

**DATE: 05 October 2008**

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

**FCC Radio Test Report**

for

**Midland Radio Corporation\***

**Equipment under test:**

**Bluetooth Headset and Intercom for Motorcycle  
Biker's Helmet**

**BT2 Intercom**

\*See customer's declaration on page 5.

Written by: *E. Ever*

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T. Shwartz, Test Engineer

Approved by: *I. Raz*

I. Raz, EMC Laboratory Manager

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This report relates only to items tested.



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# 1. General Information

## 1.1 Administrative Information

Manufacturer:	Midland Radio Corporation
Manufacturer's Address:	Thai Radio co. LTD Hi-Tech Industrial Estate 787 M00 1, Banlane Sub-District, Bang Pa-In District AYUTTHAYA 13160 Thailand
Manufacturer's Representative:	David Kingsolver
Equipment Under Test (E.U.T):	Bluetooth Headset and Intercom for Motorcycle Biker's Helmet
Equipment Model No.:	BT2 Intercom
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	13.04.08
Start of Test:	13.04.08
End of Test:	26.05.2008
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2



Date: 2/10/08

To Whom it may concern,

1. LogiCom Wireless Ltd. developed the Bluetooth Headset and Intercom for Motorcycle Biker's Helmet, Model BT2 Intercom.
2. The Bluetooth Headset and Intercom for Motorcycle Biker's Helmet, Model BT2 Intercom is manufactured by Thai Radio Company Ltd for MIDLAND RADIO CORPORATION .
3. Please issue all FCC certificates, test reports, and certifications to MIDLAND RADIO CORPORATION .

Moshe Zecharia (Zach)

General Manager  
מנהל כללי  
Logicom & Wireless Ltd  
LogiCom Wireless Ltd.

LogiCom&Wireless Ltd
62/A Mashabim St Hod HaSharon 45201 Israel Phone: 972 54 4202782 Telephone: 972 77 3455928

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## **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 product BT2 INTERCOM is a unique wireless BT2 headset for motorcycle biker that can be connected wirelessly via Bluetooth to a mobile phone and simultaneously to another unit to be utilized as a BT2 intercom.

The wireless connection is used for communications with Bluetooth devices like mobile phones, GPS Sat-Navs and MP3 players. The unit contain electronic card with BT2 class1 transmission power internally to the BT2 Intercom and printed integral 0dBi Gain antenna.

### **1.4 Test Methodology**

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4: 2003. Testing was also performed according to DA 00-705 March 30, 2000 concerning frequency hopping spread spectrum systems. 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 August 22, 2006). 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  $\pm 4$  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. System Test Configuration

### 2.1 *Justification*

The BT2 Intercom was configured for testing in a typical mode (as a customer would normally use it). During the test process all the BT2 functions operated and were configured for the maximum transmit power. Radiated emission screening was performed in 3 orthogonal orientations. The worst-case orientation was the horizontal position. Activating all the BT2 Intercom functions is the full operating mode.

### 2.2 *EUT Exercise Software*

Manufacturing software was used for the tests.

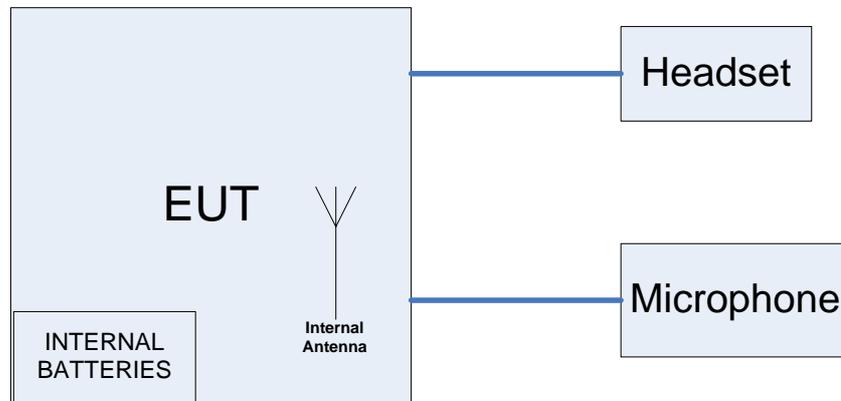
### 2.3 *Special Accessories*

No special accessories were needed to achieve compliance.

### 2.4 *Equipment Modifications*

No modifications were necessary in order to achieve compliance.

## 2.5 Configuration of Tested System



**Figure 1. Test Setup**

## 3. Theory of Operation

### 3.1 Theory of Operation

The product BT2INTERCOM is a unique wireless BT headset for motorcycle biker that can be connected wirelessly via Bluetooth to a mobile phone and simultaneously to another unit to be utilized as a BT intercom. The wireless connection is used for communications with Bluetooth devices like mobile phones, GPS Sat-Navs and MP3 players.

The unit contain electronic card with BT class1 transmission power internally to the BT IC and printed 0db antenna. The connection to the antenna is done via passive RF coupler that is used for the TX and for the RX RF signals transmission between the BT chipset and the printed antenna. The unit contains also audio amplifiers as an input stage and audio amplifiers as an output stages including variable gain amplifier for AGC that drives two 8 ohms speakers according to the level of the environmental noise. The board includes standard BT IC connected to flash memory.

The BT IC is CLK frequency is 26MHz +/-10ppm and all the relevant internal clocks are modulated and provided by that clock. The BT IC includes a 4.2V Li Polymer battery charger as well. The unit and the electronic board includes five tact switches for the unit activation and control.

## 4. Radiated Emission 9 kHz – 30 MHz

### 4.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

### 4.2 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 configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

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 at a distance of 3 meters.

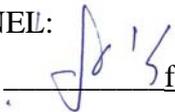
### 4.3 Measured Data

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature:  for T. Shwartz Date: 22.10.2008

Typed/Printed Name: T. Shwartz

#### 4.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 12, 2007	1 year
RF Section	HP	85420E	3705A00248	November 12, 2007	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2007	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	LaserJet 2200	JPKG19982	N/A	N/A

## 5. Spurious Radiated Emission 30 – 1000 MHz

### 5.1 Test Specification

30 MHz-1000 MHz, F.C.C., Part 15, Subpart C

### 5.2 Test Procedure

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

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

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 frequency range 30 MHz-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 30-1000 MHz, 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.

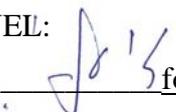
### 5.3 **Test Data**

JUDGEMENT:                      Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

The signals in the band 30 MHz – 1.0 GHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.

TEST PERSONNEL:

Tester Signature:  for T. Shwartz                      Date: 22.10.2008

Typed/Printed Name: T. Shwartz

#### 5.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 12, 2007	1 year
RF Section	HP	85420E	3705A00248	November 12, 2007	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 23, 2008	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 22, 2007	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	LaserJet 2200	JPKG19982	N/A	N/A

## 6. Spurious Radiated Emission in the Restricted Band 1 GHz to 25 GHz

### 6.1 Radiated Emission

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

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

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. 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 30 MHz - 2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 10 Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

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.)

## 6.2 Test Data

E.U.T. Description: Bluetooth Headset and Intercom for Motorcycle Biker's Helmet  
Model No.: Quasar 7Z01300

Serial Number: Not Designated

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

JUDGEMENT: Passed by 4.3 dB

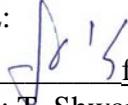
The EUT met the requirements of the F.C.C. Part 15, Subpart C.

For 2402.00 MHz there was a 10.2 dB margin at 4804.00 MHz frequency,  
vertical polarization.

For 2441.00 MHz there was an 11.1 dB margin at 4882.00 MHz frequency,  
horizontal polarization.

For 2481.00 MHz there was a 7.1 dB margin at 4962.00 MHz frequency,  
vertical polarization.

TEST PERSONNEL:

Tester Signature:  for T. Shwartz Date: 22.10.2008

Typed/Printed Name: T. Shwartz

## Radiated Emission

E.U.T Description	Bluetooth Headset and Intercom for Motorcycle Biker's Helmet
Type	BT2 Intercom
Serial Number:	Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical	Frequency range: 30 MHz to 25.0 GHz
Test Distance: 3 meters	Detector: Peak
Operation Frequency: 2402 MHz	

Freq.	Polarity	Peak Amp	Peak. Specification	Margin
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2390.00	V	53.9*	74.0	-20.1
2390.00	H	53.9*	74.0	-20.1
4804.00	H	61.7*	74.0	-12.3
4804.00	V	63.2*	74.0	-10.8

**Figure 2. Radiated Emission. Antenna Polarization: HORIZONTAL / 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 Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

# Radiated Emission

E.U.T Description    Bluetooth Headset and Intercom for  
Motorcycle Biker's Helmet

Type                      BT2 Intercom

Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 30 MHz to 25.0 GHz  
 Test Distance: 3 meters                              Detector: Average  
 Operation Frequency: 2402 MHz

<b>Freq.</b>	<b>Polarity</b>	<b>Average Amp</b>	<b>Average Specification</b>	<b>Margin</b>
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2390.00	V	41.3*	54.0	-12.7
2390.00	H	40.4*	54.0	-13.6
4804.00	H	43.8*	54.0	-10.2
4804.00	V	42.6*	54.0	-11.4

**Figure 3. Radiated Emission. Antenna Polarization: HORIZONTAL / 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 Amp” includes correction factor.

\*        Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

## Radiated Emission

E.U.T Description    Bluetooth Headset and Intercom for  
Motorcycle Biker's Helmet

Type                      BT2 Intercom

Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 30 MHz to 25.0 GHz  
 Test Distance: 3 meters                            Detector: Peak  
 Operation Frequency: 2441 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Margin
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
4882.00	H	62.9*	74.0	-11.1
4882.00	V	62.7*	74.0	-11.3

**Figure 4. Radiated Emission. Antenna Polarization: HORIZONTAL / 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 Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

# Radiated Emission

E.U.T Description    Bluetooth Headset and Intercom for  
Motorcycle Biker's Helmet

Type                    BT2 Intercom

Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 30 MHz to 25.0 GHz  
 Test Distance: 3 meters                              Detector: Average  
 Operation Frequency: 2441 MHz

<b>Freq.</b>	<b>Polarity</b>	<b>Average Amp</b>	<b>Average Specification</b>	<b>Margin</b>
(MHz)	(H/V)	(dBμV/m)	(dB μV/m)	(dB)
4882.00	H	40.1*	54.0	-13.9
4882.00	V	41.7*	54.0	-12.3

**Figure 5. Radiated Emission. Antenna Polarization: HORIZONTAL / 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 Amp” includes correction factor.

\*        Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

## Radiated Emission

E.U.T Description	Bluetooth Headset and Intercom for Motorcycle Biker's Helmet
Type	BT2 Intercom
Serial Number:	Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 30 MHz to 25.0 GHz  
 Test Distance: 3 meters      Detector: Peak  
 Operation Frequency: 2481 MHz

<b>Freq.</b>	<b>Polarity</b>	<b>Peak Amp</b>	<b>Peak. Specification</b>	<b>Margin</b>
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2483.55	V	54.6*	74.0	-19.4
2483.55	H	54.3*	74.0	-19.7
4962.00	H	62.5*	74.0	-11.5
4962.00	V	66.9*	74.0	-7.1

**Figure 6. Radiated Emission. Antenna Polarization: HORIZONTAL / 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 Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

## Radiated Emission

E.U.T Description	Bluetooth Headset and Intercom for Motorcycle Biker's Helmet
Type	BT2 Intercom
Serial Number:	Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 30 MHz to 25.0 GHz  
 Test Distance: 3 meters      Detector: Average  
 Operation Frequency: 2481 MHz

<b>Freq.</b>	<b>Polarity</b>	<b>Average Amp</b>	<b>Average Specification</b>	<b>Margin</b>
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2483.55	V	41.3*	54.0	-12.7
2483.55	H	40.6*	54.0	-13.4
4962.00	H	42.6*	54.0	-11.4
4962.00	V	41.4*	54.0	-12.6

**Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL / 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 Amp” includes correction factor.

\* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

### 6.3 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
RF Section	HP	85420E	3427A00103	November 12, 2007	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	February 4,2007	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 16, 2008	2 year
Horn Antenna	ARA	SWH-28	1008	December 8, 2006	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 2, 2007	1 year
Low Noise Amplifier	Sophia Wireless	LNA-28-B	0232	January 9, 2008	1 year
Spectrum Analyzer	HP	8592L	3926A01204	March 5, 2008	1 year

## 7. Band Edge

[In Accordance with section 15.247(d)]

### 7.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2402 MHz, and 2481 MHz correspondingly.

The E.U.T. was tested in 2 operating channels and frequencies (1 (2.402 GHz); 14 (2.481 GHz)).

## Band Edge

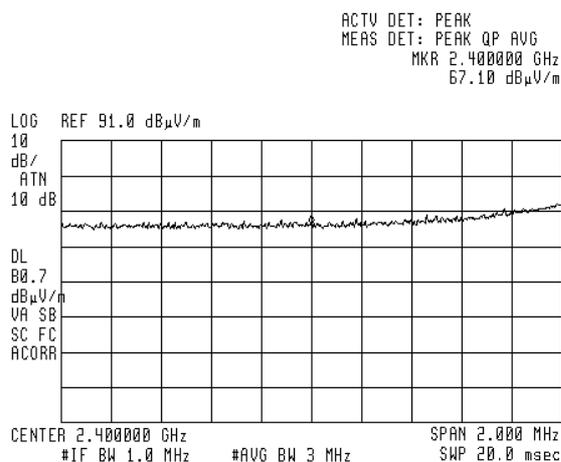
[In Accordance with section 15.247(c)]

E.U.T Description Bluetooth Headset and Intercom for  
Motorcycle Biker's Helmet

Type BT2 Intercom

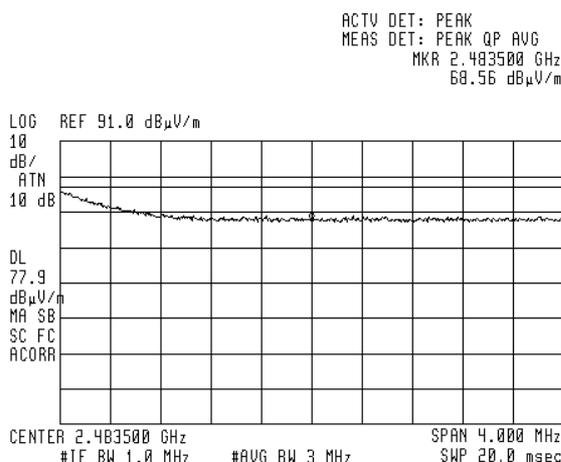
Serial Number: Not Designated

14:35:20 OCT 29, 2008



**Figure 8. Band Edge for operation Frequency 2402 MHz:**  
**Limit(20dBc)= 80.6 dB $\mu$ V/m , Peak @ 2.4835GHz=67.10 dB $\mu$ V/m**

14:26:24 OCT 29, 2008



**Figure 9. Band Edge for operation frequency 2481 MHz:**  
**Limit(20dBc)= 80.6 dB $\mu$ V/m , Peak @ 2.4835GHz=68.6 dB $\mu$ V/m**

## 7.1 Results table

E.U.T. Description: Bluetooth Headset and Intercom for Motorcycle Biker's Helmet

Model No.: BT2 Intercom

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
2402.00	2400.00	67.1	80.6	-13.5
2481.00	2483.50	68.6	80.6	-12.0

**Figure 10 Band Edge**

JUDGEMENT: Passed by 12.0 dB

TEST PERSONNEL:

Tester Signature: 

Date: 30/10/2008

Typed/Printed Name: A. Sharabi

## 7.1 Test Equipment Used.

### Band edge Spectrum

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration</b>	<b>Period</b>
Receiver	HP	85422E	3906A00276	November 12, 2007	1 year
RF Section	HP	85420E	3705A00248	November 12, 2007	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	LaserJet 2200	JPKG19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4, 2007	2 years

## 8. Number of Hopping Frequencies Section 15.247(a)(1)(iii)

### 8.1 Test Specification

F.C.C., Part 15, Subpart C

### 8.2 Test Procedure

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Span: Every 40 MHz Frequency

Band of Operation: 2402-2481 MHz

RBW: 100kHz

VBW: 300kHz

Detector Function: Peak

Trace: Maximum Hold

The number of hopping frequencies is  $21+20+20+18 = 79$  (See plots).



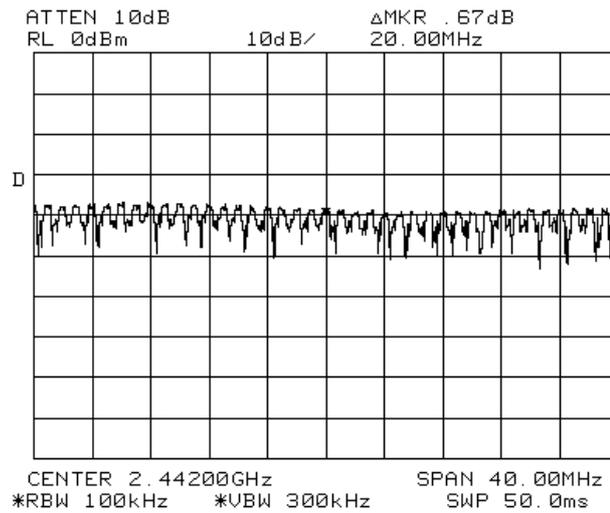


## Number of Hopping Frequencies

E.U.T Description Bluetooth Headset and Intercom for  
Motorcycle Biker's Helmet

Type BT2 Intercom

Serial Number: Not Designated



**Figure 13. 2.442 GHz**



### 8.3 Results table

E.U.T. Description: Bluetooth Headset and Intercom for Motorcycle Biker's Helmet  
Model No.: Quasar 7Z01300

Serial Number: Not Designated

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

Band1 = 2402 – 2422 (Mhz) = 21

Band2 = 2422 – 2442 (Mhz) = 20

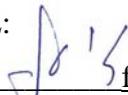
Band3 = 2442 – 2462 (Mhz) = 19

Band4 = 2462 – 2481 (Mhz) = 19

Number of Hopping Frequencies	Specification
79	>75

**Figure 15 Number of Hopping Frequencies**

TEST PERSONNEL:

Tester Signature:  for T. Shwartz

Date: 22.10.2008

Typed/Printed Name: T. Shwartz

#### 8.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

## 9. Channel Frequency Separation

### 9.1 Test procedure

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Span: 2 MHz

RBW: 10kHz

VBW: 10kHz

Detector Function: Peak

Trace: Maximum Hold

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

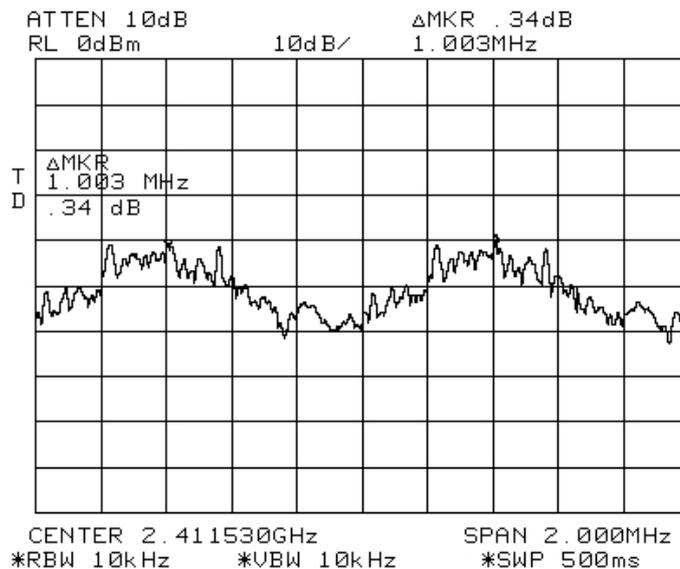


Figure 16. 2.4115 GHz.

## 9.2 Results table

E.U.T. Description: Bluetooth Headset and Intercom for Motorcycle Biker's Helmet  
 Model No.: BT2 Intercom

Serial Number: Not Designated

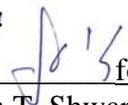
Specification: FCC Part 15, Subpart C, 15.247(a) (1)

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
1003.0	>810	193

**Figure 17 Channel Frequency Separation**

JUDGEMENT: Passed by 193 kHz

TEST PERSONNEL:

Tester Signature:  for T. Shwartz

Date: 22.10.2008

Typed/Printed Name: T. Shwartz

### 9.3 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	February 8, 2008	1 year

## 10. Radiated Power Output

### 10.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)

### 10.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

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

The E.U.T. was tested in three operating channels and frequencies (1 (2.402 GHz); 8 (2.441 GHz); 14 (2.481 GHz)).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [\text{W}]$$

The E.U.T. was tested at 2402, 2441, and 2481 MHz with QPSK modulation.

### 10.3 Results Calculation

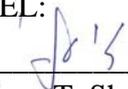
E.U.T. Description: Bluetooth Headset and Intercom for Motorcycle Biker's Helmet  
 Model No.: BT2 Intercom  
 Serial Number: Not Designated  
 Specification: F.C.C. Part 15, Subpart C: 15.247(b)

Frequency	Pol	E	E	Antenna Gain	Antenna Distance	Calculated Results	Limit	Margin
(MHz)		(dB $\mu$ V/m)	(V/m)	(dBi)	(m)	(mW)	(W)	(mW)
2402.00	V	98.83	0.08	0	3	1.92	1	-808.0
2402.00	H	100.65	0.10	0	3	3.0	1	-700.0
2441.0	V	97.48	0.07	0	3	1.47	1	-853.0
2441.0	H	102.97	0.14	0	3	5.88	1	-412.0
2481.0	V	93.87	0.04	0	3	0.48	1	-952.0
2481.0	H	97.90	0.07	0	3	1.47	1	-853.0

**Figure 18 Test Results**

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature:  for T. Shwartz Date: 22.10.2008

Typed/Printed Name: T. Shwartz

#### 10.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 12, 2007	1 year
RF Section	HP	85420E	3705A00248	November 12, 2007	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	LaserJet 2200	JKPGC19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	February 4, 2007	2 years





## 11.2 Results table

E.U.T Description: Bluetooth Headset and Intercom for Motorcycle Biker's Helmet

Model No.: BT2 Intercom

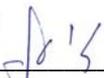
Serial Number: Not Designated

Specification: FCC Part 15, Subpart C (15.247-a2)

Operation Frequency (MHz)	Reading (kHz)
2402.0	1925.0
2448.0	1992.0
2481.0	1717.0

**Figure 22 20 dB Bandwidth**

TEST PERSONNEL:

Tester Signature:  for T. Shwartz Date: 22.10.2008

Typed/Printed Name: T. Shwartz

### 11.3 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year
Cable	Rhophase	KPS-5000- KPS	A1674	February 8, 2008	1 year

## 12. Dwell Time on Each Channel

### 12.1 Test Specification

FCC Part 15, Section 15.247(a)(1)(iii)

### 12.2 Test Procedure

The E.U.T. was tested in radiated mode using the substitutional antenna. The spectrum analyzer was set to 100 kHz RBW and 100 kHz VBW.

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 12.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(iii).

Additional information of the results is given in *Figure 23 to Figure 25*.

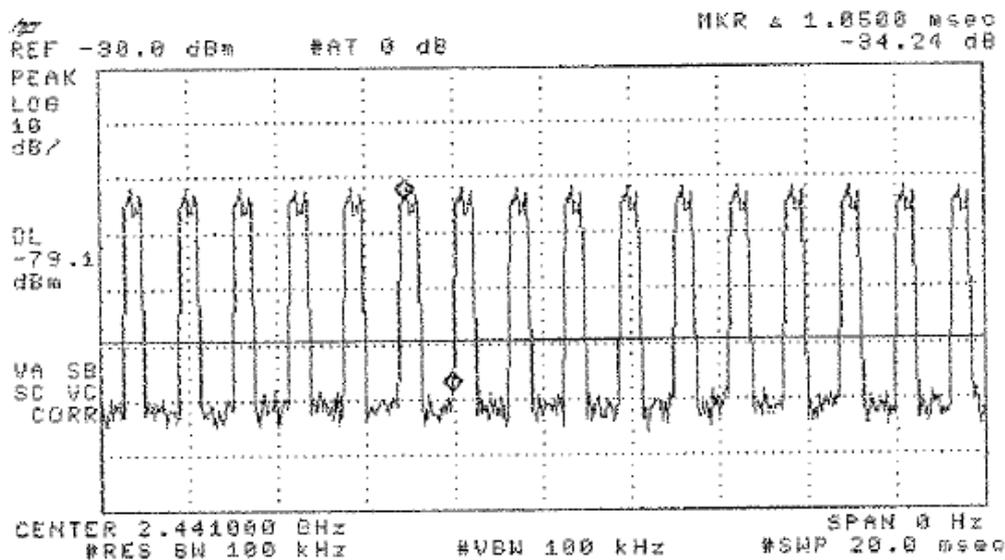


Figure 23 — T=1msec, Ton=0.3msec, D.C=30%

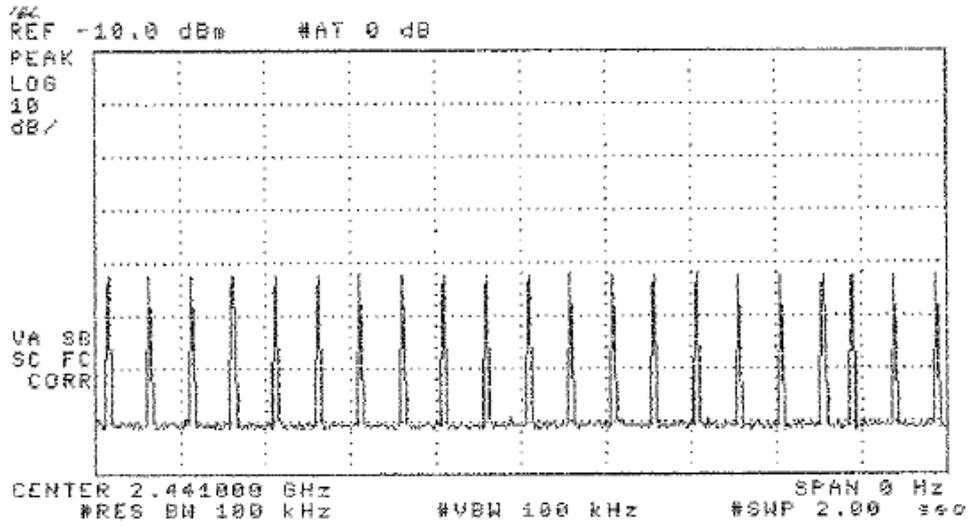


Figure 24 — Number of channels in 2 sec. =21

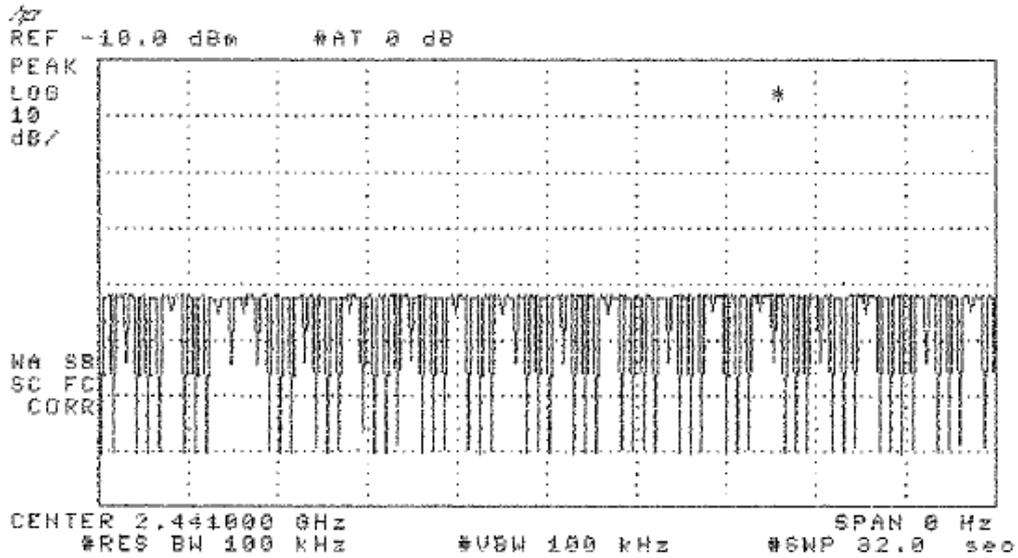


Figure 25 — Dwell time at 2.441GHz

[32/2=16, 21 x 16 =336, 336 x 0.3msec = 0.1sec , spec=0.4 sec]

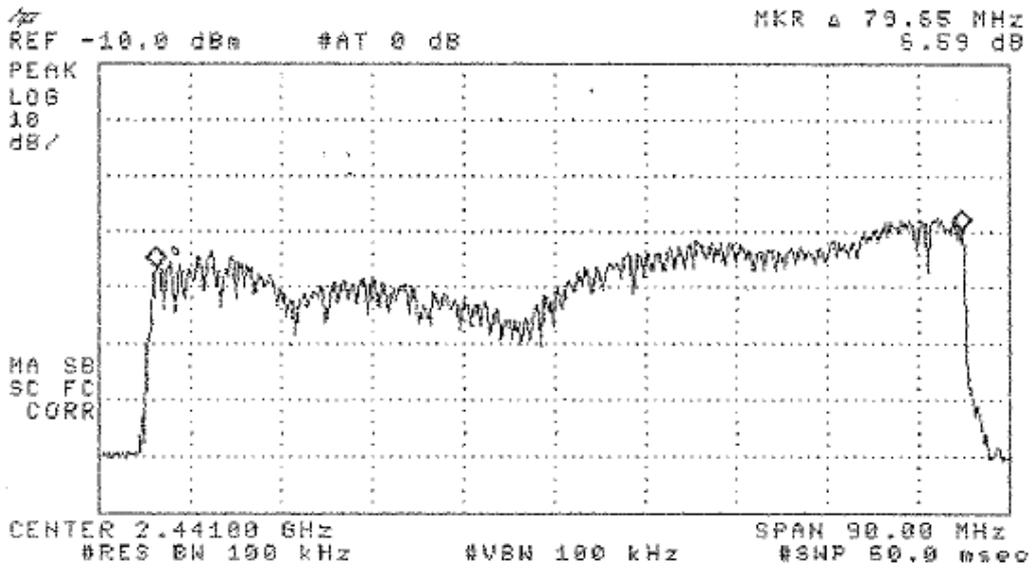


Figure 26 — Entire 79 Channels Display

#### 12.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	November 14, 2007	1 year

## 13. R.F Exposure/Safety Calculation

### 15.247 (i)

The typical use of the EUT is an intercom wireless headset for a motorcycle biker that can be connected wirelessly via Bluetooth to a mobile phone and simultaneously to another unit to be utilized as an intercom. The unit is typically placed on the biker's helmet and the distance between the E.U.T. and the user in the worst case application, is 2 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 5.88 mW (Peak) = 7.69dBm

$G_t$ - Antenna Gain, 0 dBi

$R$ - Distance from Transmitter using 2cm worst case

(c) Transmitter peak power using source based time averaging of 20% maximum, 20 msec "ON" time, "OFF" + "ON" time 100 msec:

$$P_t = \frac{5.88 \times 20}{100} = 1.176mW$$

(d) The peak power density (time averaging) is :

$$S_p = \frac{1.176 \times 1}{4\pi(2)^2} = 0.023 \frac{mW}{cm^2}$$

(e) This is significantly below the FCC limit.

## 14. APPENDIX A - CORRECTION FACTORS

### 14.1 Correction factors for CABLE from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

**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".

**14.2 Correction factors for CABLE**  
**from EMI receiver**  
**to test antenna**  
**at 3 meter range.**

<b>FREQUENCY</b> <b>(GHz)</b>	<b>CORRECTION</b> <b>FACTOR</b> <b>(dB)</b>
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.*

**14.3 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.*

**14.4 Correction factors for CABLE**  
**from EMI receiver**  
**to test antenna**  
**at 10 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	9.8
20.0	0.8	1400.0	10.0
30.0	0.9	1600.0	11.3
40.0	1.2	1800.0	12.2
50.0	1.4	2000.0	13.1
60.0	1.6	2300.0	14.5
70.0	1.8	2600.0	15.9
80.0	1.9	2900.0	16.4
90.0	2.0		
100.0	2.1		
150.0	2.6		
200.0	3.2		
250.0	3.8		
300.0	4.2		
350.0	4.6		
400.0	5.1		
450.0	5.3		
500.0	5.6		
600.0	6.3		
700.0	7.0		
800.0	7.6		
900.0	8.0		
1000.0	8.7		

**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".

## 12.6 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	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

#### Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

#### NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.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".

**14.5 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".

**14.6 Correction factors for BICONICAL ANTENNA  
Type BCD-235/B,  
at 3 meter range**

<b>FREQUENCY (MHz)</b>	<b>AFE (dB/m)</b>
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".

**14.7 Correction factors for BICONICAL ANTENNA  
Type BCD-235/B,  
10 meter range**

<b>FREQUENCY (MHz)</b>	<b>AFE (dB/m)</b>
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".

### 14.8 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENN A 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			

**14.9 Correction factors for**

**Horn Antenna  
Model: SWH-28  
at 1 meter range.**

<b>FREQUENCY (GHz)</b>	<b>AFE (dB /m)</b>	<b>Gain (dB1)</b>
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

**14.10 Correction factors for**

**Horn Antenna  
Model: V637**

<b>FREQUENCY (GHz)</b>	<b>AFE (dB /m)</b>	<b>Gain (dB1)</b>
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

### 14.11 Correction factors for ACTIVE LOOP ANTENNA

**Model 6502**

**S/N 9506-2950**

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (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