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Electrical

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 SUBPART I and PART 15 SUBPART B

FOR:

Motorola Communication Israel Ltd.

Automatic Meter Reader

Model: AMR

Table of contents

1 Applicant information

Client name:	Motorola Communication Israel Ltd.
Address:	3 Kremenetski street, P.O.B. 25016, 67899 Tel Aviv, Israel
Telephone:	+972 3565 8888
Fax:	+972 3565 8888
E-mail:	urishenfeld@motorola.com
Contact name:	Mr. Uri Shenfeld

2 Equipment under test attributes

Product name:	Automatic Meter Reader
Model(s):	AMR
Serial number:	WUB00091
Receipt date	7/25/2004 10:13:00 AM

3 Manufacturer information

Manufacturer name:	Motorola Communication Israel Ltd.
Address:	3 Kremenetski street, P.O.B. 25016, 67899 Tel Aviv, Israel
Telephone:	+972 3565 8888
Fax:	+972 3565 8888
E-Mail:	urishenfeld@motorola.com
Contact name:	Mr. Uri Shenfeld

4 Test details

Project ID:	16016
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started:	7/25/2004
Test completed:	8/10/2004
Test specification(s):	47CFR part 90, §§90.217(b), part 15 §15.109
Test suite:	FCC_90_BS_without_RF_connector_below_120mW (7/15/2004 12:13:08 AM, modified)

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.205, Maximum output power	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.213, Frequency stability	Pass
Section 90.214, Transient frequency behaviour	Pass
Section 90.217, Band edge emission	Pass
Section 90.217, Radiated spurious emissions	Pass
Section 2.1091, RF radiation exposure evaluation	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Not required
Section 15.109, Radiated emission	Pass
Section 15.111, Conducted emission at receiver antenna port	Not required

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:	Mr. Michael Lerman, test engineer	August 10, 2004	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	August 23, 2004	
	Mr. M. Nikishin, EMC group leader	August 25, 2004	
Approved by:	Mr. A. Usoskin, C.E.O.	August 26, 2004	

6 EUT description

6.1 General information

The EUT is a battery operated one-way UHF radio frequency device, operating in 450-470 MHz range, with primary purpose of interfacing with pulse-based meter to transmit the accumulated data. The interface is a dry-contact pulse-type (magnetic reed relay) open/close.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power	DC power	Battery	DC/DC	2 pin jack	1	Two wire	30 cm	Indoor
Power	DC power	DC/DC	EUT	NA	1	Two wire	30 cm	Indoor
Signal	Dry contact	OC	EUT	NA	5	24 AWG	40 cm	Outdoor
Signal	Antenna	OC	EUT	NA	1	Coax	20 cm	Outdoor

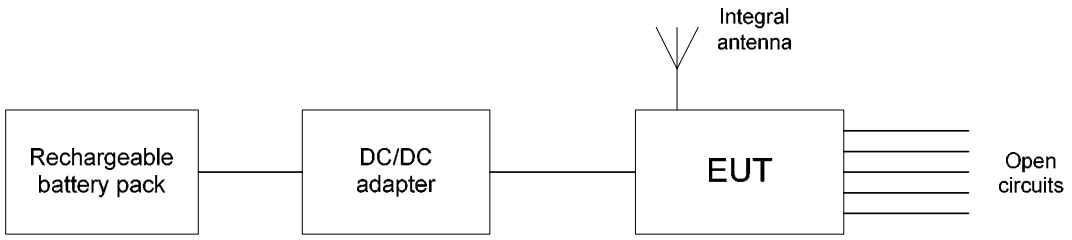
6.3 Operating frequencies

Source	Frequency, MHz
Digital portion	16.8
Transmitter	450 - 470

6.4 Changes made in the EUT

To withstand the output power test the R78 resistor was changed from 820 Ohm to 681 Ohm.

6.5 Test configuration



6.6 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					
V	mobile	Always at a distance more than 20 cm from all people					
	portable	May operate at a distance closer than 20 cm to human body					
Assigned frequency range		450 - 470 MHz					
Operating frequency range		450 - 470 MHz					
RF channel spacing		12.5 kHz					
Maximum rated output power							
		Effective radiated power (for equipment with no RF connector)				20.8 dBm	
Is transmitter output power variable?		V	No				
Antenna connection			V	integral			
					V	without temporary RF connector	
Transmitter aggregate data rate/s		1200 bps					
Transmitter aggregate symbol (baud) rate/s		600 Baud					
Type of modulation		FM					
Type of multiplexing		NA					
Modulating test signal (baseband)		PRBS					
Transmitter duty cycle supplied for test		100 %					
Transmitter power source							
V	Battery	**Nominal rated voltage**	3.2 VDC	Battery type	Lithium		
	DC	**Nominal rated voltage**					
	AC mains	**Nominal rated voltage**		Frequency			

Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 12:28:09 PM		
Temperature: 24 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 90 subpart I requirements

7.1 Effective radiated power of carrier

7.1.1 General

This test was performed to measure effective radiated power emanated by transmitter at carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Effective radiated power limit

Assigned frequency band, MHz	ERP		Equivalent field strength limit @ 3m, dB(µV/m)*
	mW	dBm	
450.0 – 470.0	120	20.8	118.18

* - Equivalent field strength limit was calculated from maximum allowed ERP as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

7.1.2 Test procedure for field strength measurements

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 field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was swept throughout the range, specified in Table 7.1.2, in both vertical and horizontal polarizations.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

7.1.3 Test procedure for substitution ERP measurements

7.1.3.1 The test equipment was set up as shown in Figure 7.1.2 and energized.

7.1.3.2 RF signal generator was set to the EUT carrier frequency and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.1.3.3 The test antenna height was swept throughout the specified in Table 7.1.2 range to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

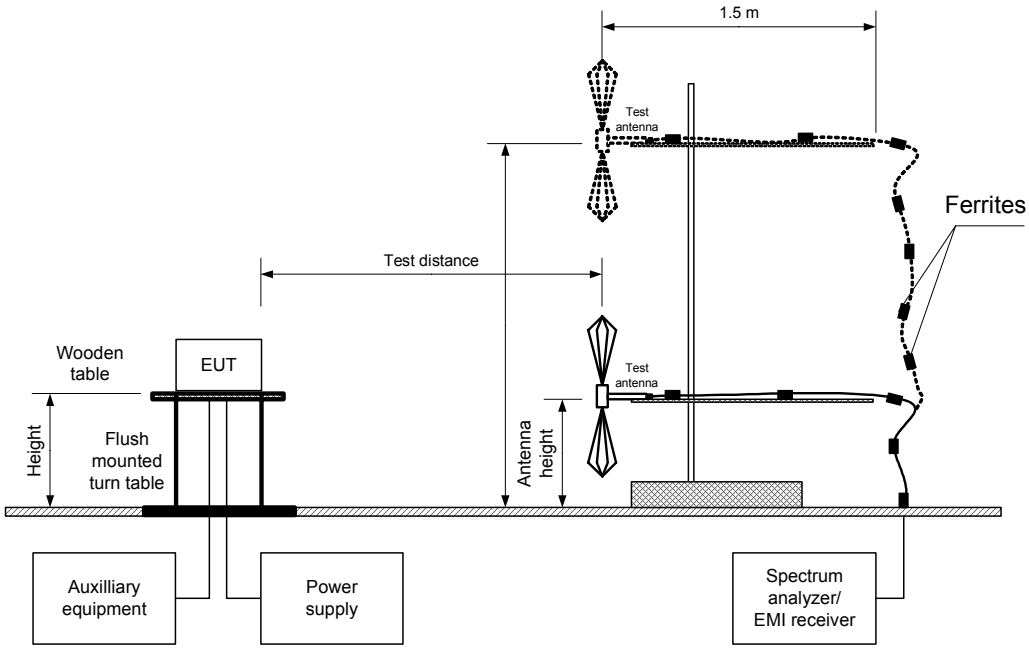
7.1.3.4 The ERP was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

7.1.3.5 The above procedure was performed in both horizontal and vertical polarizations of the test antenna.

7.1.3.6 The worst test results (the lowest margins) were recorded in Table 7.1.3 and shown in the associated plots.

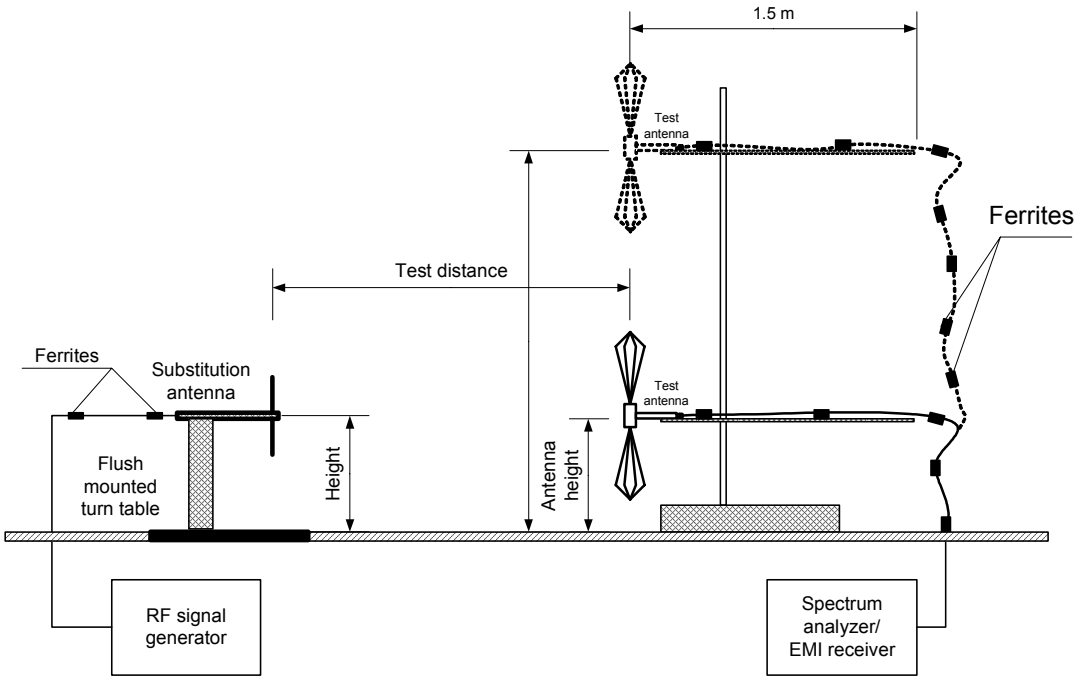
Test specification:	**Section 90.205, Maximum output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/8/2004 12:28:09 PM		
Temperature: 24 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 37 %	**Power Supply:** 3.2 VDC
Remarks:			

Figure 7.1.1 Setup for carrier field strength measurements



Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 12:28:09 PM		
Temperature: 24 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Figure 7.1.2 Setup for substitution ERP measurements



Test specification:	**Section 90.205, Maximum output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/8/2004 12:28:09 PM		
Temperature: 24 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 37 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.1.2 Transmitter carrier field strength

ASSIGNED FREQUENCY RANGE: 450 - 470 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Log periodic
MODULATION: CW
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
450.0125	121.93	118.18	3.75	120	V	1.2	358
460.0000	121.69	118.18	3.51		V	1.1	53
469.9875	120.94	118.18	2.76		V	1.2	60

*****- Margin = Field strength – calculated field strength limit.
******- EUT front panel refers to 0 degrees position of turntable.

Table 7.1.3 Transmitter carrier ERP

TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: >RBW
SUBSTITUTION ANTENNA TYPE: Tunable dipole

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
450.0125	121.93	120	V	23.45	-1.19	1.64	20.62	20.8	-0.18	Pass
460.0000	121.69		V	23.72	-0.81	1.66	20.67	20.8	-0.13	Pass
469.9875	120.94		V	22.81	-0.72	1.68	20.41	20.8	-0.39	Pass

*****- Margin = ERP – specification limit.

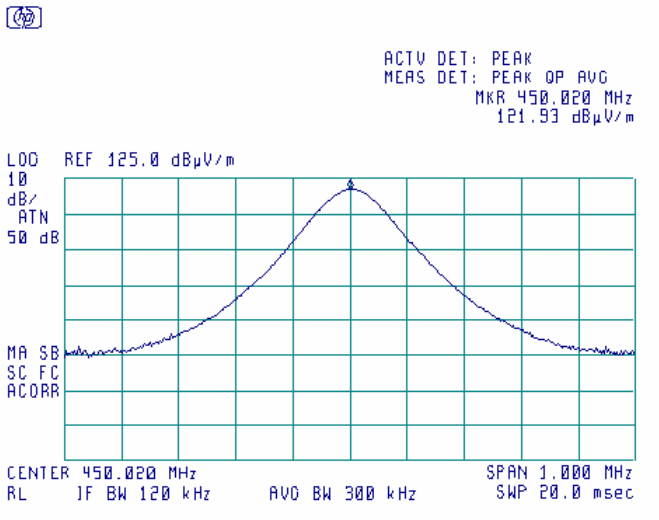
Reference numbers of test equipment used

HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 0661
HL 1947	HL 1565	HL 2400					

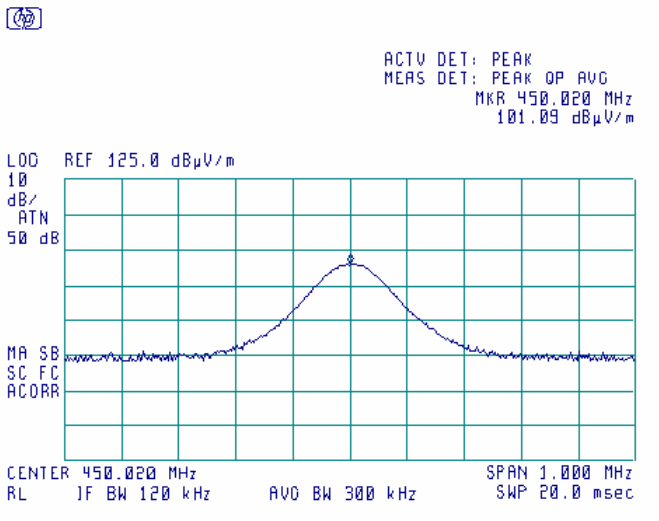
Full description is given in Appendix A.

Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 12:28:09 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.1.1 Transmitter carrier field strength at low frequency in vertical antenna polarization

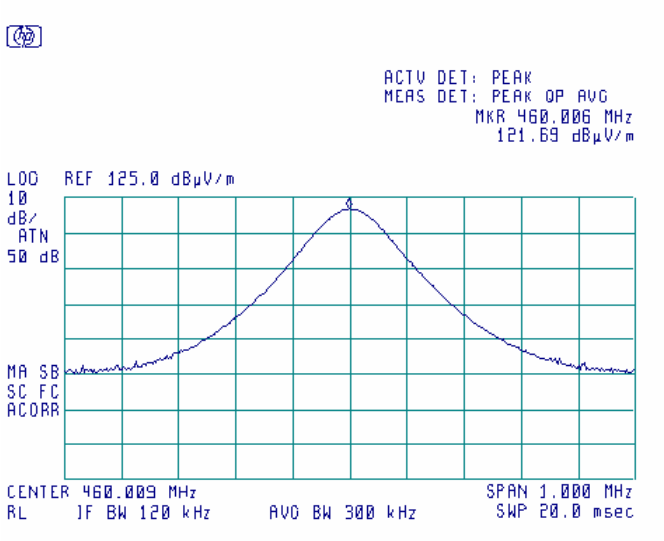


Plot 7.1.2 Transmitter carrier field strength at low frequency in horizontal antenna polarization

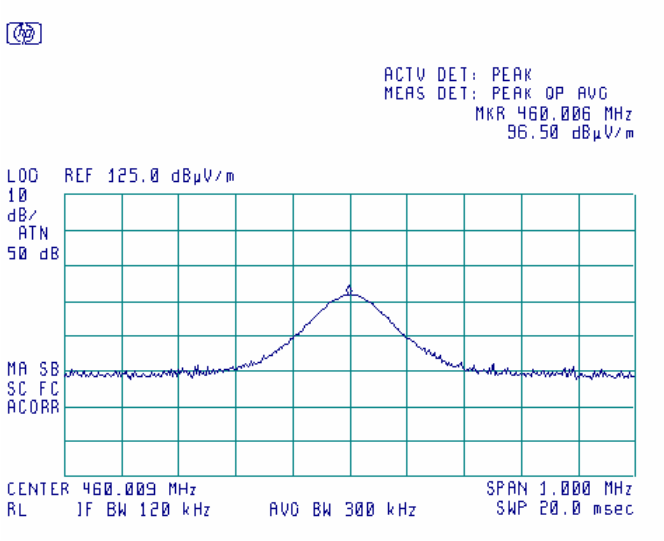


Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 12:28:09 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.1.3 Transmitter carrier field strength at mid frequency in vertical antenna polarization

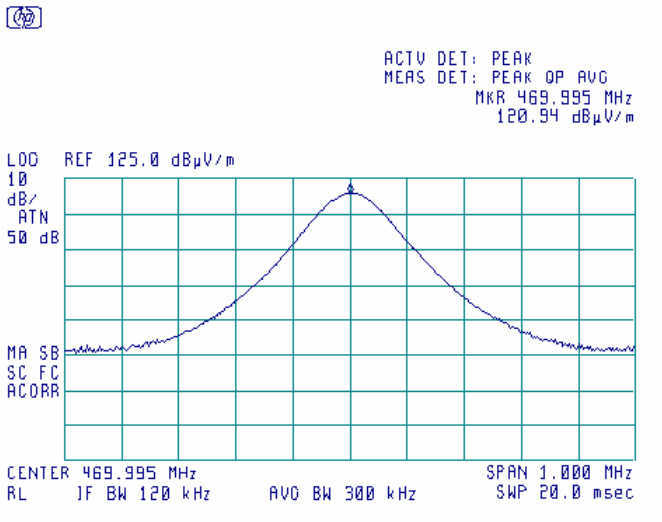


Plot 7.1.4 Transmitter carrier field strength at mid frequency in horizontal antenna polarization

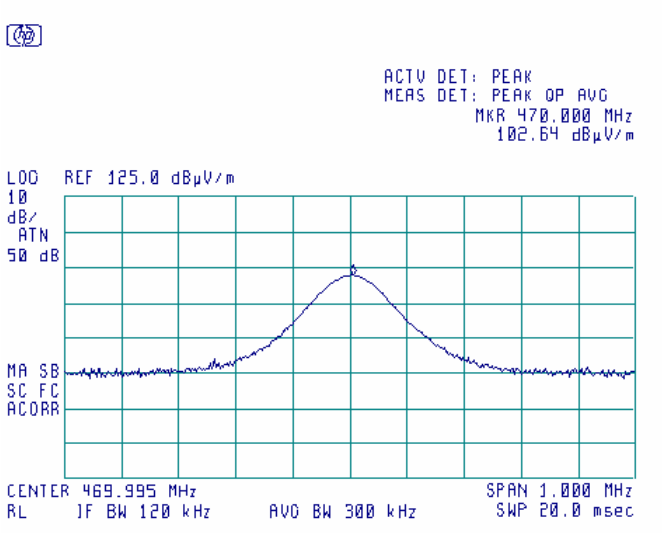


Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 12:28:09 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.1.5 Transmitter carrier field strength at high frequency in vertical antenna polarization



Plot 7.1.6 Transmitter carrier field strength at high frequency in horizontal antenna polarization



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 6:41:45 PM		
Temperature: 24 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1. The test results are provided in Table 7.2.2 and associated plots.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
450.0 – 470.0	26	11.25

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

7.2.2 Test procedure

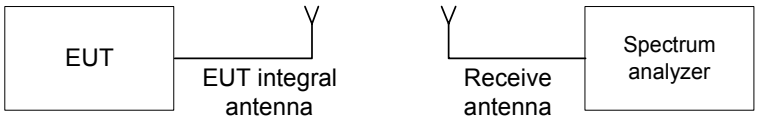
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The EUT was set to transmit unmodulated carrier and reference peak power level was measured.

7.2.2.3 The EUT was set to transmit modulated carrier.

7.2.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.2.2 and associated plot.

Figure 7.2.1 Occupied bandwidth test setup



Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/8/2004 6:41:45 PM		
Temperature: 24 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 37 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	100 Hz
VIDEO BANDWIDTH:	300 Hz
MODULATION ENVELOPE REFERENCE POINTS:	26 dBc
MODULATION:	FM
MODULATING SIGNAL:	PRBS
BIT RATE:	1200 kbps

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
450.0125	7.40	11.25	-3.85	Pass
460.0000	7.45	11.25	-3.80	Pass
469.9875	7.70	11.25	-3.55	Pass

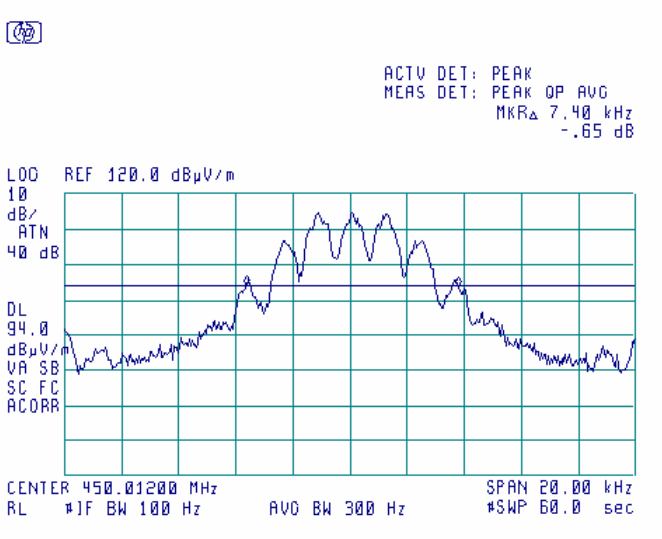
Reference numbers of test equipment used

HL 0521	HL 0589	HL 0604					

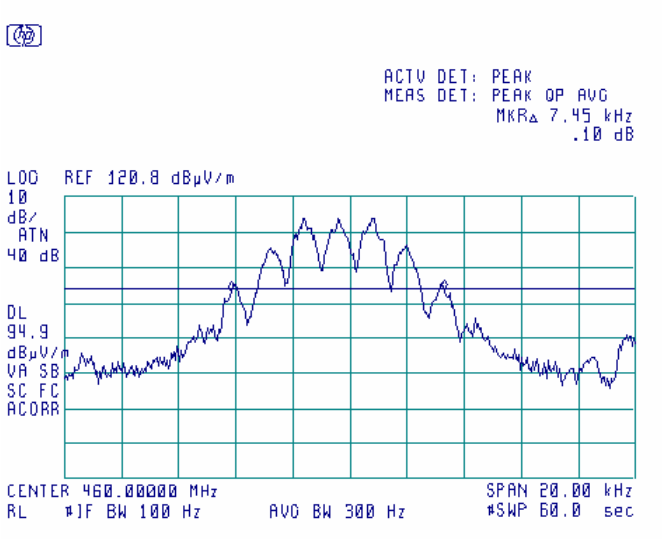
Full description is given in Appendix A.

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 6:41:45 PM		
Temperature: 24 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.2.1 Occupied bandwidth test result at low frequency

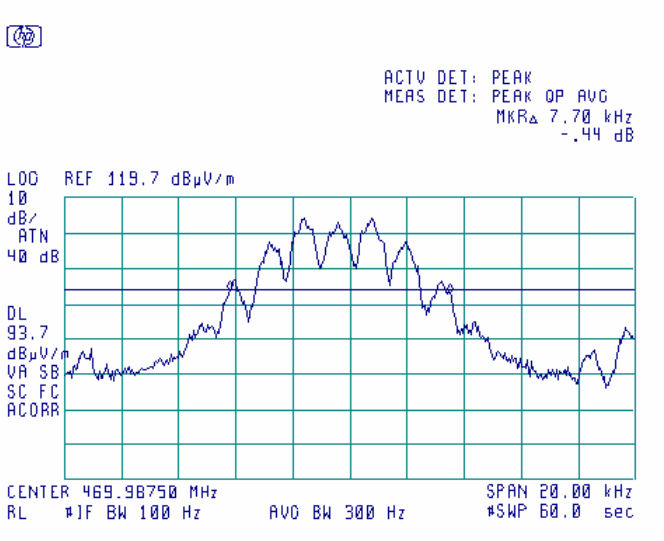


Plot 7.2.2 Occupied bandwidth test result at mid frequency



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 6:41:45 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.2.3 Occupied bandwidth test result at high frequency



Test specification:	Section 90.213, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 6:54:14 PM		
Temperature: 23 ºC	Air Pressure: 1007 hPa	Relative Humidity: 41 %	Power Supply: 3.2 VDC
Remarks:			

7.3 Frequency stability test

7.3.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.3.1. The test results are provided in Table 7.3.2.

Table 7.3.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
450.0125	1.5	675.0188
460.0000		690.0188
469.9875		704.9813

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.3.2.2 The EUT power was turned off. Temperature within test chamber was set to +30˚C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.

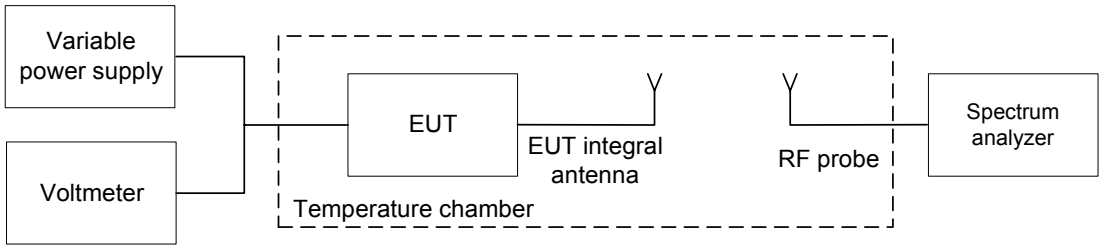
7.3.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

7.3.2.4 The above procedure was repeated at 0˚C and at the lowest test temperature.

7.3.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.

7.3.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.3.2.

Figure 7.3.1 Frequency stability test setup



Test specification:	**Section 90.213, Frequency stability**		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/8/2004 6:54:14 PM		
Temperature: 23 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 41 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.3.2 Frequency stability test results

OPERATING FREQUENCY:	450 – 470 MHz
NOMINAL POWER VOLTAGE:	3.2 V
TEMPERATURE STABILIZATION PERIOD:	20 min
POWER DURING TEMPERATURE TRANSITION:	Off
SPECTRUM ANALYZER MODE:	Counter
RESOLUTION BANDWIDTH:	10 Hz
VIDEO BANDWIDTH:	30 Hz
MODULATION:	Unmodulated

T, ºC	Voltage, V	Frequency, MHz					Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	1st min	2nd min	5th min	10th min	Positive	Negative			
Low frequency											
-30	nominal	450.011982	450.011997	450.011999	450.011999	450.012000	1	3		-672	Pass
-20	nominal	450.011953	NA	NA	NA	450.011961	42	50		-625	Pass
-10	nominal	450.011984	NA	NA	NA	450.011989	14	19		-656	Pass
0	nominal	450.011973	450.011969	450.011971	450.011969	450.011971	30	32		-643	Pass
10	nominal	450.011950	NA	NA	NA	450.011960	43	53		-622	Pass
20	+15%	450.012001	NA	NA	NA	450.012003	0	2	675	-673	Pass
20	nominal	450.011994	NA	NA	NA	450.012003*	0	0		0	Pass
20	-15%	450.011892	NA	NA	NA	450.011783	110	220		-455	Pass
30	nominal	450.011780	450.011778	450.011775	450.011773	450.011770	230	233		-442	Pass
40	nominal	450.012020	NA	NA	NA	450.012023	20	17		-692	Pass
50	nominal	450.012010	NA	NA	NA	450.011991	7	12		-663	Pass
Mid frequency											
-30	nominal	469.9865	469.986984	469.986986	469.986993	469.986987	13	7		-697	Pass
-20	nominal	469.986545	NA	NA	NA	469.986887	93	93		-597	Pass
-10	nominal	469.986713	NA	NA	NA	469.986981	1	1		-691	Pass
0	nominal	469.986715	469.986987	469.986988	469.986991	469.986982	12	2		-692	Pass
10	nominal	469.986981	NA	NA	NA	469.986988	8	8		-698	Pass
20	+15%	469.98698	NA	NA	NA	469.986979	0	1	690	-689	Pass
20	nominal	469.987021	NA	NA	NA	469.98698*	0	0		0	Pass
20	-15%	469.98698	NA	NA	NA	469.986982	2	2		-692	Pass
30	nominal	469.986998	469.987001	469.987001	469.987002	469.987003	23	23		-713	Pass
40	nominal	469.986989	NA	NA	NA	469.987000	20	20		-710	Pass
50	nominal	469.986987	NA	NA	NA	469.986999	19	19		-709	Pass
High frequency											
-30	nominal	459.999513	459.999497	459.999497	459.999493	459.999492	23	2		-707	Pass
-20	nominal	459.999542	NA	NA	NA	459.999453	52	37		-668	Pass
-10	nominal	459.999554	NA	NA	NA	459.999499	64	9		-714	Pass
0	nominal	459.999521	459.99952	459.999515	459.99951	459.999508	31	18		-723	Pass
10	nominal	459.999542	NA	NA	NA	459.999501	52	11		-716	Pass
20	+15%	459.999484	NA	NA	NA	459.999489	1	1	705	-704	Pass
20	nominal	459.999491	NA	NA	NA	459.99949*	0	0		0	Pass
20	-15%	459.99949	NA	NA	NA	459.999492	2	2		-707	Pass
30	nominal	459.999508	459.999512	459.999514	459.999515	459.999515	25	25		-730	Pass
40	nominal	459.999517	NA	NA	NA	459.999515	27	25		-730	Pass
50	nominal	459.999516	NA	NA	NA	459.999521	31	31		-736	Pass

* - Reference frequency

Reference numbers of test equipment used

HL 0337	HL 0493	HL 0808	HL 2358				

Full description is given in Appendix A.

Test specification:	Section 90.214, Transient frequency behaviour		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 10:18:09 AM		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

7.4 Transient frequency behaviour test

7.4.1 General

This test was performed to measure carrier frequency drift as function of time during transmitter start up and shut down. Specification test limits are given in Table 7.4.1. The test results are provided in the associated plots.

Table 7.4.1 Transient frequency limits

Channel bandwidth, kHz	Carrier frequency tolerance, kHz	Duration, ms	Time interval*
25.0	± 25.0	5.0	t_1
	± 12.5	20.0	t_2
	± 25.0	5.0	t_3
12.5	± 12.5	5.0	t_1
	± 6.25	20.0	t_2
	± 12.5	5.0	t_3
6.25	± 6.25	5.0	t_1
	± 3.125	20.0	t_2
	± 6.25	5.0	t_3

* - t_{on} is the instant when a 1 kHz test signal is completely suppressed;
t_1 is the time period immediately following t_{on};
t_2 is the time period immediately following t_1;
t_3 is the time period from the instant when the transmitter is turned off until t_{off};
t_{off} is the instant when the 1 kHz test signal starts to rise.

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. Variable attenuator was adjusted to provide signal level approximately 40 dB below the FM receiver maximum allowed level as measured with RF power meter. The EUT was turned off.

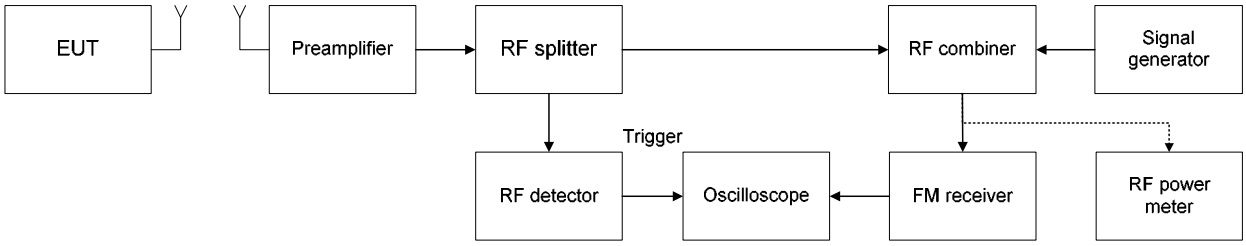
7.4.2.2 The signal generator was set to the assigned transmitter frequency modulated with 1 kHz tone at 25 kHz deviation and the output power was adjusted to provide the same as the EUT signal level at the FM receiver input as measured with power meter.

7.4.2.3 The storage oscilloscope was set to provide horizontal sweep rate 10 milliseconds per division. Amplitude control of the storage oscilloscope was adjusted to obtain 1 kHz sinusoidal signal vertically centered with ± 4 divisions amplitude.

7.4.2.4 The variable attenuator was adjusted to increase RF level supplied to splitter by 30 dB and the EUT was consequently turned on and off. Transient frequency during power switching was captured and shown in the associated plots.

Test specification:	**Section 90.214, Transient frequency behaviour**		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/8/2004 10:18:09 AM		
Temperature: 24 ºC	**Air Pressure:** 1005 hPa	**Relative Humidity:** 37 %	**Power Supply:** 3.2 VDC
Remarks:			

Figure 7.4.1 Transient frequency test setup



Test specification:	**Section 90.214, Transient frequency behaviour**		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/8/2004 10:18:09 AM		
Temperature: 24 ºC	**Air Pressure:** 1005 hPa	**Relative Humidity:** 37 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.4.2 Transient frequency behaviour test results

Carrier frequency, MHz	Time interval	Duration, ms	Frequency tolerance, kHz	Limit, kHz	Margin, kHz	Verdict
Channel bandwidth 12.5 kHz						
450.0125	t_1	5.0	1.096	± 12.5	-11.404	Pass
	t_2	20.0	0.513	± 6.25	-7.737	
	t_3	5.0	8.697	± 12.5	-3.801	
460.000	t_1	5.0	0.700	± 12.5	11.800	Pass
	t_2	20.0	0.583	± 6.25	-5.667	
	t_3	5.0	10.541	± 12.5	-1.956	
469.9875	t_1	5.0	1.399	± 12.5	-11.101	Pass
	t_2	20.0	0.653	± 6.25	-5.597	
	t_3	5.0	0.770	± 12.5	-10.480	

Reference numbers of test equipment used

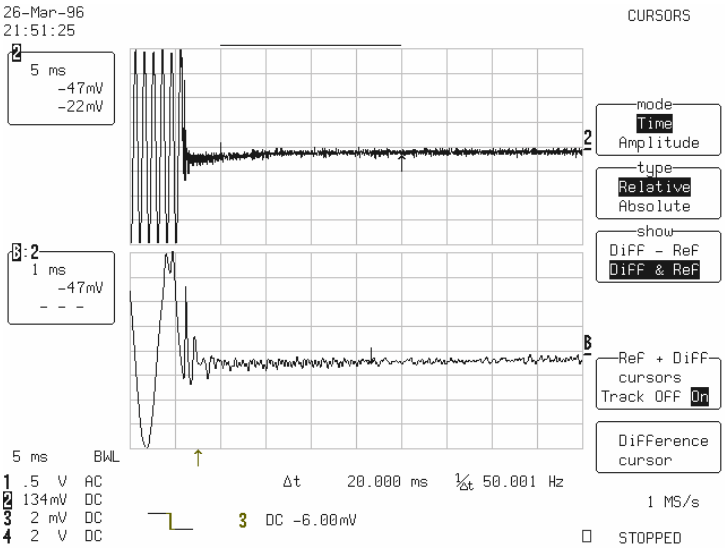
F	HL 0557	HL 0670	HL 0788	HL 0808	HL 1519	HL 1523	HL 1556	HL 1907
u	HL 2227							

F

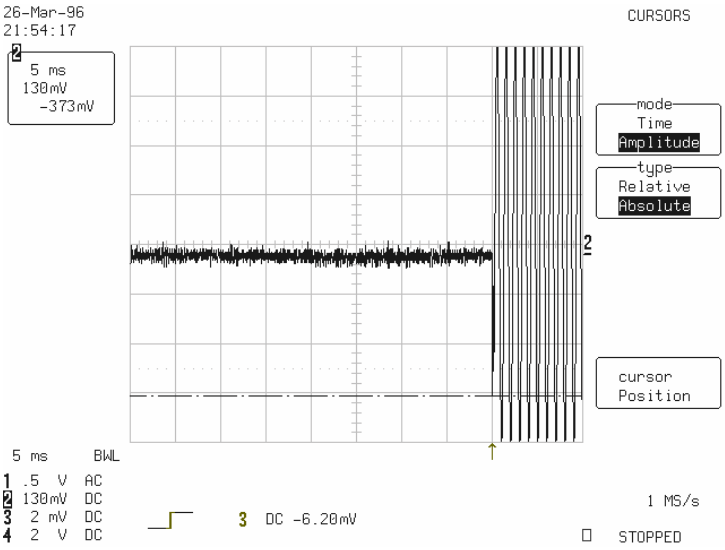
ull description is given in Appendix A.

Test specification:	Section 90.214, Transient frequency behaviour		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 10:18:09 AM		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.4.1 Transient frequency during power ON test results at low carrier frequency

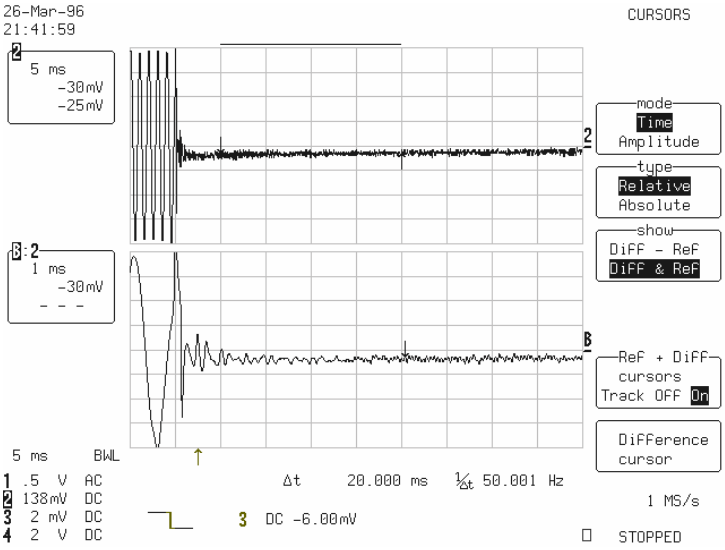


Plot 7.4.2 Transient frequency during power OFF test results at low carrier frequency

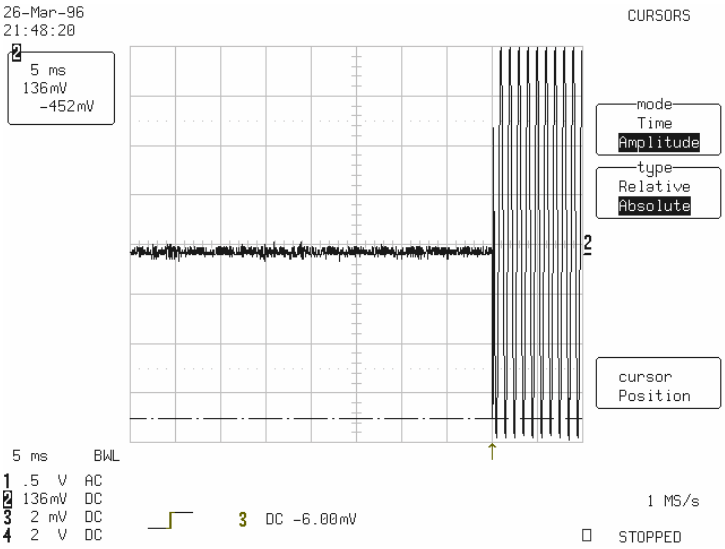


Test specification:	Section 90.214, Transient frequency behaviour		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 10:18:09 AM		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.4.3 Transient frequency during power ON test results at mid carrier frequency

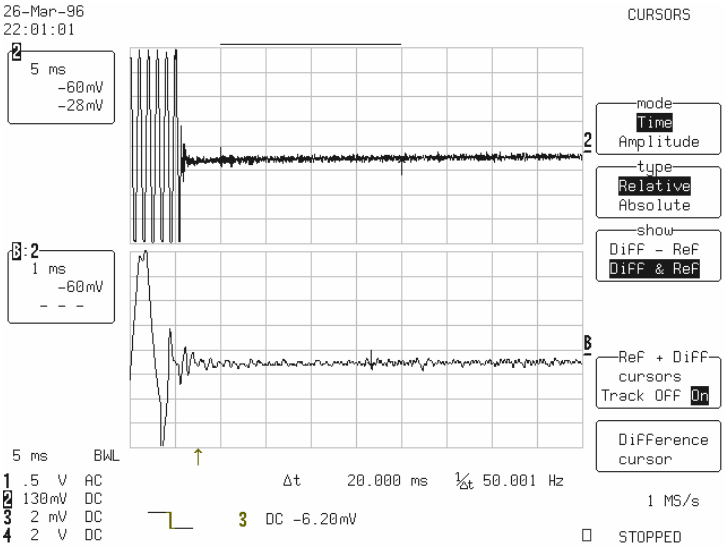


Plot 7.4.4 Transient frequency during power OFF test results at mid carrier frequency

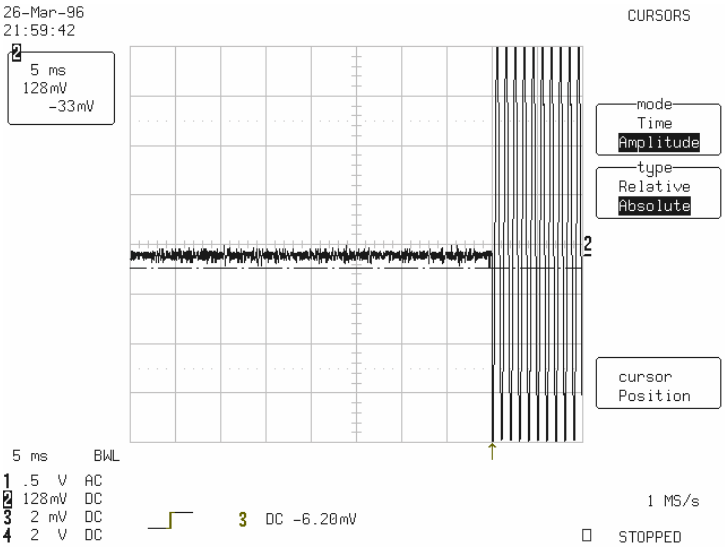


Test specification:	Section 90.214, Transient frequency behaviour		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2004 10:18:09 AM		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 37 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.4.5 Transient frequency during power ON test results at high carrier frequency



Plot 7.4.6 Transient frequency during power OFF test results at high carrier frequency



Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:19:37 PM		
Temperature: 23 ºC	Air Pressure: 1006 hPa	Relative Humidity: 40 %	Power Supply: 3.2 VDC
Remarks:			

7.5 Band edge emission

7.5.1 General

This test was performed to verify the EUT band edge emission including all associated side bands and frequency drift under extreme test conditions was attenuated at least 30 dB below the unmodulated carrier level. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Band edge emission limits

Band edge frequency shift from carrier, kHz	Channel bandwidth, kHz	Attenuation below carrier, dBc
± 40.0	25.0	30
± 25.0	12.5	30
± 12.5	6.25	30

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.

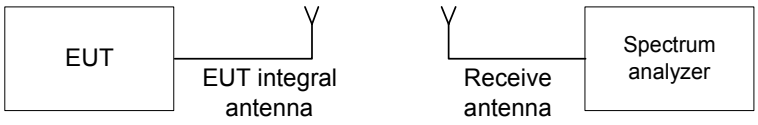
7.5.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

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

7.5.2.4 The total bandwidth was calculated by adding of the negative frequency drift to the lower measured frequency and the positive frequency drift to the higher measured frequency. The obtained bandwidth was verified to be within the allowed frequency range.

7.5.2.5 The test results were recorded in Table 7.5.2 and shown in the associated plots.

Figure 7.5.1 Band edge emission measurement set up



Test specification:	**Section 90.217, Band edge emission**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/5/2004 5:19:37 PM		
Temperature: 23 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 40 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.5.2 Band edge emission test results

OPERATING FREQUENCY RANGE: 450 – 470 MHz
DETECTOR USED: Peak hold
SWEEP RATE: 2 kHz/s
RESOLUTION BANDWIDTH: 100 Hz
VIDEO BANDWIDTH: 300 Hz
MODULATION: FM
MODULATING SIGNAL: PRBS
BIT RATE: 1200 bps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
ATTENUATION BELOW CARRIER: 30 dBc

Band edge	Measured frequency, MHz*	Frequency drift, Hz		Band edge frequency, MHz**	Band edge limit, MHz	Margin, kHz***	Verdict
		Negative	Positive				
Low carrier frequency							
Low	450.0083	230	-	450.00807	450.00625	-0.001820	Pass
High	450.0162	-	233	450.01643	450.01875	0.002317	Pass
Mid carrier frequency							
Low	459.9955	93	-	459.99541	459.99375	-0.001657	Pass
High	460.0037	-	93	460.00379	460.00625	0.002457	Pass
High carrier frequency							
Low	469.9832	37	-	469.98316	469.98125	-0.001913	Pass
High	469.9912	-	64	469.99126	469.99375	0.002486	Pass

* - Measured frequency beyond which the emission level is attenuated at least 30 dB below the unmodulated carrier
** - Band edge frequency = Measured frequency + Frequency drift under extreme conditions
*** - Margin = Band edge limit – Band edge frequency

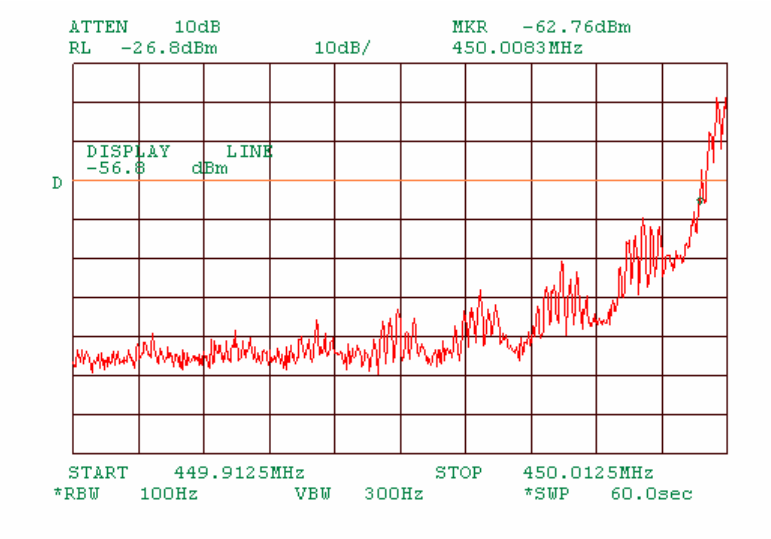
Reference numbers of test equipment used

HL 0337	HL 1424	HL 1536	HL 2524				

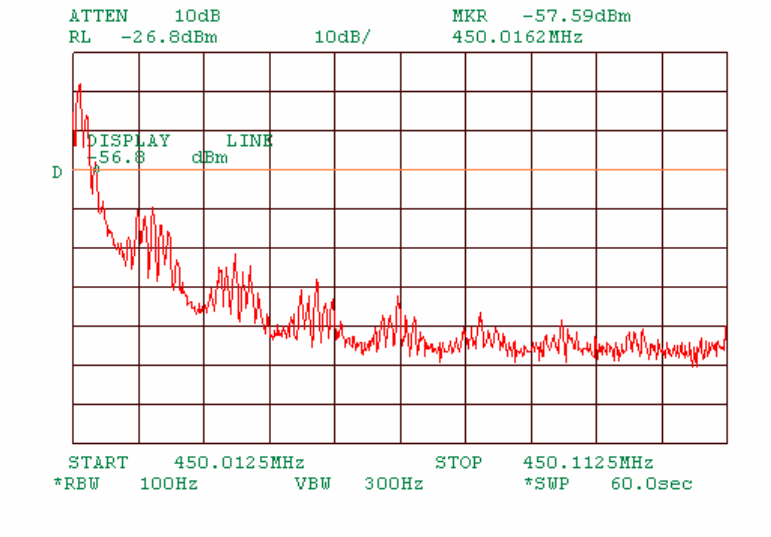
Full description is given in Appendix A.

Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:19:37 PM		
Temperature: 23 ºC	Air Pressure: 1006 hPa	Relative Humidity: 40 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.5.1 Band edge emission test results at low carrier frequency low side

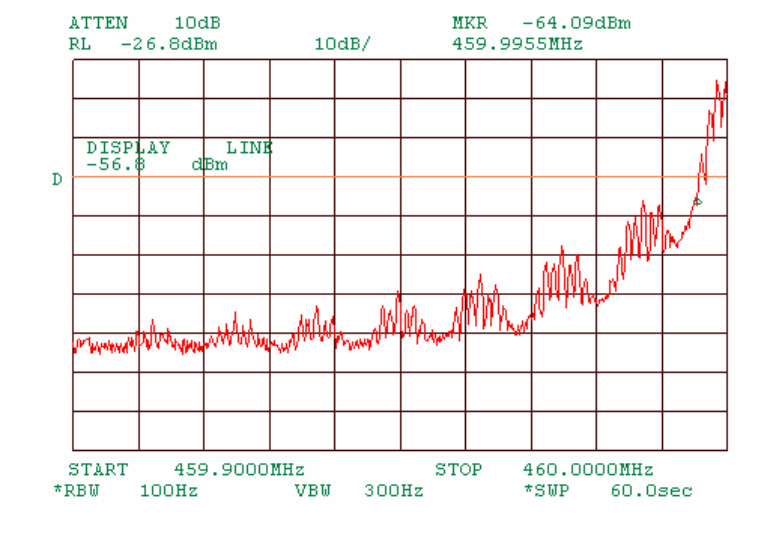


Plot 7.5.2 Band edge emission test results at low carrier frequency high side

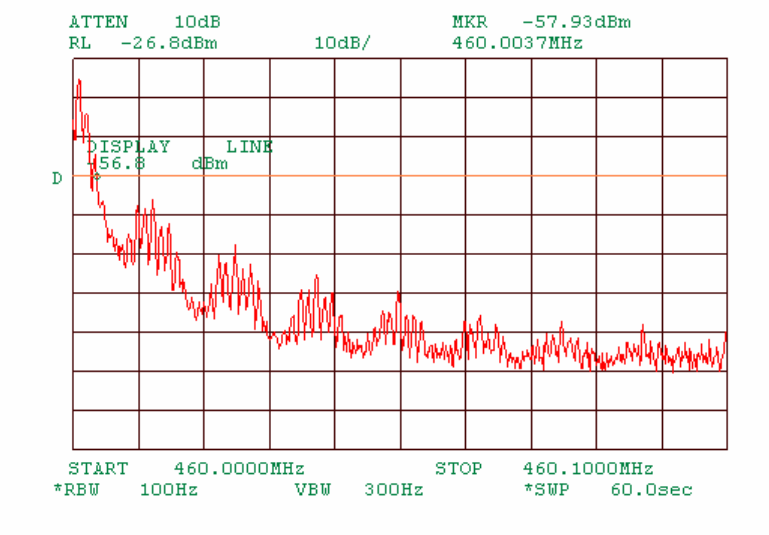


Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:19:37 PM		
Temperature: 23 ºC	Air Pressure: 1006 hPa	Relative Humidity: 40 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.5.3 Band edge emission test results at mid carrier frequency low side

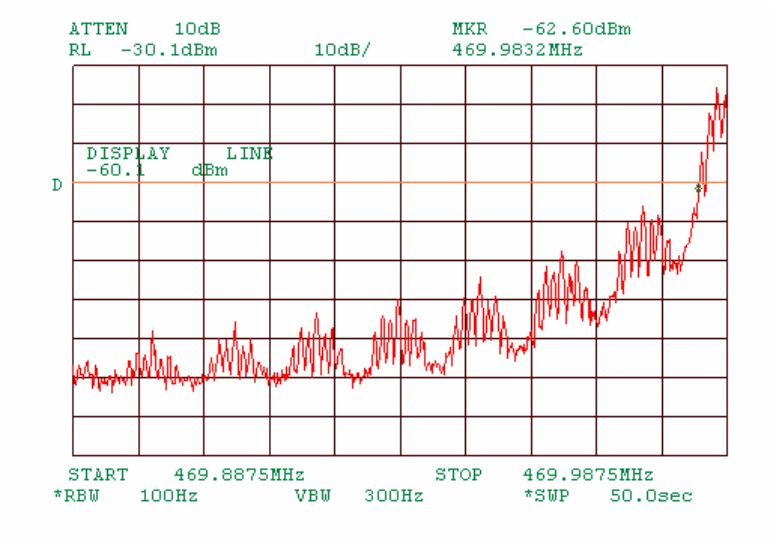


Plot 7.5.4 Band edge emission test results at mid carrier frequency high side

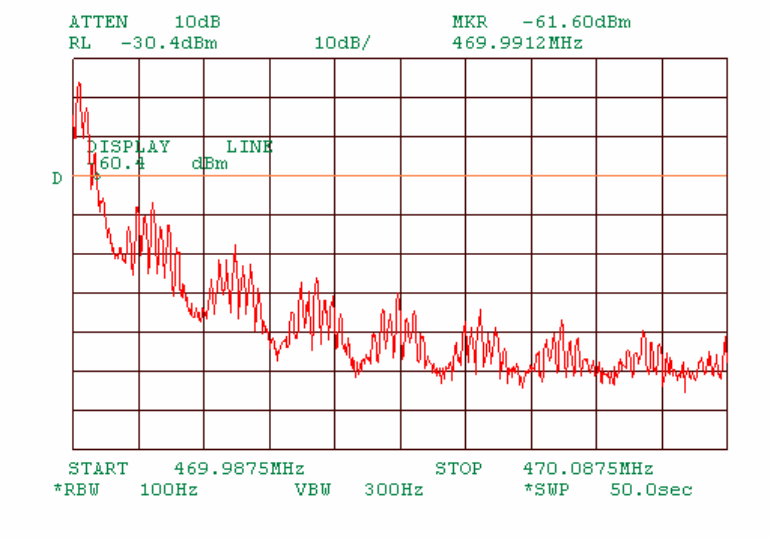


Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:19:37 PM		
Temperature: 23 ºC	Air Pressure: 1006 hPa	Relative Humidity: 40 %	Power Supply: 3.2 VDC
Remarks:			

Plot 7.5.5 Band edge emission test results at high carrier frequency low side



Plot 7.5.6 Band edge emission test results at high carrier frequency high side



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

7.6 Radiated spurious emission measurements

7.6.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of carrier, dBm	Equivalent field strength limit @ 3m, dB(µV/m)**
0.009 – 10th harmonic*	30	20.67	93.08

* - spurious emission limits do not apply to the in band emission within:
± 40 kHz from the carrier for equipment designed to operate with 25 kHz channel bandwidth
± 25 kHz from the carrier for equipment designed to operate with 12.5 kHz channel bandwidth
± 12.5 kHz from the carrier for equipment designed to operate with 6.25 kHz channel bandwidth

** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and the performance check was conducted.

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

7.6.2.3 The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

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

7.6.3.1 The EUT was set up as shown in Figure 7.6.2, energized and the performance check was conducted.

7.6.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.6.3.3 The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

7.6.4 Test procedure for substitution ERP measurements of spurious

7.6.4.1 The test equipment was set up as shown in Figure 7.6.3 and energized.

7.6.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.6.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.6.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

7.6.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

7.6.4.6 The above procedure was repeated at the rest of investigated frequencies.

7.6.4.7 The worst test results (the lowest margins) were recorded in Table 7.6.3 and shown in the associated plots.

Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

Figure 7.6.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

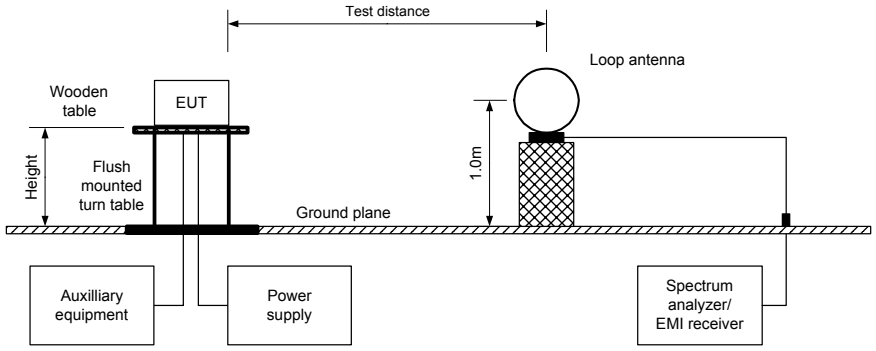
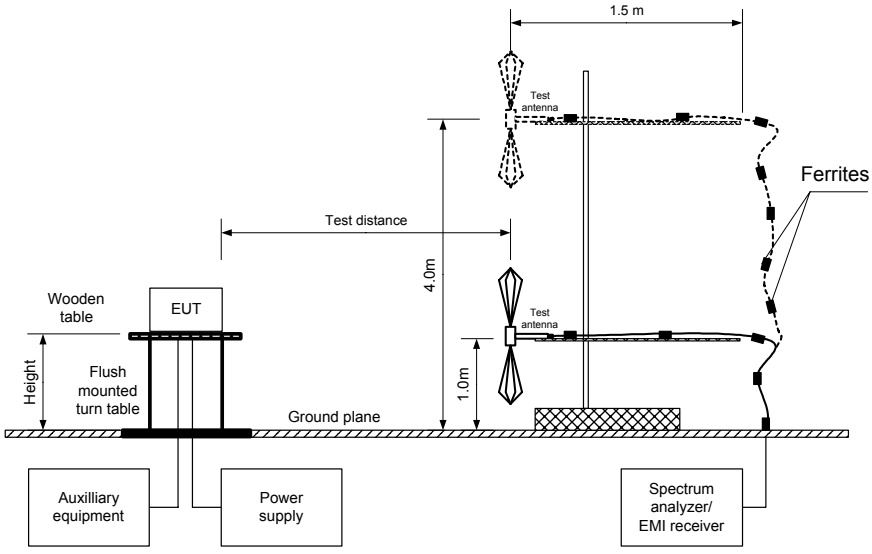
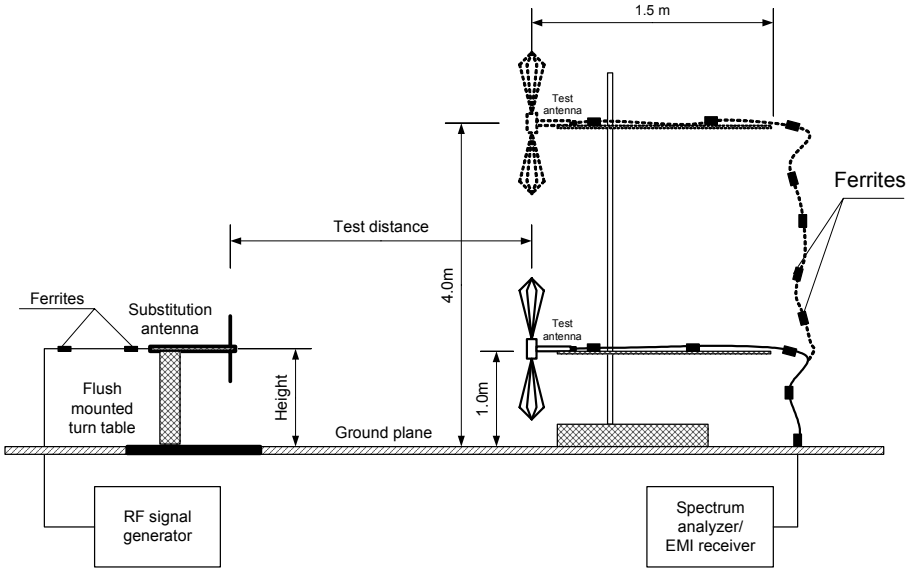


Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

Figure 7.6.3 Setup for substitution ERP measurements of spurious



Test specification:	**Section 90.217, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 39 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.6.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 450 - 470 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 5000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconical (30 MHz – 200 MHz)
Log periodic (200 MHz – 1000 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: FM
MODULATING SIGNAL: Pseudo random
BIT RATE: 1200 bps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency MHz							
900.038000	55.30	82.23	-26.93	120	V	1.1	135
1350.048575	49.79	82.23	-32.44	1000	V	1.1	100
1800.052316	54.14	82.23	-28.09	1000	H	1.7	70
2250.085628	55.75	82.23	-26.48	1000	V	1.3	47
2700.070793	55.59	82.23	-26.64	1000	V	1.3	20
3150.081562	42.71	82.23	-39.52	1000	H	1.3	66
3600.097500	41.93	82.23	-40.30	1000	V	1.0	55
Mid carrier frequency MHz							
920.011063	54.66	82.23	-27.57	120	V	1.0	343
1380.017560	50.47	82.23	-31.76	1000	V	1.1	91
2759.992344	58.10	82.23	-24.13	1000	V	1.0	276
3220.062683	42.44	82.23	-39.79	1000	V	1.5	262
3680.022479	56.73	82.23	-25.50	1000	V	1.7	263
High carrier frequency MHz							
939.987500	58.06	82.23	-24.17	120	V	1.0	230
1409.958000	50.52	82.23	-31.71	1000	H	1.0	183
1879.967770	51.99	82.23	-30.24	1000	H	1.3	200
2349.956094	56.06	82.23	-26.17	1000	H	1.3	200
2819.999035	55.14	82.23	-27.09	1000	V	1.1	290
3289.905744	42.39	82.23	-39.84	1000	V	1	204

*****- Margin = Field strength of spurious – calculated field strength limit.
******- EUT front panel refers to 0 degrees position of turntable.

Test specification:	**Section 90.217, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 39 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.6.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 450 -470 MHz
TRANSMITTER CARRIER ERP: 20.62 dBm at low frequency
20.67 dBm at mid frequency
20.41 dBm at high frequency
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(µV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency											
900.03800	55.3	120	V	-38.57	-0.47	2.98	-39.99	59.99	30.00	29.99	PASS
1350.04857	49.79	1000	V	-51.81	4.64	3.25	-43.10	63.10	30.00	33.10	PASS
1800.05231	54.14	1000	H	-46.84	4.05	3.88	-37.66	57.66	30.00	27.66	PASS
2250.08562	55.75	1000	V	-43.95	4.65	2.94	-38.71	58.71	30.00	28.71	PASS
2700.07079	55.59	1000	V	-44.43	5.39	3.22	-40.00	60.00	30.00	30.00	PASS
3150.08156	42.71	1000	H	-55.23	6.11	5.59	-52.67	72.67	30.00	42.67	PASS
3600.09750	41.93	1000	V	-55.39	5.79	6.14	-53.59	73.59	30.00	43.59	PASS
Mid carrier frequency											
920.011063	54.66	120	V	-39.21	0.31	2.93	-39.92	59.92	30.00	29.92	PASS
1380.01756	50.47	1000	V	-51.13	4.74	3.30	-42.52	62.52	30.00	32.52	PASS
2759.99234	58.1	1000	V	-41.92	5.52	3.65	-37.44	57.44	30.00	27.44	PASS
3220.06268	42.44	1000	V	-55.50	6.14	5.68	-52.96	72.96	30.00	42.96	PASS
3680.02247	56.73	1000	V	-40.59	5.42	6.23	-38.80	58.80	30.00	28.80	PASS
High carrier frequency											
939.98750	58.06	120	V	-35.81	1.10	2.88	-35.81	55.81	30.00	25.81	PASS
1409.95800	50.52	1000	H	-51.08	4.84	3.34	-42.56	62.56	30.00	32.56	PASS
1879.96777	51.99	1000	H	-48.99	4.21	3.64	-40.26	60.26	30.00	30.26	PASS
2349.95609	56.06	1000	H	-43.64	4.77	2.48	-38.92	58.92	30.00	28.92	PASS
2819.99903	55.14	1000	V	-44.88	5.65	4.09	-40.35	60.35	30.00	30.35	PASS
3289.90574	42.39	1000	V	-55.55	6.17	5.77	-53.04	73.04	30.00	43.04	PASS

*****- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

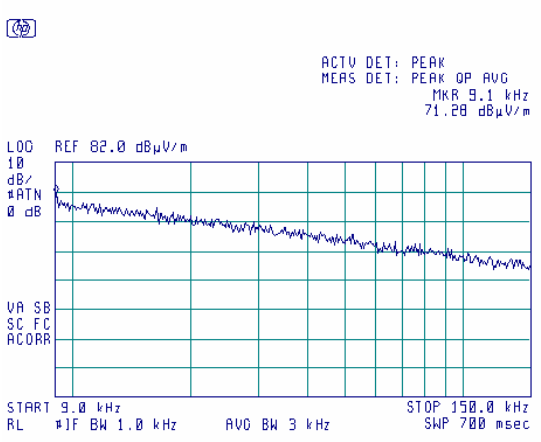
HL 0446	HL 0521	HL 0581	HL 0604	HL 0614	HL 1947	HL 1984	HL 2009

Full description is given in Appendix A.

Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

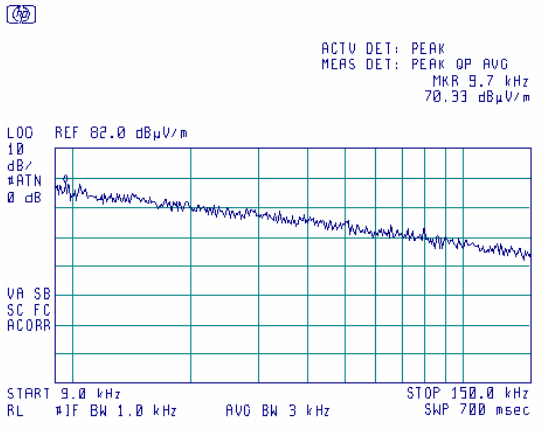
Plot 7.6.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.6.2 Radiated emission measurements in 9 - 150 kHz range

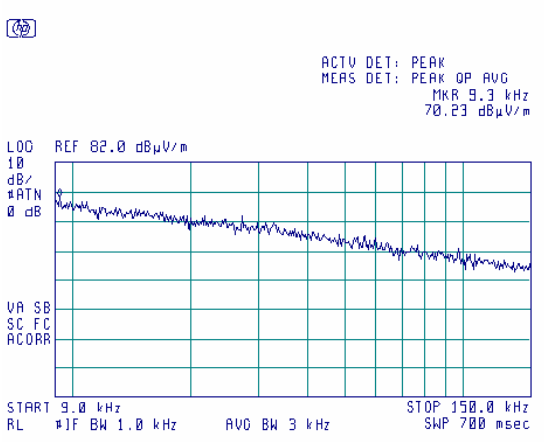
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

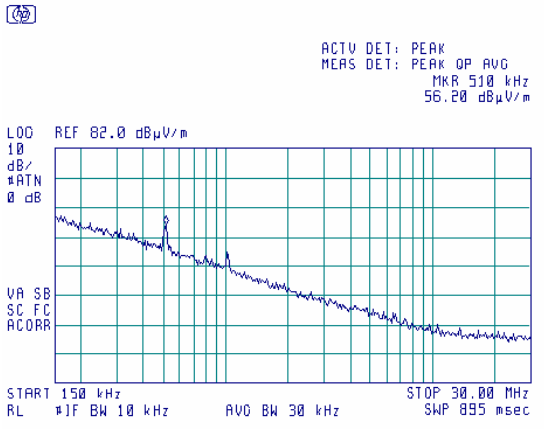
Plot 7.6.3 Radiated emission measurements in 9 - 150 kHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.6.4 Radiated emission measurements in 0.15 - 30 MHz range

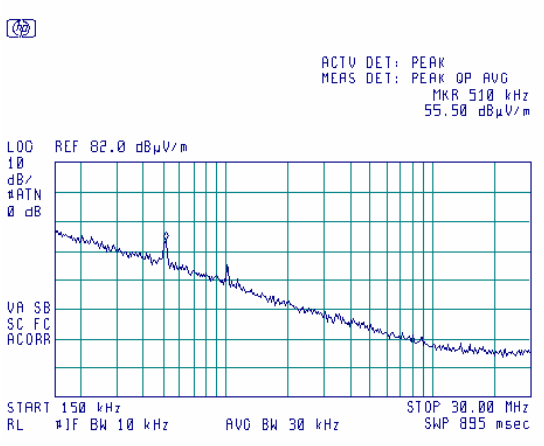
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

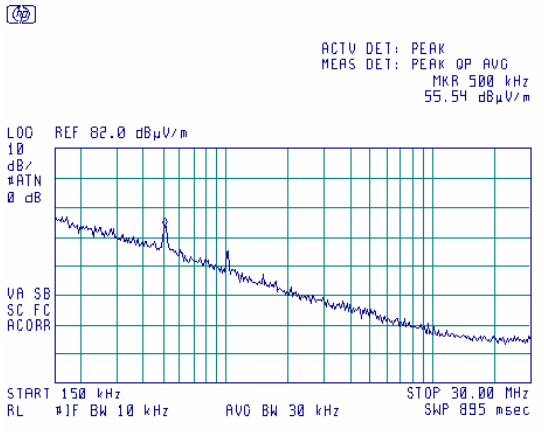
Plot 7.6.5 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.6.6 Radiated emission measurements in 0.15 - 30 MHz range

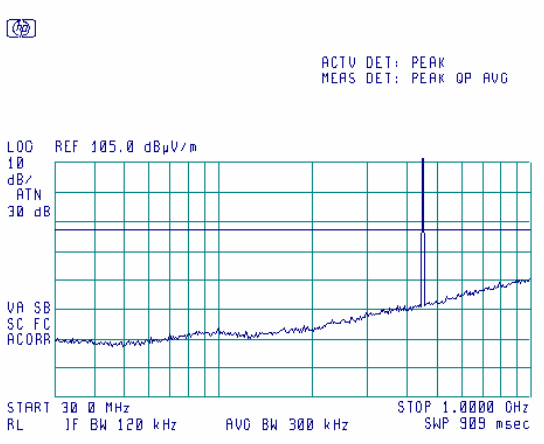
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

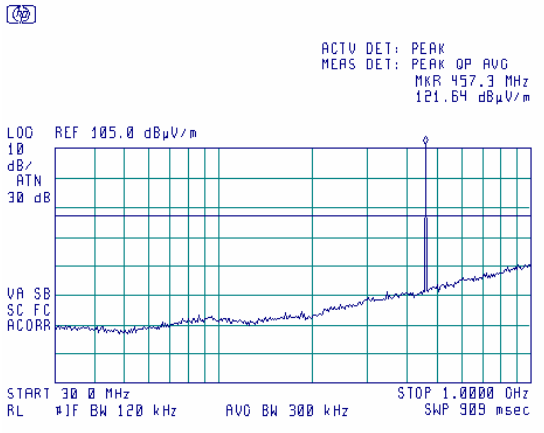
Plot 7.6.7 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.6.8 Radiated emission measurements in 30 - 1000 MHz range

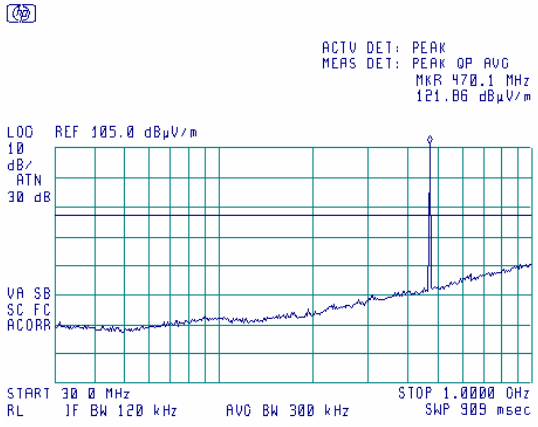
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

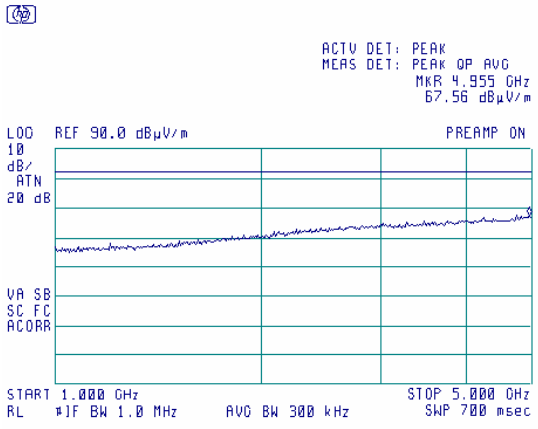
Plot 7.6.9 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.6.10 Radiated emission measurements in 1000 – 5000 MHz range

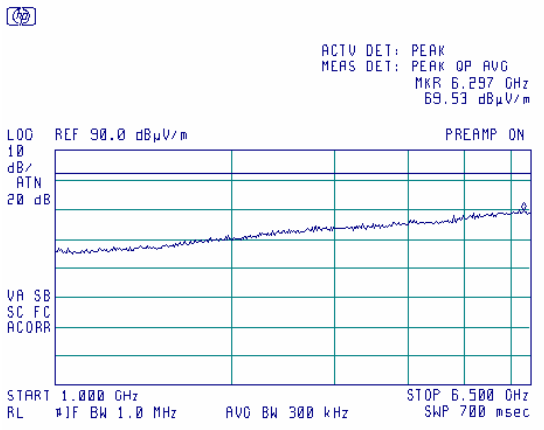
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

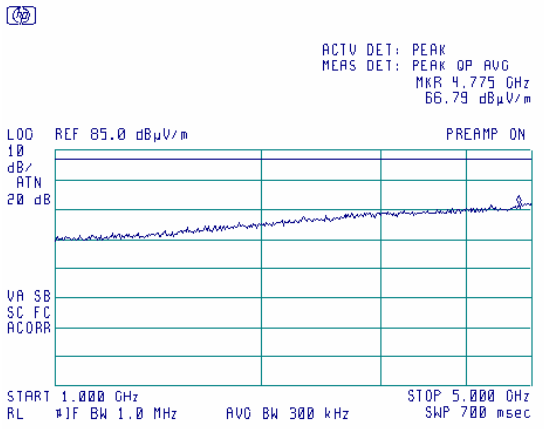
Plot 7.6.11 Radiated emission measurements in 1000 – 5000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.6.12 Radiated emission measurements in 1000 – 5000 MHz range

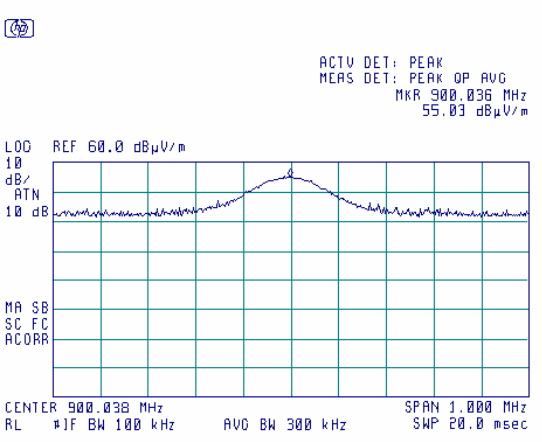
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

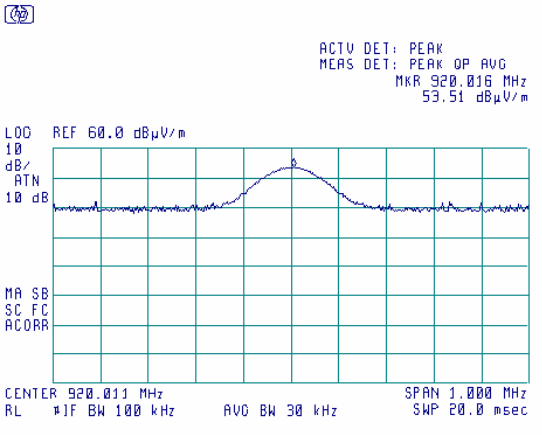
Plot 7.6.13 Radiated emission measurements at the 2nd harmonic

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.6.14 Radiated emission measurements at the 2nd harmonic

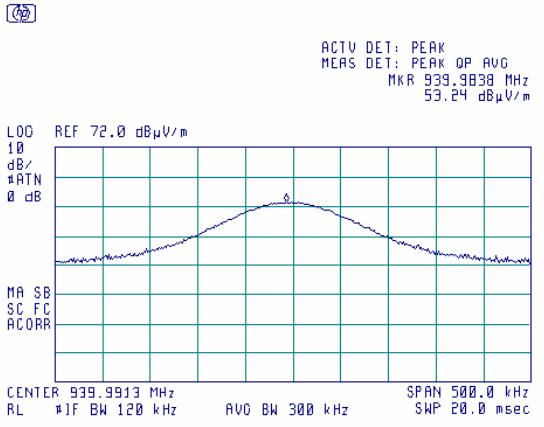
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

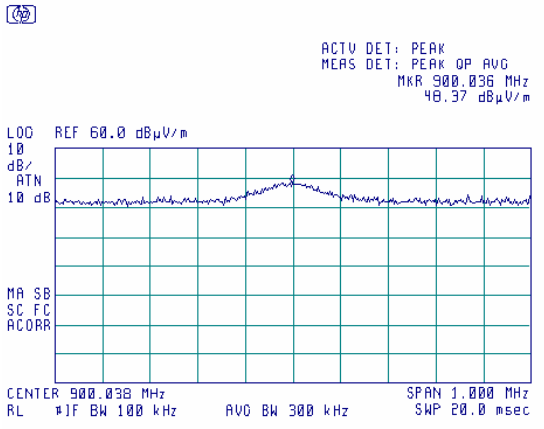
Plot 7.6.15 Radiated emission measurements at the 2nd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.16 Radiated emission measurements at the 2nd harmonic

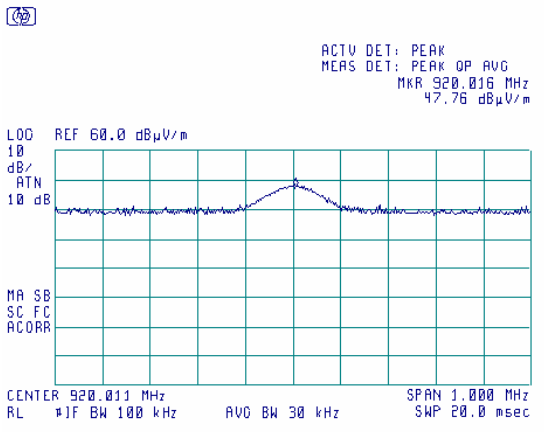
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 °C	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

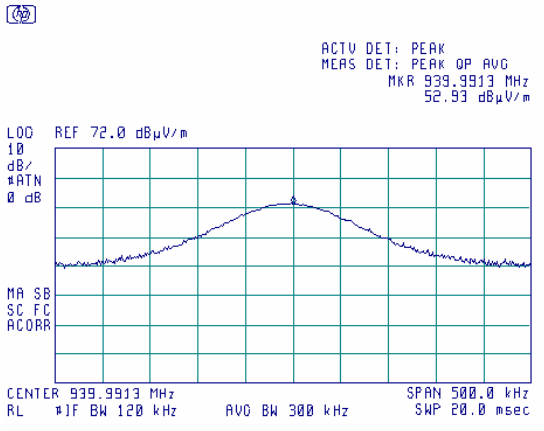
Plot 7.6.17 Radiated emission measurements at the 2nd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.6.18 Radiated emission measurements at the 2nd harmonic

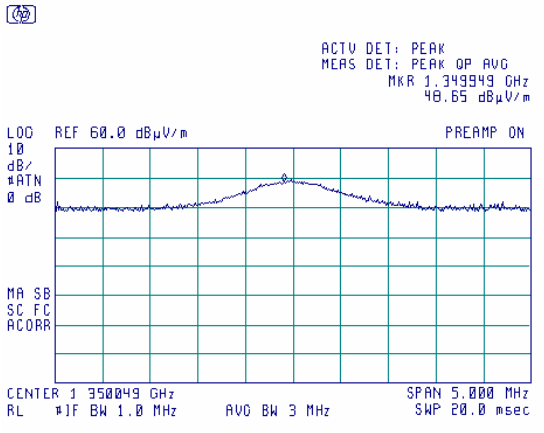
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

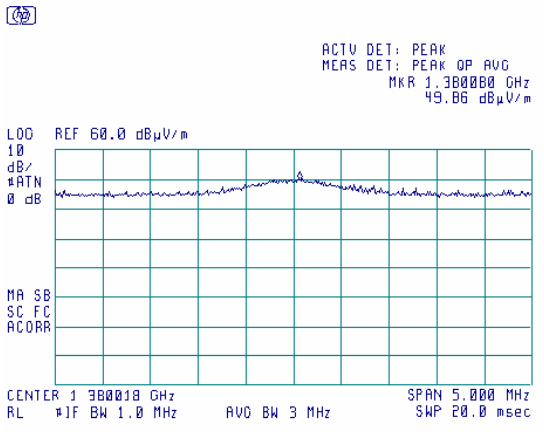
Plot 7.6.19 Radiated emission measurements at the 3rd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.20 Radiated emission measurements at the 3rd harmonic

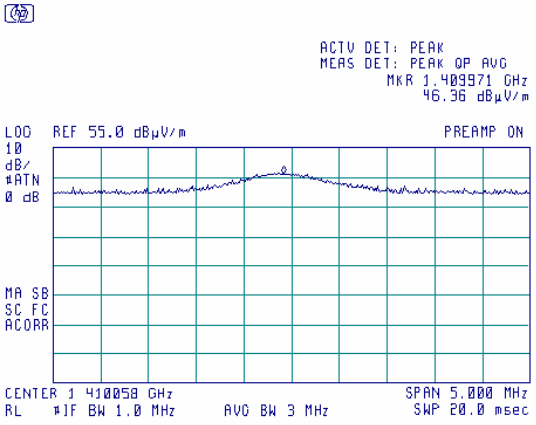
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

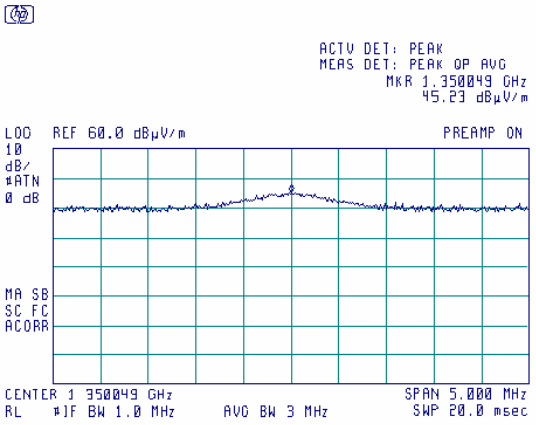
Plot 7.6.21 Radiated emission measurements at the 3rd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.22 Radiated emission measurements at the 3rd harmonic

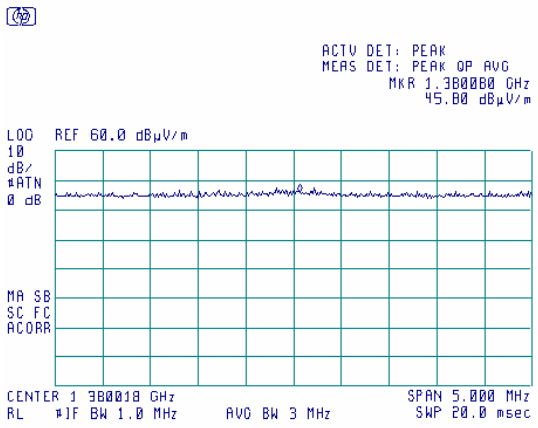
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

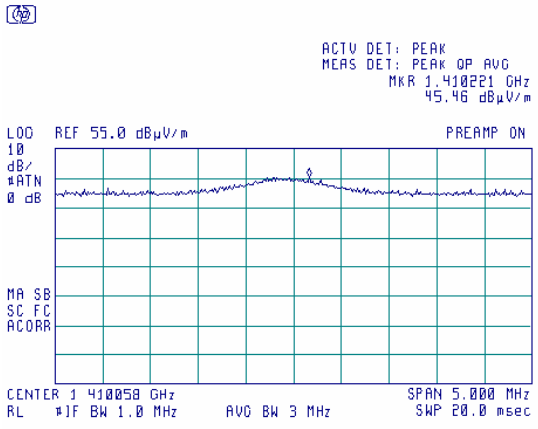
Plot 7.6.23 Radiated emission measurements at the 3rd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.6.24 Radiated emission measurements at the 3rd harmonic

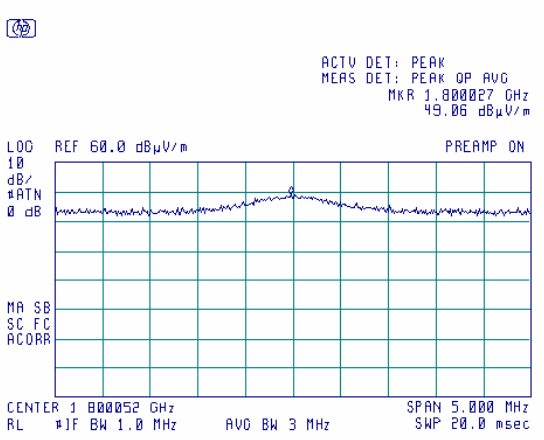
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

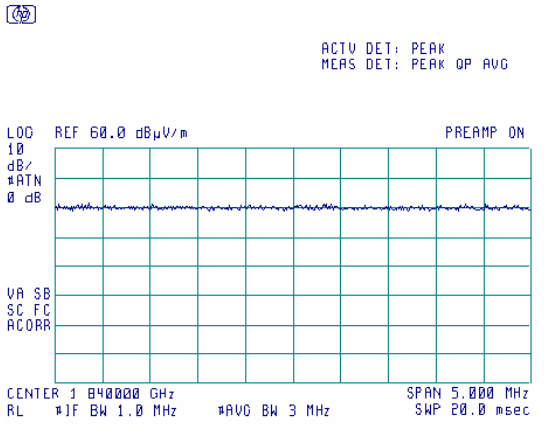
Plot 7.6.25 Radiated emission measurements at the 4th harmonic

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.6.26 Radiated emission measurements at the 4th harmonic

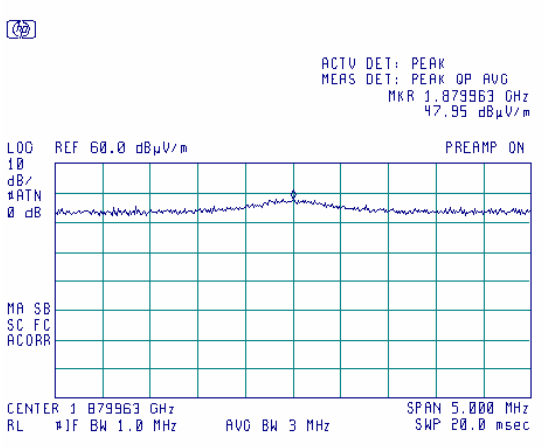
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

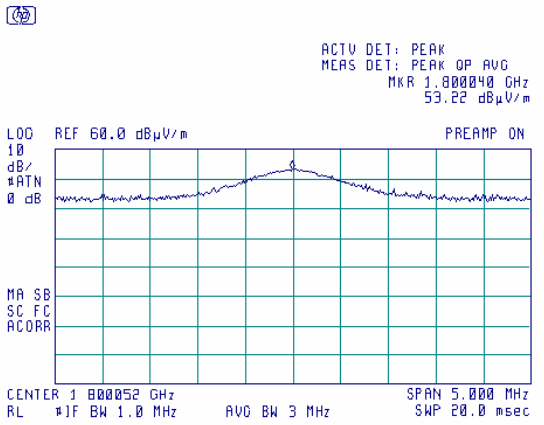
Plot 7.6.27 Radiated emission measurements at the 4th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.28 Radiated emission measurements at the 4th harmonic

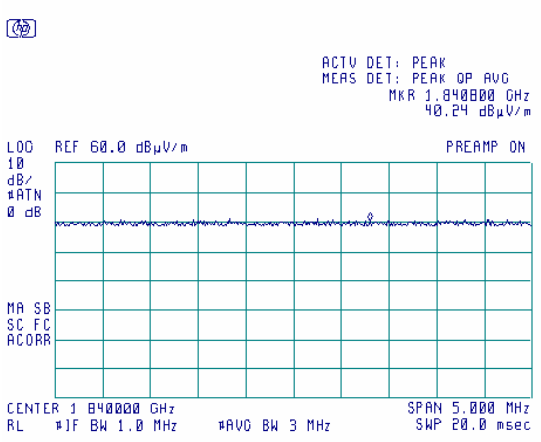
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

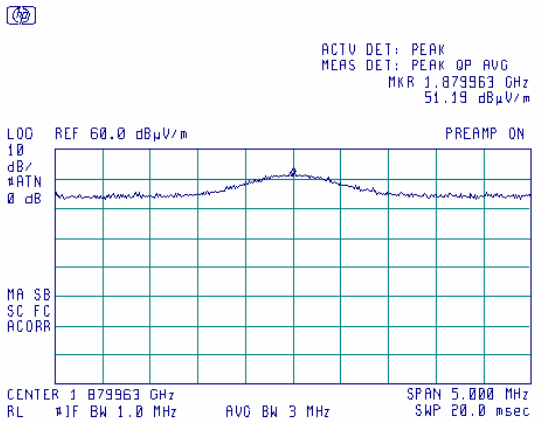
Plot 7.6.29 Radiated emission measurements at the 4th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.6.30 Radiated emission measurements at the 4th harmonic

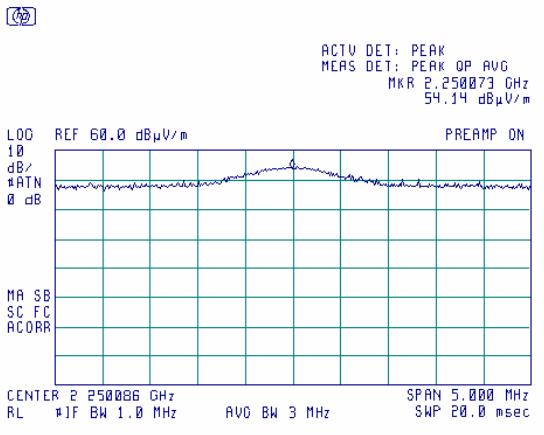
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

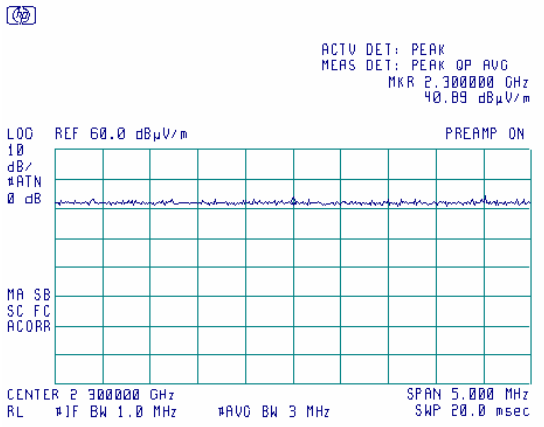
Plot 7.6.31 Radiated emission measurements at the 5th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.32 Radiated emission measurements at the 5th harmonic

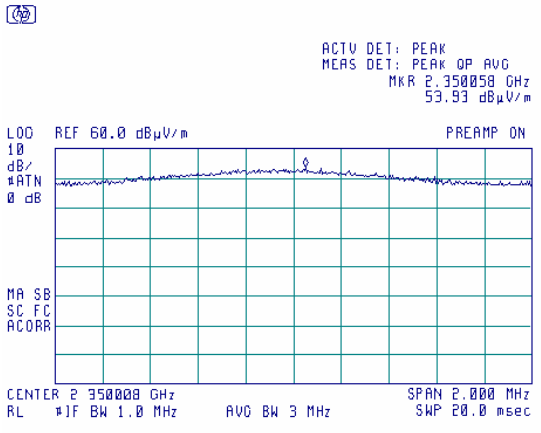
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 °C	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

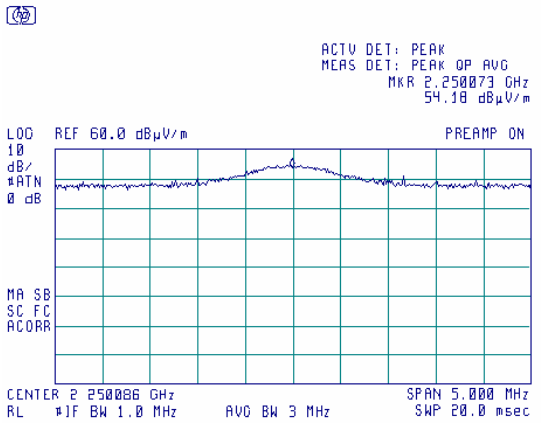
Plot 7.6.33 Radiated emission measurements at the 5th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.34 Radiated emission measurements at the 5th harmonic

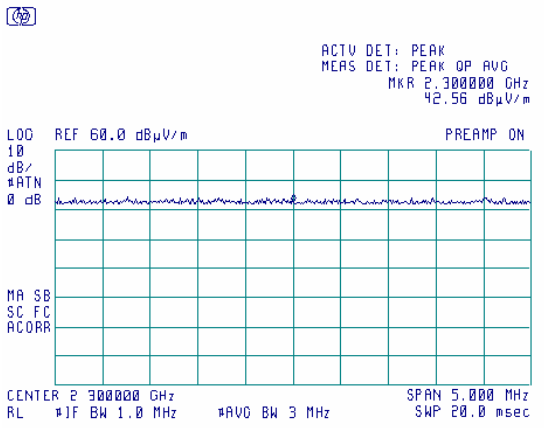
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

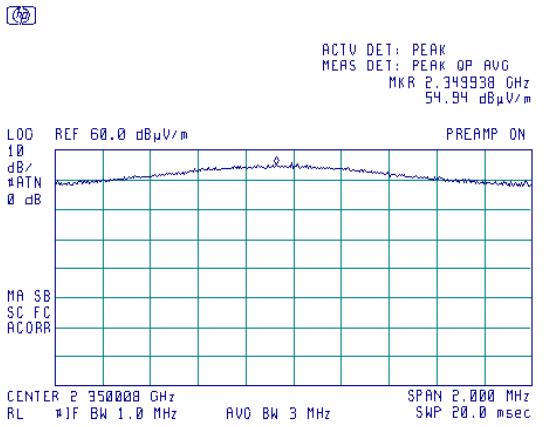
Plot 7.6.35 Radiated emission measurements at the 5th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.6.36 Radiated emission measurements at the 5th harmonic

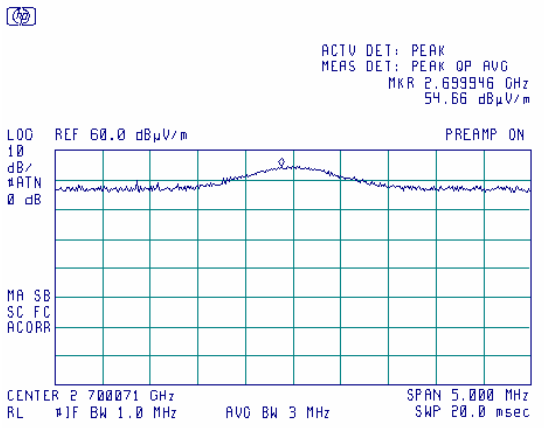
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

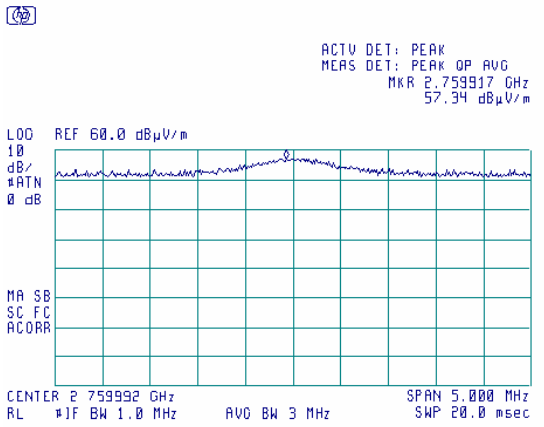
Plot 7.6.37 Radiated emission measurements at the 6th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.38 Radiated emission measurements at the 6th harmonic

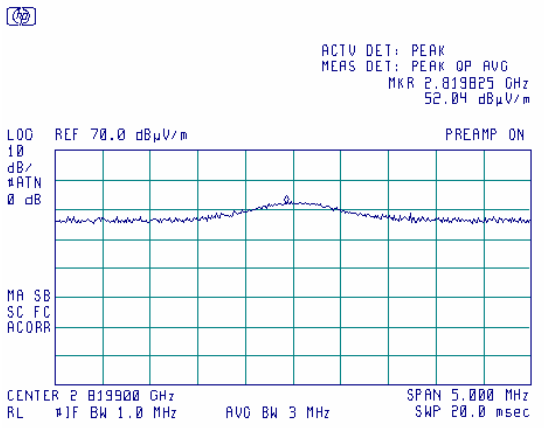
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

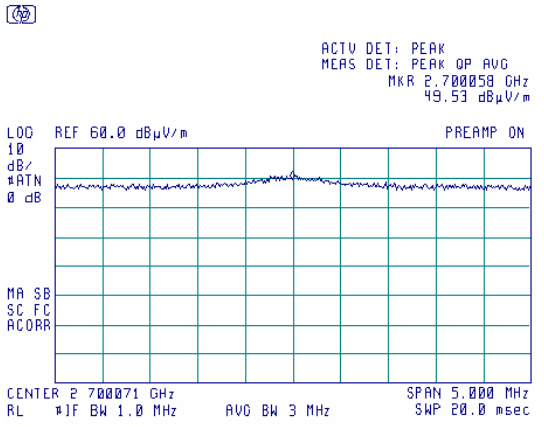
Plot 7.6.39 Radiated emission measurements at the 6th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.40 Radiated emission measurements at the 6th harmonic

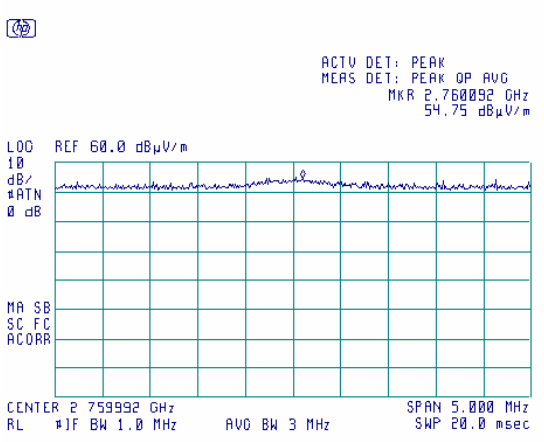
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

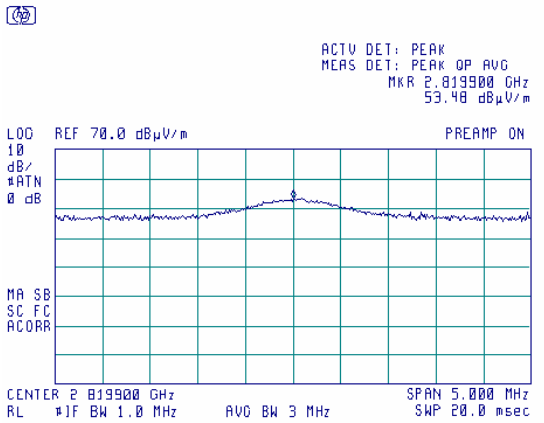
Plot 7.6.41 Radiated emission measurements at the 6th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.6.42 Radiated emission measurements at the 6th harmonic

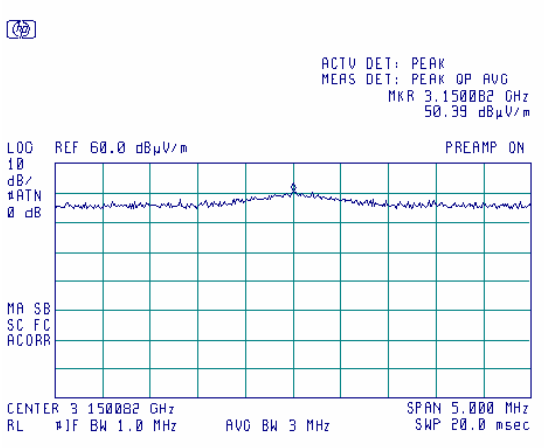
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

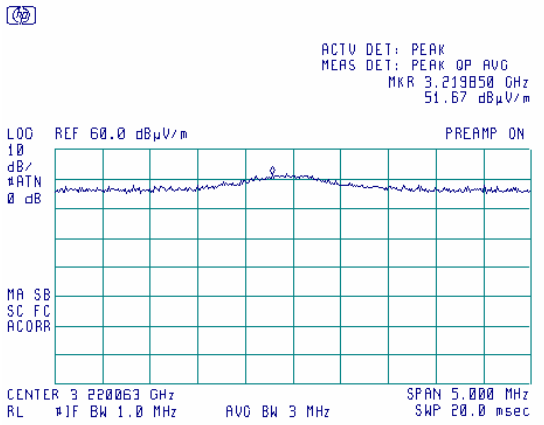
Plot 7.6.43 Radiated emission measurements at the 7th harmonic

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.6.44 Radiated emission measurements at the 7th harmonic

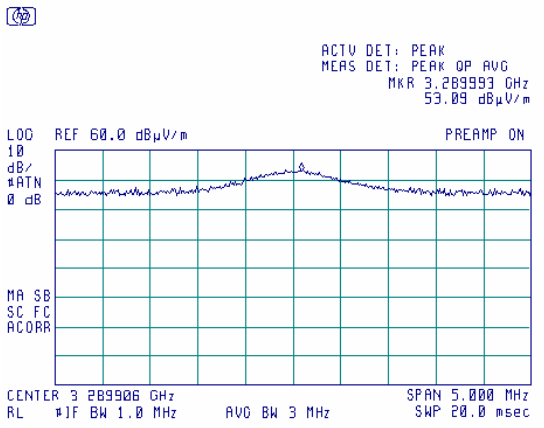
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

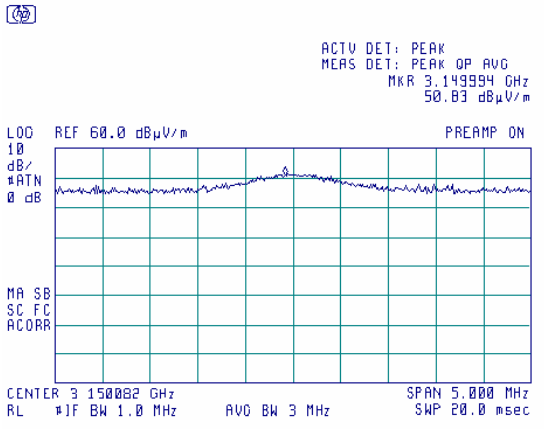
Plot 7.6.45 Radiated emission measurements at the 7th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.46 Radiated emission measurements at the 7th harmonic

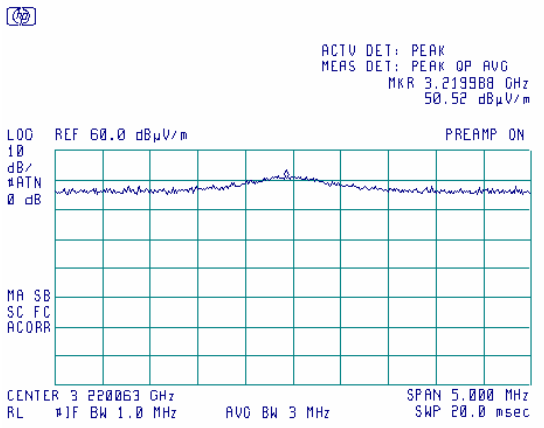
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

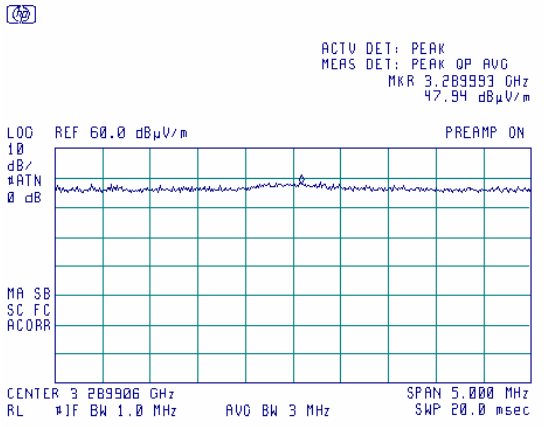
Plot 7.6.47 Radiated emission measurements at the 7th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.6.48 Radiated emission measurements at the 7th harmonic

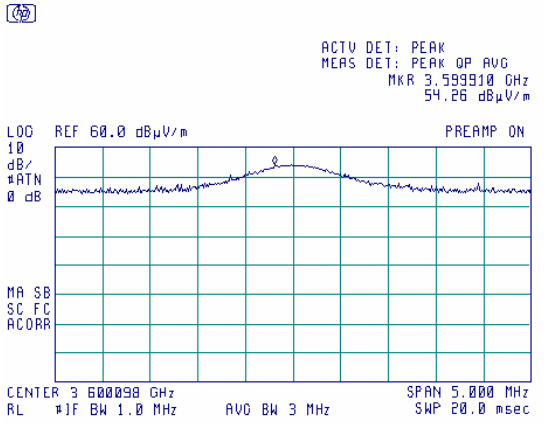
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

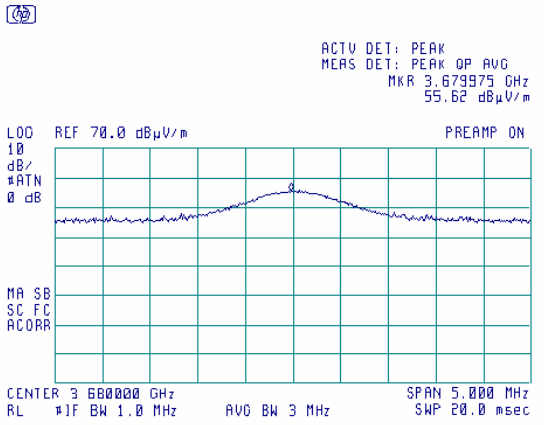
Plot 7.6.49 Radiated emission measurements at the 8th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.50 Radiated emission measurements at the 8th harmonic

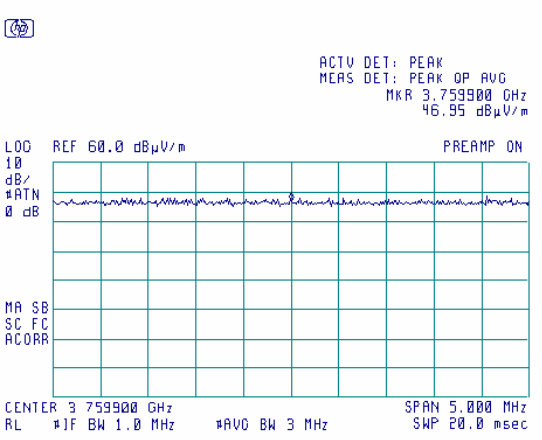
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

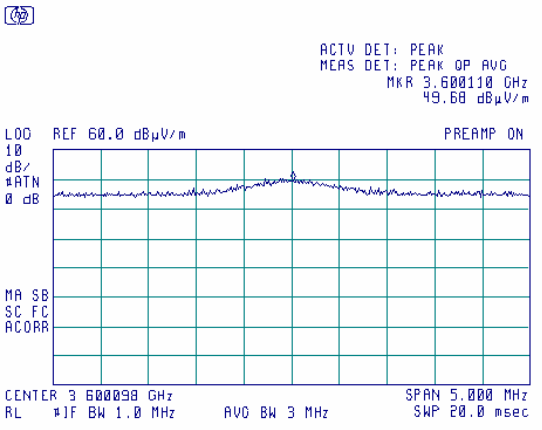
Plot 7.6.51 Radiated emission measurements at the 8th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.6.52 Radiated emission measurements at the 8th harmonic

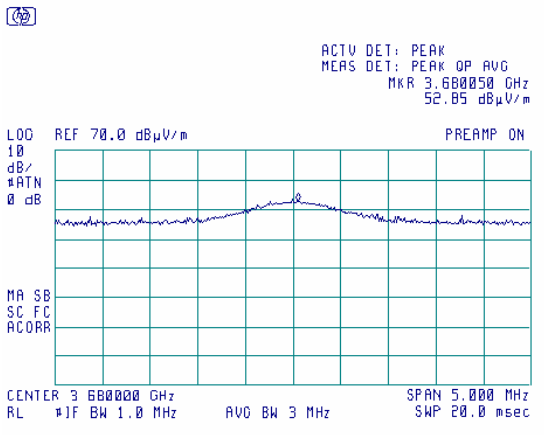
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2004 5:50:50 PM		
Temperature: 24 ºC	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.2 VDC
Remarks:			

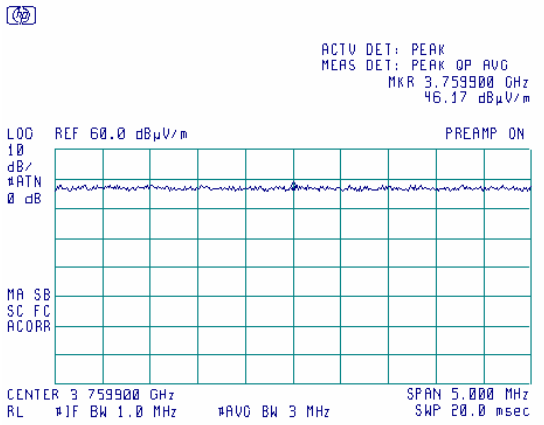
Plot 7.6.53 Radiated emission measurements at the 8th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.6.54 Radiated emission measurements at the 8th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/10/2004 8:15:15 AM		
Temperature: 23 ºC	Air Pressure: 1005 hPa	Relative Humidity: 41 %	Power Supply: 3.2 VDC
Remarks:			

7.7 Radiated emission measurements

7.7.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Radiated emission test limits

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
Above 960	43.5*	54.0	49.5	60.0*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

7.7.2 Test procedure for measurements in semi-anechoic chamber

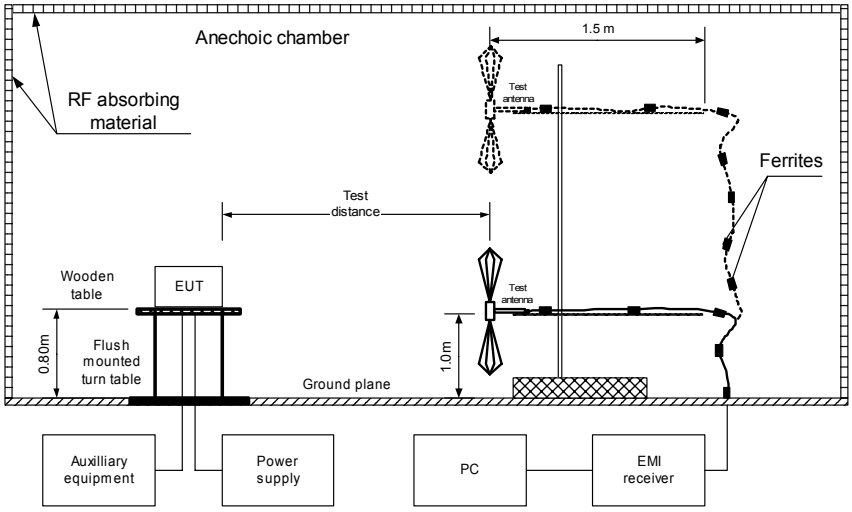
7.7.2.1 The EUT was set up as shown in Figure 7.7.1 and associated photograph/s, energized and the performance check was conducted.

7.7.2.2 The specified frequency range was investigated with biconilog antenna connected to 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 and the EUT cables position was varied.

7.7.2.3 The worst test results (the lowest margins) were recorded in Table 7.7.2 and shown in the associated plots.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/10/2004 8:15:15 AM		
Temperature: 23 ºC	Air Pressure: 1005 hPa	Relative Humidity: 41 %	Power Supply: 3.2 VDC
Remarks:			

Figure 7.7.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/10/2004 8:15:15 AM		
Temperature: 23 ºC	**Air Pressure:** 1005 hPa	**Relative Humidity:** 41 %	**Power Supply:** 3.2 VDC
Remarks:			

Table 7.7.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Stand-by
TEST SITE: ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE

Frequency, MHz	Resolution bandwidth, kHz	Measured emission, dB(µV/m	Limit, dB(µV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
30 – 1000	120	All found emissions were at least 20 dB below specified limit						Pass
1000 - 3000	1000	No emissions were found						

Reference numbers of test equipment used

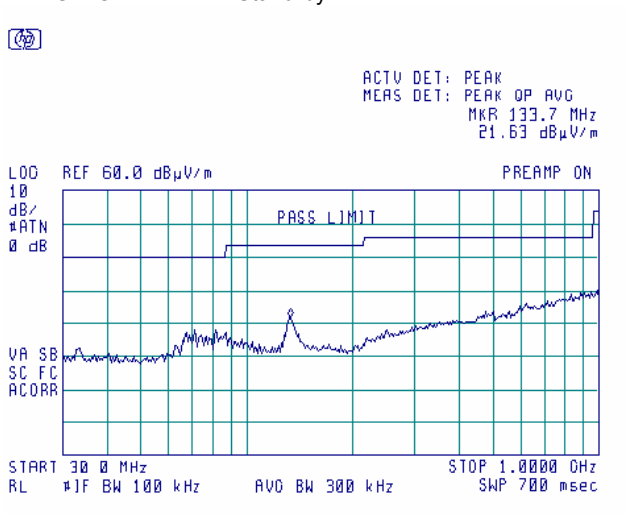
HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 1004	HL 1947
HL 2009	HL 2432						

Full description is given in Appendix A.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/10/2004 8:15:15 AM		
Temperature: 23 ºC	Air Pressure: 1005 hPa	Relative Humidity: 41 %	Power Supply: 3.2 VDC
Remarks:			

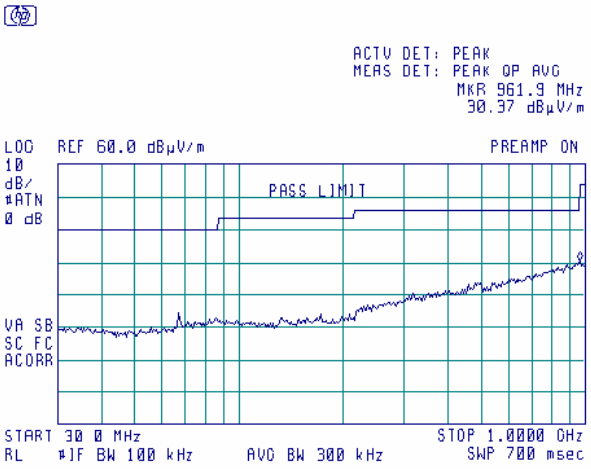
Plot 7.7.1 Radiated emission measurements in 30- 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Plot 7.7.2 Radiated emission measurements in 30- 1000 MHz range, horizontal antenna polarization

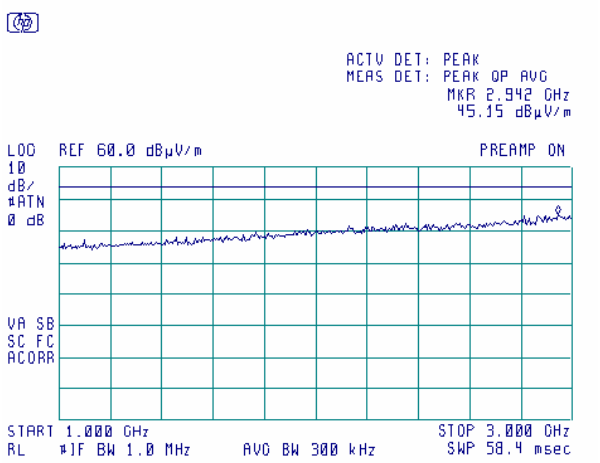
TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/10/2004 8:15:15 AM		
Temperature: 23 ºC	Air Pressure: 1005 hPa	Relative Humidity: 41 %	Power Supply: 3.2 VDC
Remarks:			

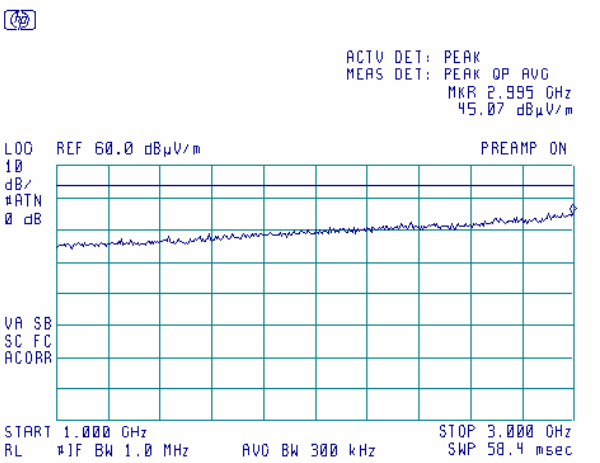
Plot 7.7.3 Radiated emission measurements in 1000- 3000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Plot 7.7.4 Radiated emission measurements in 1000 - 3000 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



8 APPENDIX A Test equipment and ancillaries used for tests

HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
0174	Monitor, field, 10kHz-1GHz, 1-300V/m, w/fiberoptic	Amplifier Research	FM1000	60525	2/05
0337	Probe set, hand held, 5 probes	Electro-Metrics	EHFP-30	238	6/05
0446	Active loop antenna, 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/04
0465	Anechoic Chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/05 check
0493	Oven temperature, -45°C ÷ +125°C	Thermotron	S-1.2 Mini-Max	4016	9/04
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/04
0557	Signal generator	Marconi Instruments	52023-002E	080	1/05
0581	Attenuator PAD, 20 dB, DC- 2 GHz	Marconi Instruments	TM 5552	581	7/05
0589	Cable coaxial, GORE A2POL118.2, 3 m	Hermon Labs	GORE-3	589	11/04
0592	Position controller	Hermon Labs	L2-SR3000	100	5/05 check
0593	Antenna mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	AM-F1	101	2/05 check
0594	Turntable for Anechoic Chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	1/05 check
0604	Antenna biconilog log-periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/05
0614	Antenna dipole tunable, 200 –500 MHz	Electro-Metrics	TDS 30-1	334	1/05
0661	Generator Swept Signal, 10MHz to 40GHz+ 10dBm	Hewlett Packard	83640B	0266	9/04
0670	Oscilloscope, Digital storage 500 MHz, 2 Gs/s, 4 ch with Telecom Mask Tester	LeCroy Corporation	LC 334A	2387	8/05
0788	Power splitter/combiner	Mini-Circuits	ZFSC-2-1	923705	9/04
0808	Analyzer spectrum, 100 Hz to 2.2 GHz, AM/FM modulator	Anritsu	MS2601B	M178731	3/05
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/04
1424	Spectrum analyzer, 30 Hz - 40 GHz	Agilent Technologies	8564EC	3946A00219	8/05
1519	Cable RF, 0.5 m	Telequis	MIL-C-17F- RG 058	1519	12/04
1523	Cable RF, 2.3 m	Telequis	MIL-C-17F-RG 058 CU	1523	12/04
1536	Cable RF, 2.0 m	Alpha Wire	RG-58 C/U	1536	9/04
1556	Cable RF, 0.5 m	Telequis	MIL-C-17F-RG 058 CU	1556	12/04
1565	Antenna, dipole, tunable, 500 - 1000 MHz	Electro-Metrics	TDS-30-2	334	1/05
1907	Power splitter/combiner, 5-500 MHz	Mini-Circuits	ZFSCC-2-1	NA	7/05

HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
1947	Cable 18 GHz, 6.5 m, blue	Rhophase Microwave Ltd	NPS-1803A-6500-NPS	T4974	10/04
1984	Antenna, double ridged waveguide horn, 1-18 GHz, 300W, N-type	EMC Test Systems	3115	9911-5964	3/05
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	12/04
2078	Isotropic Field Probe, 80 MHz - 40 GHz	Amplifier Research	FP2080	302541	2/05
2358	Power supply, 2 X 0-36 VDC, 5A, 5 VDC / 5A	Horizon Electronics	DHR3655D	767469	4/05
2400	Cable 40 GHz, 1.5 m, green	Rhophase Microwave Ltd.	KPS-1503A-1500-KPS	X2946	6/05
2227	Crystal Detector 0.01-18 GHz	Hewlett Packard	8472A	NA	10/04
2524	Attenuator, 10 dB, DC-18 GHz	Midwest Microwave	263-10	2524	3/05

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
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
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz ± 13.9 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Unintentional radiator tests	
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
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

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of ISO/IEC 17025 (or alternately ANSI/NCSL Z540-1).
The laboratory calibrates its measurement standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements. The Hermon Labs EMC measurements uncertainty is given in the table above.

10 APPENDIX C Test facility 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) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. 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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website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

47CFR part 90: 2002	Private land mobile radio services
47CFR part 1: 2003	Practice and procedure
47CFR part 2: 2002	Frequency allocations and radio treaty matters; general rules and regulations
47CFR part 15: 2004	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: 2001	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.
ANSI/TIA/EIA-603-A:2001	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

12 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
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
dBΩ	decibel referred to one Ohm
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
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PCB	printed circuit board
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

13 APPENDIX F Test equipment correction factors

Antenna factor

Biconilog antenna EMCO, model 3141, serial number 1011, HL 0604

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

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
EMC Test Systems, model 3115, serial no: 9911-5964, HL 1984

Frequency, MHz	Antenna gain, dBi	Antenna factor. dB(1/m)
1000.0	5.8	24.5
1500.0	9.0	24.8
2000.0	8.6	27.7
2500.0	9.5	28.7
3000.0	8.9	30.8
3500.0	8.2	32.9
4000.0	9.6	32.7
4500.0	11.2	32.1
5000.0	10.6	33.6
5500.0	9.8	35.3
6000.0	10.1	35.7
6500.0	10.7	35.8
7000.0	10.9	36.2
7500.0	10.5	37.2
8000.0	11.1	37.2
8500.0	10.8	38.1
9000.0	10.7	38.6
9500.0	11.5	38.3
10000.0	11.8	38.4
10500.0	12.3	38.3
11000.0	12.3	38.8
11500.0	11.5	39.9
12000.0	12.2	39.6
12500.0	12.6	39.5
13000.0	12.0	40.5
13500.0	11.7	41.1
14000.0	11.7	41.5
14500.0	12.7	40.8
15000.0	14.2	39.5
15500.0	16.0	38.1
16000.0	16.2	38.1
16500.0	14.5	40.1
17000.0	12.2	42.6
17500.0	9.7	45.4
18000.0	6.6	48.7

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

Antenna factor
Active Loop Antenna
EMC Test Systems, model 6502, serial number 2857, HL 0446

Frequency, MHz	Magnetic Antenna Factor, dB(S/m)	Electric Antenna Factor, dB(1/m)
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	9.7
0.750	-41.9	9.6
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.1
4.000	-41.4	10.1
5.000	-41.5	10.0
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(S/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μA/m).
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, GORE A2P01POL118, 2.3 m, model:GORE-3, HL 0589
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, HL 1004

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	30	0.33	≤ 6.5	±0.12
2	50	0.40		
3	100	0.57		
4	300	0.97		
5	500	1.25		
6	800	1.59		
7	1000	1.81		
8	1200	1.97		
9	1400	2.15		
10	1600	2.28		
11	1800	2.43		
12	2000	2.61		
13	2200	2.75		
14	2400	2.89		
15	2600	2.97		
16	2800	3.21	≤ 6.5	±0.12
17	3000	3.32		
18	3300	3.47		
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		±0.17
22	4500	4.07		
23	4800	4.36		
24	5100	4.62		
25	5400	4.78		
26	5700	5.16		
27	6000	5.67		
28	6500	5.99		

Cable loss
Cable 18 GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, S/N T4974, HL 1947

Frequency, GHz	Cable loss, dB
0.03	0.30
0.05	0.38
0.10	0.53
0.20	0.74
0.30	0.91
0.40	1.05
0.50	1.18
0.60	1.29
0.70	1.40
0.80	1.50
0.90	1.59
1.00	1.68
1.10	1.77
1.20	1.86
1.30	1.94
1.40	2.01
1.50	2.08
1.60	2.16
1.70	2.22
1.80	2.29
1.90	2.36
2.00	2.42
2.10	2.48
2.20	2.54
2.30	2.60
2.40	2.66
2.50	2.71
2.60	2.77
2.70	2.83
2.80	2.89
2.90	2.95
3.10	3.06
3.30	3.17
3.50	3.28
3.70	3.39
3.90	3.51
4.10	3.62
4.30	3.76
4.50	3.87
4.70	4.01
4.90	4.10
5.10	4.21
5.30	4.31
5.50	4.43
5.70	4.56
5.90	4.71

Frequency, GHz	Cable loss, dB
6.10	4.87
6.30	4.95
6.50	4.94
6.70	4.88
6.90	4.87
7.10	4.83
7.30	4.85
7.50	4.86
7.70	4.91
7.90	4.96
8.10	5.03
8.30	5.08
8.50	5.13
8.70	5.21
8.90	5.22
9.10	5.34
9.30	5.35
9.50	5.52
9.70	5.51
9.90	5.66
10.10	5.70
10.30	5.78
10.50	5.79
10.70	5.82
10.90	5.86
11.10	5.94
11.30	6.06
11.50	6.21
11.70	6.44
11.90	6.61
12.10	6.76
12.40	6.68
13.00	6.66
13.50	6.81
14.00	6.90
14.50	6.90
15.00	6.97
15.50	7.17
16.00	7.28
16.50	7.27
17.00	7.38
17.50	7.68
18.00	7.92

Cable loss
RF cable 8 m, model RG-214, HL 2009

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	1	0.10	NA	±0.12
2	10	0.14		
3	30	0.25		
4	50	0.34		
5	100	0.53		
6	300	0.99		
7	500	1.31		
8	800	1.73		
9	1000	1.98		
10	1100	2.11		
11	1200	2.21		
12	1300	2.35		
13	1400	2.46		
14	1500	2.55		
15	1600	2.68		
16	1700	2.78		
17	1800	2.88		
18	1900	2.98		
19	2000	3.09		

Cable loss
Cable coaxial, 40GHz, 1.5 m, green, Rhophase Microwave Limited, model: KPS-1503A-1500-KPS, HL 2400

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.06	6.5	1.46	15.50	2.34
0.05	0.08	6.7	1.49	16.00	2.34
0.1	0.15	6.9	1.50	16.50	2.40
0.2	0.23	7.1	1.51	17.00	2.46
0.3	0.29	7.3	1.55	17.50	2.54
0.5	0.37	7.5	1.56	18.00	2.61
0.7	0.46	7.7	1.58	18.50	2.59
0.9	0.53	7.9	1.60	19.00	2.59
1.1	0.58	8.1	1.61	19.50	2.67
1.3	0.65	8.3	1.68	20.00	2.62
1.5	0.66	8.5	1.68	20.50	2.73
1.7	0.72	8.7	1.75	21.00	2.71
1.9	0.76	8.9	1.74	21.50	2.78
2.1	0.79	9.1	1.81	22.00	2.83
2.3	0.85	9.3	1.79	22.50	2.81
2.5	0.90	9.5	1.86	23.50	2.91
2.7	0.91	9.7	1.85	24.00	2.97
2.9	0.97	9.9	1.87	24.50	2.98
3.1	0.97	10.1	1.88	25.00	2.97
3.3	1.03	10.30	1.82	25.50	3.03
3.5	1.06	10.50	1.92	26.00	3.04
3.7	1.10	10.70	1.86	26.50	3.11
3.9	1.13	10.90	1.96	27.00	2.97
4.1	1.16	11.10	1.90	28.00	3.15
4.3	1.18	11.30	1.99	29.00	3.07
4.5	1.21	11.50	1.95	30.00	3.13
4.7	1.23	11.70	2.00	31.00	3.13
4.9	1.26	11.90	2.01	32.00	3.18
5.1	1.28	12.10	1.99	33.00	3.31
5.3	1.31	12.40	2.06	34.00	3.32
5.5	1.32	13.00	2.11	35.00	3.37
5.7	1.36	13.50	2.17	36.00	3.36
5.9	1.37	14.00	2.36	37.00	3.46
6.1	1.38	14.50	2.32	39.00	3.49
6.3	1.44	15.00	2.30	40.00	3.52