



Electromagnetic Compatibility Test Report

Tests Performed on a DPAC/Trilithic, Inc.

Leakage Detector, Model MCA

Radiometrics Document RP-6171C



Product Detail:

FCC ID: RTTAB-WLNB (DPAC)

Equipment type: 2.4 GHz Spread Spectrum Transmitter

Test Standards:

US CFR Title 47, Chapter I, FCC Part 15 Subpart C

FCC Part 15 CFR Title 47: 2006

Industry Canada RSS-210, Issue 7 as required for Category I Equipment

This report concerns: Class II Permissive Change

Tests Performed For:

Trilithic, Inc.

9710 Park Davis Dr.

Indianapolis, IN 46235

Test Facility:

Radiometrics Midwest Corporation

12 East Devonwood

Romeoville, IL 60446

Test Date(s): (Month-Day-Year)

November 5 to 16, 2007

Document RP-6171C Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	December 27, 2007		

Table of Contents

1 ADMINISTRATIVE DATA 3

2 TEST SUMMARY AND RESULTS 3

 2.1 RF Exposure Compliance Requirements 4

3 EQUIPMENT UNDER TEST (EUT) DETAILS 4

 3.1 EUT Description 4

 3.2 Related Submittals 4

4 TESTED SYSTEM DETAILS 4

 4.1 Tested System Configuration 4

 4.2 Special Accessories 5

 4.3 Equipment Modifications 5

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS..... 5

6 RADIOMETRICS' TEST FACILITIES 6

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS..... 7

8 CERTIFICATION 7

9 TEST EQUIPMENT TABLE 7

10 TEST SECTIONS 7

 10.1 Spurious Radiated Emissions 7

 10.1.1 Radiated Emissions Field Strength Sample Calculation..... 8

 Figure 1. Drawing of Radiated Emissions Setup 9

 10.1.2 Spurious Radiated emissions results above 2 GHz..... 9

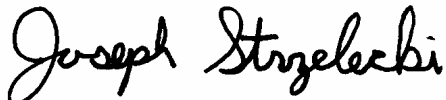
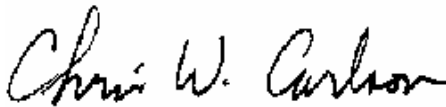
 10.1.2.1 Spurious Radiated Emissions Test Results 9

 10.1.3 Spurious Radiated Emissions Below 2 GHz (802.11)..... 11

Notice: This report must not be reproduced (except in full) without the written approval of Radiometrics Midwest Corporation.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
Testing of the Trilithic, Inc. Leakage Detector, Model MCA

1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Trilithic, Inc., Leakage Detector MCA with WI-FI Part Number: 2011029005 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> November 2, 2007	<i>Test Date(s): (Month-Day-Year)</i> November 5 thru 12, 2007
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	
<i>Radiometrics' Personnel Responsible for Test:</i> 	<i>Test Report Approved By</i> 
Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a leakage detector system, Model MCA, manufactured by DPAC Technologies for Trilithic, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
Unintentional RF Radiated Emissions	30-2,000 MHz	RSS-210	Pass

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report				
Testing of the Trilithic, Inc. Leakage Detector, Model MCA				

802.11 DTS Spread Spectrum Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS-210 Section	Test Result
6 & 20 dB Bandwidth Test;	2400 to 2483 MHz	15.247 a	6.2.2 (o) (a)	Pass; Note 1
Peak Output Power	2400 to 2483 MHz	15.247 b	6.2.2 (o) (a)	Pass; Note 1
Band-edge Compliance of RF Conducted Emissions	2400 to 2483 MHz	15.247 d	6.2.2 (o) (e)	Pass
Spurious RF Conducted Emissions	30 MHz to 25 GHz	15.247 d	6.2.2 (o) (e1)	Pass; Note 1
Spurious Radiated Emissions	30 MHz to 25 GHz	15.247 d	6.2.2 (o) (a)	Pass
Power Spectral Density	2400 to 2483 MHz	15.247 e	6.2.2 (o) (b)	Pass; Note 1

Note 1; The tests results are in the original grant report. These Tests results are not included herein, since the only change in the product was the Antenna.

No AC conducted was performed since the EUT is battery powered only.

2.1 RF Exposure Compliance Requirements

Since the power output is 85 mW EIRP, The EUT meets the FCC and IC requirements for RF exposure. The detailed calculations for RF Exposure are presented in a separate document.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Leakage Detector System with Mobile Communications Adaptor, Model Seeker, manufactured by DPAC technologies for Trilithic, Inc. The EUT was in good working condition during the tests, with no known defects. The EUT has two transmitters, an 802.11b Wi-Fi and a Bluetooth.

3.2 Related Submittals

Trilithic, Inc. is not submitting any other products simultaneously for equipment authorization related to the EUT.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's Recommendations. Power was supplied to the MCA at 13.6 VDC.

The identification for all equipment, plus descriptions of all cables used in the tested system, is:

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report					
Testing of the Trilithic, Inc. Leakage Detector, Model MCA					

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Mobile Communications Adaptor for a Leakage Detector (MCA)	E	Trilithic, Inc.	Seeker MCA	T200651151
2	Leakage Detector	E	Trilithic, Inc.	Seeker P/N 2071742000	246690
3	Mobile Mount	E	Trilithic, Inc.	2071743000	None

* Type: E = EUT, P = Peripheral

List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1	Communications cable between Communications adaptor and the Mobile Mount	#1	No
1	1	Power Cable for the Mobile mount	#1	No
1	5	Coax for External Antenna for seeker	#1	Yes

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

In order to pass the Radiated Emissions two Steward P/N 28A2026-0A2 ferrites were added to the Seeker MCA cable.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2006	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2003	2003	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 7	2007	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 2	2007	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)
FCC DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
FCC 558074	2005	Measurement of Digital Transmission Systems Operating under Section 15.247

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Trilithic, Inc. Leakage Detector, Model MCA

The test procedures used are in accordance with the FCC DA 00-705, and FCC 558074, Industry Canada RSS-212 and ANSI document C63.4-2003, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 24' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 20' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber D: Is a fully anechoic chamber that measures 22' L X 10' W X 10' H. The walls, ceiling and floor are fully lined with ferrite absorber tiles. Braden Shielding Systems of Tulsa, Oklahoma manufactured the chamber.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report							
Testing of the Trilithic, Inc. Leakage Detector, Model MCA							

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/27/06
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo.	12/27/06
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/29/06
AMP-29	HP / Agilent	Amplifier	11975A	2304A00158	2-8 GHz	12 Mo.	03/14/07
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/24/06
ANT-42	EMCO	Bicon Antenna	3104C	9512-4713	25-300MHz	24 Mo.	01/26/06
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/12/05
MXR-02	HP / Agilent	Harmonic Mixer	11970K	2332A00489	18-26.5GHz	12 Mo.	03/14/07
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	01/17/07
REC-08	Hewlett Packard	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	12 Mo.	07/05/06
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 Mo.	03/31/06

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

10.1 Spurious Radiated Emissions

Radiated emission measurements in the restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz, an Anritsu spectrum analyzer and a preamplifier were used. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 25 GHz, an HP8566A spectrum analyzer was used with a preamplifier. A harmonic mixer was used from 20 to 25 GHz. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

Radiated emission measurements are performed with linearly polarized broadband antennas. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

Final radiated emissions measurements were performed in Chamber E at a test distance of 3 meters. The entire frequency range from 30 MHz to 25 GHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The anechoic test chamber has a metal ground screen.

The device was rotated through three orthogonal axis as per 13.1.4.1 of ANSI C63.4 during the prescans and during final radiated tests.

10.1.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

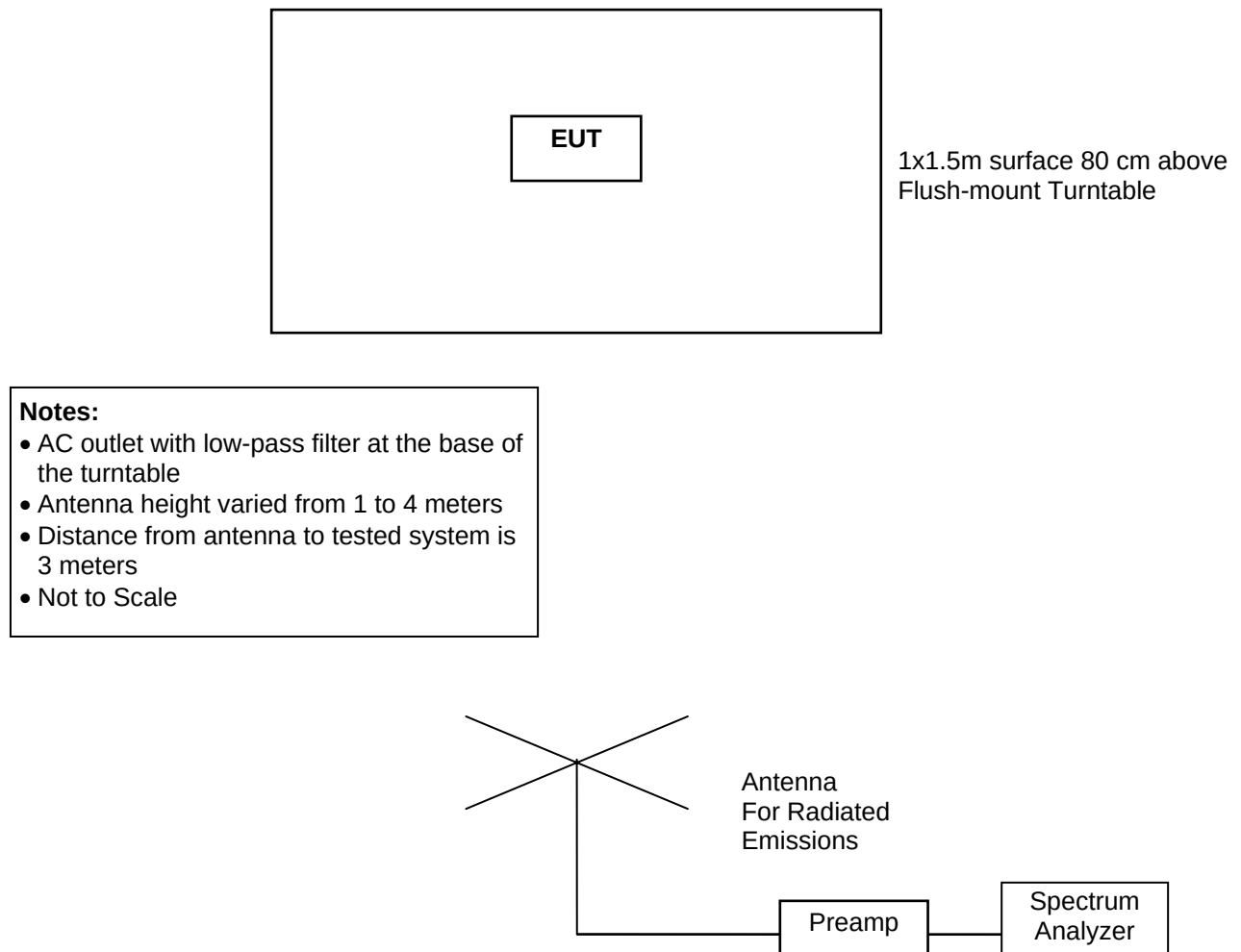
AG = Amplifier Gain

HPF = High pass Filter Loss

PKA = Peak to Average Factor (This is used for Bluetooth Average measurements only.
For all other measurements, it was zero)

The peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is $20 * \text{Log}(\text{Duty cycle}/100)$.

Figure 1. Drawing of Radiated Emissions Setup



10.1.2 Spurious Radiated emissions results above 2 GHz

10.1.2.1 Spurious Radiated Emissions Test Results

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

A Video Bandwidth of 10 Hz was used for Average measurements.

5dBi antenna

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Trilithic, Inc. Leakage Detector, Model MCA

hrm #	Tx Freq	Ant Pol.	802.11 Peak Ave Analyzer RDG dBuV		Corr Fact. dB	EUT Emission Freq MHz	Field Strength from EUT Peak Ave dBuV/m		Field Strength Limit Peak Ave dBuV/m		Margin Under Limit dB
			Peak	Ave			Peak	Ave	Peak	Ave	
be	2412	V	48.6	39.1	4.5	2386	53.1	43.6	74	54	10.4
be	2412	H	50.5	41.3	4.5	2389	55.0	45.8	74	54	8.2
2	2412	V	42.6	28.3	14	4824	56.6	42.3	74	54	11.7
2	2412	H	39.5	29.5	14	4824	53.5	43.5	74	54	10.5
3	2412	V	34.2	26.9	20.7	7236	54.9	47.6	74	54	6.4
3	2412	H	34.5	27.8	20.7	7236	55.2	48.5	74	54	5.5
2	2437	V	41.3	32.6	10.4	4874	51.7	43.0	74	54	11.0
2	2437	H	38.5	31.2	10.4	4874	48.9	41.6	74	54	12.4
3	2437	V	34.1	26.8	18.7	7311	52.8	45.5	74	54	8.5
3	2437	H	34.9	27.2	18.7	7311	53.6	45.9	74	54	8.1
be	2462	V	49.6	43.2	3.9	2498	53.5	47.1	74	54	6.9
be	2462	H	44.8	41.6	3.9	2484	48.7	45.5	74	54	8.5
2	2462	V	40.5	28.6	12.4	4924	52.9	41.0	74	54	13.0
2	2462	H	37.6	28.4	12.4	4924	50.0	40.8	74	54	13.2
3	2462	V	35.5	27.0	19.2	7386	54.7	46.2	74	54	7.8
3	2462	H	36.1	27.1	19.2	7386	55.3	46.3	74	54	7.7

* Noise Floor of analyzer; No detectable emission

- Notes: 1. hrm = Harmonic; BE = Band Edge emissions; V = Vertical; H = Horizontal
 2. The margin (last column) is the worst case margin under the peak or average limits for that row.
 3. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor

Judgment: Passed by 4.6 dB

No other emissions were detected in the restricted bands from 2 to 25 GHz.

PKA = peak to average factor in dB. The Peak to average factor is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is $20 * \text{Log}(\text{Duty cycle}/100)$.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report			
Testing of the Trilithic, Inc. Leakage Detector, Model MCA			

10.1.3 Spurious Radiated Emissions Below 2 GHz (802.11)

Manufacturer	Trilithic, Inc.	Specification	RSS-210 & FCC 15.209
Model	Seeker MCA	Test Date	November 12, 2007, 2007
Serial Number	246690	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain – Duty Cycle Factor + HP Filter Loss		

The following is the worst case emissions from EUT below 2.3 GHz. The results include intentional and unintentional emissions.

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
384.4	34.4	16.4	H/44	-16.6	34.2	46.0	11.8
401.7	38.2	16.2	V/44	-16.5	37.9	46.0	8.1
458.1	36.1	16.9	V/44	-16.2	36.8	46.0	9.2
477.2	36.9	17.7	V/44	-16.1	38.5	46.0	7.5
732.8	25.3	20.3	V/44	-14.9	30.7	46.0	15.3
73.1	37.1	6.7	H/44	-19.1	24.7	40.0	15.3
145.6	37.3	10.6	H/44	-18.2	29.7	43.5	13.8
209.6	37.1	10.7	H/44	-17.6	30.2	43.5	13.3
353.8	34.5	16.1	H/44	-16.7	33.9	46.0	12.1
377.7	38.1	16.4	H/44	-16.6	37.9	46.0	8.1
385.4	32.5	16.4	H/44	-16.6	32.3	46.0	13.7
401.5	30.7	16.2	H/44	-16.3	30.6	46.0	15.4
409.6	35.7	16.1	H/44	-16.3	35.5	46.0	10.5
412.5	30.9	16.2	H/44	-16.3	30.8	46.0	15.2
437.5	34.1	16.3	H/44	-16.1	34.3	46.0	11.7
49.0	34.9	14.5	V/44	-19.3	30.1	40.0	9.9
70.5	41.1	7.9	V/44	-19.1	29.9	40.0	10.1
133.3	38.8	13.9	V/44	-18.3	34.4	43.5	9.1
145.8	38.3	11.5	V/44	-18.2	31.6	43.5	11.9
378.7	30.1	16.5	V/44	-16.6	30.0	46.0	16.0
410.8	31.7	16.3	V/44	-16.3	31.7	46.0	14.3
440.2	33.3	16.6	V/44	-16.0	33.9	46.0	12.1
448.5	33.3	16.7	V/44	-16.0	34.0	46.0	12.0
456.9	31.8	16.9	V/44	-16.0	32.7	46.0	13.3
462.5	32.2	17.0	V/44	-16.0	33.2	46.0	12.8
1454.6	26.6	25.4	V/44	-11.7	40.3	54.0	13.7
1581.8	24.3	26.2	V/44	-11.2	39.3	54.0	14.7

Judgment: Passed by 8.1 dB

No other emissions were detected in the restricted bands.