Israel Testing Laboratories

ACCREDITED
Cert. No. 1152.01
Electrical (EMC)

DATE: 20 October 2005

I.T.L. (PRODUCT TESTING) LTD.

EMC/Radio Test

for

MTeye Security Ltd.

Equipment under test:

Bluetooth Communication Module

MT-SiW35-SiGeL-001*

* See customer's declaration on page 7.

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
E. Pitt, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

Cert. No. 1152.01
Electrical (EMC)

Measurement/Technical Report for

MTeye Security Ltd.

Bluetooth Communication Module

MT-SiW35-SiGeL-001

FCC ID: S37-SIW35-SIGL-01

20 October 2005

This report concerns: Original Grant X Class II change

Class B verification X Class A verification_____Class I change

Equipment type: Part 15 Spread Spectrum Transmitter

Request Issue of Grant:

x Immediately upon completion of review

Limits used:

CISPR 22 _____ Part 15 x

Note: This report concerns a transmitter module per FCC DA-1407 Compliance Document.

Measurement procedure used is ANSI C63.4-2003.

Application for Certification prepared by:

Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel

e-mail Sraz@itl.co.il

Applicant for this device: (different from "prepared by")

Eli Rebayeve
Mteye Security Ltd.
11 Hamelacha St.
Afek Industrial Park
Rosh Ha'ayin 48091
Israel

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e-mail: Eli_r@mti-group.co.il

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1. General Information

1.1 Administrative Information

Manufacturer:	MTeye Security Ltd.
Manufacturer's Address:	11 Hamelacha St. Afek Industrial Park Rosh Ha'ayin 48091 Israel Tel: +972-3-902-5555 Fax: +972-3-902-5556
Manufacturer's Representative:	Eli Rebayeve Shmulik Aviv
Equipment Under Test (E.U.T):	Bluetooth Communication Module
Equipment Model No.:	MT-SiW35-SiGeL-001 (See customer's declaration on following page).
Equipment Serial No.:	MTeyeBT100
Date of Receipt of E.U.T:	27.02.05
Start of Test:	27.02.05
End of Test:	01.03.05
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Sub-parts B, C

MTeye Security LTD

DATE: 09/10/05

DECLARATION

I HEREBY DECLARE THAT THE FOLLOWING PRODUCT

MT-SIW35-SiGeL-001

IS RESPECTIVELY IDENTICAL ELECTRONICALLY, PHYSICALLY, AND MECHANICALLY TO:

BLUETOOTH MODULE

Please relate to them all (from an EMC point of view) as the same product.

Thank you,

Eli Rebayeve

Eli Rebayeve

Product Engineer
E-MAIL: Eli_r@mti-group.co.il

11 Hamelacha St. Afek Industrial Park
Rosh Ha'ayin 48091
ISRAEL

Tel: +972-3-9025555
Fax: +972-3-9025556

Web Site: www.mti-group.co.il

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The E.U.T. in this Report , is RF system on chip that combines a 2.4GHz transceiver, transmits and receives radio signals through a simple matching network directly to an antenna.

The EUT is short –range radio technology and makes it possible to transmit signals over short distances delivers the ultimate synchronicity between devices.

It combines most highly integrated hardware, software and radio.

The EUT is Radio Process and most recent innovation for Bluetooth ™ @ Wireless technology fast acknowledgment and Frequency –Hopping Spread Spectrum (FHSS) makes the link robust, even in noisy radio environments.

The EUT offers combination of compact size, low power consumptions and cost effective assembly, operating from 1.8V or 3.3V for internal analog and digital circuits.

Carrier Frequency =2402 to 2480 MHz (ISM radio band) f = 2402 + k MHz, K = 0, 1, 2..., 78
Modulation : 0.5 BT Gaussian-filtered 2FSK at 1 Msymbol/s Digital FM

The peak frequency deviation is 175 kHz

The channel hopping sequence is designed to visit each 1MHz channels spacing frequency regularly. In normal operation there are 1600 hops/s.

The EUT compliance testing is shielded, as normally supplied by MTeye Security Ltd.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing December 12, 2003).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. Product Labeling

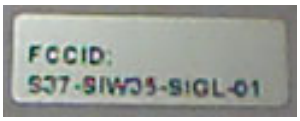


Figure 1. Product/FCC Label

Figure 2. Location of Label on EUT

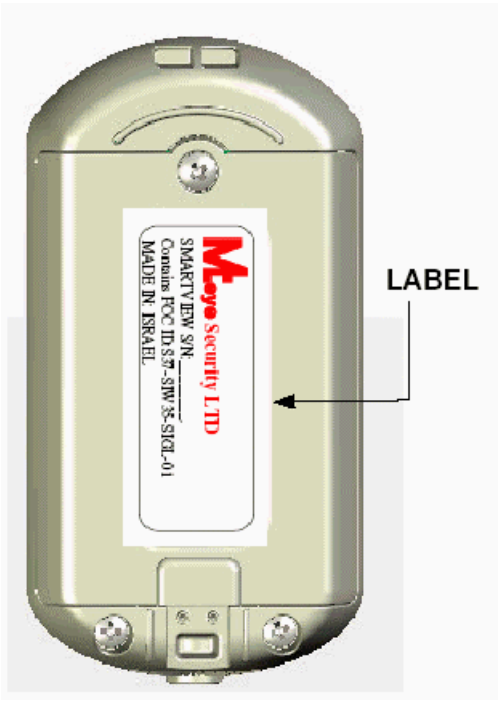


Figure 3. Location of Label on Unit Into Which Module is Installed

3. System Test Configuration

3.1 Justification

The EUT was configured for testing in typical fashion as customer normally use it. The E.U.T. was tested in vertical position as the units in which the module is installed are wall-mounted in the vertical position.

3.2 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components . The software ,(Bluetooth Development System -WDS Commander) contained on a separated disc, and is auto starting on power up.

3.3 Special Accessories

N/A

3.4 Equipment Modifications

N/A

3.5 Configuration of Tested System

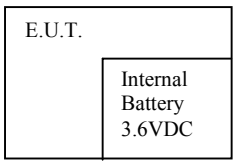
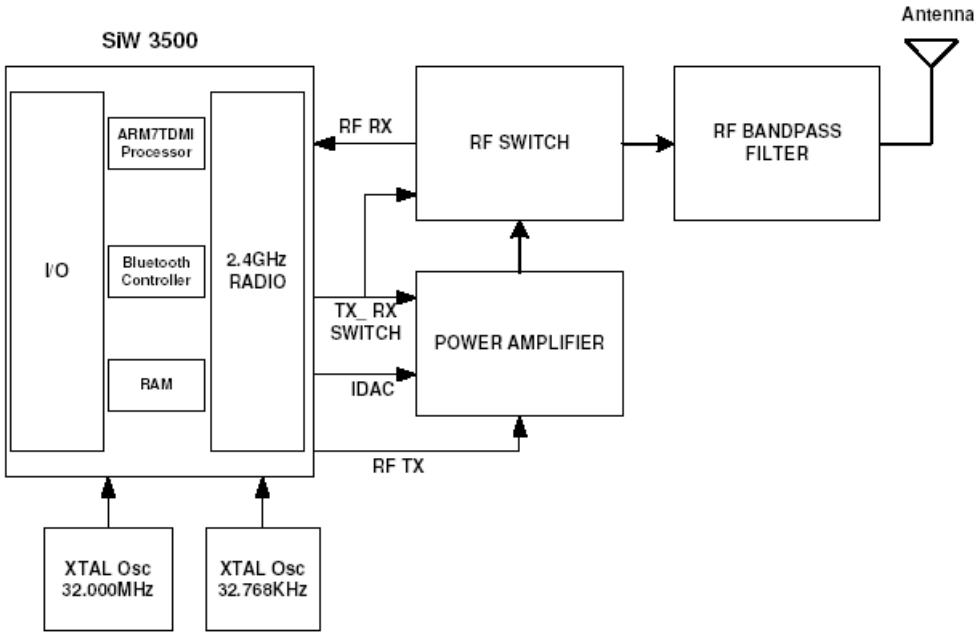


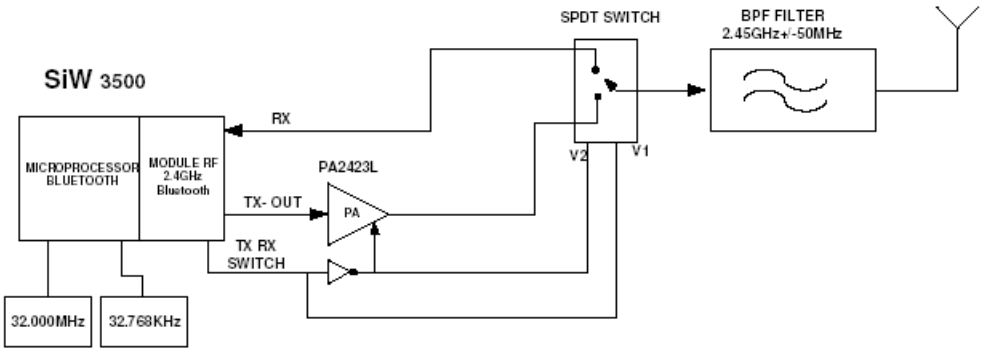
Figure 4. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram



4.2 Theory of Operation



Single –chip IC for Bluetooth wireless technology on chip protocol stack software. The input port [RX] is the normal mode the IC operation and waiting to get order from the master.

The chin of the RF is including the PA, RF switch, BPF and logic gate to controlled the RX and TX by the order from the IC core.

5. Customer's Declaration

MTeye Security LTD

DATE: 11/10/05

DECLARATION

To Whom It May Concern,

I hereby declare that the product, **Module, M/N MT-SiW35-SiGel-001, S/N MTeyeBT100** complies with the following requirements of Part 15, Sub-part C, Section 15.247:

1. Receiver B.W. matching to transmitter B.W., Section 15.247 (a) (1).
2. Non-coordination requirement, Section 15.247 (a) (h).

The Duty cycle is: T_{on} = 375 microseconds
T_{off} = 375 microseconds

Thank you,

Kobi Bentkovski

Director R&D
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Rosh Ha'ayin 48091
ISRAEL

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Web Site: www.mti-group.co.il

6. Conducted and Radiated Measurement Photos

Figure 5. Conducted Emission on Antenna Port Tests.

Figure 6. Radiated Emission Test.

7. Spurious Radiated Emission, Below 1 GHz

7.1 Test Specification

9kHz-1000 MHz, FCC, Part 15, Subpart C

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane. The configuration tested is shown in Figure 3.1.

The frequency range 9kHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.
In the frequency range 30-1000MHz, the readings were maximized by adjusting the antenna height between 1-4 meters. The turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The E.U.T. was operated at the frequencies of 2402.00, 2441.00, and 2480.00 MHz

7.3 Measured Data

The signals in the band 9 kHz – 1.0 GHz were below the spectrum analyzer noise level which is at least 20dB below the specification limit.

The results for all three operating frequencies were the same.

TEST PERSONNEL:

Tester Signature:  Date: 16.10.05

Typed/Printed Name: E. Pitt

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	February 26, 2005	1 year
RF Section	HP	85420E	3427A00103	February 26, 2005	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 14, 2005	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	October 20, 2004	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 10, 2004	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A

7.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dBµv/m]
RA:	Receiver Amplitude [dBµv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

8. Spurious Radiated Emission Above 1 GHz

8.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane . The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.
In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used. The test distance was 3 meters.
In the frequency range 2.9-25 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was operated in continuous mode.

8.2 Test Data

JUDGEMENT: Passed by 3.3 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification. The worst cases were:

for 2402.00 MHz, 8.6 dB margin at 48.4.00 MHz frequency, horizontal polarization.

for 2441.00 MHz, 4.4 dB margin at 7323.00 MHz frequency, vertical polarization

for 2480.00 MHz, 3.3 dB margin at 7440.00 MHz frequency, vertical polarization

The details of the highest emissions are given in Figure 7 to Figure 18.

TEST PERSONNEL:

Tester Signature: _____ Date: 16.10.05

Typed/Printed Name: E. Pitt

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operating Frequency: 2402.00 MHz

Freq.	Peak Result	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB µV/m)	(dB)
4804.00	65.4*	74.0	-8.6

Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2402.00 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Result	Average Specification	Avg. Margin
(MHz)	(dBμV/m)	(dB μV/m)	(dB)
4804.00	45.1*	54.0	-8.9

Figure 8. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{50}{100} = -6dB$

The maximum transmission "ON" time is 50 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operating Frequency: 2402.00 MHz

Freq.	Peak Result	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB µV/m)	(dB)
4804.00	64.7*	74.0	-9.3

Figure 9. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2402.00 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Result	Average Specification	Avg. Margin
(MHz)	(dBμV/m)	(dB μV/m)	(dB)
4804.00	42.6*	54.0	-11.4

Figure 10. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{50}{100} = -6dB$

The maximum transmission "ON" time is 50 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operating Frequency: 2441.00 MHz

Freq. (MHz)	Peak Result (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
4882.00	66.5*	74.0	-7.5
7323.00	63.5*	74.0	-10.5

Figure 11. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average
Operating Frequency: 2441.00 MHz

Freq.	Average Result	Average Specification	Avg. Margin
(MHz)	(dBμV/m)	(dB μV/m)	(dB)
4882.00	45.6*	54.0	-8.4
7323.00	48.3*	54.0	-5.7

Figure 12. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{50}{100} = -6dB$

The maximum transmission "ON" time is 50 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operating Frequency: 2441.00 MHz

Freq.	Peak Result	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB µV/m)	(dB)
4882.00	62.1*	74.0	-11.9
7323.00	66.3*	74.0	-7.7

Figure 13. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2441.00 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq. (MHz)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Avg. Margin (dB)
4882.00	43.7*	54.0	-10.3
7323.00	49.6*	54.0	-4.4

Figure 14. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{50}{100} = -6dB$

The maximum transmission "ON" time is 50 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operating Frequency: 2480.00 MHz

Freq. (MHz)	Peak Result (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
4960.00	69.7*	74.0	-4.3
7440.00	61.7*	74.0	-12.3

Figure 15. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2480.00 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Result	Average Specification	Avg. Margin
(MHz)	(dBμV/m)	(dB μV/m)	(dB)
4960.00	46.7*	54.0	-7.3
7440.00	47.4*	54.0	-6.6

Figure 16. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{50}{100} = -6dB$

The maximum transmission "ON" time is 50 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak
Operating Frequency: 2480.00 MHz

Freq. (MHz)	Peak Result (dBμV/m)	Peak. Specification (dB μV/m)	Peak. Margin (dB)
4960.00	64.0*	74.0	-10.0
7440.00	68.3*	74.0	-5.7

Figure 17. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

Radiated Emission Above 1 GHz

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2480.00 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Result	Average Specification	Avg. Margin
(MHz)	(dBμV/m)	(dB μV/m)	(dB)
4960.00	45.3*	54.0	-8.7
7440.00	50.7*	54.0	-3.3

Figure 18. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{50}{100} = -6dB$

The maximum transmission "ON" time is 50 msec. within a 100 msec. window.

8.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	February 26, 2005	1 year
RF Section	HP	85420E	3427A00103	February 26, 2005	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 24, 2005	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 17, 2004	2 year
Horn Antenna	ARA	SWH-28	1007	October 28, 2003	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	October 17, 2004	1 year
Low Noise Amplifier	Sophia Wireless	LNA-28-B	0232	February 18, 2004	1 year
Spectrum Analyzer	HP	8592L	3926A01204	February 01, 2005	1 year
Band Pass Filter	Planar Filter Company	8CL6G-4G-CD-SFF	PF253/0439	September 9, 2004	1 year

9. Number of Hopping Frequencies and Average Time of Occupancy on Any channel

9.1 Test procedure

The E.U.T. was set to hopping mode.
The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=24dB (3 × 8dB) and an appropriate coaxial cable = 0.9 dB.
The spectrum analyzer was set to the following parameters:

Span: Every 10 MHz Frequency
Band of Operation: 2402-2480 MHz
RBW: 100kHz
VBW: 100kHz
Detector Function: Peak
Trace: Maximum Hold

The number of hopping frequencies is 9+10+10+10+10+10+10+10=79 (See plots).

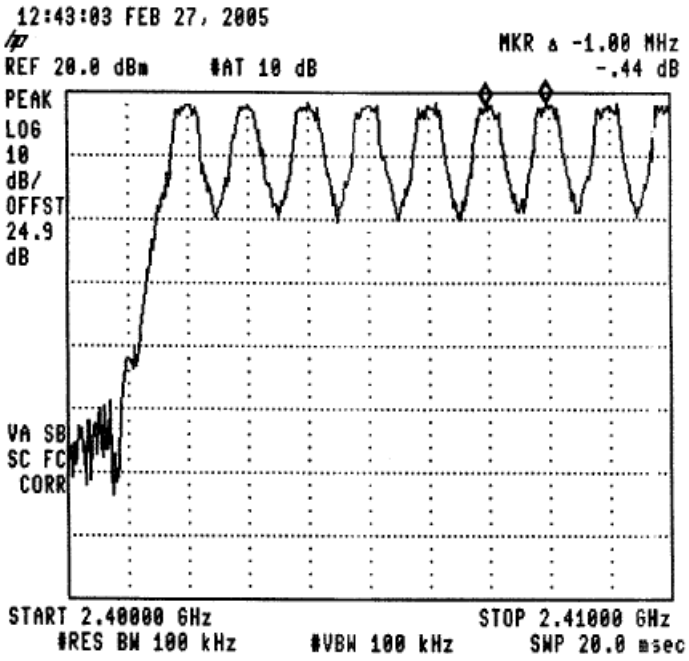

Figure 19.— 2400.0-2410.0 MHz

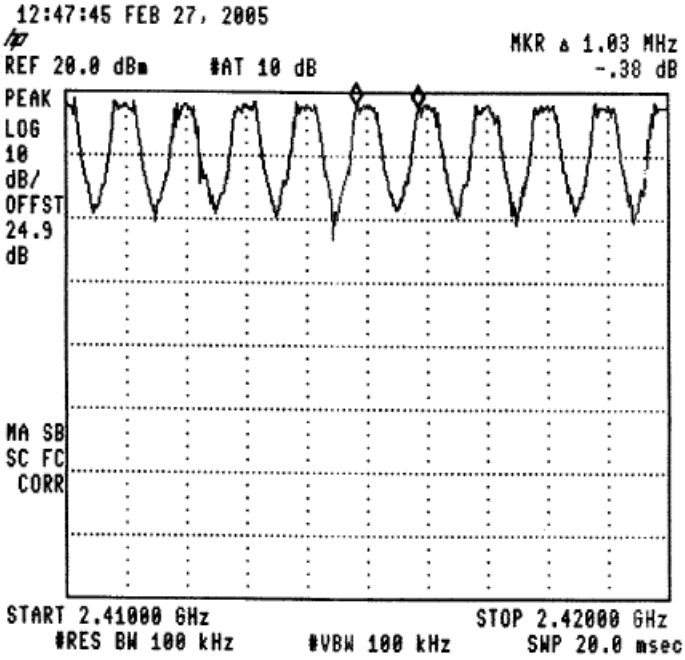

Figure 20.— 2410.0-2420.0 MHz

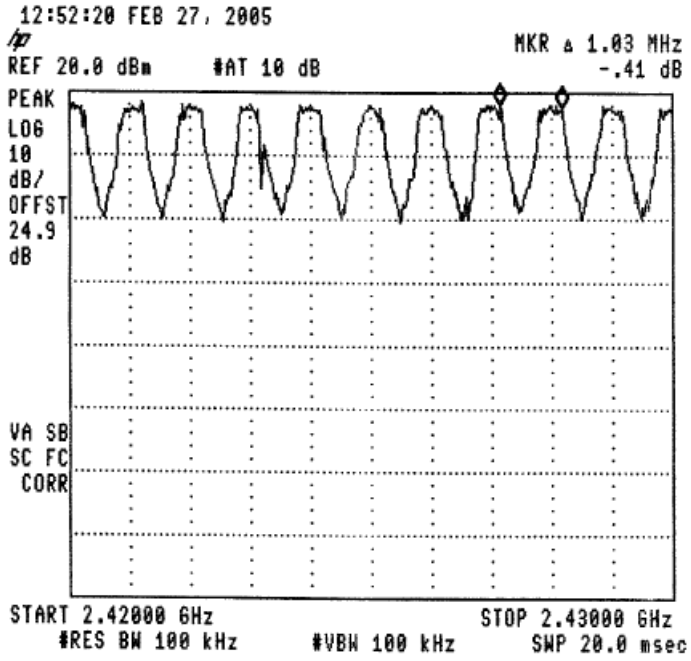

Figure 21.— 2420.0-2430.0 MHz

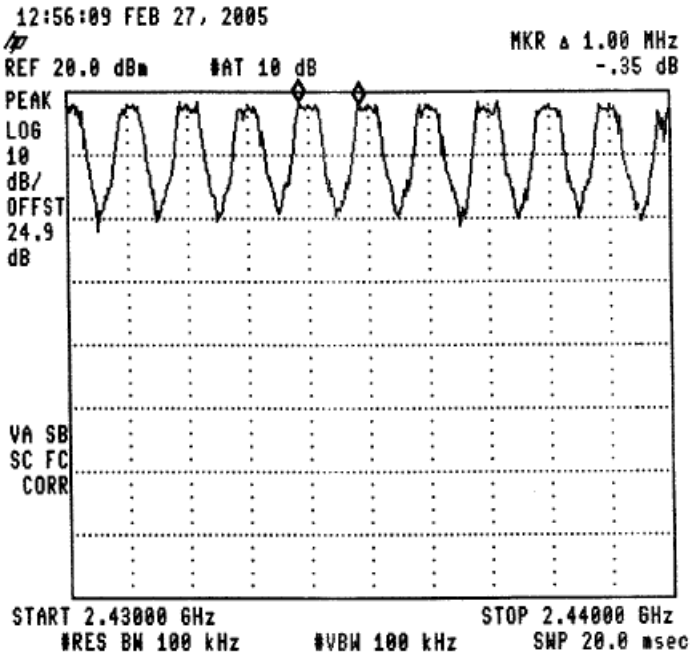

Figure 22.— 2430.0-2440.0 MHz

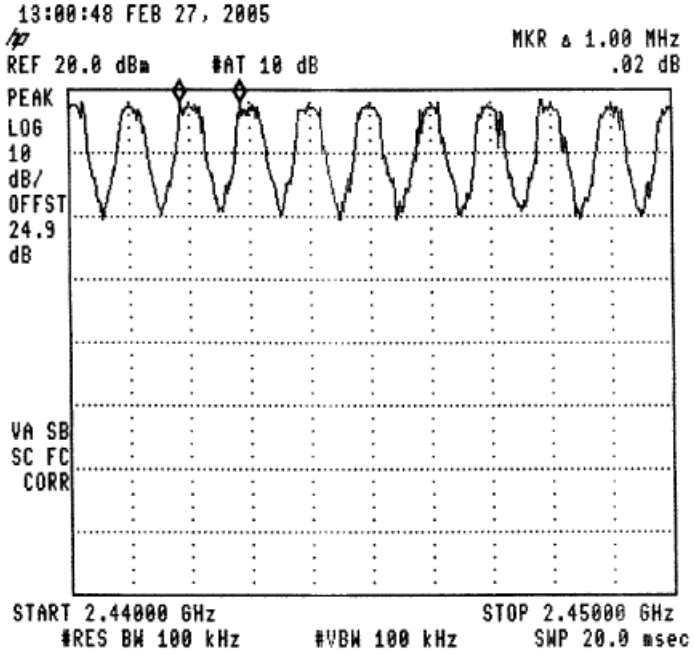

Figure 23.— 2440.0-2450.0 MHz

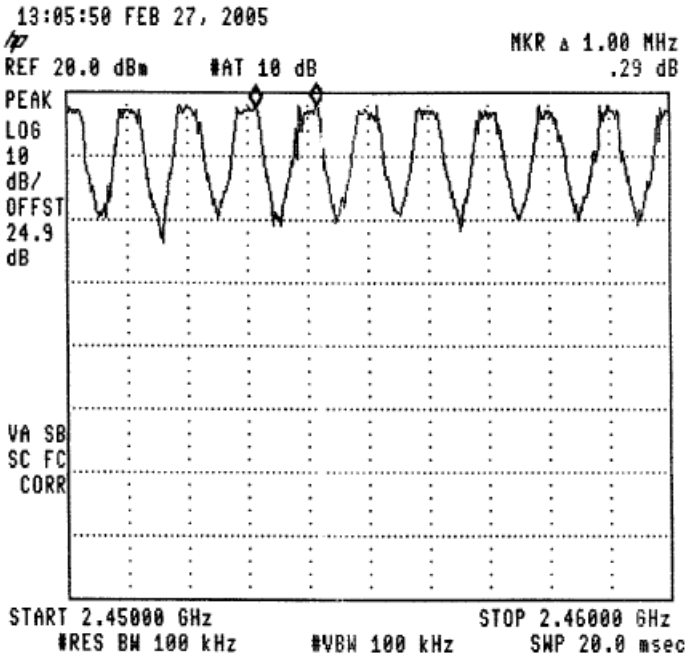

Figure 24.— 2450.0-2460.0 MHz

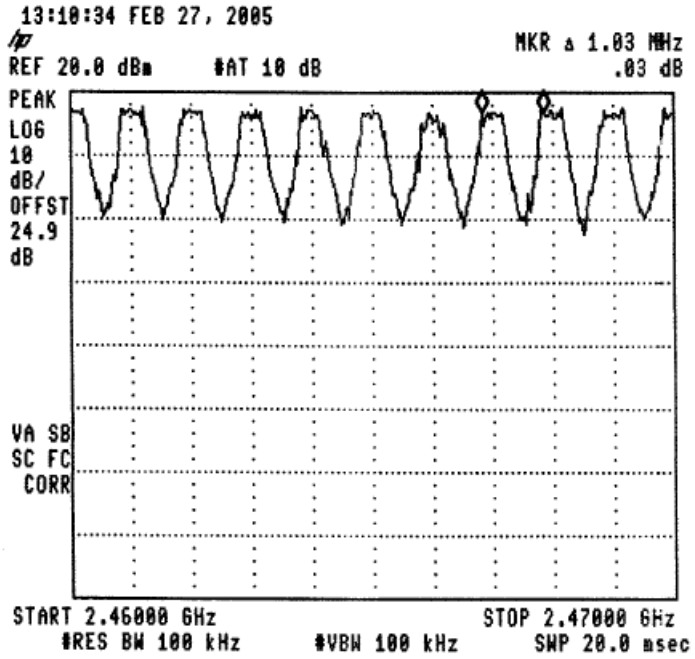

Figure 25.— 2460.0-2470.0 MHz

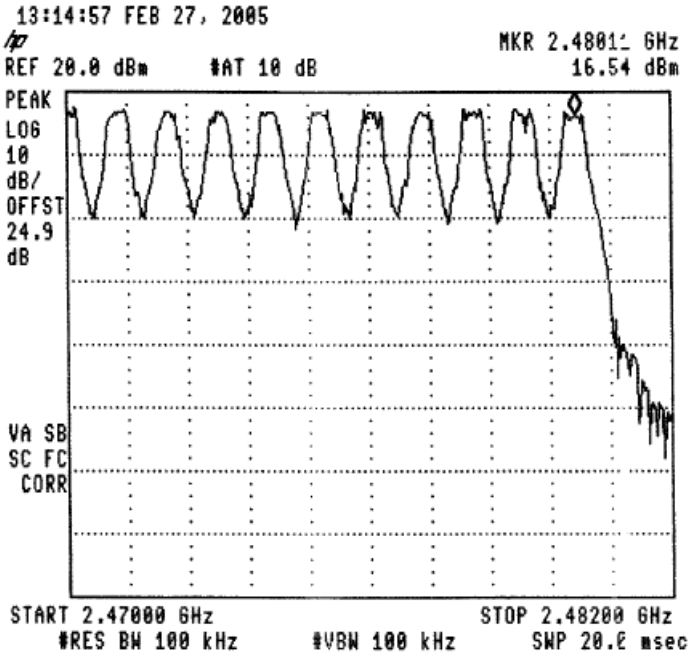

Figure 26.— 2470.0-2480.0 MHz

9.2 Average Time of Occupancy on Any Channel

Specification: FCC Part 15, Subpart C (15.247(a) (1)(iii)

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 e.g. within a period of 31.6 sec. (0.4 sec X 79 channels = 31.6 sec). Within 31.6 seconds, there may be 42.13 channels $(\frac{31.6}{0.375 \times 2} = 42.13 ch.)$, e.g. each channel will not be greater than one time. Therefore the average time occupancy is 0.375 msec.

9.3 Results table

E.U.T. Description: Bluetooth Communication Module
Model No.: MT-SiW35-SiGeL-001
Serial Number: MTeyeBT100
Specification: FCC Part 15, Subpart C (15.247(a) (1)

Number of Hopping Frequencies	Specification
79	>75

Figure 27 Number of Hopping Frequencies

TEST PERSONNEL:
Tester Signature: _____ Date: 19.10.05
Typed/Printed Name: E. Pitt

9.4 Test Equipment Used.

Number of Hopping Frequencies

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 2, 2005	1 year
Cable	AVNET	MTS	N/A	February 18, 2005	1 year
Attenuator	Macom	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	056	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	211	November 9, 2004	1 year

Figure 28 Test Equipment Used

10. Channel Frequency Separation

10.1 Test procedure

The E.U.T. was set to hopping mode.
The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=24dB (3 × 8dB) and an appropriate coaxial cable = 0.9 dB.
The spectrum analyzer was set to the following parameters:

Span: 2 MHz
RBW: 100kHz
VBW: 100kHz
Detector Function: Peak
Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

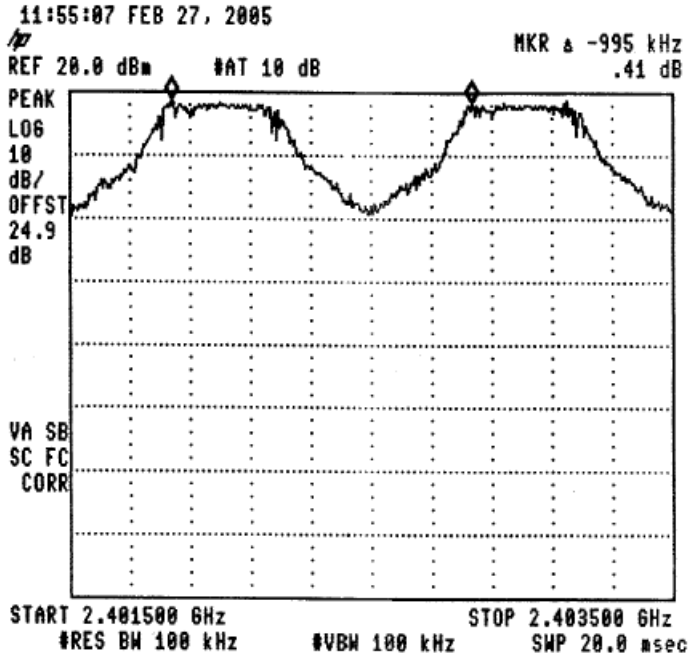

Figure 29.— 2401.0-2404.0 MHz

10.2 Results table

E.U.T. Description: Bluetooth Communication Module
Model No.: MT-SiW35-SiGeL-001
Serial Number: MTeyeBT100
Specification: FCC Part 15, Subpart C (15.247(a) (1)

Channel Frequency Separation (kHz)	Specification* (kHz)	Margin (kHz)
995	975	20

Figure 30 Channel Frequency Separation

* Measured 20 dB bandwidth (See Section 13 of this test report).

JUDGEMENT: Passed by 20 kHz

TEST PERSONNEL:
Tester Signature: _____ Date: 19.10.05
Typed/Printed Name: E. Pitt

10.3 Test Equipment Used.

Channel Frequency Separation

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 2, 2005	1 year
Cable	AVNET	MTS	N/A	February 18, 2005	1 year
Attenuator	Macom	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	056	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	211	November 9, 2004	1 year

Figure 31 Test Equipment Used

11. Maximum Transmitted Peak Power Output

11.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=24dB (3 × 8dB) and an appropriate coaxial cable=0.9dB. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 3.0 MHz RBW. Peak power level was measured at selected operation frequencies.

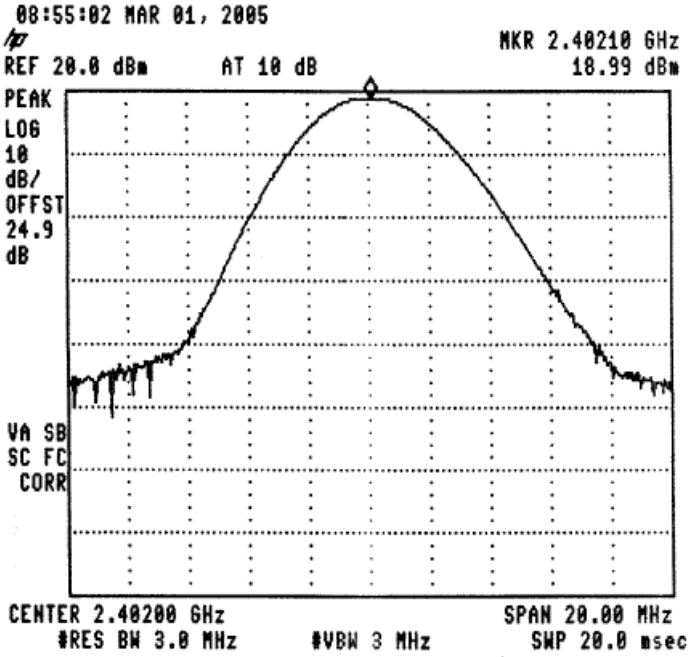

Figure 32.— 2402.0 MHz

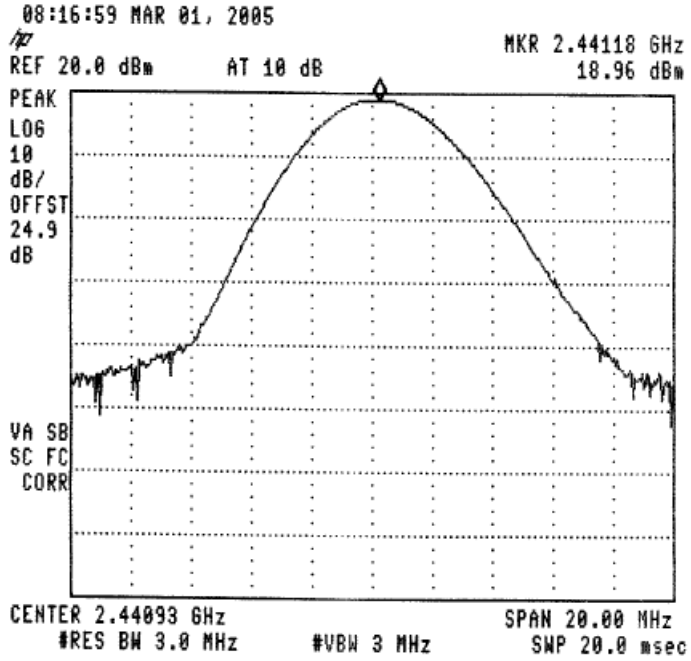

Figure 33.— 2440.0 MHz

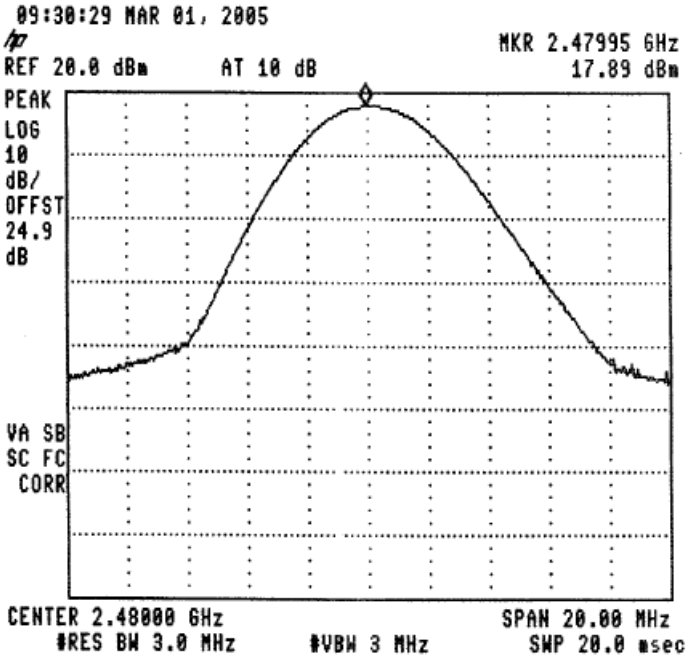

Figure 34.— 2480.0 MHz

11.2 Results table

E.U.T. Description: Bluetooth Communication Module
Model No.: MT-SiW35-SiGeL-001
Serial Number: MTeyeBT100
Specification: FCC Part 15, Subpart C

Operation Frequency (MHz)	Peak Power Output (dBm)	Specification (dBm)	Margin (dB)
2402.0	18.99	30.0	-11.01
2441.0	18.96	30.0	-11.04
2480.0	17.89	30.0	-12.11

Figure 35 Maximum Power Output

JUDGEMENT: Passed by 11.01 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 17.10.05
Typed/Printed Name: E. Pitt

11.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 2, 2005	1 year
Cable	AVNET	MTS	N/A	February 18, 2005	1 year
Attenuator	Macom	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0211	November 9, 2004	1 year

Figure 36 Test Equipment Used

12. Peak Power Output Out of 2400-2483.5 MHz Band

12.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=24dB (3 × 8dB) and an appropriate coaxial cable=0.9dB. The spectrum analyzer was set to 1 kHz RBW for the frequency range 9 kHz to 150 kHz, 30 kHz RBW for the frequency range
150 kHz to 1.0 MHz, and 100 kHz RBW for the frequency range 1.0 MHz to 25.0 GHz. The frequency range from 9 kHz to 25.0 GHz was scanned. Level of spectrum components out of the 2400-2480 MHz was measured at the selected operation frequencies.

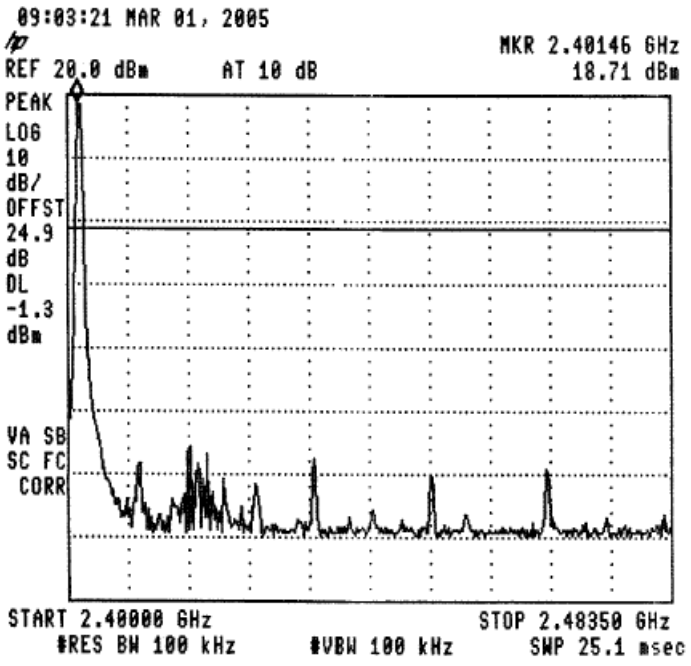

Figure 37.— 2402 MHz

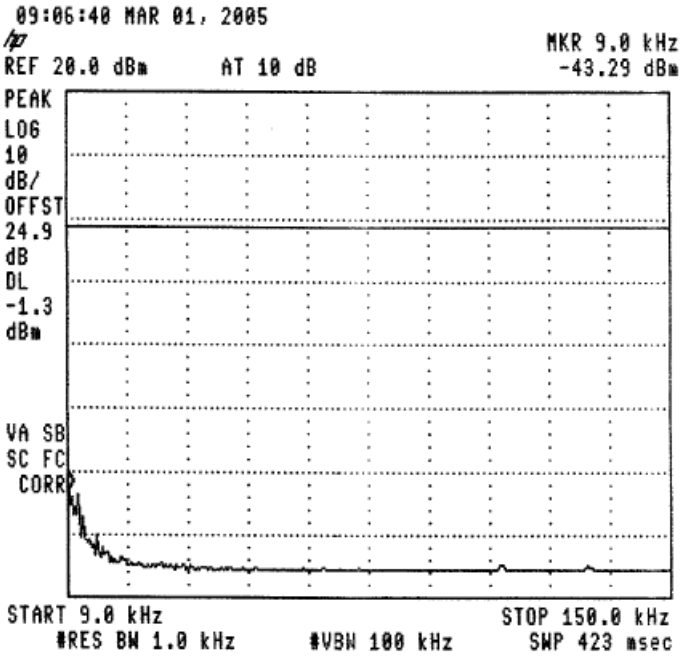

Figure 38.— 2402 MHz

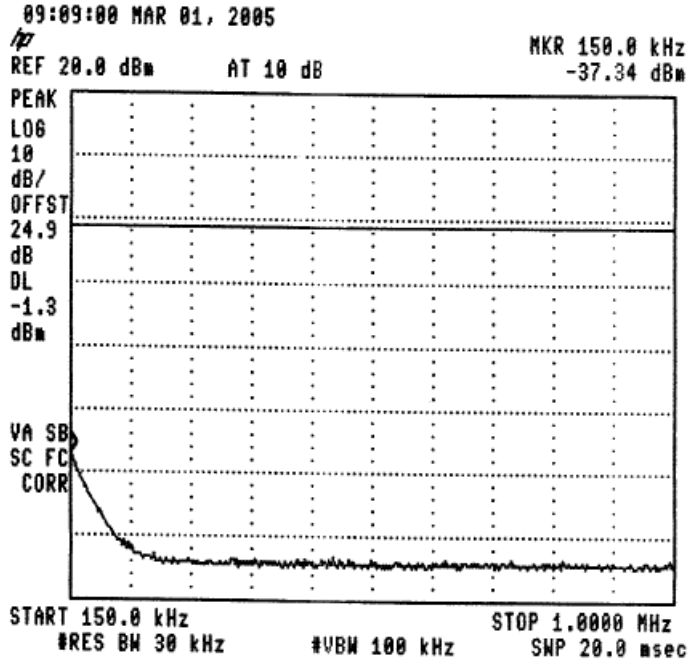

Figure 39.— 2402 MHz

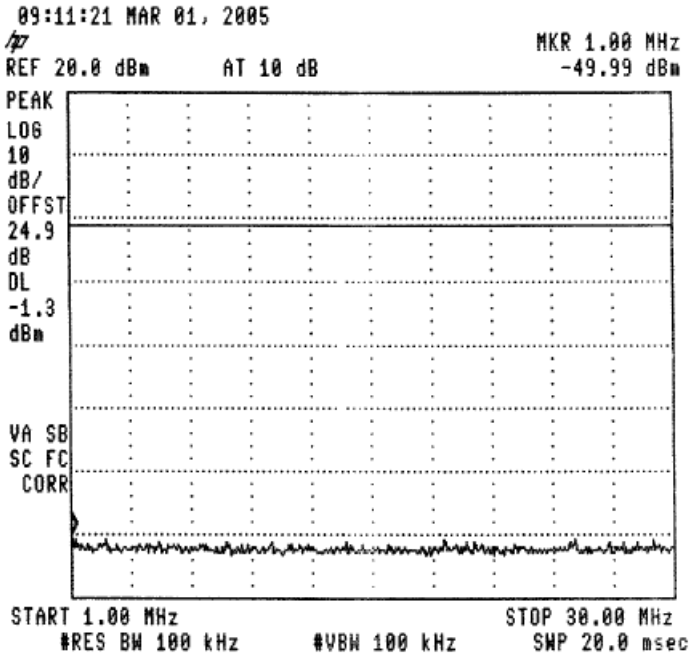

Figure 40.— 2402 MHz

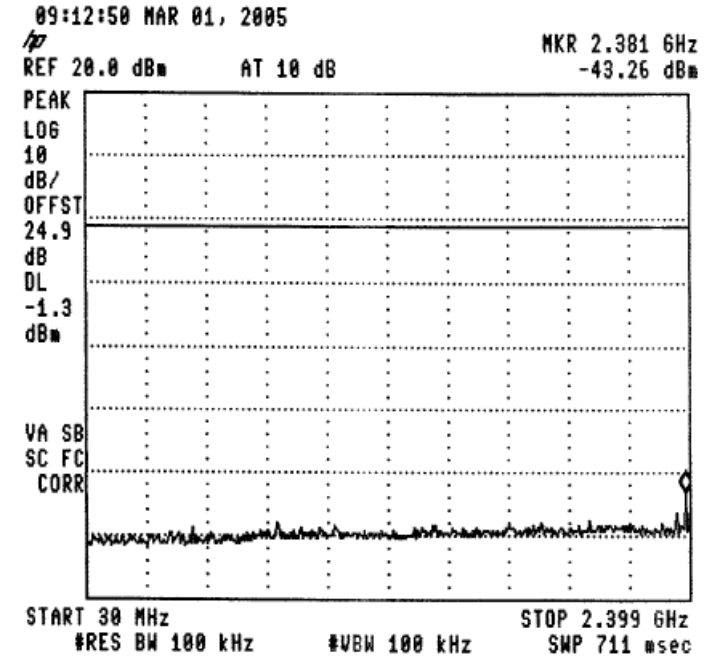

Figure 41.— 2402 MHz

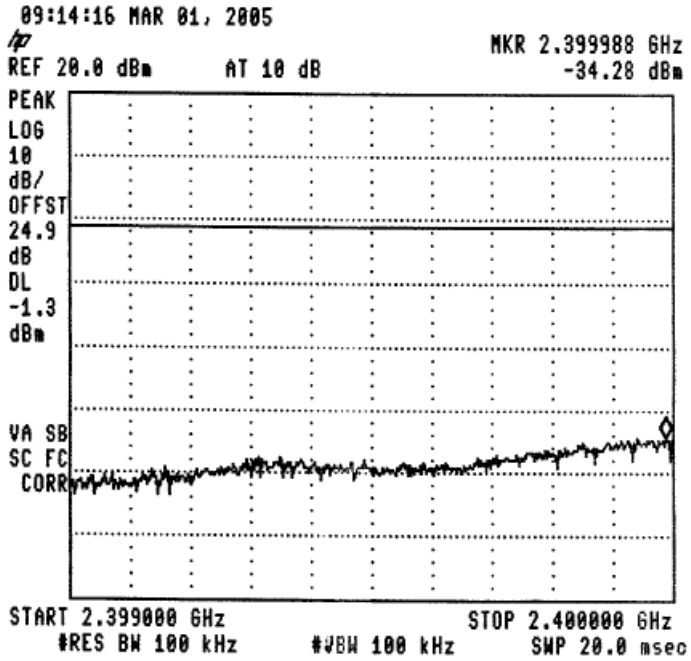

Figure 42.— 2402 MHz

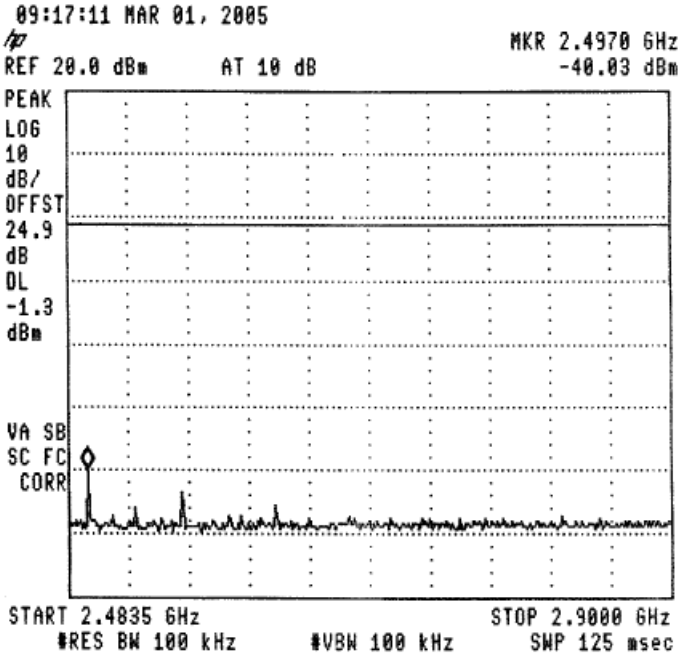

Figure 43.— 2402 MHz

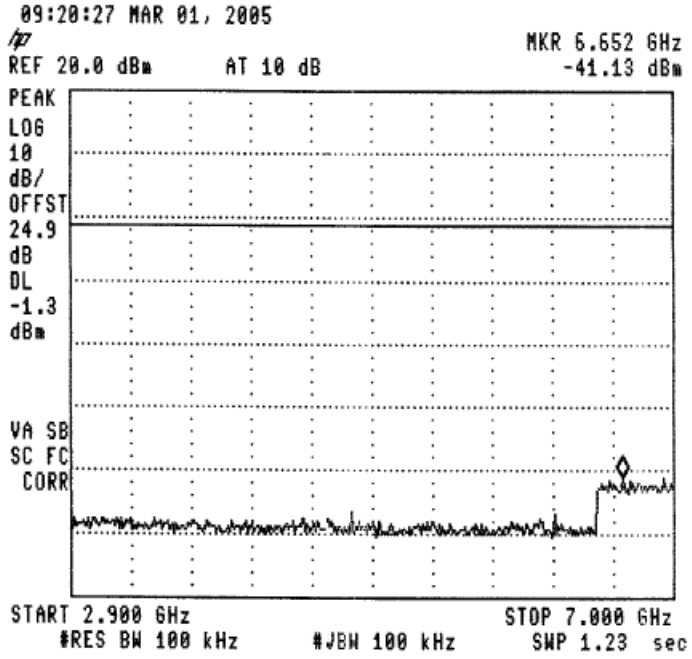

Figure 44.— 2402 MHz

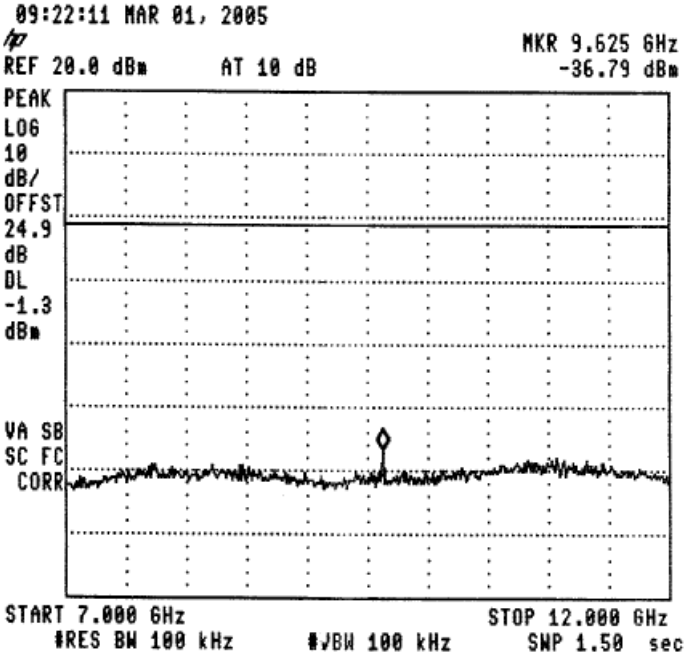

Figure 45.— 2402 MHz

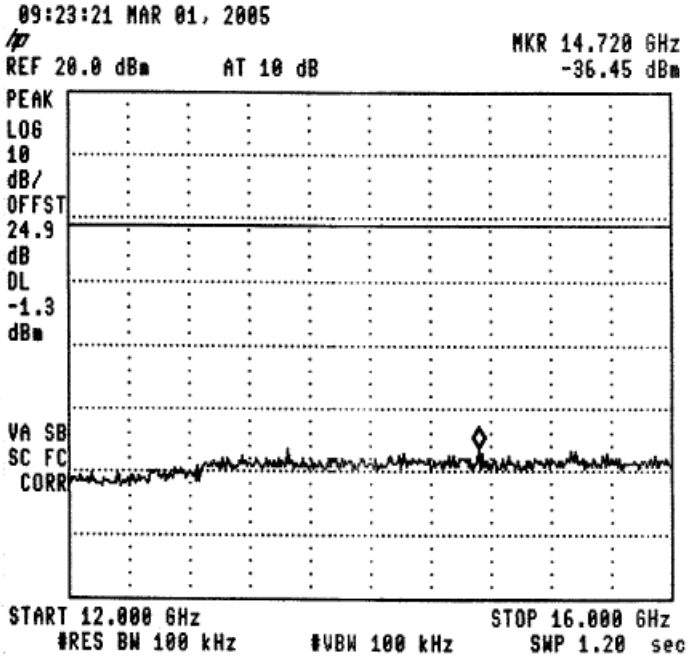

Figure 46.— 2402 MHz

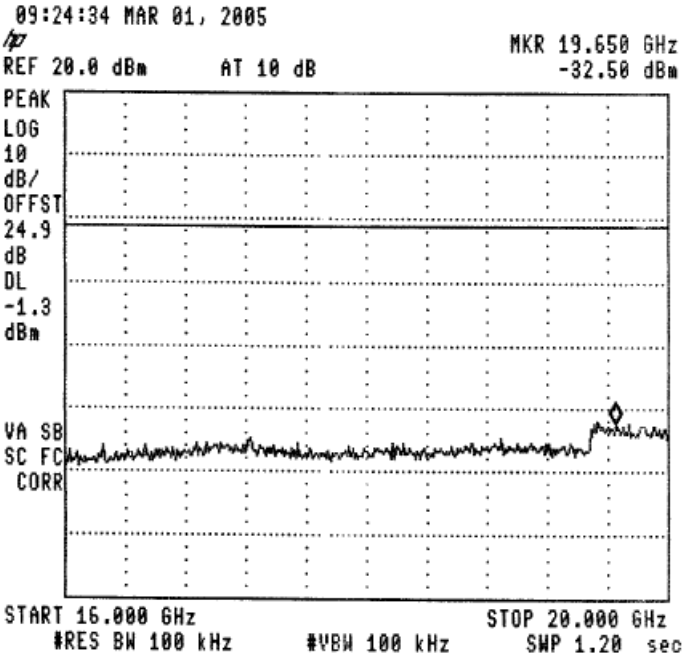

Figure 47.— 2402 MHz

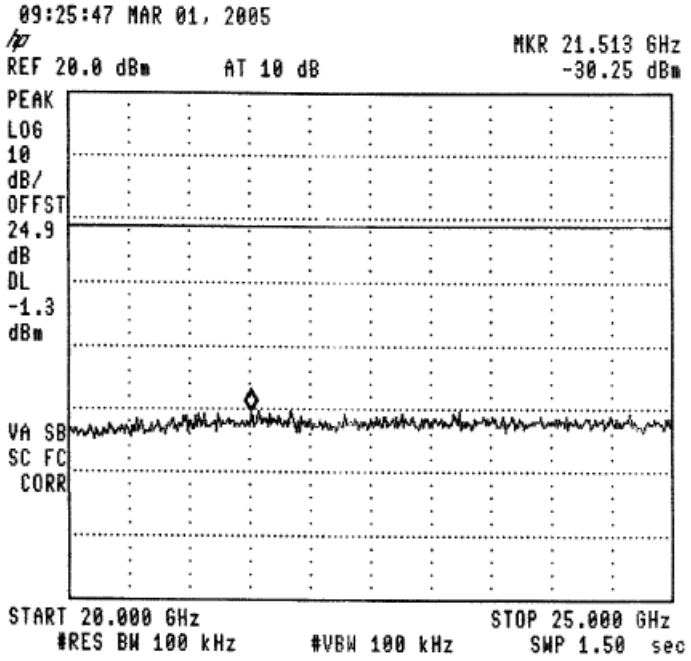

Figure 48.— 2402 MHz

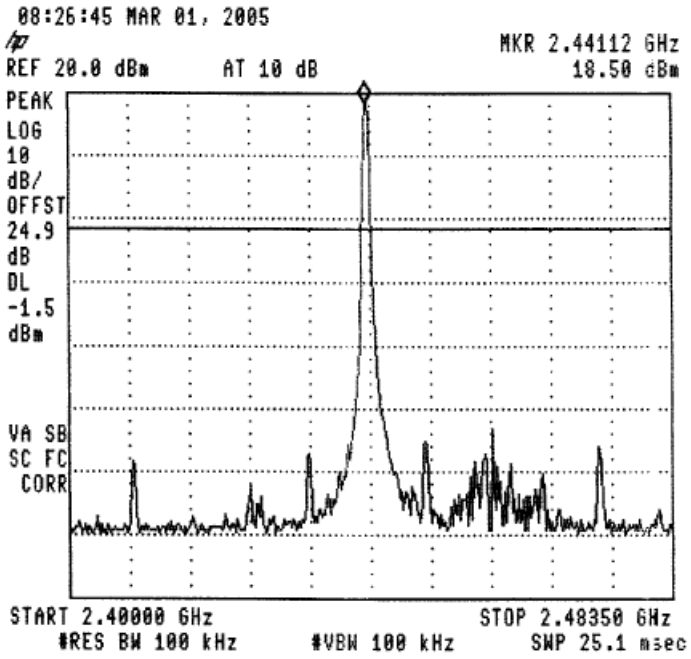

Figure 49.— 2441 MHz

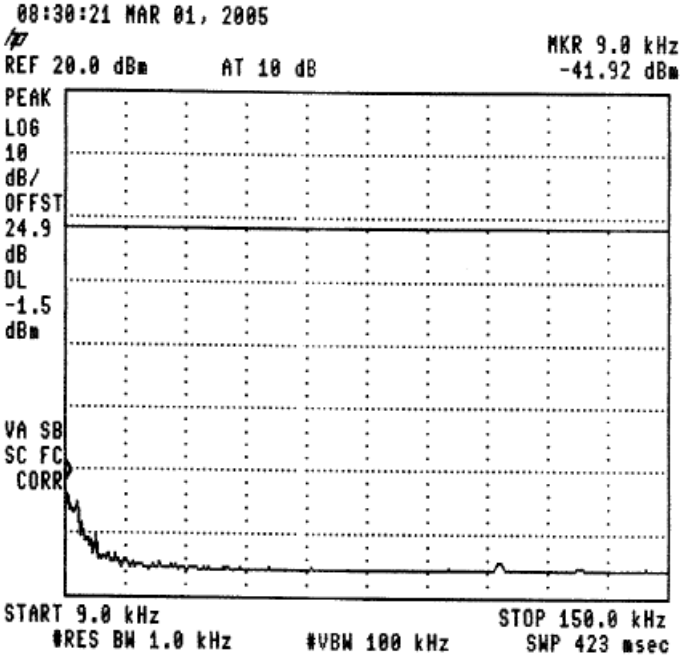

Figure 50.— 2441 MHz

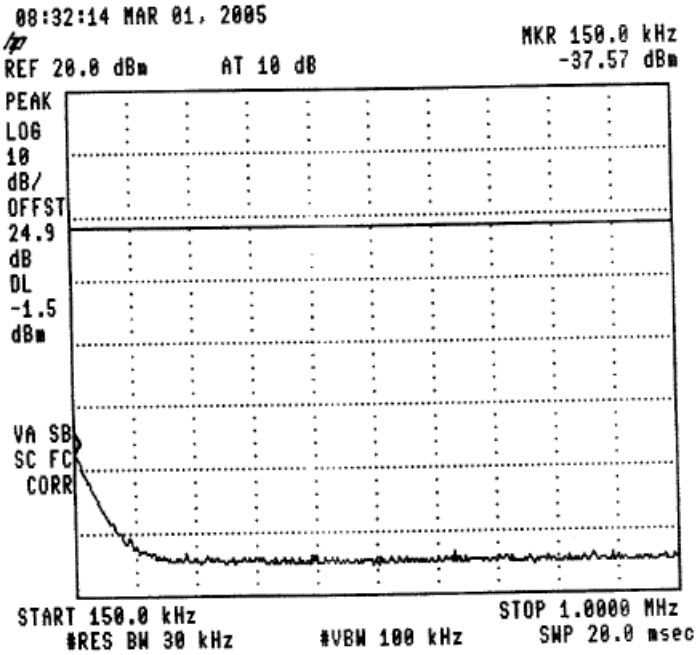

Figure 51.— 2441 MHz

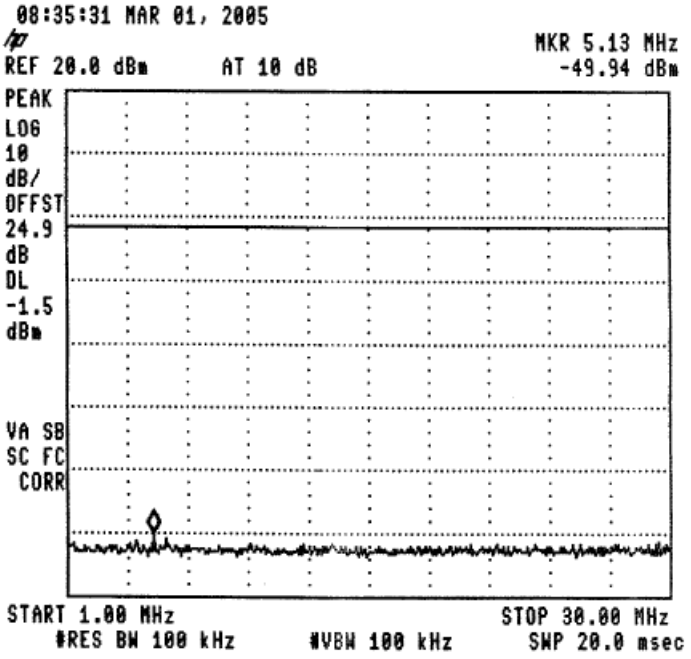

Figure 52.— 2441 MHz

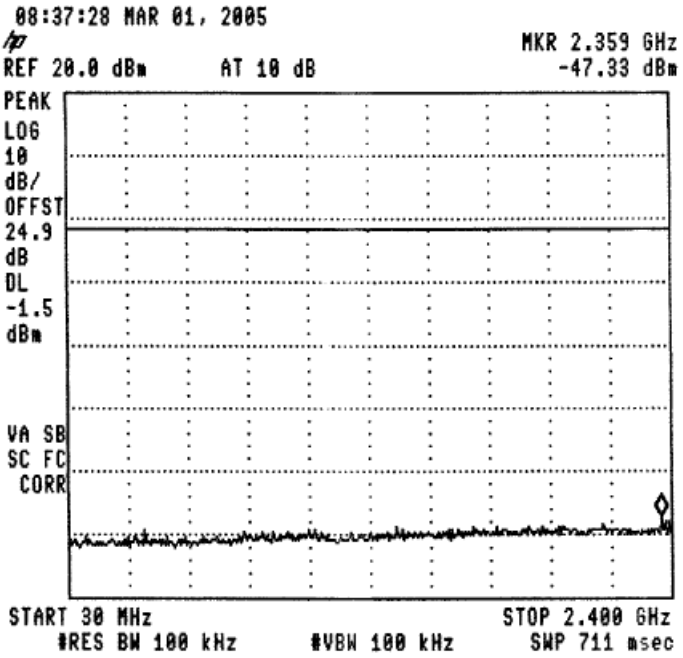

Figure 53.— 2441 MHz

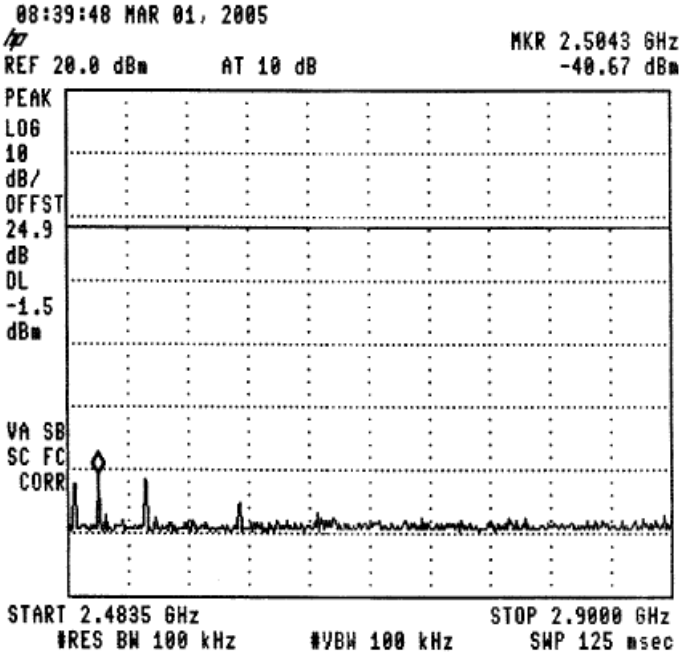

Figure 54.— 2441 MHz

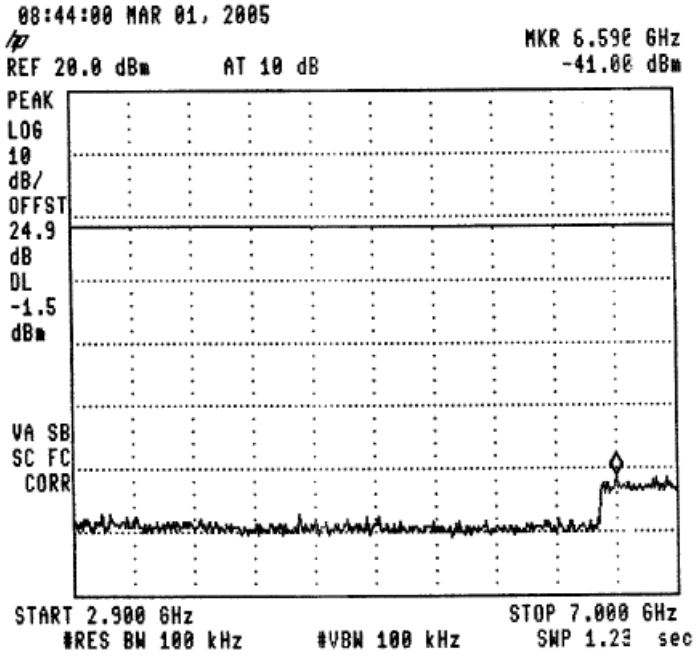

Figure 55.— 2441 MHz

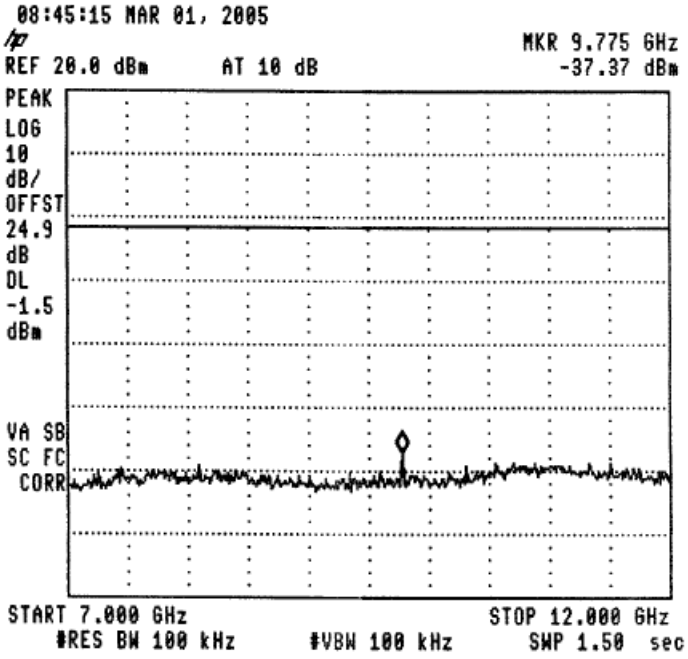

Figure 56.— 2441 MHz

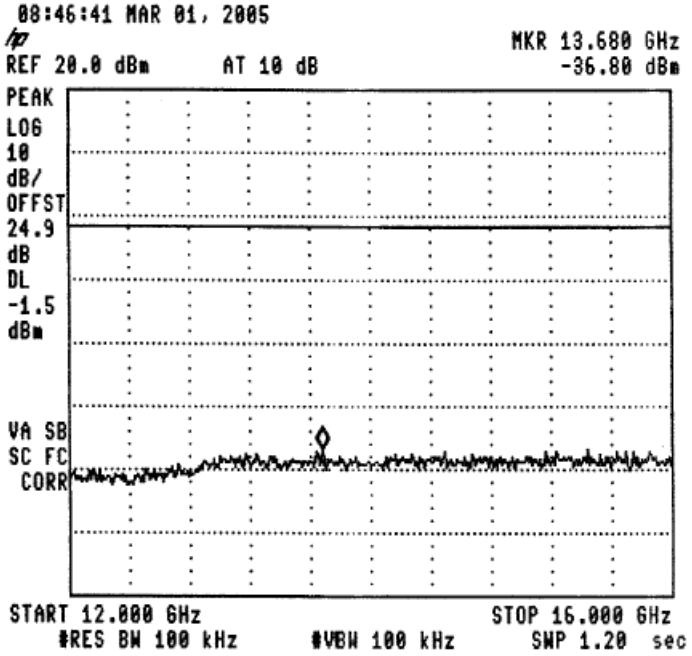

Figure 57.— 2441 MHz

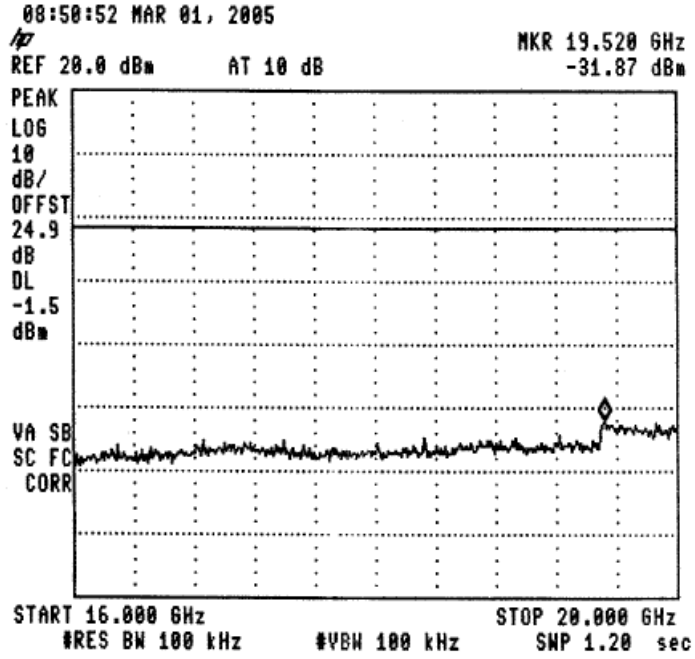

Figure 58.— 2441 MHz

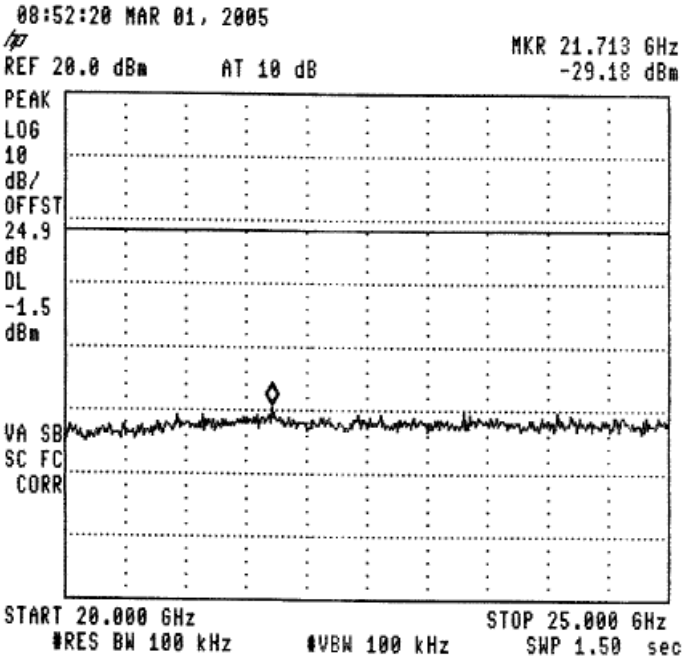

Figure 59.— 2441 MHz

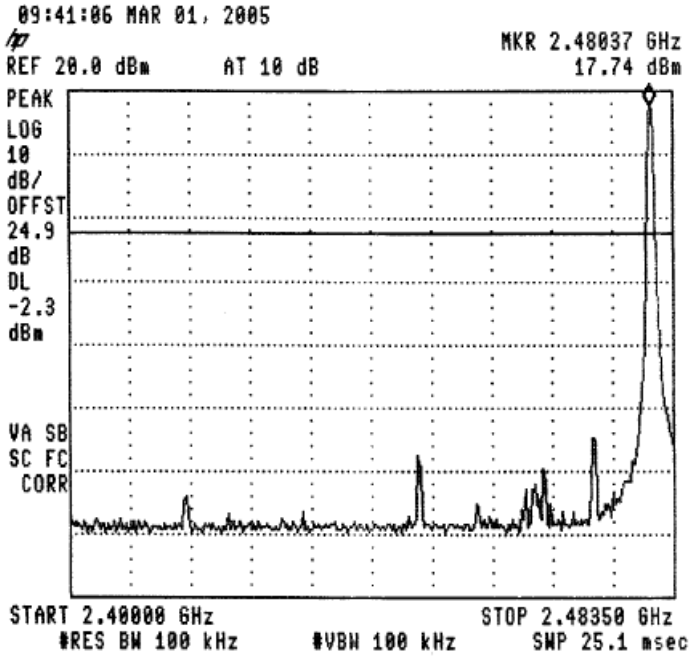

Figure 60.— 2480 MHz

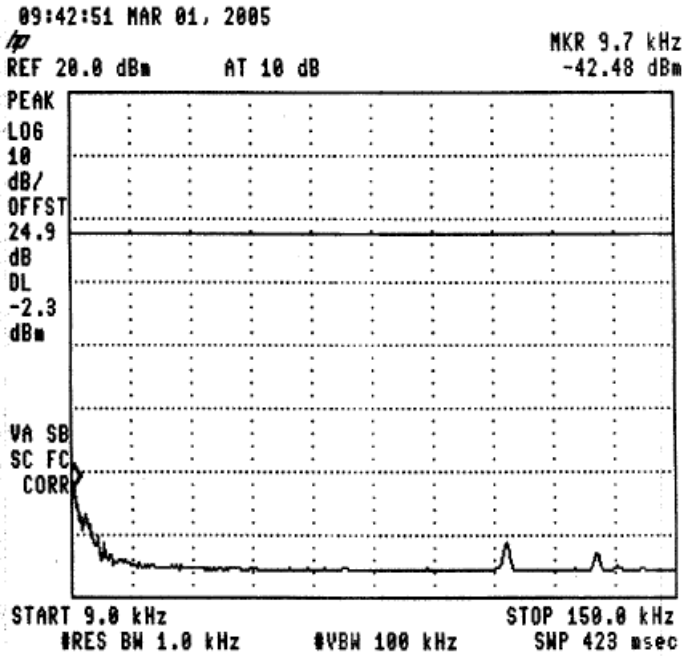

Figure 61.— 2480 MHz

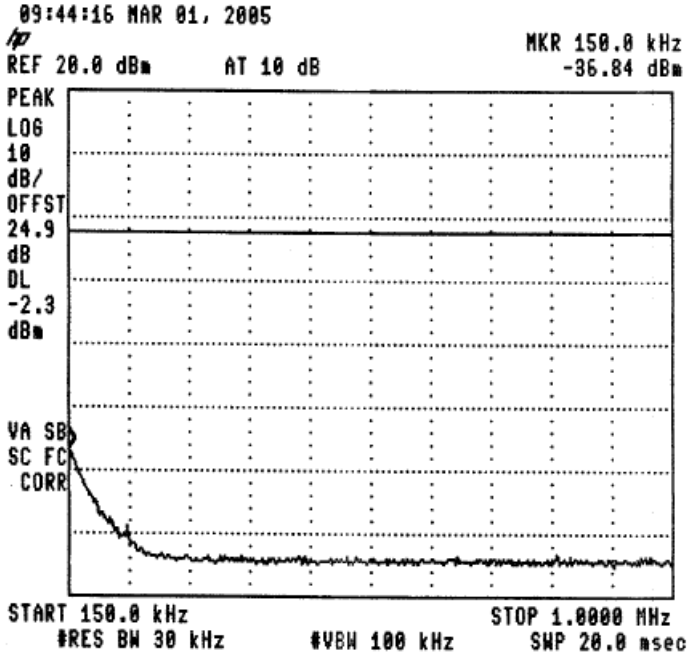

Figure 62.— 2480 MHz

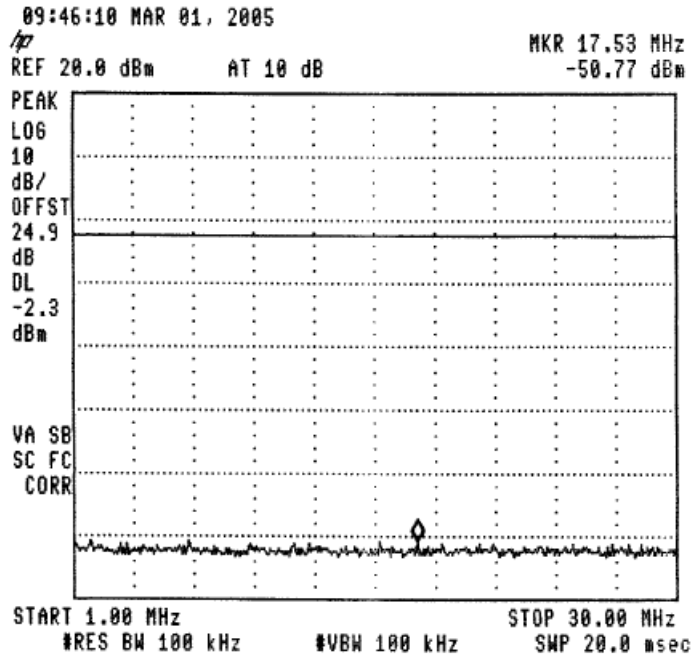

Figure 63.— 2480 MHz

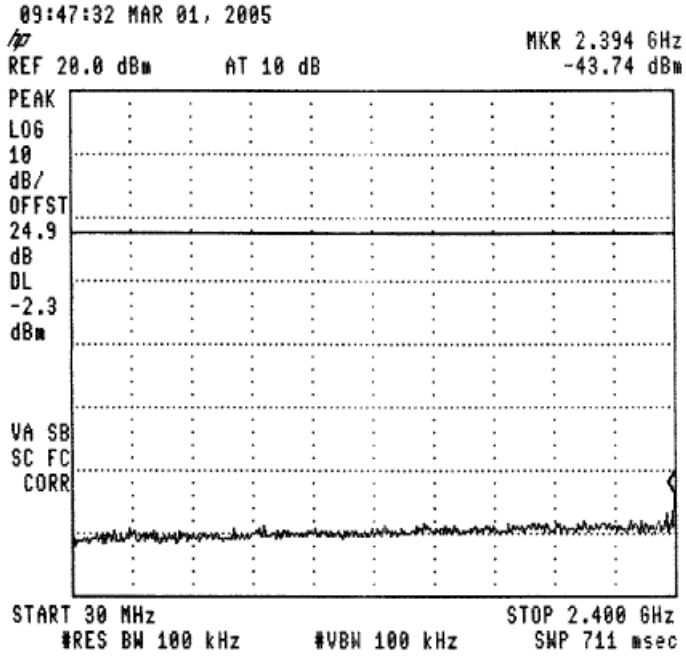

Figure 64.— 2480 MHz

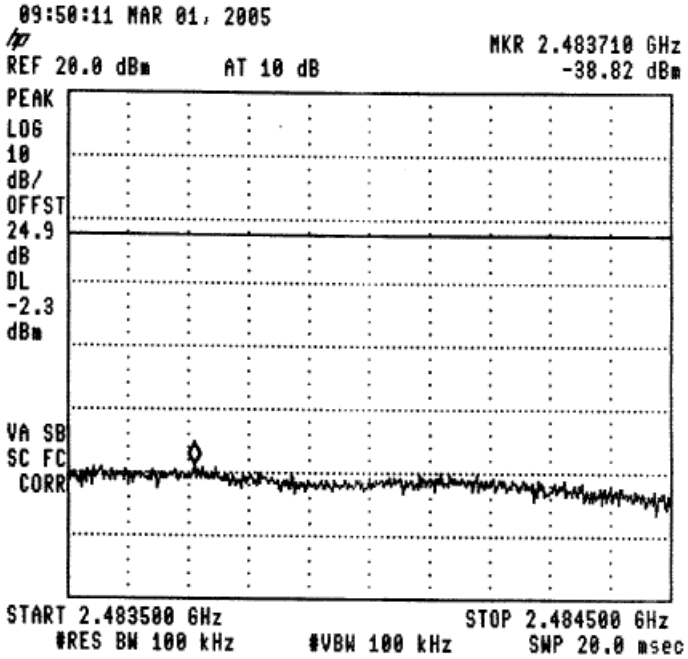

Figure 65.— 2480 MHz

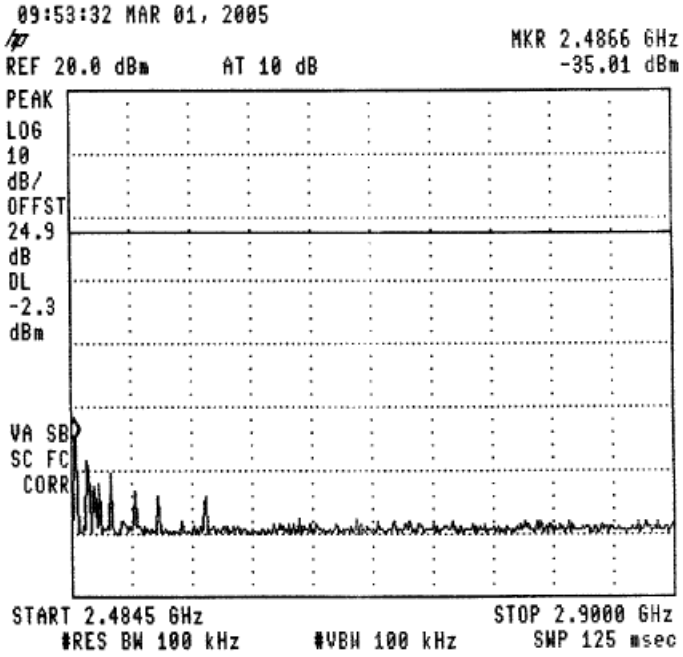

Figure 66.— 2480 MHz

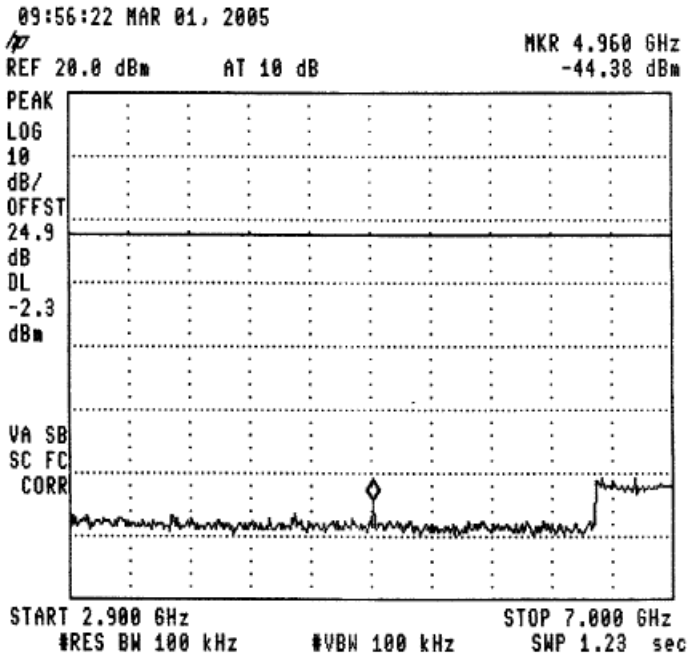

Figure 67.— 2480 MHz

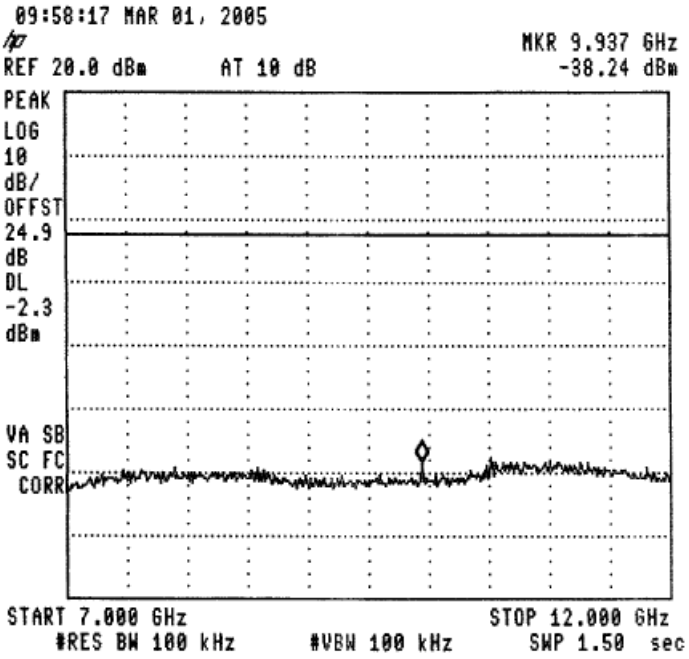

Figure 68.— 2480 MHz

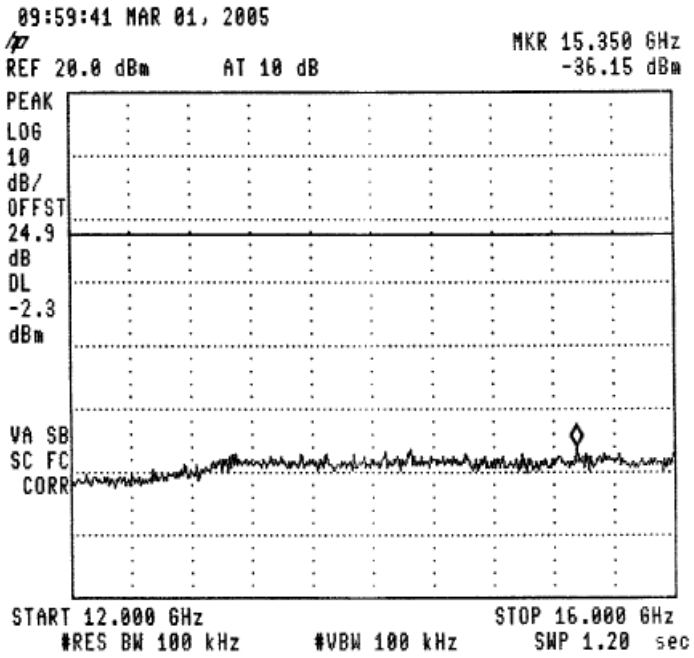

Figure 69.— 2480 MHz

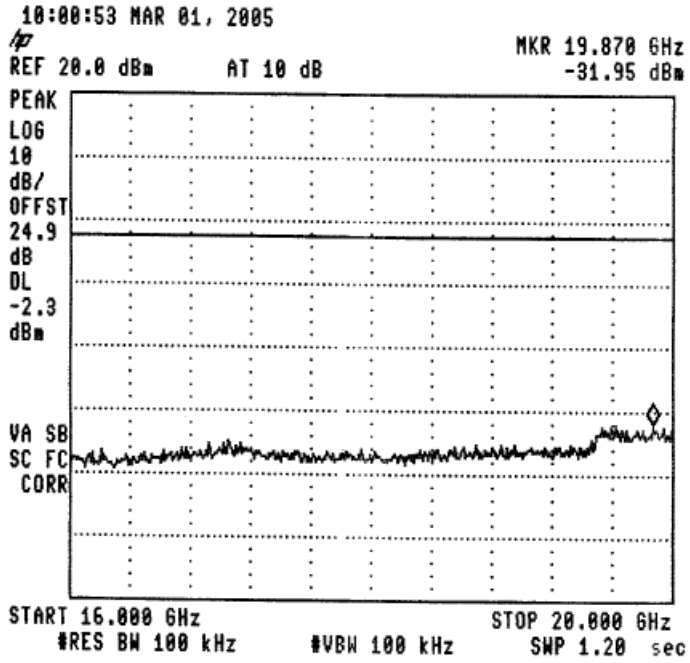

Figure 70.— 2480 MHz

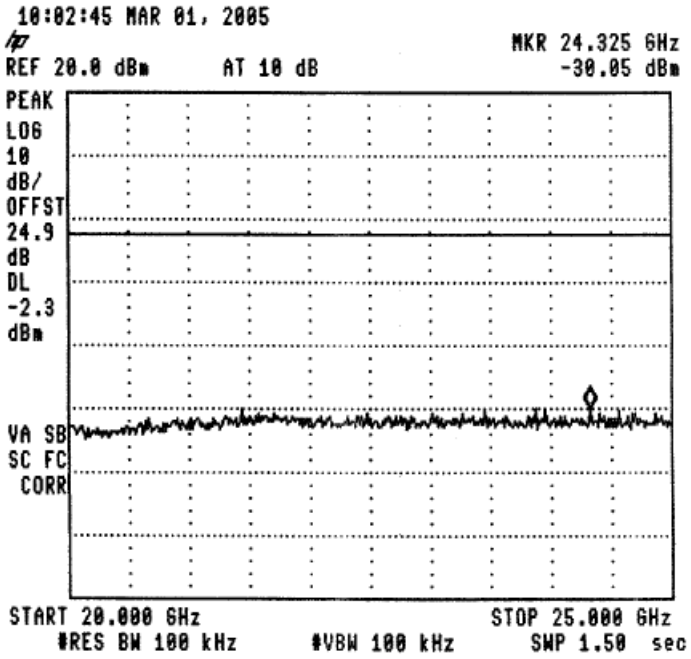

Figure 71.— 2480 MHz

12.2 Results table

E.U.T. Description: Bluetooth Communication Module
Model No.: MT-SiW35-SiGeL-001
Serial Number: MTeyeBT100
Specification: FCC Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
2402	53.0	20.0	-33.0
2441	55.9	20.0	-35.9
2480	52.7	20.0	-32.7

Figure 72 Peak Power Output of 2400.0-2480.0 MHz Band

JUDGEMENT: Passed by 32.7 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 19.10.05
Typed/Printed Name: E. Pitt

12.3 Test Equipment Used.

Peak Power Output Out of 2400-2480 MHz Band

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 2, 2005	1 year
Cable	AVNET	MTS	N/A	February 18, 2005	1 year
Attenuator	Macom	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0211	November 9, 2004	1 year

Figure 73 Test Equipment Used

13. 20 dB Bandwidth

13.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=24dB (3 × 8dB) and an appropriate coaxial cable=0.9dB. The spectrum analyzer was set to 10 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 20 dB below maximum peak power was measured and recorded.

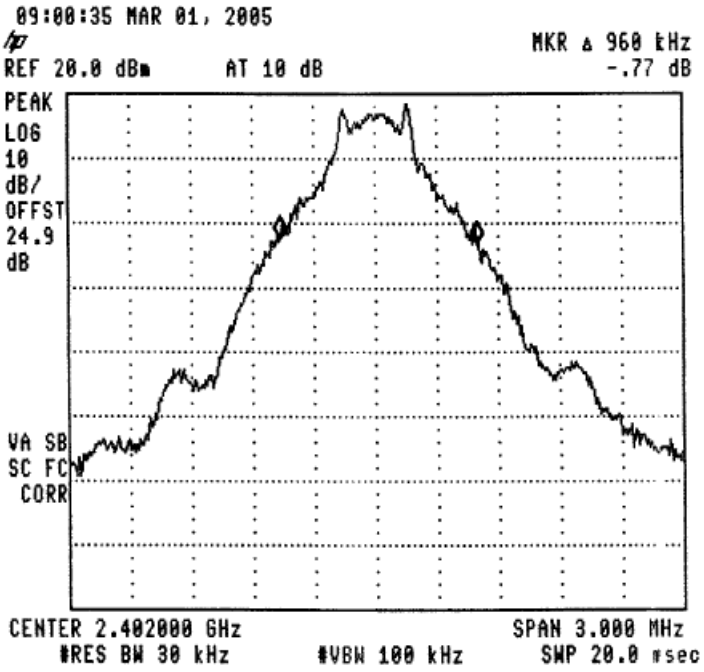

Figure 74 — 2402 MHz

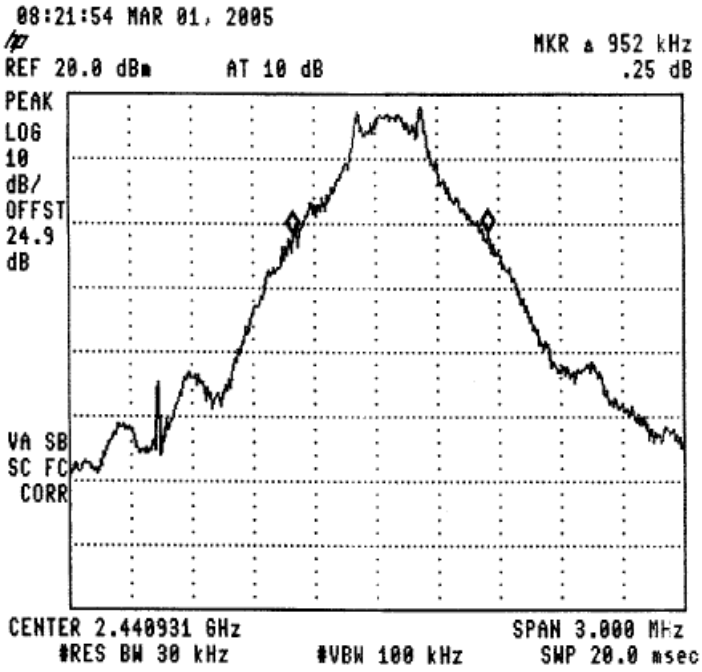

Figure 75 — 2441 MHz

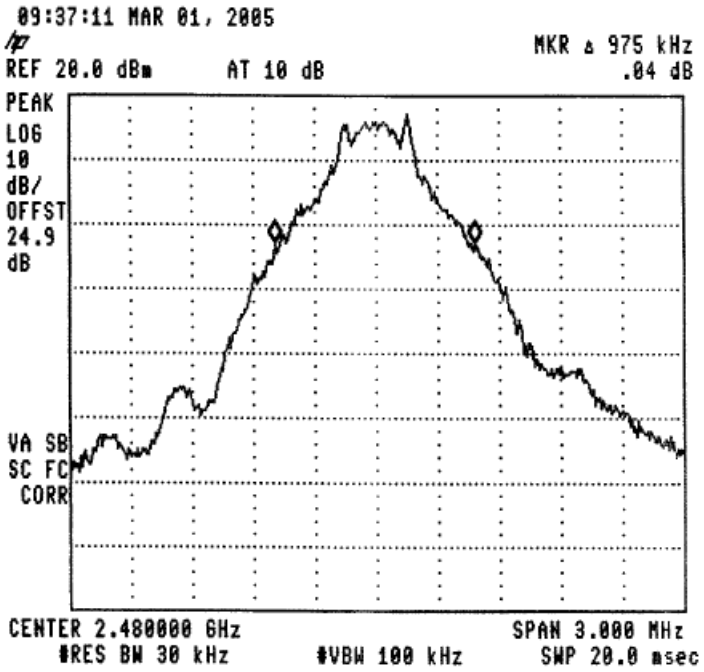

Figure 76 — 2480 MHz

13.2 Results table

E.U.T. Description: Bluetooth Communication Module
Model No.: MT-SiW35-SiGeL-001
Serial Number: MTeyeBT100
Specification: FCC Part 15, Subpart C (15.247-a2)

Operation Frequency (MHz)	Reading (kHz)
2402.0	960
2441.0	952
2480.0	975

Figure 77 20 dB Bandwidth

TEST PERSONNEL:
Tester Signature: _____ Date: 19.10.05
Typed/Printed Name: E. Pitt

13.3 Test Equipment Used.

20 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 2, 2005	1 year
Cable	AVNET	MTS	N/A	February 18, 2005	1 year
Attenuator	Macom	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0211	November 9, 2004	1 year

Figure 78 Test Equipment Used

14. Band Edge Spectrum

[In Accordance with section 15.247(c)]

14.1 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (2402.0 MHz) the middle operation frequency (2440.0 MHz) and the highest operation frequency (2480.0 MHz) in which the E.U.T. is planned to be used.

The E.U.T. antenna terminal was connected to the spectrum analyzer through EXT ATT=24dB (3 × 8dB) and an appropriate coaxial cable=0.9dB. The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2402 MHz and 2480 MHz correspondingly.

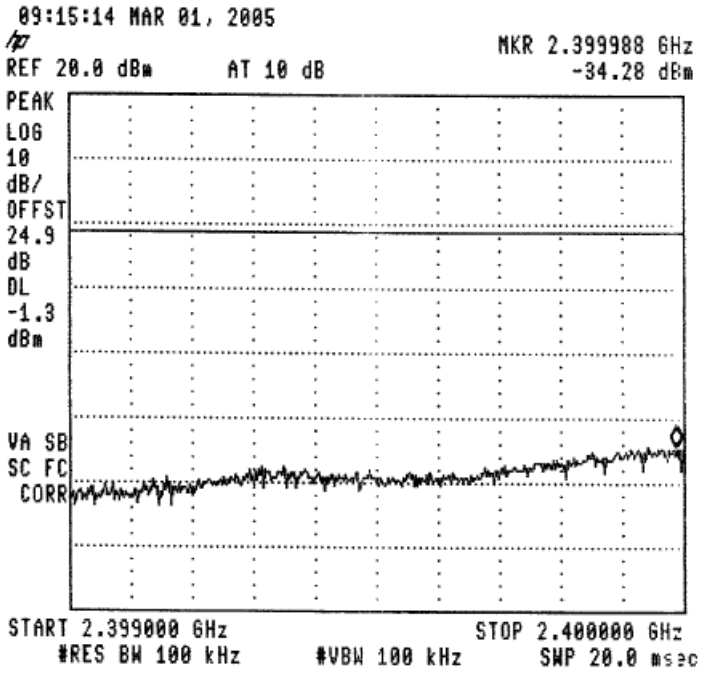

Figure 79 — 2402 MHz

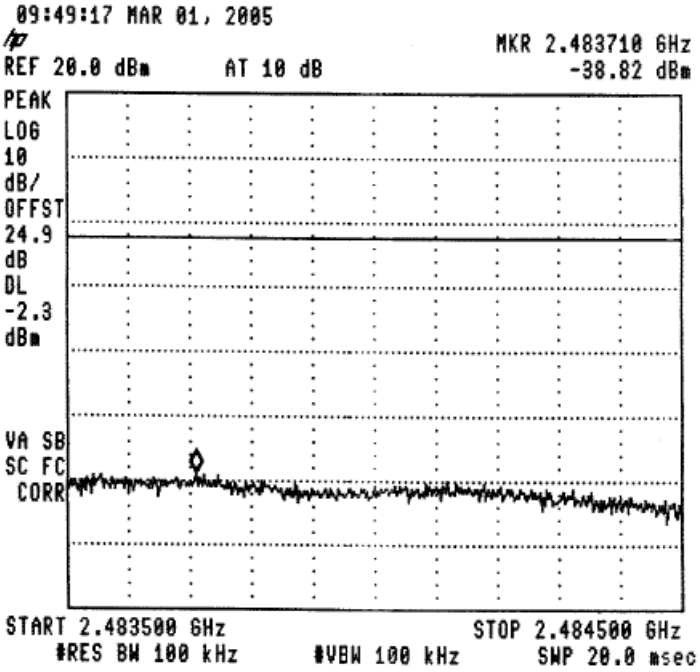

Figure 80 — 2480 MHz

14.2 Results table

E.U.T. Description: Bluetooth Communication Module
Model No.: MT-SiW35-SiGeL-001
Serial Number: MTeyeBT100
Specification: FCC Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
2402	2399.988	53.00	20.0	-33.00
2480	2483.710	56.52	20.0	-36.52

Figure 81 Band Edge Spectrum

JUDGEMENT: Passed by 33.0 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 19.10.05

Typed/Printed Name: E. Pitt

14.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 2, 2005	1 year
Cable	AVNET	MTS	N/A	February 18, 2005	1 year
Attenuator	Macom	M3933/25-74	0056	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0202	November 9, 2004	1 year
Attenuator	Macom	M3933/25-74	0211	November 9, 2004	1 year

Figure 82 Test Equipment Used

15. Antenna Gain

The gain of the antenna is 2 dBi.

16. R.F Exposure/Safety

The E.U.T. is used in fixed installations for security/alarm applications.
In typical use, the E.U.T. is installed on walls, 2.4m above the floor.
The calculation below, considers a worst case application where the distance between the general population and the E.U.T. is 30 cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2441 MHz is: $1\frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 19 dBm = 79.43 mW (Peak)

G_T- Antenna Gain, 2 dBi = 1.58

R- Distance from Transmitter using 30 cm worst case

(c) The peak power density is :

$$S_p = \frac{79.43 \times 1.58}{4\pi \times 30^2} = 0.011 \frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 0.5.

The average power over 30 minutes is:

$$P_{AV} = 79.43 \times 0.5 = 39.715 mW$$

(e) The averaged power density of the E.U.T. is:

$$S_{AV} = \frac{39.715 \times 1.58}{4\pi \times 30^2} = 5.55 \times 10^{-3} \frac{mW}{cm^2}$$

(f) This is 3 orders of magnitude below the FCC limit.

17. Radiated Emission, per FCC Part 15

17.1 Test Specification

30 kHz-1000 MHz, FCC, Part 15, Subpart B

17.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground.

The E.U.T. highest frequency source or used frequency is 32 MHz.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.

Using a frequency span less than 10 MHz.

Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the frequencies of 2402, 2441, and 2480 MHz.

17.3 Test Data

JUDGEMENT: Passed by 19.8 dB

The E.U.T met the requirements of the FCC Part 15, Subpart B ,Class B specification.

The results for all three operating frequencies were the same.

The margin between the emission level and the specification limit is 19.8 dB in the worst case at the frequency of 32.00 MHz, vertical polarization.

The details of the highest emissions are given in Figure 83 to Figure 86.

TEST PERSONNEL:

Tester Signature: _____ Date: 19.10.05

Typed/Printed Name: E. Pitt

Radiated Emission

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal
Antenna: 3 meters distance
Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Frequency (MHz)	Peak Amp (dBμV/m)	QP Amp (dBμV/m)	Correction (dB)	Specification (dBμV/m)	Margin (dB)
32.00	21.1	16.2	15.0	40.0	-23.8
64.00	17.2	11.8	10.1	40.0	-28.2
192.00	23.6	19.0	16.4	43.5	-24.5
256.00	26.9	21.8	20.7	46.0	-24.2
288.00	29.4	24.2	22.1	46.0	-21.8
320.00	29.8	24.3	23.1	46.0	-21.7

Figure 83. Radiated Emission. Antenna Polarization: HORIZONTAL. Detectors: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

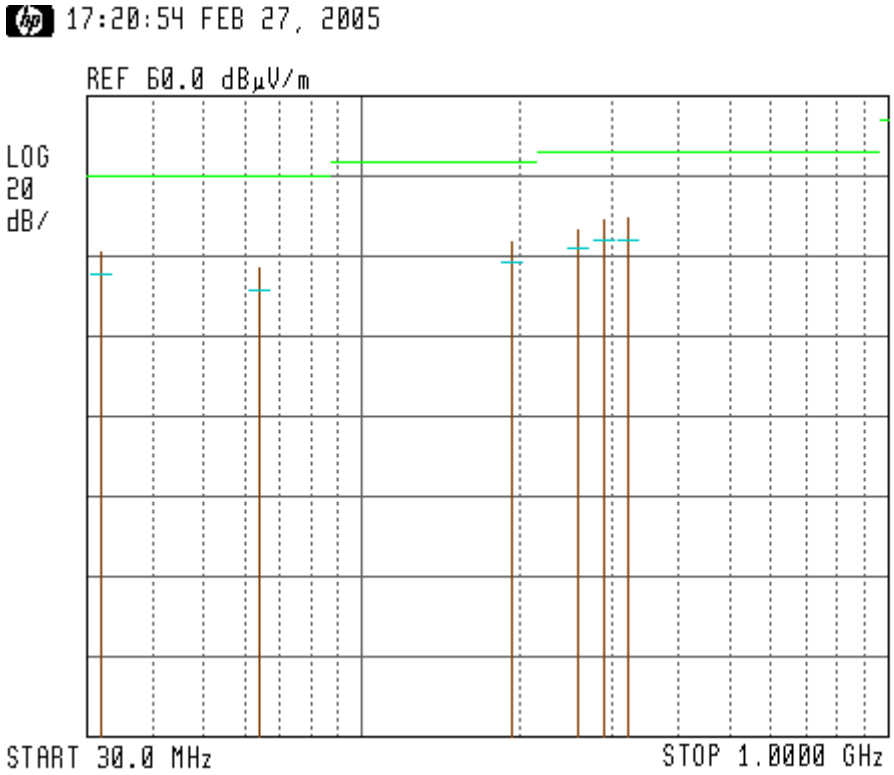

Figure 84. Radiated Emission. Antenna Polarization: HORIZONTAL Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

Radiated Emission

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Frequency (MHz)	Peak Amp (dBμV/m)	QP Amp (dBμV/m)	Correction (dB)	Specification (dBμV/m)	Margin (dB)
32.00	23.7	20.2	15.0	40.0	-19.8
64.00	19.2	14.2	10.1	40.0	-25.8
160.00	20.6	14.0	14.9	43.5	-29.5
192.00	23.8	18.0	16.4	43.5	-25.5
256.42	27.6	19.1	20.7	46.0	-26.9
320.53	30.6	24.2	23.1	46.0	-21.8

Figure 85. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	Bluetooth Communication Module
Type	MT-SiW35-SiGeL-001
Serial Number:	MTeyeBT100

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

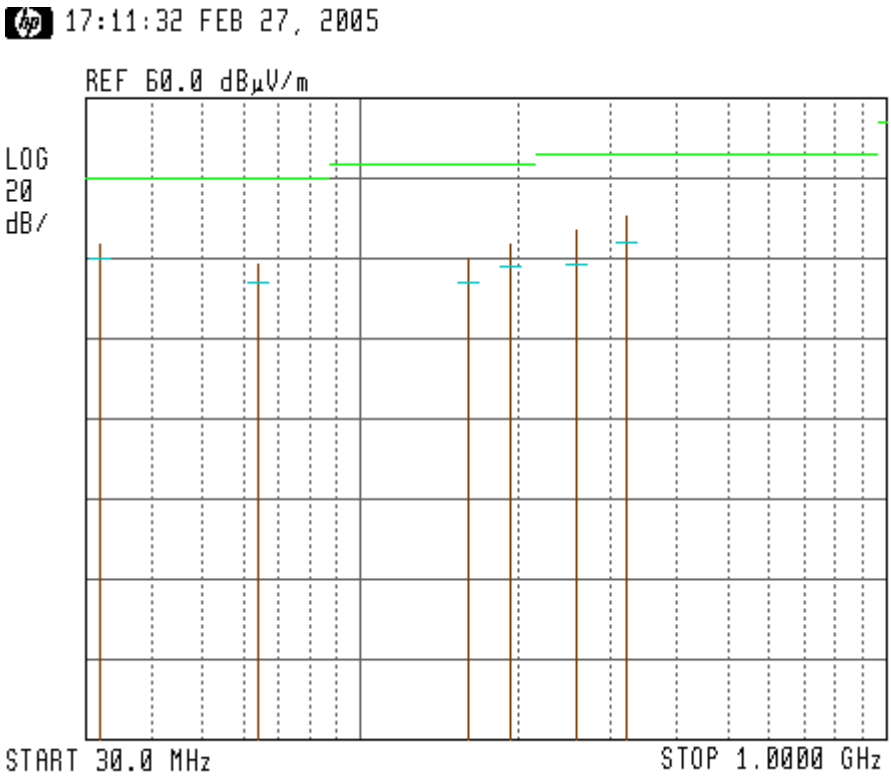

Figure 86. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*

17.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85420E/85422E	3427A00103/34	February 26, 2005	1 year
Antenna - Biconical HP	ARA	BCD-235/B	1041	April 11, 2004	1 year
Antenna - Log Periodic	ARA	LPD-2010/A	1038	March 21, 2004	1 year
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357.0	N/A	N/A

17.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dBµv/m]
RA:	Receiver Amplitude [dBµv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

18. Photographs of Tested E.U.T.

Figure 87 Top View

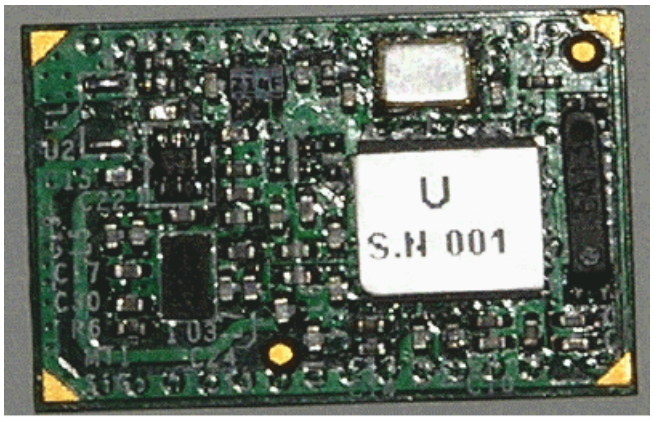

Figure 88 PCB Side 1

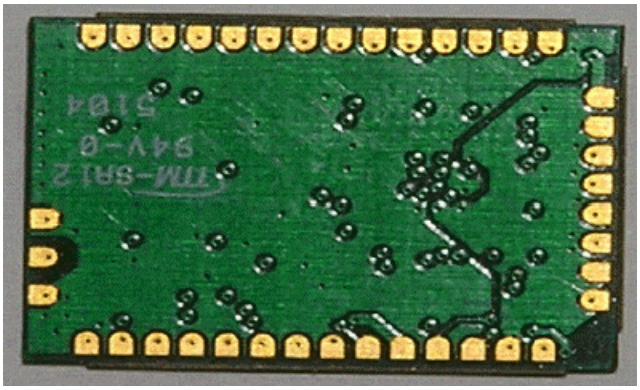

Figure 89 PCB Side 2

19. APPENDIX A - CORRECTION FACTORS

19.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.5
20.0	0.7
30.0	1.0
40.0	1.2
50.0	1.3
60.0	1.5
70.0	1.6
80.0	1.7
90.0	1.8
100.0	1.9
150.0	2.4
200.0	2.7
250.0	3.0
300.0	3.3
350.0	3.7
400.0	4.0
450.0	4.3
500.0	4.7
600.0	4.9
700.0	5.4
800.0	5.8
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.5
1400.0	8.2
1600.0	9.0
1800.0	9.6
2000.0	10.7
2300.0	11.1
2600.0	11.8
2900.0	12.8

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 27 meters.

3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

19.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

19.3 Correction factors for CABLE

from EMI receiver to test antenna

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.1
20.0	0.1
30.0	0.2
40.0	0.2
50.0	0.2
60.0	0.2
70.0	0.3
80.0	0.3
90.0	0.3
100.0	0.3
150.0	0.4
200.0	0.4
250.0	0.4
300.0	0.5
350.0	0.6
400.0	0.6
450.0	0.6
500.0	0.7
600.0	0.8
700.0	0.8
800.0	1.0
900.0	1.1
1000.0	1.1

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	1.4
1400.0	1.5
1600.0	1.5
1800.0	1.7
2000.0	1.7
2300.0	2.0
2600.0	2.1
2900.0	2.2

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 5.5 meters.

19.4 Correction factors for CABLE

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

19.5 Correction factors for CABLE

from EMI receiver to test antenna at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.6
20.0	1.1
30.0	1.3
40.0	1.6
50.0	1.7
60.0	1.9
70.0	2.0
80.0	2.2
90.0	2.3
100.0	2.4
150.0	3.1
200.0	3.6
250.0	4.2
300.0	4.5
350.0	4.8
400.0	5.2
450.0	5.5
500.0	6.2
600.0	6.4
700.0	7.0
800.0	7.5
900.0	8.1
1000.0	8.6

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	9.7
1400.0	10.5
1600.0	11.5
1800.0	12.6
2000.0	13.5
2300.0	14.3
2600.0	15.5
2900.0	16.4

NOTES:

1. *The cable type is RG-214.*
2. *The overall length of the cable is 34 meters.*
3. *The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".*

19.6 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	11.4
400.0	14.5
500.0	15.2
600.0	17.3
700.0	19.0
850.0	20.1
1000.0	22.2

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.2
400.0	14.4
500.0	15.2
600.0	17.2
700.0	19.0
850.0	20.1
1000.0	22.1

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

19.7 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. *Antenna serial number is 253.*
2. *The above lists are located in file number SAS3M0.ANT for a 3 meter range.*
3. *The files mentioned above are located on the disk marked "Antenna Factors".*

19.8 Correction factors for BICONICAL ANTENNA

Type BCD-235/B, at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

19.9 Correction factors for BICONICAL ANTENNA

Type BCD-235/B, 10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. *Antenna serial number is 1041.*
2. *The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".*

19.10 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2

17.11 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 1 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.5	5.8	10.0	37.9	12.3
1.5	25.8	8.0	10.5	38.0	12.6
2.0	27.8	8.5	11.0	38.2	12.8
2.5	28.5	9.7	11.5	38.8	12.6
3.0	30.1	9.6	12.0	38.7	13.1
3.5	31.3	9.8	12.5	38.7	13.5
4.0	32.8	9.5	13.0	39.7	12.8
4.5	32.4	10.8	13.5	40.0	12.8
5.0	33.8	10.4	14.0	40.8	12.4
5.5	34.3	10.8	14.5	40.3	13.1
6.0	34.6	11.1	15.0	39.0	14.8
6.5	34.9	11.5	15.5	37.4	16.6
7.0	35.9	11.2	16.0	37.6	16.7
7.5	37.0	10.7	16.5	39.0	15.5
8.0	36.9	11.3	17.0	41.3	13.5
8.5	37.3	11.5	17.5	44.3	10.8
9.0	37.5	11.8	18.0	46.7	8.6
9.5	37.4	12.3			

17.12 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

17.13 Correction factors for *Horn Antenna*

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

17.14 Correction factors for BICONICAL ANTENNA

Type 3109,
1.0 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	11.1
30.0	12.0
40.0	12.0
50.0	11.4
60.0	10.3
70.0	10.7
80.0	8.3
90.0	9.0
100.0	10.0
110.0	11.6
120.0	13.6
130.0	14.2
140.0	13.5
150.0	12.7
160.0	12.7
170.0	13.6
180.0	15.3
190.0	14.6
200.0	14.7
210.0	15.3
220.0	15.8
230.0	17.0
240.0	18.0
250.0	18.1
260.0	18.0
270.0	17.5
280.0	18.2
290.0	19.7
300.0	21.8

NOTES:

1. Antenna serial number is 3244.

2. The above list is located in file 44BIC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"

17.15. Correction factors for BICONICAL ANTENNA

Type 3109,
3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	18.4
30.0	14.0
40.0	12.3
50.0	10.6
60.0	8.3
70.0	8.7
80.0	7.2
90.0	8.6
100.0	10.1
110.0	11.2
120.0	11.8
130.0	12.3
140.0	12.7
150.0	12.5
160.0	12.4
170.0	12.1
180.0	12.2
190.0	12.8
200.0	13.7
210.0	14.5
220.0	15.4
230.0	15.9
240.0	16.3
250.0	16.7
260.0	17.1
270.0	17.2
280.0	17.5
290.0	18.1
300.0	18.9

NOTES:

1. Antenna serial number is 3244.

2. The above list is located in file 44BIC3M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"