Electromagnetic Compatibility Test Report

Prepared in accordance with

CFR Title 47, Part 15 C and RSS-210

On

Motion Detector

ISC-BDL2-WP12G

FCC ID: T3X-BLG2

IC ID: 1249A-BLG2

BOSCH SECURITY SYSTEMS
130 Perinton Pkwy
Fairport, NY 14450

Prepared by:

TUV Rheinland of North America, Inc.

Client:	BOSCH SECURITY SYSTEMS 130 Perinton Pkwy Fairport, NY 14450	Frank Mioduszewski 585-223-4060 / None listed Frank.ski@bosch.com	
Identification:	Motion Detector	***Serial No.:***	Production Prototype
Test item:	ISC-BDL2-WP12G	***Date tested:***	14 May 2010
Testing location:	TUV Rheinland of North America 762 Park Avenue Youngsville, NC 27596-9470 U.S.A.	Tel: (919) 554-3668 Fax: (919) 554-3542	
Test specification:	Emissions: FCC Parts 15.205, 15.207, 15.209, 15.215(c). ICES-003 and RSS-GEN 15.245(b), 15.245(b)(1), and RSS-210; A7(1) FCC Parts 15.107(a), 15.109(a) and ICES-003 FCC Part 2.1091 and RSS-102 Issue 4,		
	The above product was found to be Compliant to the above test standard(s)		

tested by: Mark Ryan	***reviewed by:*** Robert Richards
 22 June 2010 ***Date*** ***Signature***	 22 June 2010 ***Date*** ***Signature***
Other Aspects:	**None**

Abbreviations: OK, Pass, Compliant, Complies = passed
Fail, Not Compliant, Does Not Comply = failed
N/A = not applicable

FC	NVLAP	**Industry Canada**
90552 and 100881	**NVLAP Lab Code (200094-0)**	**IC-2932H**

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR Title 47, Part 15 C and RSS-210 based on the results of testing performed on 14 May 2010 on the Motion Detector, Model No. ISC-BDL2-WP12G, manufactured by BOSCH SECURITY SYSTEMS. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 *Summary of Test Results*

Applicant	**BOSCH SECURITY SYSTEMS** **130 Perinton Pkwy** **Fairport, NY 14450**	**Tel**	585-223-4060	**Contact**	Frank Mioduszewski
		Fax	None listed	**e-mail**	Frank.ski@bosch.com

Description	Motion Detector	**Model Number**	ISC-BDL2-WP12G
Serial Number	Production Prototype	**Test Voltage/Freq.**	12VDC nominal
Test Date Completed:	14 May 2010	**Test Engineer**	Mark Ryan

Standards	Description	Severity Level or Limit	Worst Case Measurement	Test Result
CFR Title 47, Part 15C and RSS-210 Annex 7	Operation in the bnads 10500-10550 MHz	See called out basic standards below	See Below	**Complies**
FCC Part 15.207(a)	Conducted Emissions	150kHz - 30MHz	Limit	**compliant**
FCC Parts 15.245(b), and RSS-210 A7	Field Strength at 3m	2500 mV/m (fundamental) 25 mV/m (Harmonics)	110.66dBµV/m 83.90dBµV/m	**compliant**
FCC Parts 15.245(b)(1), and RSS-210 A7(1)	Spurious Emissions outside the band	Restricted band limits to 17.7GHz, and 7.5 mV/m at and above (at 3 meters)	4.96 mV/m (adjusted to 3m)	**compliant**
FCC Part 15.215(c) and RSS-GEN	Bandwidth Measurements	20dB Bandwidth and 99% Power Bandwidth	280.56 kHz 735.47 kHz	**compliant**
FCC Part 15.215(c) and RSS-GEN 4.5	Duty Cycle of Pulsed Transmissions	Averge pulses not to exceed 100ms Maximum 20dB allowed	-33.89 dB (20 dB used)	**compliant**
FCC Part 15.215(c) and RSS-GEN	Band Edge	Emissions at bnad edge must be at least -20dBc	-37.96 dBc at Bandedge	**compliant**
FCC Part 15.215(c) and RSS-GEN	Frequency Stability	Must remain inside the band	8.92 MHz from Bandedge	**compliant**
FCC Parts 15.107(a), 15.109(a) and ICES-003	Radiated Emissions (when not transmitting)	Class B, 30 - 1000 MHz	EUT continuously transmits	**NA**
FCC Part 2.1091 and RSS-102 Issue 4	RF Exposure	SAR or MPE Requirements	Below required level for SAR or MPE	Complies (without testing)

2 Laboratory Information

2.1 Accreditations and Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 762 Park Avenue, Youngsville, NC 27596-9470 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Lab code: 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Industry Canada

Registration No.: IC-2932H The OATS has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2003.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174, R-1679, C-1790 and C-1791).

2.1.5 Sample Calculation – radiated & conducted emissions

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

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	3.3 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.18 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

Measurement Uncertainty Immunity

The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 2.5 %
The estimated combined standard uncertainty for ESD immunity measurements is 4.10 %
The estimated combined standard uncertainty for radiated immunity measurements is ± 2.05 dB
The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 2.92 %
The estimated combined standard uncertainty for surge immunity measurements is ± 2.92 %
The estimated combined standard uncertainty for conducted immunity measurements is ± 1.83
The estimated combined standard uncertainty for power frequency magnetic field immunity measurements is ± 5.8 %
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 1.74 %

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated Emissions (5 Meter Chamber)					
Ant. BiconiLog 30-1000 MHz	Chase	CBL6140A	1108	13-Jun-08	13-Jun-10
Antenna Horn 1-18GHz	EMCO	3115	5770	16-Jun-08	16-Jun-10
Antenna Horn 18 – 25GHz	ATM	42-442-6/CAL	G181104-01	29-Oct-08	29-Oct-10
Antenna Horn 25 – 40GHz	ATM	28-25KA-6	G047502-01	12-Dec-10	12-Dec-12
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	23-Jan-09	23-Jan-10
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	29-Jun-09	29-Jun-10
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	26-May-09	26-May-10
Cable, Coax	Andrew	FSJ1-50A	003	22-Jan-09	22-Jan-10
Cable, Coax	Andrew	FSJ1-50A	030	22-Jan-09	22-Jan-10
Cable, Coax	Andrew	FSJ1-50A	045	22-Jan-09	22-Jan-10
Notch Filter	Micro-Tronics	BRM50702	049	26-Jan-09	26-Jan-10
General Laboratory Equipment					
Meter, Multi	Fluke	179	90580752	02-Dec-08	02-Dec-09
Meter, Temp/Humid/Barom	Fisher	02-400	01	04-Mar-09	04-Mar-10

3 Product Information

3.1 Product Description

This is a family of Motion Detector products that contain an intentional radiator. These include model numbers ISC-BDL2-WP6G, ISC-BDL2-W12G and ISC-BDL2-WP12G.

All the transmitters in the "G" family are identical and are intended to be used in North America. The differences in the models have to do with options of the IR portion of the Motion Detector. The models that do not contain intentional radiators are not associated with this report.

The model ISC-BDL2-WP12G was the chosen model for testing in this report.

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

4 Radiated RF Emissions

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.4:2009 and ANSI C63.10-2009. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

Operation within the 10500-10550MHz band, under the provisions of FCC Part 15.245 and RSS-210 Annex 7, is limited to intentional radiators used as fixed disturbance sensors, excluding perimeter protection systems.

4.1 Field Strength at 3m - FCC Part 15.245(b) and RSS-210 A7

The EUT is not a fixed, point-to-point device therefore FCC part 15.249(b) is not applicable to this apparatus.

The EUT uses an internal antenna with no external antenna connector. The chip antenna is rated at 0dBi gain.

The field strength of emissions from intentional radiators operated within the frequency band of 10500 – 10550 MHz shall comply with the following limits:

Fundamental frequency (MHz)	Field Strength of Fundamental		Field Strength of harmonics	
	(mV/m)	(dBµV/m)	(mV/m)	(dBµV/m)
10500-10550	2500	128	25	88

Note: 2500 mV/m is equivalent to 128 dBµV/m [20(log 2500000 µV/m)] = 1.9 W e.i.r.p.

25 µV/m is equivalent to 88 dBµV/m [20(log 25000 µV/m)]

Maximum emission at 3m:

10525.0 MHz = 92.42 dBµV/m = **41.8 mV/m** (Worst Case emission using the average detector)

Notes: Reguardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in FCC Part 15.205 and RSS-210 section 2.2, shall not exceed the field strength limits shown in FCC Part 15.209 and RSS-210 . Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed 7.5 mV/m (77.5 dBµV/m).

The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions of FCC Part 15.35 and RSS-GEN for limiting peak emissions apply.

Per FCC Part 15.245(b)(2), all field limits are specified at a distance of 3 meters.

The worst case was investigated by observing the emissions of the EUT in three orthogonal orientations. The worst case orientation was used for all the measurements (see test setup photos).

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Type Detector Used	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
10524.80	**H**	**1**	**12**	**30.18**	**0.00**	**13.31**	**38.50**	**81.99**	**127.96**	**-45.97**
10524.80	**H**	**1**	**12**	**58.85**	**0.00**	**13.31**	**38.50**	**110.66**	**147.96**	**-37.3**
10524.80	V	1.2	324	28.74	0.00	13.31	38.50	80.55	127.96	-47.41
10524.80	V	1.2	324	57.52	0.00	13.31	38.50	109.33	147.96	-38.63
10524.80	H	1	153	25.28	0.00	13.31	38.50	77.09	127.96	-50.87
10524.80	H	1	153	44.78	0.00	13.31	38.50	96.59	147.96	-51.37

Notes: Orientations 1, 2 and 3 are shown, in order, using Average and Peak detectors.

Only the worst case polarization is shown. **Orientation 1** produced the highest emission.

Per FCC Part 15.35(b), the average and peak detectors are used.
The limit, using the peak detector, is 20 dB above the average limit.

EMC Receiver settings used:

RBW = 1 MHz

4.2 Emissions Outside the band - FCC Parts 15.245(b)(1) and RSS-210 A7(1)

4.2.1 Test Methodology

4.2.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for each 6° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.2.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

4.2.1.3 Deviations

There were no deviations from this test methodology.

4.2.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

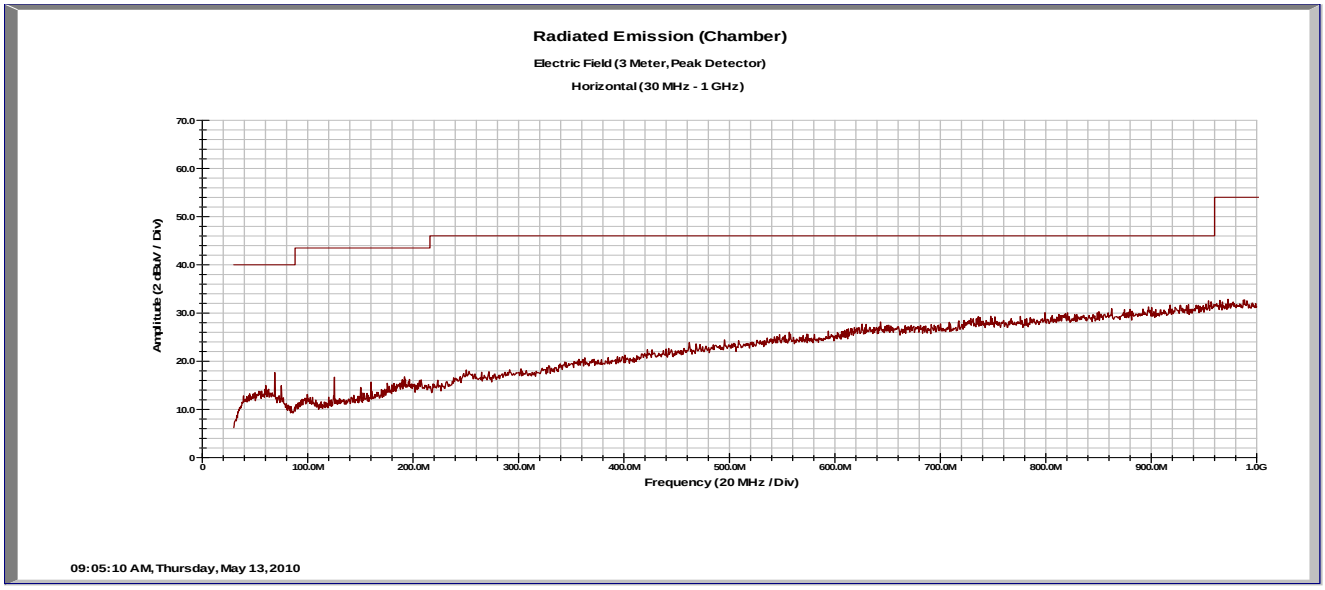
4.2.2.1 Emissions Outside the Frequency Band

Per FCC part 15.249(d): Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Sec. 15.209, whichever is the lesser attenuation.

Per FCC part 15.249(e): As shown in Sec. 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section is based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Note: only the worst-case emissions are shown in this report, all others are on file at TUV Rheinland.

Radiated Emissions 30MHz – 1 GHz
Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
75.20	H	1.3	0	2.60	0.00	0.92	8.16	11.68	40.00	-28.32
125.28	H	1	0	5.53	0.00	1.19	7.41	14.13	43.50	-29.37

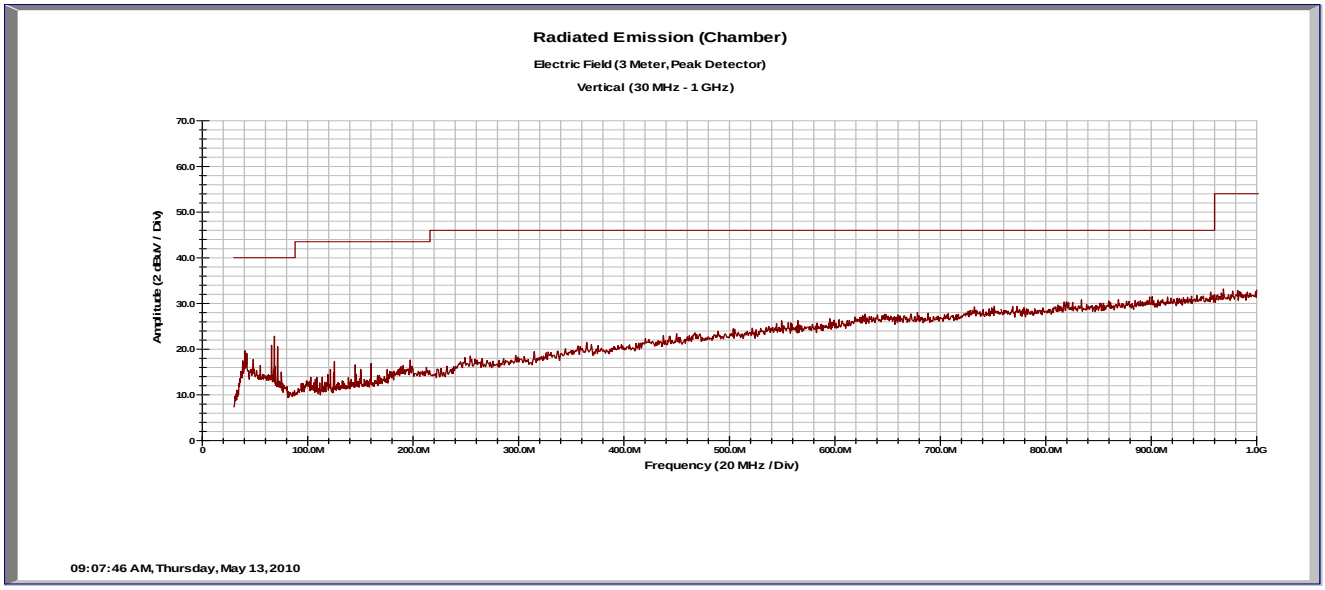
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:
Limits of 15.209 shown

Radiated Emissions 30MHz – 1 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
40.52	V	1.2	179	5.09	0.00	0.67	8.74	14.51	40.00	-25.49
75.15	V	1	0	2.42	0.00	0.92	6.69	10.03	40.00	-29.97
125.32	V	1.3	45	5.82	0.00	1.19	7.99	15.00	43.50	-28.50
160.00	V	1	0	2.83	0.00	1.36	8.30	12.49	43.50	-31.01

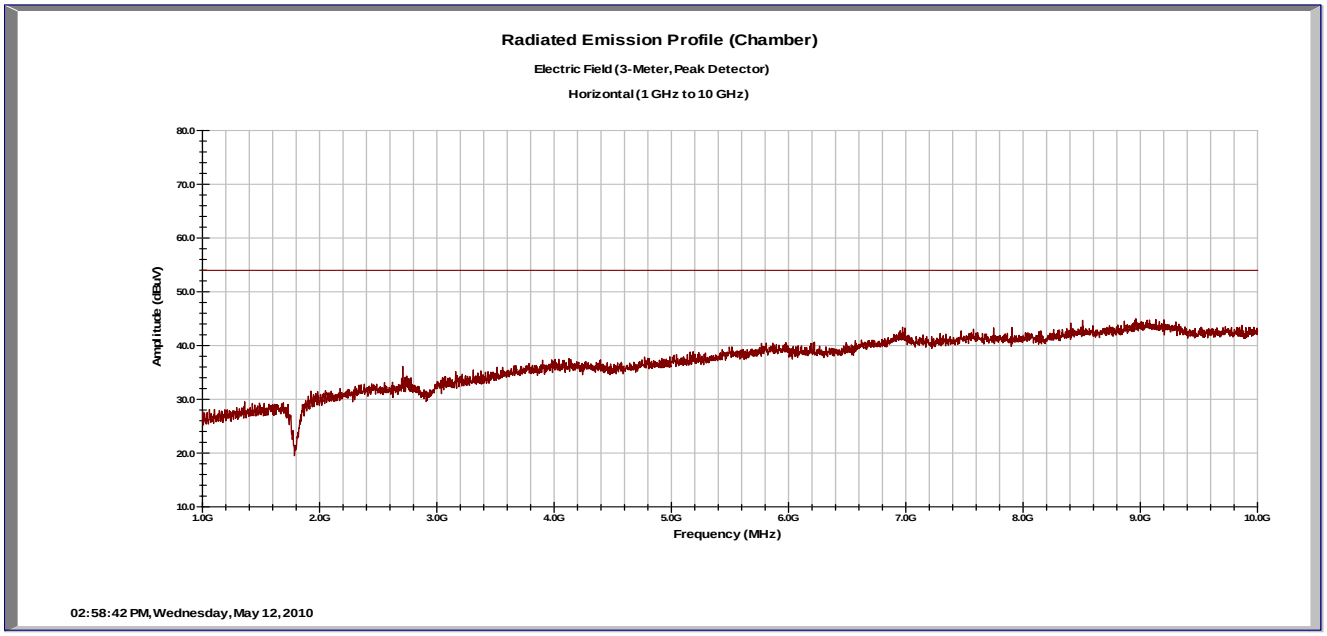
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:
Limits of 15.209 shown

Radiated Emissions 1 GHz - 10 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

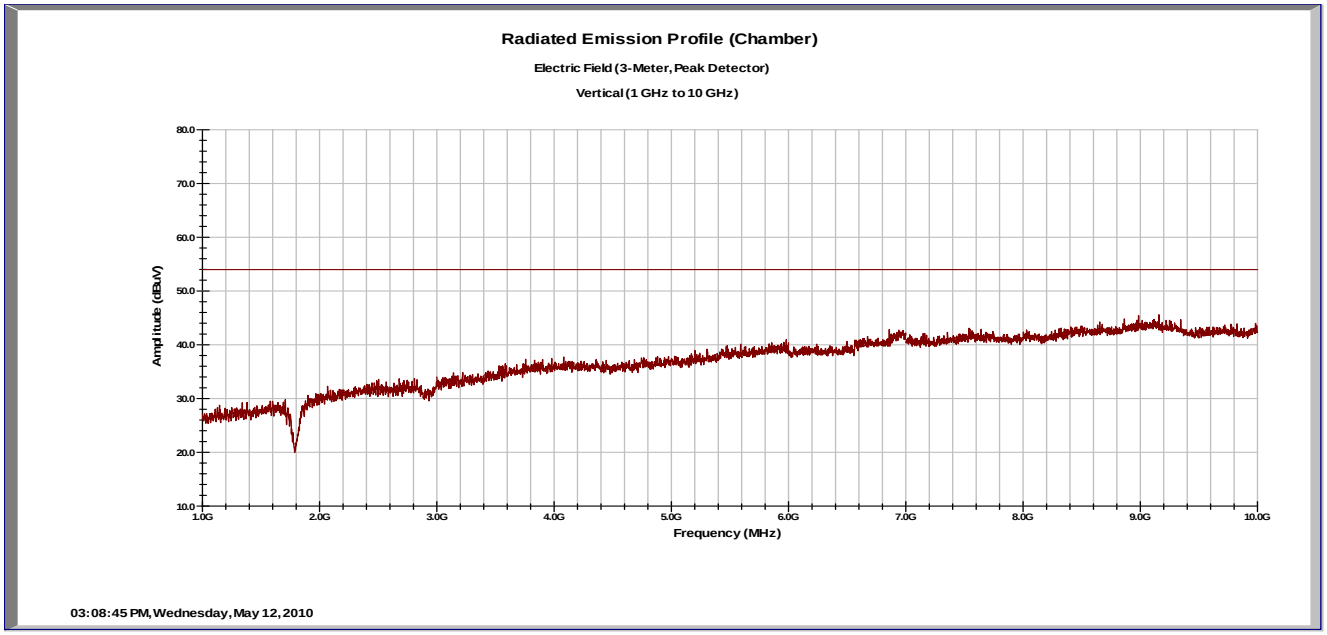
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions are below the noise level of the EMI Test Receiver
Limits of 15.209 shown

Radiated Emissions 1 GHz - 10 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

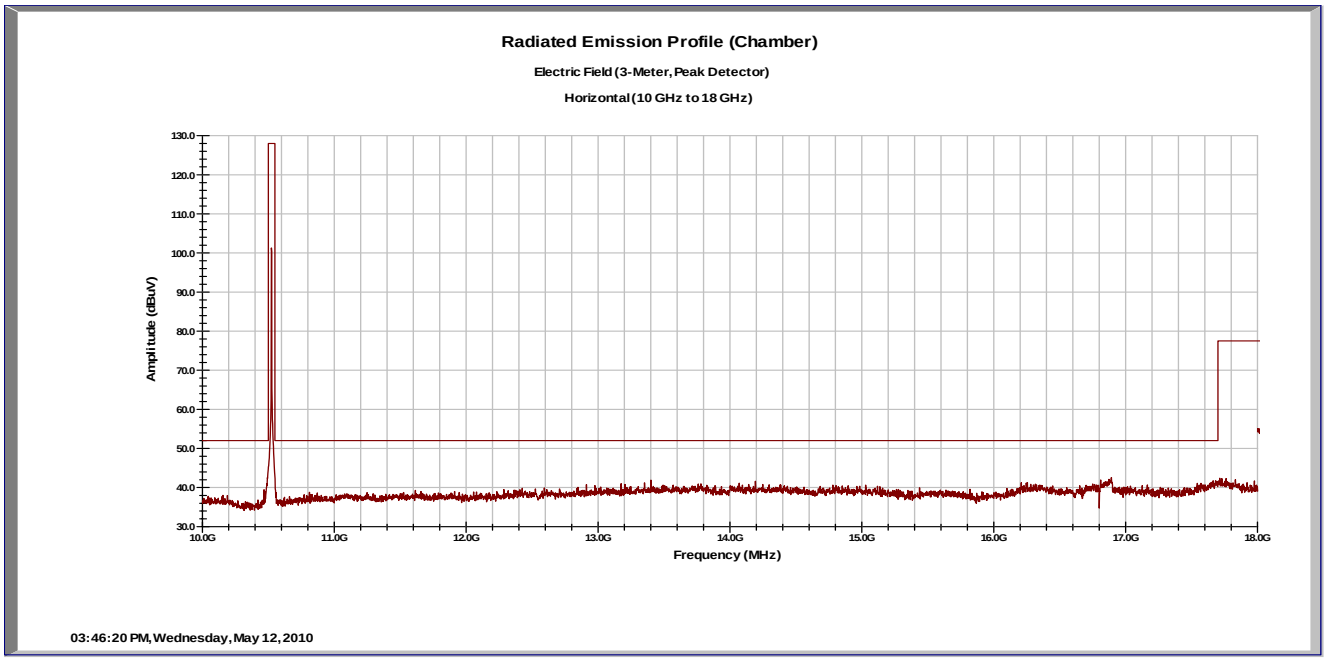
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions are below the noise level of the EMI Test Receiver
Limits of 15.209 shown

Radiated Emissions 10 GHz - 18 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

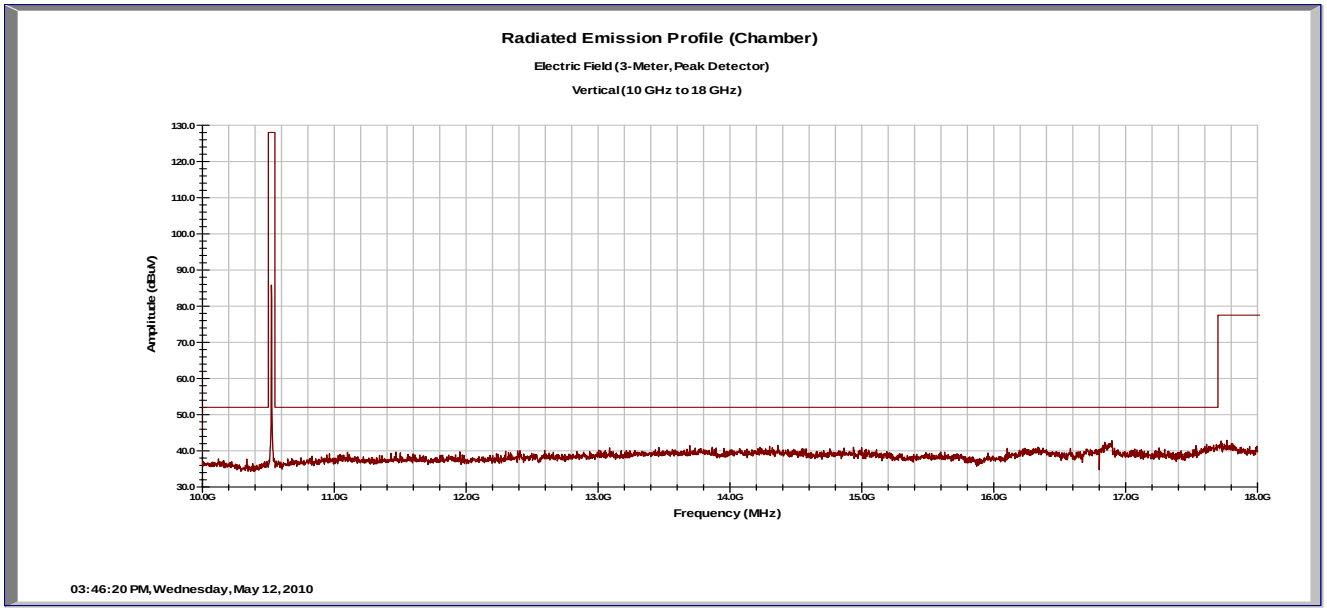
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions are below the noise level of the EMI Test Receiver
The limits shown incorporate the limits of parts 15.209 and 15.245

Radiated Emissions 10 GHz - 18 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

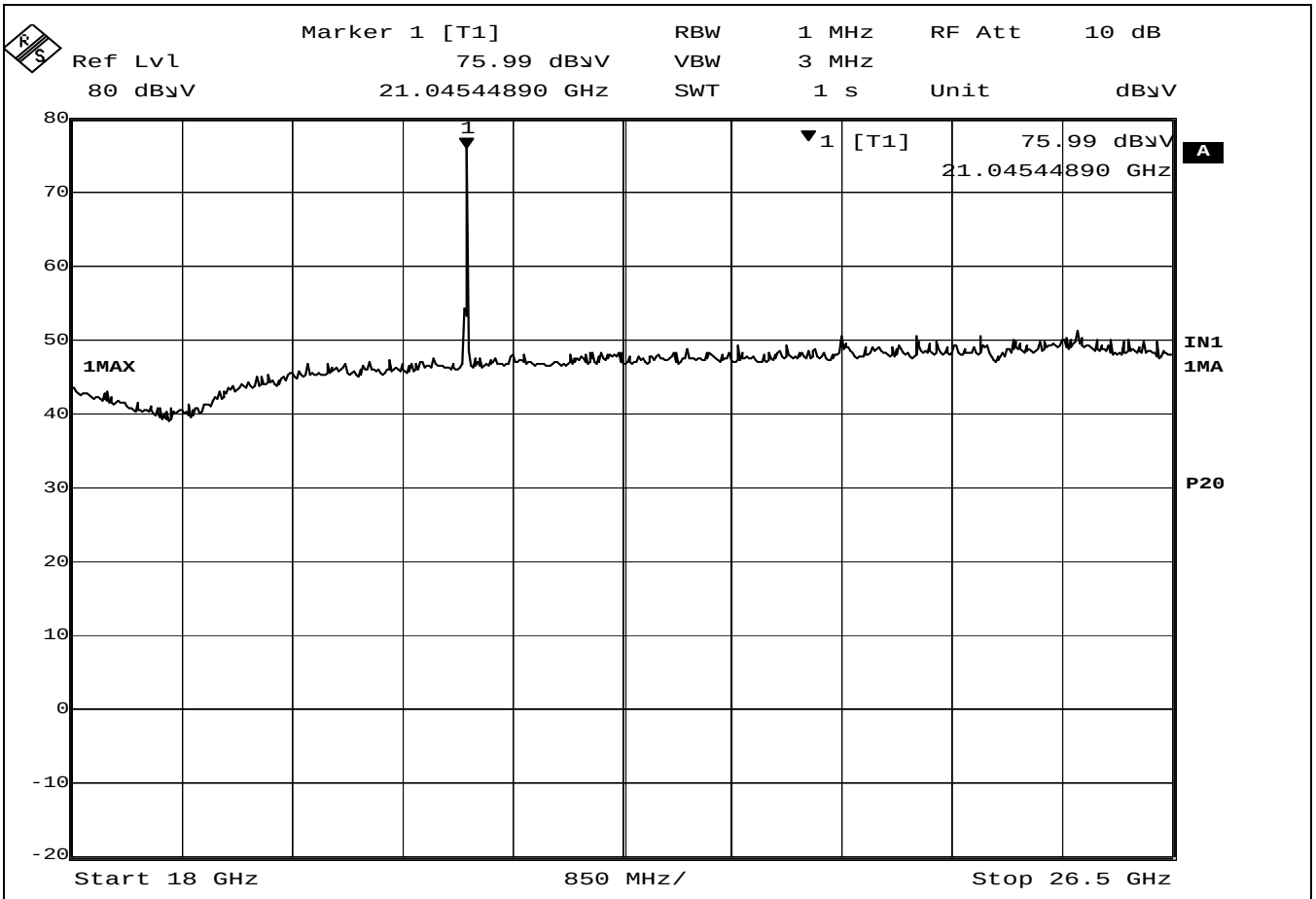
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions, except for the fundamental, are below the noise level of the EMI Test Receiver
The limits shown incorporate the limits of parts 15.209 and 15.245

Radiated Emissions 18 GHz – 26.5 GHz

Horizontal



Date: 14.MAY.2010 11:05:51

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
21045.75	H	1	354	76.24	35.36	4.83	37.40	83.80	87.04	-3.24

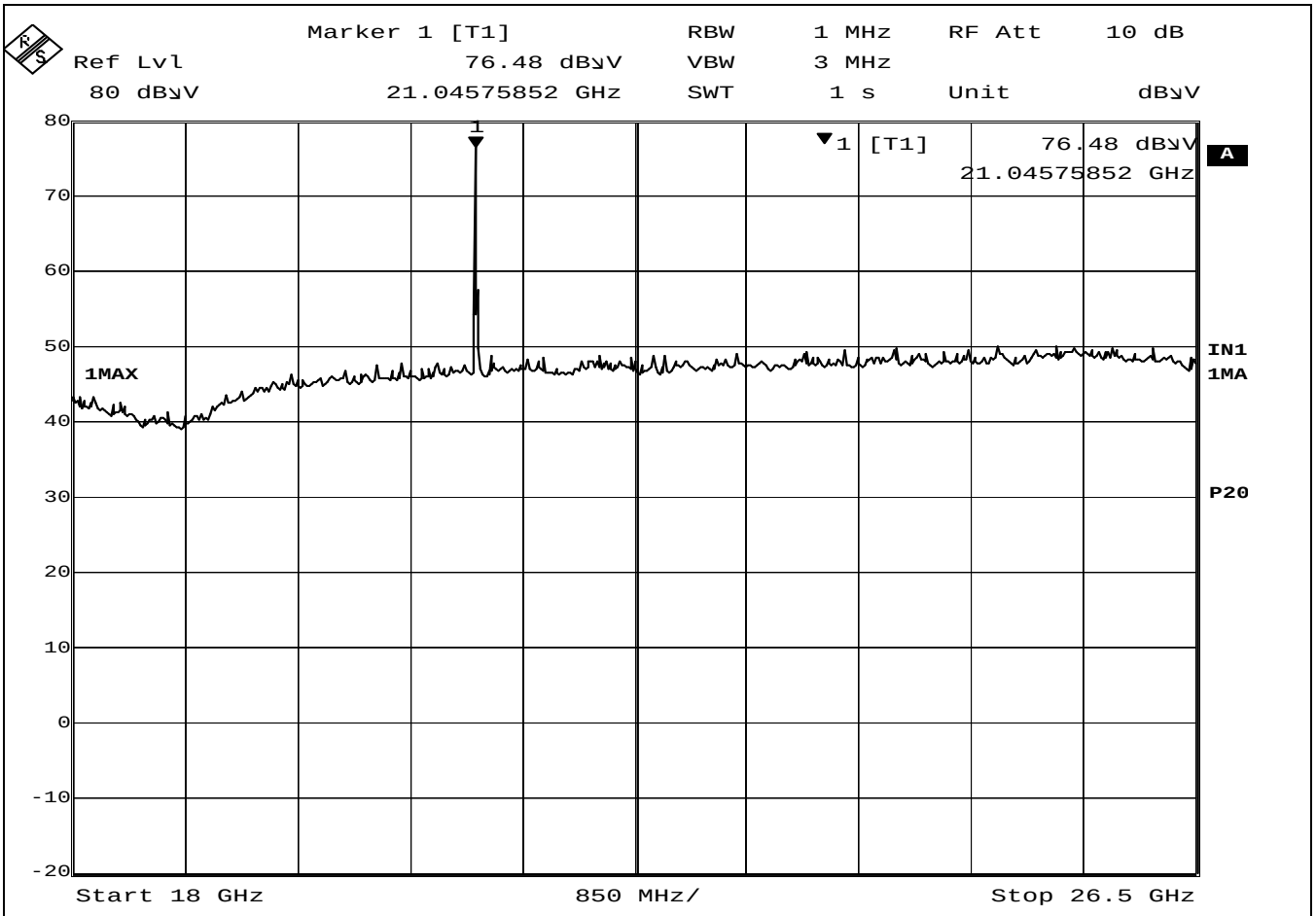
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: The 2nd harmonic plot is raw data and shown without any correction factors applied
This emission is within a restricted band therefore the limits of Part 15.245(b) apply.
The antenna was pushed in from 3m to 1 m. The limit was adjusted accordingly (77.5dB + (20log(3m/1m)).
83.80 dBuV/m at 1 meter will be equivalent to 4.9 mV/m (adjusted to 3m)
The Peak Detector was used for this measurement and the Peak measurement is below the Average Limit.

Radiated Emissions 18 GHz – 26.5 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
21045.75	V	1	84	76.93	35.36	4.83	37.50	83.90	87.04	-3.14

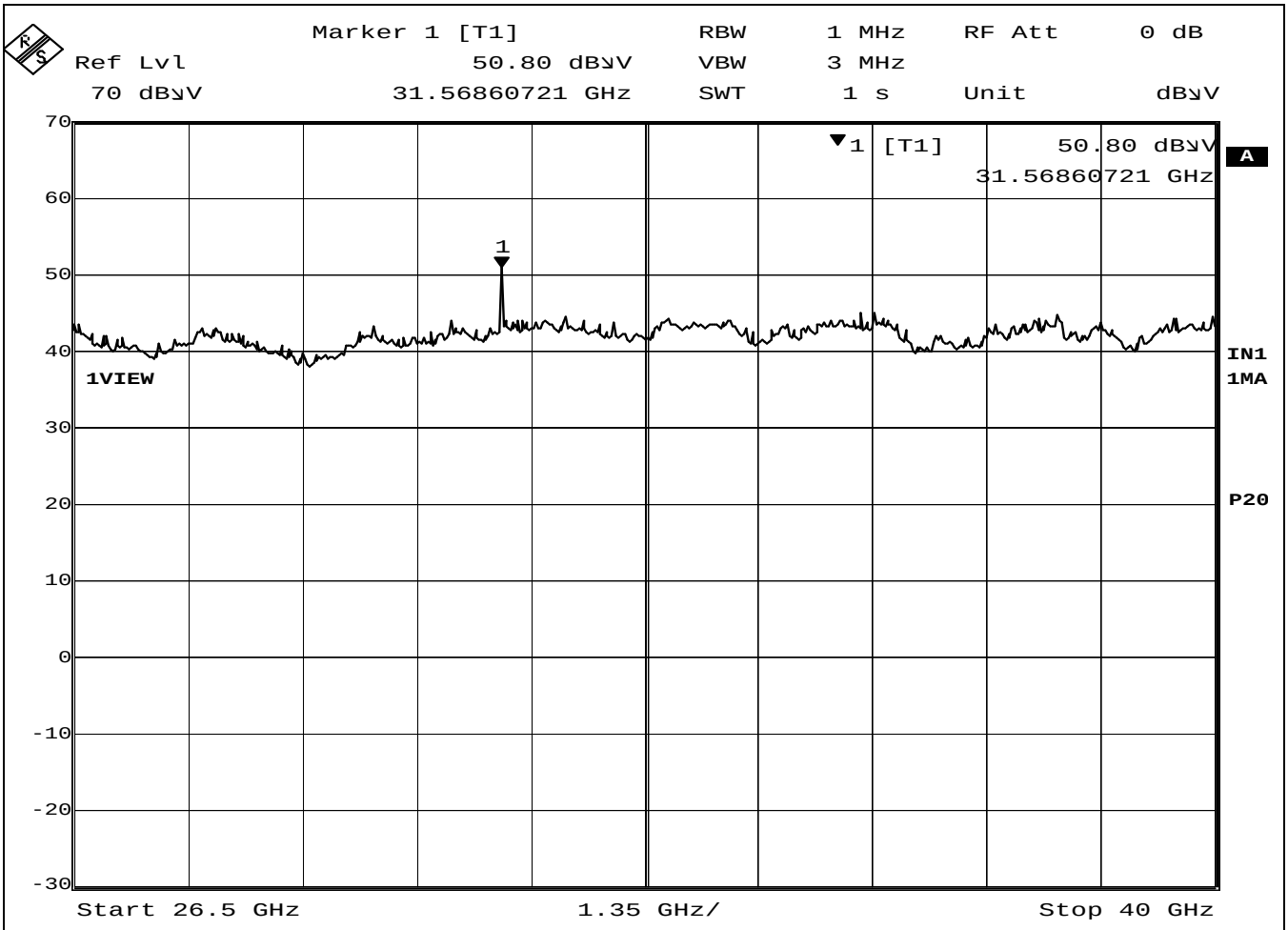
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: The 2nd harmonic plot is raw data and shown without any correction factors applied
This emission is within a restricted band therefore the limits of Part 15.245(b) apply.
The antenna was pushed in from 3m to 1 m. The limit was adjusted accordingly (77.5dB + (20log(3m/1m)).
83.90 dBuV/m at 1 meter will be equivalent to 4.95 mV/m (adjusted to 3m)
The Peak Detector was used for this measurement and the Peak measurement is below the Average Limit.

Radiated Emissions 26.5 GHz – 40 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
31568.61	H	1	0	51.07	0	1.5	41.39	93.96	107.04	-13.08

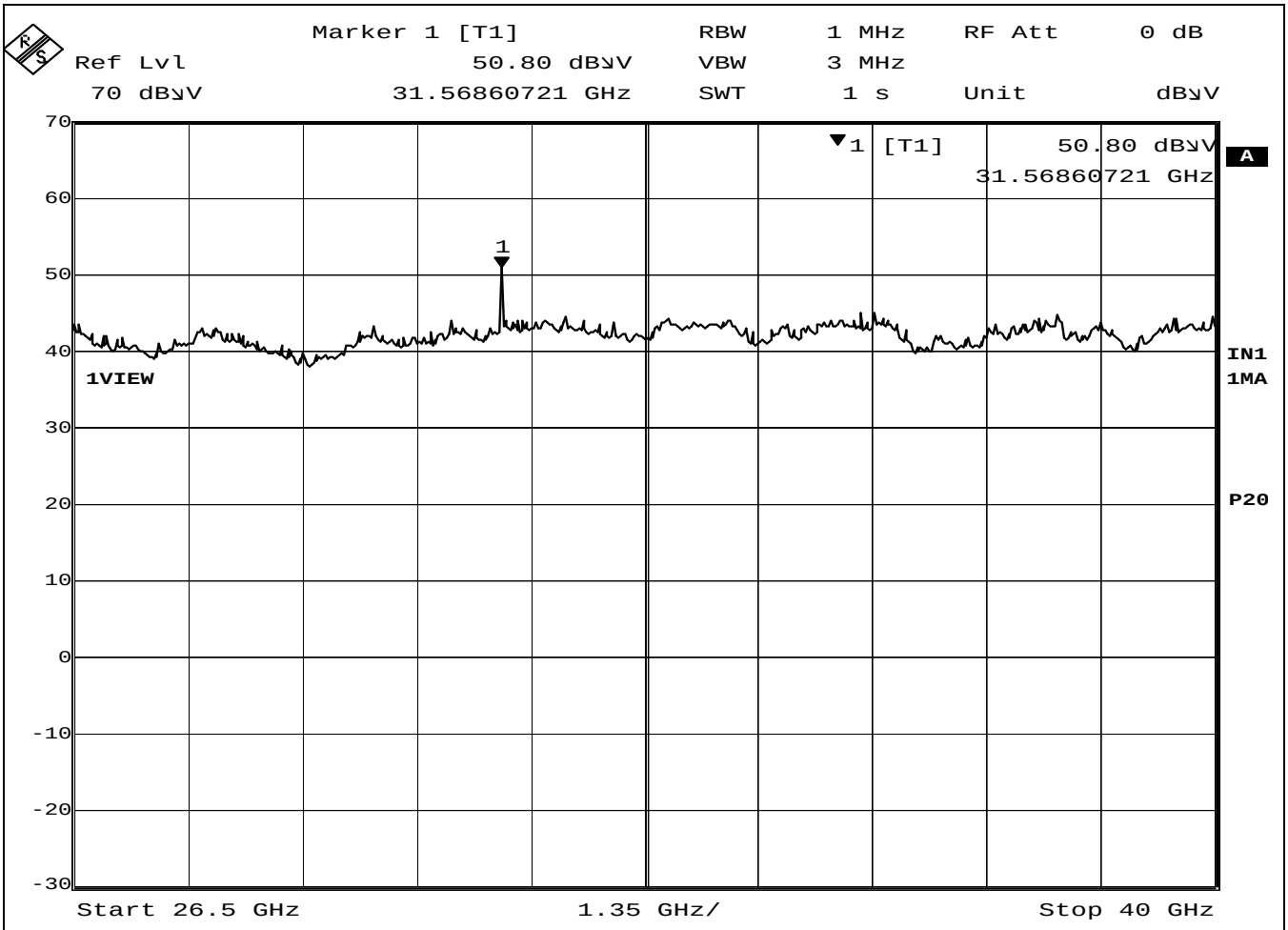
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: The 3rd harmonic plot is raw data and shown without any correction factors applied
This emission is within a restricted band therefore the limits of Part 15.245(b) apply.
The antenna was pushed in from 3m to 0.1m, the limit was adjusted accordingly (77.5dB + (20log(3m/0.1m)).
93.96 dBuV/m at 0.1 meter will be equivalent to 1.58 mV/m (adjusted to 3m)
The Peak Detector was used for this measurement and the Peak measurement is below the Average Limit.

Radiated Emissions 26.5 GHz – 40 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
31568.61	H	1	0	53.49	0	1.5	47.79	102.78	107.04	-4.26

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: The 3rd harmonic plot is raw data and shown without any correction factors applied
This emission is within a restricted band therefore the limits of Part 15.245(b) apply.
The antenna was pushed in from 3m to 0.1m, the limit was adjusted accordingly (77.5dB + (20log(3m/0.1m)).
102.76 dBuV/m at 0.1 meter will be equivalent to 4.35 mV/m (adjusted to 3m)
The Peak Detector was used for this measurement and the Peak measurement is below the Average Limit.

4.1 *20dB* Bandwidth missions – FCC Parts 15.215(c)

4.1.1 Test Procedure

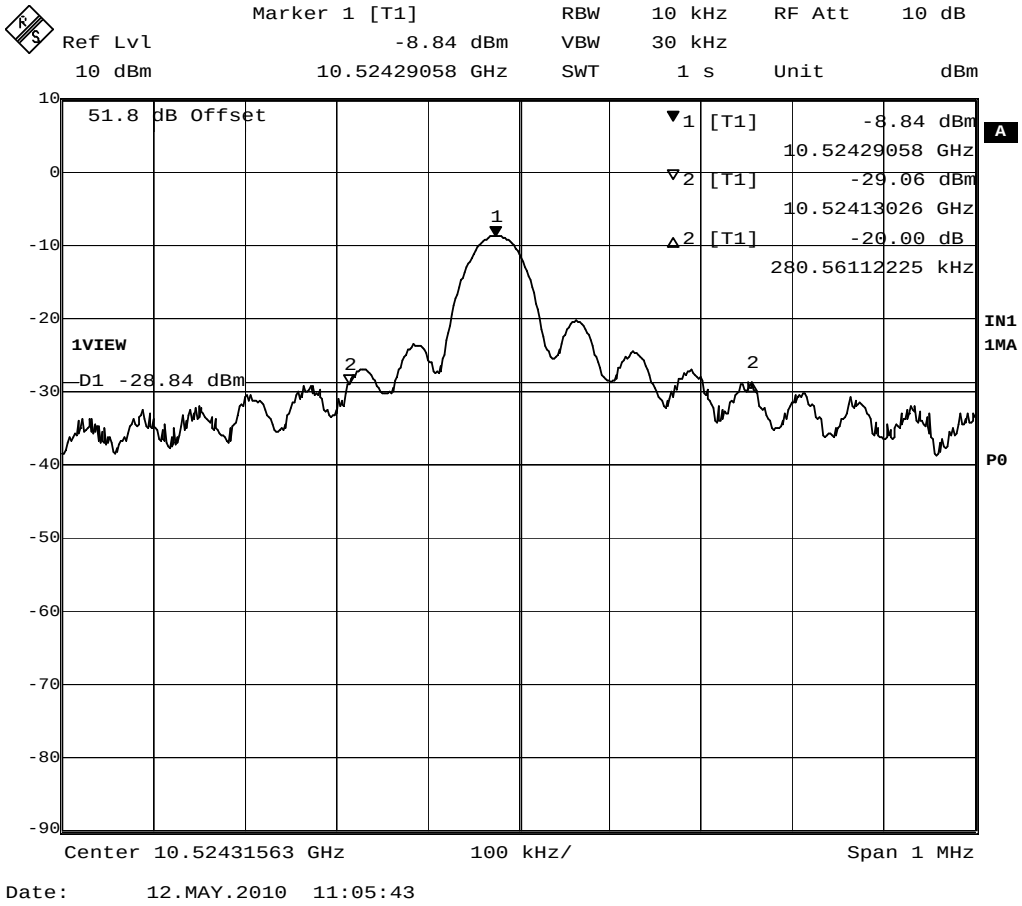
(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule.

4.1.2 Deviations from Standard Test Procedures

None.

4.1.3 Test Results

The final 20dB Bandwidth measurement is below (in compliance) with the limits.



20dB Bandwidth = 280.56 kHz

4.2 99% Power Bandwidth missions – RSS-GEN

4.2.1 Test Procedure

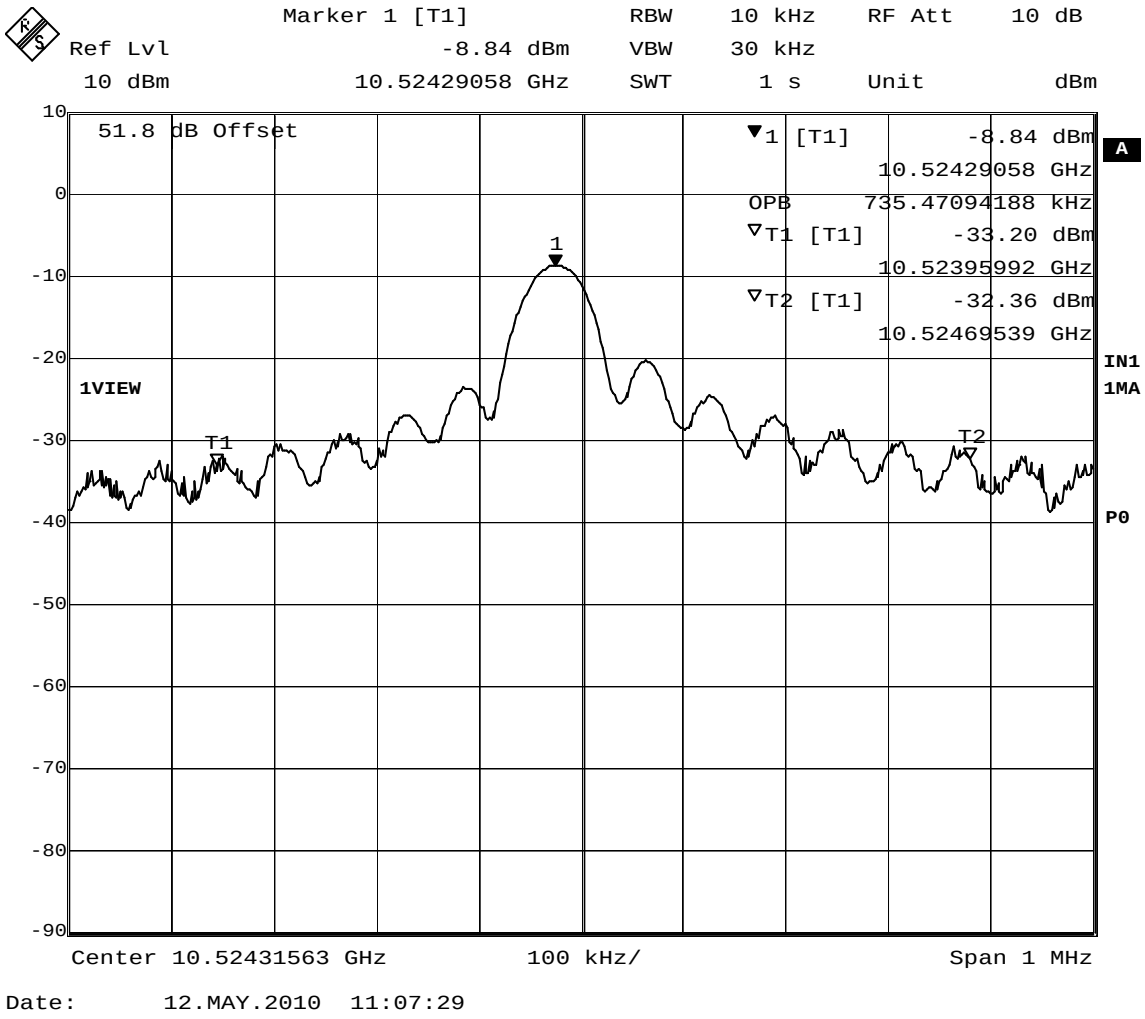
The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

4.2.2 Deviations from Standard Test Procedures

None.

4.2.3 Test Results

The final 99% Power Bandwidth measurement is below (in compliance) with the limits.



99% Power Bandwidth = 735.47 kHz

4.3 Duty Cycle of Pulsed Transmissions – FCC 15.35(c) and RSS-GEN 4.5

4.3.1 Test Procedure

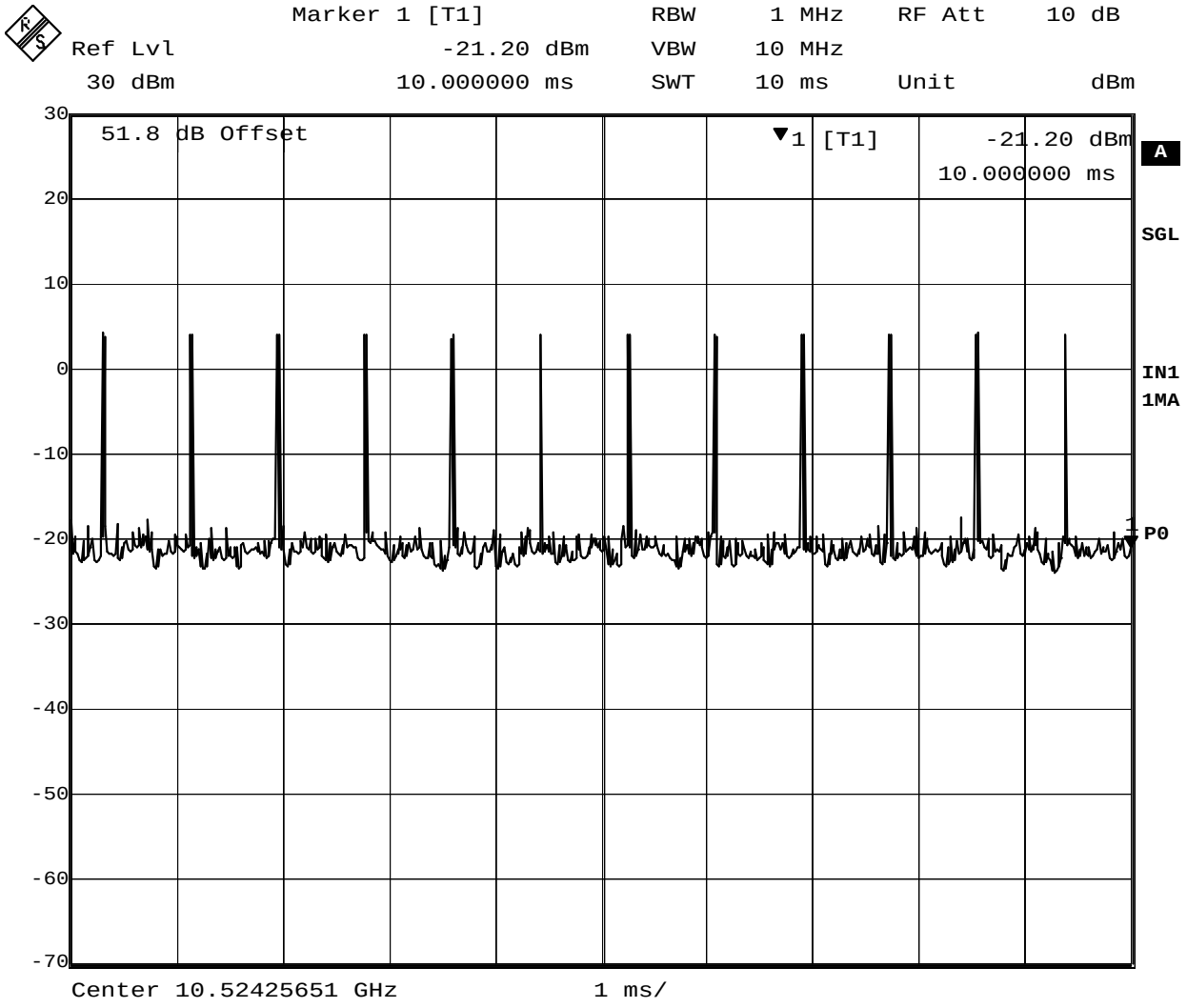
15.35(c) states that unless otherwise specified, e.g. Sec. 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

4.3.2 Deviations from Standard Test Procedures

None

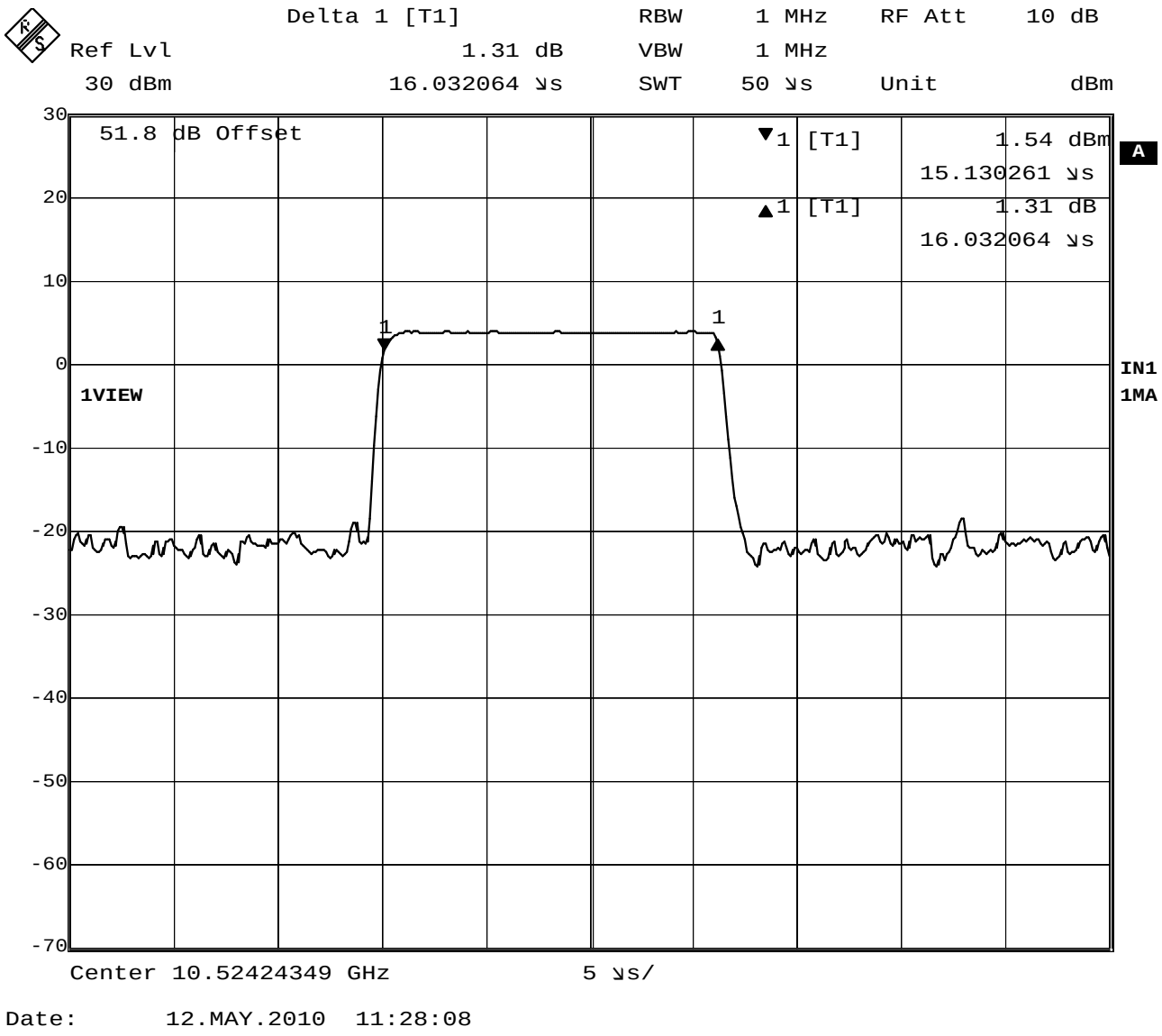
4.3.3 Test Results

Duty Cycle = 1.9% or -17.2 dB correction.



12 on times over 10ms period = 120 pulses in 100ms

One on time = 16.03µs (next page)



Duty Cycle: Single Pulse = 16.03µs

120 *16.03µs Pulses = 1.92 ms; 1.92ms / 100 ms = .019or 1.9 %

10 log (1.92ms /100ms) = 10 log (0.0921) = -17.2 dB

Duty Cycle Correction per FCC 15.35 has a **20 dB** Max Allowance

4.4 Band Edge FCC - Part 15.215(c) and RSS-GEN

4.4.1 Test Specifications

FCC Part 15.215(c)

4.4.2 Test Procedure

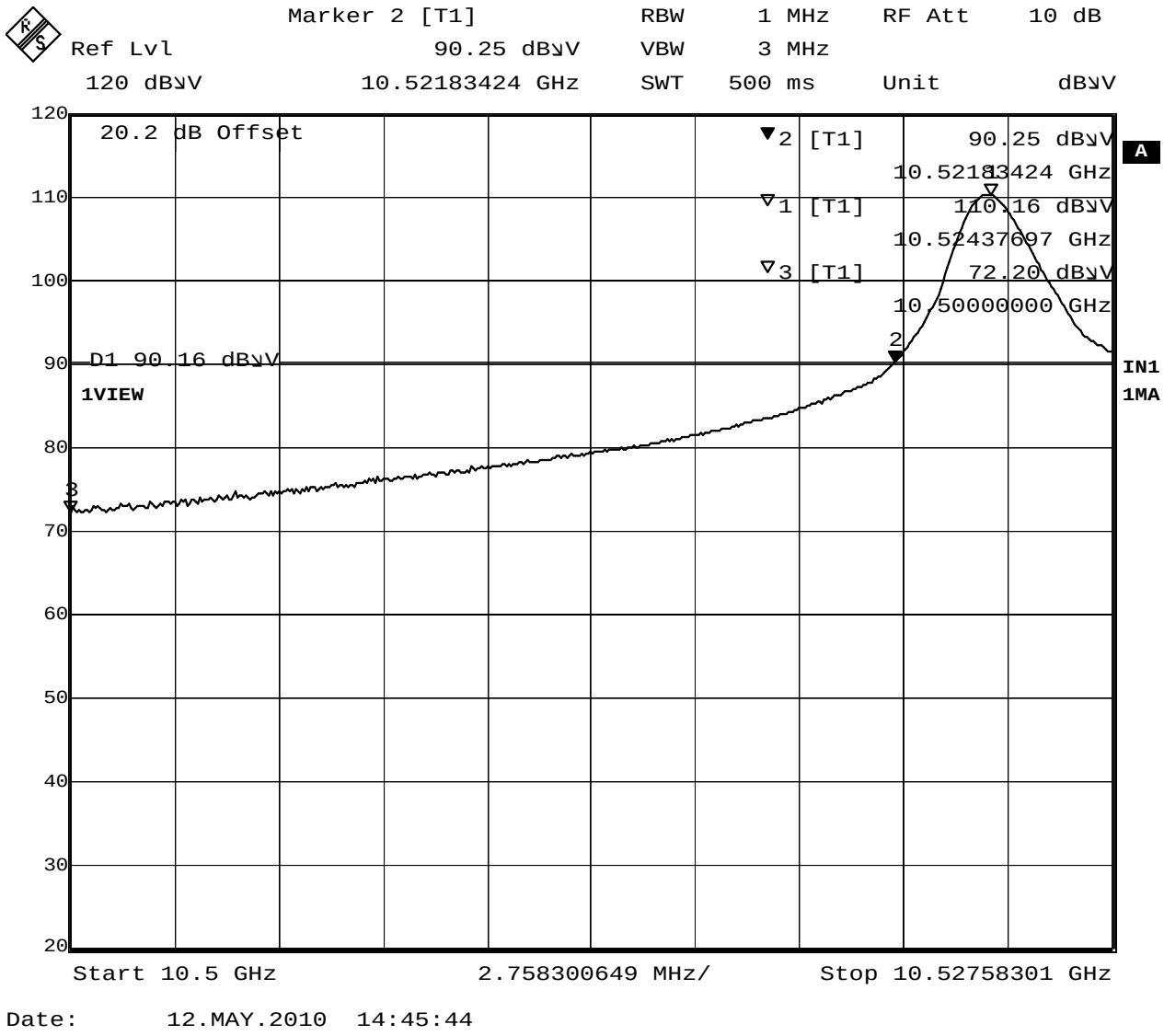
FCC Part 15.215(c) - Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule. section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.4.3 Deviations from Standard Test Procedures

FCC Part 15.245 does not specify frequency stability measurements. The Fundamental frequency is located within the central 80% of the permitted band. The frequency stability measurements were not performed.

4.4.4 Test Results

All final Band Edge measurements were within (in compliance) the limits.



Band Edge (low)

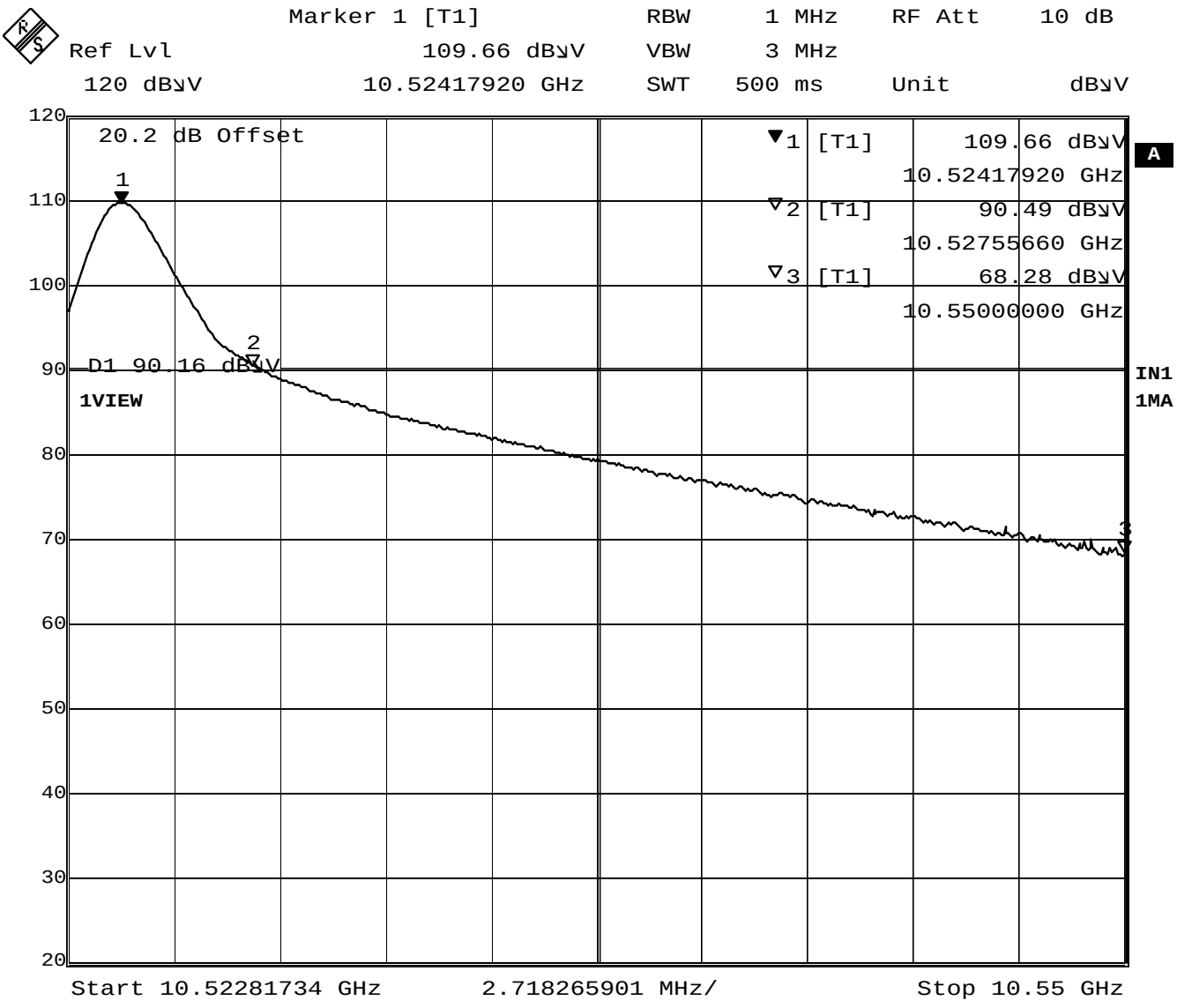
Note: Measurements made using the procedures of ANSI C63.10-2009

All measurements are using the peak detector and correction factors have been applied.

Marker 1 is the peak reading.

Marker 2 and Reference line is at the -20dBc level

Marker 3 at the band edge (10.5 GHz)



Band Edge (high)

Note: Measurements made using the procedures of ANSI C63.10-2009

All measurements are using the peak detector and correction factors have been applied.

Marker 1 is the peak reading.

Marker 2 and Reference line is at the -20dBc level

Marker 3 at the band edge (10.55 GHz)

4.4.5 Extreme Temperature Ranges

Per FCC Part 15.215(c)

4.4.5.1 Test Specifications

Clause 5.4.1.2 Extreme Temperature Ranges

Category I (General): -20ºC to + 55ºC

4.4.5.2 Deviations from Standard

None

4.4.6 Extreme Test Source Voltages

Per FCC Part 15.215(c)

4.4.6.1 Test Specifications

Clause 5.4.2 Voltage ranged described by manufacturer.

Minimum Voltage: 9VDC

Nominal Voltage: 12 VDC

Maximum Voltage: 15 VDC

4.4.6.2 Deviations from Standard

None

4.4.7 Test Results

Extreme power source voltages and temperatures

For Model G:

Reference at nominal temperature; **+20º C**

Volts	P(dBm)	Frequency in Hz	Δ to nominal Power (dB)	Δ to nominal Frequency (Hz)
12.0	77.18	10,525,566,050	0.00	0
9.0	77.14	10,525,588,550	-0.04	22,500
15.0	77.19	10,525,583,550	0.01	17,500

Extreme temperature at **+55º C**

Volts	P(dBm)	Frequency in Hz	Δ to nominal Power (dB)	Δ to nominal Frequency (Hz)
12.0	77.25	10,511,476,250	0.07	-14,089,800
9.0	77.30	10,511,462,500	0.12	-14,103,550
15.0	77.35	10,511,486,250	0.17	-14,079,800

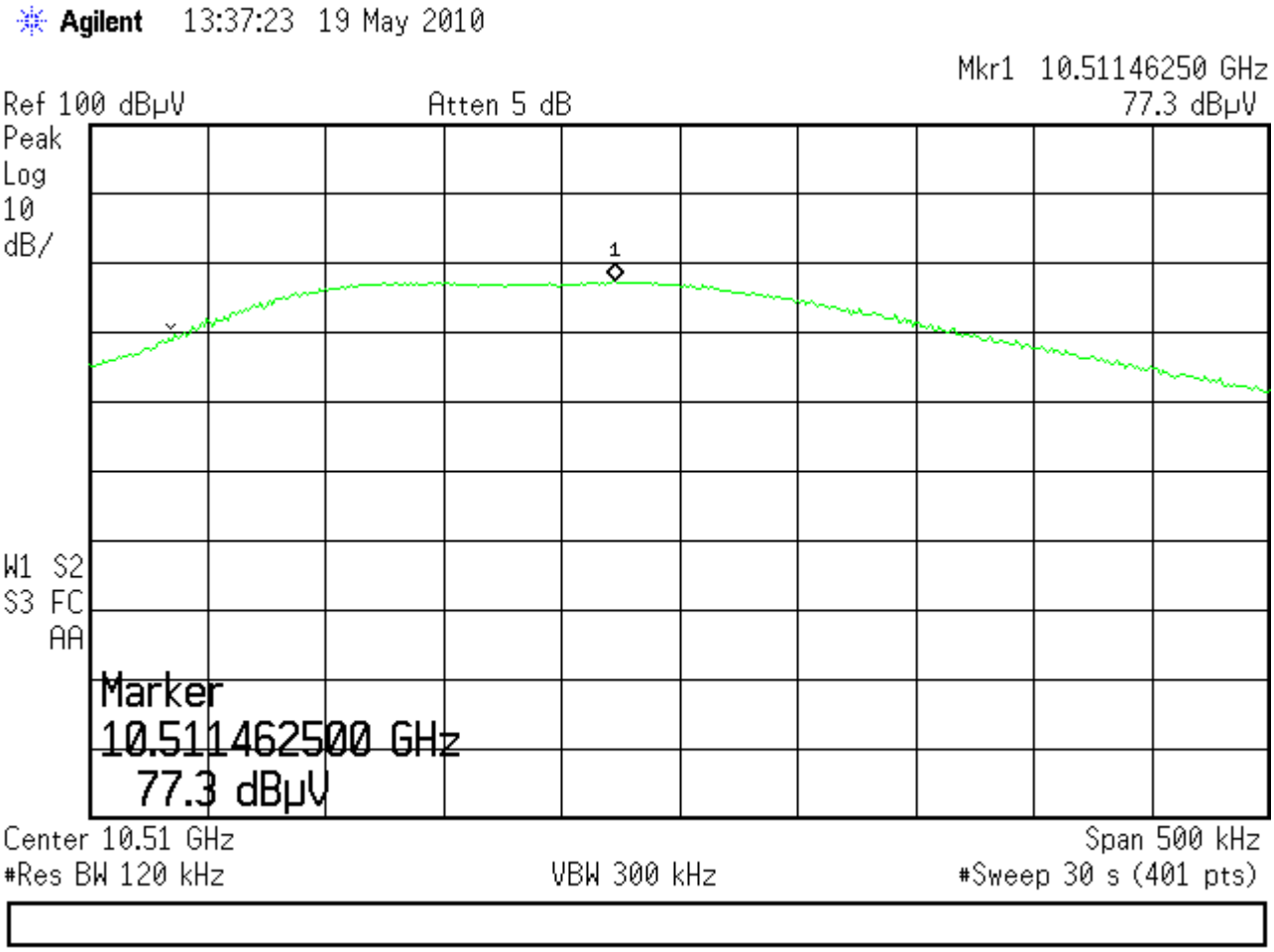
Extreme temperature at **-20º C**

Volts	P(dBm)	Frequency in Hz	Δ to nominal Power (dB)	Δ to nominal Frequency (Hz)
12.0	77.81	10,538,048,750	0.63	12,482,700
9.0	77.84	10,538,453,750	0.66	12,887,700
15.0	77.83	10,538,987,500	0.65	13,421,450

Note: Reading highlighted in Yellow is the reference frequency and power.
Reading highlighted in RED is the worst-case frequency shift
Reading highlighted in Blue is the worst-case Power shift.
All power measurements are made relative to the reference level only

Nominal Rated Voltage (V_N): 12 Volts
Minimum Voltage (V_-): 9 Volts
Max Voltage (V_+): 15 Volts

4.4.8 Test Data



Worst Case: The -20dBc is at 10.50891977GHz which is 8.92 MHz above the band-edge at 10.5 GHz.

Worst Case Plot shown, all other plots are on file at TUV Rheinland

4.5 Unintentional Emissions – FCC Parts 15.107(a), 15.109(a) and ICES-003

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT when it is not transmitting and may affect the performance of other nearby electronic equipment.

4.5.1 Over View of Test

Results	**NA** (as tested per this report)				**Date**	NA	
Standard	FCC Parts 15.107(a), 15.109(a) and ICES-003						
Product Model	ISC-BDL2-WP12G			**Serial#**	S/N		
Configuration	See test plan for details						
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table. See test plans for details						
EUT Powered By	12 VDC	**Temp**	NA	**Humidity**	NA	**Pressure**	NA
Frequency Range	NA						
Perf. Criteria	Class B. (Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.5.2 Test Procedure

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration.

4.5.3 Deviations

The EUT transmits continuously and there is no option to turn off the transmitter; therefore it is these measurements cannot be made. All peak transmitter emissions (including the harmonics), outside the band, are below the limits of FCC Parts 15.107(a) and 15.109(a).

5 Conducted Emissions on Power Line

5.1 Conducted Emissions FCC Part 15.207 and RSS-GEN

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

5.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	13 May 2010	
Standard	FCC Part 15.207						
Product Model	Model (Name\Number)			Serial#	Production Prototype		
Configuration	See test plan for details						
EUT Powered By	VAC	**Temp**	73 ° F	**Humidity**	49%	**Pressure**	1015 mbar
Frequency Range	150kHz – 30MHz						
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

5.1.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 150Khz – 30Mhz was investigated for conducted emissions.

Conducted Emissions measurements were performed in either the shielded room or ground plane location (with attached vertical ground plane) using procedures specified in the test plan and standard.

5.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

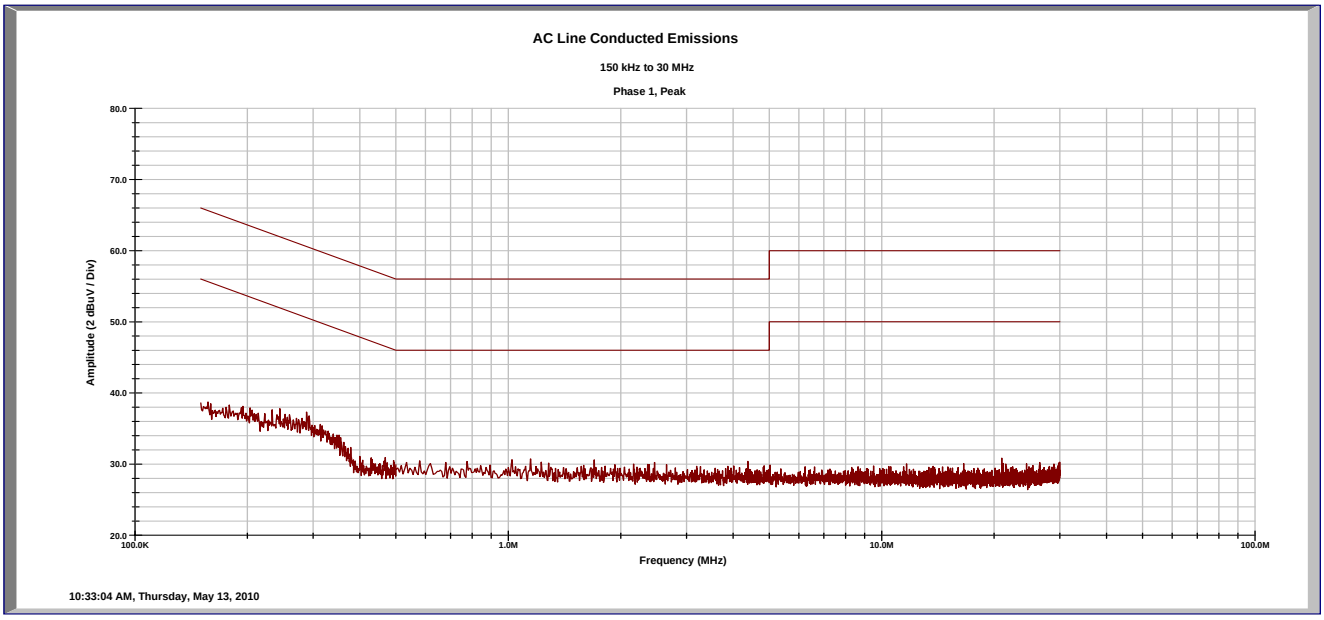
5.1.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits. It lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories.

5.1.5 Final Graphs and Tabulated Data

Conducted Emissions @ 120V/60Hz

Line 1



Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)
0.15	1	21.45	9.09	0.02	9.96	66.00	56.00	-34.57	-36.93
0.21	1	20.09	11.18	0.03	9.98	63.21	53.21	-33.10	-32.01
0.36	1	14.89	7.61	0.03	10.01	58.73	48.73	-33.79	-31.07
0.51	1	13.11	7.17	0.04	10.03	56.00	46.00	-32.82	-28.76
4.89	1	11.21	5.26	0.15	10.22	56.00	46.00	-34.42	-30.37
29.59	1	10.30	4.29	0.39	10.73	60.00	50.00	-38.58	-34.59

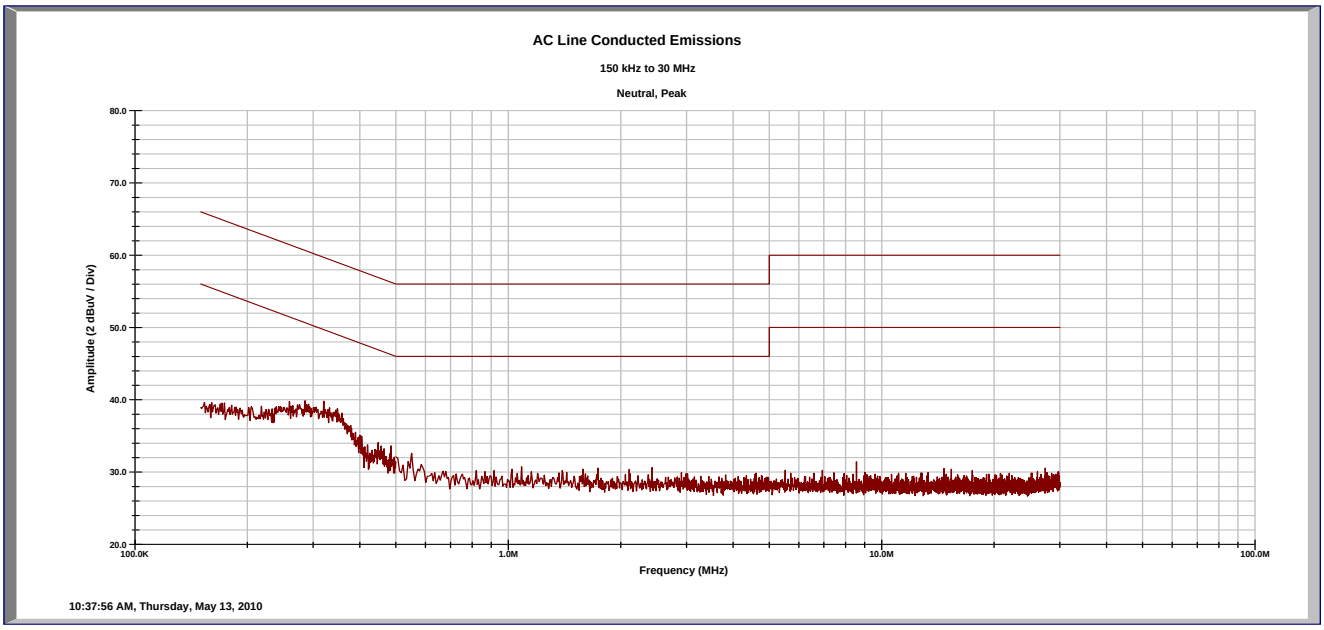
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

Conducted Emissions @ 120V/60Hz

Neutral



Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)
0.15	N	22.39	9.56	0.02	9.88	66.00	56.00	-33.71	-36.54
0.21	N	21.59	11.58	0.03	9.88	63.21	53.21	-31.71	-31.72
0.35	N	20.69	8.15	0.03	9.88	58.96	48.96	-28.36	-30.90
0.51	N	14.21	7.31	0.04	9.88	56.00	46.00	-31.87	-28.77
4.93	N	11.37	5.43	0.15	9.99	56.00	46.00	-34.50	-30.44
29.66	N	10.18	4.29	0.39	10.55	60.00	50.00	-38.89	-34.78

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

6 RF Exposure

6.1 Exposure Requirements – FCC Part 2.1091 and RSS-102 Issue 4

FCC Part 15.247(d) states that SAR evaluation in not required if "Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. *See* §1.1307(b)(1) of CFR 47."

RSS-102 section 2.5.2 states that a device is exempt from Routine Ealuation if the frequency is

- below 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 2.5 W;
- at or above 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 5 W. In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

6.1.1 Test Procedure

If the antenna is located > 20cm from the user, then an MPE calculation is acceptable.

6.1.2 Evaluation

The EUT is a motion sensor intended to be mounted > 20cm from human contact. Therefore MPE evaluation is required.

6.1.2.1 Evaluation for FCC

FCC 447498 D01 Mobile Portable RF Exposure v04, Paragraph 2) section a) i) states: "A device may be used in portable exposure conditions with no restrictions on host platforms when either the source-based time-averaged output power is ≤ $60/f_{(GHz)}$ mW or all measured 1-g SAR are < 0.4 W/kg.[11] ".

The minimum power that requires SAR is 60 / 10.525 GHz or 5.7 mW.

The maximum power output plus maximum antenna gain of the EUT is:

Highest P_{out} is 41.8mV at 3m which is equivalent to 0.035mW.

The EUT Power level is well below the 5.7mW power.

6.1.2.2 Evaluation for Industry Canada

The maximum power output plus maximum antenna gain of the EUT is:

P_{out} is 41.8mV at 3m which is equivalent to 0.035mW. .

The EUT is well below the 20mW minimum power level required for evaluation.

6.1.3 Conclusion

SAR testing is not required for either FCC or Industry Canada.