EMISSIONS TEST REPORT

Report Number: 101275145BOX-009
Project Number: G101275145

Report Issue Date: 03/30/2014

Product Designation: zLink (Bluetooth)

Standards: FCC Part 15:2014 Subpart C Section 15.247,
FCC Part 15:2014 Subpart B Class B,
RSS-210 Issue 8 December 2010,
ICES-003 Issue 5 August 2012
RSS-Gen Issue 3 December 2010

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Corventis
1410 Energy Park Drive
Suite #1
St. Paul, MN 55108
USA

Report prepared by Reviewer

Vathana Ven / Sr. Project Engineer, EMC

Report reviewed by

Kouma Sinn / Sr. Project Engineer, EMC

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test	--
5	System Setup and Method	--
6	Maximum Peak Output Power, Human RF Exposure and Duty Cycle FCC 15:2011 Subpart C, Section 15.247 (b) (1), (4) RSS-210 Issue 8 December 2010, A8.4 (2), IC RSS-102 Issue 4 March 2010, CFR47 Part 2.1093	Pass
7	Transmitter Radiated Spurious Emissions FCC 15:2013 Subpart C Section 15.247 (d) RSS-210 Issue 8 December 2010, A8.5	Pass
8	Hopping Channel Separation FCC 15:2013 Subpart C Section 15.247 (a)(1) RSS-210 Issue 8 December 2010, A8.1 (b)	Pass
9	Number of Hopping Frequency FCC 15:2013 Subpart C Section 15.247 (a)(1) (iii) RSS-210 Issue 8 December 2010, A8.1 (d)	Pass
10	Hopping Channel Bandwidth FCC 15:2013 Subpart C Section 15.247 (a)(1) RSS-210 Issue 8 December 2010, A8.1 (b)	Pass
11	Hopping Dwell time FCC 15:2011 Subpart C Section 15.247 (a)(1) (iii) RSS-210 Issue 8 December 2010, A8.1 (d)	Pass
12	Band-edge Compliance FCC 15:2013 Subpart C Section 15.247 (d) RSS-210 Issue 8 December 2010, A8.5	Pass
13	Receiver Radiated Spurious FCC Part 15:2013 Subpart B Section 15.109 (a) RSS-Gen Issue 3 December 2010, Section 6.1 (Table 2)	Pass
14	AC Line Conducted Emissions (CFR47 FCC Part 15 Subpart B 15.207, IC RSS-Gen Section 7.2.4)	Pass
15	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: Corventis
1410 Energy Park Drive Suite #1
St. Paul, MN 55108
USA

Contact: Mr. Brett Landrum
Telephone: 651-925-3778
Fax: None
Email: Brett.Landrum@corventis.com

4 Description of Equipment Under Test

Manufacturer: Corventis
1410 Energy Park Drive Suite #1
St. Paul, MN 55108
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless Transmitter (Bluetooth)	Corventis	zLink	015821

Receive Date:	02/24/2014	Test Date:	03/12/2014 – 03/24/2014
Received Condition:	Good		
Type:	Production	FCC IC ID:	Not available

Description of Equipment Under Test (provided by client)
Bluetooth utilizes 79 channels starting at 2402 MHz and extending to 2480 MHz. Channels 0 (2402 MHz), 38 (2440 MHz) and 79 (2480 MHz) were selected for testing. The device has an integral antenna.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
100-240VAC	1.1	50/60Hz	N/A
3.7VDC	1.8Ah	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmit mode – hopping enabled (DH1, DH3, and DH5) or hopping disabled, modulated on a single channel
2	Receive mode

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed using Tera Term 4.61

5 System Setup and Method

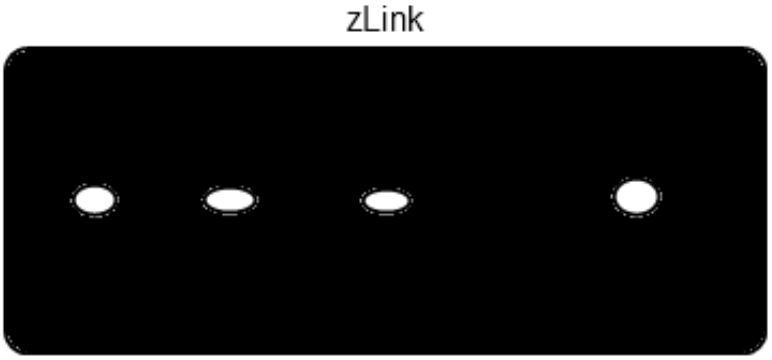
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
	None				

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	Dell	Latitude D630	JX7XX61 43367588497

5.1 Method:

Configuration as required by ANSI C 63.10:2013, FCC Part 15:2013 Subpart C Section 15.247, RSS-210 Issue 8 December 2010, RSS-Gen Issue 3 December 2010, IC RSS-102 Issue 4 March 2010, CFR47 Part 2.1093.

5.2 EUT Block Diagram:



6 Maximum Peak Output Power, Human RF Exposure and Duty Cycle

6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, CFR47 Part 2.1093, ANSI C63.10, RSS-Gen, RSS-210 Annex 8, and IC RSS-102 Issue 4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

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

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
145008'	LISN: 50 Ohm/50 microHenry	Solar	9252-50-R-24-BNC	971601	06/04/2013	06/04/2014
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014

Software Utilized:

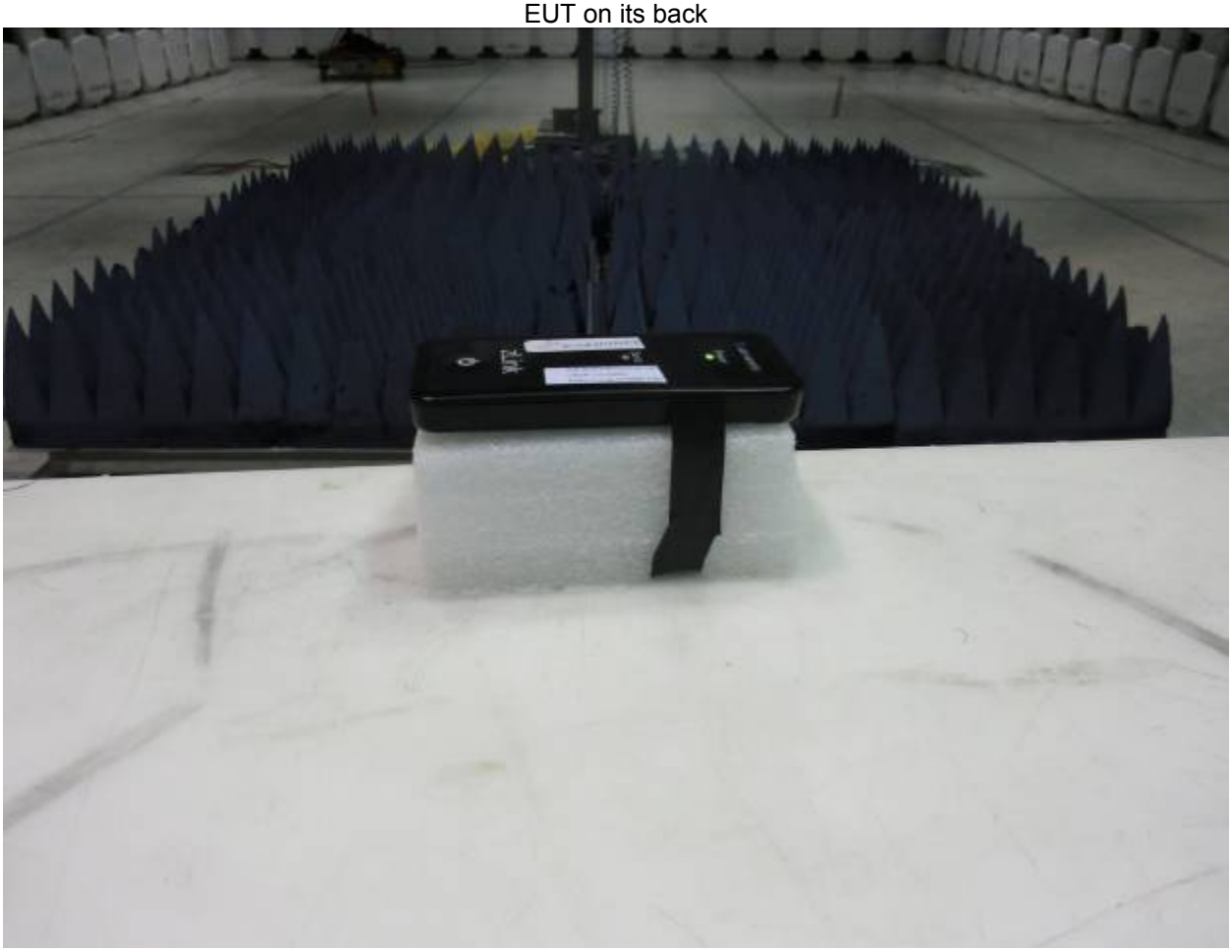
Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2010

6.3 Results:

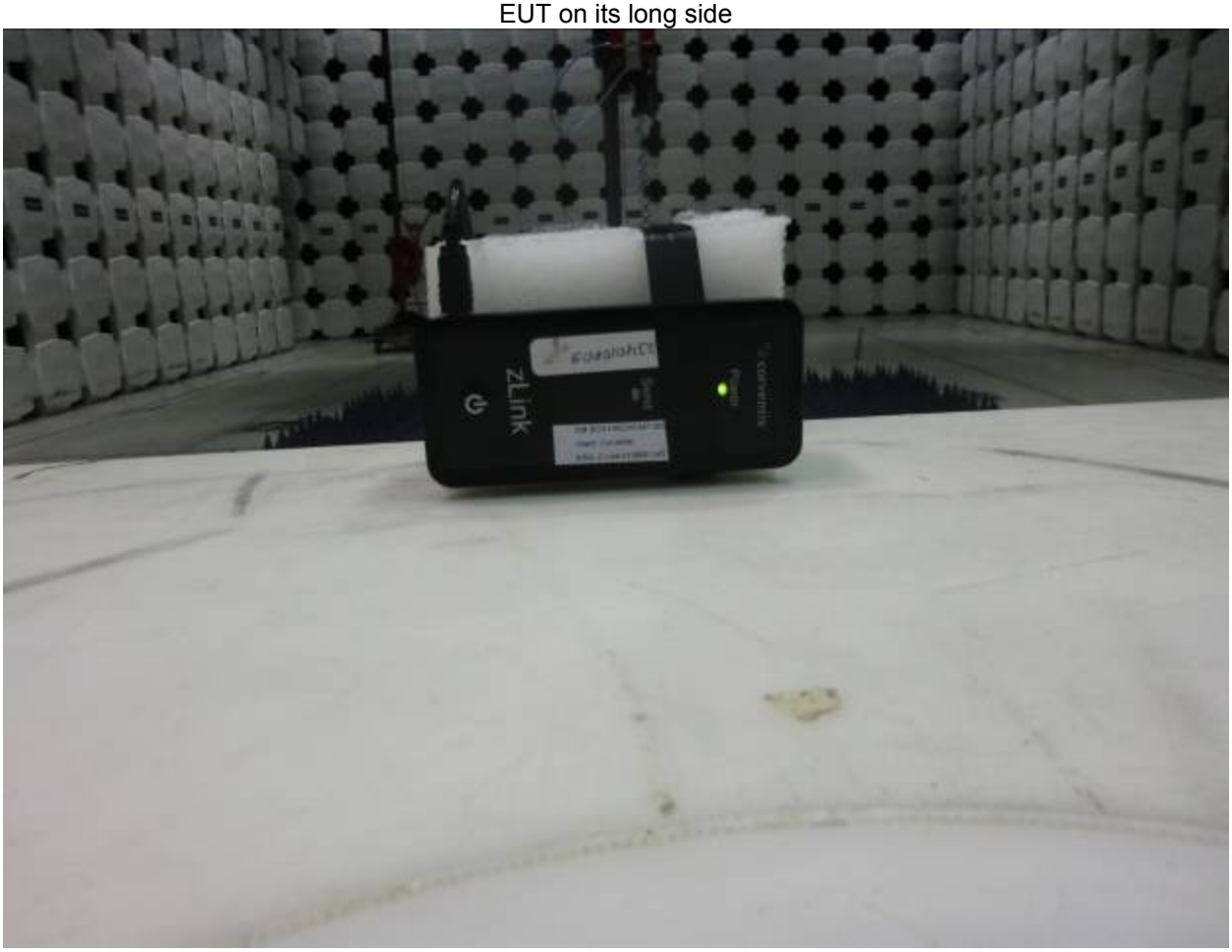
The sample tested was found to Comply.

6.4 Setup Photographs:

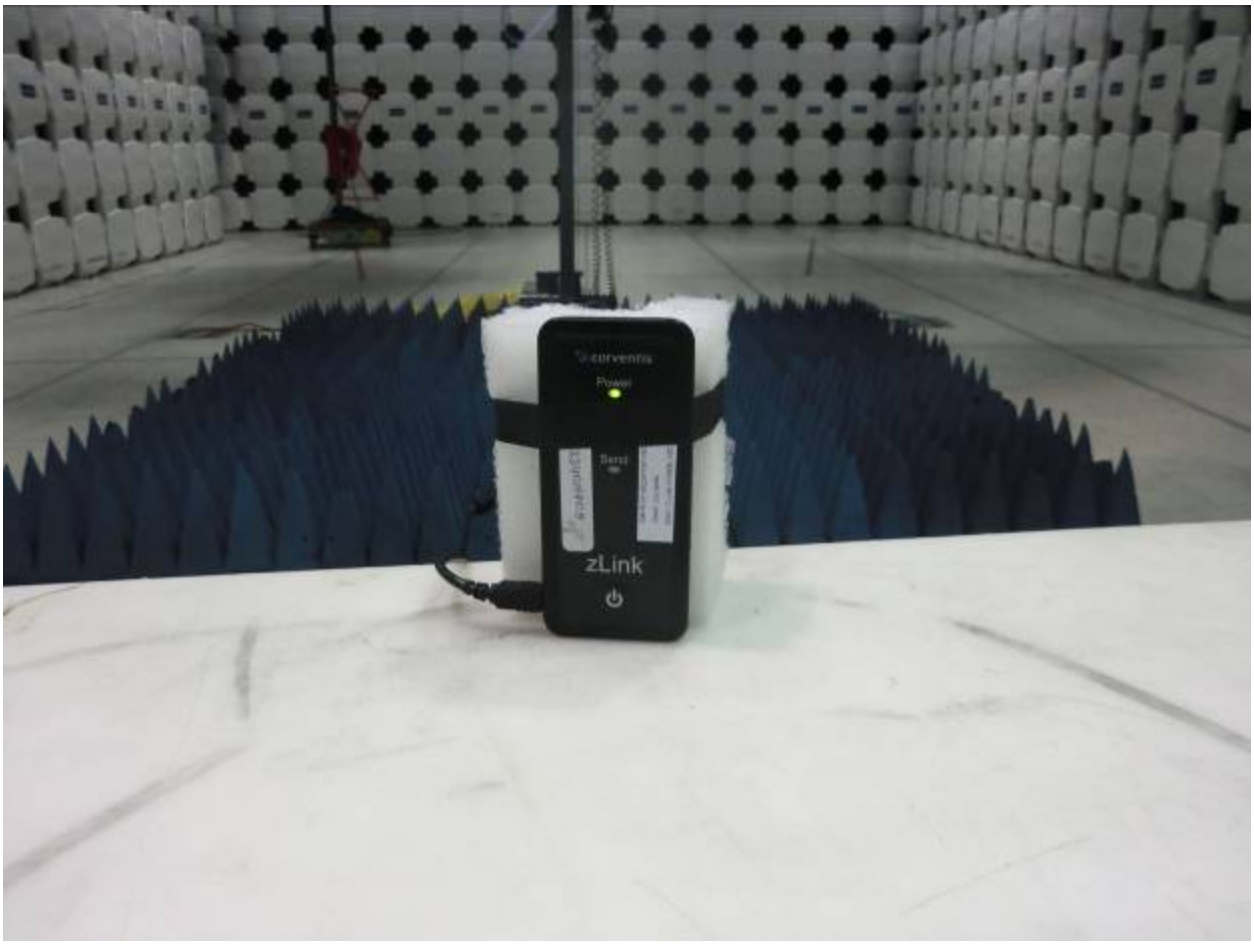
EUT on its back



EUT on its long side



EUT on its short side



6.5 Test Data:

Radiated Emissions

Company: Corventis | Antenna & Cables: SHF | Bands: N, LF, HF, SHF
Model #: zLink | Antenna: ETS001 01-06-15.txt | ETS001 01-06-15.txt
Serial #: 015821 | Cable(s): 145-416 3mTrkB 10-03-2014.txt | NONE.
Engineers: Vathana Ven | Location: 10m Chamber | Barometer: DAV004 | Filter: NONE
Project #: G101275145 | Date(s): 03/12/14
Standard: FCC Part 15 Subpart C 15.247 | Temp/Humidity/Pressure: 24c | 42% | 1007mB
Receiver: R&S ESI (145-108) 05-10-2014 | Limit Distance (m): 3
PreAmp: PRE145014 12-13-2014.txt | Test Distance (m): 3
PreAmp Used? (Y or N): N | Voltage/Frequency: 3.7VDC/120VAC | 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	EIRP Net dBm	EIRP Limit dBm	Margin dB	Bandwidth	FCC	IC	Harmonic?
Note: RF Output Power zLink														
Note: EIRP Obtained by applying the path loss correction for a 3m test distance, E(dBuV/m)@3m - 95.22 = dBm EIRP														
X - Axis														
PK	V	2402.000	54.61	32.11	5.91	0.00	0.00	-2.59	36.00	-38.59	5/10 MHz			
PK	H	2402.000	52.56	32.11	5.91	0.00	0.00	-4.64	36.00	-40.64	5/10 MHz			
PK	V	2440.000	50.94	32.20	5.98	0.00	0.00	-6.10	36.00	-42.10	5/10 MHz			
PK	H	2440.000	56.73	32.20	5.98	0.00	0.00	-0.31	36.00	-36.31	5/10 MHz			
PK	V	2480.000	53.31	32.30	6.06	0.00	0.00	-3.55	36.00	-39.55	5/10 MHz			
PK	H	2480.000	59.43	32.30	6.06	0.00	0.00	2.57	36.00	-33.43	5/10 MHz			
Y - Axis														
PK	V	2402.000	56.34	32.11	5.91	0.00	0.00	-0.86	36.00	-36.86	5/10 MHz			
PK	H	2402.000	53.64	32.11	5.91	0.00	0.00	-3.56	36.00	-39.56	5/10 MHz			
PK	V	2440.000	56.07	32.20	5.98	0.00	0.00	-0.97	36.00	-36.97	5/10 MHz			
PK	H	2440.000	55.42	32.20	5.98	0.00	0.00	-1.62	36.00	-37.62	5/10 MHz			
PK	V	2480.000	56.60	32.30	6.06	0.00	0.00	-0.26	36.00	-36.26	5/10 MHz			
PK	H	2480.000	56.79	32.30	6.06	0.00	0.00	-0.07	36.00	-36.07	5/10 MHz			
Z - Axis														
PK	V	2402.000	53.20	32.11	5.91	0.00	0.00	-4.00	36.00	-40.00	5/10 MHz			
PK	H	2402.000	55.42	32.11	5.91	0.00	0.00	-1.78	36.00	-37.78	5/10 MHz			
PK	V	2440.000	53.77	32.20	5.98	0.00	0.00	-3.27	36.00	-39.27	5/10 MHz			
PK	H	2440.000	57.40	32.20	5.98	0.00	0.00	0.36	36.00	-35.64	5/10 MHz			
PK	V	2480.000	56.73	32.30	6.06	0.00	0.00	-0.13	36.00	-36.13	5/10 MHz			
PK	H	2480.000	56.47	32.30	6.06	0.00	0.00	-0.39	36.00	-36.39	5/10 MHz			

The EUT was measured in a radiated fashion. The RF output power was measured using a resolution bandwidth which encompassed the entire emission bandwidth. The data obtained was adjusted for equipment losses and converted from a field strength reading to a power reading using the provisions of FCC KDB 558074 and RSS-Gen 4.6. The human RF exposure limit is 1 mW/cm^2. The power density S generated by some value of EIRP at a given distance d is related by the equation:

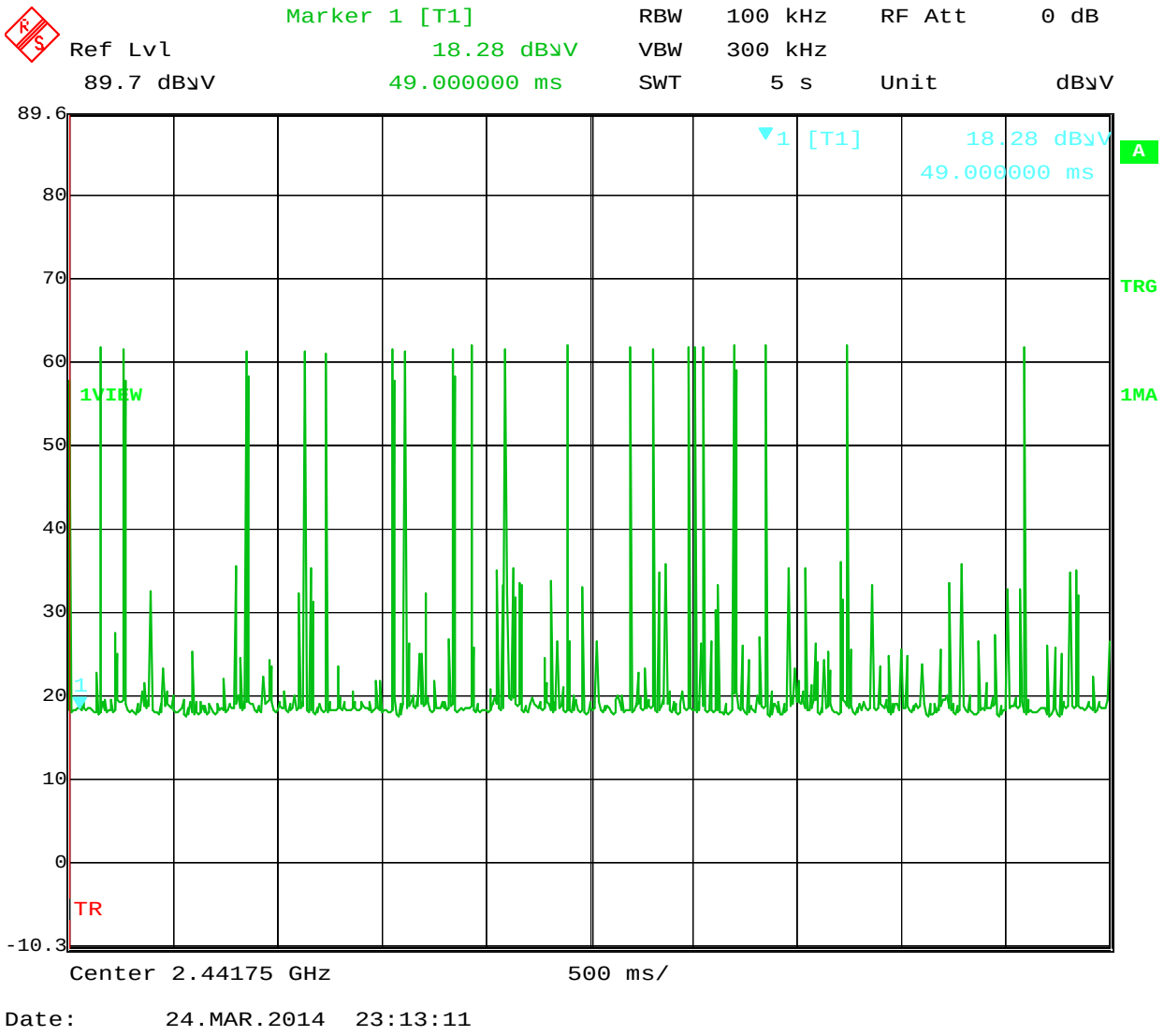
$$S=EIRP / (4\pi d^2)$$

The distance, given a maximum EIRP of 2.57 dBm (1.81 mW), at which the radiated power density of the EUT is equal to the human RF exposure limit is 0.379 cm from the antenna. This result does not take averaging into account. The EUT is exempt from FCC SAR RF Exposure evaluation because the output power is below the 60/f(GHz) average power exemption threshold of 24.2 mW.

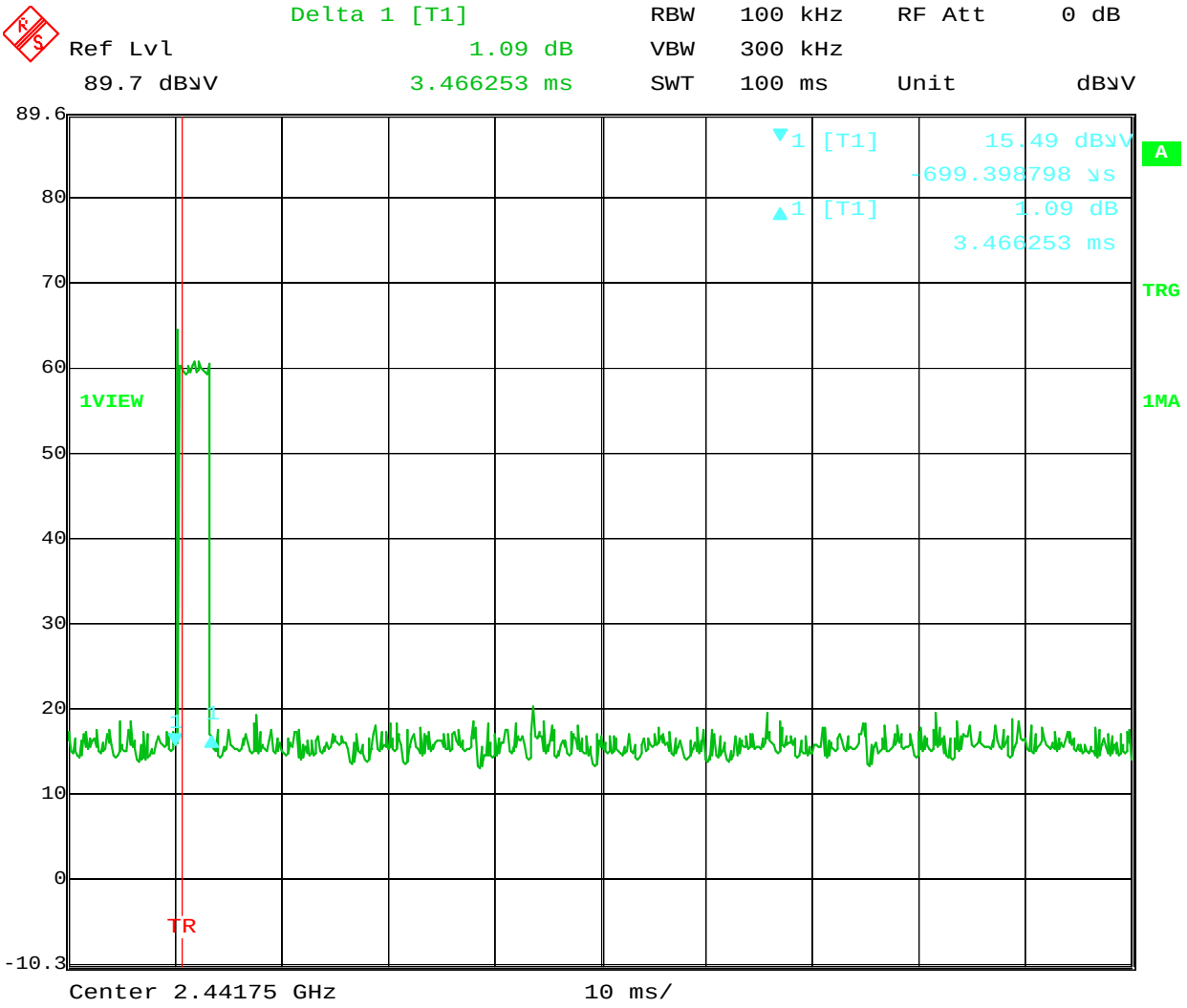
The EUT is exempt from Industry Canada SAR RF Exposure evaluation as referenced in RSS-102 because the operating frequency is between 2.2 and 3.0 GHz and the EIRP does not exceed 20 milliwatts.

Duty Cycle

The worst-case duty cycle for typical EUT operation is shown below. The pulse train repeats over a larger than 100ms period.



A pulse train with length of 3.466 ms was in a 100ms period.



The duty cycle = 3.466ms/100ms = 0.03466
Average factor = 20*LOG(0.03466) = 29.2 dB

Test Personnel:	Vathana Ven VJV	Test Date:	03/24/2014
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	15.247, CFR47 Part 2.1093, RSS-Gen, RSS-210, IC RSS-102	Limit Applied:	Below specified limits
Input Voltage:	Internal batter/120VAC/60Hz	Ambient Temperature:	21 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	59 %
		Atmospheric Pressure:	1012 mbars

Deviations, Additions, or Exclusions: None

7 Transmitter Radiated Spurious Emissions

7.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

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Sample Calculation

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
145008'	LISN: 50 Ohm/50 microHenry	Solar	9252-50-R-24-BNC	971601	06/04/2013	06/04/2014
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	10/01/2013	10/01/2014
145003'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	10/07/2013	10/07/2014
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2013	10/04/2014
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	12/19/2013	12/19/2014
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	03/12/2013	03/12/2014
REA002'	2.5GHz High Pass Filter	Reactel, Inc	7HS-2.5G/18G-S11	06-1	12/30/2013	12/30/2015

Software Utilized:

Name	Manufacturer	Version
C5	Teseq	Build 5.26.00.3
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

7.3 Results:

The sample tested was found to Comply.

In any 100 kHz bandwidth outside the frequency band , the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

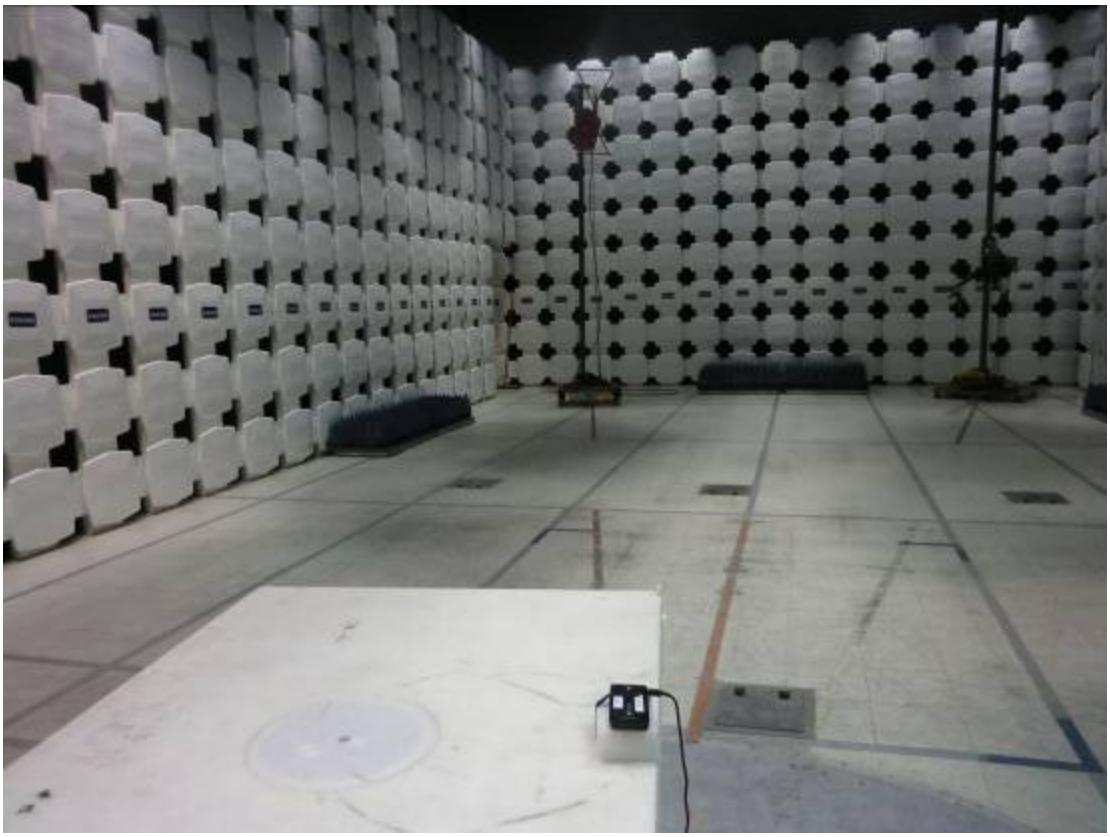
FCC Part 15.209(a) & RSS-210 A8.5 – Restricted Band Radiated Spurious/Harmonics Limits

Frequency	Field Strength		Test Distance
(MHz)	µV/m	dBµV/m	(meters)
30–88	100	40.00	3
88–216	150	43.52	3
216–960	200	46.02	3
Above 960	500	53.98	3

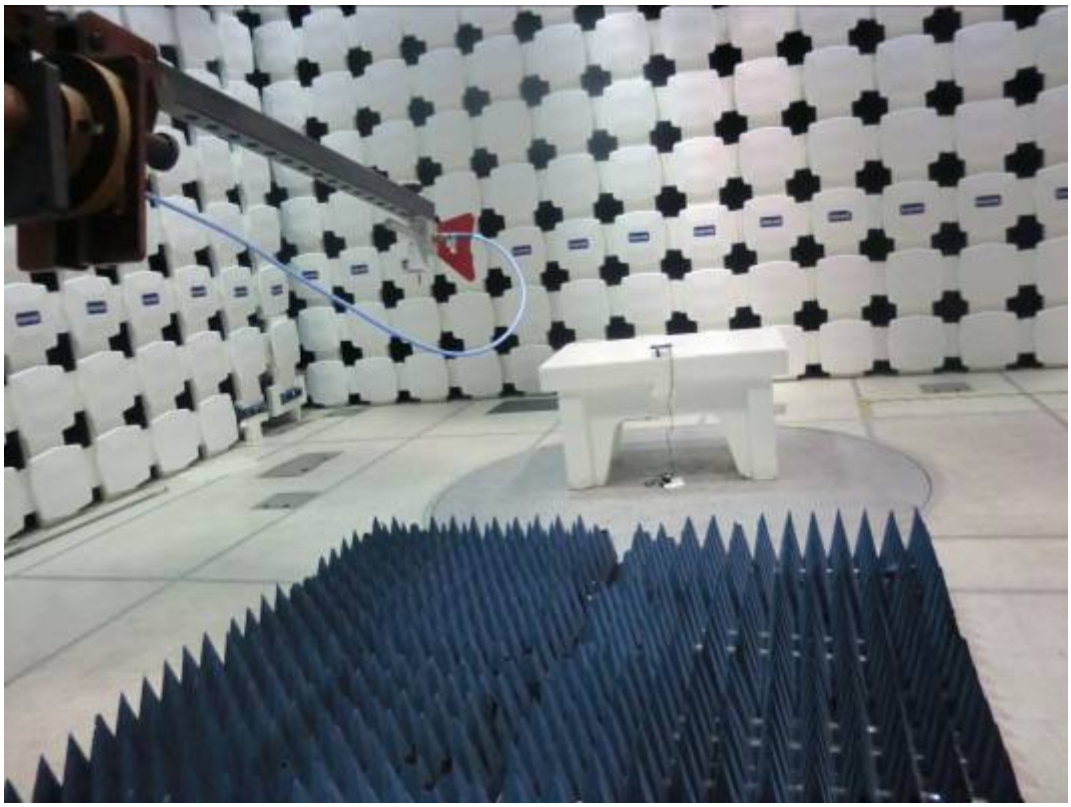
FCC Part 15.247(d) & RSS-210 A8.5 – Non Restricted Band Radiated Spurious/Harmonics Limits

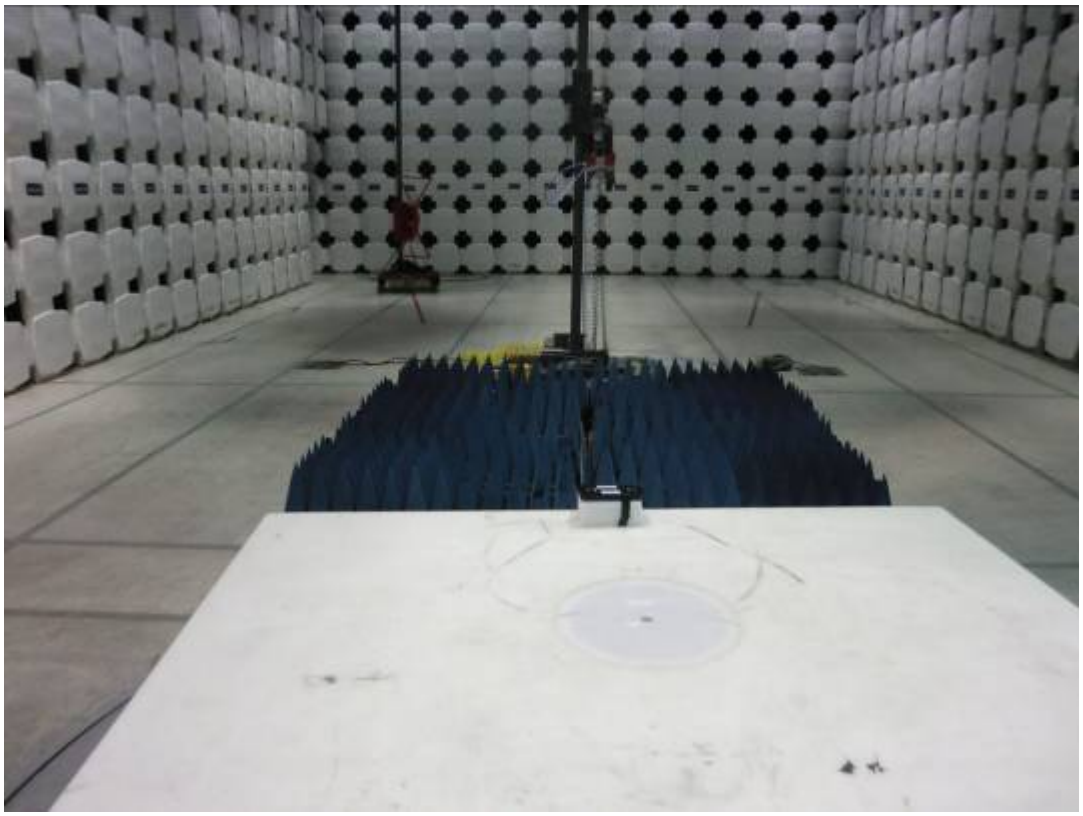
Channels	Fundamental Field Strength (dBuV/m)	Spurious/Harmonics Limits (dBuV/m)	Test Distance (meters)
0	93.82	73.82	3
38	95.33	75.33	3
79	97.32	77.32	3

7.4 Setup Photographs:

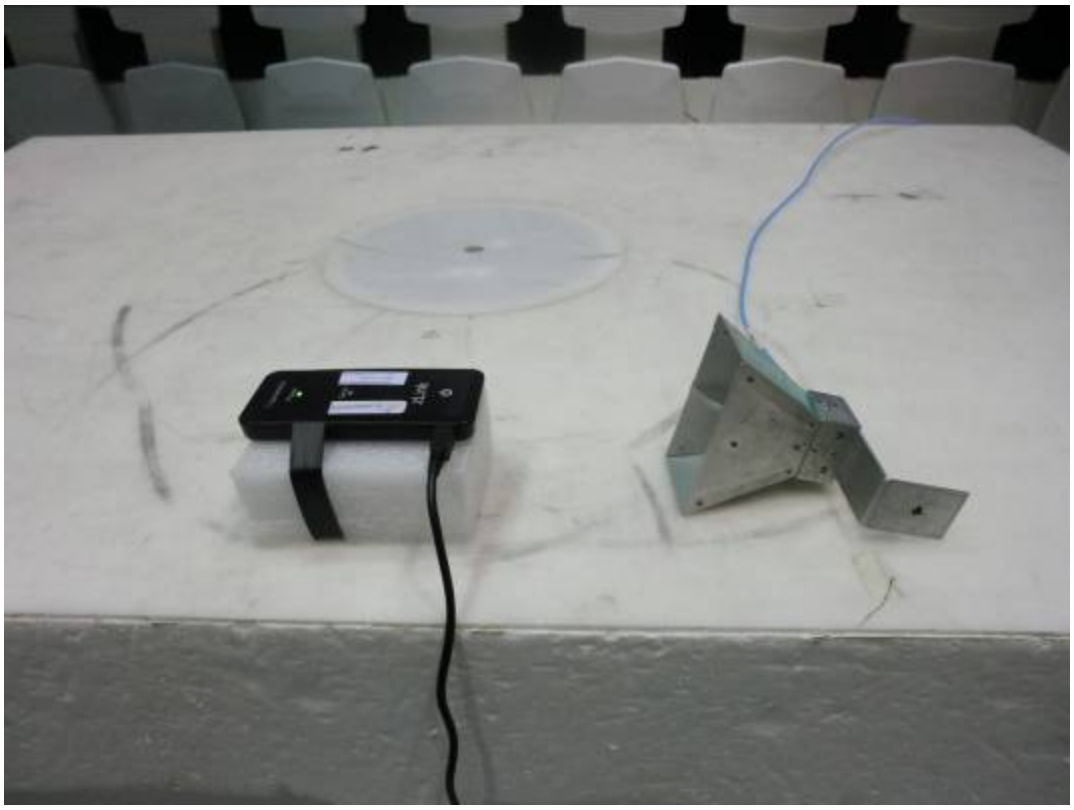


30 – 1000 MHz scan





1-18 GHz scan



18 – 25 GHz Hand scan

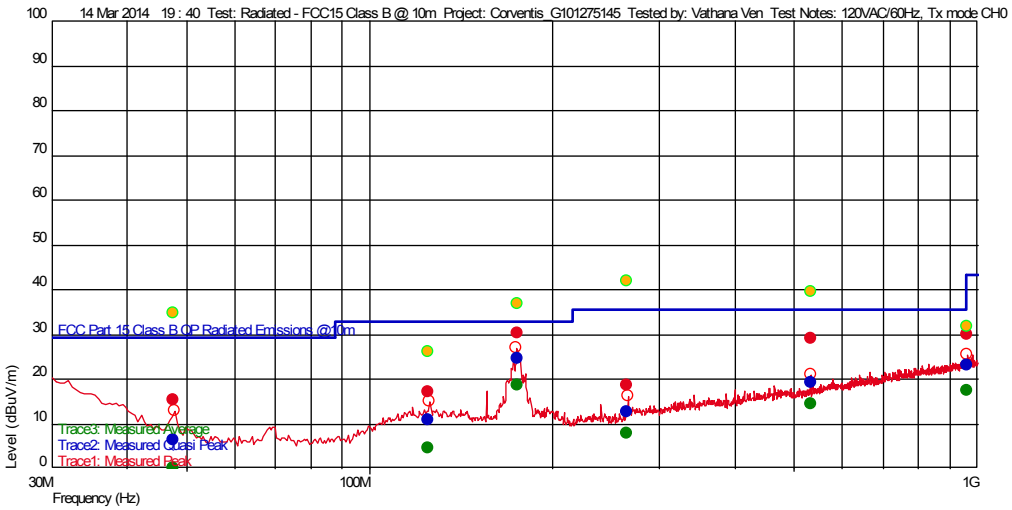
7.5 Plots/Data:

Model: zLink, Tx: CH0, FCC Part 15:209, 30-1000 MHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Corventis_G101275145	
Test Notes:	120VAC/60Hz, Tx mode CH0	
Temperature:	20 deg C	
Humidity:	23%, 1006 mB	
Tested by:	Vathana Ven	
Test Started:	14 Mar 2014 19 : 40	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

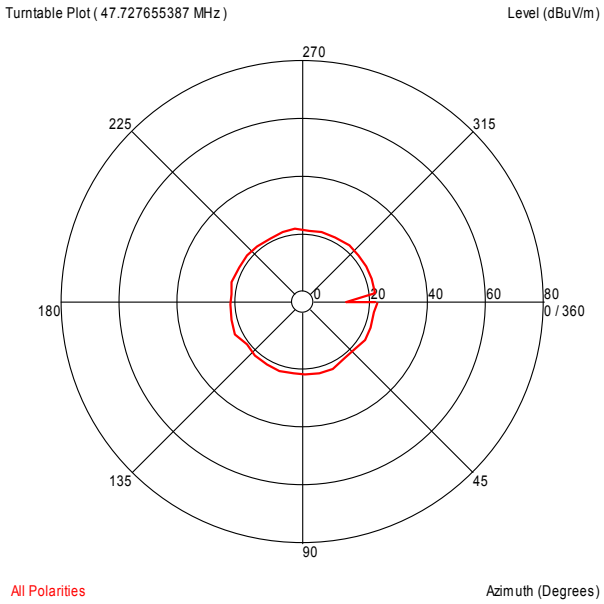
Trace1: Measured Peak

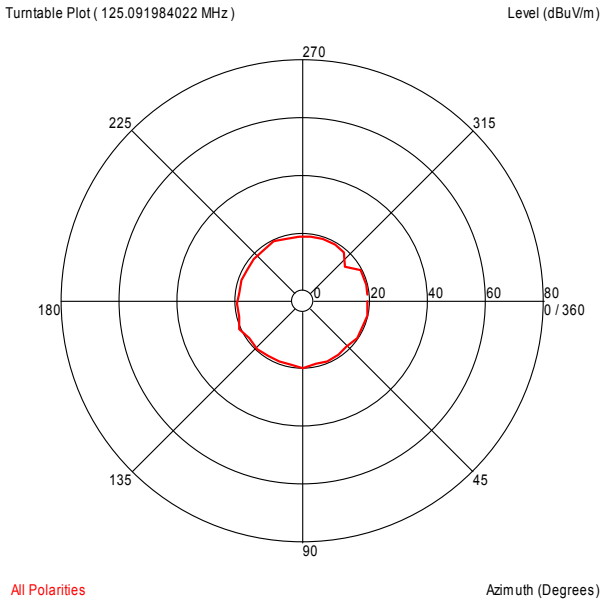
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
265.953908086 M	18.58	12.776	-23.689	--	--	|	0	1.05	120 k	
125.091984022 M	17.31	14.318	-25.365	--	--	--	166	1.15	120 k	
47.727655387 M	15.40	9.009	-25.936	--	--	|	143	2.87	120 k	
964.119037924 M	30.00	22.700	-22.435	--	--	--	0	3.04	120 k	
531.980160285 M	29.06	18.100	-24.581	--	--	--	19	2.19	120 k	
175.36713399 M	30.28	11.563	-24.560	--	--	|	341	1.04	120 k	

Trace2: Measured Quasi Peak

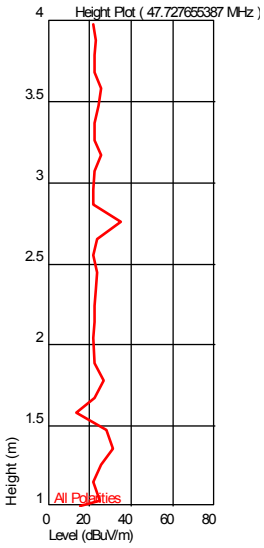
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
47.727655387 M	6.40	9.009	-25.936	29.540	-23.14	|	143	2.87	120 k	
265.953908086 M	12.70	12.776	-23.689	35.540	-22.84	|	0	1.05	120 k	
125.091984022 M	10.89	14.318	-25.365	33.040	-22.15	--	166	1.15	120 k	
964.119037924 M	23.08	22.700	-22.435	43.540	-20.46	--	0	3.04	120 k	
531.980160285 M	19.32	18.100	-24.581	35.540	-16.22	--	19	2.19	120 k	
175.36713399 M	24.73	11.563	-24.560	33.040	-8.31	|	341	1.04	120 k	

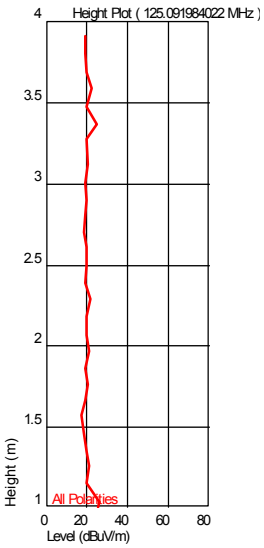
Azimuth Plots

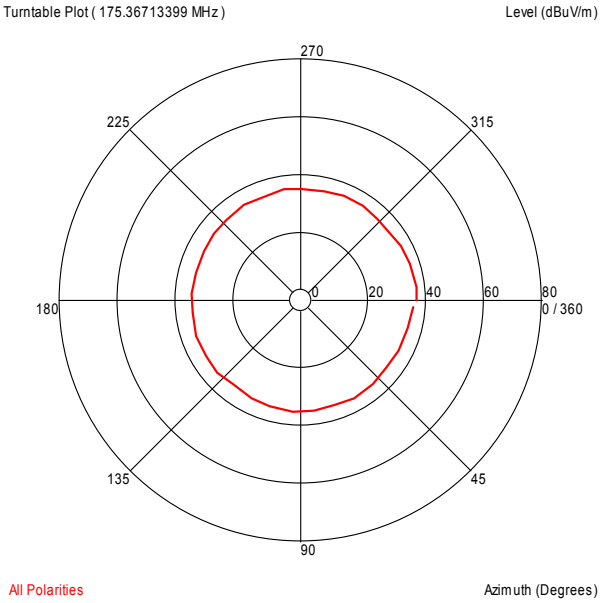


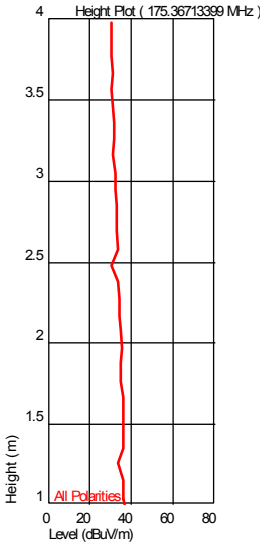


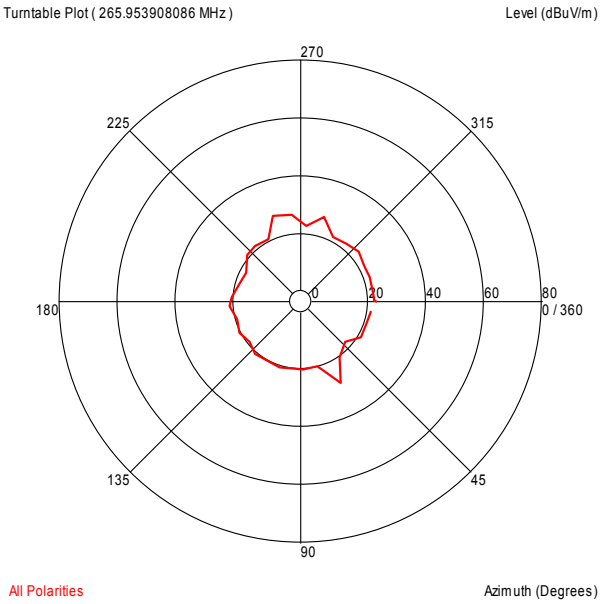
Turntable Plots

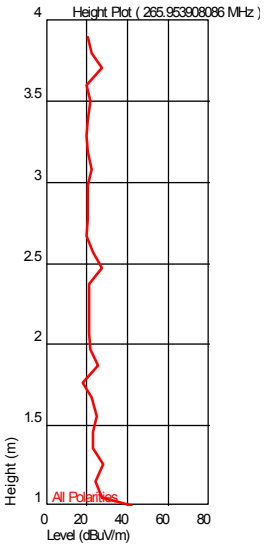


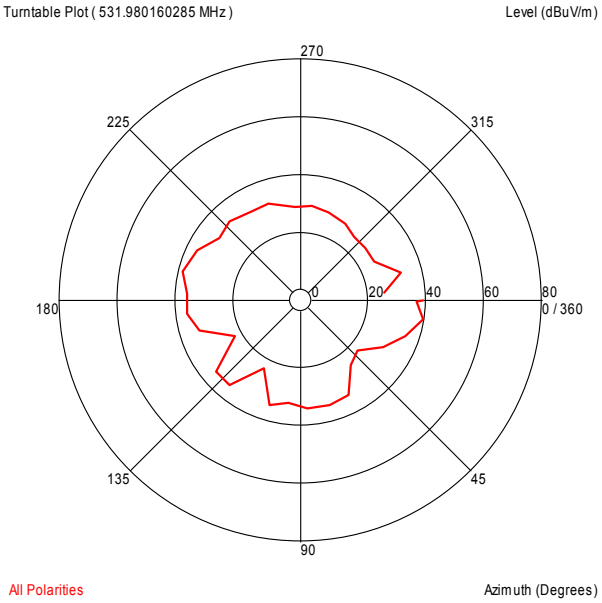


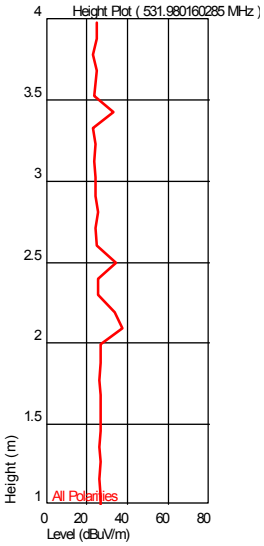

Turntable Plot (175.36713399 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

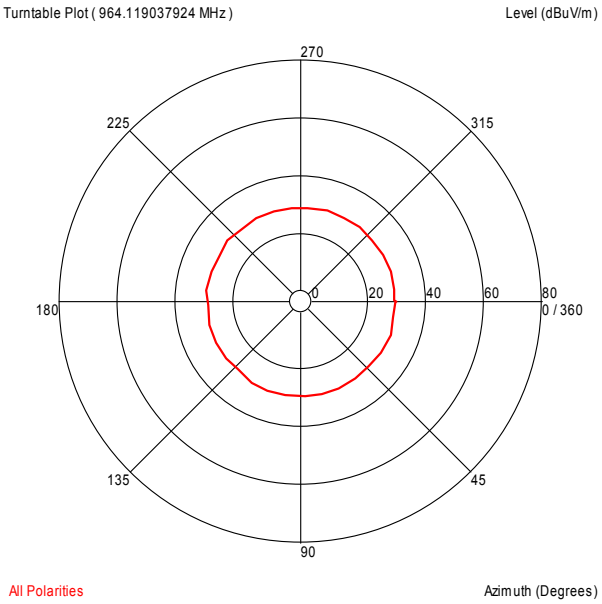

Height Plot (175.36713399 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

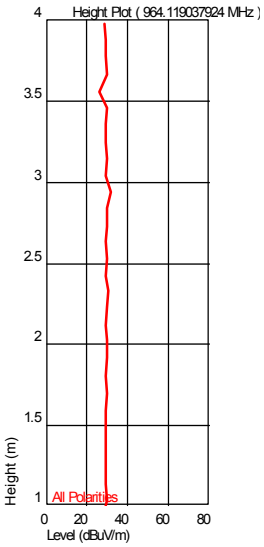

Turntable Plot (265.953908086 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (265.953908086 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (531.980160285 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (531.980160285 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (964.119037924 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

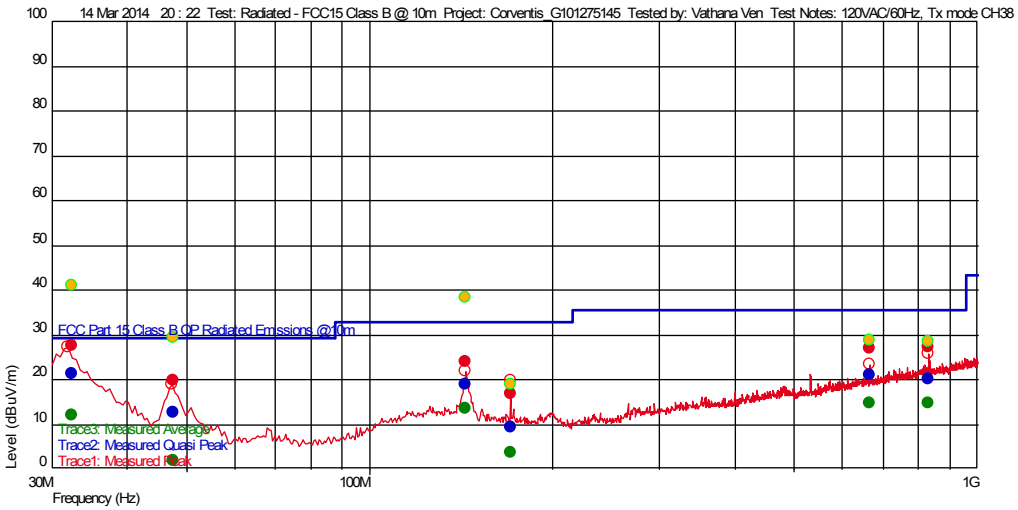

Height Plot (964.119037924 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

Model: zLink, Tx: CH38, FCC Part 15:209, 30-1000 MHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Corventis_G101275145	
Test Notes:	120VAC/60Hz, Tx mode CH38	
Temperature:	20 deg C	
Humidity:	23%, 1006 mB	
Tested by:	Vathana Ven	
Test Started:	14 Mar 2014 20 : 22	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

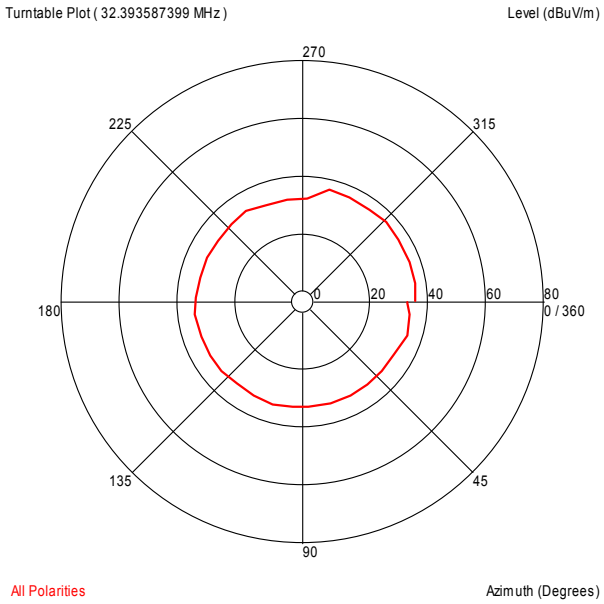
Trace1: Measured Peak

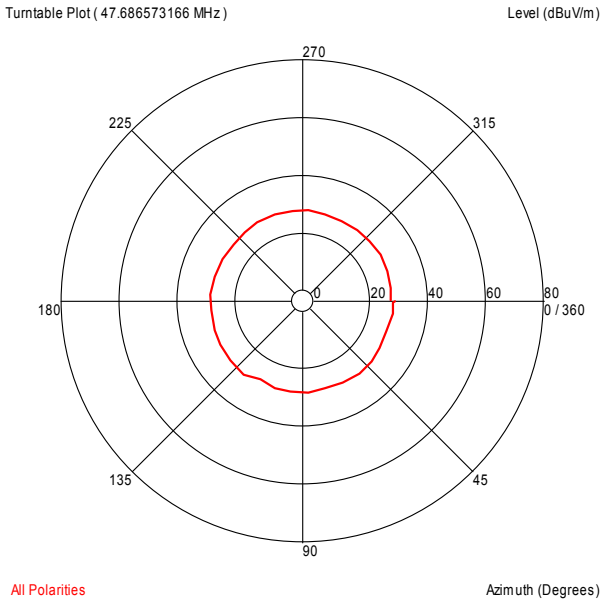
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
171.387976224 M	16.77	11.800	-24.668	--	--	|	288	1.46	120 k	
47.686573166 M	19.93	9.025	-25.937	--	--	|	141	1.05	120 k	
144.051903994 M	23.95	13.200	-25.277	--	--	|	176	2.69	120 k	
664.951302944 M	27.03	19.700	-23.917	--	--	--	40	1.46	120 k	
831.233667808 M	27.34	21.625	-23.280	--	--	|	264	3.94	120 k	
32.393587399 M	27.53	19.664	-26.228	--	--	|	327	1.04	120 k	

Trace2: Measured Quasi Peak

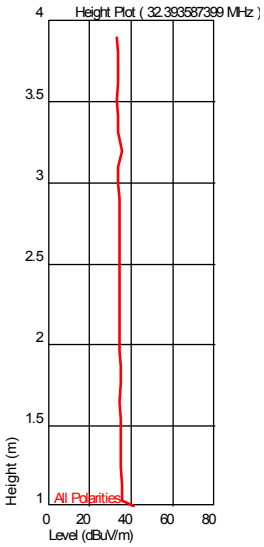
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
171.387976224 M	9.52	11.800	-24.668	33.040	-23.52	|	288	1.46	120 k	
47.686573166 M	12.77	9.025	-25.937	29.540	-16.77	|	141	1.05	120 k	
831.233667808 M	20.28	21.625	-23.280	35.540	-15.26	|	264	3.94	120 k	
664.951302944 M	21.05	19.700	-23.917	35.540	-14.49	--	40	1.46	120 k	
144.051903994 M	18.84	13.200	-25.277	33.040	-14.20	|	176	2.69	120 k	
32.393587399 M	21.45	19.664	-26.228	29.540	-8.09	|	327	1.04	120 k	

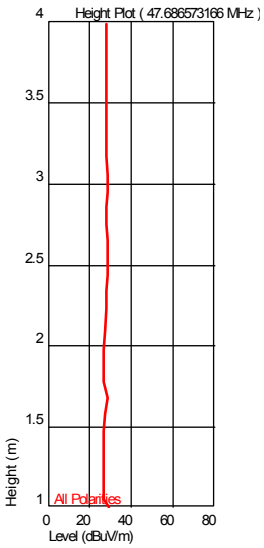
Azimuth Plots

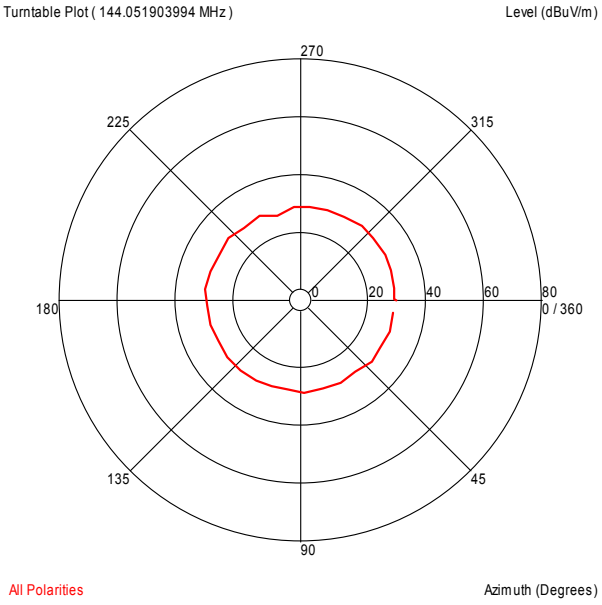


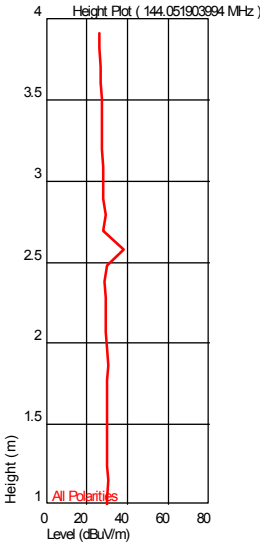


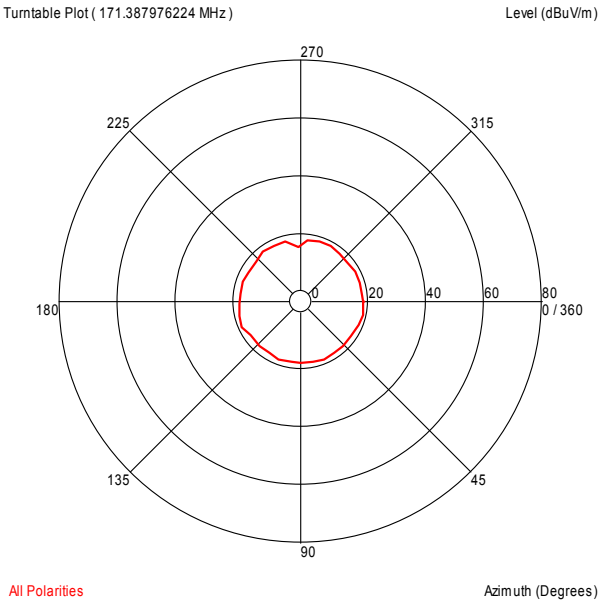
Turntable Plots

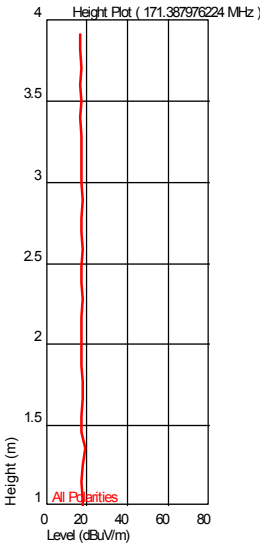


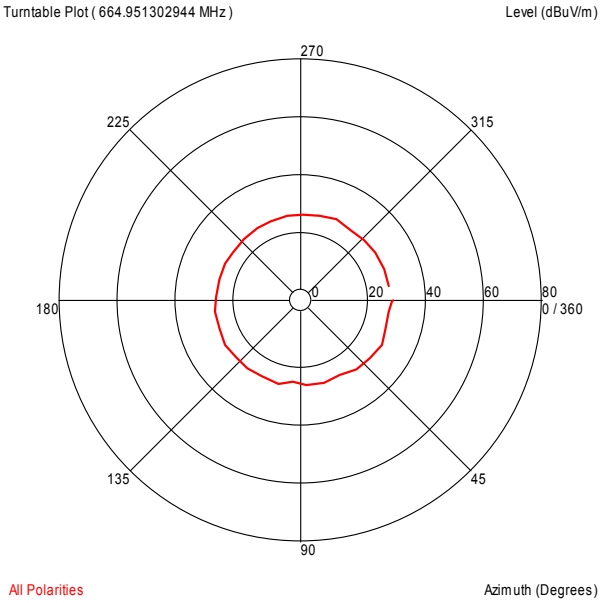


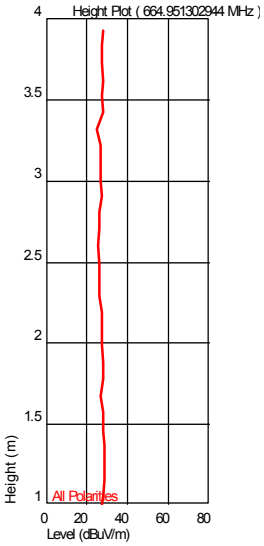

Turntable Plot (144.051903994 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

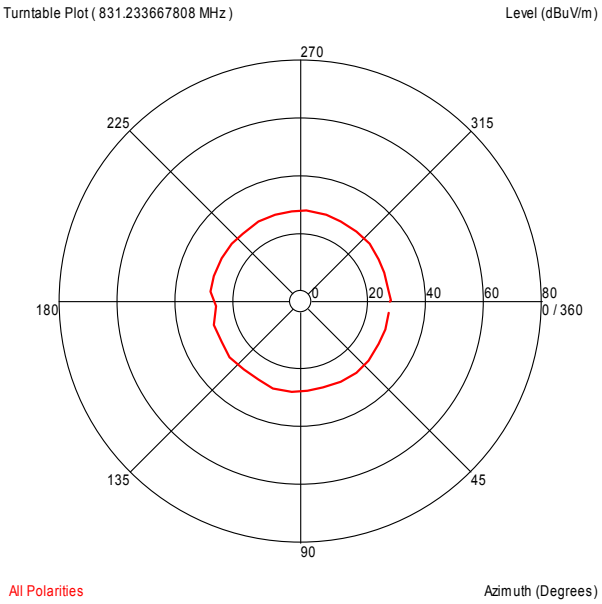

Height Plot (144.051903994 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

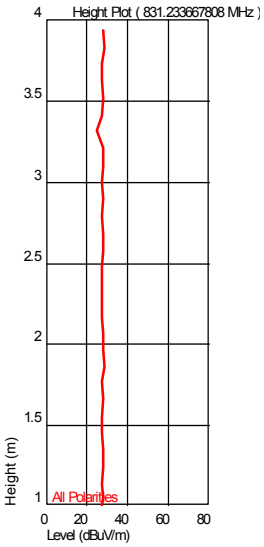

Turntable Plot (171.387976224 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (171.387976224 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (664.951302944 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (664.951302944 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (831.233667808 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

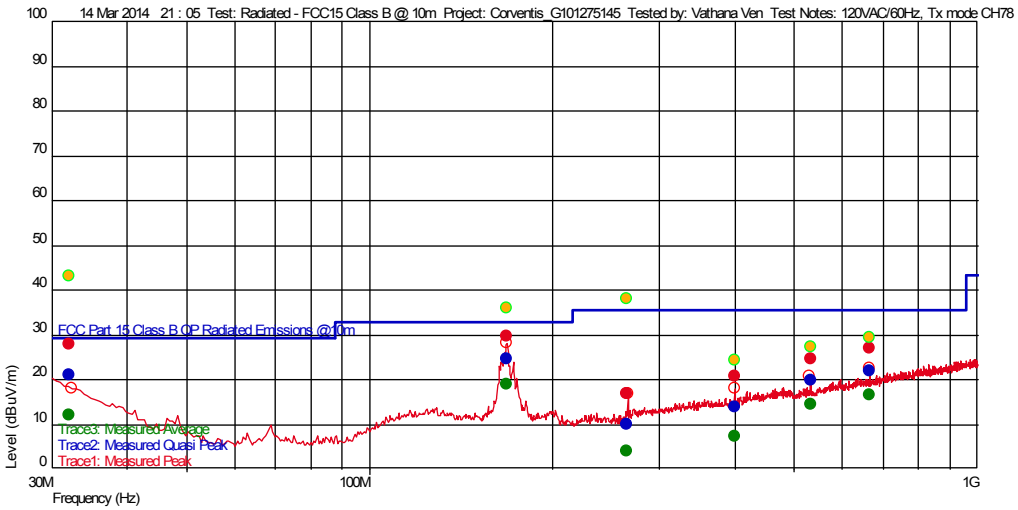

Height Plot (831.233667808 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

Model: zLink, Tx: CH78, FCC Part 15:209, 30-1000 MHz

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Corventis_G101275145	
Test Notes:	120VAC/60Hz, Tx mode CH78	
Temperature:	20 deg C	
Humidity:	23%, 1006 mB	
Tested by:	Vathana Ven	
Test Started:	14 Mar 2014 21 : 05	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

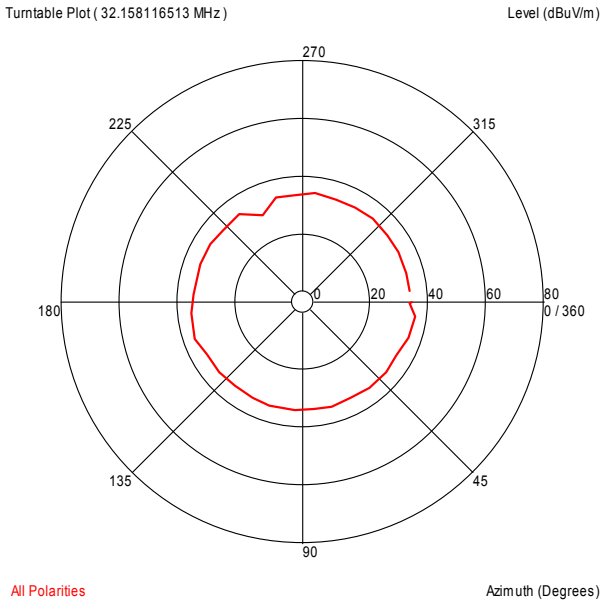
Trace1: Measured Peak

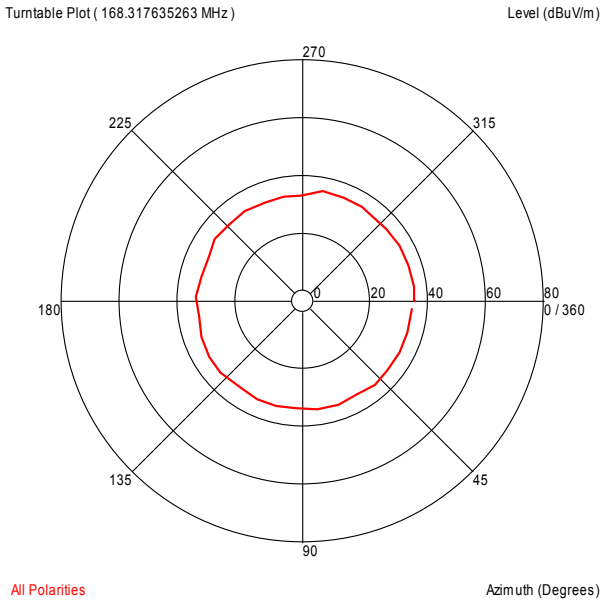
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
265.812825922 M	16.80	12.765	-23.689	--	--	|	287	1.05	120 k	
398.921642876 M	20.65	15.635	-24.030	--	--	|	334	1.17	120 k	
531.959118144 M	24.52	18.100	-24.581	--	--	--	359	1.67	120 k	
664.980962263 M	27.11	19.700	-23.917	--	--	--	360	1.46	120 k	
168.317635263 M	29.64	11.968	-24.752	--	--	|	341	1.14	120 k	
32.158116513 M	28.03	19.805	-26.231	--	--	|	174	3.56	120 k	

Trace2: Measured Quasi Peak

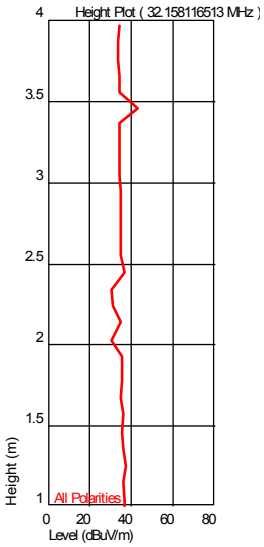
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
265.812825922 M	9.90	12.765	-23.689	35.540	-25.64	|	287	1.05	120 k	
398.921642876 M	13.88	15.635	-24.030	35.540	-21.66	|	334	1.17	120 k	
531.959118144 M	19.75	18.100	-24.581	35.540	-15.79	--	359	1.67	120 k	
664.980962263 M	21.87	19.700	-23.917	35.540	-13.67	--	360	1.46	120 k	
32.158116513 M	21.05	19.805	-26.231	29.540	-8.49	|	174	3.56	120 k	
168.317635263 M	24.56	11.968	-24.752	33.040	-8.48	|	341	1.14	120 k	

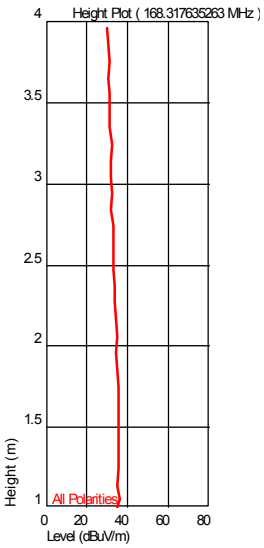
Azimuth Plots

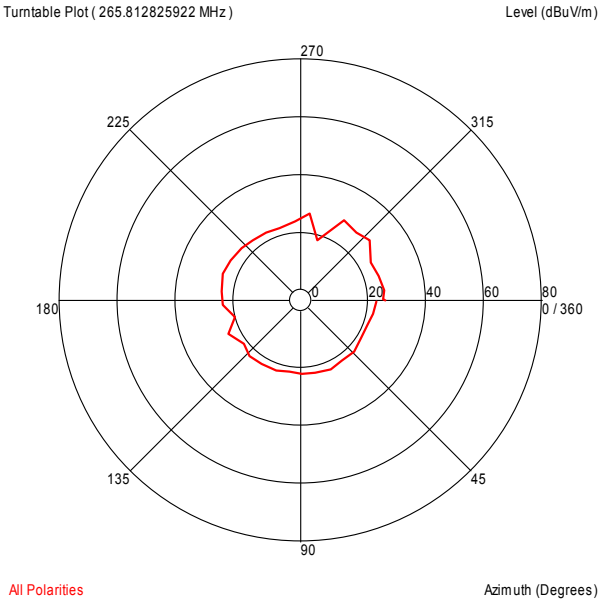


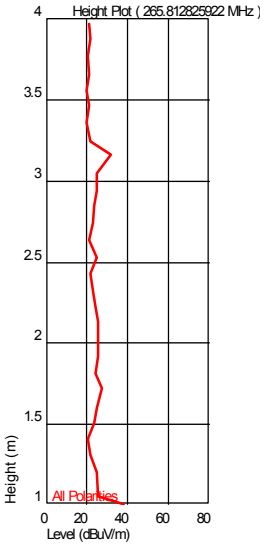


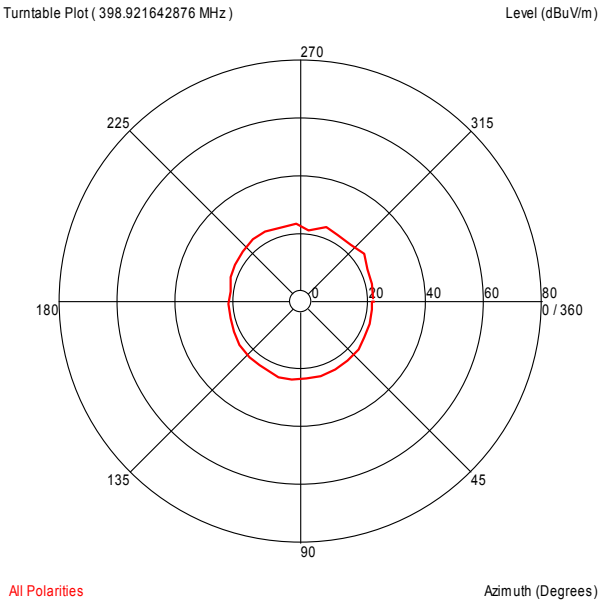
Turntable Plots

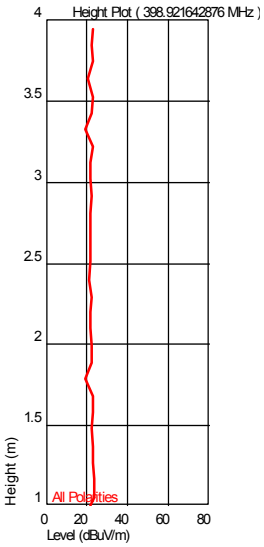


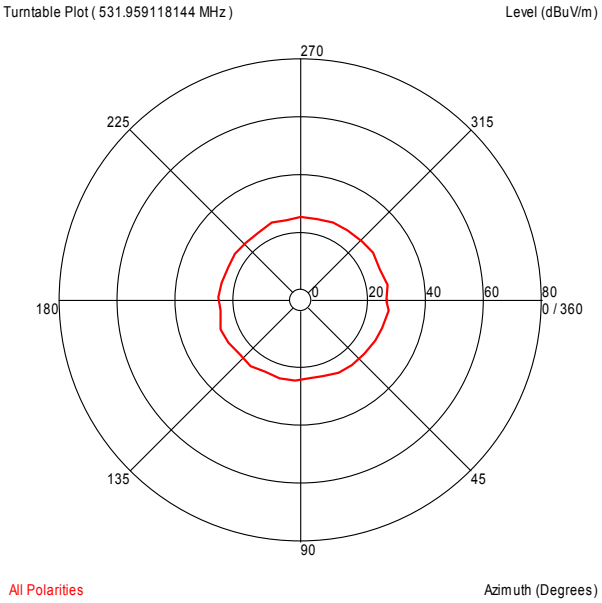


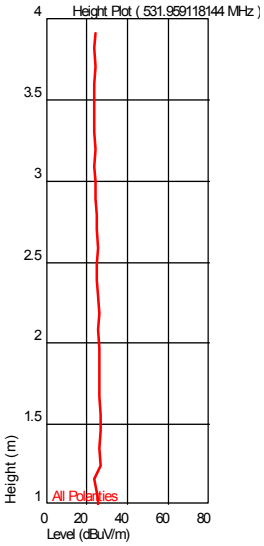

Turntable Plot (265.812825922 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

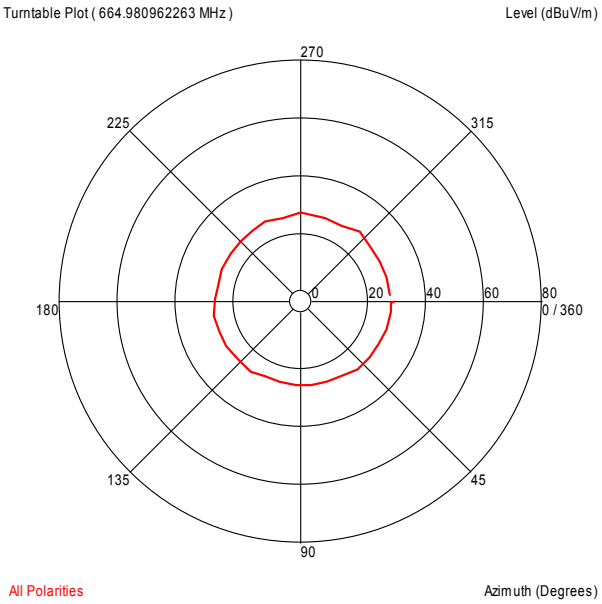

Height Plot (265.812825922 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

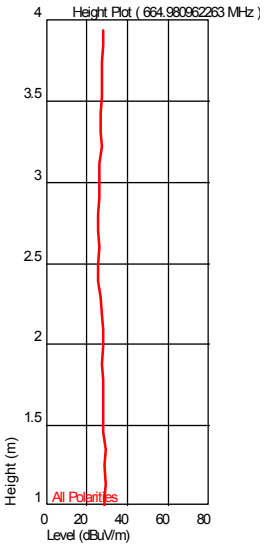

Turntable Plot (398.921642876 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (398.921642876 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (531.959118144 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (531.959118144 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (664.980962263 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (664.980962263 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

Radiated Emissions

Company: Corventis
Model #: zLink
Serial #: 015821
Engineers: Vathana Ven
Project #: G101275145
Standard: FCC Part 15 Subpart C 15.247
Receiver: R&S ESI (145-108) 05-10-2014
PreAmp: PRE145014 12-13-2014.txt
PreAmp Used? (Y or N): Y
Date(s): 03/12/14
Location: 10m Chamber
Limit Distance (m): 3
Test Distance (m): 3
Voltage/Frequency: 3.7VDC/120VAC
Antenna & Cables: SHF
Antenna: ETS001 01-06-15.txt
Cable(s): 145-416 3mTrkB 10-03-2014.txt
Barometer: DAV004
Temp/Humidity/Pressure: 24c 42% 1007mB
Bands: N, LF, HF, SHF
ETS001 01-06-15.txt EMC04
Filter: REA002
Frequency Range: 1-25GHz

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	Harmonic?
Note: Spurious Emissions Reference. Fundamental frequencies (modulated) at 3 meters with no pre-amp														
X - Axis														No Pre-Amp
PK	V	2402.000	53.40	32.11	5.91	0.00	0.00	91.42	-	-	100/300 kHz			No Pre-Amp
PK	H	2402.000	52.10	32.11	5.91	0.00	0.00	90.12	-	-	100/300 kHz			No Pre-Amp
PK	V	2440.000	50.09	32.20	5.98	0.00	0.00	88.27	-	-	100/300 kHz			
PK	H	2440.000	56.11	32.20	5.98	0.00	0.00	94.29	-	-	100/300 kHz			
PK	V	2480.000	52.63	32.30	6.06	0.00	0.00	90.99	-	-	100/300 kHz			
PK	H	2480.000	58.96	32.30	6.06	0.00	0.00	97.32	-	-	100/300 kHz			
Y - Axis														No Pre-Amp
PK	V	2402.000	55.80	32.11	5.91	0.00	0.00	93.82	-	-	100/300 kHz			No Pre-Amp
PK	H	2402.000	52.91	32.11	5.91	0.00	0.00	90.93	-	-	100/300 kHz			
PK	V	2440.000	55.49	32.20	5.98	0.00	0.00	93.67	-	-	100/300 kHz			
PK	H	2440.000	54.77	32.20	5.98	0.00	0.00	92.95	-	-	100/300 kHz			
PK	V	2480.000	55.78	32.30	6.06	0.00	0.00	94.14	-	-	100/300 kHz			
PK	H	2480.000	56.37	32.30	6.06	0.00	0.00	94.73	-	-	100/300 kHz			
Z - Axis														
PK	V	2402.000	52.94	32.11	5.91	0.00	0.00	90.96	-	-	100/300 kHz			
PK	H	2402.000	54.86	32.11	5.91	0.00	0.00	92.88	-	-	100/300 kHz			
PK	V	2440.000	53.31	32.20	5.98	0.00	0.00	91.49	-	-	100/300 kHz			
PK	H	2440.000	57.15	32.20	5.98	0.00	0.00	95.33	-	-	100/300 kHz			
PK	V	2480.000	56.17	32.30	6.06	0.00	0.00	94.53	-	-	100/300 kHz			
PK	H	2480.000	55.99	32.30	6.06	0.00	0.00	94.35	-	-	100/300 kHz			
Tx CH 0, F = 2402 MHz, Spurious emissions														
PK	H	4804.000	43.62	34.19	8.64	34.68	0.00	51.78	74.00	-22.22	1/3 MHz	RB		
AVG	H	4804.000	14.42	34.19	8.64	34.68	0.00	22.58	54.00	-31.42	1/3 MHz	RB		
PK	H	5545.090	34.88	34.59	9.56	34.31	0.00	44.72	71.42	-26.70	100/300 kHz			
PK	V	7206.000	34.04	35.76	11.02	34.60	0.00	46.22	71.42	-25.20	100/300 kHz			
PK	V	9608.000	32.95	36.83	12.75	35.22	0.00	47.31	71.42	-24.11	100/300 kHz			
PK	V	12010.000	44.80	38.81	14.94	36.23	0.00	62.32	74.00	-11.68	1/3 MHz	RB		
AVG	V	12010.000	15.60	38.81	14.94	36.23	0.00	33.12	54.00	-20.88	1/3 MHz	RB		
PK	V	14412.000	34.72	39.47	15.16	34.45	0.00	54.90	71.42	-16.52	100/300 kHz			
PK	V	16814.000	31.94	42.00	17.66	34.64	0.00	56.97	71.42	-14.45	100/300 kHz			
Tx CH 39, F = 2440 MHz, Spurious emissions														
PK	H	4880.000	41.56	34.25	8.75	34.67	0.00	49.89	74.00	-24.11	1/3 MHz	RB		
AVG	H	4880.000	12.36	34.25	8.75	34.67	0.00	20.69	54.00	-33.31	1/3 MHz	RB		
PK	H	5545.090	34.88	34.59	9.56	34.31	0.00	44.72	74.29	-29.57	100/300 kHz			
PK	V	7320.000	45.29	35.75	11.10	34.54	0.00	57.60	74.00	-16.40	1/3 MHz	RB		
AVG	V	7320.000	16.09	35.75	11.10	34.54	0.00	28.40	54.00	-25.60	1/3 MHz	RB		
PK	V	9760.000	33.66	36.96	13.11	35.64	0.00	48.10	74.29	-26.19	100/300 kHz			
PK	V	12200.000	41.30	39.03	14.80	36.43	0.00	58.70	74.00	-15.30	1/3 MHz	RB		
AVG	V	12200.000	12.10	39.03	14.80	36.43	0.00	29.50	54.00	-24.50	1/3 MHz	RB		
PK	V	14640.000	33.75	39.62	15.25	34.60	0.00	54.01	74.29	-20.28	100/300 kHz			
PK	V	17080.000	31.39	42.09	19.00	34.40	0.00	58.07	74.29	-16.22	100/300 kHz			
Tx CH 78, F = 2480 MHz, Spurious emissions														
PK	V	4960.000	42.18	34.28	8.86	34.66	0.00	50.66	74.00	-23.34	1/3 MHz	RB		
AVG	V	4960.000	12.98	34.28	8.86	34.66	0.00	21.46	54.00	-32.54	1/3 MHz	RB		
PK	V	5545.090	35.30	34.59	9.56	34.31	0.00	45.14	77.32	-32.18	100/300 kHz			
PK	V	7440.000	44.12	35.78	11.19	34.47	0.00	56.61	74.00	-17.39	1/3 MHz	RB		
AVG	V	7440.000	14.92	35.78	11.19	34.47	0.00	27.41	54.00	-26.59	1/3 MHz	RB		
PK	V	9920.000	31.84	37.11	13.49	36.07	0.00	46.37	77.32	-30.95	100/300 kHz			
PK	V	12400.000	43.95	39.22	14.65	36.64	0.00	61.19	74.00	-12.81	1/3 MHz	RB		
AVG	V	12400.000	14.75	39.22	14.65	36.64	0.00	31.99	54.00	-22.01	1/3 MHz	RB		
PK	V	14880.000	33.60	39.81	15.67	34.76	0.00	54.32	77.32	-23.00	100/300 kHz			
PK	V	17360.000	32.70	42.07	20.94	34.13	0.00	61.58	77.32	-15.74	100/300 kHz			

Average factor = 20*LOG((0.03466)/100) = 29.2 dB, 29.2 dB was applied to the peak readings to obtain average readings.

Hand scans were performed from 18-25GHz at a distance of <1m, no emissions were detected above the measuring equipment noise floor.

Test Personnel:	Vathana Ven VJV	Test Date:	03/12/2014, 03/14/2014
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	15.247, RSS-Gen, RSS-210	Limit Applied:	Below specified limits
Input Voltage:	Internal Battery Powered/120VAC/60Hz	Ambient Temperature:	24, 20 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	42, 23 %
		Atmospheric Pressure:	1007, 1006 mbars

Deviations, Additions, or Exclusions: None

8 Hopping Channel Separation

8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

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

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
MAN1'	Digital 4 Line Barometer	Mannix	0ABA116	MAN1	08/13/2012	08/13/2014
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	04/25/2014
CBLHF2012-2M-2'	2m 40GHz Coaxial Cable	Huber & Suhner	SF102	252675002	01/14/2014	01/14/2015
HORN3	HORN ANTENNA	EMCO	3115	9610-4980	04/25/2013	04/25/2014

Software Utilized:

Name	Manufacturer	Version
None		

8.3 Results:

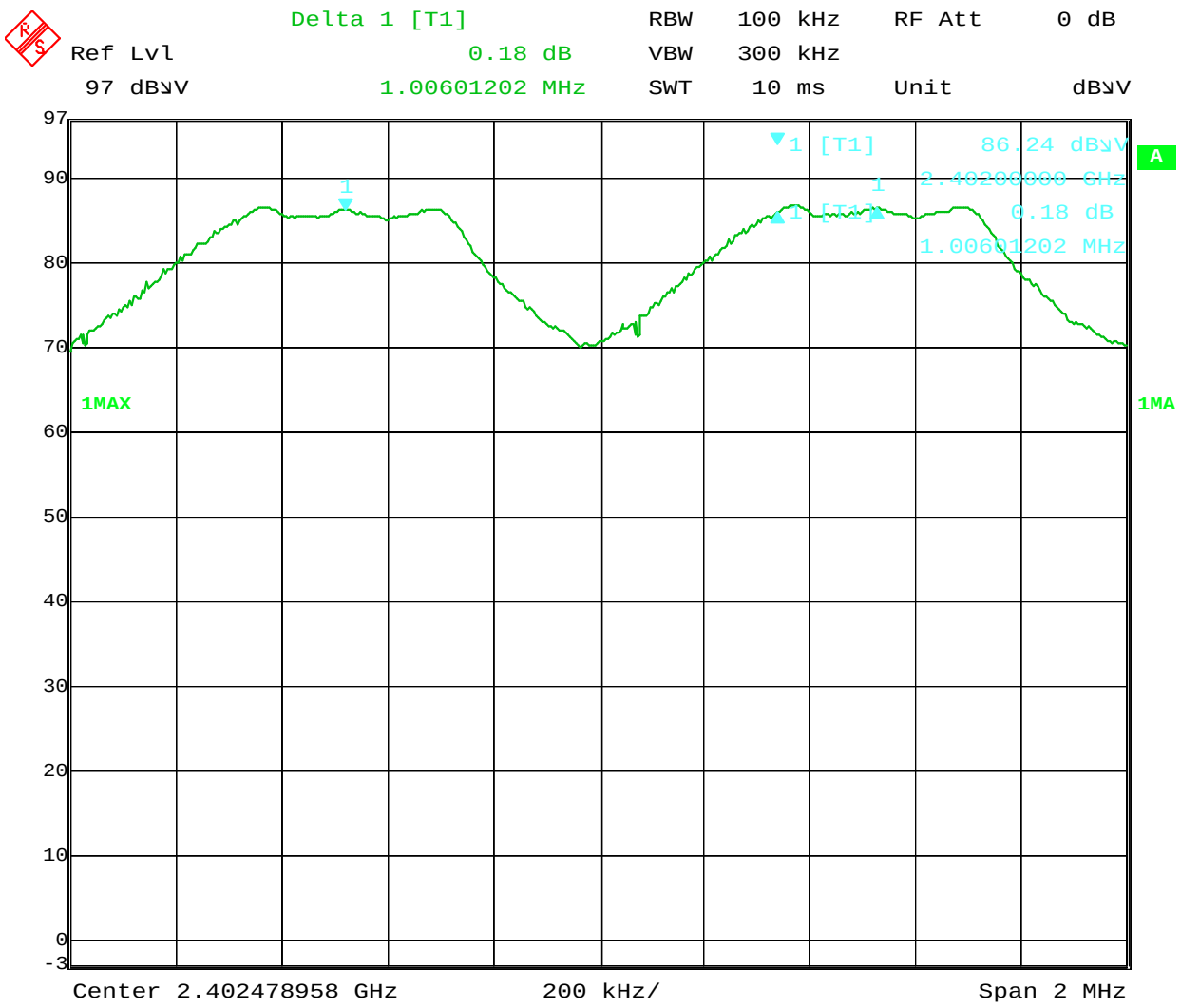
The sample tested was found to comply, since the output power is below 125 mW and therefore, the channel separation must be at least 2/3 of the 20 dB bandwidth.

FCC Part 15.247 (1) & RSS-210 A8.1 (b)
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

8.4 Setup Photograph:

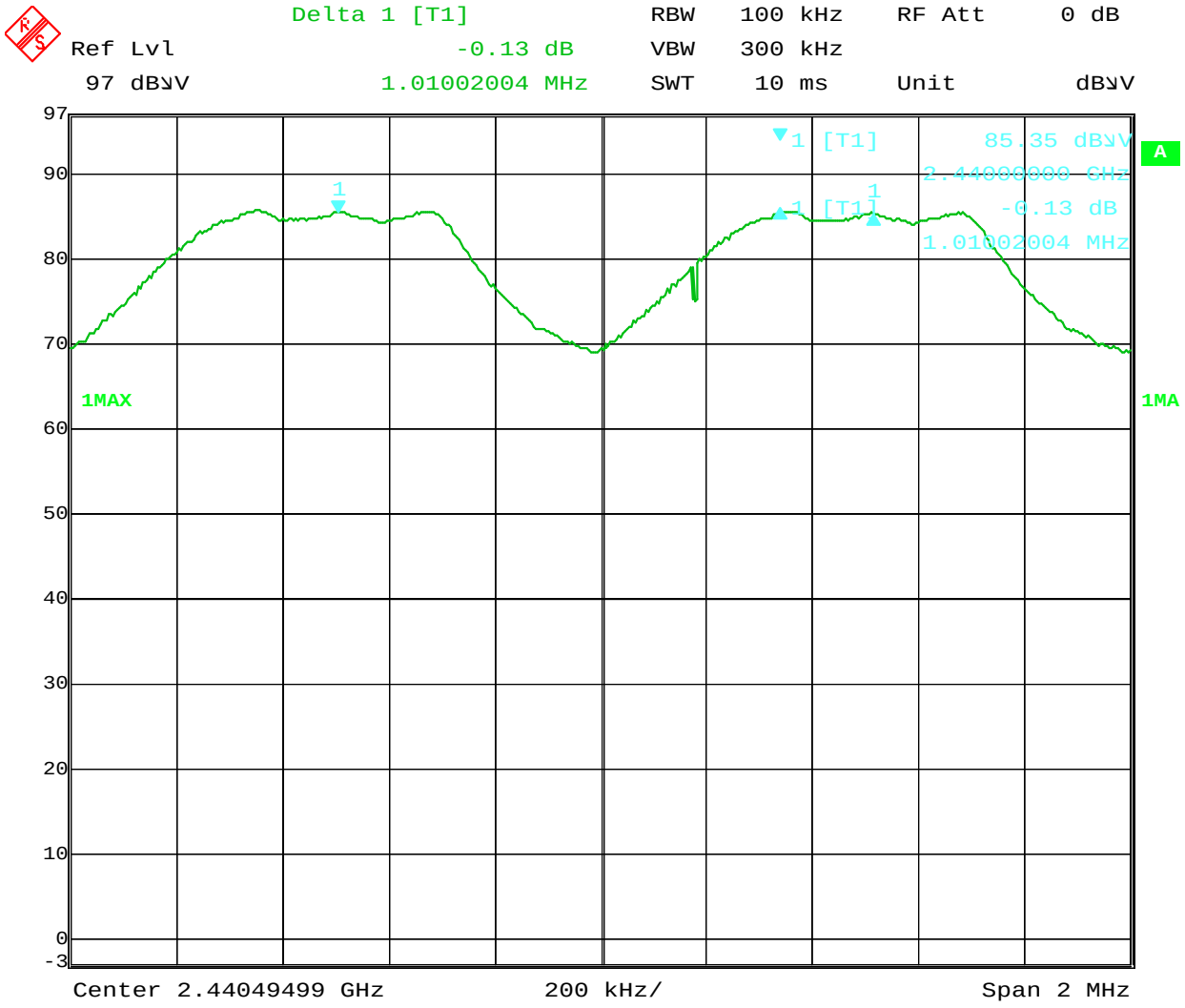
8.5 Plots/Data:

DH1 mode, Channel 0, channel separation is 1.006 MHz



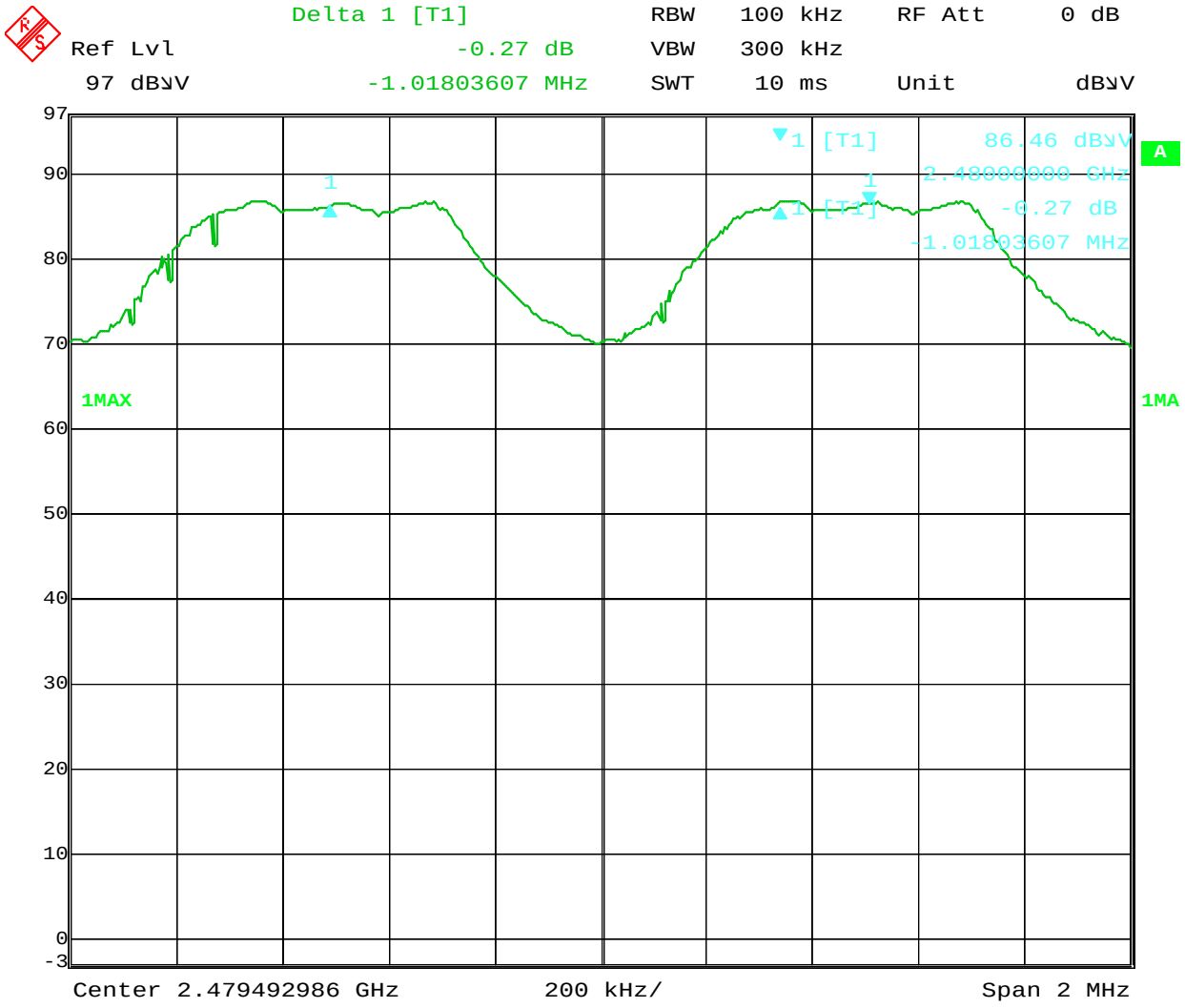
Date: 25.MAR.2014 00:43:49

DH1 mode, Channel 38, channel separation is 1.010MHz

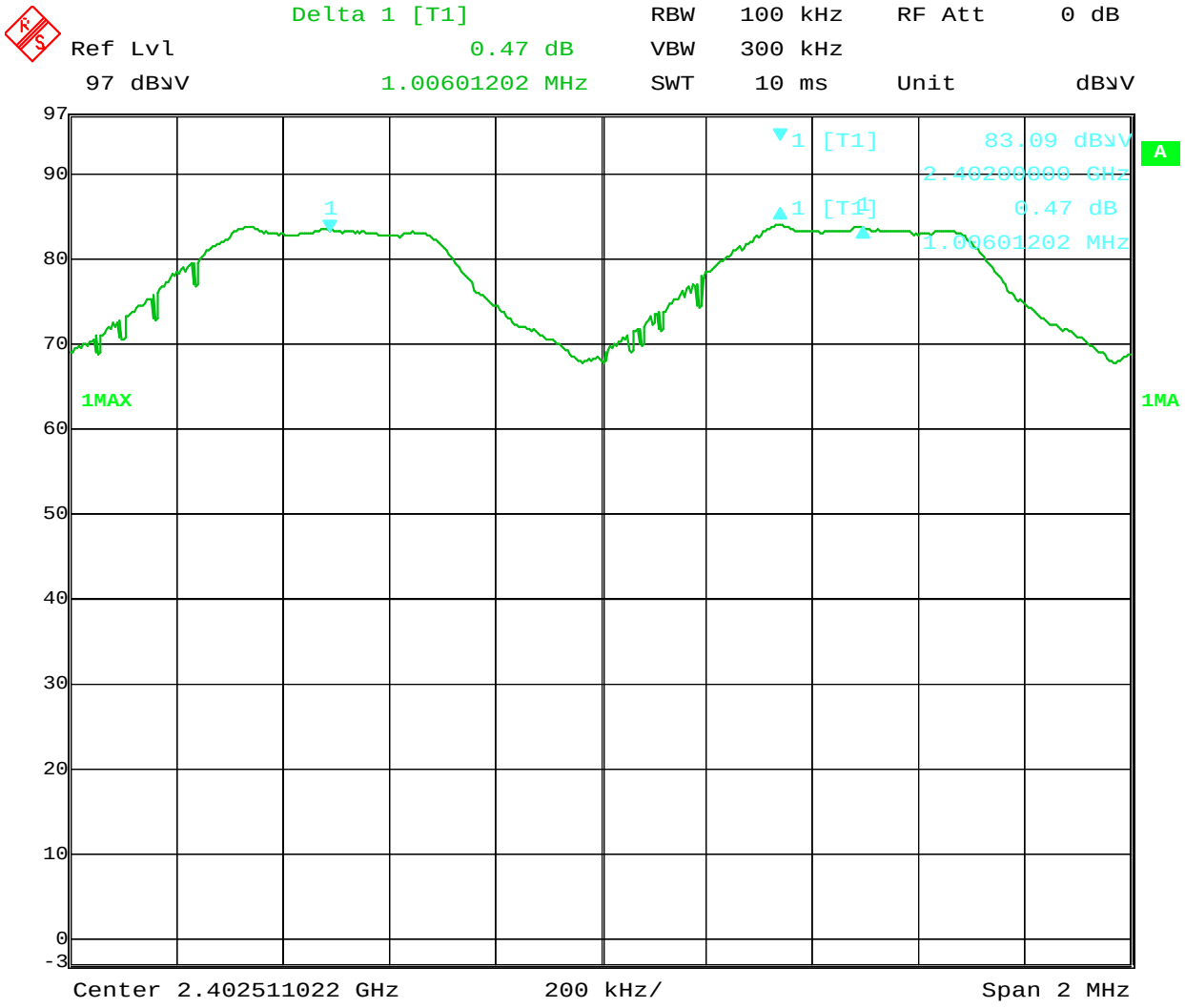


Date: 25.MAR.2014 01:12:41

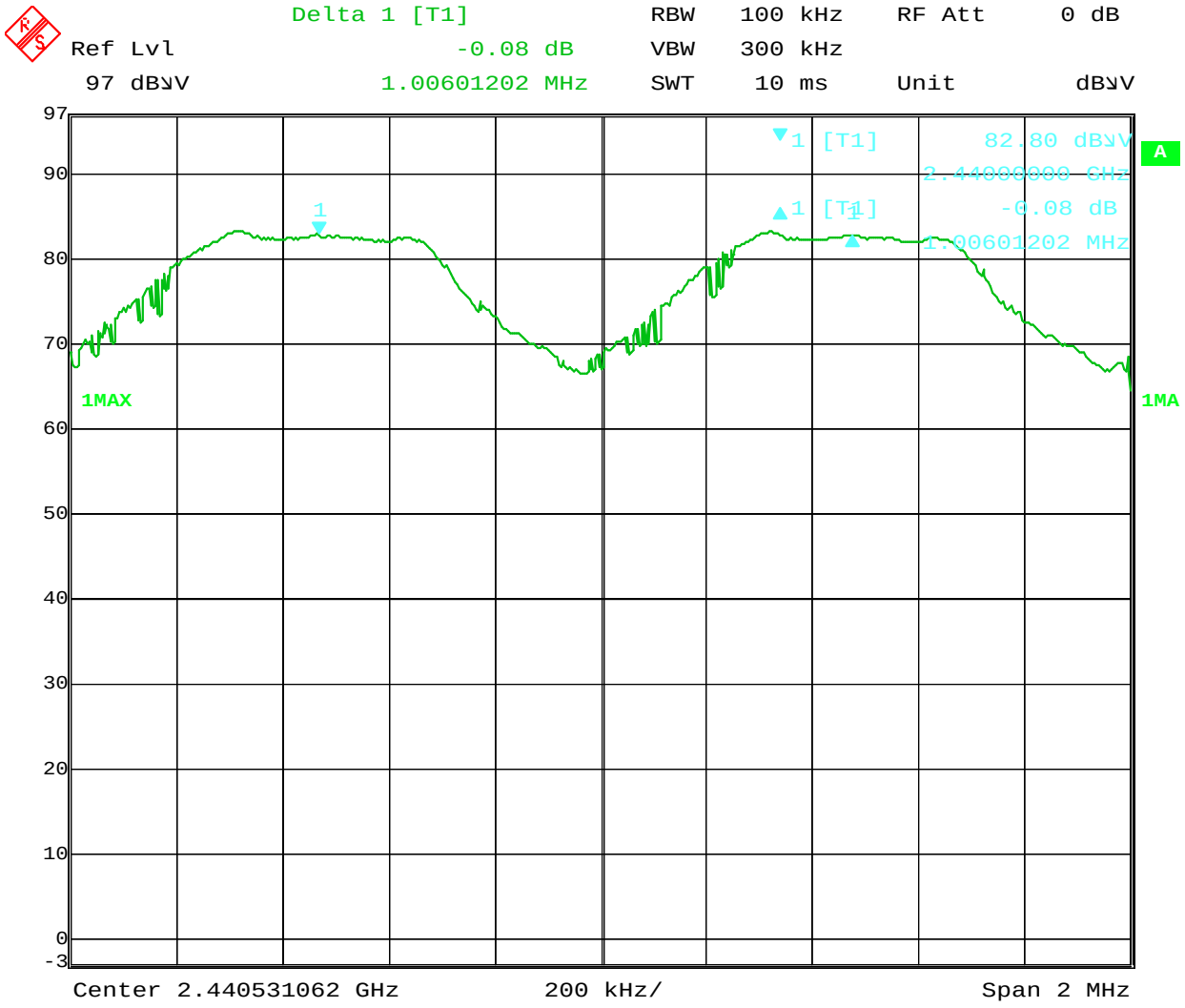
DH1 mode, Channel 79, channel separation is 1.018MHz



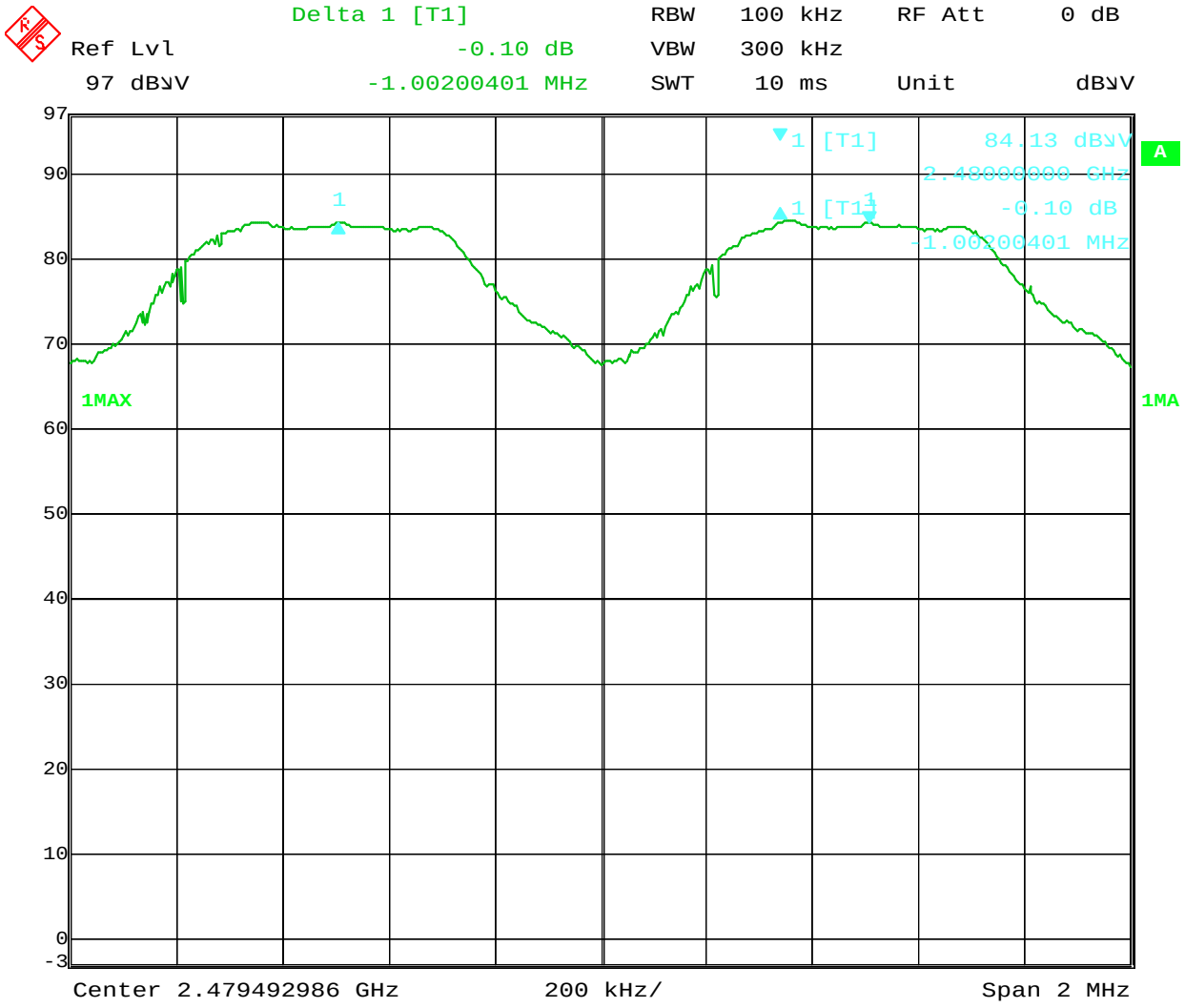
DH3 mode, Channel 0, channel separation 1.006 MHz



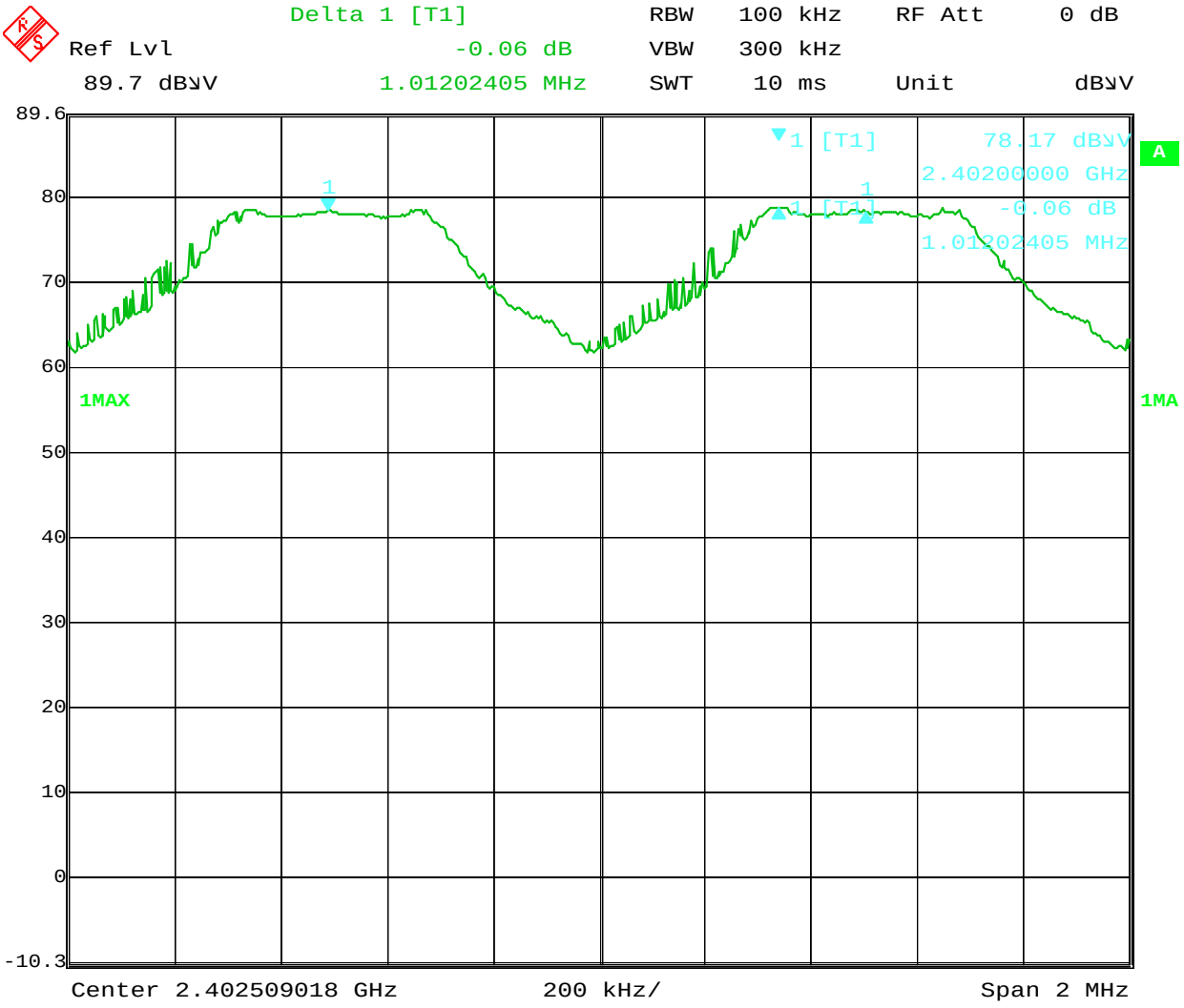
DH3 mode, Channel 40, channel separation 1.006 MHz



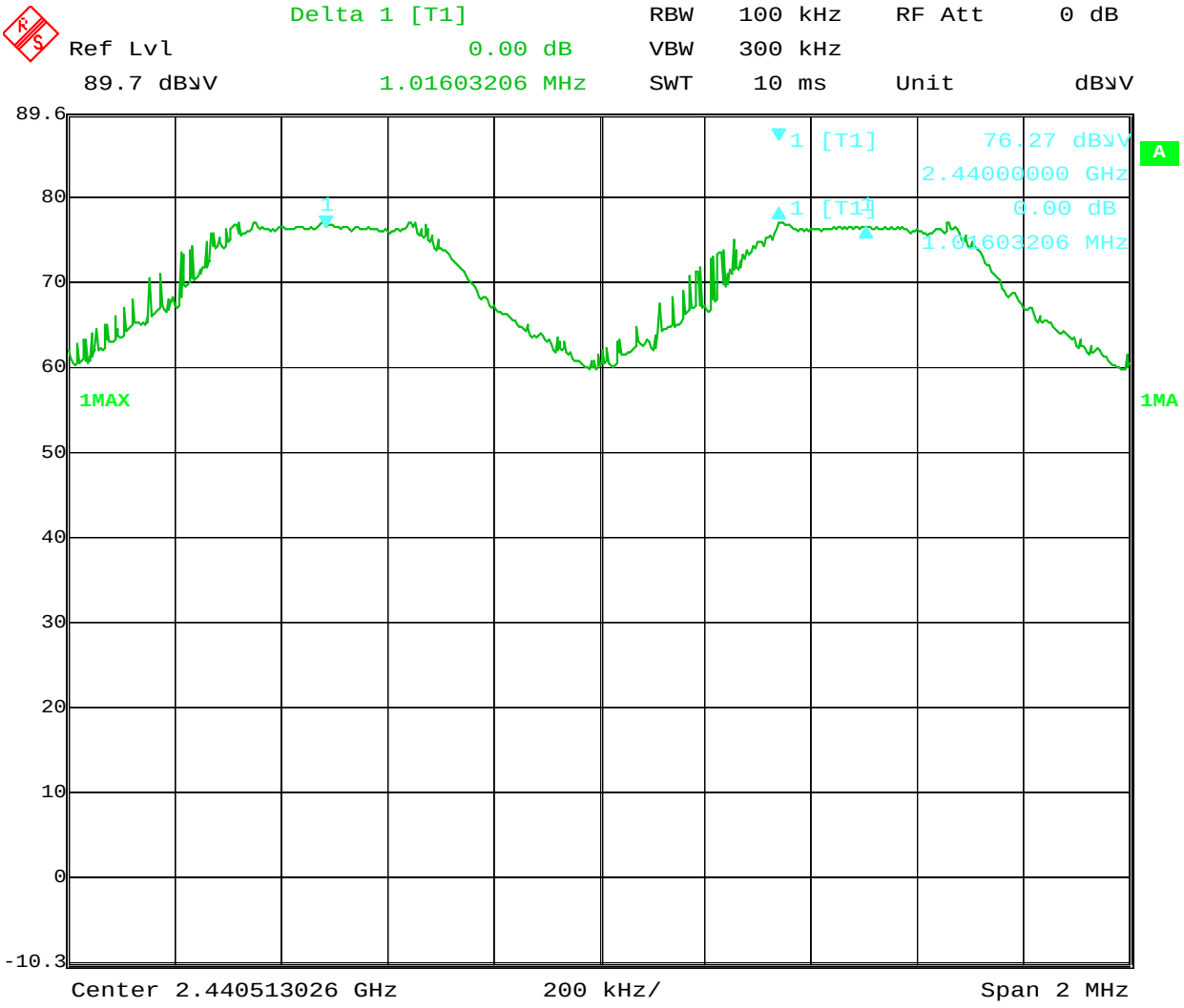
DH3 mode, Channel 79, channel separation 1.002 MHz



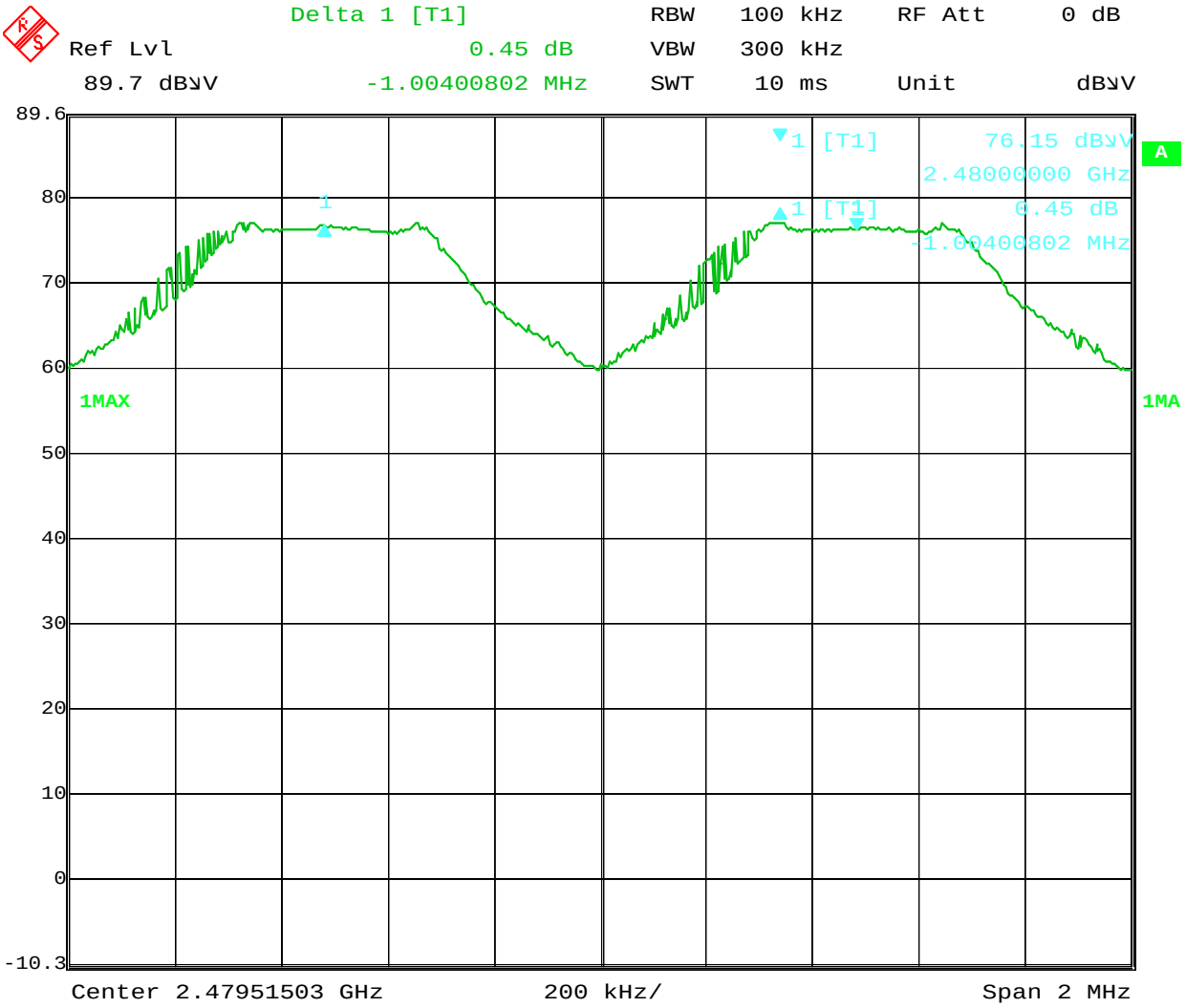
DH5 mode, Channel 0, channel separation 1.012 MHz



DH5 mode, Channel 38, channel separation 1.016 MHz



DH5 mode, Channel 78, channel separation 1.004 MHz



Test Personnel:	Vathana Ven VV	Test Date:	03/24/2014
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	15.247, CFR47 Part 2.1093, RSS-Gen, RSS-210, IC RSS-102	Limit Applied:	Below specified limits
Input Voltage:	Internal Battery, Powered/120VAC/60Hz		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	22 ºC
		Relative Humidity:	34 %
		Atmospheric Pressure:	1009 mbars

Deviations, Additions, or Exclusions: None

9 Number of hopping frequency

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

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

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
MAN1'	Digital 4 Line Barometer	Mannix	0ABA116	MAN1	08/13/2012	08/13/2014
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	04/25/2014
CBLHF2012-2M-2'	2m 40GHz Coaxial Cable	Huber & Suhner	SF102	252675002	01/14/2014	01/14/2015
HORN3'	HORN ANTENNA	EMCO	3115	9610-4980	04/25/2013	04/25/2014

Software Utilized:

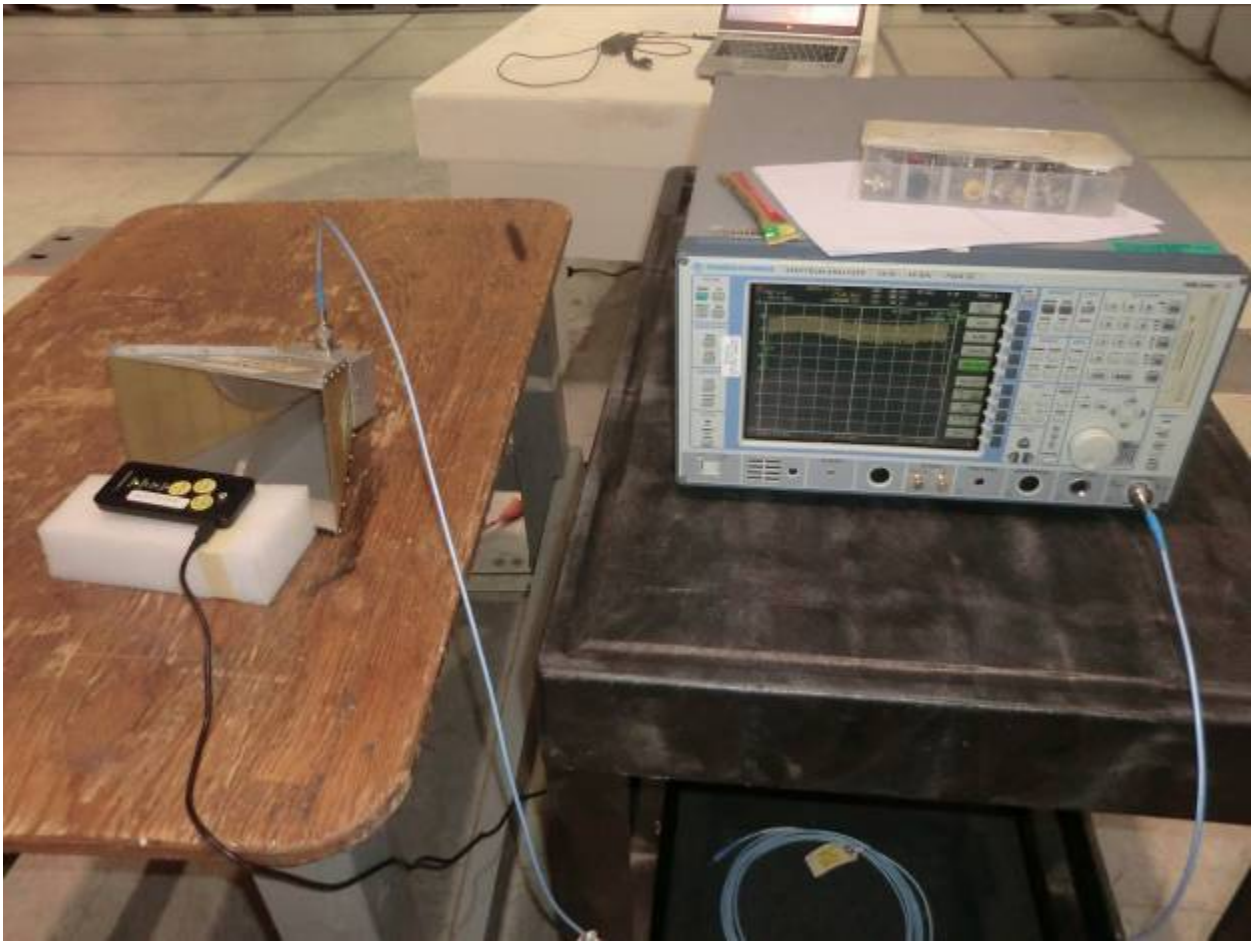
Name	Manufacturer	Version
None		

9.3 Results:

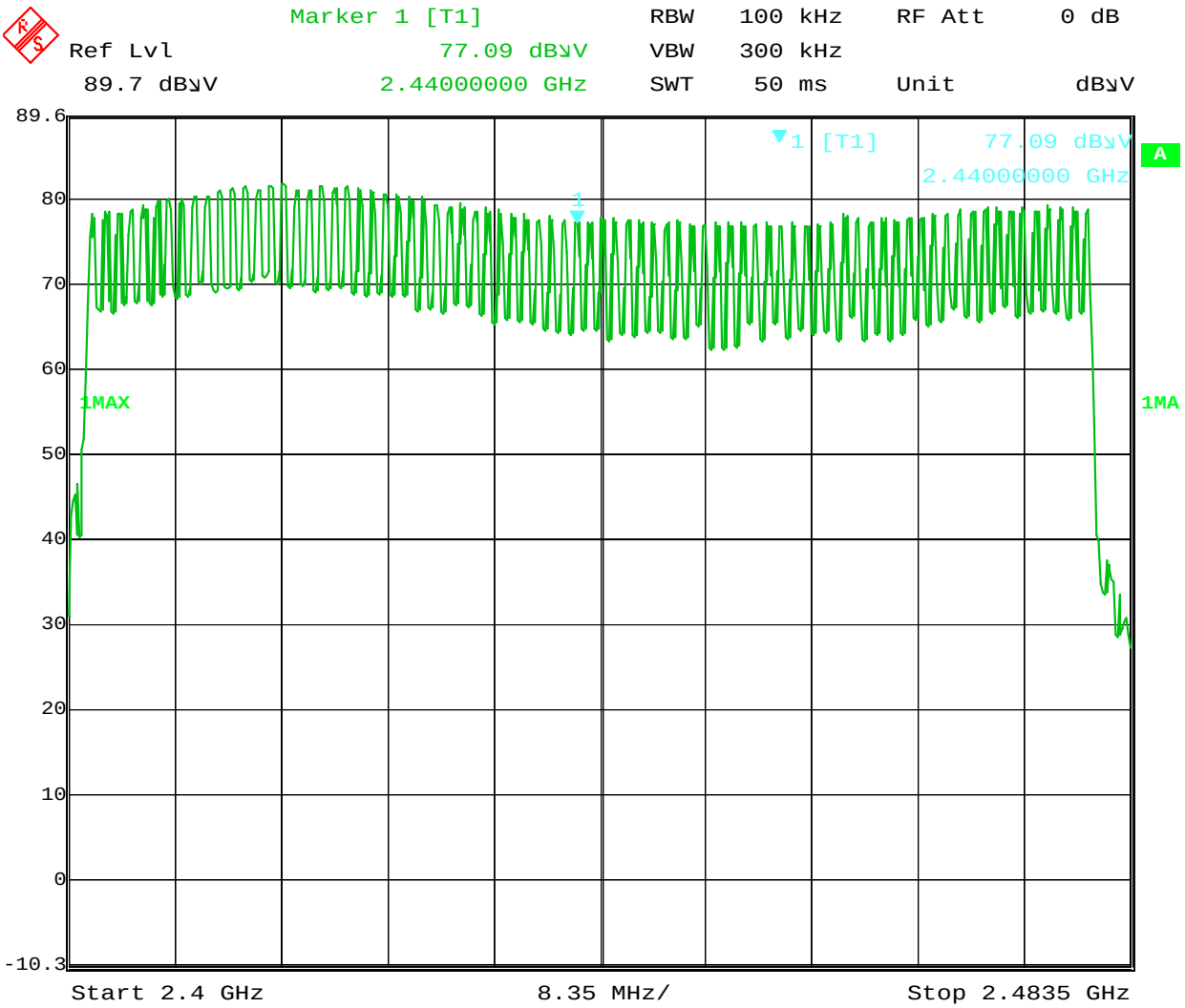
The sample tested was found to Comply.

FCC Part 15.247 (1) (iii) & RSS-210 A8.1 (d)
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

9.4 Setup Photograph:



9.5 Plots/Data:



Test Personnel:	Vathana Ven	Test Date:	03/24/2014
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	15.247, CFR47 Part 2.1093, RSS-Gen, RSS-210, IC RSS-102	Limit Applied:	Below specified limits
Input Voltage:	Internal Battery Powered, 120VAC/60Hz		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	22 ºC
		Relative Humidity:	50 %
		Atmospheric Pressure:	1009 mbars

Deviations, Additions, or Exclusions: None

10 Test Hopping Channel Bandwidth

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

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

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
MAN1'	Digital 4 Line Barometer	Mannix	0ABA116	MAN1	08/13/2012	08/13/2014
145-128'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	04/25/2014
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015

Software Utilized:

Name	Manufacturer	Version
None		

10.3 Results:

Test result of the 20-dB bandwidth – not the FCC requirements.

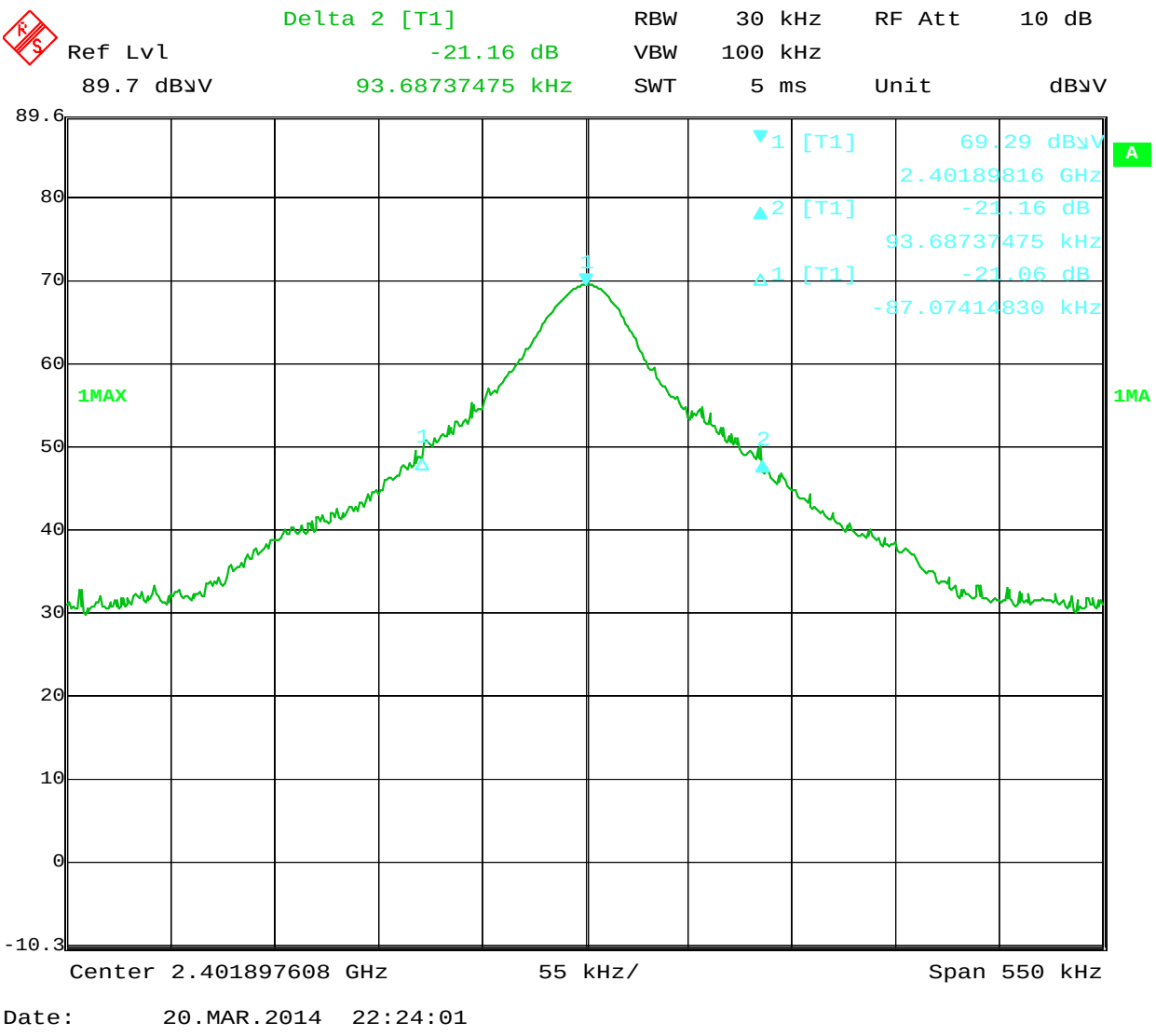
FCC Part 15.247 (1) & RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

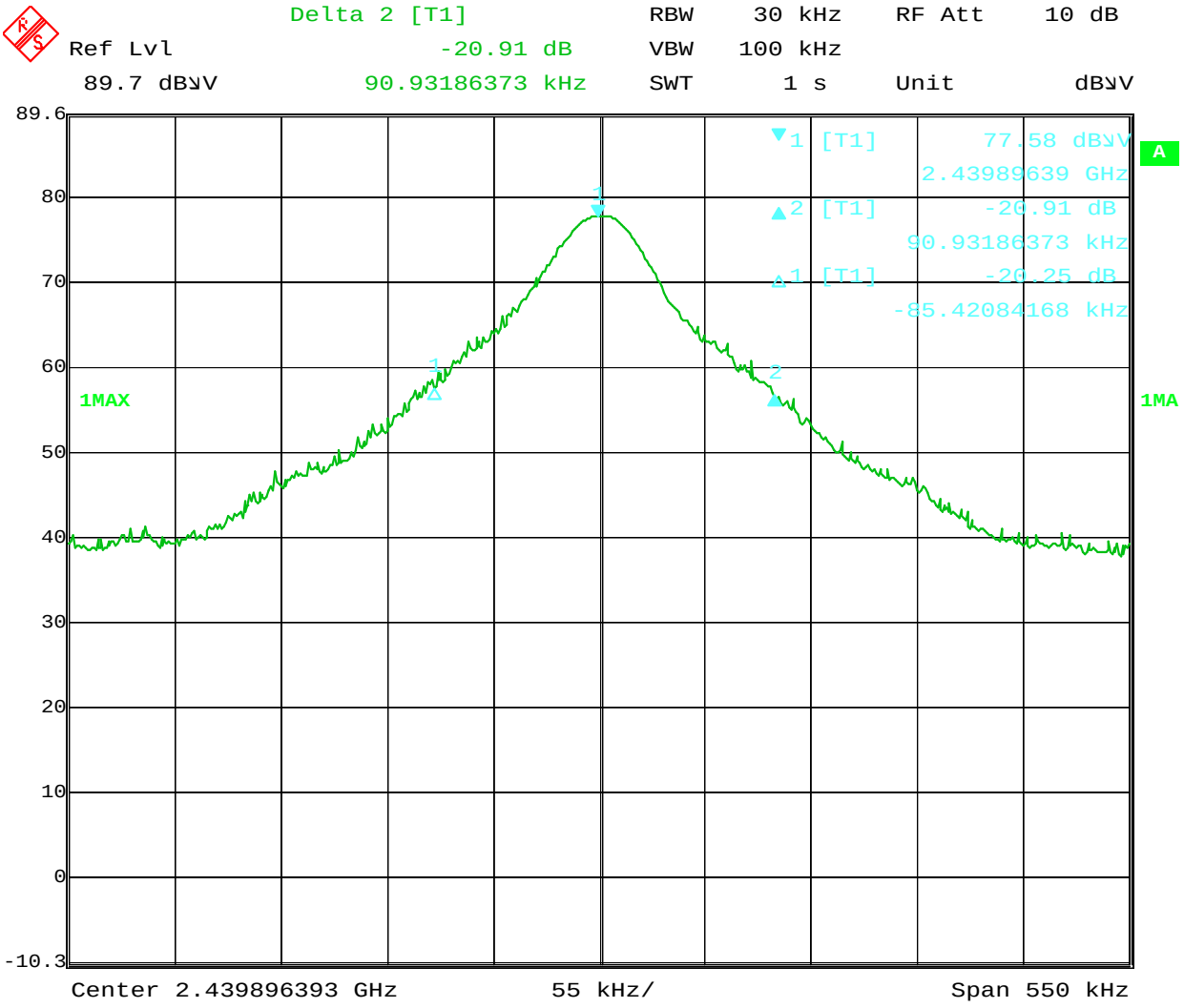
10.4 Setup Photograph:

10.5 Test Data:

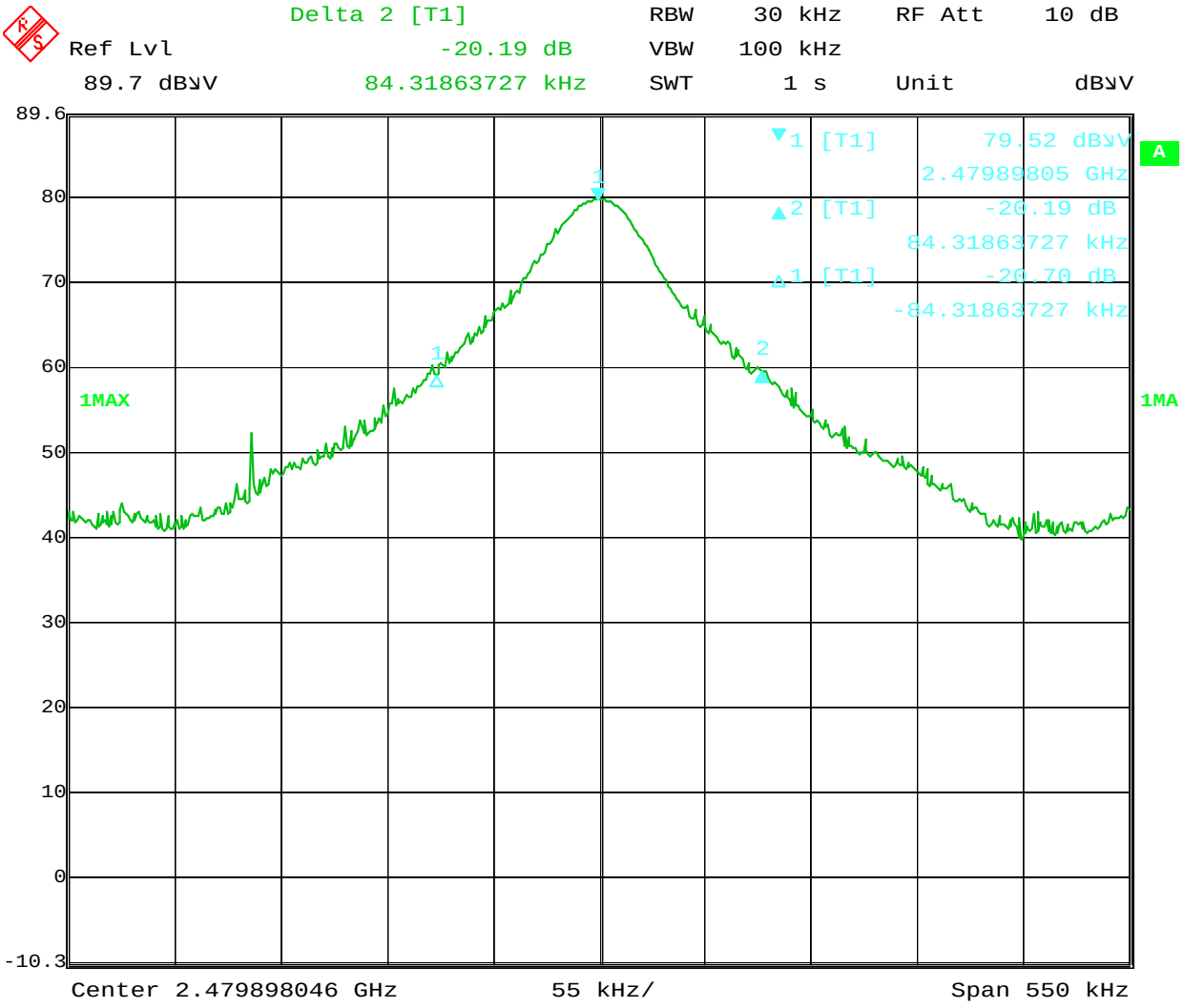
DH5 mode, Channel 0, channel bandwidth 93.69 kHz



DH5 mode, Channel 38, channel bandwidth 90.93 kHz



DH5 mode, Channel 0, channel bandwidth 84.32 kHz



Test Personnel:	Vathana Ven VSV	Test Date:	03/20/2014
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	15.247, CFR47 Part 2.1093, RSS-Gen, RSS-210, IC RSS-102	Limit Applied:	Below specified limits
Input Voltage:	Internal Battery Powered, 120VAC/60Hz		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	22 ºC
		Relative Humidity:	50 %
		Atmospheric Pressure:	1009 mbars

Deviations, Additions, or Exclusions: None

11 Hopping Dwell time

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

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

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
MAN1'	Digital 4 Line Barometer	Mannix	0ABA116	MAN1	08/13/2012	08/13/2014
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	04/25/2014
CBLHF2012-2M-2'	2m 40GHz Coaxial Cable	Huber & Suhner	SF102	252675002	01/14/2014	01/14/2015
HORN3'	HORN ANTENNA	EMCO	3115	9610-4980	04/25/2013	04/25/2014

Software Utilized:

Name	Manufacturer	Version
None		

11.3 Results:

The sample tested was found to Comply.
FCC Part 15.247 (1) (iii) & RSS-210 A8.1 (c)

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Bluetooth utilizes 79 channels, therefore dwell time must not exceed 0.4 seconds in any 31.6 second period.

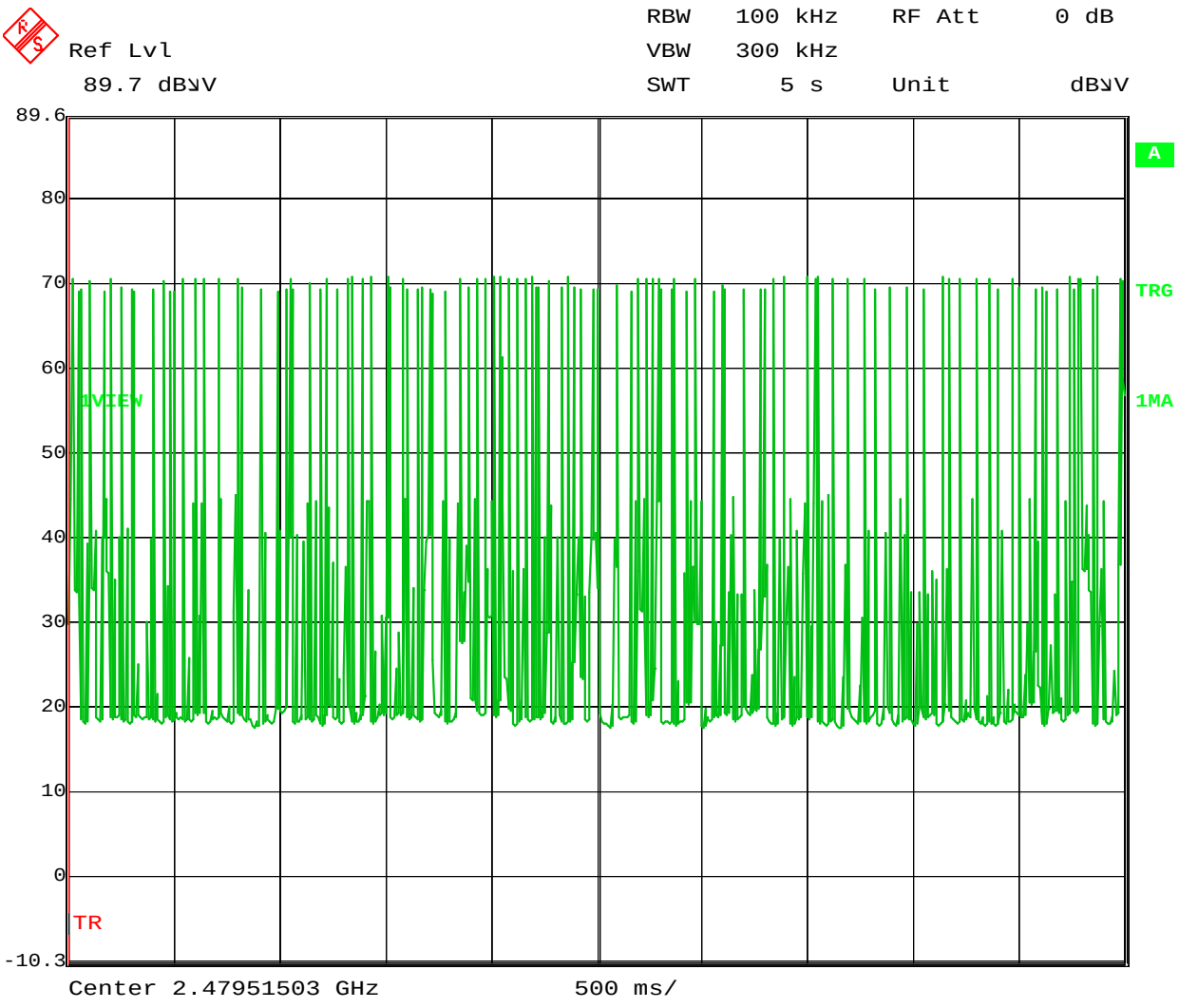
11.4 Setup Photograph:

11.5 Test Data:

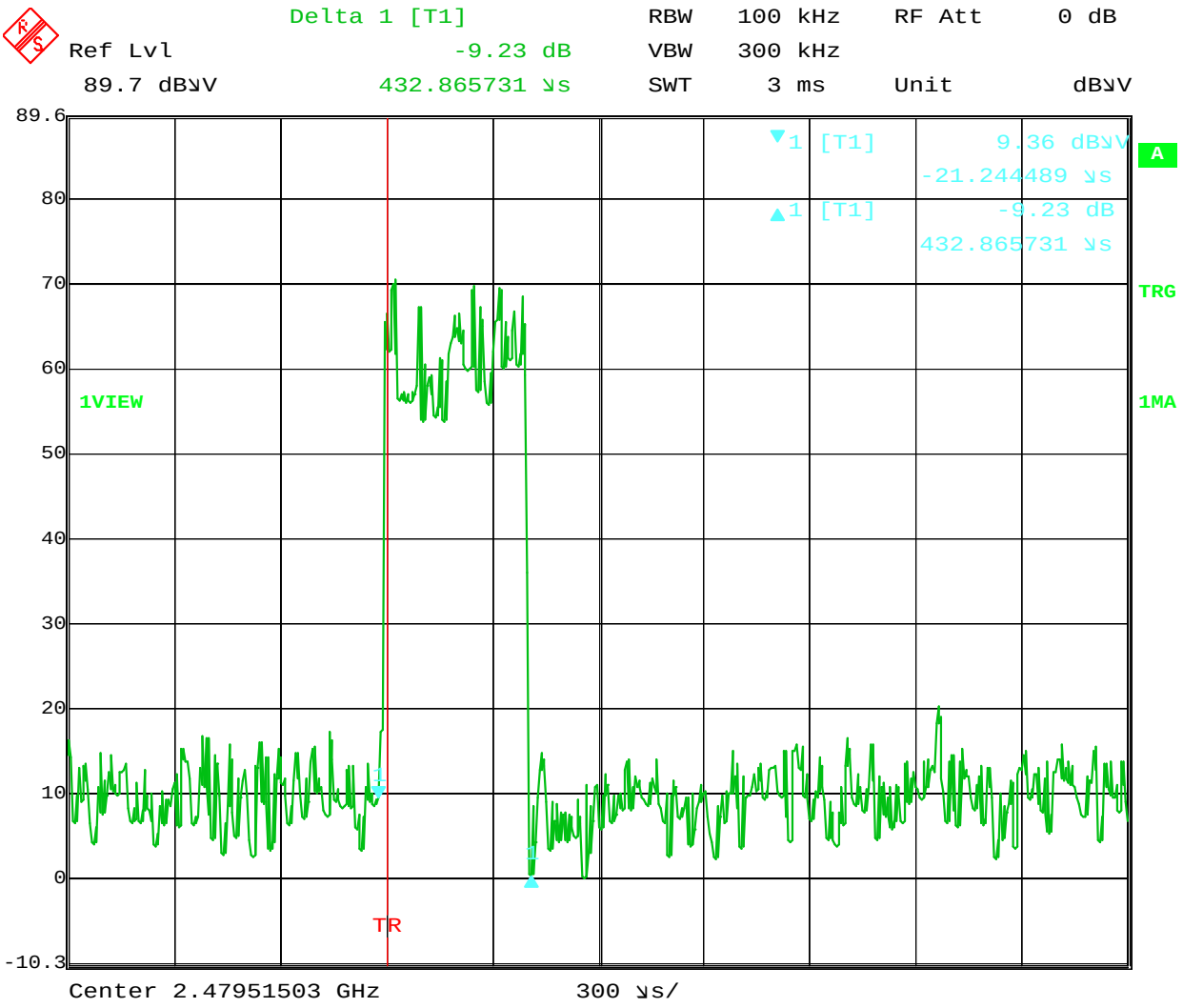
Mode	Number of transmissions in a 31.6 (79 hopping*0.4 seconds)	Length of transmission time (msec)	Results (msec)	Limit (msec)
DH1	88 (times/5s)*6.32 = 556.16 times	0.433	240.82	400
DH3	24 (times/5s)*6.32 = 151.68 times	1.683	255.27	400
DH5	34 (times/5s)*6.32 = 214.88 times	0.580	124.63	400

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

DH1

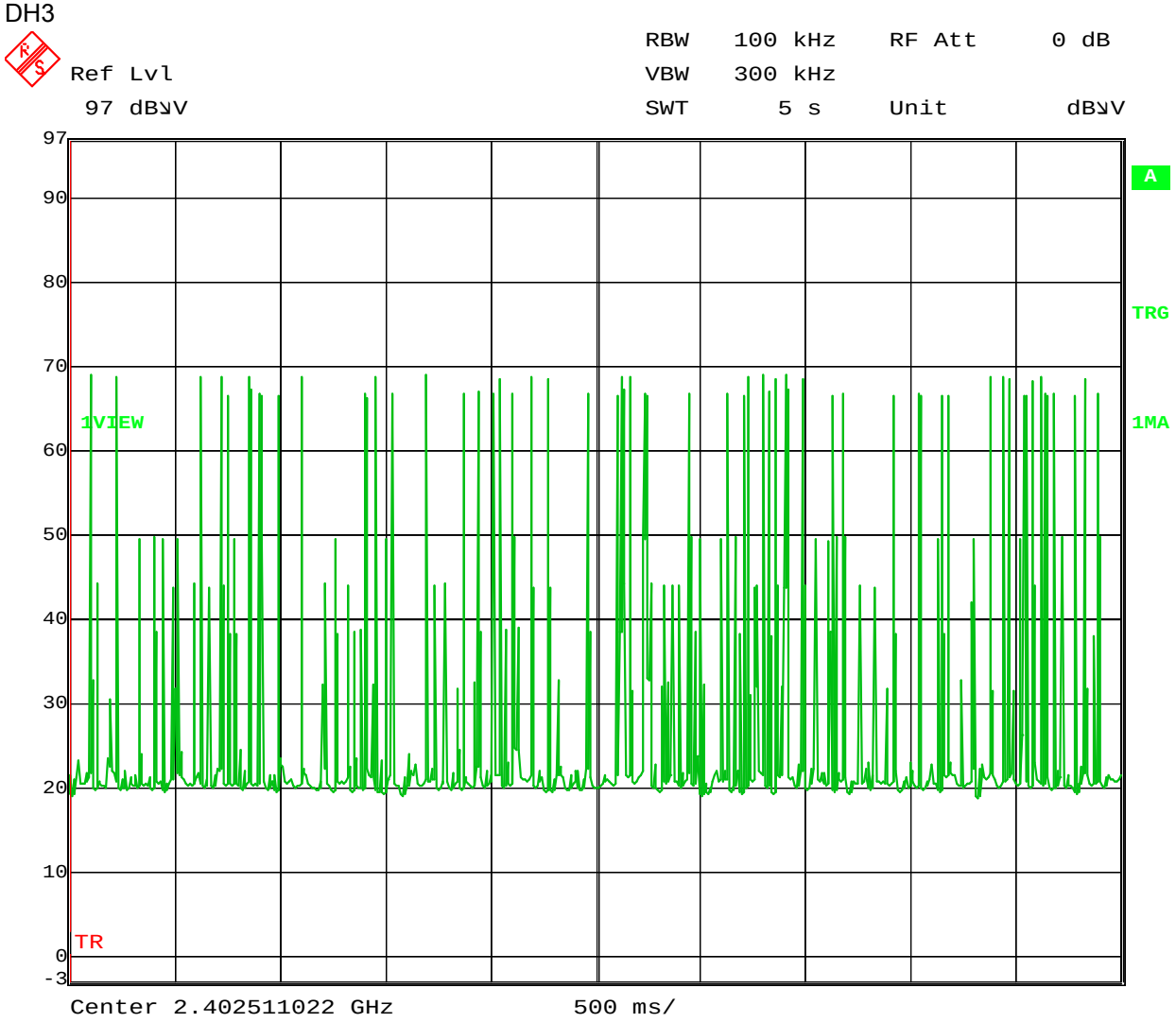


Number of hopping channels in 5s slot



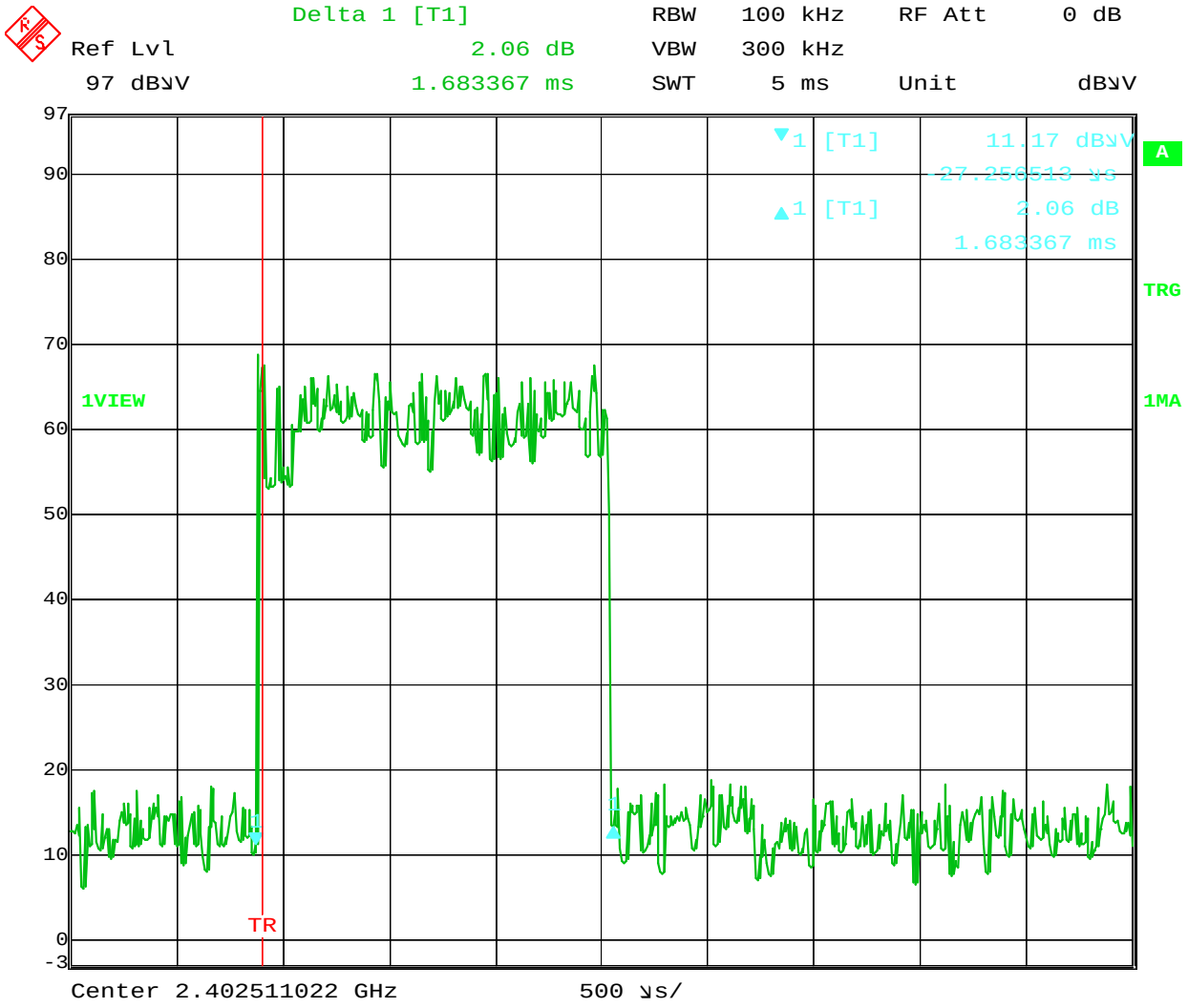
Length of transmission time

DH3



Date: 25.MAR.2014 02:56:53

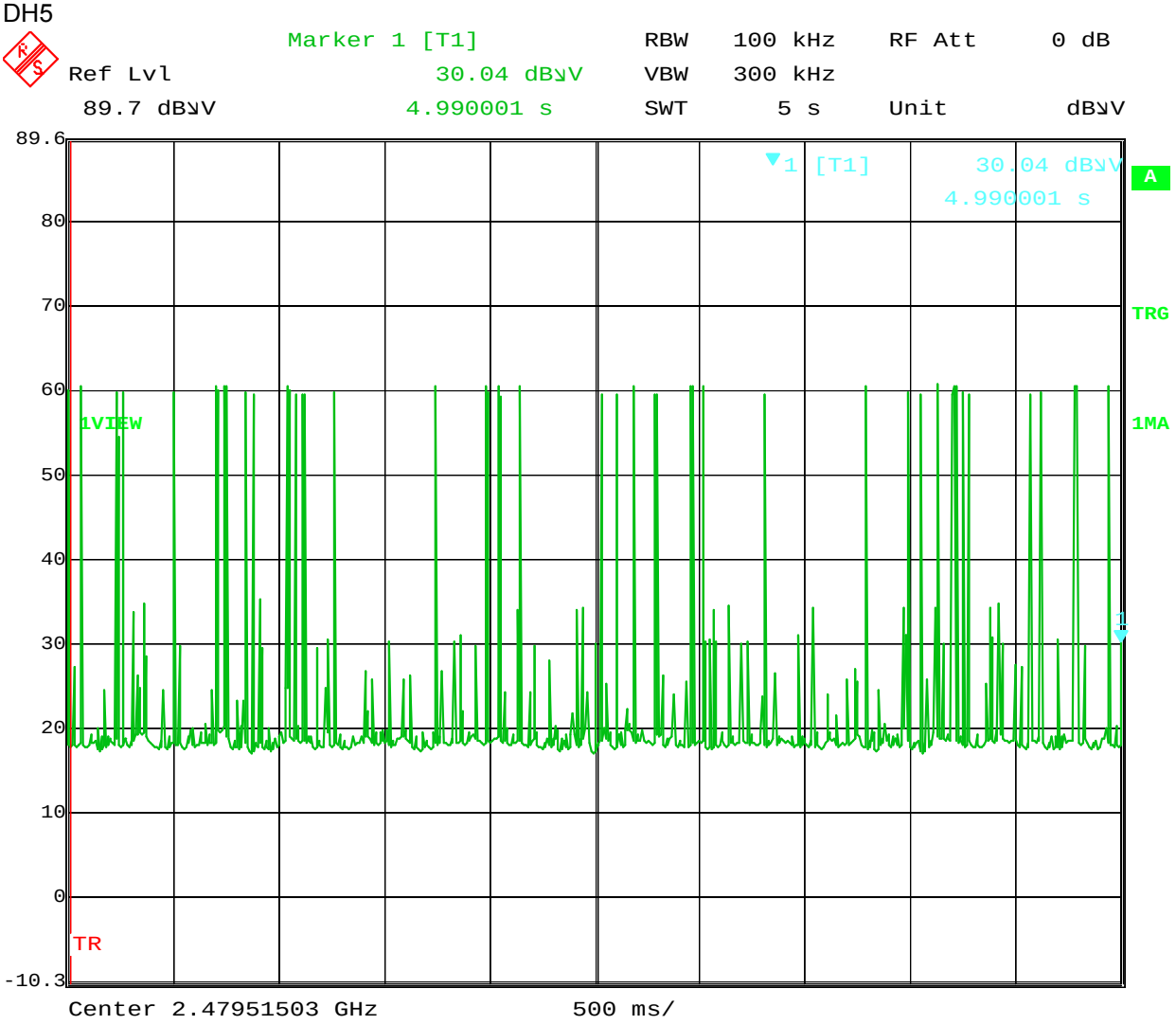
Number of hopping channels in 5s slot



Date: 25.MAR.2014 02:59:16

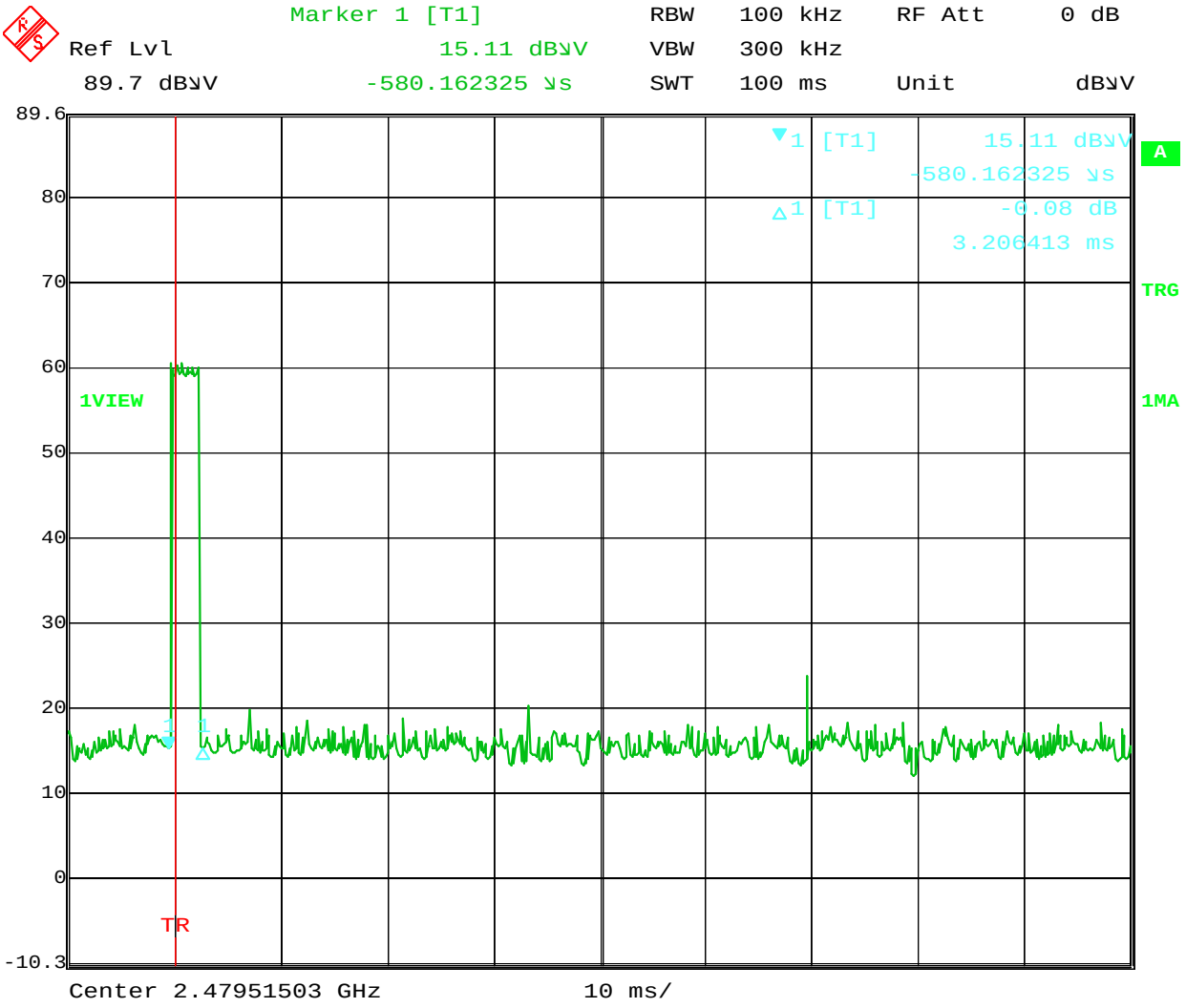
Length of transmission time

DH5



Date: 25.MAR.2014 00:00:43

Number of hopping channels in 5s slot



Test Personnel:	Vathana Ven VV	Test Date:	03/25/2014
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	15.247, CFR47 Part 2.1093, RSS-Gen, RSS-210, IC RSS-102	Limit Applied:	Below specified limits
Input Voltage:	Internal Battery Powered, 120VAC/60Hz	Ambient Temperature:	22 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	50 %
		Atmospheric Pressure:	1009 mbars

Deviations, Additions, or Exclusions: None

12 Test Band-edge Compliance

12.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

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

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

12.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
MAN1'	Digital 4 Line Barometer	Mannix	0ABA116	MAN1	08/13/2012	08/13/2014
145-128'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	04/25/2014
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015

Software Utilized:

Name	Manufacturer	Version
None		

12.3 Results:

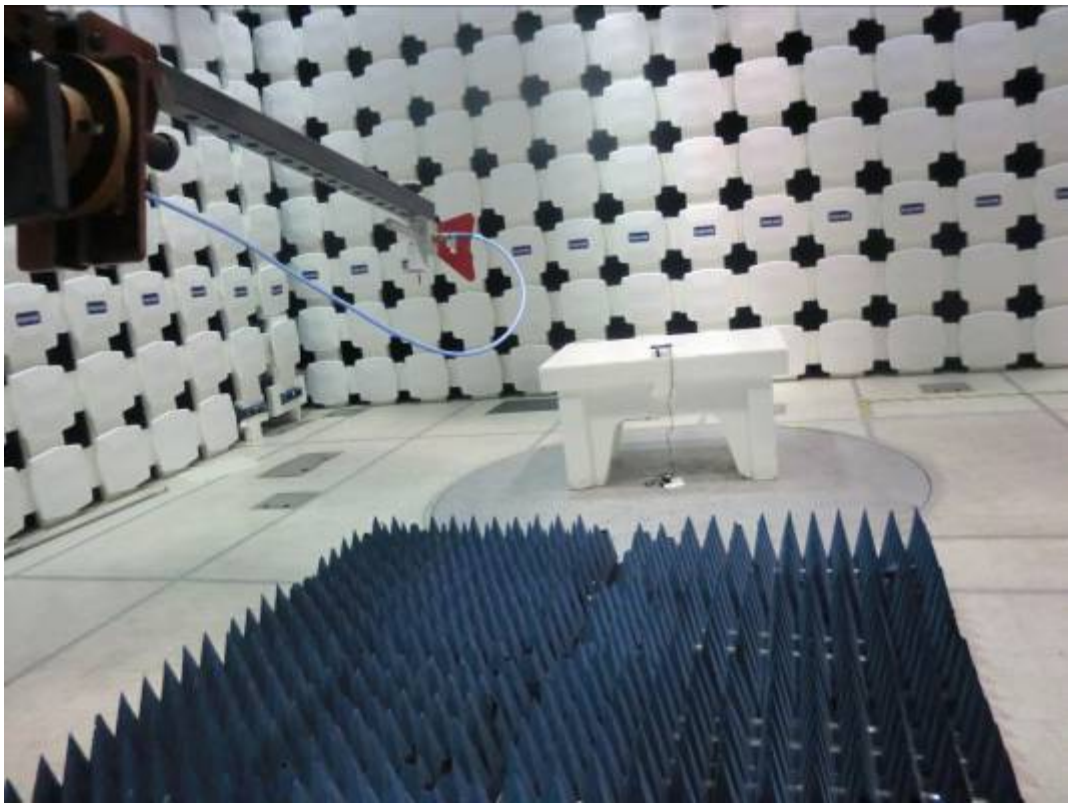
The sample tested was found to comply. Note that the requirement is 20 dBc at the lower band edge, and the device must meet the general limits of 15.209 using the marker-delta method at the upper band edge due to the restricted band located there.

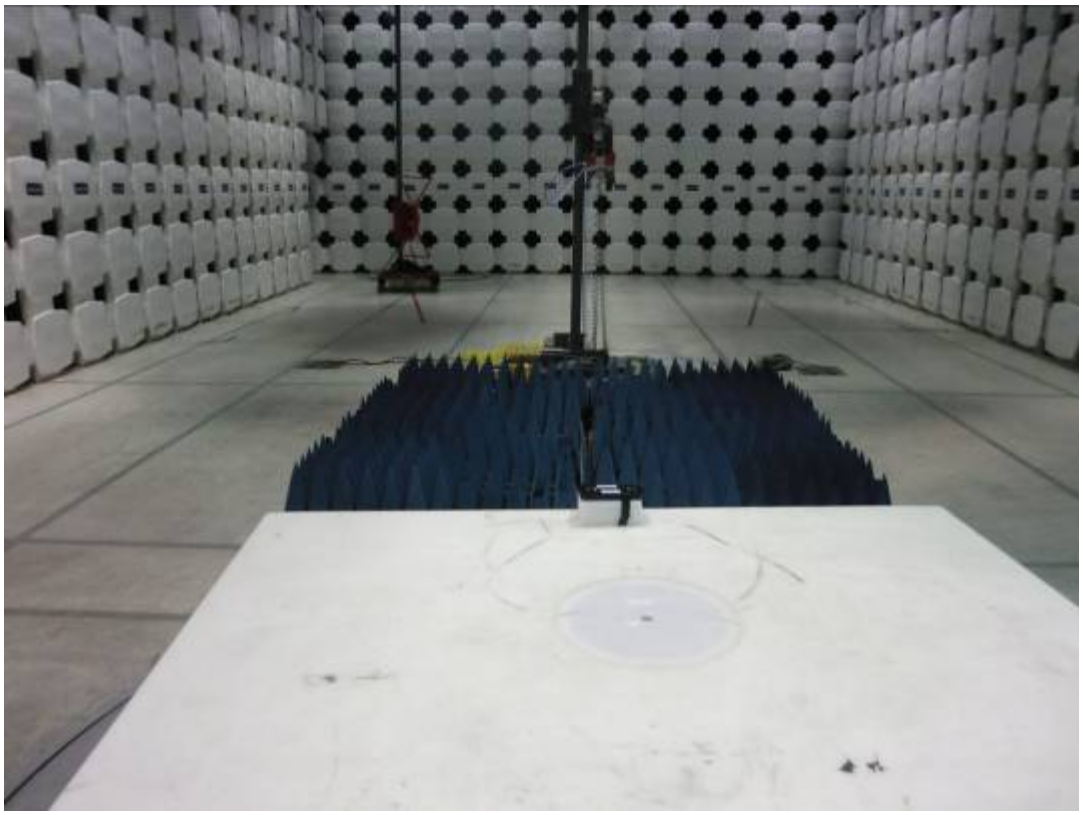
In any 100 kHz bandwidth outside the frequency band , the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

FCC Part 15.209(a) & RSS-210 A8.5 – Restricted Band Radiated Spurious/Harmonics Limits

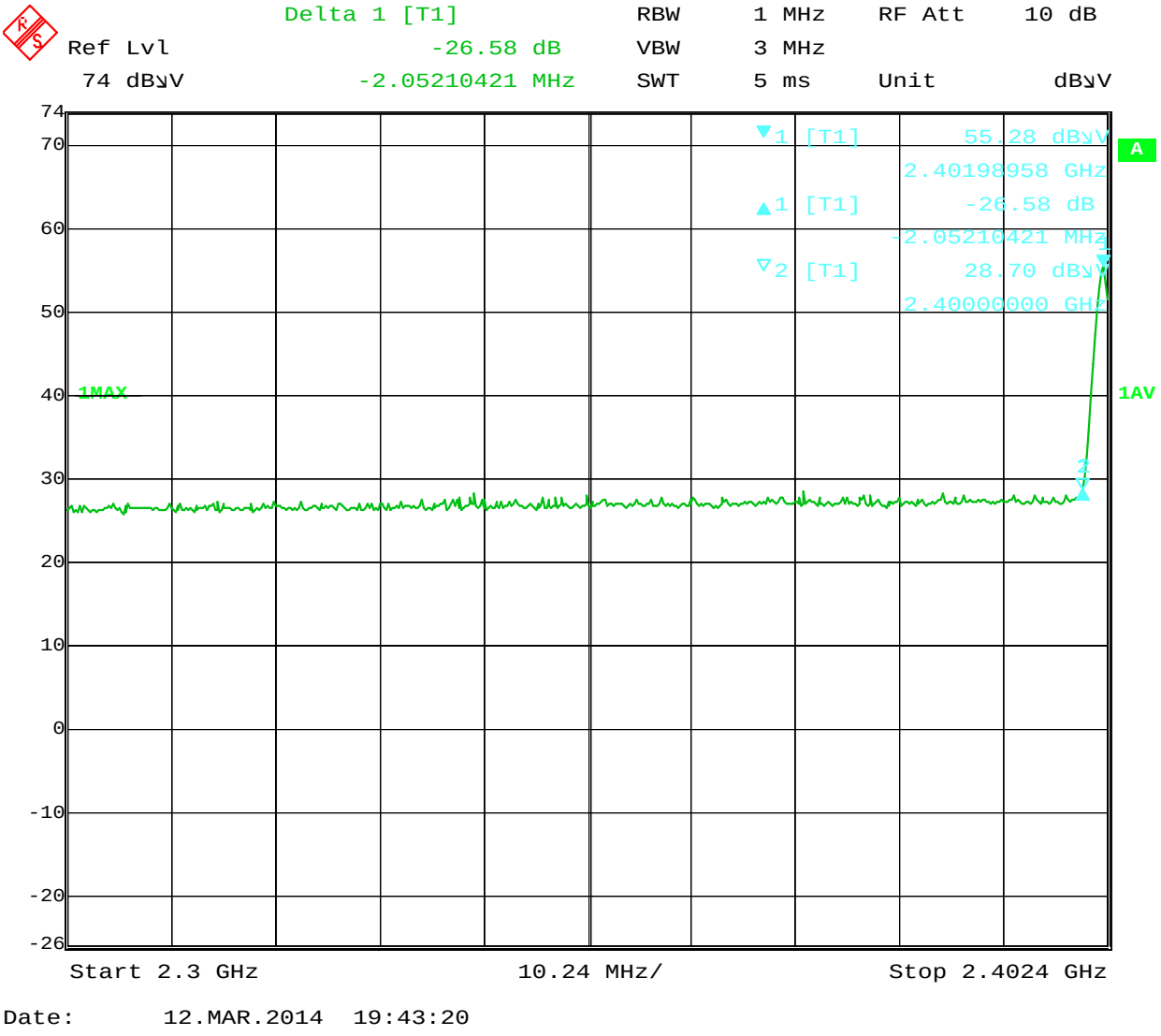
Frequency	Field Strength		Test Distance
(MHz)	µV/m	dBµV/m	(meters)
30–88	100	40.00	3
88–216	150	43.52	3
216–960	200	46.02	3
Above 960	500	53.98	3

12.4 Setup Photographs:





12.5 Test Data:



Lower Band Edge Compliance

Upper Band-Edge Compliance Radiated Emissions

Company: Corventis | Antenna & Cables: SHF | Bands: N, LF, HF, SHF
Model #: zLink | Antenna: ETS001 01-06-15.txt | ETS001 01-06-15.txt
Serial #: 015821 | Cable(s): 145-416 3mTrkB 10-03-2014.txt
Engineers: Vathana Ven | Location: 10m Chamber | Barometer: MAN1 | Filter:
Project #: G101275145 | Date(s): 03/12/14
Standard: FCC Part 15 Subpart C 15.247 | Temp/Humidity/Pressure: 24c | 42% | 1007mB
Receiver: R&S ESI (145-108) 05-10-2014 | Limit Distance (m): 3
PreAmp: PRE145014 12-13-2014.txt | Test Distance (m): 3
PreAmp Used? (Y or N): Y | Voltage/Frequency: 3.7VDC/120VAC | Frequency Range: 2483.5 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	
Note: Upper Band Edge Compliance, Marker-delta method												FCC
PK	H	2484.000	8.74	32.31	6.07	0.00	0.00	47.12	74.00	-26.88	1/3 MHz	
AVG	H	2484.000	-5.65	32.31	6.07	0.00	0.00	32.73	54.00	-21.27	1/3 MHz	
PK	H	2483.500	58.66	32.31	6.07	0.00	0.00	97.04	--	--	1/3 MHz	
PK	H	2484.000	33.70	32.31	6.07	0.00	0.00	67.49	--	--	1/3 MHz	
Relative measurement of the peak of the fundamental emission and the band-edge emission is 58.66-33.7 = 24.96												

Test Personnel: Vathana Ven VFV | Test Date: 03/12/2014
Supervising/Reviewing Engineer: (Where Applicable) N/A
Product Standard: CFR47 FCC Part 15.247, RSS-Gen, RSS-210 | Limit Applied: Below specified limits
Input Voltage: Internal Battery Powered, 120VAC/60Hz
Pretest Verification w/ Ambient Signals or BB Source: **BB Source**
Ambient Temperature: 24ºC
Relative Humidity: 42%
Atmospheric Pressure: 1007mbars

Deviations, Additions, or Exclusions: None

13 Receiver Radiated Spurious

13.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

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

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

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

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

13.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/17/2014	03/17/2015
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	10/01/2013	10/01/2014
145003'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	10/07/2013	10/07/2014
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2013	10/04/2014
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	12/19/2013	12/19/2014
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015

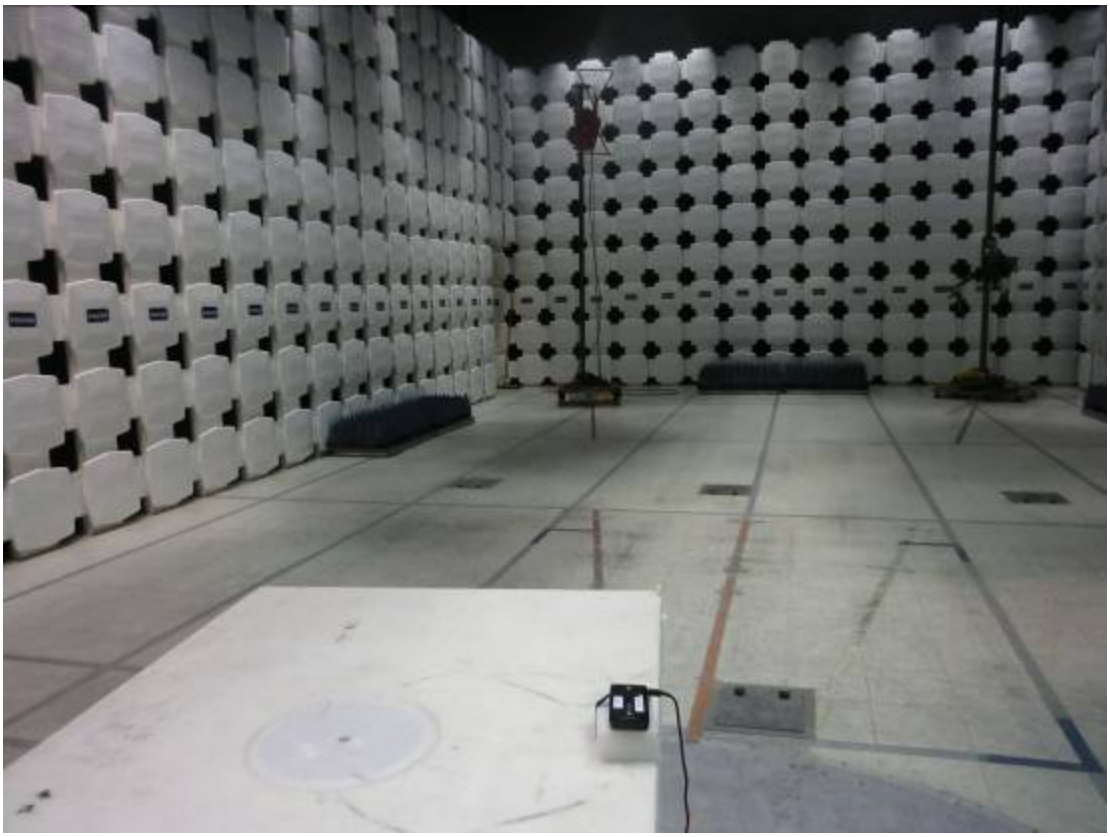
Software Utilized:

Name	Manufacturer	Version
C5	Teseq	5.26.46.46

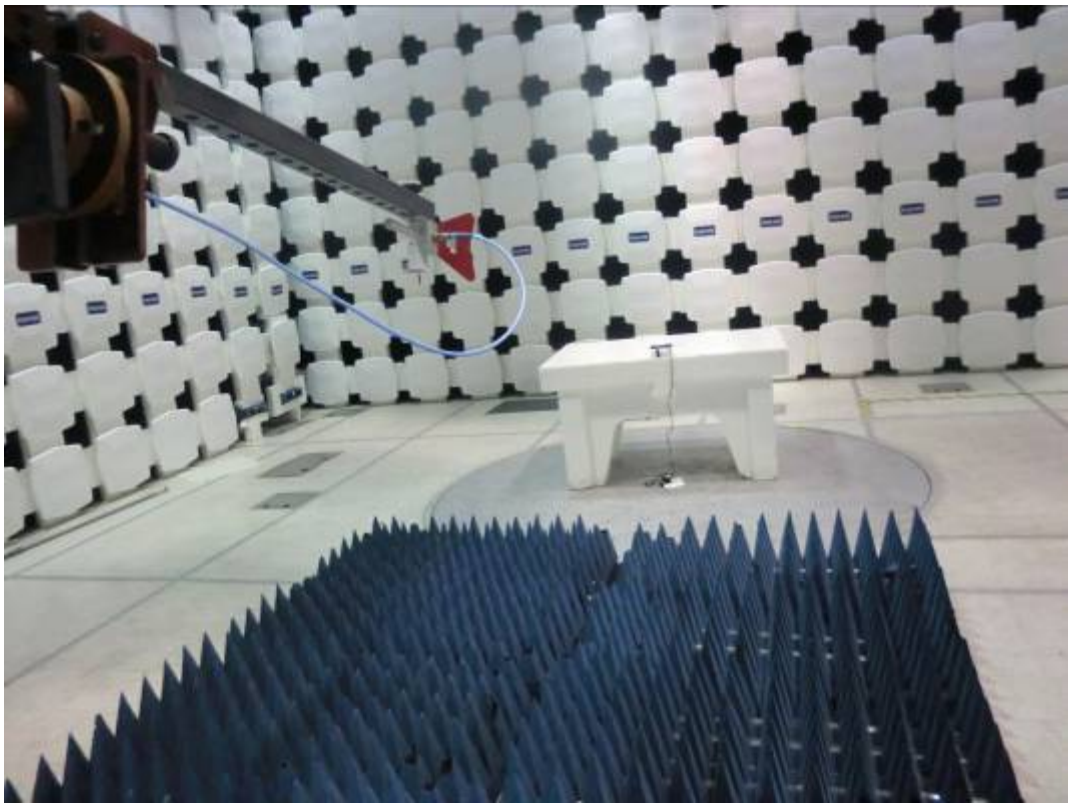
13.3 Results:

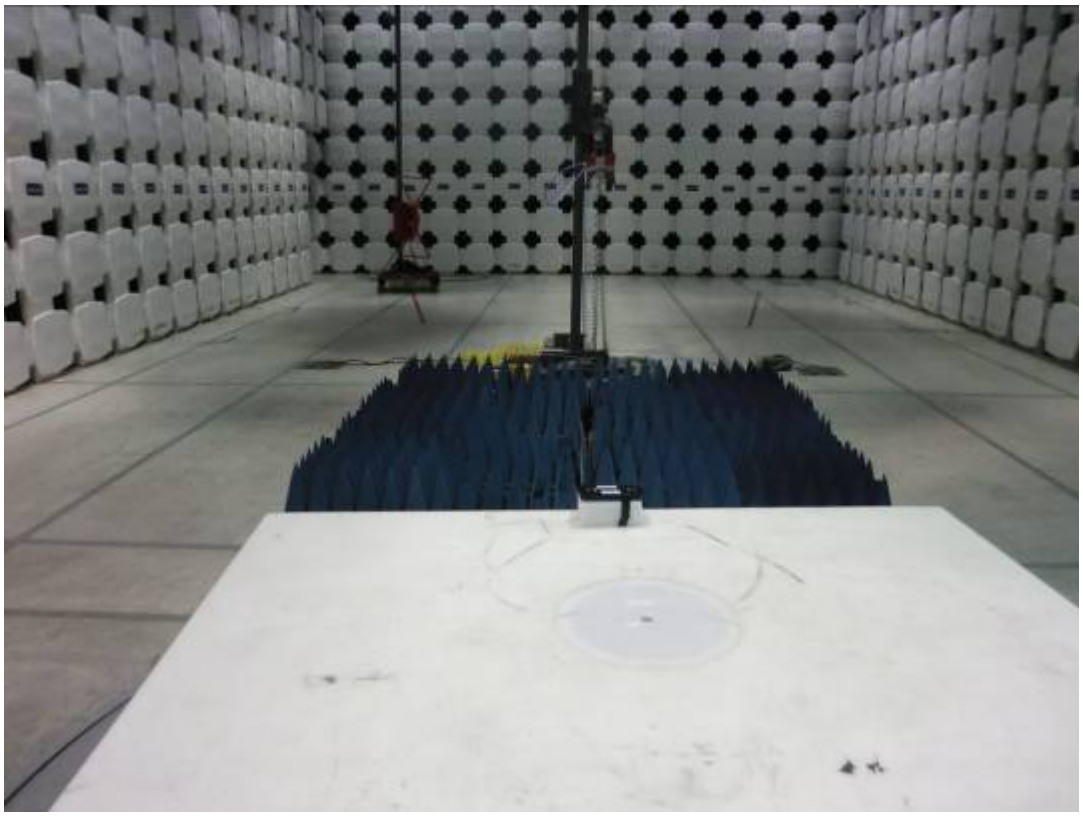
The sample tested was found to Comply.

13.4 Setup Photographs:



30 – 1000 MHz scan





1-13 GHz scan

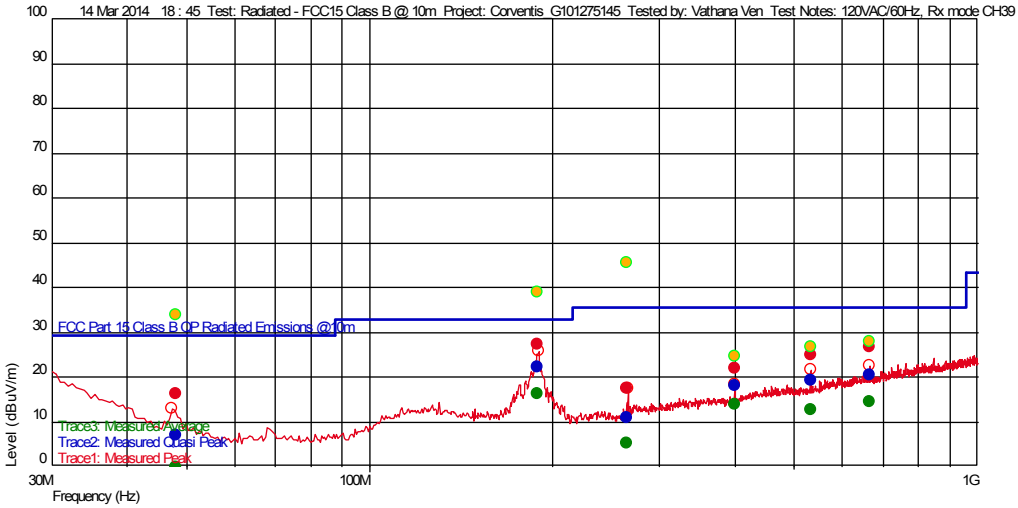
13.5 Test Data:

Model: zLink, Rx Mode, FCC Part 15:209

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 10m	
Project:	Corventis_G101275145	
Test Notes:	120VAC/60Hz, Rx mode CH39	
Temperature:	20 deg C	
Humidity:	23%, 1006 mB	
Tested by:	Vathana Ven	
Test Started:	14 Mar 2014 18 : 45	

Prescan Emission Graph



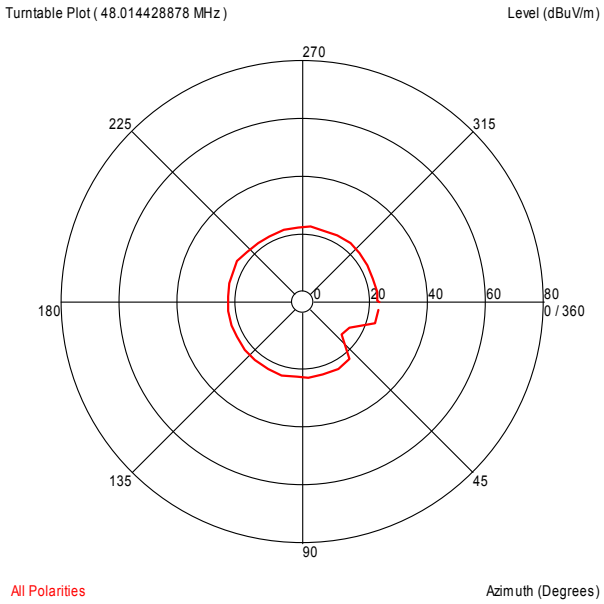
- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

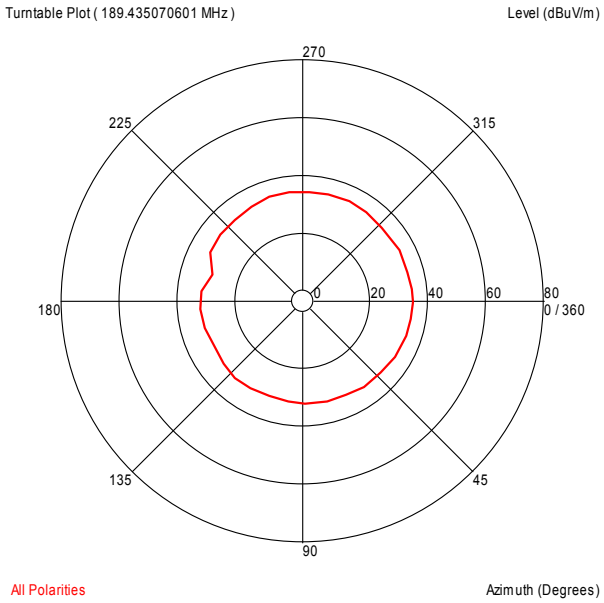
Emissions Test Data

Trace2: Measured Quasi Peak

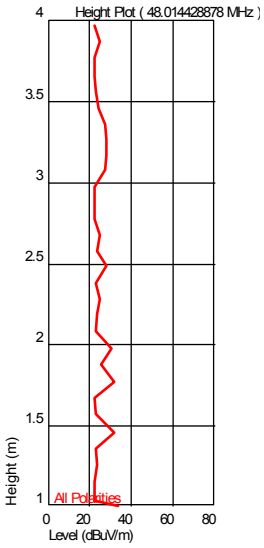
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height (m)	RBW (Hz)	Comment
265.903407084 M	11.02	12.772	-23.689	35.540	-24.52	|	265	1.05	120 k	
48.014428878 M	6.95	8.891	-25.928	29.540	-22.59	|	195	1.04	120 k	
398.987374339 M	17.91	15.639	-24.031	35.540	-17.63	|	177	1.05	120 k	
532.087575114 M	19.17	18.100	-24.580	35.540	-16.37	--	76	1.88	120 k	
665.027455248 M	20.30	19.700	-23.917	35.540	-15.24	--	264	4.00	120 k	
189.435070601 M	22.38	11.444	-24.177	33.040	-10.66	|	0	1.05	120 k	

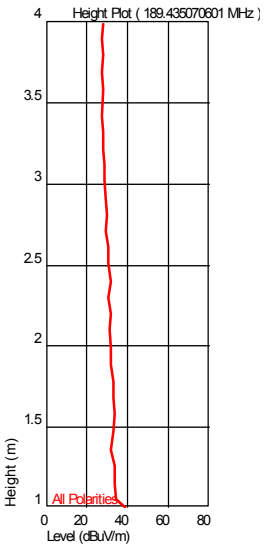
Azimuth Plots

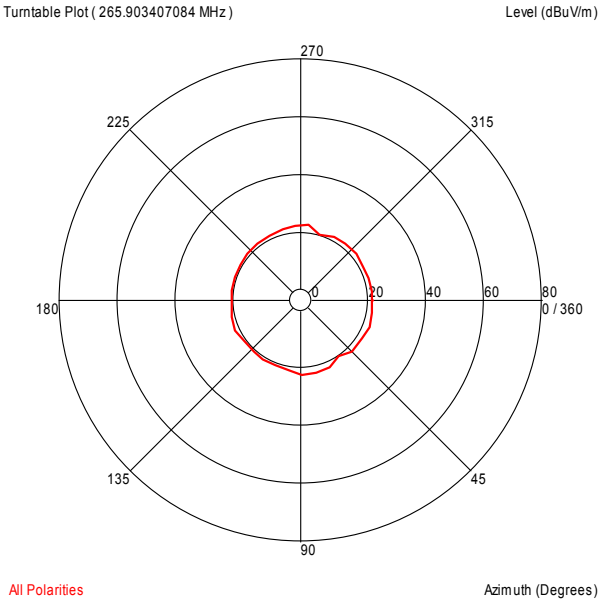


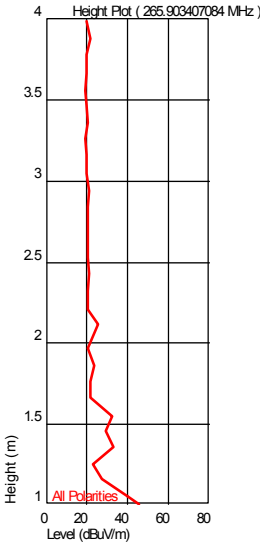


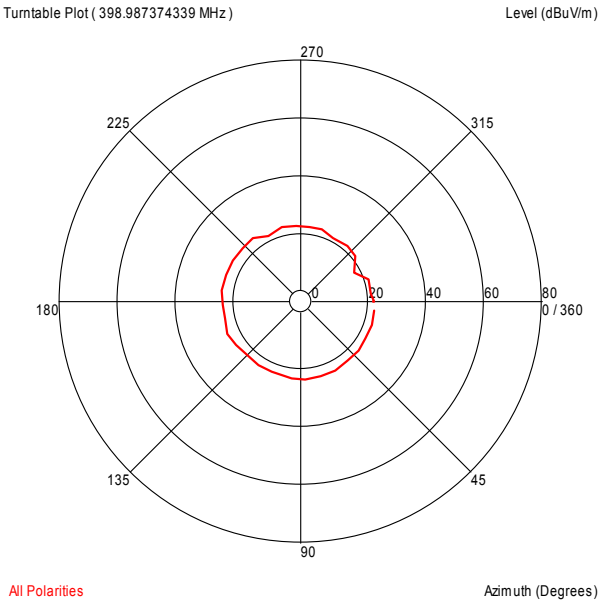
Turntable Plots

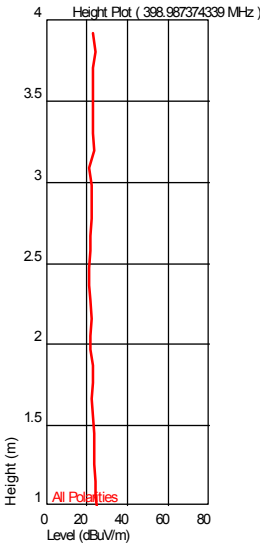


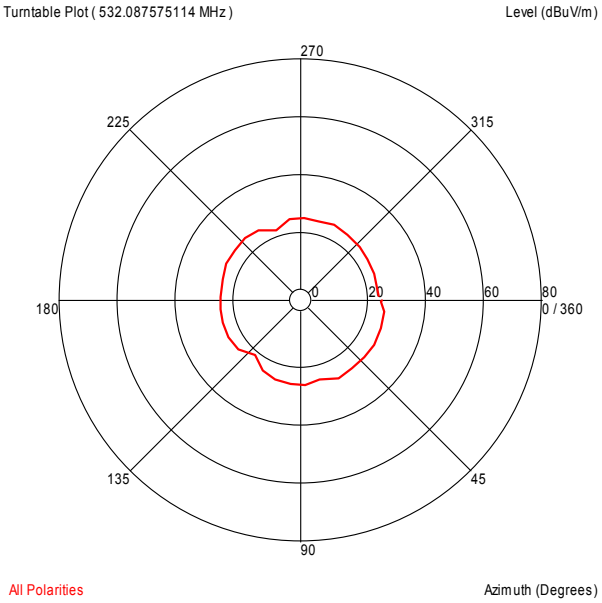


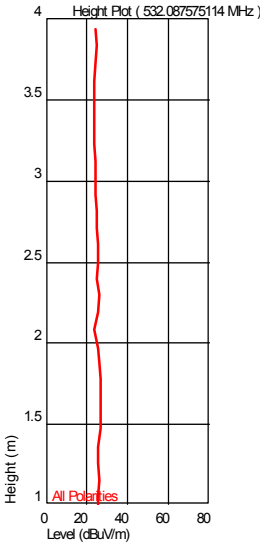

Turntable Plot (265.903407084 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)

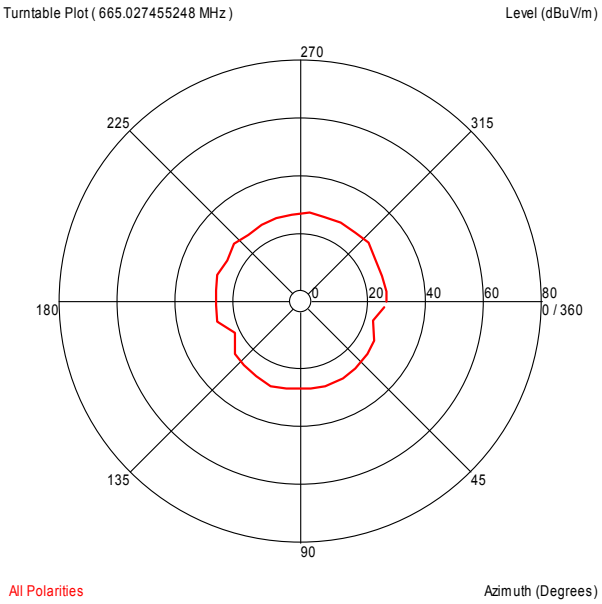

Height Plot (265.903407084 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

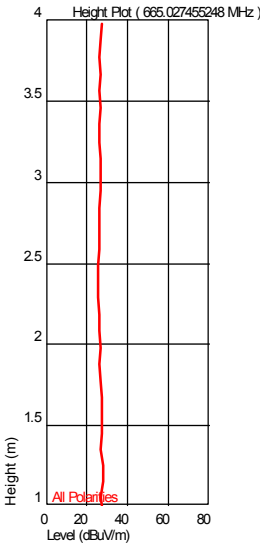

Turntable Plot (398.987374339 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (398.987374339 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)


Turntable Plot (532.087575114 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (532.087575114 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

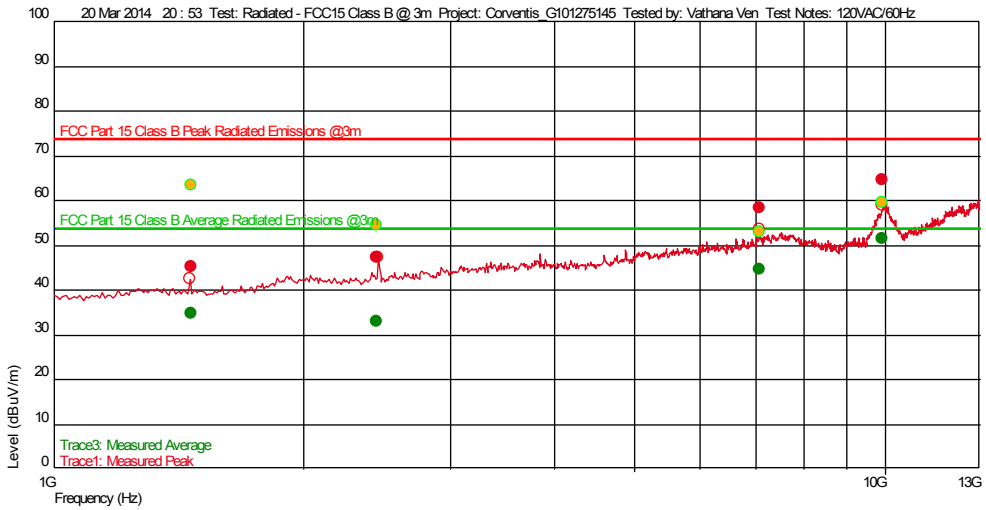

Turntable Plot (665.027455248 MHz)
Level (dBuV/m)
270
225
315
180
0
20
40
60
80
0 / 360
135
45
90
All Polarities
Azimuth (Degrees)


Height Plot (665.027455248 MHz)
4
3.5
3
2.5
2
1.5
1
Height (m)
All Polarities
0
20
40
60
80
Level (dBuV/m)

Test Information

Test Details	User Entry	Additional Information
Test:	Radiated - FCC15 Class B @ 3m	
Project:	Corventis_G101275145	
Test Notes:	120VAC/60Hz, Rx mode CH39	
Temperature:	20 deg C	
Humidity:	24%, 998 mB	
Tested by:	Vathana Ven	
Test Started:	20 Mar 2014 20 : 53	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

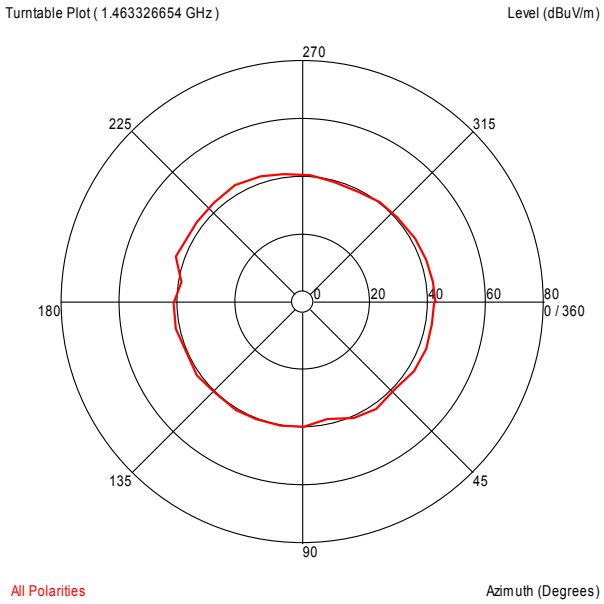
Trace1: Measured Peak

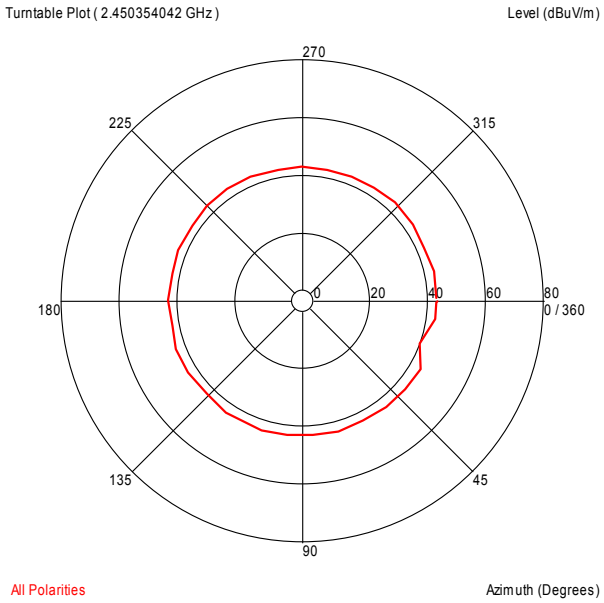
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
1.463326654 G	45.15	28.468	-27.883	74.000	-28.85	--	228	2.19	1 M	
2.450354042 G	47.38	32.226	-27.581	74.000	-26.62	--	41	1.87	1 M	
7.069465598 G	58.33	35.766	-21.471	74.000	-15.67	|	174	2.65	1 M	
9.937094189 G	64.75	37.124	-16.000	74.000	-9.25	|	151	1.55	1 M	

Trace3: Measured Average

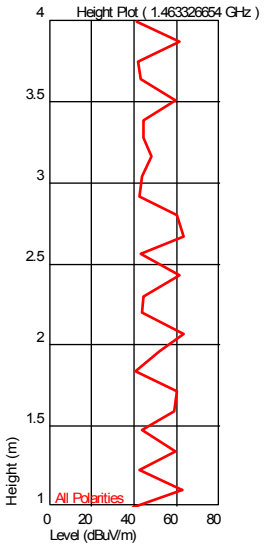
Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--), Ver (|)	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
2.450354042 G	33.06	32.226	-27.581	54.000	-20.94	--	41	1.87	1 M	
1.463326654 G	34.66	28.468	-27.883	54.000	-19.34	--	228	2.19	1 M	
7.069465598 G	44.72	35.766	-21.471	54.000	-9.28	|	174	2.65	1 M	
9.937094189 G	51.41	37.124	-16.000	54.000	-2.59	|	151	1.55	1 M	

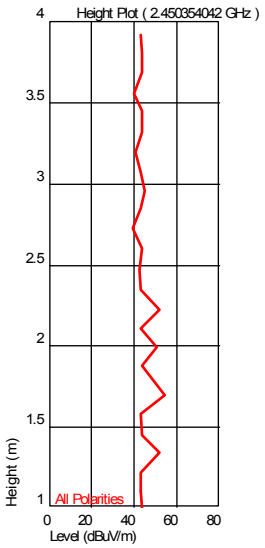
Azimuth Plots

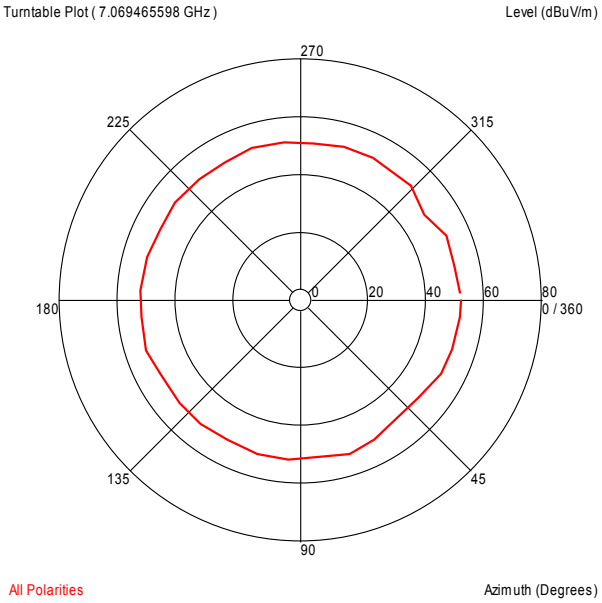


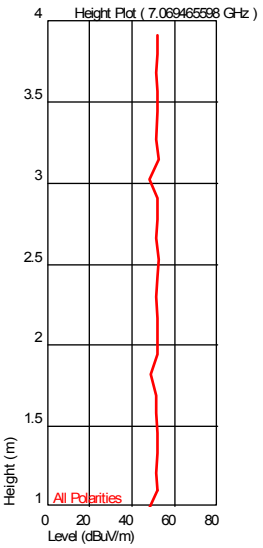


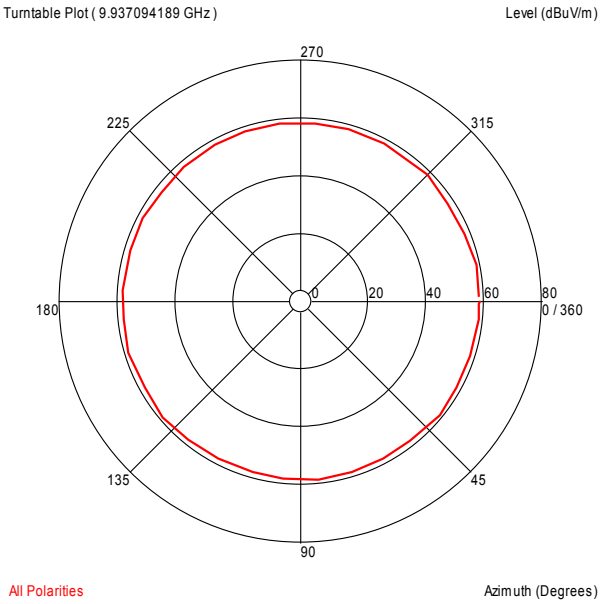
Turntable Plots

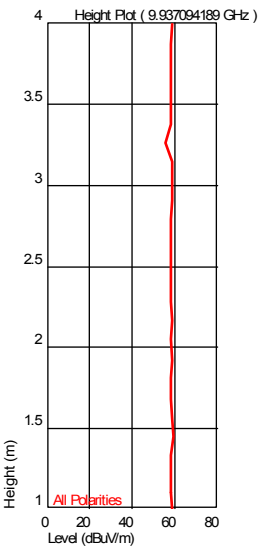












Test Personnel:	Vathana Ven VSV	Test Date:	03/14/2014
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247, RSS-Gen, RSS-210	Limit Applied:	Below specified limits
Input Voltage:	Internal Battery Powered, 120VAC/60Hz	Ambient Temperature:	20ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	24%
		Atmospheric Pressure:	998mbars

Deviations, Additions, or Exclusions: None

14 AC Mains Conducted Emissions

14.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10, RSS-Gen, RSS-210.

TEST SITE: EMC Lab

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

Measurement Uncertainty

For conducted emissions, U_{lab} (3.1 dB in worst case) < U_{CISPR} (3.6 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

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 or ISN 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
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

14.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
NAR006'	EMI CISPR Receiver	NARDA	PMM 9010	696WW30303	04/16/2013	04/16/2014
CBLBNC2012-7'	50 Ohm Coaxial Cable	Pomona	RG58C/U	CBLBNC2012-7	11/13/2013	11/13/2014
LISN-30'	Line Impedance Stabilization Network 50uH 50 Ω	Com Power	LI215A	191961	02-26-2014	02-26-2015
DS26A'	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS26A	10/04/2013	10/04/2014

Software Utilized:

Name	Manufacturer	Version
PMM Emission Suite	Narda	2.05

14.3 Results:

The sample tested was found to Comply.

14.4 Setup Photograph:

14.5 Test Data:

Conducted Emissions

Company: Corventis
Model #: zLink
Serial #: 015821
Engineer(s): Vathana Ven
Project #: G101275145
Note:
Standard: FCC Part 15 Subpart C 15.247
Barometer: SAF1083

Date: 03/12/14
Tx mode
Temp/Humidity/Pressure: 23 deg C 41% 1004 mB
Voltage/Frequency: 120VAC/60Hz

Location: 10m Chamber
Frequency Range: 0.150-30MHz

Receiver: EMI CIPR Receiver (NAR006) 04-16-2014
Cable: CBLBNC2012-7 11-13-14.txt
LISN 1: LISN30 (1) 02-26-2015.txt
LISN 2: LISN30 (2) 02-26-2015.txt
LISN 3: NONE.
LISN 4: NONE.
Attenuator: DS26A 10-04-2014.txt

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	0.620	29.74	26.50			50.01	56.00	-5.99	9/30 kHz
QP	0.635	24.51	24.11			44.78	56.00	-11.22	9/30 kHz
QP	0.650	22.00	21.80			42.27	56.00	-13.73	9/30 kHz
QP	0.665	21.00	21.09			41.36	56.00	-14.64	9/30 kHz
QP	1.065	23.67	20.80			43.98	56.00	-12.02	9/30 kHz
QP	1.105	20.80	20.80			41.11	56.00	-14.89	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	0.620	23.00	21.00			43.27	46.00	-2.73	9/30 kHz
AVG	0.635	18.00	17.80			38.27	46.00	-7.73	9/30 kHz
AVG	0.650	16.00	14.50			36.27	46.00	-9.73	9/30 kHz
AVG	0.665	14.00	13.00			34.27	46.00	-11.73	9/30 kHz
AVG	1.065	19.50	15.00			39.81	46.00	-6.19	9/30 kHz
AVG	1.105	13.00	14.50			34.81	46.00	-11.19	9/30 kHz

Conducted Emissions

Company: Corventis
Model #: zLink
Serial #: 015821
Engineer(s): Vathana Ven
Project #: G101275145 Date: 03/12/14
Note: Rx mode
Standard: FCC Part 15 Subpart C 15.247
Barometer: SAF1083 Temp/Humidity/Pressure: 23 deg C 41% 1004 mB
Voltage/Frequency: 120VAC/60Hz Frequency Range: 0.150-30MHz
Location: 10m Chamber

Receiver: EMI CIPR Receiver (NAR006) 04-16-2014
Cable: CBLBNC2012-7 11-13-14.txt
LISN 1: LISN30 (1) 02-26-2015.txt
LISN 2: LISN30 (2) 02-26-2015.txt
LISN 3: NONE.
LISN 4: NONE.
Attenuator: DS26A 10-04-2014.txt

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	0.205	21.32	25.05			45.31	63.41	-18.10	9/30 kHz
QP	0.610	27.48	23.80			47.75	56.00	-8.25	9/30 kHz
QP	0.625	29.14	25.00			49.41	56.00	-6.59	9/30 kHz
QP	0.640	23.97	21.00			44.24	56.00	-11.76	9/30 kHz
QP	4.300	20.90	21.21			41.67	56.00	-14.33	9/30 kHz
QP	4.640	21.26	24.82			45.29	56.00	-10.71	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	0.205	16.00	22.80			43.06	53.41	-10.35	9/30 kHz
AVG	0.610	20.50	18.00			40.77	46.00	-5.23	9/30 kHz
AVG	0.625	21.00	19.20			41.27	46.00	-4.73	9/30 kHz
AVG	0.640	16.80	15.80			37.07	46.00	-8.93	9/30 kHz
AVG	4.300	8.60	16.00			36.46	46.00	-9.54	9/30 kHz
AVG	4.640	14.00	20.50			40.97	46.00	-5.03	9/30 kHz

Test Personnel: Vathana Ven VSV
Test Date: 03/12/2014
Supervising/Reviewing Engineer: (Where Applicable) N/A
Product Standard: CFR47 FCC Part 15.247, RSS-Gen, RSS-210
Limit Applied: Below specified limits
Input Voltage: Internal Battery Powered, 120VAC/60Hz
Ambient Temperature: 24ºC
Pretest Verification w/ Ambient Signals or BB Source: BB Source
Relative Humidity: 42%
Atmospheric Pressure: 1007mbars

Deviations, Additions, or Exclusions: None

15 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	03/30/2014	101275145BOX-009	VFV	KPS	Original Issue