

EMC TEST REPORT

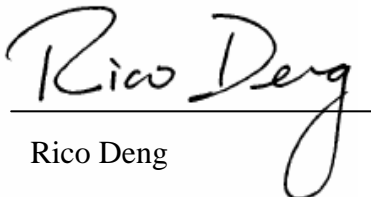
Report No. : EME-070289
Model No. : BLUE EAGLE II
Issued Date : Jul. 11, 2007

Applicant: TE-Group NV
Kapelsestraat 61-2950 Kapellen-Belgium

Test By : Intertek Testing Services Taiwan Ltd.
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

This test report consists of 42 pages in total. It may be duplicated completely for legal use with the allowance of the applicant. It shall not be reproduced except in full, without the written approval of Intertek Laboratory. The test result(s) in this report only applies to the tested sample(s).

Project Engineer


Rico Deng

Reviewed By



Kevin Chen

Table of Contents

Summary of Tests	4
1. General information	5
1.1 Identification of the EUT	5
1.2 Additional information about the EUT	5
1.3 Antenna description	5
1.4 Peripherals equipment	5
2. Test specifications	6
2.1 Test standard	6
2.2 Operation mode	6
2.3 Test equipment	7
3. 20dB Bandwidth test	8
3.1 Operating environment	8
3.2 Test setup & procedure	8
3.3 Measured data of modulated bandwidth test results	8
4. Carrier Frequency Separation test	12
4.1 Operating environment	12
4.2 Test setup & procedure	12
4.3 Measured data of Carrier Frequency Separation test result	12
5. Number of hopping frequencies test	14
5.1 Operating environment	14
5.2 Test setup & procedure	14
5.3 Measured data of number of hopping frequencies test result	14
6. Time of Occupancy (dwell time) test	16
6.1 Operating environment	16
6.2 Test setup & procedure	16
7. Maximum Output Power test	20
7.1 Operating environment	20
7.2 Test setup & procedure	20
7.3 Measured data of Maximum Output Power test results	20
8. RF Antenna Conducted Spurious test	21
8.1 Operating environment	21
8.2 Test setup & procedure	21
8.3 Measured data of the highest RF Antenna Conducted Spurious test result	21
9. Radiated Emission test	31
9.1 Operating environment	31
9.2 Test setup & procedure	31
9.3 Emission limits	33
9.4 Radiated spurious emission test data	34
9.4.1 Measurement results: frequencies equal to or less than 1 GHz	34



9.4.2 Measurement results: frequency above 1GHz.....	35
10. Emission on the band edge §FCC 15.247(C).....	38
10.1 Band-edge (Radiated method).....	39



Summary of Tests

Bluetooth Carkit-Model: BLUE EAGLE II **FCC ID: TP9BEII**

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 : TE-Group NV
Product : Bluetooth Carkit
Model No. : BLUE EAGLE II
FCC ID. : TP9BEII
Frequency Range : 2402MHz ~ 2480MHz
Channel Number : 79 channels
Frequency of Each Channel : 2402 + k MHz; k = 0-78
Type of Modulation : GFSK
Rated Power : DC 12V
Power Cord : N/A
Sample Received : Apr. 03, 2007
Test Date(s) : May 11, 2007

1.2 Additional information about the EUT

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

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 : -1.76dBi max
Antenna Type : PCB Printed antenna
Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Mobile Phone	Sony Ericsson	K750i	N/A	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 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	08/07/2007
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	EC317	08/06/2007
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	07/23/2007
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	10/31/2007
Horn Antenna	SCHWARZBECK	1GHz~18GHz	BBHA 9120 D	EC371	02/18/2008
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	EC351	07/07/2008
Bilog Antenna	SCHWARZBECK	25MHz~2GHz	VULB 9168	EC347	03/19/2008
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981	EC373	02/12/2008
Pre-Amplifier	MITEQ	26GHz~40GHz	828825	EC374	01/15/2008
Wideband Peak Power Meter/ Sensor	Anritsu	100MHz~18GHz	ML2497A/MA2491A	EC396	11/09/2007
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	01/14/2008

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

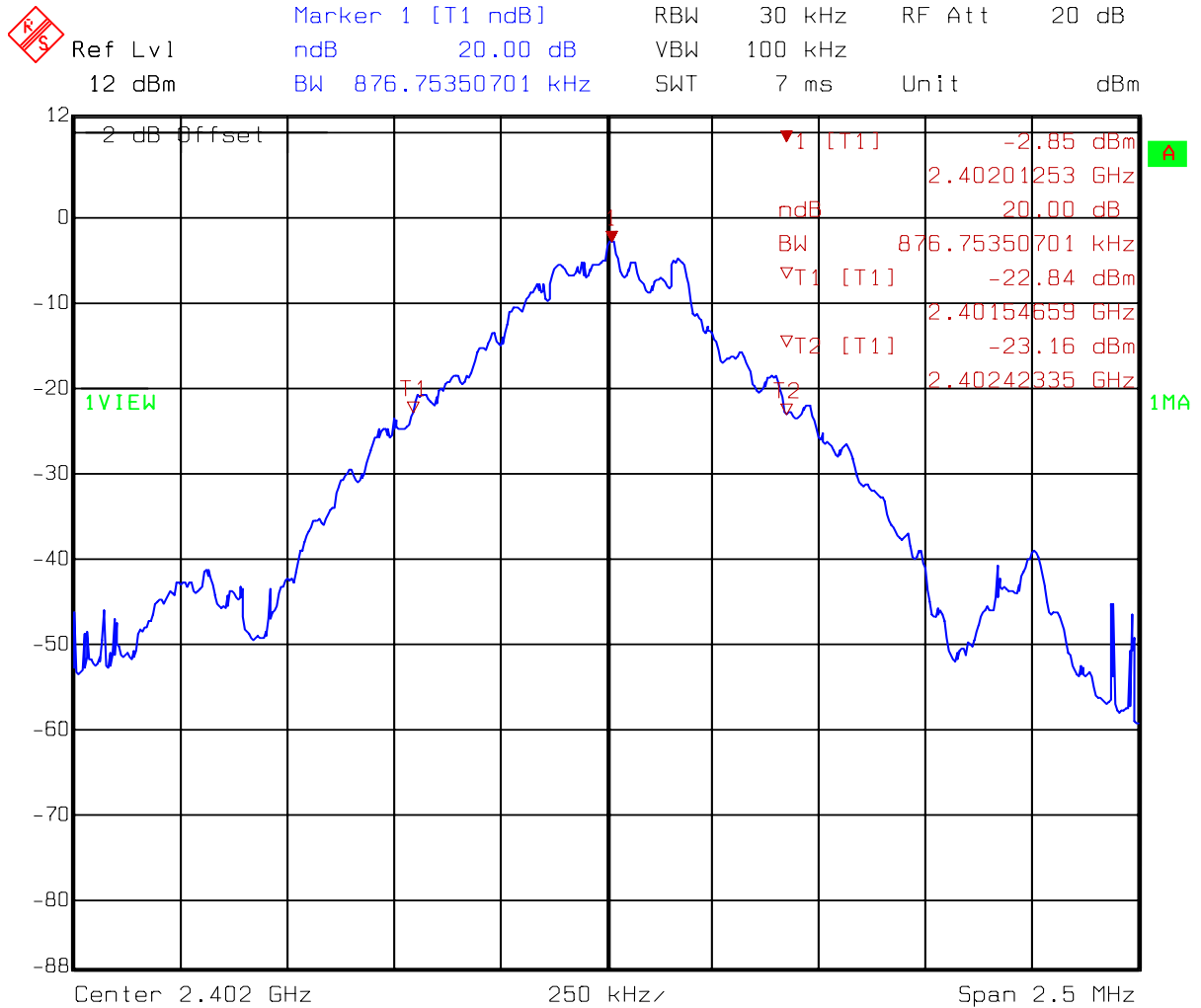
3.2 Test setup & procedure

The 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.

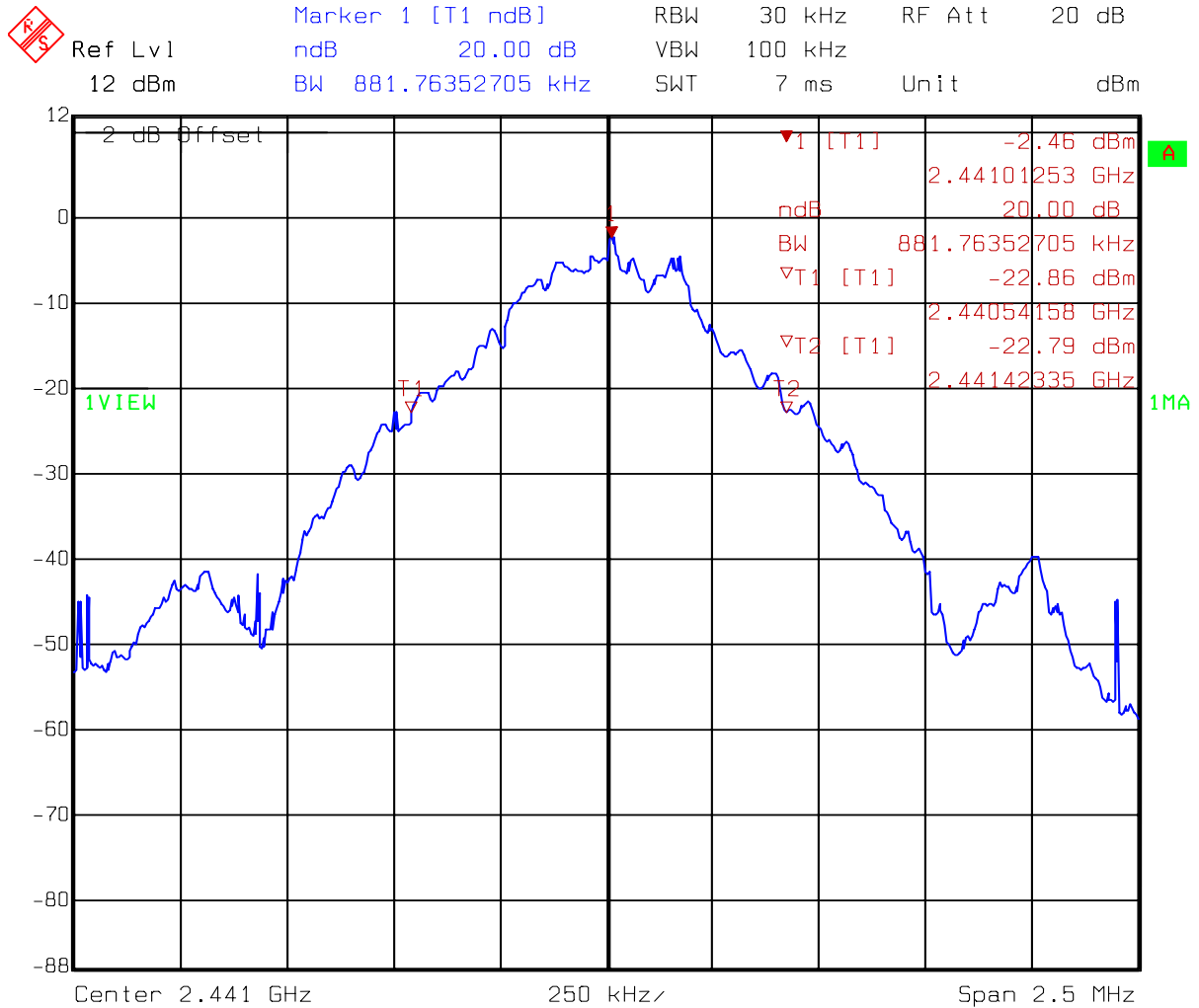
3.3 Measured data of modulated bandwidth test results

Channel	Frequency (MHz)	Bandwidth (kHz)
Channel 0	2402.000	876.75
Channel 39	2441.000	881.76
Channel 78	2480.000	876.75

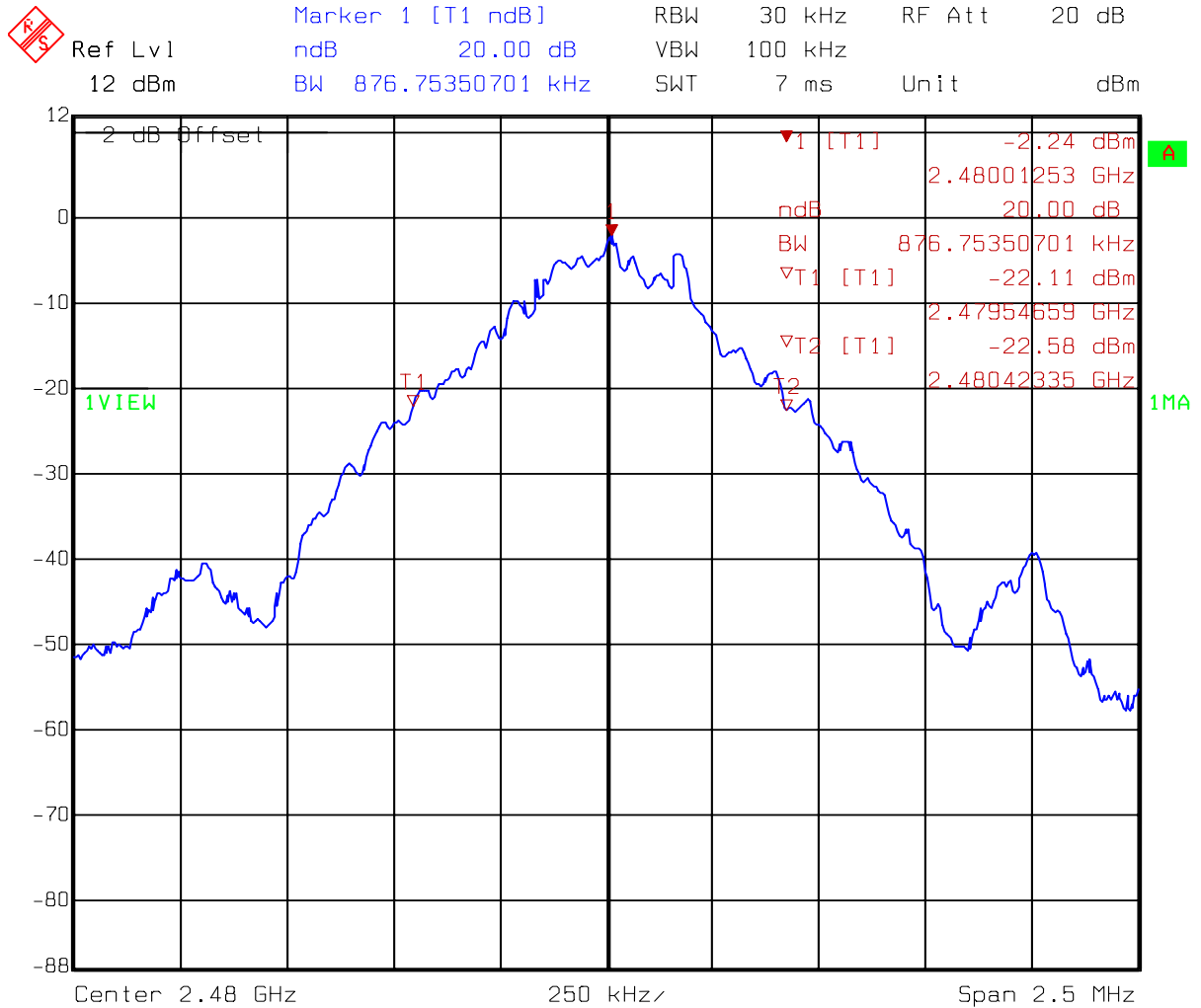
Please see the plot below.



Title: 20dB Bandwidth
Comment A: CH 0 at Bluetooth mode
Date: 11.MAY 2007 10:53:02



Title: 20dB Bandwidth
Comment A: CH 39 at Bluetooth mode
Date: 11.MAY 2007 10:55:15



Title: 20dB Bandwidth
Comment A: CH 78 at Bluetooth mode
Date: 11.MAY 2007 10:57:13

4. Carrier Frequency Separation test

4.1 Operating environment

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

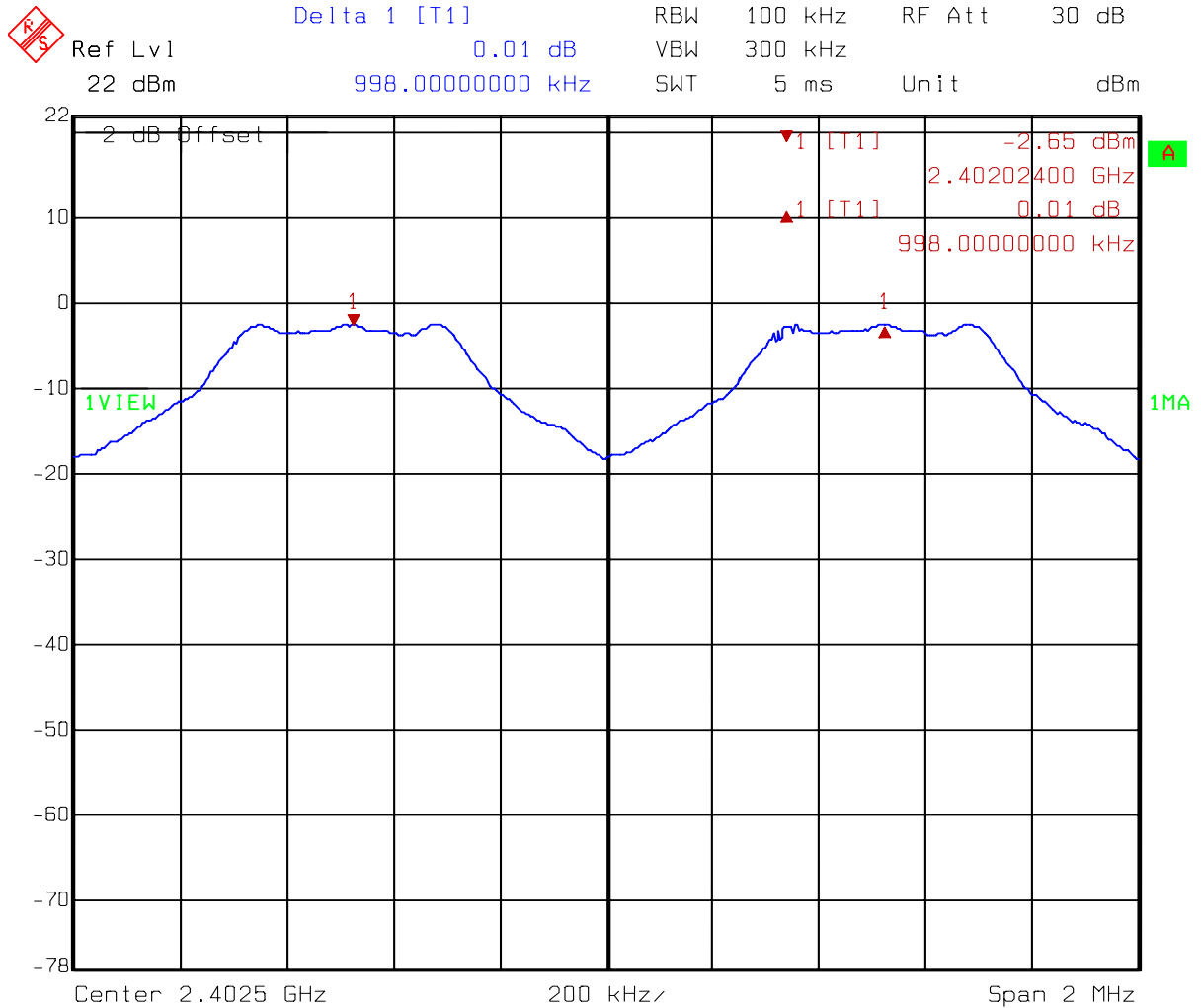
4.2 Test setup & procedure

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

Channel	Frequency (MHz)	Measurement Frequency separation (kHz)
1	2402	998.00
2	2403	

Please see the plot below.



Title: Carrier freq. separation
Comment A: at Bluetooth mode
Date: 11.MAY 2007 10:33:12



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 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

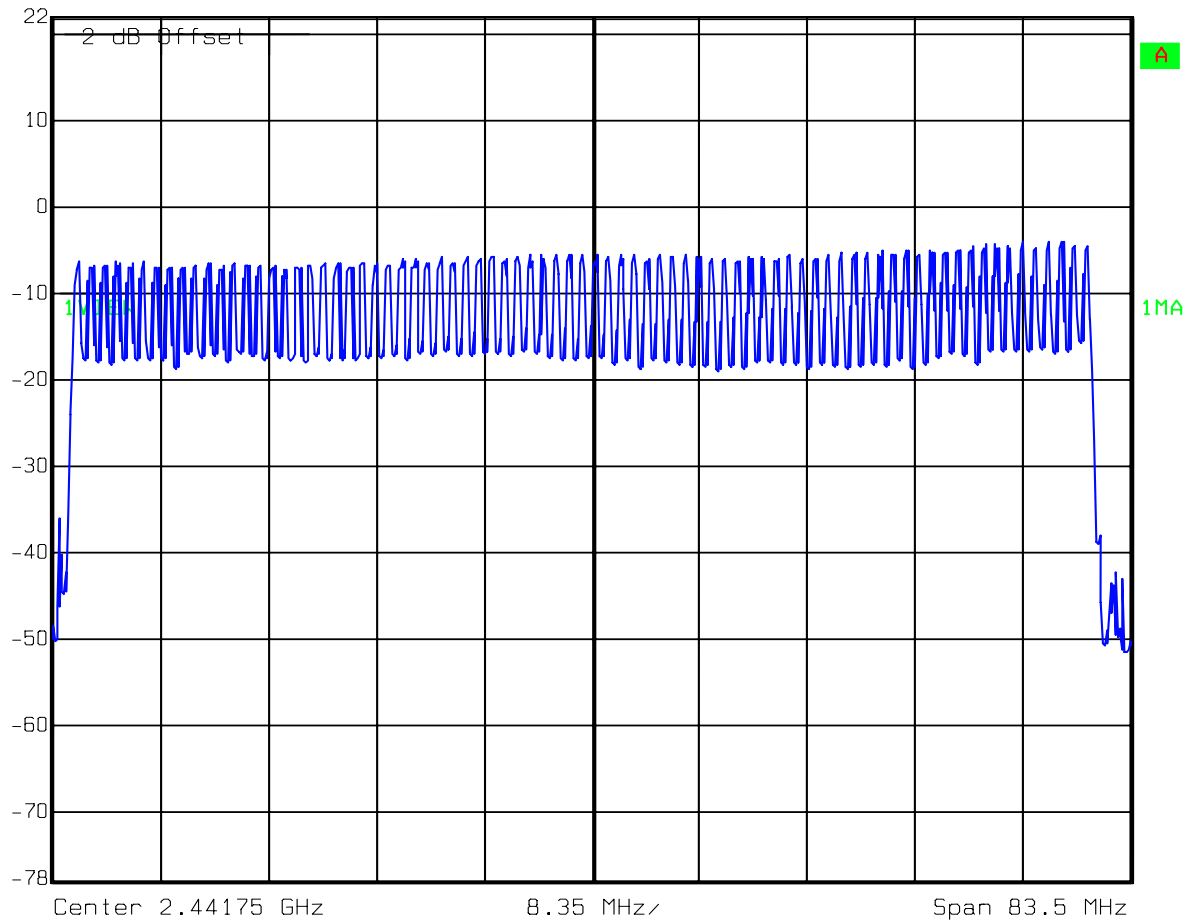
Frequency Range (MHz)	Total hopping channels
2400 ~ 2483.5	79

Please see the plot below.



Ref Lvl
22 dBm

RBW 100 kHz RF Att 30 dB
VBW 300 kHz
SWT 21 ms Unit dBm



Title: Number of hopping freq.
Comment A: CH 0 at Bluetooth mode
Date: 11.MAY 2007 10:42:34

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 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

$$\begin{aligned}\text{Dwell time} &= 421.800 \mu\text{s} * 1600 * 1/2 * 1/\text{s} / 79 * 31.6\text{s} \\ &= 134.98 \text{ ms (in a 31.6s period)}\end{aligned}$$

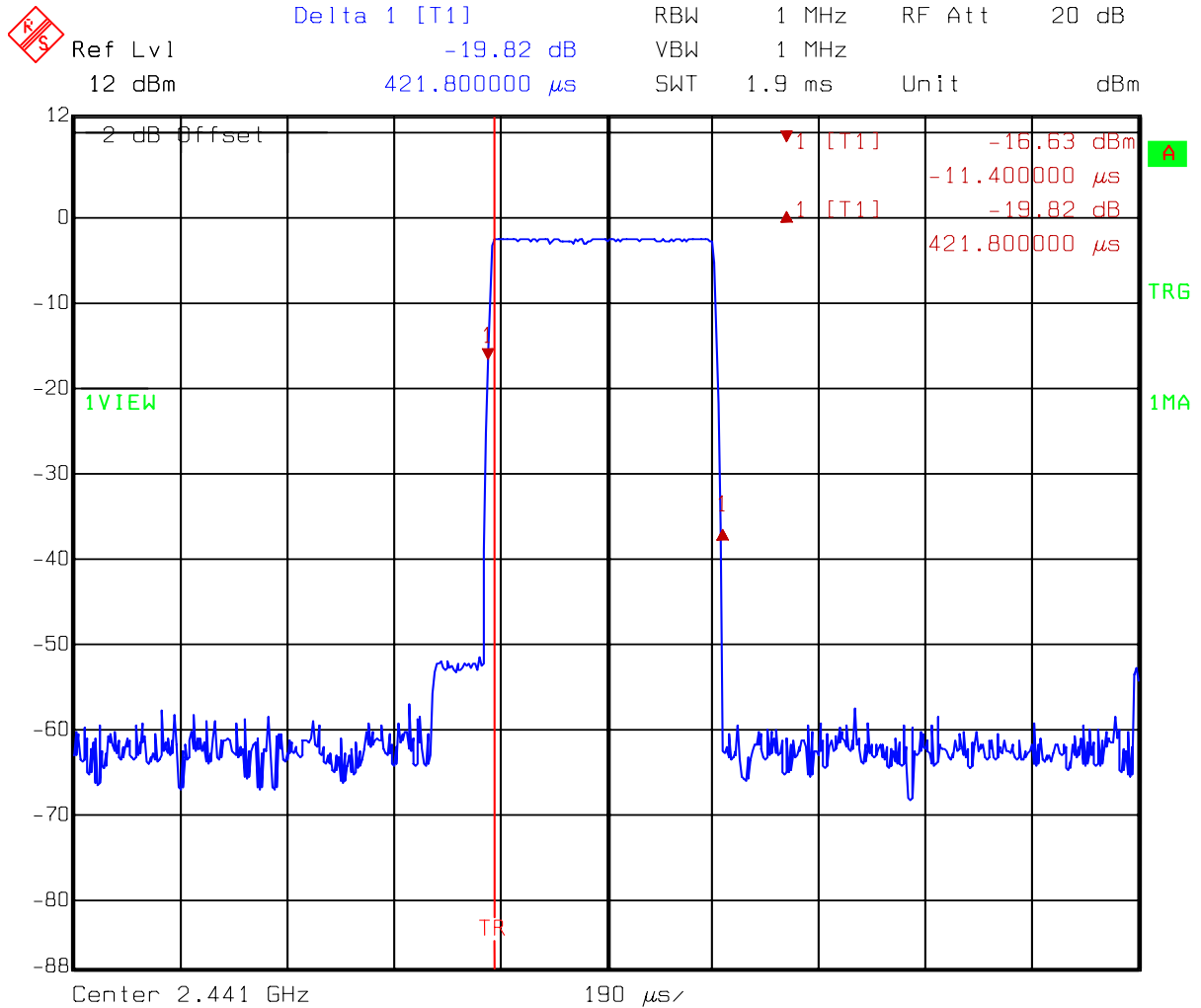
Time of occupancy (dwell time) for DH3

$$\begin{aligned}\text{Dwell time} &= 1.68 \text{ ms} * 1600 * 1/4 * 1/\text{s} / 79 * 31.6\text{s} \\ &= 268.80 \text{ ms (in a 31.6s period)}\end{aligned}$$

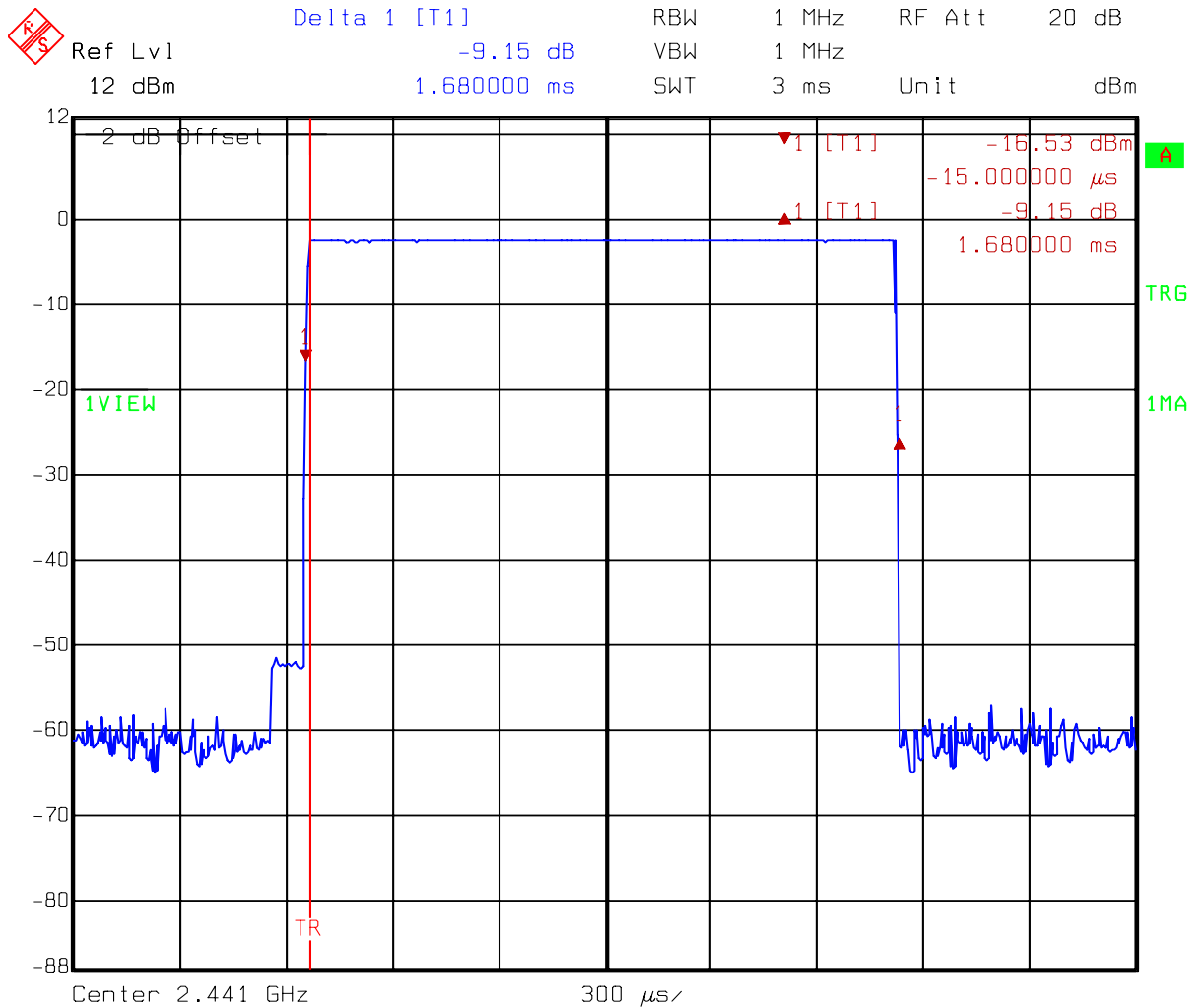
Time of occupancy (dwell time) for DH5

$$\begin{aligned}\text{Dwell time} &= 2.93 \text{ ms} * 1600 * 1/6 * 1/\text{s} / 79 * 31.6\text{s} \\ &= 312.53 \text{ ms (in a 31.6s period)}\end{aligned}$$

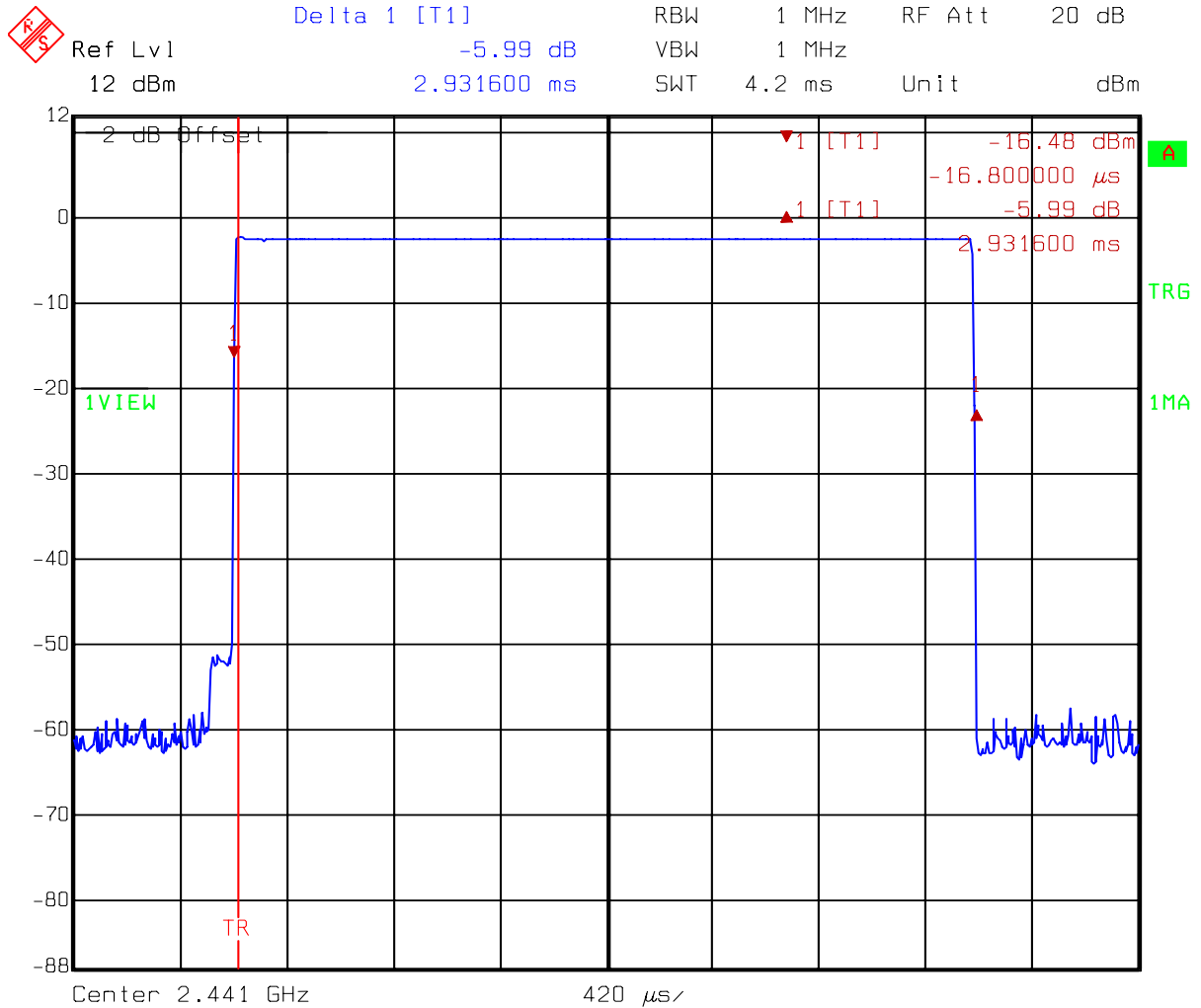
Please see the plot below.



Title: Time of occupancy
Comment A: CH 39 at Bluetooth mode DH1
Date: 11.MAY 2007 13:32:43



Title: Time of occupancy
Comment A: CH 39 at Bluetooth mode DH3
Date: 11.MAY 2007 13:35:13



Title: Time of occupancy
Comment A: CH 39 at Bluetooth mode DH5
Date: 11.MAY 2007 13:37:30

7. Maximum Output Power test

7.1 Operating environment

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

7.2 Test setup & procedure

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 (1.5 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	-4.22	1.5	-2.72	0.53	1
39 (middle)	2441	-2.97	1.5	-1.47	0.71	1
78 (highest)	2480	-10.43	1.5	-8.93	0.13	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

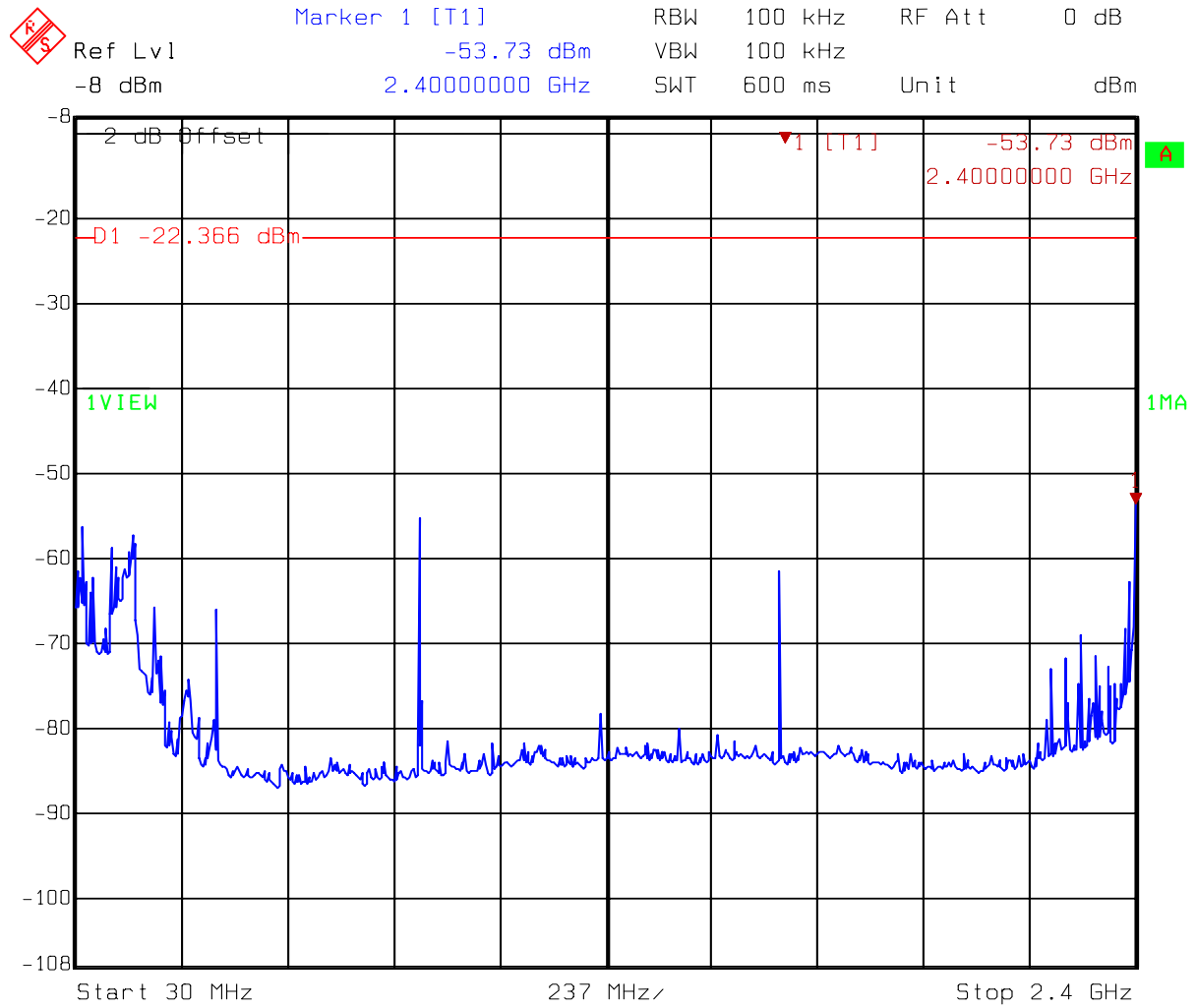
The measurements were performed from 30MHz to 25GHz RF antenna conducted per FCC 15.247 (c) was measured from the EUT antenna port using a 50ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz.

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

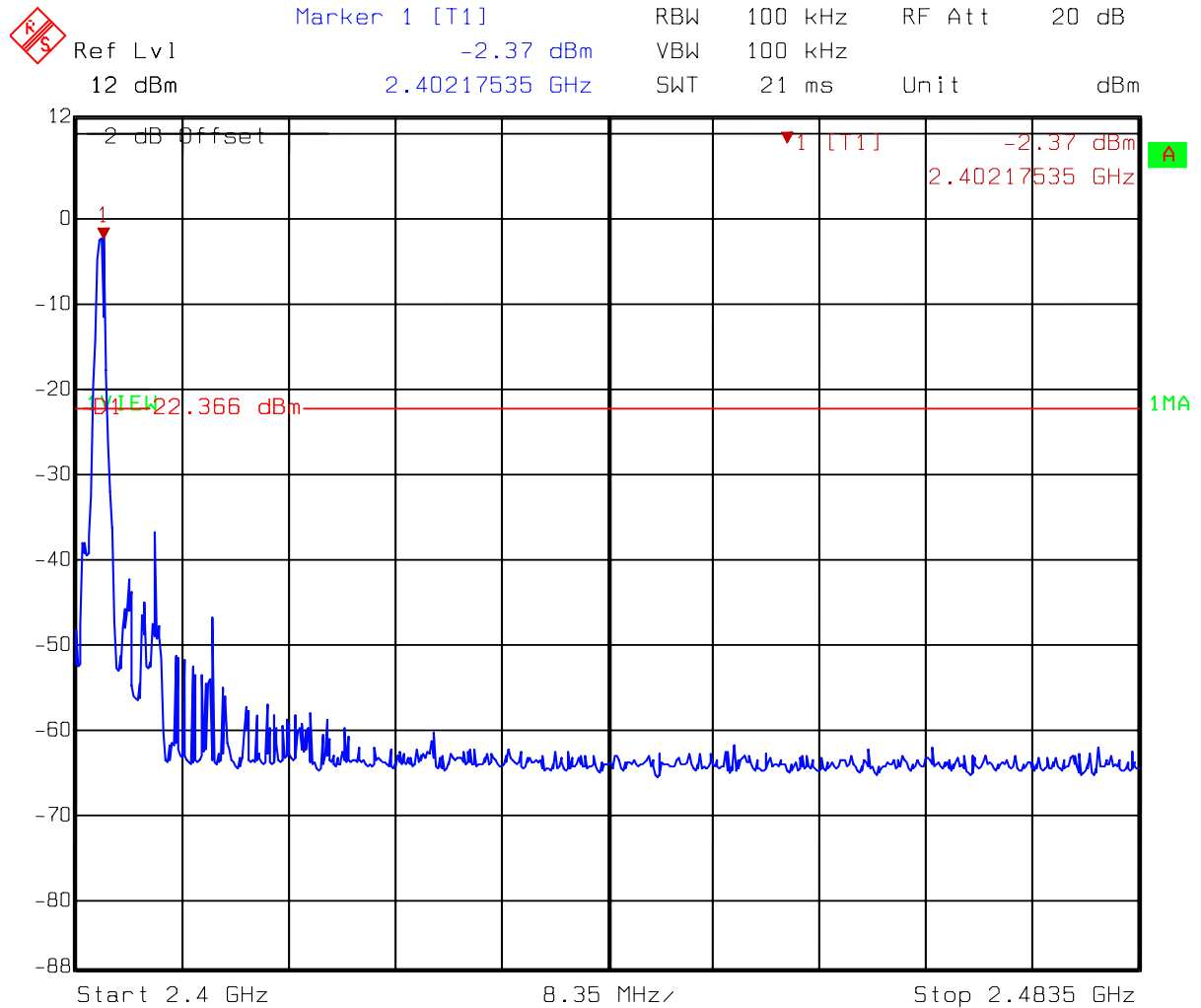
The test results please see the plot below.

CH 0



Title: Spurious
Comment A: CH 0 at Bluetooth mode 30MHz~2400MHz
Date: 11.MAY 2007 13:42:54

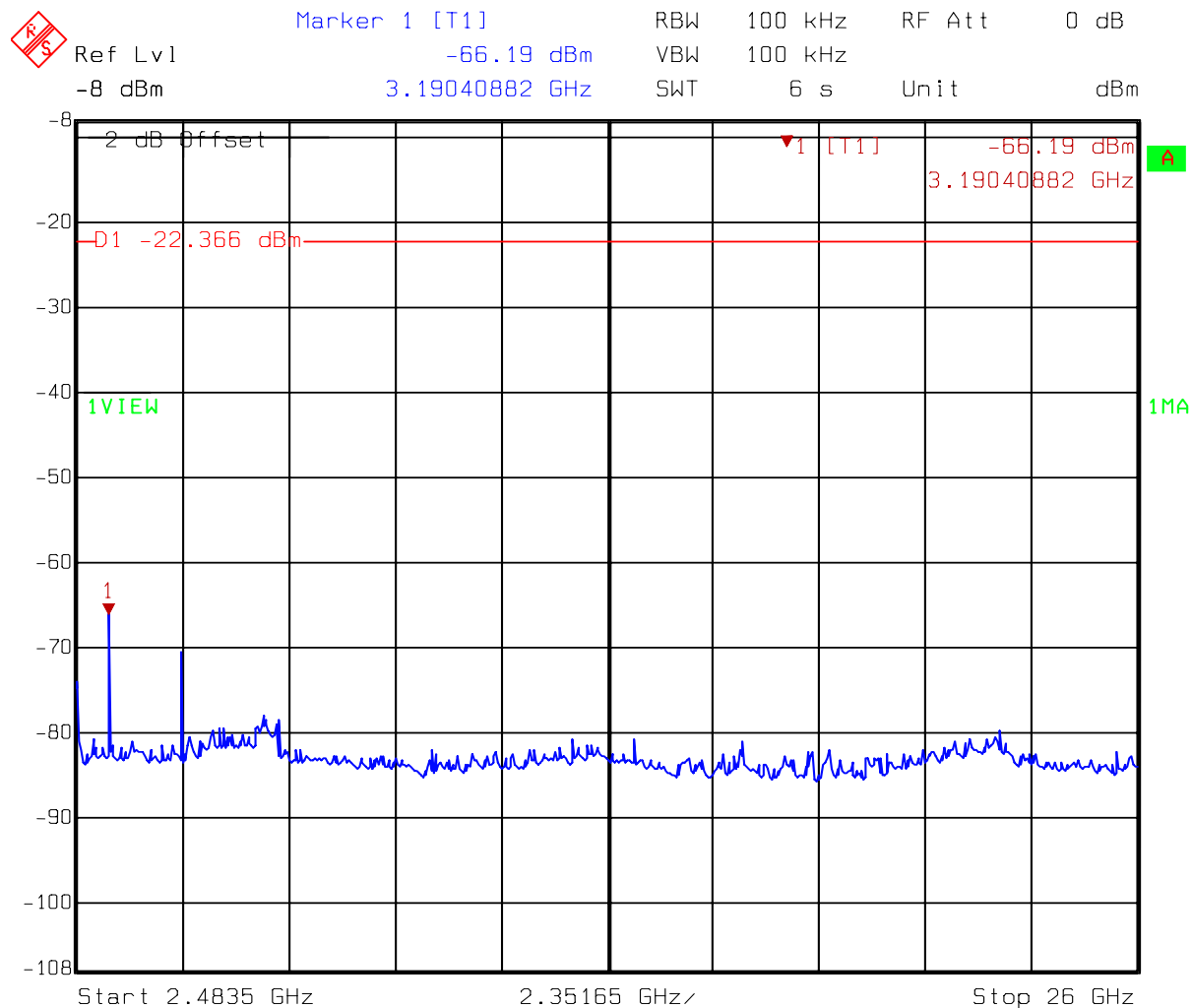
CH 0



Title: Spurious
Comment A: CH 0 at Bluetooth mode 2400MHz~2483.5MHz
Date: 11.MAY 2007 13:42:33

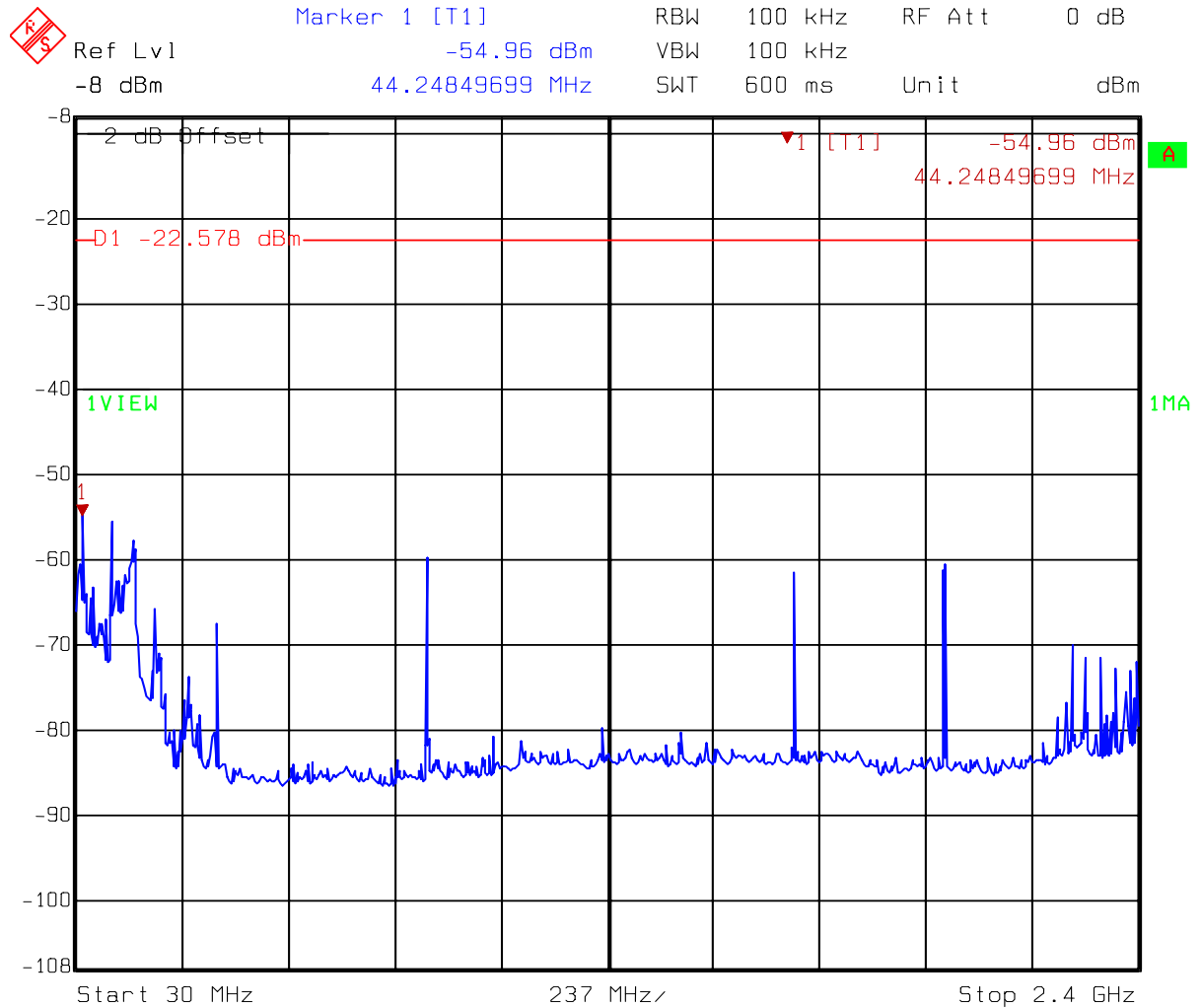


CH 0



Title: Spurious
Comment A: CH 0 at Bluetooth mode 2483.5MHz~26000MHz
Date: 11.MAY 2007 13:43:22

CH 39



Title: Spurious
Comment A: CH 39 at Bluetooth mode 30MHz~2400MHz
Date: 11.MAY 2007 13:40:09

Marker 1 [T1] RBW 100 kHz RF Att 20 dB
 Ref Lvl -2.58 dBm VBW 100 kHz
 12 dBm 2.44082966 GHz SWT 21 ms Unit dBm

2 dB Offset

1 [T1] -2.58 dBm
 2.44082966 GHz

10 MHz

100 kHz

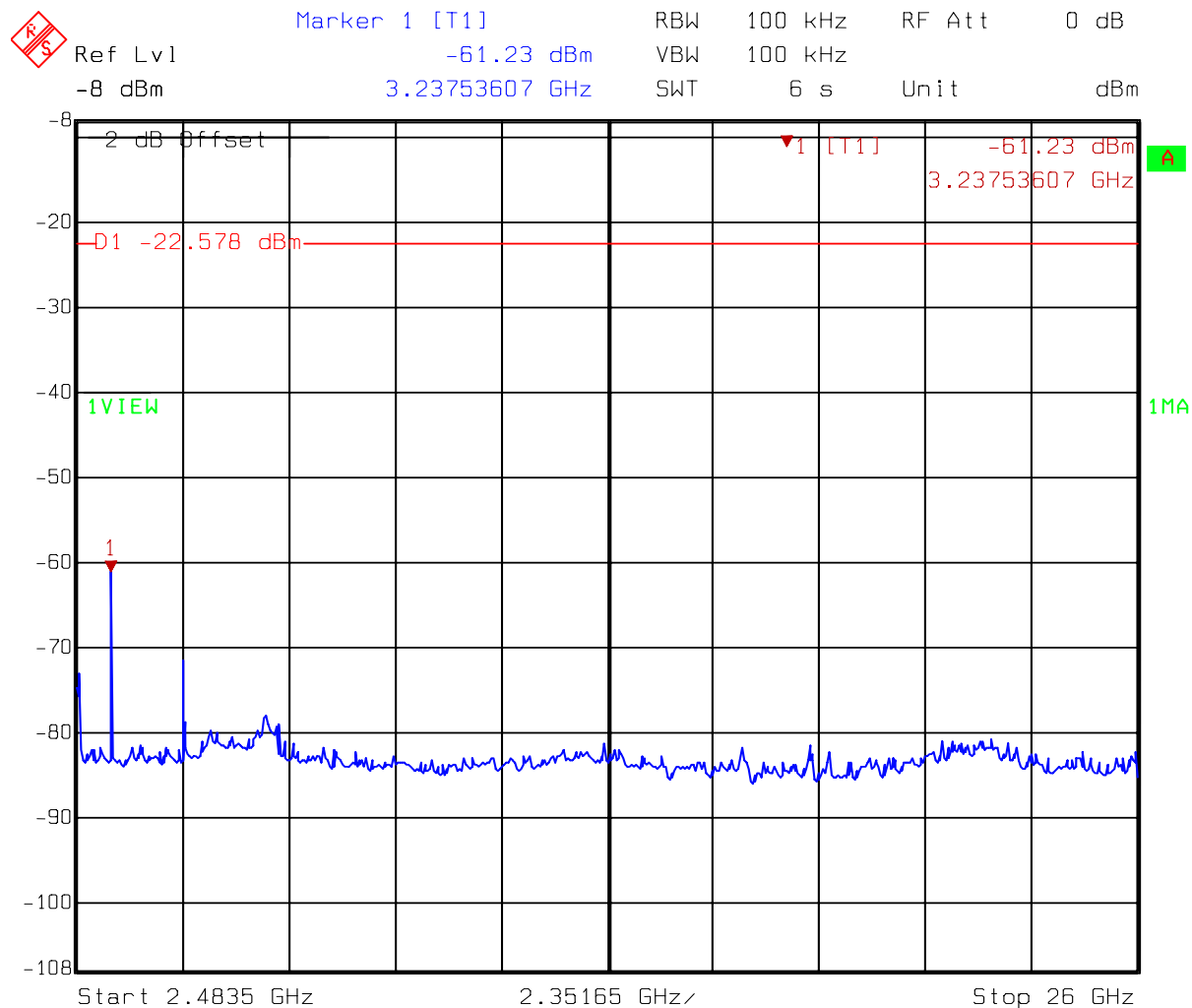
22.578 dBm

Start 2.4 GHz 8.35 MHz/ Stop 2.4835 GHz

Title: Spurious
Comment A: CH 39 at Bluetooth mode 2400MHz~2483.5MHz
Date: 11.MAY 2007 13:39:48

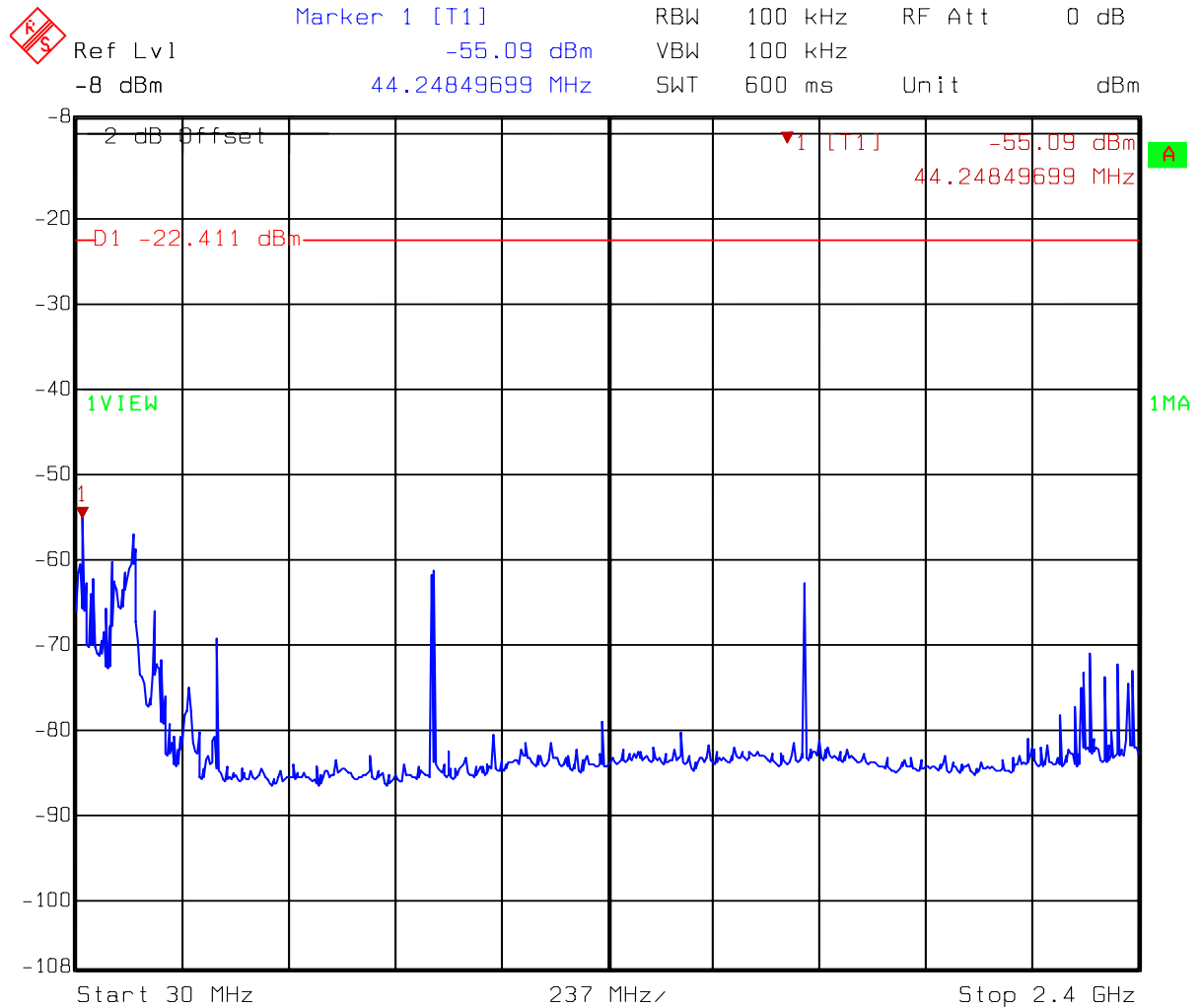


CH 39



Title: Spurious
Comment A: CH 39 at Bluetooth mode 2483.5MHz~26000MHz
Date: 11.MAY 2007 13:40:37

CH 78

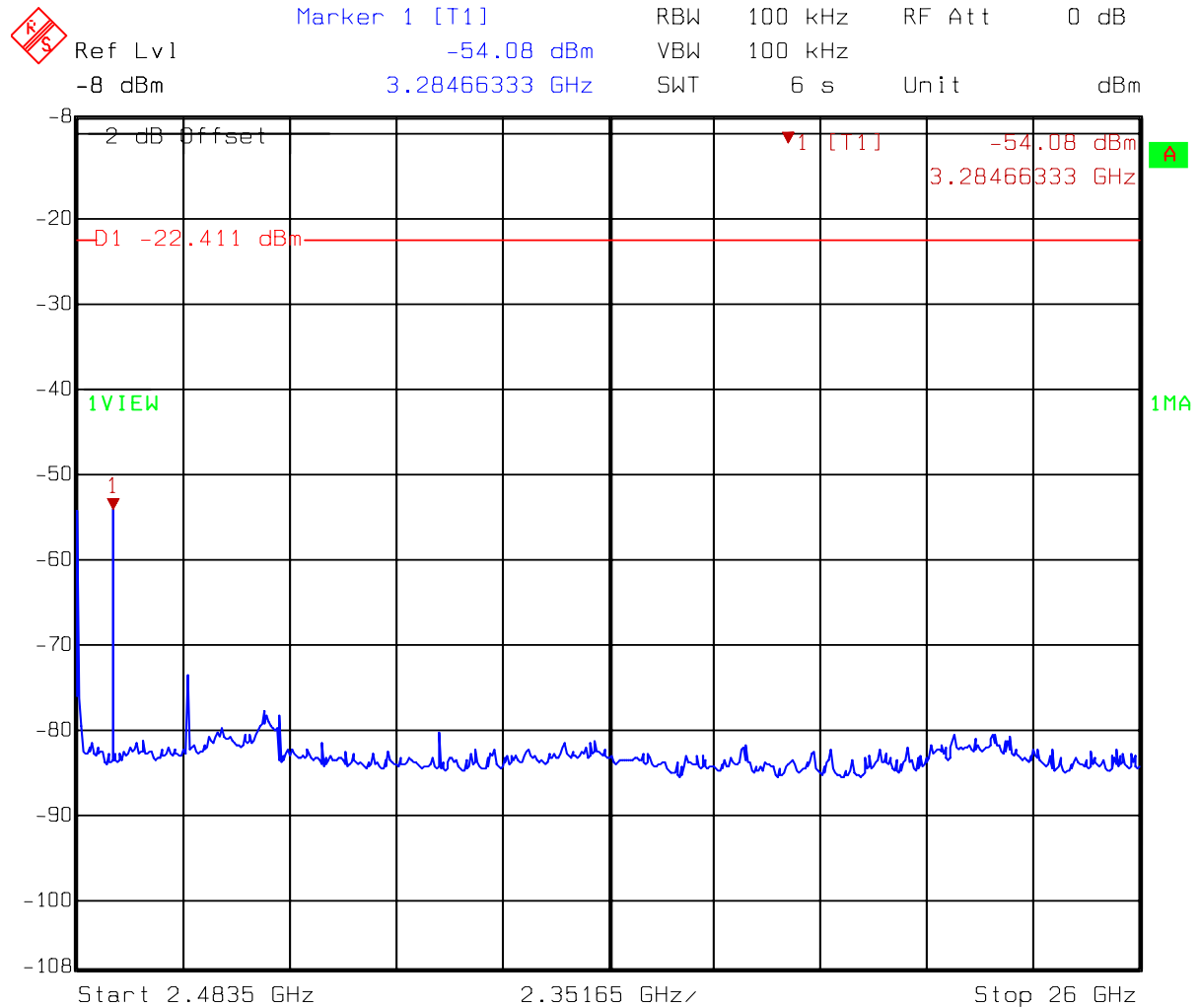


Title: Spurious
Comment A: CH 78 at Bluetooth mode 30MHz~2400MHz
Date: 11.MAY 2007 13:44:53

[illegible]

Title: Spurious
Comment A: CH 78 at Bluetooth mode 2400MHz~2483.5MHz
Date: 11.MAY 2007 13:44:31

CH 78



Title: Spurious
Comment A: CH 78 at Bluetooth mode 2483.5MHz~26000MHz
Date: 11.MAY 2007 13:45:21

9. Radiated Emission test

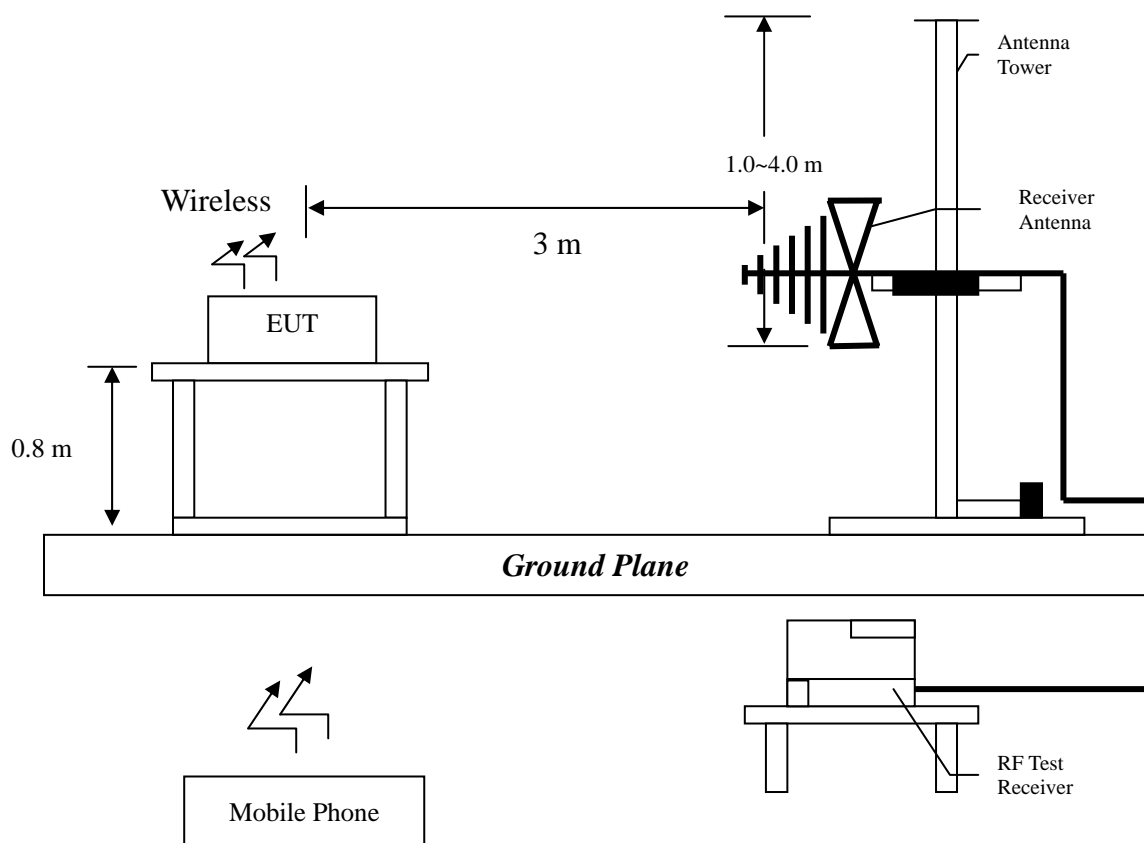
9.1 Operating environment

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

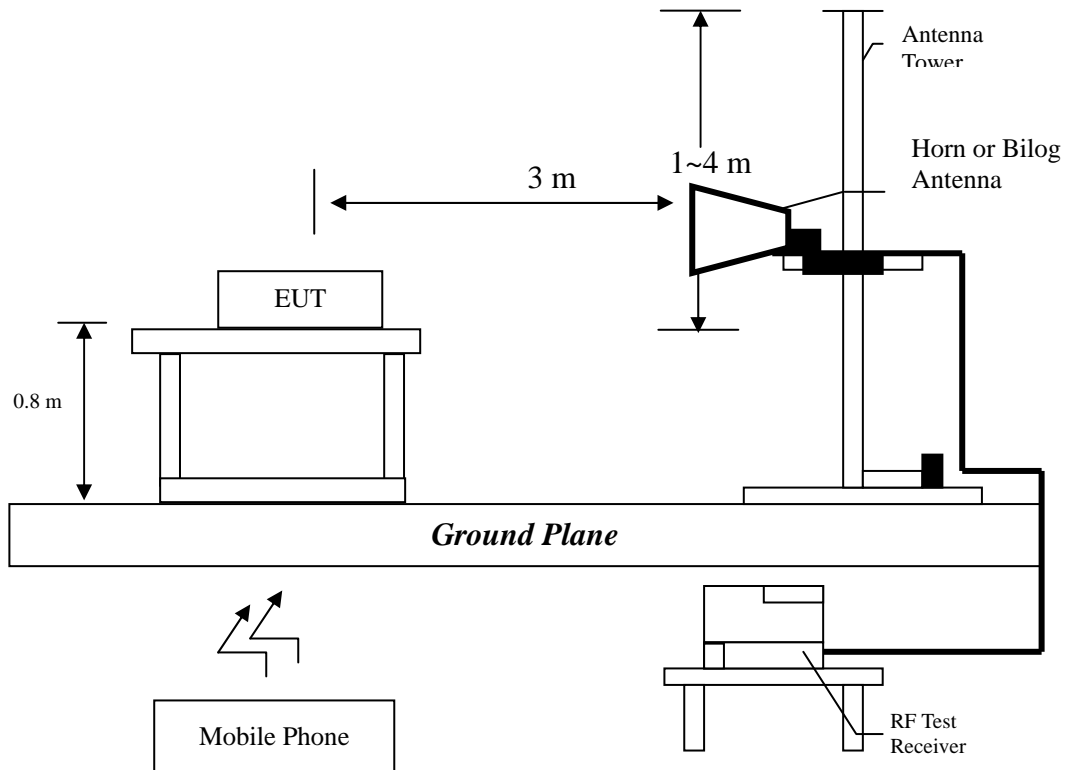
9.2 Test setup & procedure

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

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



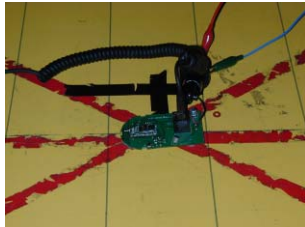
The frequency spectrum from over 1GHz was investigated.



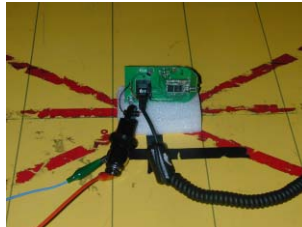
Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

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.



Setup 1



Setup 2



Setup 3

After verifying, the worst case was found out setup 1.

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 : BLUE EAGLE II
Test Condition : Normal operating mode

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	168.710	QP	15.70	15.10	30.80	43.50	-12.70
V	249.220	QP	12.22	20.76	32.98	46.00	-13.03
V	399.570	QP	16.40	10.64	27.04	46.00	-18.96
V	796.300	QP	23.19	13.27	36.46	46.00	-9.54
V	832.190	QP	23.62	12.05	35.67	46.00	-10.33
V	899.120	QP	24.35	9.81	34.16	46.00	-11.85
H	124.090	QP	11.62	23.26	34.88	43.50	-8.63
H	166.770	QP	13.84	19.87	33.71	43.50	-9.80
H	230.000	QP	11.74	24.18	35.92	46.00	-10.08
H	343.310	QP	14.40	16.76	31.16	46.00	-14.85
H	515.970	QP	18.77	10.90	29.67	46.00	-16.33
H	832.190	QP	24.04	10.85	34.89	46.00	-11.12

Remark:

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



9.4.2 Measurement results: frequency above 1GHz

EUT : BLUE EAGLE II
Test Condition : Tx at channel 0

No spurious emission was found above the spectrum analyzer's noise floor.

Noise floor level is:

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV



EUT : BLUE EAGLE II
Test Condition : Tx at channel 39

No spurious emission was found above the spectrum analyzer's noise floor.

Noise floor level is:

For PK:

1GHz-3GHz: 20dBuV

3GHz-14GHz: 27dBuV

14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV

3GHz-14GHz: 16dBuV

14GHz-26.5GHz: 28dBuV

EUT : BLUE EAGLE II
Test Condition : Tx at channel 78

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	43.29	44.99	54	-9.01
4960.00	PK	H	36.07	37.77	45.95	47.65	54	-6.35

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 noise floor, the others please refer to noise floor level.

Noise floor level is :

For PK:

1GHz-3GHz: 20dBuV
3GHz-14GHz: 27dBuV
14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV
3GHz-14GHz: 16dBuV
14GHz-26.5GHz: 28dBuV

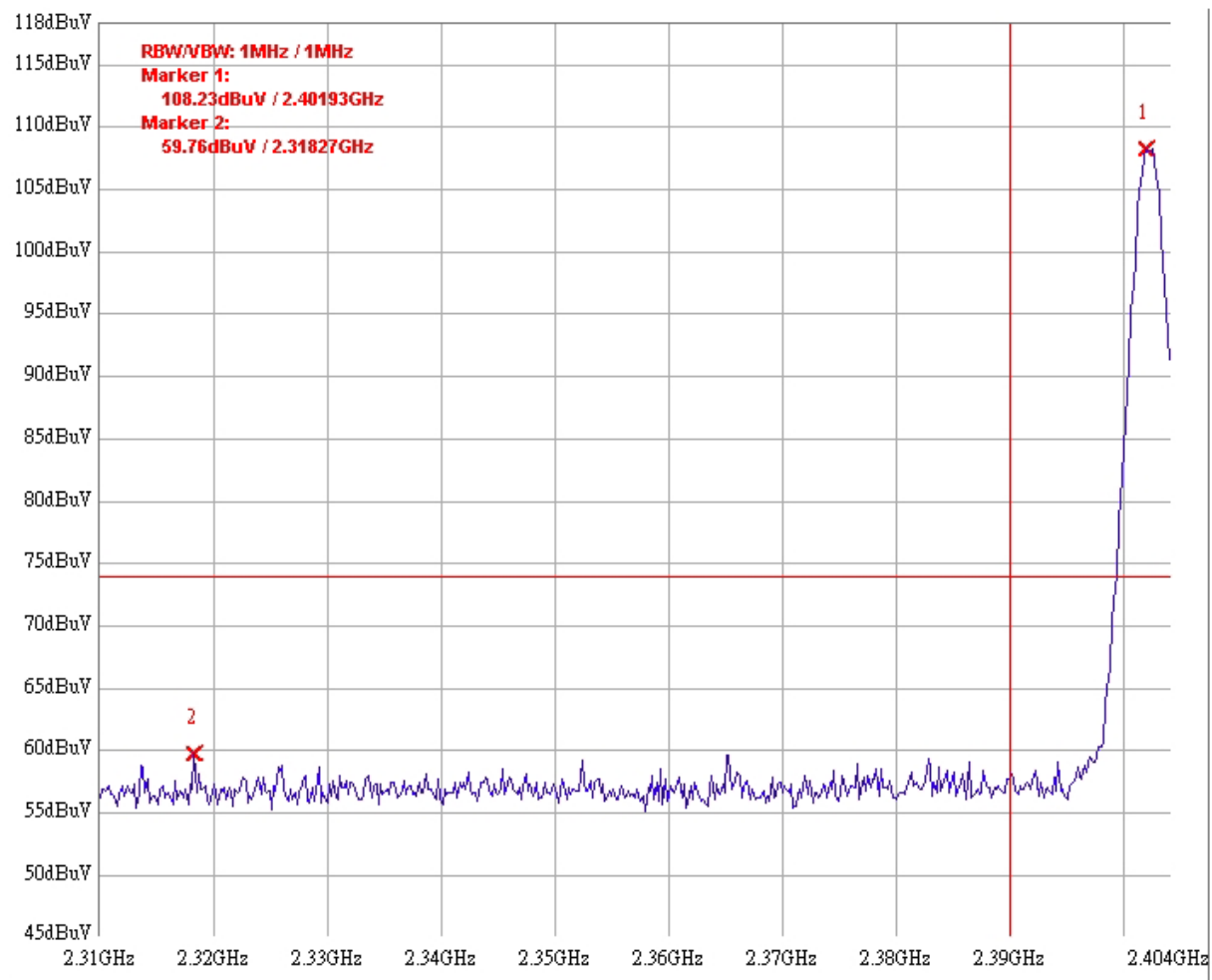
10. Emission on the band edge §FCC 15.247(C)

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.

Please see the plot below.

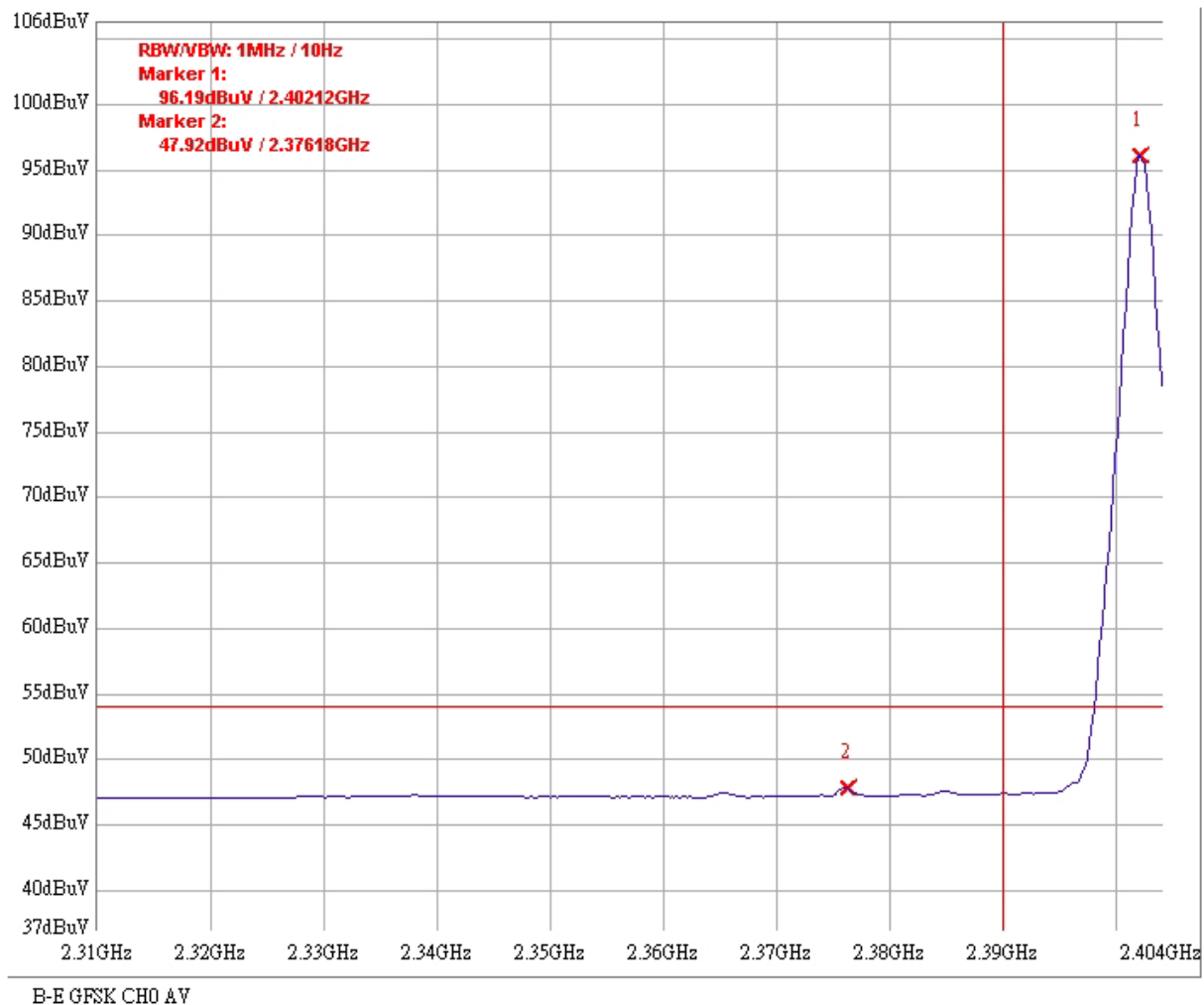
10.1 Band-edge (Radiated method)

CH0-PK

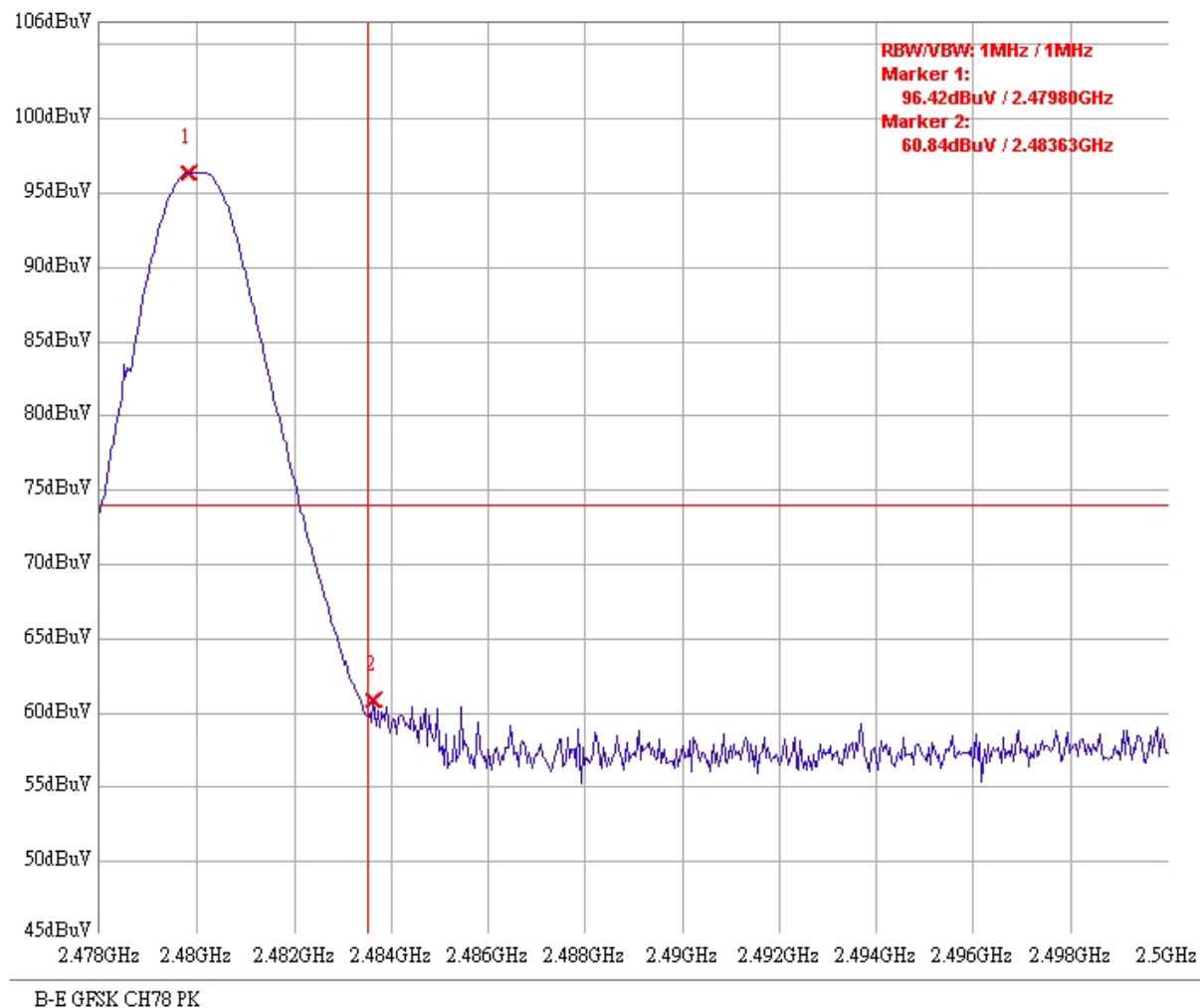


B-E GFSK CH0 PK

CH0-AV



CH78-PK



CH78-AV

