

EMC TEST REPORT

Report No. : EME-071309

Model No. : BTD-12X

Issued Date : Jan. 28, 2008

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1F, No. 9, R&D. II, SBIP, Hsin-Chu, Taiwan**

**Test By : Intertek Testing Services Taiwan Ltd.
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Summary of Tests**Bluetooth Class2 dongle-Model: BTD-12X**
FCC ID: QWOBTD-121

Test	Reference	Results
Maximum Output Power test	15.247(b)	Pass
Carrier Frequency Separation test	15.247(a)(1)	Pass
Number of hopping frequencies test	15.247(a)(1)	Pass
Time of Occupancy (dwell time) test	15.247(a)(1)	Pass
20dB Bandwidth test	15.247(a)(1)	Pass
Radiated Spurious Emission test	15.205, 15.209	Pass
Emission on the Band Edge test	15.247(d)	Pass
AC Power Line Conducted Emission test	15.207	Pass

1. General information

1.1 Identification of the EUT

Applicant : Rayson Technology Co., Ltd.
Product : Bluetooth Class2 dongle
Model No. : BTD-121
FCC ID. : QWOBT-121
Frequency Range : 2400MHz ~ 2483.5MHz
Channel Number : 79 channels
Frequency of Each Channel : 2402 + k MHz; k = 0-78
Type of Modulation : GFSK
Rated Power : DC 5V from Notebook PC
Power Cord : N/A
Sample Received : Dec. 27, 2007
Test Date(s) : Jan 21, 2008 ~ Jan. 23, 2008

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The EUT is a Bluetooth Class2 dongle, and was defined as information technology equipment.

The model BTD-12X is identical to model BTD-121 (EUT), denote of “X” in model number as 0~9 and A~Z, the different model number for different brand serves as marketing strategy.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 2dBi max

Antenna Type : PCB Printed antenna

Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook PC	DELL	Latitude D610	5YWZK1S	FCC DoC Approved
Printer	HP	DeskJet 400	TH86K1N2ZB	FCC DoC Approved
Modem	Dynalink	V1456VQE	00V230A00051494	FCC DoC Approved

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section § 15.205, §15.207, §15.209, §15.247, DA 00-705 and ANSI C63.4/2003.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT was transmitted continuously during the test.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Intertek ID No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	EC303	08/08/2008
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	08/05/2008
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	11/12/2008
Horn Antenna	SCHWARZBECK	1GHz~18GHz	BBHA 9120 D	EC371	03/04/2008
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	EC351	08/08/2008
Bilog Antenna	SCHWARZBECK	25MHz~2GHz	VULB 9168	EC347	03/20/2008
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981	EC373	03/18/2008
Pre-Amplifier	MITEQ	26GHz~40GHz	828825	EC374	01/15/2009
Wideband Peak Power Meter/ Sensor	Anritsu	100MHz~18GHz	ML2497A/ MA2491A	EC396	11/12/2008
Controller	HDGmbH	N/A	CM 100	EP346	N/A
Antenna Tower	HDGmbH	N/A	MA 240	EP347	N/A
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	EC344	03/30/2008

Note: 1. The above equipments are within the valid calibration period.
2. The test antennas (receiving antenna) are calibration per 1 year.

3. 20dB Bandwidth test

3.1 Operating environment

Temperature: 25
Relative Humidity: 55 %
Atmospheric Pressure: 1023 hPa

3.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines DA 00-705.

The 20dB bandwidth per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth RBW, and the SPAN may equal to approximately 2 to 3 times the 20dB bandwidth. The test was performed at 3 channels (lowest, middle and highest channel). The maximum 20dB modulation bandwidth is in the following Table.

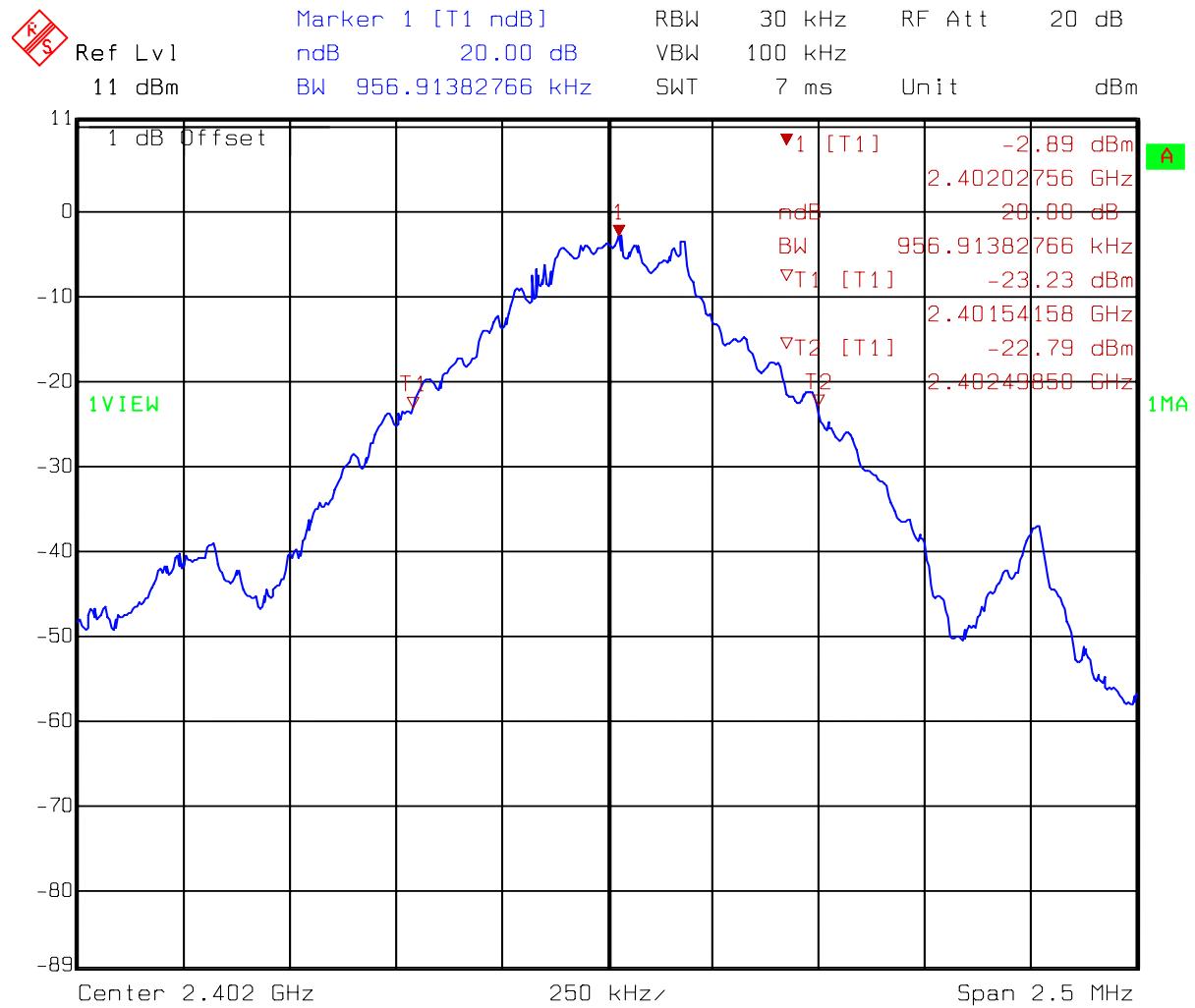
3.3 Measured data of modulated bandwidth test results

Test Mode: GFSK

Channel	Frequency (MHz)	Bandwidth (kHz)
Channel 0	2402.00	956.914
Channel 39	2441.00	956.914
Channel 78	2480.00	896.794

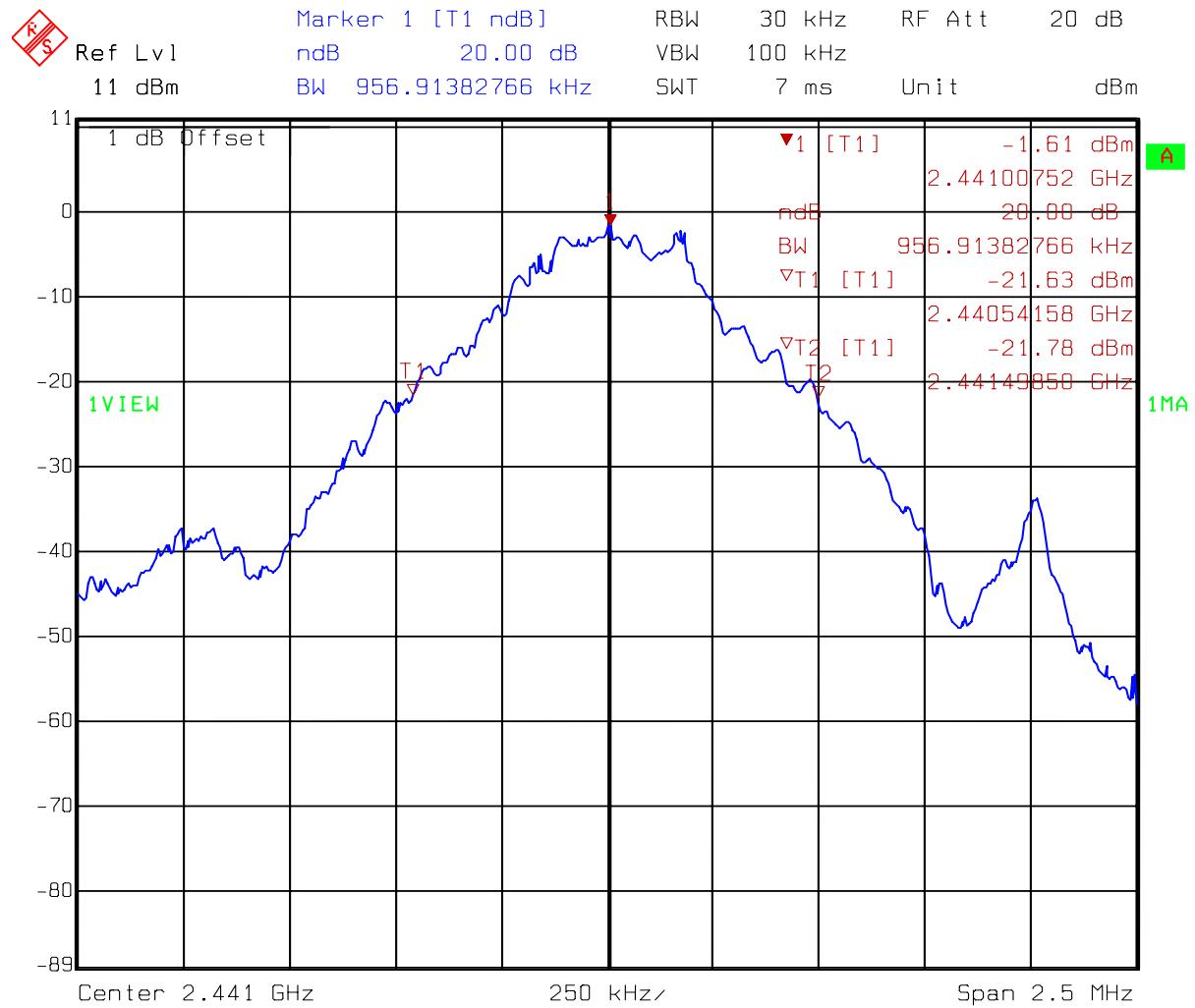
Please see the plot below.

Test mode: GFSK (ch0)



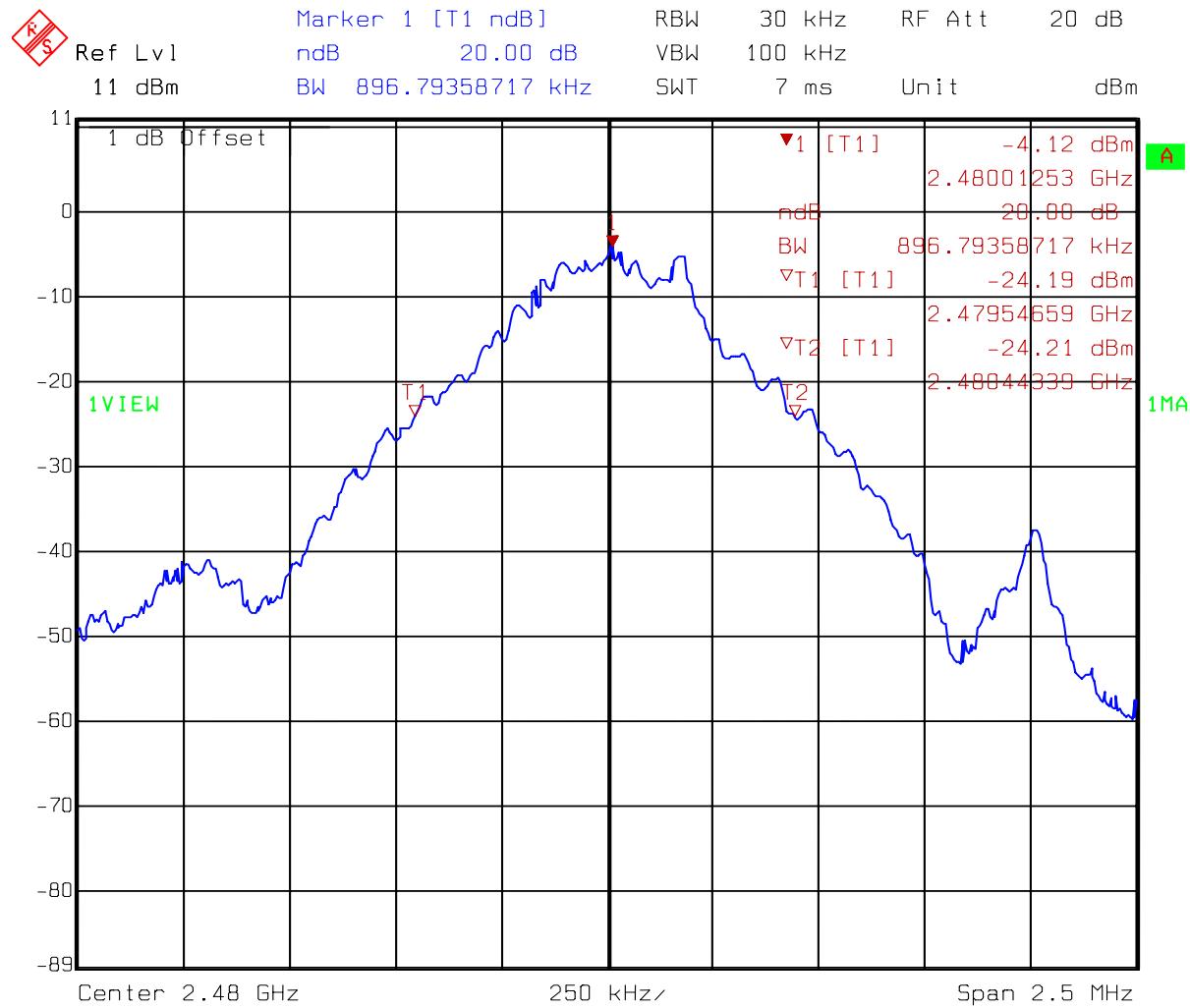
Title: 20dB Bandwidth
Comment A: CH 0 at Bluetooth mode
Date: 21.JAN.2008 15:48:54

Test mode: GFSK (ch39)



Title: 20dB Bandwidth
Comment A: CH 39 at Bluetooth mode
Date: 21.JAN.2008 15:51:25

Test mode: GFSK (ch78)



Title: 20dB Bandwidth
Comment A: CH 78 at Bluetooth mode
Date: 21.JAN.2008 15:54:17

4. Carrier Frequency Separation test

4.1 Operating environment

Temperature: 25
Relative Humidity: 55 %
Atmospheric Pressure: 1023 hPa

4.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines DA 00-705.

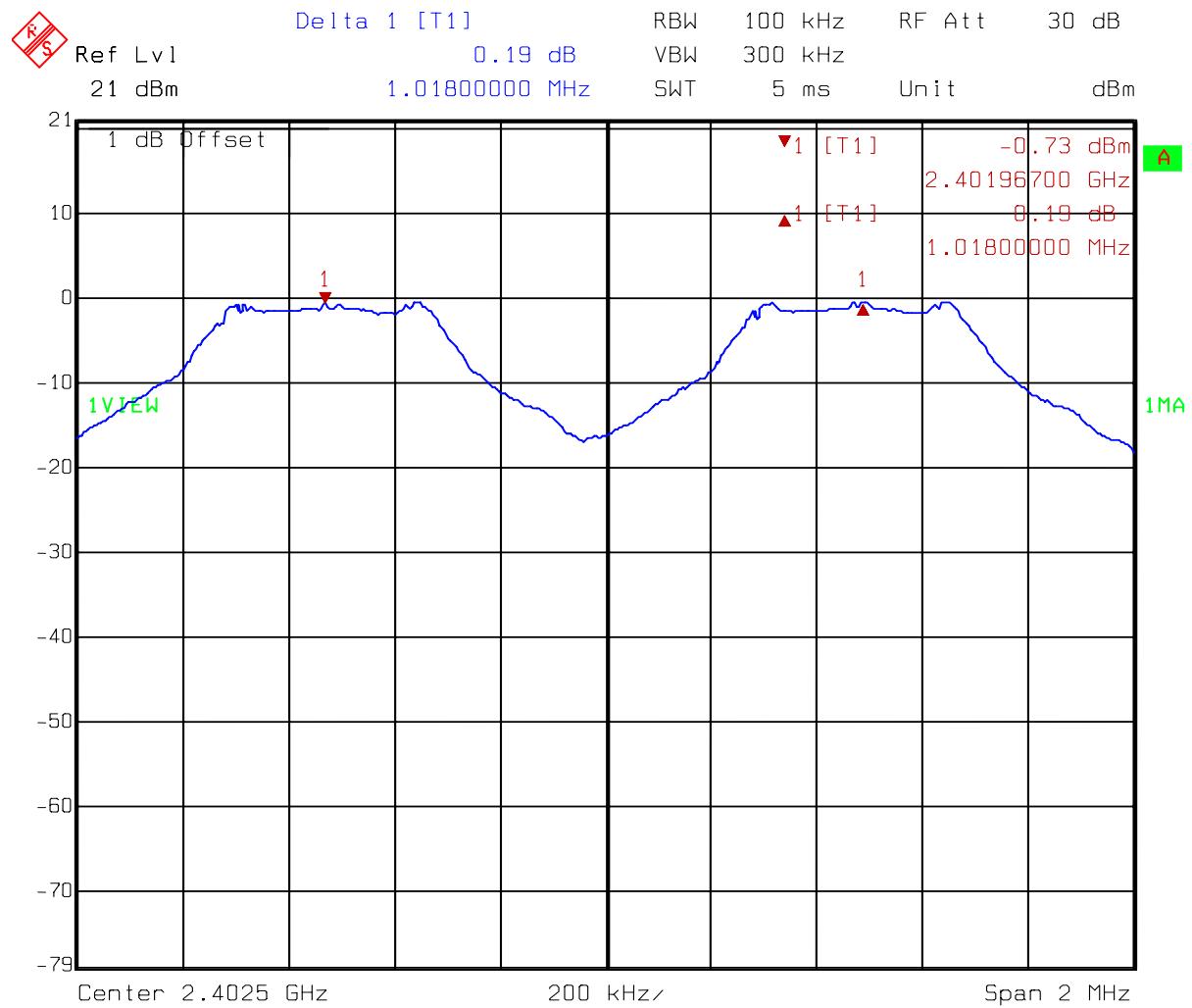
The carrier frequency separation per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 1 % of the span, the video bandwidth RBW, and the SPAN was wide enough to capture the peaks of two adjacent channels. The carrier frequency separation result is in the following Table.

4.3 Measured data of Carrier Frequency Separation test result

Test mode: GFSK

Channel	Frequency (MHz)	Measurement Frequency separation (kHz)
1	2402	1018.000
2	2403	

Please see the plot below.

Test mode: GFSK

Title: Carrier freq. separation
Comment A: at Bluetooth mode
Date: 21.JAN.2008 15:40:56

5. Number of hopping frequencies test

5.1 Operating environment

Temperature: 25
Relative Humidity: 55 %
Atmospheric Pressure: 1023 hPa

5.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines DA 00-705.

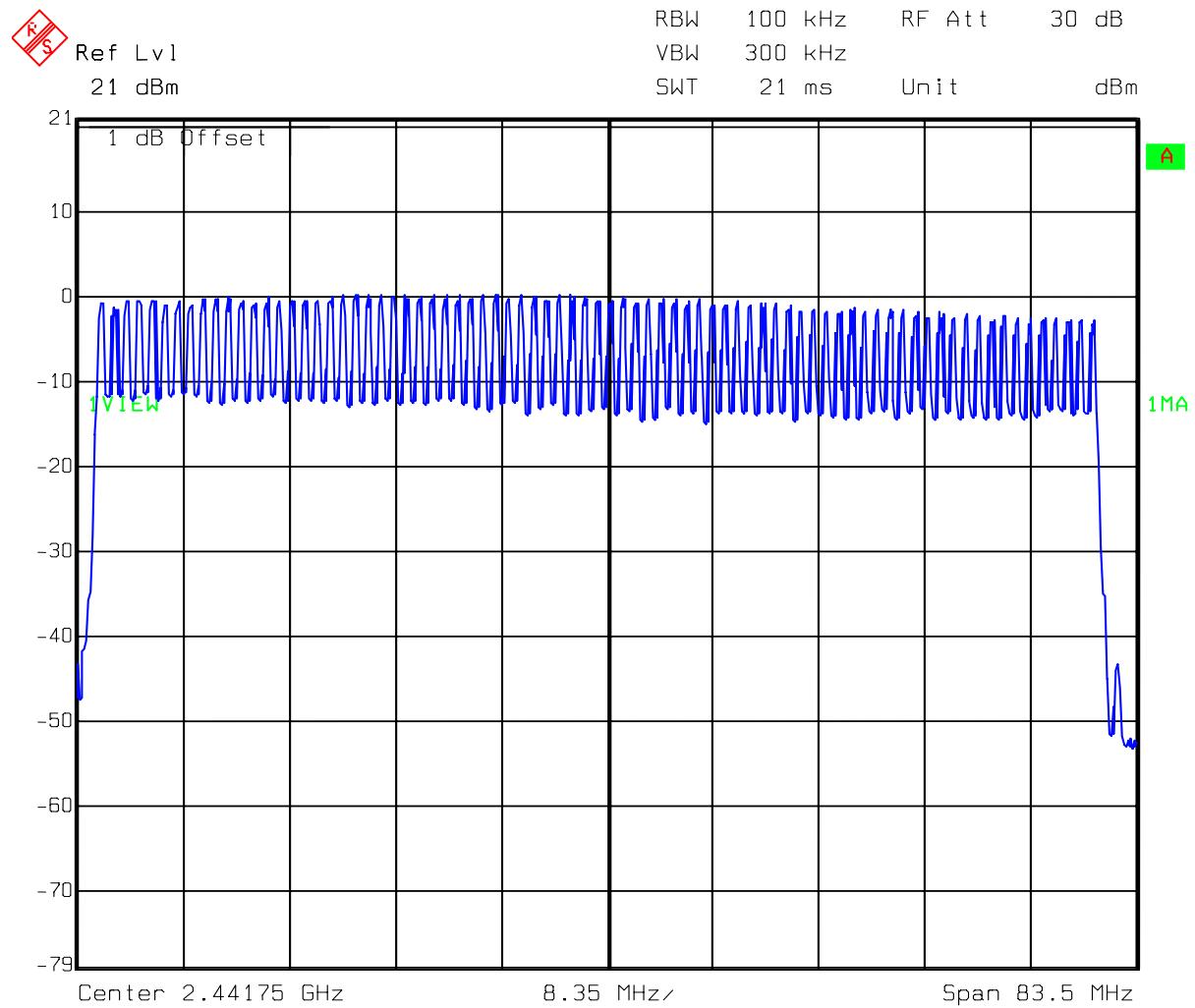
The number of hopping frequencies per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 1 % of the span, the video bandwidth RBW, and the SPAN was the frequency band of operation. The carrier frequency separation result is in the following Table.

5.3 Measured data of number of hopping frequencies test result

Test mode: GFSK

Frequency Range (MHz)	Total hopping channels
2400 ~ 2483.5	79

Please see the plot below.

Test mode: GFSK

Title: Number of hopping freq.
Comment A: CH 0 at Bluetooth mode
Date: 21.JAN.2008 15:47:28

6. Time of Occupancy (dwell time) test

6.1 Operating environment

Temperature: 25
Relative Humidity: 55 %
Atmospheric Pressure: 1023 hPa

6.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines DA 00-705.

The time of occupancy (dwell time) per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 1MHz, the video bandwidth RBW, and the zero span function of spectrum analyzer was enable. The EUT has its hopping function enable.

The system makes worst case 1600 hops per second or 1 time slot has a length of 625μs with 79 channels.

Time of occupancy (dwell time) for DH1

$$\begin{aligned}\text{Dwell time} &= 421.800 \mu\text{s} * 1600 * 1/2 * 1/\text{s} / 79 * 31.6\text{s} \\ &= 134.976 \text{ ms (in a 31.6s period)}\end{aligned}$$

Time of occupancy (dwell time) for DH3

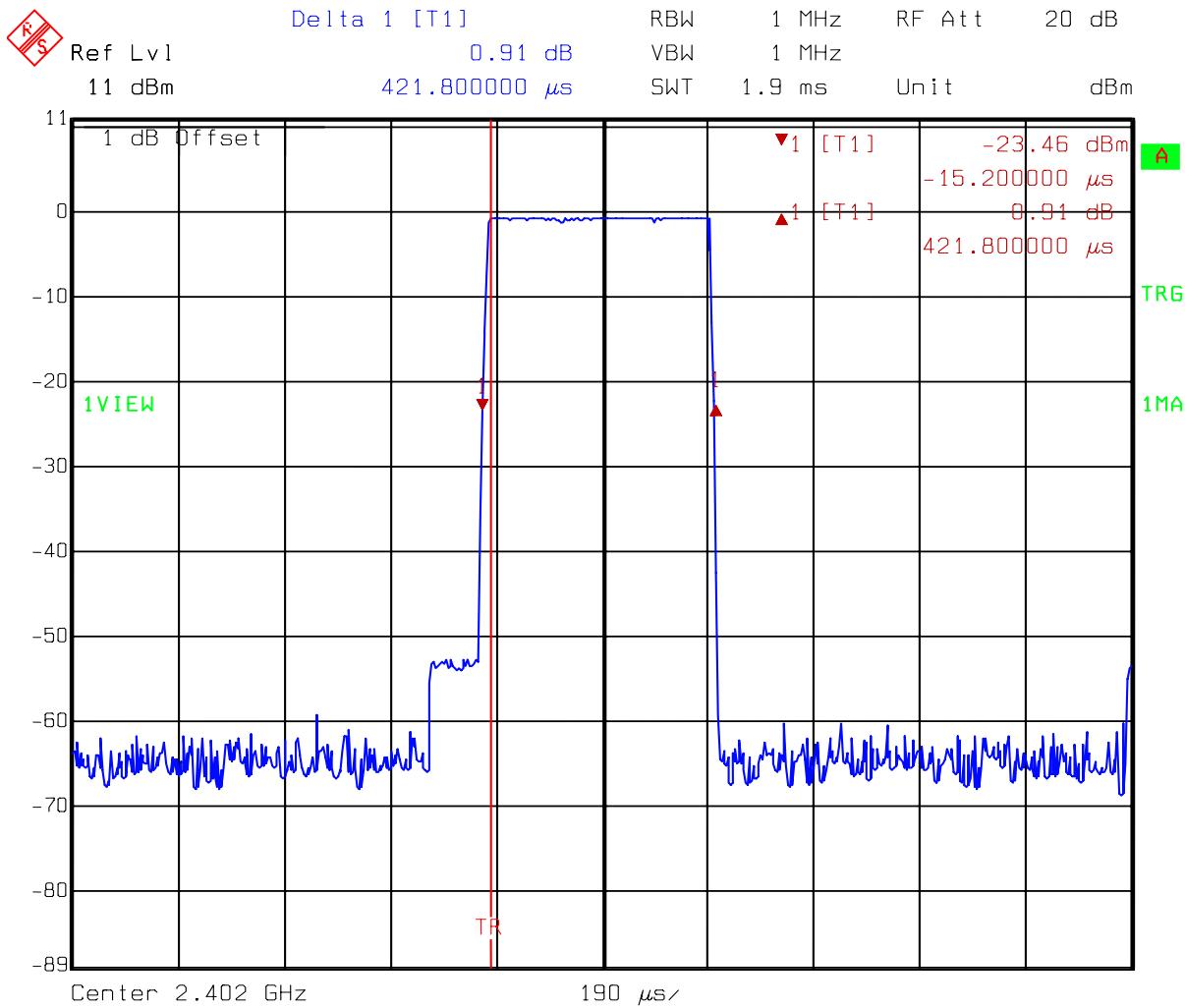
$$\begin{aligned}\text{Dwell time} &= 1.680 \text{ ms} * 1600 * 1/4 * 1/\text{s} / 79 * 31.6\text{s} \\ &= 268.800 \text{ ms (in a 31.6s period)}\end{aligned}$$

Time of occupancy (dwell time) for DH5

$$\begin{aligned}\text{Dwell time} &= 2.932 \text{ ms} * 1600 * 1/6 * 1/\text{s} / 79 * 31.6\text{s} \\ &= 312.747 \text{ ms (in a 31.6s period)}\end{aligned}$$

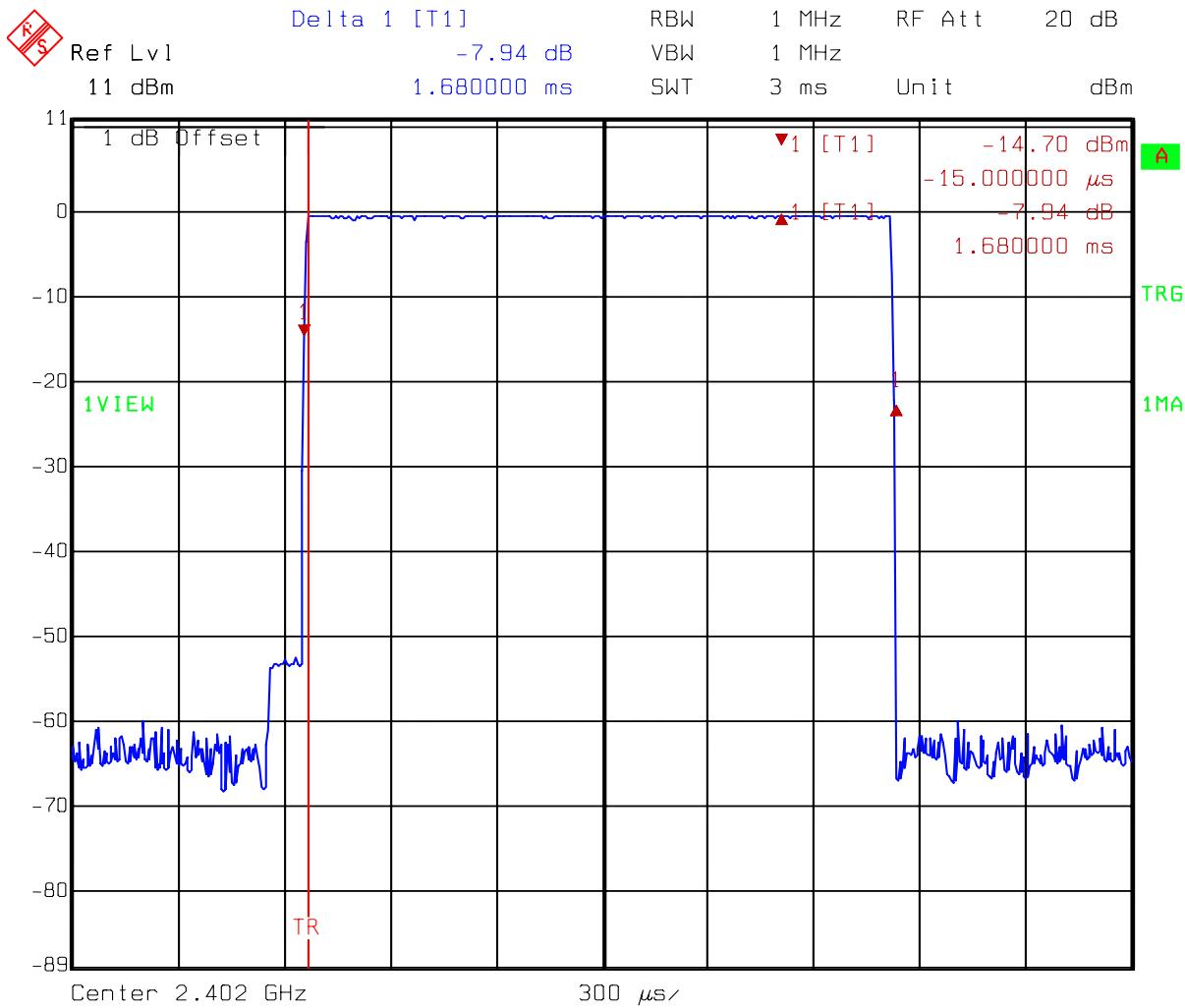
Please see the plot below.

Test mode: GFSK at DH1



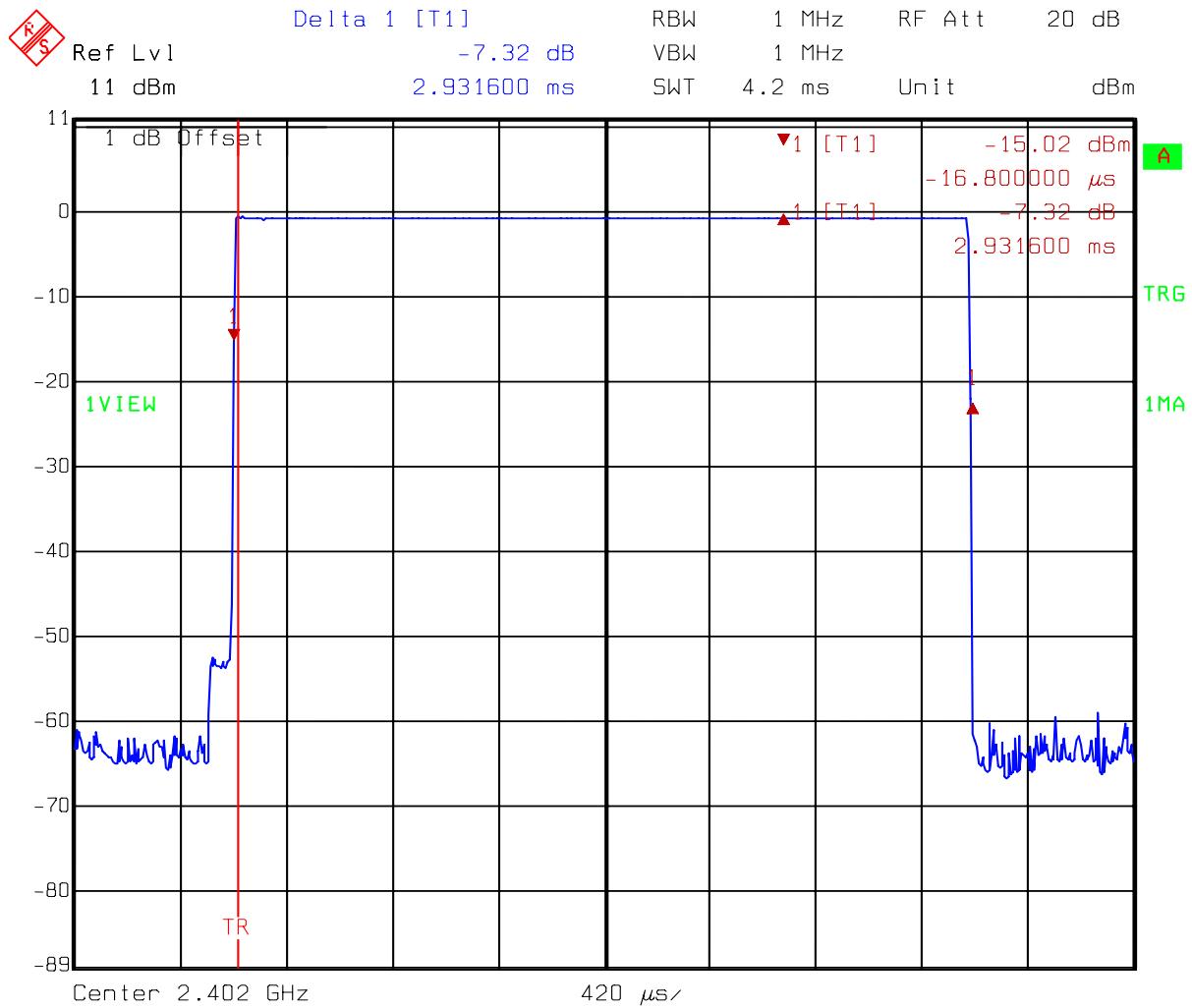
Title: Time of occupancy
Comment A: CH 0 at Bluetooth mode DH1
Date: 21.JAN.2008 15:35:13

Test mode: GFSK at DH3



Title: Time of occupancy
Comment A: CH 0 at Bluetooth mode DH3
Date: 21.JAN.2008 15:37:03

Test mode: GFSK at DH5



Title: Time of occupancy
Comment A: CH 0 at Bluetooth mode DH5
Date: 21.JAN.2008 15:38:34

7. Maximum Output Power test

7.1 Operating environment

Temperature: 25
Relative Humidity: 50 %
Atmospheric Pressure: 1022 hPa

7.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines DA 00-705.

The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to peak power meter via power sensor. Power was read directly and cable loss correction (2 dB) was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel).

7.3 Measured data of Maximum Output Power test results

Channel	Freq. (MHz)	C.L. (dB)	Reading (dBm)	Conducted Peak Output Power		Limit (W)
				(dBm)	(mW)	
0 (lowest)	2402	2	-1.13	0.87	1.2218	1
39 (middle)	2441	2	-0.53	1.47	1.4028	1
78 (highest)	2480	2	-2.51	-0.51	0.8892	1

Remark:

Conducted Peak Output Power = Reading + C.L.

8. RF Antenna Conducted Spurious test

8.1 Operating environment

Temperature: 25
Relative Humidity: 58 %

8.2 Test setup & procedure

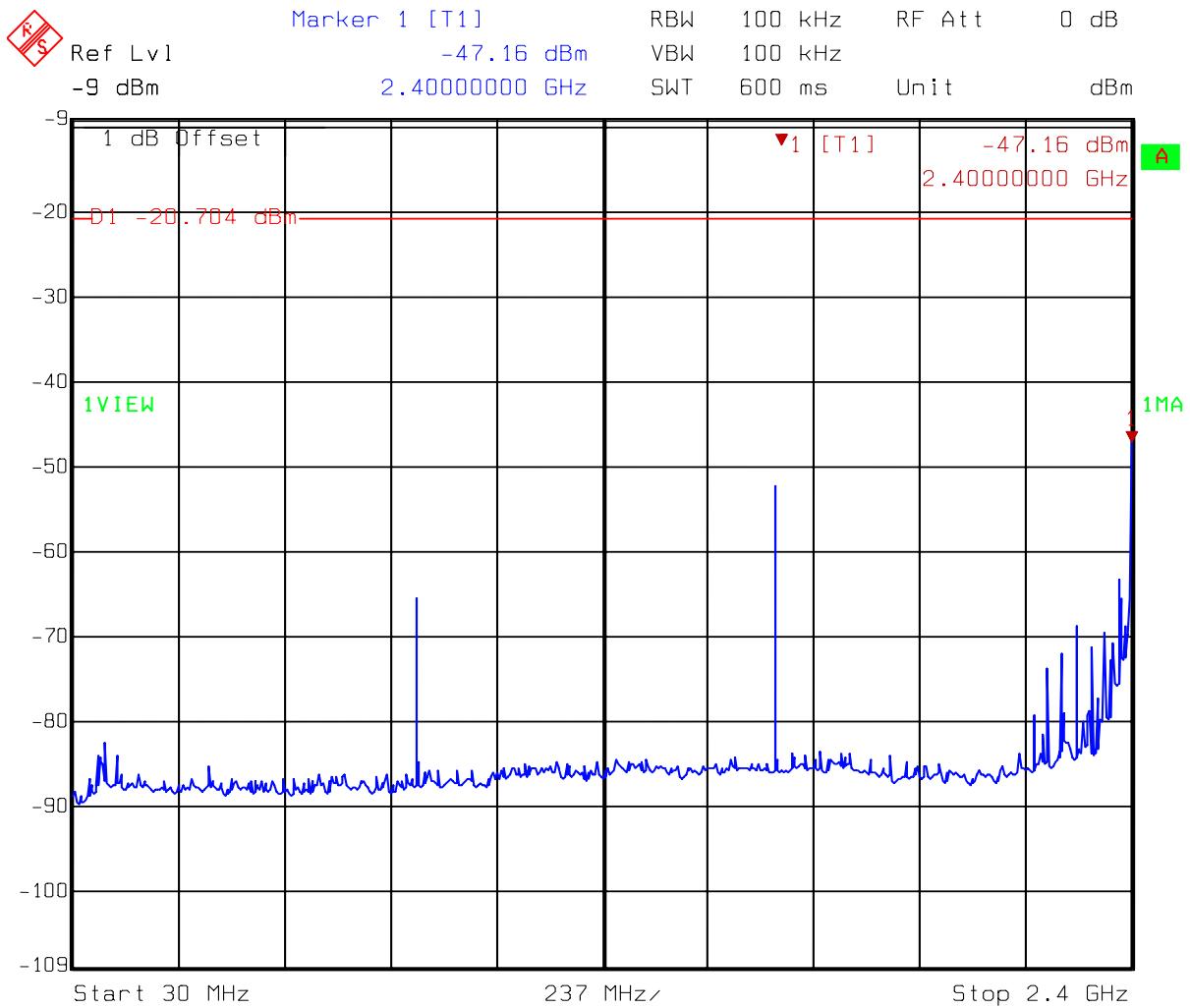
The test procedure was according to FCC measurement guidelines DA 00-705.

The measurements were performed from 30MHz to 25GHz RF antenna conducted per FCC 15.247 (c) was measured from the EUT antenna port using a 50ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz.

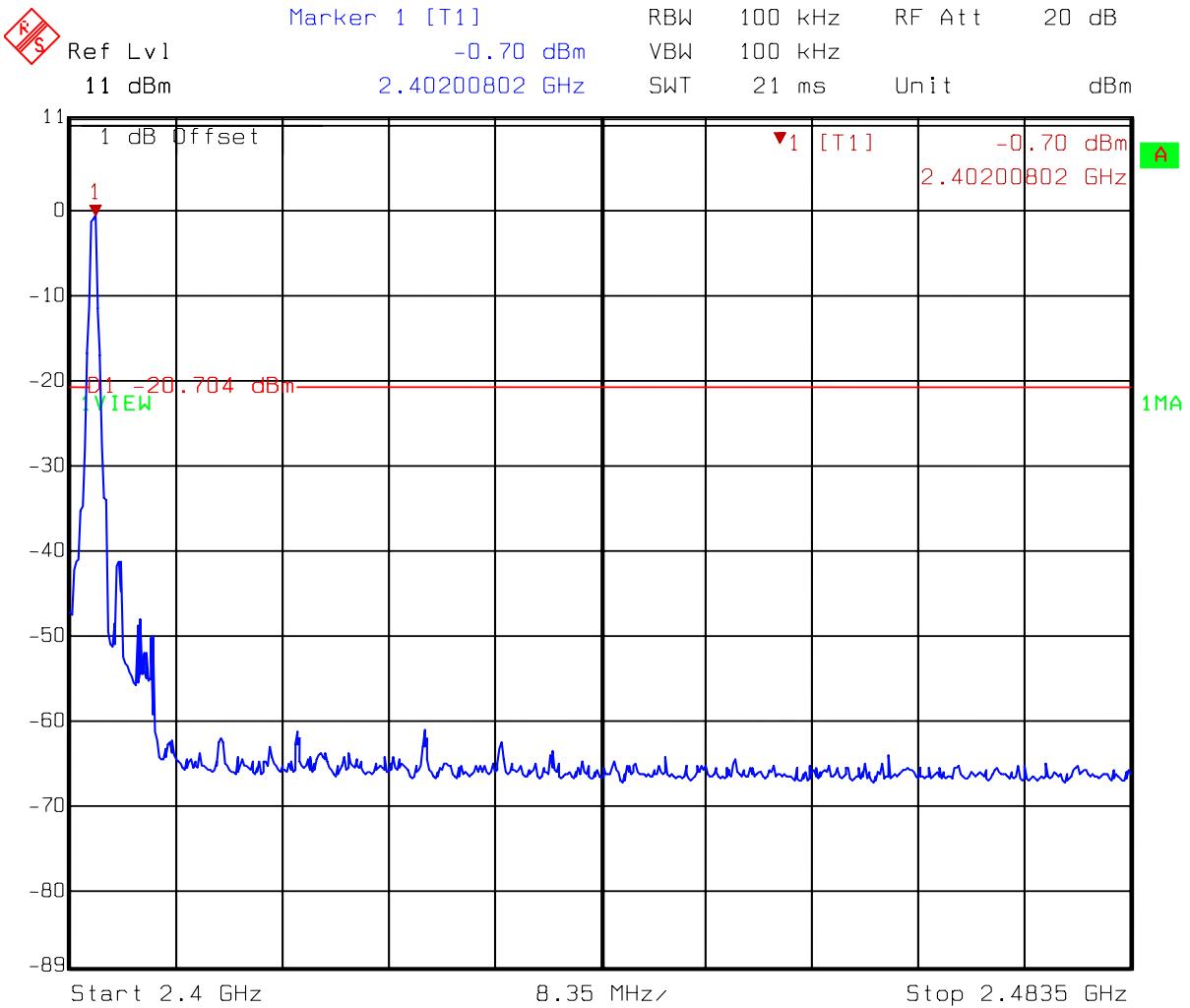
Harmonics and spurious noise must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The table below is the results from the highest emission for each channel within the authorized band. This table was used to determine the spurious limits for each channel.

8.3 Measured data of the highest RF Antenna Conducted Spurious test result

The test results please see the plot below.

Test mode: GFSK at ch0

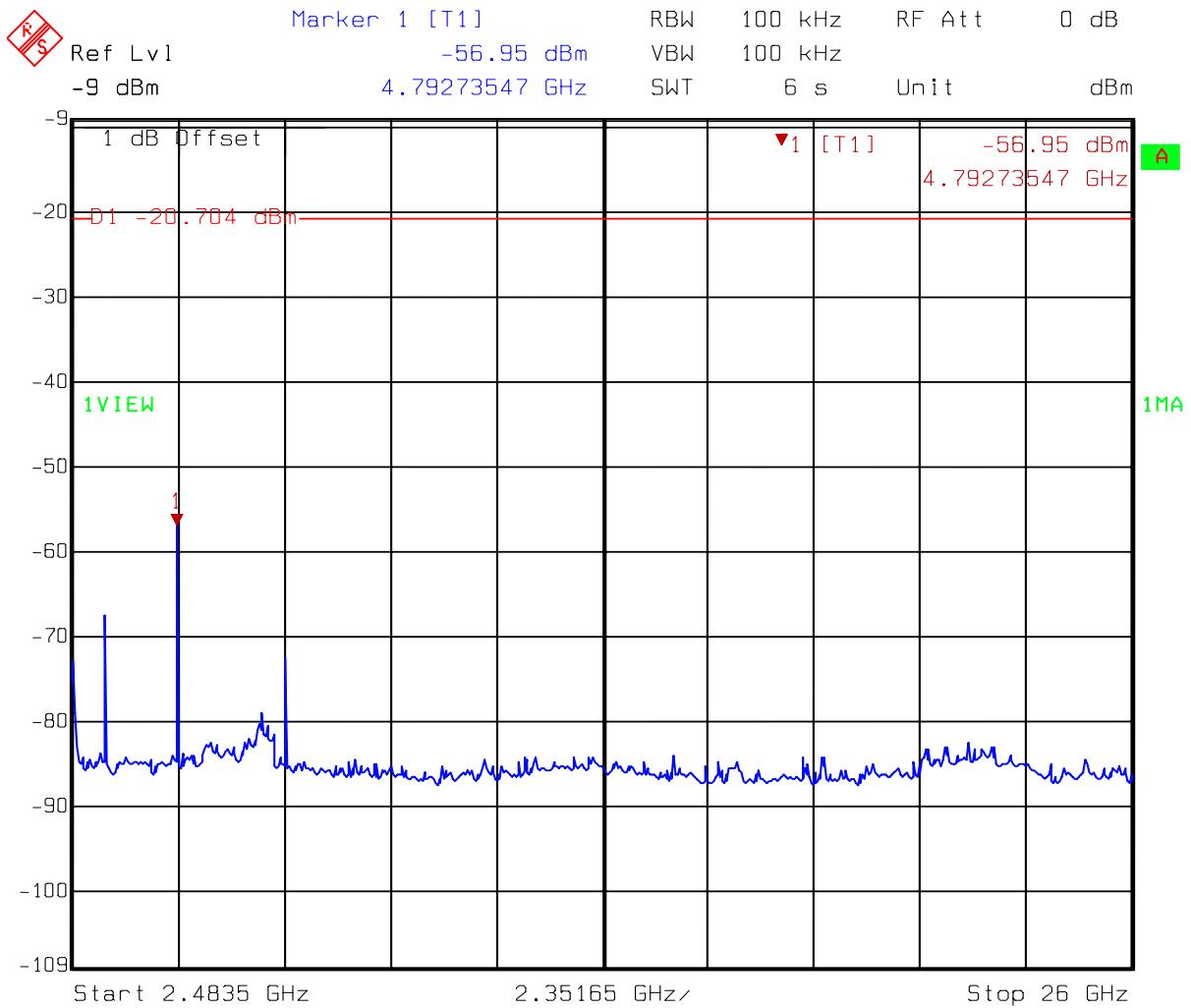
Title: Spurious
Comment A: CH 0 at Bluetooth mode 30MHz~2400MHz
Date: 21.JAN.2008 15:49:43

Test mode: GFSK at ch0

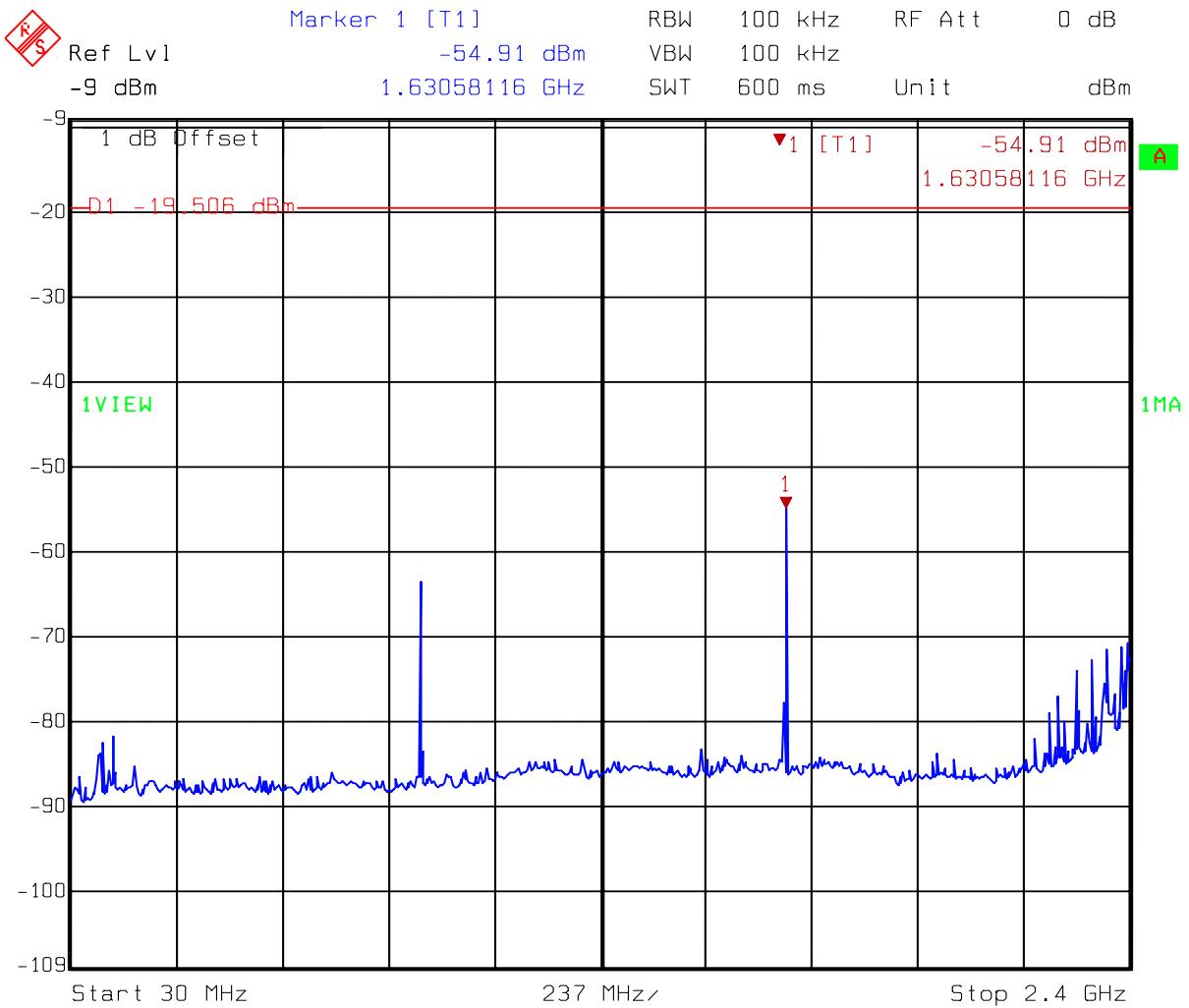
Title: Spurious

Comment A: CH 0 at Bluetooth mode 2400MHz~2483.5MHz

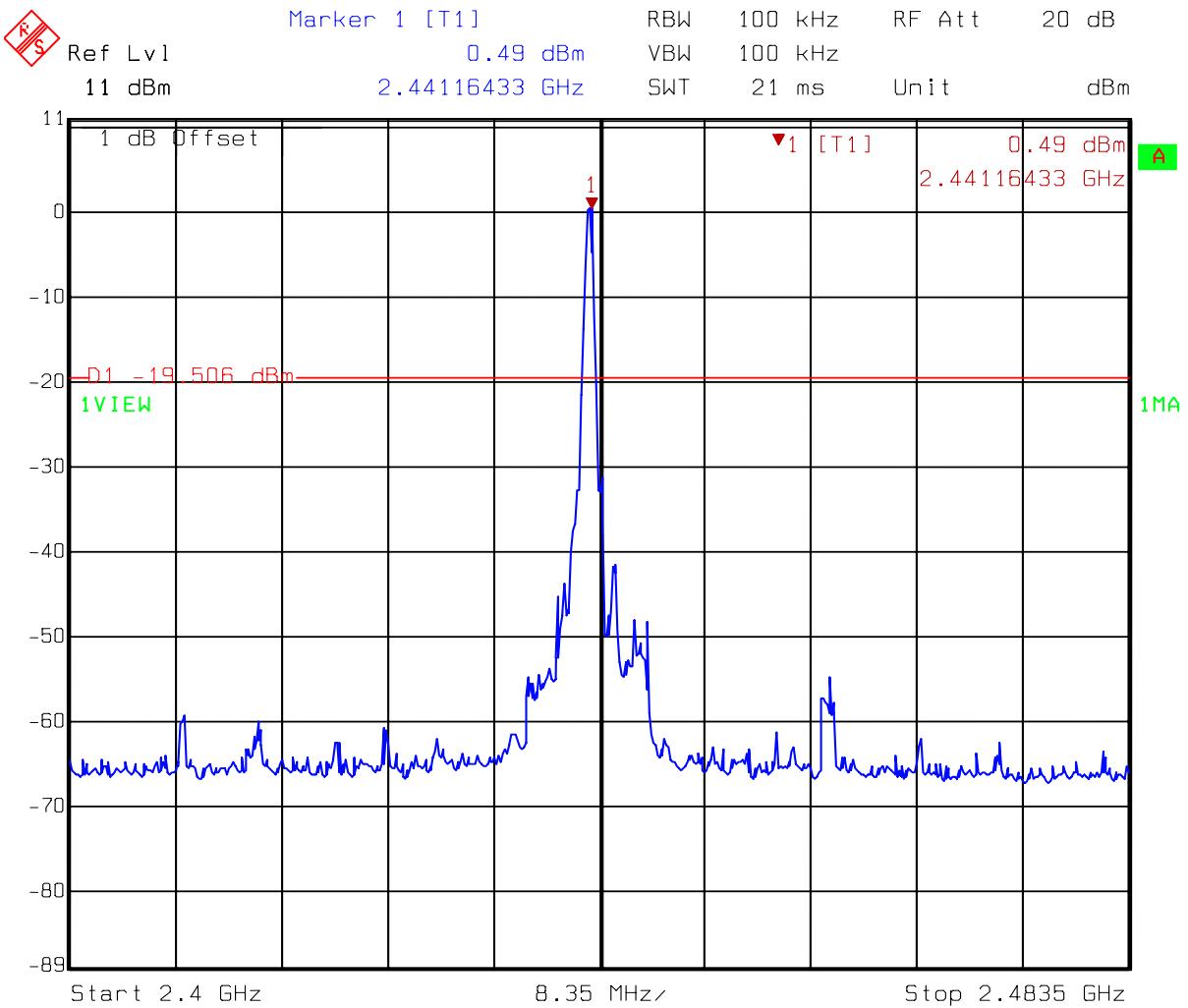
Date: 21.JAN.2008 15:49:22

Test mode: GFSK at ch0

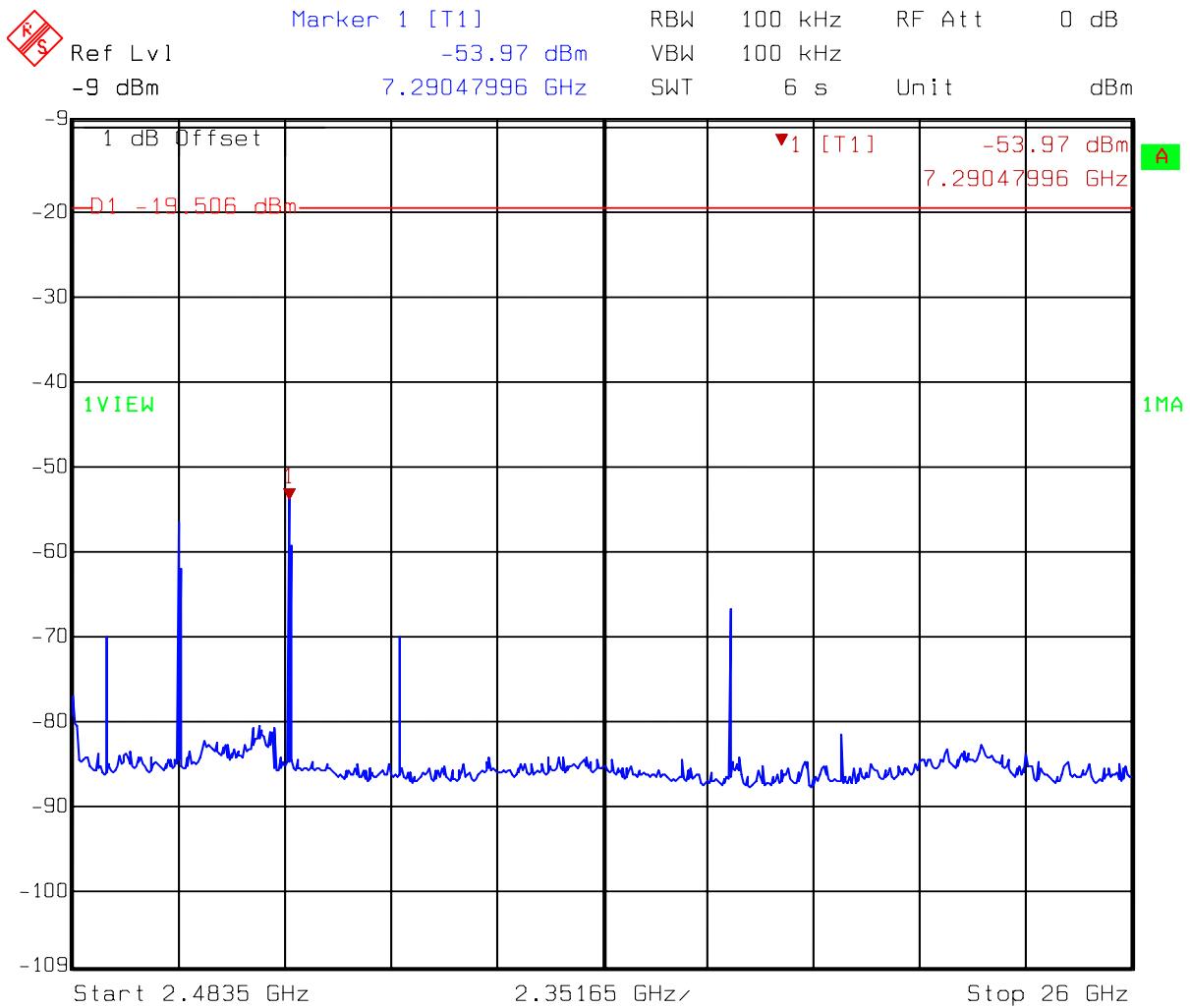
Test mode: GFSK at ch39



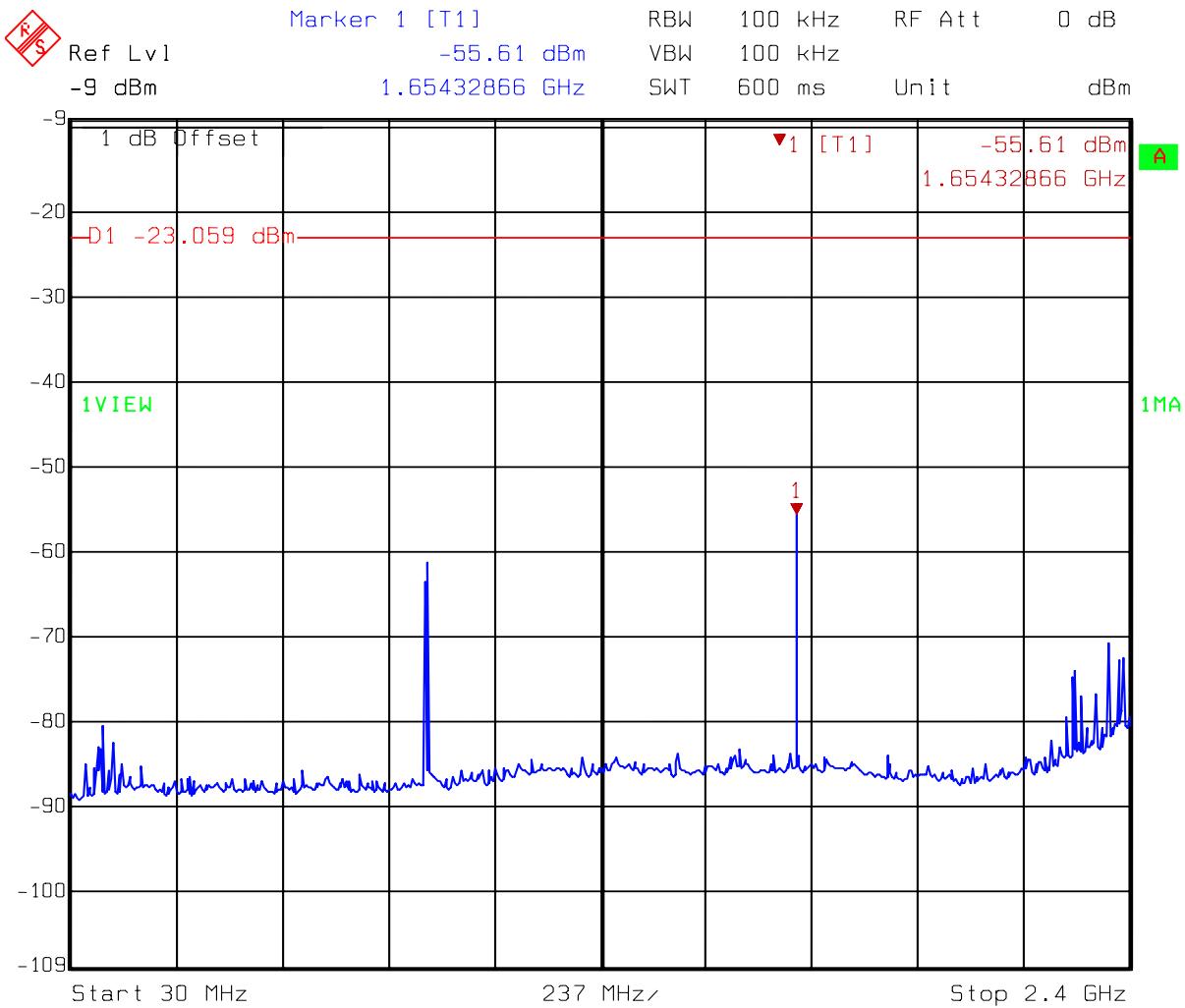
Test mode: GFSK at ch39



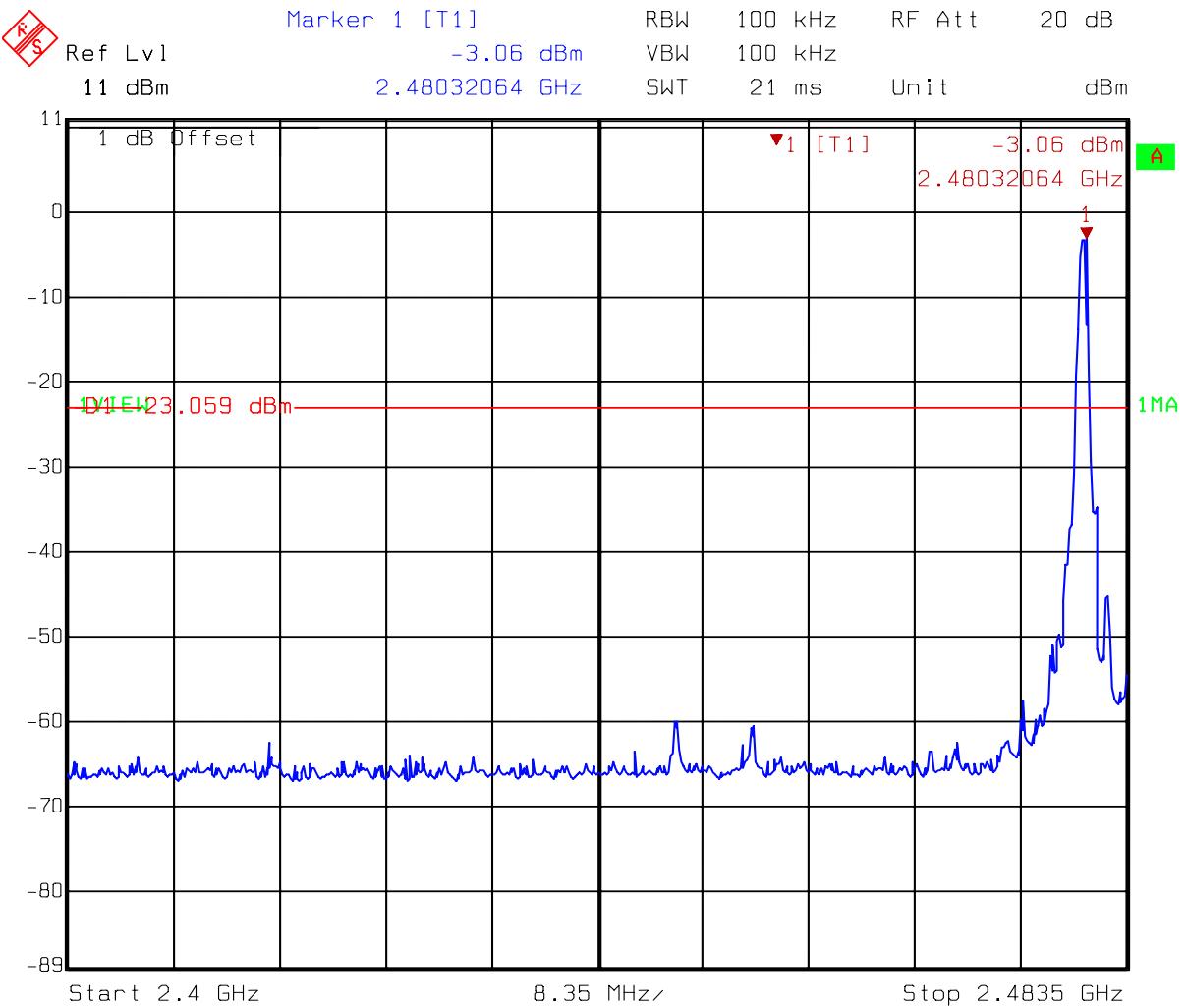
Title: Spurious
Comment A: CH 39 at Bluetooth mode 2400MHz~2483.5MHz
Date: 21.JAN.2008 15:51:53

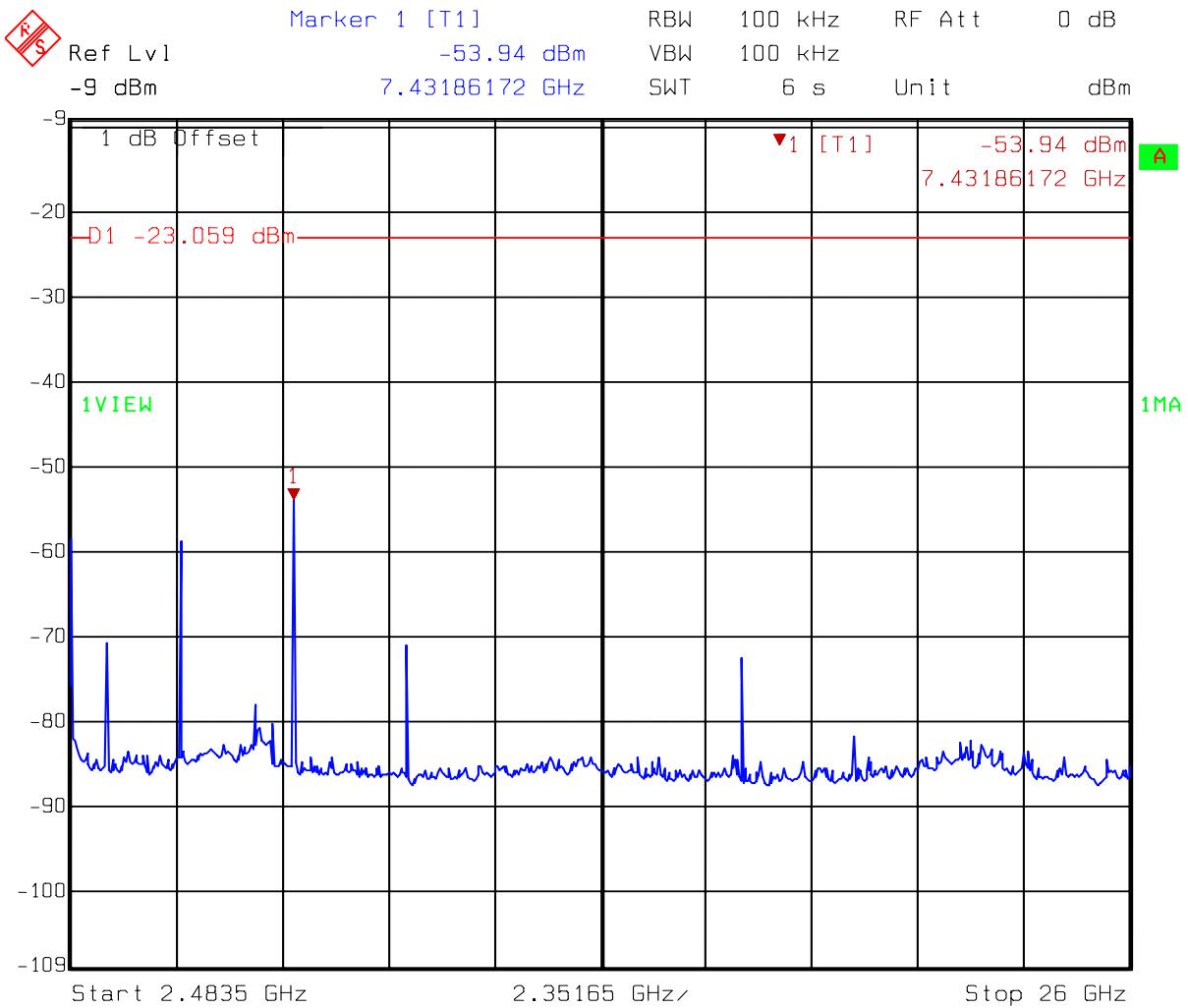
Test mode: GFSK at ch39

Title: Spurious
Comment A: CH 39 at Bluetooth mode 2483.5MHz~26000MHz
Date: 21.JAN.2008 15:52:43

Test mode: GFSK at ch78

Title: Spurious
Comment A: CH 78 at Bluetooth mode 30MHz~2400MHz
Date: 21.JAN.2008 15:55:07

Test mode: GFSK at ch78

Test mode: GFSK at ch78

Title: Spurious
Comment A: CH 78 at Bluetooth mode 2483.5MHz~26000MHz
Date: 21.JAN.2008 15:55:35

9. Radiated Emission test

9.1 Operating environment

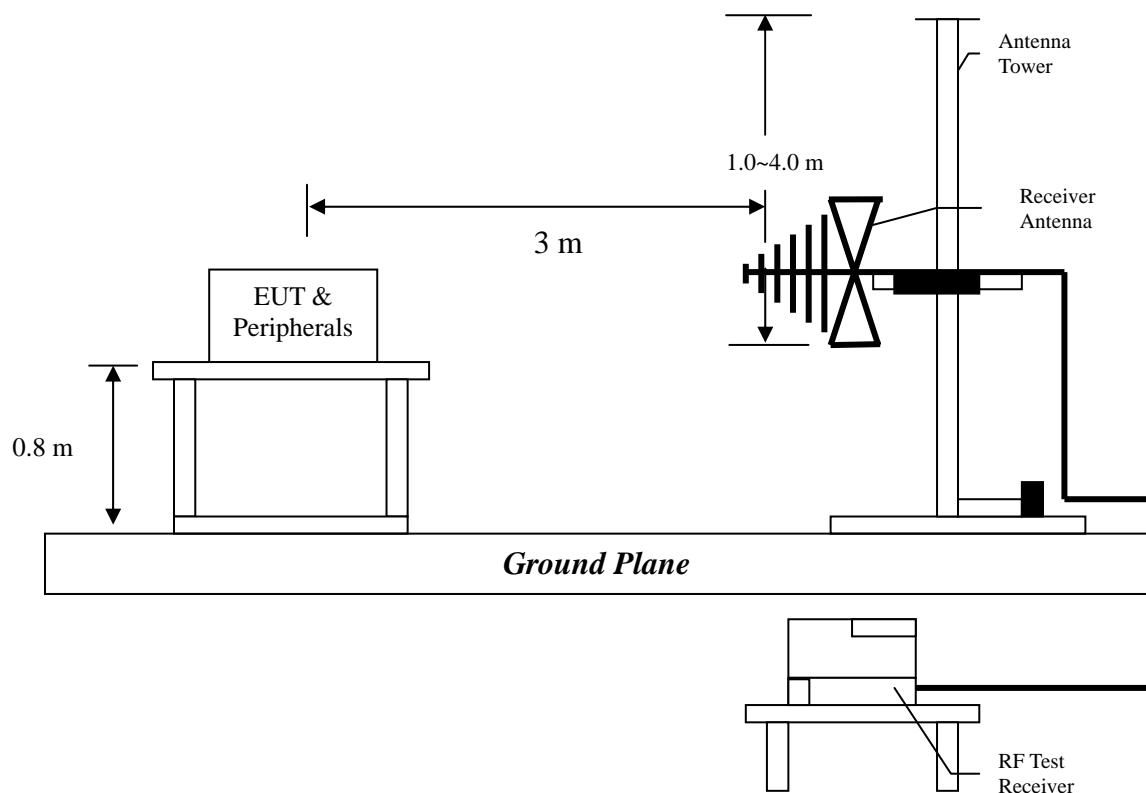
Temperature: 23
Relative Humidity: 53 %
Atmospheric Pressure: 1023 hPa

9.2 Test setup & procedure

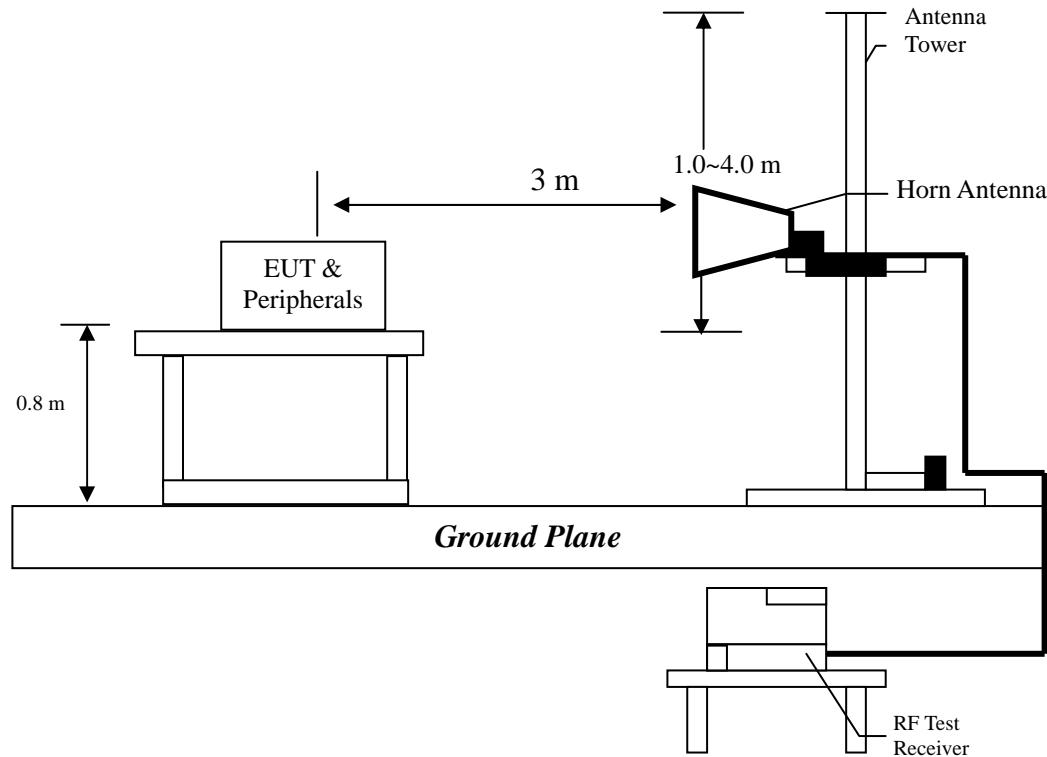
The test procedure was according to FCC measurement guidelines DA 00-705 and ANSI C63.4/2003.

The Diagram below shows the test setup, which is utilized to make these measurements.

The frequency spectrum from 30MHz to 1000MHz was investigated.



The frequency spectrum from over 1GHz was investigated.



Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent 3 meter reading using inverse scaling with distance.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

9.3 Emission limits

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81.

Expanded uncertainty (k=2) of radiated emission measurement is 4.98 dB.

9.4 Radiated spurious emission test data**9.4.1 Measurement results: frequencies equal to or less than 1 GHz**

EUT : BTD-121
Worst Case: : GFSK for ch39

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
V	365.620	QP	15.06	11.16	26.22	46.00	-19.78
V	499.480	QP	18.43	7.84	26.27	46.00	-19.74
V	566.410	QP	19.53	7.76	27.29	46.00	-18.71
V	599.390	QP	20.71	8.05	28.76	46.00	-17.24
V	630.430	QP	21.53	8.54	30.07	46.00	-15.93
V	1000.000	QP	25.44	7.58	33.02	54.00	-20.98
H	299.660	QP	14.17	11.77	25.94	46.00	-20.07
H	364.650	QP	15.48	11.88	27.36	46.00	-18.65
H	399.570	QP	16.74	13.89	30.63	46.00	-15.37
H	480.080	QP	18.64	8.43	27.07	46.00	-18.93
H	565.440	QP	19.72	7.49	27.21	46.00	-18.79
H	874.870	QP	24.12	7.38	31.50	46.00	-14.51

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

9.4.2 Measurement results: frequency above 1GHz

EUT : BTD-121
Test Condition : Tx at ch0

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4804.00	PK	V	36.07	37.77	38.55	40.25	54	-13.75
4804.00	PK	H	36.07	37.77	36.24	37.94	54	-16.06

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the system noise floor.

EUT : BTD-121
Test Condition : Tx at ch39

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4882.00	PK	V	36.07	37.77	37.78	39.48	54	-14.52
4882.00	PK	H	36.07	37.77	35.12	36.82	54	-17.18

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the system noise floor.

EUT : BTD-121
Test Condition : Tx at ch78

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4960.00	PK	V	36.07	37.77	38.11	39.81	54	-14.19
4960.00	PK	H	36.07	37.77	35.06	36.76	54	-17.24

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz. The data value listed above which is higher than the system noise floor.

10. Emission on the band edge §FCC 15.247(C)

In any 100kHz bandwidth outside the frequency band in which the spread spectrum 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.

10.1 Test setup & procedure

Please refer to the clause 9.2 of this report.

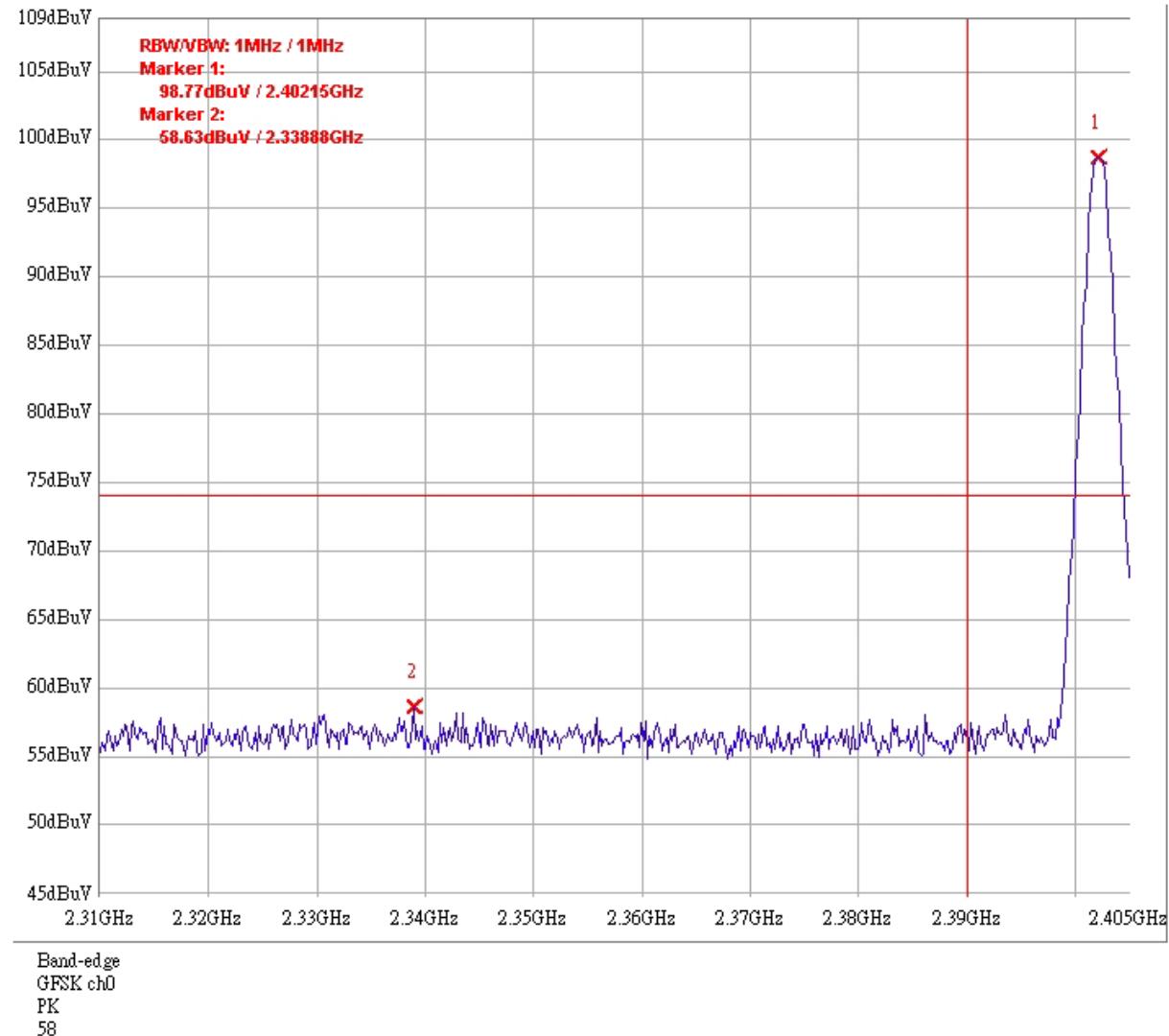
Please see the plot below.

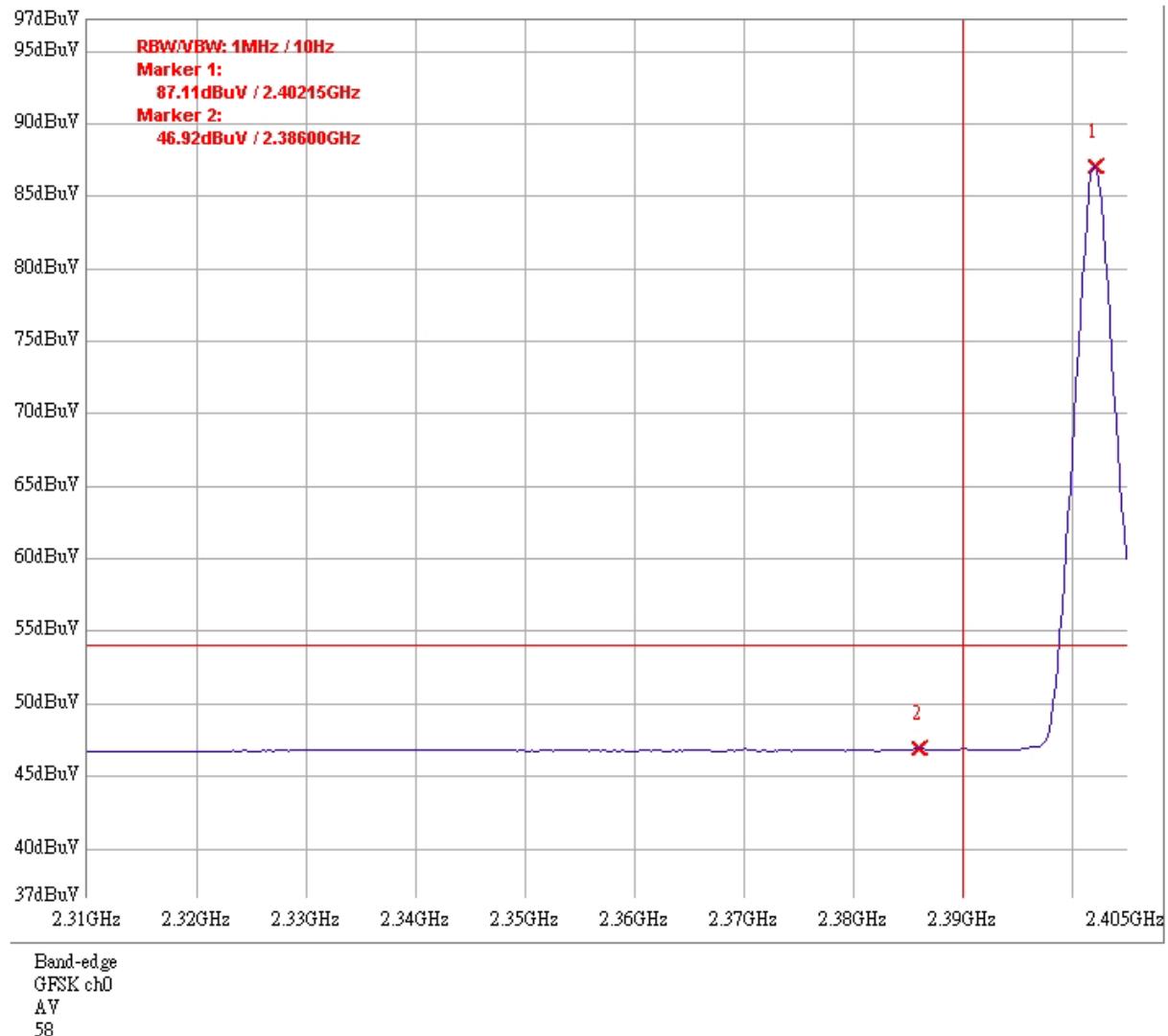
10.2 Test Result**Test Mode: GFSK mode**

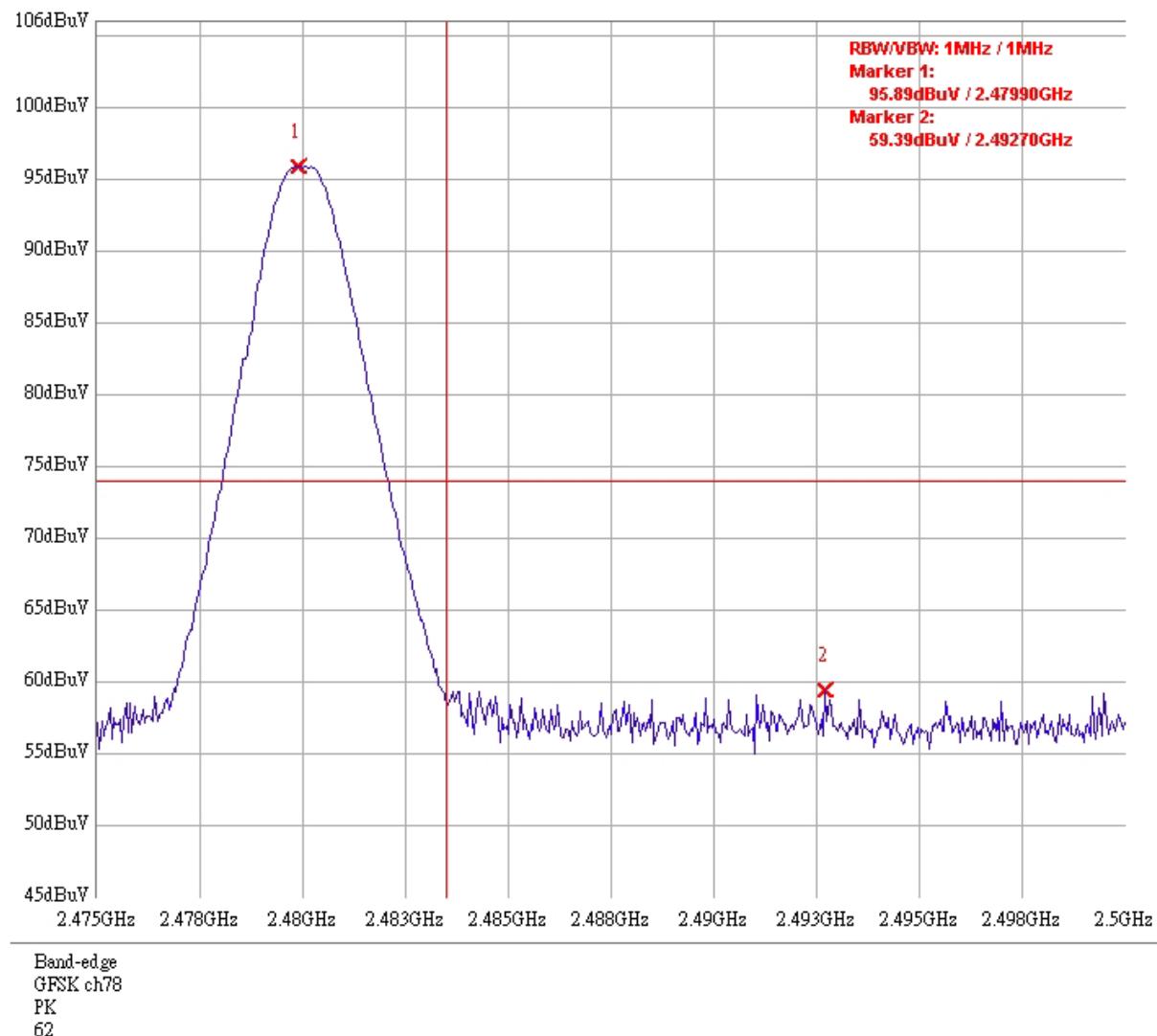
Channel	Measurement Freq.Band (MHz)	Detector	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
0 (lowest)	2310-2390	PK	58.63	74	-15.37
		AV	46.92	54	-7.08
78 (highest)	2483.5-2500	PK	59.39	74	-14.61
		AV	52.59	54	-1.41

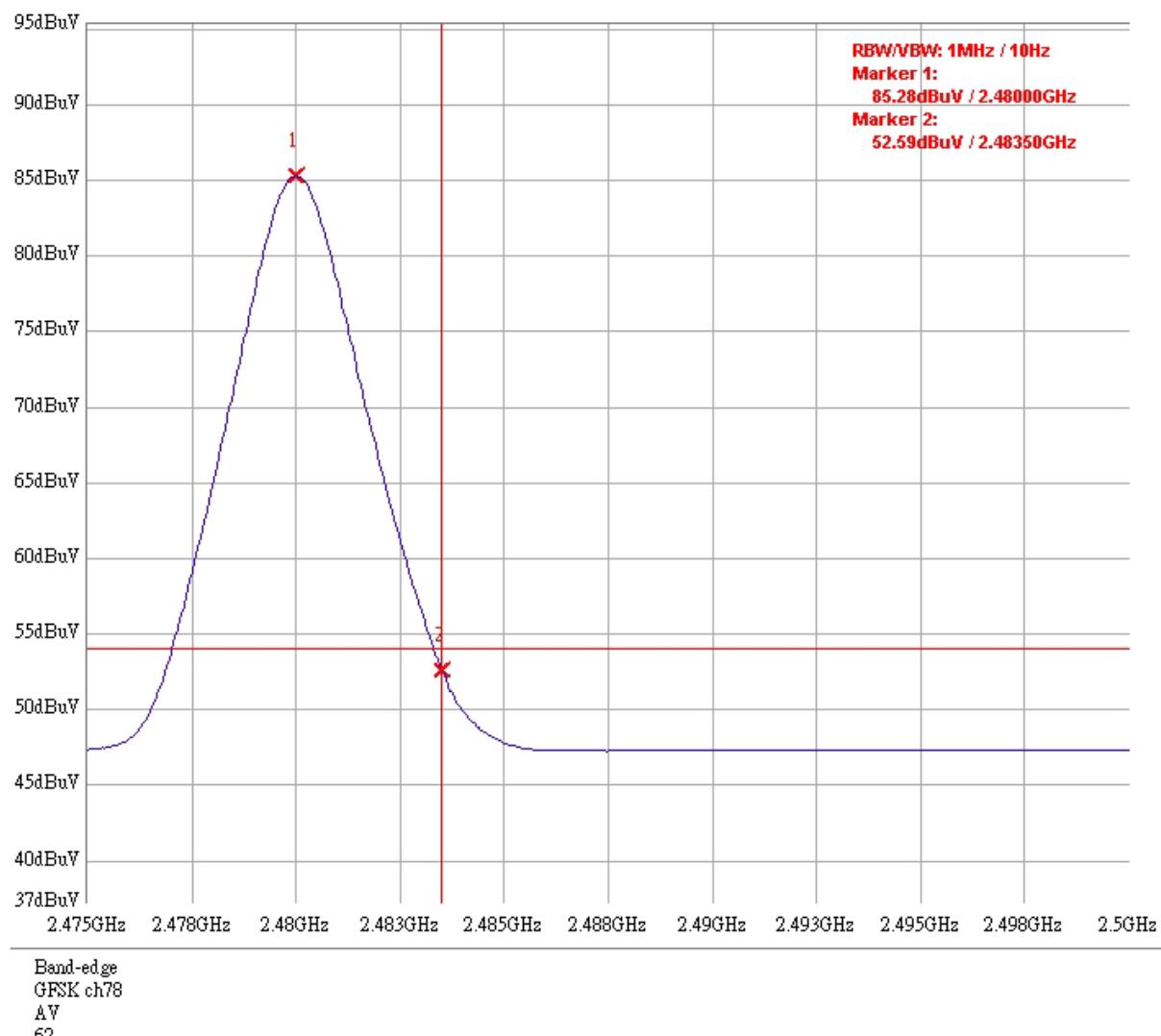
10.2.1 Band-edge

Test Mode: GFSK mode ch0 PK



Test Mode: GFSK mode ch0 AV

Test Mode: GFSK mode ch78 PK

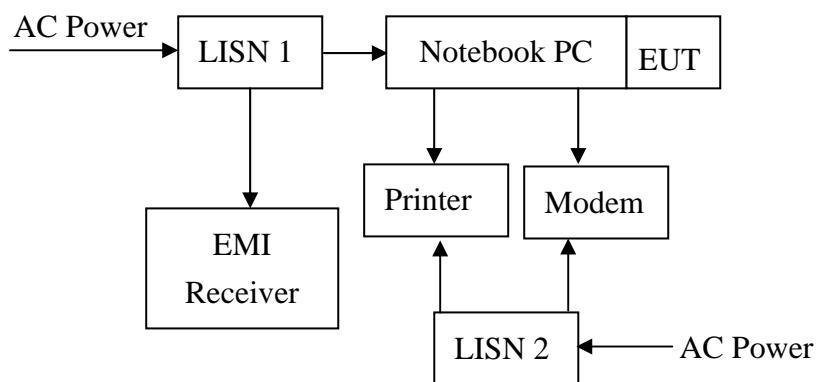
Test Mode: GFSK mode ch78 AV

11. Power Line Conducted Emission test §FCC 15.207

11.1 Operating environment

Temperature: 25
Relative Humidity: 60 %
Atmospheric Pressure 1023 hPa

11.2 Test setup & procedure



The test procedure was according to ANSI C63.4/2003.

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement. The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

The EUT configuration please refer to the “Conducted set-up photo.pdf”.

11.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

11.4 Uncertainty of Conducted Emission

Expanded uncertainty ($k=2$) of conducted emission measurement is ± 2.26 dB.

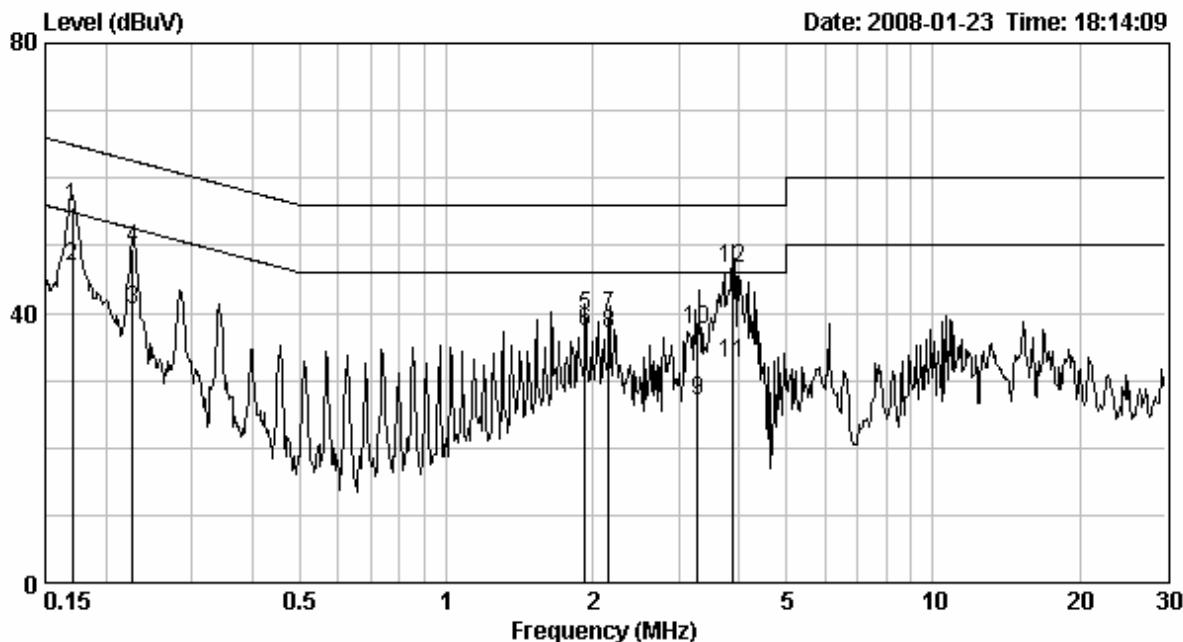
11.5 Power Line Conducted Emission test data

Phase : Line
EUT : BTD-121
Test Condition : Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level		Limit		Margin	
		Qp (dBuV)	Qp (dBuV)	AV (dBuV)	Av (dBuV)	Qp (dB)	Av (dB)
0.170	0.80	55.74	64.94	46.92	54.94	-9.20	-8.02
0.227	0.67	49.58	62.56	40.54	52.56	-12.98	-12.02
1.927	0.14	39.57	56.00	37.20	46.00	-16.43	-8.80
2.152	0.16	39.58	56.00	36.94	46.00	-16.42	-9.06
3.286	0.25	37.56	56.00	27.00	46.00	-18.44	-19.00
3.863	0.28	46.67	56.00	32.66	46.00	-9.33	-13.34

Remark:

1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase : Neutral
EUT : BTD-121
Test Condition : Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB)	
						Qp	Av
0.169	0.10	52.44	65.01	44.79	55.01	-12.57	-10.22
0.225	0.10	45.84	62.62	38.05	52.62	-16.78	-14.57
2.199	0.16	35.38	56.00	32.63	46.00	-20.62	-13.37
3.319	0.25	39.20	56.00	30.50	46.00	-16.80	-15.50
3.771	0.27	47.96	56.00	36.68	46.00	-8.04	-9.32
4.062	0.29	35.91	56.00	23.85	46.00	-20.09	-22.15

Remark:

1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

