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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C (15.247) FHSS Specifications and Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the Zultys Technologies Model: ZIP4x5

FCC ID:	R7NZIP4X5
UPN:	4478A-ZIP4X5
GRANTEE:	Zultys Technologies 771 Vaqueros Avenue Sunnyvale, CA 94085
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	May 21, 2004
FINAL TEST DATE:	May 19, 2004
AUTHORIZED SIGNATORY:	Mark Briggs Vice President of Engineering

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the Zultys Technologies model ZIP4x5 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and RSS-210 Issue 5 for license-exempt low power devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Zultys Technologies model ZIP4x5 and therefore apply only to the tested sample. The sample was selected and prepared by David Tu of Zultys Technologies

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules and RSS-210 Issue 5 for license-exempt low power devices for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units that are subsequently manufactured.

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
	6.2.2(o)(a)	20dB Bandwidth	908 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
	6.2.2(o)(a)	Channel Separation	1000 kHz		Complies
	6.2.2(o)(a)	Number of Channels	79	**2400- 2483.5 MHz**: 75 hopping frequencies: average time of occupancy <0.4 second within a 30 second period.	Complies
	6.2.2(o)(a)	Channel Dwell Time	390m seconds per 30 seconds		Complies
	6.2.2(o)(a)	Channel Utilization	All channels are used equally	The system uses the BlueTooth algorithm and, therefore, meets all requirements for channel utilization.	Complies
15.247 (b) (3)	6.2.2(o)(a)	Output Power, 2400 - 2483.5 MHz	1.5 dBm (1.5mW) EIRP = 0.0015 W	Multi-point applications: **2400 – 2483.5 MHz** Maximum permitted is 1Watt, with EIRP limited to 4.	Complies
	6.2.2(o)(e1)	Spurious Emissions – 30MHz – 25GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Radiated Spurious Emissions 30MHz – 25GHz	48.3 dBuV/m @ 2390.000 MHz (- 5.7 dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.207		AC Conducted Emissions	-14.1dB @ 0.490MHz	FCC 15.207	Complies
	6.6	AC Conducted Emissions	-5.9dB @ 0.490MHz	RSS 210 section 6.6	Complies
15.247 (b) (5)		RF Exposure Requirements	Output power is below the threshold for SAR evaluation and below the threshold requiring no co-location warnings.	Threshold for SAR for portable devices is 60/f mW. For 2.4Ghz device this threshold is 25mW. The output power is less than 5mW.	Complies
15.203		RF Connector	Integral antenna	Integral antenna or specialized connector required	Complies

Note 1 - the EUT is powered from an external AC-DC adapter

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Zultys Technologies model ZIP4x5 is a VOIP telephone with a Bluetooth transceiver for use with cordless headsets. Normally, the EUT would be placed on a tabletop during operation. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT's external AC-DC adapter is 120V, 60Hz 11.5Watts.

The sample was received on May 19, 2004 and tested on May 19, 2004. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	Proposed FCC ID #
Zultys ZIP4x5 VOIP Phone	000BEA8004D4	TBP

OTHER EUT DETAILS

The EUT uses a Bluetooth transceiver module. The transceiver is designed to operate from 2402 to 2480 MHz using 79 channels for frequency hopping spread spectrum. The device meets the Bluetooth protocol requirements, thereby meeting the FCC's and Industry requirements for channel occupancy, number of channels.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 15 cm wide by 20 cm deep by 3 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number	FCC ID Number
Zultys ZIP4x5 VOIP Phone	00BEA004D3	N/A
Advanced American 148 Analog	J670801	N/A
Dell Latitude Laptop PC	-	-

No equipment was used as remote support equipment for emissions testing:

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
EUT ethernet 1-4	Support VOIP phone ports 1-4	Cat 5 UTP	unshielded	3
EUT Analog	Analog phone	RJ11	unshielded	10
EUT serial **	Laptop	-	shielded	2
EUT DC In	EUT AC-DC adapter	integral to adapter	unshielded	1.5

** Note: The serial port was connected for testing purposes only to program the transceiver to transmit/receive as detailed in the operational description below. During testing the cable was disconnected. The connector was inside the EUT and not user accessible. The port is intended for testing purposes only and would not be used during normal operation.

EUT OPERATION DURING TESTING

During testing the EUT was configured to transmit continuously on a specified channel (power and spurious emissions measurements), hop across all channels (occupancy and related measurements) or receive continuously on a specified channel. For channel-specific measurements the lowest, highest and center channels (2402, 2480 and 2441 MHz) were used.

ANTENNA REQUIREMENTS

The antenna is integrated onto the circuit board of the rf transceiver.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on May 19, 2004 at the Elliott Laboratories Open Area Test Site #4 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 5 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

A power meter and peak power sensor are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

Measurement bandwidths (video and resolution) are set in accordance with FCC procedures for the type of radio being tested.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions from the AC power port are given in units of microvolts, the limits for radiated electric field emissions are given in units of microvolts per meter at a specified test distance and the output power limits are given in temrs of Watts, milliwatts or dBm. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp) the following formula is used to determine the field strength limit in terms of microvolts per meter at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \text{ v } 30 \text{ P}}{3} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For reference, converting the voltage and electric field strength specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. Conversion of power specification limits from linear units (in milliwatts) to decibel form (in dBm) is accomplished by taking the base ten logarithm, then multiplying by 10.

FCC 15.247 (a)and RSS 210 (o) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Number Of Channels	Output Power
902 – 928	>=50	1 W (30 dBm)
902 – 928	< 50	0.25 W (24 dBm)
2400 – 2483.5	>= 75	1 W (30 dBm)
2400 – 2483.5	>= 75	0.125 W (21 dBm)
5725 – 5850	>=75	1 W (30 dBm)

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

RSS 210 (o) AND FCC 15.247 SPURIOUS RADIATED EMISSIONS LIMITS

T limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands detailed in Part 15.205 and for all spurious emissions from the receiver are:

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level.

FCC AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.207.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

RSS-210 SECTION 6.6 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in Industry Canada RSS-210 section 6.6.

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions and Radio Performance Tests, 19-May-04
Engineer: Mark Briggs

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer 30Hz - 40 GHz, Sunnyvale	8564E (84125C)	1148	02-Jun-04

Conducted Emissions - AC Power, 15-Jun-04
Engineer: Joseph Cadigal

Manufacturer	Description	Model #	Asset #	Cal Due
Fischer Custom Comm.	LISN, Freq. 0.9 -30 MHz,16 Amp	FCC-LISN-50/250	1079	01-Jul-04
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	05-Jan-05
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1593	04-May-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T55685 17 Pages

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EMC Test Data

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Emissions Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A
Immunity Spec:	N/A	Environment:	N/A

EMC Test Data

For The

Zultys

Model

Zip 4x5 (VOIP Phone with Bluetooth)

Date of Last Test: 6/11/2004

Elliott

EMC Test Data

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Emissions Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A
Immunity Spec:	N/A	Environment:	N/A

EUT INFORMATION

General Description

The EUT is a VOIP telephone with a Bluetooth transceiver for use with cordless headsets.. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT's external AC-DC adapter is 120V, 60Hz 11.5Watts.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Zultys	Zip4x5	VOIP Phone	000BEA8004D4	**Required**

Other EUT Details

The EUT uses a Bluetooth transceiver module. The transceiver is designed to operate from 2402 to 2480 MHz using 79 channels for frequency hopping spread spectrum. The device meets the Bluetooth protocol requirements, thereby meeting the FCC's and Industry requirements for channel occupancy, number of channels.

EUT Enclosure

The EUT enclosure is primarily constructed of plastic. It measures approximately 15 cm wide by 20 cm deep by 3 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None made

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

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EMC Test Data

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Emissions Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A
Immunity Spec:	N/A	Environment:	N/A

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Zultys	Zip 4x5	VOIP Phone	000BEA004D3	N/A
Advanced American	148	Analog	J670801	N/A
Dell	Latitude	Laptop PC	-	-

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
EUT ethernet 1-4	Support VOIP phone	Cat 5 UTP	unshielded	3
EUT Analog	Analog phone	RJ11	unshielded	10
EUT serial **	Laptop	-	shielded	2
EUT DC In	EUT AC-DC adapter	integral to adapter	unshielded	1.5

** Note: The serial port was connected for testing purposes only to program the transceiver to transmit/receive as detailed in the operational description below. During testing the cable was disconnected. The connector was inside the EUT and not user accesible. The port is intended for testing purposes only and would not be used during normal operation.
For conducted emissions tests the ethernet ports were looped to each other and not connected to a second VOIP telephone.

EUT Operation During Emissions

During testing the EUT was confugred to transmit continuously on a specified channel (power and spurious emissions measurements), hop across all channels (occupancy and related measurements) or receive continuously on a specified channel. For channel-specific measurements the lowest, highest and center channels (2402, 2480 and 2441 MHz) were used.

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

Conducted Emissions - Power Ports

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/15/2004
Test Engineer: Joseph Cadigal
Test Location: SVOATS #1

Config. Used: 1
Config Change: none
EUT Voltage: 230V/50Hz and 120V/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature: 21.7 °C
Rel. Humidity: 63 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	CE, AC Power,120V/60Hz	FCC 15.207	Pass	-14.1dB @ 0.490MHz
2	CE, AC Power,120V/60Hz	RSS 210	Pass	-5.9dB @ 0.490MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

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EMC Test Data

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz

Refer to Test Log T54595 for details.

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

model MW41-1200600

Frequency	Level	AC	EN55022 B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.490	42.1	line	56.2	-14.1	QP	
5.925	35.3	neutral	50.0	-14.7	Average	
0.150	49.9	line	66.0	-16.1	QP	
0.680	25.1	neutral	46.0	-20.9	Average	
18.860	36.1	neutral	60.0	-23.9	QP	
18.860	25.6	neutral	50.0	-24.4	Average	
5.925	34.6	neutral	60.0	-25.4	QP	
0.680	27.2	neutral	56.0	-28.8	QP	
0.490	14.6	line	46.2	-31.6	Average	
18.900	14.8	line	50.0	-35.2	Average	
18.900	24.5	line	60.0	-35.5	QP	
5.945	14.0	line	50.0	-36.0	Average	
0.150	19.8	line	56.0	-36.2	Average	
5.945	23.2	line	60.0	-36.8	QP	

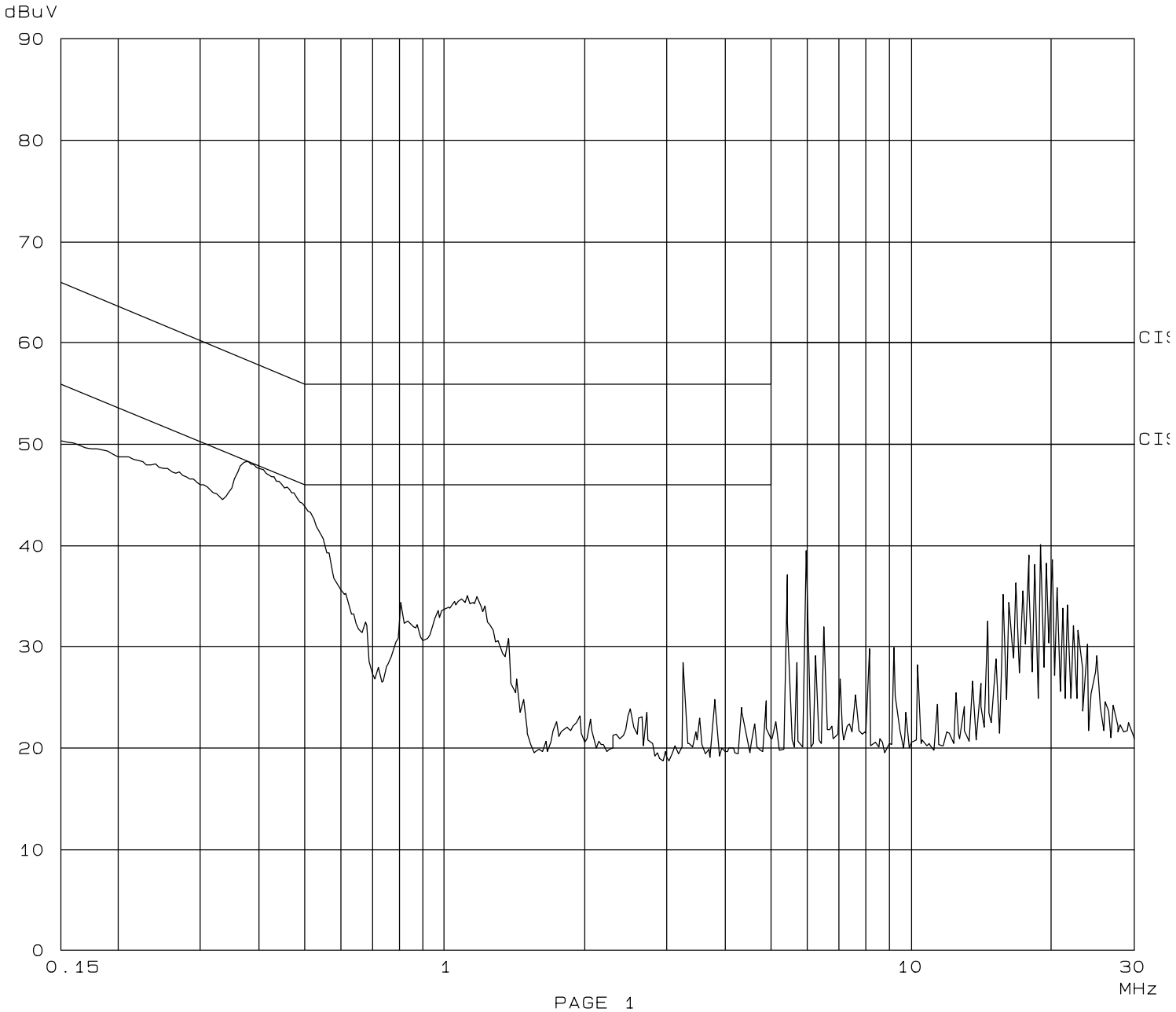
model MW41-1200600

Frequency	Level	AC	RSS 210		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.490	42.1	line	48.0	-5.9	QP	
18.860	36.1	neutral	48.0	-11.9	QP	
5.925	34.6	neutral	48.0	-13.4	QP	
0.680	27.2	neutral	48.0	-20.8	QP	
18.900	24.5	line	48.0	-23.5	QP	
5.945	23.2	line	48.0	-24.8	QP	

Elliott Laboratories
AC Conducted Emissions

15. Jun 04 11:21

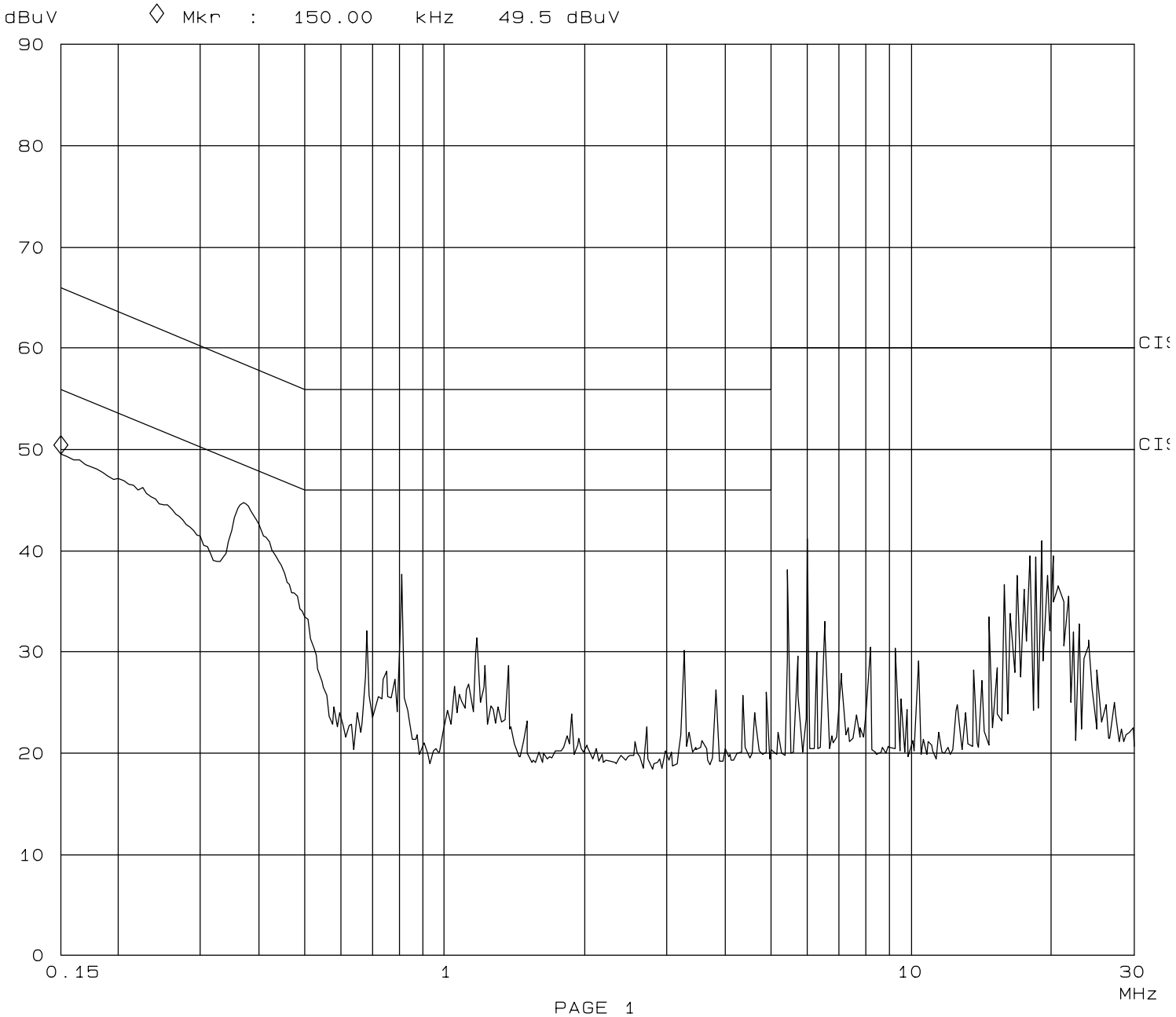
EUT:	ZIP4x5
Manuf:	Zultys
Op Cond:	230V / 50Hz
Operator:	Joseph Cadigal
Test Spec:	EN55022 B
Comment:	Run 1 Line
	J54594 / T54595



Elliott Laboratories
AC Conducted Emissions

15. Jun 04 11:04

EUT:	ZIP4x5
Manuf:	Zultys
Op Cond:	230V / 50Hz
Operator:	Joseph Cadigal
Test Spec:	EN55022 B
Comment:	Run 1 Line
	J54594 / T54595

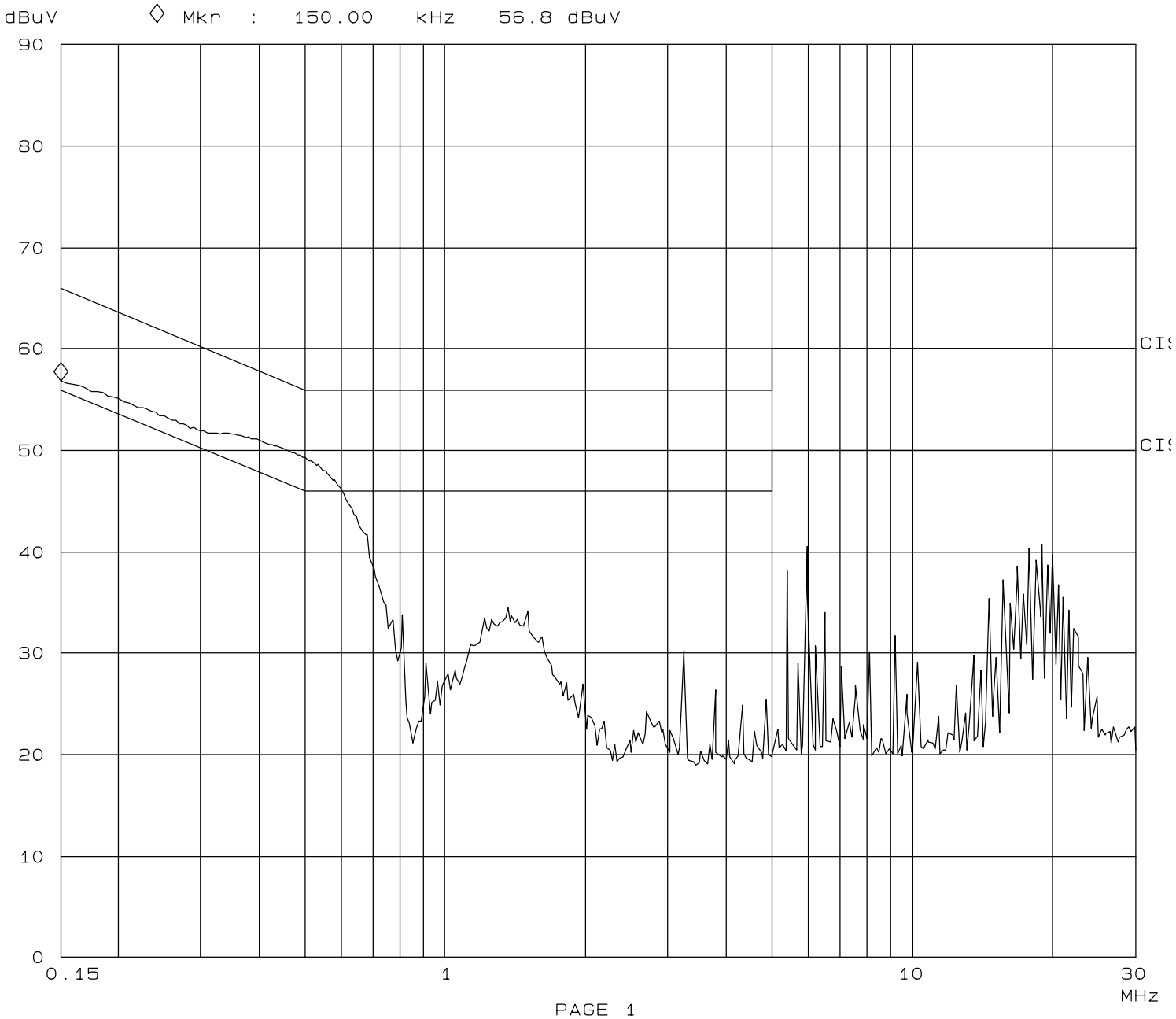


Elliott Laboratories

15. Jun 04 11:38

AC Conducted Emissions

EUT: ZIP4x5
Manuf: Zultys
Op Cond: 120V / 60Hz
Operator: Joseph Cadigal
Test Spec: EN55022 B
Comment: Run 1 Neutral
J54594 / T54595 model MW41-12000600

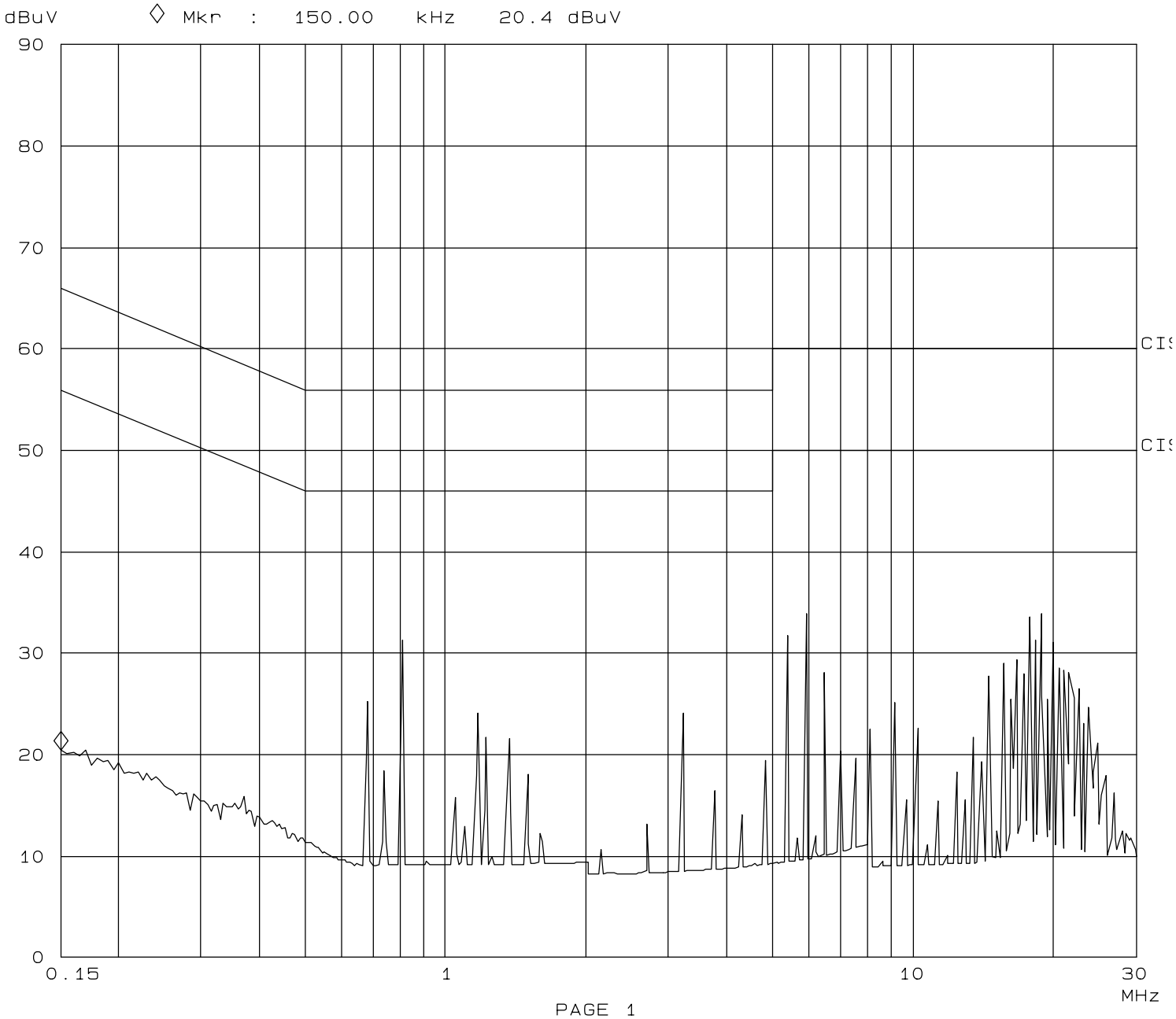


Elliott Laboratories

15. Jun 04 11:58

AC Conducted Emissions

EUT: ZIP4x5
Manuf: Zultys
Op Cond: 120V / 60Hz
Operator: Joseph Cadigal
Test Spec: EN55022 B
Comment: Run 1 Line
J54594 / T54595 model MW41-12000600



Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/19/2004
Test Engineer: Mark Briggs
Test Location: SVOATS #4

Config. Used: #1
Config Change: N/A
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. The laptop was located beneath the table (it was not connected to the EUT when measurements were made).

Unless stated otherwise, the measurement antenna was located 3 meters from the EUT.

Unless stated otherwise the EUT was operating such that it constantly transmitted on either the low, center or high channel.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin / Comment
1a-c	RE, 30 - 2500 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c) / RSS 210	Pass	-5.7dB @ 2390 MHz
1d	RE, 30 - 25000 MHz - Spurious Emissions (Receive Mode)	RSS 210	Pass	> 20dB
2	20dB Bandwidth	15.247(a)	Pass	908 kHz
3	Output Power	15.247(b)	Pass	1.5dBm (1.5mW, 0.0015W)
4	Channel Occupancy / Separation	15.247(a)	Pass	390mS / 30 seconds; 1MHz separation
4	Number of Channels	15.247(a)	Pass	79 channels

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

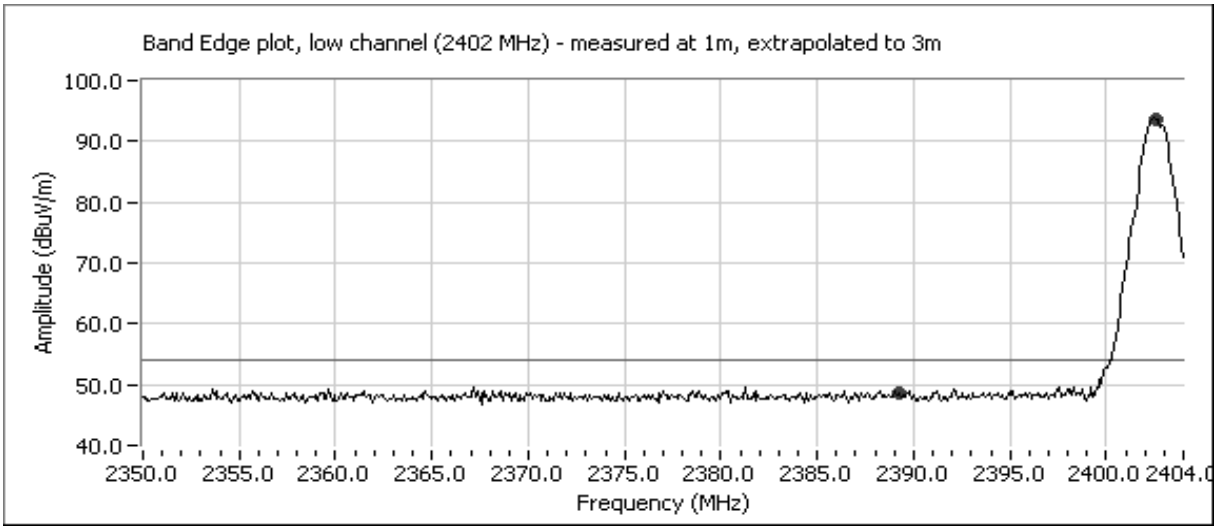
No deviations were made from the requirements of the standard.

EMC Test Data

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

Run #1a: Radiated Spurious Emissions, 30 - 25000 MHz. Low Channel @ 2402 MHz

	H	V
Fundamental emission level @ 3m in 3MHz RBW:	96.2	96.8
Delta Marker - Peak	38.8 dB	
Delta Marker - Average	48.5 dB	
Calculated Band-Edge Measurement:	58 dBuV/m	
Calculated Band-Edge Measurement:	48.3 dBuV/m	



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2402.045	96.2	H	-	-	Pk	235	1.3	RB=2MHz, VB=3MHz
2402.020	96.8	V	-	-	Pk	225	1.0	RB=2MHz, VB=3MHz
2390.000	48.3	H	54.0	-5.7	AVG	225	1.0	
2390.000	58.0	H	74.0	-16.0	PK	225	1.0	
4804.015	37.4	H	54.0	-16.6	AVG	299	1.4	
4803.988	36.3	V	54.0	-17.7	AVG	143	1.4	
4804.015	47.7	H	74.0	-26.3	PK	299	1.4	
4803.988	47.0	V	74.0	-27.0	PK	143	1.4	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	Average measurements made with RB=1MHz, VB=10Hz. Peak measurements made using RB=VB=1MHz.
Note 3:	Delta marker between in-band and restricted band signal level was 48.5dB (average), giving band edge level of 48.3dBuV/m. The peak delta was 38.8dB, giving band edge level of 58.0dBuV/m.
Note 4:	Scans were made with the receive antenna located 50cm from the device to determine that there were no spurious signals of a significant level, other than the second harmonic.

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EMC Test Data

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

Run #1b: Radiated Spurious Emissions, 30 - 25000 MHz. Center Channel @ 2441 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2441.110	95.4	V	-	-	Pk	220	1.0	RB=2MHz, VB=3MHz
2441.055	96.7	H	-	-	Pk	234	1.2	RB=2MHz, VB=3MHz
4881.970	40.9	V	54.0	-13.1	AVG	191	1.0	
4881.989	38.5	H	54.0	-15.6	AVG	163	1.0	
4881.970	49.5	V	74.0	-24.5	PK	191	1.0	
4881.989	48.1	H	74.0	-25.9	PK	163	1.0	

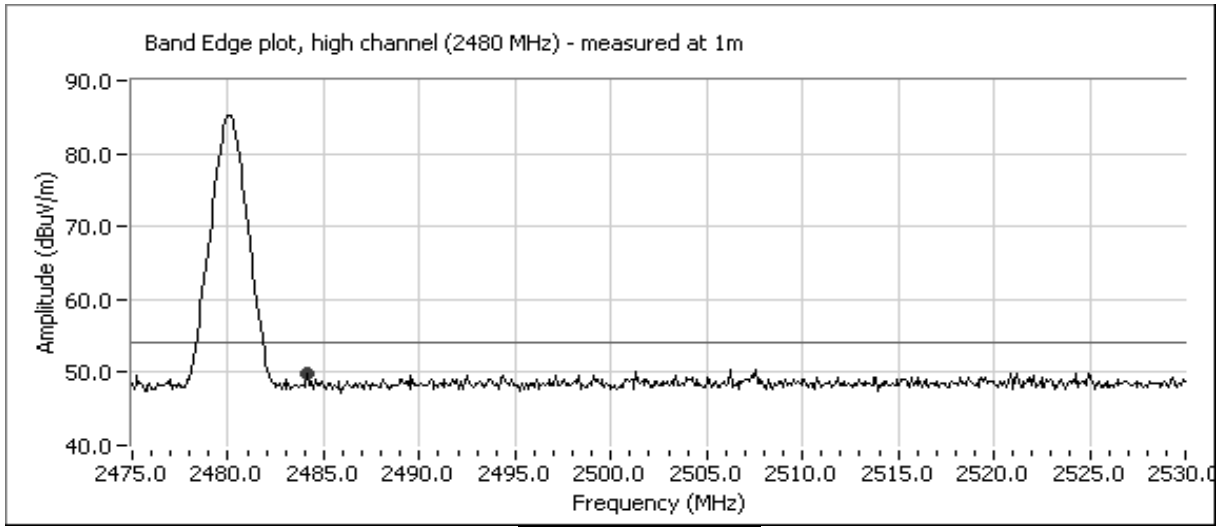
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 3:	Average measurements made with RB=1MHz, VB=10Hz. Peak measurements made using RB=VB=1MHz.
Note 3:	Scans were made with the receive antenna located 50cm from the device to determine that there were no spurious signals of a significant level, other than the second harmonic.

EMC Test Data

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30 - 24800 MHz. High Channel @ 2480 MHz

	H	V
Fundamental emission level @ 3m in 1MHz RBW:	94.1	94.5
Delta Marker - Peak	43.5 dB	
Delta Marker - Average	46.3 dB	
Calculated Band-Edge Measurement:	51.0 dBuV/m	
Calculated Band-Edge Measurement:	48.2 dBuV/m	



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2480.005	94.5	V	-	-	Pk	162	1.2	RB=2MHz, VB=3MHz
2480.030	94.1	H	-	-	Pk	226	1.2	RB=2MHz, VB=3MHz
2483.500	46.3	V	54.0	-7.7	Avg	162	1.2	Note 2
4959.993	41.2	H	54.0	-12.8	AVG	256	1.7	
4959.850	39.9	V	54.0	-14.1	AVG	190	2.0	
2483.500	51.0	V	74.0	-23.0	Pk	162	1.2	Note 2
4959.993	48.8	H	74.0	-25.2	PK	256	1.7	
4959.850	48.2	V	74.0	-25.8	PK	190	2.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used.
Note 2:	Note: Plot shows signal below band edge limit when measured at 1m (data extrapolated to 3m). Delta marker between in-band and restricted band signal level was 48.2dB (average) and 43.5dB (peak), giving restricted band levels of 46.3dBuV/m (average).
Note 3:	Average measurements made with RB=1MHz, VB=10Hz. Peak measurements made using RB=VB=1MHz.
Note 3:	Scans were made with the receive antenna located 50cm from the device to determine that there were no spurious signals of a significant level, other than the second harmonic.

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

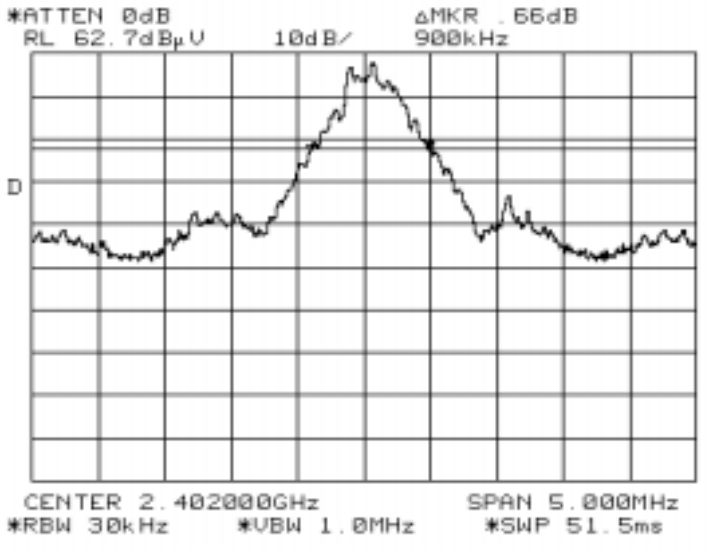
Run #1d: Radiated Spurious Emissions, 30 - 10000 MHz. Receive Mode

No signals from the receive circuitry were observed. Scans were made with the receive antenna located 50cm from the device to determine that there were no spurious signals of a significant level, other than the second harmonic. Scans were made with the EUT operating in receive-only mode on all three channels (top, center and bottom).

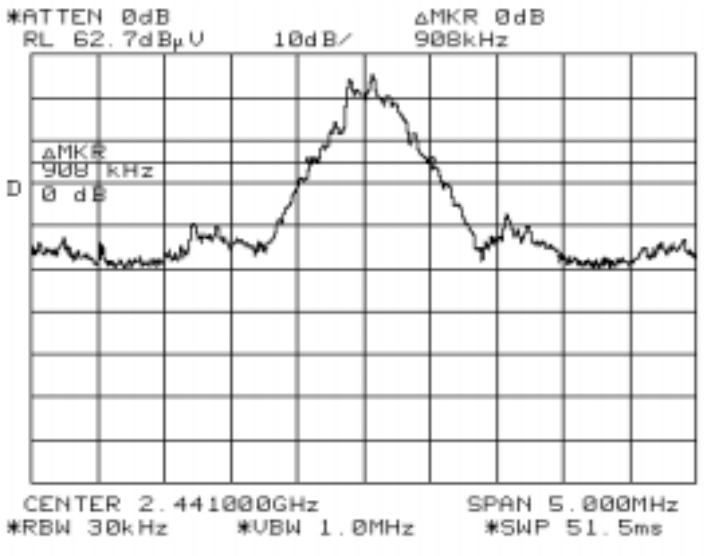
Run #2: Signal Bandwidth

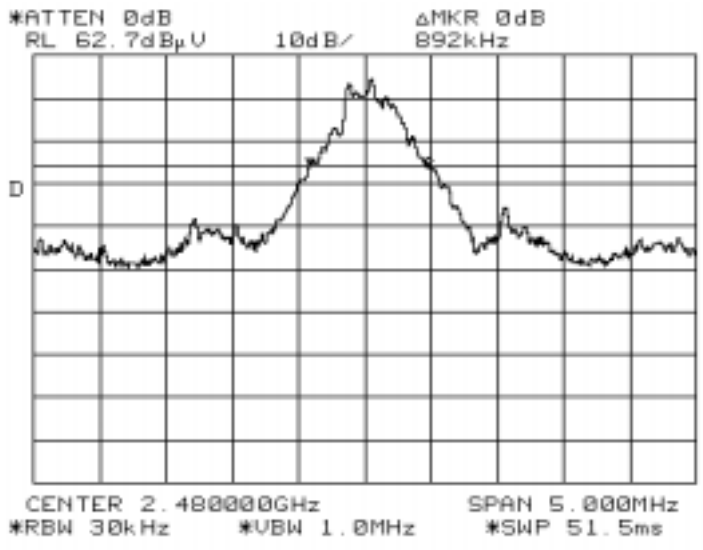
Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth
Low	2402	30kHz	900 kHz
Mid	2441	30kHz	908 kHz
High	2480	30kHz	892 kHz

Note 1:	Signal bandwidth (nominal) was 1MHz so a resolution bandwidth of 30kHz (3% of nominal bandwidth) was used.



Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A





Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

Run #2: Output Power

Channel	Frequency (MHz)	Field Strength at 3m	Antenna Pol. (H/V)	Res BW	Output Power dBm	Output Power mW
Low	2402	96.8	H	3MHz	1.5	1.41
Mid	2441	96.7	H	3MHz	1.4	1.38
High	2480	94.5	V	3MHz	-0.8	0.83

Note 1:	Field strengths taken from run #1,a, 1b and 1c. All measured using RB=2MHz, VB=3MHz. Output power calculated using Friis' free space equation.

Run #3: Channel Occupancy And Spacing, Number of Channels

The channel occupancy was measured with the radio transmitting normally (i.e. In hopping mode)

The channel spacing was: 1000 kHz

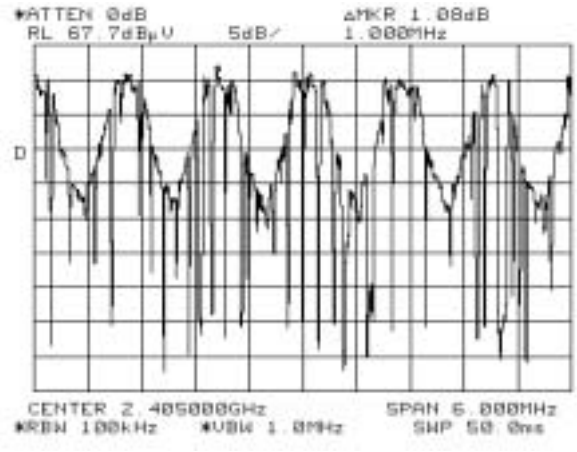
The dwell time on the center channel in a 30 second period was: 380 ms (see plots below)

Device hops on the same channel every 98.7ms. With 79 channels, occupancy is 0.38seconds per channel per 30 seconds.

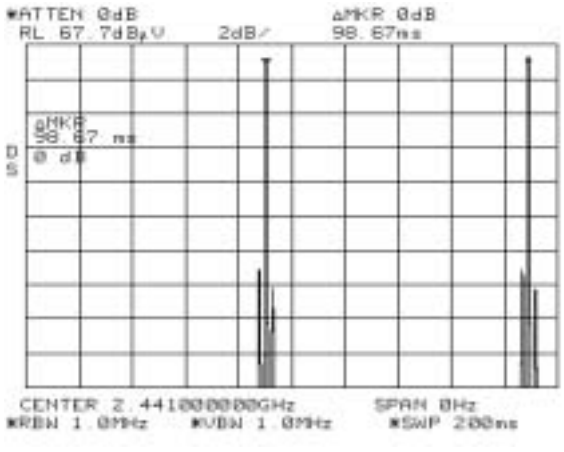
The number of channels was verified with the radio transmitting normally (i.e. In hopping mode)

The number of channels was: 79 (verified by plots on next page)

Note: the device is compliant with the Bluetooth protocol and, therefore, meets timing and channel utilization requirements of RSS 210 and FCC 15.247 for frequency hopping radios operating in the 2.4GHz band.



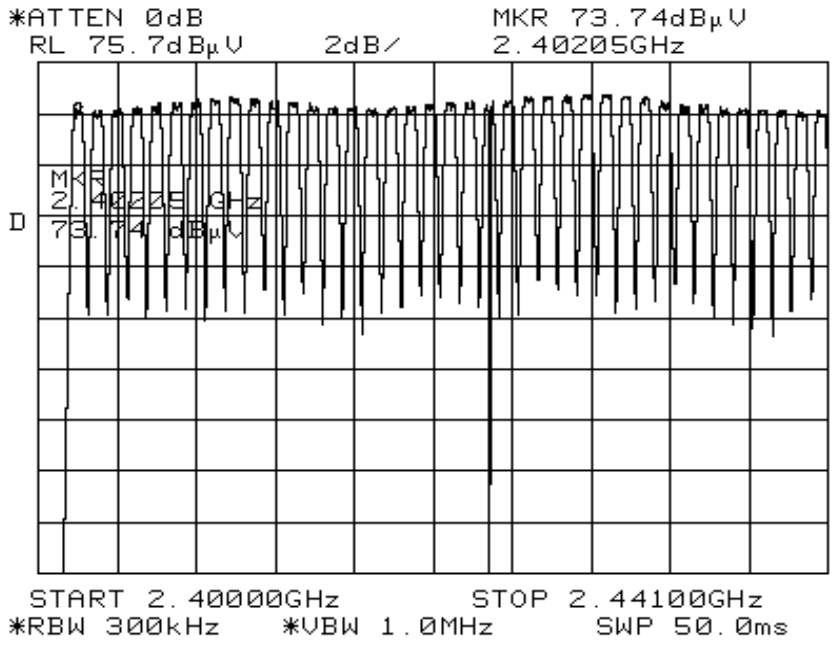
Channel Spacing Plot



Channel Occupancy Plot

Client:	Zultys	Job Number:	J54594
Model:	Zip 4x5 (VOIP Phone with Bluetooth)	T-Log Number:	T55685
		Account Manager:	TBD
Contact:	David Tu		
Spec:	FCC 15.247, RSS 210 FHSS	Class:	N/A

39 channels from 2402 - 2440, 40 channels from 2441 - 2480 MHz



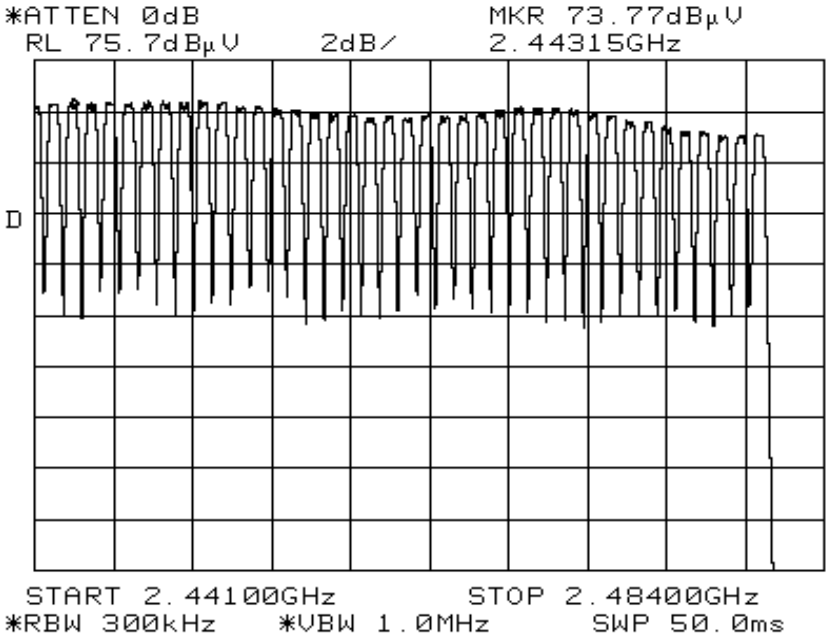


EXHIBIT 3: Test Configuration Photographs

Uploaded as Separate Document

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of Zultys Technologies Model ZIP4x5Construction

Uploaded as Separate Document

EXHIBIT 6: Operator's Manual for Zultys Technologies Model ZIP4x5

Uploaded as Separate Document

EXHIBIT 7: Block Diagram of Zultys Technologies Model ZIP4x5

Uploaded as Separate Document

EXHIBIT 8: Schematic Diagrams for Zultys Technologies Model ZIP4x5

Uploaded as Separate Document

EXHIBIT 9: Theory of Operation for Zultys Technologies Model ZIP4x5

Uploaded as Separate Document

EXHIBIT 10: Advertising Literature

Uploaded as Separate Document

EXHIBIT 11: RF Exposure Information

The module meets the requirements for a portable device that may be used at separation distances of less than 2.5cm from the human body because its output power is below the threshold of $60/f_{GHz}$ mW (25mW for a 2.4GHz device).

As the output power is less than 5mW no co-location warnings are required.