EMISSIONS TEST REPORT

Report Number: 100442884BOX-005
Project Number: G100442884

Report Issue Date: 11/30/2011

Product Designation: SINELINK 24G Point-to-Point Radio, Model: HP5-120100

Standards: **CFR47 "Telecommunications" FCC Part 15 Subpart C "Intentional Radiators" 15.249**
CFR47 "Telecommunications" FCC Part 15 Subpart B "Unintentional Radiators"
IC RSS-210 Issue 8 December 2010 "Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment" Annex 12 "Fixed Point-to-Point Systems in the Band 24.05-24.25 GHz"
IC RSS-Gen Issue 3 December 2010 "General Requirements and Information for the Certification of Radio Apparatus"

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

Tested at the request of:
Hitachi Kokusai Electric America, Ltd.
150 Crossways Park Drive
Woodbury, NY 11797

Applicant:
Hitachi Kokusai Electric Inc.
4-14-1 Sotokanda,
Chiyoda-ku, Tokyo 101-8980, Japan

Report prepared by Reviewer

Nicholas Abbondante/Staff Engineer

Report reviewed by

Kouma Sinn/Senior Project Engineer

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. 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	Fundamental Field Strength (FCC Part 15 Subpart C 15.249(b)(1); IC RSS-210 Annex 12(a))	Pass
7	Occupied Bandwidth (FCC Part 15 Subpart C 15.215 and IC RSS-Gen Section 4.6)	Pass
8	Transmitter Radiated Emissions, 30 MHz – 40 GHz (FCC Part 15 Subpart C 15.249(d), IC RSS-210 Annex 12(d))	Pass
9	Transmitter Radiated Emissions, 40-100 GHz (FCC Part 15 Subpart C 15.249(d), IC RSS-210 Annex 12(d))	Pass
10	Receiver Radiated Emissions (FCC Part 15 Subpart B 15.109, IC RSS-Gen Section 6.0)	Pass
11	Frequency Stability (FCC Part 15 Subpart C 15.249(b)(2), IC RSS-210 Annex 12(b))	Pass
12	AC Mains Conducted Emissions (FCC Part 15 Subpart C 15.207, IC RSS-Gen Section 7.2.4)	Pass
13	Revision History	

3 Client Information

This EUT was tested at the request of:

Company: Hitachi Kokusai Electric America, Ltd.
150 Crossways Park Drive
Woodbury, NY 11797
Contact: Mr. Yoshiya Hashimoto
Telephone: (516) 682-4428
Fax: (516) 496-3718
Email: yoshiya.hashimoto@hitachikokusai.us

This testing was performed on the behalf of the applicant:

Company: Hitachi Kokusai Electric Inc.
4-14-1 Sotokanda,
Chiyoda-ku, Tokyo 101-8980, Japan
Contact: Mr. Shigeto Takada
Telephone: +81-3-6734-9502
Fax: +81-3-5209-5942
Email: takada.shigeto@h-kokusai.com

4 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
SINELINK 24GHz Point-to-Point Radio	Hitachi Kokusai Electric America, Ltd.	HP5-120100	CS001
SINELINK 24GHz Point-to-Point Radio	Hitachi Kokusai Electric America, Ltd.	HP5-120100	CS006

Receive Date:	07/08/2011
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The SINELINK 24G is a 24 GHz point-to-point radio with an integral Patch antenna used to transfer data. It utilizes QPSK, QAM16, and QAM64 modulation. It is powered over the Ethernet from a Power-over-Ethernet (PoE) device.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
3.3V PoE	Not Labeled	DC	None

Operating modes of the EUT:

No.	Descriptions of EUT Exercising using SL24GTT Test Tool
1	During transmit mode testing, the transmitter was operated with a modulated carrier. During pretesting, QPSK modulation was determined to be the worst-case. The EUT was powered from the PoE support equipment, which was powered from 120V/60Hz
2	During receive mode testing, the transmitter was placed in receive mode. The EUT was powered from the PoE support equipment, which was powered from 120V/60Hz
3	For frequency stability testing, a CW carrier was utilized. The EUT was powered from the PoE support equipment, which was powered from 120V/60Hz. Voltage variations were performed on the AC input to the PoE device.

5 System Setup and Method

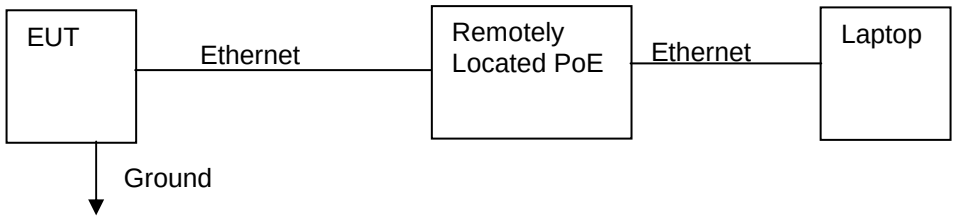
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
	Ethernet	1.9m	Foil	None	EUT-PoE
	Ground	~1.5m	None	None	EUT-Ground

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	Toshiba	Tecra	N/A
Power over Ethernet Injector	Buffalo	BIJ-POE-1P	N/A

5.1 Method:

Configuration as required by ANSI C63.4:2003.

5.2 EUT Block Diagram:



6 Fundamental Field Strength

6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C and IC RSS-210.

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 wooden 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:

Duty Cycle Measurement, 07/29/2011

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
~DAV002	Weather Station	Davis Instruments	7400	PE80519A93	08/12/2010	08/12/2011
~EMC04	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	01/25/2011	01/25/2012
~145-416	Cables 145-400 145-408 145-402 145-404	Huber + Suhner	3m Track B cables	multiple	08/31/2010	08/31/2011
~145128	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	08/10/2010	08/10/2011

Fundamental Measurement, 09/28/2011

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
~DAV003	Weather Station	Davis Instruments	7400	PE80529A39A	08/02/2011	08/02/2012
~EMC04	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	01/25/2011	01/25/2012
~CBL030	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	01/06/2011	01/06/2012
~ROS001	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	01/13/2011	01/13/2012

Software Utilized:

Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2011

6.3 Results:

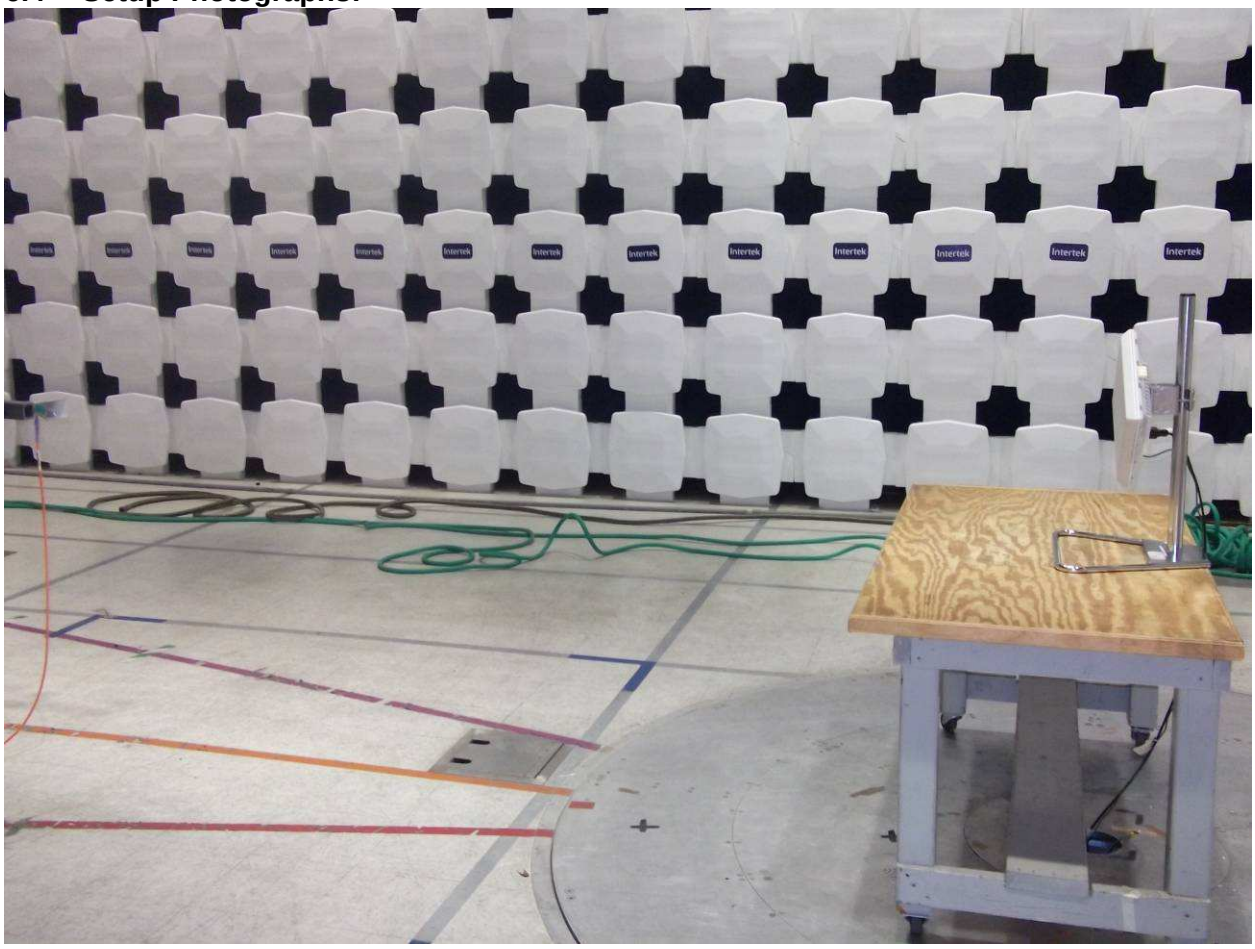
Average results were obtained from peak readings by applying a 49.2% duty cycle correction factor (6.15 dB). Results are presented in two ways. First, the integrated power across the emission bandwidth was measured and then converted back from a dBm measurement to a dBuV measurement, adjusted for antenna factors, cable loss, and preamp factors and compared to the limits. Second, the field strength in a 1 MHz RBW was measured and compared to the limits without integrating across the emissions bandwidth. In both cases the requirements were met.

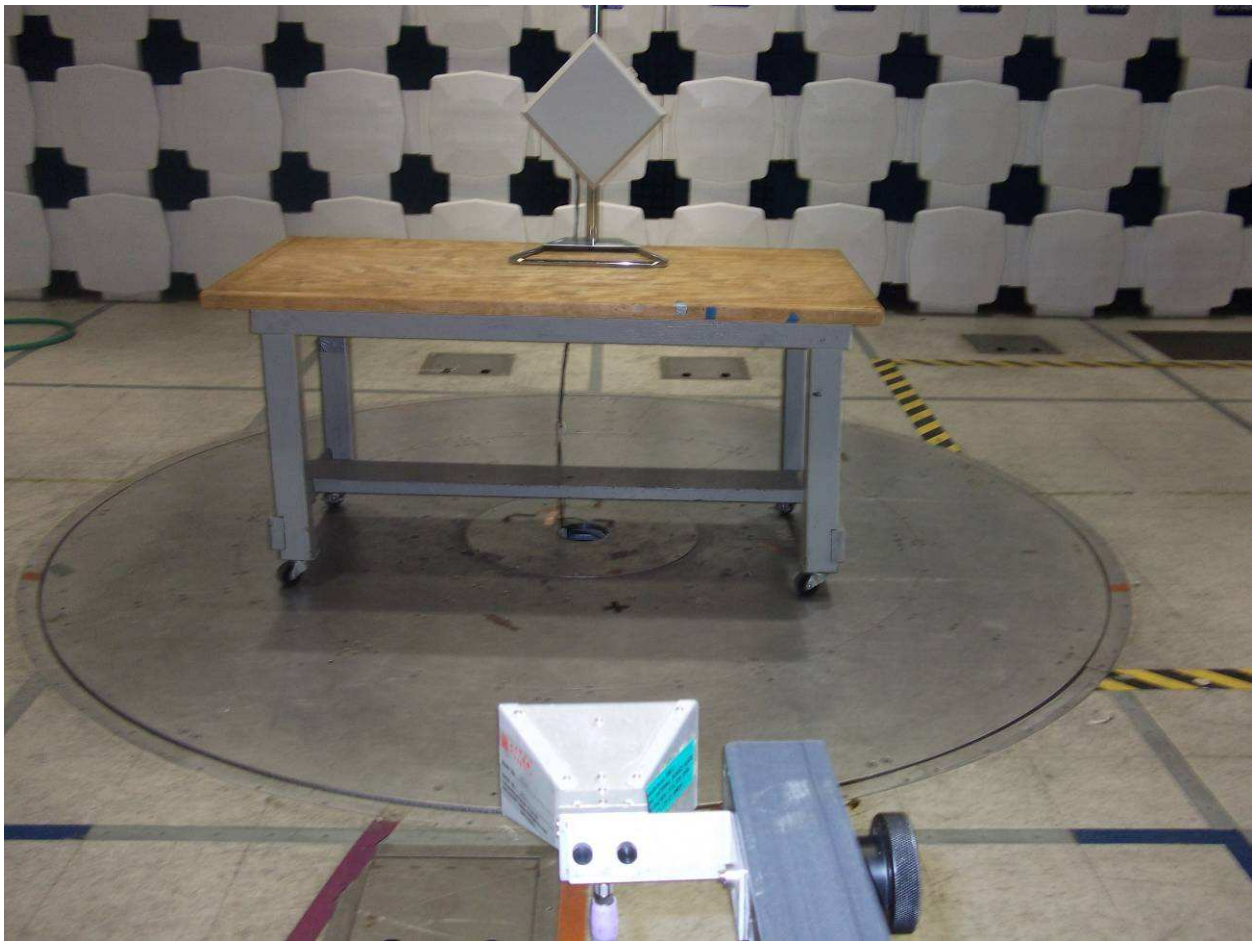
FCC Part 15 Subpart C 15.249(b)(1) & (e):
The average field strength of emissions in this band shall not exceed 2500 millivolts/meter (128 dBuV/m). For point-to-point operation the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth. Results are based on field strength in a 1 MHz resolution bandwidth.

IC RSS-210 Annex 12
(a) The field strength of emissions in this band shall not exceed 25 V/m (148 dBuV/m) measured at a distance of 3 metres. The power delivered to the antenna shall not exceed 1 mW.
(e) The field strength limit in (a) of this section is based on average limit. However, the peak field strength shall not exceed 25 V/m measured at 3 metres along the antenna boresight.
Results are based on the full power in the full emission bandwidth.

The sample tested was found to Comply.

6.4 Setup Photographs:





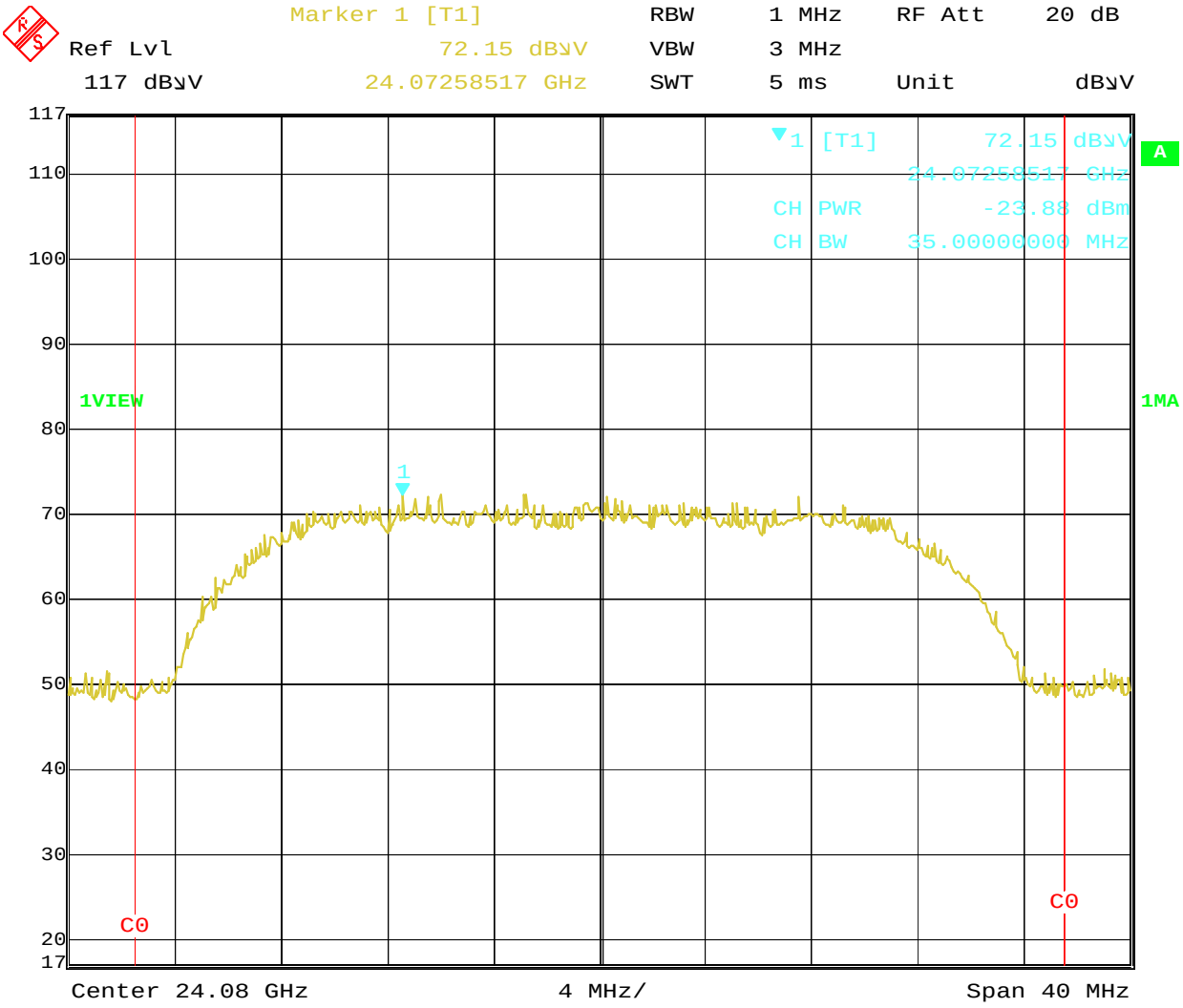
6.5 Plots/Data:

Intertek

Radiated Emissions

Company: Hitachi Kokusai Electric America, Ltd. Antenna & Cables: SHF Bands: N, LF, HF, SHF
Model #: HP5-120100 Antenna: EMC04 V3m 01-25-2012.txt EMC04 H3m 01-25-2012.txt
Serial #: CS006 Cable(s): CBL030 01-06-2012.txt NONE.
Engineers: Nicholas Abbondante Location: 10m chamber Barometer: DAV003 Filter: NONE
Project #: G100442884 Date(s): 09/28/11
Standard: FCC Part 15 Subpart C 15.249 P-P/IC RSS-210 Temp/Humidity/Pressure: 20c 64% 1006mB
Receiver: R&S FSEK-30 (ROS001) 01-13-2012 Limit Distance (m): 3
PreAmp: NONE. Test Distance (m): 3
PreAmp Used? (Y or N): N Voltage/Frequency: PoE Frequency Range: Fundamental
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 dBuV	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: 1 dBm Tx setting in software													
Note: Duty cycle of 49.2% used to obtain average from peak measurements (-6.15 dB duty cycle correction factor)													
Industry Canada (power integration across a 35 MHz bandwidth used, then dBm+107 = dBuV used to obtain dBuV)													
Note: QPSK													
PK	V	24080.000	83.12	45.20	5.30	0.00	0.00	133.62	148.00	-14.38	1/3 MHz		
AVG	V	24080.000	76.97	45.20	5.30	0.00	0.00	127.47	148.00	-20.53	1/3 MHz		
PK	V	24140.000	83.14	45.25	5.33	0.00	0.00	133.72	148.00	-14.28	1/3 MHz		
AVG	V	24140.000	76.99	45.25	5.33	0.00	0.00	127.57	148.00	-20.43	1/3 MHz		
PK	V	24220.000	83.23	45.31	5.38	0.00	0.00	133.92	148.00	-14.08	1/3 MHz		
AVG	V	24220.000	77.08	45.31	5.38	0.00	0.00	127.77	148.00	-20.23	1/3 MHz		
Note: 16QAM													
PK	V	24080.000	82.90	45.20	5.30	0.00	0.00	133.40	148.00	-14.60	1/3 MHz		
AVG	V	24080.000	76.75	45.20	5.30	0.00	0.00	127.25	148.00	-20.75	1/3 MHz		
PK	V	24140.000	83.14	45.25	5.33	0.00	0.00	133.72	148.00	-14.28	1/3 MHz		
AVG	V	24140.000	76.99	45.25	5.33	0.00	0.00	127.57	148.00	-20.43	1/3 MHz		
PK	V	24220.000	82.61	45.31	5.38	0.00	0.00	133.30	148.00	-14.70	1/3 MHz		
AVG	V	24220.000	76.46	45.31	5.38	0.00	0.00	127.15	148.00	-20.85	1/3 MHz		
Note: 64QAM													
PK	V	24080.000	82.50	45.20	5.30	0.00	0.00	133.00	148.00	-15.00	1/3 MHz		
AVG	V	24080.000	76.35	45.20	5.30	0.00	0.00	126.85	148.00	-21.15	1/3 MHz		
PK	V	24140.000	83.01	45.25	5.33	0.00	0.00	133.59	148.00	-14.41	1/3 MHz		
AVG	V	24140.000	76.86	45.25	5.33	0.00	0.00	127.44	148.00	-20.56	1/3 MHz		
PK	V	24220.000	82.26	45.31	5.38	0.00	0.00	132.95	148.00	-15.05	1/3 MHz		
AVG	V	24220.000	76.11	45.31	5.38	0.00	0.00	126.80	148.00	-21.20	1/3 MHz		
Note: FCC (field strength measured using a 1 MHz RBW without integration)													
Note: QPSK													
PK	V	24080.000	72.15	45.20	5.30	0.00	0.00	122.65	128.00	-5.35	1/3 MHz		
AVG	V	24080.000	66.00	45.20	5.30	0.00	0.00	116.50	128.00	-11.50	1/3 MHz		
PK	V	24140.000	73.22	45.25	5.33	0.00	0.00	123.80	128.00	-4.20	1/3 MHz		
AVG	V	24140.000	67.07	45.25	5.33	0.00	0.00	117.65	128.00	-10.35	1/3 MHz		
PK	V	24220.000	72.21	45.31	5.38	0.00	0.00	122.90	128.00	-5.10	1/3 MHz		
AVG	V	24220.000	66.06	45.31	5.38	0.00	0.00	116.75	128.00	-11.25	1/3 MHz		
Note: 16QAM													
PK	V	24080.000	71.78	45.20	5.30	0.00	0.00	122.28	128.00	-5.72	1/3 MHz		
AVG	V	24080.000	65.63	45.20	5.30	0.00	0.00	116.13	128.00	-11.87	1/3 MHz		
PK	V	24140.000	71.87	45.25	5.33	0.00	0.00	122.45	128.00	-5.55	1/3 MHz		
AVG	V	24140.000	65.72	45.25	5.33	0.00	0.00	116.30	128.00	-11.70	1/3 MHz		
PK	V	24220.000	71.46	45.31	5.38	0.00	0.00	122.15	128.00	-5.85	1/3 MHz		
AVG	V	24220.000	65.31	45.31	5.38	0.00	0.00	116.00	128.00	-12.00	1/3 MHz		
Note: 64QAM													
PK	V	24080.000	71.43	45.20	5.30	0.00	0.00	121.93	128.00	-6.07	1/3 MHz		
AVG	V	24080.000	65.28	45.20	5.30	0.00	0.00	115.78	128.00	-12.22	1/3 MHz		
PK	V	24140.000	71.94	45.25	5.33	0.00	0.00	122.52	128.00	-5.48	1/3 MHz		
AVG	V	24140.000	65.79	45.25	5.33	0.00	0.00	116.37	128.00	-11.63	1/3 MHz		
PK	V	24220.000	71.70	45.31	5.38	0.00	0.00	122.39	128.00	-5.61	1/3 MHz		
AVG	V	24220.000	65.55	45.31	5.38	0.00	0.00	116.24	128.00	-11.76	1/3 MHz		
Note: FCC CW													
PK	V	24080.000	75.01	45.20	5.30	0.00	0.00	125.51	128.00	-2.49	1/3 MHz		
AVG	V	24080.000	74.75	45.20	5.30	0.00	0.00	125.25	128.00	-2.75	1/3 MHz		
PK	V	24140.000	75.32	45.25	5.33	0.00	0.00	125.90	128.00	-2.10	1/3 MHz		
AVG	V	24140.000	75.04	45.25	5.33	0.00	0.00	125.62	128.00	-2.38	1/3 MHz		
PK	V	24220.000	74.55	45.31	5.38	0.00	0.00	125.24	128.00	-2.76	1/3 MHz		
AVG	V	24220.000	74.20	45.31	5.38	0.00	0.00	124.89	128.00	-3.11	1/3 MHz		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SWT 5 ms
Unit dBµV
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C0
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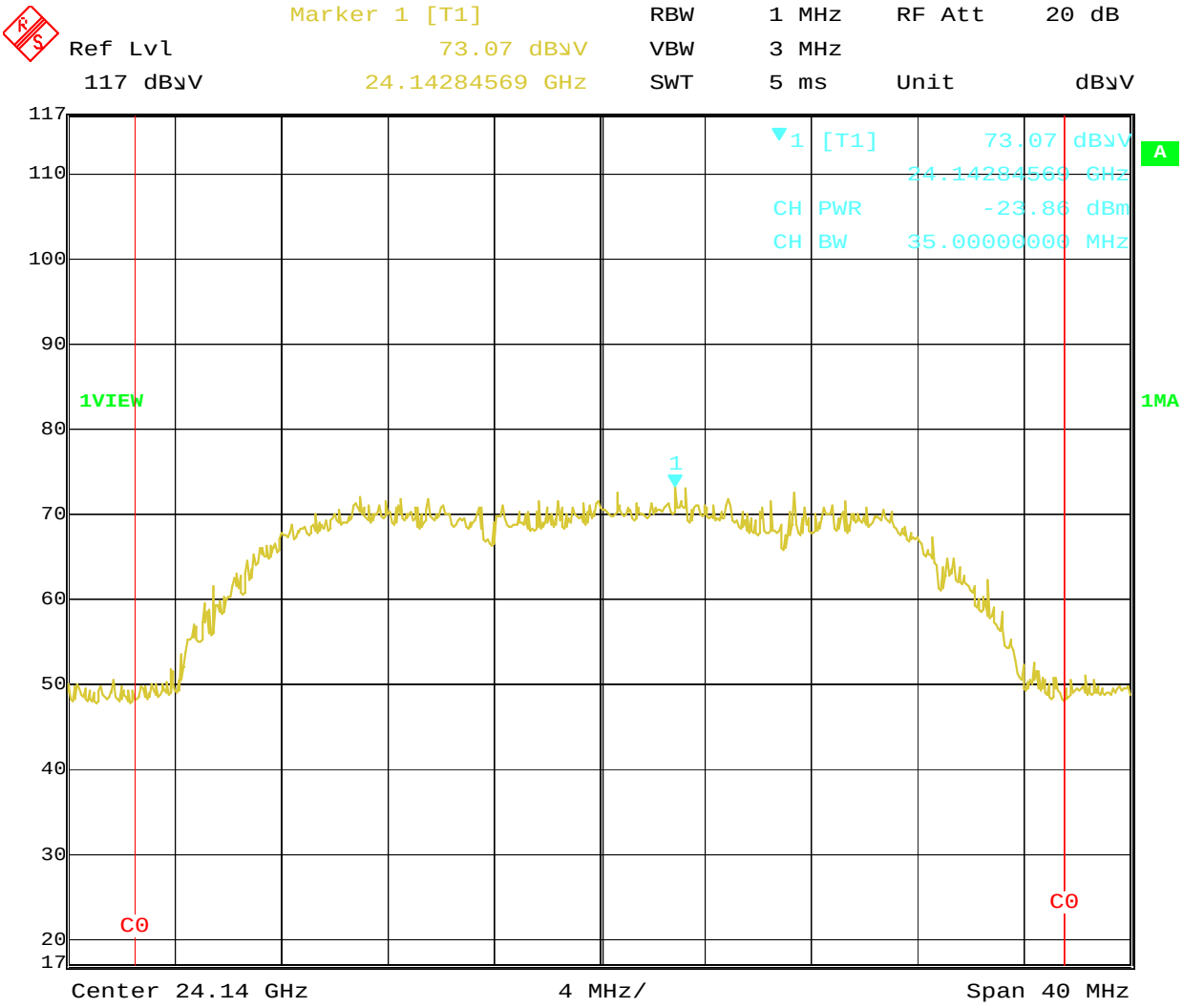
Ch1 QPSK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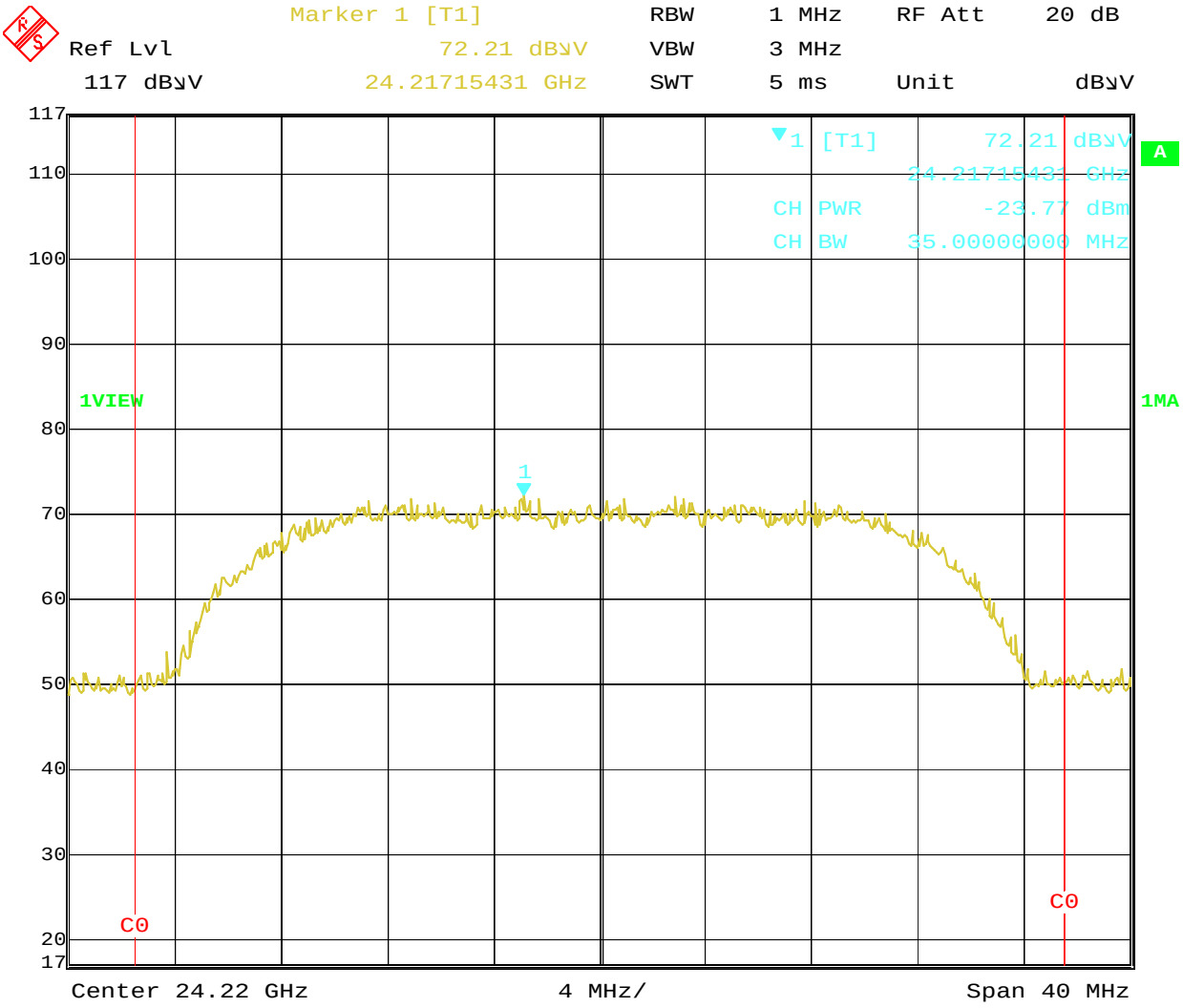
Ch4 QPSK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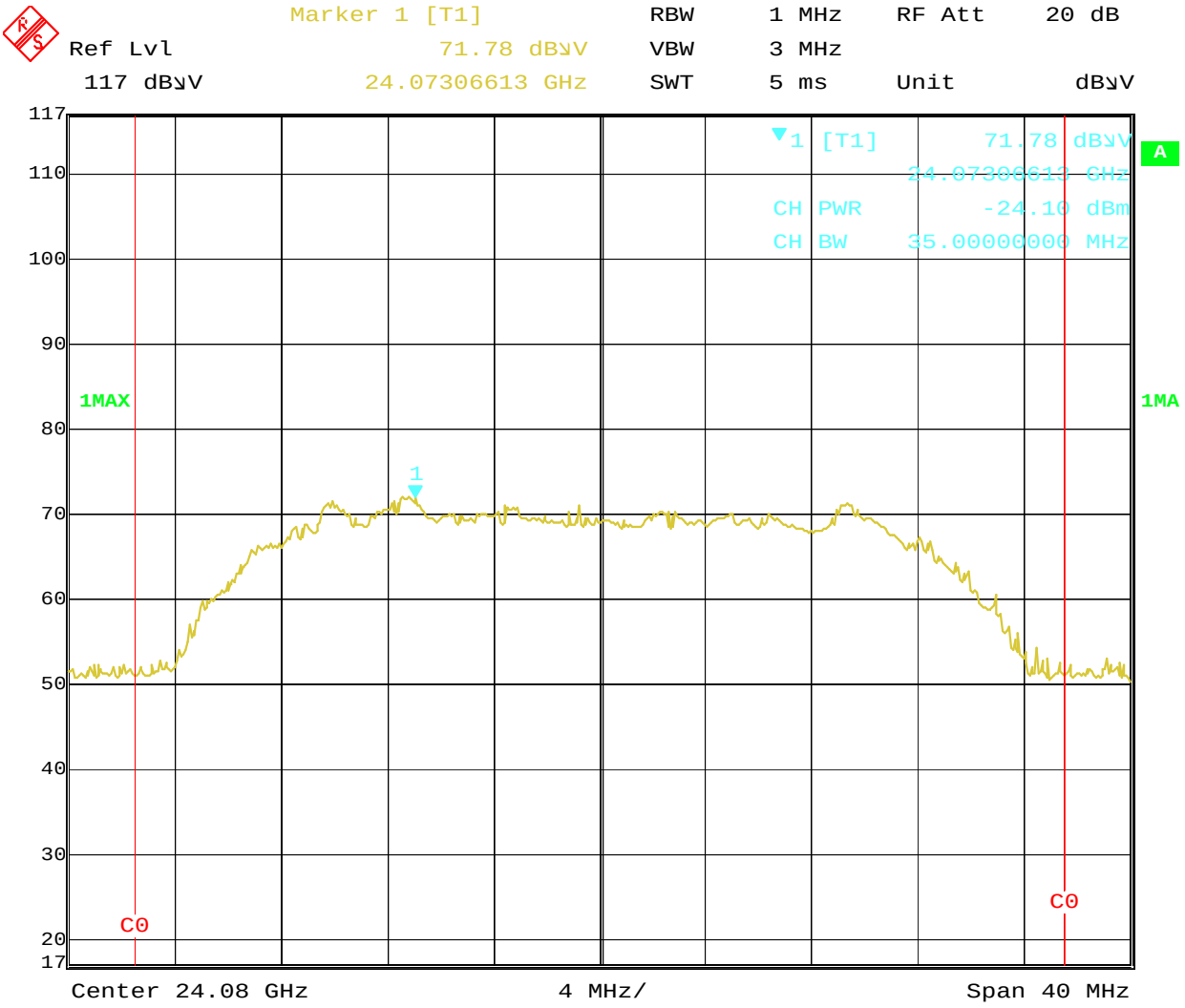
Ch8 QPSK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RF Att 20 dB
Ref Lvl
71.78 dBµV
VBW 3 MHz
117 dBµV
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24.07306613 GHz
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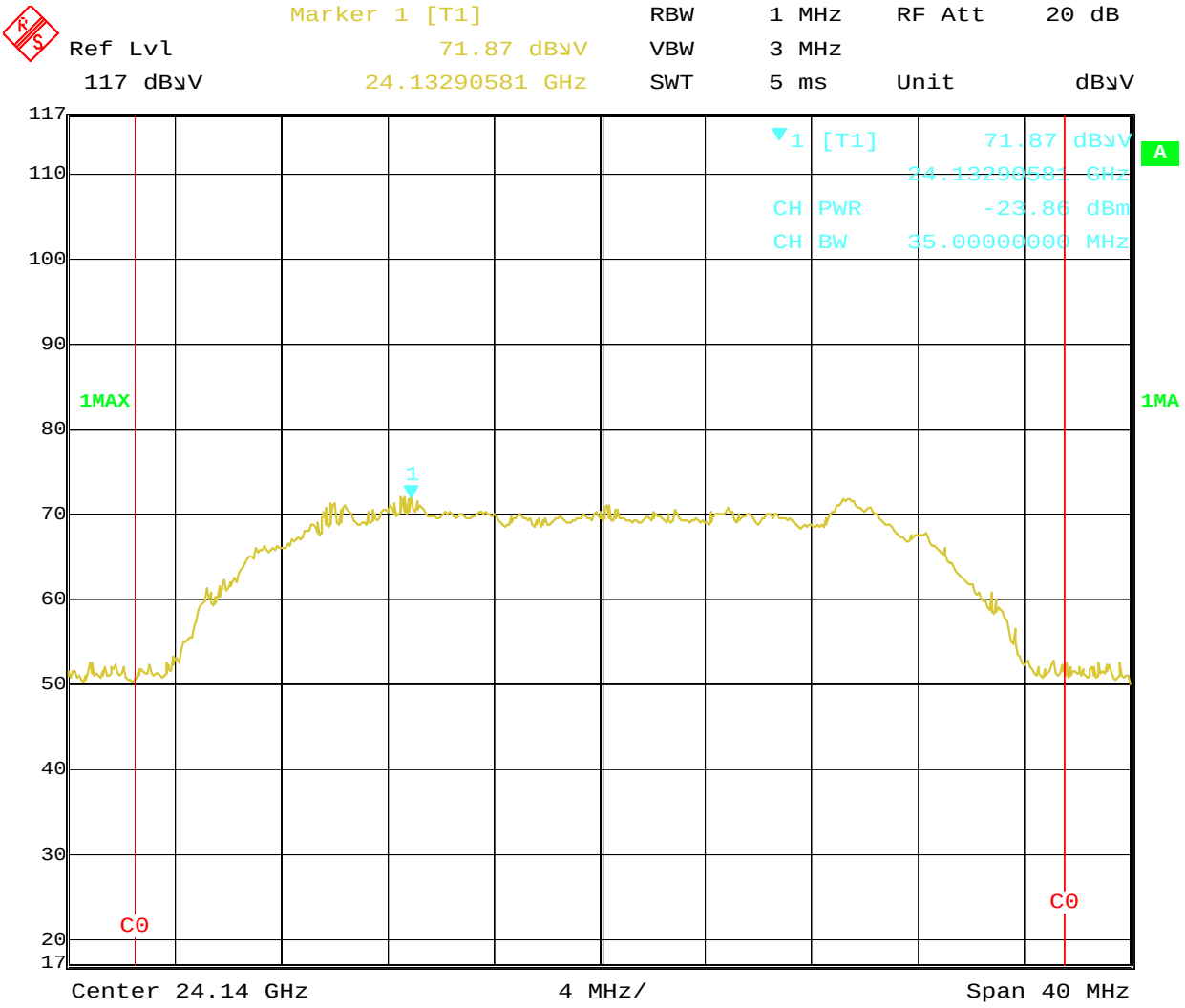
Ch1 QAM16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Unit dBµV
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24.13290581 GHz
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4 MHz/
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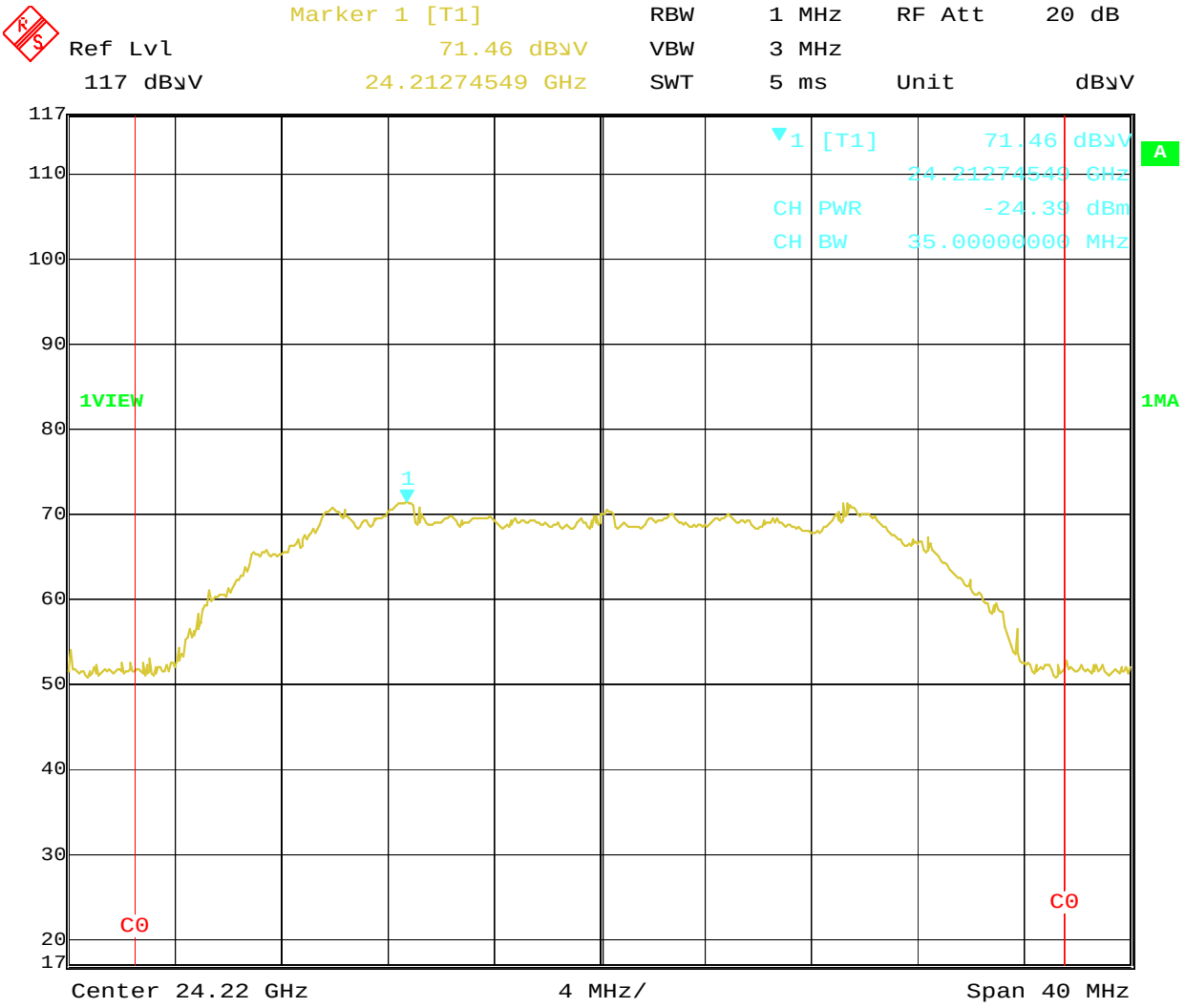
Ch4 QAM16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117 dBµV
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SWT 5 ms
Unit dBµV
1 [T1] 71.46 dBµV
24.21274549 GHz
CH PWR -24.39 dBm
CH BW 35.00000000 MHz
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C0
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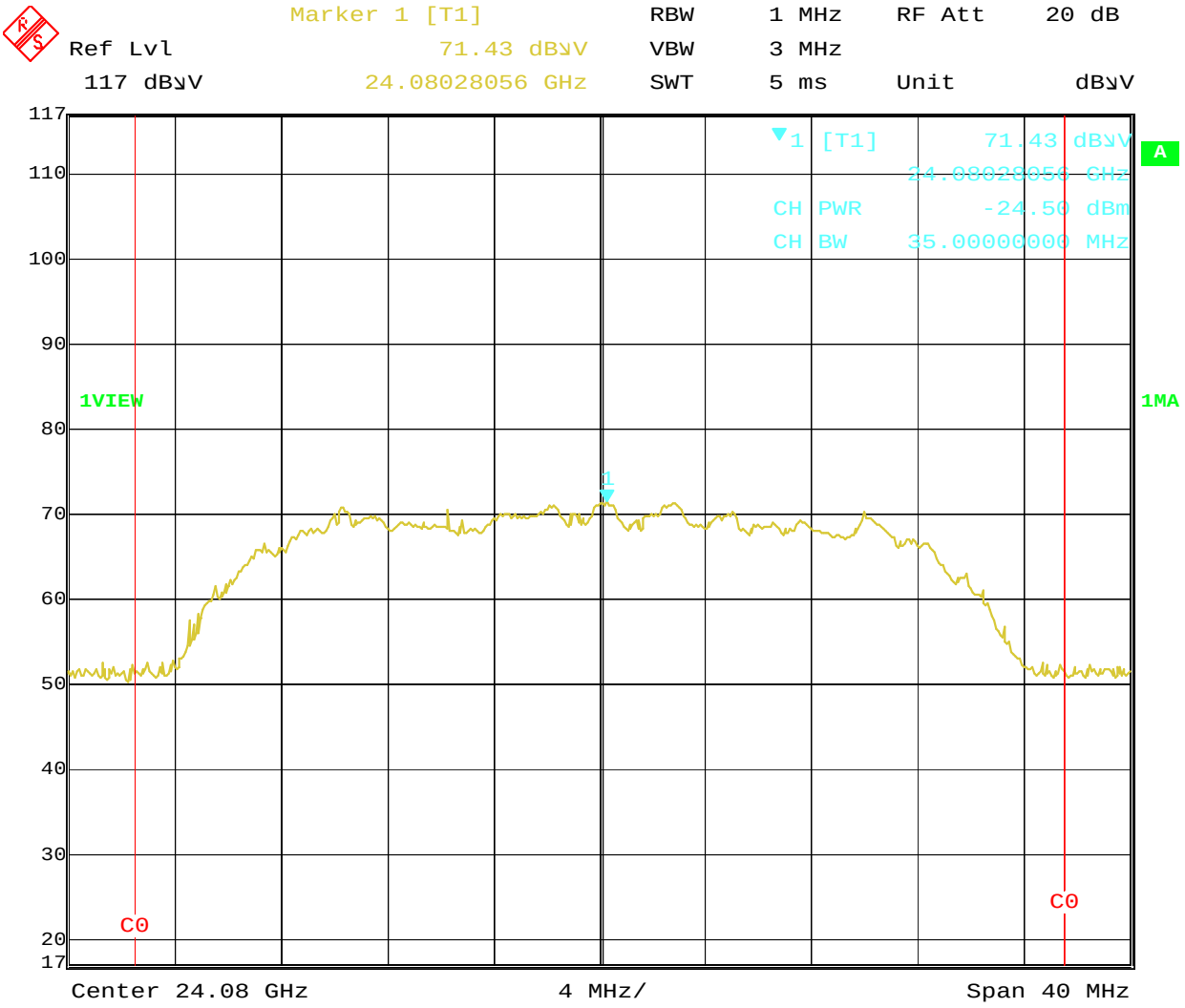
Ch8 QAM16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RF Att 20 dB
Ref Lvl
71.43 dBµV
VBW 3 MHz
117 dBµV
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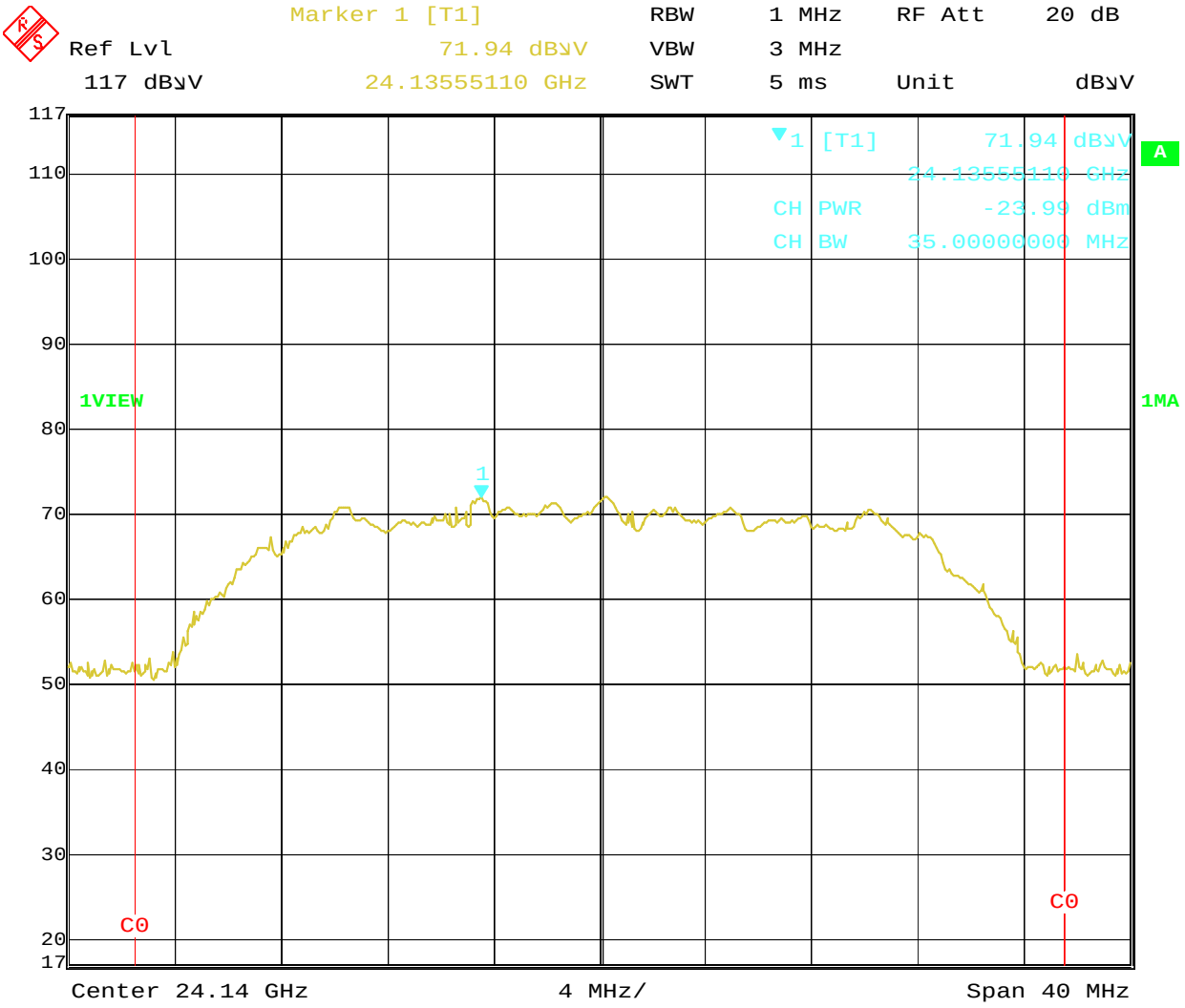
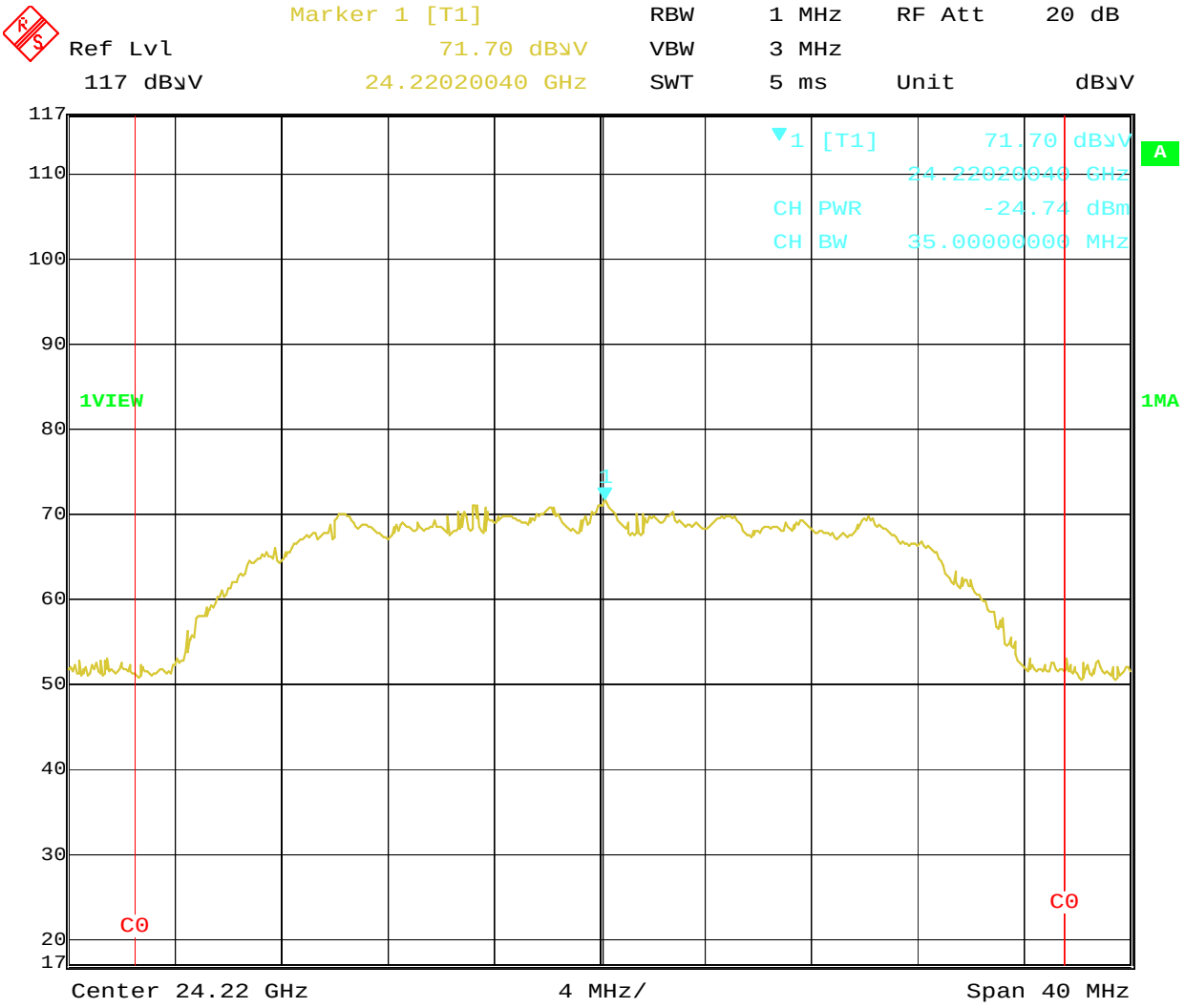
SWT 5 ms
Unit dBµV
1 [T1] 71.43 dBµV
24.08028056 GHz
CH PWR -24.50 dBm
CH BW 35.00000000 MHz
A
1VIEW
1MA
C0
C0
Center 24.08 GHz
4 MHz/
Span 40 MHz
Date: 28.SEP.2011 23:54:15

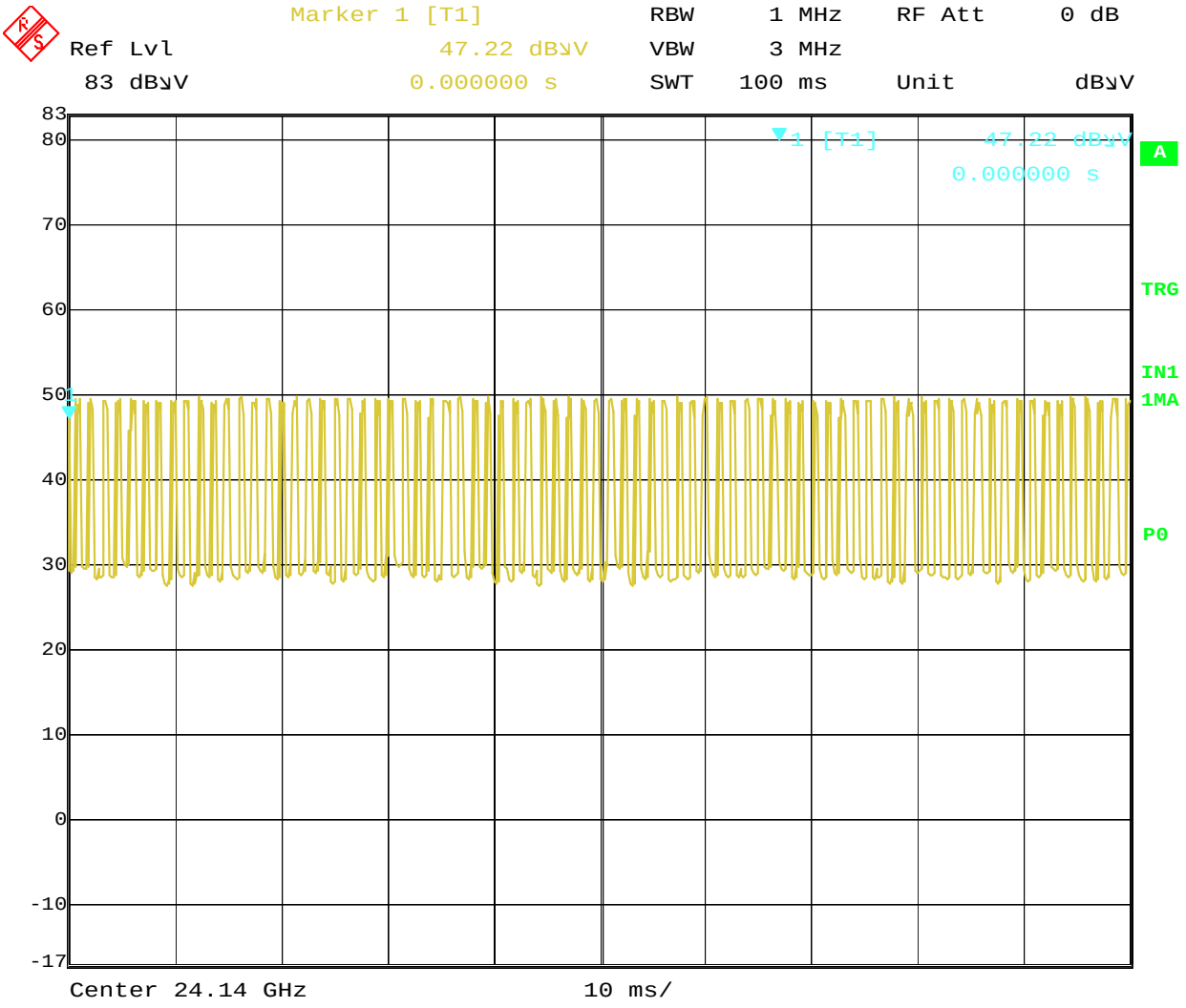
Ch1 QAM64


Marker 1 [T1]
RBW 1 MHz
RF Att 20 dB
Ref Lvl
71.94 dBµV
VBW 3 MHz
117 dBµV
24.13555110 GHz
SWT 5 ms
Unit dBµV
1 [T1] 71.94 dBµV
24.13555110 GHz
CH PWR -23.99 dBm
CH BW 35.00000000 MHz
A
1VIEW
1MA
C0
C0
Center 24.14 GHz
4 MHz/
Span 40 MHz
Date: 28.SEP.2011 23:34:04

Ch4 QAM 64

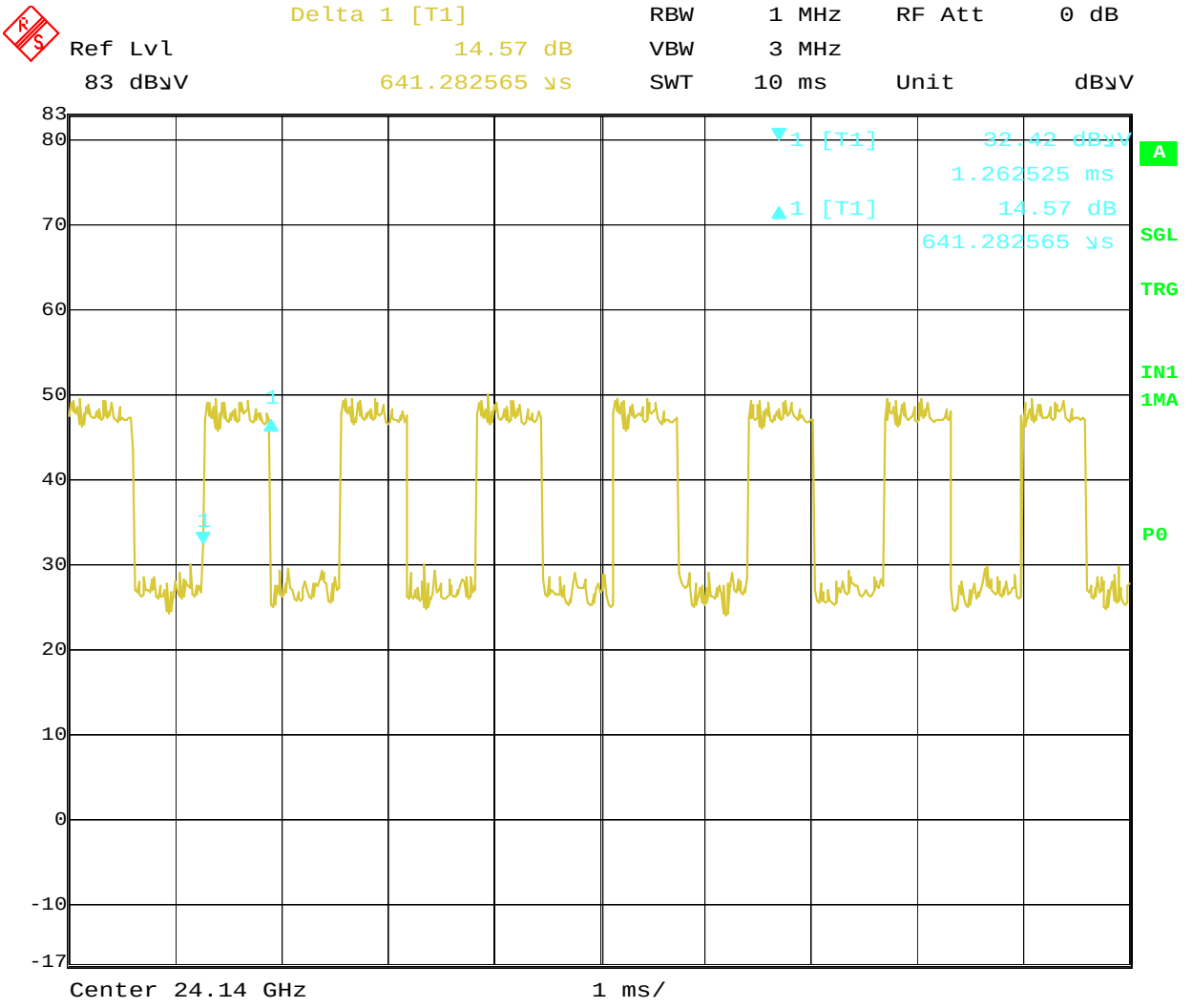

Marker 1 [T1]
RBW 1 MHz
RF Att 20 dB
Ref Lvl
71.70 dBµV
VBW 3 MHz
117 dBµV
24.22020040 GHz
SWT 5 ms
Unit dBµV
1 [T1] 71.70 dBµV
24.22020040 GHz
CH PWR -24.74 dBm
CH BW 35.00000000 MHz
A
1VIEW
1MA
C0
C0
117
110
100
90
80
70
60
50
40
30
20
17
Center 24.22 GHz
4 MHz/
Span 40 MHz
Date: 28.SEP.2011 23:59:58

Ch8 QAM64



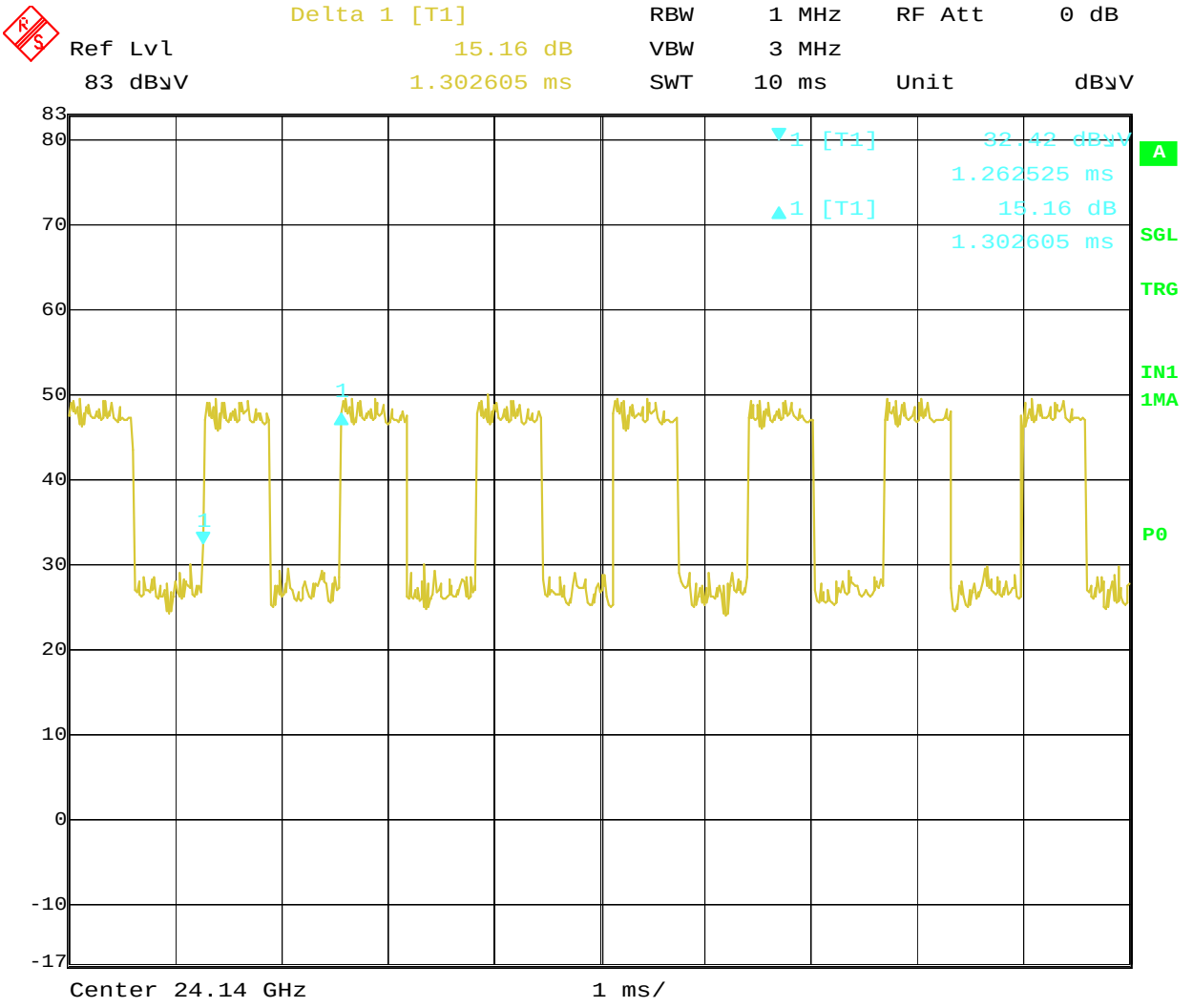
Date: 29.JUL.2011 00:17:39

Duty Cycle, 100ms



Date: 29.JUL.2011 00:19:16

Duty Cycle, Burst Length, 641.3 us



Duty Cycle, Burst Period, 1.302 ms

Test Personnel:	Nicholas Abbondante	Test Date:	07/29/2011, 09/28/2011
Supervising Engineer: (Where Applicable)	N/A	Test Levels:	See section 6.3
Product Standard:	FCC Part 15 Subpart C 15.249(b)(1); IC RSS-210 Annex 12(a)	Ambient Temperature:	20, 20 ºC
Input Voltage:	PoE	Relative Humidity:	67, 64 %
Pretest Verification w/ Ambient Signals or BB Source:	**Ambient**	Atmospheric Pressure:	1007, 1006 mbars

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth

7.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.215 and IC RSS-Gen Section 4.6.

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 wooden table 80 cm high is used for table-top equipment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
~DAV003	Weather Station	Davis Instruments	7400	PE80529A39A	08/02/2011	08/02/2012
~EMC04	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	01/25/2011	01/25/2012
~CBL030	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	01/06/2011	01/06/2012
~ROS001	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	01/13/2011	01/13/2012

Software Utilized:

Name	Manufacturer	Version
None		

7.3 Results:

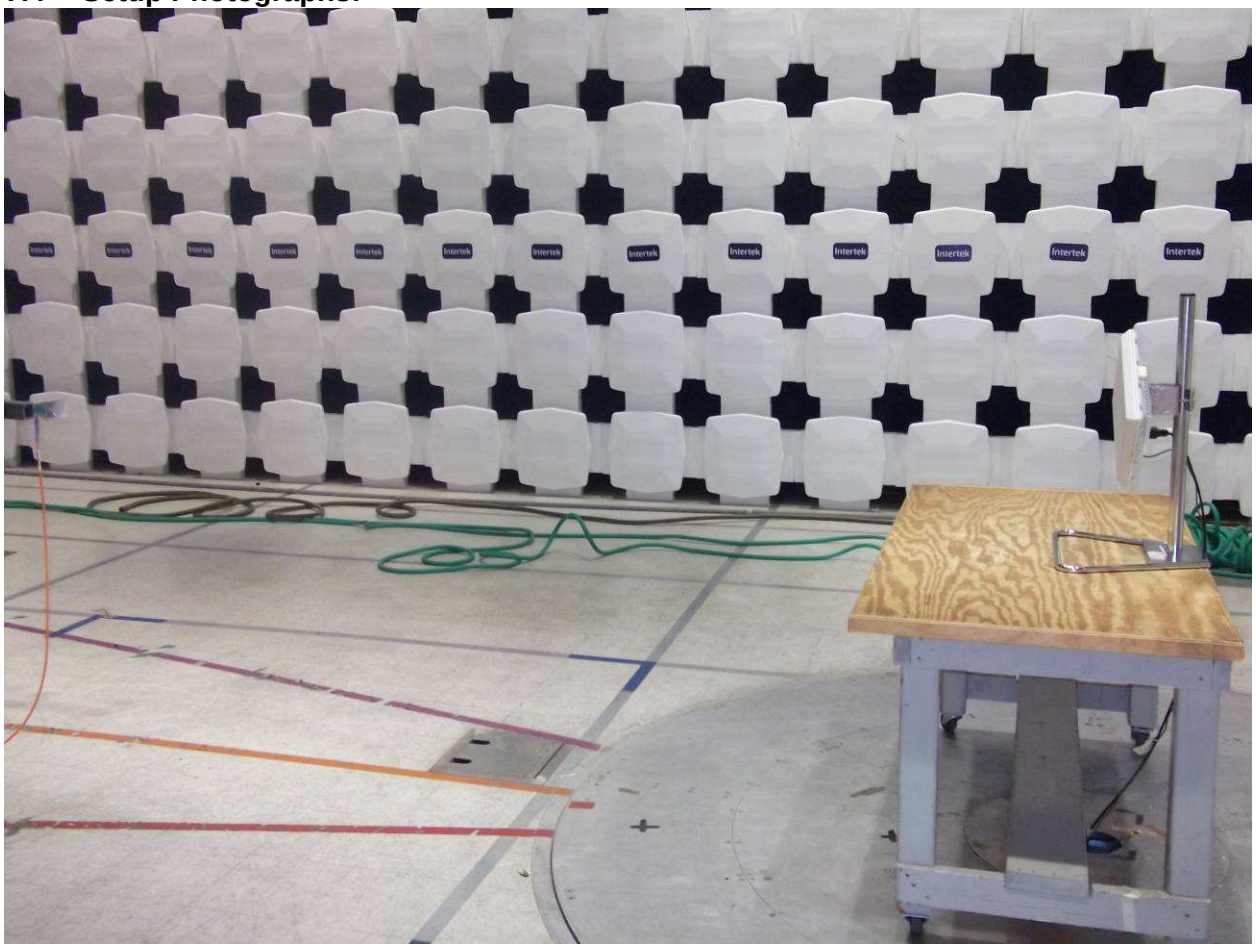
The 99% power occupied bandwidth must remain within the assigned frequency band.

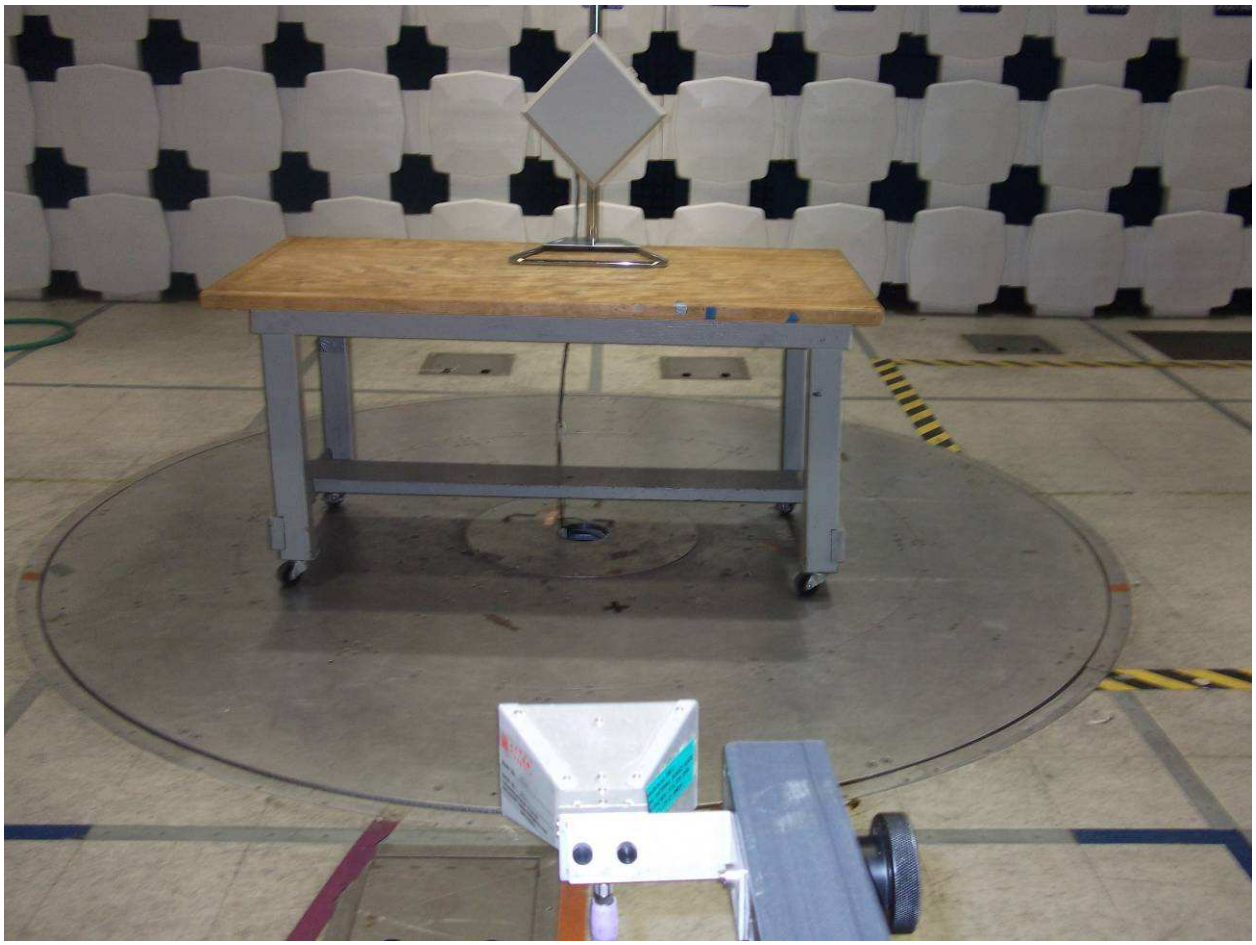
Channel center frequencies:
Channel 1: 24080 MHz
Channel 4: 24140 MHz
Channel 8: 24220 MHz

Measured 99% power bandwidth:
QPSK: 28.86 MHz
QAM16: 29.58 MHz
QAM64: 29.58 MHz

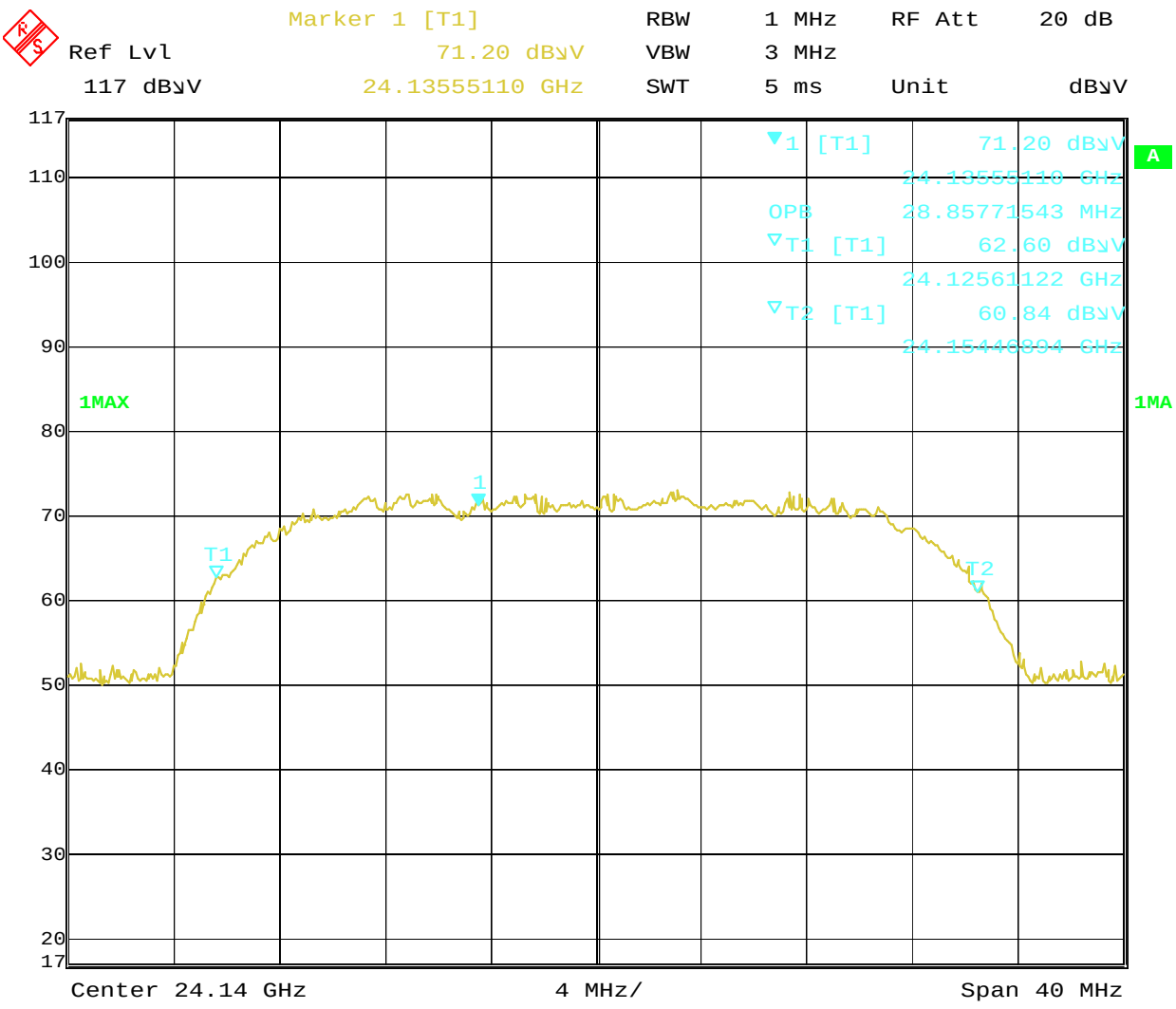
The sample tested was found to Comply. Note that half of the largest occupied bandwidth measured is 14.8 MHz, and the frequency separation between the band edge and the center frequency of the lowest and highest channels is 30 MHz.

7.4 Setup Photographs:

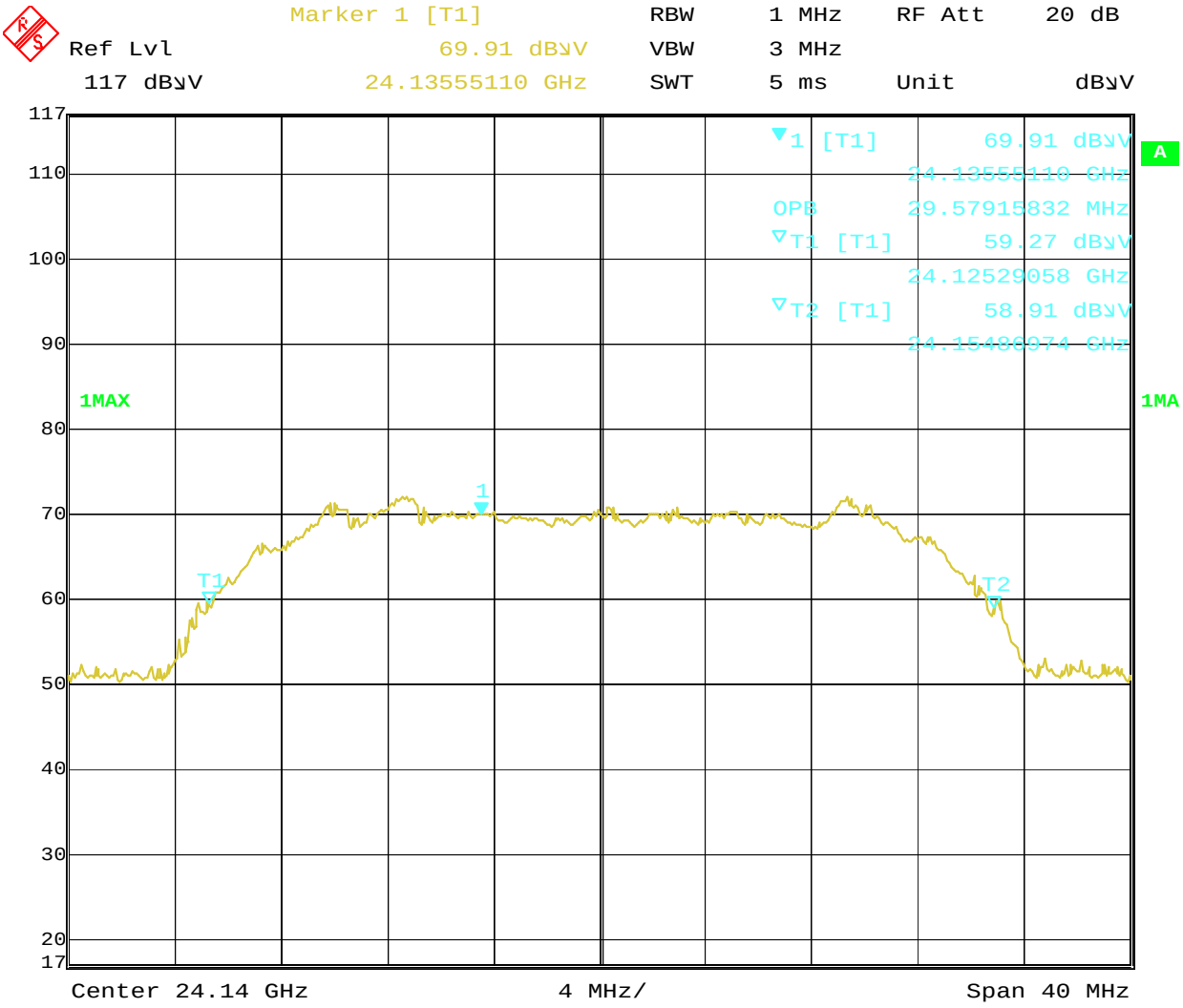




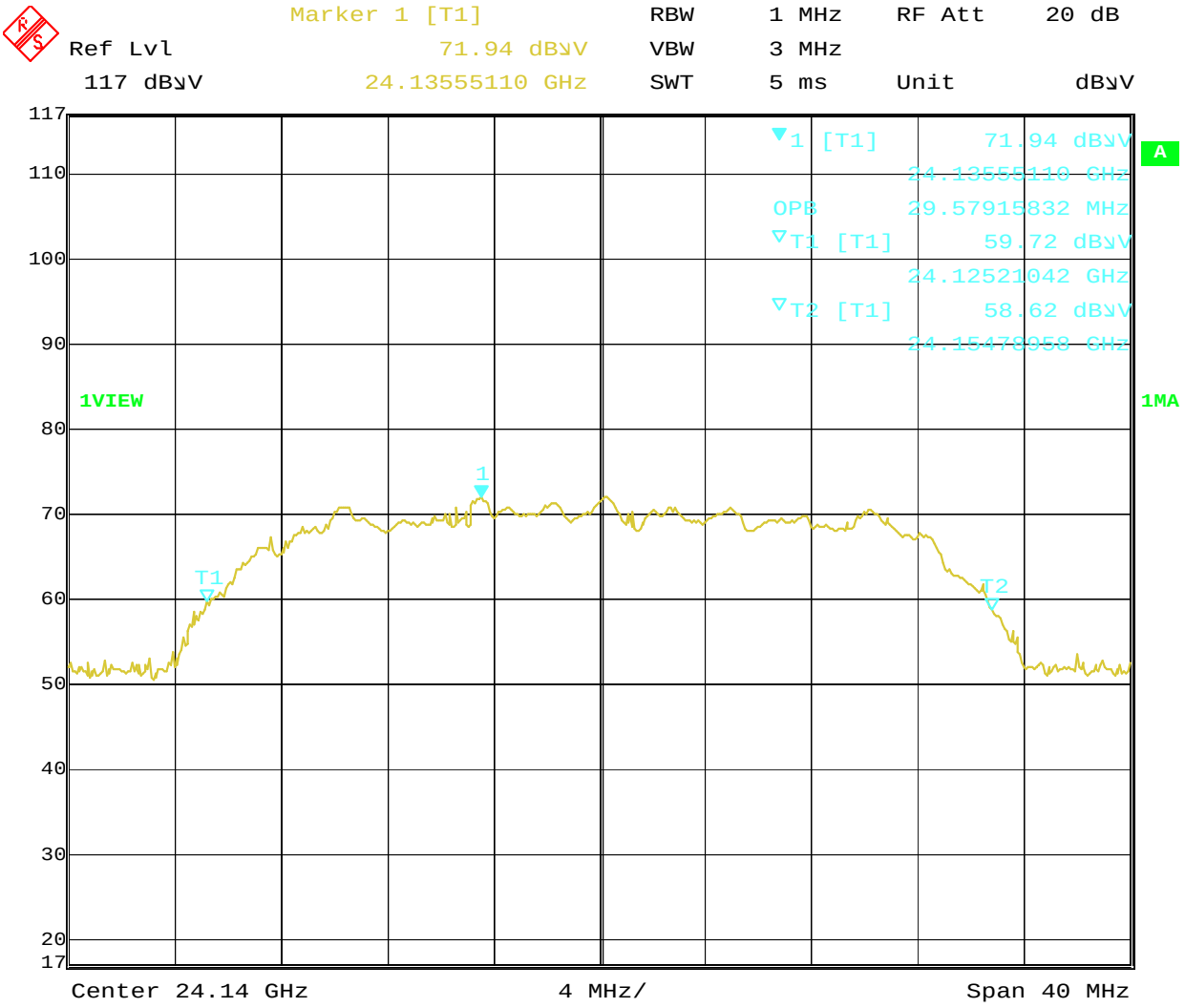
7.5 Plots/Data:



QPSK, Ch4 24.14 GHz



QAM16, Ch4 24.14 GHz



QAM64, Ch4 24.14 GHz

Test Personnel:	Nicholas Abbondante	Test Date:	09/28/2011
Supervising Engineer: (Where Applicable)	N/A	Test Levels:	Emissions must remain within the 24.05 – 24.25 GHz band
Product Standard:	FCC Part 15 Subpart C 15.215 and IC RSS-Gen Section 4.6	Ambient Temperature:	20 ºC
Input Voltage:	PoE	Relative Humidity:	64 %
Pretest Verification w/ Ambient Signals or BB Source:	**Ambient**	Atmospheric Pressure:	1006 mbars

Deviations, Additions, or Exclusions: None

8 Transmitter Radiated Emissions, 30 MHz – 40 GHz

8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.249(d), IC RSS-210 Annex 12(d)).

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 wooden 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
~DAV003	Weather Station	Davis Instruments	7400	PE80529A39A	08/02/2011	08/02/2012
~EMC04	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	01/25/2011	01/25/2012
~HORN3	HORN ANTENNA	EMCO	3115	9610-4980	03/28/2011	03/28/2012
~145128	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	08/23/2011	08/23/2012
~ROS001	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	01/13/2011	01/13/2012
~CBL030	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	01/06/2011	01/06/2012
~MEG005	High Frequency Cable	Megaphase	TM40-K1K1-197	8148601-001	01/06/2011	01/06/2012
~PRE9	100MHz-40GHz Preamp	MITEQ	NSP4000-NFG	1260417	05/12/2011	05/12/2012
~PRE7	PREAMPLIFIER	Hewlett Packard	8447D	2944A08718	07/01/2011	07/01/2012
~145106	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	08/15/2011	08/15/2012
~145-410	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	09/04/2011	09/04/2012

Software Utilized:

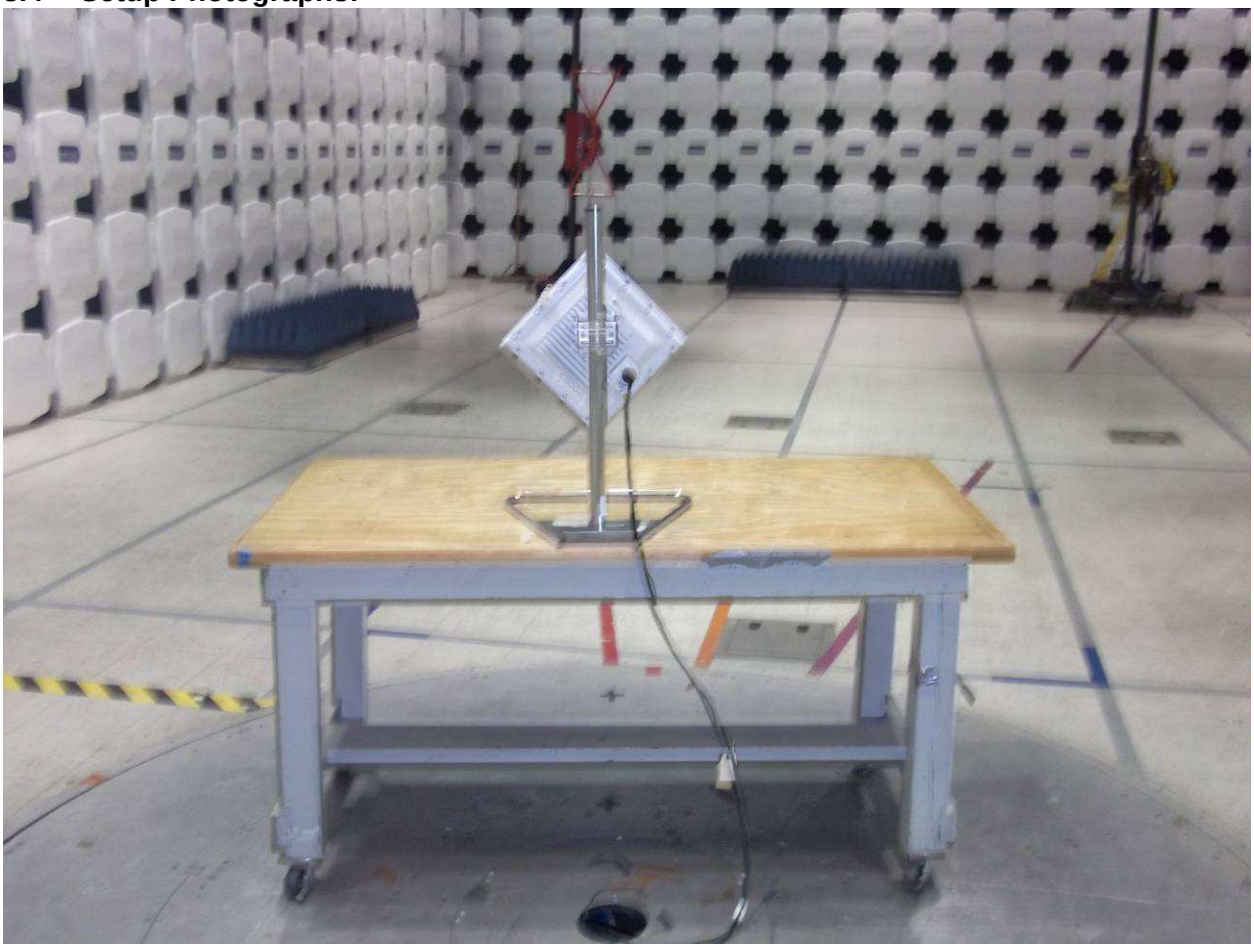
Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2011
C5	TESEQ	5.26.00 Build 5.26.00.3

8.3 Results:

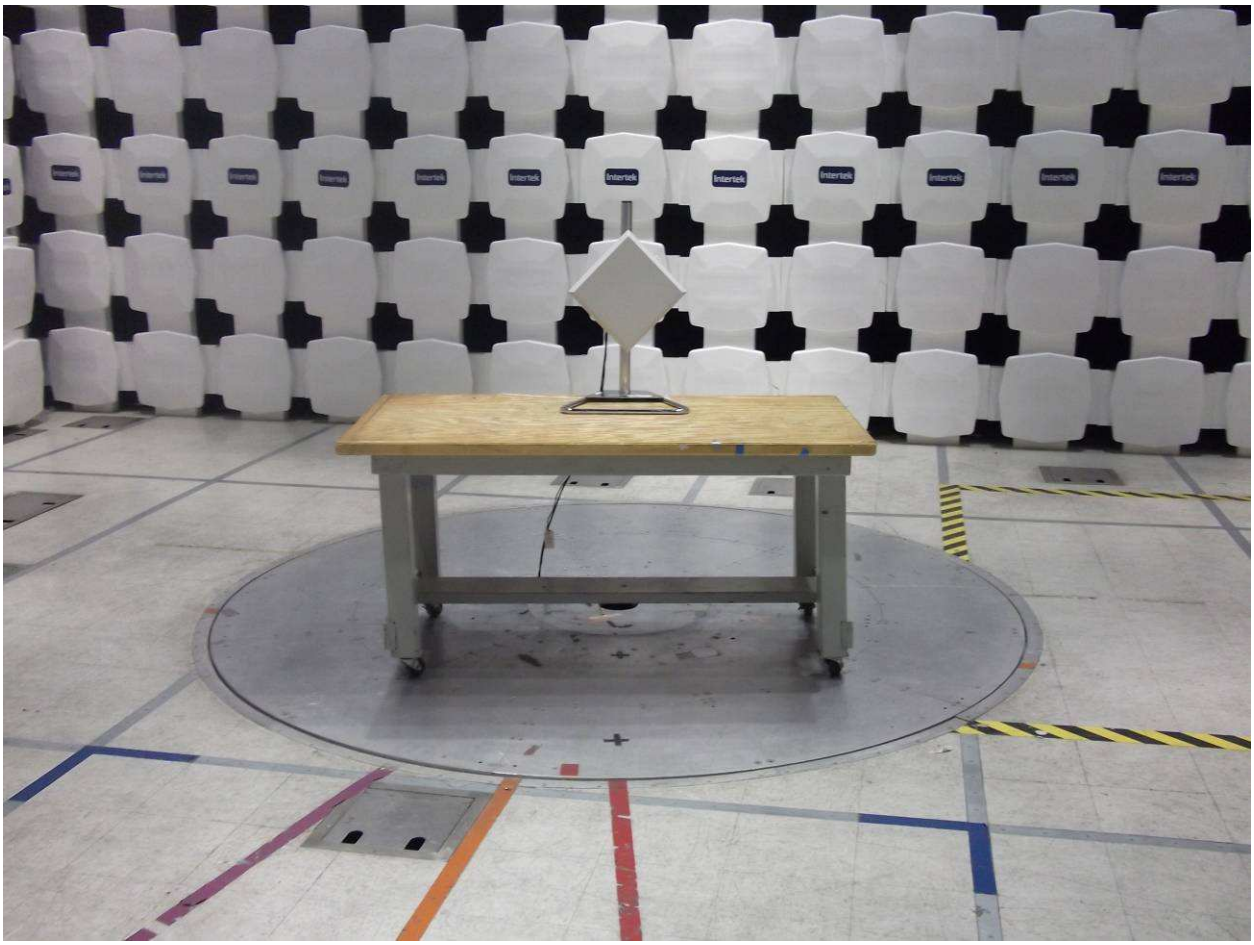
Except for harmonics, out-of-band emissions shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in IC RSS-Gen and FCC 15.209, whichever is less stringent. Harmonics shall be limited to a maximum level of 2.5 mV/m measured at 3 metres. In some cases the 15.209 limit is presented instead of the 50 dBc limit, even if it is more stringent than necessary.

The sample tested was found to Comply.

8.4 Setup Photographs:

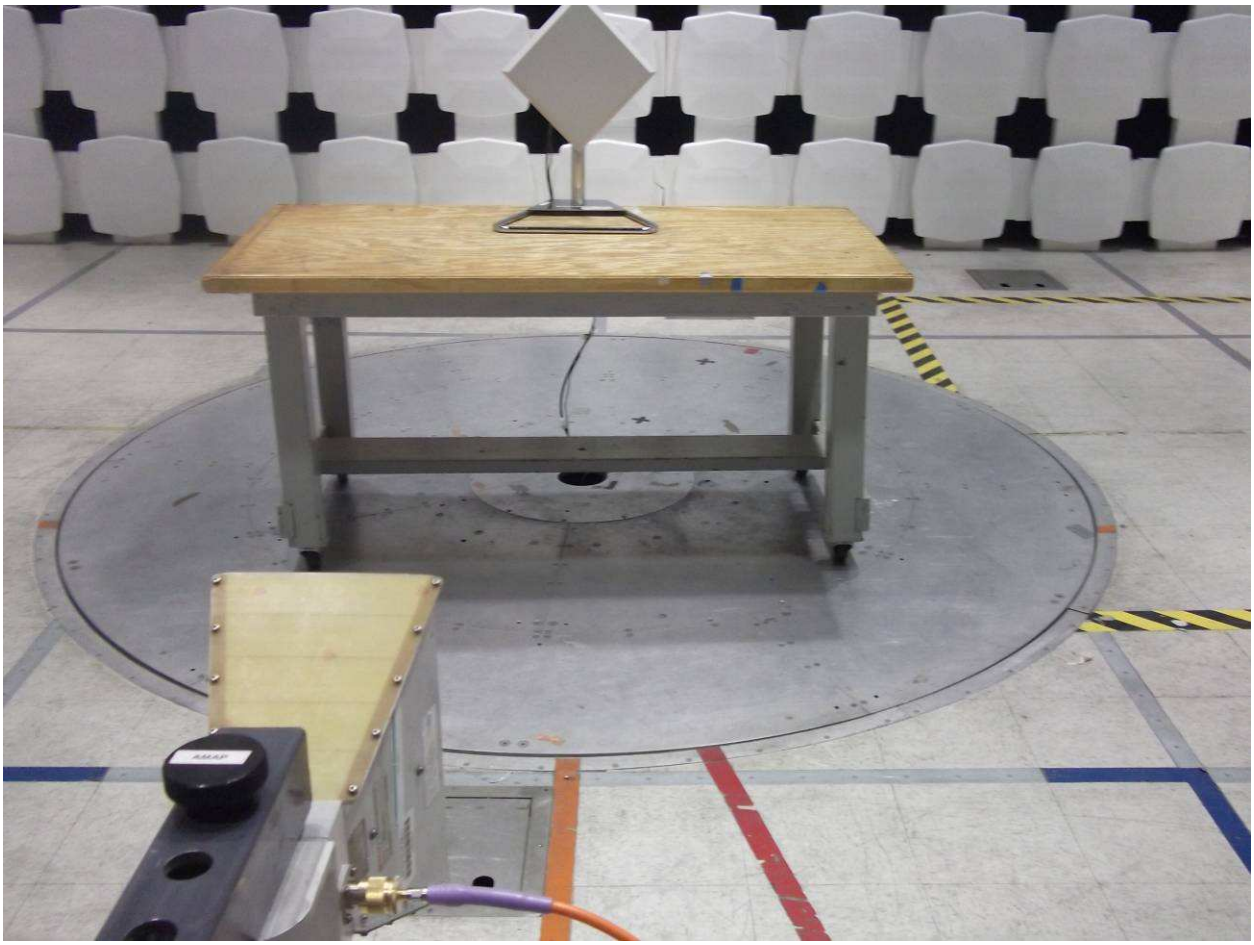


30-1000 MHz

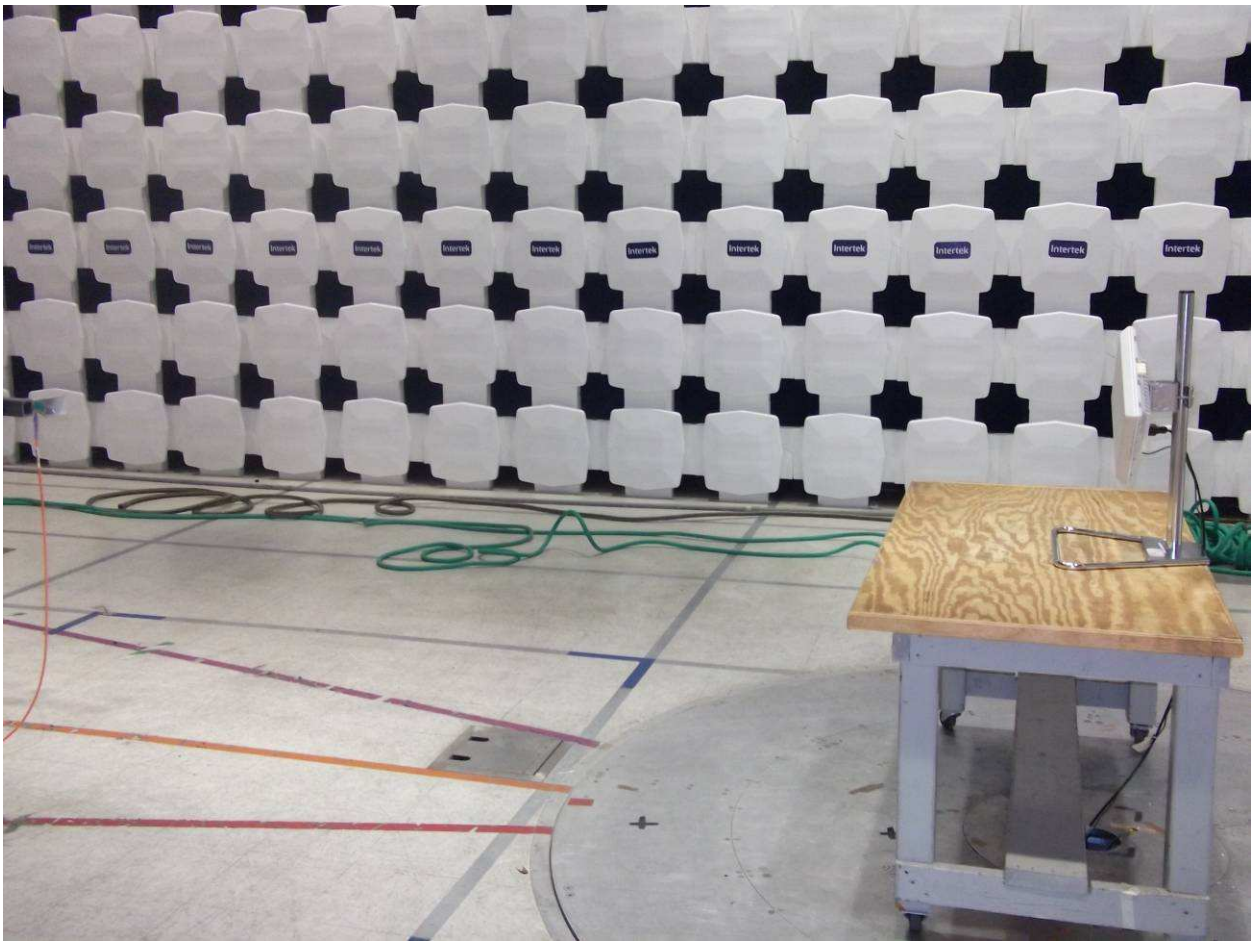


30-1000 MHz

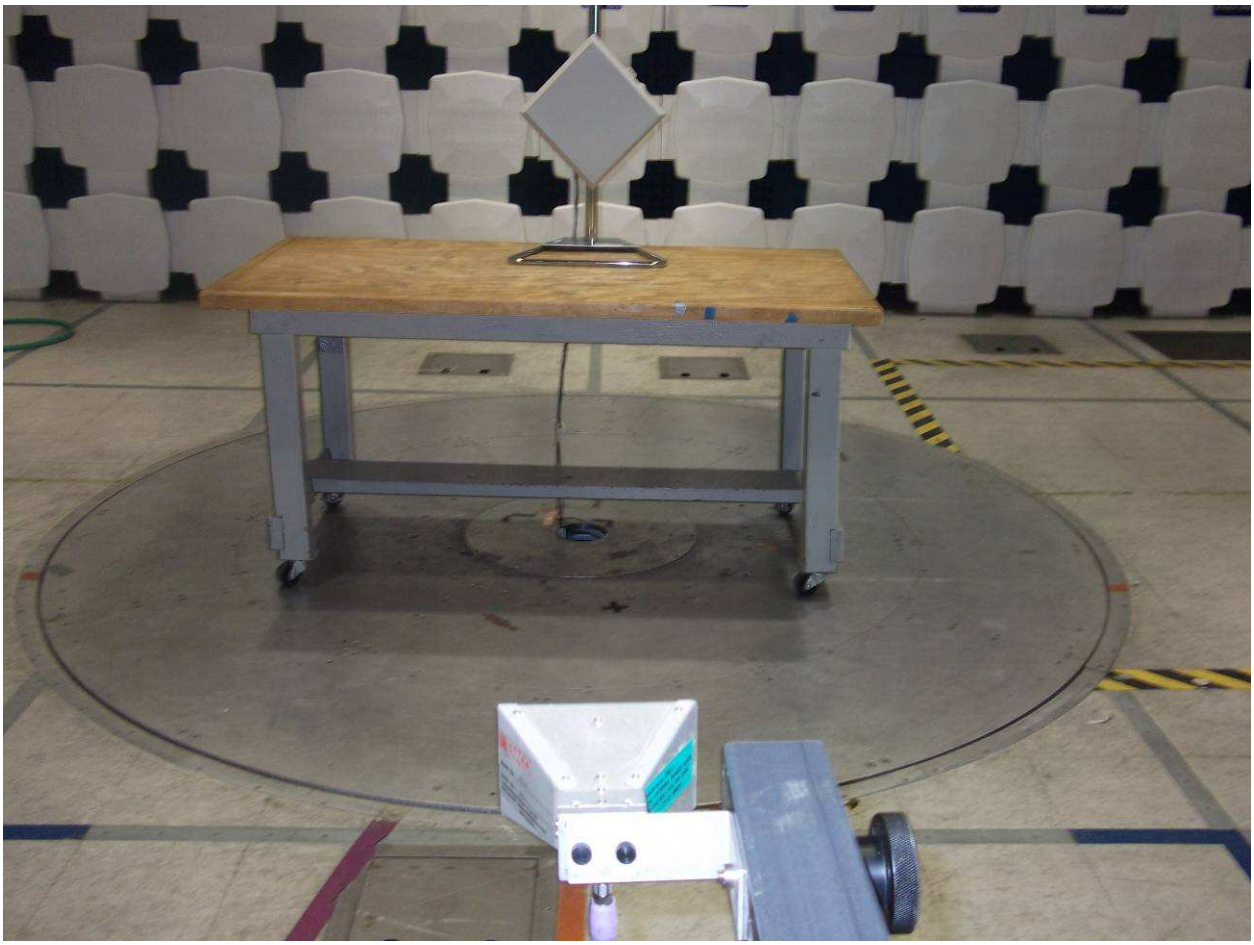
1-18 GHz



1-18 GHz



18-40 GHz

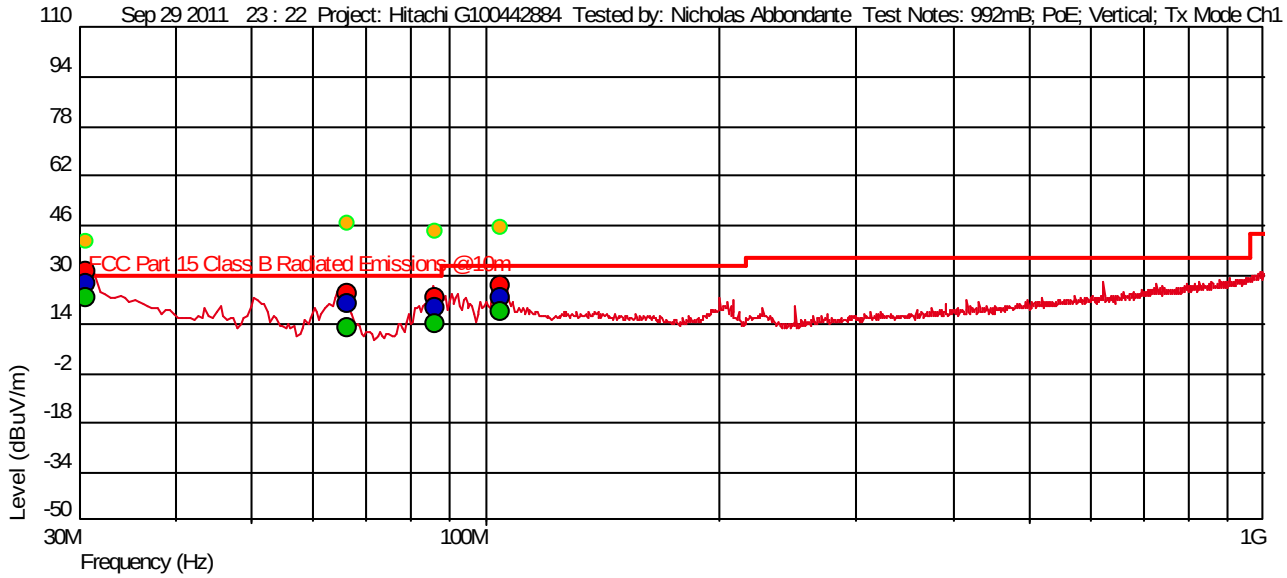


18-40 GHz

8.5 Plots/Data:

Test Information

Test Details	User Input
Project:	Hitachi G100442884
Test Notes:	992mB; PoE; Vertical; Tx Mode Ch1
Temperature:	20c
Humidity:	68%
Tested by:	Nicholas Abbondante
Test Started:	Sep 29 2011 23 : 22



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

Level (dBuV/m) = AF + CL + PA + Raw

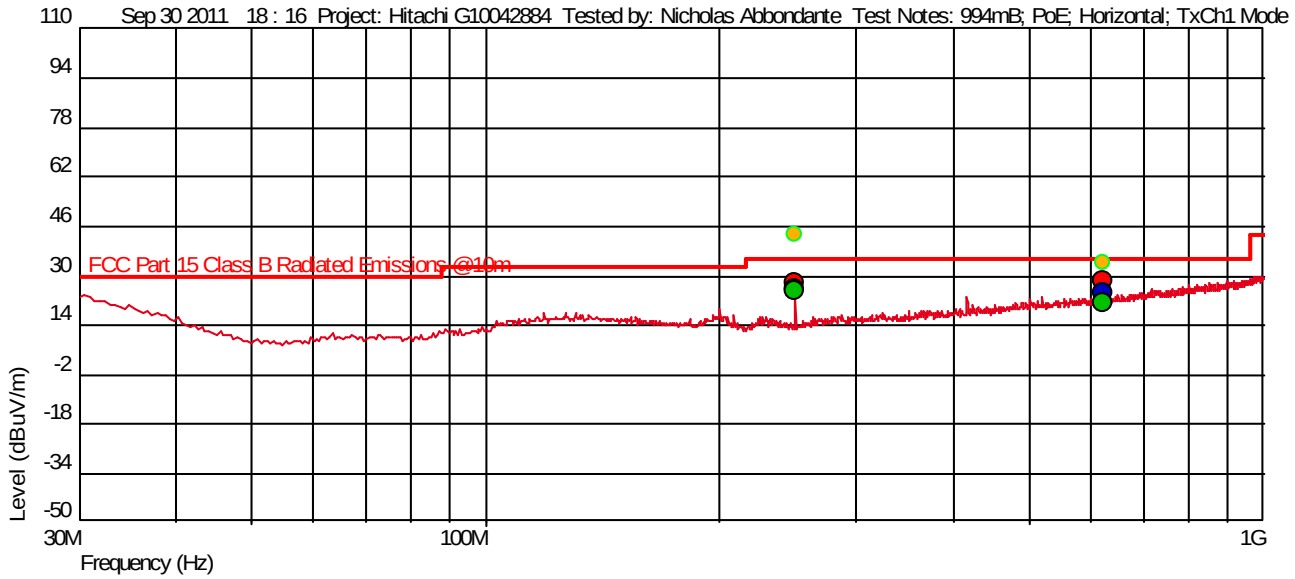
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin(dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
30.643 M	27.37	20.285	-25.517	29.54	-2.17	|	9	2.32	120 k
66.325 M	20.37	7.967	-25.911	29.54	-9.17	|	17	2.92	120 k
86.051 M	19.38	7.805	-25.646	29.54	-10.16	|	265	3.98	120 k
104.602 M	22.75	11.421	-25.468	33.04	-10.29	|	345	1.37	120 k

Test Information

Test Details	User Input
Project:	Hitachi G10042884
Test Notes:	994mB; PoE; Horizontal; TxCh1 Mode
Temperature:	21c
Humidity:	60%
Tested by:	Nicholas Abbondante
Test Started:	Sep 30 2011 18 : 16



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

Level (dBuV/m) = AF + CL + PA + Raw

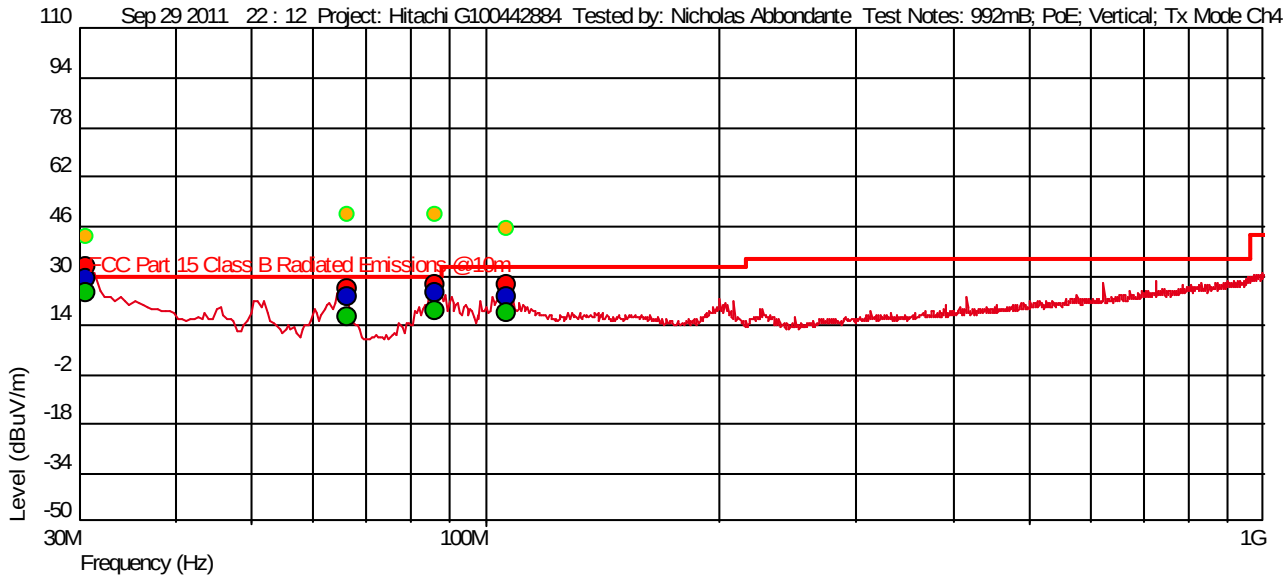
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
249.958 M	25.77	11.600	-23.960	35.54	-9.77	--	311	3.25	120 k
624.005 M	24.24	19.240	-23.995	35.54	-11.30	--	131	3.23	120 k

Test Information

Test Details	User Input
Project:	Hitachi G100442884
Test Notes:	992mB; PoE; Vertical; Tx Mode Ch4
Temperature:	20c
Humidity:	68%
Tested by:	Nicholas Abbondante
Test Started:	Sep 29 2011 22 : 12



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

Level (dBuV/m) = AF + CL + PA + Raw

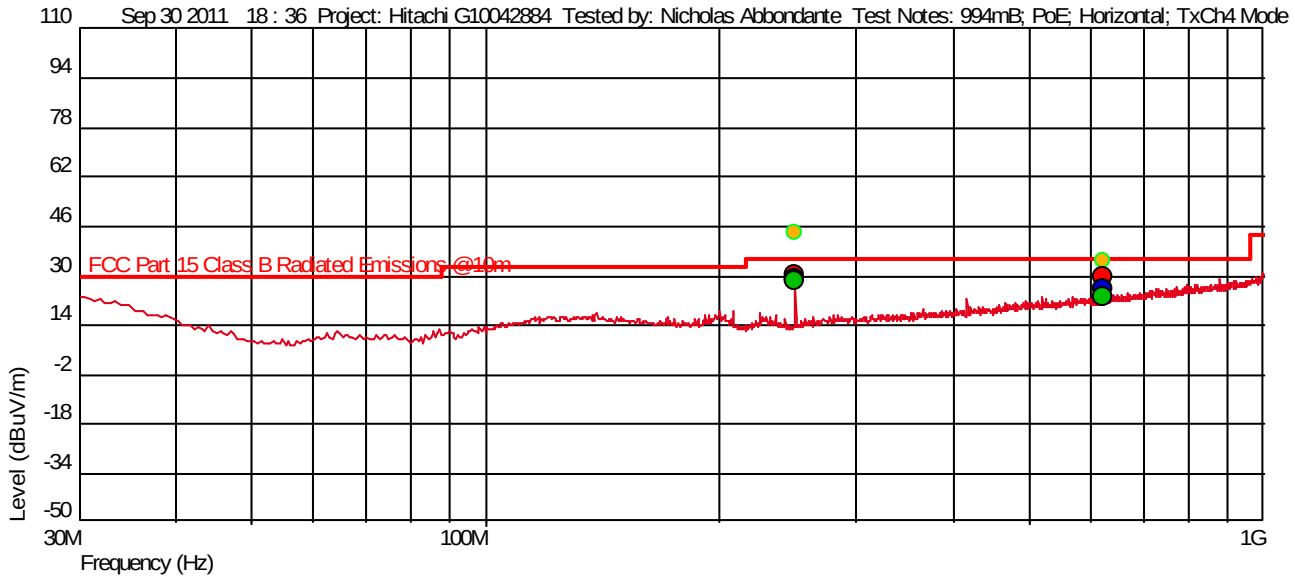
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
30.695 M	29.15	20.244	-25.519	29.54	-0.39	|	334	1.40	120 k
66.247 M	23.17	7.975	-25.911	29.54	-6.37	|	289	1.51	120 k
86.105 M	24.24	7.811	-25.645	29.54	-5.30	|	25	2.36	120 k
106.641 M	23.08	11.828	-25.437	33.04	-9.96	|	88	1.36	120 k

Test Information

Test Details	User Input
Project:	Hitachi G10042884
Test Notes:	994mB; PoE; Horizontal; TxCh4 Mode
Temperature:	21c
Humidity:	60%
Tested by:	Nicholas Abbondante
Test Started:	Sep 30 2011 18 : 36



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

Level (dBuV/m) = AF + CL + PA + Raw

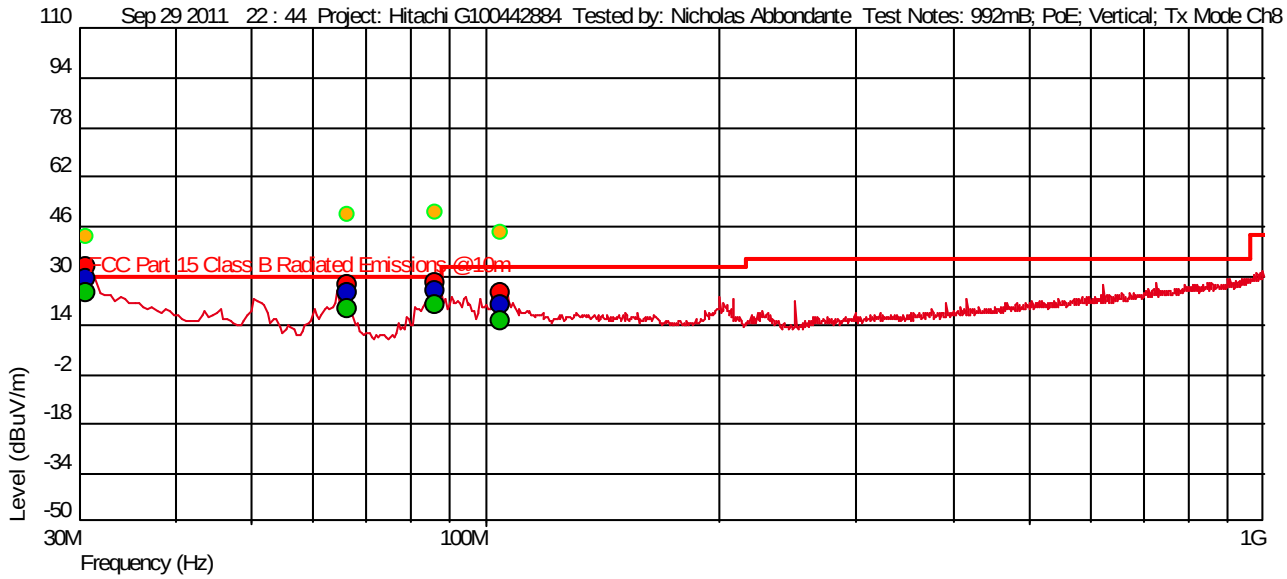
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
249.978 M	29.00	11.600	-23.960	35.54	-6.54	--	294	3.56	120 k
623.982 M	25.48	19.239	-23.996	35.54	-10.06	--	219	1.29	120 k

Test Information

Test Details	User Input
Project:	Hitachi G100442884
Test Notes:	992mB; PoE; Vertical; Tx Mode Ch8
Temperature:	20c
Humidity:	68%
Tested by:	Nicholas Abbondante
Test Started:	Sep 29 2011 22 : 44



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

Level (dBuV/m) = AF + CL + PA + Raw

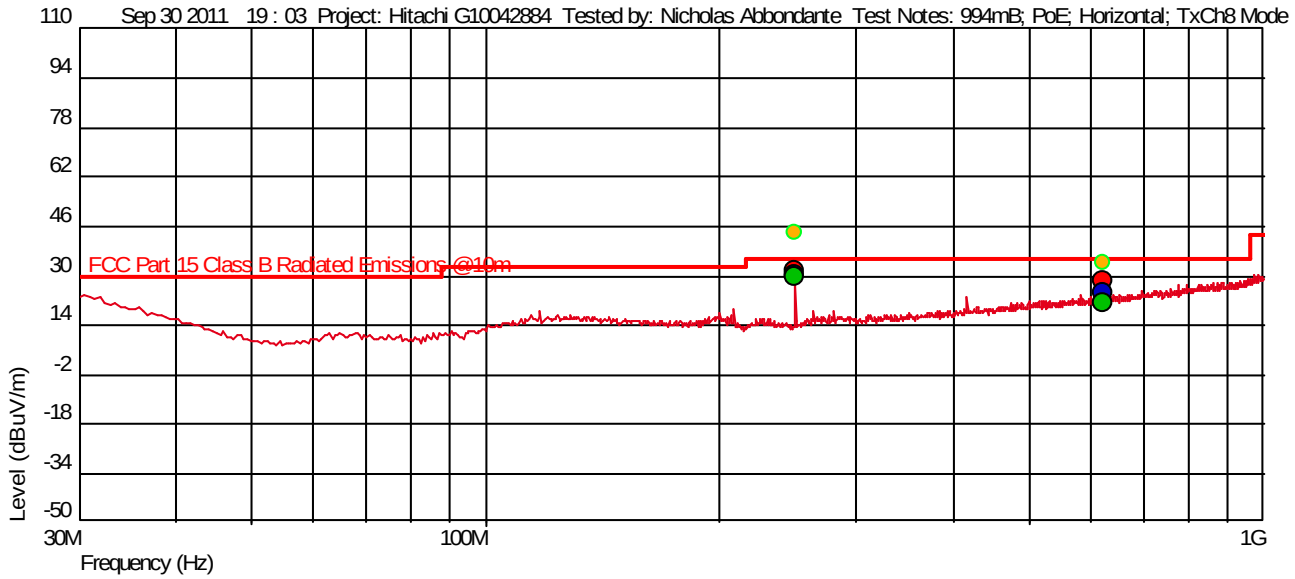
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
30.693 M	29.07	20.246	-25.519	29.54	-0.47	|	293	1.18	120 k
66.277 M	24.26	7.972	-25.911	29.54	-5.28	|	291	1.19	120 k
86.065 M	25.39	7.807	-25.645	29.54	-4.15	|	40	2.18	120 k
104.830 M	20.73	11.466	-25.464	33.04	-12.31	|	45	1.47	120 k

Test Information

Test Details	User Input
Project:	Hitachi G10042884
Test Notes:	994mB; PoE; Horizontal; TxCh8 Mode
Temperature:	21c
Humidity:	60%
Tested by:	Nicholas Abbondante
Test Started:	Sep 30 2011 19 : 03



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

Level (dBuV/m) = AF + CL + PA + Raw

AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
250.003 M	30.07	11.600	-23.960	35.54	-5.47	--	290	3.47	120 k
624.008 M	24.39	19.241	-23.995	35.54	-11.15	--	218	3.92	120 k

Intertek

Special Radiated Emissions

Company: Hitachi Kokusai Electric America, Ltd. Antenna & Cables: LF Bands: N, LF, HF, SHF
Model #: HP5-120100 Antenna: HORN3 V3m 03-28-2012.txt HORN3 H3m 03-28-2012.txt
Serial #: CS006 Cable(s): CBL030 01-06-2012.txt MEG005 01-06-2012.txt
Engineers: Nicholas Abbondante Location: 10m Chamber Barometer: DAV003 Filter: NONE
Project #: G100442884 Date(s): 09/29/11
Standard: FCC Part 15 Subpart C 15.249 P-P Temp/Humidity/Pressure: 20c 68% 992mB
Receiver: R&S FSEK-30 (ROS001) 01-13-2012 Limit Distance (m): 3
PreAmp: PRE9 05-12-2012.txt Test Distance (m): 1
PreAmp Used? (Y or N): Y Voltage/Frequency: PoE Frequency Range: 1-18 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: Noise Floor (a prescan was also performed at a closer distance than 1m to identify emissions)													
PK	V	1000.000	36.62	24.31	2.46	28.06	9.54	25.78	74.00	-48.22	1/3 MHz	RB	RB
AVG	V	1000.000	25.46	24.31	2.46	28.06	9.54	14.62	54.00	-39.38	1/3 MHz	RB	RB
PK	V	5000.000	36.39	34.04	6.55	29.38	9.54	38.06	74.00	-35.94	1/3 MHz	RB	RB
AVG	V	5000.000	25.46	34.04	6.55	29.38	9.54	27.13	54.00	-26.87	1/3 MHz	RB	RB
PK	V	10000.000	34.25	39.92	11.13	26.40	9.54	49.36	74.00	-24.64	1/3 MHz		
AVG	V	10000.000	22.92	39.92	11.13	26.40	9.54	38.03	54.00	-15.97	1/3 MHz		
PK	V	15000.000	34.36	43.02	15.44	25.98	9.54	57.30	74.00	-16.70	1/3 MHz		
AVG	V	15000.000	23.08	43.02	15.44	25.98	9.54	46.02	54.00	-7.98	1/3 MHz		
PK	V	18000.000	33.97	48.46	16.66	28.52	9.54	61.03	74.00	-12.97	1/3 MHz	RB	RB
AVG	V	18000.000	22.92	48.46	16.66	28.52	9.54	49.98	54.00	-4.02	1/3 MHz	RB	RB
Note: Only 'Real' Emission													
PK	V	1175.000	40.67	25.18	3.16	27.85	9.54	31.62	74.00	-42.38	1/3 MHz	RB	RB
AVG	V	1175.000	36.15	25.18	3.16	27.85	9.54	27.10	54.00	-26.90	1/3 MHz	RB	RB
Note: Ch1 only													
PK	H	5515.000	40.43	35.19	8.02	29.72	9.54	44.38	93.80	-49.42	1/3 MHz		
AVG	H	5515.000	36.22	35.19	8.02	29.72	9.54	40.17	73.80	-33.63	1/3 MHz		
Note: Ch4 Only													
PK	H	5535.000	40.43	35.15	8.02	29.66	9.54	44.39	93.80	-49.41	1/3 MHz		
AVG	H	5535.000	36.87	35.15	8.02	29.66	9.54	40.83	73.80	-32.97	1/3 MHz		
Note: Ch8 Only													
PK	H	5555.000	43.24	35.10	8.02	29.62	9.54	47.20	93.80	-46.60	1/3 MHz		
AVG	H	5555.000	40.63	35.10	8.02	29.62	9.54	44.59	73.80	-29.21	1/3 MHz		
Note: Receive Mode Only													
PK	H	5520.000	41.12	35.18	8.02	29.70	9.54	45.07	93.80	-48.73	1/3 MHz		
AVG	H	5520.000	37.62	35.18	8.02	29.70	9.54	41.57	73.80	-32.23	1/3 MHz		

Intertek

Radiated Emissions

Company: Hitachi Kokusai Electric America, Ltd. Antenna & Cables: HF Bands: N, LF, HF, SHF
Model #: HP5-120100 Antenna: EMC04 V3m 01-25-2012.txt EMC04 H3m 01-25-2012.txt
Serial #: CS006 Cable(s): CBL030 01-06-2012.txt MEG005 01-06-2012.txt
Engineers: Nicholas Abbondante Location: 10m chamber Barometer: DAV003 Filter: NONE
Project #: G100442884 Date(s): 09/28/11
Standard: FCC Part 15 Subpart C 15.249 P-P Temp/Humidity/Pressure: 20c 64% 1006mB
Receiver: R&S FSEK-30 (ROS001) 01-13-2012 Limit Distance (m): 3
PreAmp: PRE9 05-12-2012.txt Test Distance (m): 1
PreAmp Used? (Y or N): Y Voltage/Frequency: PoE Frequency Range: 18-40 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dBuV	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: 1 dBm Tx setting in software													
Note: Band Edge Compliance													
Note: 1m test distance, noise floor													
Note: QPSK													
PK	V	24000.000	29.42	45.13	18.90	26.47	9.54	57.44	74.00	-16.56	1/3 MHz	RB	RB
AVG	V	24000.000	22.26	45.13	18.90	26.47	9.54	50.28	54.00	-3.72	1/3 MHz	RB	RB
Note: QAM16													
PK	V	24000.000	28.02	45.13	18.90	26.47	9.54	56.04	74.00	-17.96	1/3 MHz	RB	RB
AVG	V	24000.000	23.02	45.13	18.90	26.47	9.54	51.04	54.00	-2.96	1/3 MHz	RB	RB
Note: QAM64													
PK	V	24000.000	28.27	45.13	18.90	26.47	9.54	56.29	74.00	-17.71	1/3 MHz	RB	RB
AVG	V	24000.000	22.26	45.13	18.90	26.47	9.54	50.28	54.00	-3.72	1/3 MHz	RB	RB
Note: 3m Test Distance, waveform envelope													
Note: QPSK													
PK	V	24250.000	37.11	45.34	19.42	27.85	0.00	74.02	93.80	-19.78	1/3 MHz		
AVG	V	24250.000	27.88	45.34	19.42	27.85	0.00	64.79	73.80	-9.01	1/3 MHz		
Note: QAM16													
PK	V	24250.000	35.28	45.34	19.42	27.85	0.00	72.19	93.80	-21.61	1/3 MHz		
AVG	V	24250.000	26.54	45.34	19.42	27.85	0.00	63.45	73.80	-10.35	1/3 MHz		
Note: QAM64													
PK	V	24250.000	35.75	45.34	19.42	27.85	0.00	72.66	93.80	-21.14	1/3 MHz		
AVG	V	24250.000	25.52	45.34	19.42	27.85	0.00	62.43	73.80	-11.37	1/3 MHz		
Note: No Spurious emissions detected, noise floor (hand scan performed at <1m test distance), Transmit and Receive Modes													
PK	V	18000.000	26.16	44.70	16.66	28.52	9.54	49.46	74.00	-24.54	1/3 MHz	RB	RB
AVG	V	18000.000	20.52	44.70	16.66	28.52	9.54	43.82	54.00	-10.18	1/3 MHz	RB	RB
PK	V	26000.000	32.25	46.19	20.32	24.91	9.54	64.31	93.80	-29.49	1/3 MHz		
AVG	V	26000.000	23.02	46.19	20.32	24.91	9.54	55.08	73.80	-18.72	1/3 MHz		
PK	V	38000.000	42.32	44.85	29.41	30.21	9.54	76.83	93.80	-16.97	1/3 MHz		
AVG	V	38000.000	34.50	44.85	29.41	30.21	9.54	69.01	73.80	-4.79	1/3 MHz		

Test Personnel:	Nicholas Abbondante	Test Date:	09/28-30/2011
Supervising Engineer: (Where Applicable)	N/A	Test Levels:	See section 8.3
Product Standard:	FCC Part 15 Subpart C 15.249(d), IC RSS-210 Annex 12(d))	Ambient Temperature:	20, 20, 21 ºC
Input Voltage:	PoE	Relative Humidity:	64, 68, 60 %
Pretest Verification w/ Ambient Signals or BB Source:	**Ambient**	Atmospheric Pressure:	1006, 992, 994 mbars

Deviations, Additions, or Exclusions: None

9 Transmitter Radiated Emissions, 40-100 GHz

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.249(d), IC RSS-210 Annex 12(d)).

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 wooden 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
~DAV003	Weather Station	Davis Instruments	7400	PE80529A39A	08/02/2011	08/02/2012
~ROS001	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	01/13/2011	01/13/2012
~MEG005	High Frequency Cable	Megaphase	TM40-K1K1-197	8148601-001	01/06/2011	01/06/2012
~OML2	Mixer / Antenna	Oleson Microwave Lab	M08HWA	F21011-1	04/08/2011 Verified	04/08/2012
~OML3	Mixer / Antenna	Oleson Microwave Lab	M12HWD	E21011-1	04/08/2011 Verified	04/08/2012
~OML4	Mixer / Antenna	Oleson Microwave Lab	M19HWA	U21011-1	04/08/2011 Verified	04/08/2012

Software Utilized:

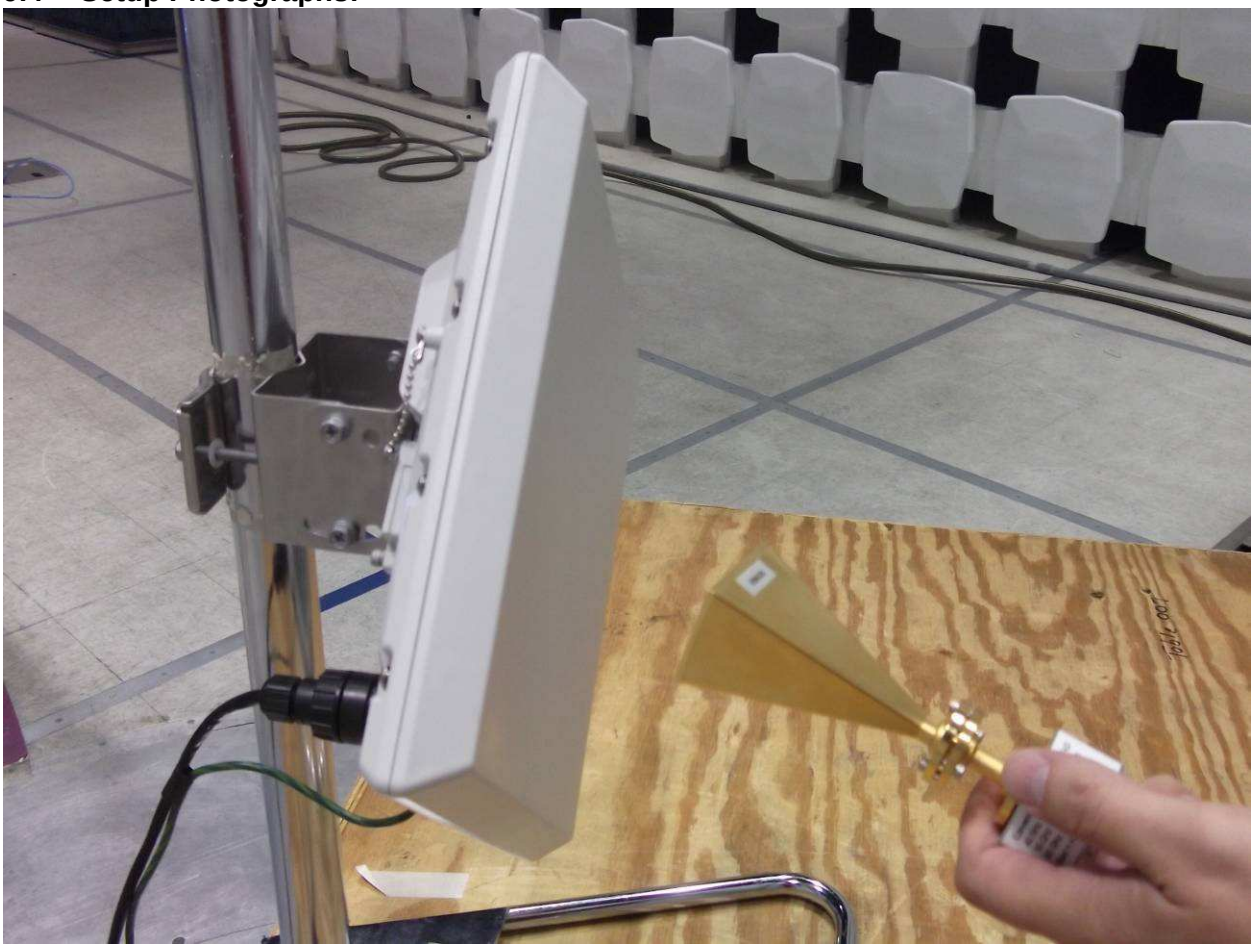
Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2011

9.3 Results:

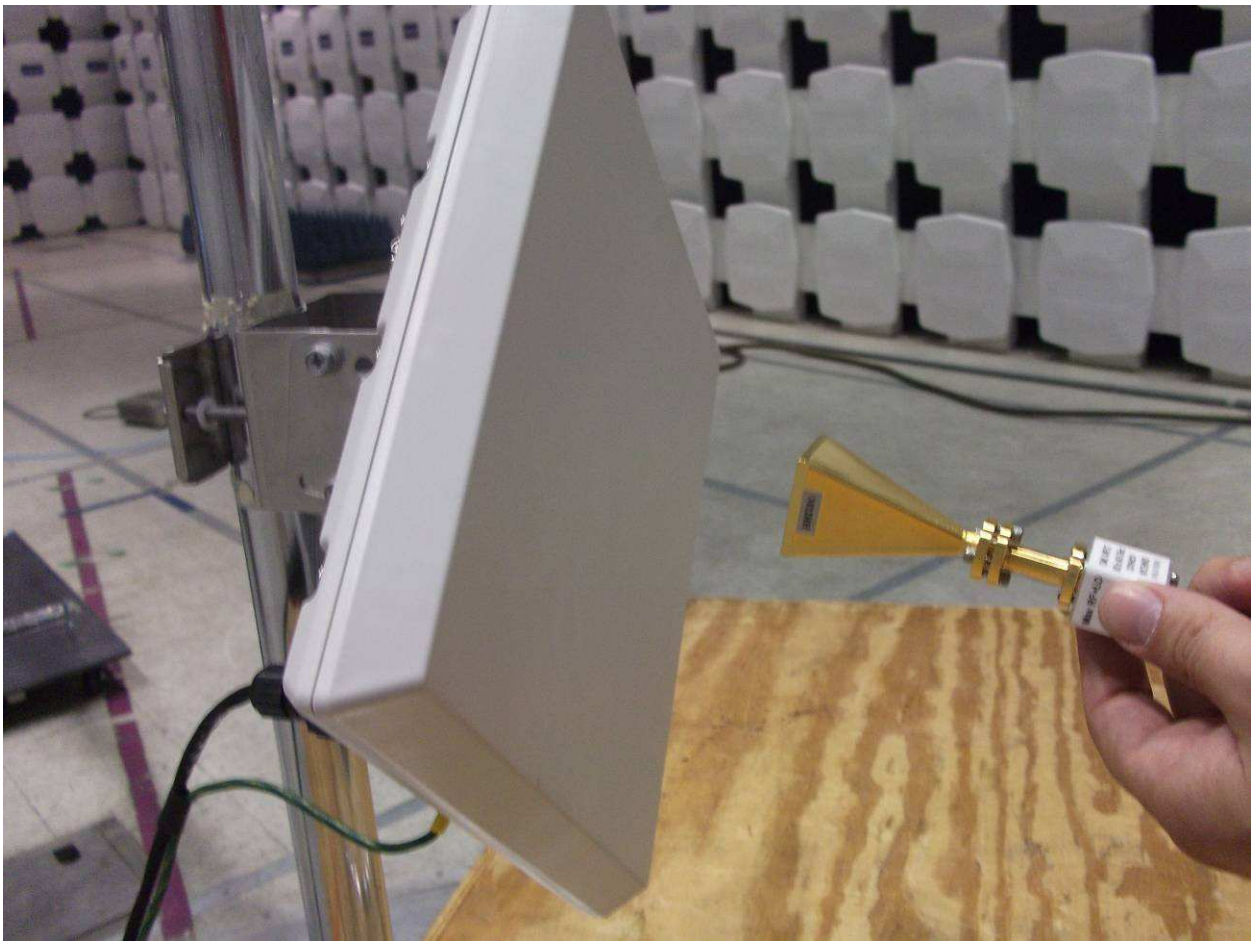
The sample tested was found to Comply.

Except for harmonics, out-of-band emissions shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in IC RSS-Gen and FCC 15.209, whichever is less stringent. Harmonics shall be limited to a maximum level of 2.5 mV/m measured at 3 metres.

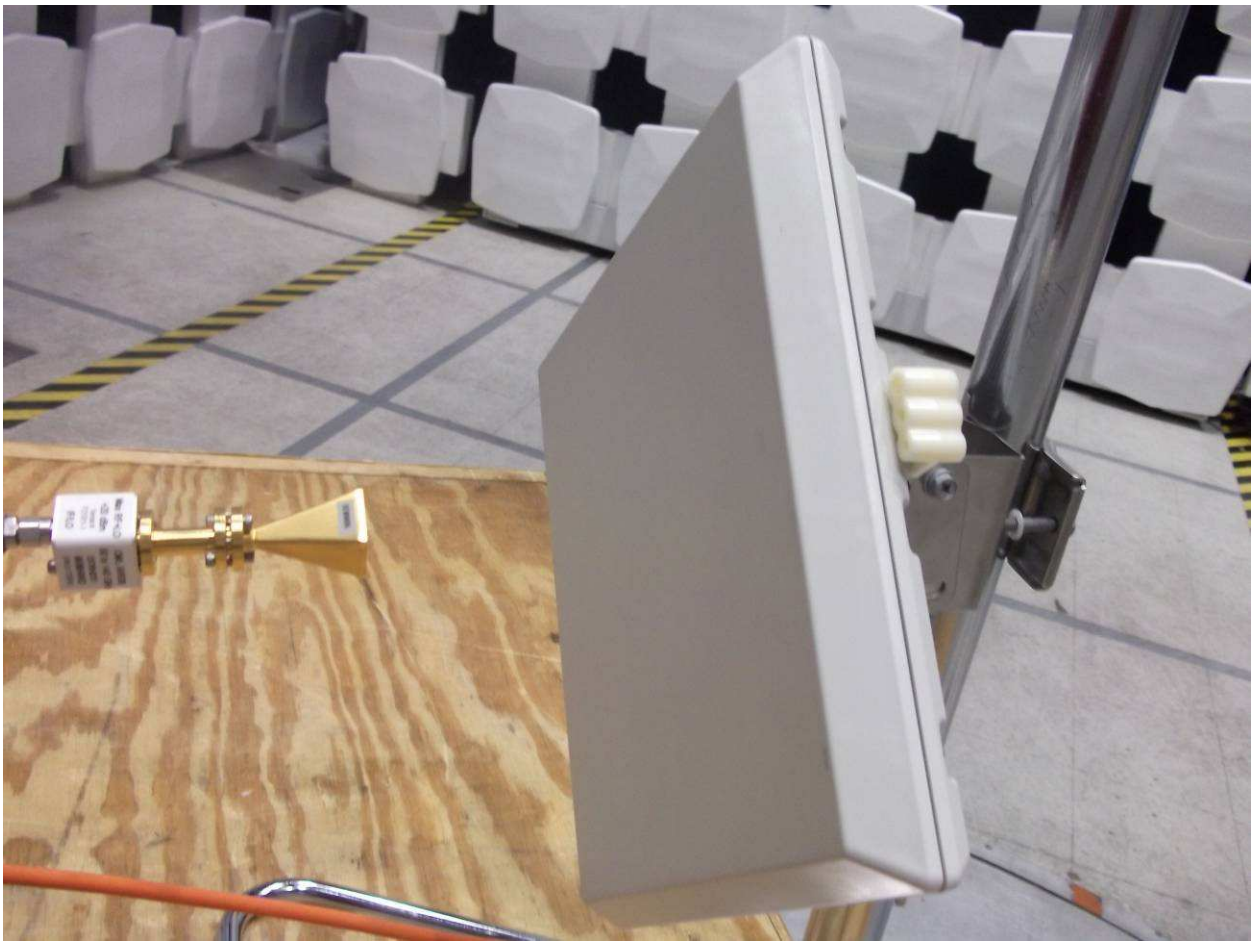
9.4 Setup Photographs:



40-60 GHz



60-90 GHz



90-100 GHz

9.5 Plots/Data:

Intertek

Special Radiated Emissions

Company: Hitachi Kokusai Electric America, Ltd. Antenna & Cables: N Bands: N, LF, HF, SHF
Model #: HP5-120100 Antenna: OML2, OML3, OML4 04/08/2012 NONE.
Serial #: CS006 Cable(s): MEG005 01-06-2012.txt NONE.
Engineers: Nicholas Abbondante Location: 10m Chamber Barometer: DAV003 Filter: NONE
Project #: G100442884 Date(s): 09/29/11
Standard: FCC Part 15 Subpart C 15.249 P-P Temp/Humidity/Pressure: 20c 68% 992mB
Receiver: R&S FSEK-30 (ROS001) 01-13-2012 Limit Distance (m): 3
PreAmp: PRE9 05-12-2012.txt Test Distance (m): 0.01
PreAmp Used? (Y or N): N Voltage/Frequency: PoE Frequency Range: 40 - 100 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC	Harmonic?
PK	V	40000.000	42.92	38.23	1.49	0.00	49.54	33.09	74.00	-40.91	1/3 MHz	RB	RB	
AVG	V	40000.000	30.18	38.23	1.49	0.00	49.54	20.35	54.00	-33.65	1/3 MHz	RB	RB	
PK	V	48160.000	45.06	39.84	1.49	0.00	49.54	36.85	88.00	-51.15	1/3 MHz	RB		Harm
AVG	V	48160.000	32.28	39.84	1.49	0.00	49.54	24.07	68.00	-43.93	1/3 MHz	RB		Harm
PK	V	48280.000	45.33	39.86	1.49	0.00	49.54	37.14	88.00	-50.86	1/3 MHz	RB		Harm
AVG	V	48280.000	32.77	39.86	1.49	0.00	49.54	24.58	68.00	-43.42	1/3 MHz	RB		Harm
PK	V	48440.000	45.02	39.89	1.49	0.00	49.54	36.86	88.00	-51.14	1/3 MHz	RB		Harm
AVG	V	48440.000	32.92	39.89	1.49	0.00	49.54	24.76	68.00	-43.24	1/3 MHz	RB		Harm
PK	V	60000.000	50.76	41.75	1.49	0.00	49.54	44.45	74.00	-29.55	1/3 MHz	RB		
AVG	V	60000.000	38.63	41.75	1.49	0.00	49.54	32.32	54.00	-21.68	1/3 MHz	RB		
PK	V	60000.000	49.10	41.75	1.49	0.00	49.54	42.79	74.00	-31.21	1/3 MHz	RB		
AVG	V	60000.000	36.83	41.75	1.49	0.00	49.54	30.52	54.00	-23.48	1/3 MHz	RB		
PK	V	72240.000	47.12	43.36	1.49	0.00	49.54	42.43	88.00	-45.57	1/3 MHz	RB		Harm
AVG	V	72240.000	35.01	43.36	1.49	0.00	49.54	30.32	68.00	-37.68	1/3 MHz	RB		Harm
PK	V	72420.000	47.67	43.38	1.49	0.00	49.54	43.00	88.00	-45.00	1/3 MHz	RB		Harm
AVG	V	72420.000	34.90	43.38	1.49	0.00	49.54	30.23	68.00	-37.77	1/3 MHz	RB		Harm
PK	V	72660.000	46.91	43.41	1.49	0.00	49.54	42.27	88.00	-45.73	1/3 MHz	RB		Harm
AVG	V	72660.000	34.74	43.41	1.49	0.00	49.54	30.10	68.00	-37.90	1/3 MHz	RB		Harm
PK	V	90000.000	49.39	45.27	1.49	0.00	49.54	46.61	74.00	-27.39	1/3 MHz	RB		
AVG	V	90000.000	37.26	45.27	1.49	0.00	49.54	34.48	54.00	-19.52	1/3 MHz	RB		
PK	V	90000.000	54.32	45.27	1.49	0.00	49.54	51.54	74.00	-22.46	1/3 MHz	RB		
AVG	V	90000.000	42.90	45.27	1.49	0.00	49.54	40.12	54.00	-13.88	1/3 MHz	RB		
PK	V	96320.000	63.01	45.86	1.49	0.00	49.54	60.82	74.00	-13.18	1/3 MHz	RB		Harm
AVG	V	96320.000	51.21	45.86	1.49	0.00	49.54	49.02	54.00	-4.98	1/3 MHz	RB		Harm
PK	V	96560.000	63.19	45.88	1.49	0.00	49.54	61.02	74.00	-12.98	1/3 MHz	RB		Harm
AVG	V	96560.000	51.31	45.88	1.49	0.00	49.54	49.14	54.00	-4.86	1/3 MHz	RB		Harm
PK	V	96880.000	63.39	45.91	1.49	0.00	49.54	61.25	74.00	-12.75	1/3 MHz	RB		Harm
AVG	V	96880.000	51.73	45.91	1.49	0.00	49.54	49.59	54.00	-4.41	1/3 MHz	RB		Harm
PK	V	100000.000	55.05	46.18	1.49	0.00	49.54	53.18	74.00	-20.82	1/3 MHz	RB		
AVG	V	100000.000	43.51	46.18	1.49	0.00	49.54	41.64	54.00	-12.36	1/3 MHz	RB		

Test Personnel:	Nicholas Abbondante	Test Date:	09/29/2011
Supervising Engineer: (Where Applicable)	N/A	Test Levels:	See section 9.3
Product Standard:	FCC Part 15 Subpart C 15.249(d), IC RSS-210 Annex 12(d))	Ambient Temperature:	20 ºC
Input Voltage:	PoE	Relative Humidity:	68 %
Pretest Verification w/ Ambient Signals or BB Source:	**Ambient**	Atmospheric Pressure:	992 mbars

Deviations, Additions, or Exclusions: None

10 Receiver Radiated Emissions

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B 15.109, IC RSS-Gen Section 6.0.

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 wooden 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
~DAV003	Weather Station	Davis Instruments	7400	PE80529A39A	08/02/2011	08/02/2012
~EMC04	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	01/25/2011	01/25/2012
~HORN3	HORN ANTENNA	EMCO	3115	9610-4980	03/28/2011	03/28/2012
~145128	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	08/23/2011	08/23/2012
~ROS001	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	01/13/2011	01/13/2012
~CBL030	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	01/06/2011	01/06/2012
~MEG005	High Frequency Cable	Megaphase	TM40-K1K1-197	8148601-001	01/06/2011	01/06/2012
~PRE9	100MHz-40GHz Preamp	MITEQ	NSP4000-NFG	1260417	05/12/2011	05/12/2012
~PRE7	PREAMPLIFIER	Hewlett Packard	8447D	2944A08718	07/01/2011	07/01/2012
~145106	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	08/15/2011	08/15/2012
~145-410	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	09/04/2011	09/04/2012

Software Utilized:

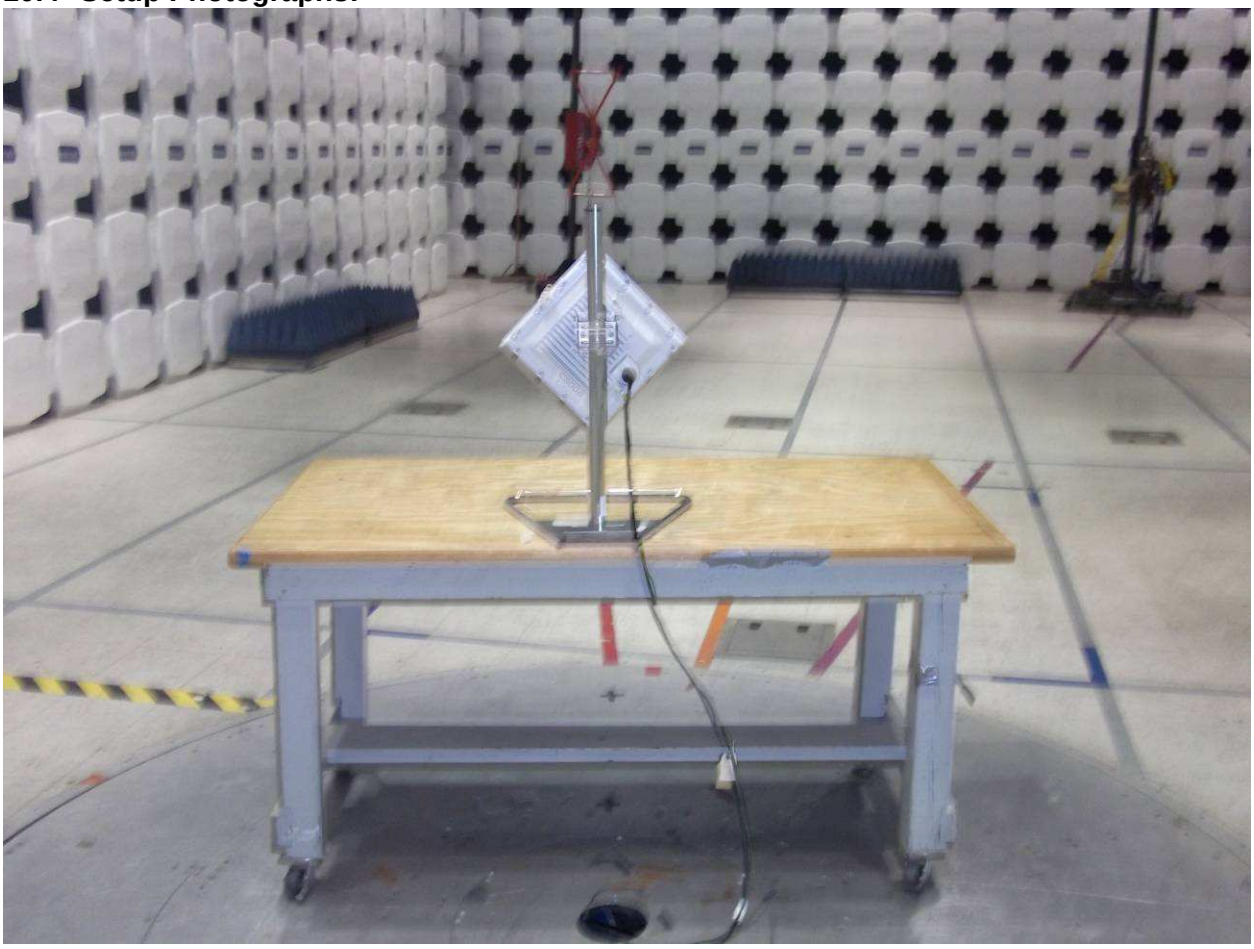
Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2011
C5	TESEQ	5.26.00 Build 5.26.00.3

10.3 Results:

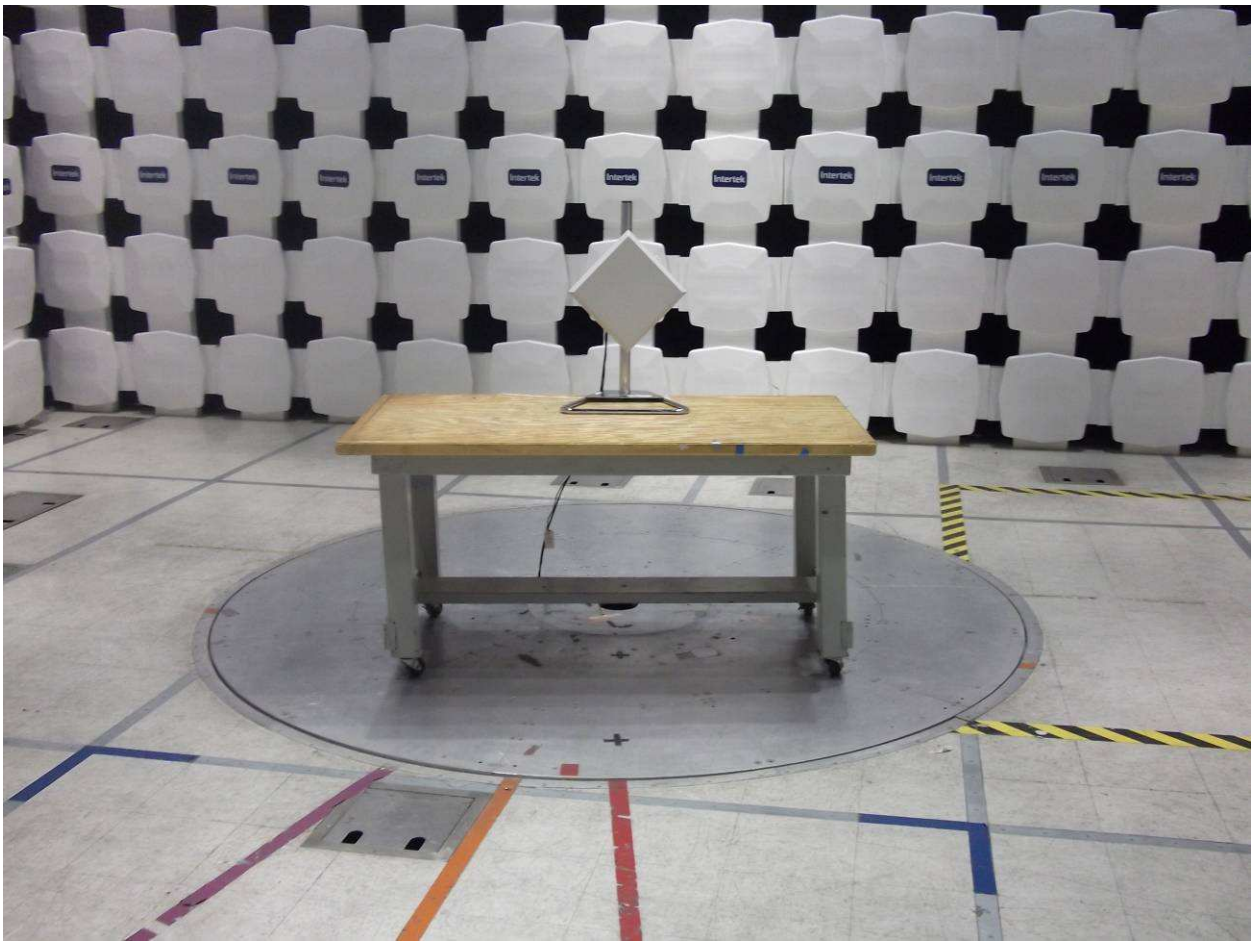
Emissions in receive mode must meet the general limits of FCC 15.109 and IC RSS-Gen.

The sample tested was found to Comply.

10.4 Setup Photographs:

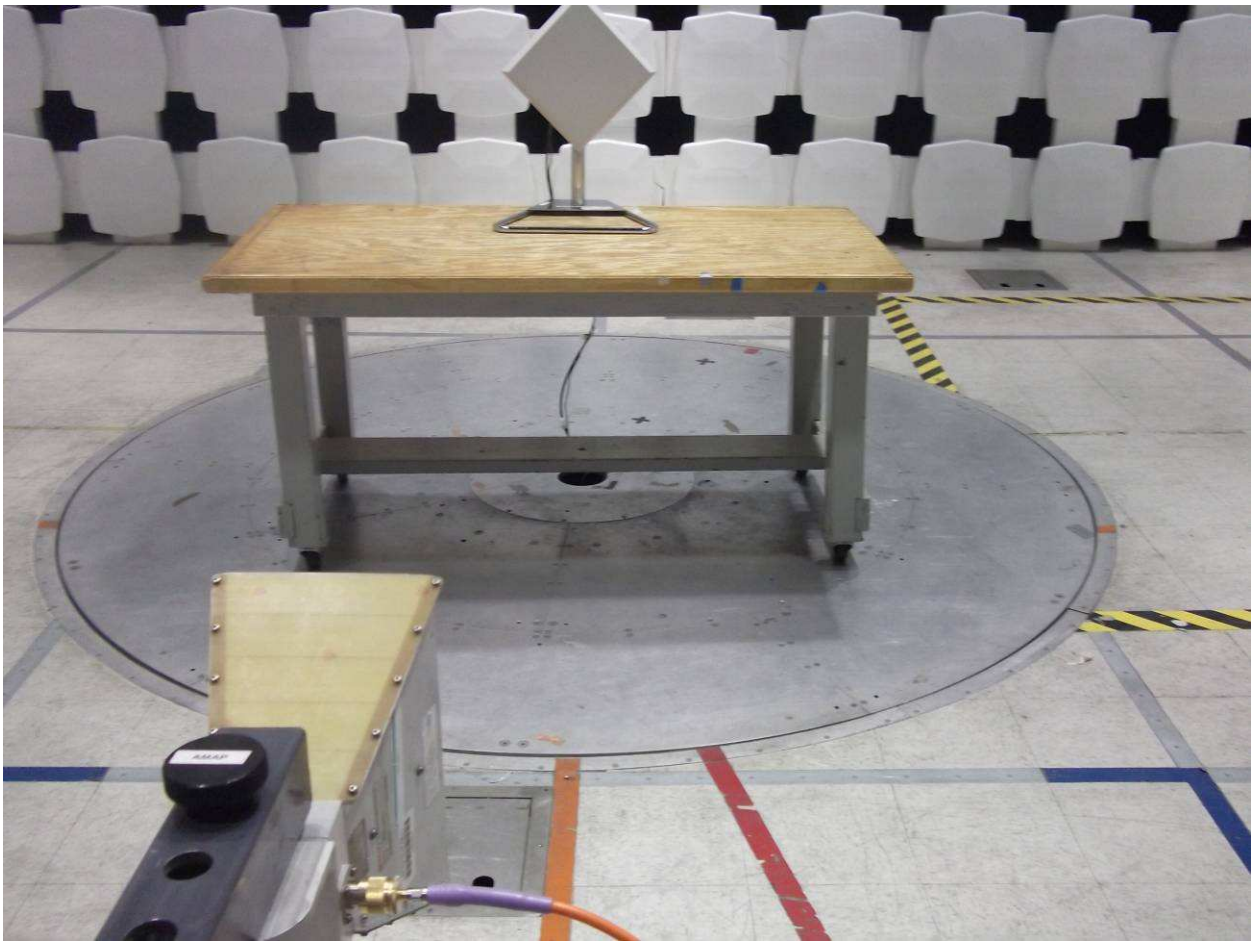


30-1000 MHz

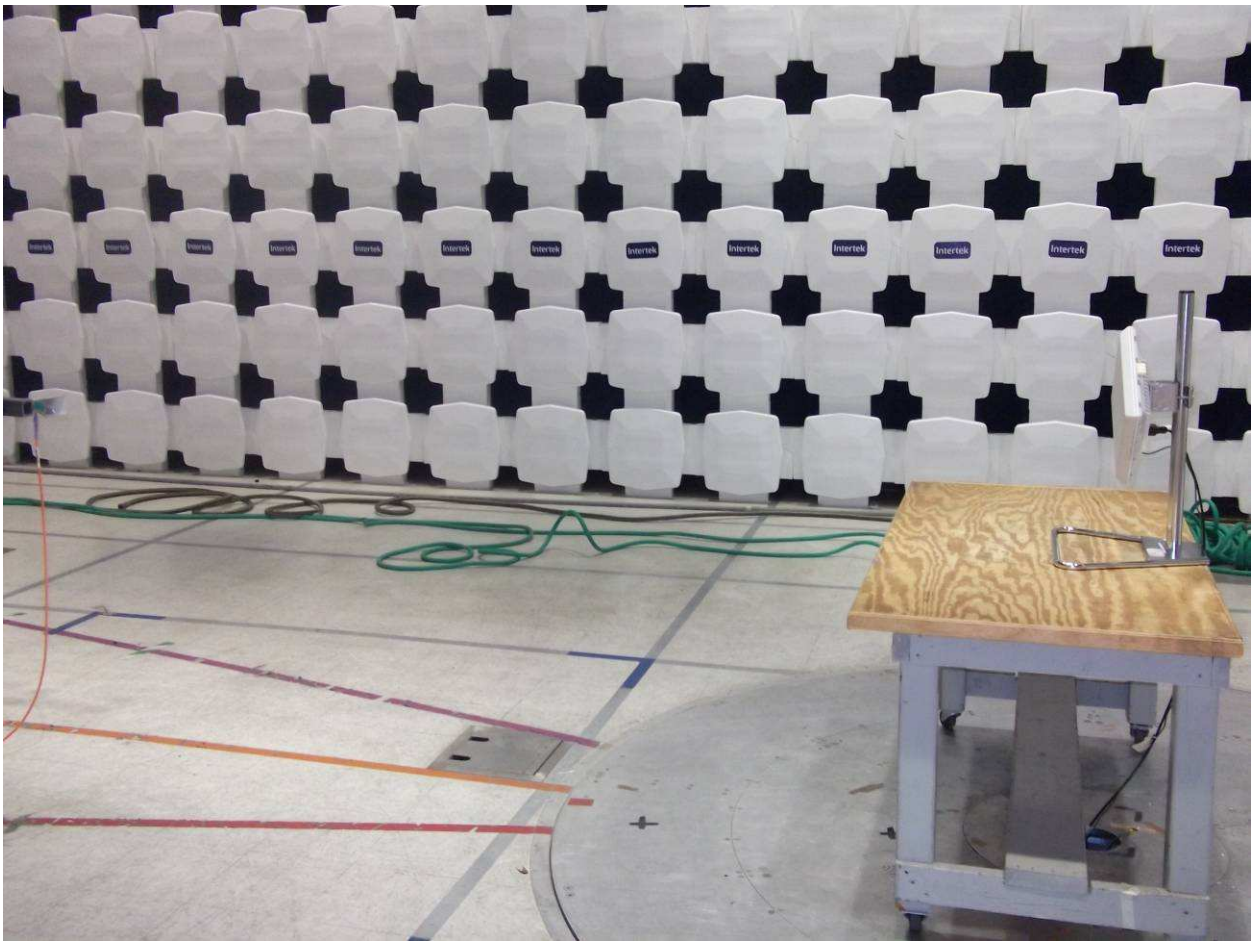


30-1000 MHz

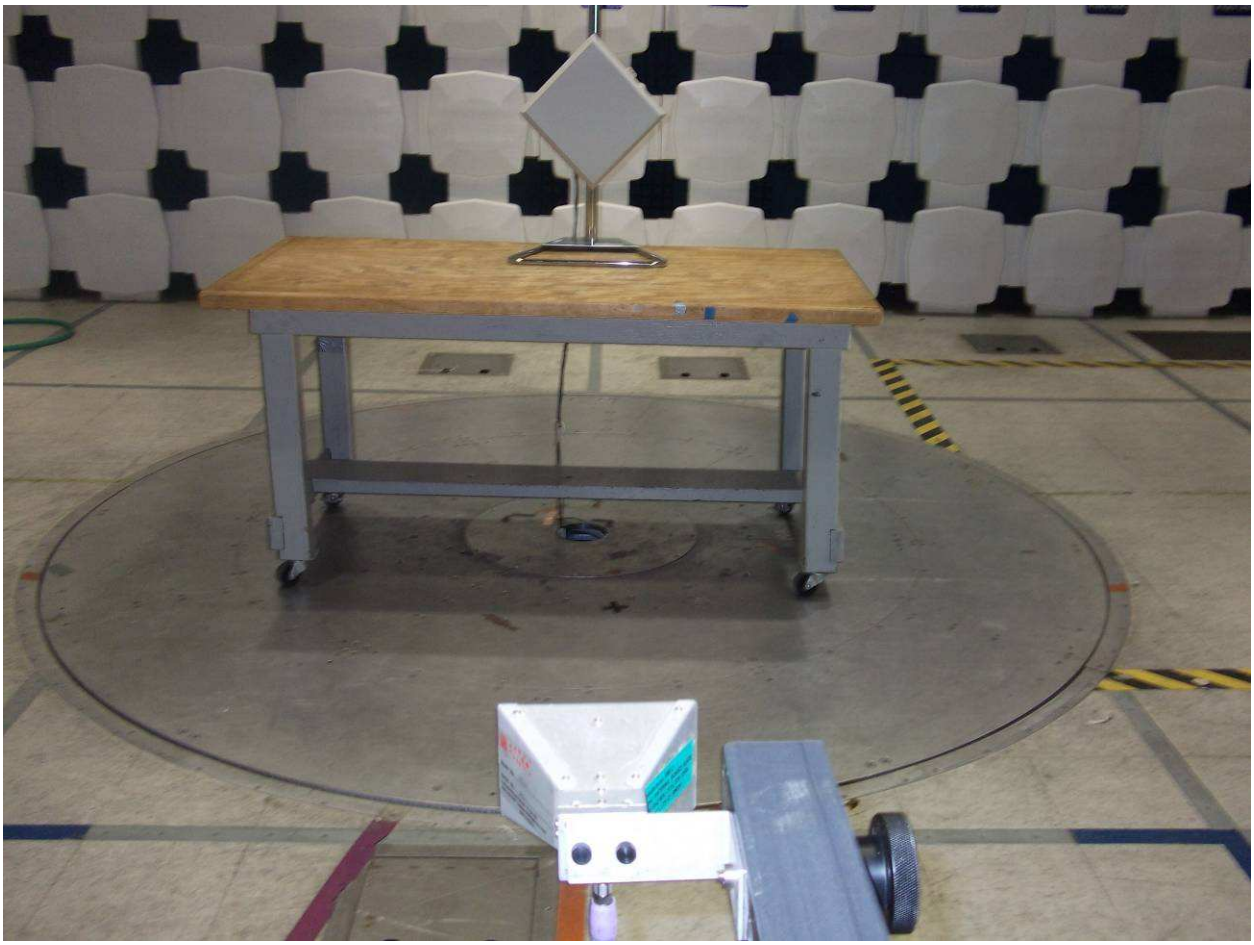
1-18 GHz



1-18 GHz



18-40 GHz

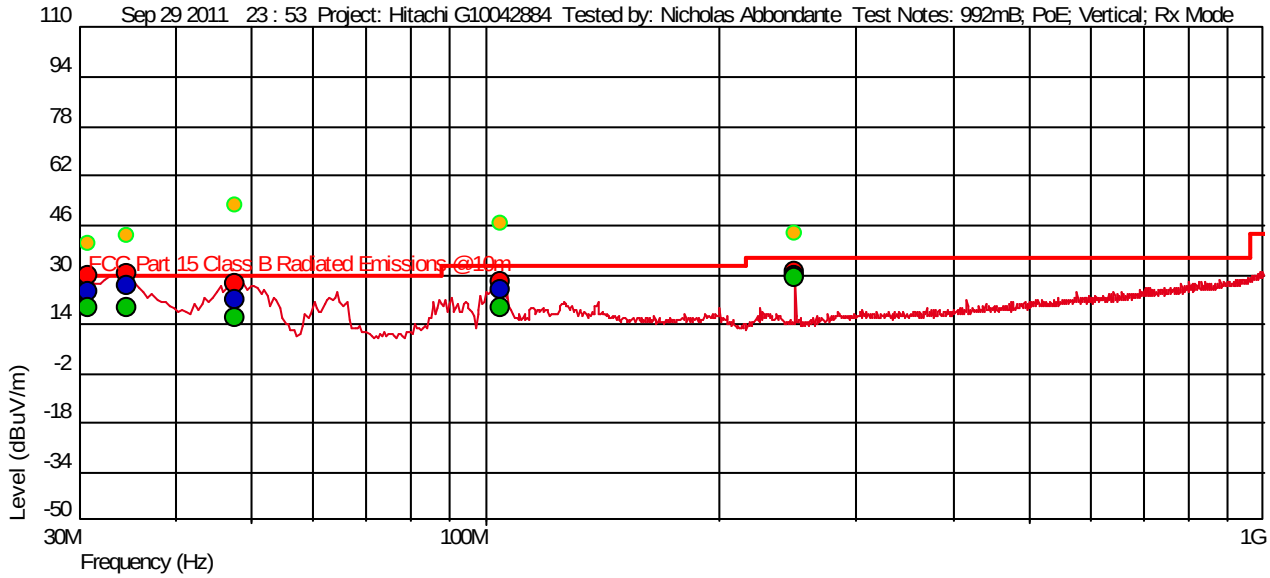


18-40 GHz

10.5 Plots/Data:

Test Information

Test Details	User Input
Project:	Hitachi G10042884
Test Notes:	992mB; PoE; Vertical; Rx Mode
Temperature:	20c
Humidity:	68%
Tested by:	Nicholas Abbondante
Test Started:	Sep 29 2011 23 : 53



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

Level (dBuV/m) = AF + CL + PA + Raw

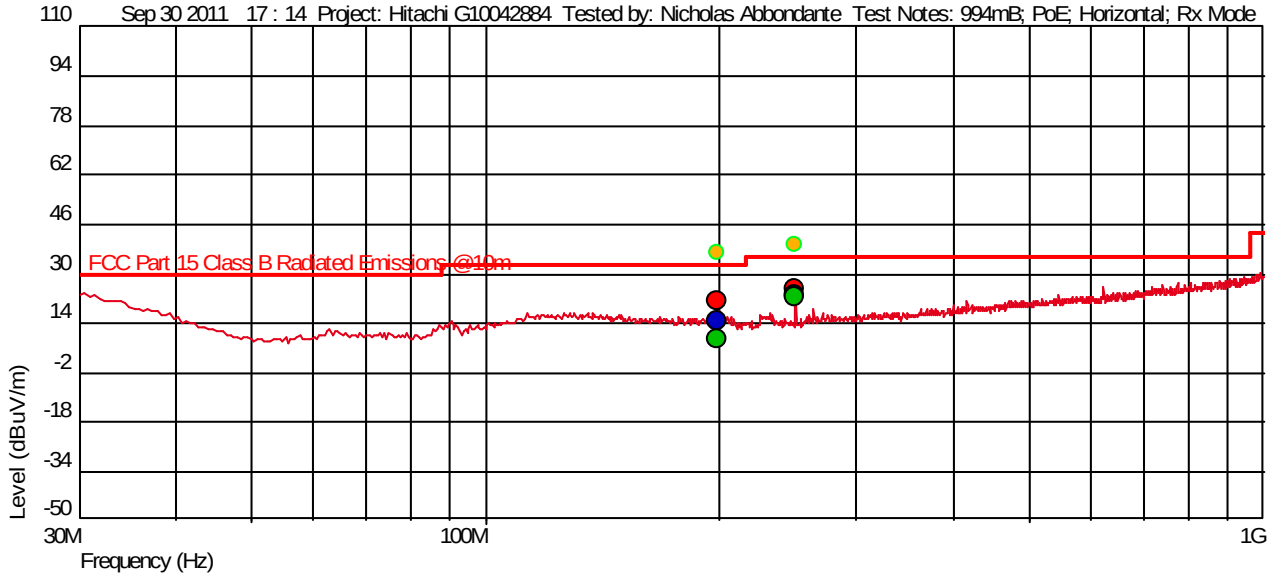
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
30.756 M	24.17	20.195	-25.522	29.54	-5.37	|	52	1.19	120 k
34.639 M	26.52	17.552	-25.673	29.54	-3.02	|	60	2.14	120 k
47.713 M	22.07	8.900	-25.930	29.54	-7.47	|	51	2.28	120 k
104.806 M	24.85	11.461	-25.465	33.04	-8.19	|	342	1.18	120 k
249.993 M	29.58	12.000	-23.960	35.54	-5.96	|	330	1.20	120 k

Test Information

Test Details	User Input
Project:	Hitachi G10042884
Test Notes:	994mB; PoE; Horizontal; Rx Mode
Temperature:	21c
Humidity:	60%
Tested by:	Nicholas Abbondante
Test Started:	Sep 30 2011 17 : 14



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

Level (dBuV/m) = AF + CL + PA + Raw

AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level* (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor (--), Ver (|)	Angle (Deg)	Mast Height (m)	RBW(Hz)
198.259 M	15.01	12.526	-24.425	33.04	-18.03	--	50	3.93	120 k
250.024 M	22.96	11.600	-23.960	35.54	-12.58	--	128	3.85	120 k

Intertek

Special Radiated Emissions

Company: Hitachi Kokusai Electric America, Ltd. Antenna & Cables: LF Bands: N, LF, HF, SHF
Model #: HP5-120100 Antenna: HORN3 V3m 03-28-2012.txt HORN3 H3m 03-28-2012.txt
Serial #: CS006 Cable(s): CBL030 01-06-2012.txt MEG005 01-06-2012.txt
Engineers: Nicholas Abbondante Location: 10m Chamber Barometer: DAV003 Filter: NONE
Project #: G100442884 Date(s): 09/29/11
Standard: FCC Part 15 Subpart C 15.249 P-P Temp/Humidity/Pressure: 20c 68% 992mB
Receiver: R&S FSEK-30 (ROS001) 01-13-2012 Limit Distance (m): 3
PreAmp: PRE9 05-12-2012.txt Test Distance (m): 1
PreAmp Used? (Y or N): Y Voltage/Frequency: PoE Frequency Range: 1-18 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: Noise Floor (a prescan was also performed at a closer distance than 1m to identify emissions)													
PK	V	1000.000	36.62	24.31	2.46	28.06	9.54	25.78	74.00	-48.22	1/3 MHz	RB	RB
AVG	V	1000.000	25.46	24.31	2.46	28.06	9.54	14.62	54.00	-39.38	1/3 MHz	RB	RB
PK	V	5000.000	36.39	34.04	6.55	29.38	9.54	38.06	74.00	-35.94	1/3 MHz	RB	RB
AVG	V	5000.000	25.46	34.04	6.55	29.38	9.54	27.13	54.00	-26.87	1/3 MHz	RB	RB
PK	V	10000.000	34.25	39.92	11.13	26.40	9.54	49.36	74.00	-24.64	1/3 MHz		
AVG	V	10000.000	22.92	39.92	11.13	26.40	9.54	38.03	54.00	-15.97	1/3 MHz		
PK	V	15000.000	34.36	43.02	15.44	25.98	9.54	57.30	74.00	-16.70	1/3 MHz		
AVG	V	15000.000	23.08	43.02	15.44	25.98	9.54	46.02	54.00	-7.98	1/3 MHz		
PK	V	18000.000	33.97	48.46	16.66	28.52	9.54	61.03	74.00	-12.97	1/3 MHz	RB	RB
AVG	V	18000.000	22.92	48.46	16.66	28.52	9.54	49.98	54.00	-4.02	1/3 MHz	RB	RB
Note: Only 'Real' Emissions													
PK	V	1175.000	40.67	25.18	3.16	27.85	9.54	31.62	74.00	-42.38	1/3 MHz	RB	RB
AVG	V	1175.000	36.15	25.18	3.16	27.85	9.54	27.10	54.00	-26.90	1/3 MHz	RB	RB
PK	H	5520.000	41.12	35.18	8.02	29.70	9.54	45.07	93.80	-48.73	1/3 MHz		
AVG	H	5520.000	37.62	35.18	8.02	29.70	9.54	41.57	73.80	-32.23	1/3 MHz		

Intertek

Radiated Emissions

Company: Hitachi Kokusai Electric America, Ltd. Antenna & Cables: HF Bands: N, LF, HF, SHF
Model #: HP5-120100 Antenna: EMC04 V3m 01-25-2012.txt EMC04 H3m 01-25-2012.txt
Serial #: CS006 Cable(s): CBL030 01-06-2012.txt MEG005 01-06-2012.txt
Engineers: Nicholas Abbondante Location: 10m chamber Barometer: DAV003 Filter: NONE
Project #: G100442884 Date(s): 09/28/11
Standard: FCC Part 15 Subpart C 15.249 P-P Temp/Humidity/Pressure: 20c 64% 1006mB
Receiver: R&S FSEK-30 (ROS001) 01-13-2012 Limit Distance (m): 3
PreAmp: PRE9 05-12-2012.txt Test Distance (m): 1
PreAmp Used? (Y or N): Y Voltage/Frequency: PoE Frequency Range: 18-40 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dBuV	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: Receive Mode													
Note: No Spurious emissions detected, noise floor (hand scan performed at <1m test distance), Transmit and Receive Modes													
PK	V	18000.000	26.16	44.70	16.66	28.52	9.54	49.46	74.00	-24.54	1/3 MHz	RB	RB
AVG	V	18000.000	20.52	44.70	16.66	28.52	9.54	43.82	54.00	-10.18	1/3 MHz	RB	RB
PK	V	26000.000	32.25	46.19	20.32	24.91	9.54	64.31	93.80	-29.49	1/3 MHz		
AVG	V	26000.000	23.02	46.19	20.32	24.91	9.54	55.08	73.80	-18.72	1/3 MHz		
PK	V	38000.000	42.32	44.85	29.41	30.21	9.54	76.83	93.80	-16.97	1/3 MHz		
AVG	V	38000.000	34.50	44.85	29.41	30.21	9.54	69.01	73.80	-4.79	1/3 MHz		

Test Personnel:	Nicholas Abbondante	Test Date:	09/28-30/2011
Supervising Engineer: (Where Applicable)	N/A	Test Levels:	See tables and section 10.3
Product Standard:	FCC Part 15 Subpart B 15.109, IC RSS-Gen Section 6.0	Ambient Temperature:	21, 20, 20 ºC
Input Voltage:	PoE	Relative Humidity:	60, 64, 68 %
Pretest Verification w/ Ambient Signals or BB Source:	**Ambient**	Atmospheric Pressure:	994, 1006, 992 mbars

Deviations, Additions, or Exclusions: None

11 Frequency Stability

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.249(b)(2), IC RSS-210 Annex 12(b).

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 wooden table 80 cm high is used for table-top equipment.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
~SAF279	Variac, 0-280VAC	Staco Energy	3PN2520B	SAF279	VBU	Verified
~148012	Temp/Humidity Chamber	Envirotronics	SH27C	08015563S11263	10/05/2011	10/05/2012
~145108	EMI Test Receiver (20Hz - 40GHz)	Rohde & Schwarz	ESIB40	100209	04/28/2011	04/28/2012
~EMC04	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	01/25/2011	01/25/2012

Software Utilized:

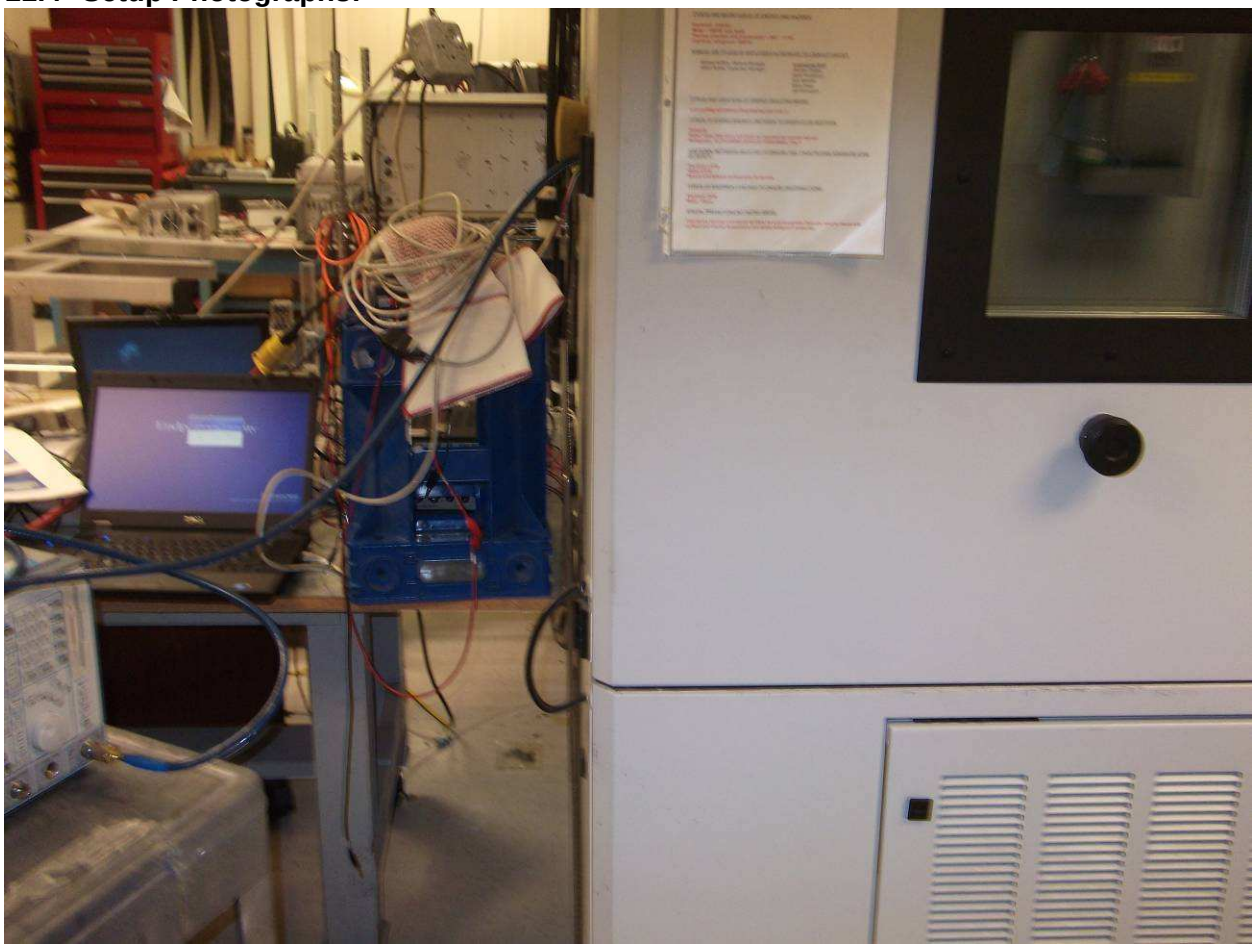
Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2011

11.3 Results:

The frequency of the carrier must be maintained within a tolerance of ±0.001%.

The sample tested was found to Comply.

11.4 Setup Photographs:



11.5 Plots/Data:

Intertek

Frequency Stability

Company: Hitachi Kokusai Electric America, Ltd.
Model #: HP5-120100
Serial #: CS006
Engineer(s): Nicholas Abbondante Location: AMAP
Project #: G100442884 Date(s): 10/25/11
Standard: FCC Part 15 Subpart C 15.249 P-P
Limit: 10 PPM

Test Equipment Used:
148012 145108 EMC04 SAF279

Nominal f: 24140 MHz Voltage: 120 VDC

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	102	24140.004446	-0.011	241.40
+0%	120	24140.004457	0	241.40
+15%	138	24140.004420	-0.037	241.40

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	24140.010147	5.69	241.40
-20	24140.009375	4.918	241.40
-10	24140.009882	5.425	241.40
0	24140.010522	6.065	241.40
10	24140.007260	2.803	241.40
20	24140.004457	0	241.40
30	24140.005157	0.7	241.40
40	24140.004204	-0.253	241.40
50	24140.004495	0.038	241.40

Test Personnel:	Nicholas Abbondante	Test Date:	10/25/2011
Supervising Engineer: (Where Applicable)	N/A	Test Levels:	See section 11.3
Product Standard:	FCC Part 15 Subpart C 15.249(b)(2), IC RSS-210 Annex 12(b)	Ambient Temperature:	N/A ºC
Input Voltage:	PoE	Relative Humidity:	N/A %
Pretest Verification w/ Ambient Signals or BB Source:	**Ambient**	Atmospheric Pressure:	N/A mbars

Deviations, Additions, or Exclusions: None

12 AC Mains Conducted Emissions

12.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.207, IC RSS-Gen Section 7.2.4.

TEST SITE: 10m Chamber Bump-out

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

The AMAP Building and Lab includes general lab space that can be used for testing where a shielded/enclosed environment is not required.

Measurement Uncertainty

For conducted emissions, U_{lab} (3.2 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 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

12.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
~DAV003	Weather Station	Davis Instruments	7400	PE80529A39A	08/02/2011	08/02/2012
~CBLBNC61	50 ohm Coaxial Cable	Coleman Cable	RG223/U	CBLBNC61	09/08/2011	09/08/2012
~145015	LISN: 50 Ohm/50 microHenry	Solar Electronics	9252-50-R-24-BNC	971617	01/18/2011	01/18/2012
~ROS002	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	04/15/2011	04/15/2012
~DS27	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS27	04/19/2011	04/19/2012

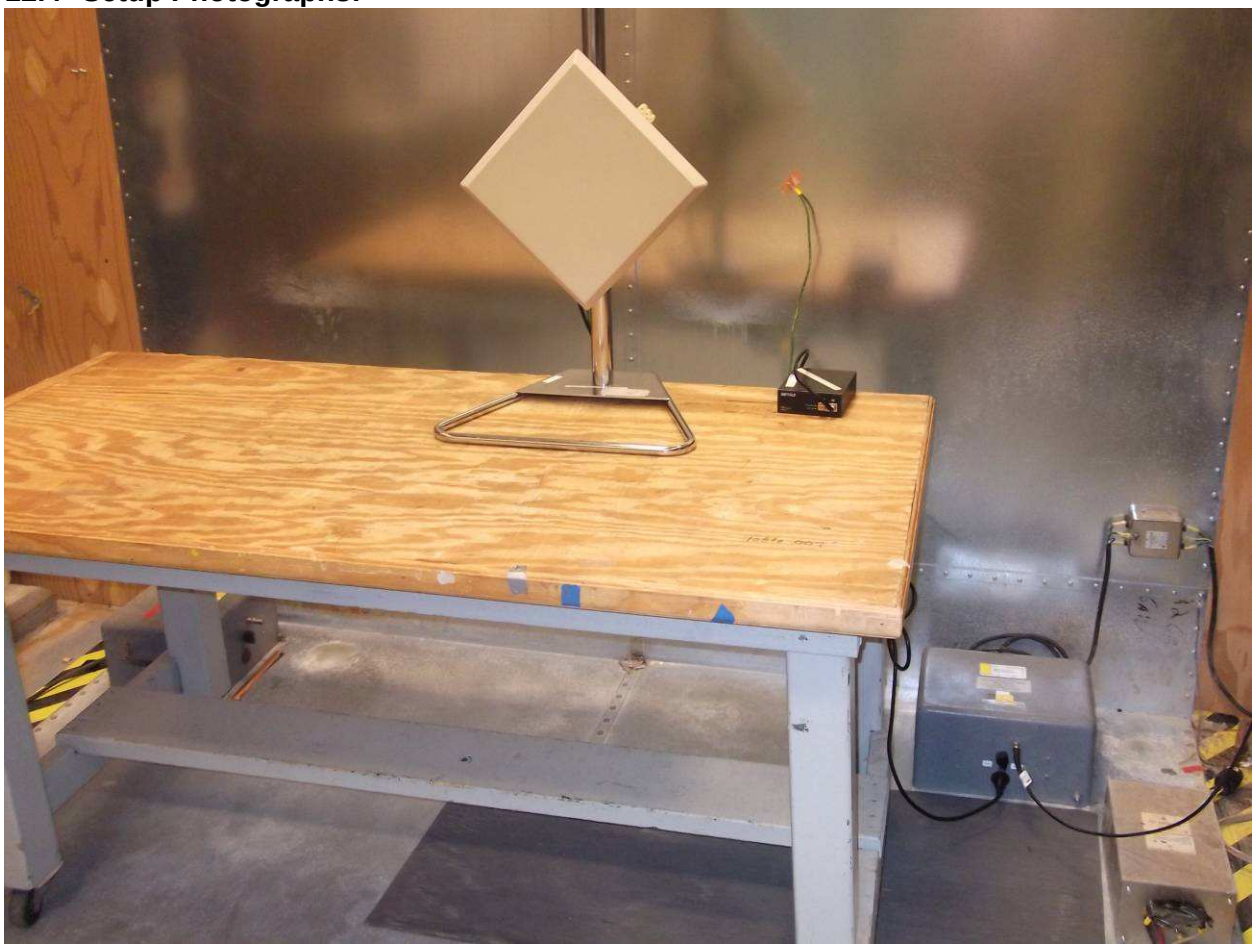
Software Utilized:

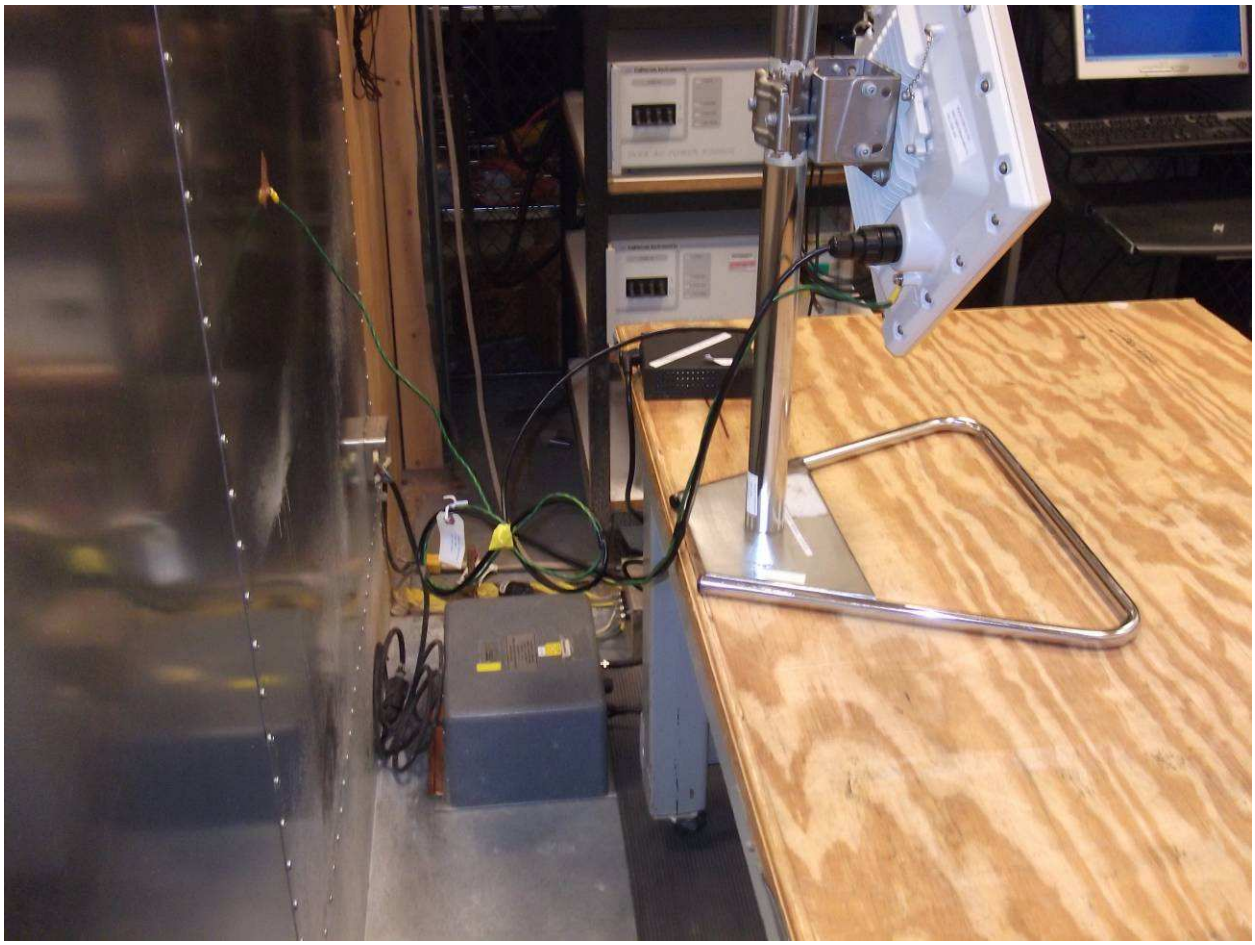
Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2011

12.3 Results:

The sample tested was found to Comply.

12.4 Setup Photographs:





12.5 Data:

Intertek

Conducted Emissions

Company: Hitachi Kokusai Electric America, Ltd.
Model #: HP5-120100
Serial #: CS006
Engineer(s): Nicholas Abbondante
Project #: G100442884 Date: 10/17/11
Standard: FCC Part 15 Subpart C 15.249 P-P
Barometer: DAV003 Temp/Humidity/Pressure: 20c 41% 995mB
Voltage/Frequency: 120V/60Hz
Location: 10m Chamber
Frequency Range: 150 kHz - 30 MHz

Receiver: R&S ESCI (ROS002) 04-15-2012
Cable: CBLBNC61_9-08-2012.txt
LISN 1: LISN145015_line1_1-18-2012.txt
LISN 2: LISN145015_line2_1-18-2012.txt
LISN 3: NONE.
LISN 4: NONE.
Attenuator: DS27_4-19-2012.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
Note: Tx Mode									
QP	0.188	22.40	22.20			42.72	64.12	-21.40	9/30 kHz
QP	0.259	26.80	25.40			47.05	61.48	-14.42	9/30 kHz
QP	0.517	16.60	10.00			36.82	56.00	-19.18	9/30 kHz
QP	2.845	14.10	22.10			42.41	56.00	-13.59	9/30 kHz
QP	12.154	8.70	9.00			29.53	60.00	-30.47	9/30 kHz
QP	15.518	9.20	9.10			29.79	60.00	-30.21	9/30 kHz
Note: Rx Mode									
QP	0.187	22.30	22.40			42.72	64.17	-21.45	9/30 kHz
QP	0.259	26.70	25.60			46.95	61.47	-14.52	9/30 kHz
QP	0.517	16.70	10.10			36.92	56.00	-19.08	9/30 kHz
QP	2.844	14.20	22.20			42.51	56.00	-13.49	9/30 kHz
QP	12.154	8.40	8.90			29.43	60.00	-30.57	9/30 kHz
QP	17.325	9.30	9.40			29.99	60.00	-30.01	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
Note: Tx Mode									
AVG	0.188	19.50	16.20			39.82	54.12	-14.30	9/30 kHz
AVG	0.259	26.40	24.70			46.65	51.48	-4.82	9/30 kHz
AVG	0.517	16.00	9.30			36.22	46.00	-9.78	9/30 kHz
AVG	2.845	13.70	22.10			42.41	46.00	-3.59	9/30 kHz
AVG	12.154	7.80	8.20			28.73	50.00	-21.27	9/30 kHz
AVG	15.518	8.30	8.30			28.89	50.00	-21.11	9/30 kHz
Note: Rx Mode									
AVG	0.187	19.60	16.40			39.92	54.17	-14.25	9/30 kHz
AVG	0.259	26.30	24.80			46.55	51.47	-4.92	9/30 kHz
AVG	0.517	16.10	9.50			36.32	46.00	-9.68	9/30 kHz
AVG	2.844	13.90	22.20			42.51	46.00	-3.49	9/30 kHz
AVG	12.154	7.50	8.00			28.53	50.00	-21.47	9/30 kHz
AVG	17.325	7.90	8.00			28.59	50.00	-21.41	9/30 kHz

Test Personnel:	Nicholas Abbondante	Test Date:	10/17/2011
Supervising Engineer: (Where Applicable)	N/A	Test Levels:	See tables
Product Standard:	FCC Part 15 Subpart C 15.207, IC RSS-Gen Section 7.2.4	Ambient Temperature:	20 ºC
Input Voltage:	PoE	Relative Humidity:	41 %
Pretest Verification w/ Ambient Signals or BB Source:	**Ambient**	Atmospheric Pressure:	995 mbars

Deviations, Additions, or Exclusions: None

13 Revision History

Revision Level	Date	Report Number	Notes
0	11/30/2011	100442884BOX-005	Original Issue