EMISSIONS TEST REPORT

Report Number: 3144422BOX-017
Project Number: 3144422

Testing performed on the

Merlin™@home

Model: EX1150

To

CFR47 "Telecommunications" FCC Part 95 Subpart I
IC RSS-243 Issue 2 November 2005

For

St. Jude Medical

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719

Test Authorized by:
St. Jude Medical
15900 Valley View Court
Sylmar, CA 91342

Prepared by: _____ Date: 05/07/2008
Nicholas Abbondante

Reviewed by: _____ Date: 5/12/08
Michael F. Murphy

1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company:	Plexus Services Corp. 55 Jewelers Park Drive Neenah, WI 54957
Contact:	Mr. Jeffrey Newhouse
Telephone:	(920) 751-5658
Fax:	(920) 751-5395
Email:	Jeffrey.Newhouse@Plexus.com

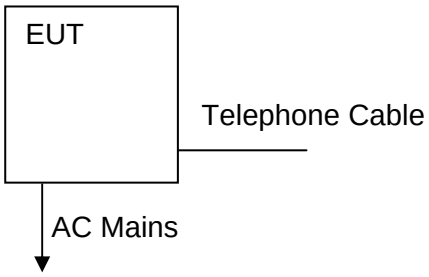
1.2 Equipment Under Test

Equipment Type:	Merlin™@home
Model Number(s):	EX1150
Serial number(s):	6070823, 6070813, 6070824
Manufacturer:	Plexus Services Corp.
EUT receive date:	02/11/2008
EUT received condition:	Prototypes in Good Condition
Test start date:	02/25/2008
Test end date:	04/09/2008

1.3 Test Plan Reference: Tested according to the standards listed, ANSI C63.4:2003, and RSS-Gen Issue 2 June 2007.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2. Cables:

Cable	Shielding	Connector	Length (m)	Qty.
AC Mains	None	Plastic	2.5	1
Telephone	None	Plastic RJ11	2.7	1

1.4.3. Support Equipment:

Name: None
Model No.:
Serial No.:

1.5 Mode(s) of Operation:

The EUT was activated from 120V/60Hz AC power and was transmitting a modulated carrier during testing, except during frequency error testing where a CW signal was transmitted. Channel 4 (403.35 MHz) was utilized for testing unless otherwise indicated.

A laptop PC was used to program the device for testing, but was not present during testing. For testing, an Alpha3 prototype was used. It has been indicated that the color of the plastic housing may change in the future. This type of change is cosmetic and would be considered a class I permissive change, with no effect on test results.

2.0 Test Summary

TEST STANDARD	RESULTS	
CFR47 Telecommunications FCC Part 95 Subpart I IC RSS-243 Issue 2 September 2005		
SUB-TEST	**TEST PARAMETER**	**COMMENT**
Effective Radiated Power FCC §95.639(f), RSS-243 Section 5.4	The maximum effective radiated power is 25μW or 18.2 mV/meter at 3m test distance (85.2 dBμV/m at 3m).	Pass
Emission Bandwidth FCC §95.633(e), RSS-243 Section 5.1	The maximum bandwidth is 300 kHz.	Pass
Radiated Spurious Emissions FCC §95.635, RSS-243 Sections 5.5, 5.6	Spurious emissions more than 250 kHz removed from the MICS band (402-405 MHz) at 3 meters test distance must not exceed 40.0 dBμV/m in the range from 30-88 MHz, 43.5 dBμV/m from 88-216 MHz, 46.0 dBμV/m from 216-960 MHz, and 54.0 dBμV/m above 960 MHz. Emissions within 250 kHz of the MICS band must be attenuated by at least 20 dB below the maximum permitted output power, using an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth. Emissions within the MICS band more than 150 kHz away from the center frequency of the spectrum the transmission is intended to occupy, will be attenuated below the transmitter output power by at least 20 dB, using an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth.	Pass
Frequency Error FCC §95.628(e), RSS-243 Section 5.3	The carrier frequency must not deviate from the reference frequency by more than ±100 PPM.	Pass
MICS Operation FCC §95.628(a)(1-4), RSS-243 Section 5.7	The MICS communication sessions must meet operating requirements for System Threshold Power Levels, Monitoring System Bandwidth, Scan Cycle Time, Minimum Channel Monitoring Period, Channel Access, Discontinuation of a MICS Session, and Use of a Pre-Scanned Alternate Channel.	Pass
AC Line-Conducted Emissions FCC §15.207, RSS-Gen Section 7.2.2	The AC line-conducted emissions must not exceed the FCC 15.207 and RSS-Gen Section 7.2.2 Table 2 limits.	Pass

REVISION SUMMARY – The following changes have been made to this Report:

Date	Project No.	Project Handler	Page(s)	Item	Description of Change

3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

Level in μV/m = [10(32 dBμV/m)/20] = 39.8 μV/m

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(48.1\ dB\mu V / 20)}$ = 254 μV/m

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.
The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:

±3.5 dB at 10m, ±3.8 dB at 3m

The expanded uncertainty (k = 2) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

±2.6 dB

The expanded uncertainty (k = 2) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

±3.2 for ISN and voltage probe measurements
±3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Test Results: Pass

Test Standard: FCC Part 95 Subpart I, IC RSS-243

Test: Effective Radiated Power

Performance Criterion: The maximum effective radiated power is 25μW or 18.2 mV/meter at 3m test distance (85.2 dBμV/m at 3m).

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	20	Humidity (%):	25	Pressure (hPa):	1050
Pretest Verification Performed		Yes		Equipment under Test:		Merlin™@home	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		6070823	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	ANTENNA	EMCO	3142	9711-1225	06/05/2008
3	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/17/2008
4	Spectrum Analyzer	Hewlett Packard	8591E	3308A01445	02/15/2009

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Details:

Special Radiated Emissions

Company: Plexus Services Corp. | Antenna & Cables: N | Bands: N, LF, HF, SHF
Model #: EX1150 | Antenna: LOG4 06-05-08 V3.txt | LOG4 06-05-08 H3.txt
Serial #: 6070823 | Cable(s): S2 3M FLR 9-17-08.txt | NONE.
Engineers: Nicholas Abbondante | Location: Site 2 | Barometer: BAR2
Project #: 3144422 | Date(s): 03/27/08
Standard: FCC Part 95 Subpart I | Temp/Humidity/Pressure: 20c | 25% | 1050mB
Receiver: HP 8591E (SA0001) | Limit Distance (m): 3
PreAmp: PRE9 3-25-08.txt | Test Distance (m): 3
PreAmp Used? (Y or N): N | Voltage/Frequency: 120V/60Hz | Frequency Range: Frequencies Shown

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: Channel 0, Power 74, CONTMOD, TXIFAMP 1													
PK	H	402.150	60.5	16.4	2.6	0.0	0.0	79.5	85.2	-5.7	300/1000 kHz	RB	RB
Note: Channel 4, Power 20, CONTMOD, TXIFAMP 1													
PK	H	403.350	65.3	16.4	2.6	0.0	0.0	84.3	85.2	-0.9	300/1000 kHz	RB	RB
Note: Channel 6, Power 81, CONTMOD, TXIFAMP 1													
PK	H	403.950	66.1	16.4	2.6	0.0	0.0	85.1	85.2	-0.1	300/1000 kHz	RB	RB
Note: Channel 8, Power 13, CONTMOD, TXIFAMP 1													
PK	H	404.550	62.4	16.4	2.6	0.0	0.0	81.4	85.2	-3.8	300/1000 kHz	RB	RB
Note: Channel 9, Power 74, CONTMOD, TXIFAMP 1													
PK	H	404.850	60.2	16.4	2.6	0.0	0.0	79.2	85.2	-6.0	300/1000 kHz	RB	RB

Notes: In order to meet the spurious emissions requirements for spurs more than 250 kHz offset from the band of operation, the following power settings were utilized on sample 6070823.

Channels 0, 1, 2: Power Setting 74
Channels 3, 4, 5: Power Setting 20
Channel 6: Power Setting 81
Channels 7, 8: Power Setting 13
Channel 9: Power Setting 74

Test Results: Pass

Test Standard: FCC Part 95 Subpart I, IC RSS-243

Test: Emission Bandwidth

Performance Criterion: The maximum bandwidth is 300 kHz.

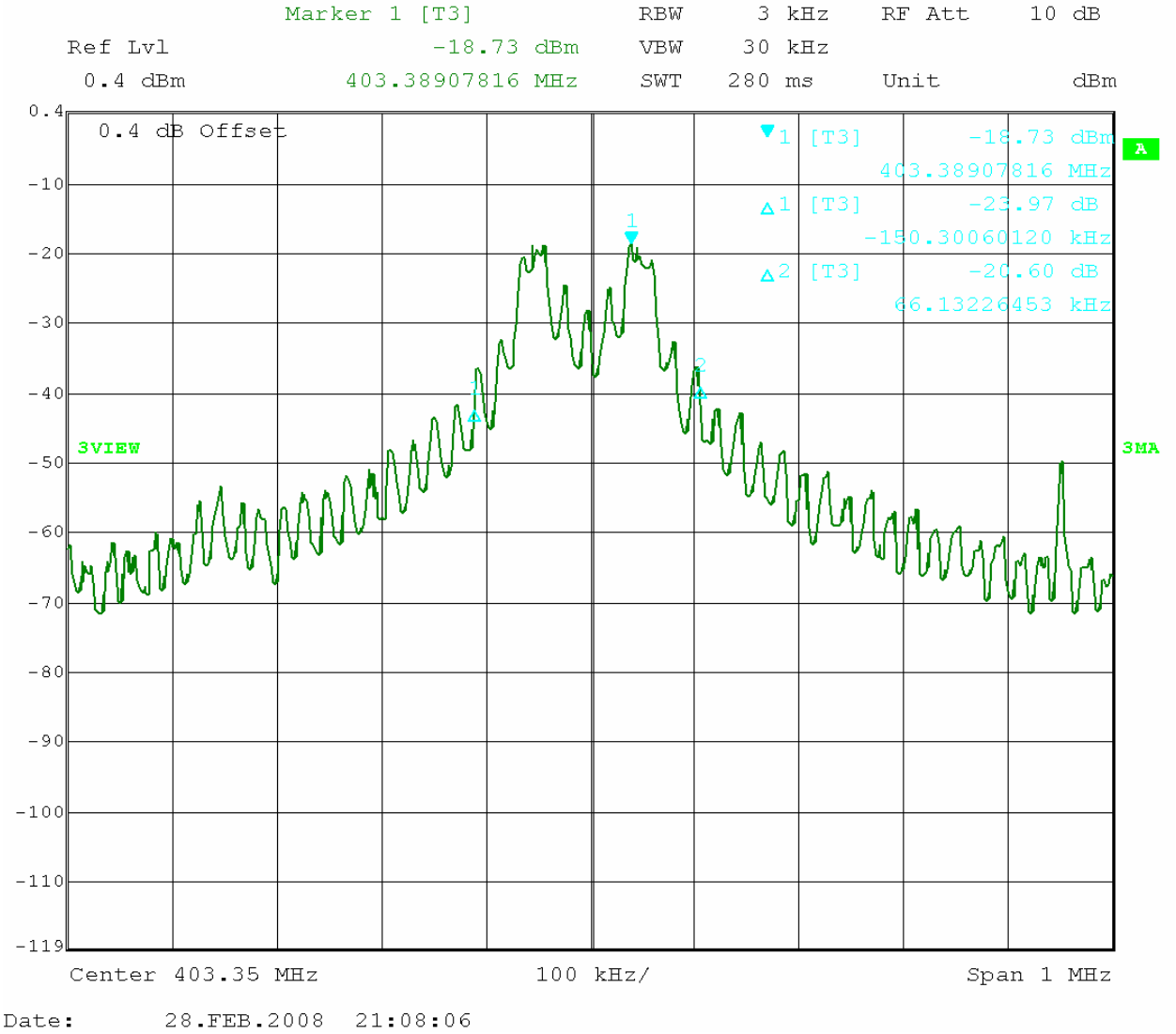
Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	N/A	Humidity (%):	N/A	Pressure (hPa):	N/A
Pretest Verification Performed		Yes		Equipment under Test:		Merlin™@home	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		6070823	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	11/26/2008
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/06/2008
3	HORN ANTENNA	EMCO	3115	9602-4675	09/24/2008

Test Details:



Channel 4 20 dB Bandwidth, 216.4 kHz

Test Results: Pass

Test Standard: FCC Part 95 Subpart I, IC RSS-243

Test: Radiated Spurious Emissions

Performance Criterion: Spurious emissions more than 250 kHz removed from the MICS band (402-405 MHz) at 3 meters test distance must not exceed 40.0 dBμV/m in the range from 30-88 MHz, 43.5 dBμV/m from 88-216 MHz, 46.0 dBμV/m from 216-960 MHz, and 54.0 dBμV/m above 960 MHz.
Emissions within 250 kHz of the MICS band must be attenuated by at least 20 dB below the maximum permitted output power, using an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth.
Emissions within the MICS band more than 150 kHz away from the center frequency of the spectrum the transmission is intended to occupy, will be attenuated below the transmitter output power by at least 20 dB, using an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth.

Test Environment:

Environmental Conditions During Testing:	Ambient (°C):	See Tables	Humidity (%):	See Tables	Pressure (hPa):	See Tables
Pretest Verification Performed	Yes		Equipment under Test:		Merlin™@home	
Test Engineer(s):	Nicholas Abbondante		EUT Serial Number:		6070823, 6070824	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	ANTENNA	EMCO	3142	9711-1225	06/05/2008
3	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/17/2008
4	Spectrum Analyzer	Hewlett Packard	8591E	3308A01445	02/15/2009
5	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	11/26/2008
6	100MHz-40GHz Preamp	MITEQ	NSP4000-NFG	1260417	03/25/2008
7	40GHz Cable	Megaphase	TM40-K1K1-197	7030801 001	05/23/2008
8	40 GHz Cable	Megaphase	TM40-K1K1-197	7030801 002	05/23/2008
9	HORN ANTENNA	EMCO	3115	9602-4675	09/24/2008
10	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	01/25/2009

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Results:

Special Radiated Emissions

Company: Plexus Services Corp. | Antenna & Cables: N | Bands: N, LF, HF, SHF
Model #: EX1150 | Antenna: LOG4 06-05-08 V3.txt | LOG4 06-05-08 H3.txt
Serial #: 6070824 | Cable(s): S2 3M FLR 9-17-08.txt | NONE.
Engineers: Nicholas Abbondante | Location: Site 2 | Barometer: BAR2
Project #: 3144422 | Date(s): 03/03/08
Standard: FCC Part 95 Subpart I/IC RSS-243 | Temp/Humidity/Pressure: 19c | 24% | 1050mB
Receiver: R&S ESCI (ROS002) | Limit Distance (m): 3
PreAmp: PRE9 3-25-08.txt | Test Distance (m): 3
PreAmp Used? (Y or N): N | Voltage/Frequency: 120V/60Hz | Frequency Range: 30-1000 MHz

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
QP	V	85.790	14.9	7.7	1.1	0.0	0.0	23.8	40.0	-16.2	120/300 kHz		
QP	V	111.440	14.6	7.9	1.3	0.0	0.0	23.8	43.5	-19.7	120/300 kHz	RB	RB
QP	V	181.576	16.2	9.1	1.7	0.0	0.0	27.0	43.5	-16.5	120/300 kHz		
QP	V	354.138	15.9	15.3	2.5	0.0	0.0	33.8	46.0	-12.2	120/300 kHz		
QP	V	411.234	19.4	15.7	2.7	0.0	0.0	37.8	46.0	-8.2	120/300 kHz		
QP	V	971.140	15.5	23.5	4.7	0.0	0.0	43.8	54.0	-10.2	120/300 kHz	RB	RB
QP	V	401.258	27.5	15.4	2.6	0.0	0.0	45.5	46.0	-0.5	120/300 kHz	RB	RB
QP	H	401.750	24.8	16.4	2.6	0.0	0.0	43.8	46.0	-2.2	120/300 kHz	RB	RB
QP	H	405.250	26.8	16.4	2.6	0.0	0.0	45.8	46.0	-0.2	120/300 kHz	RB	RB

Special Radiated Emissions

Company: Plexus Services Corp. Antenna & Cables: SHF Bands: N, LF, HF, SHF
Model #: EX1150 Antenna: Horn2 V1m 9-24-2008.txt Horn2 H1m 9-24-2008.txt
Serial #: 6070824 Cable(s): MEG001 05-23-08.txt MEG002 05-23-08.txt
Engineers: Nicholas Abbondante Location: Site 2 Barometer: BAR2
Project #: 3144422 Date(s): 03/03/08
Standard: FCC Part 95 Subpart I/IC RSS-243 Temp/Humidity/Pressure: 19c 24% 1050mB
Receiver: R&S FSEK-30 (ROS001) Limit Distance (m): 3
PreAmp: PRE9 3-25-08.txt Test Distance (m): 3
PreAmp Used? (Y or N): Y Voltage/Frequency: 120V/60Hz Frequency Range: 1-4.1 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
PK	H	1210.050	36.7	25.5	4.0	28.8	0.0	37.5	74.0	-36.5	1/3 MHz	RB	RB
AVG	H	1210.050	29.5	25.5	4.0	28.8	0.0	30.2	54.0	-23.8	1/3 MHz	RB	RB
PK	V	1613.400	36.6	25.9	4.7	28.7	0.0	38.5	74.0	-35.5	1/3 MHz	RB	RB
AVG	V	1613.400	27.7	25.9	4.7	28.7	0.0	29.6	54.0	-24.4	1/3 MHz	RB	RB
PK	H	2016.750	36.2	28.0	5.4	28.7	0.0	40.9	74.0	-33.1	1/3 MHz		
AVG	H	2016.750	27.1	28.0	5.4	28.7	0.0	31.8	54.0	-22.2	1/3 MHz		
PK	V	2420.100	33.9	28.7	5.9	28.7	0.0	39.9	74.0	-34.1	1/3 MHz		
AVG	V	2420.100	26.3	28.7	5.9	28.7	0.0	32.2	54.0	-21.8	1/3 MHz		
PK	H	2823.450	36.0	30.1	6.5	28.6	0.0	44.0	74.0	-30.0	1/3 MHz	RB	RB
AVG	H	2823.450	27.5	30.1	6.5	28.6	0.0	35.4	54.0	-18.6	1/3 MHz	RB	RB
PK	V	3226.800	36.5	31.1	7.0	28.6	0.0	46.0	74.0	-28.0	1/3 MHz		
AVG	V	3226.800	27.2	31.1	7.0	28.6	0.0	36.7	54.0	-17.3	1/3 MHz		
PK	H	3630.150	36.3	32.0	7.5	28.5	0.0	47.2	74.0	-26.8	1/3 MHz	RB	RB
AVG	H	3630.150	26.9	32.0	7.5	28.5	0.0	37.8	54.0	-16.2	1/3 MHz	RB	RB
PK	V	4033.500	36.9	32.9	8.0	28.5	0.0	49.3	74.0	-24.7	1/3 MHz	RB	RB
AVG	V	4033.500	27.5	32.9	8.0	28.5	0.0	39.8	54.0	-14.2	1/3 MHz	RB	RB
PK	V	1200.000	42.3	25.3	4.0	28.8	0.0	42.8	74.0	-31.2	1/3 MHz	RB	RB
AVG	V	1200.000	37.3	25.3	4.0	28.8	0.0	37.8	54.0	-16.2	1/3 MHz	RB	RB
PK	H	1439.950	38.9	25.4	4.4	28.8	0.0	40.0	74.0	-34.0	1/3 MHz	RB	RB
AVG	H	1439.950	32.0	25.4	4.4	28.8	0.0	33.0	54.0	-21.0	1/3 MHz	RB	RB
PK	H	1560.128	38.4	25.7	4.6	28.7	0.0	40.0	74.0	-34.0	1/3 MHz	RB	RB
AVG	H	1560.128	31.4	25.7	4.6	28.7	0.0	33.0	54.0	-21.0	1/3 MHz	RB	RB

Special Radiated Emissions

Company: Plexus Services Corp.
Model #: EX1150
Serial #: 6070823
Engineers: Nicholas Abbondante
Project #: 3144422
Standard: FCC Part 95 Subpart I/IC RSS-243
Receiver: HP 8591E (SA0001)
PreAmp: PRE9 3-25-08.txt

Location: Site 2
Date(s): 03/27/08
Limit Distance (m): 3
Test Distance (m): 3

Antenna & Cables: N
Antenna: LOG4 06-05-08 V3.txt
Cable(s): S2 3M FLR 9-17-08.txt
Barometer: BAR2

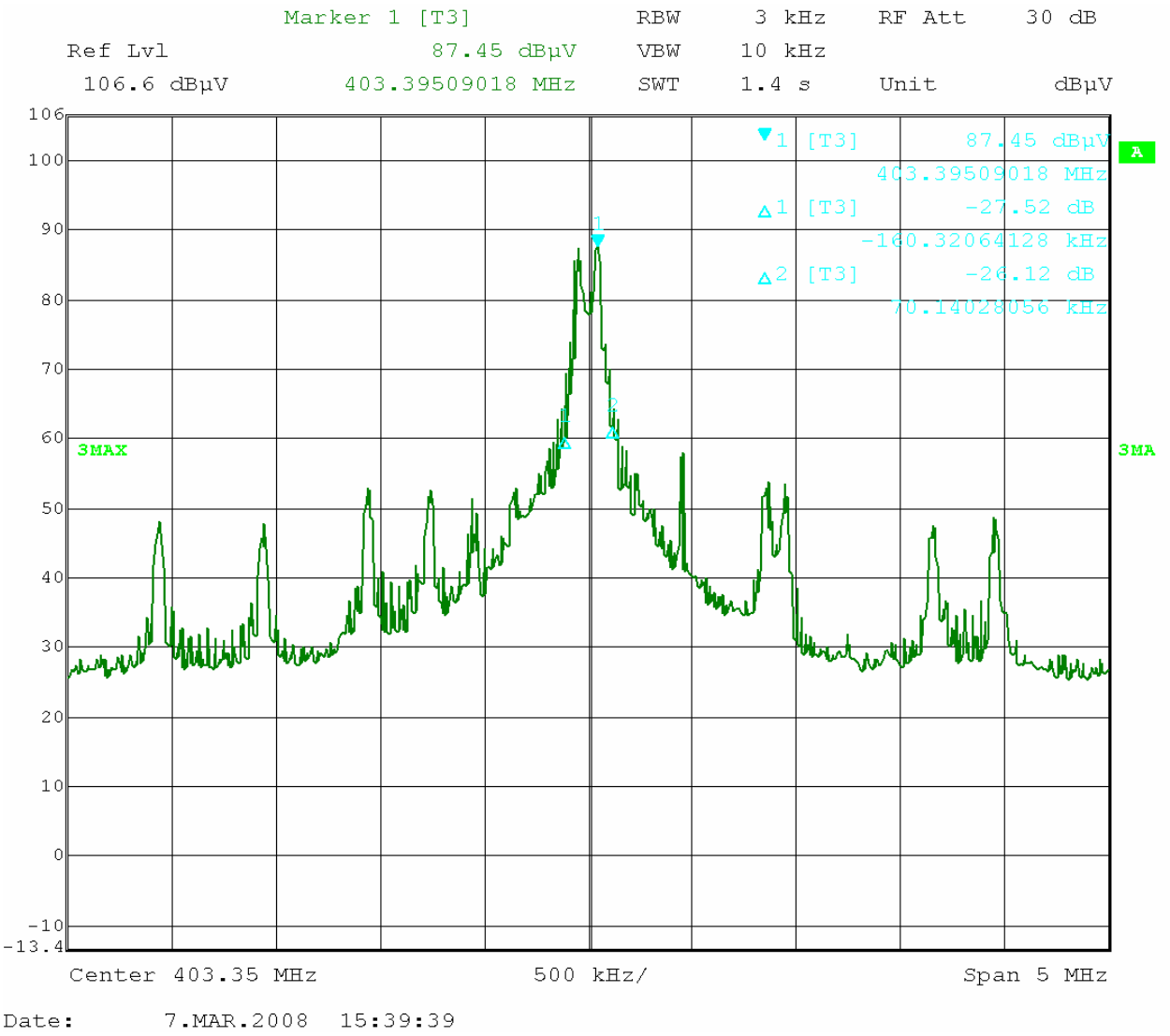
Bands: N, LF, HF, SHF
LOG4 06-05-08 H3.txt
NONE.

Temp/Humidity/Pressure: 20c 25% 1050mB

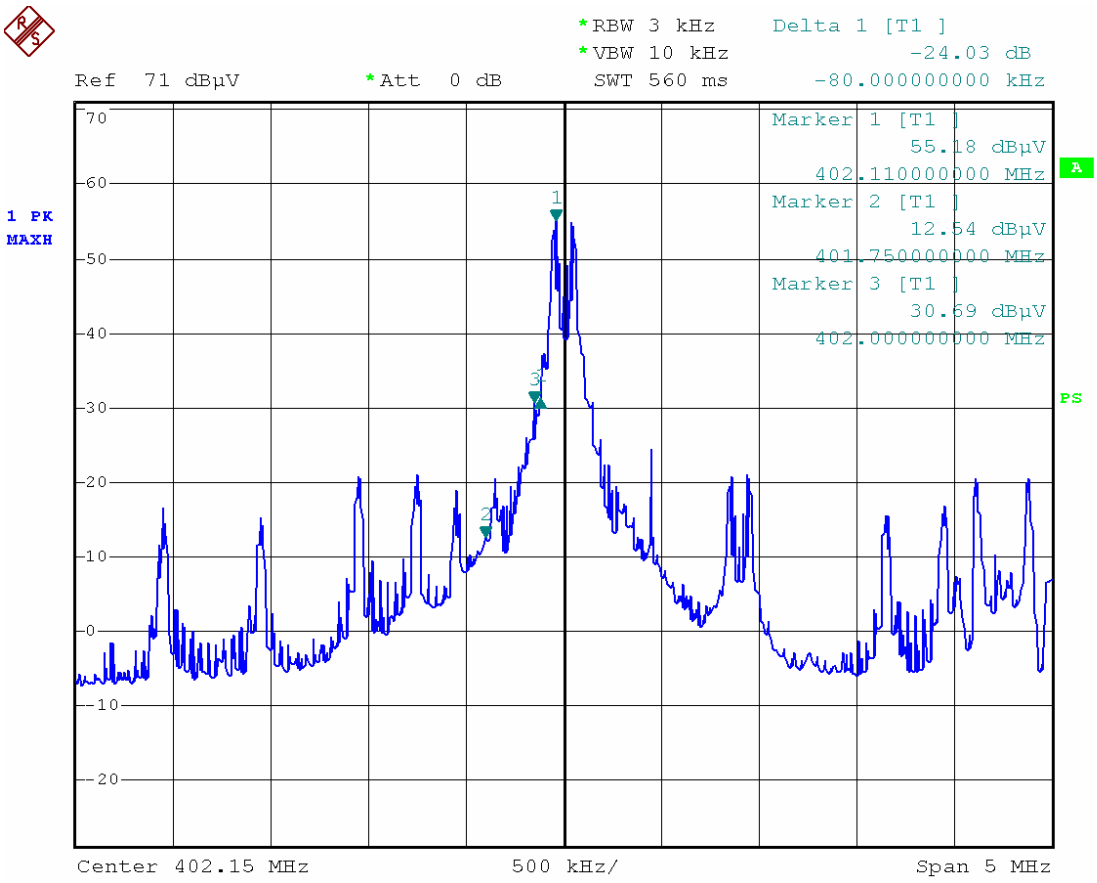
PreAmp Used? (Y or N): N
Voltage/Frequency: 120V/60Hz
Frequency Range: Frequencies Shown

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

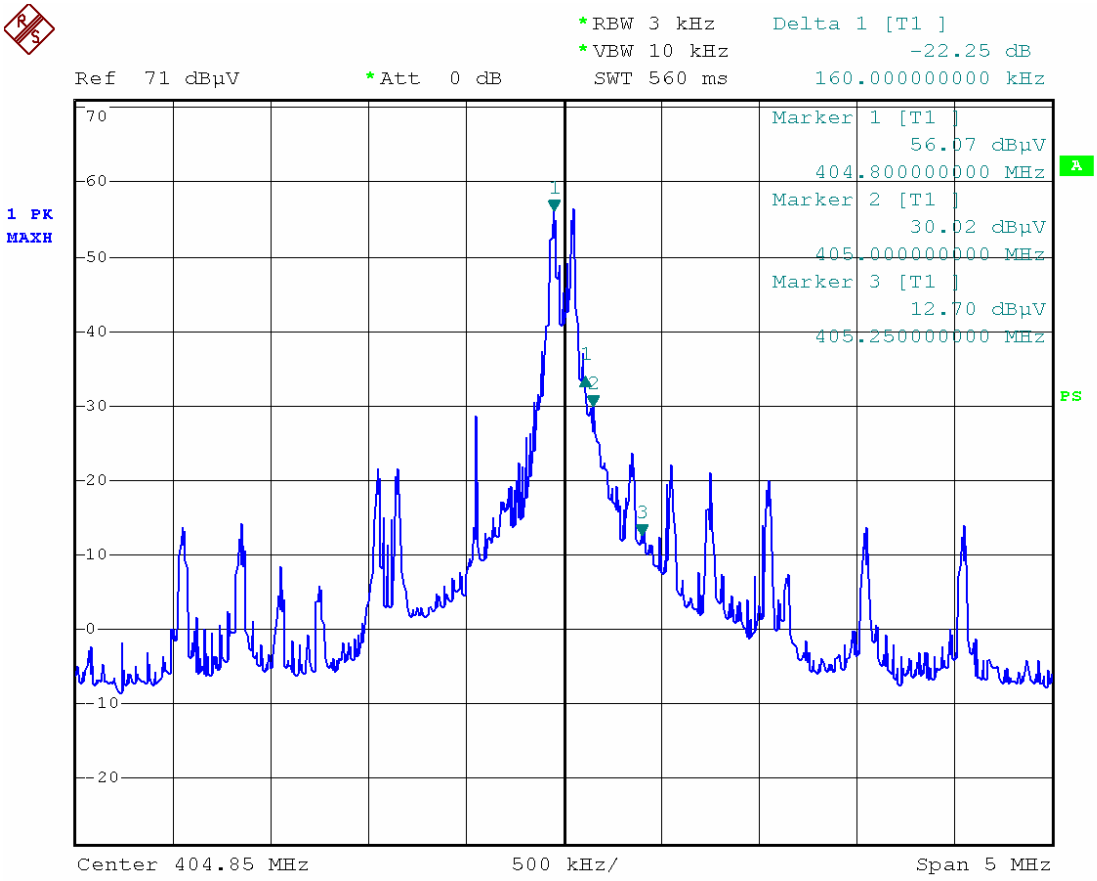
Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: Channel 0, Power 74, CONTMOD, TXIFAMP 1													
QP	H	401.750	24.8	16.4	2.6	0.0	0.0	43.8	46.0	-2.2	120/300 kHz	RB	RB
QP	H	401.097	26.9	16.4	2.6	0.0	0.0	45.9	46.0	-0.1	120/300 kHz	RB	RB
Note: Channel 4, Power 20, CONTMOD, TXIFAMP 1													
QP	H	401.289	27.0	16.4	2.6	0.0	0.0	46.0	46.0	-0.0	120/300 kHz	RB	RB
QP	H	405.307	26.7	16.4	2.6	0.0	0.0	45.7	46.0	-0.3	120/300 kHz	RB	RB
Note: Channel 6, Power 81, CONTMOD, TXIFAMP 1													
QP	H	406.003	24.1	16.4	2.6	0.0	0.0	43.1	46.0	-2.9	120/300 kHz	RB	RB
Note: Channel 8, Power 13, CONTMOD, TXIFAMP 1													
QP	H	405.250	22.3	16.4	2.6	0.0	0.0	41.3	46.0	-4.7	120/300 kHz	RB	RB
QP	H	405.603	26.9	16.4	2.6	0.0	0.0	45.9	46.0	-0.1	120/300 kHz	RB	RB
Note: Channel 9, Power 74, CONTMOD, TXIFAMP 1													
QP	H	405.250	26.8	16.4	2.6	0.0	0.0	45.8	46.0	-0.2	120/300 kHz	RB	RB
QP	H	405.892	25.0	16.4	2.6	0.0	0.0	44.0	46.0	-2.0	120/300 kHz	RB	RB



Emissions outside 150 kHz offset from the intended frequency



Lower 250 kHz band edge



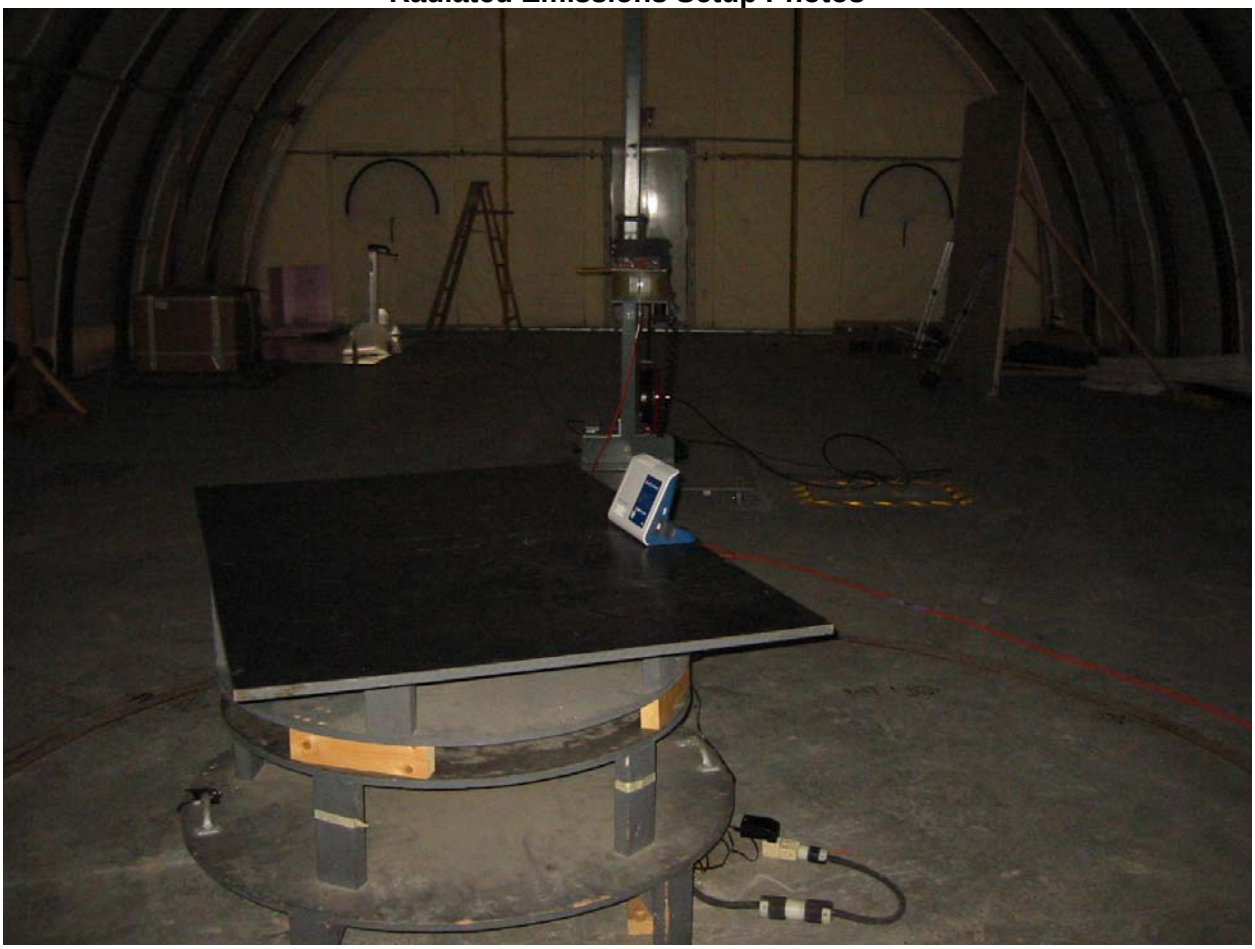
Date: 27.MAR.2008 20:40:30

Upper 250 kHz band edge

Radiated Emissions Setup Photos

Radiated Emissions Setup Photos

Radiated Emissions Setup Photos



Radiated Emissions Setup Photos

Test Results: Pass

Test Standard: FCC Part 95 Subpart I, IC RSS-243

Test: Frequency Error

Performance Criterion: The carrier frequency must not deviate from the reference frequency by more than ±100 PPM.

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	N/A	Humidity (%):	N/A	Pressure (hPa):	N/A
Pretest Verification Performed		Yes		Equipment under Test:		Merlin™@home	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		6070823	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2008
2	40 GHz Cable	Megaphase	TM40-K1K1-80	7030802 002	05/23/2008
3	Microprocessor Thermometer	Omega	HH23	T-192119	8/30/2008
4	Temperature Chamber	Envirotronics, USA	SH27C	08015562-S-11263	3/12/2008
5	AC Power Source	Elgar	1001	287	Verified
6	Multimeter	FLUKE	187	89940156	8/30/2008
7	variable transformer	Staco Energy	3PN1520B	none	Verified

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Details:

Frequency Stability

Company: Plexus Services Corp.
Model #: EX1150
Serial #: 6070823
Engineer(s): Nicholas Abbondante Location: Littleton
Project #: 3144422 Date(s): 02/26/08
Standard: FCC Part 95 Subpart I/IC RSS-243
Limit: 100 PPM

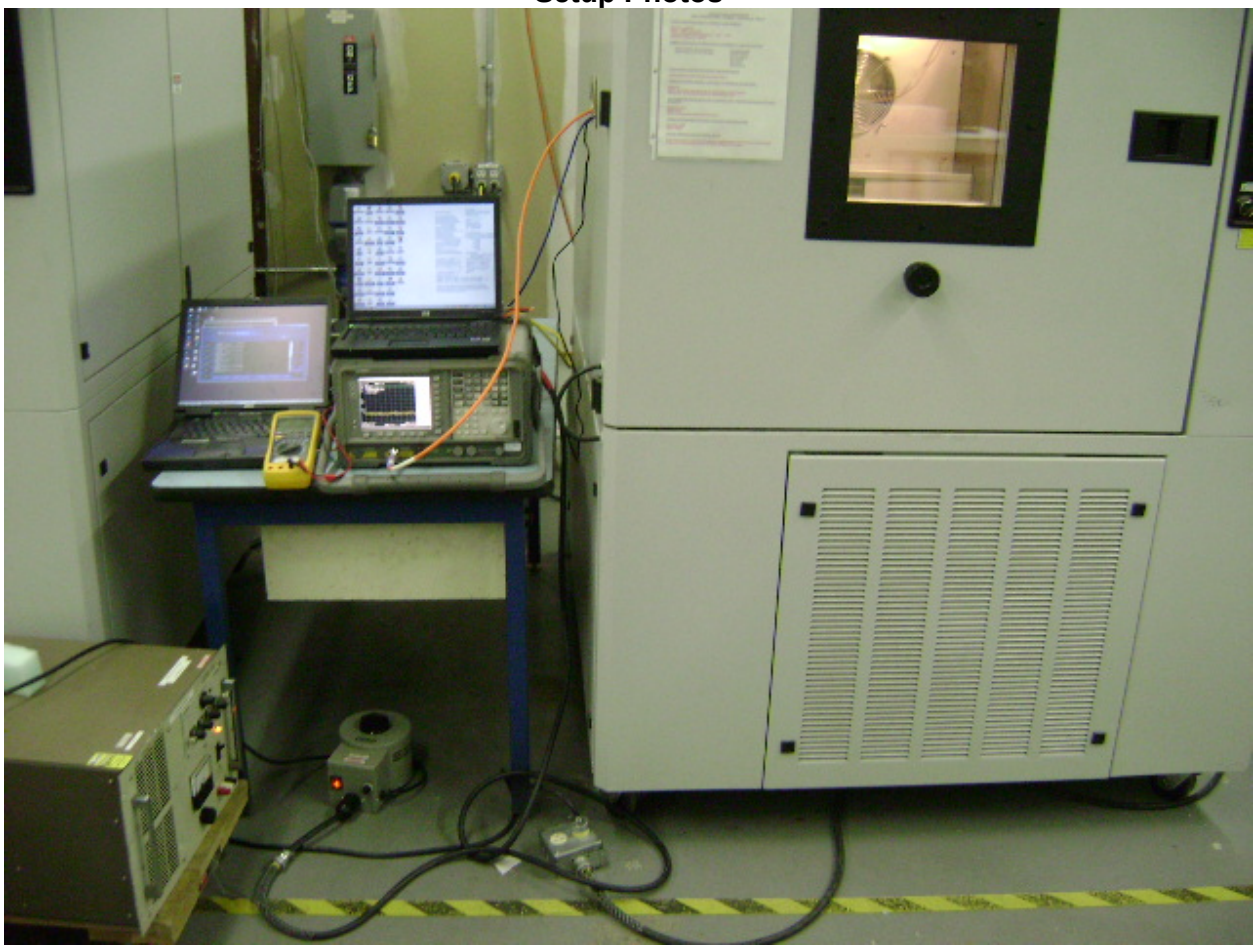
Nominal f: 403.35 MHz Voltage: 120 VAC

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	102	403.34909	0.062	40.34
+0%	120	403.34903	0	40.34
+15%	138	403.34897	-0.063	40.34

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
0	403.351676	2.12	40.34
10	403.348438	-1.118	40.34
20	403.349556	0	40.34
30	403.350031	0.475	40.34
40	403.349310	-0.246	40.34
50	403.350242	0.686	40.34
55	403.348749	-0.807	40.34

Setup Photos

Setup Photos



Test Results: Pass

Test Standard: FCC Part 95 Subpart I, IC RSS-243

Test: MICS Operation

Performance Criterion: The MICS communication sessions must meet operating requirements for System Threshold Power Levels, Monitoring System Bandwidth, Scan Cycle Time, Minimum Channel Monitoring Period, Channel Access, Discontinuation of a MICS Session, and Use of a Pre-Scanned Alternate Channel.

Test Environment:

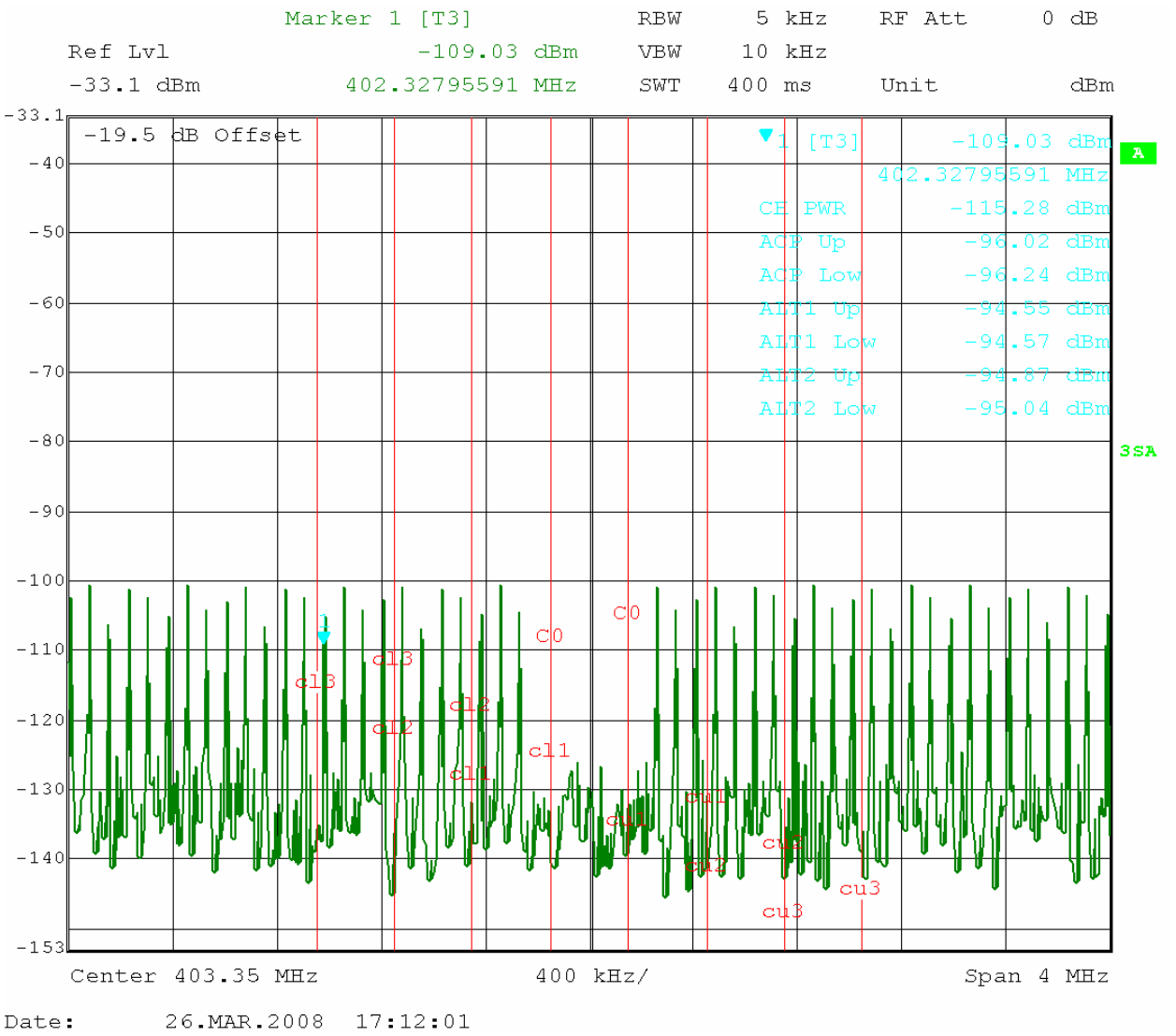
Environmental Conditions During Testing:		Ambient (°C):	N/A	Humidity (%):	N/A	Pressure (hPa):	N/A
Pretest Verification Performed		Yes		Equipment under Test:		Merlin™@home	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		6070813	

Test Equipment Used:

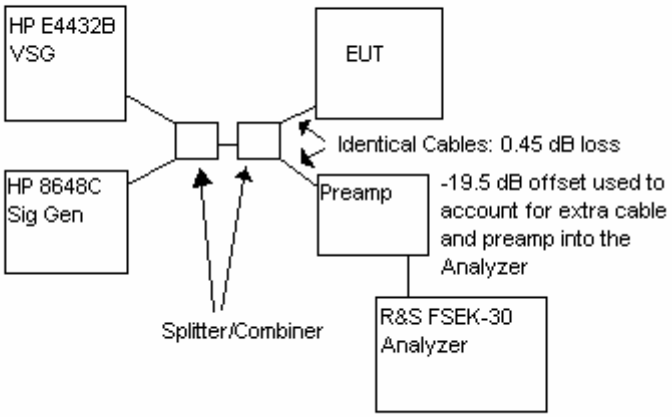
TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwarz	FSEK-30	100225	11/26/2008
2	Vector Signal Generator	Agilent	E-4432B ESG-D	US38440932	09/01/2008
3	Generator, Signal	Hewlett Packard	8648C	3426A01040	09/05/2008
4	PREAMPLFIER 1- 40 GHz	MITEQ	NSP4000-NF	507145	11/09/2008
5	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL027	12/06/2008
6	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL028	12/06/2008
7	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL029	12/06/2008
8	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/06/2008
9	Splitter/Combiner 2-Way DC-2000 MHz	Mini Circuits	ZFRSC-2050	none	Verified
10	Splitter/Combiner	Mini Circuits	ZFRSC-2050	none	Verified
11	Synthesized Sweep Generator	Hewlett Packard	83620A	3213A01244	02/06/2009
12	Attenuator	Weinschel Corp	47-10-34	BD8309	07/06/2008
13	10W, 30dB Attenuator	Weinschel Corp	47-30-34	BD43291	07/06/2008
14	Attenuator, 30dB	Weinschel Corp	47-30-34	BD4327	09/13/2008

Test Details:

For these tests, a blocking band was created using the vector signal generator. A notch was created in the blocking band by removing some of the tones, or by lowering the output power of some of the tones in relation to the other. A second signal generator was used to generate a tone on specific channels. For some tests, more than one notch at different levels were created. Below is an example plot of the blocking band at the EUT, including a single notch in the center. For some tests, the center notch was narrowed further so that the EUT only transmitted in the notch.



Blocking Band Example


HP E4432B
VSG
EUT
Identical Cables: 0.45 dB loss
HP 8648C
Sig Gen
Preamp
-19.5 dB offset used to
account for extra cable
and preamp into the
Analyzer
Splitter/Combiner
R&S FSEK-30
Analyzer

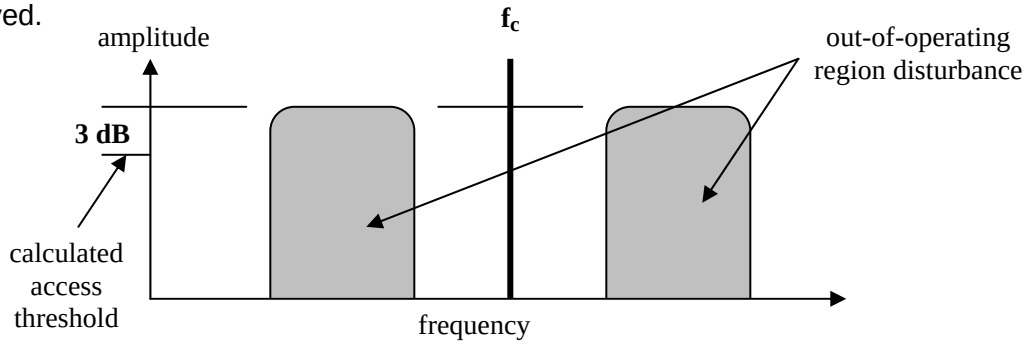
System Threshold Power Levels

The monitoring threshold power level shall not be greater than the calculated level given by the equation, 10 $\log_{10}$B (Hz) – 150 (dBm/Hz) + G(dBi), where B is the emission bandwidth of the MICS communication session transmitter having the widest emission bandwidth and G is the antenna gain of the medical implant programmer/control transmitter monitoring system, relative to an isotropic antenna.

B = 216400 Hz G = -1.2 dBi

10 $\log_{10}$213000 (Hz) – 150 (dBm/Hz) + 6(dBi) = 53.35 – 150 – 1.2 = -97.9 dBm

The blocking band was set to ~-94.9 dBm per channel (3 dB above the calculated threshold level), with a notch left open at channel 4 (403.35) MHz. A tone was introduced at the center of the notch at -103.9 dBm, and was stepped up to the threshold level, -97.9 dBm. At each step, a MICS communications session was initiated and the selected channel was observed.

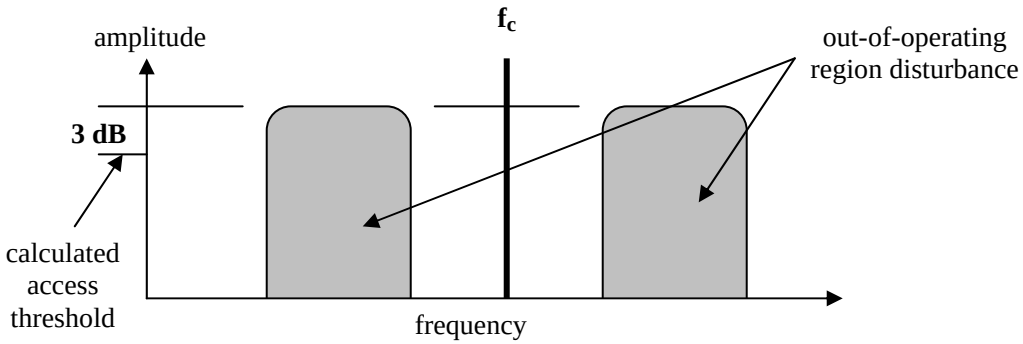


-103.9 dBm Tx on channel
-102.9 dBm Tx on channel
-101.9 dBm Tx on channel
-100.9 dBm Tx on channel
-99.9 dBm Tx off channel
-98.9 dBm Tx off channel

Threshold power = -99.9 dBm

Monitoring System Bandwidth
The monitoring system bandwidth measured at its 20 dB down points shall be equal to, or greater than the emission bandwidth of the intended transmission.

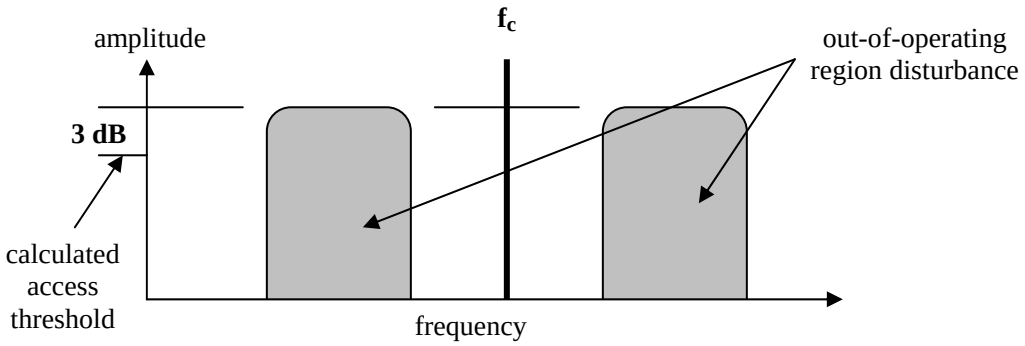
The blocking band was set to ~-94.9 dBm per channel (3 dB above the calculated threshold level), with a notch left open at channel 4 (403.35) MHz. A tone was introduced at the frequencies corresponding to the 20 dB down points of the fundamental emission, and was increased until the EUT no longer transmitted on channel 4. At each step, a MICS communications session was initiated and the selected channel was observed. The difference between the values at which the EUT detects the center-channel emission and the channel edge emissions should be less than 20 dB in order for the monitoring system bandwidth to be wider than the emission bandwidth.



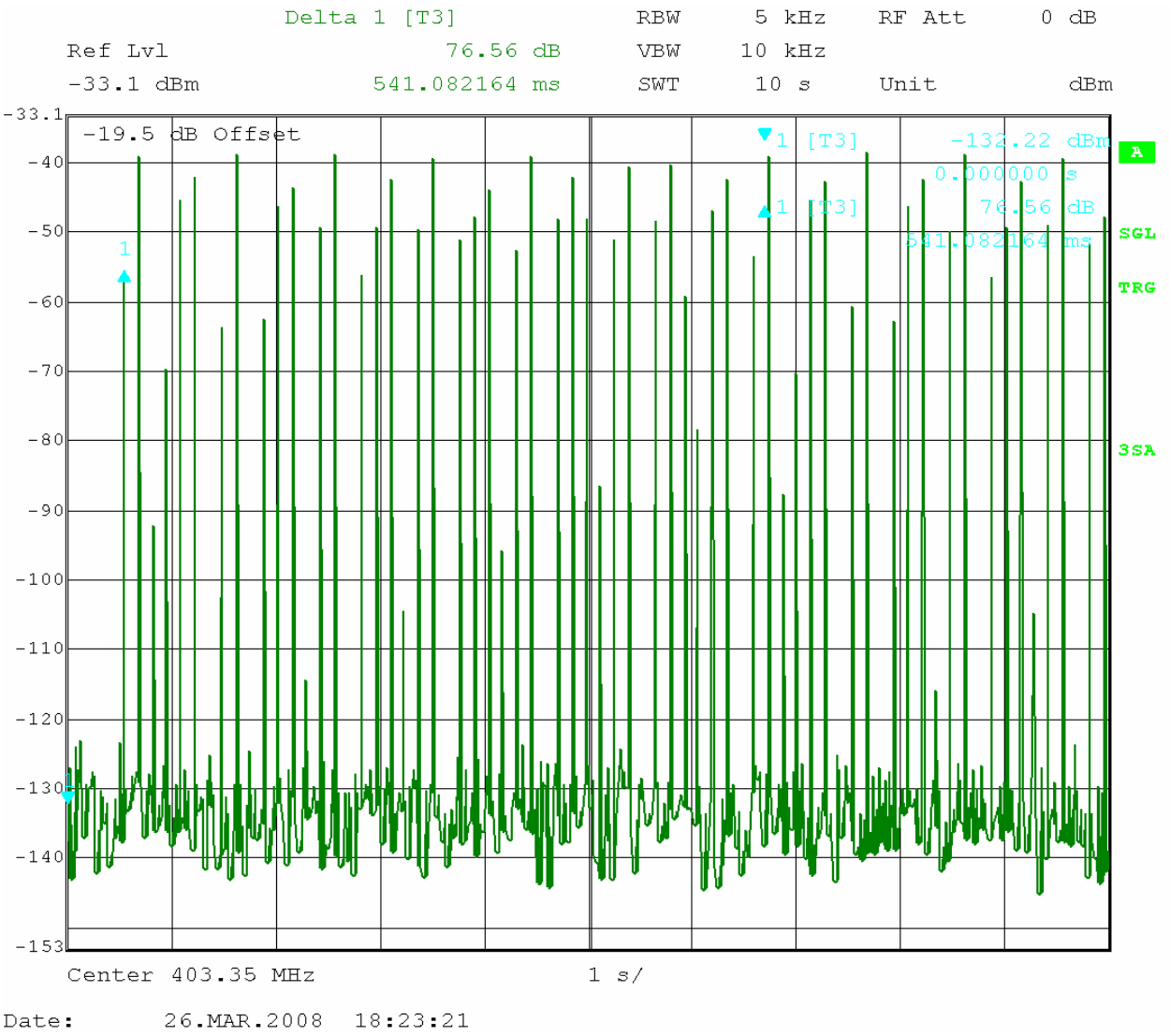
-96.9 dBm Tx off channel
-97.9 dBm Tx on channel
P_a = -97.9 dBm
F_{low} = 403.239 MHz
F_{low} -97.9 dBm Tx on channel
F_{low} -96.9 dBm Tx on channel
F_{low} -95.9 dBm Tx on channel
F_{low} -94.9 dBm Tx off channel
P_b = -94.9 dBm
F_{high} = 403.455 MHz
F_{high} -97.9 dBm Tx on channel
F_{high} -96.9 dBm Tx on channel
F_{high} -95.9 dBm Tx on channel
F_{high} -94.9 dBm Tx off channel
P_c = -94.9 dBm
$D_1 = P_a – P_b$ = -3 dB
$D_2 = P_a - P_c$ = -3 dB
D_1 and D_2 are both less than 20 dB

Scan Cycle Time
Within 5 seconds prior to initiating a communications session, circuitry associated with a medical implant programmer/control transmitter shall monitor all the channels in the 402-405 MHz frequency band.

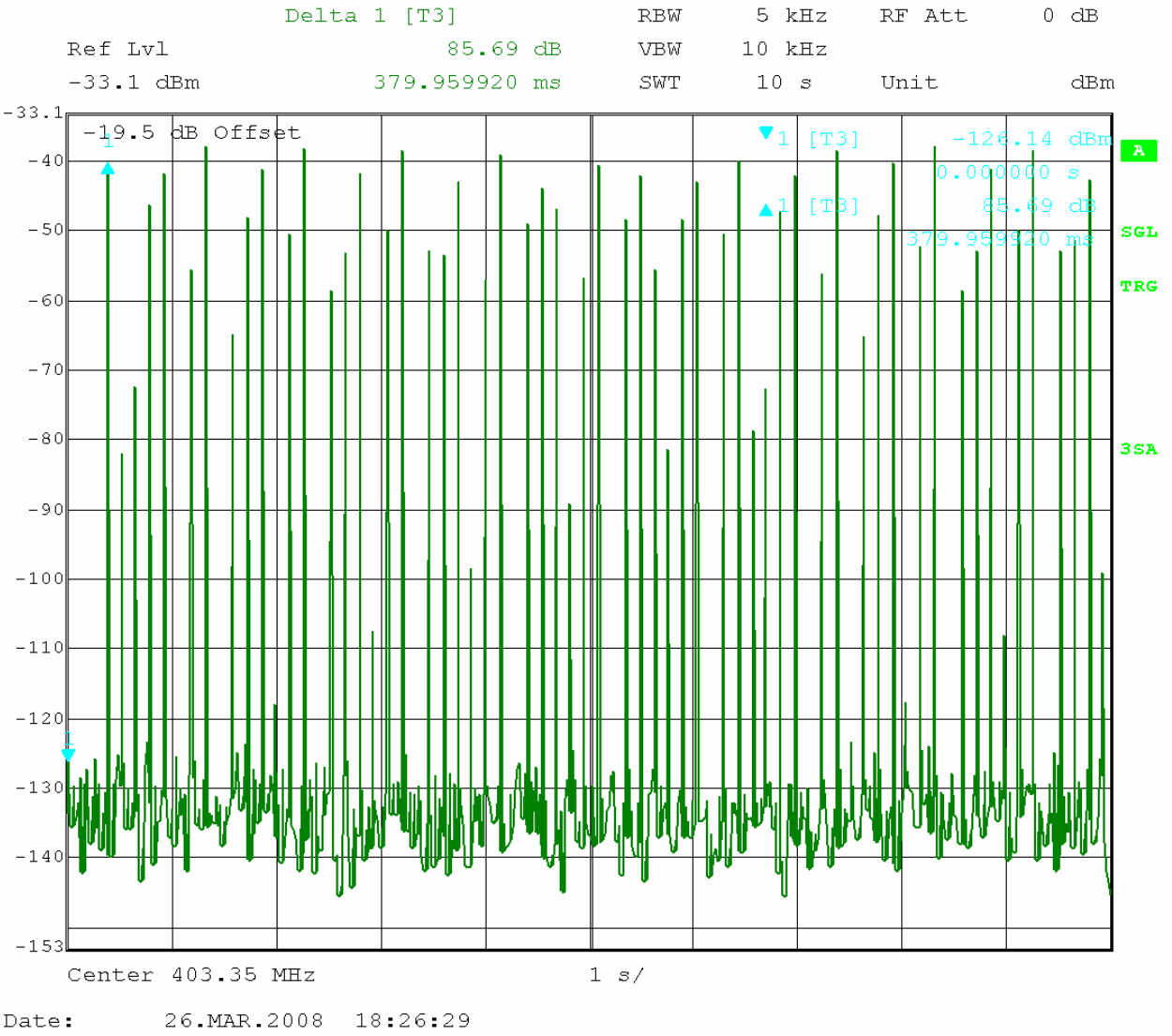
The blocking band was set to ~-94.9 dBm per channel (3 dB above the calculated threshold level), with a notch left open at channel 4 (403.35) MHz. A tone was introduced at the center of the notch at -91.9 dBm. The tone was removed and a MICS communications session was initiated. The time elapsed between removal of the CW tone and the start of the MICS session was recorded. The highest value was 541.1 ms.



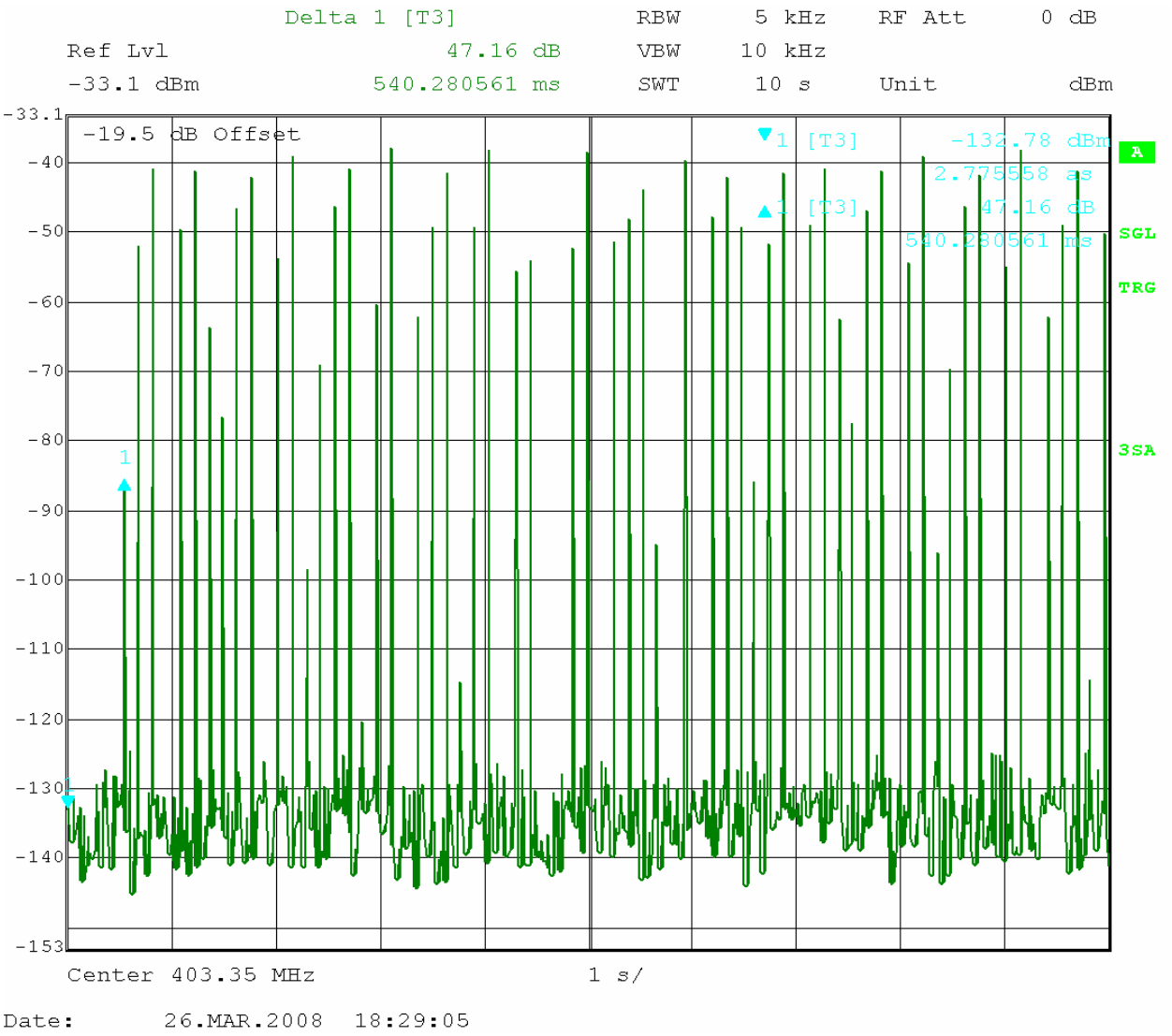
541.1ms – Scan cycle time 1
380.0ms – Scan cycle time 2
540.3ms – Scan cycle time 3
319.8ms – Scan cycle time 4
440.1ms – Scan cycle time 5



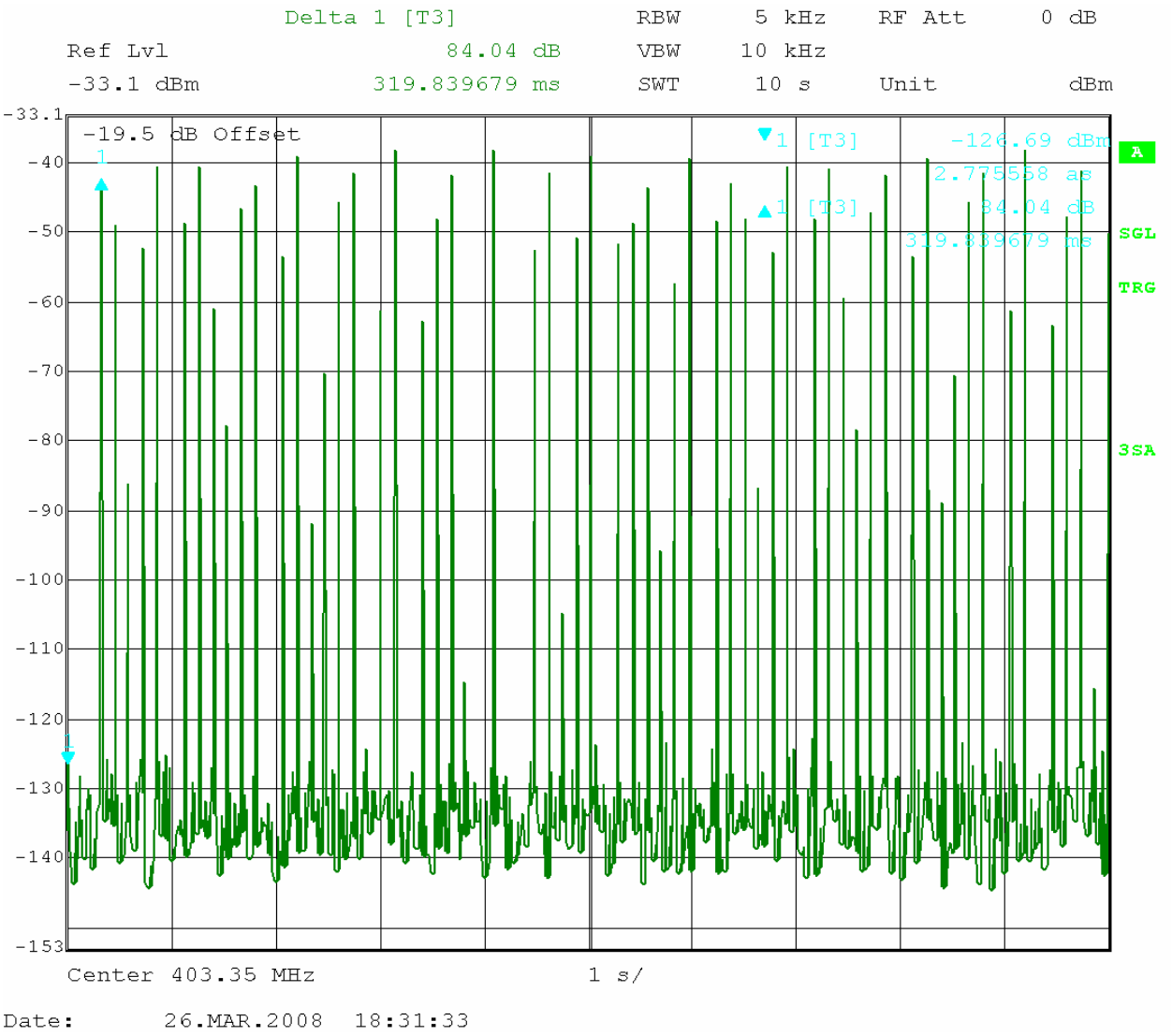
Scan Cycle Time 1 (541.1 ms)



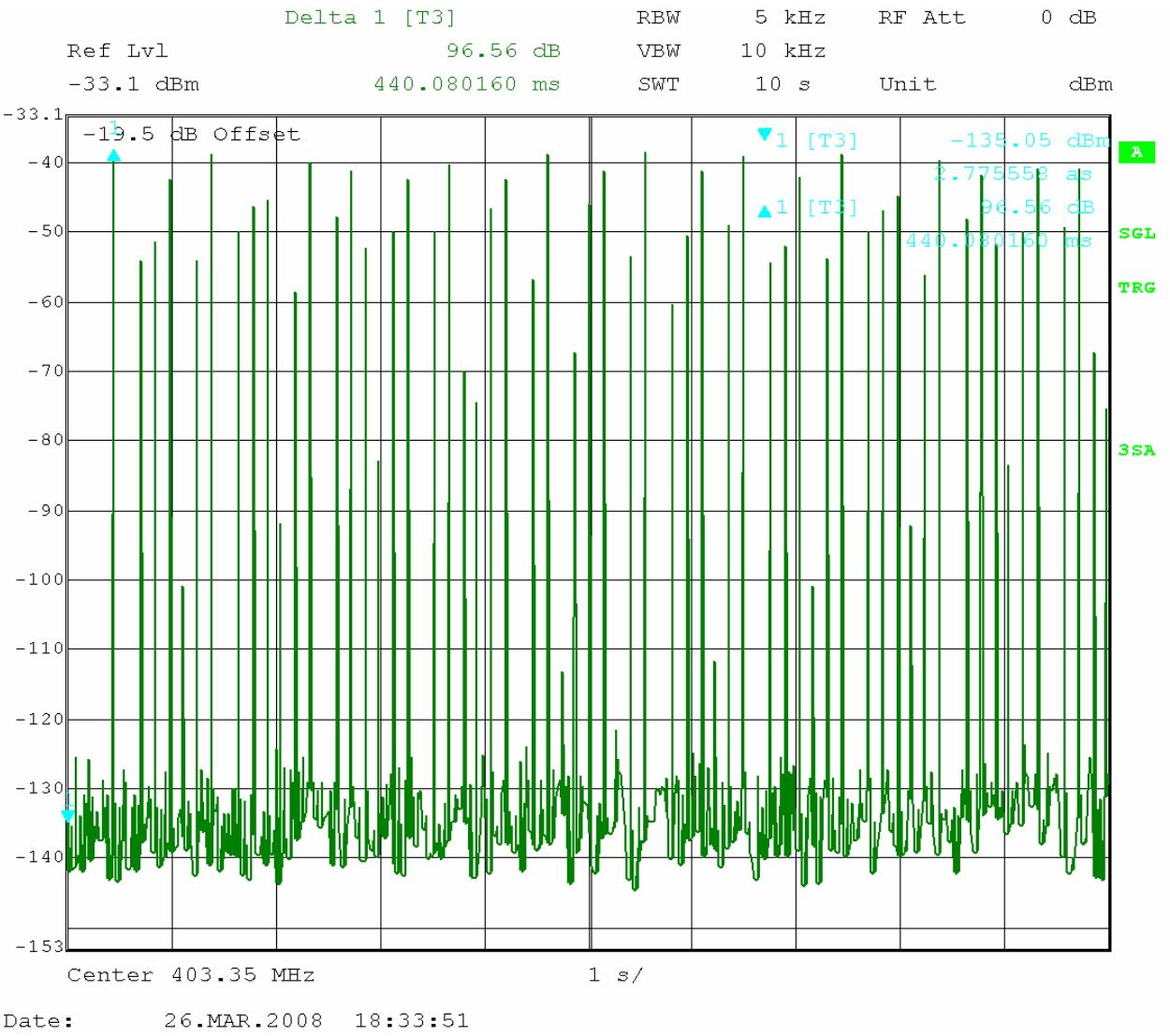
Scan Cycle Time 2 (380.0 ms)



Scan Cycle Time 3 (540.3 ms)



Scan Cycle Time 4 (319.8 ms)



Scan Cycle Time 5 (440.1 ms)

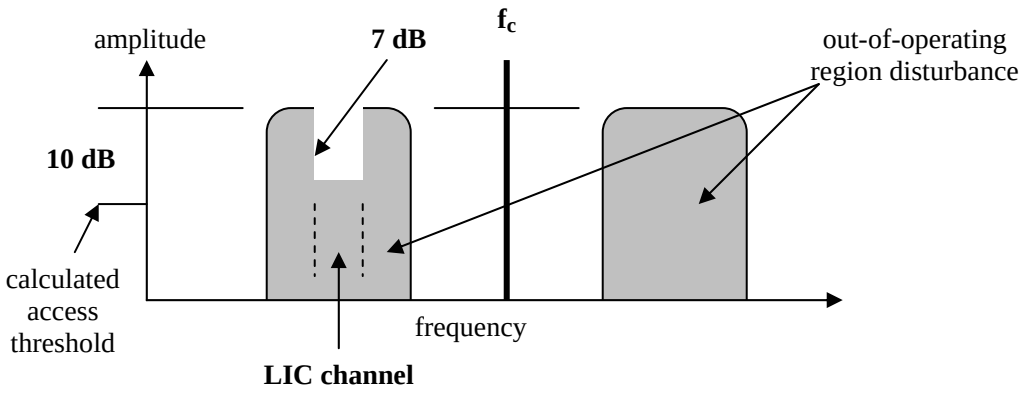
Minimum Channel Monitoring Period
Each MICS channel shall be monitored for a minimum of 10 milliseconds during each scan cycle of 5 seconds or less.

The blocking band was set to ~-91.3 dBm per channel, with a notch left open at channel 4 (403.35) MHz. A tone was introduced at the center of the notch at -88.3 dBm. A MICS communication session was initiated and it was verified that the EUT did not select channel 4 over several attempts. The CW tone was then pulsed with a 100μs pulse length and a 10 ms pulse interval (100 Hz PRF). It was then verified that the EUT continued not to select channel 5 over 20+ attempts.

Channel Access

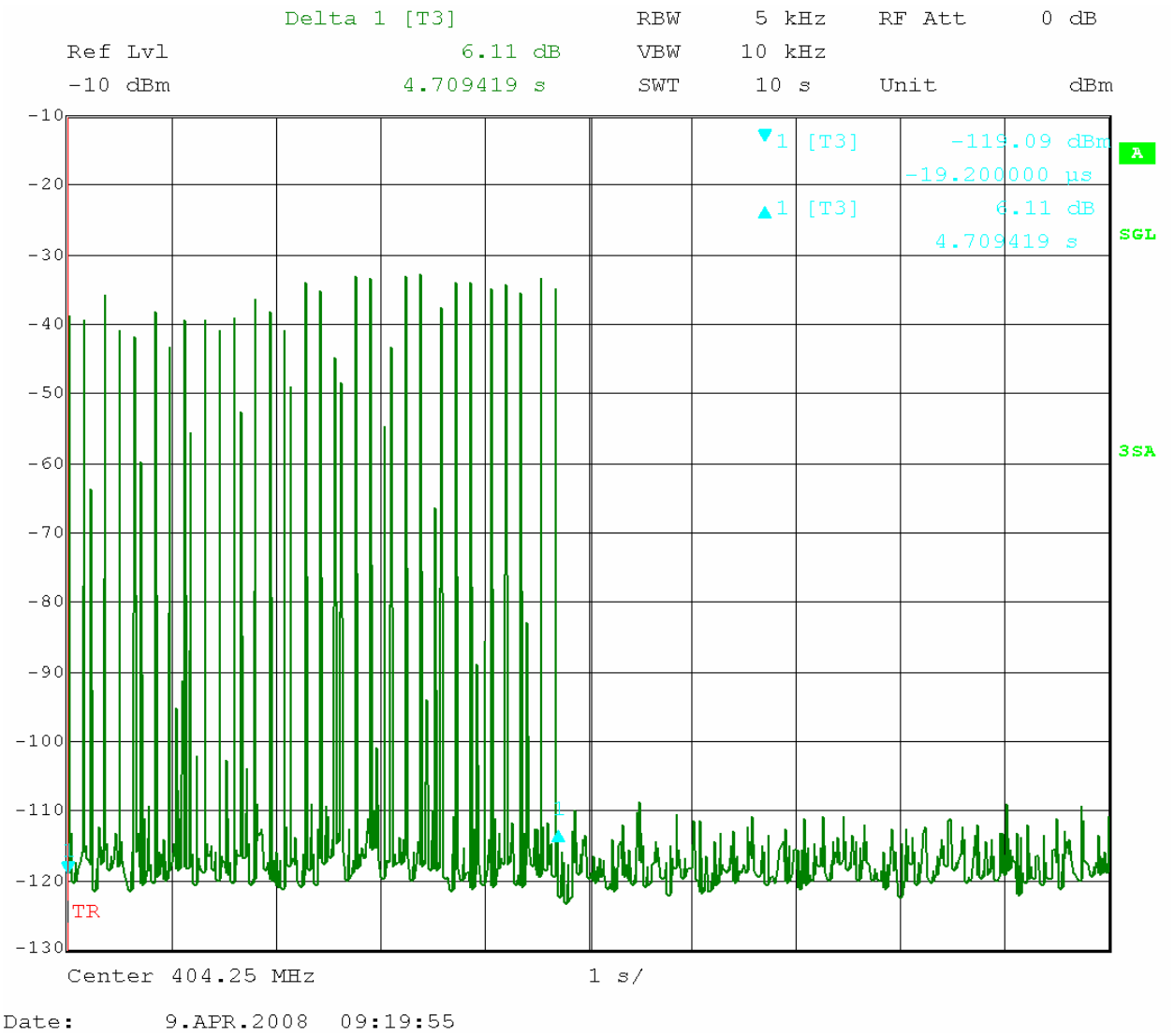
Immediate access is permitted on any channel having an ambient power level that is below the maximum threshold. If no channel having an ambient power level below the maximum threshold is available, the equipment under test shall access and transmit on the least interfered channel (LIC).

The blocking band was set to ~-87.9 dBm per channel (10 dB above the calculated threshold level), with a notch left open at channel 4 (403.35) MHz. A second notch was created at channel 7 (404.25 MHz) by lowering the blocking tones at channel 7 by 7 dB. A tone was introduced at the center of the channel 4 notch at -100.9 dBm. A MICS communication session was then initiated and it was verified that the EUT transmitted only on channel 4 through several attempts. The CW tone at channel 4 was then increased to -91.9 dBm, and it was verified that the EUT transmitted only on channel 7 over 10+ attempts.



Discontinuation of a MICS Session
MICS shall cease transmission in the event the communications session is interrupted for a period of 5 seconds or more.

A MICS communication session was initiated, and the MICS implant was caused to cease transmission during the session. The time from when the implant ceased transmission until the programmer/controller ceased communication was 4.71 seconds, as shown in the plot below. Communication did not resume.



Discontinuation of a MICS session

Use of the Pre-scanned Alternate Channel
Pre-scanned alternate channel operation is not implemented.

Test Results: Pass

Test Standard: FCC Part 95 Subpart I, IC RSS-243

Test: AC Line-Conducted Emissions

Performance Criterion: The AC line-conducted emissions must not exceed the FCC 15.207 and RSS-Gen Section 7.2.2 Table 2 limits.

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	22	Humidity (%):	23	Pressure (hPa):	1050
Pretest Verification Performed		Yes		Equipment under Test:		Merlin™@home	
Test Engineer(s):	Vathana Ven			EUT Serial Number:		6070823	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	LISN, 50uH, .01 - 50MHz, 24A	Solar Electronics	9252-50-R-24-BNC	941714	10/11/2008
3	RG223 50ohm Coaxial Cable	Intertek	BNC-30	CBLBNC6	12/28/2008
4	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS24	09/18/2008
5	EMI Receiver (9 KHz to 2.9 GHz)	Hewlett Packard	HP85422E	3906A00273	03/06/2009
6	RFI Filter Section	Hewlett Packard	85420E	3705A00230	03/06/2009

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Results:

Conducted Emissions

Company:	Plexus Services Corp.	Receiver:	HP 8542E (145-092)
Model #:	EX1150	Cable:	CBLBNC6 12-28-08.txt
Serial #:	6070823	LISN 1:	LISN12 [1] 10-11-08.txt
Engineer(s):	Vathana Ven	Location: Site 2	LISN 2: LISN12 [2] 10-11-08.txt
Project #:	3144422	Date: 02/25/08	LISN 3: NONE.
Standard:	FCC Part 15.207/IC RSS-Gen Table 2		LISN 4: NONE.
Notes:	MICS, Channel 4, Power=22		

Barometer: BAR2 Temp/Humidity/Pressure: 22 deg. C 23% 1050 mB Attenuator: DS24 9-18-08.txt

Voltage/Frequency: 120V/60 Hz Frequency Range: 0.150-30 MHz

Net is the sum of worst-case lisn, cable, & attenuator losses, and initial reading, factors are not shown

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	QP Limit dB(uV)	Margin dB	Bandwidth
QP	0.166	14.1	16.2			37.9	65.2	-27.2	9/30 kHz
QP	0.250	11.2	14.0			35.7	61.8	-26.1	9/30 kHz
QP	0.335	10.2	13.1			34.8	59.3	-24.6	9/30 kHz
QP	0.753	8.0	10.7			32.3	56.0	-23.7	9/30 kHz
QP	20.170	17.4	21.5			43.8	60.0	-16.2	9/30 kHz
QP	21.220	15.0	20.0			42.3	60.0	-17.7	9/30 kHz

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	Average Limit dB(uV)	Margin dB	Bandwidth
AVG	0.166	5.1	8.5			30.2	55.2	-24.9	9/30 kHz
AVG	0.250	-1.0	2.9			24.6	51.8	-27.2	9/30 kHz
AVG	0.335	-2.5	2.9			24.6	49.3	-24.8	9/30 kHz
AVG	0.753	5.0	5.7			27.3	46.0	-18.7	9/30 kHz
AVG	20.170	11.7	14.7			37.0	50.0	-13.0	9/30 kHz
AVG	21.220	9.5	12.4			34.7	50.0	-15.3	9/30 kHz

AC Line-Conducted Emissions Setup Photos

AC Line-Conducted Emissions Setup Photos