

Test & Certification Center (TCC) - Dallas

FCC ID: QVVRH-51

Test Report #: WR161.004

April 13, 2004

Accredited Laboratory
Certificate Number: 1819-01

Ver 1.0

CFR 47 Part 15 Test Report

Test Report Number: WR161.004

Terminal device:

FCC ID: QVVRH-51 Model: 7610 Type: RH-51 HW: 3001 SW: C3.0405.1.BT
(Detailed information is listed in section 4).

Originator: J. Torres
Function: TCC - Dallas – EMC
Version/Status: 1.0 Approved
Location: TCC Directories
Date: April 13, 2004

Change History:

Version	Date	Status	Handled By	Comments
0.1	24 Mar 04	Draft	J. Torres	
0.2	05 Apr 04	Proposal	Mark Severson	
0.3	06 Apr 04	Reviewed	Michael Mobley Mark Severson	
1.0	13 Apr 04	Approved	Nerina Walton	

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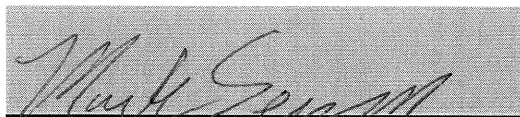
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Date and signatures:

April 13, 2004

For the contents:



Mark Severson, EMC Engineer
Technical Review



Nerina Walton, General Manager
Manager Review

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1. GENERAL

1.1 Quality System

The quality system in place for TCC-Dallas conforms to ISO/IEC 17025 and has been audited to the standard by A2LA (American Association of Laboratory Accreditation). TCC - Dallas has also been audited using the ISO 9000 Quality System, as part of Nokia Mobile Phones, Inc., by ABS (American Bureau of Shipping) Quality Evaluations Inc.

TCC-Dallas is a recognized laboratory with the Federal Communications Commission in filing applications for Certification under Parts 15 and 18, Registration Number 100060, and Industry Canada, Registration Number IC 661.

1.2 Objective

All tests and measurement data shown was performed to determine whether the selected handset was in compliance as specified in FCC: CFR47 Parts 15.207 and 15.247.

1.3 Test Summary

Test Results: *The test result relates only to those tested devices mentioned in Section 4 of this test report.*

Test Performed	Reference		Section of Report	Complies / Does not comply / Not Tested
Carrier frequency separation	15.247, a1	6.2.2 (o), a1	7	Complies
Number of hopping frequencies	15.247, a1ii	6.2.2 (o), a3	8	Complies
Time of occupancy	15.247, a1ii, 15.247, f	6.2.2 (o), a3	9	Complies
20dB bandwidth	15.247, a	6.2.2 (o), a1	10	Complies
Peak output power	15.247, b1	6.2.2 (o), a3	11	Complies
Band-edge compliance of RF emissions	15.247, c	6.2.2 (o), e1	12	Complies
AC powerline conducted emissions	15.207	6.6	13	Complies
Spurious radiated emissions	15.247, c	6.2.2 (o), e1	15	Complies
Spurious RF conducted emissions	15.247, c	6.2.2 (o), e1	14	Complies

2. STANDARDS BASIS

Testing has been carried out in accordance with:

REF.	Code of the standard	Name of the standard
1	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.
2	FCC: CFR 47 Part 15	Code of Federal Regulations (CFR) Title 47, Part 15 – Radio Frequency Devices: Subpart B – Unintentional Radiators and Subpart C – Intentional Radiators
3	CISPR 22 / EN55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.
4	ICES-003	Digital Apparatus, Industry Canada
5	RSS-132	800 MHz Cellular Telephones Employing New Technologies
6	RSS-133	2 GHz Personal Communications Services, Industry Canada
7	RSS-210	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
8	RSS-212	Test Facilities and Test Methods for Radio Equipment, Industry Canada (Provisional)
9	RSP-100	Radio Equipment Certification Procedure

Note: Unless otherwise stated, (by reference to a version number and a publication date), the latest version of the above documents applies.

Deviations:

Not Applicable.



3. LIST OF ABBREVIATIONS, ACRONYMS AND TERMS

3.1 Abbreviations

dB - decibel

dBm - decibels per milliwatt (absolute measurement)

dB μ V - decibel per microvolt

dB μ V/m - decibel of microvolt per meter

GHz - gigahertz or 1000000000 hertz

kHz - kilohertz or 1000 hertz

MHz - megahertz or 1000000 hertz

ms - millisecond or 0.001 second

μ s - microsecond or 0.000001 second

3.2 Acronyms

BT - Bluetooth

EMC - Electromagnetic Compatibility

EMI - Electromagnetic Interference

EUT - Equipment under Test

GSM - Global System for Mobile communications

PRBS - Pseudo Random Bit Sequence

RF - Radio Frequency

3.3 Terms

Base Station Simulator (BSS) - simulates all the necessary signals that a phone would experience while on a live network. There are many types of base station simulators catering for all current protocols, i.e., GSM, AMPS, TDMA, and CDMA.

4. EQUIPMENT-UNDER-TEST (EUT)

The results in this report relate only to the items listed below:

4.1 Description of Tested Device(s):

Test Performed	Mode of Operation	Date of Receipt	Condition of Sample	Item	Identifying Information
FCC Part 15.247(a)(1), FCC Part 15.247(a)(1)iii, FCC Part 15.247(b)(1), FCC Part 15.247(c)	BT 2.4 - 2.4835 GHz	March 24, 2004	Operational	Phone	FCC ID: QVVRH-51 Type: RH-51 HW: 3001 SW: C3.0405.1.BT IMEI: 004400/33/172966/3
FCC Part 15.247(a)(1), FCC Part 15.247(a)(1)iii, FCC Part 15.247(b)(1), FCC Part 15.247(c)	BT 2.4 - 2.4835 GHz	March 24, 2004	Operational	Battery	Type: BL-5C Other: 3.7V

5. TEST EQUIPMENT LIST

The listing below indicates the test equipment utilized for the test (s). Calibration interval on all items listed can be obtained from the Engineering Services Group within NMP, Product Creation - Dallas. Where relevant, measuring equipment is subjected to in-service checks between testing. TCC - Dallas shall notify clients promptly, in writing, of identification of defective measuring equipment that casts doubt on the validity of results given in this report.

Section of Report	NMP#	Test Equipment	Mfr. #	Model #	Calibration Due Date	Calibration Interval
13	03007	LISN	EMCO	3816/2	20 May 04	1 year
13	N/A	10dB Attenuator	Weinschel	Model 2	N/A	N/A
7,8,9,10,11, 12,12,13	03857	Base Station	Rhodes & Schwartz	CMU 200	04 Sept 04	1 year
13	00367 00368	EMI Receiver	Hewlett Packard	8546 / 85460A	22 Jul 04	1 year
15	02680	EMI Analyzer	Agilent	E7405A	24 Nov 04	1 year
7,8,9,10,11, 12,14	03155	Power Splitter (must have 6 dB insertion loss)	Agilent	33120A	N/A	N/A
7,8,9,10,11, 12,14	N/A	6dB Attenuator	Weinschel	Model 2	N/A	N/A
7,8,9,10,11, 12,14	03459	Spectrum Analyzer	Rhodes & Schwartz	FSP	07-Jan-05	1 year
7,8,9,10,11, 12,14	03459	Spectrum Analyzer	R&S	FSP	17 Sep 2005	12 Mo.
15	00065	Horn Antenna	EMCO	3115	25-Jul-04	12 months
15	02868	Biconilog Antenna	EMCO	3142	08 Aug 03	12 Mo.

6. EUT TEST SETUPS

For each test the EUT was exercised to find out the worst case of operation modes and device configuration.

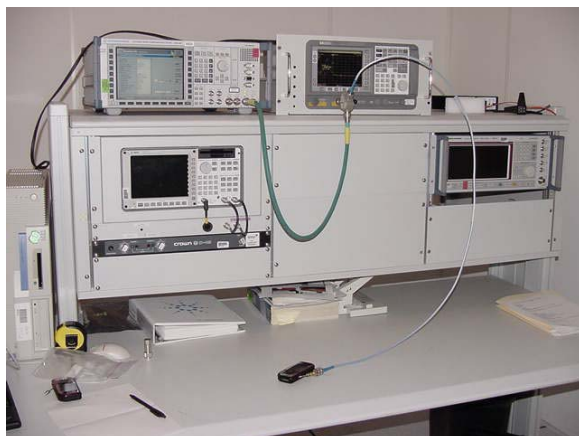
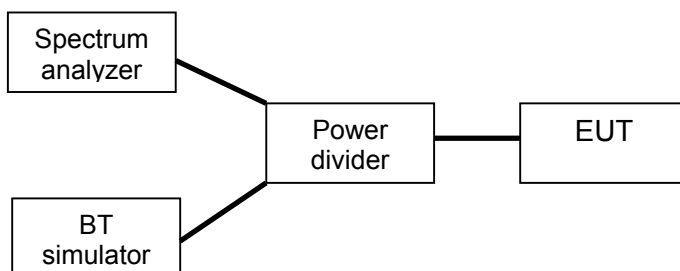
Two different test setups were used: one for conducted measurements, another for radiated measurements. One EUT was equipped with an external antenna connector for conductive measurements.

6.1 EUT test set-up A (conducted measurement)

This setup was used in conducted measurements. The Bluetooth simulator was used to control the following:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns

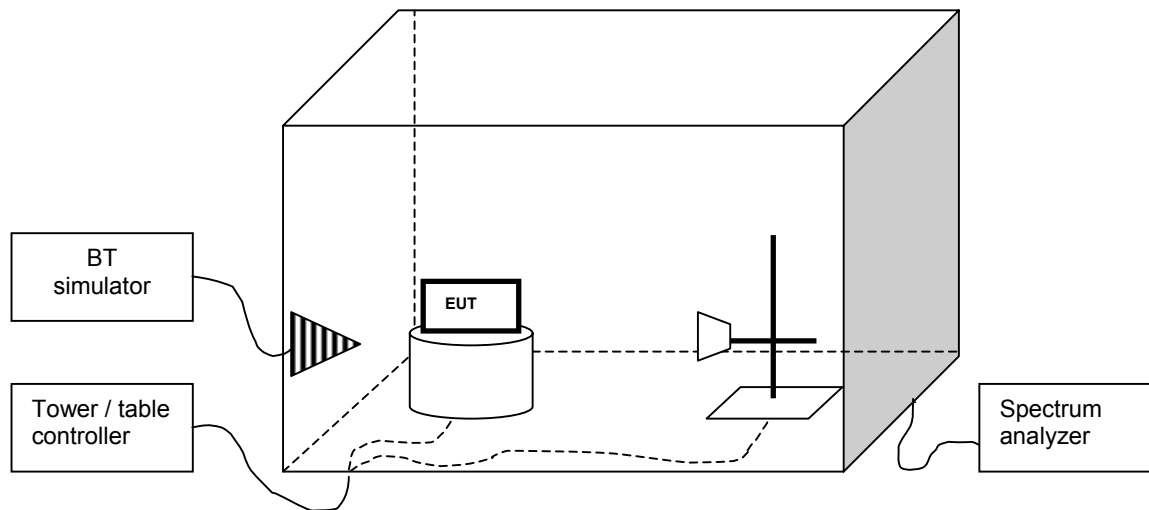
In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



6.2 EUT test set-up B (radiated measurement)

The EUT was set on a non-conductive turn table in a semi anechoic chamber. In the corner of the chamber there was a communication antenna, which was connected to the BT simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The Bluetooth simulator was used to the same as in conducted measurements.

In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



7. CARRIER FREQUENCY SEPARATION

Specification: FCC Part 15.247 (a) (1)

7.1 Setup

Used test set-up: A (see section 6)

7.2 Test Results

Test Technician / Engineer	M. Severson, J. Torres
Date of Measurement	24-Mar-04
Temperature	22 to 26 °C
Humidity	37 to 48 %RH
Test Result	Complies with FCC Part 15.247 (a) (1)

7.3 EUT operation mode

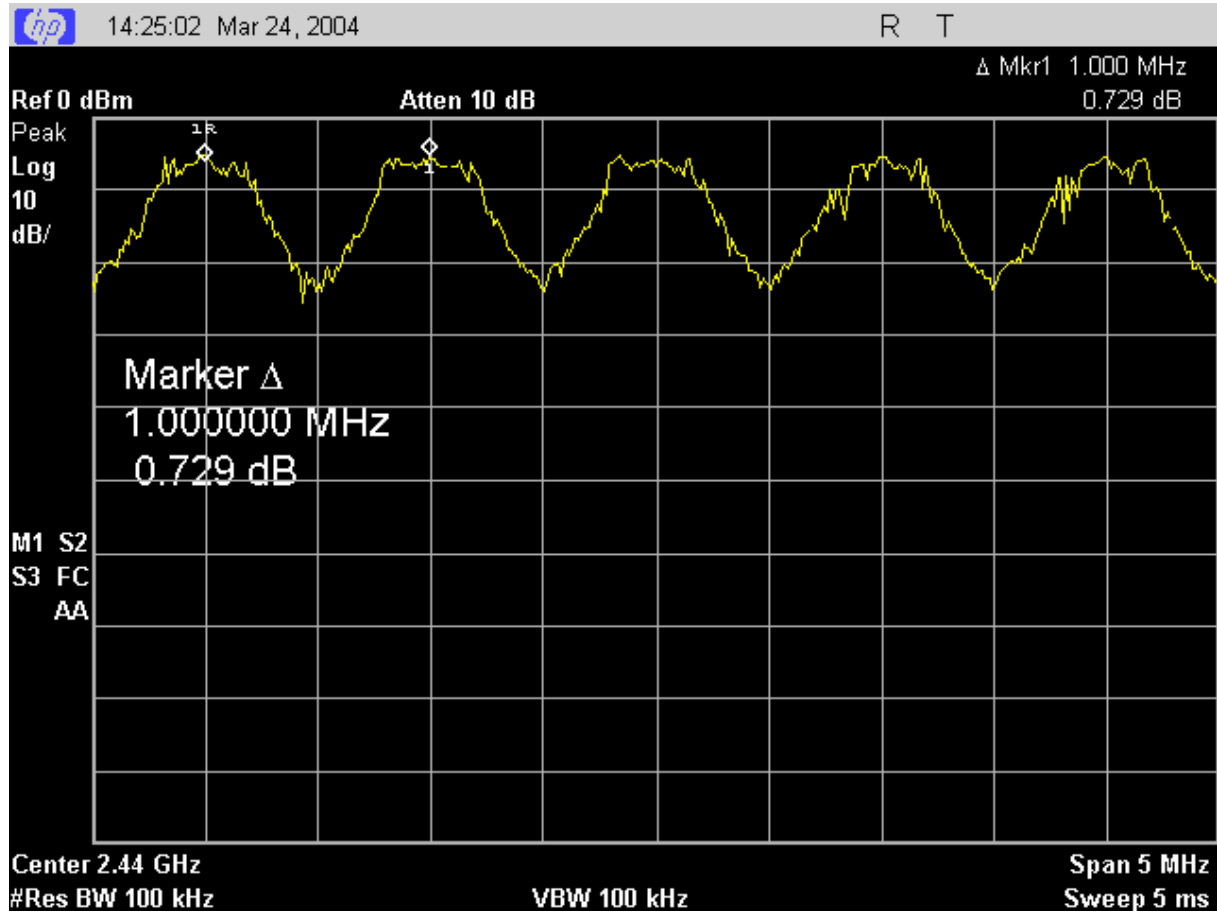
EUT operation mode	Connection, DH5, Static PRBS
EUT channel	Hopping (Euro / US)
EUT TX power level	Nominal

7.4 Pass/Fail Criteria

Limit (MHz)	Measured value (MHz)
≥ 0.025 or 20dB	1 MHz

7.5 Screen shot

Carrier frequency separation of channels 36 and 37



8. NUMBER OF HOPPING FREQUENCIES

Specification: FCC Part 15.247 (a) (1)iii

8.1 Setup

See section 6.

8.2 Test Results

Test Technician / Engineer	M. Severson, J. Torres
Date of Measurement	24-Mar-04
Temperature	37 to 48 °C
Humidity	22 to 26 %RH
Test Result	Complies with FCC Part 15.247 (a) (2)

8.3 EUT operation mode

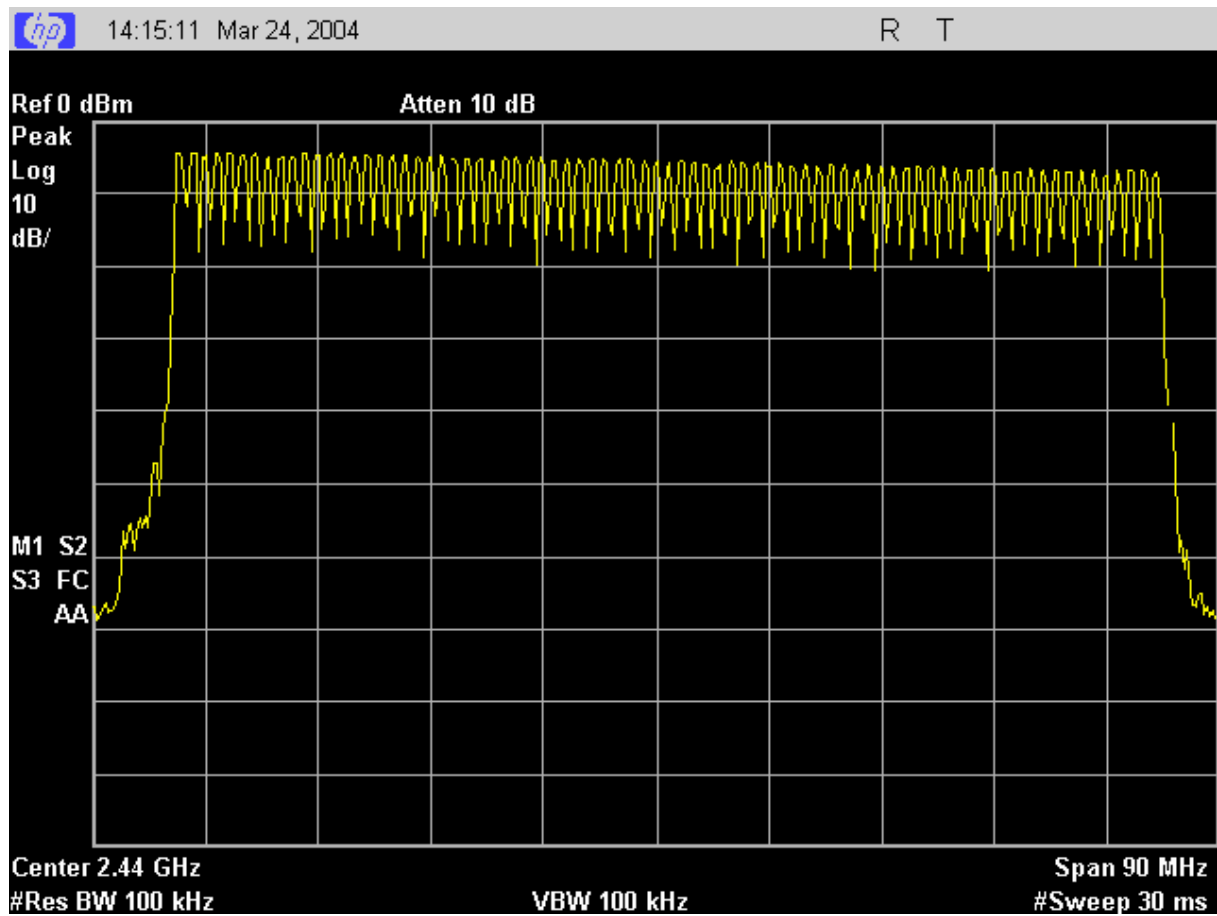
EUT operation mode	Connection, DH5, Static PRBS
EUT channel	Hopping
EUT TX power level	Nominal

8.4 Pass/Fail Criteria

Number	Measured value
≥ 75	79

8.5 Screen shot

Number of Hopping Frequencies



9. TIME OF OCCUPANCY

Specification: FCC Part 15.247 (a)(1)iii

9.1 Setup

Used test set-up: A (see section 6)

9.2 Test Results

Test Technician / Engineer	Michael Sundstrom / Jesse Torres
Date of Measurement	30, 31, March 2004
Temperature	23-25 °C
Humidity	33-40 %RH
Test Result inquiry	Complies with FCC Part 15.247 (a) (3)
Test Result paging	Complies with FCC Part 15.247 (a) (3)
Test Result connection mode	Complies with FCC Part 15.247 (a) (3)

9.3 EUT operation mode: Inquiry

EUT operation mode	Connection
EUT channel	Hopping
EUT TX power level	Nominal

9.4 Pass/Fail Criteria

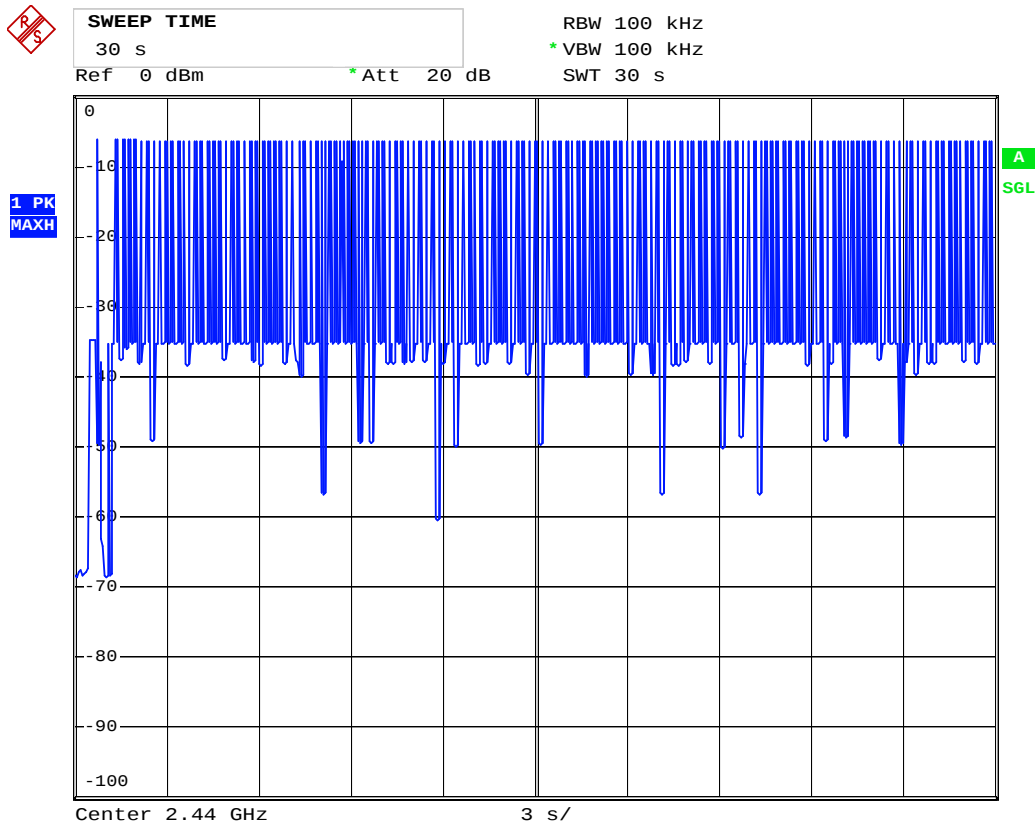
Limit (s)	Measured value (ms)
≤ 0.4	131.2

(800 Transmissions / 79 Channels) * 30S * One Transmission = Time of Occupancy

9.5 Screen shots

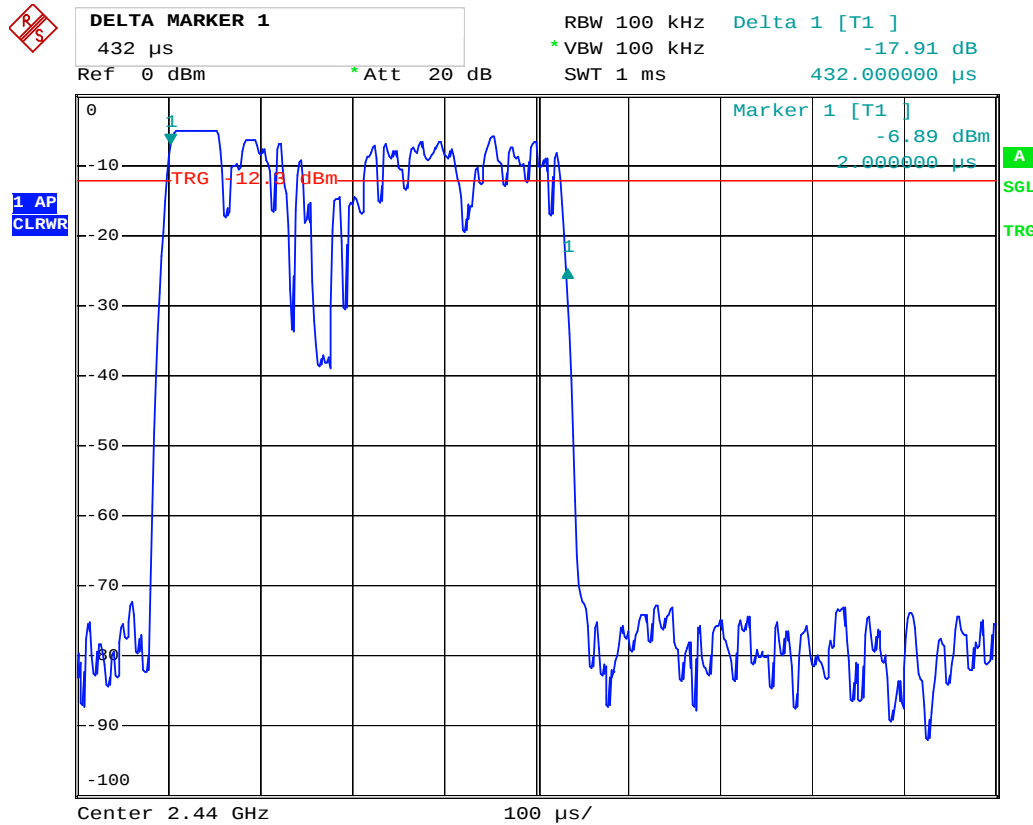
9.6 Screen shots

Number of transmissions, channel 38.



Date: 31.MAR.2004 10:37:17

Duration of one transmission, channel 38.



Date: 1.APR.2004 10:46:32

10. 20dB BANDWIDTH

Specification: FCC Part 15.247 (a) (1)

10.1 Setup

Used test set-up: A (see section 6)

10.2 Test Results

Test Technician / Engineer	M. Severson, J. Torres
Date of Measurement	24-Mar-04
Temperature	22 to 26 °C
Humidity	37 to 48 %RH
Test Result	Complies with FCC Part 15.247 (a) (1)

10.3 EUT operation mode

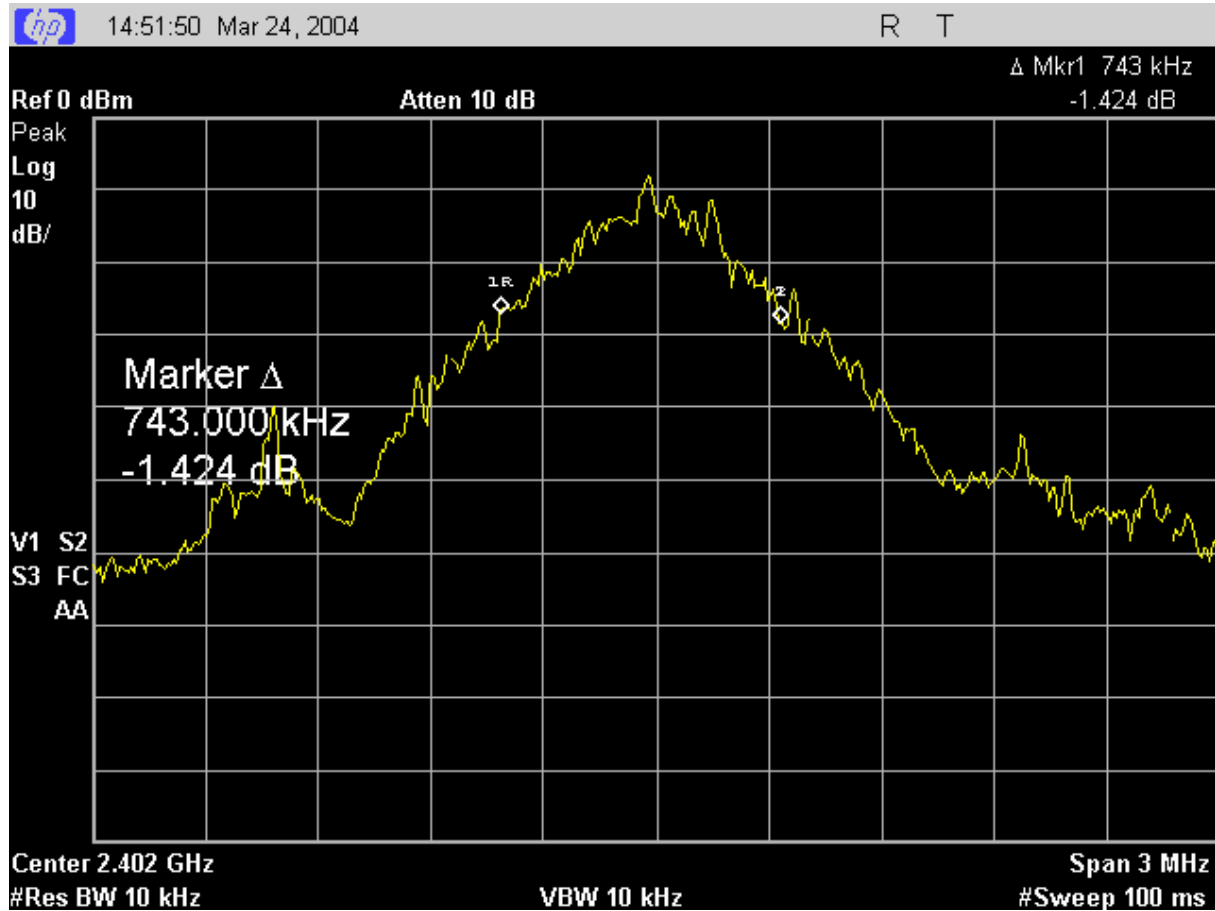
EUT operation mode	Connection, DH5, Static PRBS
EUT channel	0 (2402 MHz), 38 (2440 MHz), 78 (2480MHz)
EUT TX power level	Nominal

10.4 Pass/Fail Criteria

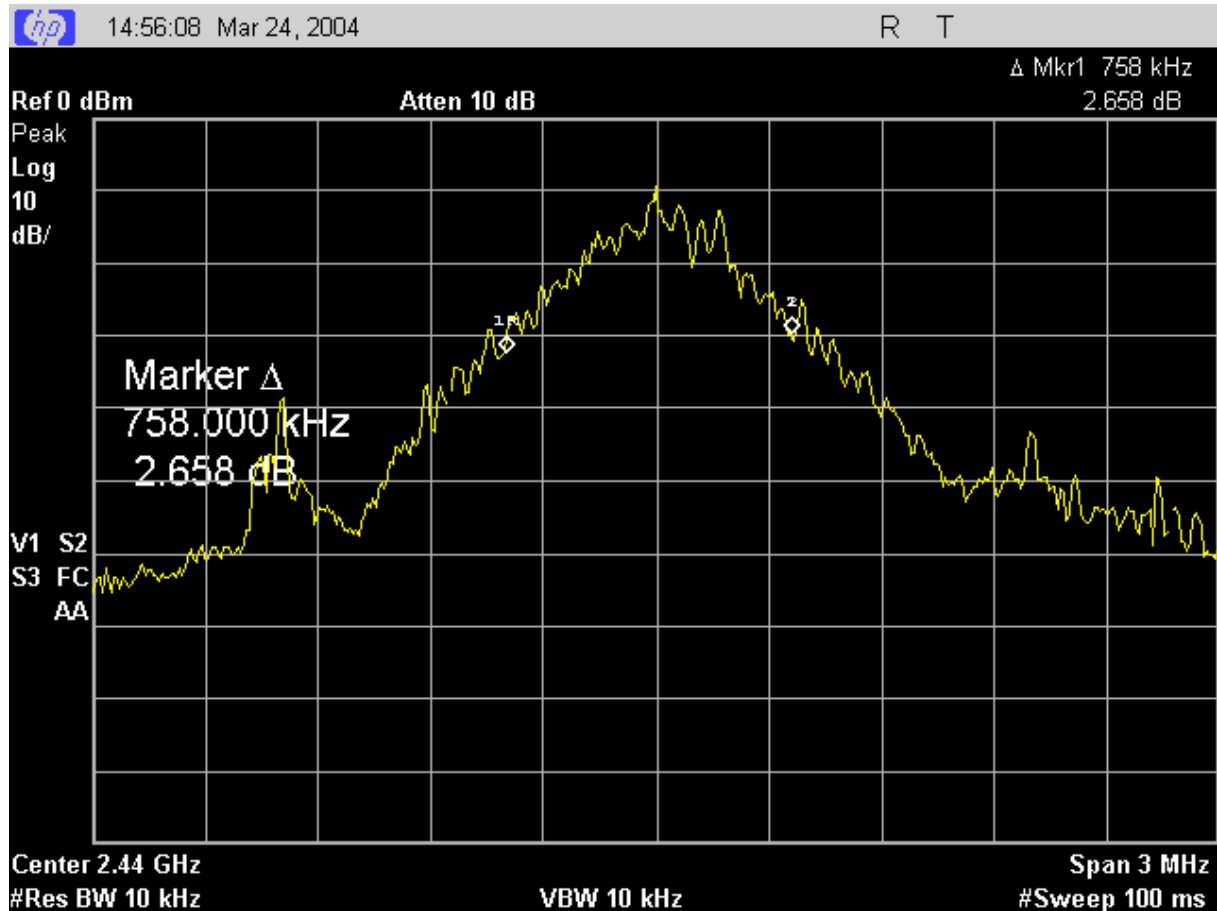
EUT channel	Limit (MHz)	Measured value (MHz)
0	≤ 1.0	0.743
38		0.758
78		0.803

10.5 Screen shots

20dB bandwidth, channel 0



20dB bandwidth, channel 38



20dB bandwidth, channel 78



11. PEAK OUTPUT POWER

Specification: FCC Part 15.247 (b) (1)

11.1 Setup

Used test set-up: A (see section 6)

11.2 Test Results

Test Technician / Engineer	M. Severson, J. Torres
Date of Measurement	25-Mar-04
Temperature	21 °C
Humidity	50 to 55 %RH
Test Result	Complies with FCC Part 15.247 (b) (1)

11.3 EUT operation mode

EUT operation mode	Connection, DH5, Static PRBS
EUT channel	0 (2402 MHz), 38 (2440 MHz), 78 (2480MHz)
EUT TX power level	Nominal

11.4 Pass/Fail Criteria

EUT channel	Limit (W)	Test result (mW)
0	≤ 1.0	1.86
38		1.56
78		1.07

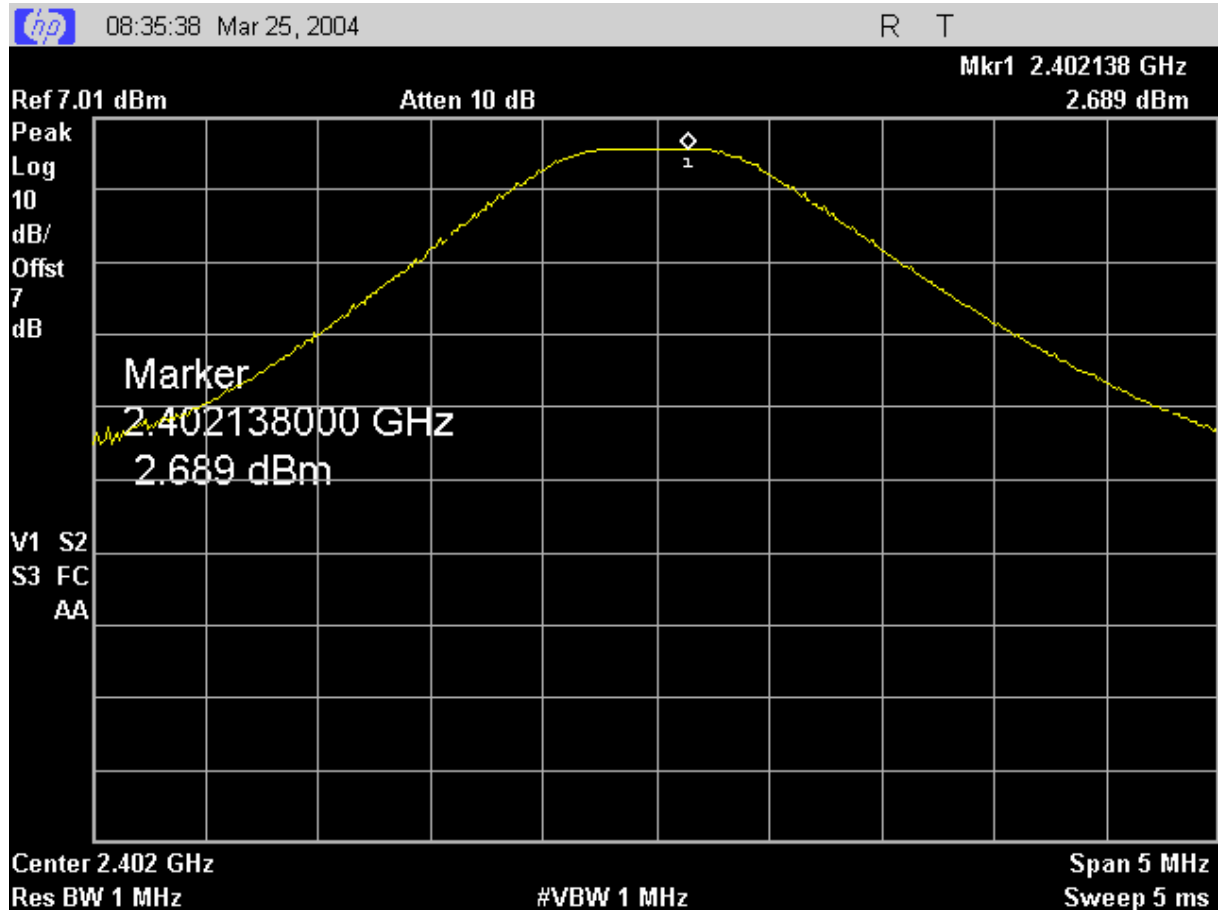
The measured power values were corrected with the attenuation of the cables, attenuator and power divider using the formula:

$$P[W] = \frac{10^{(P_{Meas}[dBm] + L_{Cables}[dB] + L_{Divider}[dB])}}{1000}$$

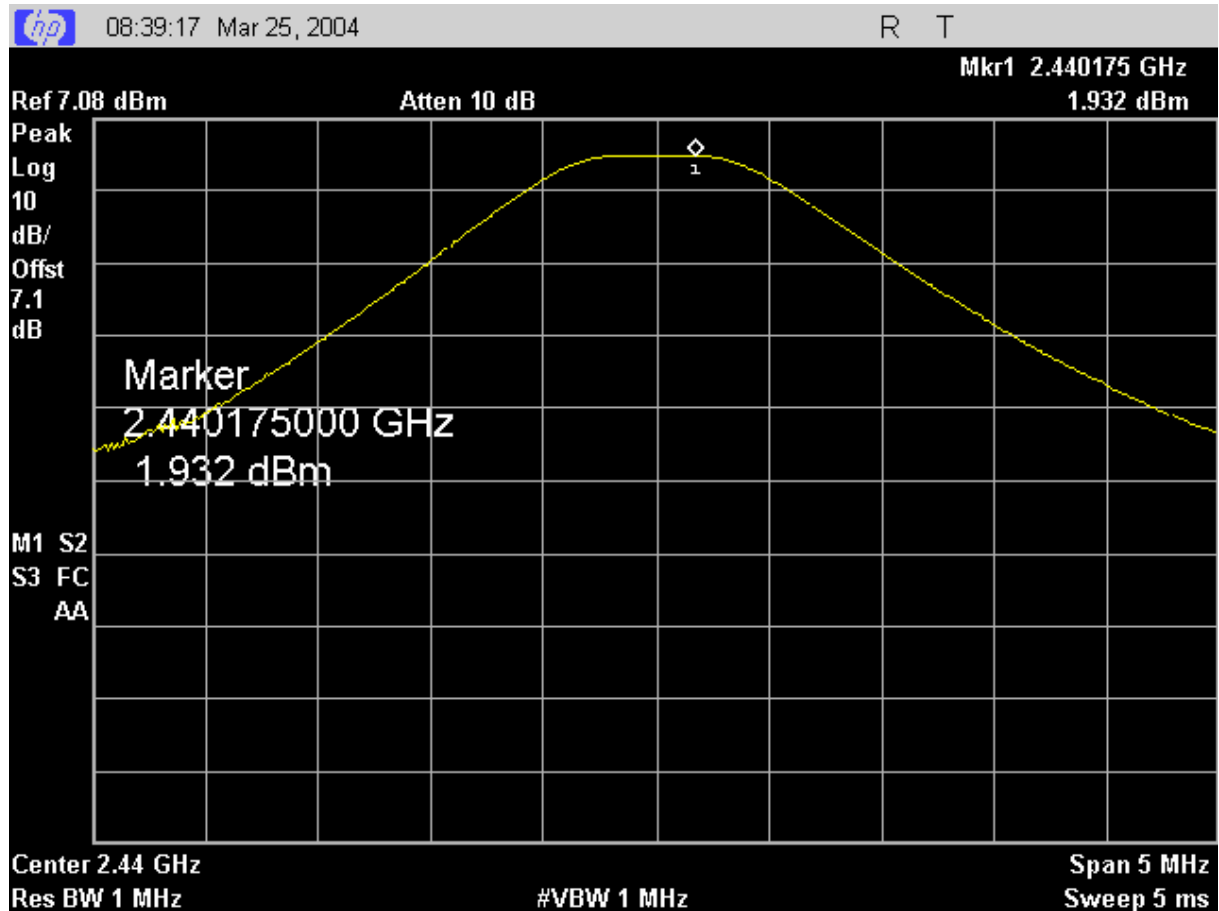
EUT channel	Measured value [dBm]	Cable loss [dB]	Divider loss [dB]	Peak output power [dBm]	Peak output power [W]
0	-4.3	1.0	6.0	2.7	.00186
38	-5.2	1.1	6.0	1.9	.00155
78	-6.8	1.1	6.0	0.3	.00107

11.5 Screen shots

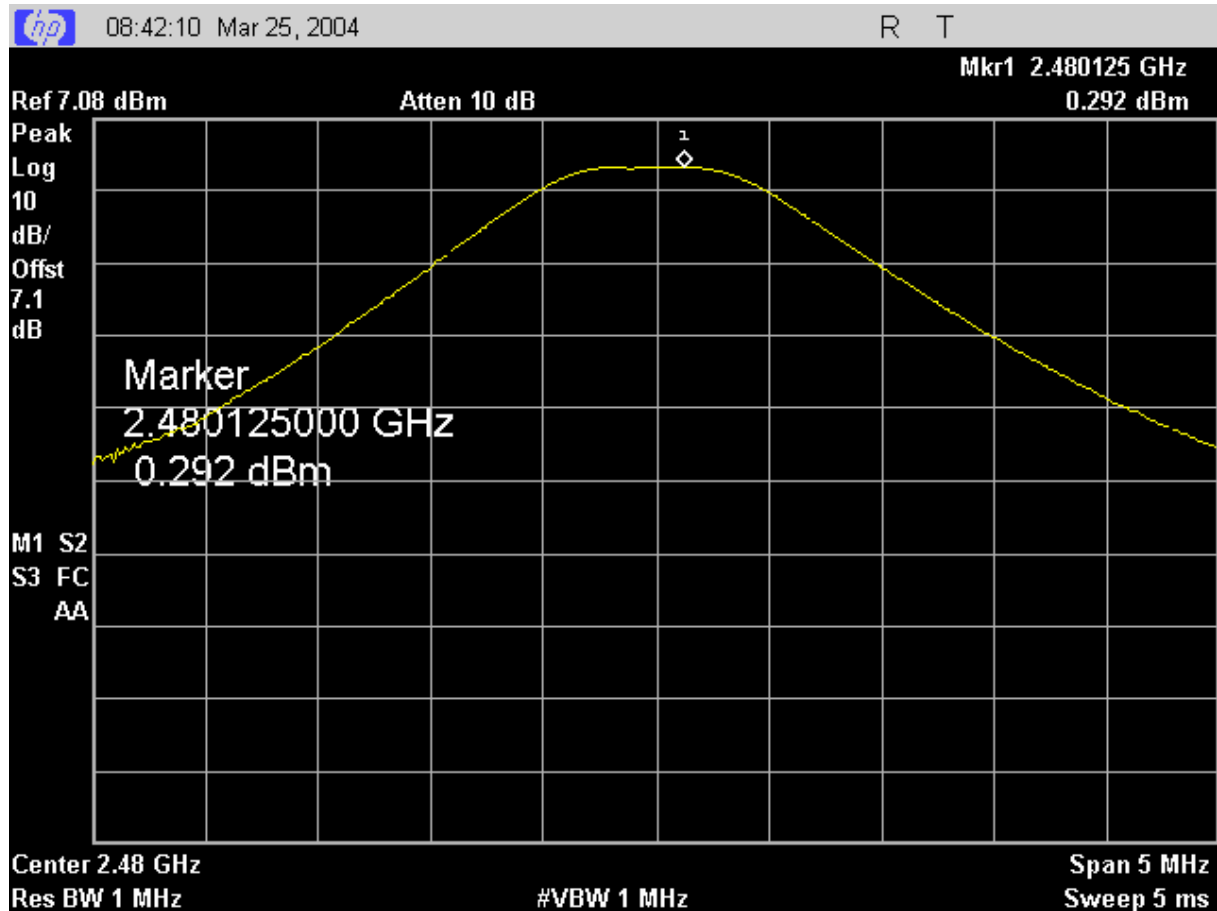
Peak output power, channel 0.



Peak output power, channel 38.



Peak output power, channel 78.



12. BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

Specification: FCC Part 15.247 (c)

12.1 Setup

Used test set-up: A (see section 6)

12.2 Test Results

Test Technician / Engineer	M. Severson, J. Torres
Date of Measurement	24-Mar-04
Temperature	22 to 26 °C
Humidity	37 to 48 %RH
Test Result	Complies with FCC Part 15.247 (c)

12.3 EUT operation mode

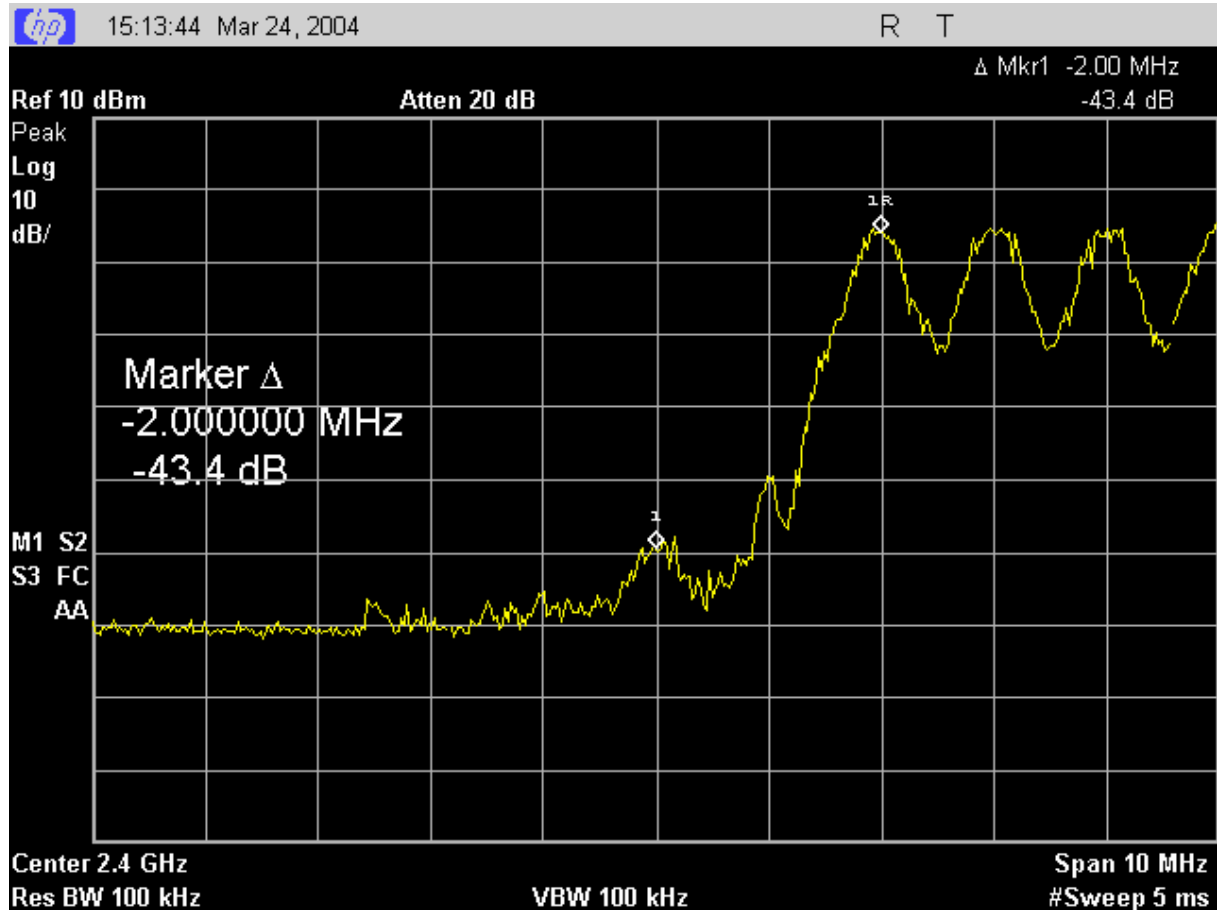
EUT operation mode	Connection, DH5, Static PRBS
EUT channel	Hopping, 0 (2402 MHz); 78 (2480 MHz)
EUT TX power level	Nominal

12.4 Pass/Fail Criteria

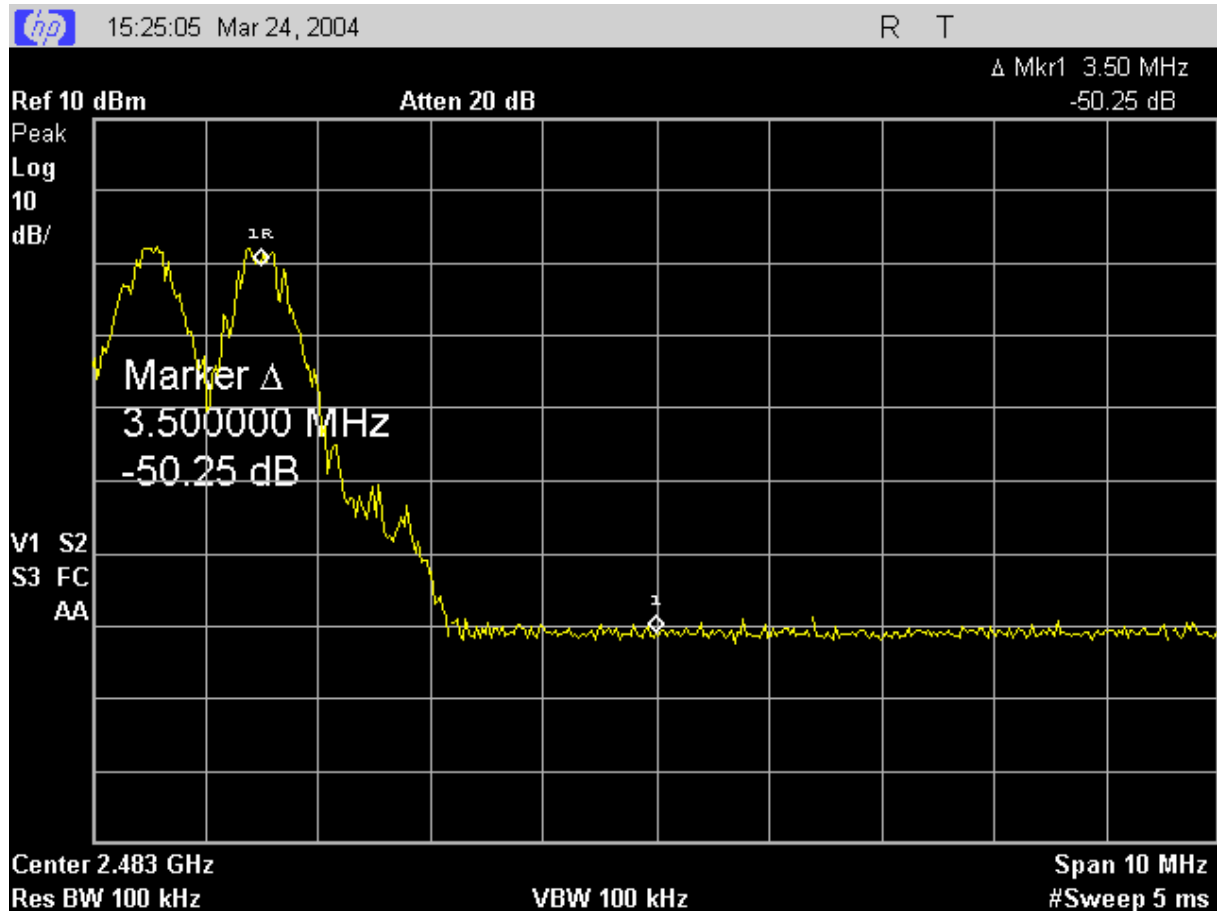
EUT channel	Limit (dBc)	Measured value (dBc)
Low End, Hopping mode	≤ -20	-43.4
High End, Hopping mode		-50.25
0		-41.95
78		-54.0

12.5 Screen shots

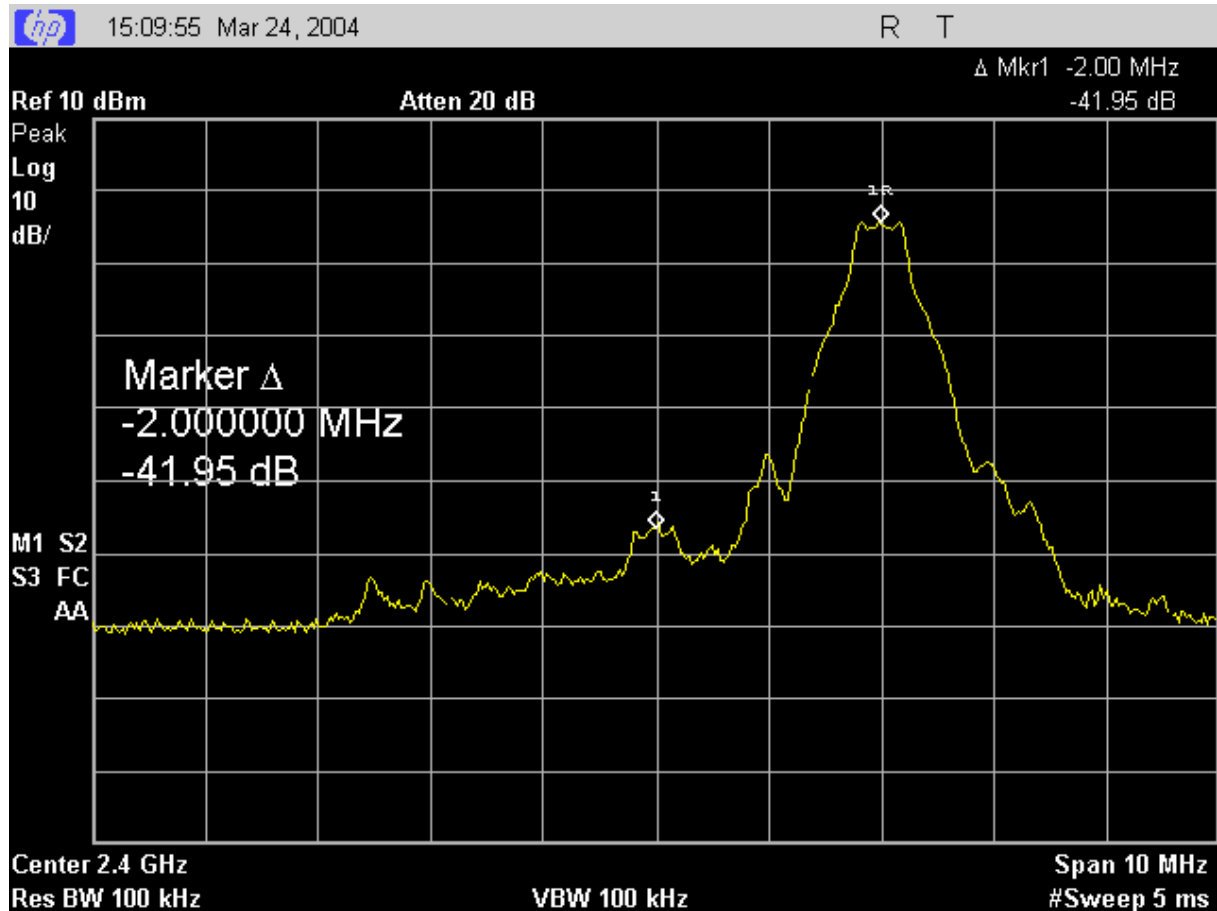
Bandedge compliance, low end, hopping mode



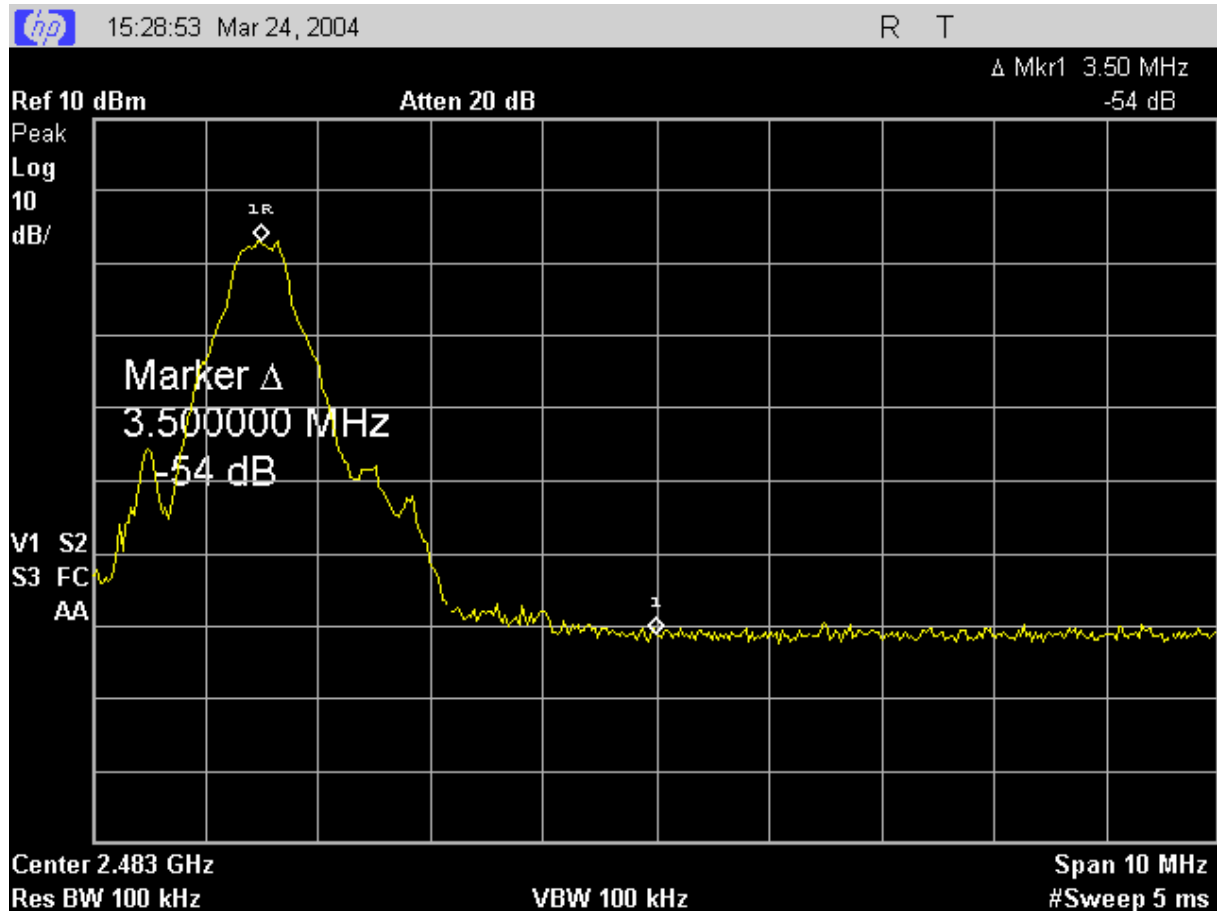
Bandedge compliance, high end, hopping mode



Bandedge compliance, low end, channel 0



Bandedge compliance, high end, channel 78



13. AC CONDUCTED EMISSIONS

Specification: FCC Part 15.207

13.1 Setup

Testing was performed in accordance with ANSI C63.4, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.



13.2 Test Results

Test Technician / Engineer	Michael Sundstrom
Date of Measurement	25 Mar 2004
Temperature	22-23 °C
Humidity	45-48 %RH
Test Result	Complies with FCC Part 15.207

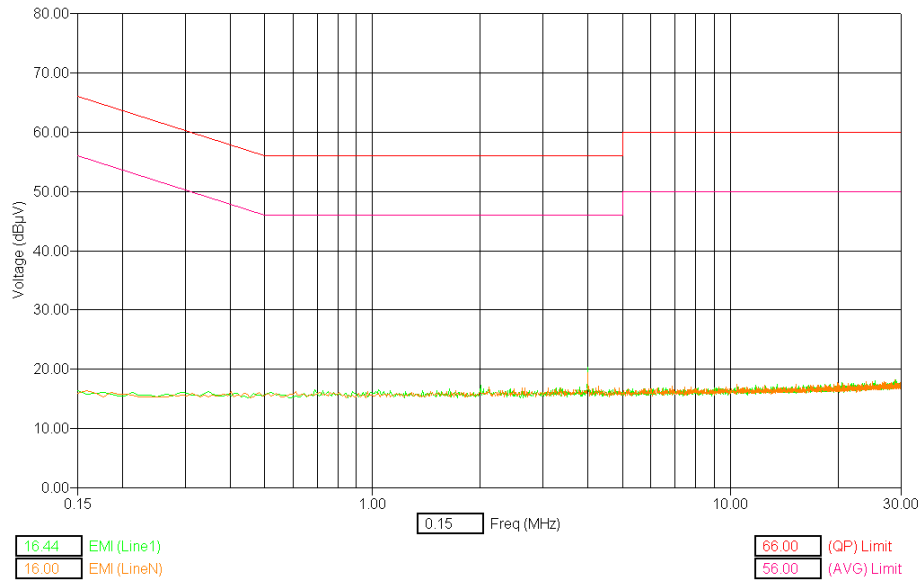
13.3 Pass/Fail Criteria

Frequency Range	AC Conducted Emission Limits (CISPR 22)	
	Quasi-peak (dBμV)	Average (dBμV)
0.15MHz - 0.5MHz	66 - 56	56 - 46
0.5MHz - 5MHz -	56	46
5MHz - 30MHz	60	50

13.4 EUT operation mode

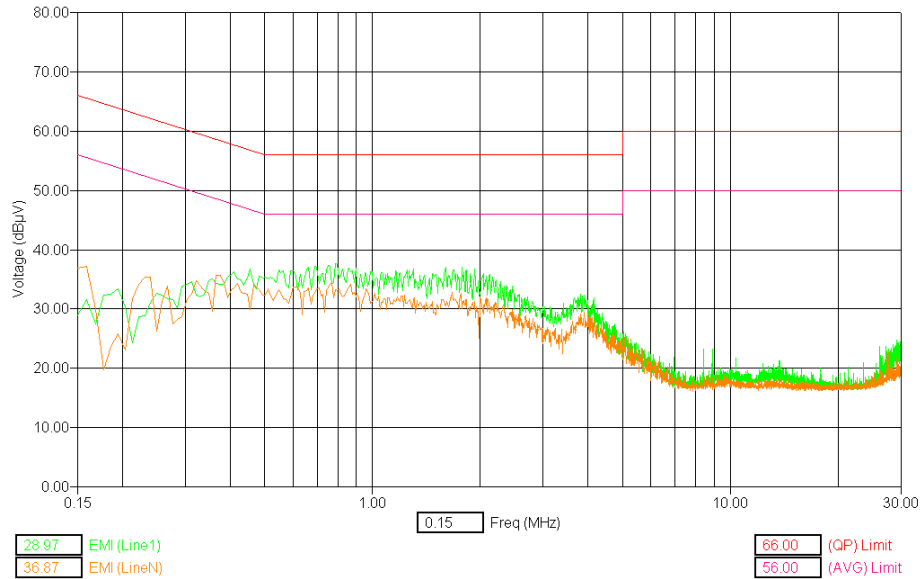
EUT operation mode	Connection, DH5, Static PRBS
EUT channel	0 (2402 MHz), 38 (2440 MHz), 78 (2480MHz)
EUT TX power level	Nominal

13.4.1 Ambient Scan



13.4.2 FCC Part 15.207

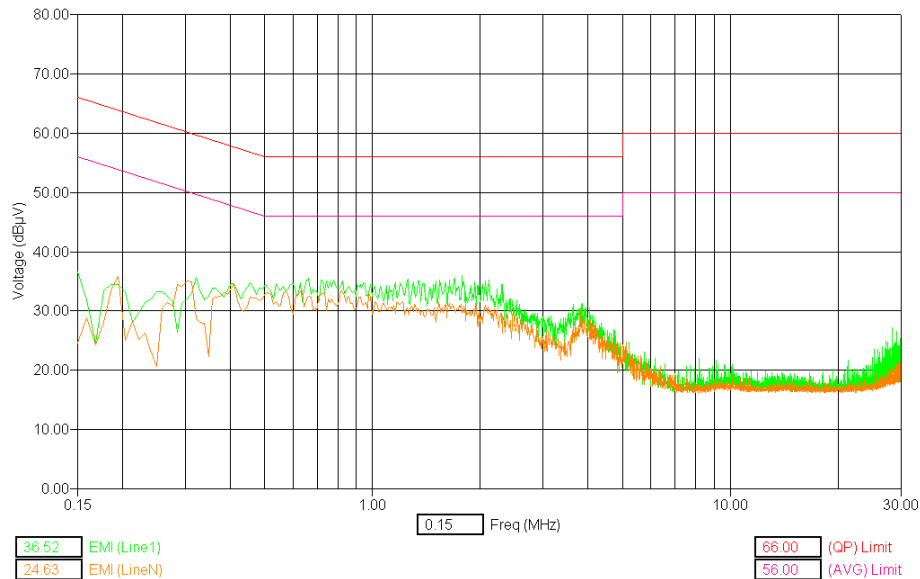
BT Paired, RH-51 with ACP-12U and HS-10:



Freq [Max] [MHz]	[AVG] Trace [dBµV]	[QP] Trace [dBµV]	Transducer [dB]	Cable [dB]	Line	[AVG] EMI [dBµV]	[QP] EMI [dBµV]	[AVG] Limit [dBµV]	[QP] Limit [dBµV]
0.16	36.37	36.64	0.05	0.02	N	36.45	36.72	55.52	65.52
0.24	20.64	28.35	0.05	0.06	N	20.75	28.46	52.10	62.10
0.38	18.47	26.17	0.05	0.07	N	18.59	26.29	48.59	58.59
0.66	20.64	27.35	0.05	0.10	L1	20.79	27.50	46.00	56.00
0.74	13.88	20.33	0.05	0.09	L1	14.02	20.47	46.00	56.00
0.80	10.89	16.19	0.05	0.10	L1	11.04	16.34	46.00	56.00

13.4.3 FCC Part 15.207

BT, Normal Hopping, RH-51 with ACP-12U and HS-10:



Freq [Max] [MHz]	[AVG] Trace [dBμV]	[QP] Trace [dBμV]	Transducer [dB]	Cable [dB]	Line	[AVG] EMI [dBμV]	[QP] EMI [dBμV]	[AVG] Limit [dBμV]	[QP] Limit [dBμV]
0.20	12.31	23.82	0.05	0.07	L1	12.43	23.94	53.82	63.82
0.21	12.85	27.05	0.05	0.07	N	12.97	27.17	53.82	63.82
0.30	11.60	21.50	0.05	0.07	N	11.71	21.61	50.16	60.16
0.33	29.07	33.85	0.05	0.06	L1	29.18	33.96	49.68	59.68
0.41	16.20	19.68	0.05	0.09	N	16.34	19.82	47.63	57.63
0.65	11.14	19.52	0.05	0.11	L1	11.30	19.68	46.00	56.00

13.5 Measurement Uncertainty

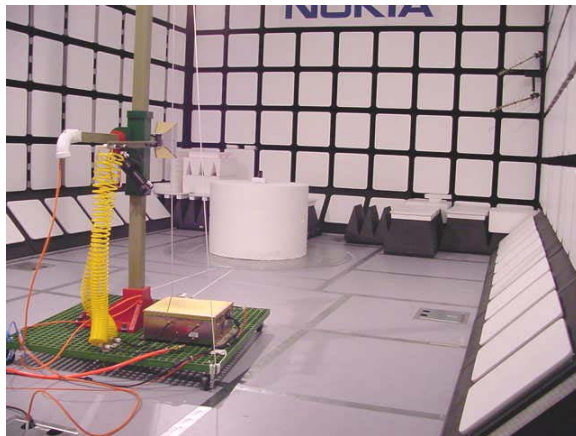
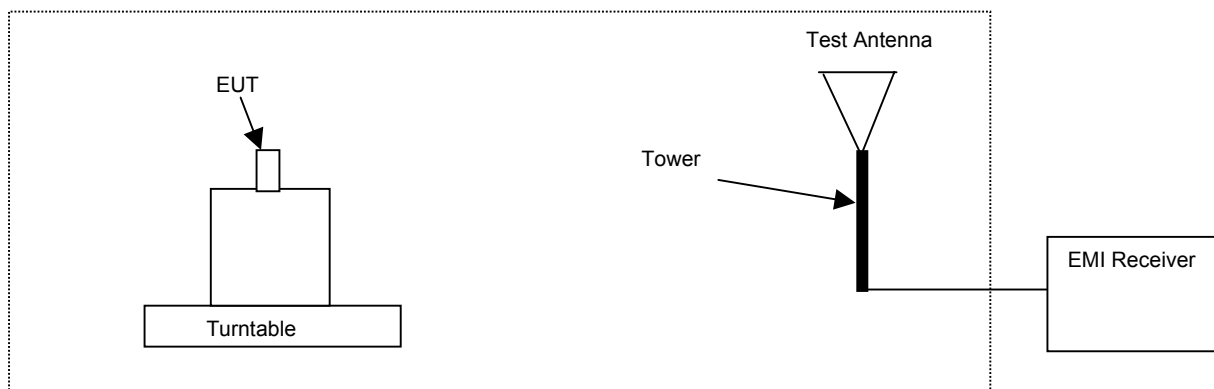
The measurement uncertainty for this test is +/- 2.7dB.

14. RADIATED EMISSIONS

Specification: FCC Part 15.247 (c)

14.1 Setup

Testing was performed in accordance with ANSI C63.4, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.



14.2 Test Results BT idle

Test Technician / Engineer	Chi Nguyen/ Jesse Torres
Date of Measurement	31-Mar-04
Temperature	21 to 25 °C
Humidity	32 to 39 %RH
Test Result	Complies with FCC Part 15.209

14.2.1 EUT operation mode

EUT operation mode	Connection, DH5, Static PRBS
EUT channel	Idle
EUT TX power level	Nominal

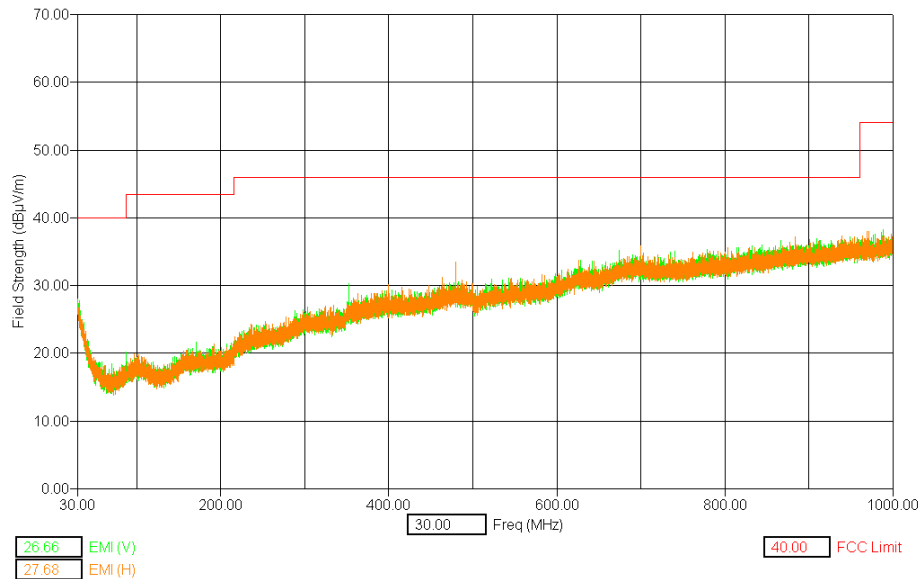
14.2.2 Pass/Fail Criteria

Band	Frequency Range (MHz)	FCC Class B Limit (dBμV/m at 3m)	Detector
BT	30 – 88	40	QP
BT	88 – 216	43.5	QP
BT	216 – 960	46	QP
BT	960 – 1000	54	QP
BT	> 1000	74.0/ 54.0	PK/ AV

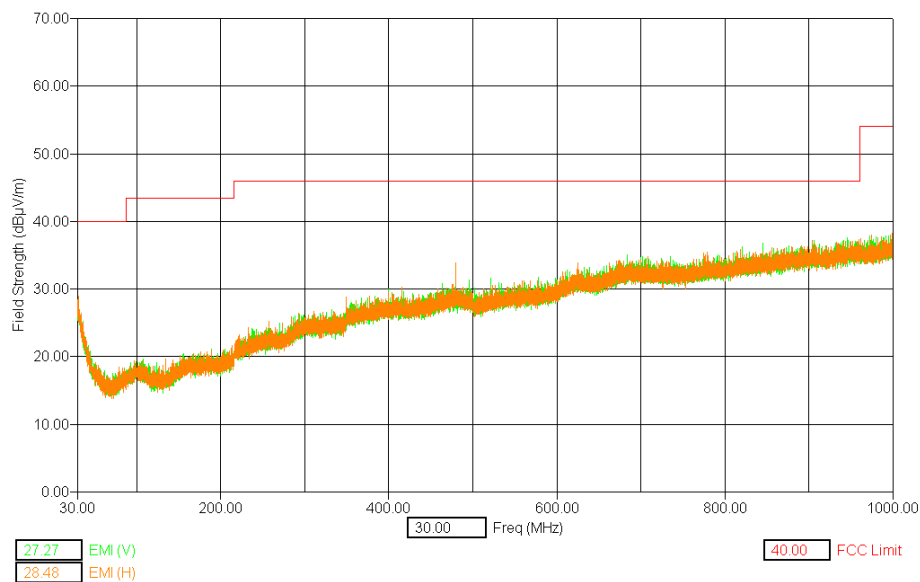
14.2.3 Results

BT, RH-51

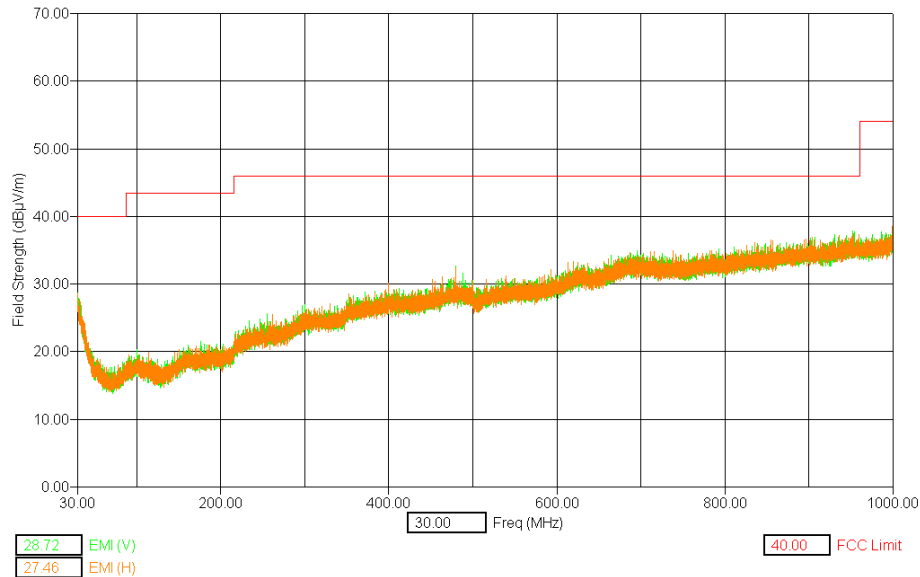
Channel 0 from 30MHz to 1GHz



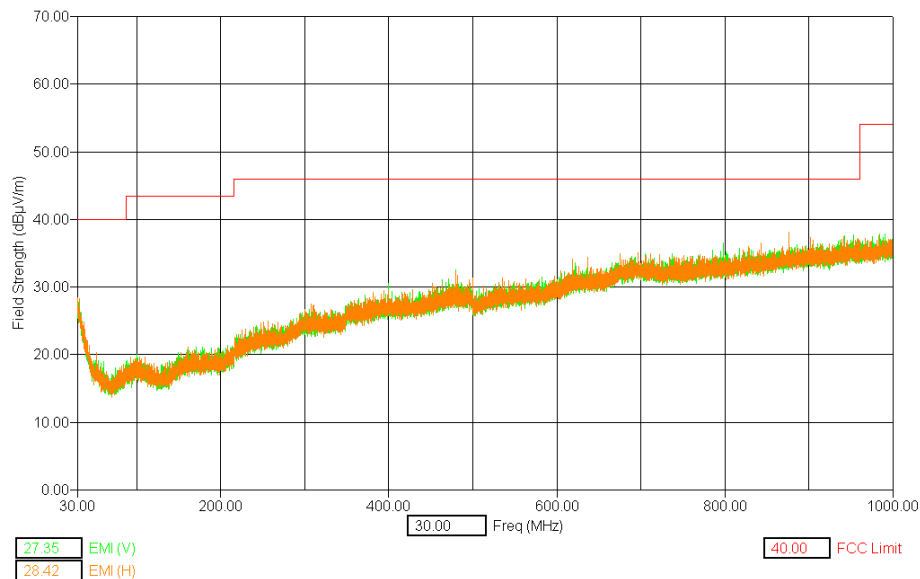
Channel 38 from 30MHz to 1GHz



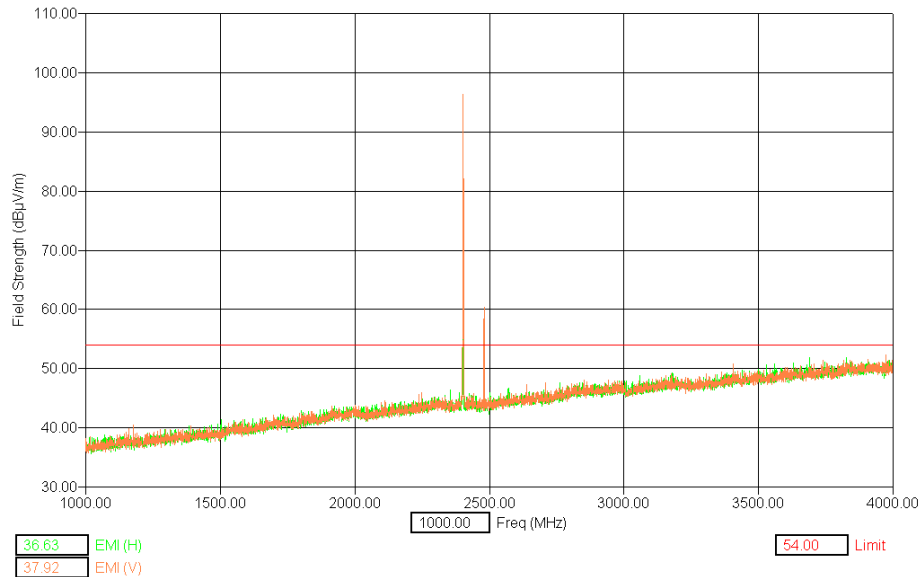
Channel 78 from 30MHz to 1GHz



Hop Channel 78 from 30MHz to 1GHz

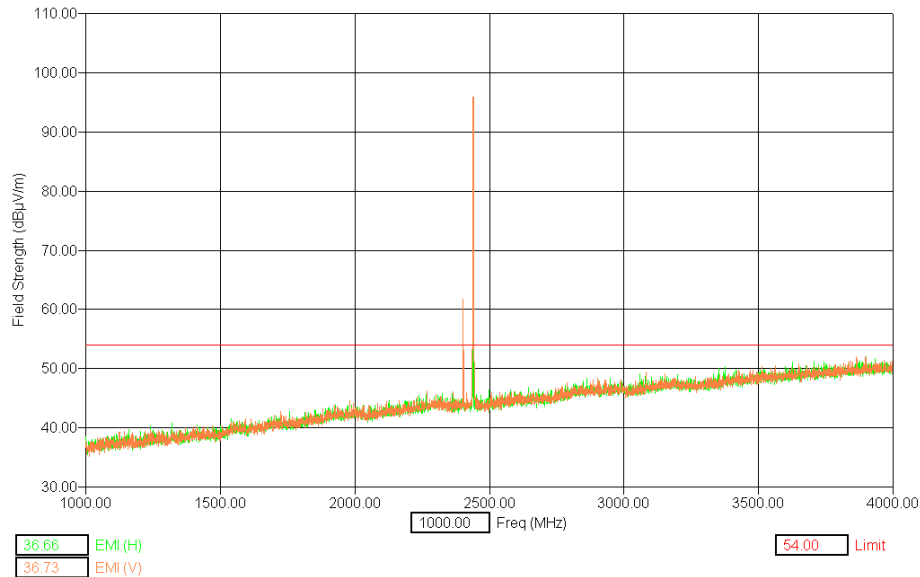


Channel 0 from 1GHz to 4GHz



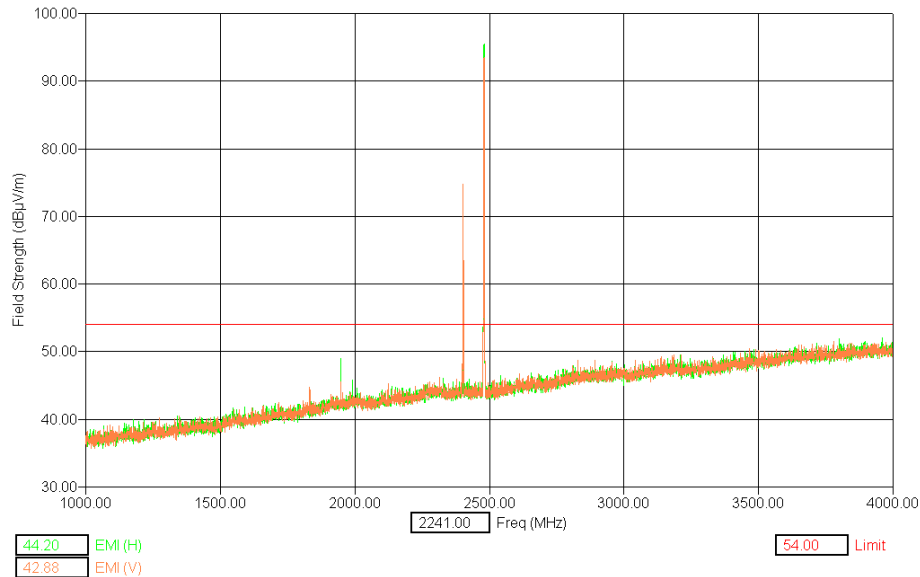
2402MHz = BT Carrier
2480MHz = Communication Tester

Channel 38 from 1GHz to 4GHz



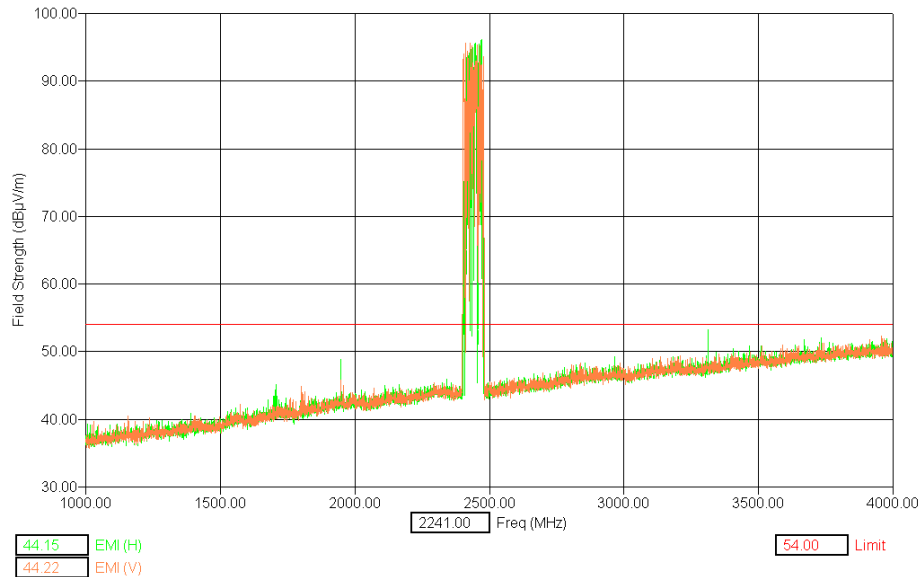
2402MHz = Communication Tester
2440MHz = BT Carrier

Channel 78 from 1GHz to 4GHz



1948MHz = Communication Tester GSM Control Channel
2402MHz = Communication Tester
2480MHz = BT Carrier

Hop Channel 78 from 1GHz to 4GHz



1948MHz = Communication Tester GSM Control Channel
2402-2480MHz = BT Carrier

Freq [GHz]	U _{RX} [dBuV]	A _{CABLE} [dB]	AF [1/m]	G _{PREAMP} [dB]	C _{DISTANCE} [dB]	E [dBuV/]	E [uV/m]	Limit [uV/m]
Harmonics								
3.312500	13.57	6.76	32.96	0.00	0.00	53.29	461.85	500

14.2.4 Emission measurement data, 1GHz - 18GHz

The measurement results were obtained as described below.

$$E[uV/m] = U_{RX} + A_{CABLE} + AF - G_{PREAMP} - C_{DISTANCE}$$

Where

U_{RX} receiver reading

A_{CABLE} Attenuation of the cable

AF Antenna factor

G_{PREAMP} Gain of the preamplifier

$C_{DISTANCE}$ Conversion factor from 3m to 1m measurement distance

Freq [GHz]	U_{RX} [dBuV]	A_{CABLE} [dB]	AF [1/m]	G_{PREAMP} [dB]	$C_{DISTANCE}$ [dB]	E [dBuV/]	E [uV/m]	Limit [uV/m]
Harmonics								
7.880000	46.57	1.90	37.40	28.60	9.54	47.73	243.50	500
Fundamental								
2.402000	57.59	5.77	30.24	0.00	0.00	93.60	47863.01	
2.440000	59.77	5.83	30.30	0.00	0.00	95.90	62373.48	
2.480000	59.17	5.86	30.37	0.00	0.00	95.40	58884.37	

No emissions detected in restricted bands.

14.2.5 Measurement Uncertainty

The measurement uncertainty for this test is +/- 5.2dB for 30-300MHz; +/- 5.2dB for 300-1000MHz and +/- 5.6dB for 1-4GHz.

15. SPURIOUS RF CONDUCTED EMISSIONS

Specification: FCC Part 15.247 (c)

15.1 Setup

Used test set-up: A (see section 6)

15.2 Test Results

Test Technician / Engineer	Michael Sundstrom
Date of Measurement	26, 29 March 2004
Temperature	23-24 °C
Humidity	41-47 %RH
Test Result	Complies with FCC Part 15.247(c)

15.3 EUT operation mode

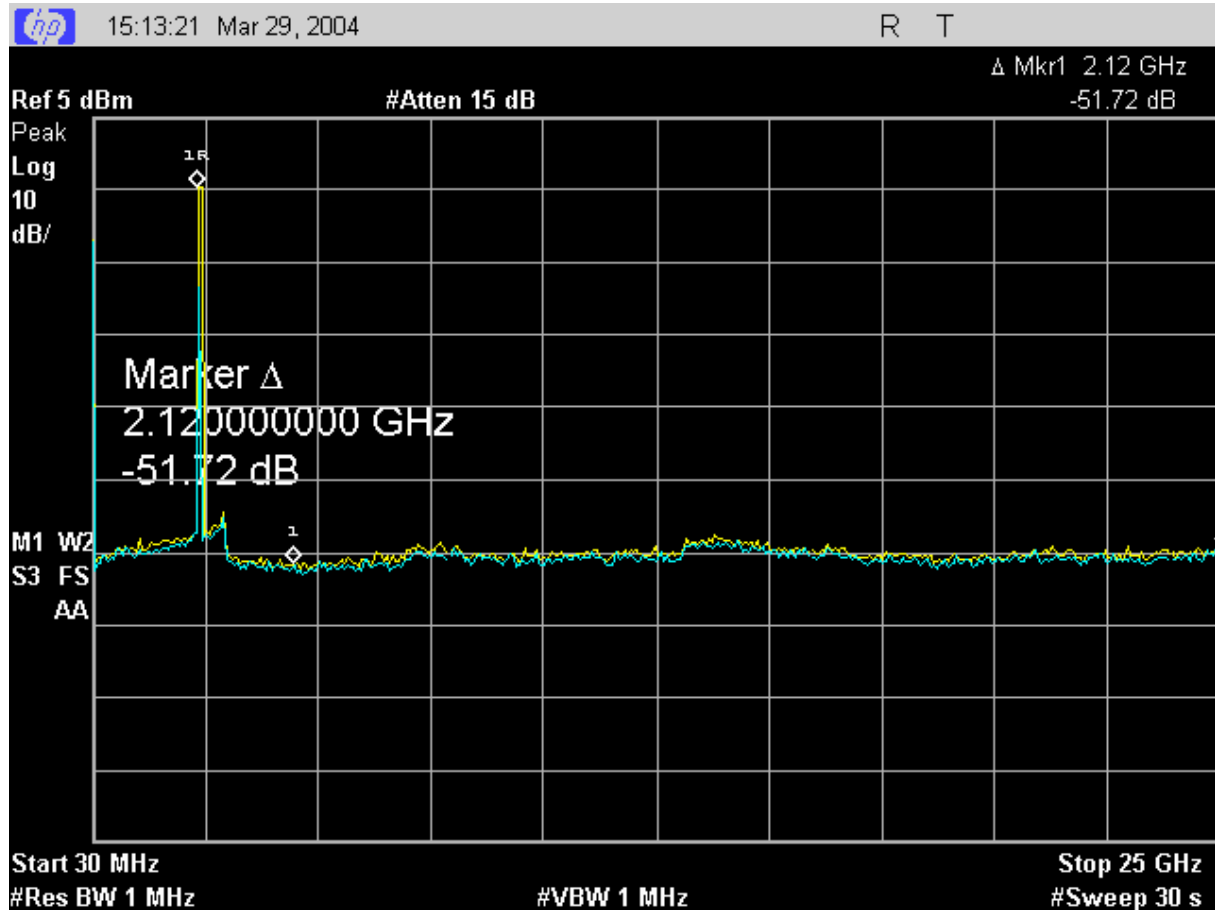
EUT operation mode	Connection, DH5, Static PRBS
EUT channel	0 (2402 MHz); 38 (2440 MHz); 78 (2480 MHz)
EUT TX power level	Nominal

15.4 Pass/Fail Criteria

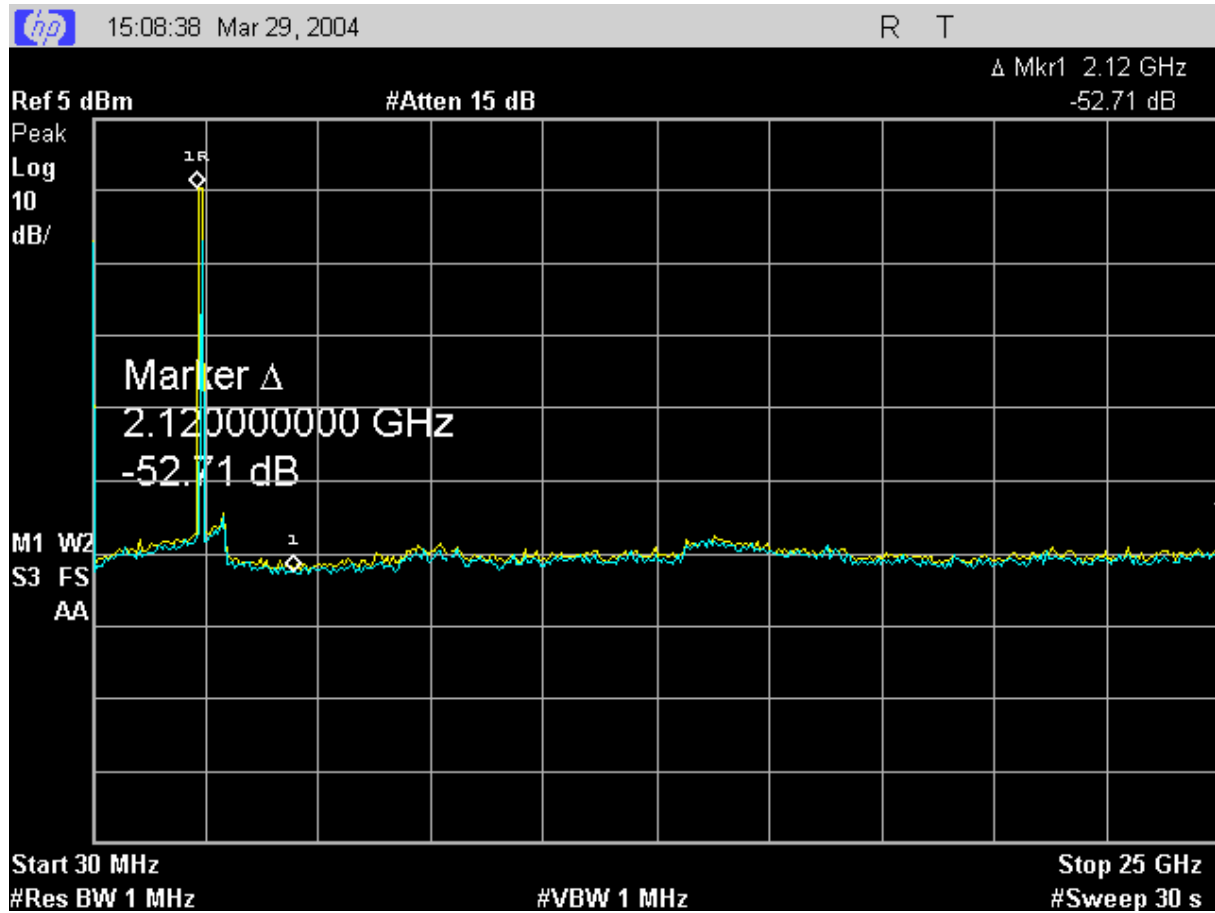
EUT channel	Limit (dBc)	Measured value (dBc)
0	≤ -20	-51.7
38		-52.7
78		-52.7

15.5 Screen shots

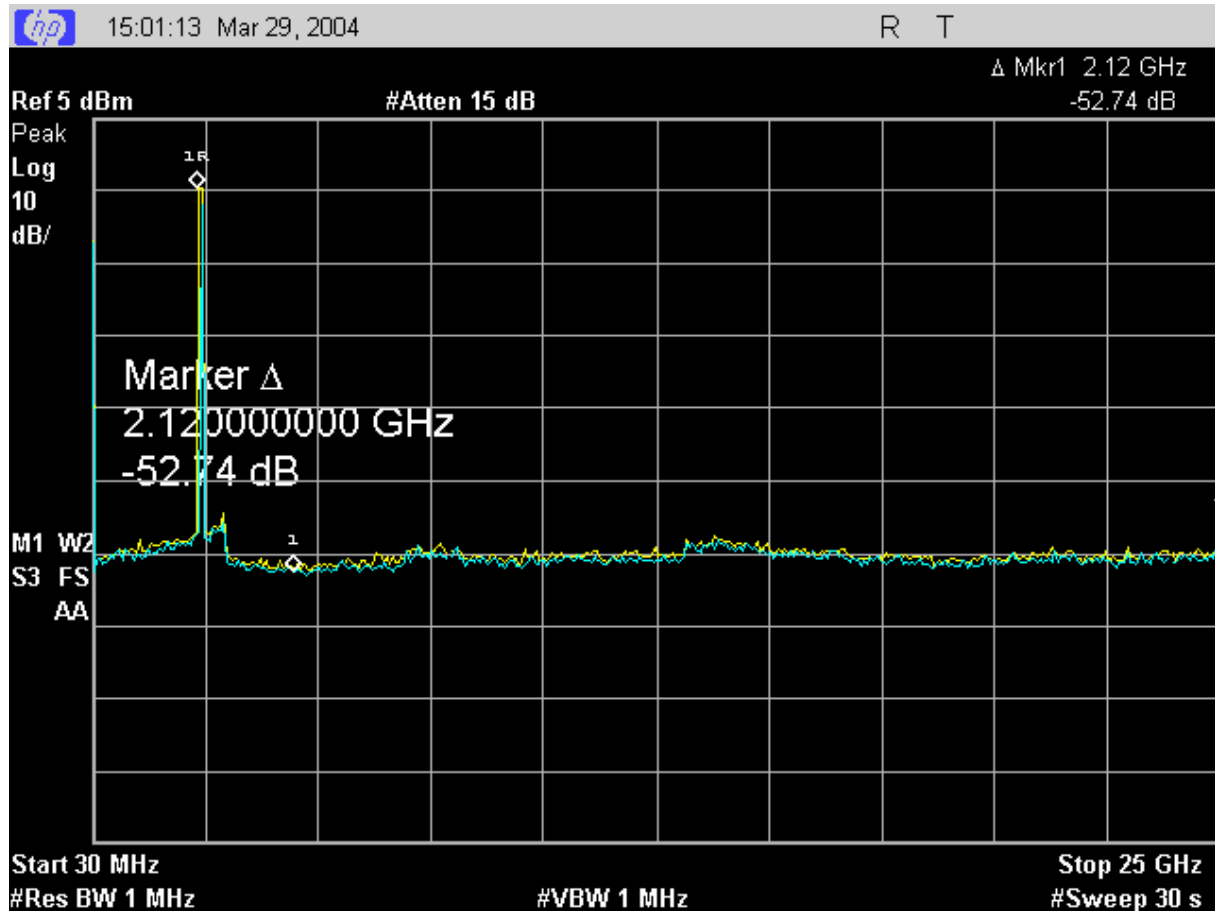
Spurious RF conducted emissions, TX on channel 0



Spurious RF conducted emissions, TX on channel 38



Spurious RF conducted emissions, TX on channel 78



15.6 Measurement Uncertainty

The measurement uncertainty for this test is +/- 3.7dB for 100kHz - 1000MHz and +/- 5.3dB for 1 - 20GHz.