Test of Hosiden Corporation
Smartlook In-Home Display CFU0288

To: FCC 47 CFR Part 15, SubPart C 15.247 &
RSS-210 Annex 8

Test Report Serial No.: GLUE08-U1 Rev B

TEST REPORT

From

Test of: Hosiden Corporation In-Home Display CFU0288

To: FCC 47 CFR Part 15, SubPart C 15.247 & RSS-210 Annex 8

Test Report Serial No.: GLUE08-U1 Rev B

This report supersedes: GLUE08-U1 Rev A

Applicant: Hosiden Corporation
4-33, Kitakyuhoji 1-chome
Yao, Osaka 581-0071
Japan

Product Function: ZigBee In-home Display

Copy No: pdf **Issue Date:** 6th February 2012

This Test Report is Issued Under the Authority of;

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ACCREDITED
TESTING CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1 ACCREDITATION, LISTINGS & RECOGNITION

1.1 TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

1.2 RECOGNITION

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	Listing #: 4143A
Japan	MIC	CAB	APEC MRA 2	210
	VCCI	--	--	No. 2959
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

1.3 PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC Guide 65. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC Guide 65:1996 *General requirements for bodies operating product certification systems*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system for a Telecommunications Certification Body (TCB) meeting FCC (U.S.), Japan (MIC), and IC (Canada) requirements.

Presented this 24th day of June 2010.

President & CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to March 31, 2012
Revised January 20, 2012

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

United States of America – Telecommunication Certification Body (TCB)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)
RCB Identifier - 210

2 DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	23rd January 2012	Initial Release
Rev B	6th February 2012	Clarification of 802.15.4 Time Averaged Duty Cycle on P53.

3 TEST RESULT CERTIFICATE

Applicant:	Hosiden Corporation 4-33, Kitakyuhoji 1-chome Yao, Osaka 581-0071 Japan	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
Product:	ZigBee In-home display	Telephone:	+1 925 462 0304
Model No.:	CFU0288	Fax:	+1 925 462 0306
S/No's:	Not Available		
Date(s) Tested:	21st – 23rd October 2011	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15, SubPart C 15.247 & RSS-210 Annex 8	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:

ACCREDITED
TESTING CERTIFICATE #2381.01

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

4 REFERENCES AND MEASUREMENT UNCERTAINTY

4.1 Normative References

Ref.	Publication	Year	Title
i.	FCC 47 CFR Part 15, SubPart C 15.247	2010	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES Subpart C—Intentional Radiators
ii.	RSS-210 Annex 8	2010	Radio Standards Specification 210, Issue 8, Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment,
iii.	RSS-GEN	2010	Radio Standards Specification-Gen, Issue 3, General Requirements and Information for the Certification of Radiocommunication Equipment,
iv.	47 CFR Part 15, SubPart B	2010	47 CFR Part 15, SubPart B; Unintentional Radiators
v.	ICES-003	2004	Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard Digital Apparatus; Issue 4
vi.	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
vii.	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
viii.	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
ix.	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
x.	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
xi.	A2LA	9th June 2010	Reference to A2LA Accreditation Status – A2LA Advertising Policy

4.2 Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

5 TEST SUMMARY

List of Measurements: The following table represents the list of measurements required under FCC 47 CFR Part 15, SubPart C 15.247 & industry Canada RSS-210 Annex 8.

Standard Section(s)	Test Description	Condition	Result	Notes	Test Report Section
15.247 (a)(2)	6 dB Occupied Bandwidth	Conducted	PASS	Note 1,2,3	7.1
15.247 (i)	Maximum Permissible Exposure	Calculation	PASS	Note 1,2,3	7.2
15.247 (b)(3), 15.247 (b)(4)	Peak Output Power	Conducted	PASS	Note 1,2,3	7.3
15.247 (e)	Peak Power Spectral Density	Conducted	PASS	Note 1,2,3	7.4
15.247 (d)	Spurious Emissions	Conducted	PASS	Note 1,2,3	7.5
15.247 (d), 15.205, 15.209	Transmitter Radiated Spurious Emissions	Radiated	PASS	Note 1,2,3	7.6.1
RSS-GEN	Radiated Receiver Emissions	Radiated	PASS	Note 1,2,3	7.6.2
15.207	AC Wireline Emissions 0.15 – 30 MHz	Conducted	PASS	Note 1,2,3	7.7

Note 1: Test results reported in this document relate only to the items tested

Note 2: The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria

Note 3: Section 6.11 Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix

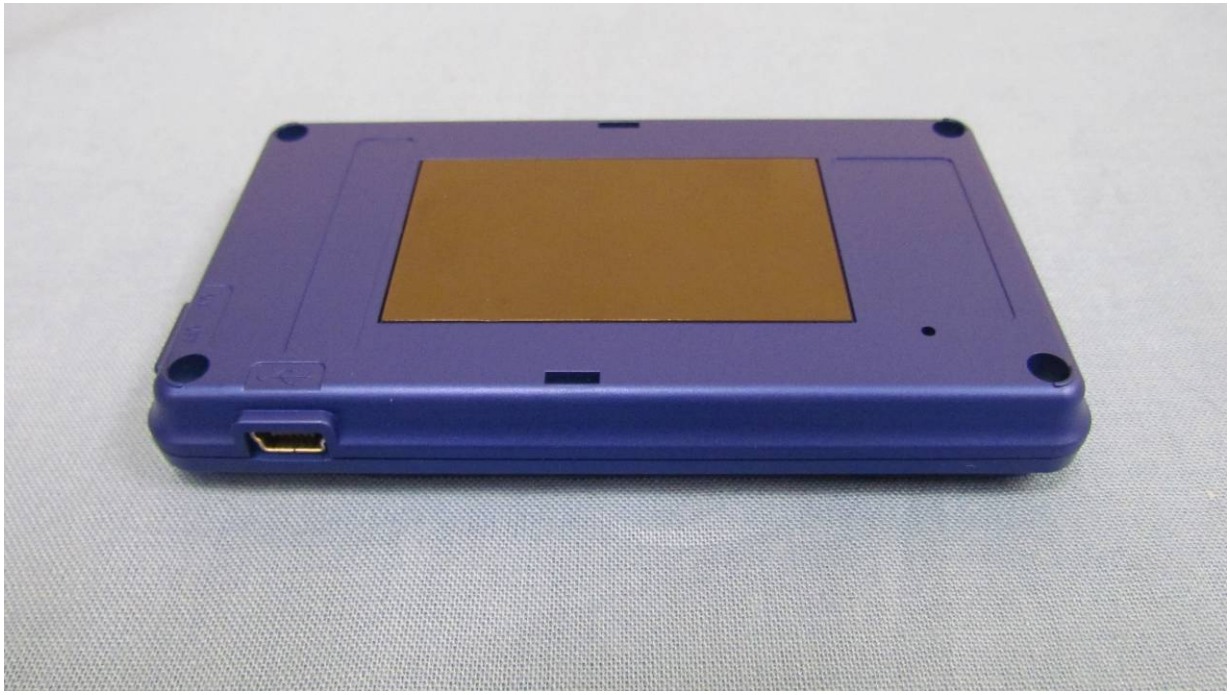
6 PRODUCT DETAILS AND TEST CONFIGURATIONS

6.1 Test Program Scope

The scope of the test program was to test the Hosiden Corporation SmartLook CFU0288 802.15.4 ZigBee device for compliance against FCC 47 CFR Part 15, SubPart C 15.247 & RSS-210 Annex 8.

APPLICANT: Hosiden Corporation **PRODUCT:** SmartLook CFU0288 Front

APPLICANT: Hosiden Corporation **PRODUCT:** SmartLook CFU0288 Back



AC-DC Switch Mode Adapter; ENG, Model No; 3A-058WU05

6.2 EUT Details

DETAIL	DESCRIPTION
Purpose:	Test of the Hosiden Corporation Smartlook In-Home Display CFU0288 transmitter for compliance against FCC 47 CFR Part 15, SubPart C 15.247 & RSS-210 Annex 8
Applicant:	Hosiden Corporation 4-33, Kitakyuhoji 1-chome Yao, Osaka 581-0071 Japan
Manufacturer:	Same as Applicant
Test Laboratory:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	GLUE08-U1 Rev B
Date EUT received:	6th October 2011
Dates of test (from - to):	21st – 23rd October 2011
No of Units Tested:	1
Product Name:	SmartLook
Manufacturers Trade Name:	Hosiden Corporation
Model No.:	CFU0288
Equipment Primary Function:	ZigBee in home display
Equipment Secondary Function(s):	N/A
Type of Technology:	802.15.4 Low rate Personal Area Network (LR-WPAN)
Installation type:	Portable
Construction/Location for Use:	Indoor
Software/Firmware Release:	July 13, 2011 SMSP firmware
Hardware	CFU0288-01
Test Software Release:	HOS1 2/14/11
Rated Input Voltage and Current DC:	Nominal: 3.7V; Battery: 3.0 V – 4.2 V, 0.5 A Charger (USB) supply: 5V +/- 10% 1.0A
Operating Temperature Range ºC:	Min: 0 °C Max: 40 °C
Equipment Dimensions:	98 x 55 x 14.4 mm
Weight:	68g
Transmit/Receive Operation:	Simplex
Output Power Type	Fixed

6.3 External A.C. / D.C. Power Adaptor

Model	Description
ENG, Model No; 3A-058WU05	Input: 100 - 240V AC; 50-60 Hz; 0.3 Amp Output: 5V DC; 1 Amp

6.4 Operational Power Range

DECLARED O/P POWER RANGE	ZIGBEE	
	MAX	MIN
EUT	17 ± 2 dBm	N/A

6.5 Types of Modulation Supported

MODULATION / MODE	BW 1
802.15.4	QPSK, DSSS

6.6 Antenna Details

The following is a description of the EUT antennas.

ANTENNA TYPE:	MANUFACTURER	MODEL	GAIN (dBi)	FREQUENCY RANGE (MHZ)
Integral: Inverse-F PCB	Hosiden Corporation	N/A	2.42	2400 – 2500 MHz

6.7 Cabling and I/O Ports

The following is a description of the cable and input, output ports available on the EUT.

TYPE OF I/O PORTS	DESCRIPTION	SHIELDED (Y/N)	LENGTH	QTY	TESTED (Y/N)
Power supply	Power connector - mini USB for charging using power supply (3A-058WU05)	Y	< 3 meters	1	Y

6.8 EUT Configurations

BAND (GHZ)	MODE	FREQ BAND (MHZ)	FREQ. RANGE (MHZ)	LOW CH.	MID CH.	HIGH CH.	# CH.	CH. SPACING (MHZ)
2.4	ZigBee	2400 - 2483.5	2405- 2480	2405	2445	2480	16	5

6.9 Equipment Details

The following is a description of supporting equipment used during the test program.

TYPE	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO (S).	TESTED
AC-DC Adapter	I.T.E. Power Supply	ENG	3A-058WU05	N/A	N

6.10 Test Configurations

OPERATIONAL MODE(S)	DATA RATE TESTED	DUTY CYCLE
ZigBee	250 kbit/s	100 %

6.11 Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. None

6.12 Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. None

7 TEST RESULTS

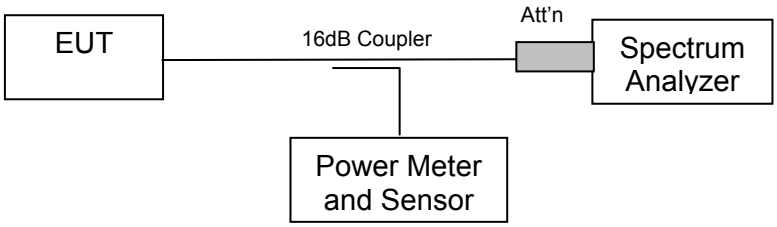
7.1 6 dB and 99% Bandwidth

Test Procedure

The test methodology and conditions utilized for each measurement is referenced in the following test results matrix. 6 dB and 99% bandwidth were measured per the Test Configuration identified below.

Testing was restricted to a single port.

Test Configuration



Test setup for 6 dB & 99% Bandwidth

Specification for 6dB Bandwidth Limits

FCC §15.247 (a)(2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

Industry Canada RSS-210 §A8.2 (a)

These include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to all three bands:

(a) The minimum -6 dB bandwidth shall be at least 500 kHz.

Traceability

Method	Test Equipment Used
WI-03	0158, 0252, 0313, 0314, 0116, 0117, 0287, 0363

7.1.1 6 dB and 99% Bandwidth Results: 802.15.4

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	2.4 G ZigBee	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	2.42 dBi
Applied Voltage:	3.70 Vdc		
Notes 1:			
Notes 2:			

6 dB Bandwidth

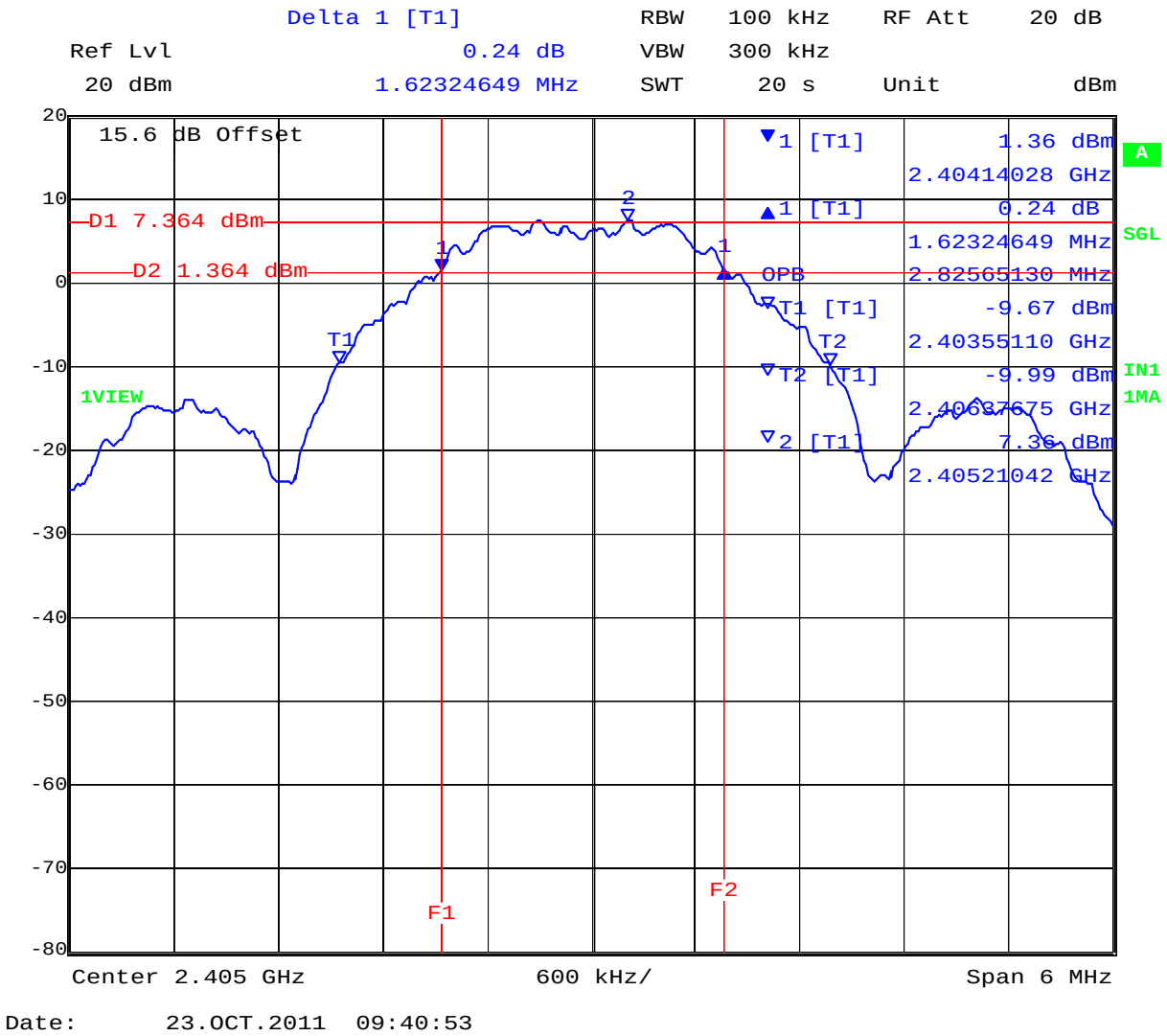
Test Frequency	6 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	a	b	c	d	kHz	MHz	MHz
2405.00	1.623000	--	--	--	500	0.5	-1.123000
2445.00	1.623000	--	--	--			-1.123000
2480.00	1.623000	--	--	--			-1.123000

99% Bandwidth

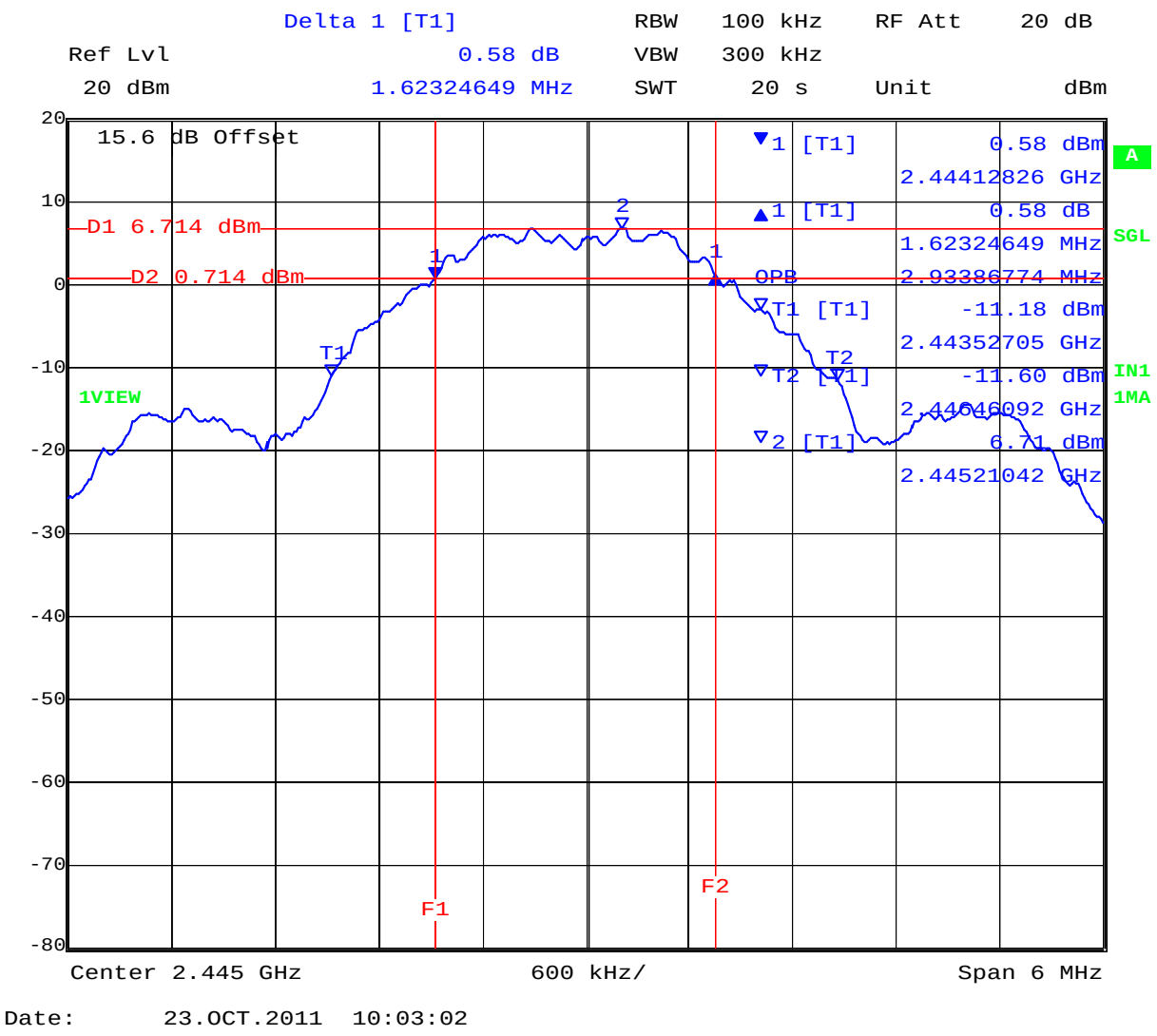
Test Frequency	99 % Bandwidth						
	MHz						
MHz	a	b	c	d			
2405.00	2.826000	--	--	--			
2445.00	2.934000	--	--	--			
2480.00	3.030000	--	--	--			

Measurement uncertainty:	±2.81 dB

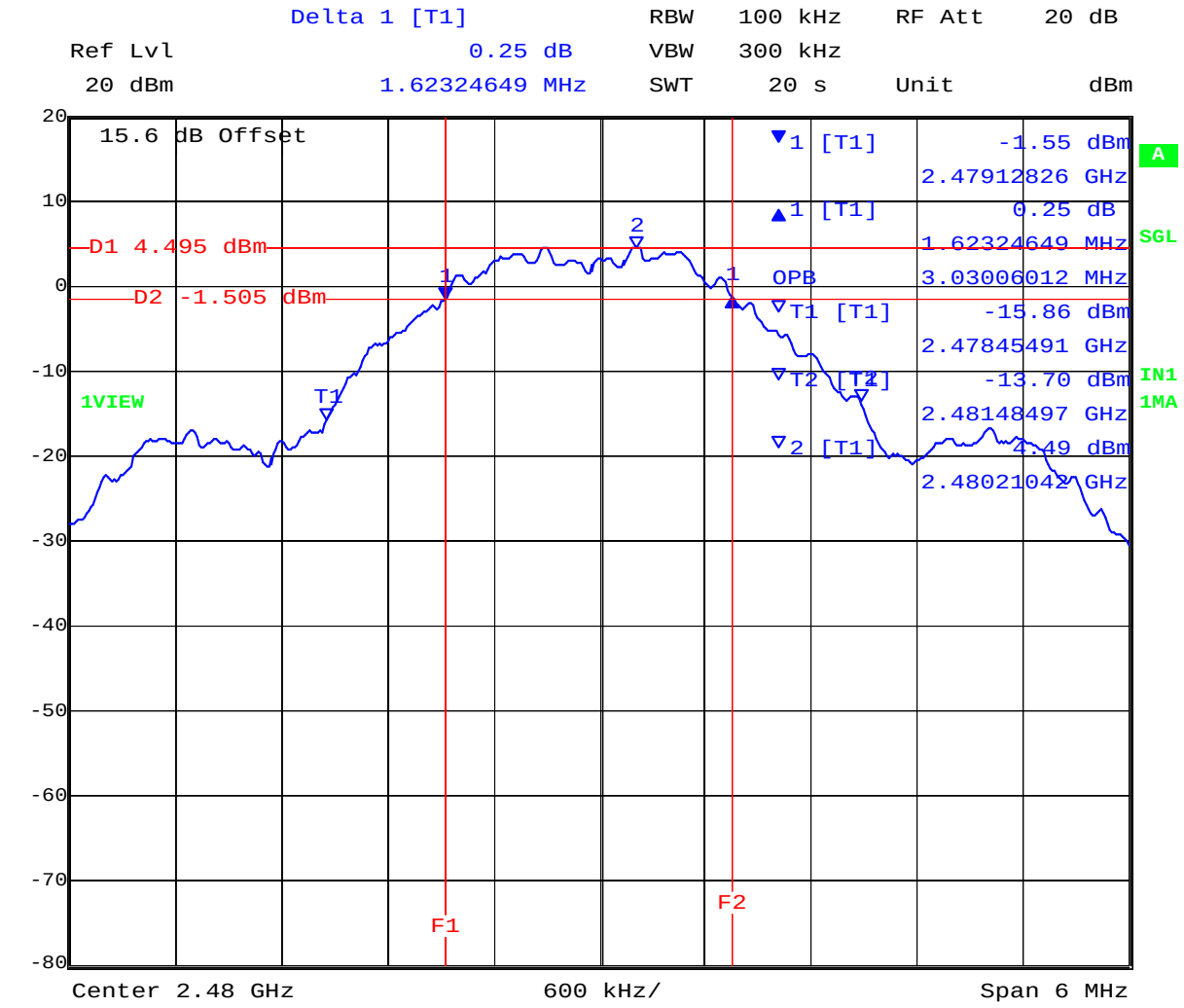
2405 MHz 802.15.4 6 dB and 99% Bandwidth



2445 MHz 802.15.4 6 dB and 99% Bandwidth



2480 MHz 802.15.4 6 dB and 99% Bandwidth

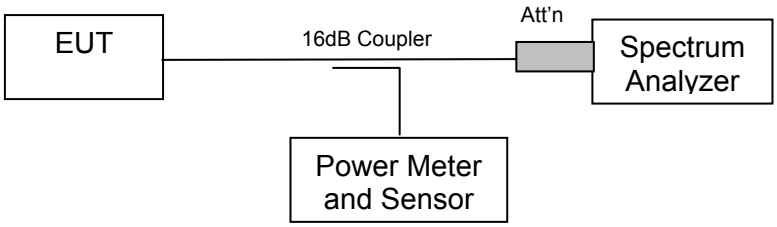


7.2 Peak Output Power

Test Procedure

The test methodology and conditions utilized for each measurement is referenced in the test results matrix. The average output power was measured per the test configuration identified below. Per the standard measurements were taken at ambient conditions, nominal voltage.

Test Measurement Set up



Measurement set up for Transmitter Output Power

Specification for Peak Output Power Limits

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1.0 watt.

15.247 (b) (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

15.247 (c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:
(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

§15.31 (e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Specification for Peak Output Power Limits (continued)

Industry Canada RSS-210 §A8.4 (4)

(4) For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

(5) Point-to-point systems in the bands 2400-2483.5 MHz and 5725-5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding 4 W e.i.r.p. However, remote stations of point-to-multipoint systems shall be allowed to operate at greater than 4 W e.i.r.p. under the same conditions as for point-to-point systems.

Note: "Fixed point-to-point operation" excludes point-to-multipoint systems, omni directional applications and multiple co-located transmitters transmitting the same information.

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287, 0363

7.2.1 Measurement results for 802.15.4

Test Conditions:	15.247 (b)	**Rel. Humidity (%):**	35 to 42
Variant:	2.4 G ZigBee	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	2.42 dBi
Applied Voltage:	3.70 Vdc		
Notes 1:			
Notes 2:			

Test Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
2405	17.92	--	--	--	N/A	17.92	30.00	-12.08
2445	18.46	--	--	--	N/A	18.46	30.00	-11.54
2480	17.89	--	--	--	N/A	17.89	30.00	-12.11

Measurement uncertainty:	±1.33 dB

The above Output power table has been amended according to the power reduction required by the Radiated Band-Edge test which can be found in Section 7.6.1 Transmitter Radiated Spurious Emissions.

7.3 Maximum Permissible Exposure

Calculations for Maximum Permissible Exposure Levels

Power Density = Pd (mW/cm2) = EIRP/(4πd2)
EIRP = P * G
P = Peak output power (mW)
G = Antenna numeric gain (numeric)
d = Separation distance (cm)
Numeric Gain = 10 ^ (G (dBi)/10)

The Peak Power in mW is the highest transmitter power measured and summed across all transmitters. Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm2

Freq. Band (GHz)	Antenna Gain (dBi)	Peak Output Power (dBm)	Antenna Gain (numeric)	Peak Output Power (mW)	Power Density (mW/cm^2) @ 20 cm	Minimum Separation Distance (cm)
2.4 - 2.4835	2.42	+18.46	1.75	70.2	0.025	20

Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

Specification

Maximum Permissible Exposure Limits

FCC §1.1310

Limit = 1mW / cm^2 from 1.310 Table 1

RSS-Gen §5.6

Exposure of Humans to RF Fields: Category I and Category II equipment shall comply with the applicable requirements of RSS-102.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

7.4 Peak Power Spectral Density

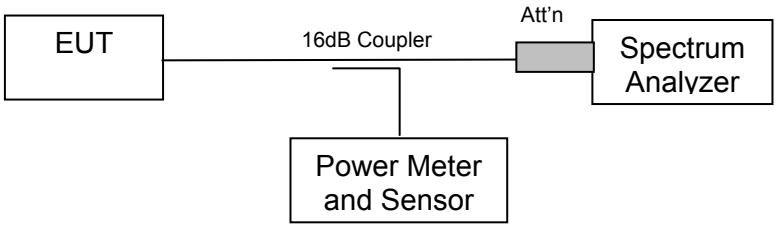
Test Procedure

The test methodology and conditions utilized for each measurement is referenced in the following test results matrix. RF output power, transmit power control and power density were measured per the Test Configuration identified below.

Testing was performed on the highest and lowest power settings of the equipment.

Per the standard measurements were taken at ambient and extreme temperature conditions at nominal and extreme voltage levels.

Test Measurement Set up



Measurement setup for Peak Power Spectral Density

Specification for Peak Power Spectral Density Limits

FCC §15.247 (e)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission

Industry Canada RSS-210 §A8.2 (b)

(b) The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section A8.4 (4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287, 0363

7.4.1 Measurement results for 802.15.4

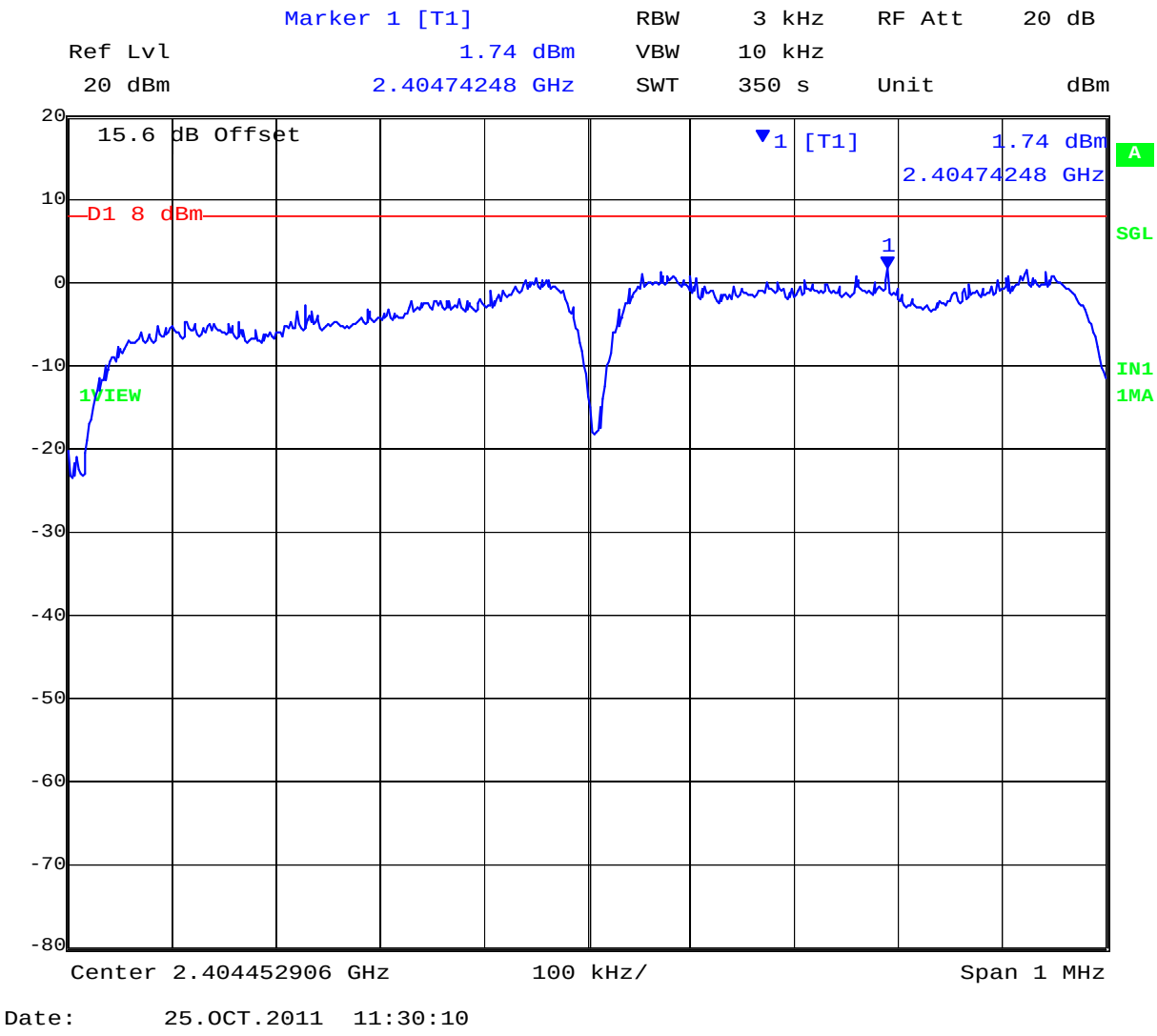
Test Conditions:	15.247 (e)	**Rel. Humidity (%):**	35 to 42
Variant:	2.4 G ZigBee	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	2.42 dBi
Applied Voltage:	3.70 Vdc	**Antenna Ports (N):**	1
Notes 1:			
Notes 2:			

Test Frequency	Measured Power Density RF Port (dBm)				Correction factor	Peak Power Spectral Density	Limit	Margin
MHz	a	b	c	d	10Log(N)	dBm	dBm	dB
2405.000	1.74	--	--	--	0.00	1.74	8.00	-6.26
2445.000	4.65	--	--	--	0.00	4.65	8.00	-3.35
2480.000	1.29	--	--	--	0.00	1.29	8.00	-6.71

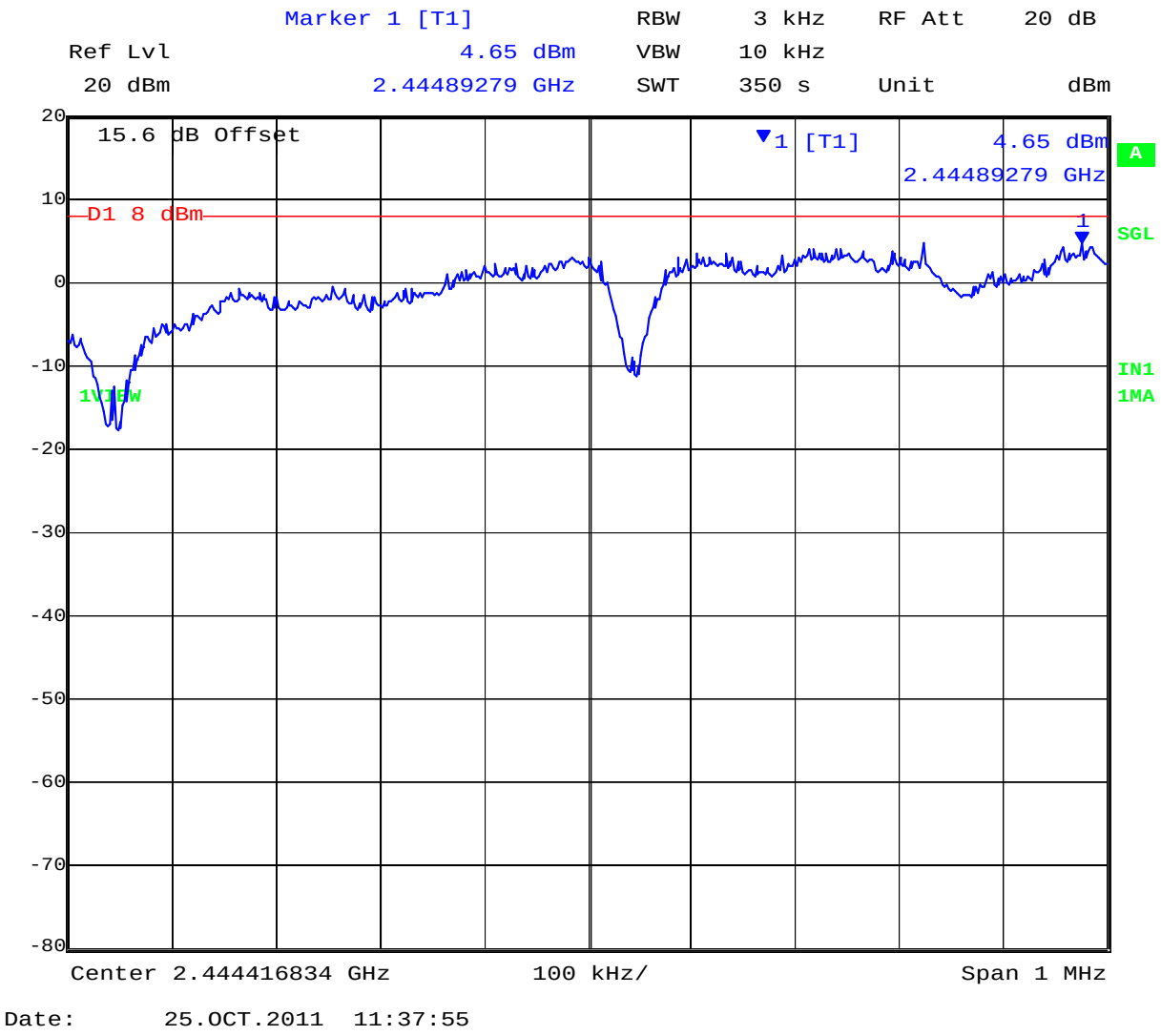
Measurement uncertainty:	± 1.33 dB

The above Power Density table has been amended according to the power reduction required by the Radiated Band-Edge test which can be found in Section 7.6.1 Transmitter Radiated Spurious Emissions.

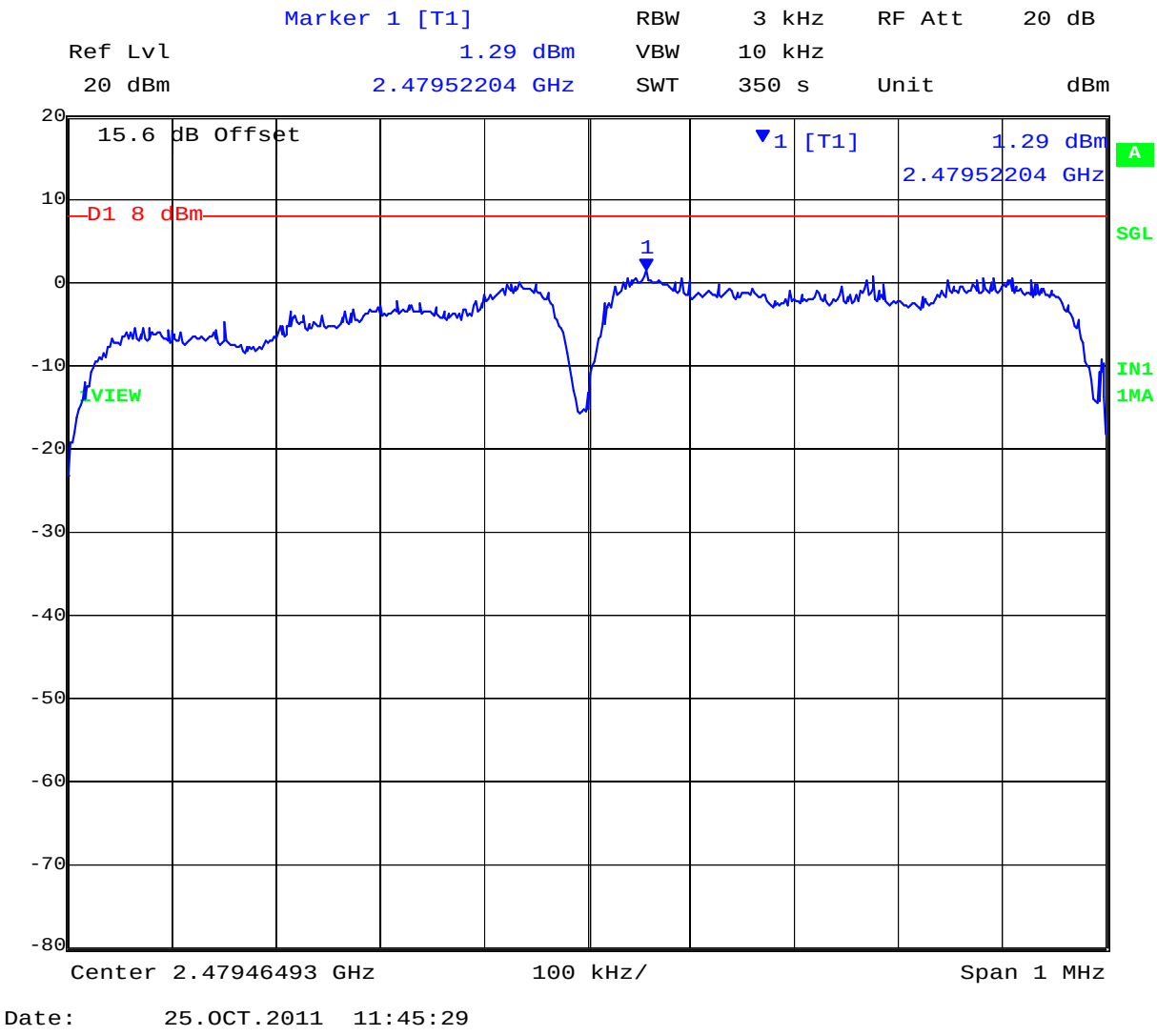
2405 MHz 802.15.4 - Peak Power Spectral Density



2445 MHz 802.15.4 - Peak Power Spectral Density



2480 MHz 802.15.4 - Peak Power Spectral Density



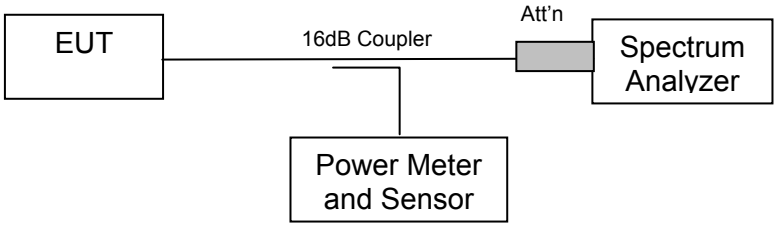
7.5 Conducted Spurious Emissions

Test Procedure

Conducted emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Emissions at the band edge were measured and recorded. Measurements were made while EUT was operating in transmit mode of operation at the appropriate center frequency.

Measurements were made using a combiner with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limits which were derived from the peak emission.

Test Measurement Set up



Measurement setup for Conducted Spurious Emission

Specification

FCC §15.247(d) RSS-210 §A8.5

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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)).

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
2,400 MHz	2,483.5 MHz	≥ 20 dB
5725 MHz	5850 MHz	

Traceability

Method	Test Equipment Used
WI-05	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287, 0363.

7.5.1 Measurement Results for 802.15.4

Test Conditions:	15.247 (a)(2)		**Rel. Humidity (%):**	35 to 42	
Variant:	2.4 G ZigBee		**Ambient Temp. (ºC):**	19 to 22	
TPC:	HIGH		**Pressure (mBars):**	998 to 1003	
Modulation:	ON		**Duty Cycle (%):**	100	
Beam Forming Gain	N/A	dB	**Antenna Gain:**	2.42	dBi
Applied Voltage:	3.70	Vdc	**Antenna Ports (N):**		
Notes 1:					
Notes 2:					

Conducted Spurious Measurement

Test Freq.	Start Freq.	Stop Freq.	Port A		Port B		Port C		Port D	
MHz	MHz	MHz	SE dBm	Limit dBm	SE dBm	Limit dBm	SE dBm	Limit dBm	SE dBm	Limit dBm
2405.00	30.00	26000.00	-44.30	-13.60						
2445.00	30.00	26000.00	-43.41	-14.98						
2480.00	30.00	26000.00	-44.34	-17.69						

SE: Maximum spurious emsission found

Band-edge Measurement

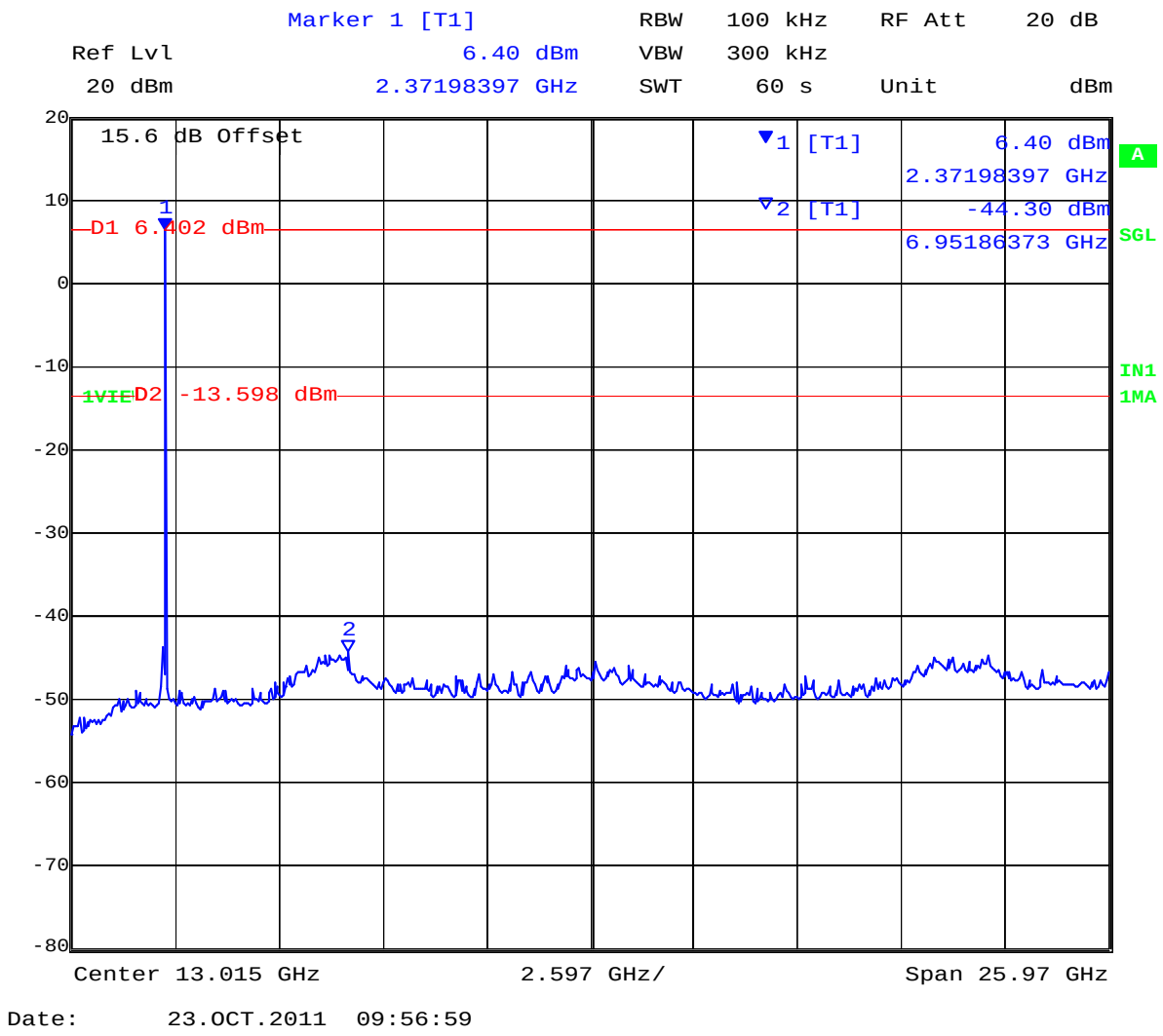
Test Freq.	Band-edge freq.	Port A		Port B		Port C		Port D	
MHz	MHz	BE dBm	Limit dBm	BE dBm	Limit dBm	BE dBm	Limit dBm	BE dBm	Limit dBm
2405.00	2400.00	-41.03	-12.66						
2480.00	2483.50	-36.30	-15.60						

BE: Maximum Band edge emssion found

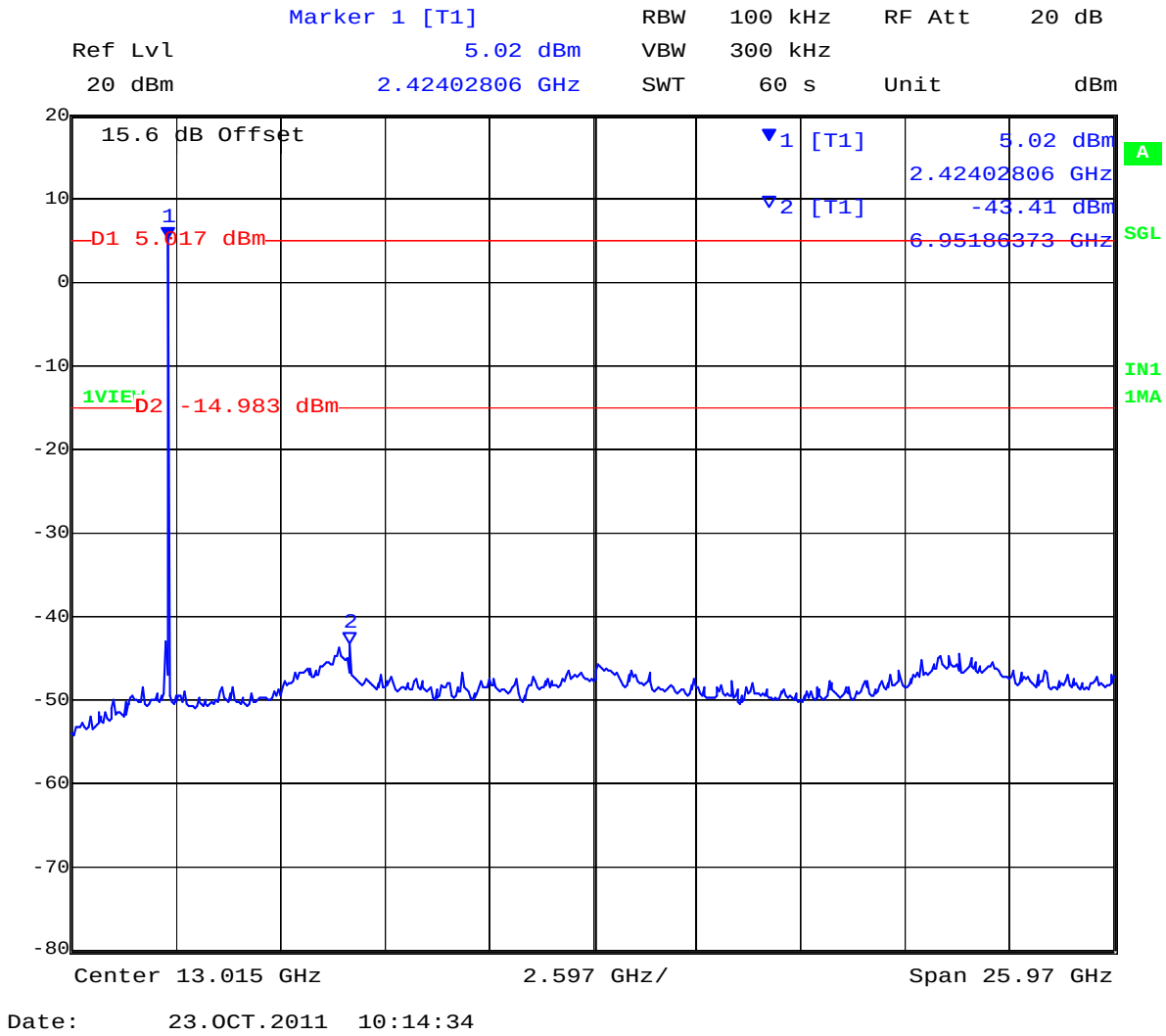
Measurement uncertainty:	±2.81 dB

Note: Limit is based on 20dB down from fundamental emissions

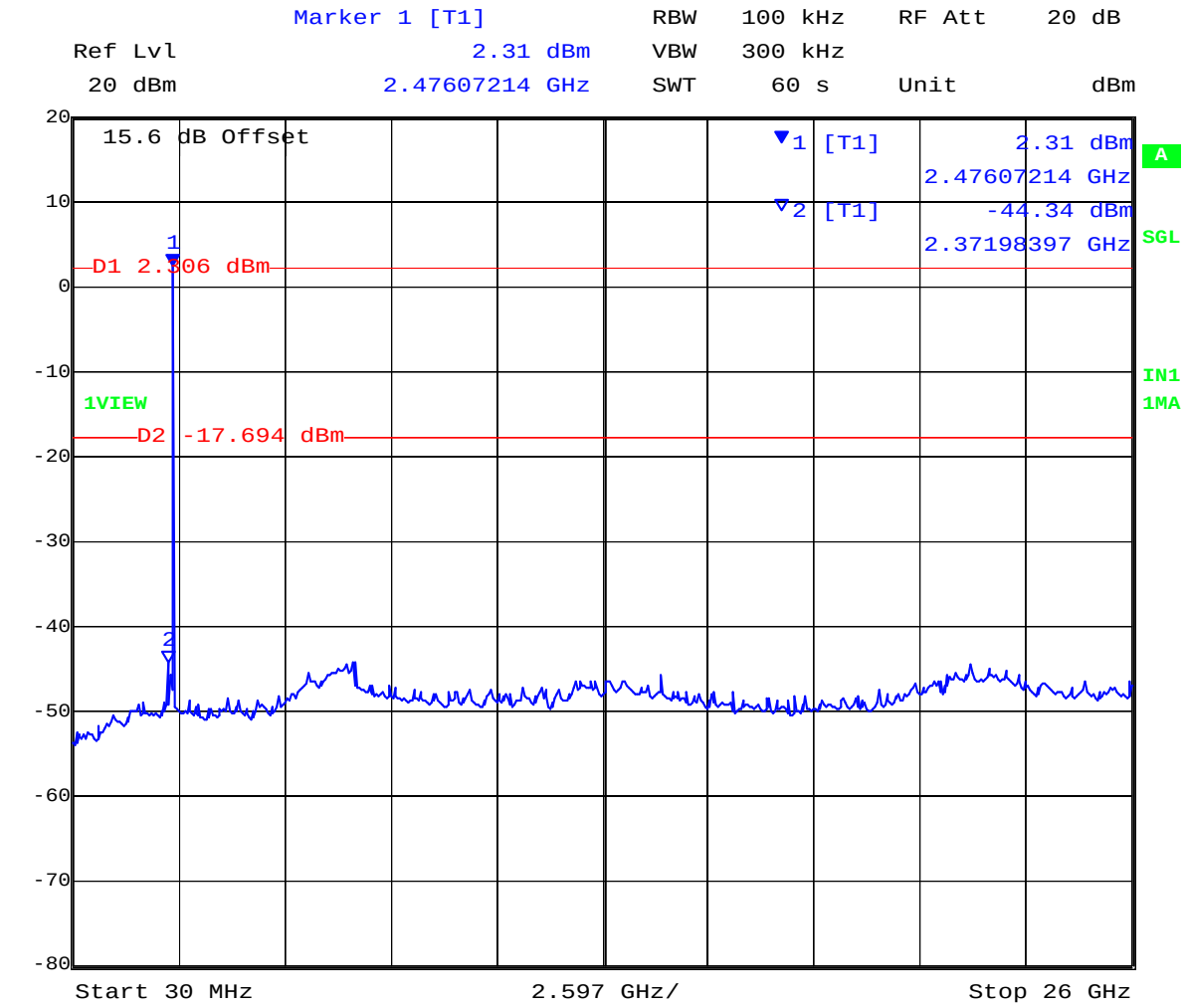
2405 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



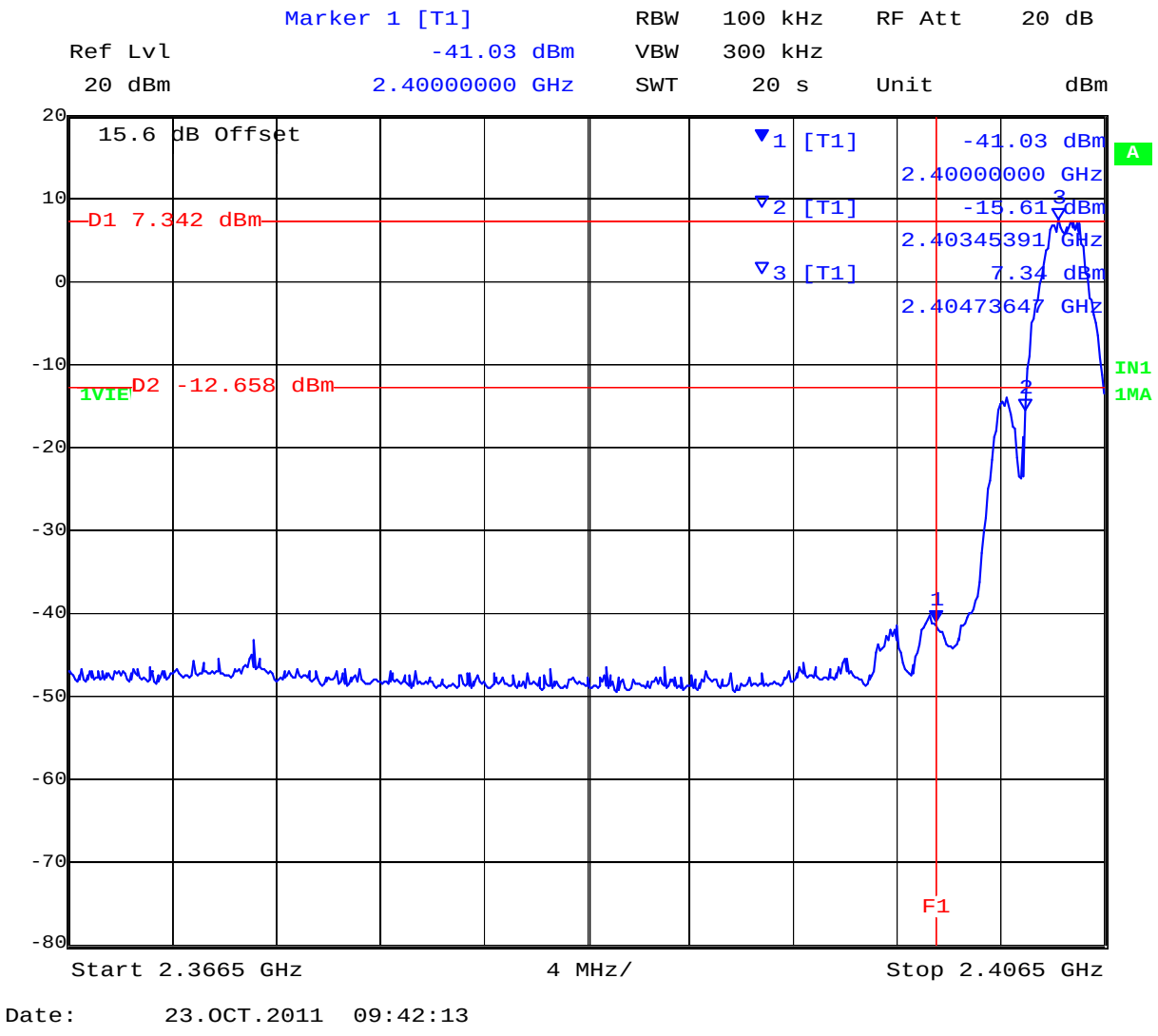
2445 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



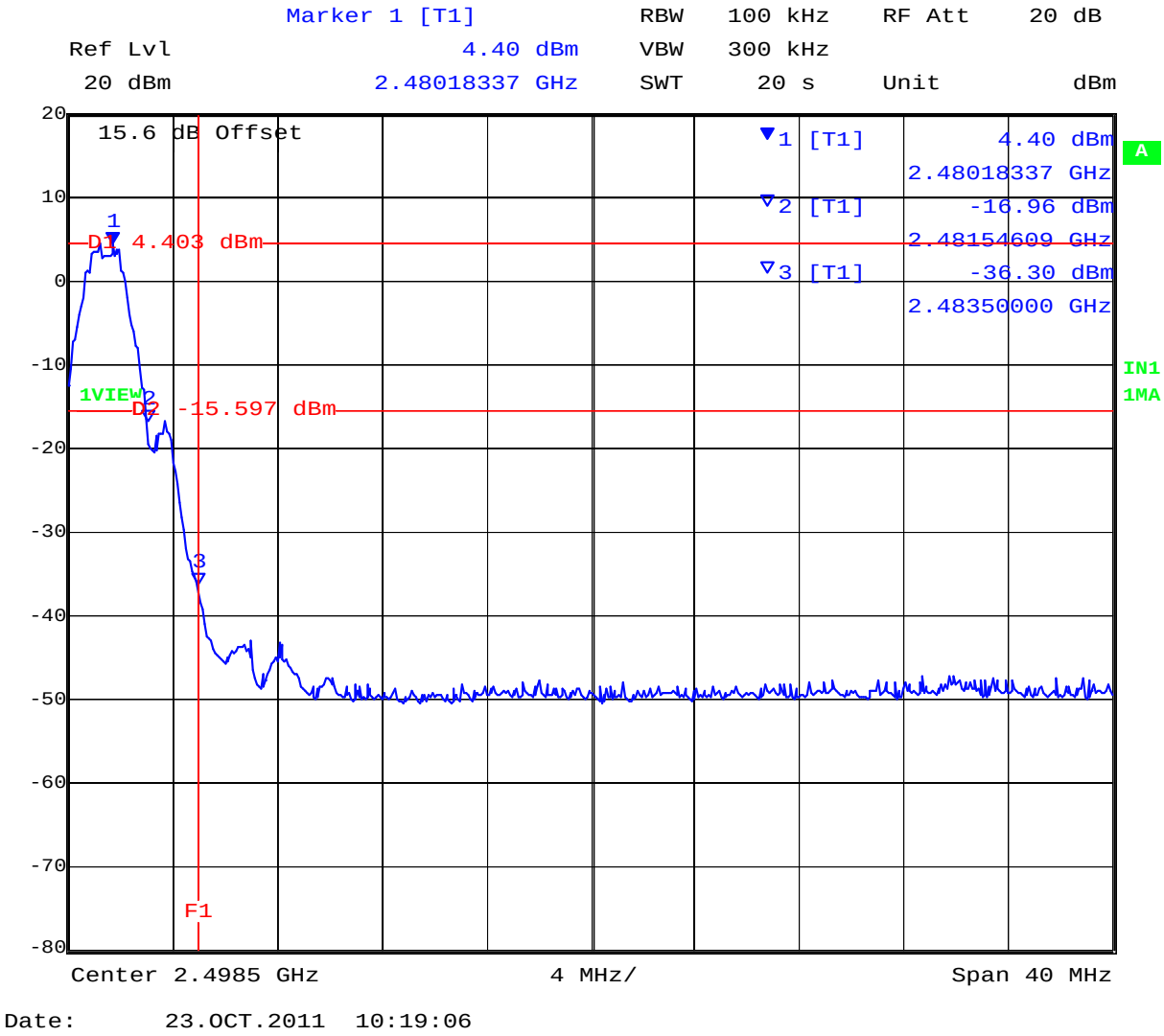
2480 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



Conducted Spurious Emissions at the 2,400 MHz Band Edge



Conducted Spurious Emissions at the 2,483.5 MHz Band Edge



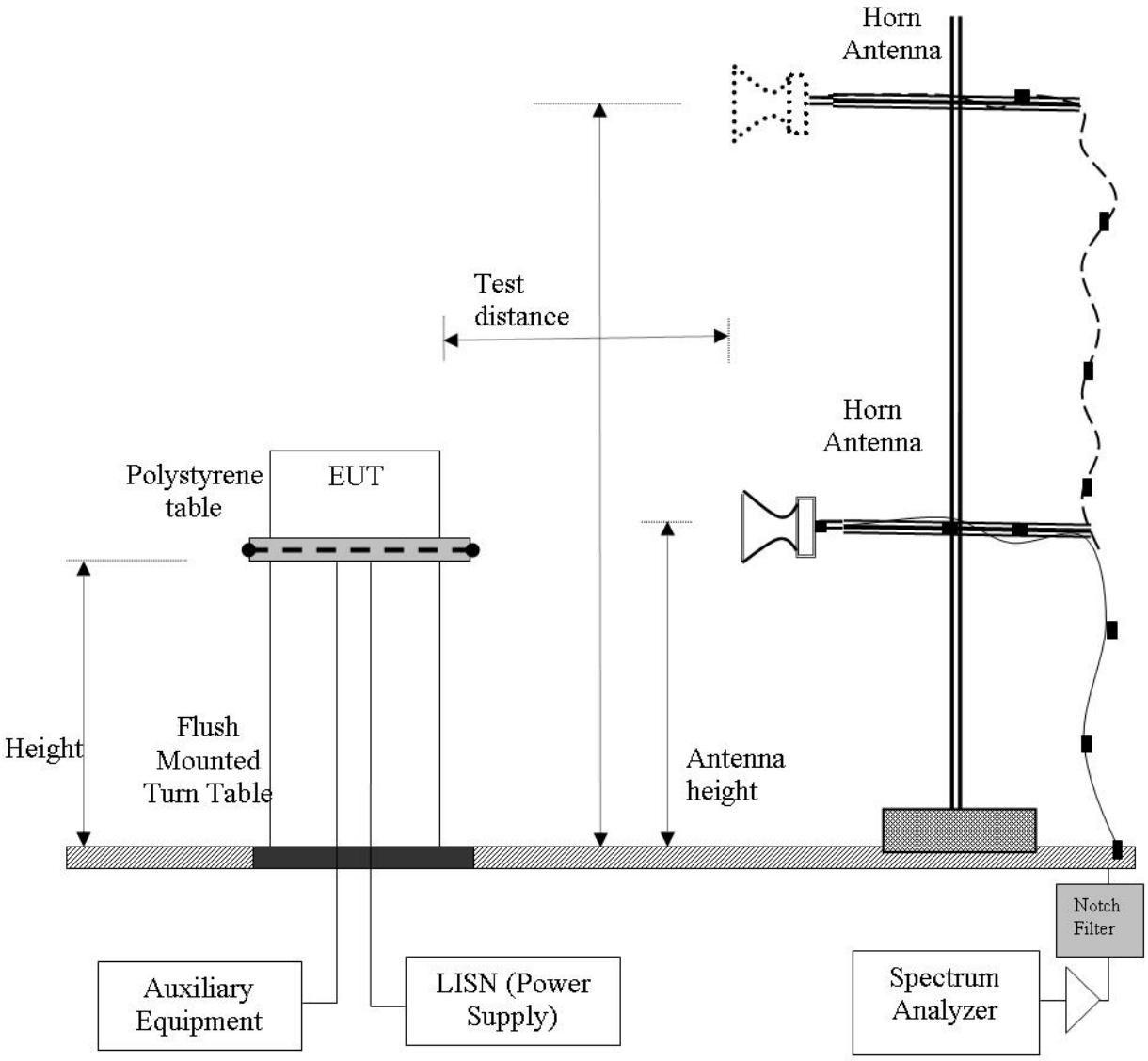
7.6 Radiated Spurious Emissions

Test Procedure

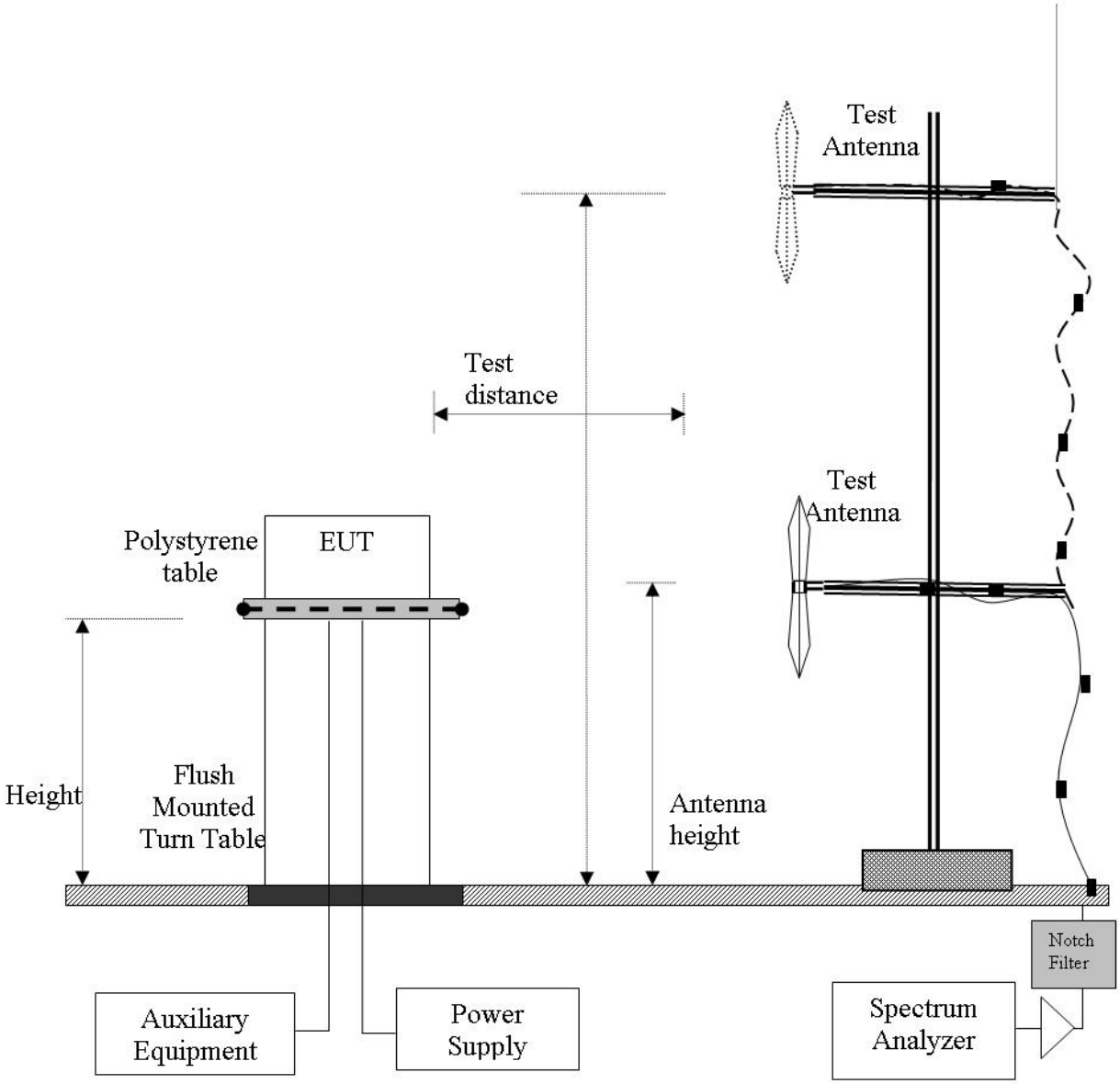
Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.

Radiated Emission Measurement Setup – Above 1 GHz



Radiated Emission Measurement Setup – Below 1 GHz



Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

FS = R + AF + CORR – FO

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation Example:

Given receiver input reading of 51.5 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

Specification for FCC Part 15 Radiated Spurious Emissions

FCC §15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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 radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

FCC §15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

Table 1: FCC 15.209 Spurious Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Specification for Industry Canada RSS-Gen Radiated Transmitter Spurious Emissions

RSS-Gen §7.2.5 Transmitter Spurious Emissions Limits
Spurious emissions from license-exempt transmitters shall comply with the field strength limits shown below. Additionally, the level of any transmitter spurious emission shall not exceed the level of the transmitter's fundamental emission.

Table 1: RSS-Gen §7.2.5 Radiated Transmitter Spurious Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Specification for Industry Canada RSS-Gen Radiated Receiver Spurious Emissions

RSS-Gen §6.1 Receiver Spurious Emissions Limits
Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals.

Spurious emissions from receivers shall not exceed the radiated limits shown in the table below.

Table 1: RSS-Gen §6.1 Radiated Receiver Spurious Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement Uncertainty	+5.6/ -4.5 dB

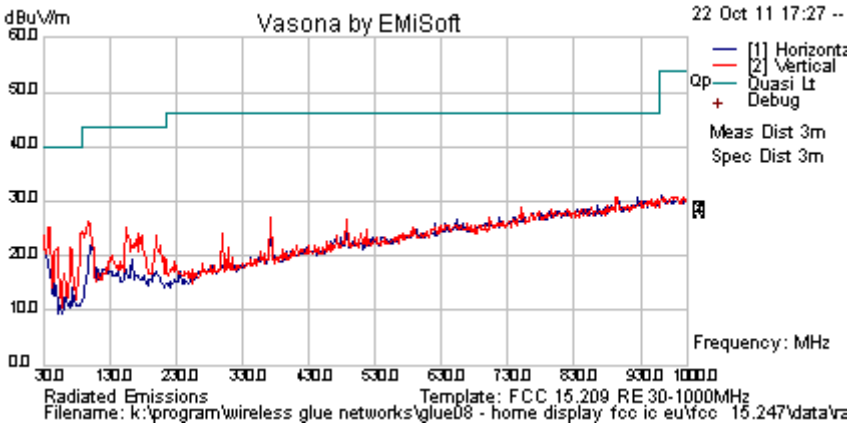
Traceability:

Method	Test Equipment Used
Work instruction WI-03	0287, 0193, 0342, 0158, 0303, 0304, 0134, 0310, 0312

7.6.1 Transmitter Radiated Spurious Emissions

Powered by ac/dc adapter

Test Freq.	2405 MHz	**Engineer**	GMH
Variant	802.15.4 ZigBee	**Temp (°C)**	24
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	34
Power Setting	17	**Press. (mBars)**	1006
Antenna	Inverse-F PCB, Hosiden, 2.42dBi	**Duty Cycle (%)**	100
Test Notes 1	Antenna Freq Range 2400 - 2483.5 MHz		
Test Notes 2	Powered by AC adaptor		



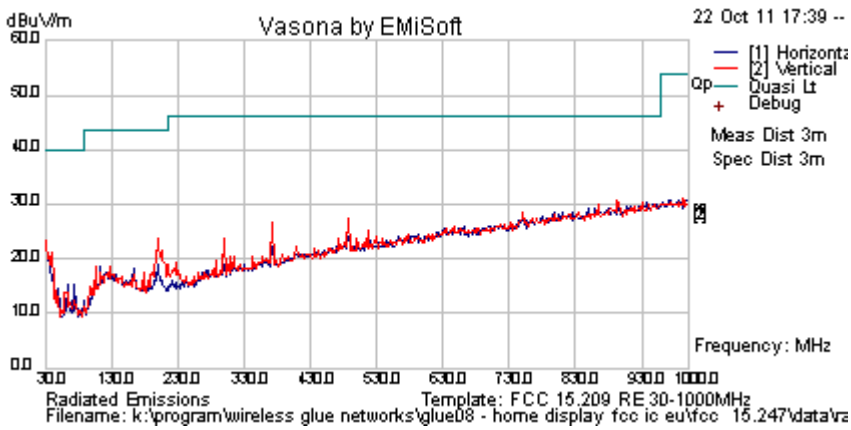
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
44.018	29.5	3.6	-19.7	13.4	Peak [Scan]	H	98	360	40.0	-26.6	Pass	
38.876	30.3	3.6	-16.2	17.7	Peak [Scan]	H	98	360	40	-22.3	Pass	
97.688	36.2	4.1	-21.5	18.9	Peak [Scan]	H	98	360	43.5	-24.6	Pass	
154.481	31.2	4.5	-18.3	17.4	Peak [Scan]	H	98	360	43.5	-26.1	Pass	
199.394	30.0	4.8	-17.7	17.1	Peak [Scan]	H	98	360	43.5	-26.4	Pass	
372.698	32.1	5.6	-15.0	22.6	Peak [Scan]	H	98	360	46	-23.4	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Battery Operation

Test Freq.	2405 MHz	**Engineer**	GMH
Variant	802.15.4 ZigBee	**Temp (°C)**	24
Freq. Range	30MHz - 1000 MHz	**Rel. Hum.(%)**	34
Power Setting	17	**Press. (mBars)**	1006
Antenna	Inverse-F PCB, Hosiden, 2.42dBi	**Duty Cycle (%)**	100
Test Notes 1	Antenna Freq Range 2400 - 2483.5 MHz		
Test Notes 2	Battery operated.		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
114.628	30.4	4.3	-17.6	17.0	Peak [Scan]	H	98	360	43.5	-26.5	Pass	
199.479	31.6	4.8	-17.7	18.7	Peak [Scan]	H	98	360	43.5	-24.8	Pass	
39.209	29.6	3.6	-16.3	16.8	Peak [Scan]	H	98	360	40	-23.2	Pass	
63.083	34.7	3.8	-23.3	15.3	Peak [Scan]	H	98	360	40	-24.8	Pass	
373.220	30.1	5.6	-15.0	20.7	Peak [Scan]	H	98	360	46	-25.4	Pass	
199.470	31.6	4.8	-17.7	18.7	Peak [Scan]	H	98	360	43.5	-24.8	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

802.15.4 Time Averaged Duty Cycle

The radio is a IEEE 802.15.4 radio operating in the 2.4 GHz band. The normal operational mode which ZigBee abides by, utilizes the following settings to operate the transmitter:

Maximum packet size is 127 bytes and the data rate is approximately 250,000 bits/second. Including headers this equates to a 4.256ms packet length as the absolute maximum data packet radio pulse train, with data, that the radio is capable of transmitting.

Therefore the question of maximum duty cycle equates to how often this 4.256 (itself a maximum data length) is transmitted in transmission.

An acknowledgement from another radio to the above packet is of length 0.352 ms per the specification.

Long Frame (time for packet) / [Random Backoff time (CSMA-CA)+ Long Frame(time for packet)+Time(between ack)+Ack(time for packet)+LIFS (interframe spacing time)] = duty cycle.

Plug in the numbers: 4.256ms / [2.368ms + 4.256ms + 0.192ms + 0.352 ms + 0.640ms] = 0.6mS

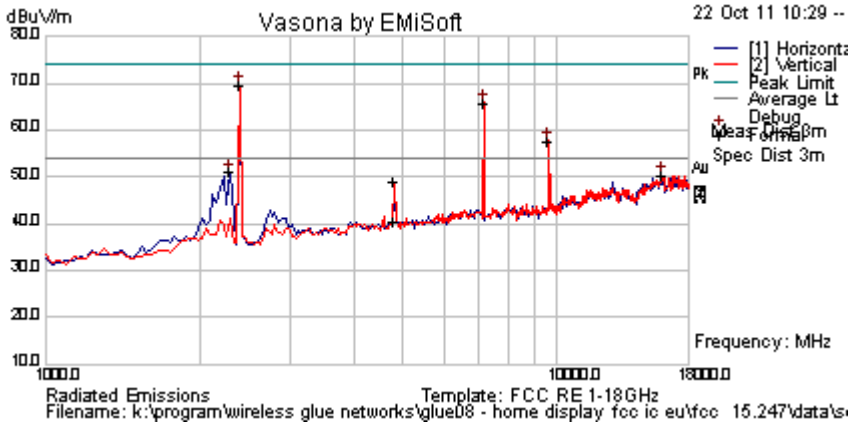
The maximum duty cycle that can happen is 60% if 100% of packets are full length. However, this scenario actually does not happen in ZigBee, because ZigBee is a "beaconless" network. An overly dense ZigBee network will have packet traffic once every second. This means:

4.256ms / [2.368ms + 4.256ms + 0.192ms + 0.352 ms+ 0.640ms + 993ms] = 0.04, or 4% duty cycle.

Per ANSI 63.4 maximum period for calculation = 100 mS therefore time averaged duty cycle;

4/100 = 4%

Test Freq.	2405 MHz	**Engineer**	GMH
Variant	802.15.4	**Temp (ºC)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	34
Power Setting	17	**Press. (mBars)**	1006
Antenna	Inverse-F PCB, Hosiden, 2.42dBi	**Duty Cycle (%)**	100
Test Notes 1	Antenna Freq Range 2400 - 2483.5 MHz		
Test Notes 2	Powered by AC adaptor		



Formally measured emission peaks

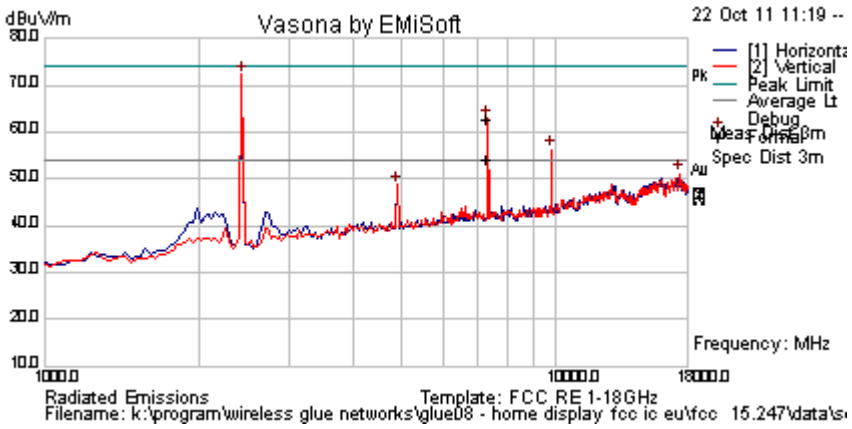
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
4810.936	54.6	4.5	-9.9	49.2	Peak Max	V	98	100	74.0	-24.8	Pass	RB
4810.936				21.24	Time Aver.	V			54.0	-32.76	Pass	RB
2396.794	78.3	3.0	-11.6	69.6	Peak [Scan]	V						FUND
7200.401	66.2	5.4	-5.7	66.0	Peak [Scan]	V					Pass	NRB
9619.238	55.1	6.3	-3.6	57.8	Peak [Scan]	V					Pass	NRB
2387.621	59.9	2.9	-11.8	51.0	Peak [Scan]	V			74.0	-23.0	Pass	RB
2387.621				23.04	Time Aver.	V			54.0	-30.96	Pass	RB
15989.980	41.0	9.0	0.2	50.3	Peak [Scan]	H	100	0	54	-3.7	Pass	NOISE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Duty cycle correction factor was applied to spurious emissions.

EUT Operational Duty Cycle: 4 %
Correction Factor = 20 * LOG (4 / 100)
Correction Factor = -27.96 dB
Corrected Value = Measured Value (dB) – 27.96 (dB)
Level (dBµV/m) = Raw + Cable Loss + AF + Correction Factor

Test Freq.	2445 MHz	**Engineer**	GMH
Variant	802.15.4	**Temp (ºC)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	34
Power Setting	17	**Press. (mBars)**	1006
Antenna	Inverse-F PCB, Hosiden, 2.42dBi	**Duty Cycle (%)**	100
Test Notes 1	Antenna Freq Range 2400 - 2483.5 MHz		
Test Notes 2			



Formally measured emission peaks

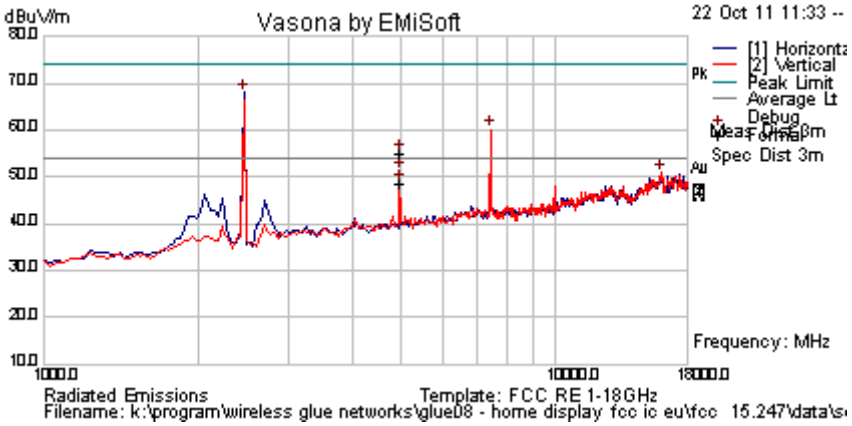
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
7336.393	62.7	5.5	-5.3	62.8	Peak Max	V	190	79	74.0	-11.2	Pass	RB
7336.393				34.84	Time Aver.	V			54.0	-19.16	Pass	RB
4890.855	56.5	4.5	-10.0	51.1	Peak Max	V	100	276	74.0	-23.0	Pass	RB
4890.855				23.14	Time Aver.	V			54	-30.86	Pass	RB
2430.862	81.0	3.0	-11.6	72.4	Peak [Scan]	V						FUND
9789.579	53.6	6.4	-3.8	56.2	Peak [Scan]	V					Pass	NRB
17386.774	40.8	8.7	1.7	51.2	Peak [Scan]	V	100	0	54	-2.8	Pass	NOISE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Duty cycle correction factor was applied to spurious emissions.

EUT Operational Duty Cycle: 4 %
Correction Factor = 20 * LOG (4 / 100)
Correction Factor = -27.96 dB
Corrected Value = Measured Value (dB) – 27.96 (dB)
Level (dBµV/m) = Raw + Cable Loss + AF + Correction Factor

Test Freq.	2480 MHz	**Engineer**	GMH
Variant	802.15.4	**Temp (°C)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	34
Power Setting	17	**Press. (mBars)**	1006
Antenna	Inverse-F PCB, Hosiden, 2.42dBi	**Duty Cycle (%)**	100
Test Notes 1	Antenna Freq Range 2400 - 2483.5 MHz		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2464.930	76.6	3.0	-11.6	68.0	Peak [Scan]	H						FUND
15989.980	41.6	9.0	0.2	50.8	Peak [Scan]	V	100	0	54	-3.2	Pass	NOISE
2483.5	80.4	3.1	-11.0	72.5	Peak Max				74	-1.5	Pass	RB
2483.5				44.54	Time Aver.				54	-9.46	Pass	RB
4960.878	60.2	4.6	-9.9	54.9	Peak Max	V	164	88	74	-19.1	Pass	RB
4960.878				26.94	Time Aver.				54	-27.06	Pass	RB
7438.471	62.0	5.5	-5.1	62.4	Peak Max	V	178	72	74	-11.6	Pass	RB
7438.471				34.44	Time Aver.				54	-19.56	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

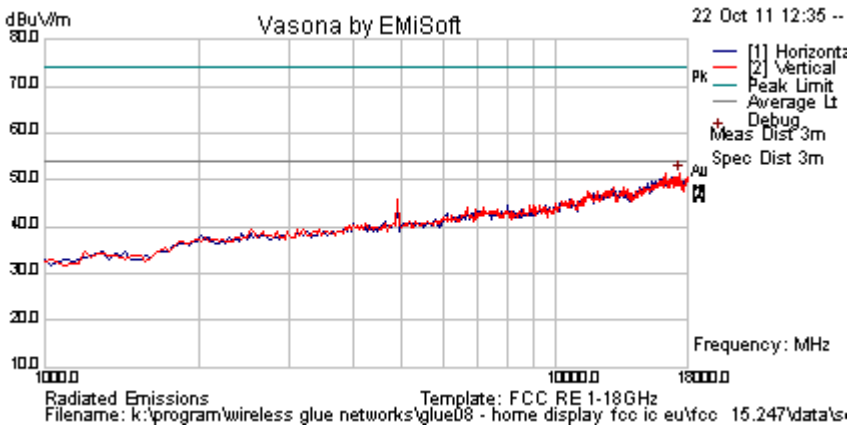
Duty cycle correction factor was applied to spurious emissions.

EUT Operational Duty Cycle: 4 %
Correction Factor = 20 * LOG (4 / 100)
Correction Factor = -27.96 dB
Corrected Value = Measured Value (dB) – 27.96 (dB)
Level (dBµV/m) = Raw + Cable Loss + AF + Correction Factor

7.6.2 Receiver Radiated Emissions

Measurement Results for Radiated Spurious Emissions – Receiver

Test Freq.	2445 MHz	**Engineer**	GMH
Variant	802.15.4 ZigBee	**Temp (°C)**	25
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	Not Applicable in Receive Mode	**Press. (mBars)**	1005
Antenna	Inverse-F PCB, Hosiden, 2.42dBi		
Test Notes 1	Antenna Freq Range 2400 - 2483.5 MHz		
Test Notes 2	Powered by AC adaptor		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
17352.705	41.1	8.7	1.6	51.4	Peak [Scan]	V	150	0	54	-2.6	Pass	Noise

Legend:	TRANS = Transient Emission; RB = Restricted Band; NRB = Non-Restricted Band;
	BE = Emission in Restricted Band Nearest Transmission Band Edge; FUND = Fundamental Freq.

7.7 Conducted Disturbance at Mains Terminal (150 kHz – 30 MHz)

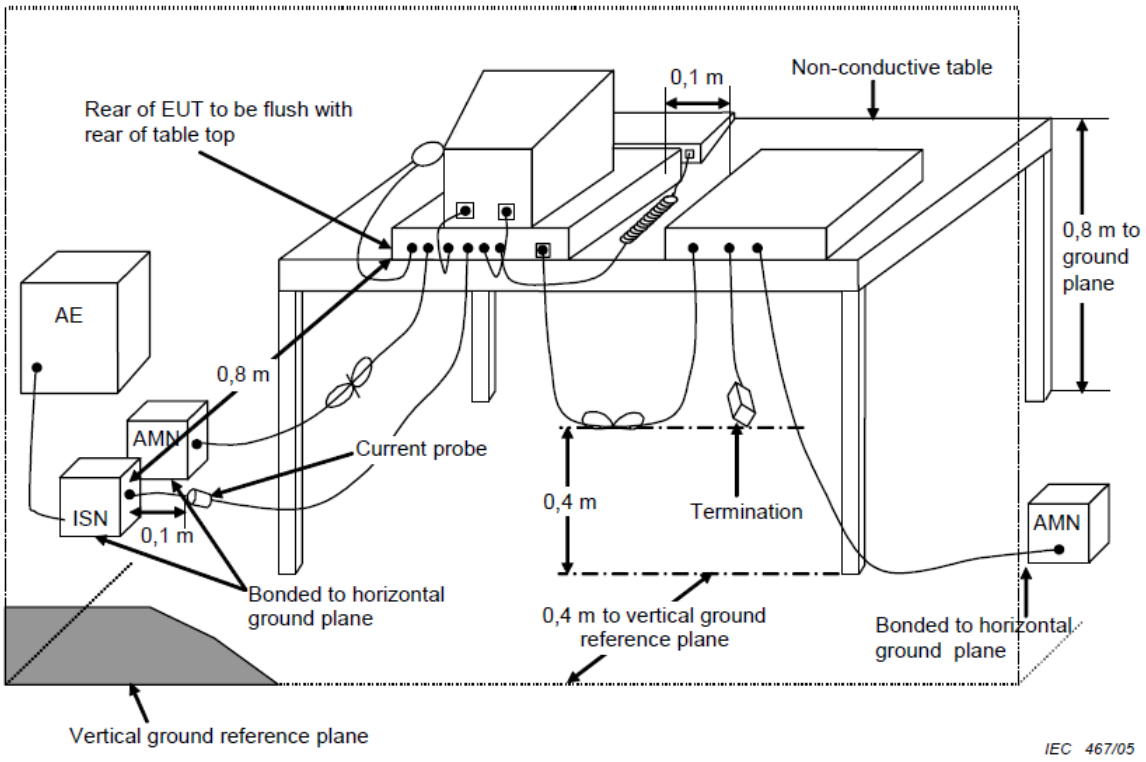
Test Procedure

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

Test Measurement Setup



Measurement setup for Conducted Disturbance at Mains Terminals

Specification for Conducted Disturbance at Mains Terminal – Digital Apparatus

FCC §15.207 (a)

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

RSS-GEN §7.2.4

AC Power Line Conducted Emissions Limits: Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The more stringent limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network (LISN).

Limits

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Traceability

Laboratory Measurement Uncertainty for Conducted Emissions

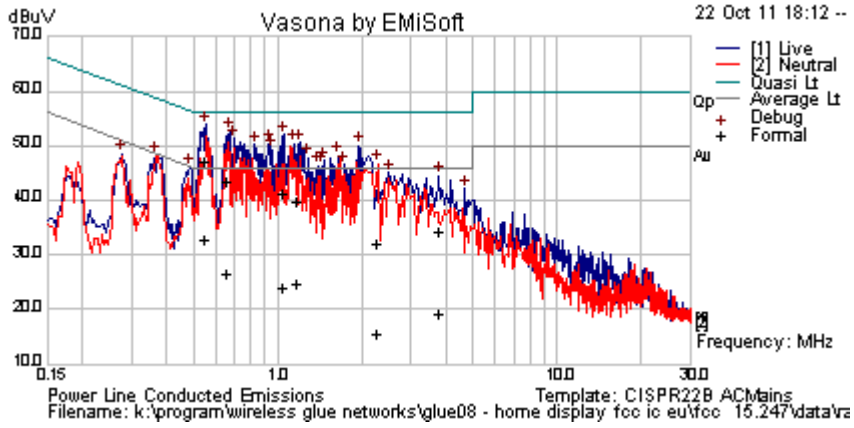
Measurement uncertainty	±2.64 dB

Traceability

Method	Test Equipment Used
Work instruction WI-EMC-01	0158, 0184, 0193, 0190, 0293, 0307

7.7.1 Conducted Disturbance at Mains Terminal (150 kHz – 30 MHz)

Test Freq.	N/A	**Engineer**	GMH
Variant	AC Line Emissions	**Temp (ºC)**	24
Freq. Range	0.150 MHz - 30 MHz	**Rel. Hum.(%)**	34
Power Setting	17	**Press. (mBars)**	1006
Antenna			
Test Notes 1	Antenna Freq Range 2400 - 2483.5 MHz		
Test Notes 2	All measurement is powered by AC adaptor		



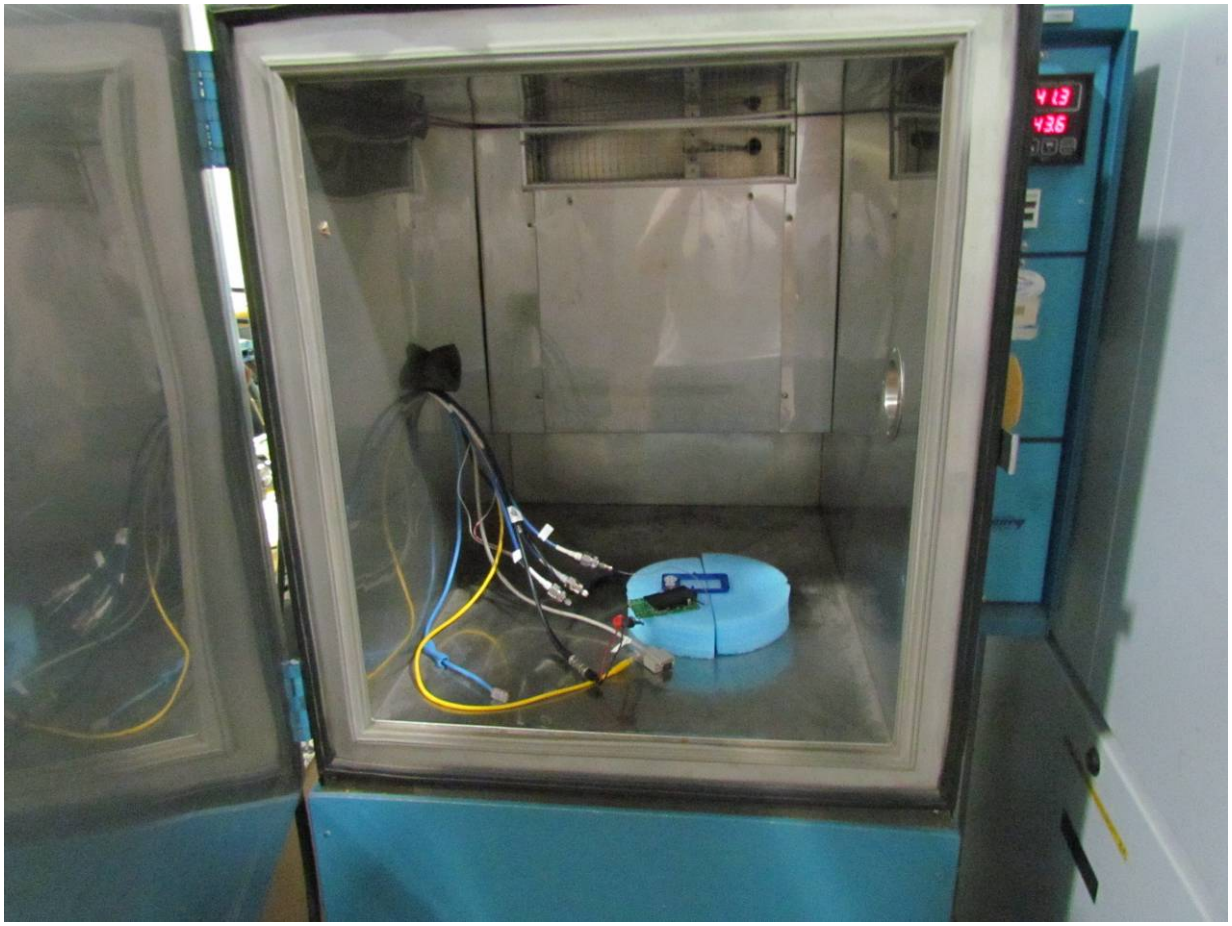
Formally measured emission peaks

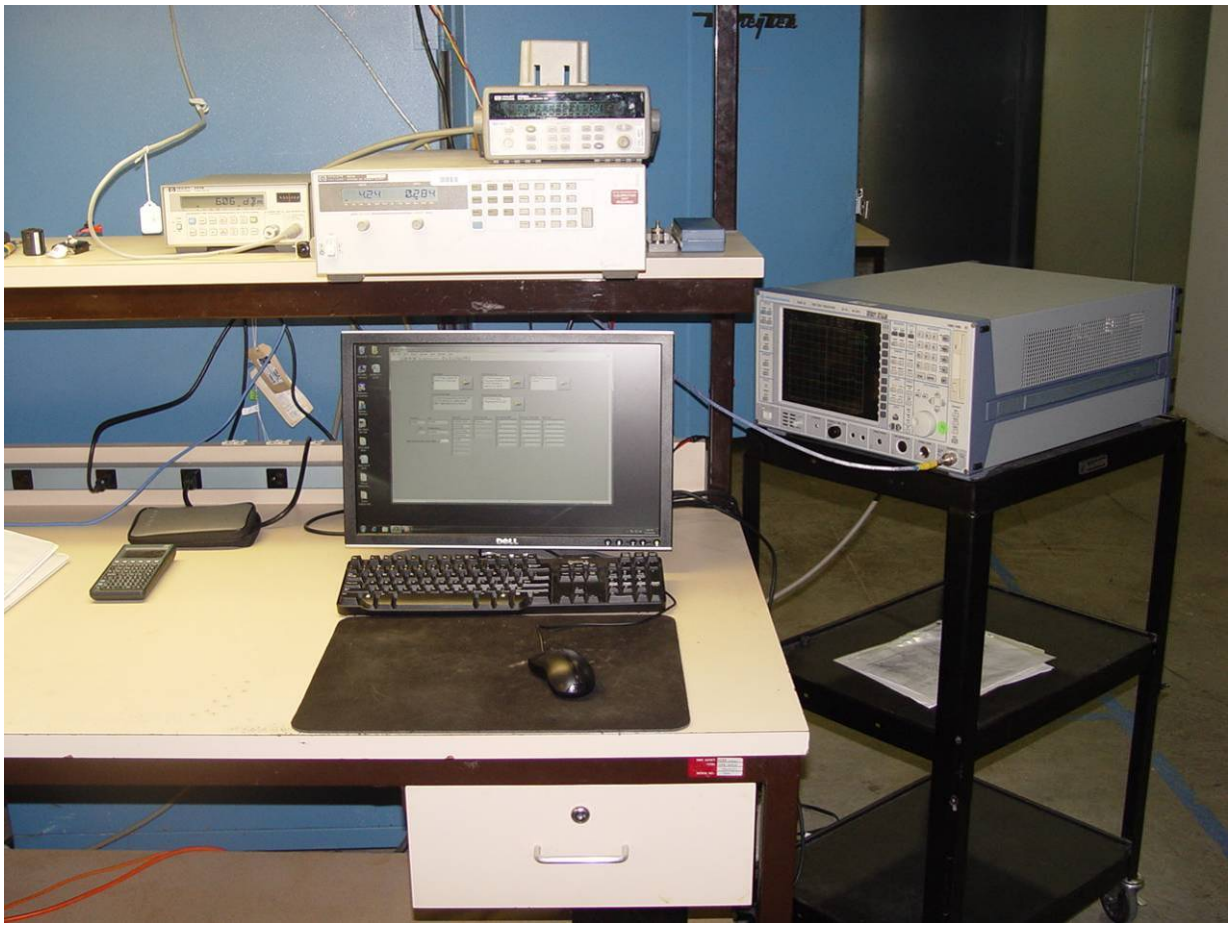
Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
3.809	24.2	10.1	0.2	34.5	Quasi Peak	Live	56	-21.6	Pass	
0.554	37.1	9.9	0.1	47.1	Quasi Peak	Live	56	-8.9	Pass	
0.665	33.4	10.0	0.1	43.4	Quasi Peak	Live	56	-12.6	Pass	
1.044	31.4	9.9	0.1	41.4	Quasi Peak	Live	56	-14.6	Pass	
1.188	29.9	9.9	0.1	40.0	Quasi Peak	Live	56	-16.1	Pass	
2.288	21.9	10.1	0.1	32.1	Quasi Peak	Neutral	56	-24.0	Pass	
3.809	9.1	10.1	0.2	19.4	Average	Live	46	-26.6	Pass	
0.554	22.7	9.9	0.1	32.7	Average	Live	46	-13.3	Pass	
0.665	16.6	10.0	0.1	26.6	Average	Live	46	-19.4	Pass	
1.044	13.8	9.9	0.1	23.8	Average	Live	46	-22.2	Pass	
1.188	14.5	9.9	0.1	24.6	Average	Live	46	-21.4	Pass	
2.288	5.3	10.1	0.1	15.5	Average	Neutral	46	-30.5	Pass	

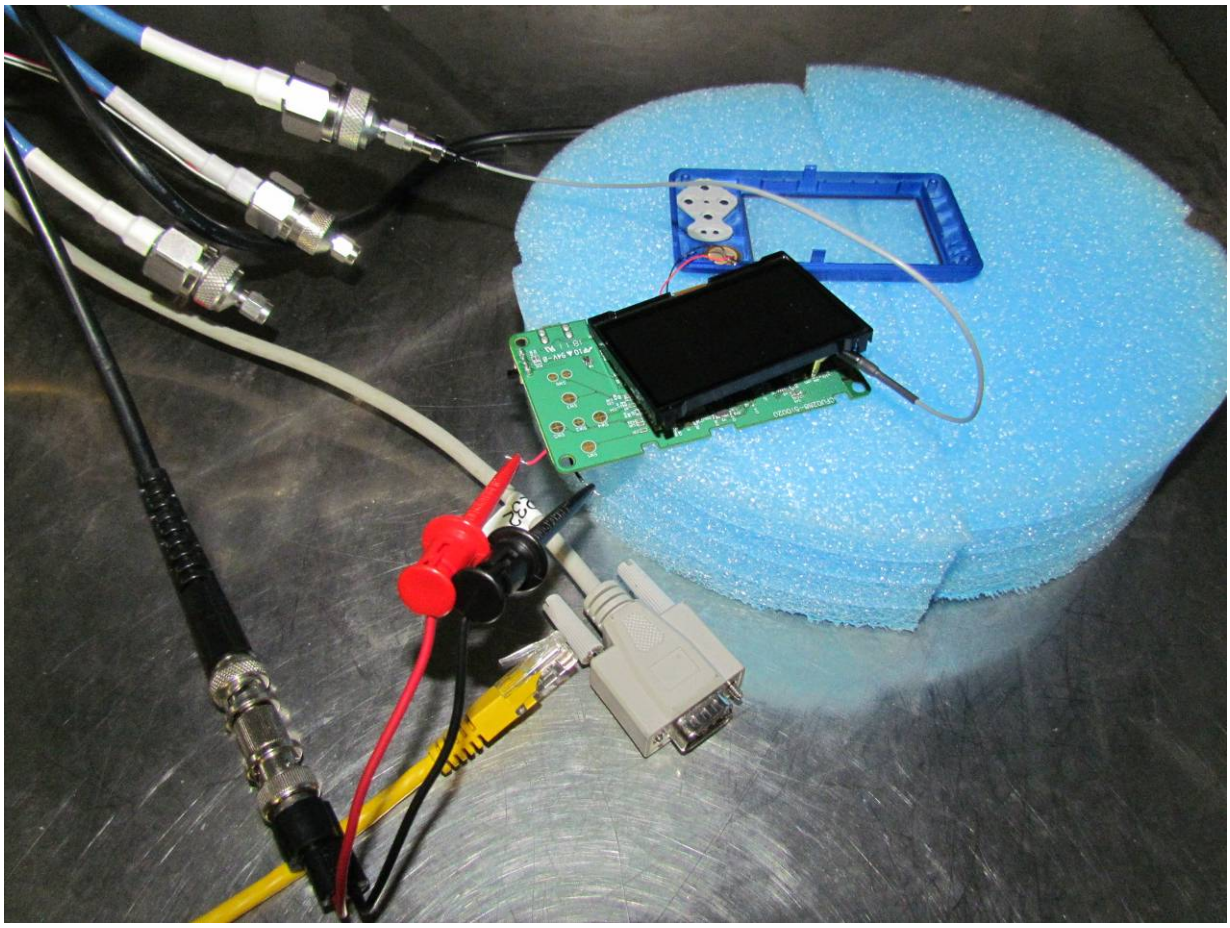
Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

8 Photographs

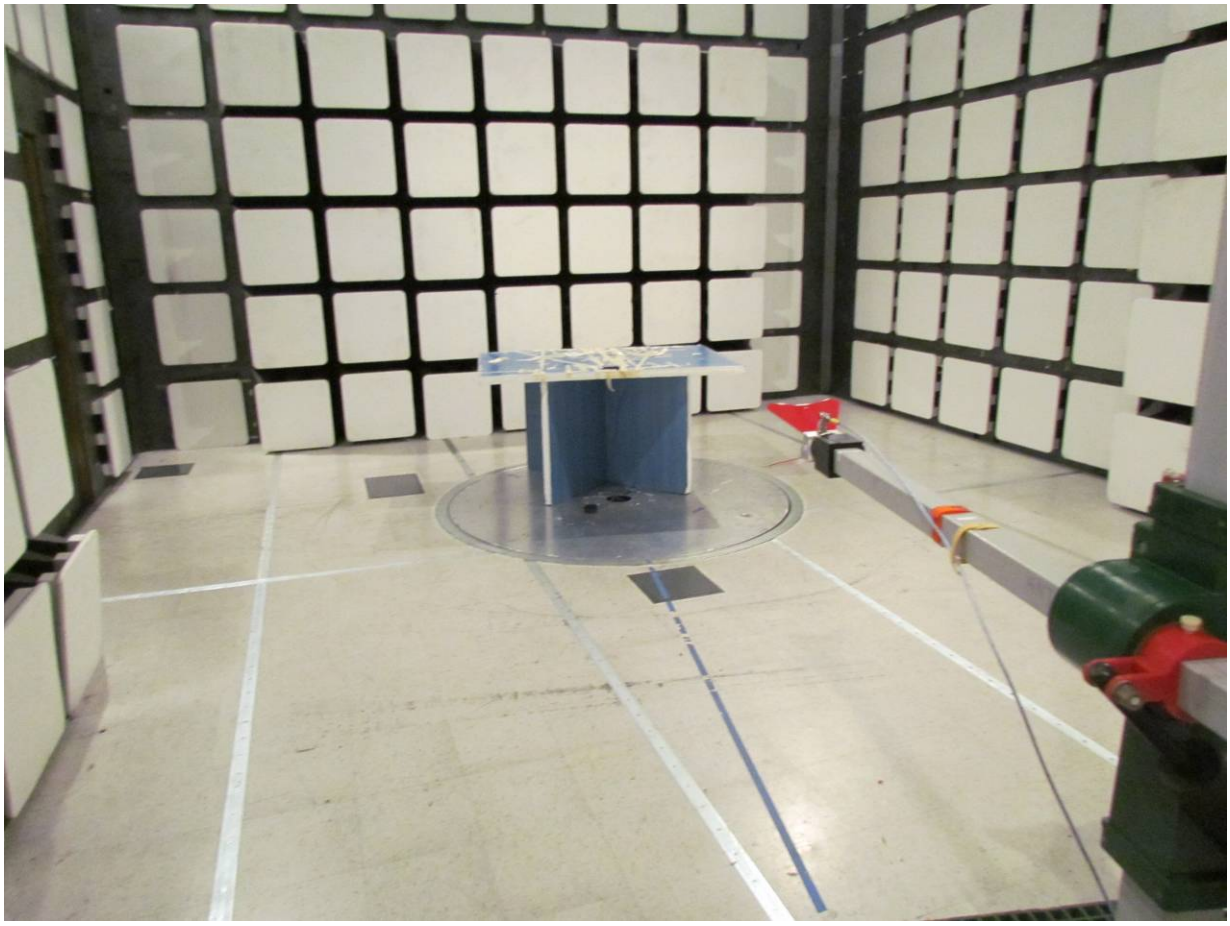
8.1 Conducted RF Emissions



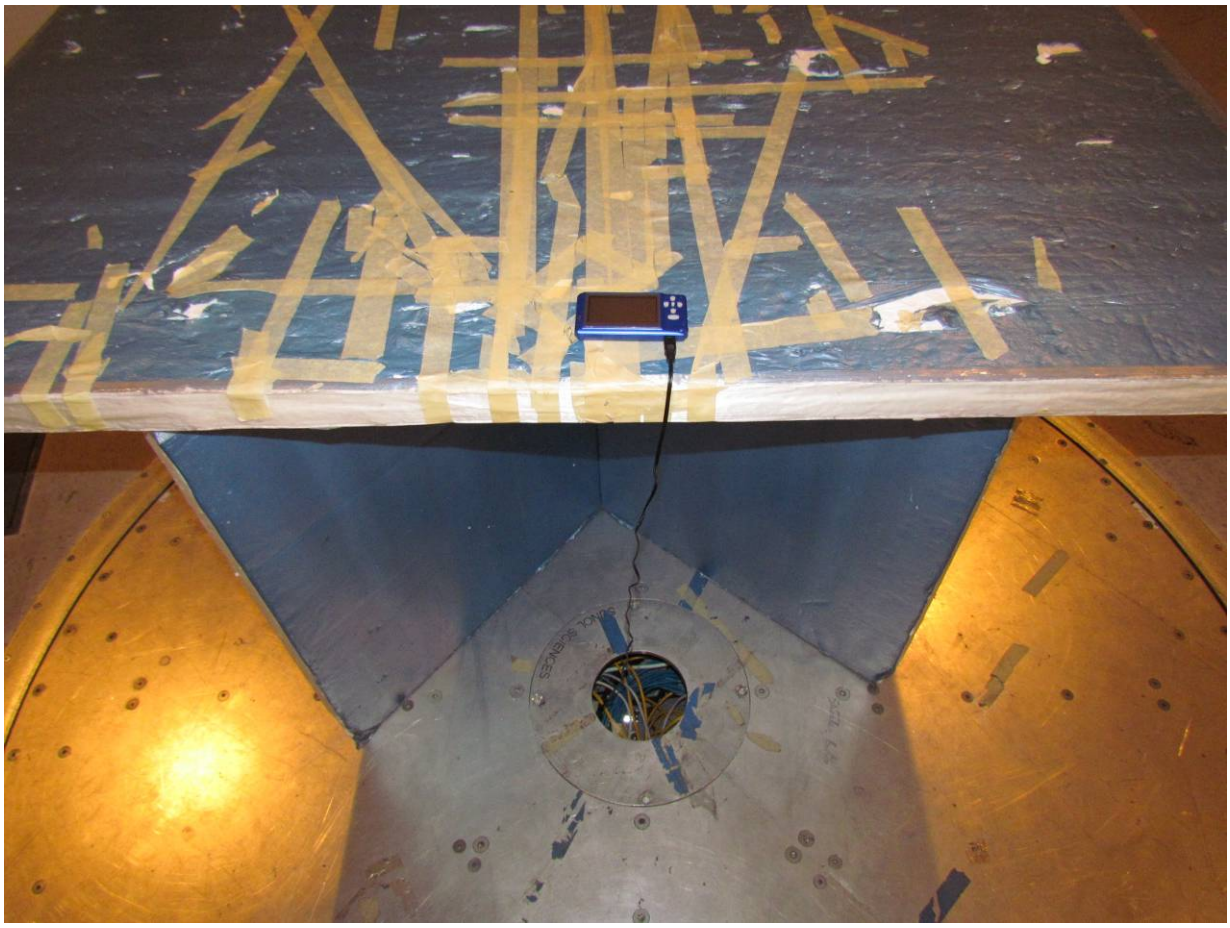




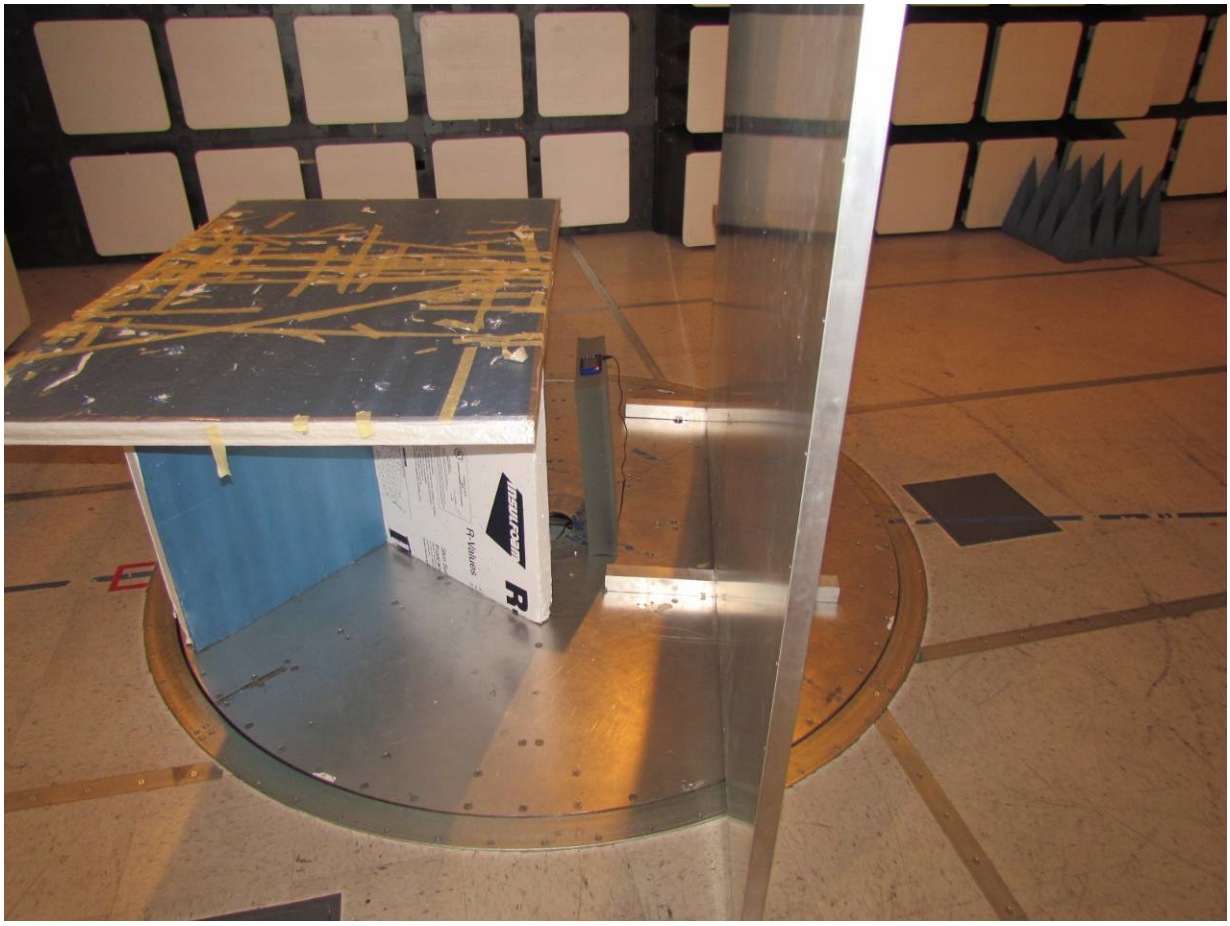
8.2 Transmitter Radiated Spurious Emission above 1 GHz



8.3 Radiated Emissions below 1 GHz



8.4 AC Mains Conducted Emissions



9 TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0287	EMI Receiver	Rhode & Schwartz	ESIB 40	100201
0193	EMI Receiver	Rhode & Schwartz	ESIB 7	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0301	5.6 GHz Notch Filter	Micro-Tronics	RBC50704	001
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002
0303	5.8 GHz Notch Filter	Micro-Tronics	BRC50705	003
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0335	1-18GHz Horn Antenna	ETS- Lindgren	3117	00066580
0337	Amplifier	MiCOM Labs	--	--
0338	Antenna	Sunol Sciences	JB-3	A052907
0342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1

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