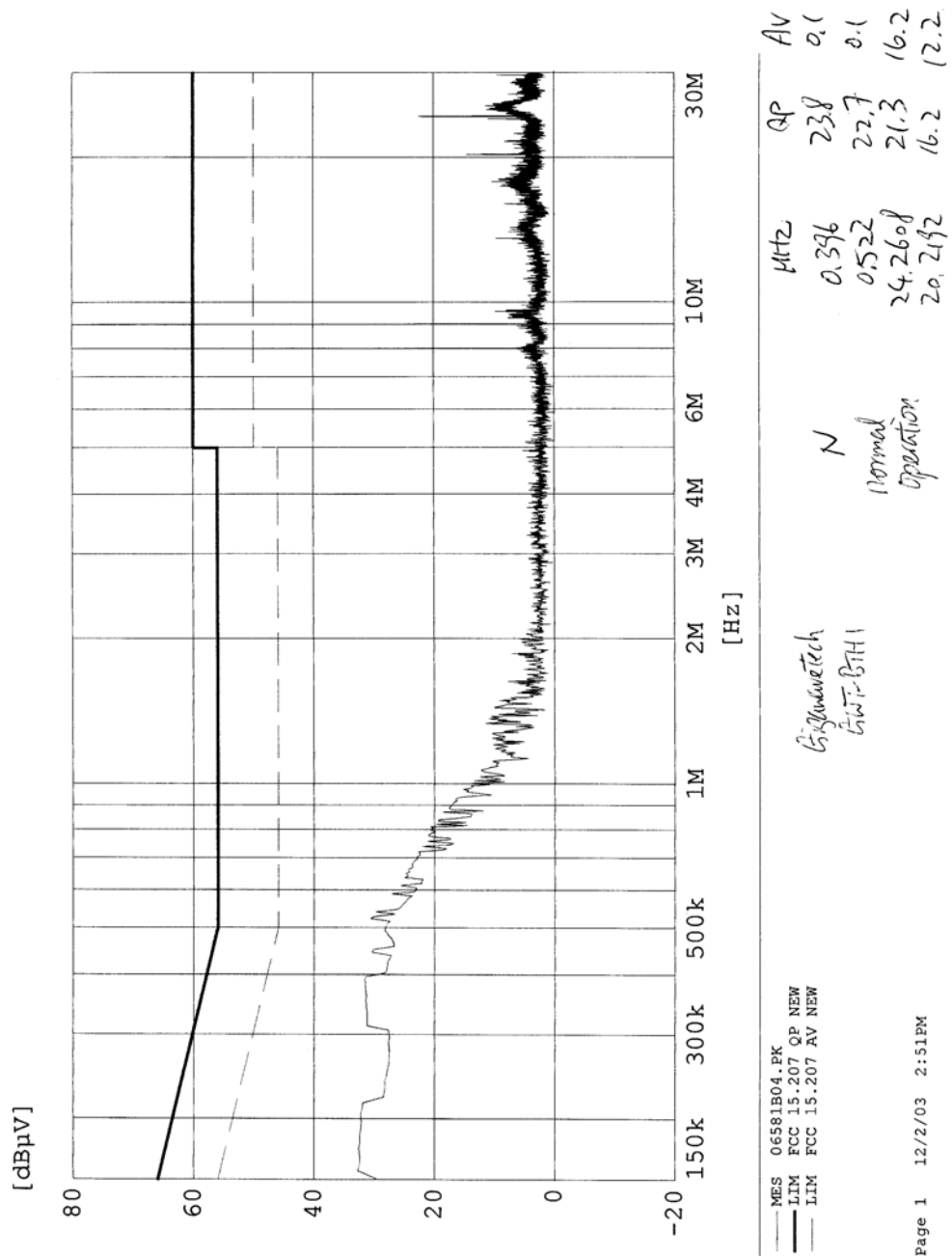


MES 06581B03.PK
 LIM FCC 15.207 QP NEW
 LIM FCC 15.207 AV NEW
 GigawaveTech
 GWT-BTH1
 L
 Normal
 operation
 MHz QP AV
 0.472 194 0.1
 24.2673 17.6 12.6

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 5 von 63
 Page 5 of 63



Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 6 von 63
 Page 6 of 63

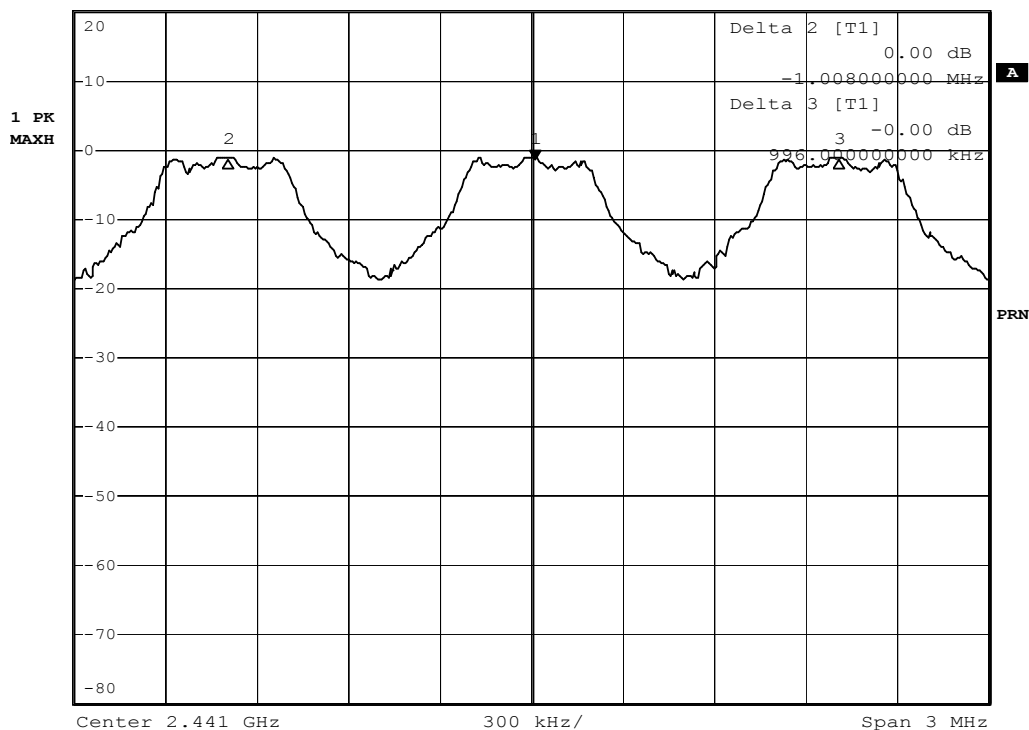
Carrier Frequency Separation

Date: 27 Nov 2003
 EUT: GWT-BTH1
 Company: Gigawavetech Pte Ltd.
 Humidity: 57%
 Temperature: 26°C
 Voltage supply: 3.7V Lithium battery
 Test by: Hugo Wan
 Op. mode: Hopping on

Reference frequency (MHz)	Channel Separation (MHz)	Results
2441.012	0.996	Pass



*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz -1.01 dBm
 Ref 20 dBm *Att 30 dB SWT 2.5 ms 2.441012000 GHz



Date: 27.NOV.2003 16:41:24

Prüfbericht - Nr.:
Test Report No.

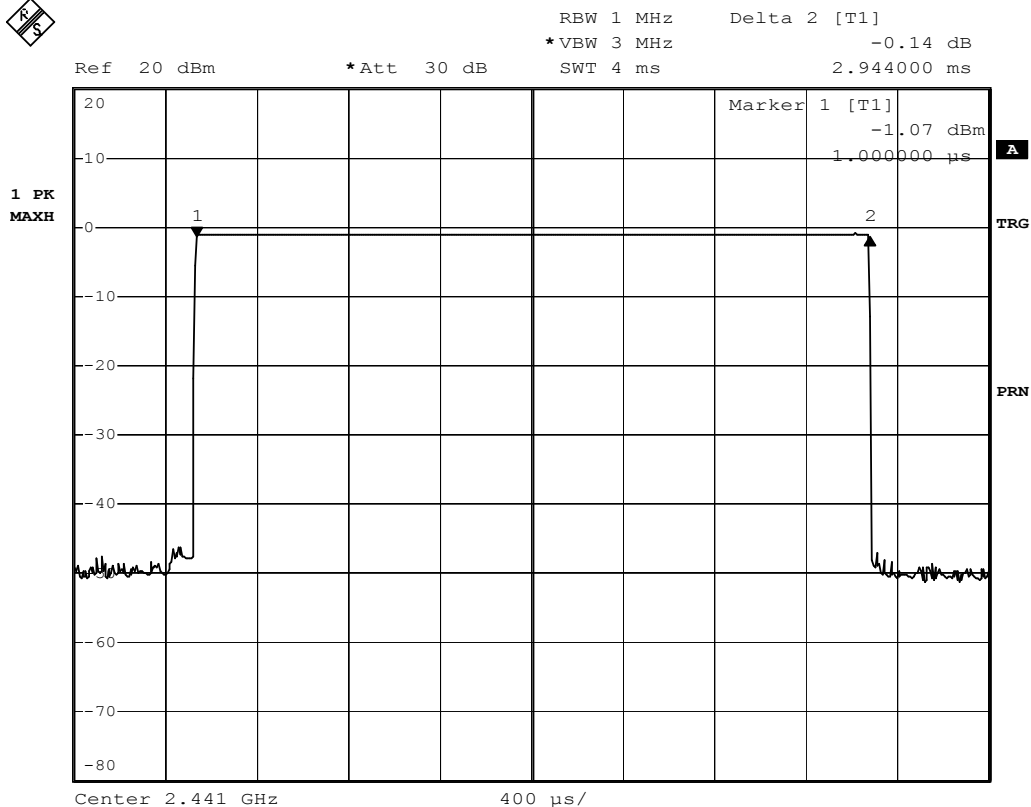
14004957 001

Seite 7 von 63
 Page 7 of 63

Dwell Time

Date: 27 Nov 2003
 EUT: GWT-BTH1
 Company: Gigawavetech Pte Ltd.
 Humidity: 57%
 Temperature: 26°C
 Voltage supply: 3.7V Lithium battery
 Test by: Hugo Wan
 Op. mode: Hopping on

Burst Duration (ms)	Number of hopping	Time of occupancy (s)	Results
2.944	27	$0.002944 \times 27 =$ 0.07949	Pass

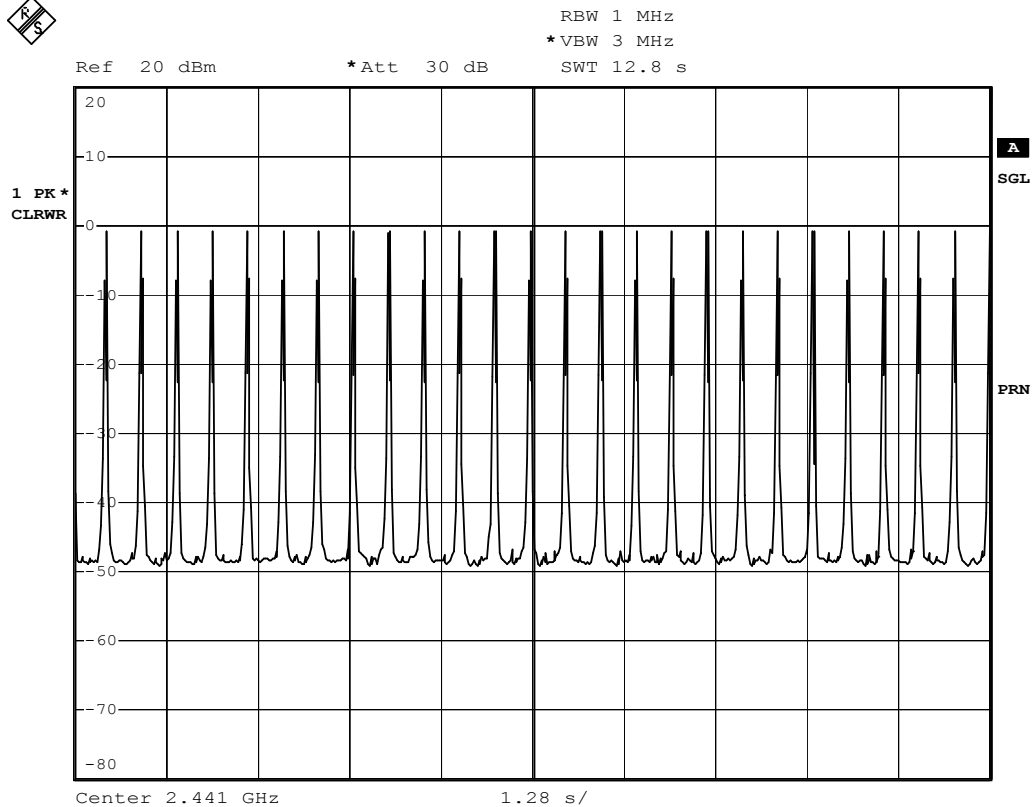


Date: 27.NOV.2003 16:43:50

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 8 von 63
Page 8 of 63



Date: 27.NOV.2003 16:44:56

Prüfbericht - Nr.:
 Test Report No.

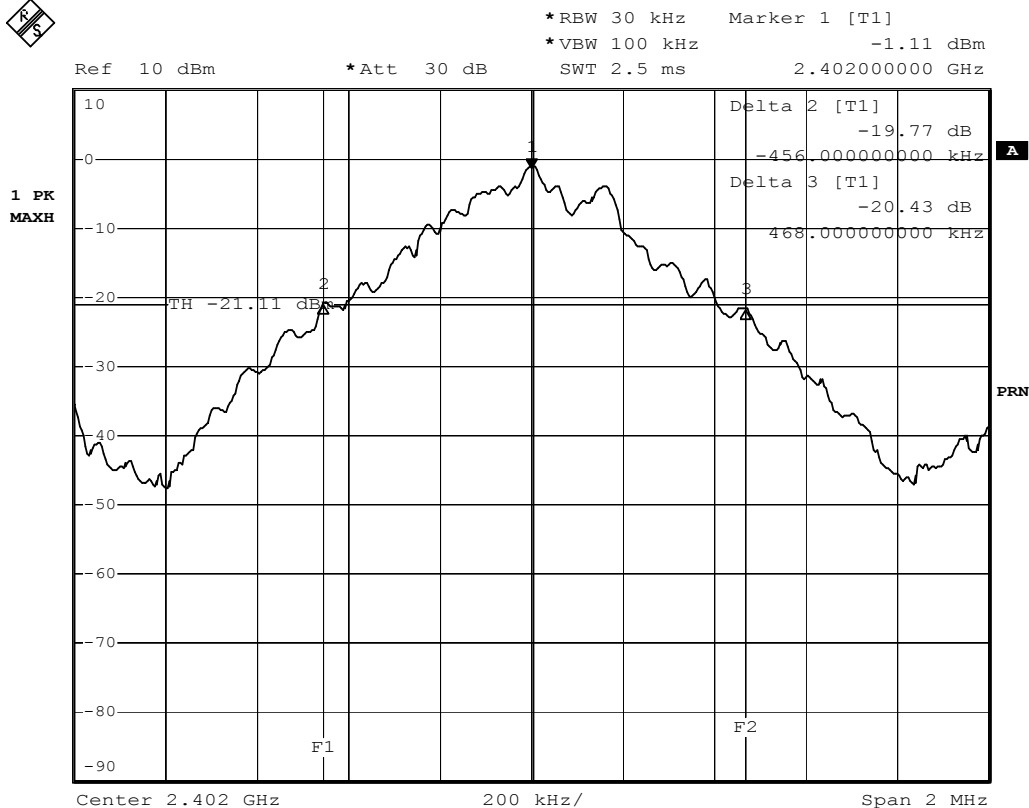
14004957 001

Seite 9 von 63
 Page 9 of 63

20dB Bandwidth

Date: 27 Nov 2003
 EUT: GWT-BTH1
 Company: Gigawavetech Pte Ltd.
 Humidity: 57%
 Temperature: 26°C
 Voltage supply: 3.7V Lithium battery
 Test by: Hugo Wan
 Op. mode: TX mode, DH5 with PRBS9 payload

Tx frequency (MHz)	Δf_L (MHz)	Δf_H (MHz)	$ \Delta f_H + \Delta f_L $ (MHz)	Results
2402	-0.456	0.468	0.924	Pass
2441	-0.456	0.456	0.912	Pass
2480	-0.452	0.456	0.908	Pass



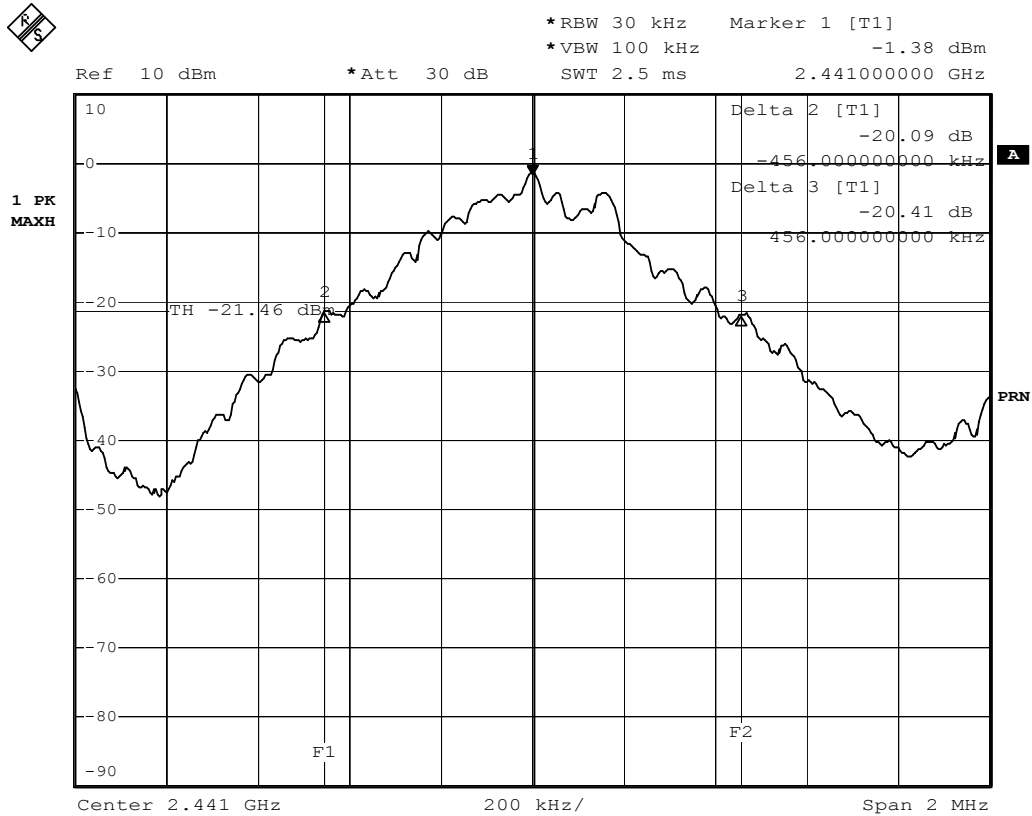
Date: 27.NOV.2003 16:49:34

Tx frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 10 von 63
 Page 10 of 63



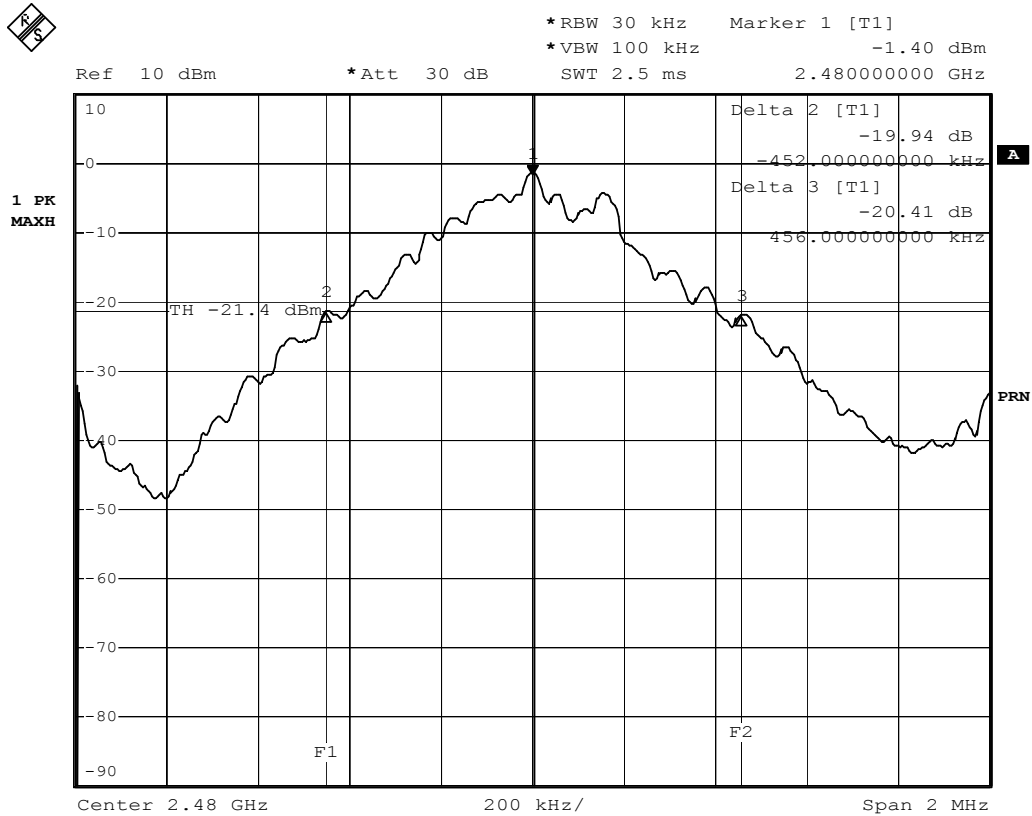
Date: 27.NOV.2003 16:53:06

Tx frequency: 2441MHz

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 11 von 63
 Page 11 of 63



Date: 27.NOV.2003 16:55:52

Tx frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.

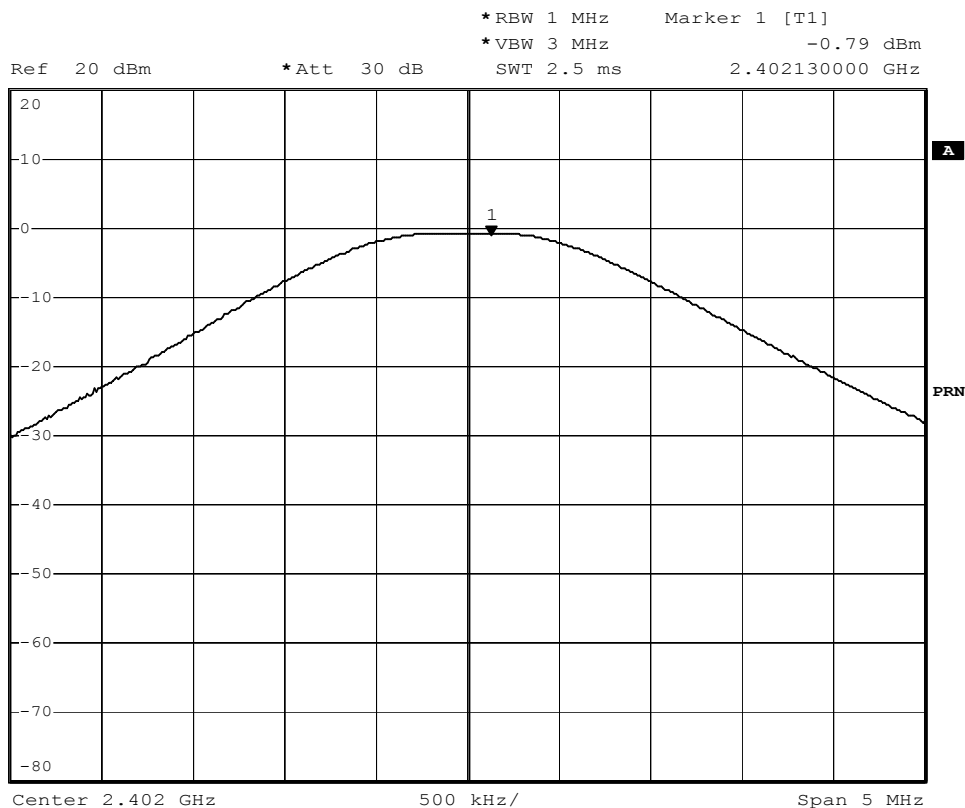
14004957 001

Seite 12 von 63
 Page 12 of 63

Peak Output Power

Date: 27 Nov 2003
 EUT: GWT-BTH1
 Company: Gigawavetech Pte Ltd.
 Humidity: 57%
 Temperature: 26°C
 Voltage supply: 3.7V Lithium battery
 Test by: Hugo Wan
 Op. mode: TX mode, DH1 with PRBS9 payload

Tx Frequency (MHz)	Cable Attenuation (dB)	Power P _{PK} (dBm)	Actual Peak Power (dBm)	Results
2402	4.30	-0.79	3.51	Pass
2441	4.15	-1.09	3.06	Pass
2480	4.50	-1.43	3.07	Pass



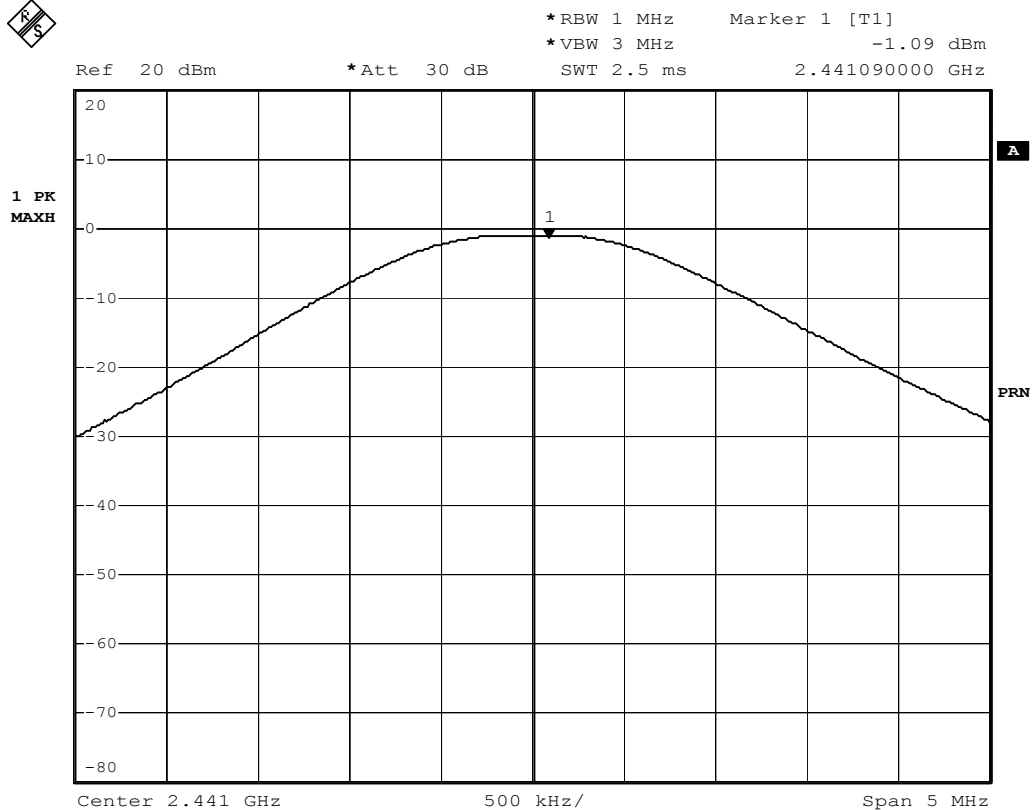
Date: 27.NOV.2003 17:01:18

Tx frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 13 von 63
 Page 13 of 63



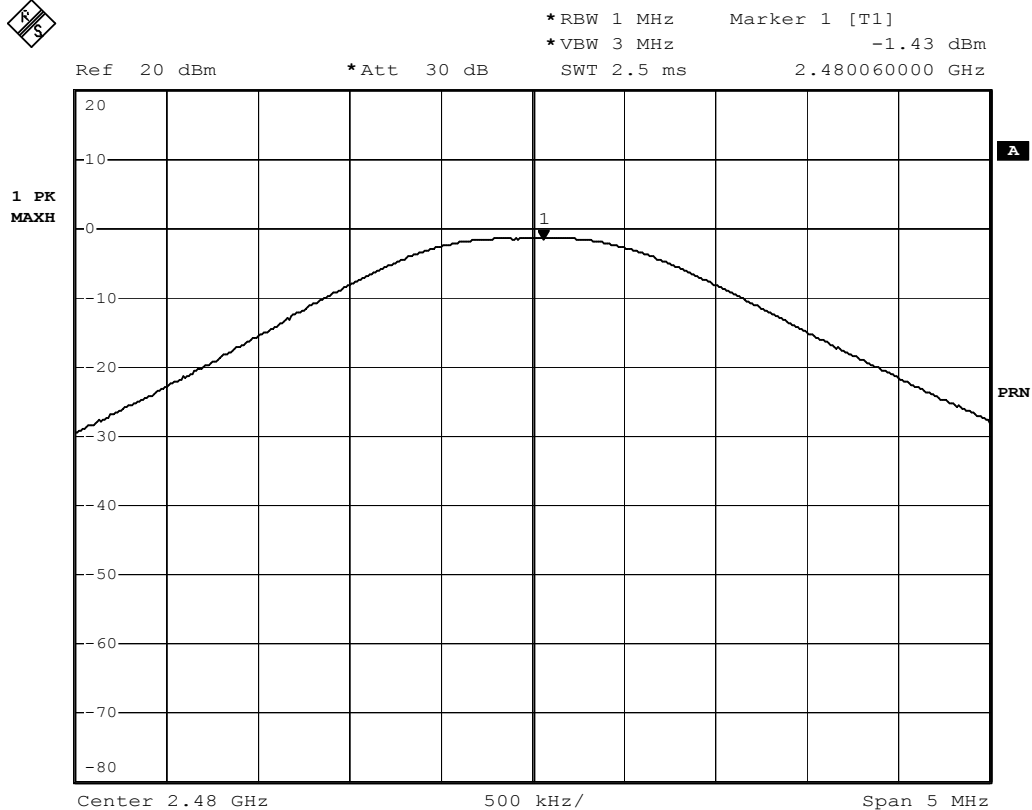
Date: 27.NOV.2003 17:02:30

Tx frequency: 2441MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 14 von 63
 Page 14 of 63



Date: 27.NOV.2003 17:03:34

Tx frequency: 2480MHz

Prüfbericht - Nr.:
 Test Report No.

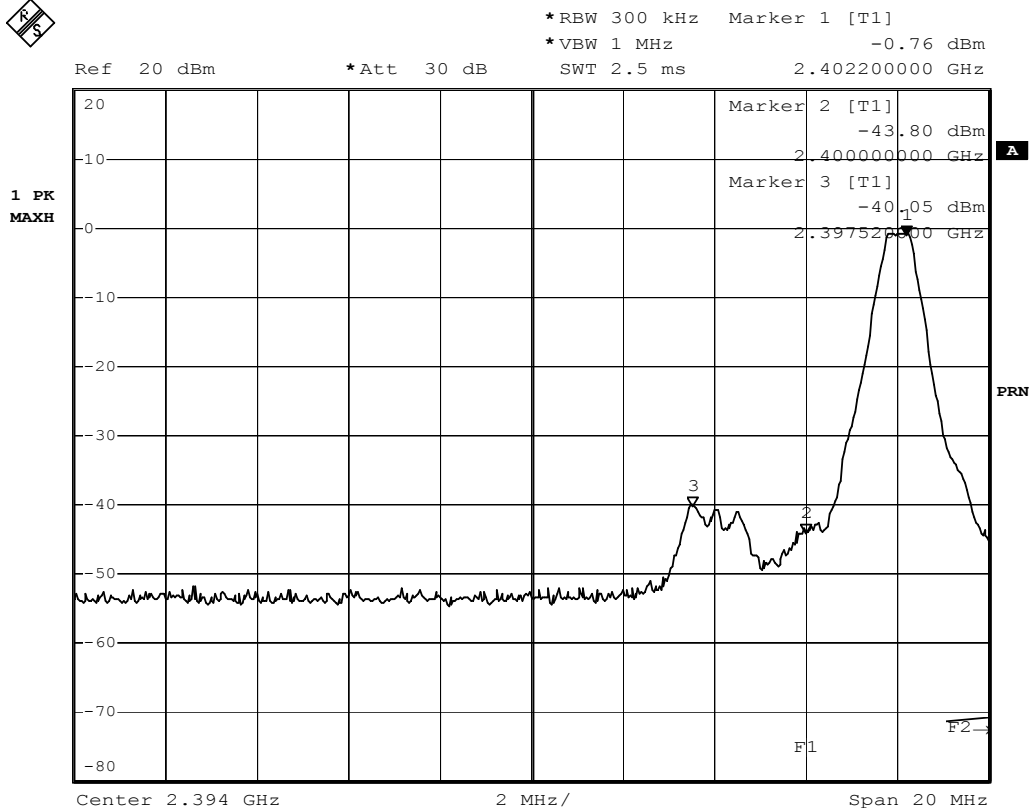
14004957 001

Seite 15 von 63
 Page 15 of 63

Band Edge Compliance

Date: 27 Nov 2003
 EUT: GWT-BTH1
 Company: Gigawavetech Pte Ltd.
 Humidity: 57%
 Temperature: 26°C
 Voltage supply: 3.7V Lithium battery
 Test by: Hugo Wan
 Op. mode: TX mode, DH1 with PRBS9 payload

Tx Frequency (MHz)	Peak in band Power level (dBm)	RF power outside 100kHz BW (MHz)	RF power difference outside 100kHz BW (dB)	Results
2402	-0.76	No Peak	-	Pass
2480	-1.29	No Peak	-	Pass



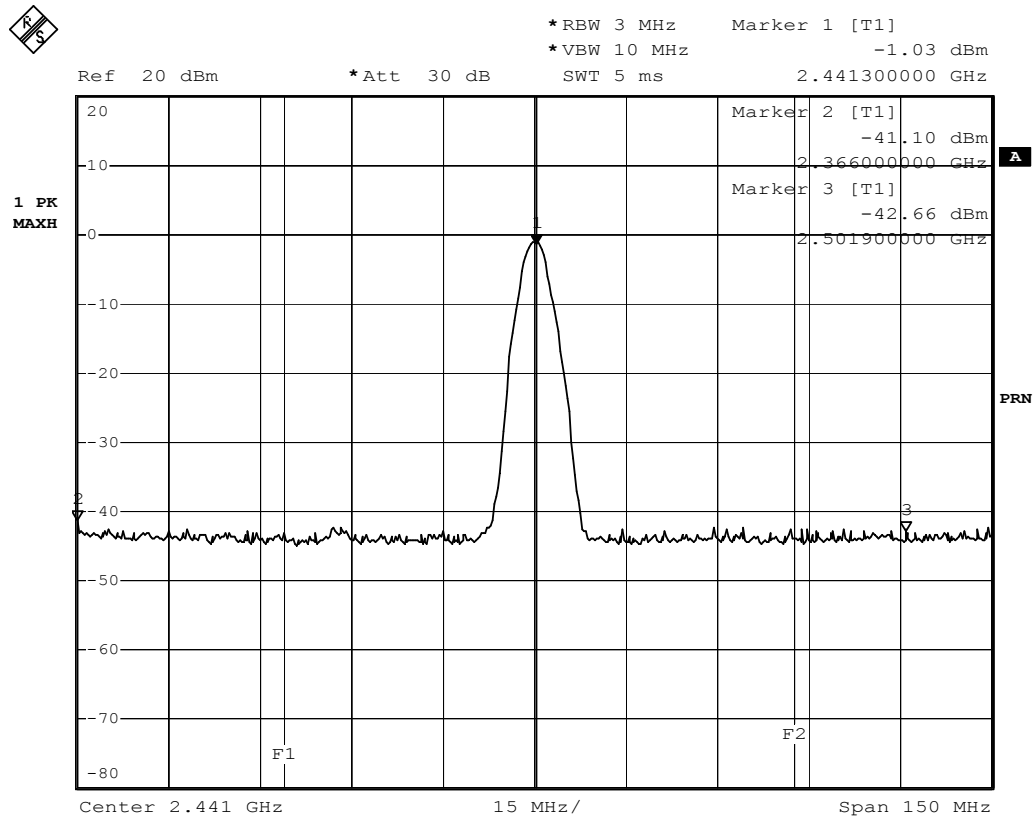
Date: 27.NOV.2003 17:11:10

Tx frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 16 von 63
 Page 16 of 63



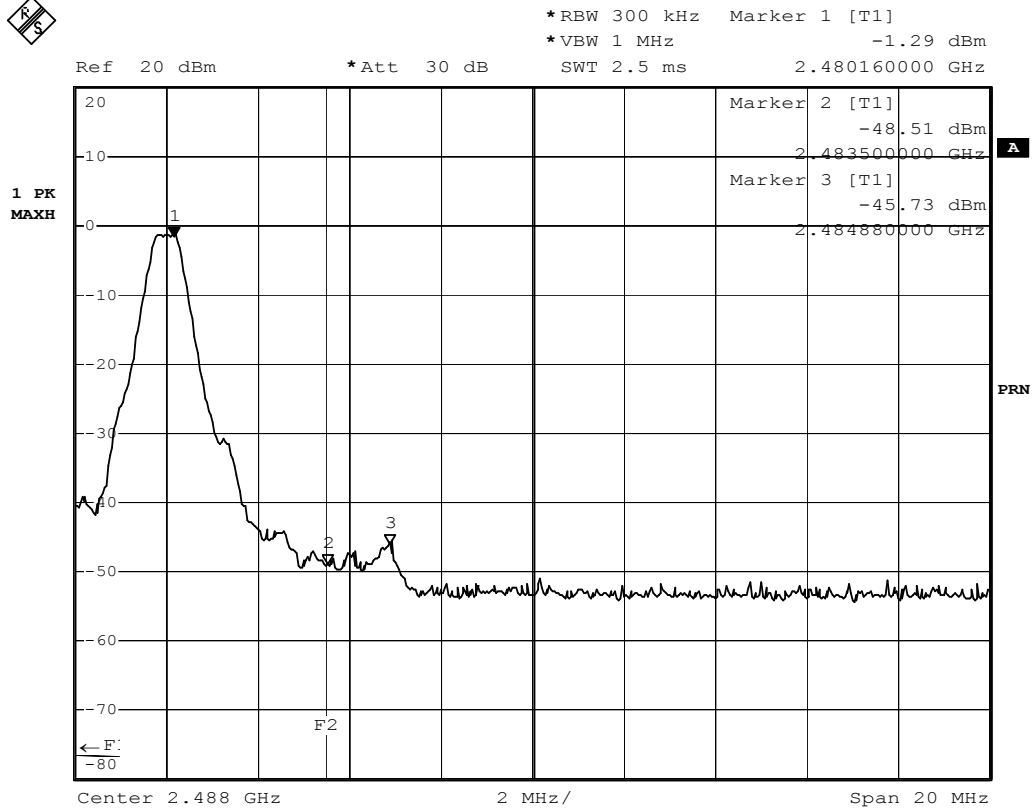
Date: 27.NOV.2003 17:08:29

Tx frequency: 2441MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 17 von 63
 Page 17 of 63



Date: 27.NOV.2003 17:06:59

Tx frequency: 2480MHz

Prüfbericht - Nr.:

14004957 001

Seite 18 von 63
Page 18 of 63

Test Report No.

Spurious Emissions - Conducted

Date: 27 Nov 2003

EUT: GWT-BTH1

Company: Gigawavetech Pte Ltd.

Humidity: 57%

Temperature: 26°C

Voltage supply: 3.7V Lithium battery

Test by: Hugo Wan

Op. mode: TX mode, DH1 with PRBS9 payload

Tx frequency : 2402MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)	Results
No peak found	-	-	-	Pass

Tx frequency : 2441MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)	Results
No peak found	-	-	-	Pass

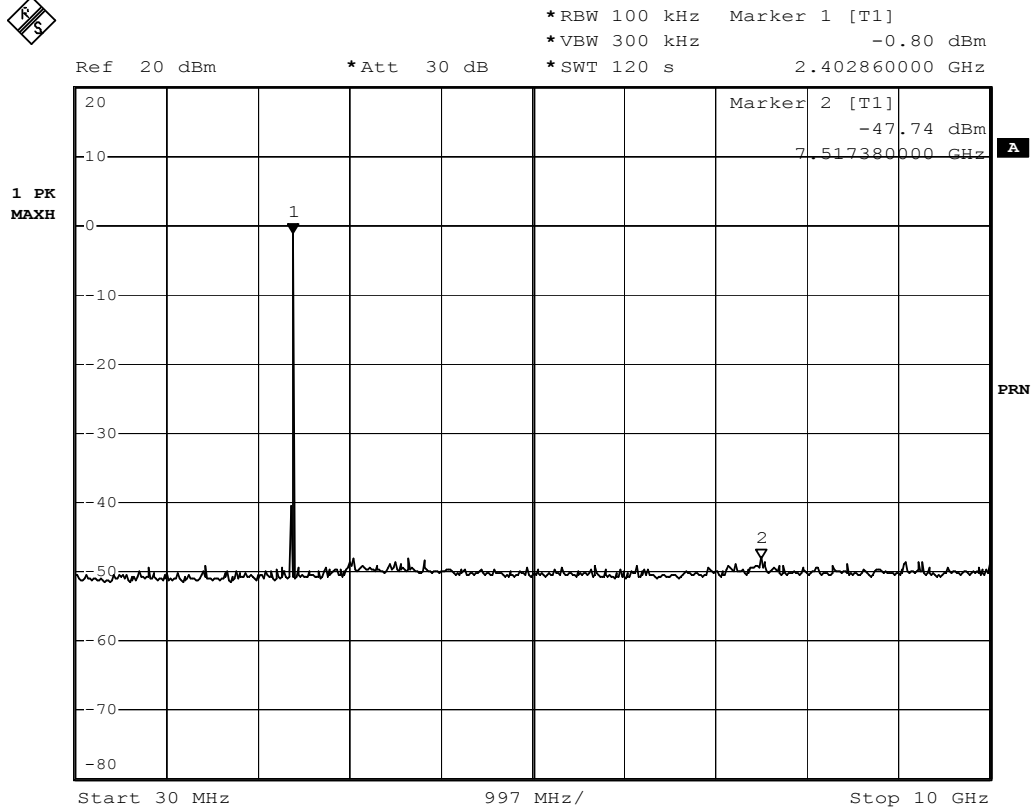
Tx frequency : 2480MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)	Results
No peak found	-	-	-	Pass

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 19 von 63
 Page 19 of 63



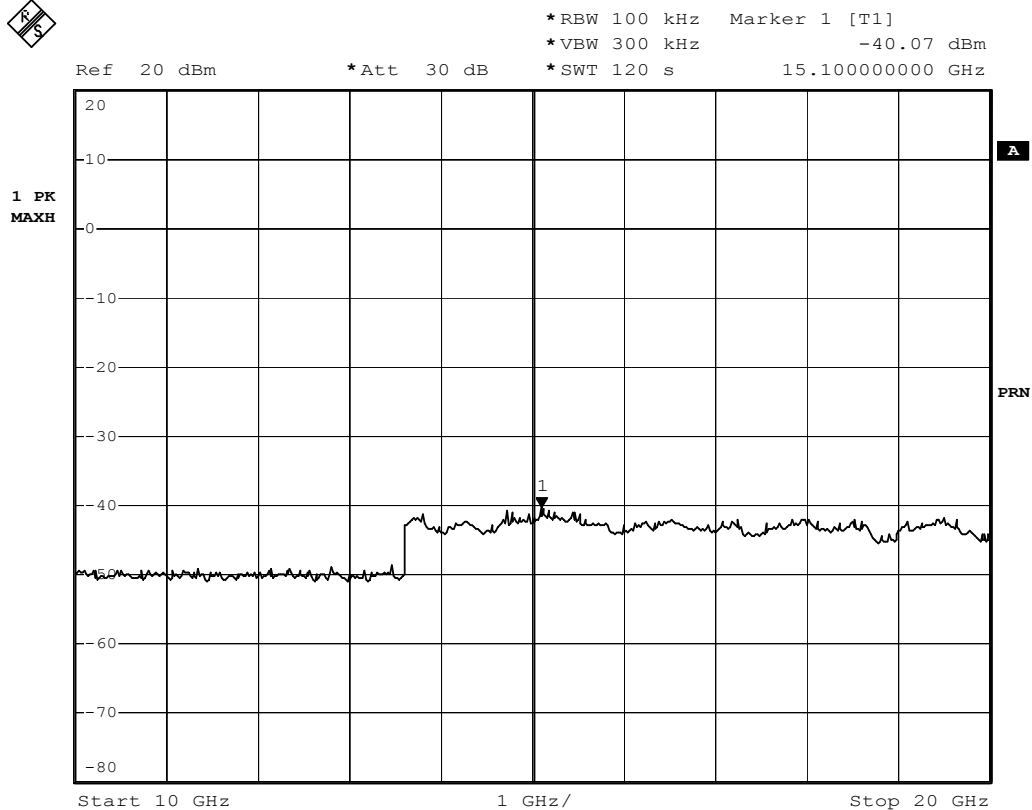
Date: 27.NOV.2003 17:22:15

Tx frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 20 von 63
 Page 20 of 63



Date: 27.NOV.2003 17:28:16

Tx frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 21 von 63
 Page 21 of 63

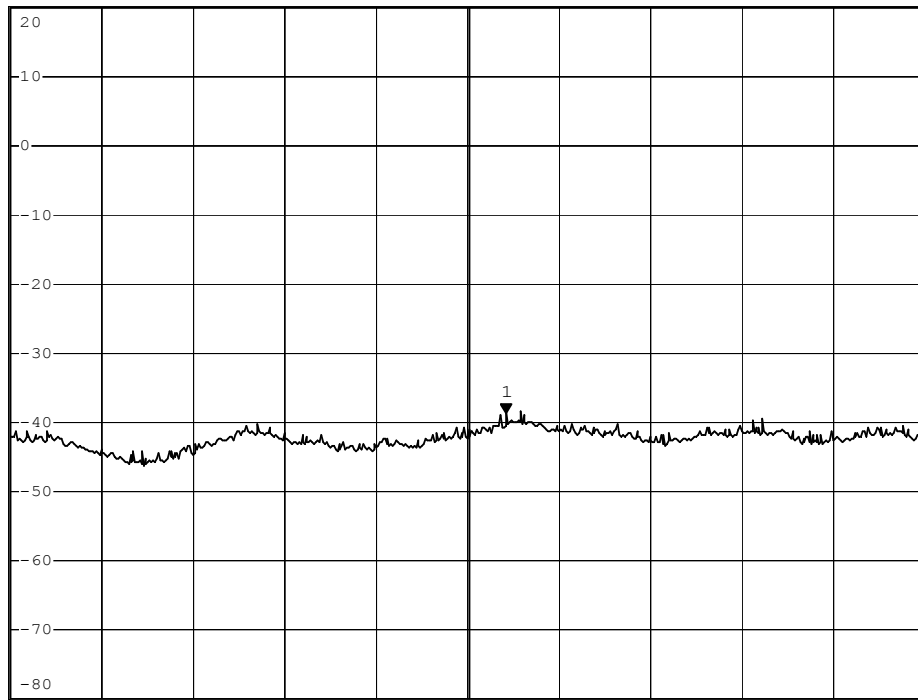


*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz -38.38 dBm
 *SWT 120 s 22.71000000 GHz

Ref 20 dBm

*Att 30 dB

1 PK
 MAXH



Start 20 GHz

500 MHz/

Stop 25 GHz

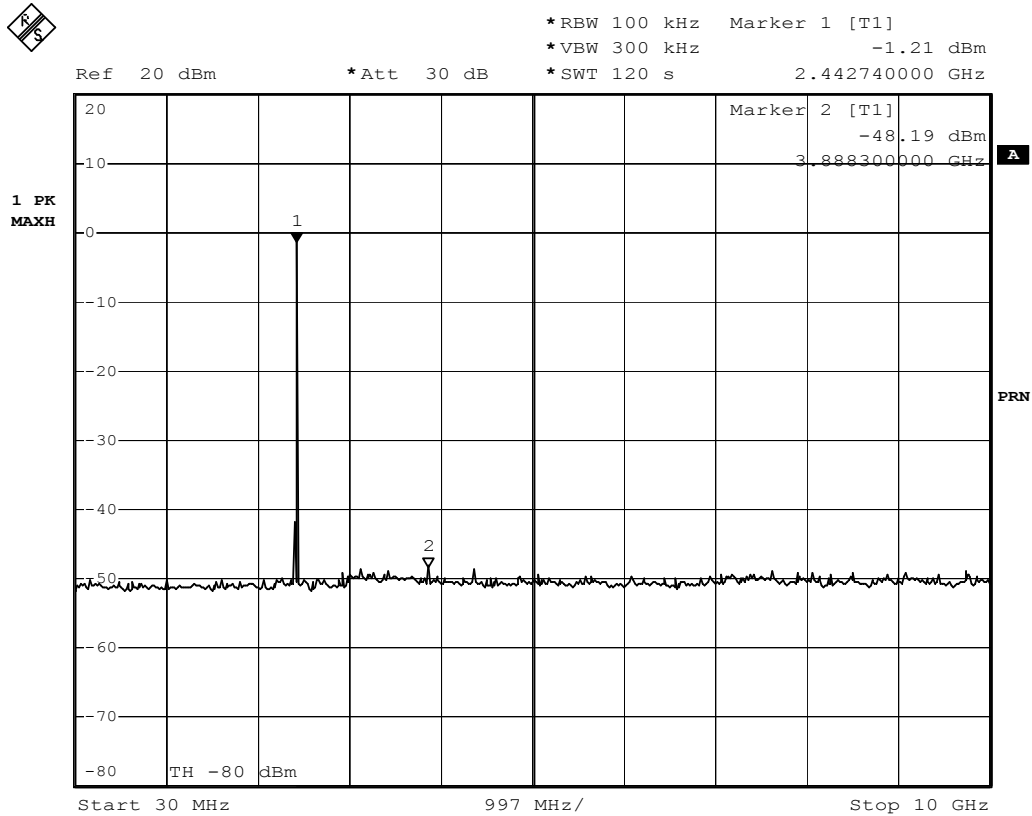
Date: 27.NOV.2003 17:31:03

Tx frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 22 von 63
 Page 22 of 63



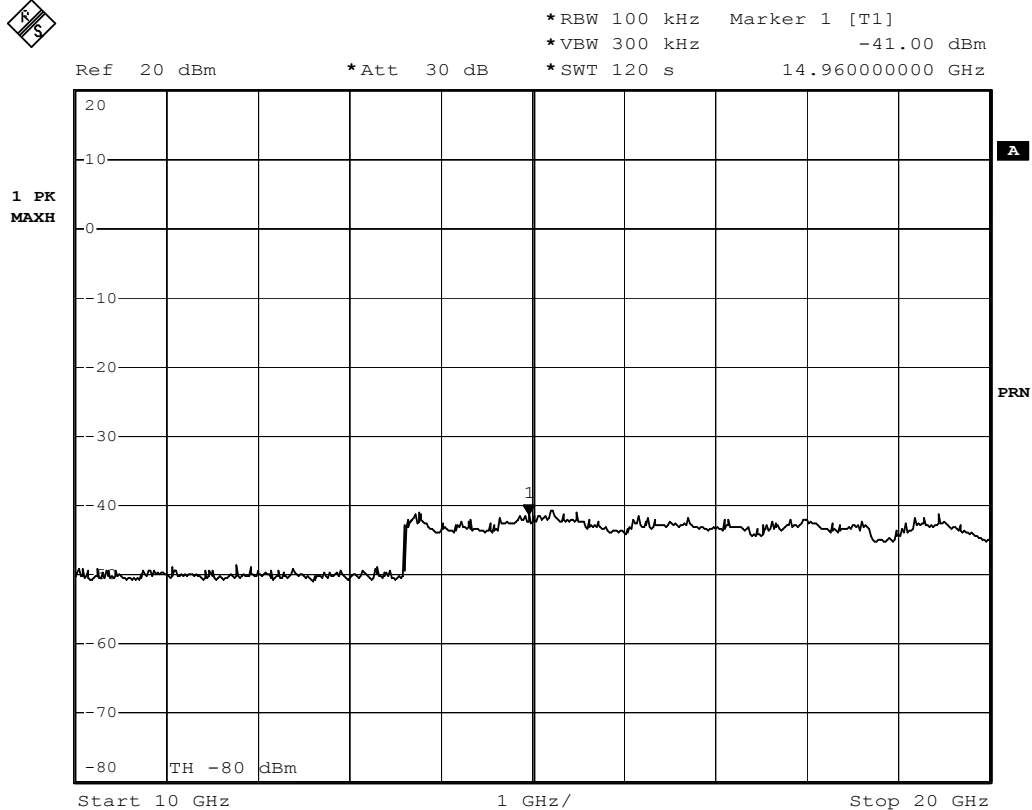
Date: 27.NOV.2003 17:49:24

Tx frequency: 2441MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 23 von 63
 Page 23 of 63



Date: 27.NOV.2003 17:44:42

Tx frequency: 2441MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 24 von 63
 Page 24 of 63

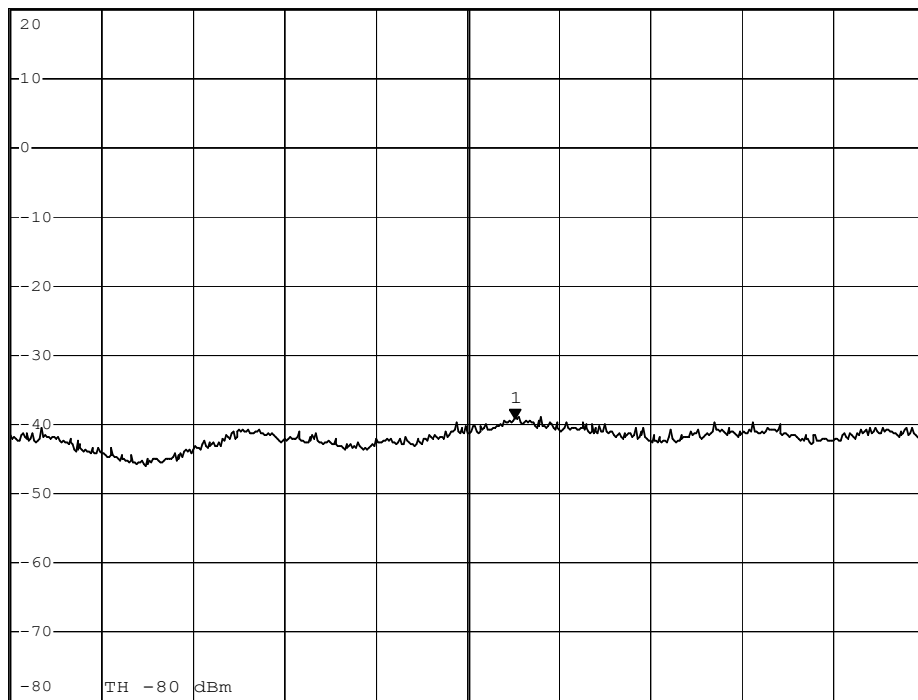


*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz -38.88 dBm
 *SWT 120 s 22.760000000 GHz

Ref 20 dBm

*Att 30 dB

1 PK
 MAXH



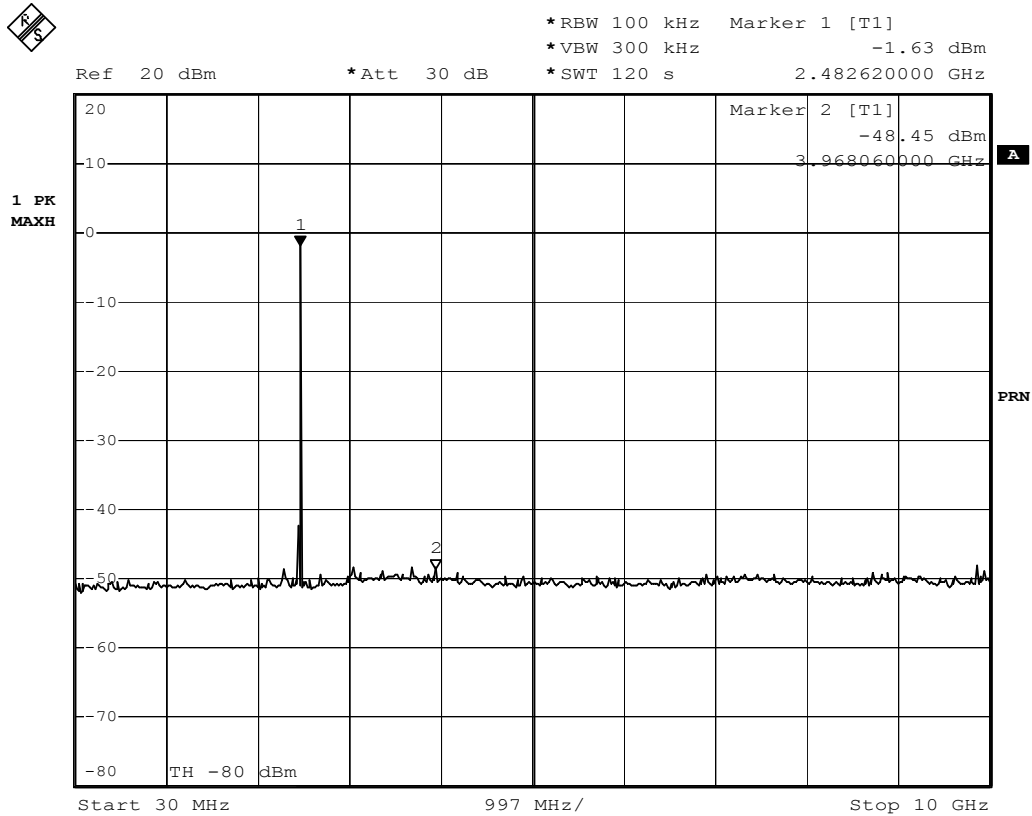
Date: 27.NOV.2003 17:38:42

Tx frequency: 2441MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 25 von 63
 Page 25 of 63



Date: 27.NOV.2003 17:55:39

Tx frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 26 von 63
 Page 26 of 63

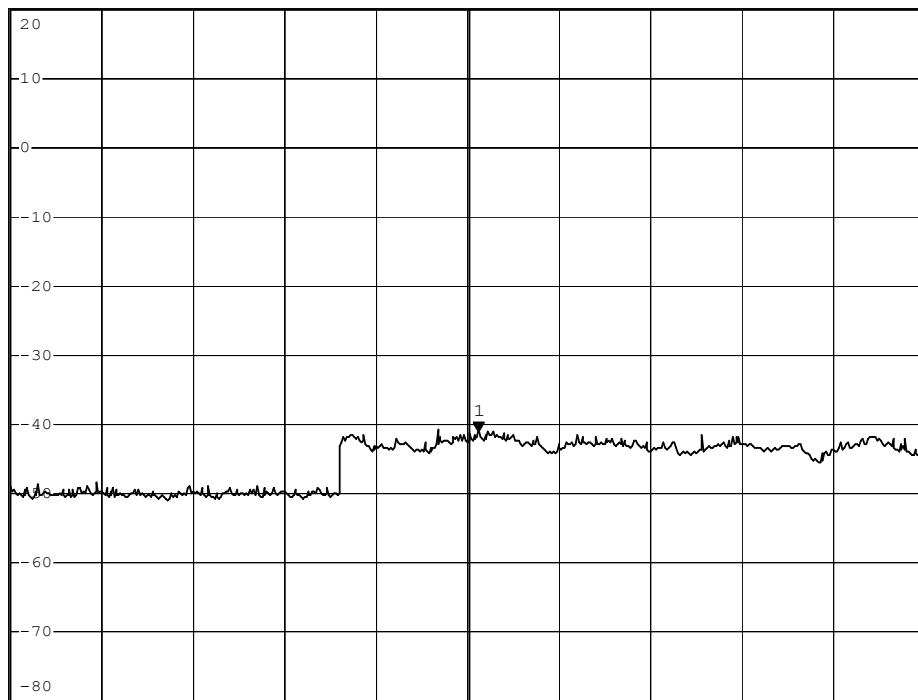


*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz -40.75 dBm
 *SWT 120 s 15.12000000 GHz

Ref 20 dBm

*Att 30 dB

1 PK
 MAXH



Start 10 GHz

1 GHz/

Stop 20 GHz

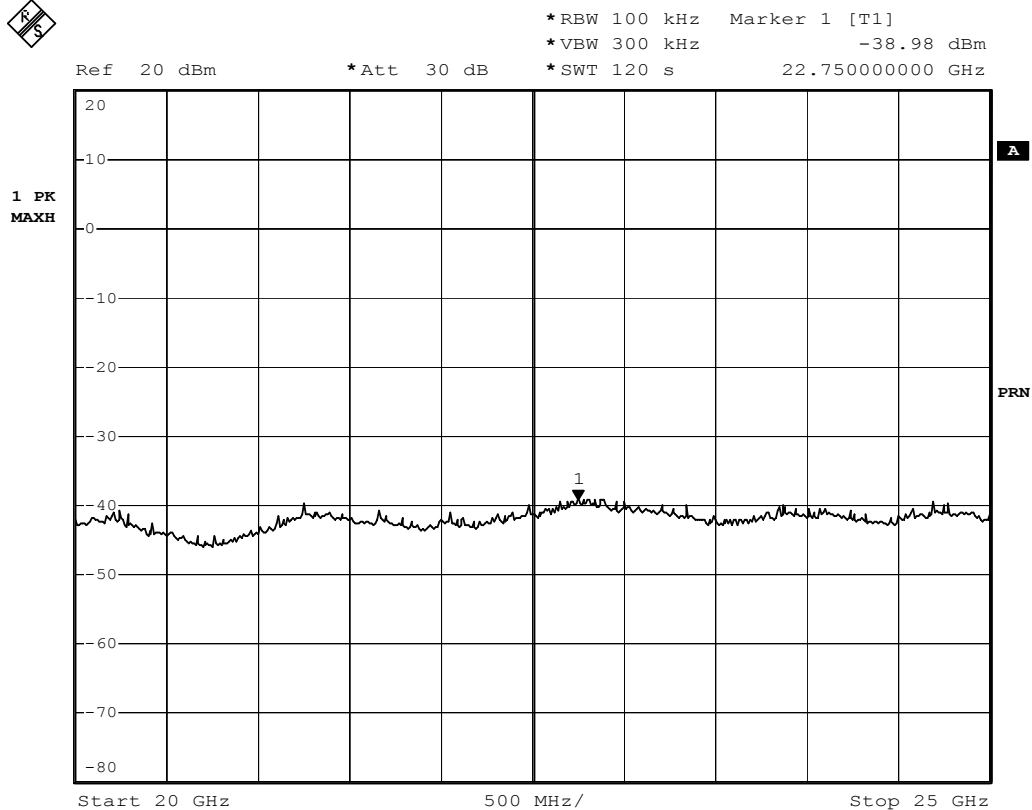
Date: 27.NOV.2003 18:03:16

Tx frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 27 von 63
 Page 27 of 63



Date: 27.NOV.2003 18:08:52

Tx frequency: 2480MHz

Prüfbericht - Nr.:

14004957 001

Seite 28 von 63
 Page 28 of 63

Test Report No.

Spurious Emissions - Radiated

Date: 17 Nov 2003

EUT: GWT-BTH1

Company: Gigawavetech Pte Ltd.

Voltage supply: 3.7V Lithium battery

Test by: Hugo Wan

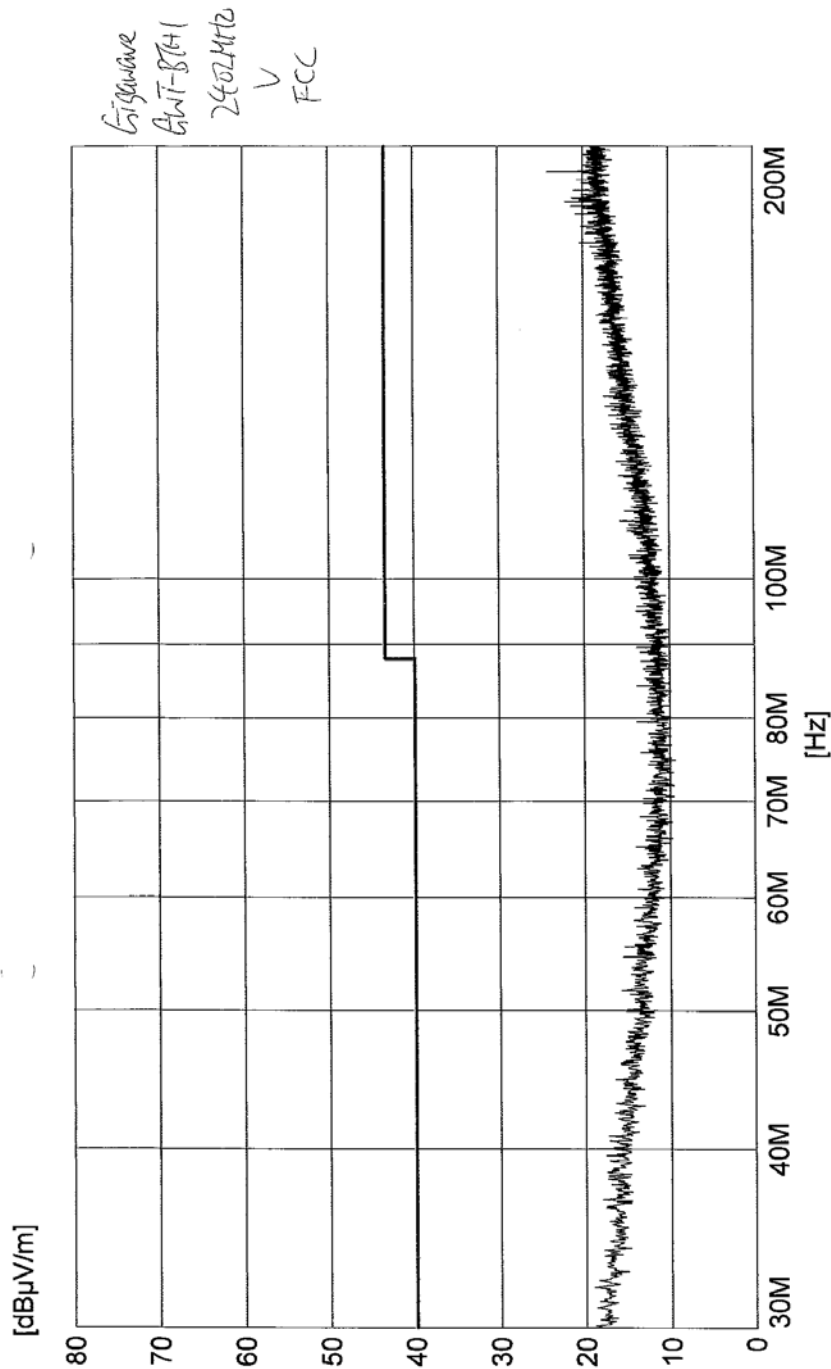
Op. mode: TX mode, DH1 with PRBS9 payload

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (P/QP/A)
2402	H	1200.500	38.47	P
Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (P/QP/A)
2441	V	1220.000	35.76	P
2441	H	1219.980	29.29	P
Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (P/QP/A)
2480	V	1239.500	32.35	P
2480	H	1239.500	38.41	P

Prüfbericht - Nr.:
 Test Report No.

14004957 001

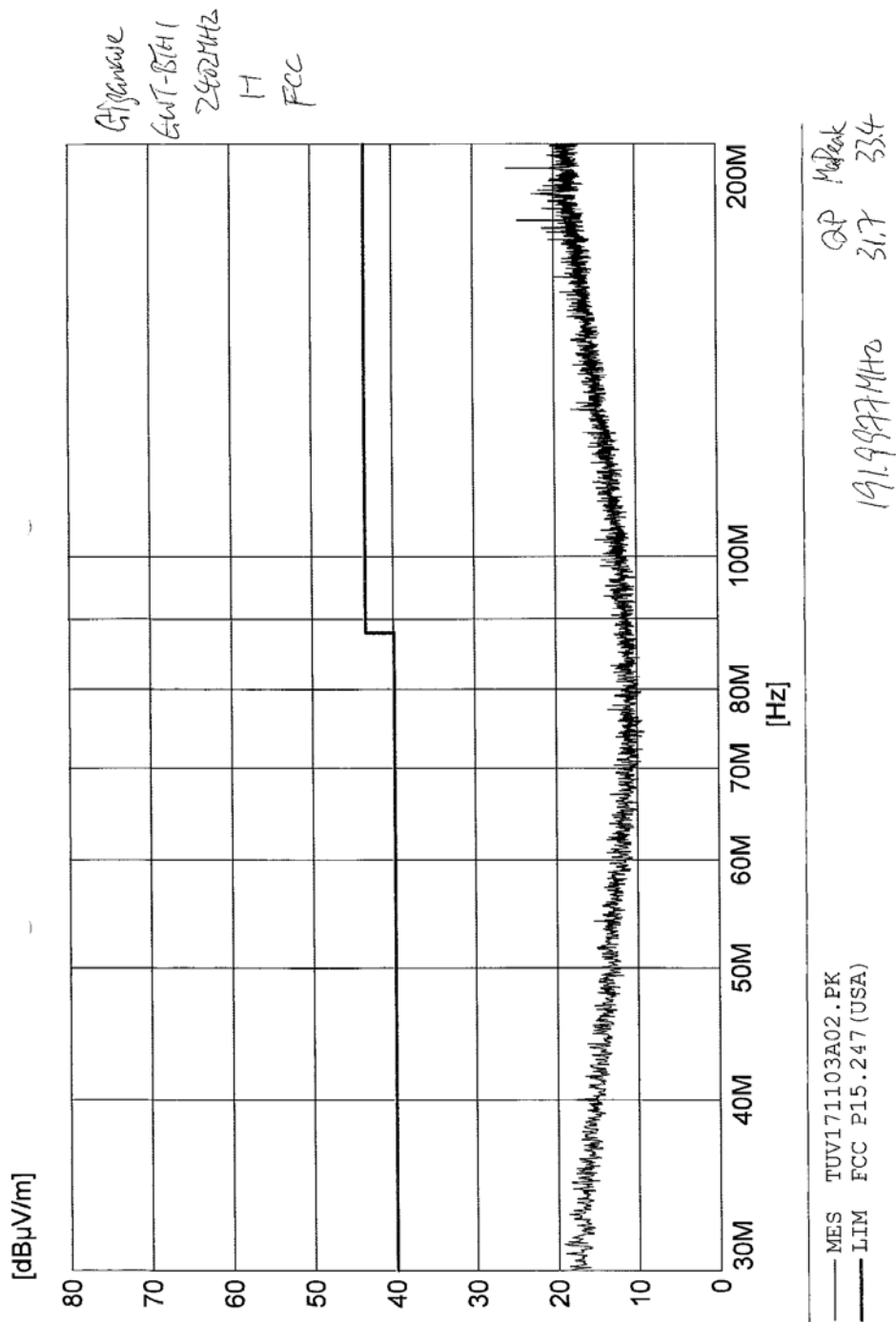
Seite 29 von 63
 Page 29 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

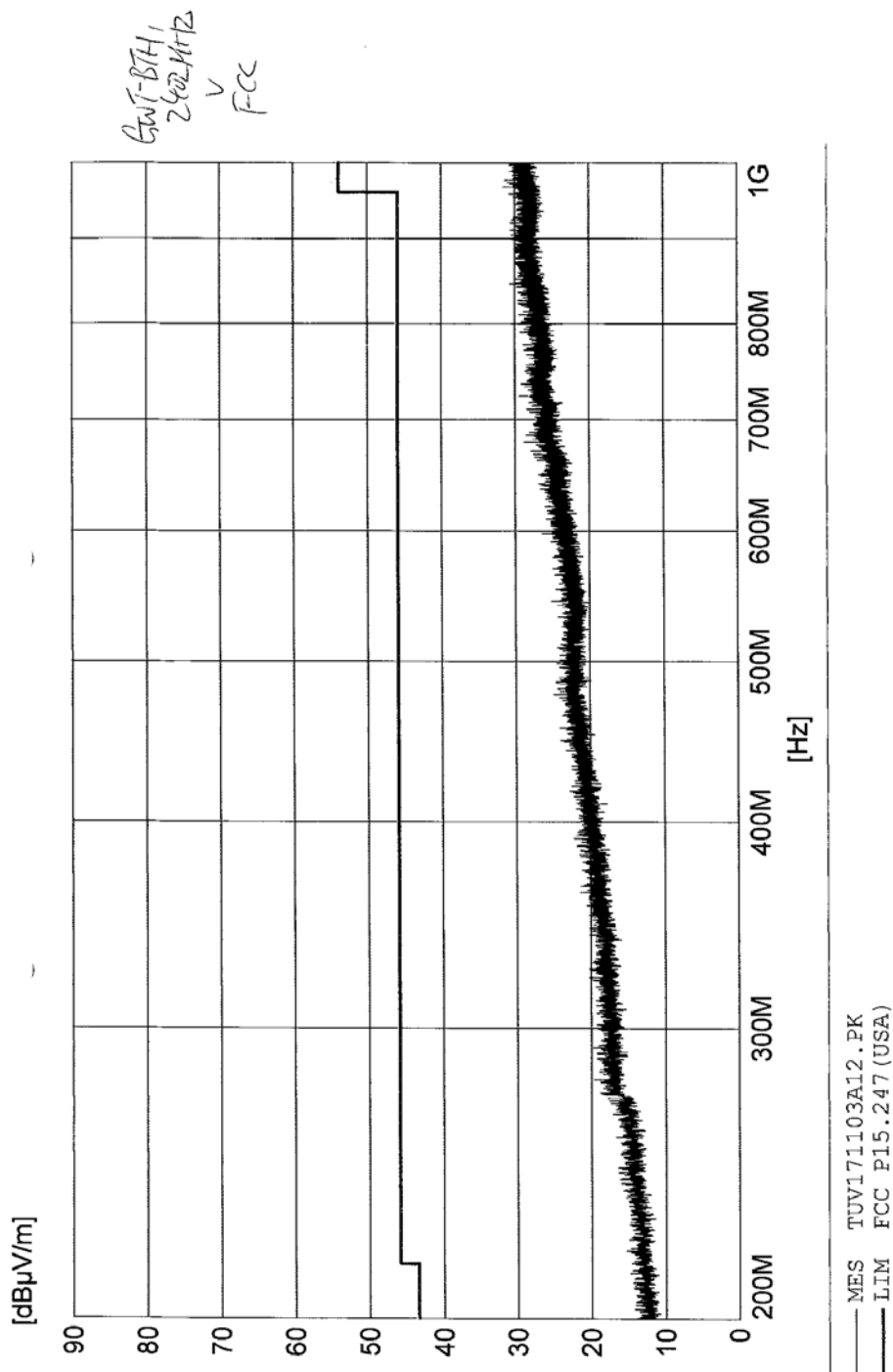
Seite 30 von 63
 Page 30 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

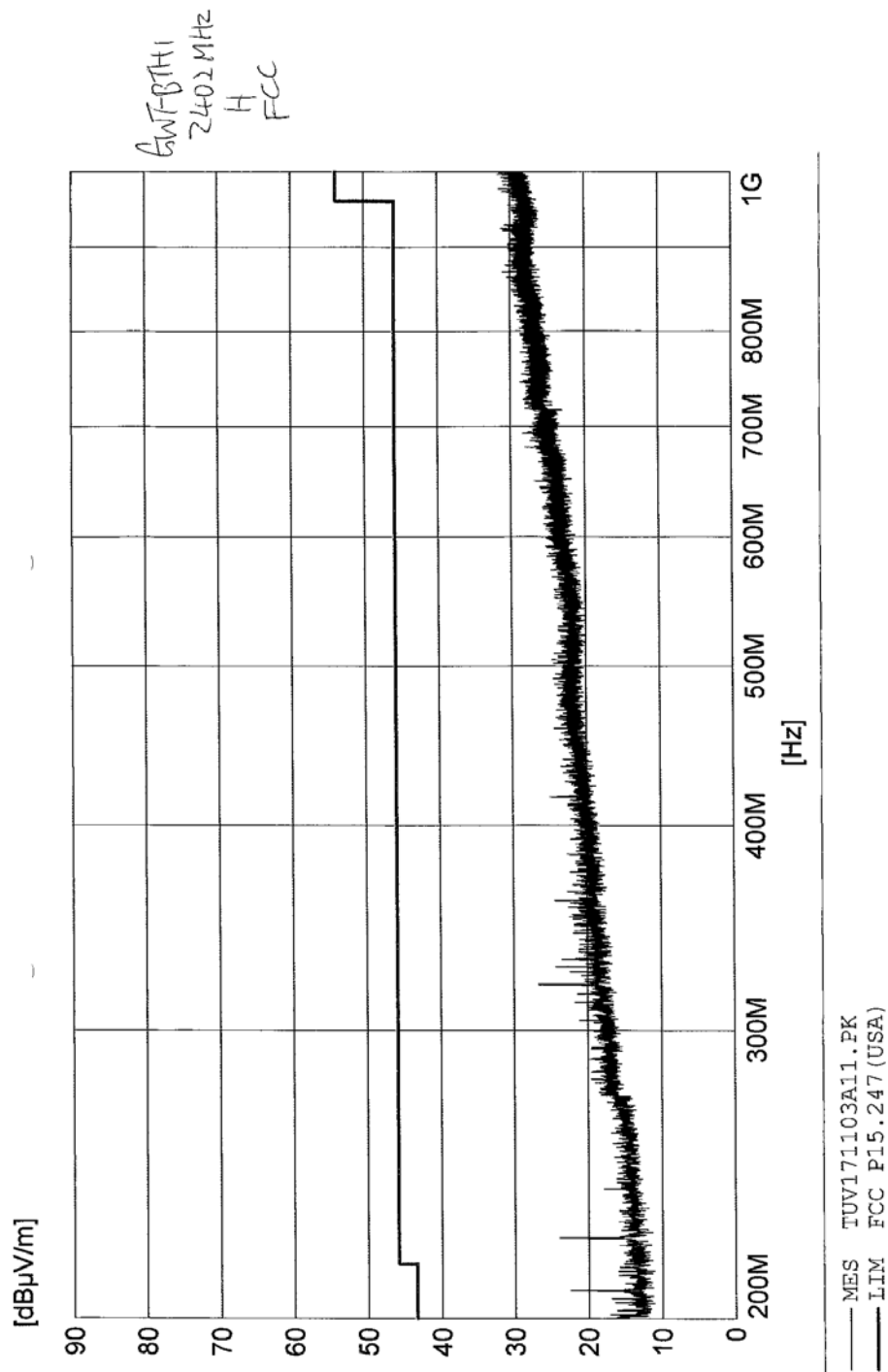
Seite 31 von 63
 Page 31 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

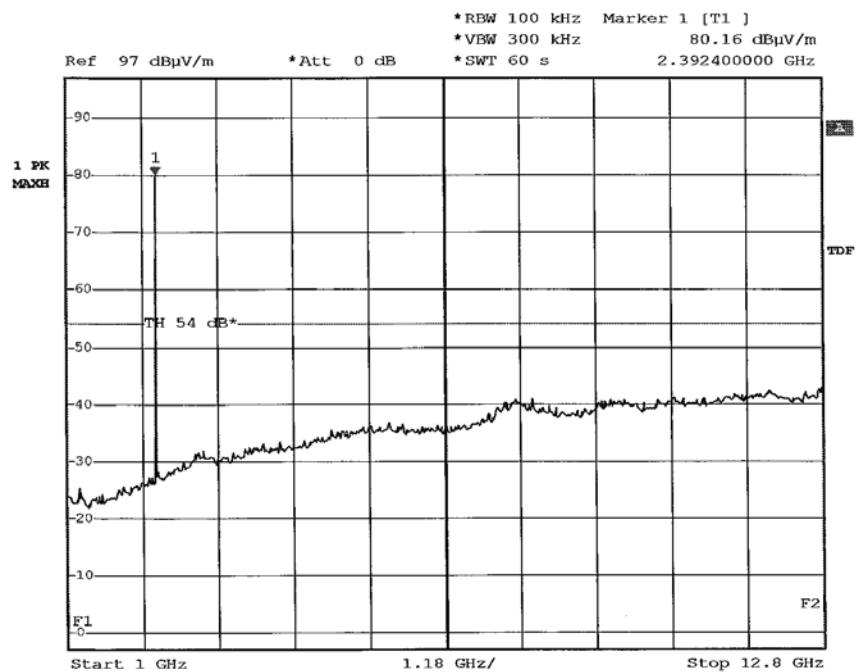
Seite 32 von 63
 Page 32 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 33 von 63
 Page 33 of 63



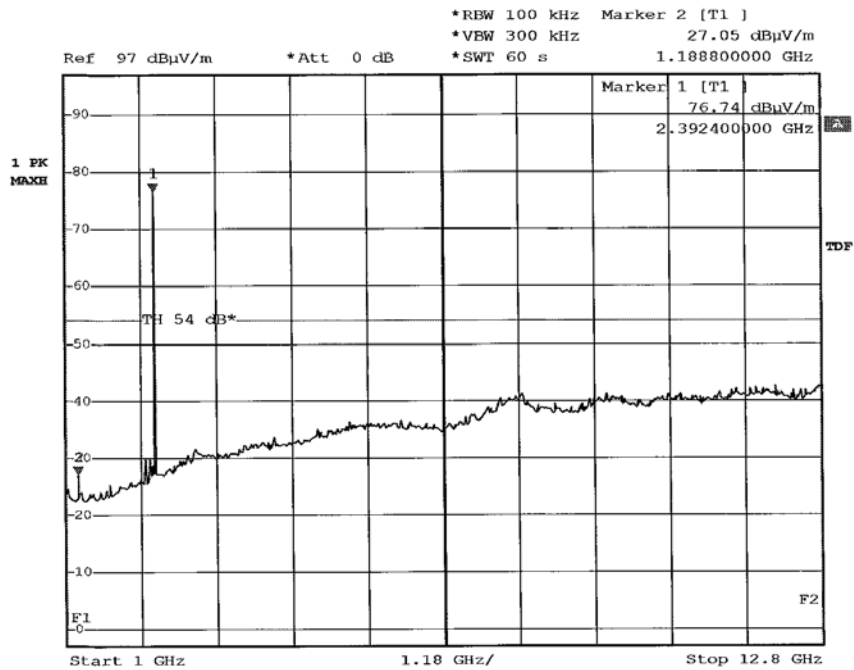
Date: 20.NOV.2003 11:47:29

GW-BTH1
 240MHz
 V
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 34 von 63
 Page 34 of 63



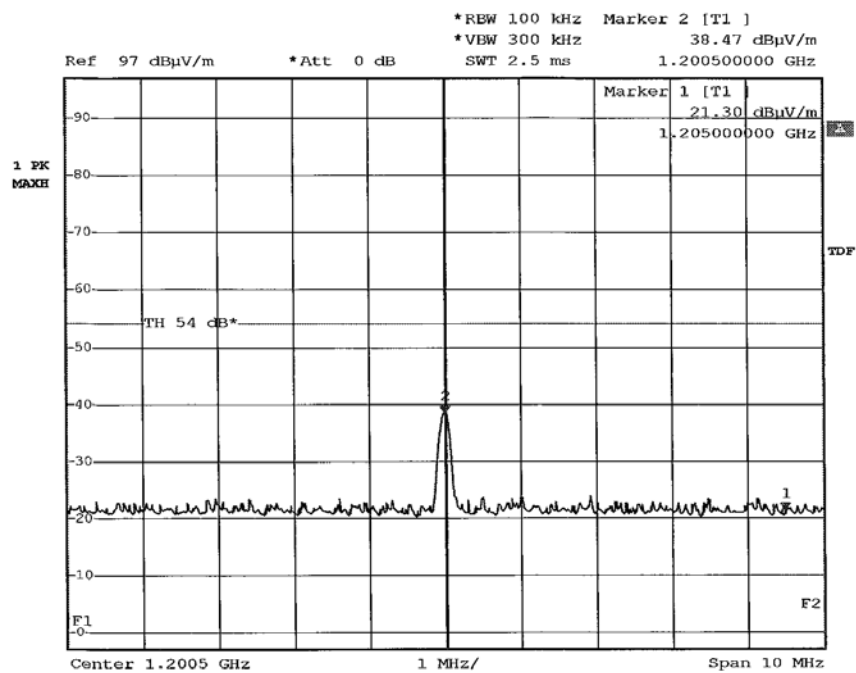
Date: 20.NOV.2003 11:39:16

GWT-BTH1
 2402MHz
 H
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 35 von 63
 Page 35 of 63



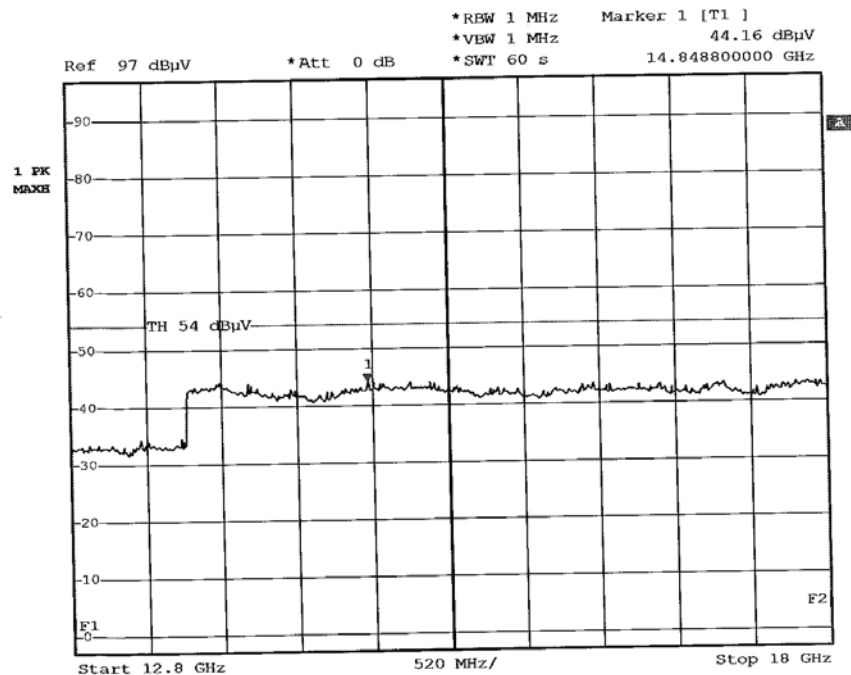
Date: 20.NOV.2003 11:44:07

GW-13711
 240MHz
 1-1
 FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 36 von 63
Page 36 of 63



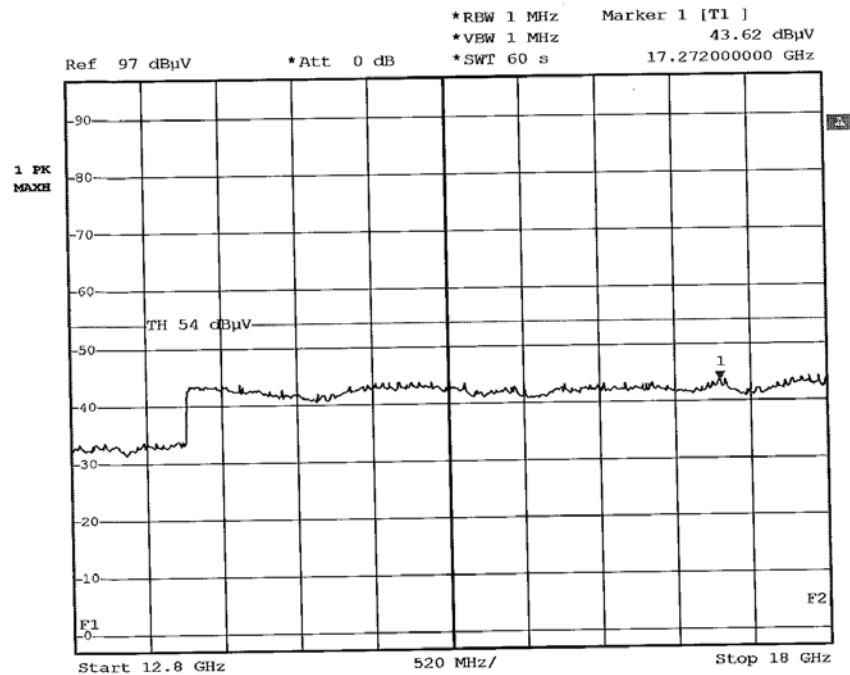
Date: 27.NOV.2003 12:33:13

GWT-BTH1
2402 MHz
V
FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 37 von 63
 Page 37 of 63



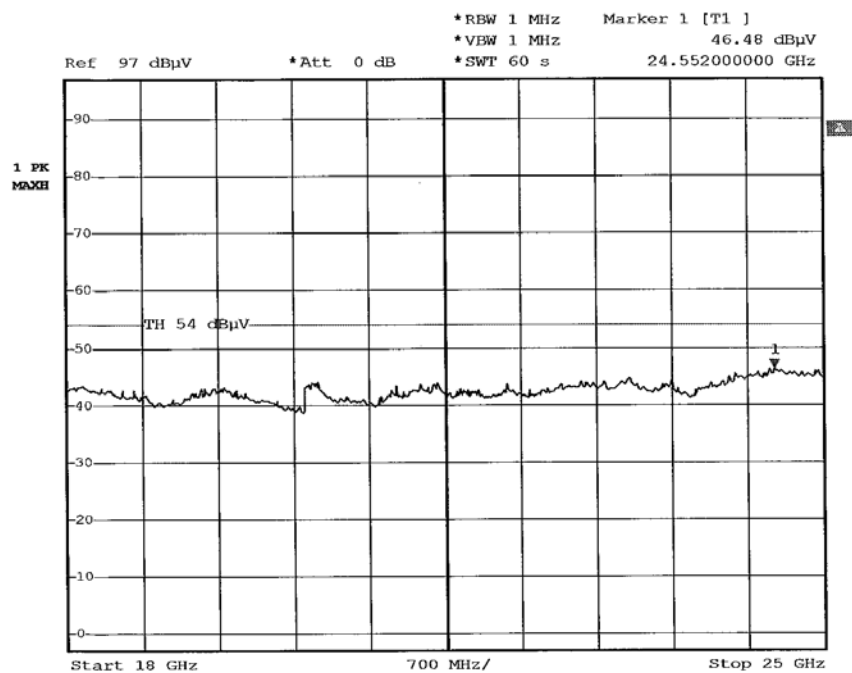
Date: 27.NOV.2003 12:36:58

GWT-BTH1
 2402MHz
 H
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 38 von 63
 Page 38 of 63



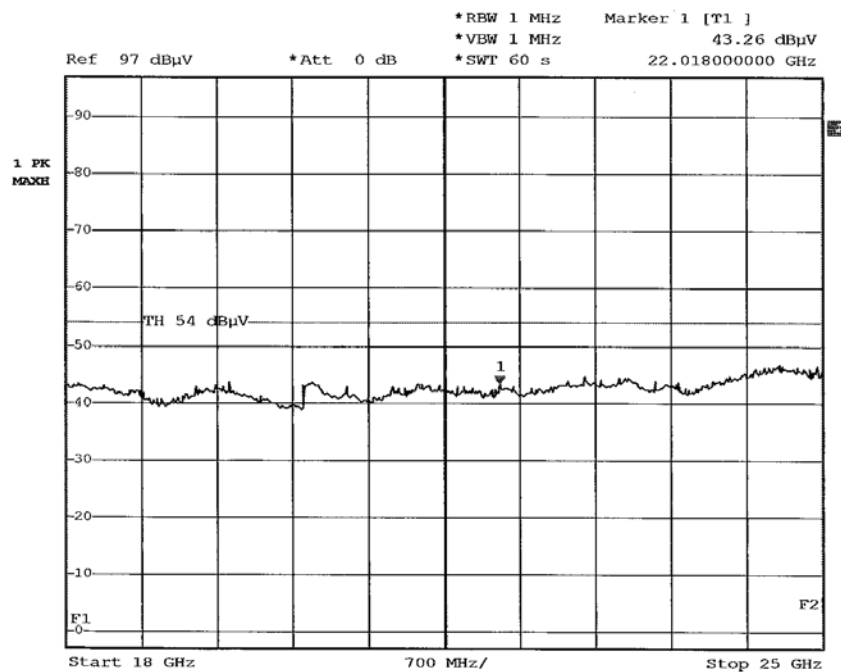
Date: 27.NOV.2003 13:12:19

GWT-BTH1
 2402MHz
 V
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 39 von 63
 Page 39 of 63



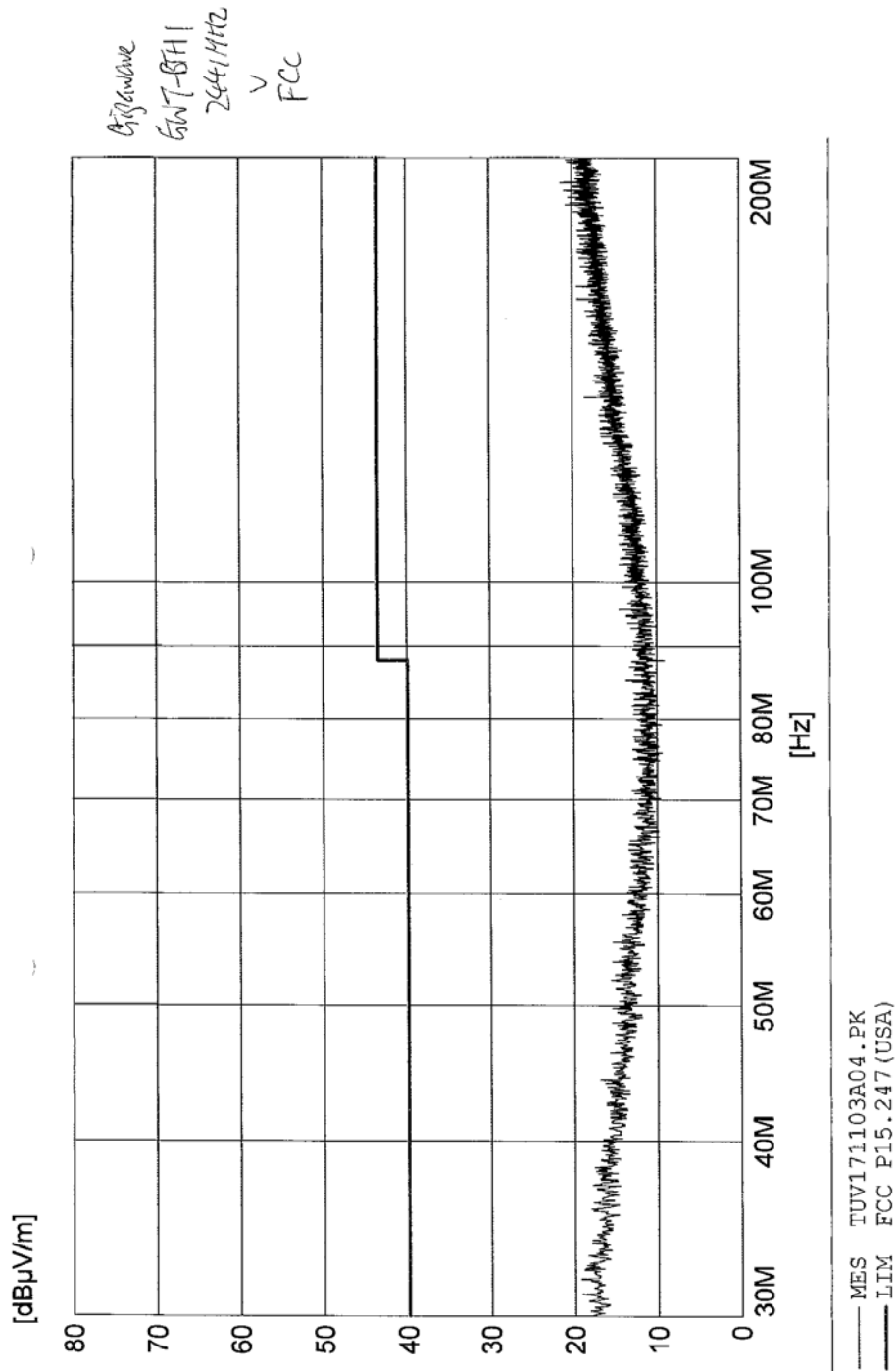
Date: 27.NOV.2003 13:06:23

GWT-BTH1
 2402MHz
 H
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

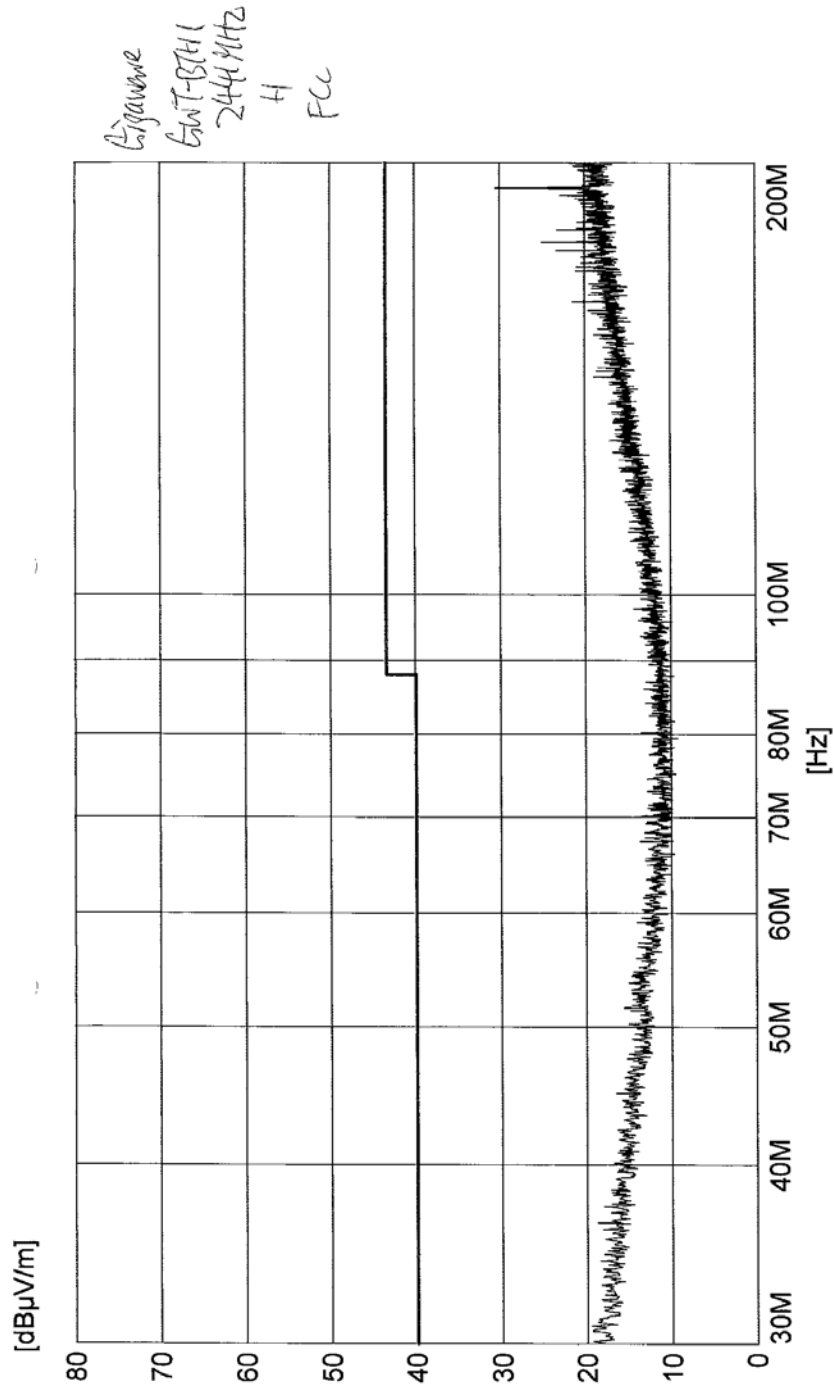
Seite 40 von 63
 Page 40 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 41 von 63
 Page 41 of 63

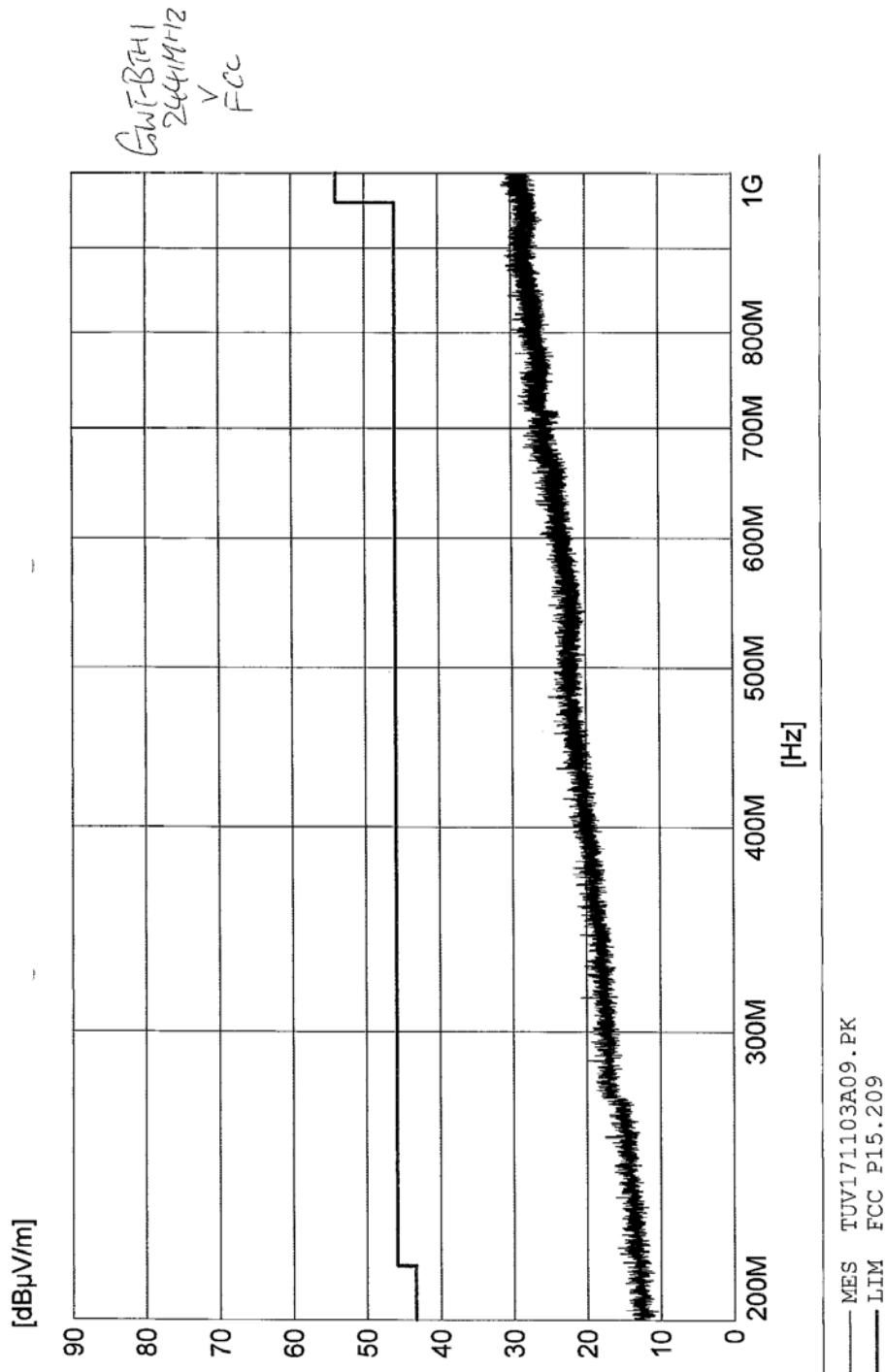


Handwritten notes:
 192.00 MHz
 26.6
 26.8

Prüfbericht - Nr.:
 Test Report No.

14004957 001

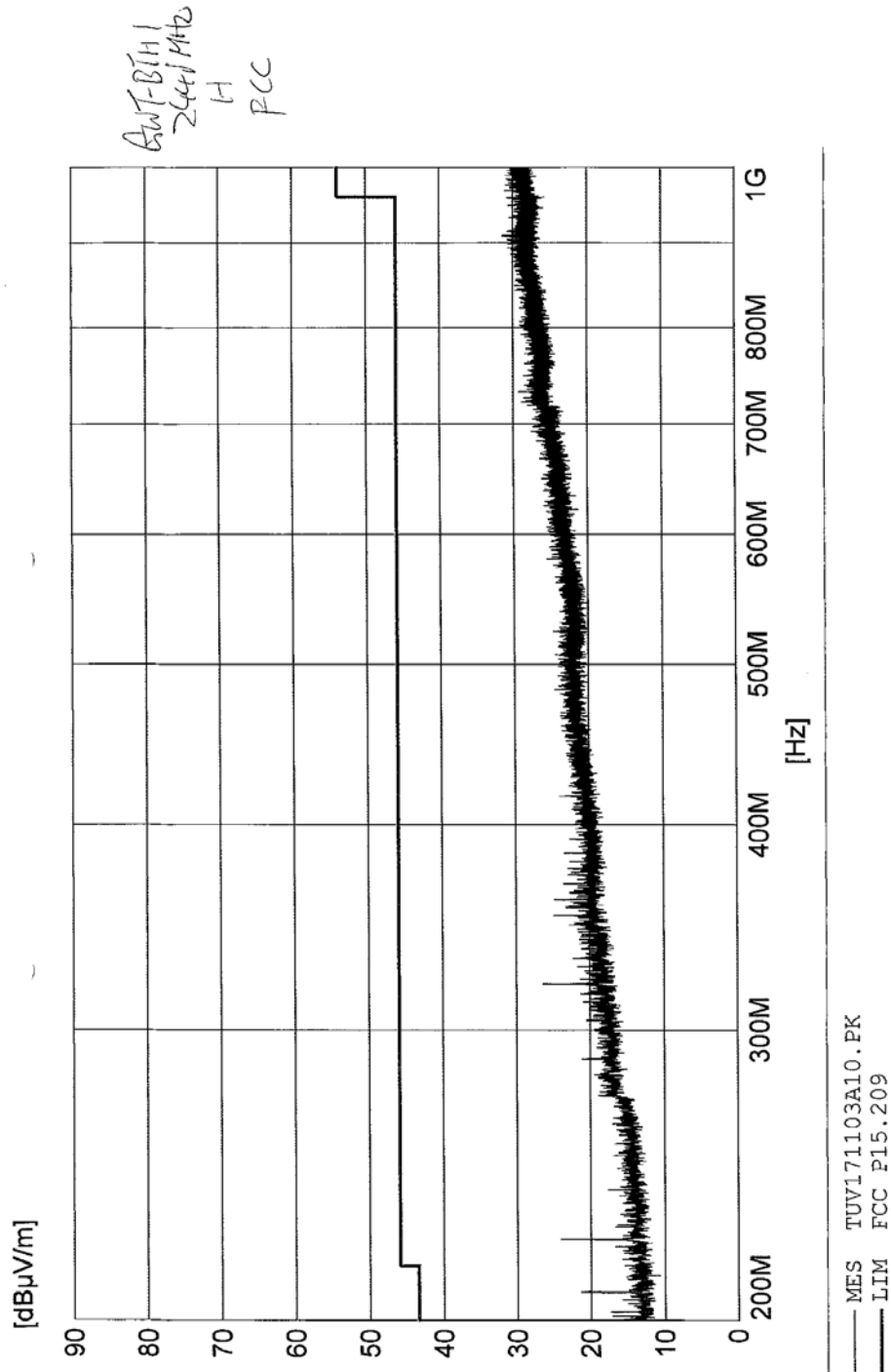
Seite 42 von 63
 Page 42 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

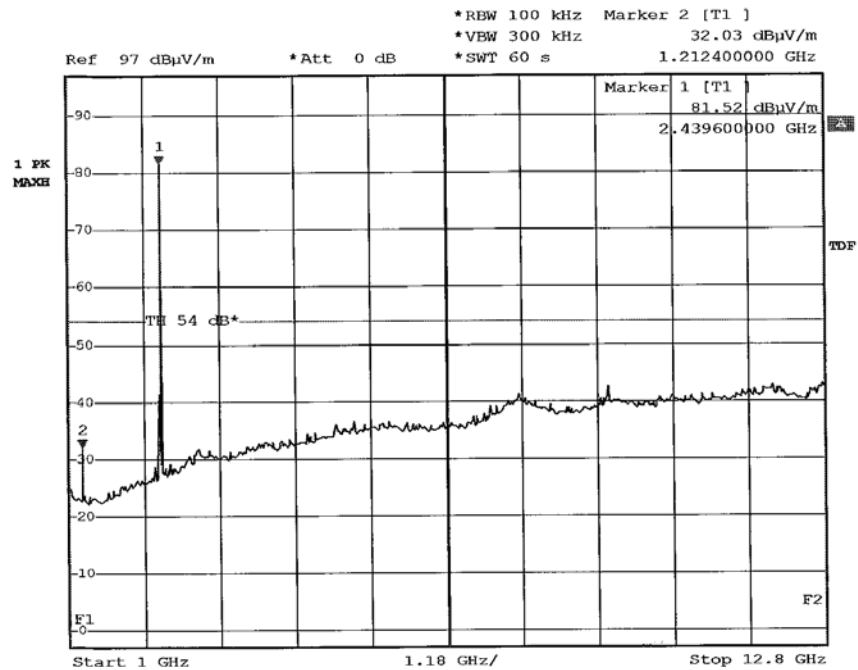
Seite 43 von 63
 Page 43 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 44 von 63
 Page 44 of 63



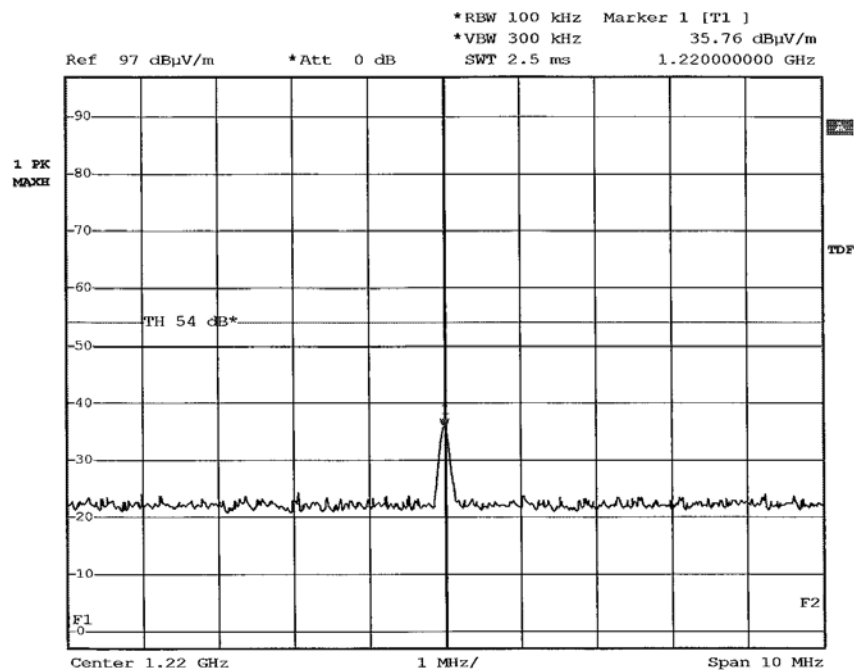
Date: 20.NOV.2003 11:56:44

GWT-BTH1
 2044 MHz
 V
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 45 von 63
 Page 45 of 63



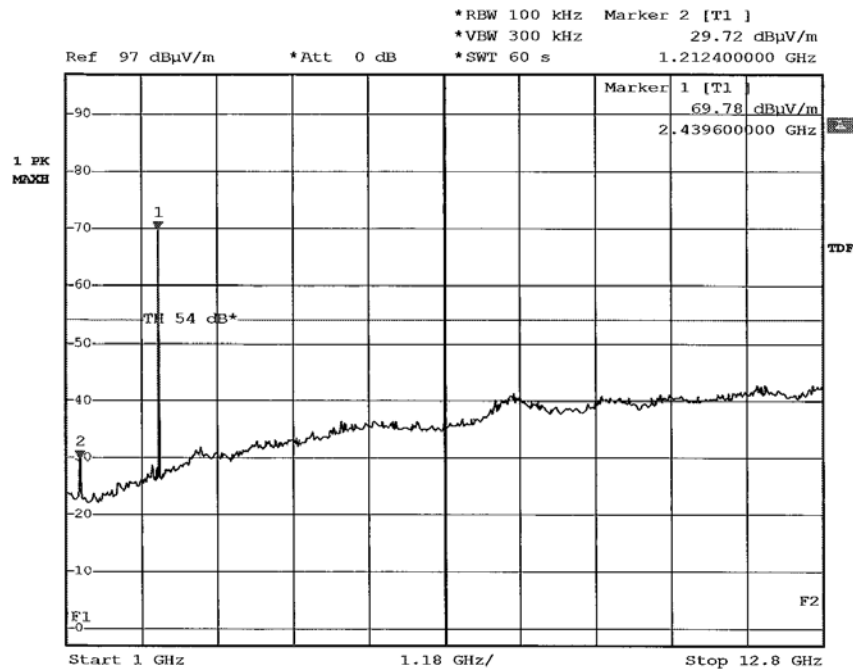
Date: 20.NOV.2003 11:58:49

GW7-BTH
 2804 MHz
 V
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 46 von 63
 Page 46 of 63



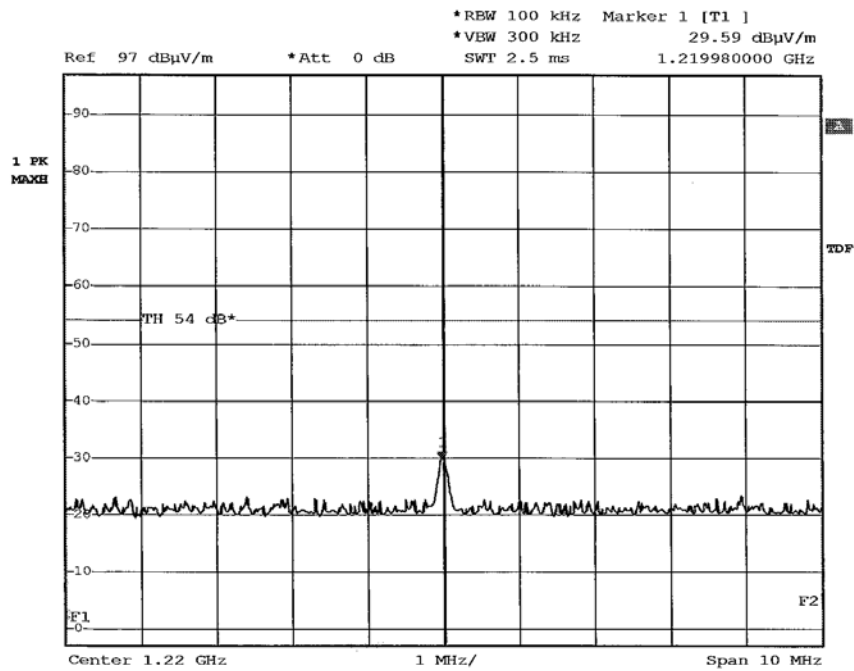
Date: 20.NOV.2003 12:01:45

GWT-BTH1
 244 MHz
 H
 FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 47 von 63
Page 47 of 63



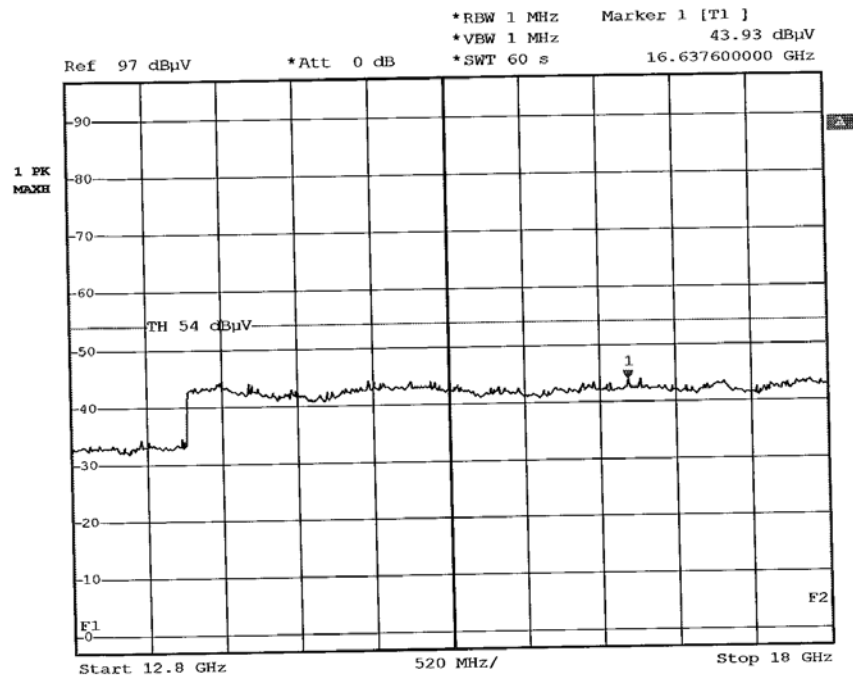
Date: 20.NOV.2003 11:59:13

GWT-BTH1
2441MHz
H
FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 48 von 63
 Page 48 of 63



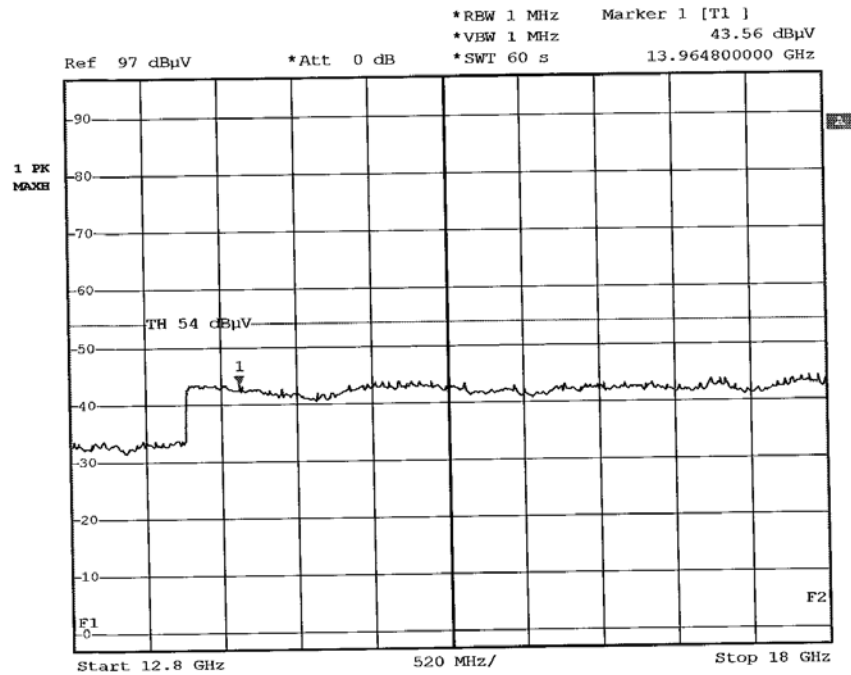
Date: 27.NOV.2003 12:33:38

GW-BTH1
 2441MHz
 V
 FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 49 von 63
Page 49 of 63



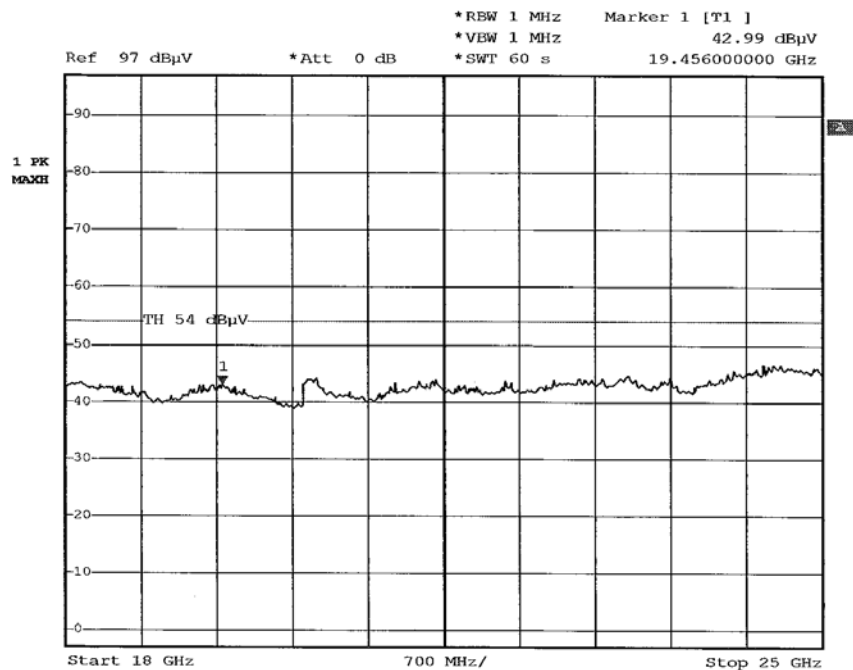
Date: 27.NOV.2003 12:37:30

EW-BTH1
2641MHz
H
FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 50 von 63
 Page 50 of 63



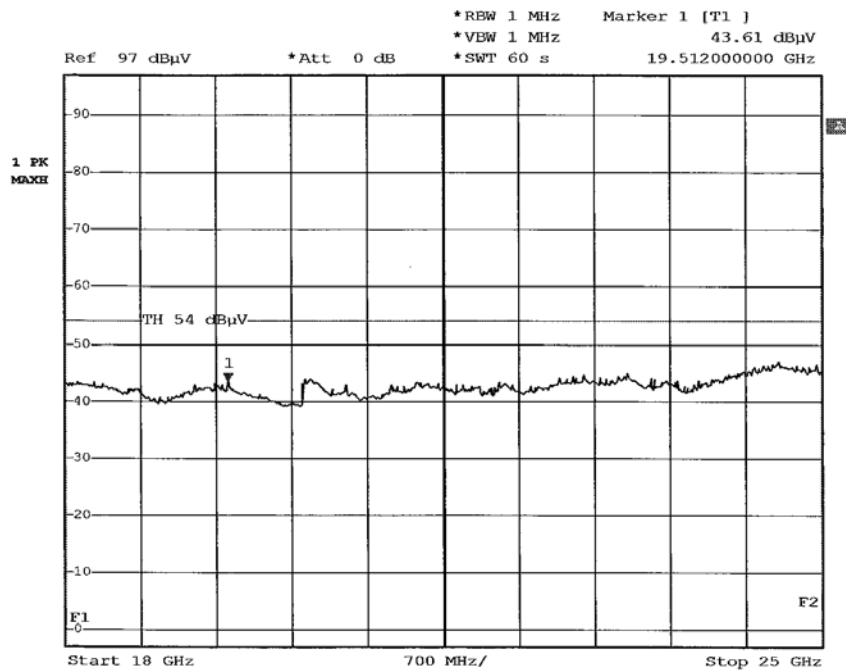
Date: 27.NOV.2003 13:13:07

GWT-BTH1
 2441 MHz
 V
 FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 51 von 63
Page 51 of 63



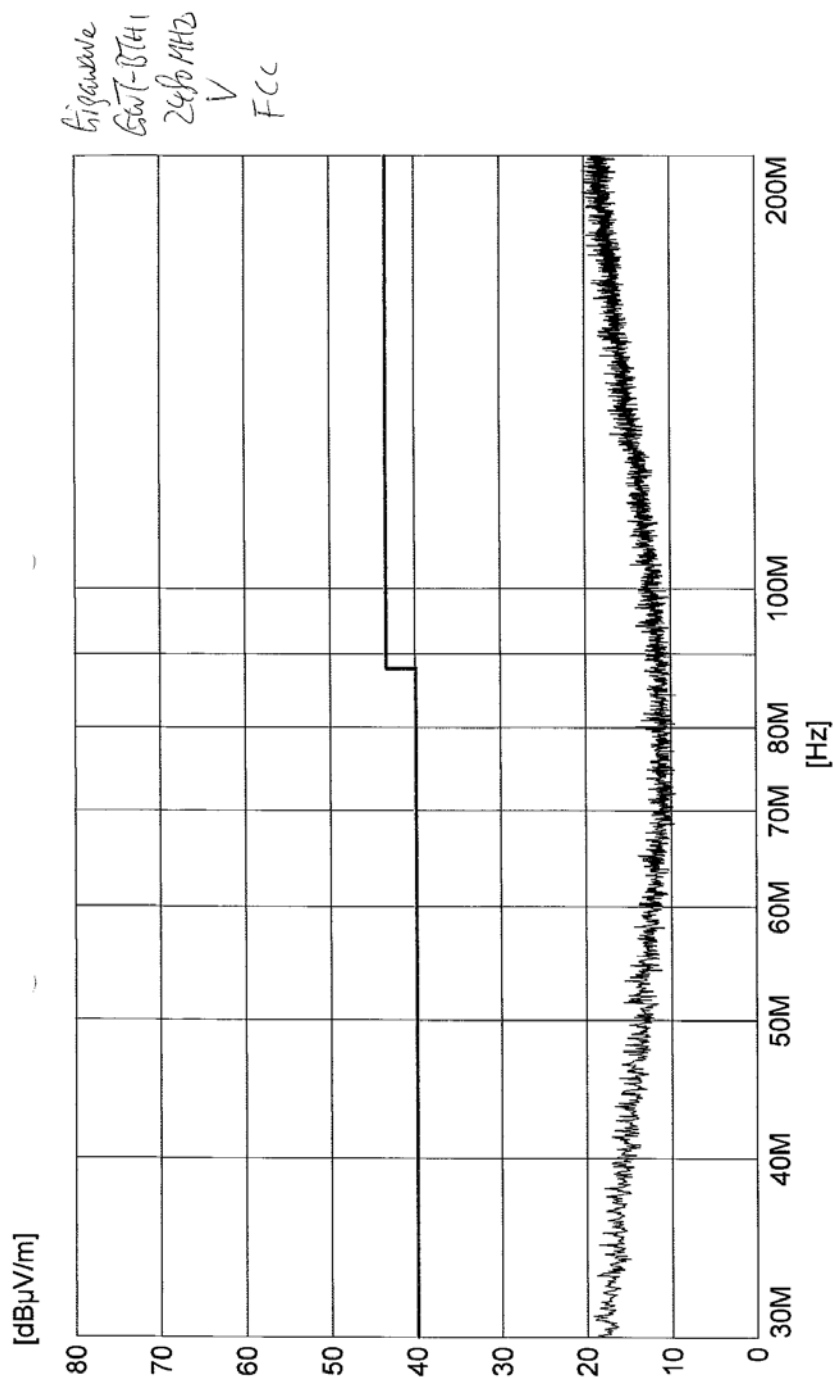
Date: 27.NOV.2003 13:07:35

AWT-BTH1
2441MHz
H
FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 52 von 63
 Page 52 of 63

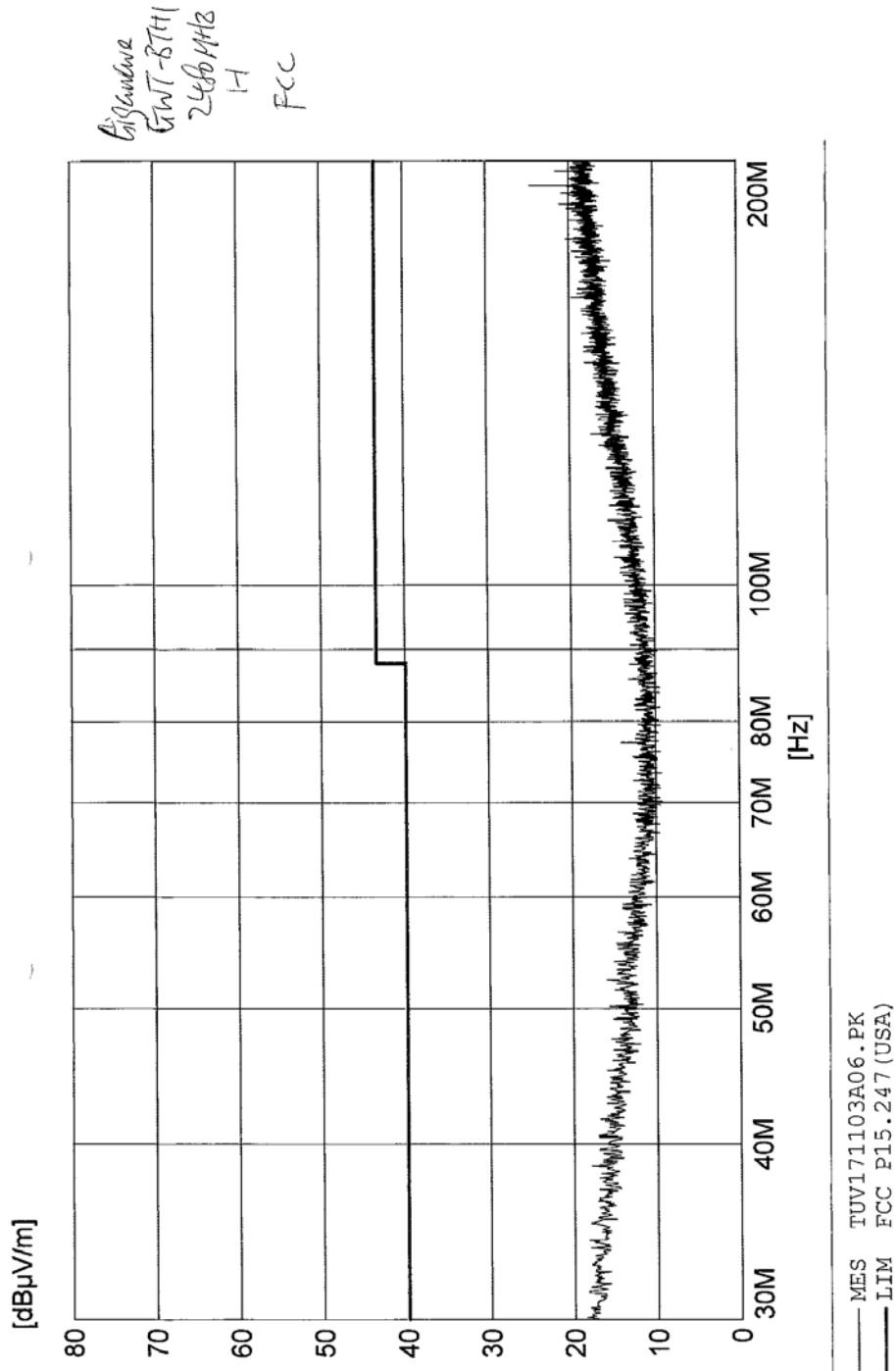


— MES TUV171103A05.PK
 - - - LIM FCC P15.247 (USA)

Prüfbericht - Nr.:
 Test Report No.

14004957 001

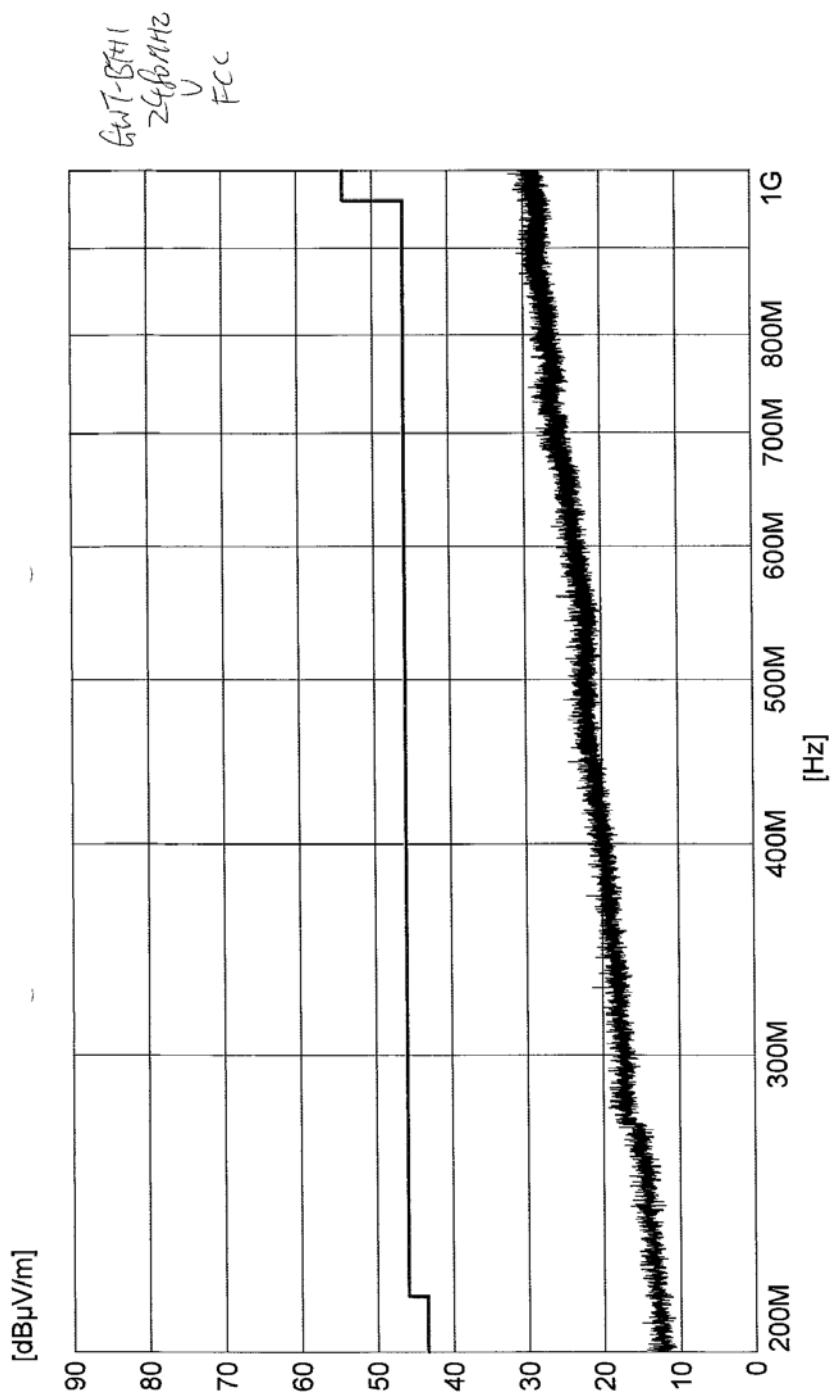
Seite 53 von 63
 Page 53 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

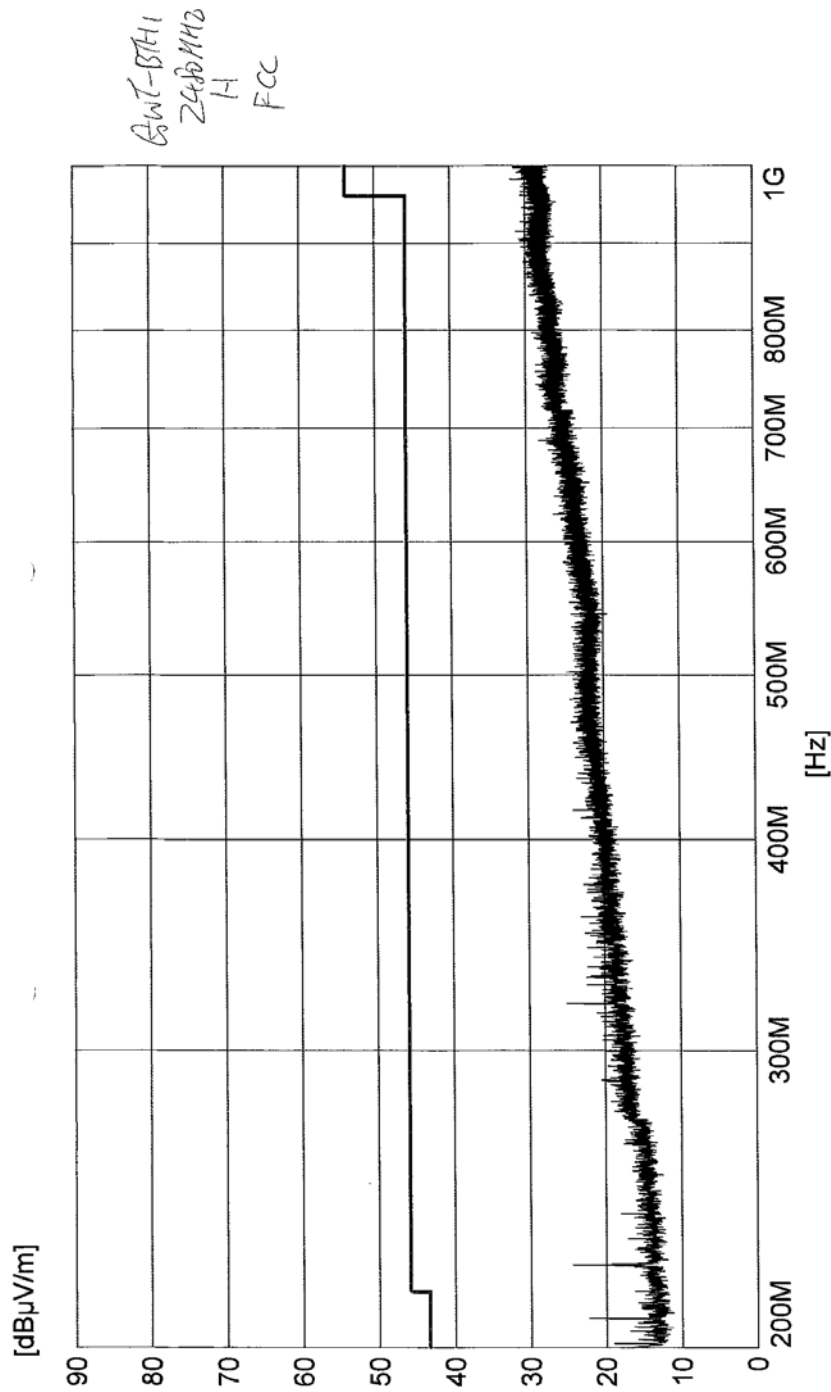
Seite 54 von 63
 Page 54 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

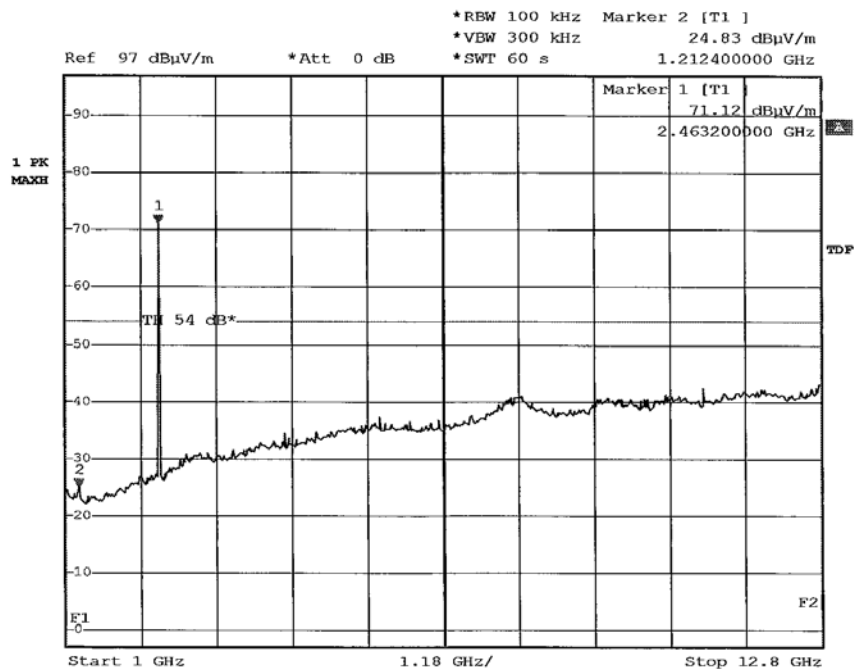
Seite 55 von 63
 Page 55 of 63



Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 56 von 63
 Page 56 of 63



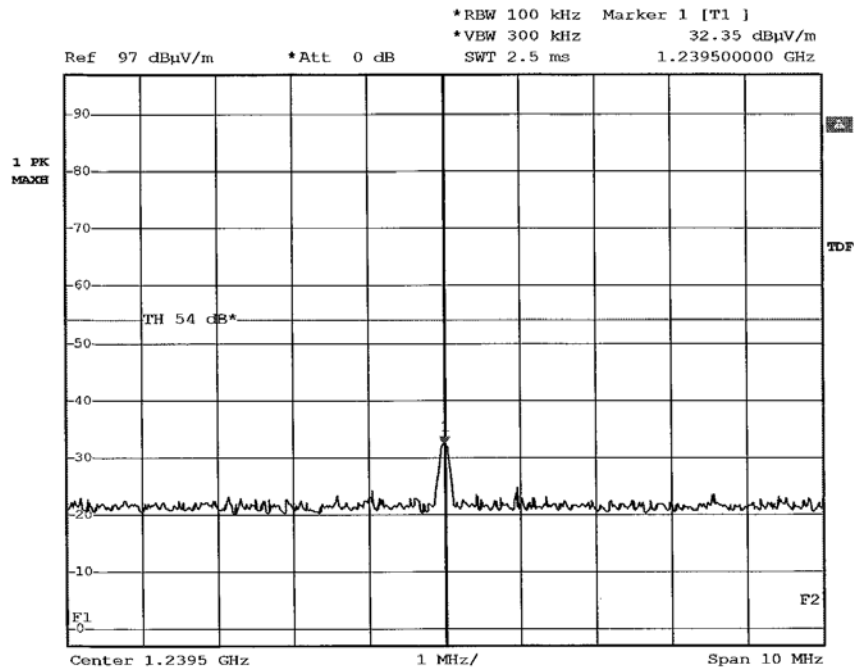
Date: 20.NOV.2003 12:15:14

GWT-BTH1
 2480 MHz
 V
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 57 von 63
 Page 57 of 63



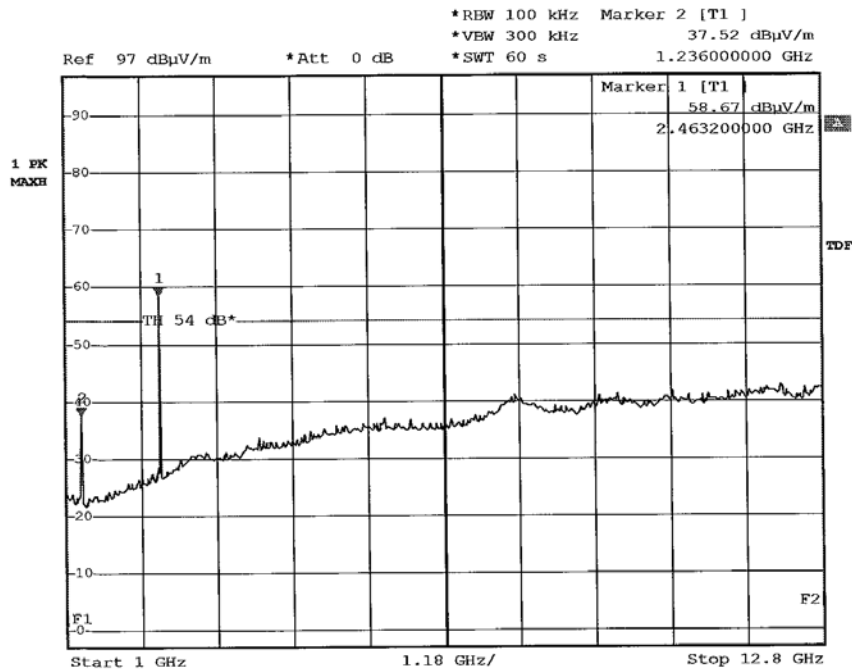
Date: 20.NOV.2003 12:12:29

GWT-BIH1
 2400 MHz
 V
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 58 von 63
 Page 58 of 63



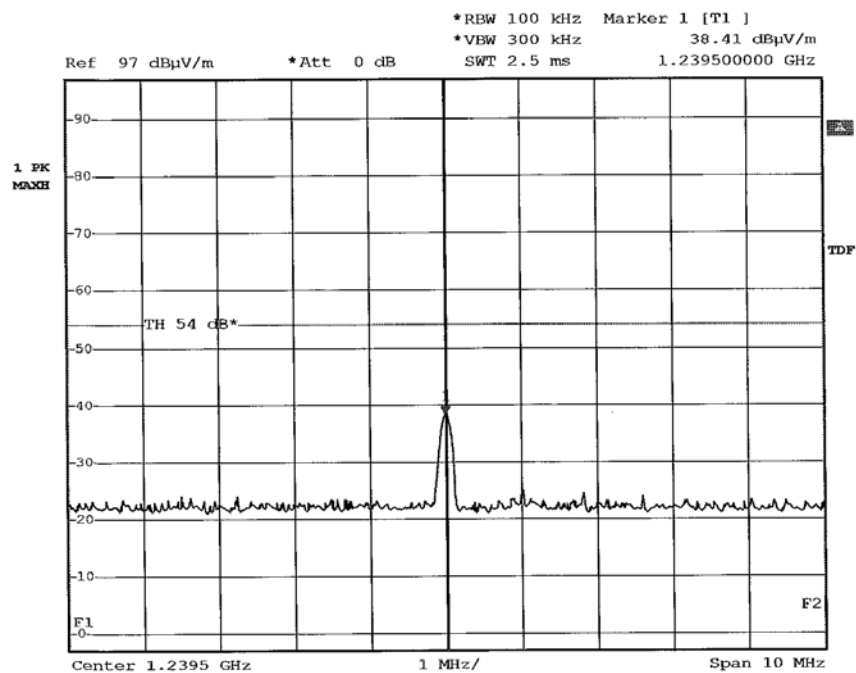
Date: 20.NOV.2003 12:09:04

GWT-BIT1
 2400MHz
 (H
 FCC

Prüfbericht - Nr.:
 Test Report No.

14004957 001

Seite 59 von 63
 Page 59 of 63



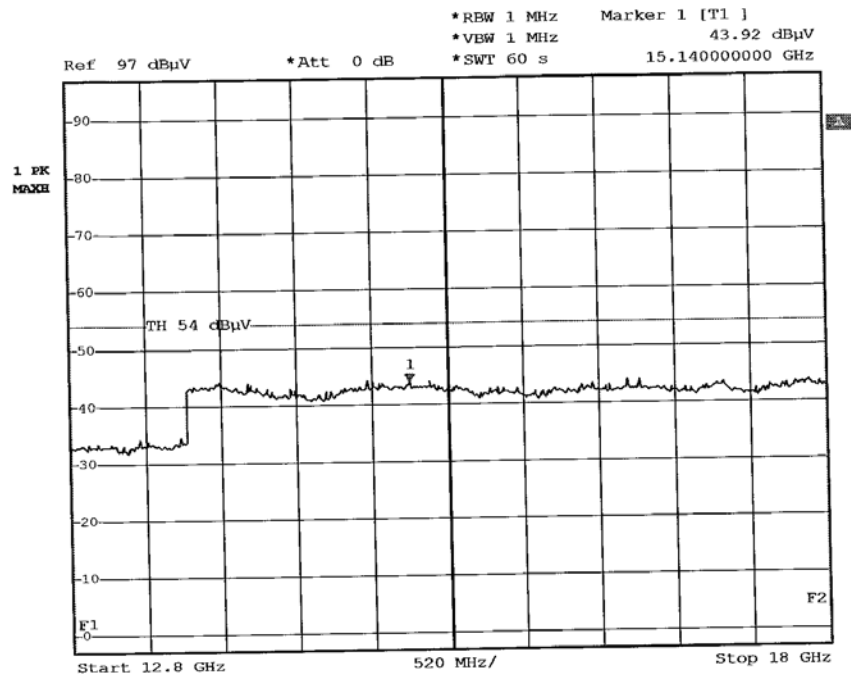
Date: 20.NOV.2003 12:11:44

GW-BTH1
 240 MHz
 H
 FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 60 von 63
Page 60 of 63



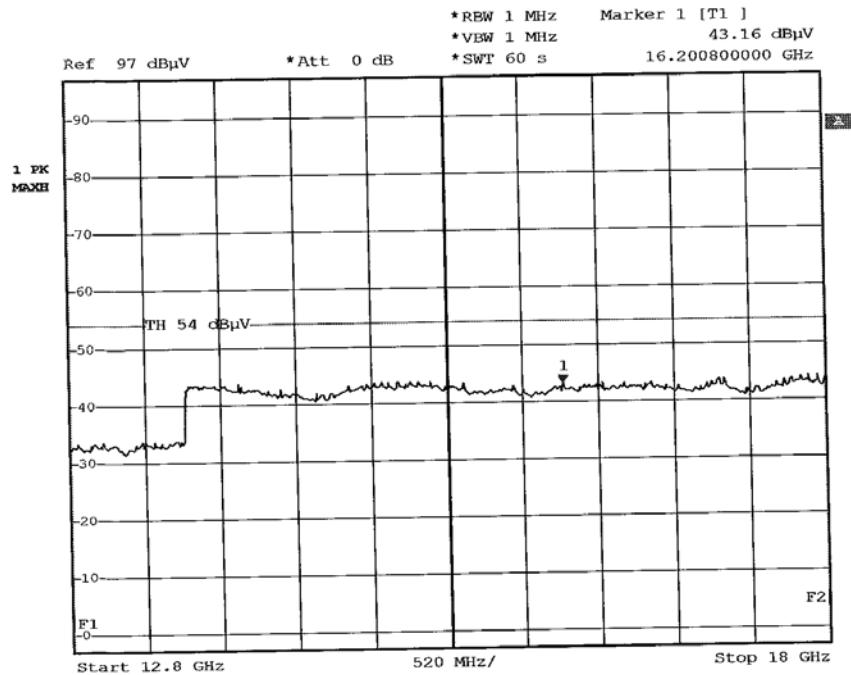
Date: 27.NOV.2003 12:34:09

GWT-BTH1
24.6 MHz
V
FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 61 von 63
Page 61 of 63



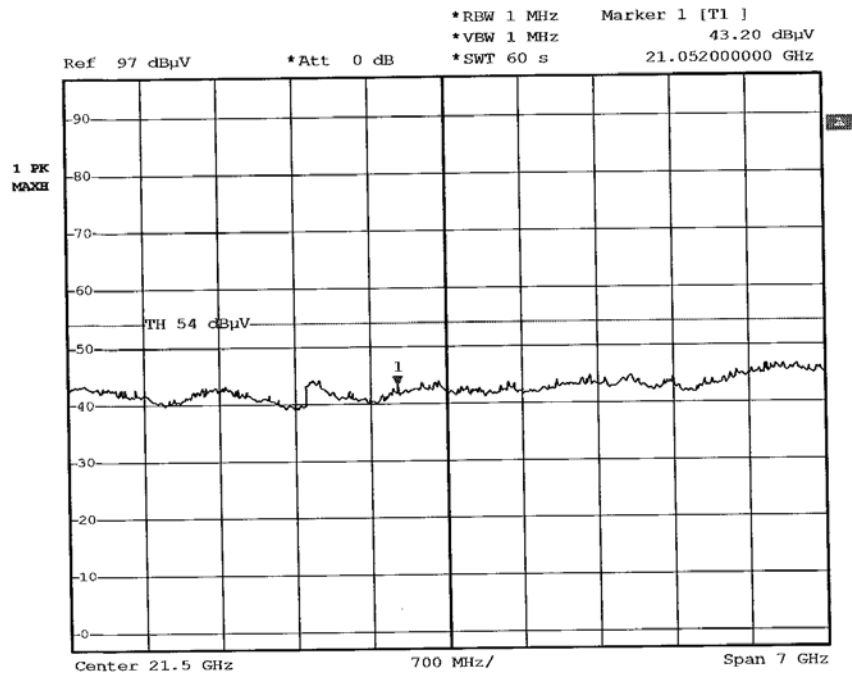
Date: 27.NOV.2003 12:37:15

GW-BTH
240 MHz
1-
FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 62 von 63
Page 62 of 63



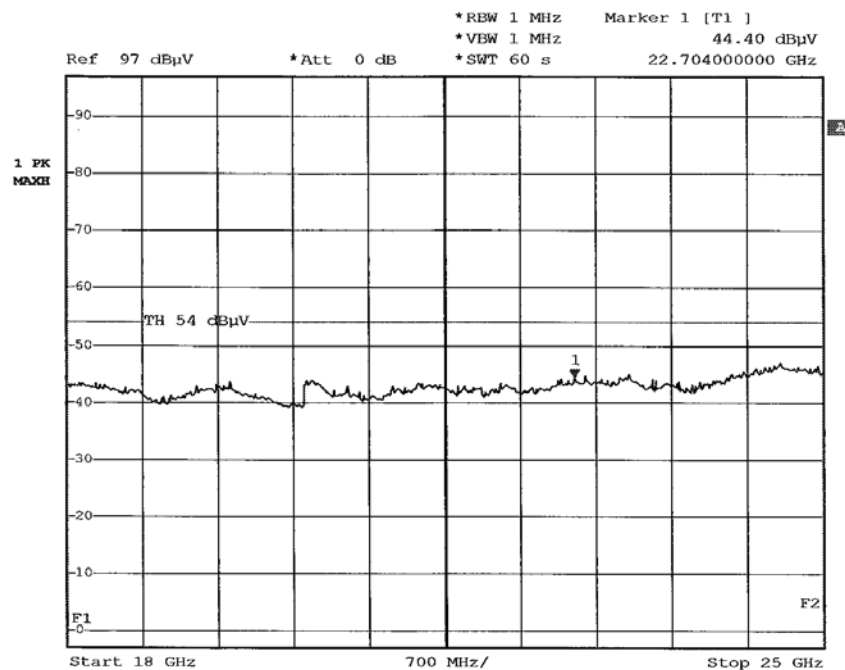
Date: 27.NOV.2003 13:14:08

GWT-BTH1
2480 MHz
V
FCC

Prüfbericht - Nr.:
Test Report No.

14004957 001

Seite 63 von 63
Page 63 of 63



Date: 27.NOV.2003 13:08:34

AWT-BTH1
248MHz
H
FCC