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839.01
Electrical

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 subpart C, section 15.249

FOR:

On Track Innovations Ltd.

RF Nozzle reader (SC transceiver)

Model: EFP-RFN 900

Table of contents

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1 Applicant information

Client name:	On Track Innovations Ltd.
Address:	P.O.B. 32, ZHR Industrial Zone, Rosh Pina, Index 12000, Israel
Telephone:	+972 4686 8000
Fax:	+972 4693 8887
E-mail:	h_itay@otiglobal.com
Contact name:	Mr. Hemy Itay

2 Equipment under test attributes

Product name:	RF Nozzle reader
Product type:	SC transceiver
Model(s):	EFP-RFN 900
Serial number:	0015
Receipt date	3/10/2010

3 Manufacturer information

Manufacturer name:	On Track Innovations Ltd.
Address:	P.O.B. 32, ZHR Industrial Zone, Rosh Pina, Index 12000, Israel
Telephone:	+972 4686 8000
Fax:	+972 4693 8887
E-Mail:	h_itay@otiglobal.com
Contact name:	Mr. Hemy Itay

4 Test details

Project ID:	20581
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	3/10/2010
Test completed:	3/25/2010
Test specification(s):	FCC Part 15, subpart C, §15.249

5 Tests summary

Test	Status
Transmitter characteristics	
FCC part 15 Section 15.249(a)(d), Field strength of emissions	Pass
FCC part 15 Section 15.249(d), Band edge emissions	Pass
FCC part 15 Section 15.207(a), Conducted emission	Not required
FCC part 15 Section 15.203, Antenna requirement	Pass
FCC part 15 Section 15.215(c), Occupied bandwidth	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	March 25, 2010	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 31, 2010	
Approved by:	Mr. M. Nikishin, EMC and radio group manager	March 31, 2010	

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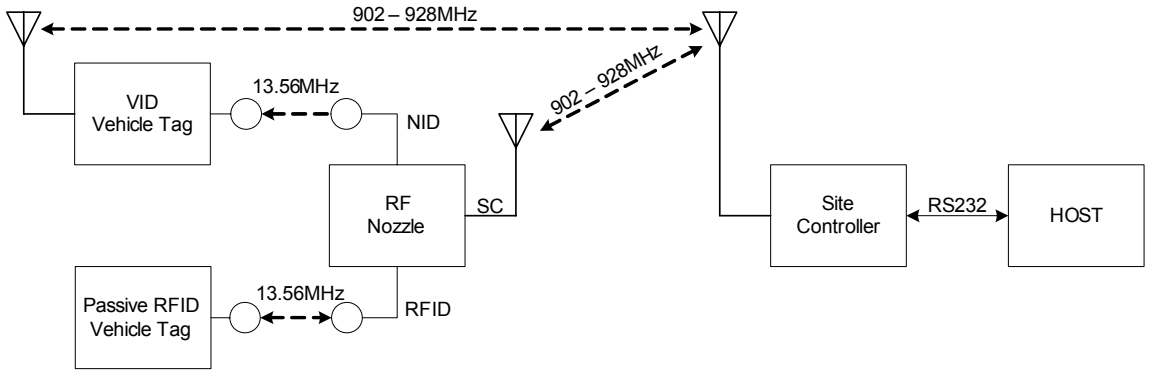
6 EUT description

6.1 General information

The EUT, "RF Nozzle" reader, is designed to serve as an interface between the refueled vehicle and the pump/station SC (Site Controller) to facilitate controlled and secured refueling. It is mounted on the refueling nozzle.

The RF Nozzle is a battery powered unit, comprising three different RF sections: a RFID 13.56 MHz transceiver, a NID (Nozzle ID) 13.56 MHz transmitter and a SC (Site Controller) 902-928 MHz transceiver, all operating under the control of a local microprocessor.

The principle of the EUT operation is shown in the diagram below.



6.2 Changes made in EUT

No changes were performed in the EUT.

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6.3 EUT positions during testing

Photograph 6.3.1 EUT vertical position (X-axis)

Photograph 6.3.2 EUT typical position (Y-axis)

Photograph 6.3.3 EUT horizontal position (Z-axis)

6.4 Transmitter characteristics

Type of equipment								
V	Stand-alone (Equipment with or without its own control provisions)							
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)							
	Plug-in card (Equipment intended for a variety of host systems)							
Intended use		**Condition of use**						
	Fixed	Always at a distance more than 2 m from all people						
	mobile	Always at a distance more than 20 cm from all people						
V	portable	May operate at a distance closer than 20 cm to human body						
Assigned frequency range		902 - 928 MHz						
Operating frequency range		902.328 – 927.498 MHz						
Maximum field strength		88.2 dB(µV/m) at 3 m test distance						
Is transmitter output power variable?			No					
		V	Yes		continuous variable			
				V	stepped variable with stepsize, software controlled	1 dB		
				Maximum field strength		88.2 dB(µV/m) at 3 m test distance		
Antenna connection								
unique coupling	**V**	standard connector		Integral	**V**	with temporary RF connector		
						without temporary RF connector		
Antenna/s technical characteristics								
Type		Manufacturer		Model number		Gain		
¼ λ omni-directional		Antenna Factor		ANT-916-JJB-ST		-2.16 dBi		
Transmitter aggregate data rate/s		9.6 Mbps						
Type of modulation		FSK						
Modulating test signal (baseband)		HEX code 55, continuous transmission						
Transmitter duty cycle supplied for test		100%						
Transmitter power source								
V	Battery	**Nominal rated voltage**	3.6 V	Battery type	Lithium			
	DC	**Nominal rated voltage**						
	AC mains	**Nominal rated voltage**		Frequency				
Common power source for transmitter and receiver			**V**	yes		no		

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Field strength of emissions

7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.1.1, Table 7.1.2 and Table 7.1.3.

Table 7.1.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(µV/m)
	Quasi-Peak
902 – 928	94

Table 7.1.2 Harmonics limits

Fundamental frequency, MHz	Field strength at 3 m, dB(µV/m)	
	Peak	Average
902 – 928	74.0	54.0

Table 7.1.3 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(µV/m)*			
	Peak	Quasi Peak	Average	Attenuation below carrier
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	50 dBc (whichever is the less stringent)
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0*		69.5		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
Above 1000	74.0	NA	54.0	

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

**- The limit decreases linearly with the logarithm of frequency.

Note: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 GHz for intentional radiators operated above 10 GHz.

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

7.1.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

7.1.2.2 The measurements were performed in three EUT orthogonal positions.

7.1.2.3 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

7.1.2.4 The worst test results (the lowest margins) found in the EUT 3 orthogonal positions, were recorded in the associated tables and shown in the associated plots.

7.1.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.1.3.1 The EUT was set up as shown in Figure 7.1.2, energized and the performance check was conducted.

7.1.3.2 The measurements were performed in three EUT orthogonal positions.

7.1.3.3 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.1.3.4 The worst test results (the lowest margins) found in the EUT 3 orthogonal positions, were recorded in the associated tables and shown in the associated plots.

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

Figure 7.1.1 Setup for spurious emission field strength measurements below 30 MHz

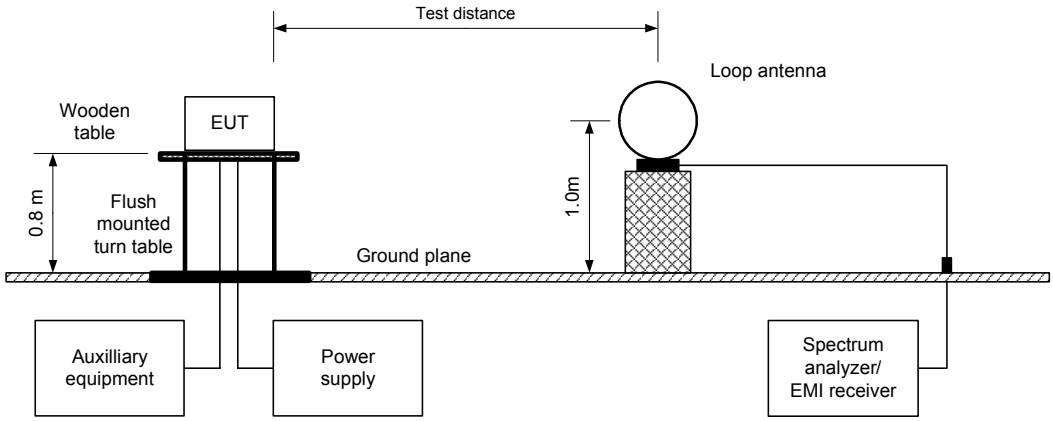
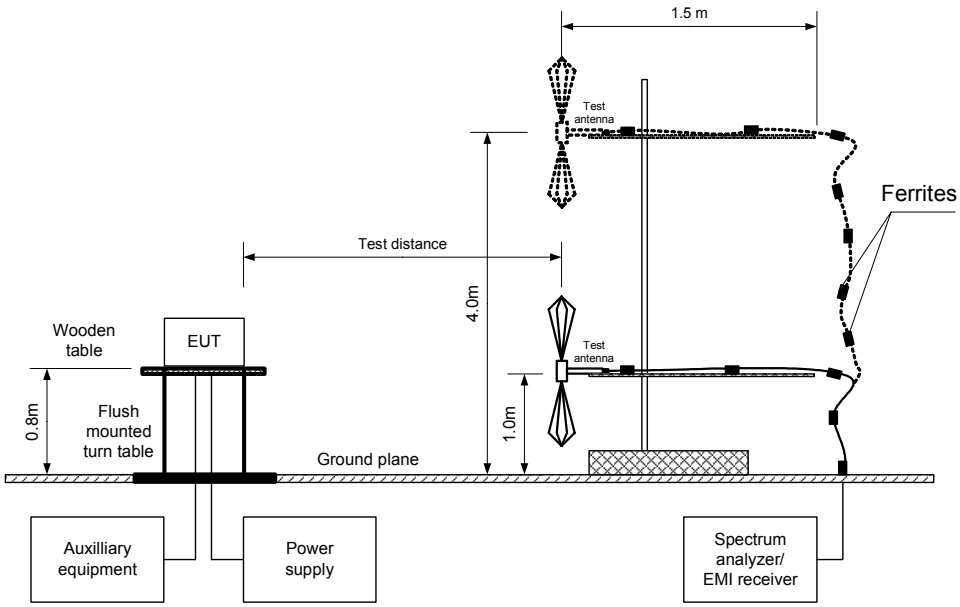


Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

Table 7.1.4 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	3 orthogonal (X / Y / Z)
MODULATION:	FSK
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 9300 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Fundamental emission

Frequency, MHz	Antenna		Azimuth, degrees*	Peak emission, dB(µV/m)	Quasi-peak			Verdict
	Pol.	Height, m			Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
902.328	V	1.3	30	88.28	88.20	94	-5.80	Pass
914.998	V	1.1	41	86.45	86.40	94	-7.60	Pass
927.498	V	1.5	23	87.02	86.15	94	-7.85	Pass

Spurious emissions

Freq., MHz	Antenna		Azimuth, degrees*	Peak field strength			Average factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
Low Channel											
1804.60	V	1.2	6	48.98	74.00	-25.02	-18.67	30.31	54.00	-23.69	Pass
2707.05	V	1.1	0	61.35	74.00	-12.65	-18.67	42.68	54.00	-11.32	
3609.28	H	1.2	90	71.85	74.00	-2.15	-18.67	53.18	54.00	-0.82	
4511.65	V	1.1	270	54.21	74.00	-19.79	-18.67	35.54	54.00	-18.46	
Mid Channel											
1830.00	V	1.2	186	45.15	74.00	-28.85	-18.67	26.48	54.00	-27.52	
2745.00	H	1.2	10	60.80	74.00	-13.20	-18.67	42.13	54.00	-11.87	
3659.98	H	1.2	90	70.61	74.00	-3.39	-18.67	51.94	54.00	-2.06	
4575.03	V	1.3	90	51.98	74.00	-22.02	-18.67	33.31	54.00	-20.69	
High Channel											
1855.00	V	1.2	175	47.03	74.00	-26.97	-18.67	28.36	54.00	-25.64	
2782.53	H	1.3	0	61.26	74.00	-12.74	-18.67	42.59	54.00	-11.41	
3709.91	H	1.2	90	71.12	74.00	-2.88	-18.67	52.45	54.00	-1.55	
4637.53	V	1.0	270	52.79	74.00	-21.21	-18.67	34.12	54.00	-19.88	

*- EUT front panel refers to 0 degrees position of turntable.
**- Margin = dB below (negative if above) specification limit.
*** Max value was obtained at Unom input power voltage.

Test specification:	**Section 15.249(a)(d), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 41 %	**Power Supply:** 3.6 VDC
Remarks:			

Table 7.1.5 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
11.65	1250	NA	NA	NA	-18.67

*- Average factor was calculated as follows

for pulse train shorter than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train\right)$$

for pulse train longer than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\,ms} \times Number\ of\ bursts\ within\ 100\,ms\right)$$

Reference numbers of test equipment used

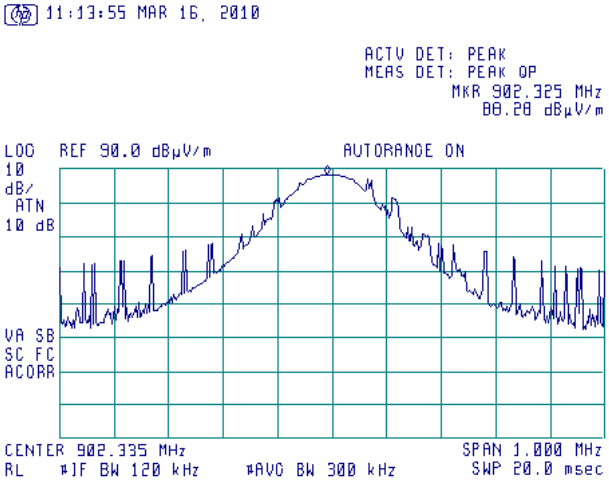
HL 0415	HL 0446	HL 0587	HL 0604	HL 0812	HL 1425	HL 1430	HL 1984
HL 2883	HL 3119	HL 3883					

Full description is given in Appendix A.

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

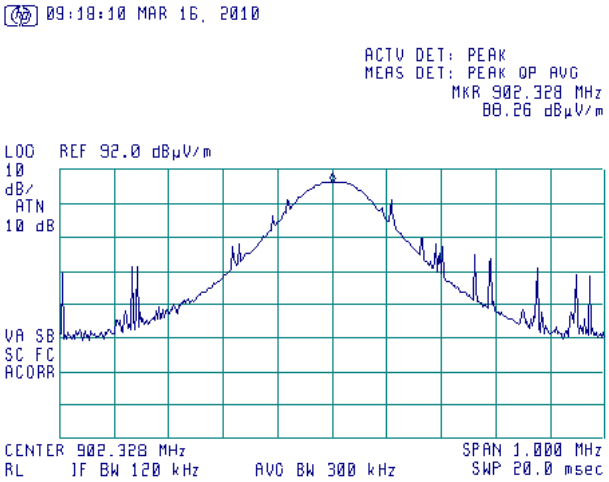
Plot 7.1.1 Radiated emission measurements at the fundamental frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Low



Plot 7.1.2 Radiated emission measurements at the fundamental frequency

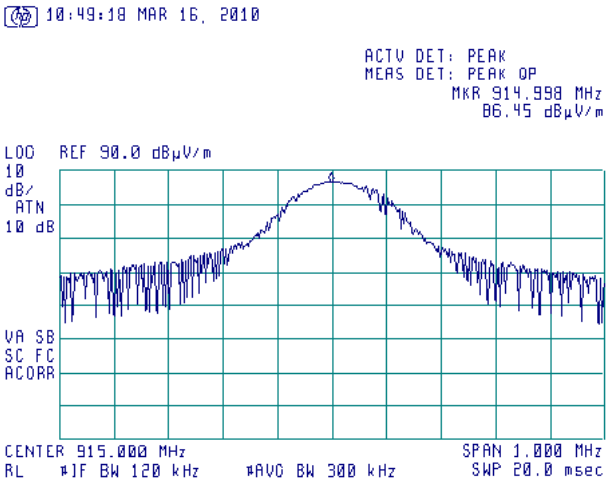
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Low



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

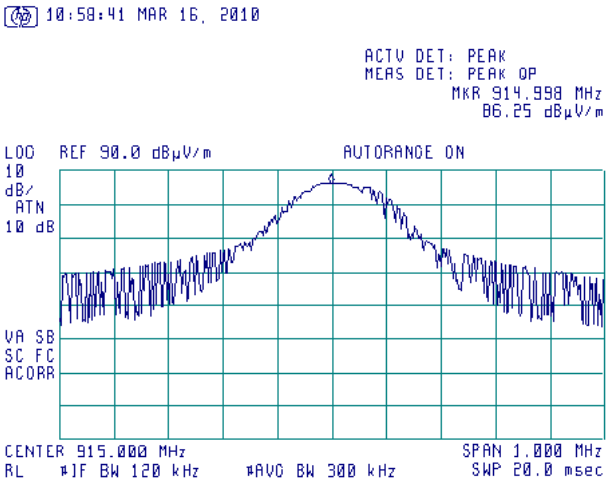
Plot 7.1.3 Radiated emission measurements at the fundamental frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Mid



Plot 7.1.4 Radiated emission measurements at the fundamental frequency

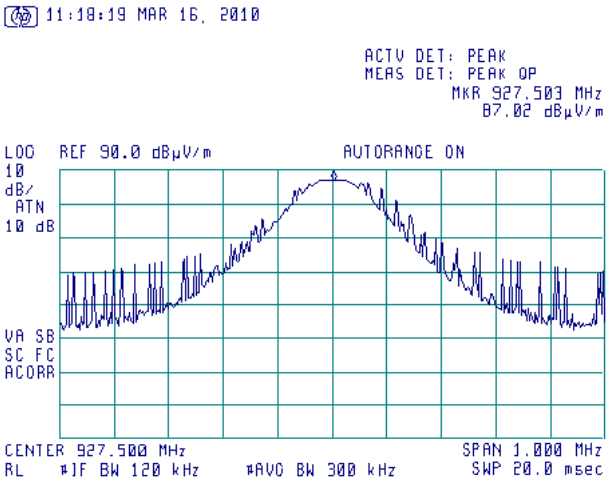
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Mid



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

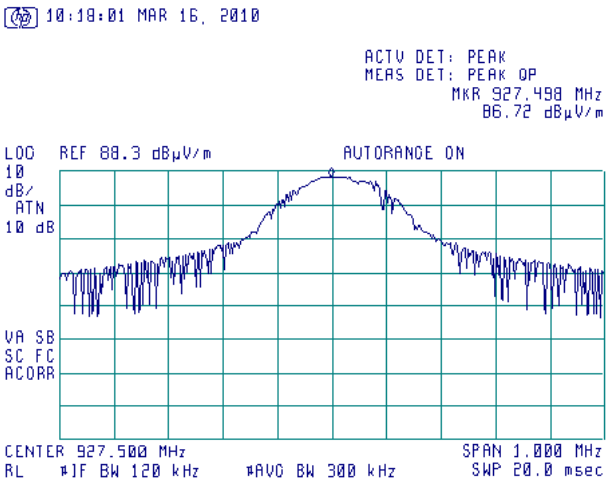
Plot 7.1.5 Radiated emission measurements at the fundamental frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	High



Plot 7.1.6 Radiated emission measurements at the fundamental frequency

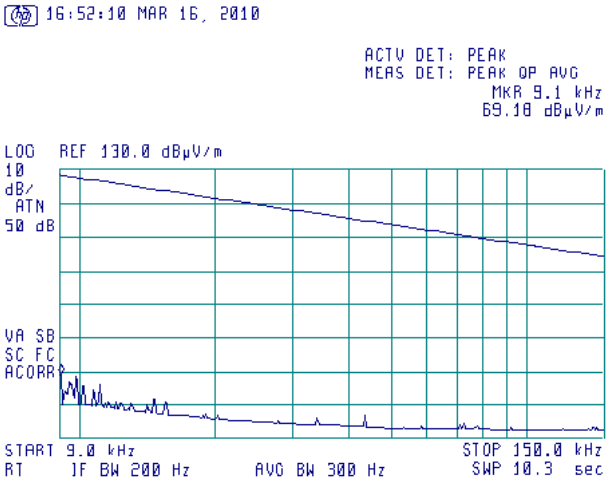
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	High



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

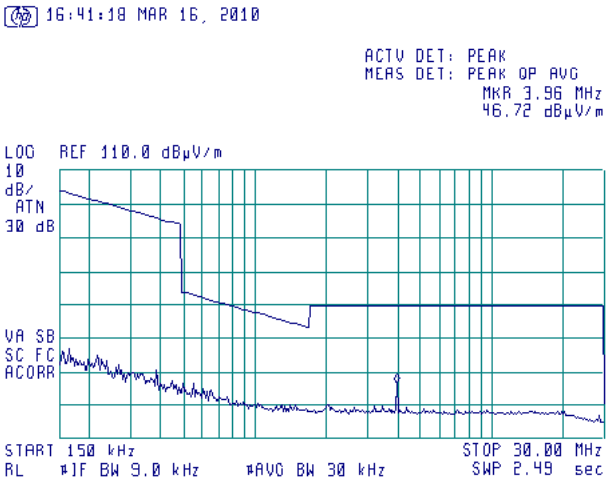
Plot 7.1.7 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Plot 7.1.8 Radiated emission measurements from 0.15 to 30 MHz

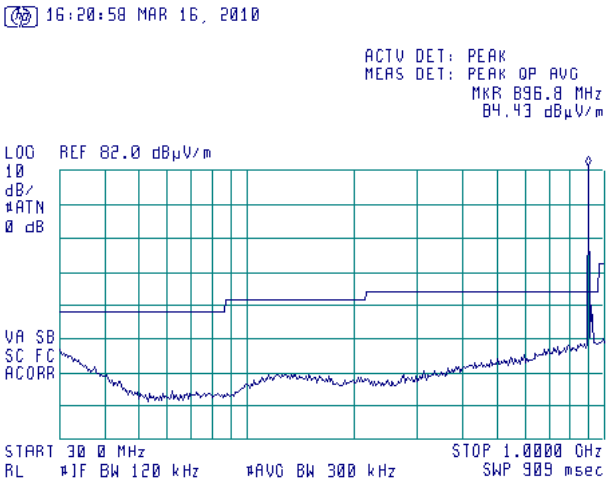
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

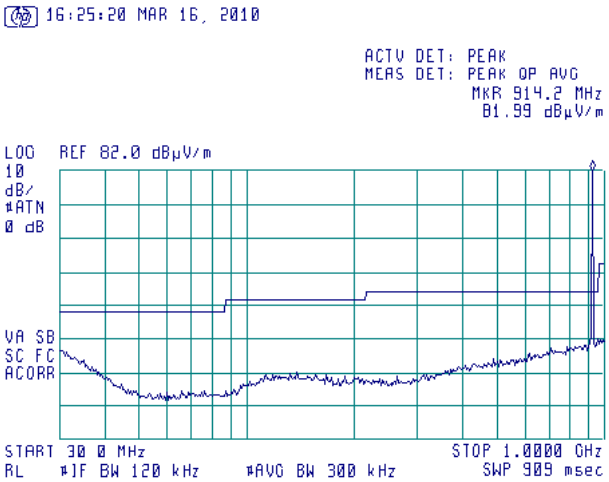
Plot 7.1.9 Radiated emission measurements from 30 to 1000 MHz

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Low



Plot 7.1.10 Radiated emission measurements from 30 to 1000 MHz

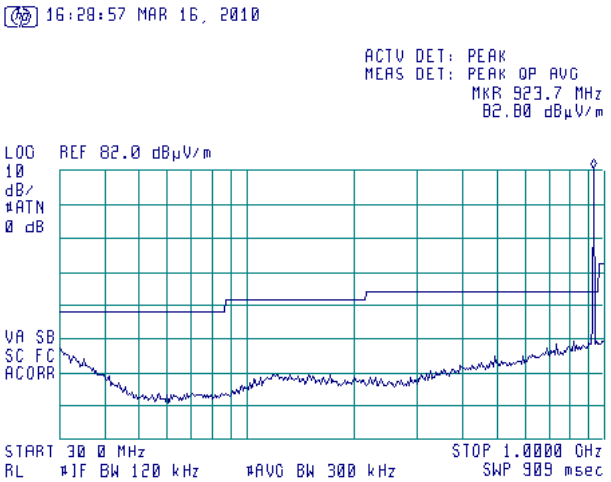
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Mid



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

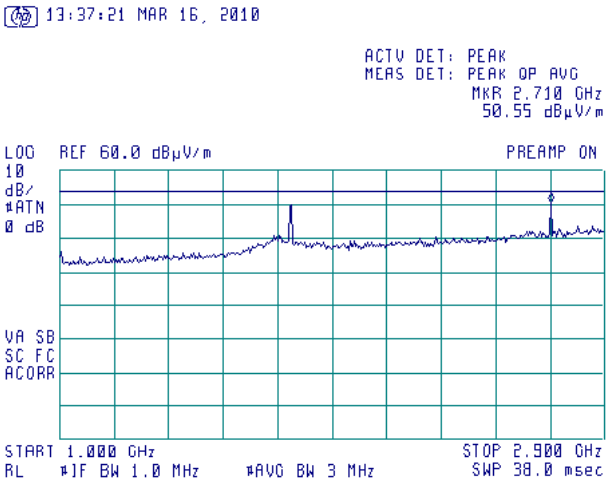
Plot 7.1.11 Radiated emission measurements from 30 to 1000 MHz

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	High



Plot 7.1.12 Radiated emission measurements from 1.0 to 2.9 GHz

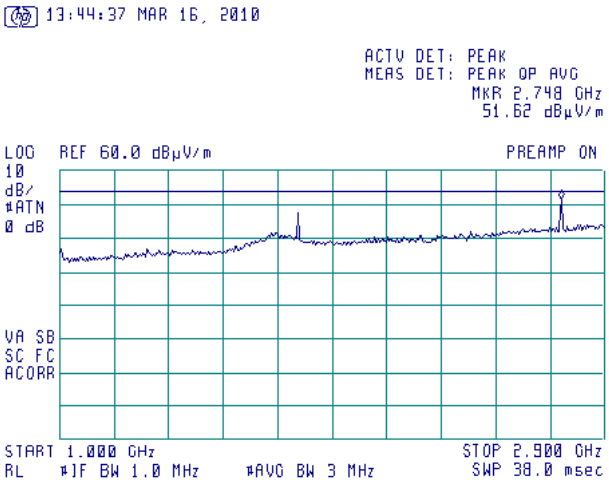
TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Low



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

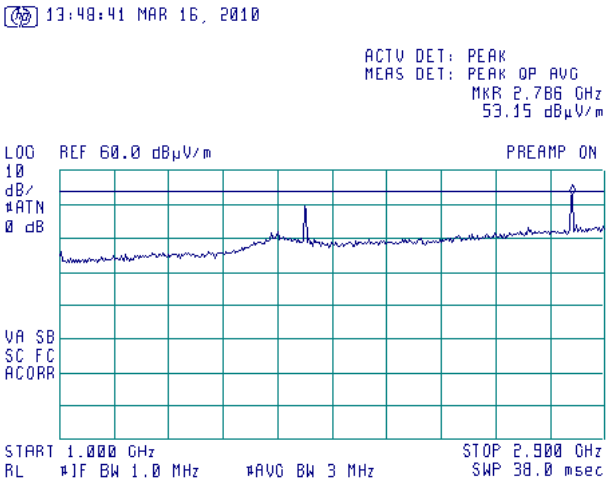
Plot 7.1.13 Radiated emission measurements from 1.0 to 2.9 GHz

TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	Mid



Plot 7.1.14 Radiated emission measurements from 1.0 to 2.9 GHz

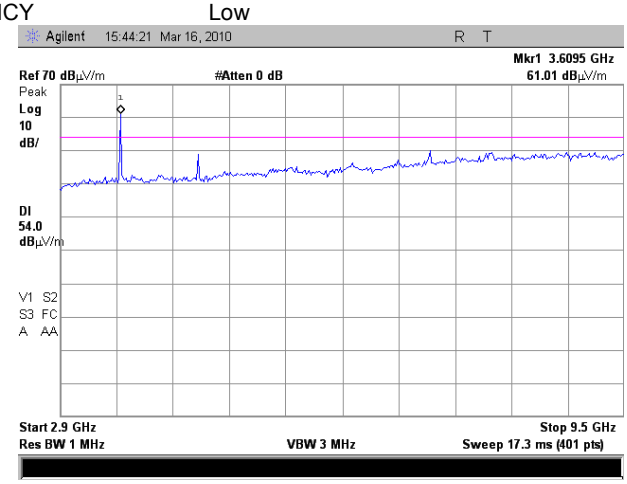
TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	High



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

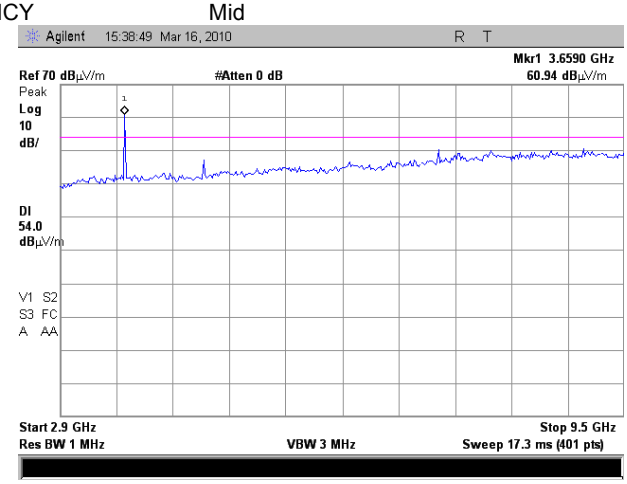
Plot 7.1.15 Radiated emission measurements from 2.9 to 9.3 GHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)
FREQUENCY Low



Plot 7.1.16 Radiated emission measurements from 2.9 to 9.3 GHz

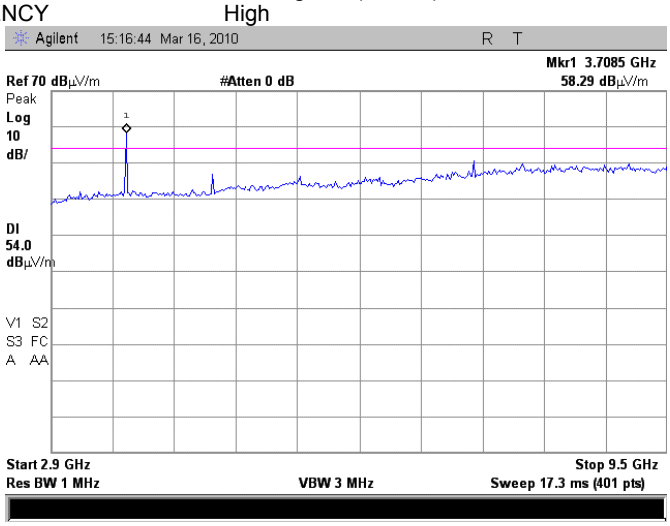
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)
FREQUENCY Mid



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

Plot 7.1.17 Radiated emission measurements from 2.9 to 9.3 GHz

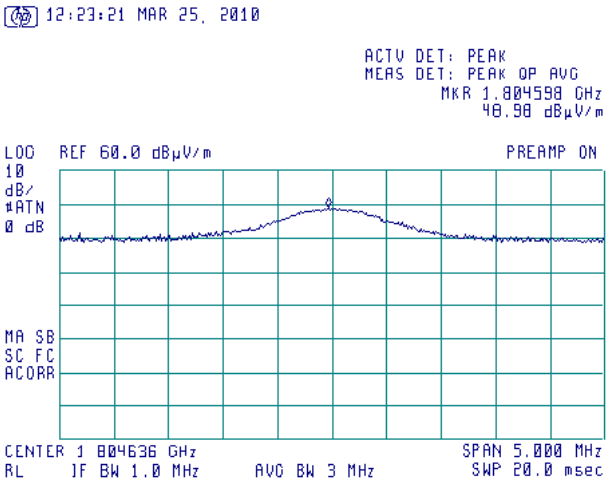
TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)
FREQUENCY	High



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

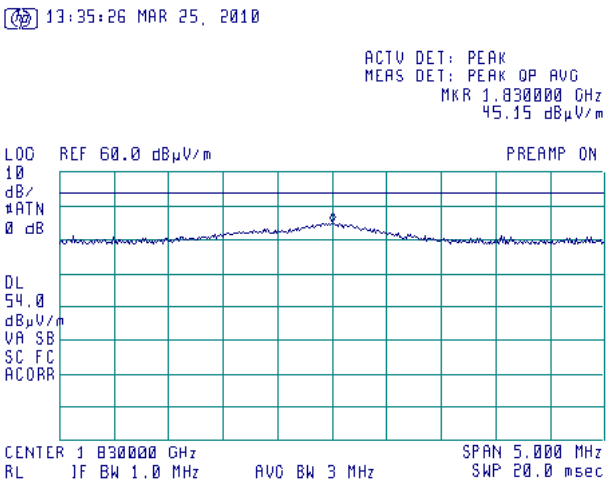
Plot 7.1.18 Radiated emission measurements at the second harmonic frequency at low channel

TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical & Horizontal
EUT POSITION:	X-axis
DETECTOR:	Peak



Plot 7.1.19 Radiated emission measurements at the second harmonic frequency at mid channel

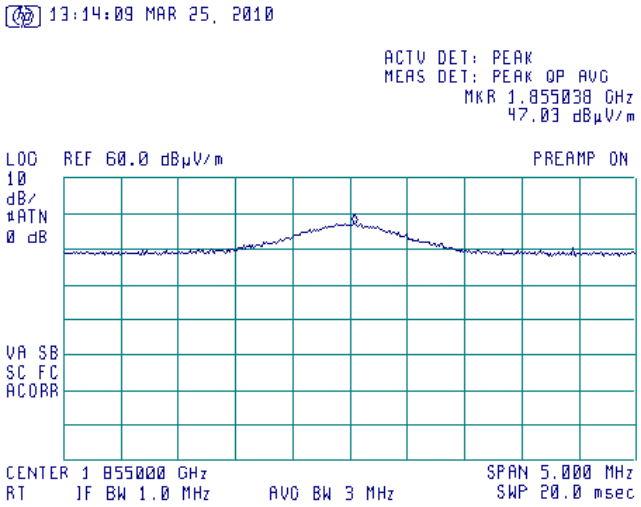
TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical & Horizontal
EUT POSITION:	X-axis
DETECTOR:	Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

Plot 7.1.20 Radiated emission measurements at the second harmonic frequency at high channel

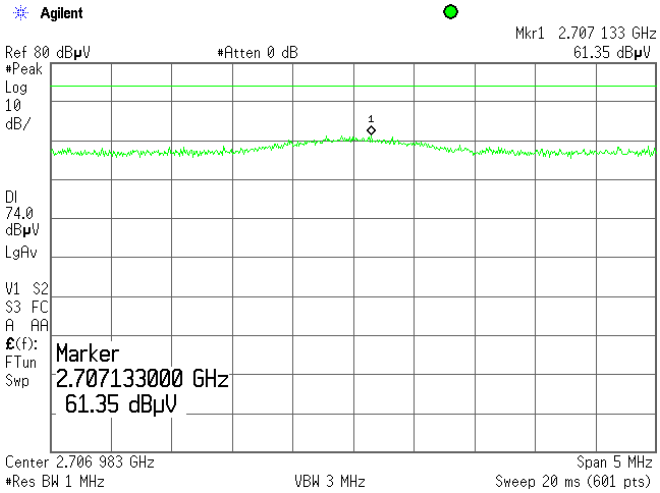
TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical & Horizontal
EUT POSITION:	X-axis
DETECTOR:	Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

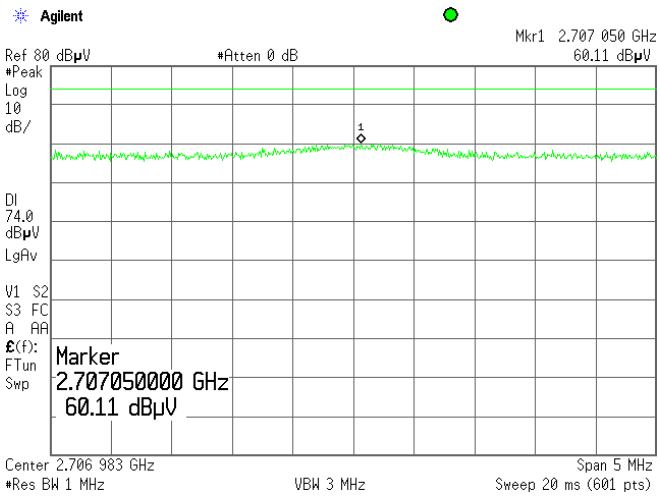
Plot 7.1.21 Radiated emission measurements at the third harmonic frequency at low channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.22 Radiated emission measurements at the third harmonic frequency at low channel

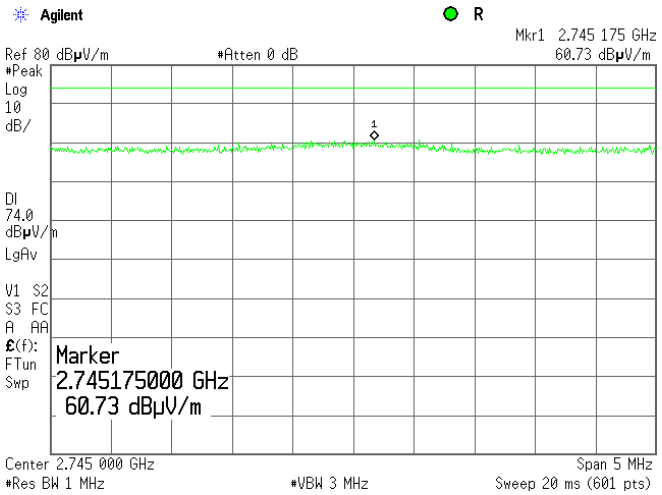
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

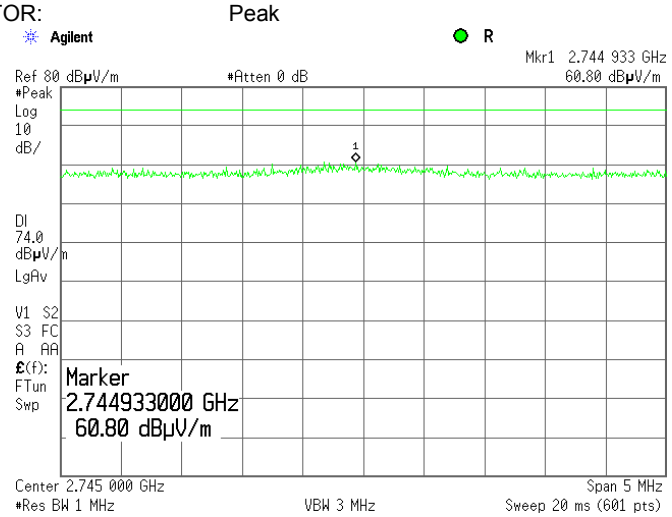
Plot 7.1.23 Radiated emission measurements at the third harmonic frequency at mid channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.24 Radiated emission measurements at the third harmonic frequency at mid channel

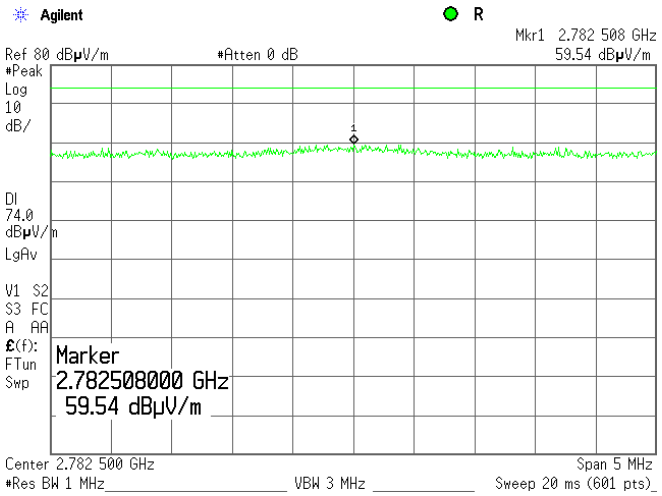
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

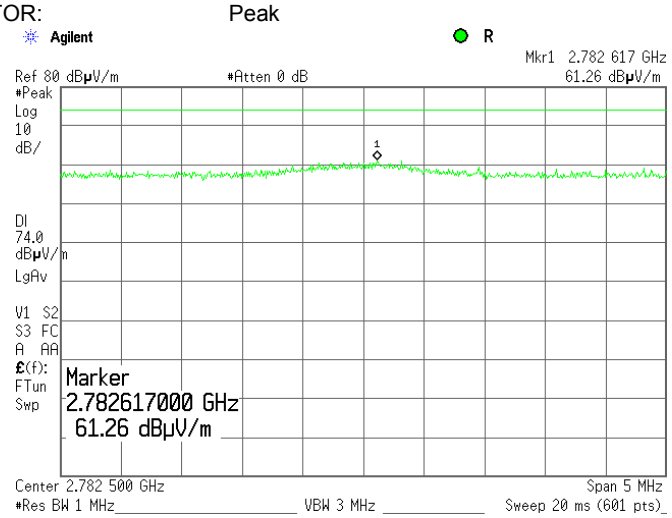
Plot 7.1.25 Radiated emission measurements at the third harmonic frequency at high channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.26 Radiated emission measurements at the third harmonic frequency at high channel

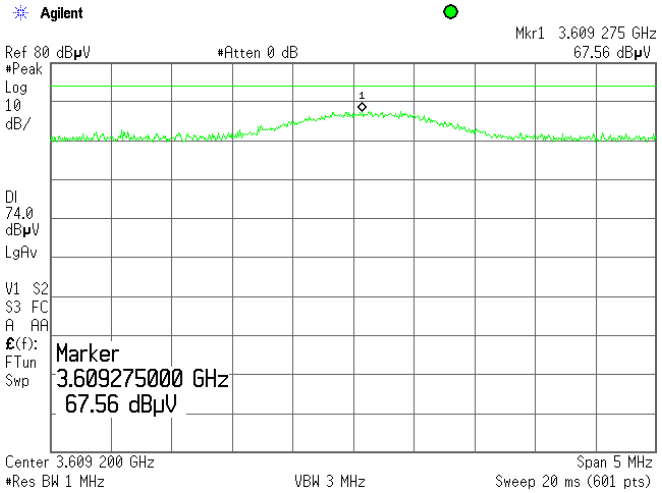
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

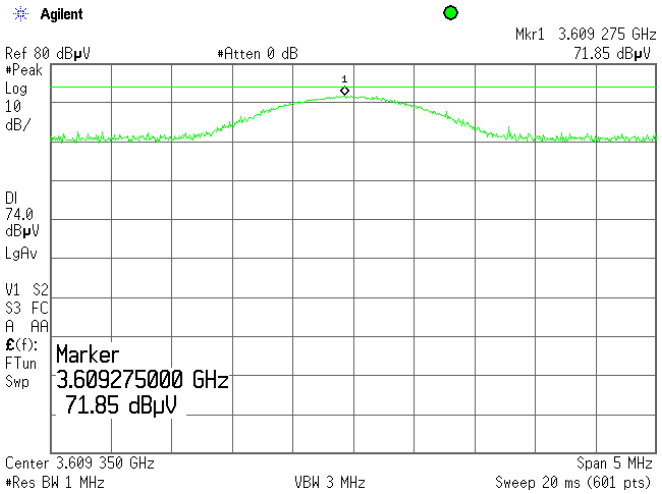
Plot 7.1.27 Radiated emission measurements at the fourth harmonic frequency at low channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.28 Radiated emission measurements at the fourth harmonic frequency at low channel

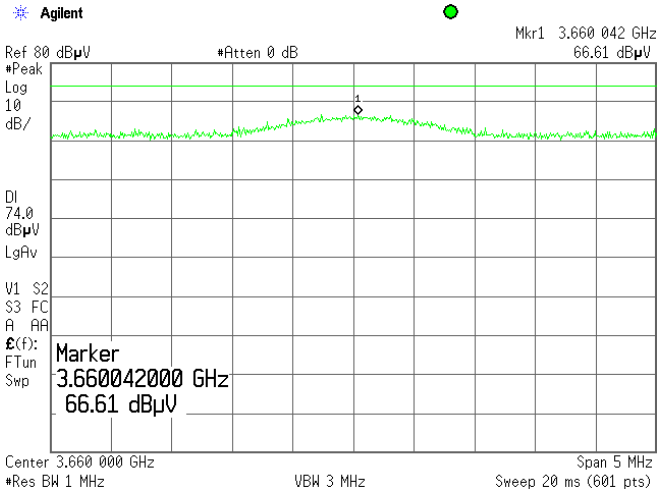
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

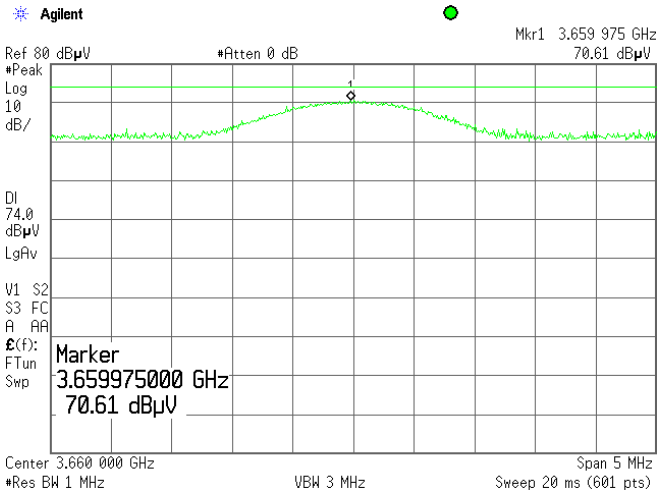
Plot 7.1.29 Radiated emission measurements at the fourth harmonic frequency at mid channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.30 Radiated emission measurements at the fourth harmonic frequency at mid channel

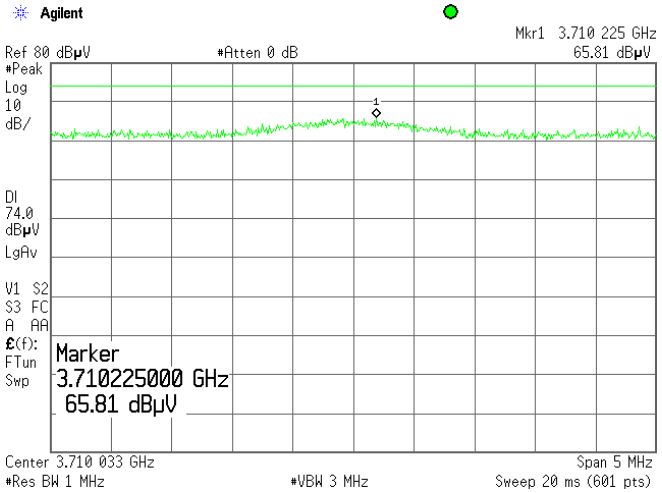
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

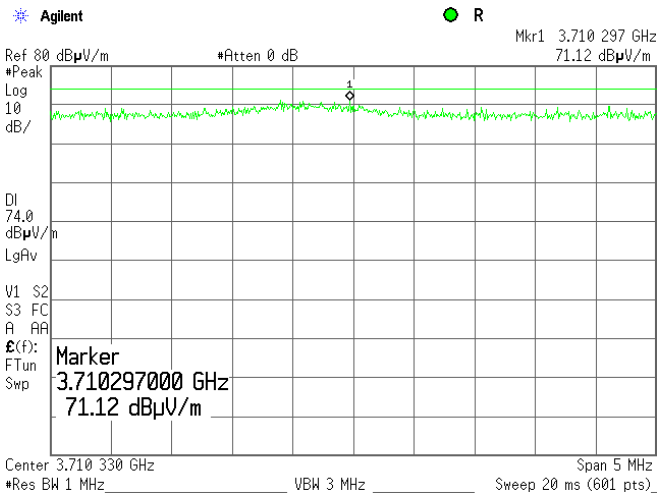
Plot 7.1.31 Radiated emission measurements at the fourth harmonic frequency at high channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.32 Radiated emission measurements at the fourth harmonic frequency at high channel

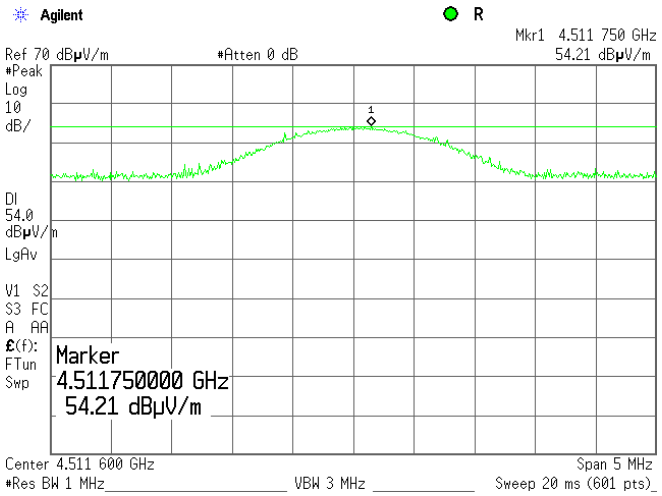
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

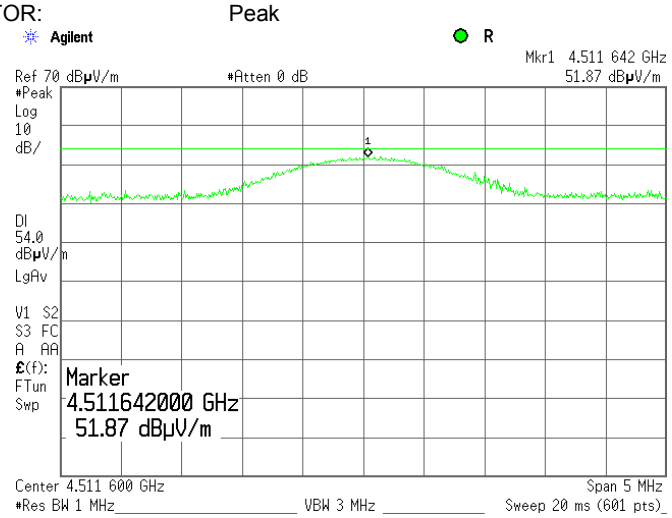
Plot 7.1.33 Radiated emission measurements at the fifth harmonic frequency at low channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.34 Radiated emission measurements at the fifth harmonic frequency at low channel

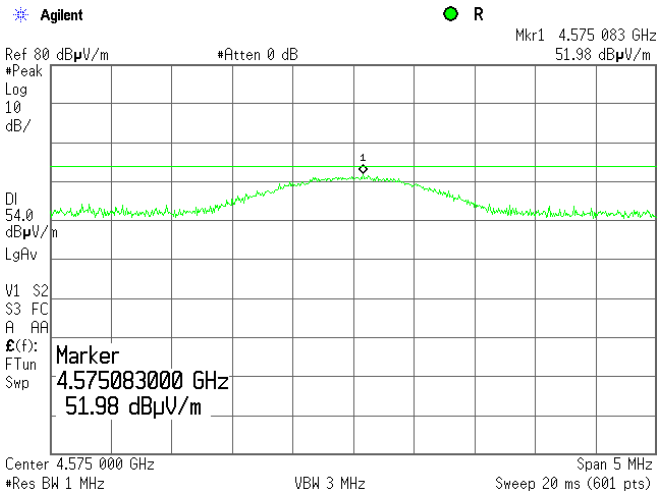
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

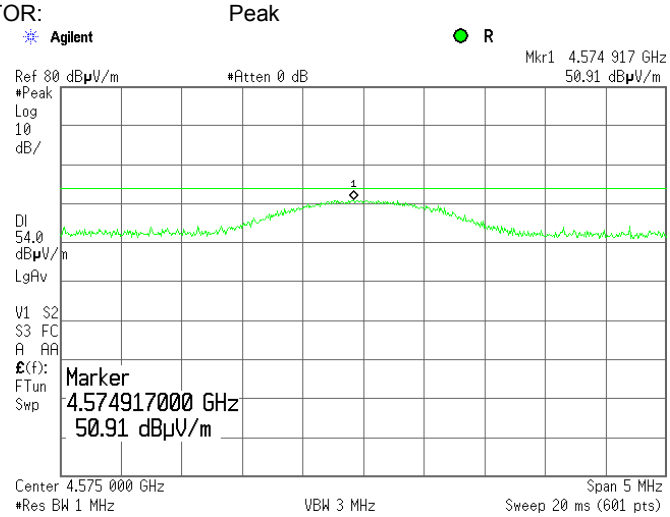
Plot 7.1.35 Radiated emission measurements at the fifth harmonic frequency at mid channel

TEST SITE:	OATS
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	X-axis
DETECTOR:	Peak



Plot 7.1.36 Radiated emission measurements at the fifth harmonic frequency at mid channel

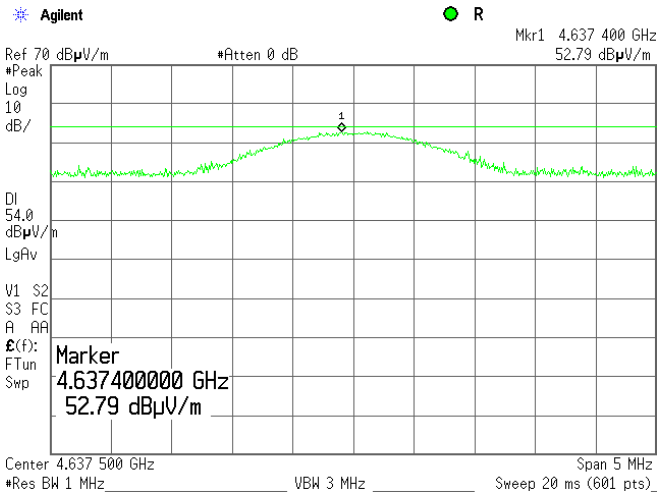
TEST SITE:	OATS
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	X-axis
DETECTOR:	Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

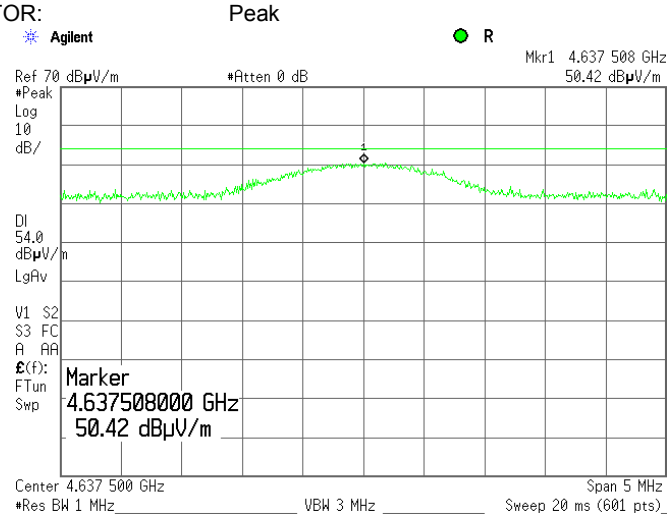
Plot 7.1.37 Radiated emission measurements at the fifth harmonic frequency at high channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.38 Radiated emission measurements at the fifth harmonic frequency at high channel

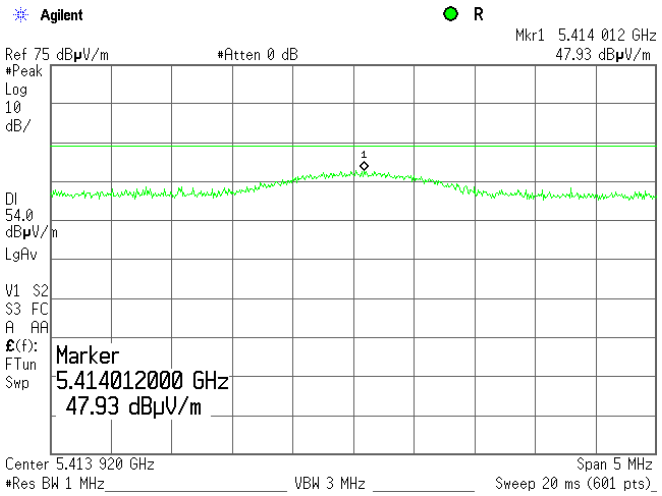
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

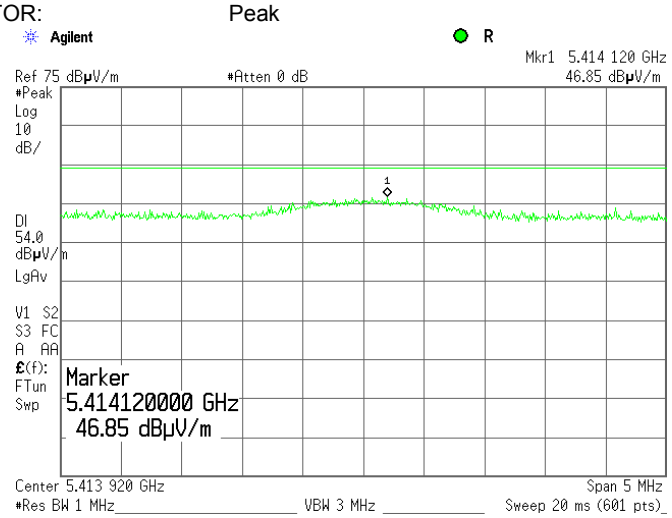
Plot 7.1.39 Radiated emission measurements at the sixth harmonic frequency at low channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.40 Radiated emission measurements at the sixth harmonic frequency at low channel

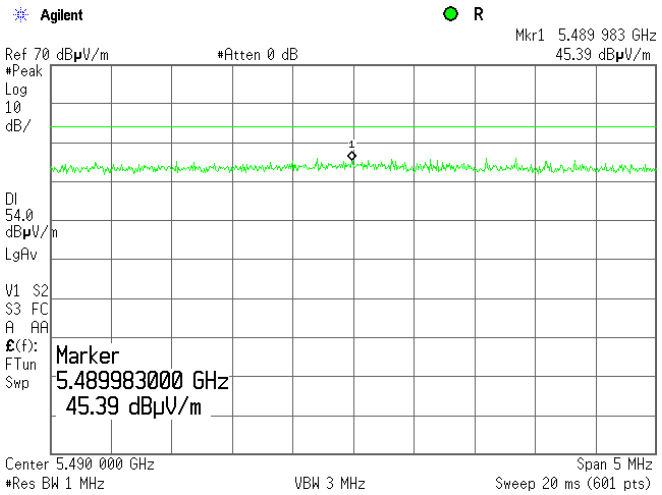
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

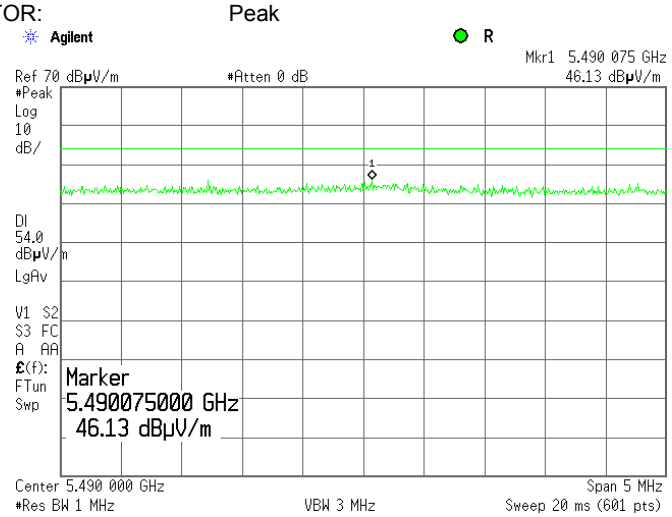
Plot 7.1.41 Radiated emission measurements at the sixth harmonic frequency at mid channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.42 Radiated emission measurements at the sixth harmonic frequency at mid channel

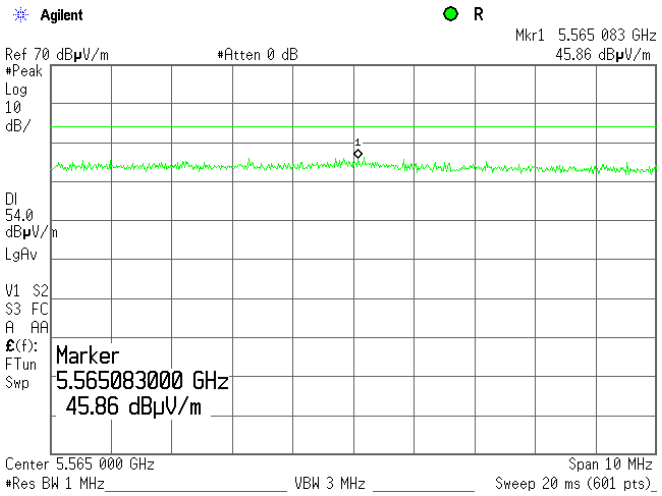
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

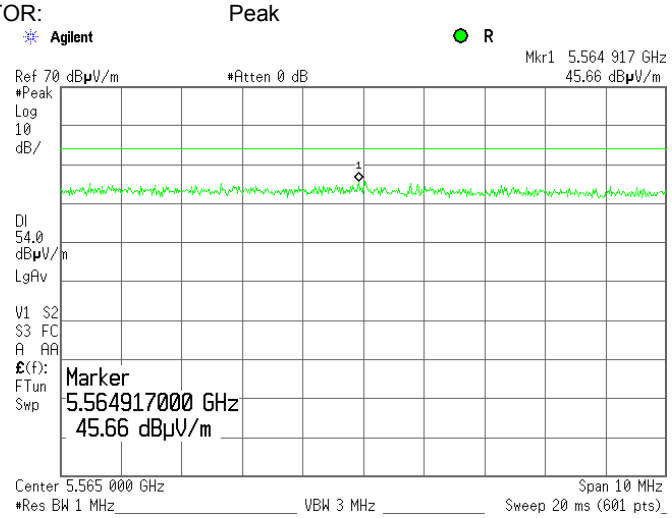
Plot 7.1.43 Radiated emission measurements at the sixth harmonic frequency at high channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.44 Radiated emission measurements at the sixth harmonic frequency at high channel

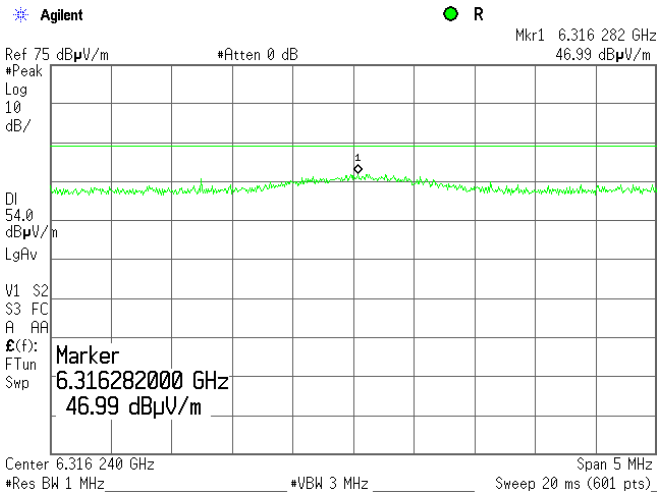
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

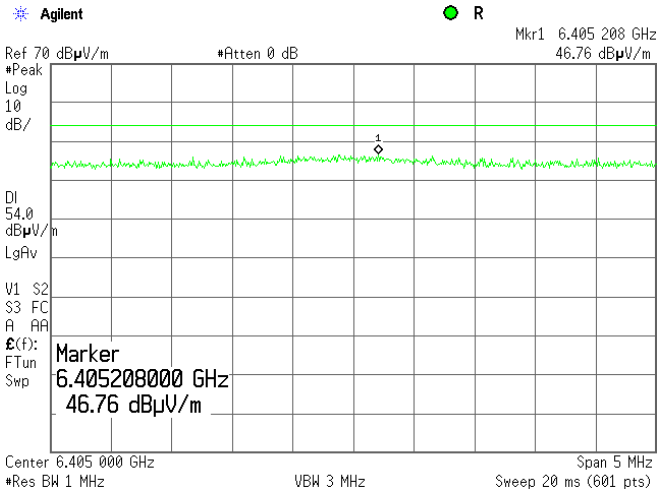
Plot 7.1.45 Radiated emission measurements at the seventh harmonic frequency at low channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.46 Radiated emission measurements at the seventh harmonic frequency at mid channel

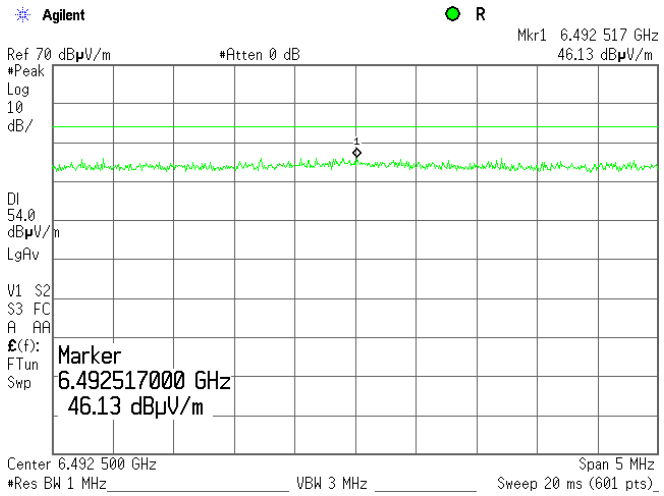
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

Plot 7.1.47 Radiated emission measurements at the seventh harmonic frequency at high channel

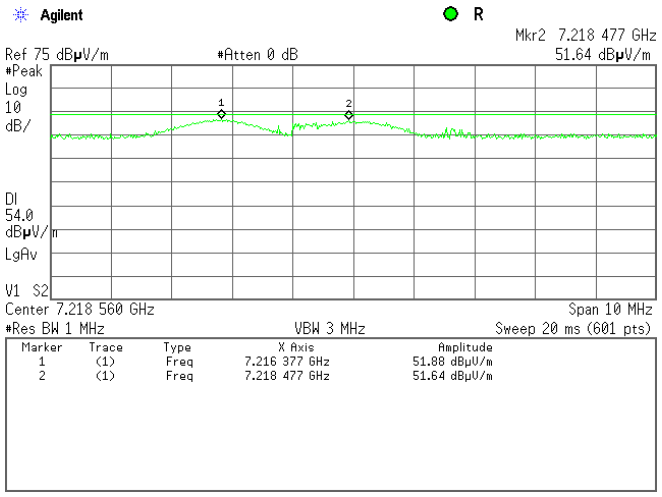
TEST SITE:	OATS
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and horizontal
EUT POSITION:	X-axis
DETECTOR:	Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

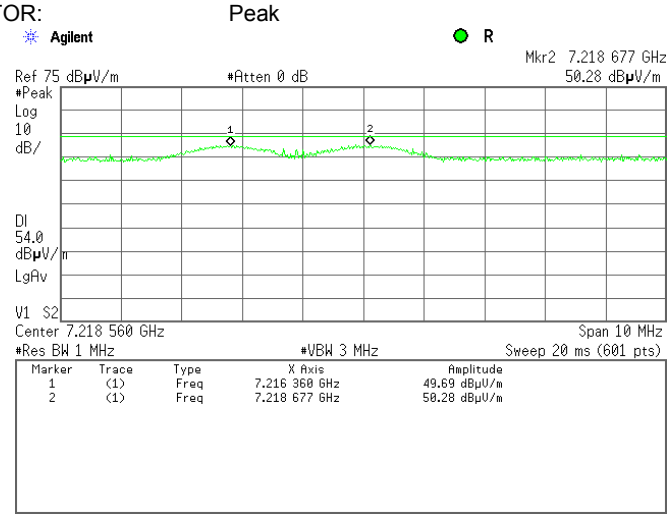
Plot 7.1.48 Radiated emission measurements at the eighth harmonic frequency at low channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.49 Radiated emission measurements at the eighth harmonic frequency at low channel

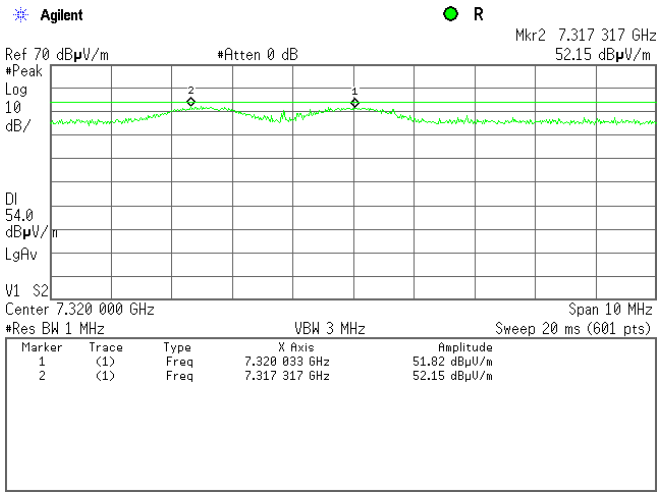
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

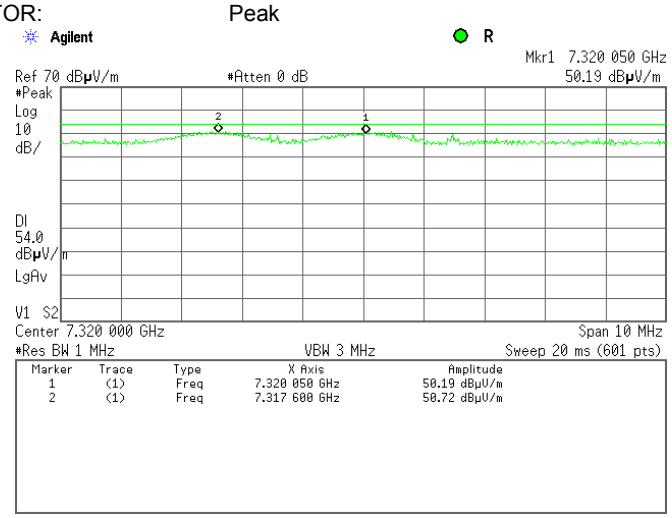
Plot 7.1.50 Radiated emission measurements at the eighth harmonic frequency at mid channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



Plot 7.1.51 Radiated emission measurements at the eighth harmonic frequency at mid channel

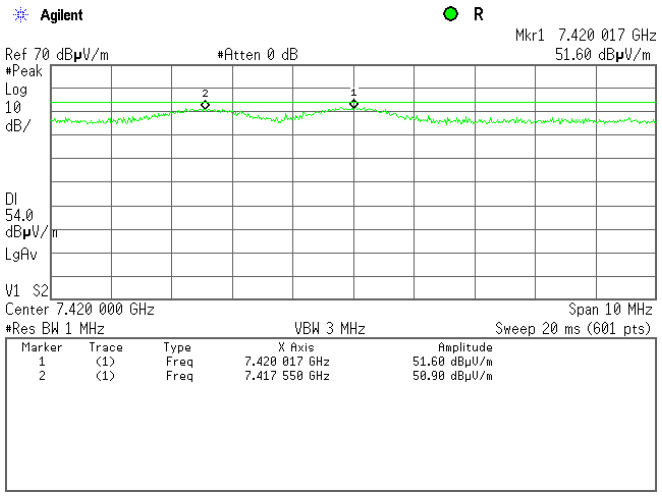
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

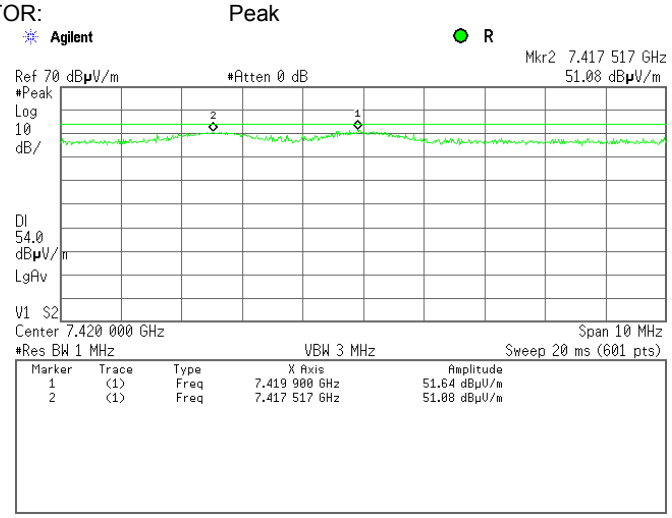
Plot 7.1.52 Radiated emission measurements at the eighth harmonic frequency at high channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
DETECTOR: Peak



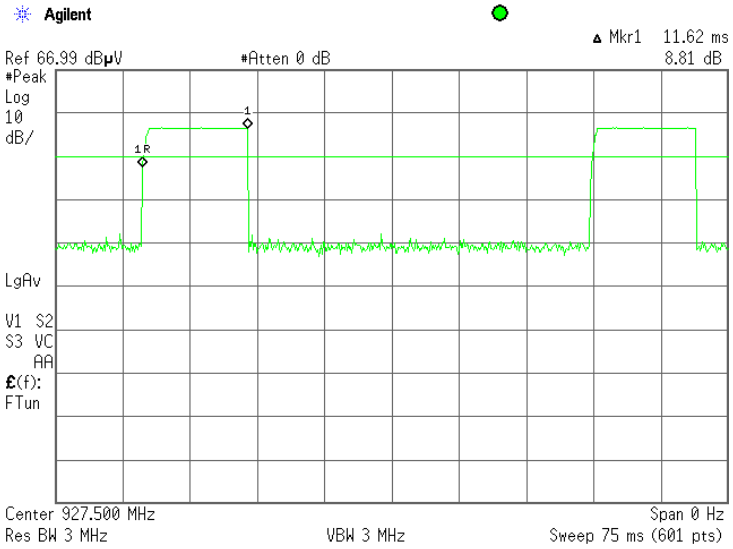
Plot 7.1.53 Radiated emission measurements at the eighth harmonic frequency at high channel

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis
DETECTOR: Peak

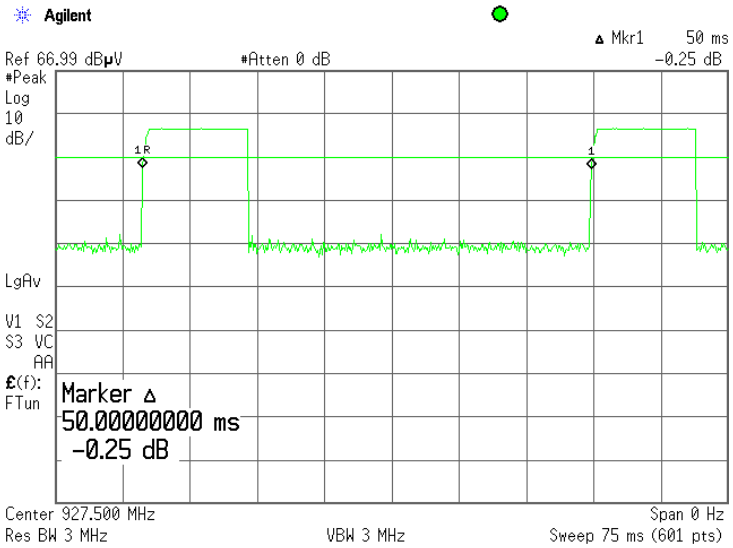


Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

Plot 7.1.54 Transmission pulse duration (supplied for test)

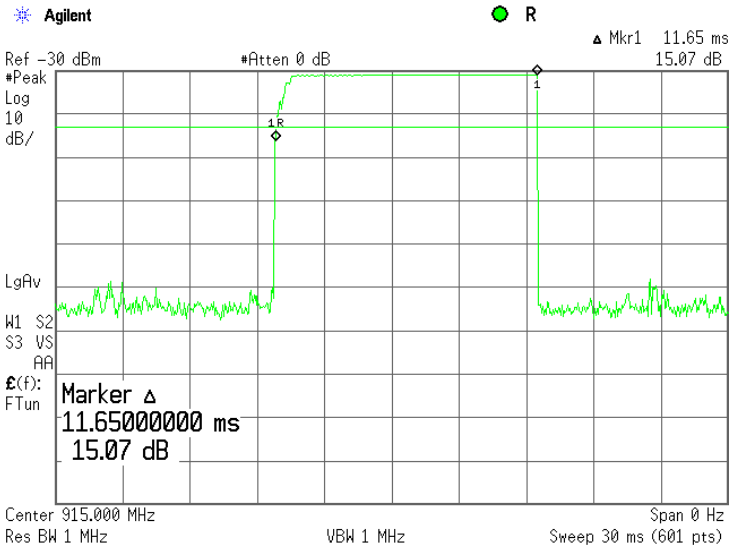


Plot 7.1.55 Transmission pulse period (supplied for test)

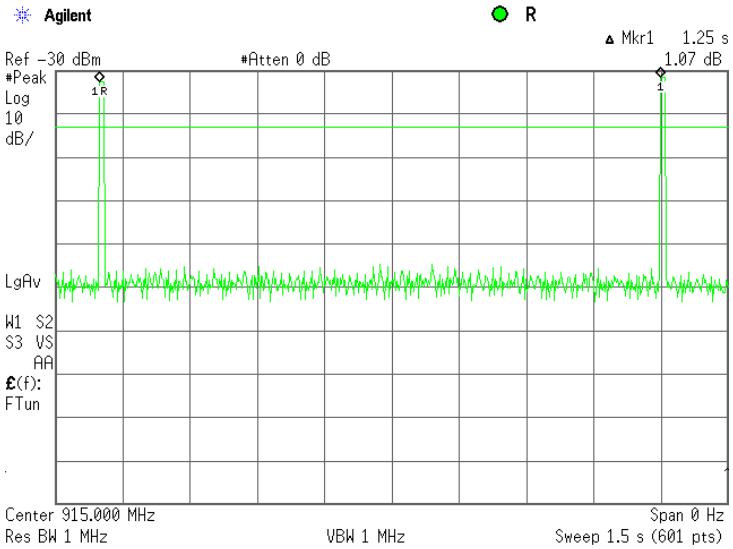


Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/25/2010 3:30:18 PM		
Temperature: 24.6 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 3.6 VDC
Remarks:			

Plot 7.1.56 Transmission pulse duration (in normal use)



Plot 7.1.57 Transmission pulse period (in normal use)



Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/17/2010 2:56:48 PM		
Temperature: 24.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 3.6 VDC
Remarks:			

7.2 Band edge emission

7.2.1 General

This test was performed to verify the EUT band edge emission including all associated side bands was attenuated at least 50 dB below the unmodulated carrier level or below the general spurious emission limit. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Band edge emission limits

Frequency band, MHz	Field strength limit at 3 m, dBµV/m		Attenuation below carrier, dBc
	Peak	QP	
902-928	NA	46	50

7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

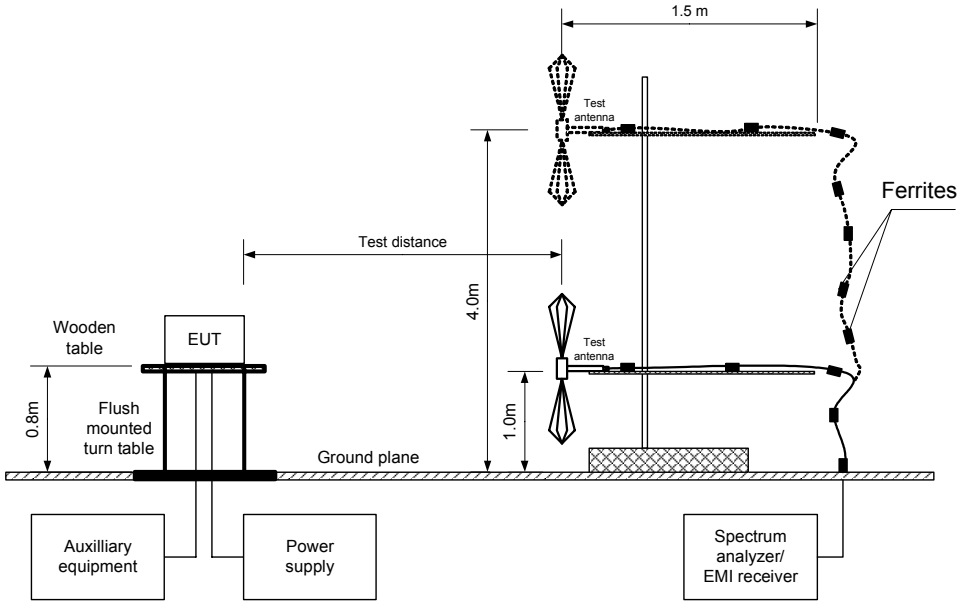
7.2.2.2 The spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.2.2.3 The frequency of modulation envelope points beyond which power level drops below the band edge emission limit was measured.

7.2.2.4 The test results were recorded in Table 7.2.2 and shown in the associated plots.

Test specification:	**Section 15.249(d), Band edge emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/17/2010 2:56:48 PM		
Temperature: 24.3 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 42 %	**Power Supply:** 3.6 VDC
Remarks:			

Figure 7.2.1 Band edge emission measurement set up



Test specification:	**Section 15.249(d), Band edge emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/17/2010 2:56:48 PM		
Temperature: 24.3 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 42 %	**Power Supply:** 3.6 VDC
Remarks:			

Table 7.2.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 120 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION: FSK
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Modulation envelope		Measured peak emission, dBµV/m	Measured QP emission, dBµV/m	QP limit, dBµV/m	Margin, dB *	Verdict
Edge	Frequency, MHz					
Low	902	64.8	42.9	46	-3.1	Pass
High	928	59.5	38.8	46	-7.2	Pass

* - Margin = measured value– limit

Reference numbers of test equipment used

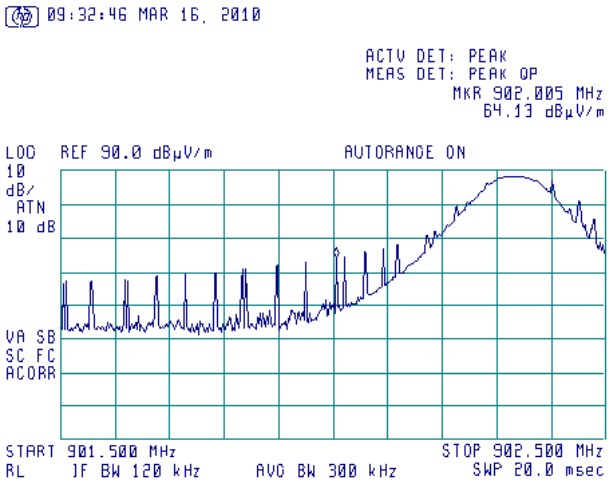
HL 0415	HL 0583	HL 0812	HL 1425				

Full description is given in Appendix A.

Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/17/2010 2:56:48 PM		
Temperature: 24.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 3.6 VDC
Remarks:			

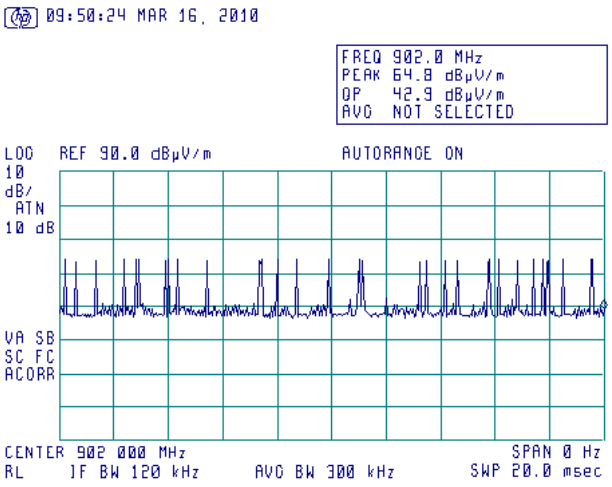
Plot 7.2.1 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical (X-axis)



Plot 7.2.2 Low band edge emission test result

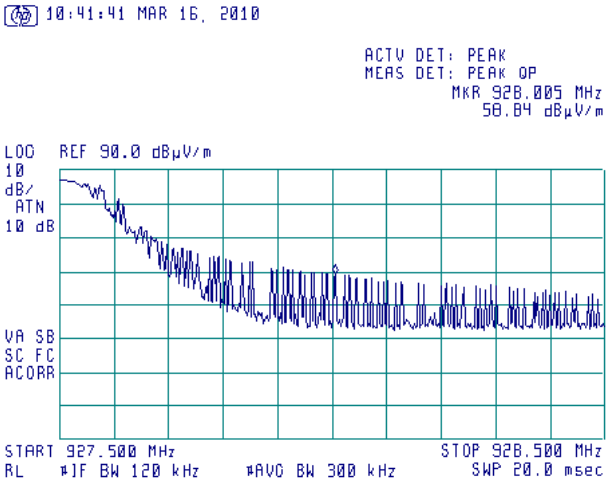
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical (X-axis)



Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/17/2010 2:56:48 PM		
Temperature: 24.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 3.6 VDC
Remarks:			

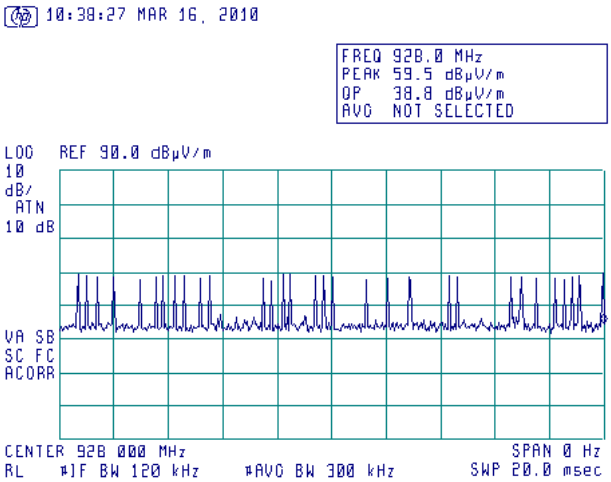
Plot 7.2.3 High band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical (X-axis)



Plot 7.2.4 High band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical (X-axis)



Test specification:	**Section 15.203, Antenna requirement**		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/17/2010 2:40:03 PM		
Temperature: 24.3 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 42 %	**Power Supply:** 3.6 VDC
Remarks:			

7.3 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.3.1.

Table 7.3.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	

Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/17/2010 3:01:02 PM		
Temperature: 24.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 3.6 VDC
Remarks:			

7.4 Occupied bandwidth test

7.4.1 General

This test was performed to verify that the 20 dB bandwidth of the emissions was contained within the standard specified frequency band according to FCC §15.215 requirements. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc
902 - 928	20.0

*- Modulation envelope reference points provided in terms of attenuation below modulated carrier.

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

7.4.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.4.2.3 The peak of emission was measured. The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.4.2 and the associated plot.

Figure 7.4.1 Occupied bandwidth test setup

Test specification:	**Section 15.215(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/17/2010 3:01:02 PM		
Temperature: 24.3 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 42 %	**Power Supply:** 3.6 VDC
Remarks:			

Table 7.4.2 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND	902-928 MHz
DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	10 kHz
VIDEO BANDWIDTH:	100 kHz
MODULATION ENVELOPE REFERENCE POINTS:	20 dBc
MODULATION:	FSK
MODULATING SIGNAL:	enable

Band edge	Cross point frequency, MHz	Frequency drift, kHz		Modulation band edge, MHz	Assigned band edge, MHz	Verdict
		Negative	Positive			
Low	902.255	NA	NA	902.255	902	Pass
High	927.635	NA	NA	927.635	928	Pass

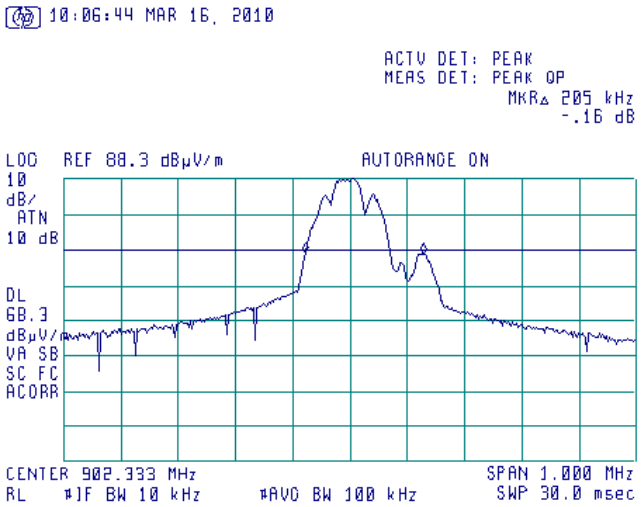
Reference numbers of test equipment used

HL 1425	HL 0583	HL 0415	HL 0812					

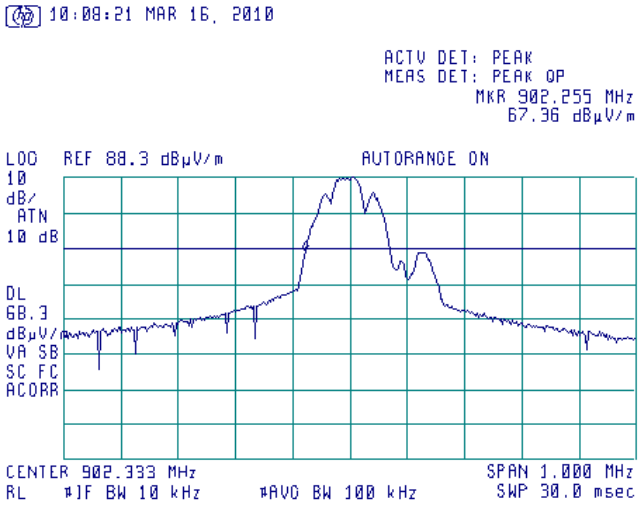
Full description is given in Appendix A.

Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/17/2010 3:01:02 PM		
Temperature: 24.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 3.6 VDC
Remarks:			

Plot 7.4.1 Occupied bandwidth test result at low channel

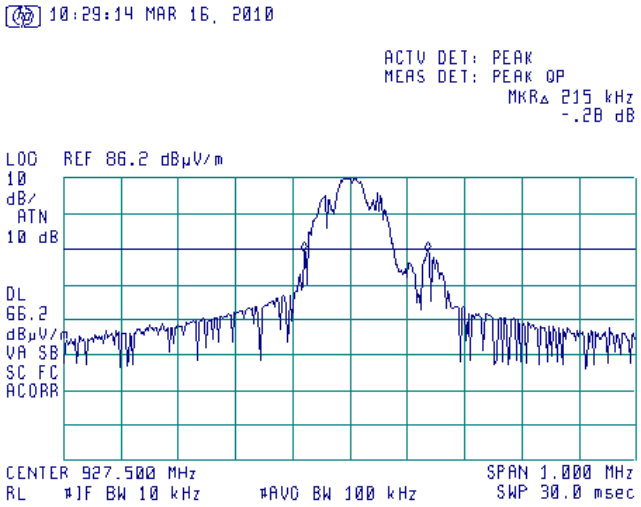


Plot 7.4.2 Occupied bandwidth test result at low channel, low edge

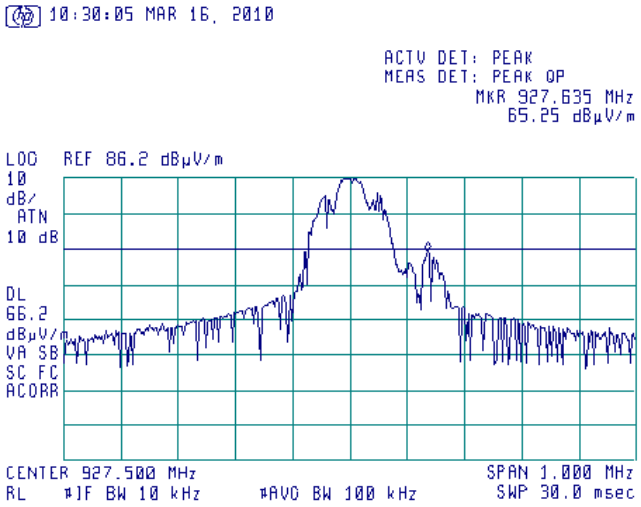


Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/17/2010 3:01:02 PM		
Temperature: 24.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 3.6 VDC
Remarks:			

Plot 7.4.3 Occupied bandwidth test result at high channel



Plot 7.4.4 Occupied bandwidth test result at high channel, high edge



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0415	Cable, Coax, RF, RG-214	Hermon Laboratories	CC-3	056	01-Dec-09	01-Dec-10
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-09	29-Jun-10
0583	Antenna, Log Periodic, 200 - 1000 MHz	Hermon Laboratories	LP 200/1000	035	23-Dec-09	23-Dec-10
0587	Load Termination 50 Ohm, 0.5 W, DC-1GHz	RELM	LT-50	096	16-Nov-09	16-Nov-10
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-10	11-Jan-11
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	Hermon Laboratories	C214-11	148	02-Dec-09	02-Dec-10
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A00222, 3705A00204	28-Aug-09	28-Aug-10
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A00262,3705A00217	31-Aug-09	31-Aug-10
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	29-Jan-10	29-Jan-11
2883	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539003	01-Dec-09	01-Dec-10
3119	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539004	29-Nov-09	29-Nov-10
3883	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out.	Agilent Technologies	87405C	MY47010406	13-Jan-10	13-Jan-11

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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11 APPENDIX D Specification references

47CFR part 15: 2009	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

12 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

Frequency, MHz	Antenna Factor, dB(1/m)	Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8	940	24.0
28	7.8	960	24.1
30	7.8	980	24.5
40	7.2	1000	24.9
60	7.1	1020	25.0
70	8.5	1040	25.2
80	9.4	1060	25.4
90	9.8	1080	25.6
100	9.7	1100	25.7
110	9.3	1120	26.0
120	8.8	1140	26.4
130	8.7	1160	27.0
140	9.2	1180	27.0
150	9.8	1200	26.7
160	10.2	1220	26.5
170	10.4	1240	26.5
180	10.4	1260	26.5
190	10.3	1280	26.6
200	10.6	1300	27.0
220	11.6	1320	27.8
240	12.4	1340	28.3
260	12.8	1360	28.2
280	13.7	1380	27.9
300	14.7	1400	27.9
320	15.2	1420	27.9
340	15.4	1440	27.8
360	16.1	1460	27.8
380	16.4	1480	28.0
400	16.6	1500	28.5
420	16.7	1520	28.9
440	17.0	1540	29.6
460	17.7	1560	29.8
480	18.1	1580	29.6
500	18.5	1600	29.5
520	19.1	1620	29.3
540	19.5	1640	29.2
560	19.8	1660	29.4
580	20.6	1680	29.6
600	21.3	1700	29.8
620	21.5	1720	30.3
640	21.2	1740	30.8
660	21.4	1760	31.1
680	21.9	1780	31.0
700	22.2	1800	30.9
720	22.2	1820	30.7
740	22.1	1840	30.6
760	22.3	1860	30.6
780	22.6	1880	30.6
800	22.7	1900	30.6
820	22.9	1920	30.7
840	23.1	1940	30.9
860	23.4	1960	31.2
880	23.8	1980	31.6
900	24.1	2000	32.0
920	24.1		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984

Frequency, MHz	Antenna factor, dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Cable loss
Cable Coaxial, RG-58/RG-214, s/n 056, HL 0415
+ Cable Coaxial, RG-214, 11.5m, s/n 148, HL 0812

No.	Frequency, MHz	Cable loss, dB	Measured uncertainty, dB
1	20	0.73	±0.12
2	30	0.91	
3	50	1.2	
4	80	1.56	
5	100	1.76	
6	200	2.59	
7	300	3.26	
8	400	3.93	
9	500	4.42	
10	600	4.92	
11	700	5.36	
12	800	5.88	
13	900	6.41	
14	1000	6.71	
15	1500	8.63	
16	2000	10.39	

Cable loss
Cable coaxial, Bird, 18 GHz, N-type, M-F, model TC-MNFN-3.0, S/N 211539 003
HL 2883

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.06	5750	1.70	12000	2.46
30	0.12	6000	1.75	12250	2.48
100	0.21	6250	1.80	12500	2.52
250	0.34	6500	1.81	12750	2.50
500	0.47	6750	1.86	13000	2.54
750	0.59	7000	1.86	13250	2.48
1000	0.67	7250	1.92	13500	2.63
1250	0.76	7500	1.96	13750	2.65
1500	0.84	7750	1.98	14000	2.72
1750	0.92	8000	2.02	14250	2.67
2000	0.98	8250	2.03	14500	2.70
2250	1.05	8500	2.05	14750	2.72
2500	1.12	8750	2.11	15000	2.79
2750	1.17	9000	2.17	15250	2.80
3000	1.22	9250	2.17	15500	2.83
3250	1.27	9500	2.20	15750	2.75
3500	1.33	9750	2.19	16000	2.82
3750	1.38	10000	2.22	16250	2.85
4000	1.42	10250	2.25	16500	2.90
4250	1.46	10500	2.30	16750	2.89
4500	1.51	10750	2.28	17000	2.88
4750	1.54	11000	2.32	17250	2.85
5000	1.59	11250	2.34	17500	2.96
5250	1.62	11500	2.39	17750	3.04
5500	1.65	11750	2.42	18000	3.04

Cable loss
Cable 18 GHz, N-type, M-F, 3 m, Bird Electronic Corp., model TC-MNFN-3.0, S/N 211539004
HL 3119

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.06	3600	1.34	7400	2.00	11200	2.48	15100	2.90
30	0.09	3700	1.36	7500	2.01	11300	2.45	15200	2.89
50	0.11	3800	1.37	7600	2.03	11400	2.51	15300	2.91
100	0.23	3900	1.39	7700	2.05	11500	2.45	15400	2.85
200	0.30	4000	1.39	7800	2.07	11600	2.49	15500	2.83
300	0.42	4100	1.42	7900	2.06	11700	2.51	15600	2.89
400	0.39	4200	1.45	8000	2.06	11800	2.50	15700	2.85
500	0.47	4300	1.47	8100	2.09	11900	2.52	15800	2.87
600	0.49	4400	1.49	8200	2.10	12000	2.48	15900	2.91
700	0.63	4500	1.51	8300	2.11	12100	2.53	16000	2.90
800	0.62	4600	1.53	8400	2.15	12200	2.54	16100	2.94
900	0.70	4700	1.55	8500	2.15	12300	2.56	16200	2.91
1000	0.70	4800	1.54	8600	2.17	12400	2.57	16300	2.96
1100	0.77	4900	1.57	8700	2.19	12500	2.57	16400	3.01
1200	0.78	5000	1.60	8800	2.20	12600	2.55	16500	3.01
1300	0.83	5100	1.60	8900	2.21	12700	2.50	16600	2.98
1400	0.86	5200	1.62	9000	2.22	12800	2.57	16700	3.00
1500	0.85	5300	1.65	9100	2.23	12900	2.57	16800	3.01
1600	0.94	5400	1.66	9200	2.25	13000	2.55	16900	3.06
1700	0.90	5500	1.69	9300	2.24	13100	2.62	17000	3.07
1800	0.90	5600	1.70	9400	2.28	13200	2.60	17100	3.09
1900	0.95	5700	1.72	9500	2.28	13300	2.67	17200	3.10
2000	0.97	5800	1.74	9600	2.27	13400	2.66	17300	3.11
2100	1.00	5900	1.75	9700	2.30	13500	2.71	17400	3.16
2200	1.02	6000	1.77	9800	2.30	13600	2.73	17500	3.15
2300	1.05	6100	1.79	9900	2.34	13700	2.73	17600	3.21
2400	1.08	6200	1.82	10000	2.32	13800	2.85	17700	3.21
2500	1.10	6300	1.83	10100	2.31	13900	2.83	17800	3.18
2600	1.13	6400	1.83	10200	2.31	14000	2.83	17900	3.25
2700	1.15	6500	1.87	10300	2.26	14100	2.83	18000	3.14
2800	1.17	6600	1.88	10400	2.32	14200	2.84		
2900	1.21	6700	1.90	10500	2.26	14300	2.90		
3000	1.22	6800	1.93	10600	2.26	14400	2.84		
3100	1.25	6900	1.92	10700	2.31	14600	2.88		
3200	1.27	7000	1.95	10800	2.24	14700	2.85		
3300	1.29	7100	1.96	10900	2.39	14800	2.92		
3400	1.28	7200	1.99	11000	2.41	14900	2.93		
3500	1.31	7300	2.00	11100	2.46	15000	2.83		

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PCB	printed circuit board
PM	pulse modulation
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere
WB	wideband

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