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Report Number:	10CA28335-FCC
Project Number:	10CA28335
File Number:	MC16580
Date:	July 30, 2010
Model:	CMGYZHPECD 3.0 (Gateway for GE Series I-210 meter)

Electromagnetic Compatibility Test Report

for

Consert Inc.

Raleigh, NC

Test Report Details

Tests Performed By:	**Underwriters Laboratories Inc. 12 Laboratory Dr. Research Triangle Park, NC 27709**
Tests Performed For:	**Consert Inc. 4700 Falls of the Neuse Rd Raleigh, NC 27612**
Applicant Contact:	**Thi Phan**
Phone:	**(919) 855-1069**
E-mail:	**tphan@consert.com**
Test Report Date:	**07/30/2010**
Product Type:	**Spread-Spectrum Transmitter**
Product standards	**FCC Part 15, Subpart C, Section 15.247**
Model Number:	**CMGYZHPECD 3.0**
Sample Serial Number:	**2410-00000034**
EUT Category:	**Low-Powered Transmitter**
Testing Start Date:	**06/29/2010**
Date Testing Complete:	**07/06/2010 (Follow-up measurement on 07/29/2010)**
Overall Results:	**Compliant**

Underwriters Laboratories Inc. reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. Underwriters Laboratories Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from Underwriters Laboratories Inc. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or endorsement by NVLAP, NIST, A2LA, or any agency of the US government.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report.

Report Directory

Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
-	Initial Release	J. Marley	M. Nolting
Nov 3, 2010	Revised	J. Marley	M. Nolting

1.0 G E N E R A L - Product Description

1.1 Equipment Description

The device is a 2.4-2.4835 GHz band transmitter operating using ZigBee protocol. It has a permanently attached antenna integrated unto the printed wiring board.

1.2 Equipment Marking Plate

The sample tested had no marking plate.

1.3 Device Configuration During Test

1.3.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Low-Powered Transmitter	Consert	CMGYZHPECD 3.0	ZigBee Gateway Board
ACC	Meter	GE	I-210 Series	Host meter
Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)				

1.3.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	AC Mains	AC	N	N	
2	Antenna	N/E	N/A	N/A	
Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical TP = Telecommunication Ports I/O = Input/Output					

1.3.3 EUT Internal Operating Frequencies:

Frequency (MHz)	Description
2400 – 2483.5	Transmit Frequency Range

1.3.4 Power Interface:

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Comments
1	240	-	-	AC	Device is operated between Line 1 and Line 2 of utility power.

1.4 Block Diagram:

Block Diagram is provided as a separate exhibit.

1.5 EUT Configurations

Mode #	Description
1	Radiated Measurements: Low-Powered Transmitter with antenna on non-conductive foam test table measuring 1.5m x 1.0m x 80cm high. Device is mounted in a representative meter in each of three orthogonal axes (X, Y, or Z plane orientation) as noted. For upright position an extra 1" piece on foam was used to position the device, because of the positioning of the AC power cord.
2	Conducted Measurements (Antenna port): EUT antenna port was connected directly to a temporary connector at the receiver's 50-ohm antenna input to perform antenna port conducted tests.
3	Conducted Measurements (AC): Low-Powered Transmitter with antenna on non-conductive foam test table measuring 1.5m x 1.0m x 80cm high. AC Power was attached via a LISN. Device was positioned 40cm from a vertical plane.

1.6 EUT Operation Modes

Mode #	Description
1	Transmitter operating on low, middle, or high channel (as described) with normal modulation and permanently affixed antenna. Or, for antenna port conducted tests, with a temporary connector in place of the antenna port.

2.0 Summary

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

2.1 Deviations from standard test methods

None

2.2 Device Modifications Necessary for Compliance

Product was found not to comply if “boost mode” was enabled via firmware. All data was collected at maximum power level with boost mode disabled. Boost mode will be disabled at time of manufacture and cannot be enabled by the user.

2.3 Reference Standards

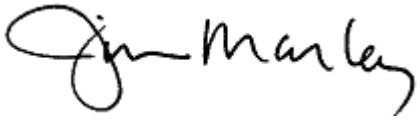
Standard Number	Standard Name	Standard Date
FCC Part 15	Radio Frequency Devices (Sections 15.207, 15.209 (restricted bands) and 15.247)	Oct 1, 2009

2.4 Results Summary

This product is considered Class B. Transmitter spurious emissions must comply with 15.209 where frequencies fall in a 15.205 restricted band.

Requirement – Test	Result (Compliant / Non-Compliant)*
Conducted Power	Compliant
Spurious Emissions – Conducted	Compliant
Spurious Emissions – Radiated	Complaint
Radiated Emissions – Unintentional / Radiated Spurious < 1 GHz	Compliant
Band Edge	Compliant
Spectral Density	Compliant
Occupied Bandwidth	Compliant
Antenna Gain Calculation	Antenna < 6 dBi gain
Conducted Emissions - AC	Compliant
Maximum Permissible Exposure	Compliant
Note: Other required tests are considered to remain valid from the original certification and were not repeated here.	

Test Engineer:



Jim Marley (Ext.919-549-1408)
Staff Engineer
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Conformity Assessment Services-

Reviewer:

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Staff Engineer
International EMC Services
Conformity Assessment Services

Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

4.0 Emissions Test Results

The emissions tests were performed according to following regulations:

FCC 47 CFR	47 CFR Part 15.247

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 ± 150

4.1 Test Conditions and Results – CONDUCTED POWER

Test Description	Peak Conducted Power is recorded with the output of the EUT antenna port directly connected to the spectrum analyzer/receiver input. The EUT channel is set to low, middle, and high channels with normal modulation and continuous transmission. Resolution Bandwidth was set to 5 MHz (greater than emission bandwidth). Video Bandwidth was set to 10 MHz. The results are recorded for each frequency and compared to the maximum permissible limit as provided in 15.247.	
Basic Standard	47 CFR Part 15.247(b)(3), ANSI C63.4:2003 RSS-210 Issue 7, A8.4(4)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	Low, Middle, and High Channels	Radiated Power, Conducted Power
Limits (Power)		
1 Watt		

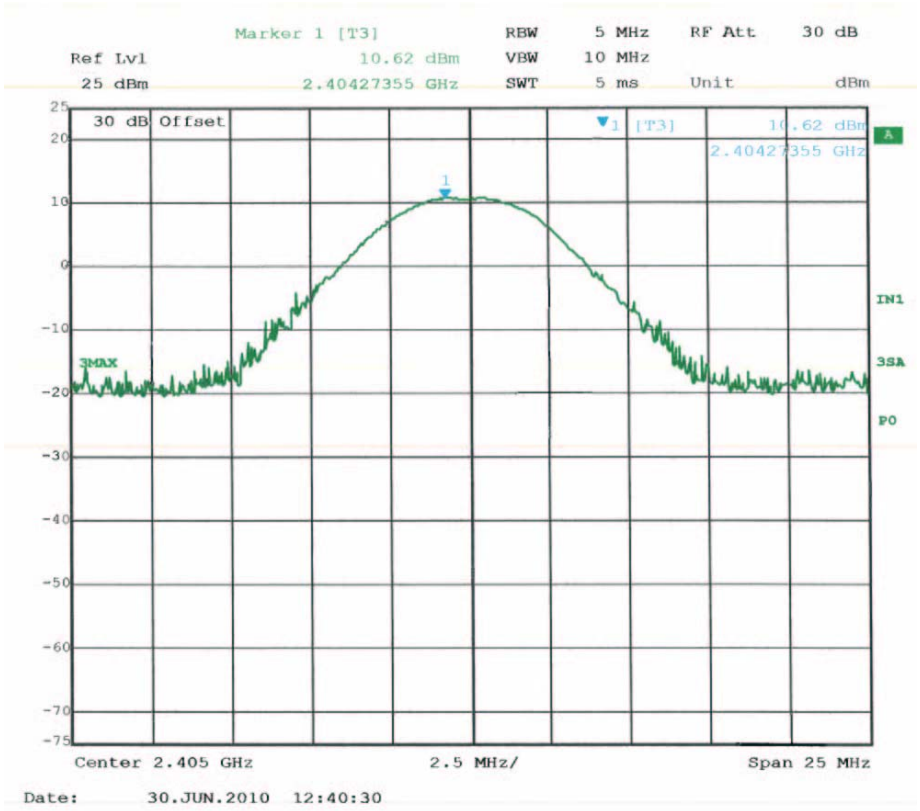
Table 1 Conducted Power EUT Configuration Settings

Power Interface Mode # (See Section 1.3.4)	EUT Configurations Mode # (See Section 1.6)	EUT Operation Mode # (See 1.5)
1	3 (Connected directly to receiver input)	1 (Low, Middle, and High Channels)
Supplementary information: Note: Output was set via firmware to “Boost Mode = Off”.		

Table 2 Conducted Power Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
ATA231	30 dB Attenuator, 2 W	Mini-Circuits	SMA 3.5	2/19/10	2/28/11

Table 3 Conducted Power Plot



Low Channel (above) was highest measured. 30 dB attenuator offset is shown in the top left of the screen. Other channel measurement shown in table on the following page.

Table 4 Conducted Power Results

Channel (#)	Frequency Measured (MHz)	Detector Type* (P/Q/A)	Measured Value (dBm)	Peak Conducted Power (mW)	Conducted Power Limit (mW)	Pass/Fail (P/F)
Low	2405	P	10.62	11.53	1000	P
Mid	2440	P	10.26	10.61	1000	P
High	2475	P	9.32	8.55	1000	P

* P= Peak
** Measured value includes 30 dB offset added for attenuator
** RBW=5 MHz, VBW=10 MHz

Sample Calculations:

(1) Conversion from Conducted Power (dBuV) to Conducted Power (dBm) in a 50-ohm impedance:

Conducted Power (dBm) = Conducted Voltage (dBuV) – 106.99

(2) Conversion from Conducted Power (dBm) to Conducted Power (mW):

$$\text{Conducted Power (mW)} = 10^{(\text{Conducted Power (dBm)} / 10)}$$

4.2 Test Conditions and Results – SPURIOUS EMISSIONS – Antenna Port Conducted

Test Description	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 Section 15.209(a) is not required.	
Basic Standard	47 CFR Part 15.247(d) , ANSI C63.4:2003 RSS-210 Issue 7, A8.5	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30 MHz – 24.835 GHz (10^{th} harmonic)	Antenna port
Limits (Antenna Conducted)		
All spurious emissions must be 20dB below the level of the fundamental frequency.		

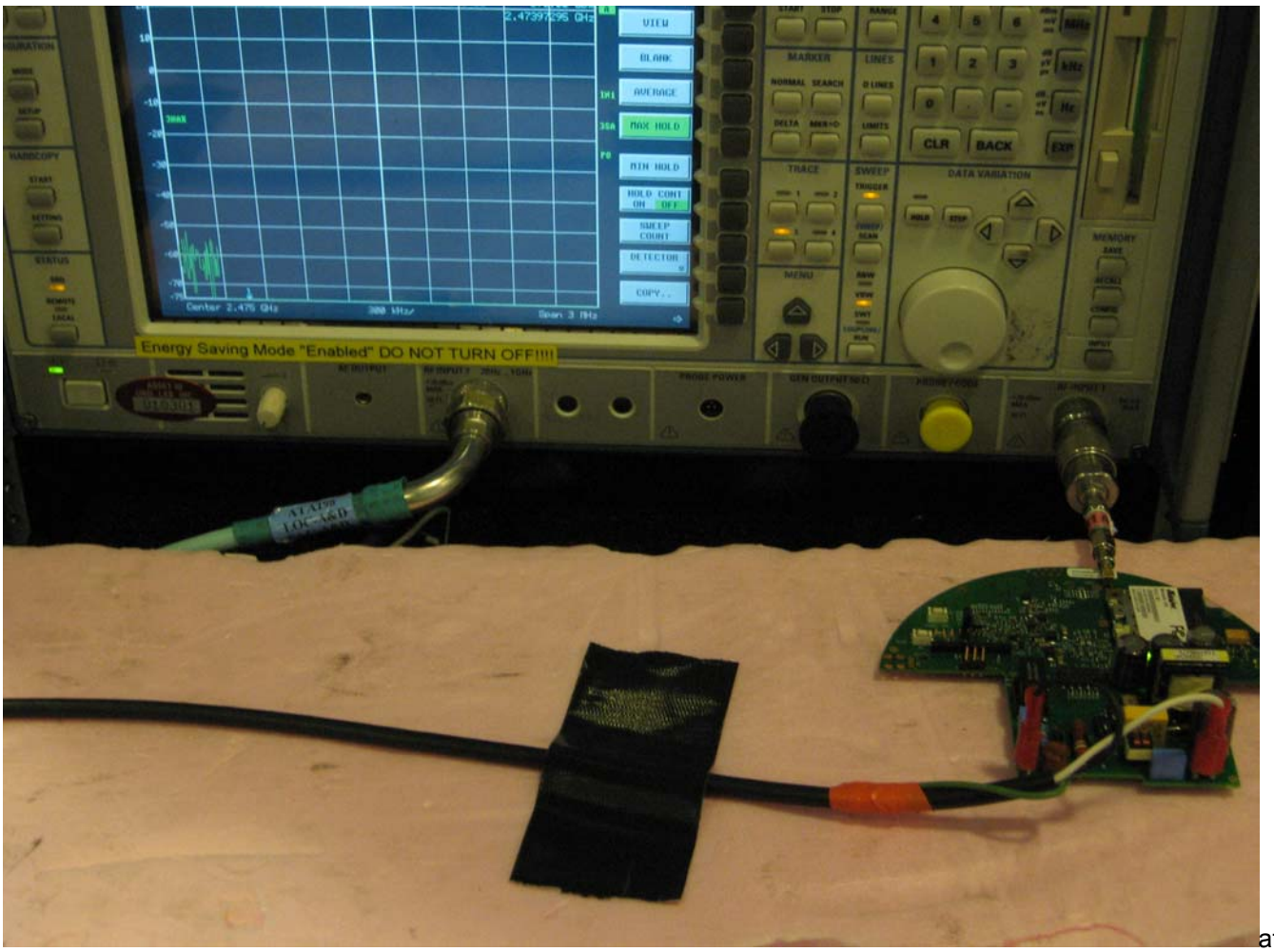
Table 5 SPURIOUS EMISSIONS EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2 (Conducted Spurious)	1 (low, mid, high channel)
Supplementary information: None		

Table 6 SPURIOUS CONDUCTED EMISSIONS Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	3/18/10	3/31/11
ATA231	30 dB Attenuator, 2 W	Mini-Circuits	SMA 3.5	2/19/10	2/28/11

Test setup for SPURIOUS EMISSIONS –Conducted



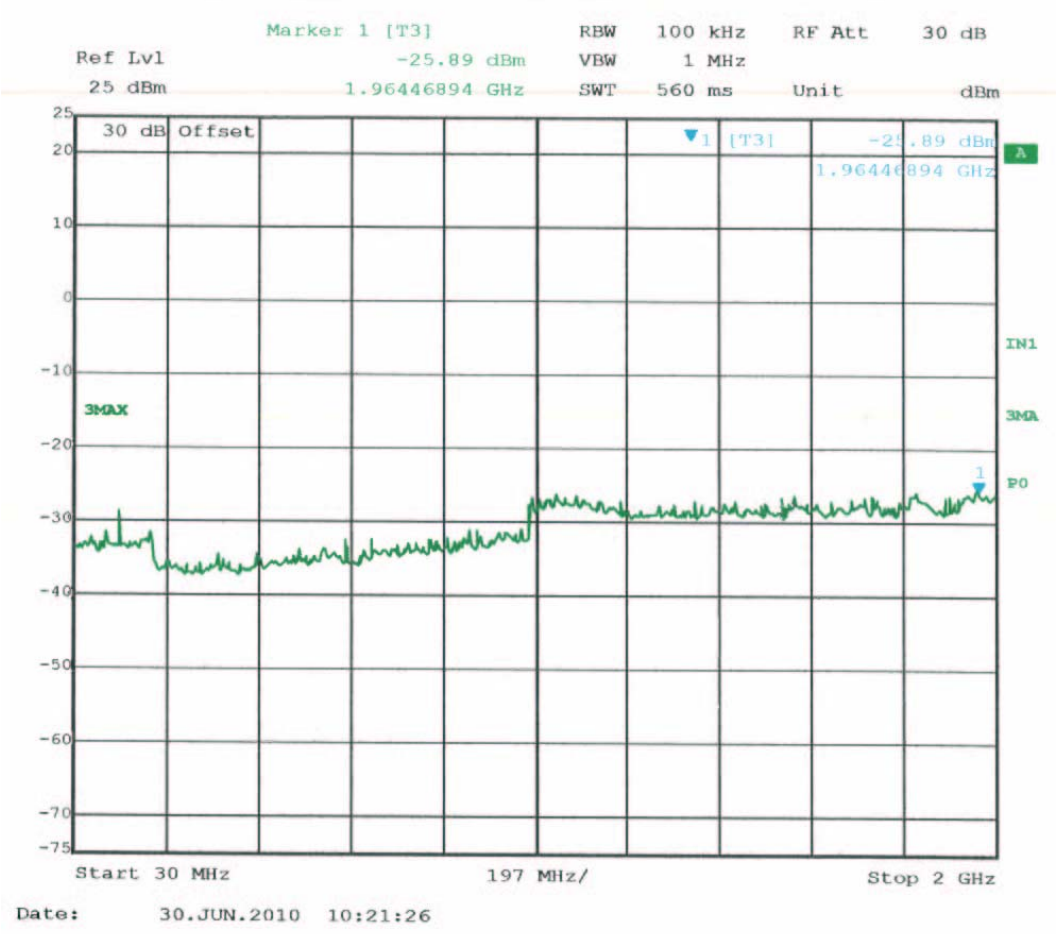
at0

Antenna Port Conducted Measurement Setup
(EUT removed from case for port access)

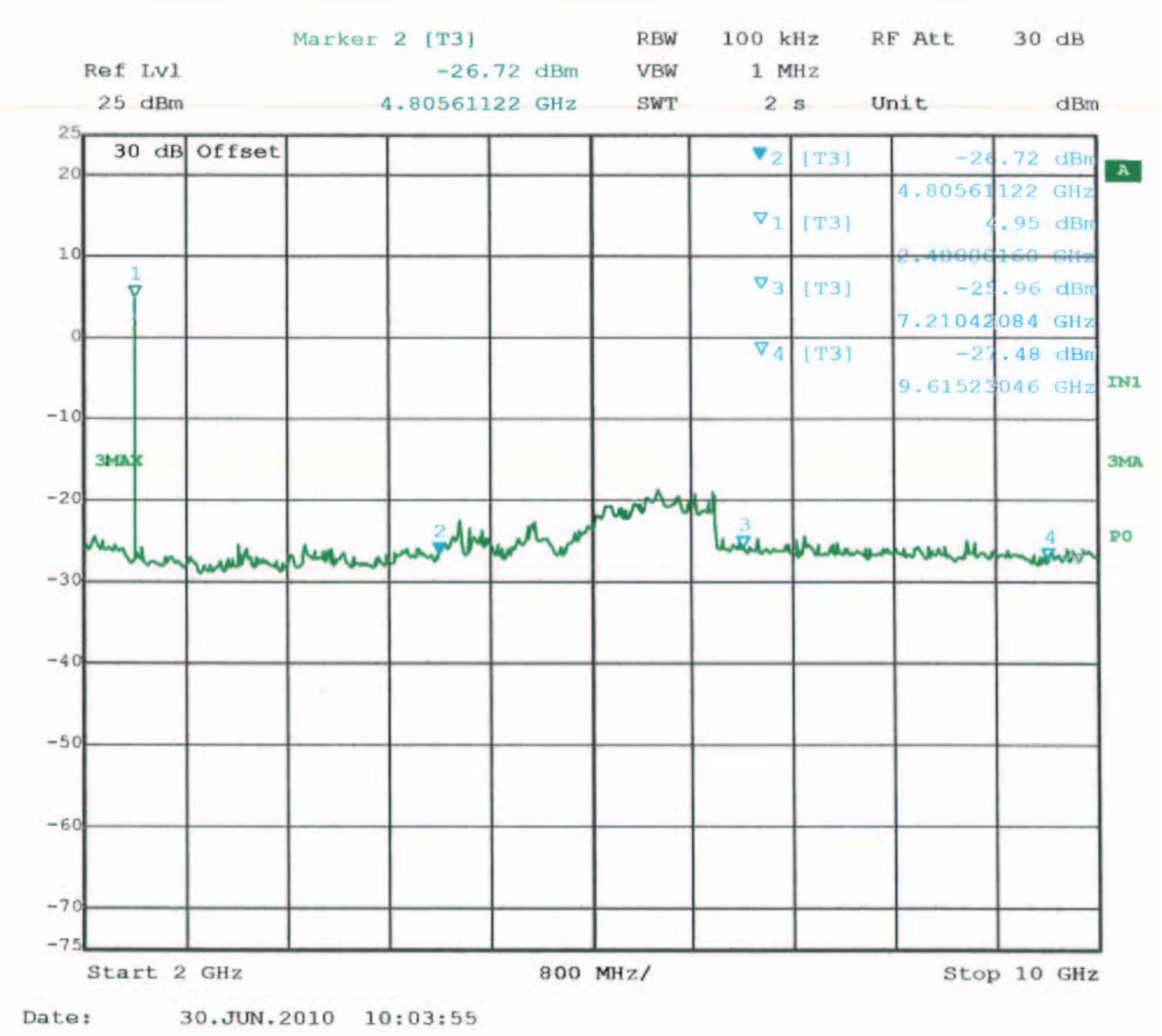
Figure 1 30MHz - 25 GHz Antenna Port Spurious Emissions Plots TX Mode, Low Channel.

Note: No significant conducted spurious emissions are observed above noise floor. 30 dB attenuator is used. Low Channel plots are shown. Middle and High Channel plots are similar. Data table is shown for low, middle, and high transmit frequencies.

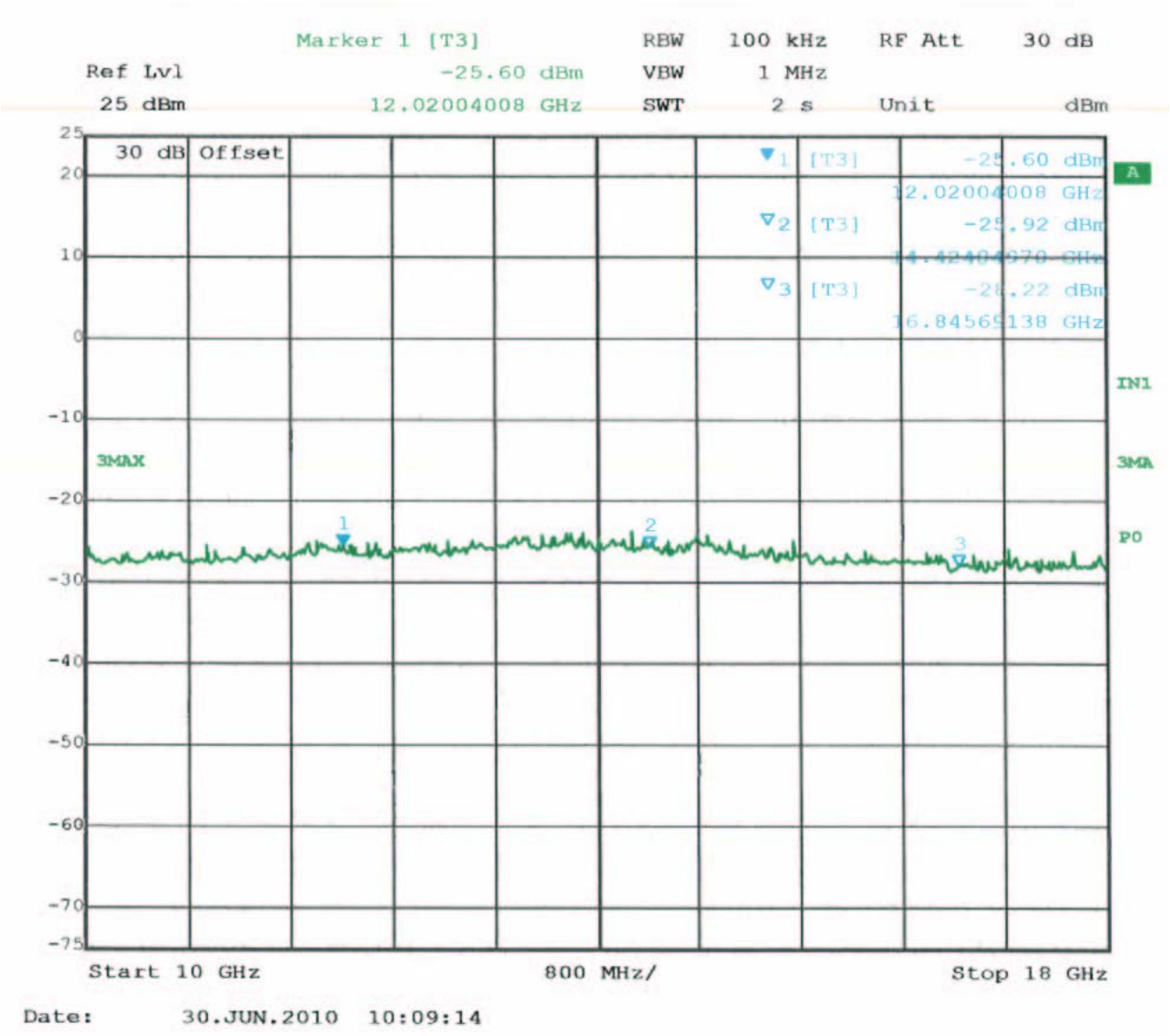
Conducted Spurious Emissions - 30 MHz – 2 GHz (Low Channel Shown)



Conducted Spurious Emissions – 2 GHz – 10 GHz (Low Channel Shown)



Conducted Spurious Emissions – 10 GHz – 18 GHz (Low Channel Shown)



Conducted Spurious Emissions – 18 GHz – 25 GHz (Low Channel Shown)

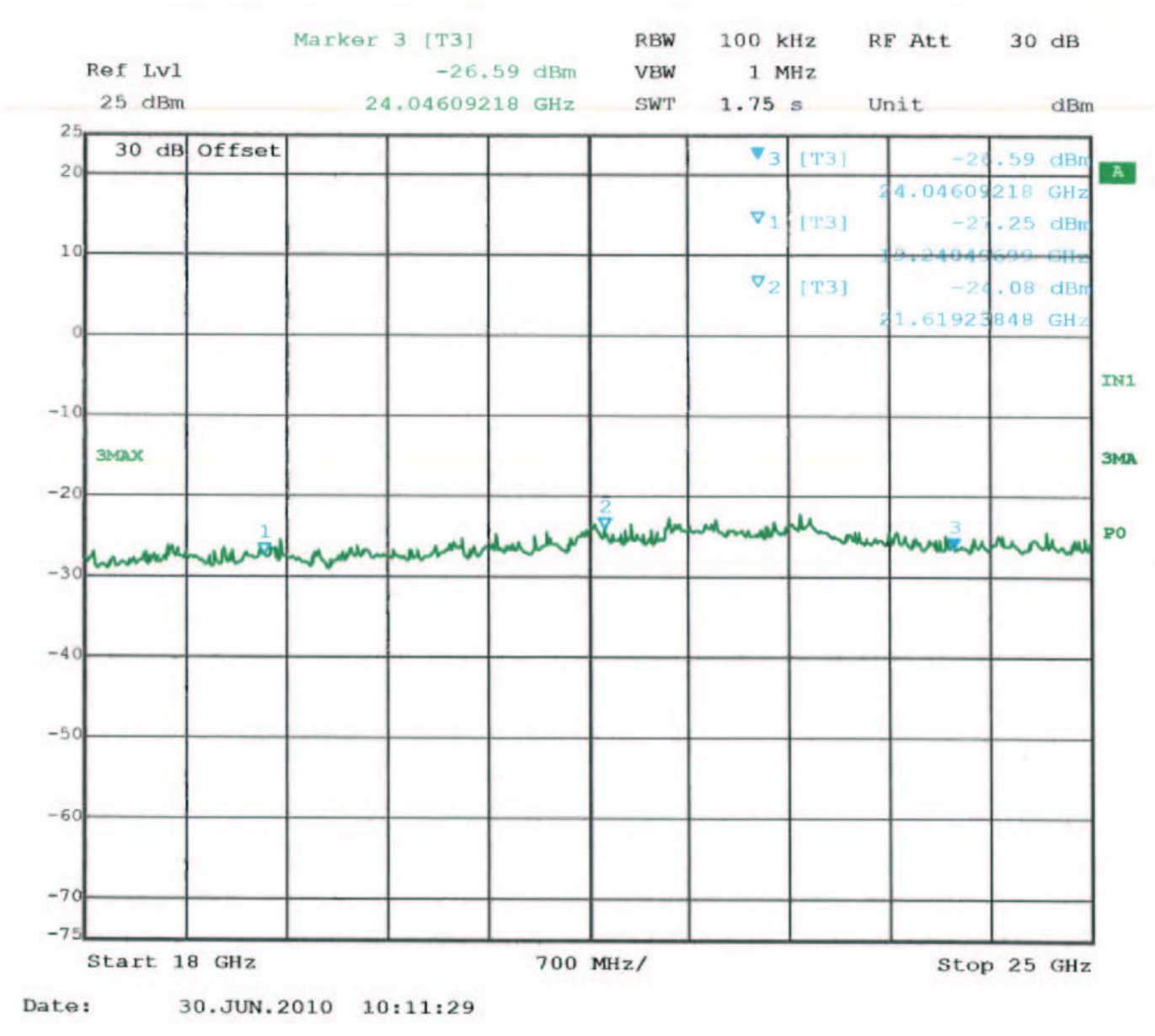


Table 7 30MHz - 25 GHz Antenna Port Conducted Spurious Emissions Table, Low Channel.

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBm)	Specified Limit** (dBm)	Spec Margin (dB)	See Comment (#)
P	2405	4.95	-		
P	4810	-26.72	-15.05	-11.67	Noise Floor
P	7215	-25.96	-15.05	-10.91	Noise Floor
P	9620	-27.48	-15.05	-12.43	Noise Floor
P	12025	-25.60	-15.05	-10.55	Noise Floor
P	14430	-25.92	-15.05	-10.87	Noise Floor
P	16835	-28.22	-15.05	-13.17	Noise Floor
P	19240	-27.25	-15.05	-12.20	Noise Floor
P	14430	-24.08	-15.05	-9.03	Noise Floor
P	16845	-26.59	-15.05	-11.54	Noise Floor

** Limit for Spurious is 20 dB below Transmit Frequency Value.

Table 8 30MHz - 25 GHz Antenna Port Conducted Spurious Emissions Table, Middle Channel.

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBm)	Specified Limit** (dBm)	Spec Margin (dB)	See Comment (#)***
P	2440	4.87	-		
P	4880	-25.65	-15.13	-10.52	Noise Floor
P	7320	-25.69	-15.13	-10.56	Noise Floor
P	9760	-27.52	-15.13	-12.39	Noise Floor
P	12200	-26.64	-15.13	-11.51	Noise Floor
P	14640	-26.20	-15.13	-11.07	Noise Floor
P	17080	-28.37	-15.13	-13.24	Noise Floor
P	19520	-27.84	-15.13	-12.71	Noise Floor
P	21960	-25.06	-15.13	-9.93	Noise Floor
P	24400	-24.98	-15.13	-9.85	Noise Floor

Table 9 30MHz-10 GHz Antenna Port Spurious Emissions Table, High Channel.

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBm)	Specified Limit** (dBm)	Spec Margin (dB)	See Comment (#)***
P	2475	4.66	-	-	
P	4950	-24.81	-15.34	-9.47	Noise Floor
P	7425	-26.81	-15.34	-11.47	Noise Floor
P	9900	-27.19	-15.34	-11.85	Noise Floor
P	12375	-26.66	-15.34	-11.32	Noise Floor
P	14850	-26.18	-15.34	-10.84	Noise Floor
P	17325	-27.76	-15.34	-12.42	Noise Floor
P	19800	-27.83	-15.34	-12.49	Noise Floor
P	22275	-23.73	-15.34	-8.39	Noise Floor
P	24750	-26.56	-15.34	-11.22	Noise Floor

4.3 Test Conditions and Results – SPURIOUS EMISSIONS – Radiated (>1 GHz)

Test Description	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 Section 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 Section15.205(c)).

Basic Standard	47 CFR Part 15.247(d) , ANSI C63.4:2003 RSS-210 Issue 7, A8.5	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30 MHz – 25 GHz (10th harmonic)	3 meter distance (18 – 25 GHz measured at 1 m)

Limits (Radiated – Restricted Bands Only)

Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Average	
	General Emissions	Fundamental	Spurious
30 – 88	40	-	-
88 – 216	43.5	-	-
216 – 960	46	-	-
960 – 1000	54	-	-
1,000 – 25,000 (10th harmonic)	-	-	54

Supplementary information: Radiated spurious emissions below 1 GHz is combined with unintentional radiator measurements shown elsewhere in this report. Radiated spurious measurements are performed with antenna in place. Each of three orthogonal axes were tested.

Table 10 RADIATED SPURIOUS EMISSIONS EUT Configuration Settings

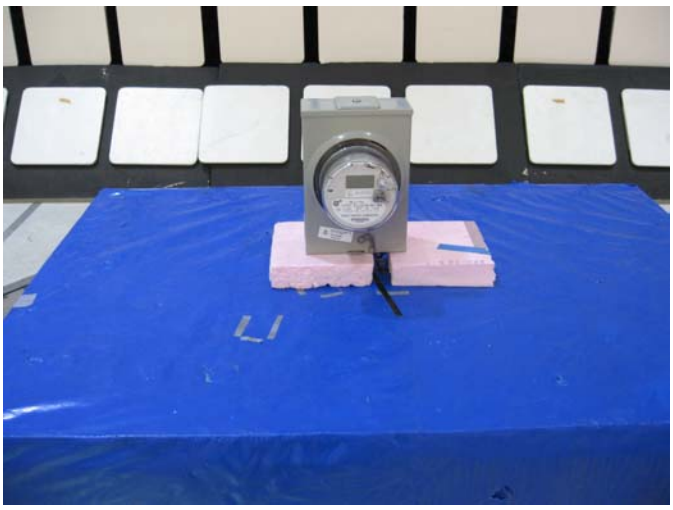
Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1 (Radiated Spurious)	1 (low, mid, high channel)
Supplementary information: None		

Table 11 RADIATED SPURIOUS EMISSIONS Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz Range				
AT0021	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	12/22/09	12/31/10
AT0022	Log-periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	12/22/09	12/31/10
	1-18 GHz				
AT0032	Horn Antenna 1 to 18 GHz	EMC Test Systems	3115	9/25/09	9/30/10
	18-26.5 GHz				
AT0053	(1) 18-26.5 GHz antenna (2) 26.5-40 GHz antenna (3) 18-40 GHz Pre-amplifier (4) Cable	(1) Antenna Rsrch (2) Antenna Rsrch (3) Miteq (4) -	(1) SWH-28 Antenna (2) SWH-29 Antenna (3) - (4) SMA-Coaxial Cable	7/7/10	7/31/11
	Substitution Equipment				
FGR002	Signal Generator	Hewlett-Packard			
AT0026	Double Ridged Horn Antenna	EMCO	ETS-Lindgren	1/18/10	1/31/11
ATA198	Cable	-	SMA 3.5 Male-to-Male	-	-
PAR005	Power Meter	Rhode & Schwarz	NRVD	2/18/10	2/28/11
PAR005	Power Meter Sensor (Thermal)	Rhode & Schwarz	NRV-Z51	2/18/10	2/28/11
	Gain-Loss Chains				
SAC_C (Biconical 3m location)	(1) ATA084: Attenuator (2) ATA124: Amplifier (3) ATA224: Cable (4) ATA132: Cable (5) ATA229: DC Bias Tee (6) ATA199: Cable	(1) Pasternack (2) Miteq (3) Eupen (4) UL (5) Miteq (6) Micro-Coax	(1) PE7002-6 (2) AM-3A-000110-N (3) CMS/RG 214 (4) UFA210A-0-6000-50U-50U (5) BT2000-C (6) UFB293C-0-0720-5GU50U)	08/24/09	08/31/10

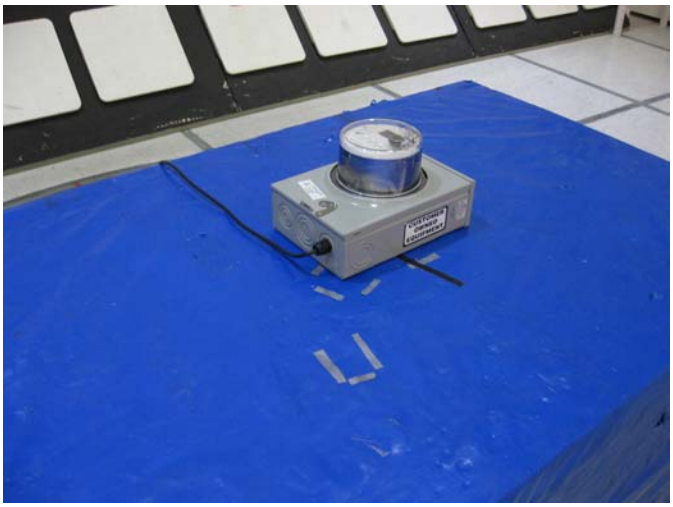
Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAC_D (Log-Periodic 3m location)	(1) ATA085: Attenuator (2) ATA125: Amplifier (3) ATA225: Cable (4) ATA189: Cable (5) ATA115: DC Bias Tee (6) ATA198: Cable	(1) Pasternack (2) Miteq (3) EUPEN (4) EUPE (5) Miteq (6) Micro-Coax	(1) PE7002-6 (2) AM-3A-000110-N (3) CMS/RG 214 (4) CMS/RG 214 (5) AM-1523-7687 (6) UFB293C-0-0720-5GU50U	02/17/10	08/31/10
SAC_E_HORN (Horn 3m location)	(1) ATA144: Amplifier (2) ATA207: Cable (3) ATA096: Cable (4) ATA199: Cable	(1) Miteq (2) Micro-Coax (3) Micro-Coax (4) Micro-Coax	(1) AFS42-00101800-25-N-42MF (2) UFB293C-1-3360-50U50U (3) UTiFLEX (4) UFB293C-0-0720-5GU50U	08/24/09	08/31/10
	Receiver and Software				
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0034	Environmental meter (T/H/P)	Control Company	99760-00	10/19/09	10/31/10
MG1180	Tape Measure	Lufkin	HI-VIZ	8/8/08	8/31/11

Test setup for RADIATED SPURIOUS EMISSIONS – Radiated



EUT Upright (On Bottom)

EUT On Side

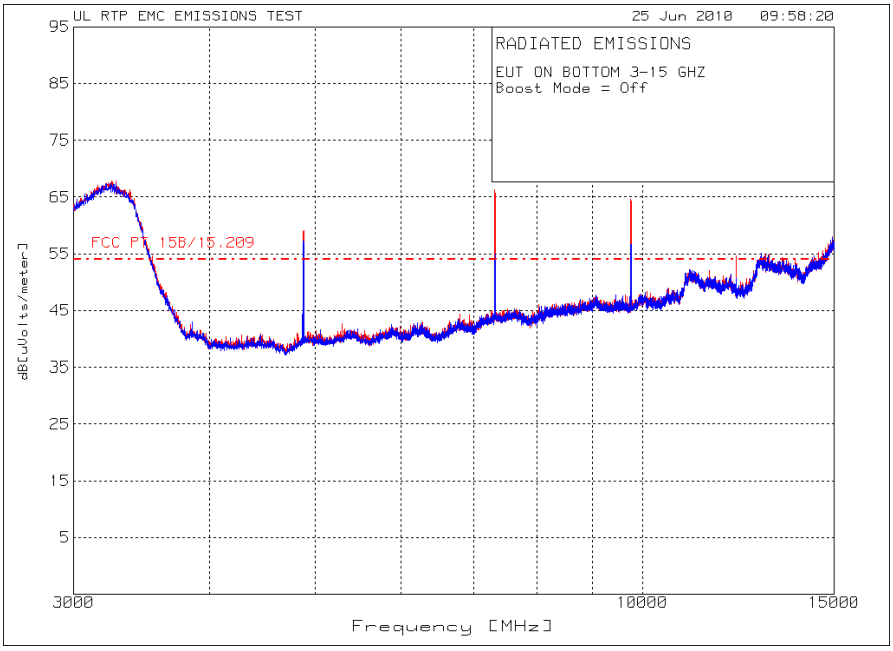


EUT on Back (Flat)

Figure 2 Radiated Spurious Emissions above 1GHz, Middle Channel – Worst-case orientation

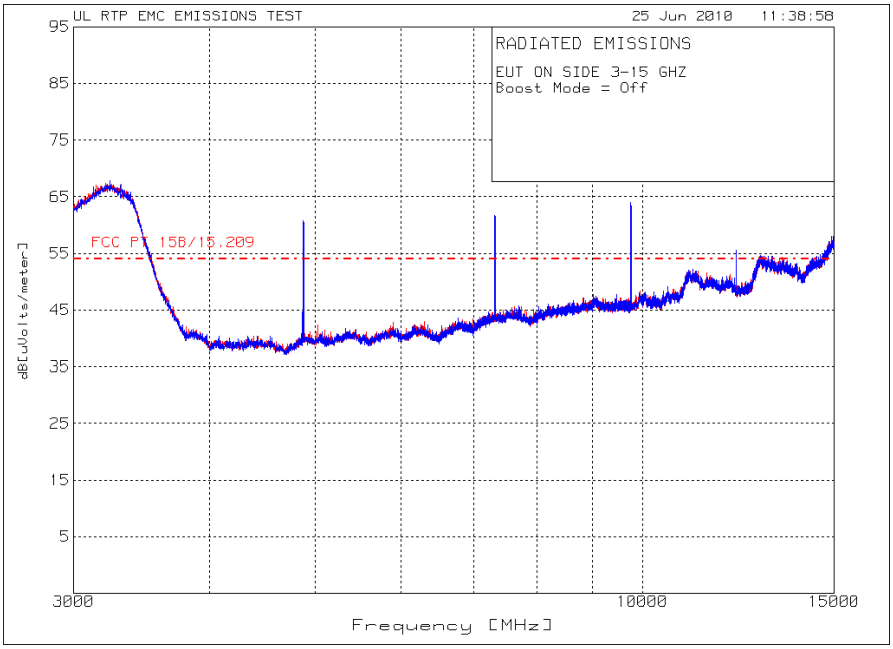
From data below at Middle channel, upright orientation was determined to be worst-case for radiated spurious emissions. Low and High channels are measured in this orientation. Middle channel plots are shown. All results are shown in data table.

On Bottom (Upright)

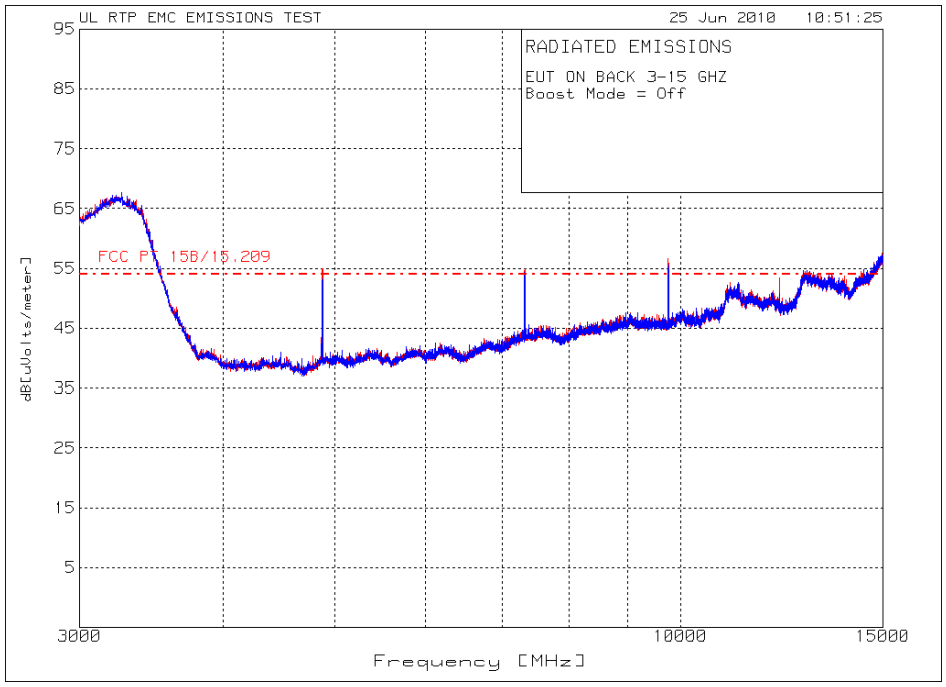


Note: Broad hump below 4 GHz is mathematical correction for high-pass filter. A follow-up 12.5-15 GHz measurement is shown on the following page where noise floor exceeds limit.

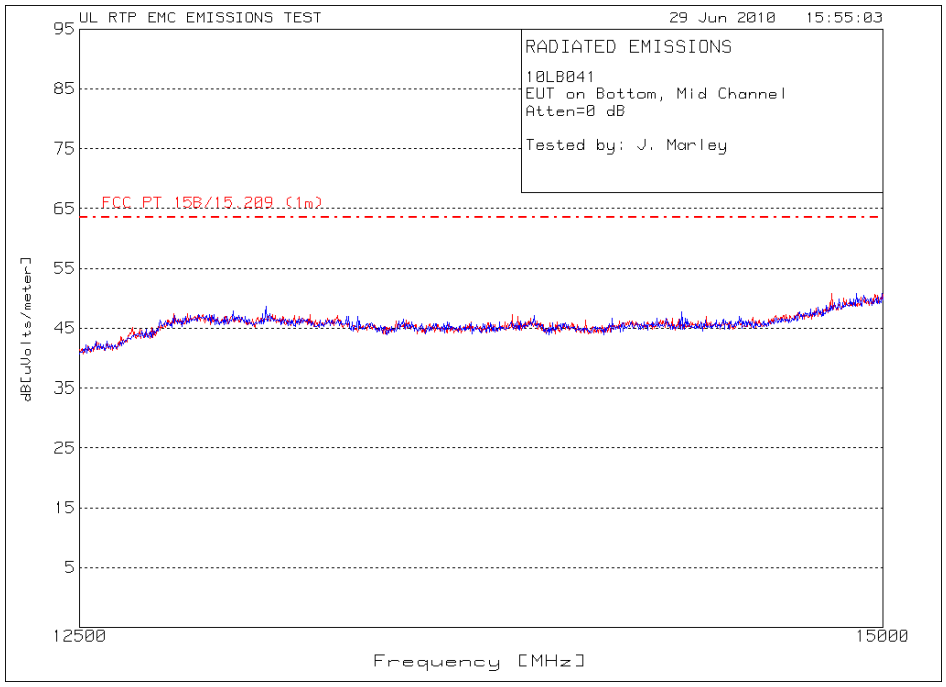
On Side



On Back

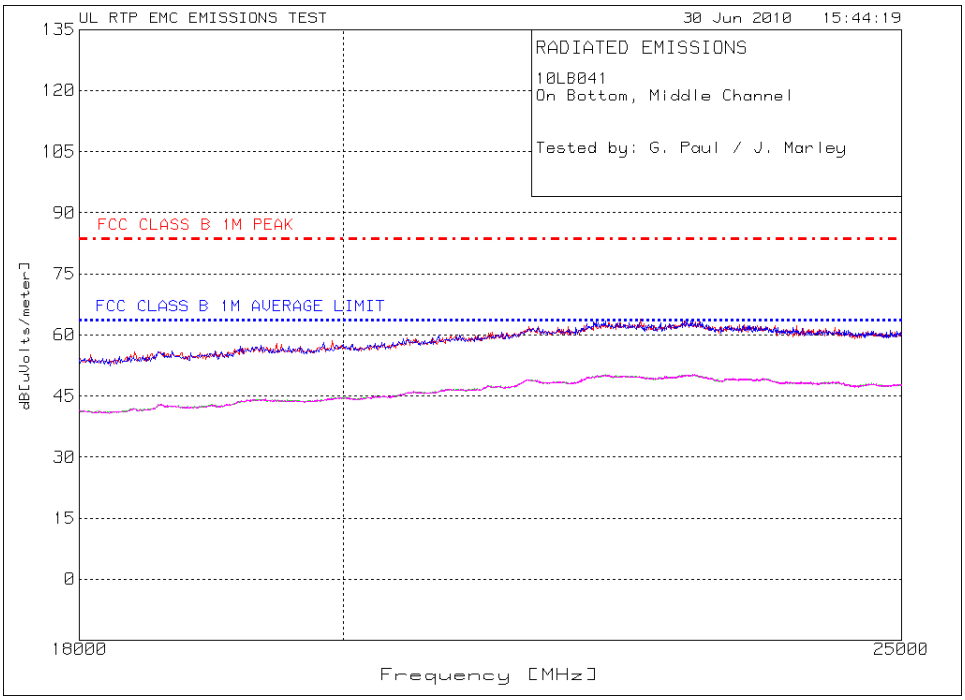


12-15 GHz Plot (0dBm atten)



Note: No significant radiated spurious emission was observed above 12.5 GHz in any orientation. Mid Channel, upright orientation is shown.

18-25 GHz Plot (1m distance)



Note: No significant spurious emission was observed above 12.5 GHz in any orientation. Mid Channel, upright orientation is shown.

Note: Lower trace represents slow, reduced-VBW sweep.

Table 12 1 GHz-10 GHz Radiated Spurious Emissions Table, Middle Channel, Upright Orientation

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Gain/Loss (dB)	Antenna Factor (dB)	Corrected Value (dBuV/m)	Average Limit** (dBuV/m)	Average Margin (dB)	Peak Limit (dBuV/m)	Peak Margin (dBuV/m)	Antenna Polarity (V/H)	Antenna Height (cm)	Turntable Angle (degrees)
P	4878.911	59.73	-33.0	32.9	59.63	-	-	74	-14.36	V	112	172
A	4878.755	41.60	-33.0	32.9	41.50	54	-12.5	-	-	V	100	167
P	7318.4664	59.30	-30.1	36.5	65.70	-	-	74	-8.3	V	100	161
P	9757.6916	54.55	-27.5	37.7	64.75	-	-	74	-9.25	V	157	139
P	12197.166	44.96	-27.6	38.6	55.96	-	-	74	-18.04	V	177	137
A	7318.4597	38.45	-30.1	36.5	44.85	54	-9.15	-	-	V	152	160
A	9761.822	33.99	-27.5	37.7	44.19	54	-9.81	-	-	V	151	145
A	12197.173	28.92	-27.6	38.6	39.92	54	-14.08	-	-	V	178	139

*P= Peak, Q= Quasi-Peak, A= Average

Table 13 1 GHz-10 GHz Radiated Spurious Emissions Table TX Mode, Low Channel, Upright Orientation

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Gain/Loss (dB)	Transducer Factor (dB)	Corrected Value (dBuV/m)	Average Limit** (dBuV/m)	Average Margin (dB)	Peak Limit** (dBuV/m)	Peak Margin (dBuV/m)	Antenna Polarity (V/H)	Antenna Height (cm)	Turntable Angle (degrees)
P	4808.9653	60.76	-33.2	32.8	60.36	-	-	74	-13.64	V	101	130
A	4809.0192	41.94	-33.2	32.8	41.54	54	-12.46	-	-	V	100	168
P	7213.3944	59.73	-30.1	36.0	65.63	-	-	74	-10.37	V	136	158
P	9617.6803	56.87	-27.0	37.5	67.37	-	-	74	-6.63	V	100	121
P	12022.003	44.60	-26.2	39.0	57.40	-	-	74	-19.60	V	102	141
P	7213.3944	57.95	-30.1	36.0	63.85	-	-	74	-10.15	V	100	148
P	9617.5839	57.23	-27.0	37.5	67.73	-	-	74	-6.27	V	100	122
P	12021.944	43.98	-26.2	39.0	56.78	-	-	74	-17.22	V	163	143
A	7213.5046	40.77	-30.1	36.0	46.67	54	-7.33	-	-	V	126	120
A	9617.783	36.86	-27.0	37.5	47.36	54	-6.64	-	-	V	112	144
A	12022.25	25.68	-26.2	39.0	40.81	54	-13.19	-	-	V	161	166
P	14440.330	38.53	-25.6	41.9	54.83	-	-	74	-19.17	H	156	346
A	14426.366	26.42	-25.8	41.9	42.52	54	-11.48	-	-	H	109	84

*P= Peak, Q= Quasi-Peak, A= Average

**Average Limit and Peak Limit applied to frequencies within 15.209 restricted bands.

Table 14 1 GHz-10 GHz Radiated Spurious Emissions Table TX Mode, High Channel, Upright Orientation

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Gain/Loss (dB)	Transducer Factor (dB)	Corrected Value (dBuV/m)	Average Limit** (dBuV/m)	Average Margin (dB)	Peak Limit (dBuV/m)	Peak Margin (dBuV/m)	Antenna Polarity (V/H)	Antenna Height (cm)	Turntable Angle (degrees)
P	4949.300	59.20	-33	33.1	59.3	-		74	-14.7	V	102	rot
A	4948.807	40.44	-33	33.1	40.54	54	-13.46	-	-	V	115	54
P	7422.237	43.61	-30	36.6	50.21	-		74	-23.79	V	100	rot
A	7423.3853	28.86	-30	36.6	35.46	54	-18.54	-		V	107	355
P	9902.15	39.91	-27.6	38.0	50.31	-		74	-23.69	V	100	rot
A	9905.1931	23.79	-27.6	38.0	34.29	54	-19.71	-	-	V	100	13
P	12377.563	45.7	-27.1	38.6	57.2	-	-	74	-16.8	V	149	rot
A	12372.209	29.18	-27.0	38.6	40.78	54	-13.22	-	-	V	102	286
P	4951.301	58.84	-33.0	33.1	58.94	-		74	-15.06	H	100	rot
A	4948.9283	42.34	-33.0	-33.1	42.44	54	-11.56	-	-	H	100	268
P	12377.563	41.74	-27.1	38.6	53.24	-	-	74	-20.76	H	149	rot
A	12372.188	28.73	-27.0	38.6	40.33	54	-13.67	-	-	H	130	10

4.4 Test Conditions and Results – RADIATED EMISSIONS – Unintentional / Spurious (30-1000 MHz)

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

Basic Standard	47 CFR Part 15.247(d), Subpart B, ANSI C63.4:2003 RSS-210 Issue 7, A8.5, ICES-003 Issue 4	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30 MHz – 1GHz	(3 meter measurement distance)

Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Average
30 – 88	40	-
88 – 216	43.5	-
216 – 960	46	-
960 – 1000	54	-

Supplementary information: Highest operating frequency, not including transmit frequencies, is less than 108 MHz. Therefore, no testing above 1000 MHz is required.

Table 15 Radiated Emissions EUT Configuration Settings

Power Interface Mode # (See Section 1.3.4)	EUT Configurations Mode # (See Section 1.6)	EUT Operation Mode # (See 1.5)
1	1	1 (Middle Channel)

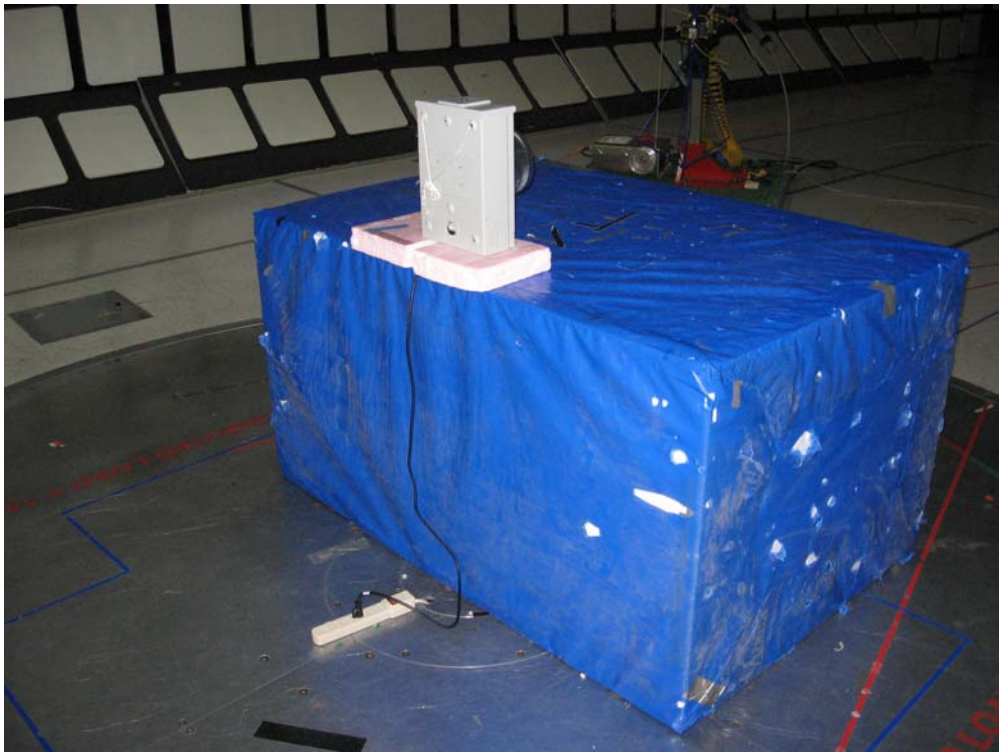
Supplementary information:

None

Table 16 Radiated Emissions Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz Range				
AT0021	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	12/22/09	12/31/10
AT0022	Log-periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	12/22/09	12/31/10
	Gain-Loss Chains				
SAC_C (Biconical 3m location)	(7) ATA084: Attenuator (8) ATA124: Amplifier (9) ATA224: Cable (10) ATA132: Cable (11) ATA229: DC Bias Tee (12) ATA199: Cable	(7) Pasternack (8) Miteq (9) Eupen (10) UL (11) Miteq (12) Micro-Coax	(7) PE7002-6 (8) AM-3A-000110-N (9) CMS/RG 214 (10) UFA210A-0-6000-50U-50U (11) BT2000-C (12) UFB293C-0-0720-5GU50U)	08/24/09	08/31/10
SAC_D (Log-Periodic 3m location)	(7) ATA085: Attenuator (8) ATA125: Amplifier (9) ATA225: Cable (10) ATA189: Cable (11) ATA115: DC Bias Tee (12) ATA198: Cable	(7) Pasternack (8) Miteq (9) EUPEN (10) EUPE (11) Miteq (12) Micro-Coax	(7) PE7002-6 (8) AM-3A-000110-N (9) CMS/RG 214 (10) CMS/RG 214 (11) AM-1523-7687 (12) UFB293C-0-0720-5GU50U	02/17/10	08/31/10
	Receiver and Software				
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0034	Environmental meter (T/H/P)	Control Company	99760-00	10/19/09	10/31/10
MG1180	Tape Measure	Lufkin	HI-VIZ	8/8/08	8/31/11

Figure 3 Test setup for Radiated Emissions



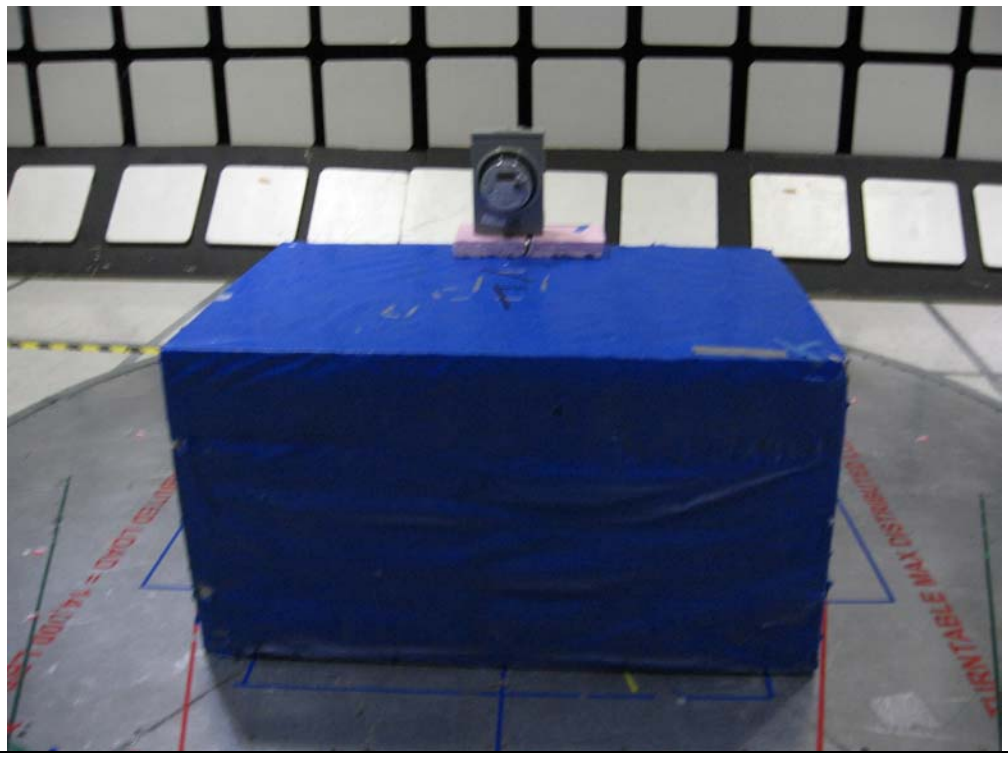


Figure 4 Radiated Unintentional emissions / Spurious Emissions 30-1000 MHz

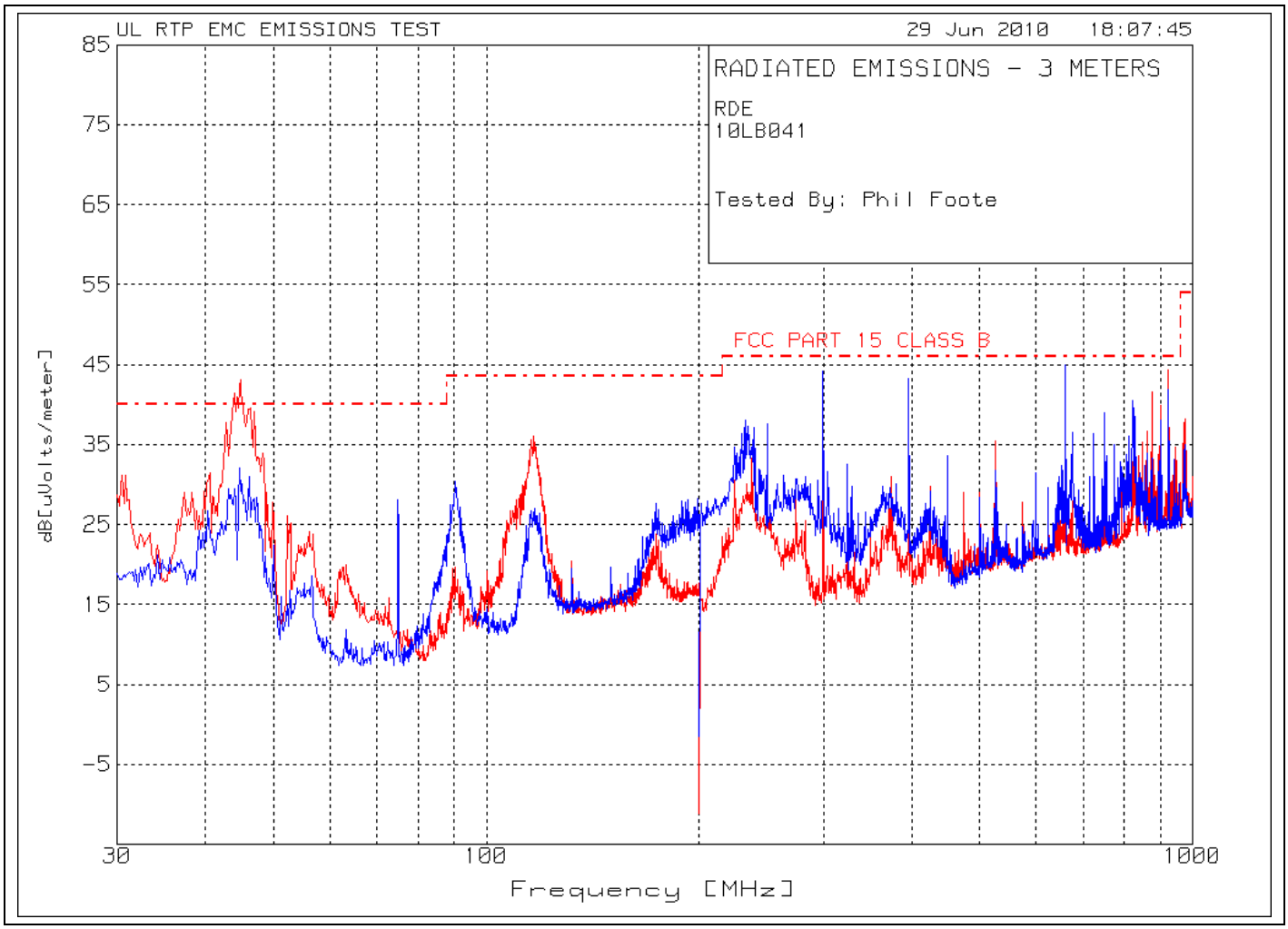


Table 17 Radiated Emissions / Spurious Emissions Data Points

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Gain/Loss (dB)	Transducer Factor (dB)	Corrected Value (dBuV/m)	Quasi-Pk Limit** (dBuV/m)	Quasi-Pk Margin (dB)	Antenna Polarity (V/H)	Antenna Height (cm)	Turntable Angle (degrees)	Comment (#)
P	44.8048	57.46	-26.8	12.4	43.06	40	3.06	V	101	rot	
P	299.7999	58.04	-26.8	12.9	44.14	46	-1.86	H	100	rot	
P	396.3976	53.5	-25.7	15.4	43.2	46	-2.80	H	200	rot	
P	660.5737	49.25	-24.4	20.1	44.95	46	-1.05	H	100	rot	
P	822.2815	41.52	-23.4	22.4	40.52	46	-5.48	H	100	rot	
P	875.1167	41.79	-23.3	23.1	41.59	46	-4.41	H	100	rot	
P	924.7498	44.36	-23.0	23.0	44.36	46	-1.64	V	100	rot	
P	924.7498	41.85	-23.0	23.0	41.85	46	-4.15	H	200	rot	
Q	44.8150	50.20	-26.7	12.4	35.90	40	-4.10	V	101	228	
Q	300.0006	59.13	-26.8	12.9	45.23	46	-0.77	H	102	332	1
Q	396.2880	53.55	-25.6	15.4	43.35	46	-2.65	H	194	320	
Q	660.4772	48.95	-24.4	20.1	44.65	46	-1.35	H	112	18	
Q	822.7966	32.05	-23.4	22.4	31.05	46	-14.95	H	164	71	
Q	875.0062	41.58	-23.3	23.1	41.38	46	-4.62	V	111	40	
Q	924.6663	41.93	-23.0	23.0	41.93	46	-4.07	H	194	0	
Q	924.6743	43.39	-23.0	23.0	43.39	46	-2.61	V	102	38	

**P= Peak, Q= Quasi-Peak, A= Average, rot = rotated

Comments:

(1) Closest to Limit for Unintentional Radiated Emissions – 300.006 MHz measured at 45.23 dBuV/m (limit 46.0 dBuV/m).

4.5 Test Conditions and Results – BAND EDGE

Test Description	Bandedge measurement is performed as a radiated emissions test. Measurements at the lower and upper band edges are recorded. Restricted Band Edge: two measurements are taken. A measurement at 2390 MHz and 2483.5 MHz are recorded to demonstrate that the general limit is met at the upper and lower restricted band edges. Operating Band Edge: measurements are recorded to ensure that emissions at the operating band edges (2400 and 2483.5 MHz) are greater than –20dBc from the nearest channel. Because the upper band edge at 2483.5 MHz is the also lowest frequency of a restricted band, then the –20dBc measurement is not needed.	
Basic Standard	47 CFR Part 15.209, ANSI C63.4:2003 ICES-003 Issue 4	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	Low Bandedge	2390 MHz (Restricted Band), 2400 MHz (15.247 Band edge)
	High Bandedge	2483.5 MHz (Restricted Band)
Limits		
-20dBc (Bandedge), 54dBuV/m (avg Restricted Band), 74dBuV/m(peak Restricted Band)		

Table 18 Conducted Power EUT Configuration Settings

Power Interface Mode # (See Section 1.3.4)	EUT Configurations Mode # (See Section 1.6)	EUT Operation Mode # (See 1.5)
1	1 (radiated)	1 (Low and High Channels)
Supplementary information: Note: Output was set via firmware to “Boost Mode = Off”.		

Table 19 Bandedge Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz Range				
AT0021	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	12/22/09	12/31/10
AT0022	Log-periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	12/22/09	12/31/10
	Gain-Loss Chains				
SAC_C (Biconical 3m location)	(13) ATA084: Attenuator (14) ATA124: Amplifier (15) ATA224: Cable (16) ATA132: Cable (17) ATA229: DC Bias Tee (18) ATA199: Cable	(13) Pasternack (14) Miteq (15) Eupen (16) UL (17) Miteq (18) Micro-Coax	(13) PE7002-6 (14) AM-3A-000110-N (15) CMS/RG 214 (16) UFA210A-0-6000-50U-50U (17) BT2000-C (18) UFB293C-0-0720-5GU50U)	08/24/09	08/31/10
SAC_D (Log-Periodic 3m location)	(13) ATA085: Attenuator (14) ATA125: Amplifier (15) ATA225: Cable (16) ATA189: Cable (17) ATA115: DC Bias Tee (18) ATA198: Cable	(13) Pasternack (14) Miteq (15) EUPEN (16) EUPE (17) Miteq (18) Micro-Coax	(13) PE7002-6 (14) AM-3A-000110-N (15) CMS/RG 214 (16) CMS/RG 214 (17) AM-1523-7687 (18) UFB293C-0-0720-5GU50U	02/17/10	08/31/10
	Receiver and Software				
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0034	Environmental meter (T/H/P)	Control Company	99760-00	10/19/09	10/31/10
MG1180	Tape Measure	Lufkin	HI-VIZ	8/8/08	8/31/11

Figure 20 Bandedge Results (Low Channel)

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Cable Loss (dB)	Antenna Factor (dB)	Field Strength (dBuV/m)	Average Limit** (dBuV/m)	Average Margin (dB)	Peak Limit (dBuV/m)	Peak Margin (dB)	Comment (#)
P	2405	73.11	10.5	28.4	112.01	-	-	-	-	1
P	2400	30.68	10.5	28.4	69.58	-	-	-92.01	-32.43	2
P	2390	22.56	10.5	28.4	61.46	-	-	74	-12.54	3
A	2390	7.58	10.5	28.4	46.48	54	-7.52	-	-	3

(1) Positioned at highest radiated power position and polarity, (100cm, 308deg).
(2) –20 dBc.
(3) Highest emission at or just below 2390 MHz.

Figure 21 Bandedge Results (High Channel)

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Cable Loss (dB)	Antenna Factor (dB)	Field Strength (dBuV/m)	Average Limit** (dBuV/m)	Average Margin (dB)	Peak Limit (dBuV/m)	Peak Margin (dB)	Comment (#)
P	2475	73.19	10.7	28.6	112.49	-	-	-	-	4
P	2483.5	22.99	10.7	28.6	62.29	-	-	74	-11.71	5
A	2483.5	8.60	10.7	28.6	47.90	54.0	-6.1	-	-	5

(4) Positioned at highest radiated power position and polarity (.
(5) Highest emission at or just above 2483.5 MHz.

Figure 22 Bandedge (2405 MHz, Peak)

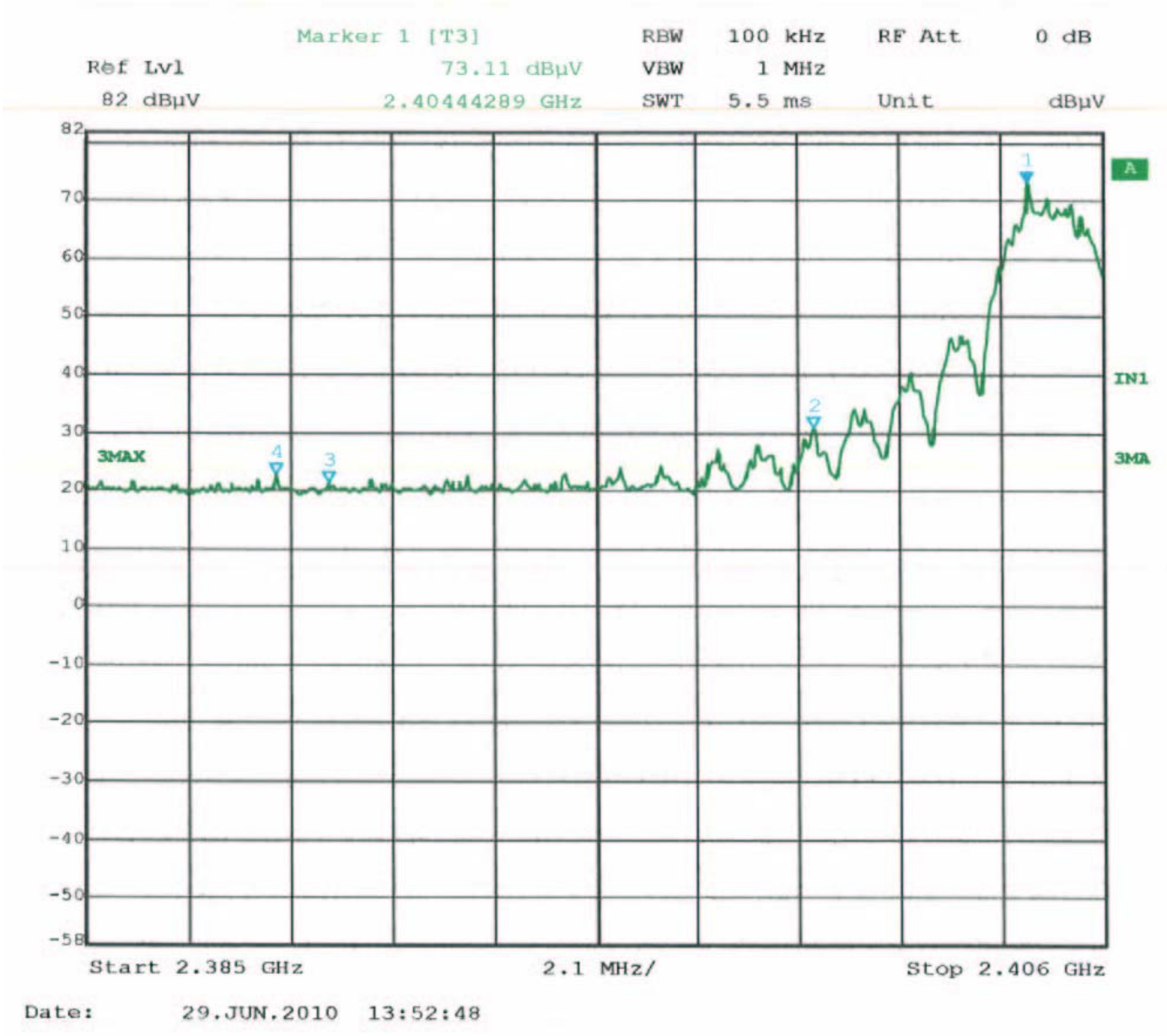


Figure 23 Bandedge (2400 MHz, Peak)

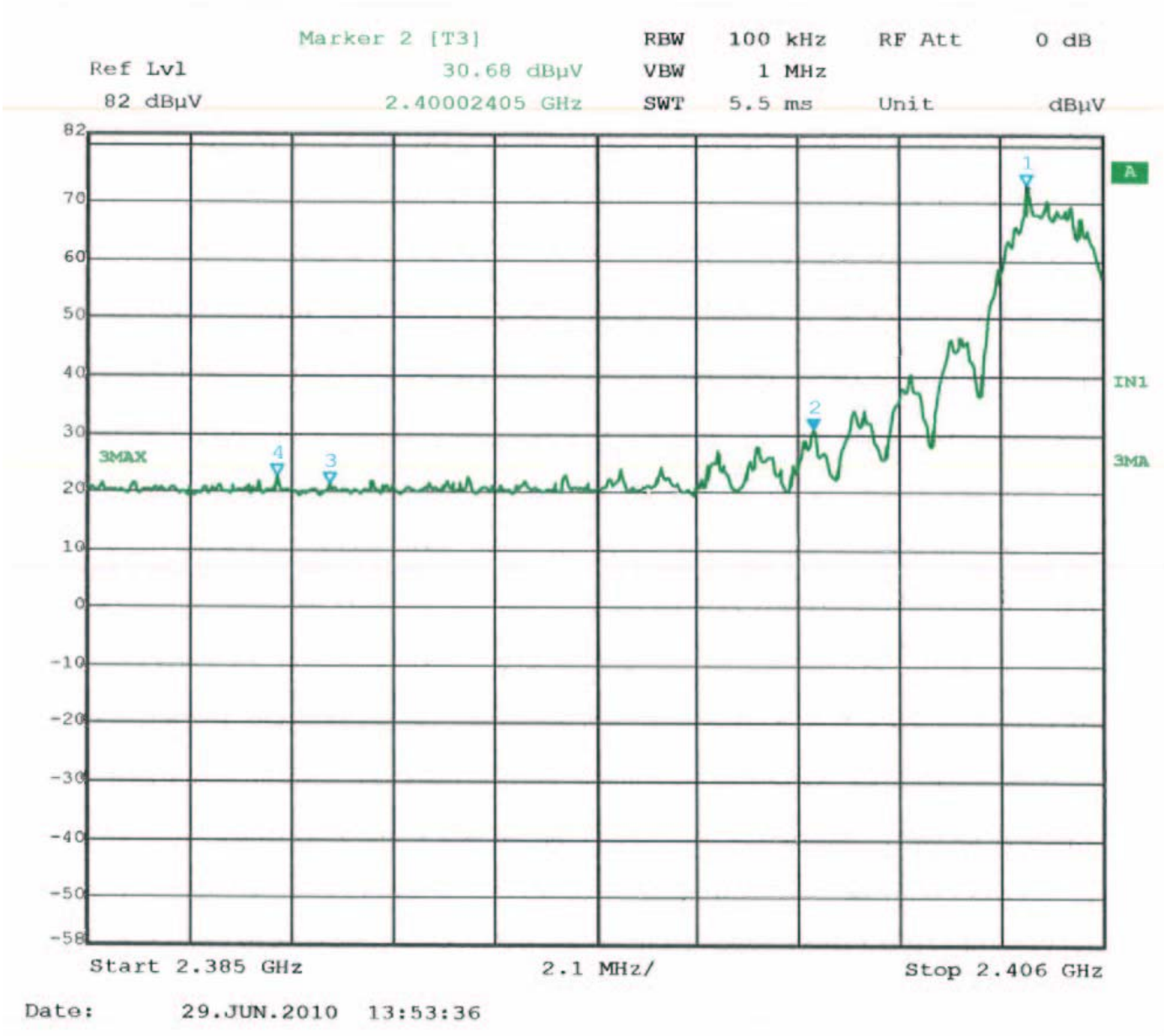


Figure 24 Bandedge (2390 MHz, Peak)

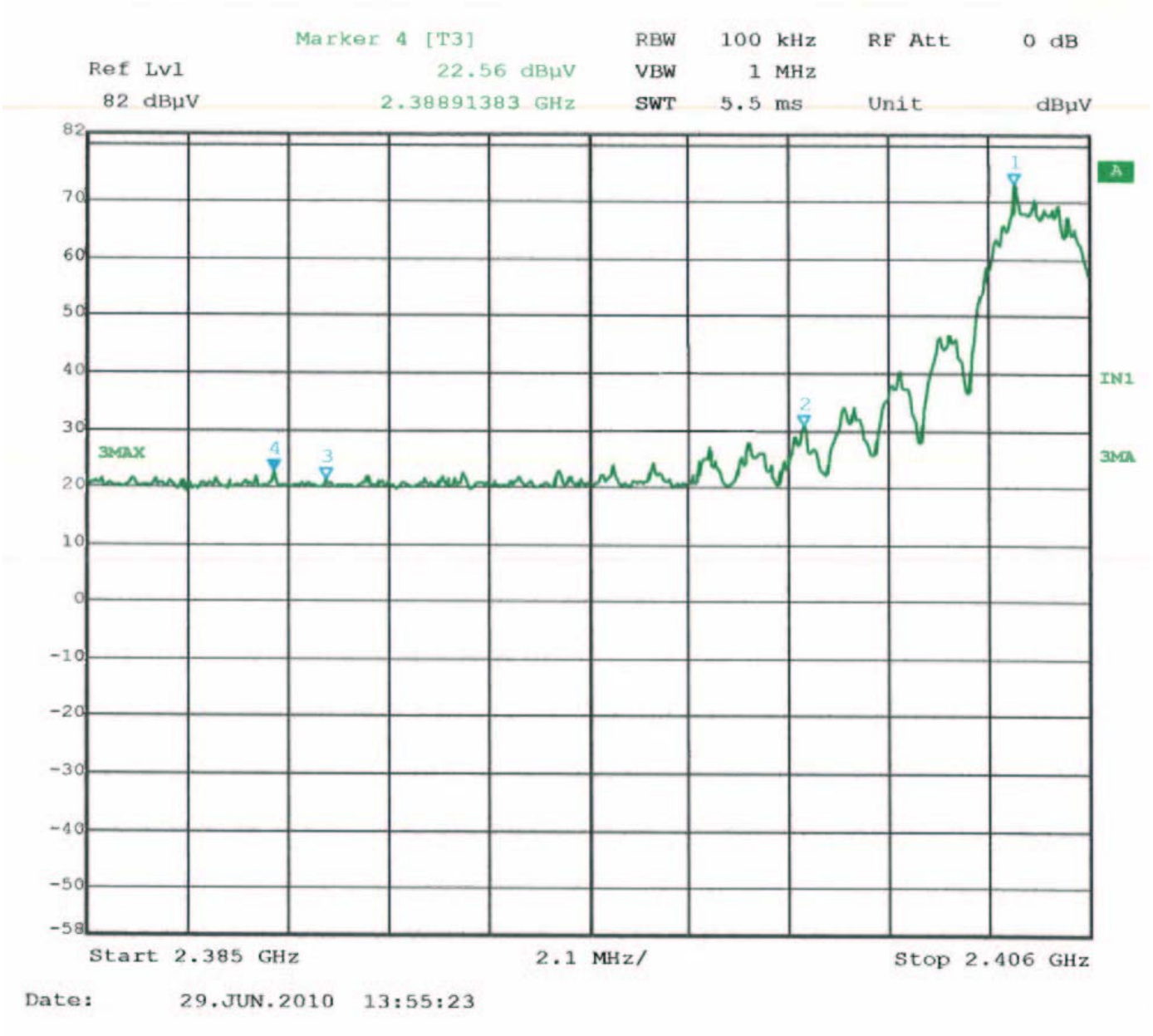


Figure 25 Bandedge (2390 MHz, VBW = 10 Hz, Average)

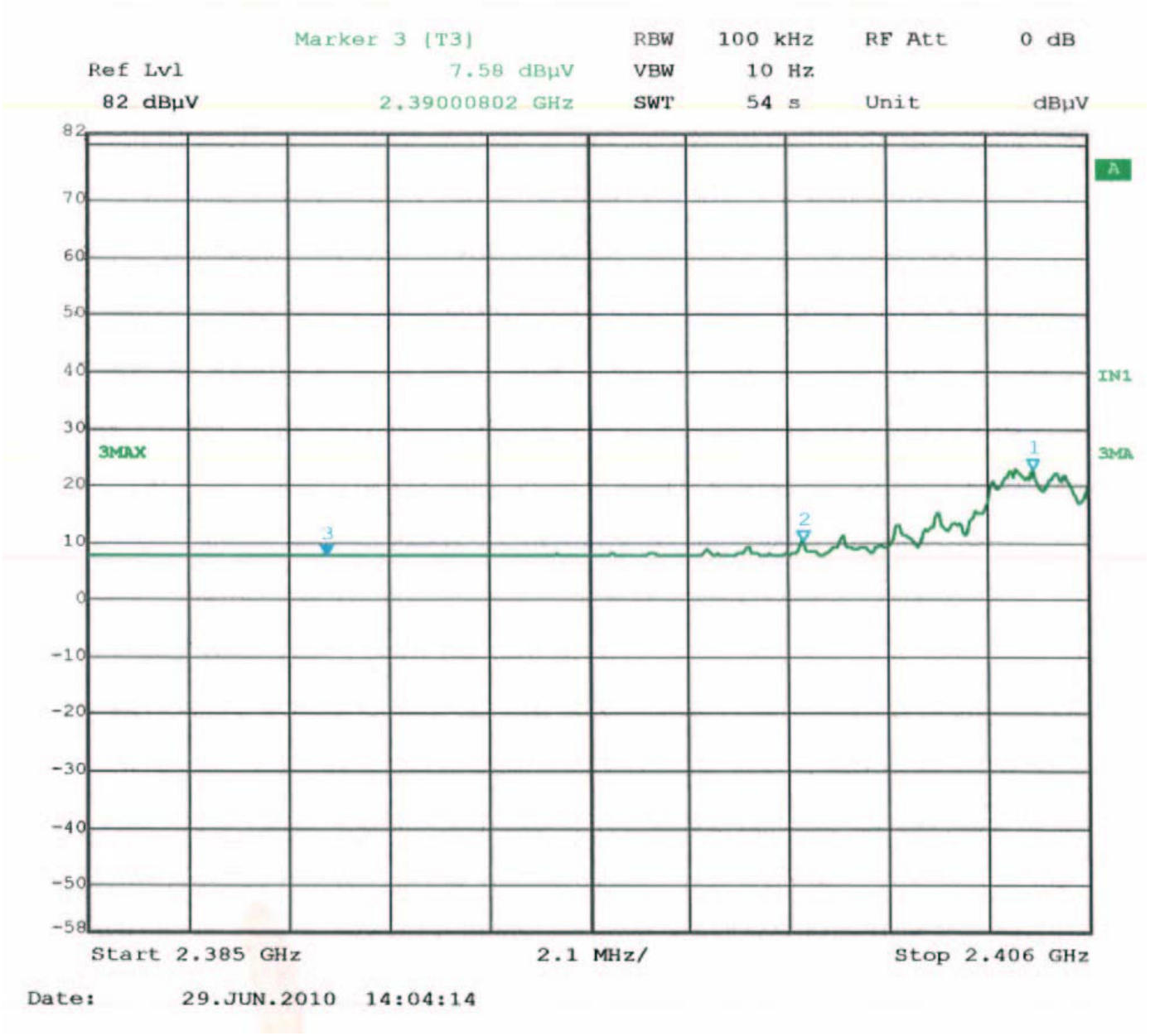


Figure 26 Bandedge (2475 MHz, Peak)

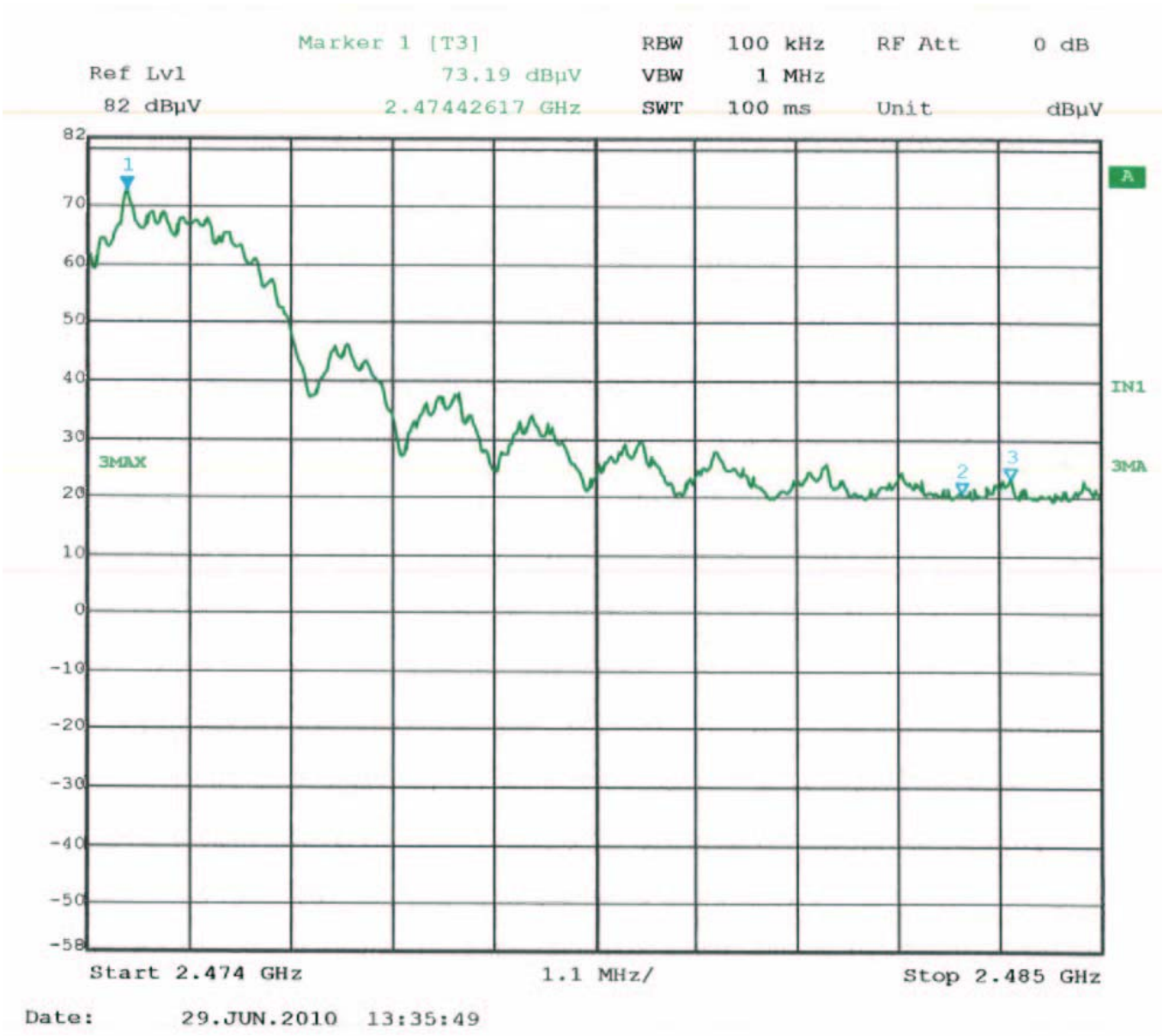


Figure 27 Bandedge (2483.5 MHz, Peak)

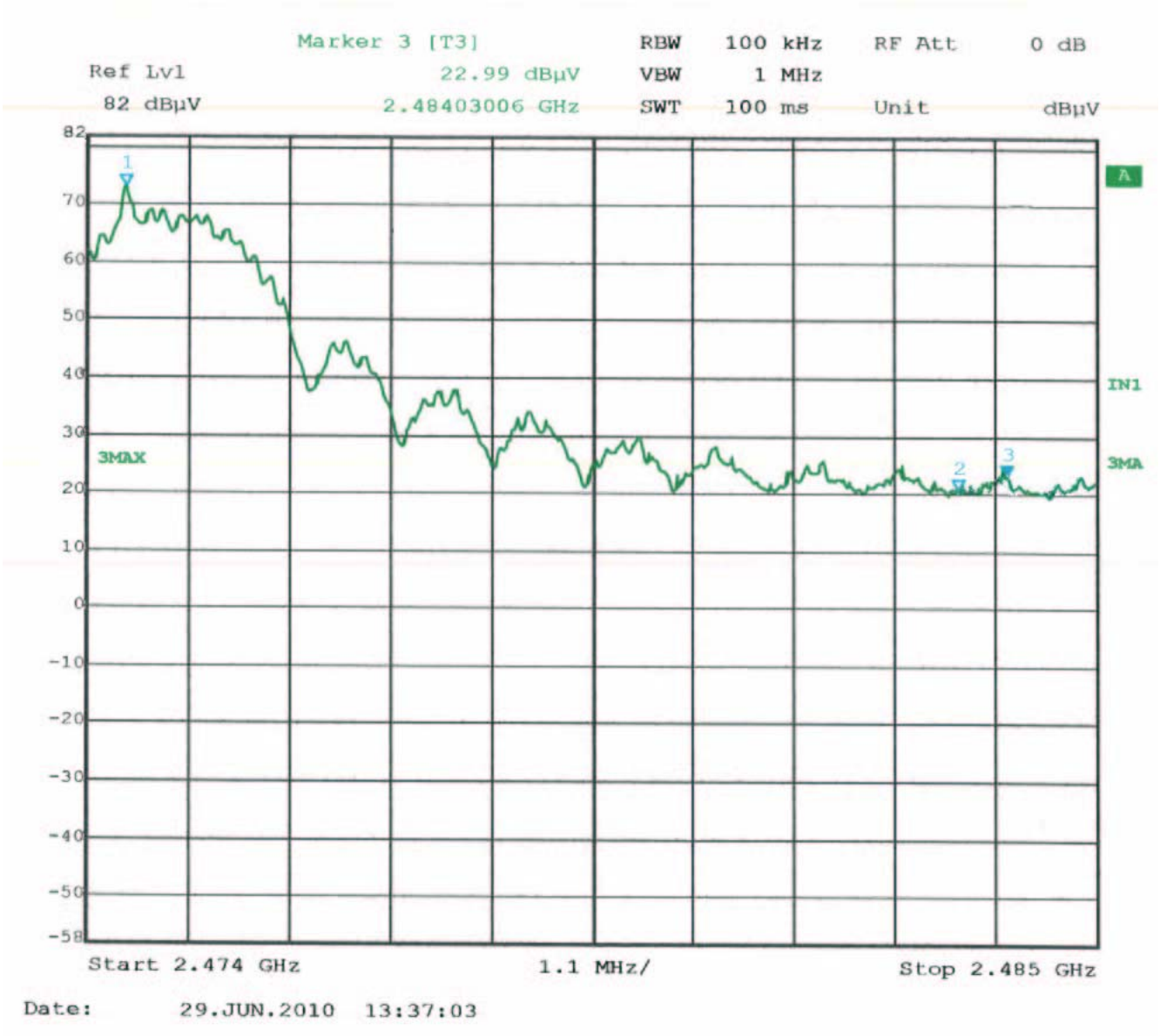
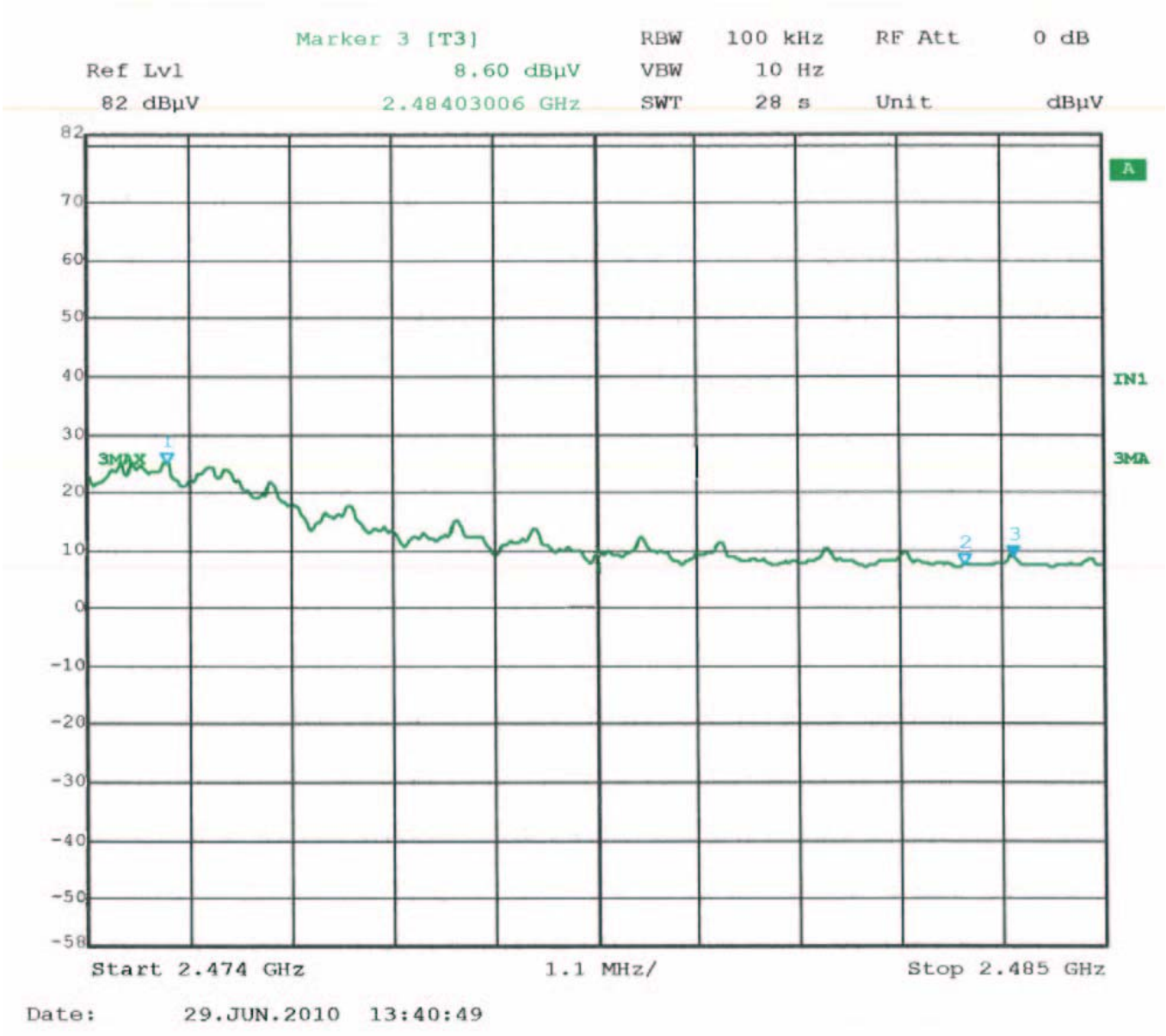


Figure 28 Bandedge – (2483.5 MHz, VBW=10 Hz Average)



4.6 Test Conditions and Results – SPECTRAL DENSITY

Test Description	Measurement is performed to demonstrate that minimum spectral density requirement is met. Resolution Bandwidth is set to 3kHz. Video Bandwidth is larger than Resolution Bandwidth. Span is set to be larger than the occupied bandwidth. Sweep time is set to sweep slowly per FCC KDB XXXXXX.	
Basic Standard	47 CFR Part 15.247(e) , ANSI C63.4:2003 RSS-210 Issue 7, A8.2(b)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	Low, Middle, and High Channels	Spectral Density, Conducted Power
Limits (Power)		
+8dBm in any 3kHz bandwidth		

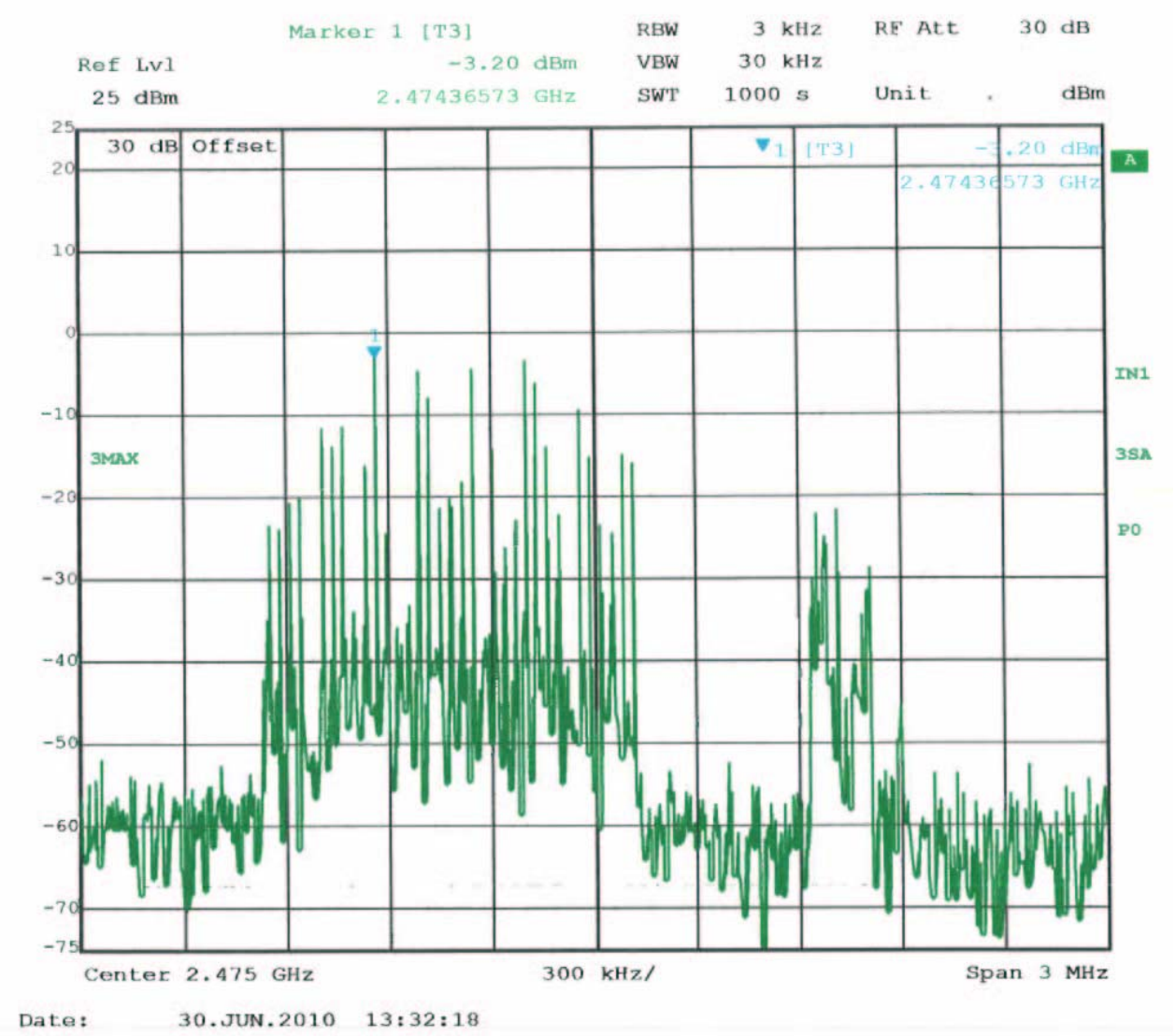
Table 29 Conducted Power EUT Configuration Settings

Power Interface Mode # (See Section 1.3.4)	EUT Configurations Mode # (See Section 1.6)	EUT Operation Mode # (See 1.5)
1	3 (Connected directly to receiver input)	1 (Low, Middle, and High Channels)
Supplementary information:		

Table 30 Spectral Density Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
ATA231	30 dB Attenuator, 2 W	Mini-Circuits	SMA 3.5	2/19/10	2/28/11

Table 31 Spectral Density Plot – High Channel



Note: High Channel was worst-case Spectral Density. Other Channels shown in table below.

Table 32 Spectral Density Results

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBm)	Peak Limit (dBuV/m)	Peak Margin (dB)	Pass/Fail (P/F)	Comment (#)
P	2405	-17.34	8.0	-25.66	P	
P	2440	-7.93	8.0	-15.93	P	
P	2475	-3.20	8.0	-11.20	P	

4.7 Test Conditions and Results – MINIMUM BANDWIDTH / OCCUPIED BANDWIDTH

Test Description	Minimum 6 dB bandwidth is 500 kHz	
Basic Standard	47 CFR Part 15.247(a)(2) RSS-210 Issue 7, A8.2(a)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	Low, Middle, and High Channels	Conducted Power
Limits		
500 kHz (minimum 6 dB bandwidth)		

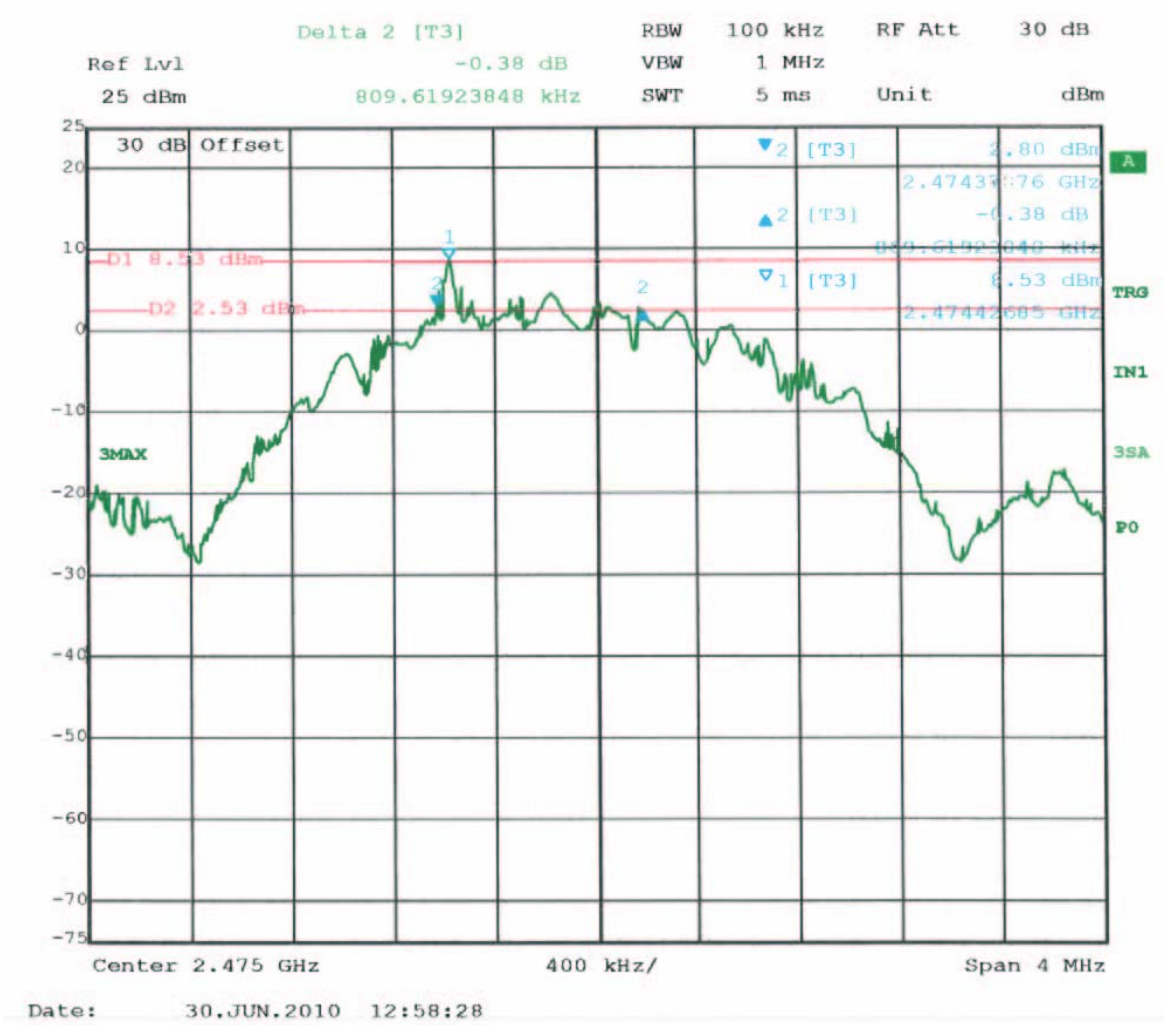
Table 33 Conducted Power EUT Configuration Settings

Power Interface Mode # (See Section 1.3.4)	EUT Configurations Mode # (See Section 1.6)	EUT Operation Mode # (See 1.5)
1	3 (Connected directly to receiver input)	1 (Low, Middle, and High Channels)
Supplementary information: None		

Table 34 Occupied Bandwdith Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
ATA231	30 dB Attenuator, 2 W	Mini-Circuits	SMA 3.5	2/19/10	2/28/11

Table 35 Minimum 6dB Bandwidth Plot



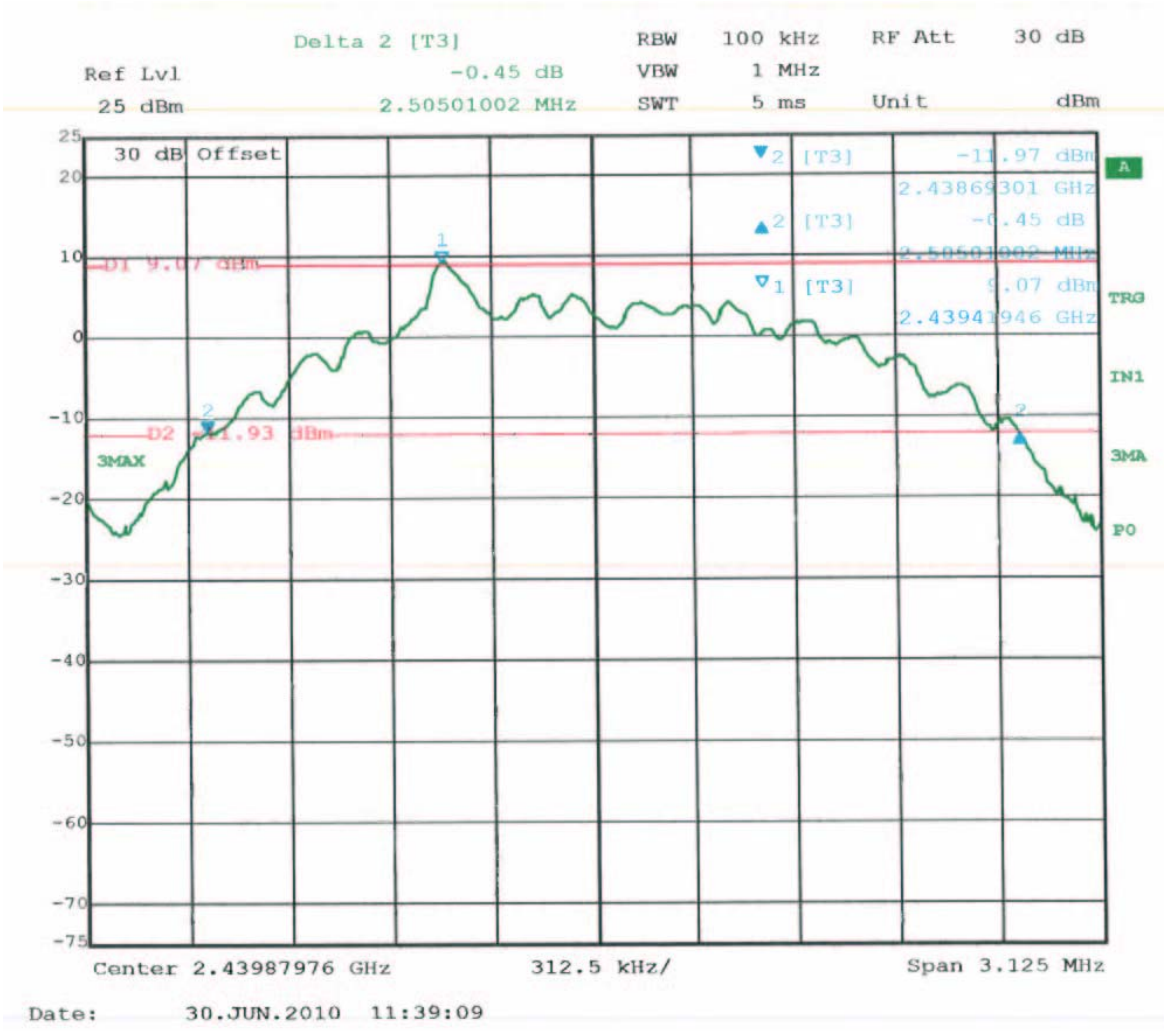
High Channel (above) was closest to minimum requirement. 30 dB attenuator offset is shown in the top left of the screen. Other channel measurement shown in table on the following page.

Table 36 Minimum 6 dB Bandwidth Results

Channel (#)	Frequency Measured (MHz)	Detector Type* (P/Q/A)	Measured Value (kHz)	Minimum Value (kHz)	Conducted Power Limit (mW)	Pass/Fail (P/F)
Low	2405	P	977.95	500	1000	P
Mid	2440	P	970.69	500	1000	P
High	2475	P	809.62	500	1000	P

* P= Peak
** Measured value includes 30 dB offset added for attenuator
** RBW=100 kHz, VBW=1 MHz

Table 37 20 dB Occupied Bandwidth Plot



Middle Channel (above) shows the largest occupied bandwidth. 30 dB attenuator offset is shown in the top left of the screen. Other channel measurement shown in table below.

Table 38 Minimum Bandwidth Results

Channel (#)	Frequency Measured (MHz)	Detector Type* (P/Q/A)	Measured Value (MHz)
Low	2405	P	2.397
Mid	2440	P	2.505
High	2475	P	2.373

* P= Peak

** Measured value includes 30 dB offset added for attenuator

** RBW=100 kHz, VBW=1 MHz

4.8 Test Conditions and Results – ANTENNA GAIN / EIRP

Test Description	Antenna Gain is measured by performing a Radiated Power measurement and a Conducted Power measurement at three transmit frequencies (low, middle, and high channels). The Radiated Power measurement is performed with the EUT in place on a 1.0m x 1.5m x 80cm high non-conductive table with the receive antenna positioned 3 meters away. The maximum turntable angle and antenna height are found and the receiver reading is recorded. The EUT is then substituted with a signal generator and calibrated horn antenna. The signal generator output level is adjusted until the same signal level is observed on the receiver. Finally, the signal generator is connected to a power meter to measure the power input to the horn antenna. After the antenna factor is applied, then the equivalent isotropic radiated power of the antenna is known. This power is compared to the conducted power measurement performed in the previous section. The difference between the radiated power and conducted power measurement is defined to be the antenna gain (dBi).	
Basic Standard	47 CFR Part 15.247(b)(4) RSS-210 Issue 7, A8.4(5)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	Low, Middle, and High Channels	Radiated Power, Conducted Power
Limits (Antenna Conducted)		
If antenna gain is measured to be greater than 6 dB, then output power limit is reduced by the amount of gain in excess of 6 dB.		

Table 39 Antenna Gain EUT Configuration Settings

Power Interface Mode # (See Section 1.3.4)	EUT Configurations Mode # (See Section 1.6)	EUT Operation Mode # (See 1.5)
1	2 (Conducted power – connected directly to receiver)	1 (Low, Middle, and High channels)
1	1 (Radiated power)	1 (Low, Middle, and High channels)
Supplementary information: None.		

Table 40 Antenna Gain Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Receive Antenna				
AT0026	1-18 GHz Double-ridged Horn Antenna	EMCO	3115	9/25/09	9/30/10
	Gain-Loss Chains				
SAC_D (Log-Periodic 3m location)	(19) ATA085: Attenuator (20) ATA125: Amplifier (21) ATA225: Cable (22) ATA189: Cable (23) ATA115: DC Bias Tee (24) ATA198: Cable	(19) Pasternack (20) Miteq (21) EUPEN (22) EUPE (23) Miteq (24) Micro-Coax	(19) PE7002-6 (20) AM-3A-000110-N (21) CMS/RG 214 (22) CMS/RG 214 (23) AM-1523-7687 (24) UFB293C-0-0720-5GU50U	02/17/10	08/31/10
	Receiver and Software				
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	3/18/10	3/31/11
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0034	Environmental meter (T/H/P)	Control Company	99760-00	10/19/09	10/31/10
MG1180	Tape Measure	Lufkin	HI-VIZ	8/8/08	8/31/11

Table 41 Antenna Gain Results

Chan.	Freq. (MHz)	EUT Orient-ation	Polarity	Maximum Received Signal (dBuV)	Signal Generator Setting to duplicate signal strength (dBm)	Power Meter reading at end of cable (dBm)	Substitution Antenna Gain (dBi)	Equivalent Isotropic Radiated Power (dBm EIRP)	Conducted Power Measure-ment - Direct (dBm)	Antenna Gain (Radiated Power minus Conducted Power) (dBi)
Low	2405	Upright	H	70.00	-	-	-	-	-	-
			V	74.72	4.5	3.66	10.37	14.03	10.62	3.41
		On Side	H	76.65	5.8	5.03	10.37	15.40	10.62	4.78
			V	67.97	-	-	-	-	-	-
		On Back	H	70.81	-	-	-	-	-	-
			V	63.84	-	-	-	-	-	-
Mid	2440	Upright	H	70.00	-	-	-	-	-	-
			V	73.75	4.6	3.80	10.34	14.14	10.26	3.88
		On Side	H	74.12	3.6	2.77	10.34	13.11	10.26	2.85
			V	69.24	-	-	-	-	-	-
		On Back	H	69.49	-	-	-	-	-	-
			V	63.48	-	-	-	-	-	-
High	2475	Upright	H	68.29	-	-	-	-	-	-
			V	72.81	3.7	2.92	10.31	13.23	9.32	3.91
		On Side	H	74.12	3.7	2.92	10.31	13.23	9.32	3.91
			V	69.38	-	-	-	-	-	-
		On Back	H	69.61	-	-	-	-	-	-
			V	63.72	-	-	-	-	-	-

Substitution was only performed on highest observed reading in each polarity and channel.

Maximum Antenna Gain:

Maximum Antenna Gain observed was **4.78** dBi. This is less than 6 dBi, so no reduction in the maximum output power limit is required.

Maximum EIRP:

Maximum EIRP observed was **15.40 dBm** or **34.67 mW**.

Maximum Conducted Power:

Maximum Conducted Power was **10.62 dBm**, or **11.53 mW**.

4.9 Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.		
Basic Standard		47 CFR Part 15.207, FCC Part 15, Subpart B, ANSI C63.4:2003 RSS-210 Issue 7, ICES-003 Issue 4	
UL LPG		80-EM-S0026	
		Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range		150kHz to 30MHz	Mains
Limits – 15.107 / 15.207			
Frequency (MHz)	Limit (dBµV)		
	Quasi-Peak	Average	
0.15 - 0.5	66 to 56	56 to 46	
0.5 - 5	56	46	
5 - 30	60	50	
Supplementary information: None			

Table 42 Conducted Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 43 Conducted Emissions Test Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Equipment – 10m SAC (A)				
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
ATA013, ATA014	Coaxial Cables	-	ATA030 (UL RG-223) ATA096 (Micro-Coax UTiFLEX) ATA199 (Micro-Coax UFB293C-0-0720-5GU50U)	08/24/09	08/31/10
HI0034	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	10/19/09	10/31/10

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Transient Limiter				
ATA001	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM-7600	3/1/09	3/31/10
	LISNs				
ATA064	LISN, 50-ohm/50-uH, 24A	Solar Electronics	9629-50-TS-24-BNC	3/1/09	3/31/10
ATA065	LISN, 50-ohm/50-uH, 24A	Solar Electronics	9629-50-TS-24-BNC	3/1/09	3/31/10

Figure 5 Test Setup for Conducted Emissions

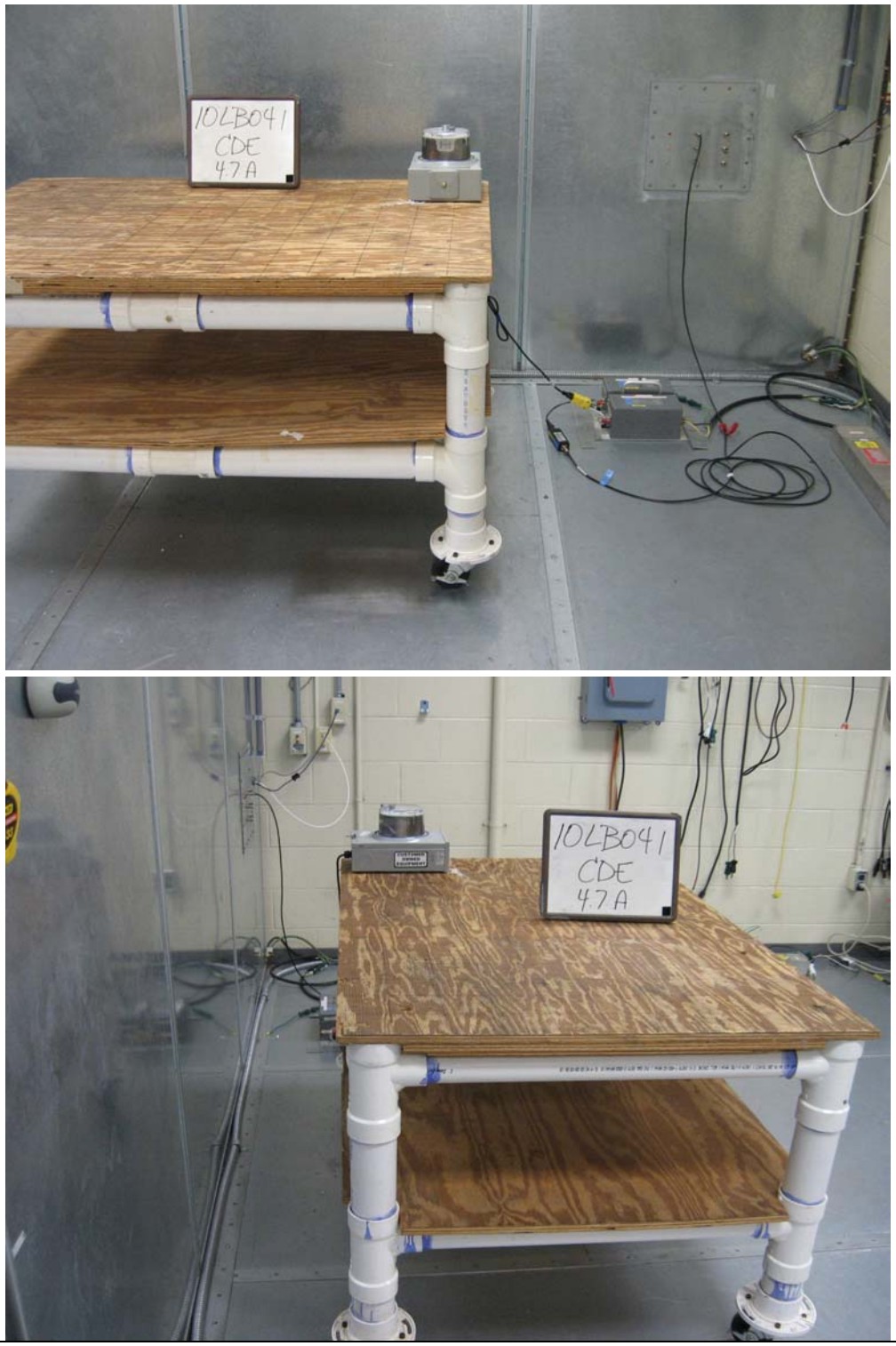


Figure 6 Conducted Emissions Graph – Line

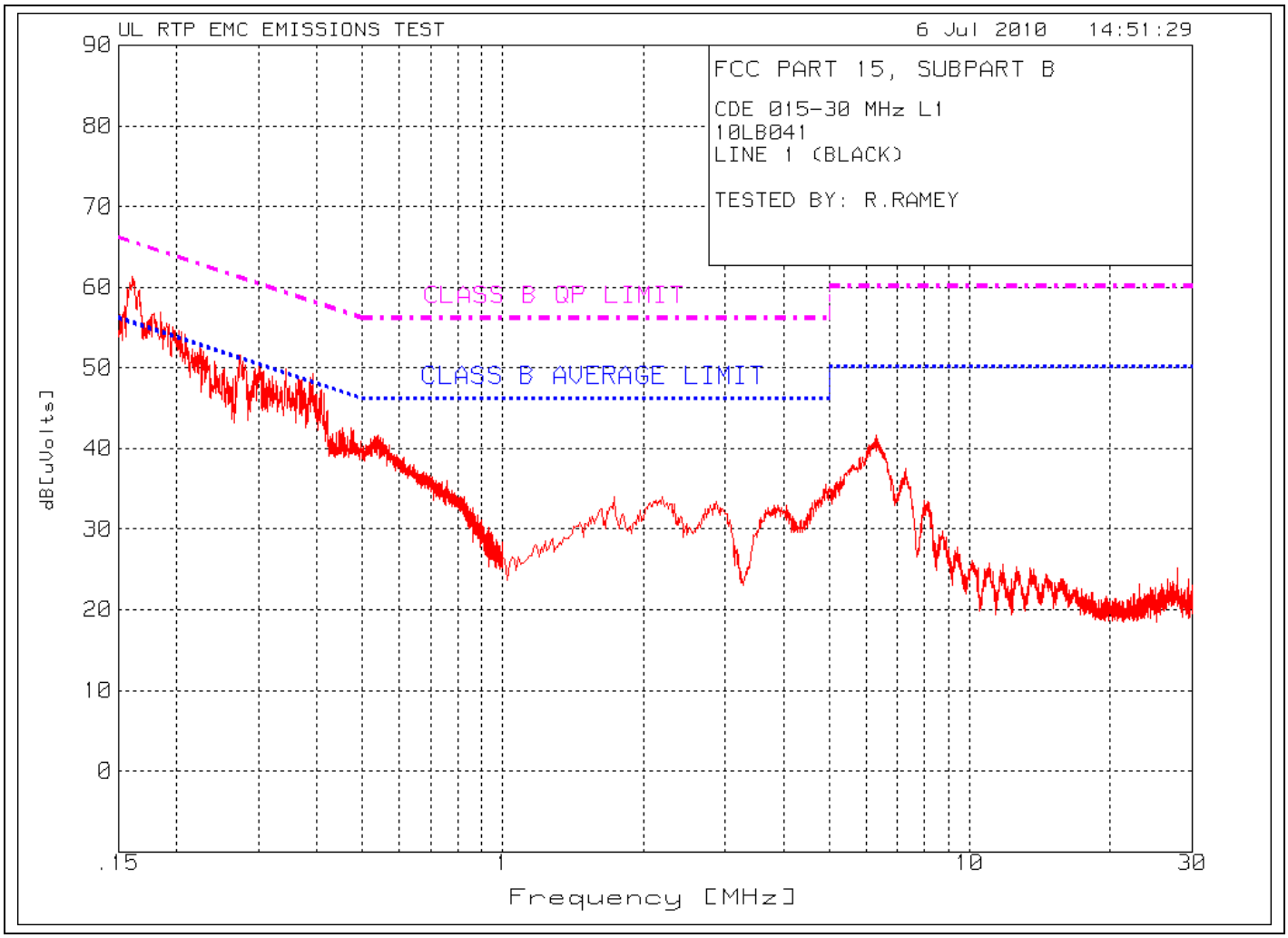


Table 44 Conducted Emissions Data Points – Line

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Gain/Loss (dB)	LISN Factor (dB)	Corrected Value (dBuV)	Quasi-Pk Limit (dBuV)	Quasi-Pk Margin (dB)	Average Limit (dBuV)	Average Margin (dB)	Comments (#)
P	0.16122	51.64	9.6	0.1	61.34	65.4	-4.06	-	-	1
P	0.17891	47.09	9.6	0.1	56.79	64.5	-7.71	-	-	
P	0.20238	44.89	9.6	0.1	54.59	63.5	-8.91	-	-	
P	0.22483	43.08	9.6	0.1	52.78	62.6	-9.82	-	-	
P	0.27347	41.90	9.6	0.1	51.60	61.0	-9.40	-	-	
P	0.30034	41.07	9.6	0.0	50.67	60.2	-9.53	-	-	
P	0.34252	40.31	9.6	0.0	49.91	59.1	-9.19	-	-	
P	0.36769	38.90	9.6	0.0	48.50	58.6	-10.10	-	-	
P	0.39218	39.61	9.6	0.0	49.21	58.0	-8.79	-	-	
P	0.41429	37.21	9.6	0.0	46.81	57.6	-10.79	-	-	
P	0.53469	31.69	9.6	0.0	41.29	56.0	-14.71	-	-	
A	0.16034	35.38	9.6	0.1	45.08	-	-	55.4	-10.32	
A	0.16138	35.17	9.6	0.1	44.87	-	-	55.4	-10.53	
A	0.18551	30.78	9.6	0.1	40.48	-	-	54.2	-13.72	
A	0.20957	28.33	9.6	0.1	38.03	-	-	53.2	-15.17	
A	0.27281	25.40	9.6	0.1	35.10	-	-	51.0	-15.90	
A	0.29877	24.41	9.6	0.0	34.01	-	-	50.3	-16.29	
A	0.34846	23.28	9.6	0.0	32.88	-	-	49.0	-16.12	
A	0.36417	23.00	9.6	0.0	32.60	-	-	58.6	-16.00	
A	0.38957	23.56	9.6	0.0	33.16	-	-	48.1	-14.94	
A	0.40354	22.48	9.6	0.0	32.08	-	-	47.8	-15.72	
A	0.54546	22.24	9.6	0.0	31.84	-	-	46.0	-14.16	

(1) Closest Emission to Limit: 0.16122 MHz measured 61.34 dBuV (avg) compared to limit of 65.4 dBuV.

Figure 7 Conducted Emissions Graph – Line 2

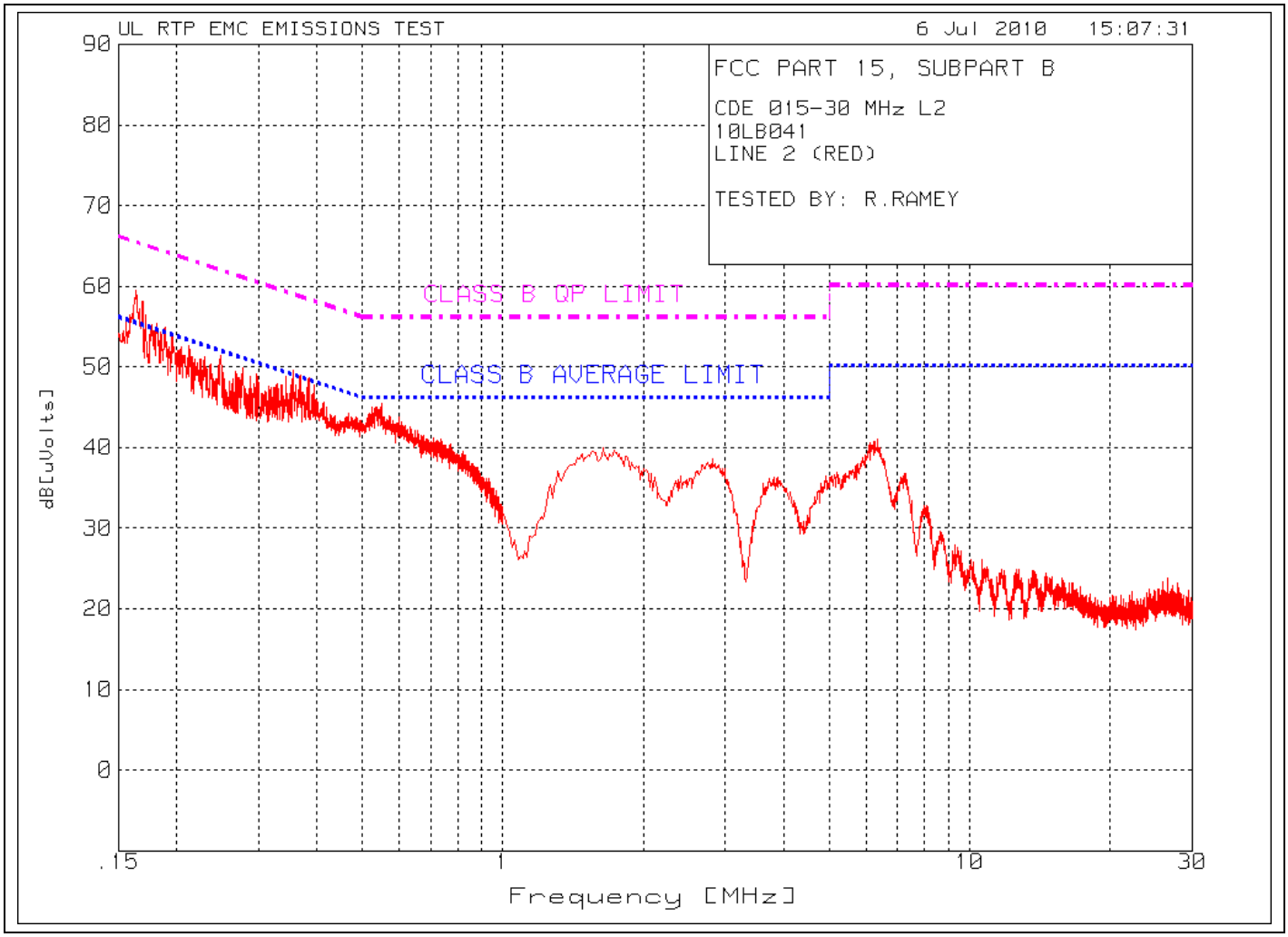


Table 45 Conducted Emissions Data Points – Line 2

Detector Type* (P/Q/A)	Measured Frequency (MHz)	Measured Value (dBuV)	Gain/Loss (dB)	LISN Factor (dB)	Corrected Value (dBuV)	Quasi-Pk Limit (dBuV)	Quasi-Pk Margin (dB)	Average Limit (dBuV)	Average Margin (dB)	Comments (#)
P	0.15646	46.13	9.6	0.1	55.83	65.6	-9.77	-	-	
P	0.16395	49.82	9.6	0.1	59.52	65.3	-5.78	-	-	
P	0.16939	48.40	9.6	0.1	58.10	65.0	-6.9	-	-	
P	0.18197	45.55	9.6	0.1	55.25	64.4	-9.15	-	-	
P	0.19592	44.20	9.6	0.1	53.90	63.8	-9.9	-	-	
P	0.21225	42.94	9.6	0.1	52.64	63.1	-10.46	-	-	
P	0.24898	41.73	9.6	0.1	51.43	61.8	-10.37	-	-	
P	0.27755	40.22	9.6	0.0	49.82	60.9	-11.08	-	-	
P	0.29728	39.49	9.6	0.0	49.09	60.3	-11.21	-	-	
P	0.34286	39.29	9.6	0.0	48.89	59.1	-10.21	-	-	
P	0.36803	39.30	9.6	0.0	48.90	58.5	-9.6	-	-	
P	0.38401	39.10	9.6	0.0	48.70	58.2	-9.5	-	-	
P	.0.53708	35.47	9.6	0.0	45.07	56.0	-10.93	-	-	
A	0.15993	35.01	9.6	0.1	44.71	-	-	55.5	-10.79	
A	0.16031	34.90	9.6	0.1	44.60	-	-	55.4	-10.80	
A	0.16059	34.87	9.6	0.1	44.57	-	-	55.4	-10.83	
A	0.16505	34.53	9.6	0.1	44.23	-	-	55.2	-10.97	
A	0.1802	31.58	9.6	0.1	41.28	-	-	54.5	-13.22	
A	0.19649	29.35	9.6	0.1	39.05			53.8	-14.75	
A	0.23663	26.72	9.6	0.1	36.42			52.2	-15.78	
A	0.27752	25.34	9.6	0.0	34.94	-	-	50.9	-15.96	
A	0.29535	25.06	9.6	0.0	34.66	-	-	50.4	-15.74	
A	0.35569	24.42	9.6	0.0	34.02	-	-	48.8	-14.78	
A	0.36756	24.91	9.6	0.0	34.51	-	-	48.6	-14.09	
A	0.38985	25.19	9.6	0.0	34.79	-	-	48.1	-13.31	
A	0.5447	26.31	9.6	0.0	35.91	-	-	46.0	-10.09	

4.10 Test Conditions and Results – DUTY CYCLE

Test Description	A measurement is performed to document the on/off transmit cycle time. The spectrum analyzer frequency span is set to zero at the transmit frequency. The sweep time is set to view the transmit duration and the total period including off time. Markers are set to measure the times. The duty cycle is calculated by dividing the total "on" time per cycle by the total cycle time (not to exceed 100 ms for averaging). Duty cycle may be measured over longer periods for purposes of RF exposure calculation.	
Basic Standard	N/A	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	One representative channel	Antenna Port
Limits		
No limit, however operating cycle can affect peak-to-average reduction or RF exposure		

Table 46 Antenna Gain EUT Configuration Settings

Power Interface Mode # (See Section 1.3.4)	EUT Configurations Mode # (See Section 1.6)	EUT Operation Mode # (See 1.5)
1	2 (Conducted power – connected directly to receiver)	1 (One channel)
Supplementary information: None.		

Table 47 Duty Cycle Test Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	1088.7490K40	1/18/10	1/31/11
ATA231	30 dB Attenuator, 2 W	Mini-Circuits	SMA 3.5	2/19/10	2/28/11

Table 48 Duty Cycle Test Results

Item	"On" time per cycle (ms)	Cycle duration (ms, max 100)	Fraction of time operating	Decibel peak-to-average ratio (dB)*	Comments
1	4.148	20.040	0.207	-13.68 dB	1

Note: Duty Cycle measured for test represents worst-case. Typical duty cycle when deployed is lower.
*20 Log (Fraction of time operating)

Table 49 Duty Cycle Measurements – "On" Time per cycle

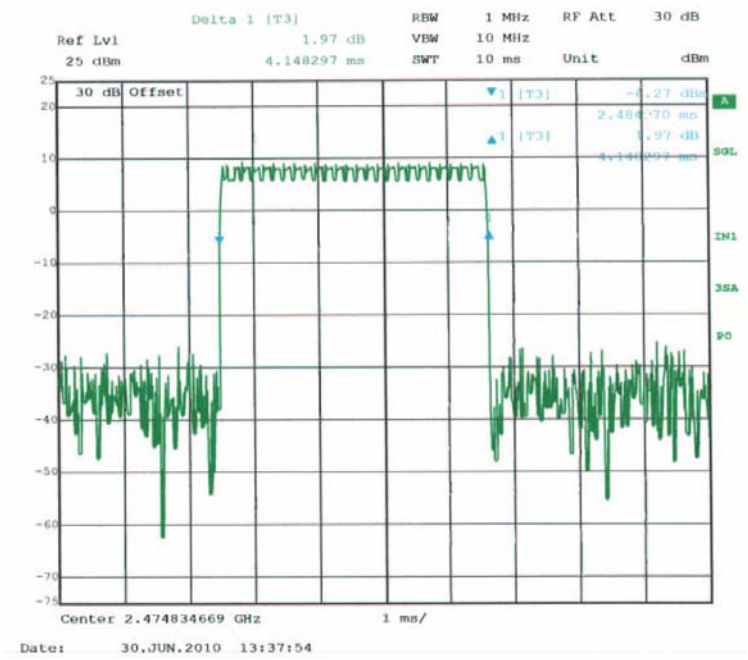
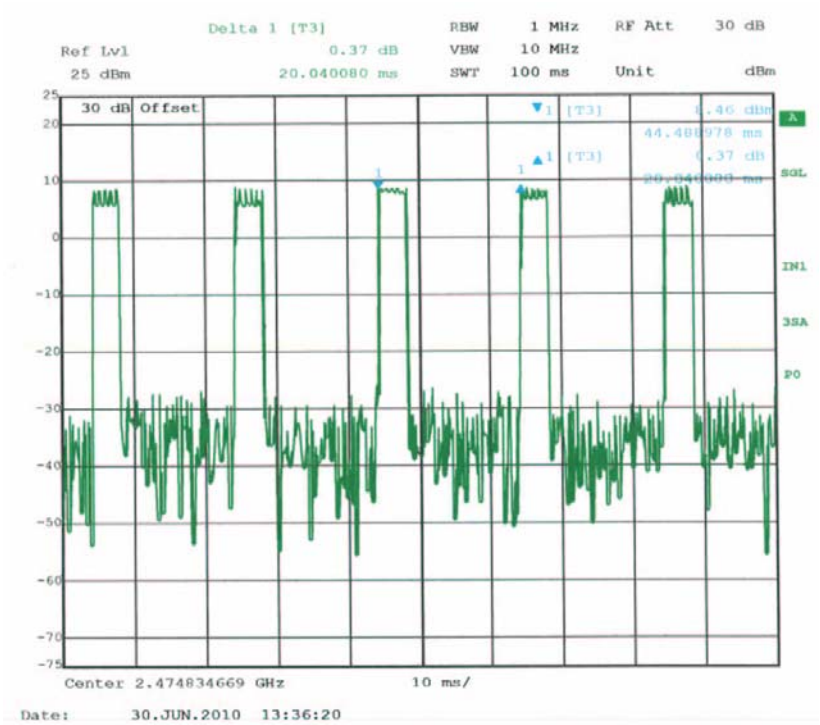


Table 50 Duty Cycle Measurements – Full Cycle Measurement



4.11 Test Conditions and Results – MAXIMUM PERMISSIBLE EXPOSURE CALCULATION (MPE)

Test Description	Maximum Permissible Exposure calculation is performed to ensure that this device meets RF exposure limits for its intended environment. This device is required to meet the General Population/Uncontrolled exposure limits.
Basic Standard	47 CFR Part 1.1307 Health Canada Safety Code 6

FCC Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E^2\|$, $\|H^2\|$. or S (minutes)
0.3 – 3.0	614	1.63	(100)*	6
3.0 - 30	1824/F	4.89/F	($900/F^2$)*	6
30 - 300	61.4	0.163	1.0	6
300 – 1500	-	-	F/300	6
1500 – 100,000	-	-	5.0	6
FCC Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E^2\|$, $\|H^2\|$. or S (minutes)
0.3 - 1.34	614	1.63	(100)*	30
1.34 - 30	824/F	2.19/F	($180/F^2$)*	30
30 - 300	27.5	0.073	0.2	30
300 – 1500	-	-	F/1500	30
1500 – 100,000	-	-	1.0	30

Table 51 MPE - EUT Configuration Settings

Calculation is performed from conducted power and antenna gain measurements documented within this report.

Background: Per the following guidance from OET Bulletin 65 Supplement C required minimum spacings are provided to the professional installer.

Transmitter or Device Type[18]	Output[19]	Applicable Methods to Ensure Compliance[20]
Transmitters using indoor antennas that operate at 20 cm or more from nearby persons	>2.5 W at 915 MHz	If the MPE distance is greater than that required for normal operation of the device, operating instructions, warning instructions and/or warning labels may be used to ensure compliance by indicating the minimal separation distance to comply with MPE limits. If the antennas are professionally installed to ensure compliance, warning instructions and warning labels are not necessary.
	=< 2.5 W at 915 MHz or =< 4 W at 2450 MHz	Transmitters operating at 2.5 W EIRP (1.5 W ERP) or less at 915 MHz, or at 4 W EIRP (2.4 W ERP) or less at 2450 MHz, generally are not expected to exceed MPE limits when nearby persons are 20 cm or more from most antennas. Therefore, special instructions and warnings are normally not necessary to ensure compliance.

Table 52 MPE - Calculation

MPE Calculation with highest EIRP:

The highest radiated power was observed at the center channel (2440 MHz) and these measurements are used for the calculation. Duty cycle is programmable and we assume worst case for this calculation (100%).

$S = EIRP / (4 * Pi * R^2)$,

Power Density = EIRP / (4 * Pi * R^2),
where EIRP = Output Power * Antenna Gain

Uncontrolled/General Exposure
11.53 mW, 4.78 dBi antenna (3.00 gain linear), 20 cm spacing

Operating Frequency	2440 MHz		
Output Power (Peak)	**0.01153** Watts		
Antenna Gain	**4.78** dB	or (linear)	3.00 (unitless)
Separation Distance	**0.2** m	-or-	7.874 inches

Peak Power Density	0.069 W/m^2	- or -	0.0069 mW/cm^2
Exposure % (over 6 min timespan for uncontrolled)	100%		
Transmit Duty Cycle (Peak-to-Average Ratio)	20.7% (Note: Worst-case Duty Cycle)		
Average Power Density	**0.0143** W/m^2	- or -	**0.00143** mW/cm^2
Limit for **Uncontrolled** Exposure at Operating Frequency	**10** W/m^2	- or -	**1** mW/cm^2

The product was found to comply with this requirement.

Appendix A

Accreditations and Authorizations

NVLAP Lab code: 200246-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see http://ts.nist.gov/ts/htdocs/210/214/scopes/2002460.htm

FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91039).

Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180C

VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.:

- Test Station 5 (Test Location A) R-722/C-2427
- Test Station 1 (Location D) C-742/T-235
- Test Station 4 (Test Location E) C-743/T-236
- Test Station 6 (Location C) C-744/T-237

ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).

NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 89/336/EEC, Article 10 (2). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.
NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).
NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6