HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 subpart C, section 15.231(a)

FOR:

Visonic Ltd.

Control panel of wireless alarm control system

Model:PowerMaxComplete

FCC ID:WP3PWRMCOMPLETEV2

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1 Applicant information

Client name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 61920, Israel
Telephone:	+972 3645 6714
Fax:	+972 3645 6788
E-mail:	aelshtein@visonic.com
Contact name:	Mr. Arik Elshtein

2 Equipment under test attributes

Product name:	Control panel of wireless alarm control system
Product type:	Transmitter
Model(s):	PowerMaxComplete
Receipt date	1/02/2008

3 Manufacturer information

Manufacturer name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 61920, Israel
Telephone:	+972 3645 6714
Fax:	+972 3645 6788
E-Mail:	aelshtein@visonic.com
Contact name:	Mr. Arick Elshtein

4 Test details

Project ID:	22344
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	1/02/2008
Test completed:	3/27/2008
Test specification(s):	FCC Part 15, subpart C, §15.231

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Part 15, Section 231(a), Periodic operation requirements	Pass
FCC Part 15, Section 231(b), Field strength of emissions	Pass
FCC Part 15, Section 231(c), Occupied bandwidth	Pass
FCC Part 15, Section 207(a), Conducted emission	Pass
FCC Part 15, Section 203, Antenna requirements	Pass

Testing was completed against the 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. S. Samokha, test engineer	March 27, 2008	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	December 27, 2011	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	December 28, 2011	

6 EUT description

6.1 General information

The EUT is a control panel of a wireless alarm control system. The Powermax Complete has several states of alertness, such as "armed " and "disarmed", the reactions to each state differs and is explained in the manuals. Those various states are achieved via the on board/integrated keypad, via the RFID proximity sensor (131 kHz) and via the RF transmitter type MCT 234 operating at 315 MHz.

The EUT transmits alarm messages to Visonic's wireless siren and receives alarm messages from various wireless detectors. The device utilizes integral antennas, separate for each radio. Once event was encountered the system also automatically reports via a public telephone network or alternatively via GSM modem through the cellular network to a central monitoring station. The GSM module GE864Q2 (FCC ID:RI7GE864Q2), manufactured by Telit Communications S.p.A., operates in 824 – 849 MHz and 1850 – 1910 MHz frequency bands.

The EUT is powered from AC mains via external AC/DC adapter and is equipped with a rechargeable backup battery pack.

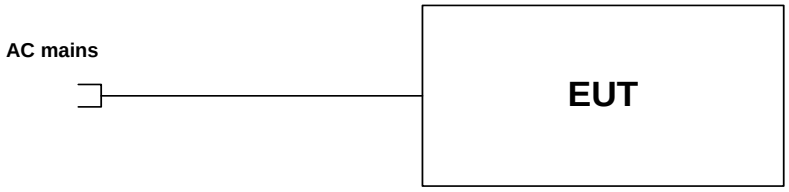
6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length
		From	To				
Power	AC mains	EUT	AC mains	Terminal block	1	Unshielded	2 m

6.3 Changes made in the EUT

No changes were implemented.

6.4 Test configuration



6.5 Transmitter characteristics

Type of equipment						
X	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
X	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

Operating frequency	315 MHz

Maximum rated output power	Maximum field strength	75.95 (µV/m) at 3 m test distance

Is transmitter output power variable?					
X	No				
	Yes		continuous variable		
			stepped variable with stepsize	dB	
			minimum RF power	dBm	
			maximum RF power	dBm	

Antenna connection					
unique coupling	standard connector	X	integral		with temporary RF connector
				X	without temporary RF connector

Antenna characteristics			
Type	Manufacturer	Model number	Gain
Wire	Visonic Ltd.	NA	NA

Type of modulation	ASK

Modulating test signal (baseband)	ID code

Maximum transmitter duty cycle	55 %

Transmitter power source						
	Battery	**Nominal rated voltage**		Battery type		
X	AC mains	**Nominal rated voltage**	120 VAC	Frequency	60 Hz	

Common power source for transmitter and receiver	X	yes		no

Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

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

7.1 Periodic operation requirements

7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Total duration of polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not exceed 2 seconds per hour;
- Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

7.1.2 Test procedure for transmitter shut down test

7.1.2.1 The EUT was set up as shown in Figure 7.1.1.

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

7.1.2.4 The transmission time was captured and shown in Plot 7.1.1 to Plot 7.1.6.

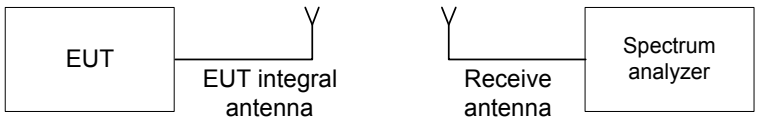
7.1.3 Test procedure for measurements of polling / supervision transmission duration

7.1.3.1 The EUT was set up as shown in Figure 7.1.1.

7.1.3.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.3.3 The transmission time was captured and shown in the associated plots.

Figure 7.1.1 Setup for transmitter shut down test



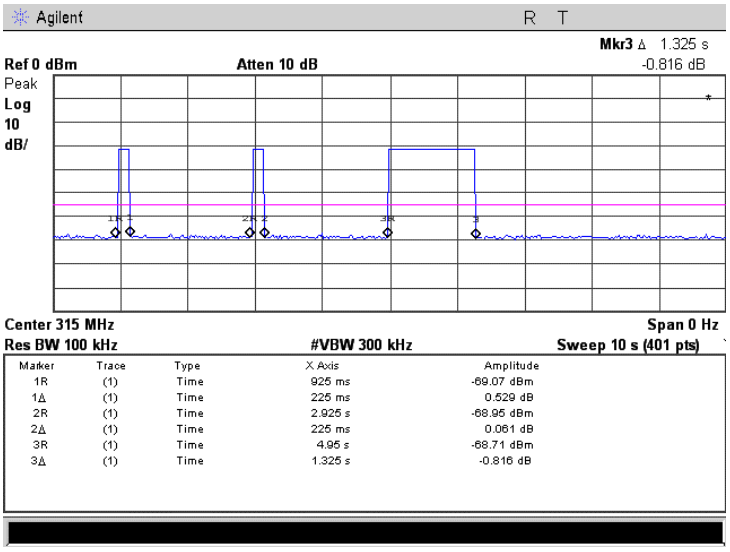
Test specification:	**Section 15.231(a), Periodic operation requirements**		
Test procedure:	Supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date:	3/19/2008		
Temperature: 25ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 38 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.1.1 Periodic operation requirements

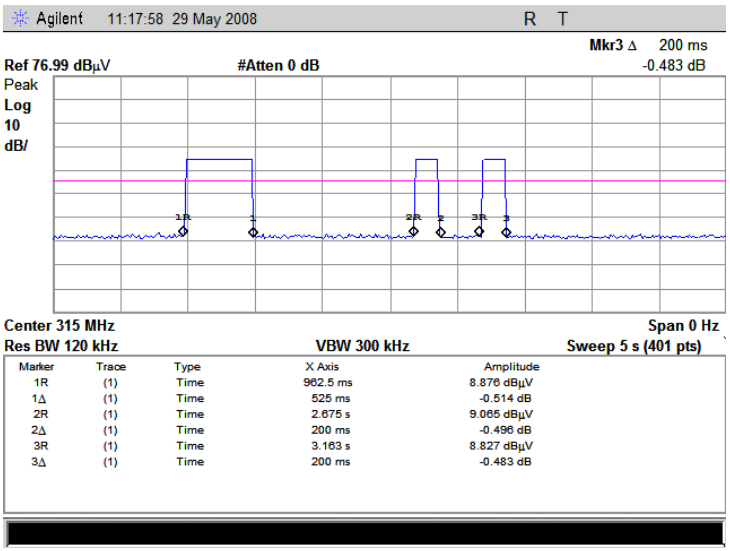
Requirement	Rationale	Verdict
Continuous transmissions are not permitted	Supplier declaration	Comply
A manually operated transmitter shall be deactivated within not more than 5 seconds of switch being released	NA	Comply
Transmitter activated automatically shall cease transmission within 5 seconds	Plots 7.1.1 to 7.1.12	Comply
Periodic transmissions at regular predetermined intervals are not permitted	Supplier declaration	Comply
Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour	Supplier declaration	Comply
Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.	Supplier declaration	Comply

Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.1 Transmitter shut down test result (initialization)

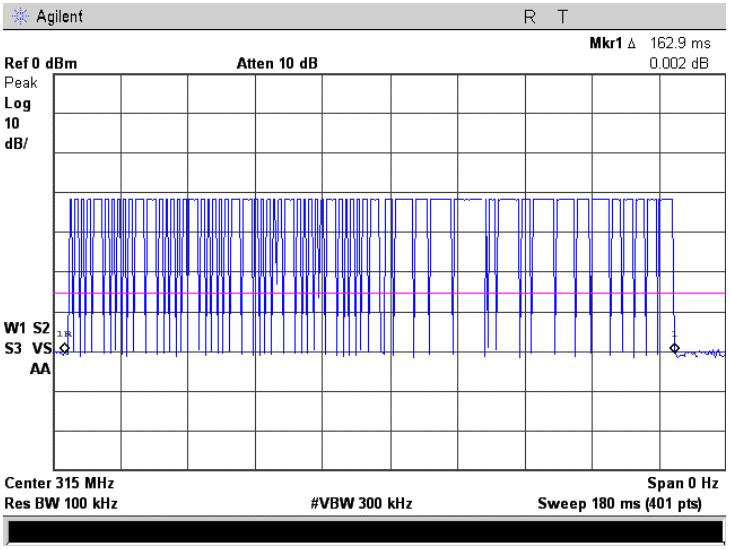


Plot 7.1.2 Transmitter shut down test result (initialization - without siren)

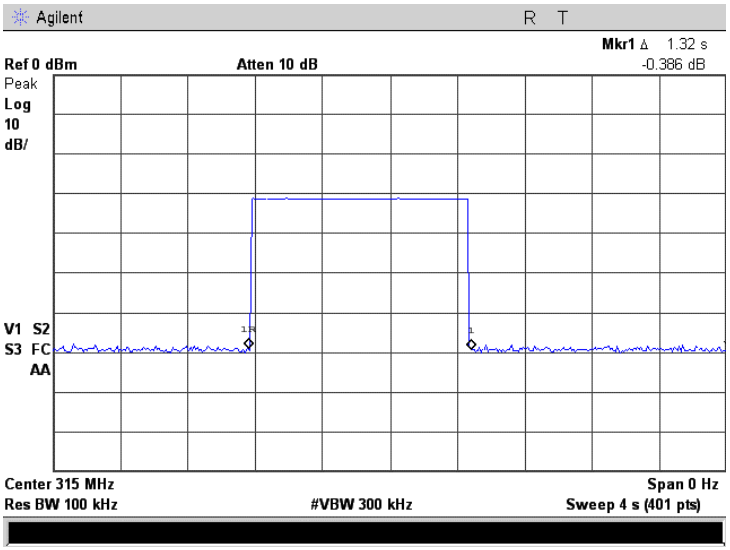


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.3 Transmitter shut down test result (initialization – short burst)

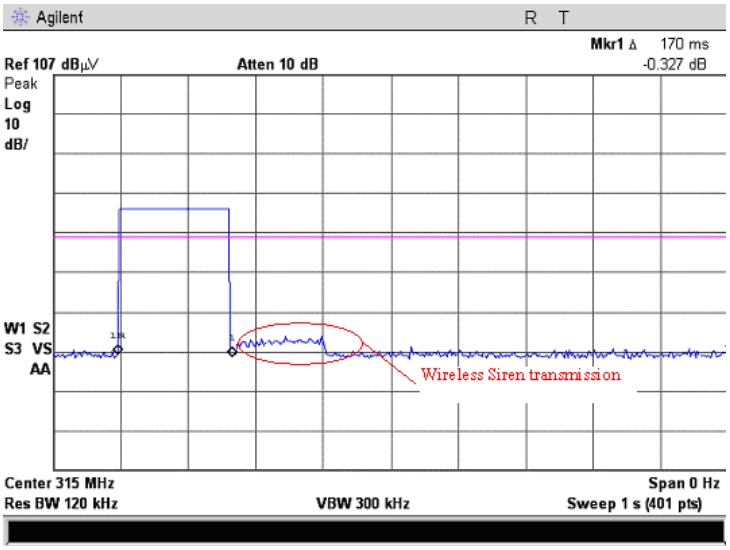


Plot 7.1.4 Transmitter shut down test result (initialization – long burst)



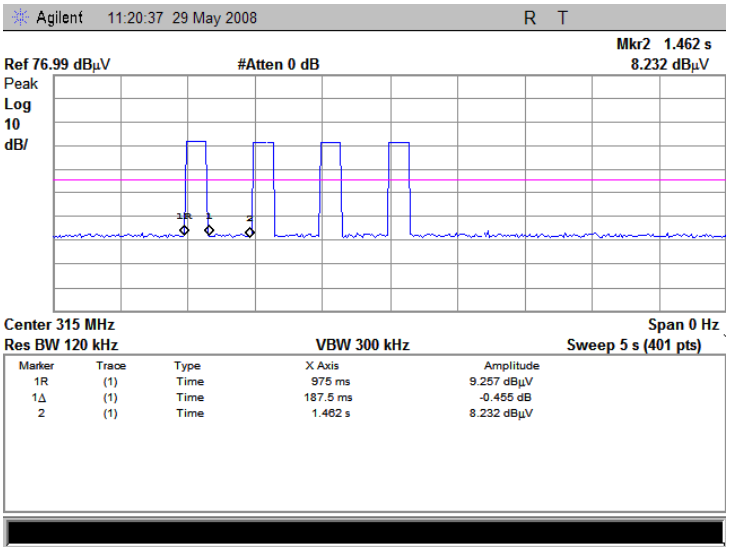
Test specification:	**Section 15.231(a), Periodic operation requirements**		
Test procedure:	Supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date:	3/19/2008		
Temperature: 25ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 38 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.1.5 Transmitter shut down test result (disarming)

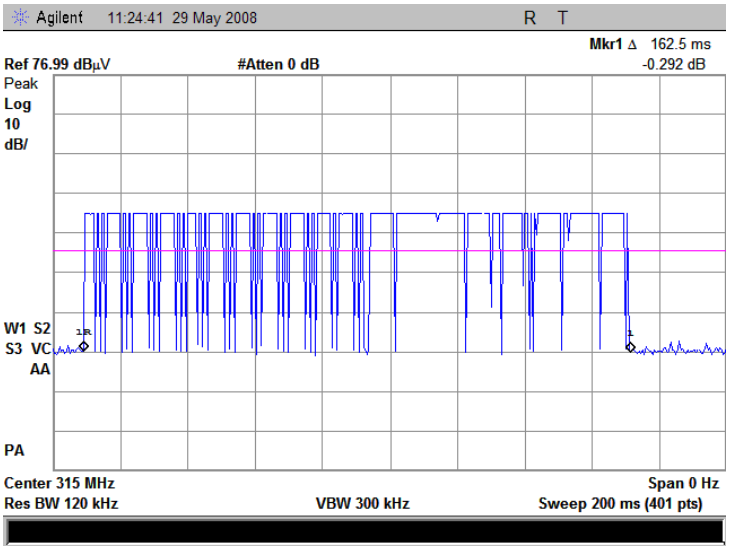


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.6 Transmitter shut down test result (disarming – without siren)

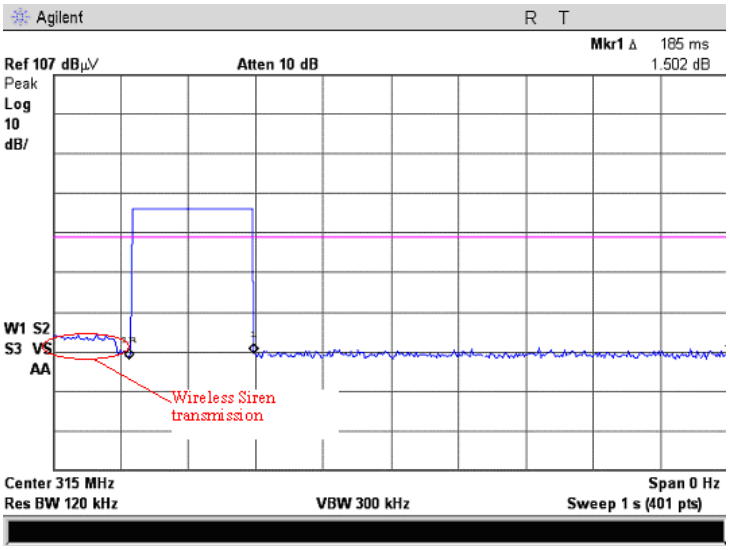


Plot 7.1.7 Transmitter shut down test result pulse (disarming – without siren)

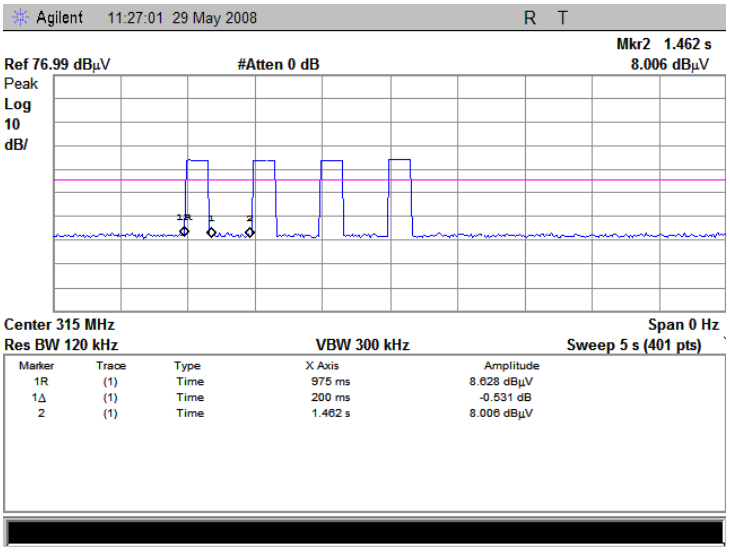


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.8 Transmitter shut down test result (alarm)

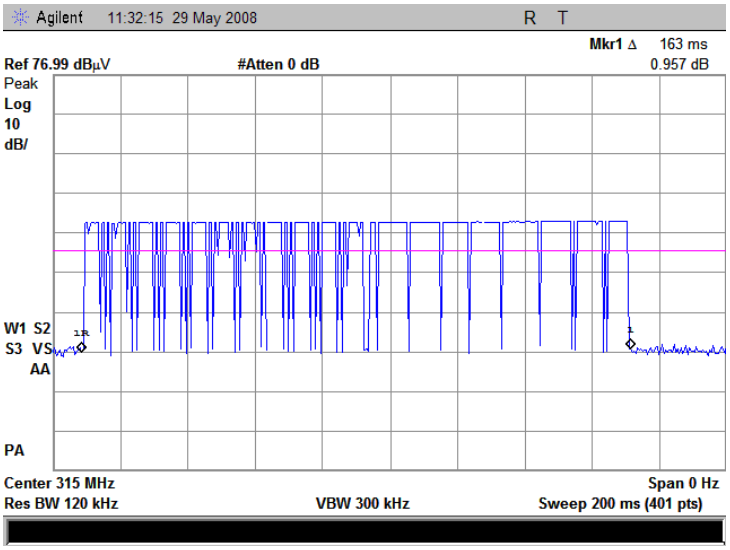


Plot 7.1.9 Transmitter shut down test result (alarm -without siren)



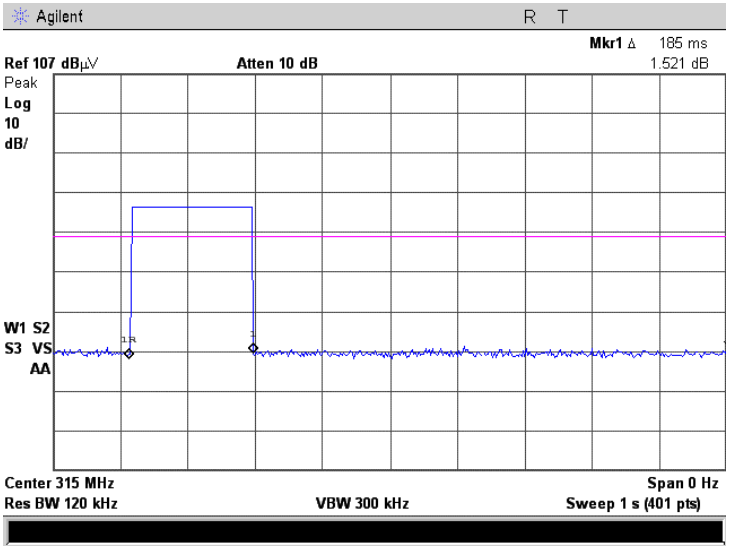
Test specification:	**Section 15.231(a), Periodic operation requirements**		
Test procedure:	Supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date:	3/19/2008		
Temperature: 25ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 38 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.1.10 Transmitter shut down test result pulse duration (alarm -without siren)

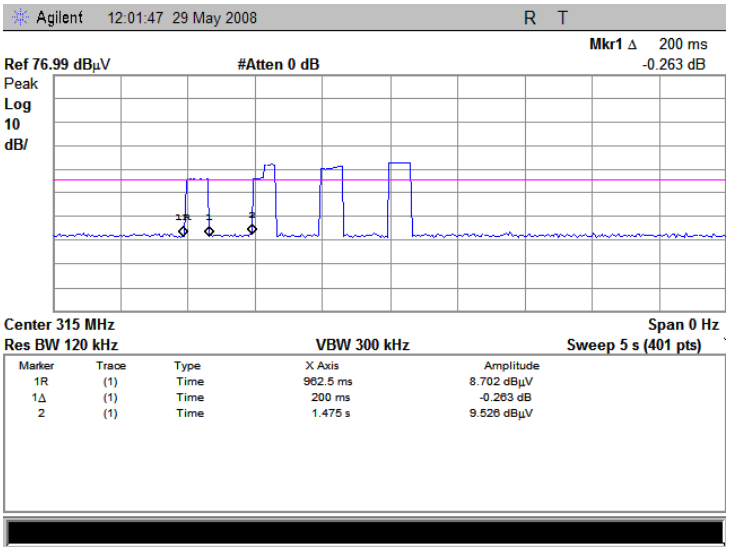


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.11 Transmitter shut down test result (control panel open cover)

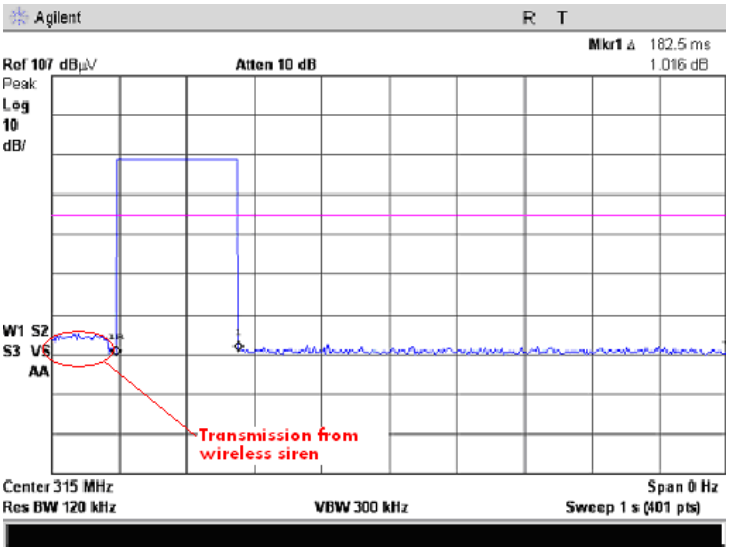


Plot 7.1.12 Transmitter shut down test result (control panel open cover - without siren)



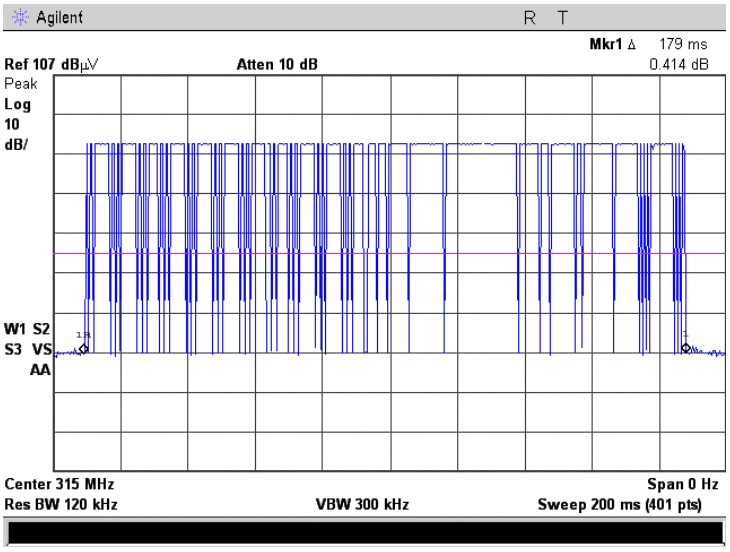
Test specification:	**Section 15.231(a), Periodic operation requirements**		
Test procedure:	Supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date:	3/19/2008		
Temperature: 25ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 38 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.1.13 Polling / supervision transmission duration

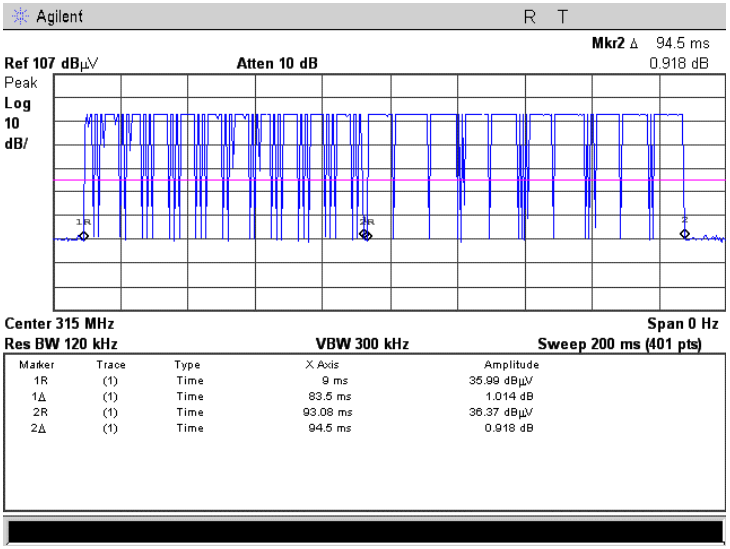


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.14 Polling / supervision transmission burst duration

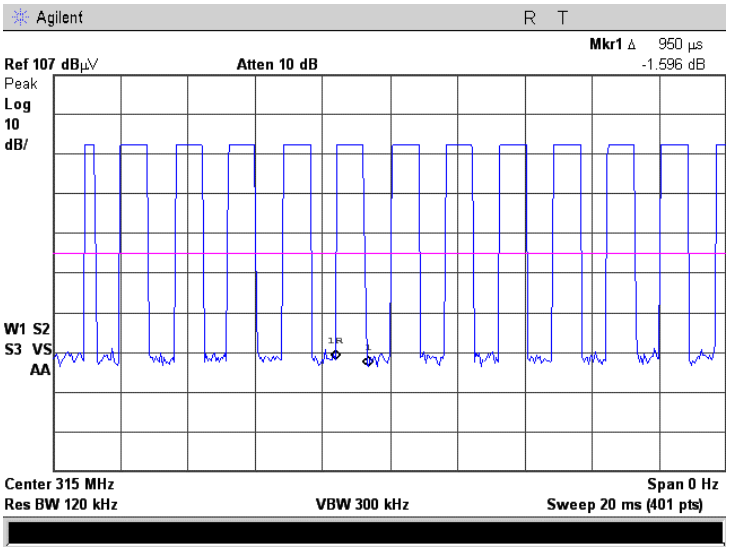


Plot 7.1.15 Polling / supervision transmission burst duration (first and second parts marked)

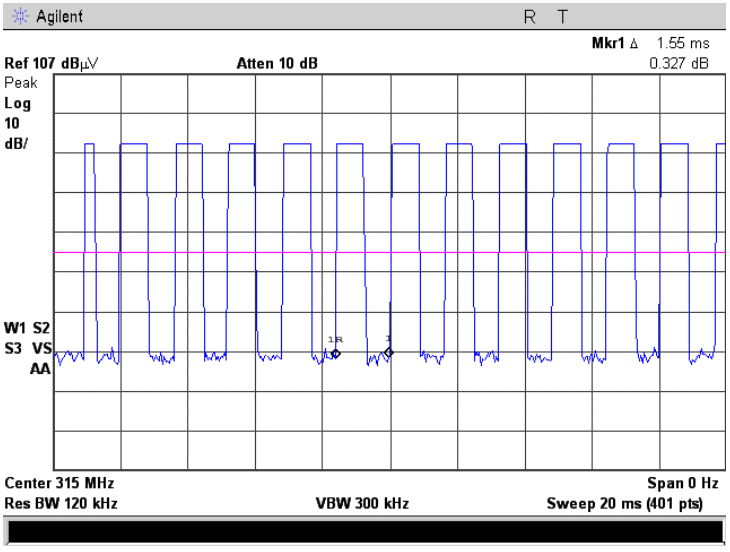


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.16 Polling / supervision pulse transmission duration, first part

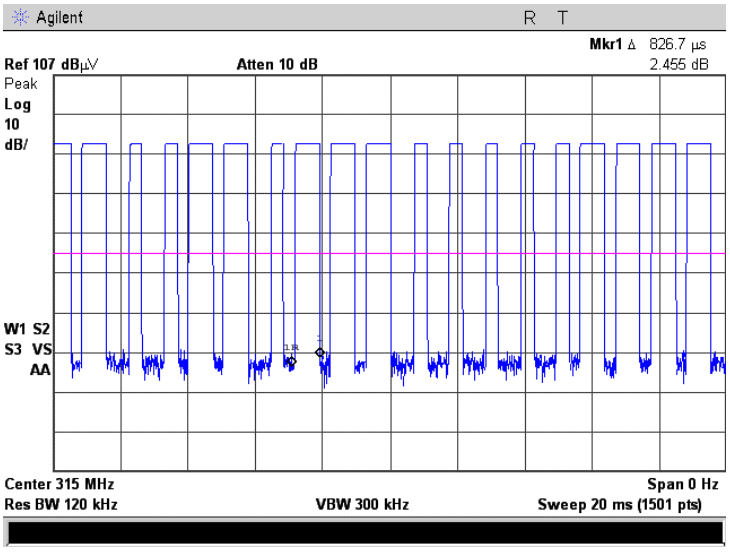


Plot 7.1.17 Polling / supervision pulse transmission period, first part

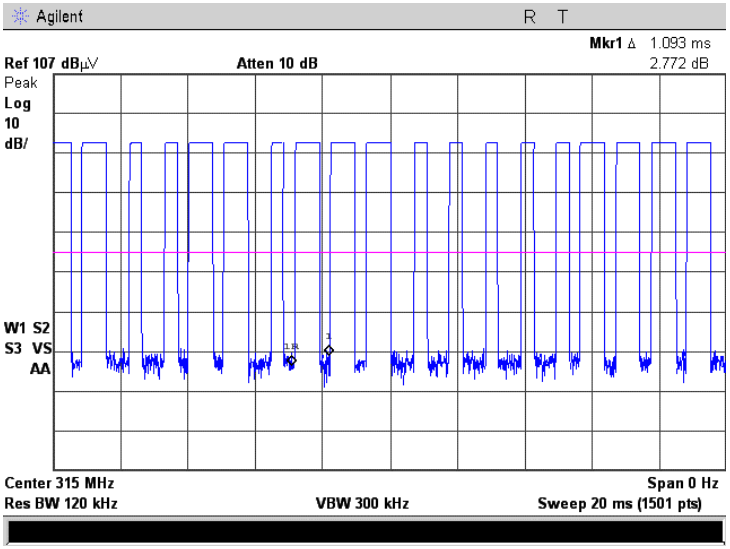


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.18 Polling / supervision pulse transmission duration, second part



Plot 7.1.19 Polling / supervision pulse transmission period, second part



Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date:	3/19/2008		
Temperature: 25ºC	Air Pressure: 1017 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.20 Total duration of polling / supervision transmissions

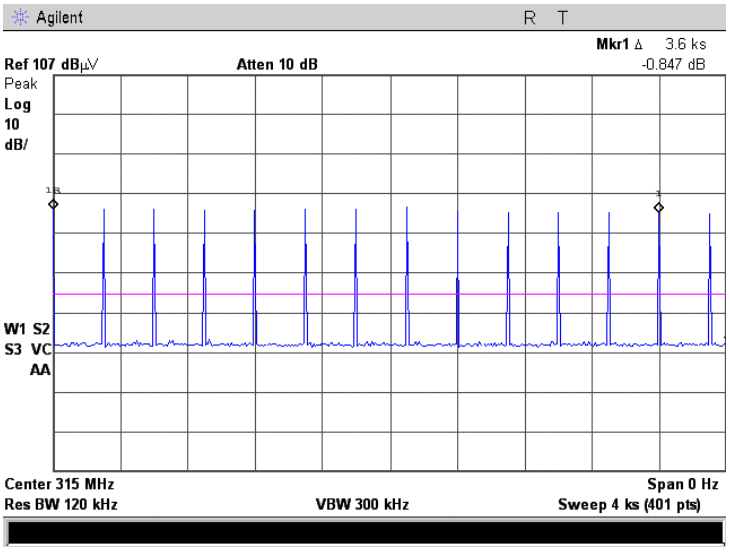


Table 7.1.2 Total duration of polling / supervision transmissions

Duration, ms	Repetition period, ms	Maximum number of transmissions within 1 hour	Total duration within 1 hour, ms
122.593	5000	13	1593.71

First part of the supervison burst:
total duration = 83.5 ms
pulse duration = 0.95 ms
pulse period = 1.55 ms
total "ON" time = (83.5/1.55)*0.95 = 51.177 ms

Second part of the supervison burst:
total duration = 94.5 ms
pulse duration = 0.826 ms
pulse period = 1.093 ms
total "ON" time = (94.5/1.093)*0.826 = 71.415 ms

Total transmission time within one supervision burst = 122.6 ms

Reference numbers of test equipment used

HL 2780							

Full description is given in Appendix A.

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

7.2 Field strength of emissions

7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
315	95.62	75.62

Table 7.2.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	75.62	55.62
0.090 – 0.110	NA	108.5 – 106.8**	NA		
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**		
0.490 – 1.705	NA	73.8 – 63.0**	NA		
1.705 – 30.0*		69.5			
30 – 88		40.0			
88 – 216		43.5			
216 – 960		46.0			
960 - 1000		54.0			
Above 1000	74.0	NA	54.0		

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

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

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

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

Note 1: The fundamental emission limit in dB(μV/m) was calculated as follows:

$$Lim_{AVR} = 20 \times \log(56.81818 \times F - 6136.3636)$$ - within 130 – 174 MHz band;

$$Lim_{AVR} = 20 \times \log(41.6667 \times F - 7083.3333)$$ - within 260 – 470 MHz band,

where F is the carrier frequency in MHz.

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

Note 2: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

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

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

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

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

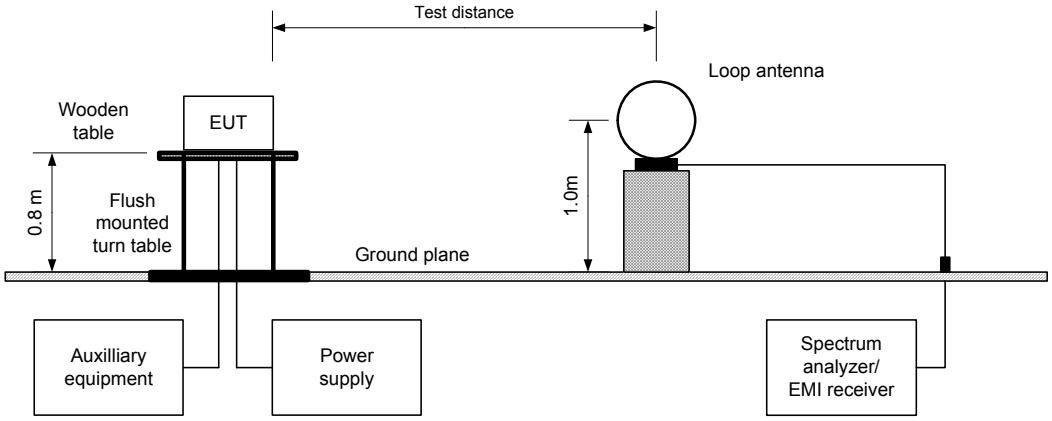
7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

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

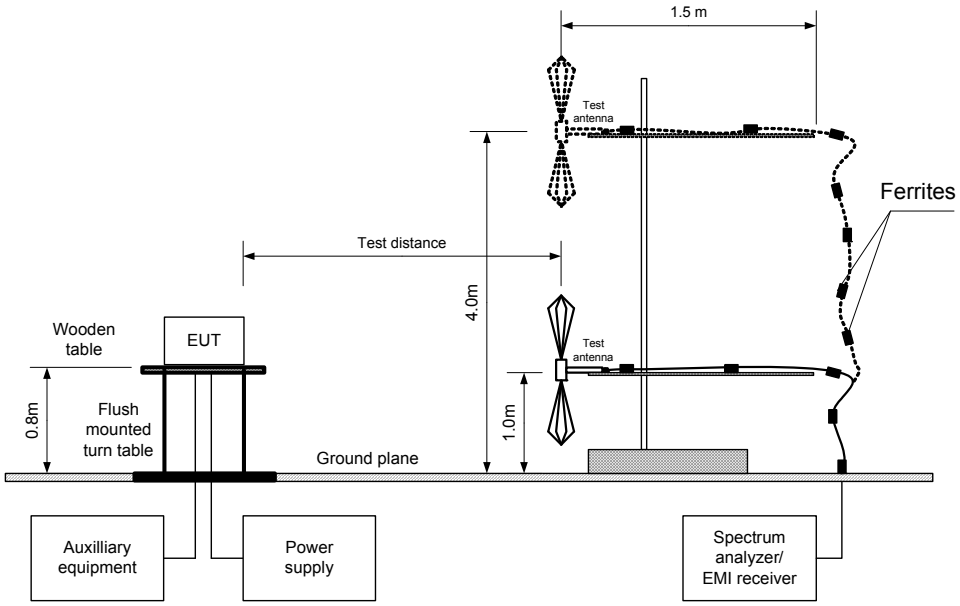
7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz



Test specification:	**Section 15.231(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/2/2008		
Temperature: 22 ºC	**Air Pressure:** 1003 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 15.231(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/2/2008		
Temperature: 22 ºC	**Air Pressure:** 1003 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	ASK
MODULATING SIGNAL:	ID code
BIT RATE:	3 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 - 3500 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Fundamental emission											
315.00	V	1.6	101	68.95	95.62	-26.67	-3.92	65.03	75.62	-10.59	Pass
315.00	H	1.0	171	75.95	95.62	-19.67	-3.92	72.03	75.62	-3.59	Pass
Spurious emissions											
944.988	V	1.0	243	43.77	75.62	-31.85	-3.92	39.85	55.62	-15.77	Pass
1575.10	V	1.0	179	45.44	74.00	-28.56	-3.92	41.52	54.00	-12.48	Pass

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = dB below (negative if above) specification limit.

Table 7.2.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Tx ON		
Burst 1				100.0	-3.92
0.8	1.55	20	10.3225		
Burst 2					
0.7	1.05	80	53.3333		

*- Average factor was calculated as follows

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

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

Reference numbers of test equipment used

HL 0034	HL 0415	HL 0446	HL 0812	HL 1365	HL 1425	HL 1430	HL 1553
HL 1566	HL 1567	HL 1984	HL 2259	HL 2697	HL 2871	HL 2909	

Full description is given in Appendix A.

Test specification:	**Section 15.231(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/2/2008		
Temperature: 22 ºC	**Air Pressure:** 1003 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.2.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	ASK
MODULATING SIGNAL:	ID code
BIT RATE:	3 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No emissions were found								Pass

*- Margin = Measured emission - specification limit.
**- EUT front panel refer to 0 degrees position of turntable.

Table 7.2.6 Restricted bands

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 – 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 – 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

Reference numbers of test equipment used

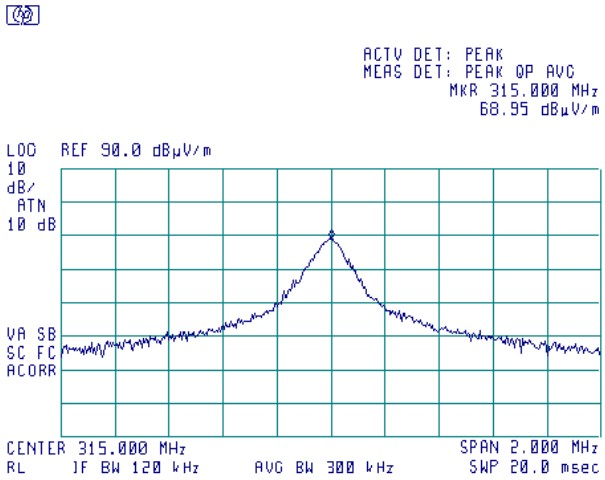
HL 0034	HL 0415	HL 0446	HL 0812	HL 1365	HL 1425	HL 1430	HL 1553
HL 1566	HL 1567	HL 1984	HL 2259	HL 2697	HL 2871	HL 2909	

Full description is given in Appendix A.

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

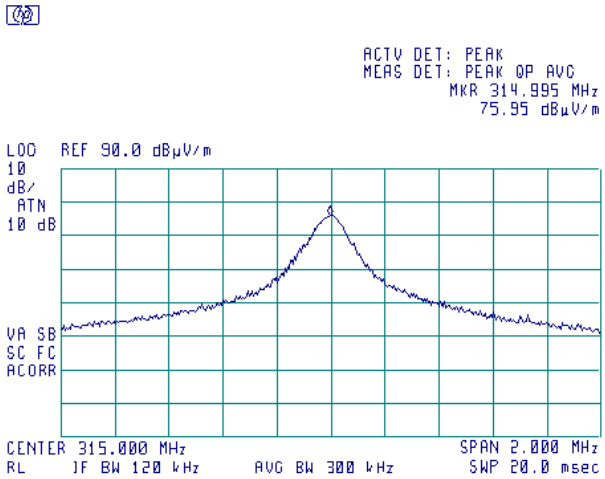
Plot 7.2.1 Radiated emission measurements at the fundamental frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.2 Radiated emission measurements at the fundamental frequency

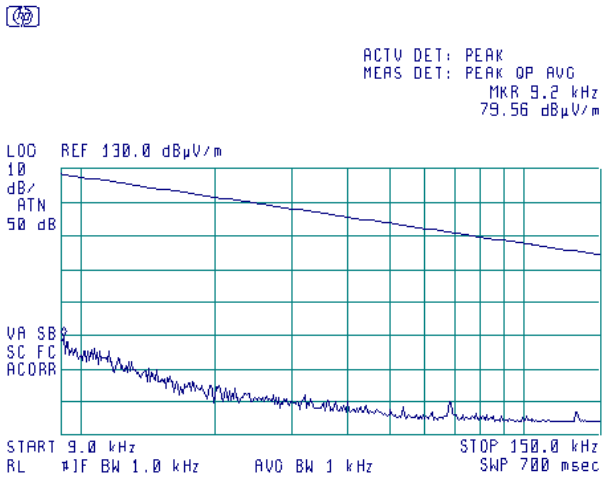
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	**Section 15.231(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/2/2008		
Temperature: 22 ºC	**Air Pressure:** 1003 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

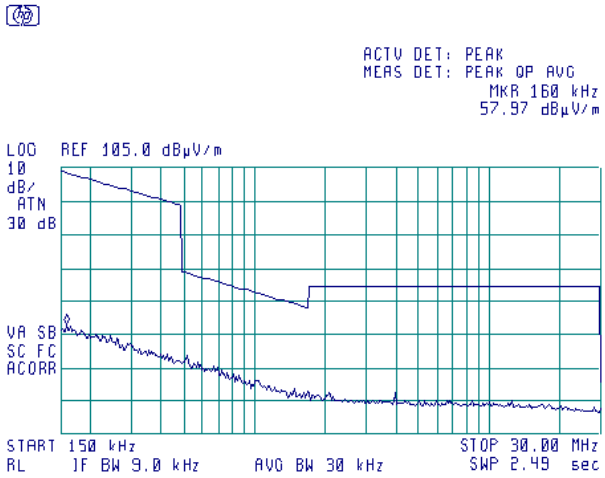
Plot 7.2.3 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.4 Radiated emission measurements from 0.15 to 30 MHz

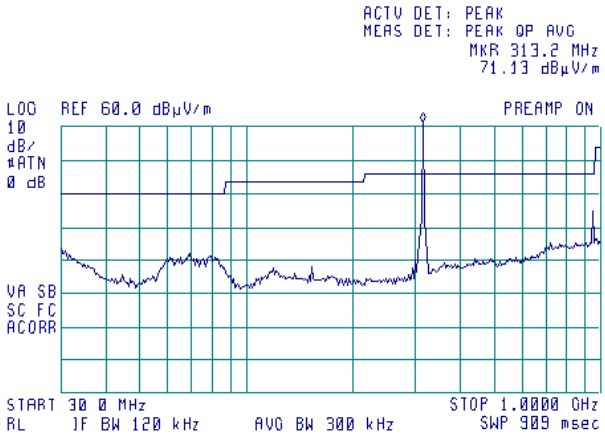
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Test specification:	**Section 15.231(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/2/2008		
Temperature: 22 ºC	**Air Pressure:** 1003 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

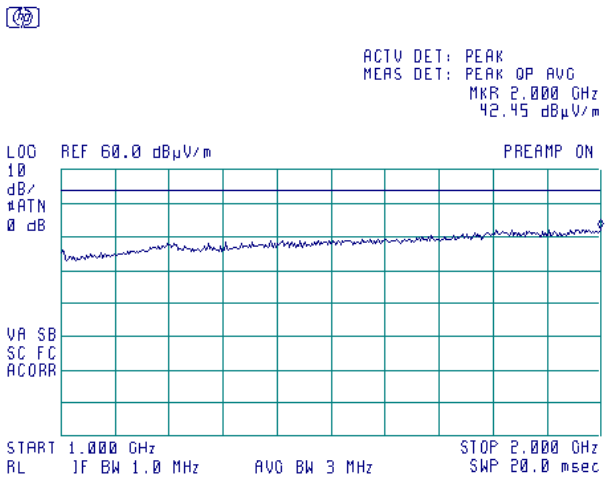
Plot 7.2.5 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Plot 7.2.6 Radiated emission measurements from 1000 to 2000 MHz

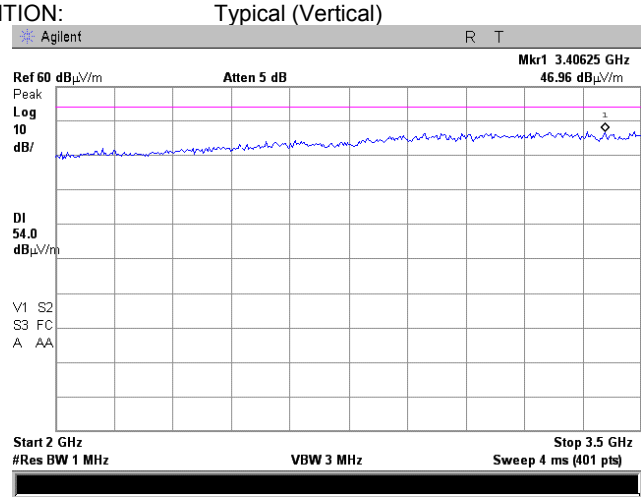
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	**Section 15.231(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/2/2008		
Temperature: 22 ºC	**Air Pressure:** 1003 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.2.7 Radiated emission measurements from 2000 to 3500 MHz

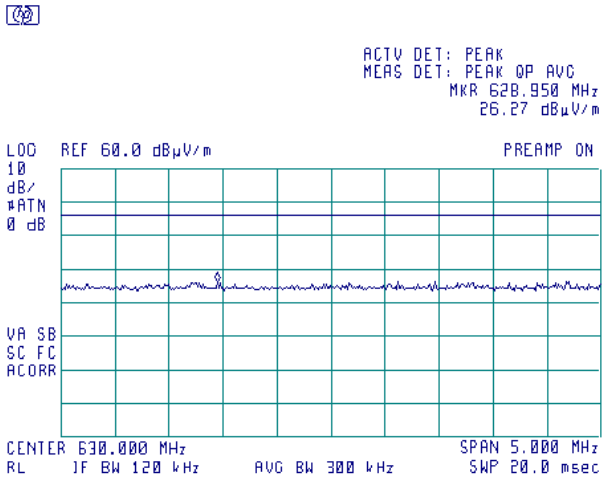
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

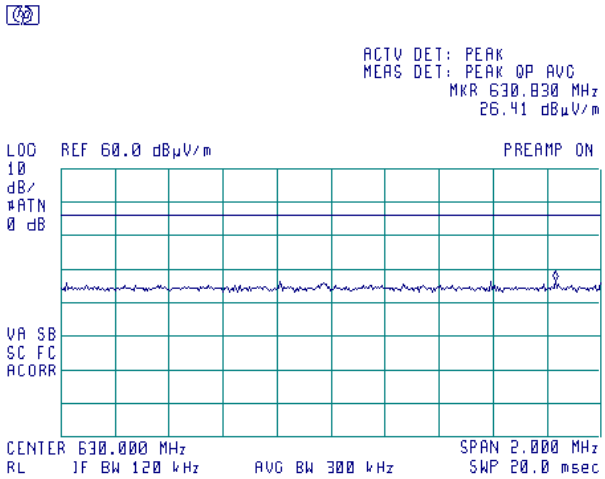
Plot 7.2.8 Radiated emission measurements at the second harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.9 Radiated emission measurements at the second harmonic frequency

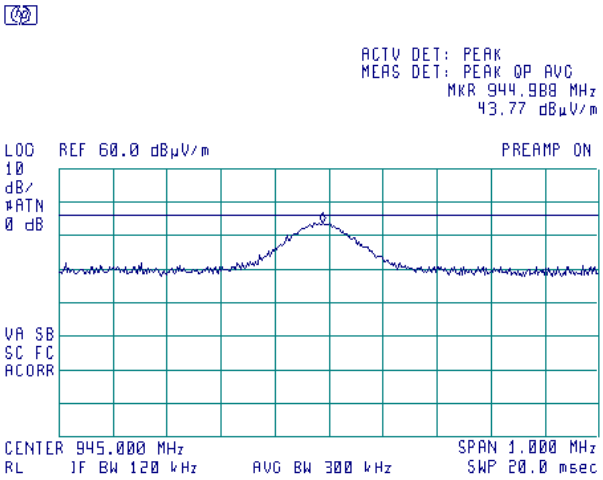
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

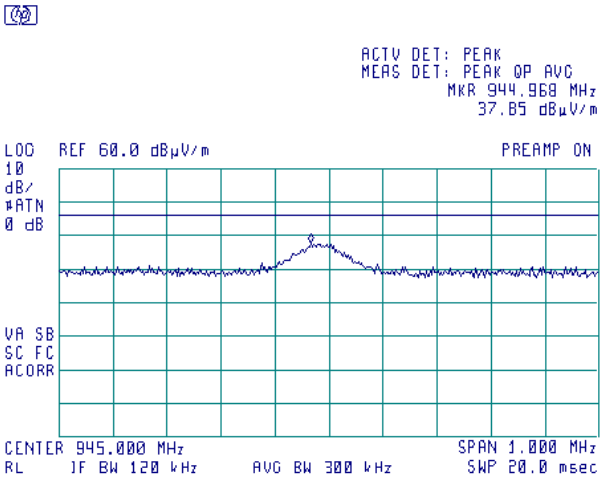
Plot 7.2.10 Radiated emission measurements at the third harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.11 Radiated emission measurements at the third harmonic frequency

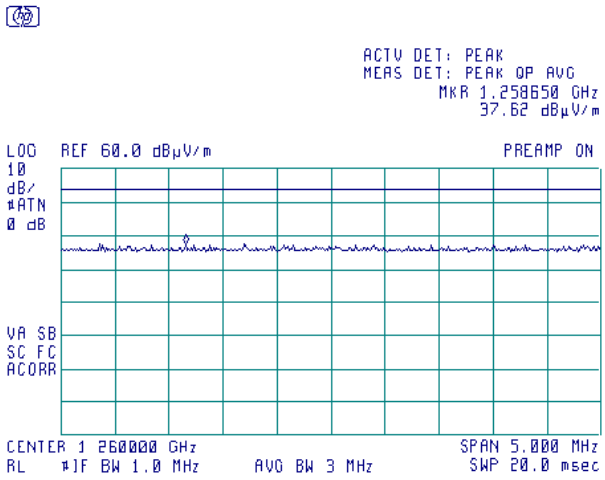
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

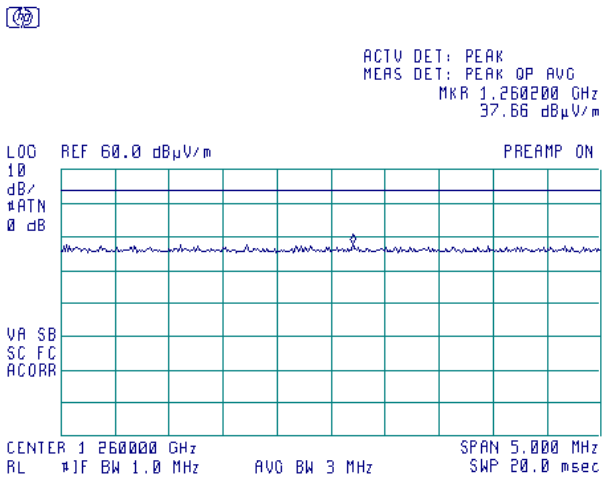
Plot 7.2.12 Radiated emission measurements at the fourth harmonic frequency

TEST SITE: Anechoic Chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.13 Radiated emission measurements at the fourth harmonic frequency

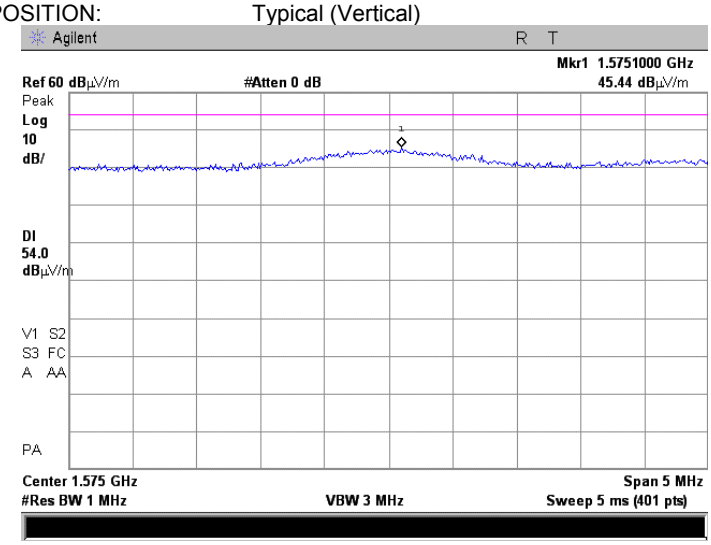
TEST SITE: Anechoic Chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

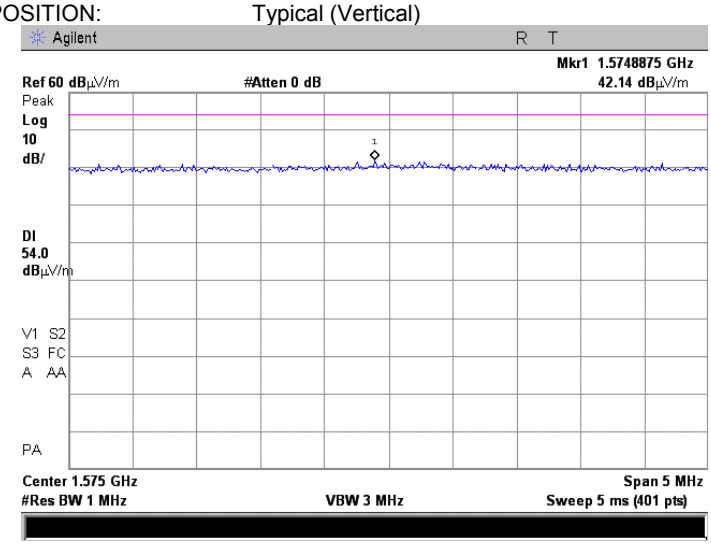
Plot 7.2.14 Radiated emission measurements at the fifth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.15 Radiated emission measurements at the fifth harmonic frequency

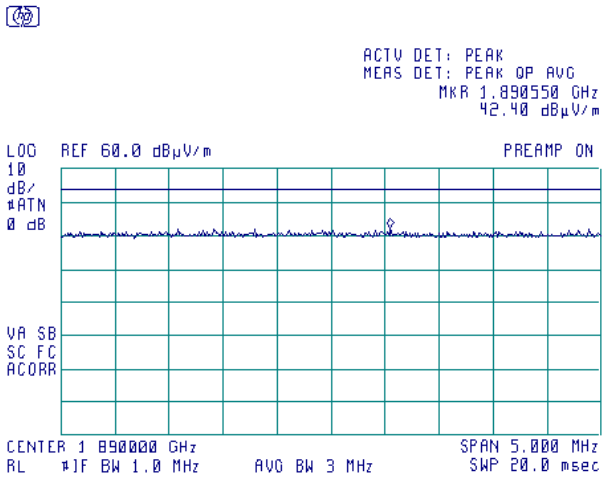
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

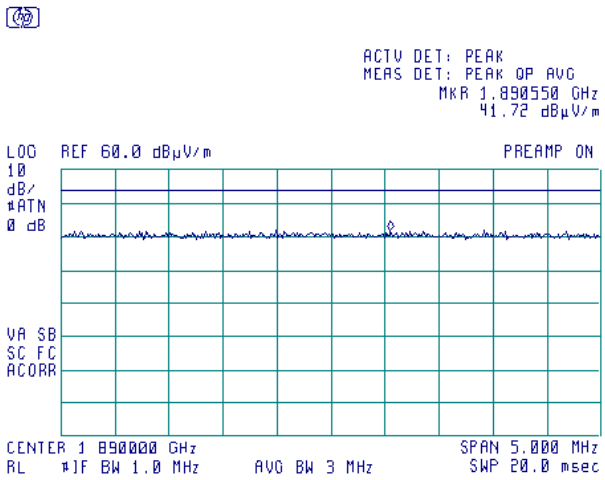
Plot 7.2.16 Radiated emission measurements at the sixth harmonic frequency

TEST SITE: Anechoic Chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.17 Radiated emission measurements at the sixth harmonic frequency

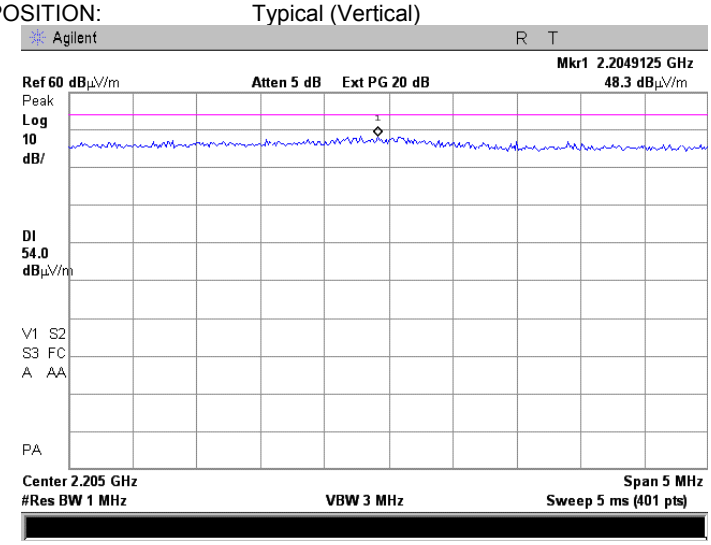
TEST SITE: Anechoic Chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

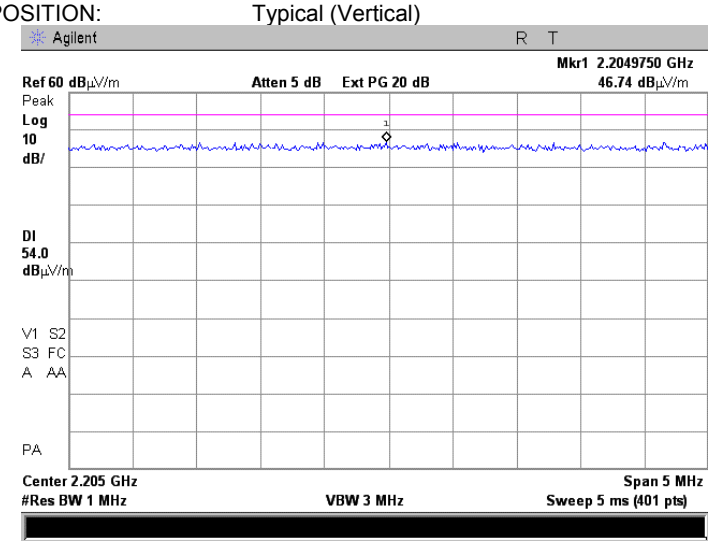
Plot 7.2.18 Radiated emission measurements at the seventh harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.19 Radiated emission measurements at the seventh harmonic frequency

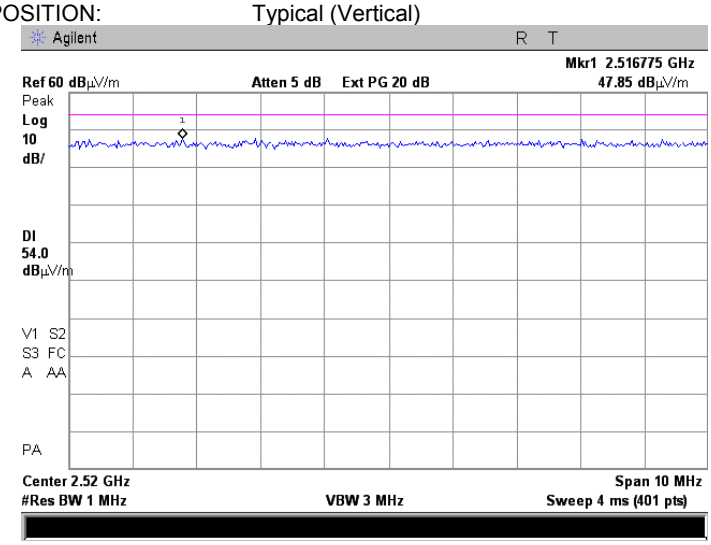
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

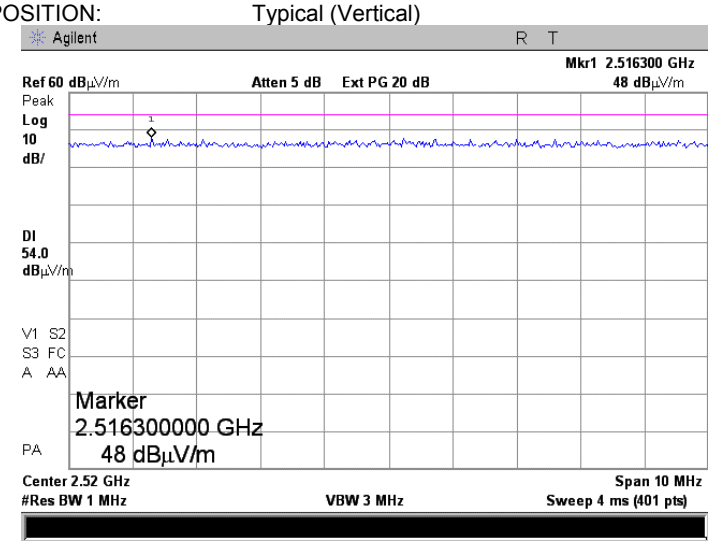
Plot 7.2.20 Radiated emission measurements at the eighth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.21 Radiated emission measurements at the eighth harmonic frequency

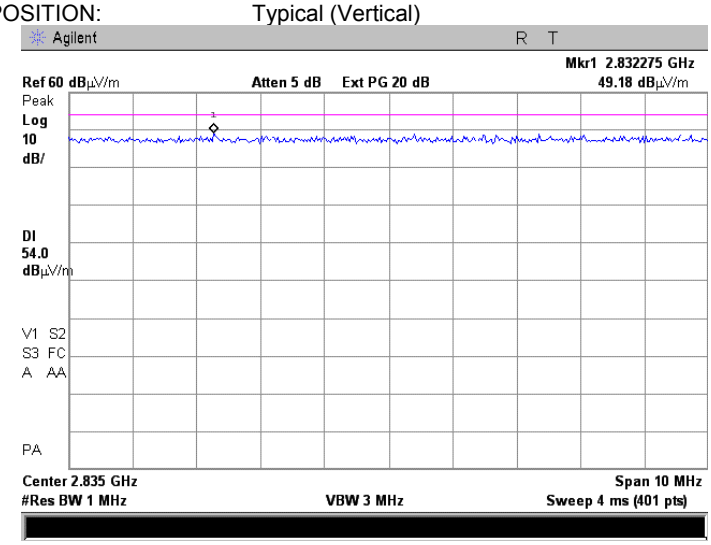
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

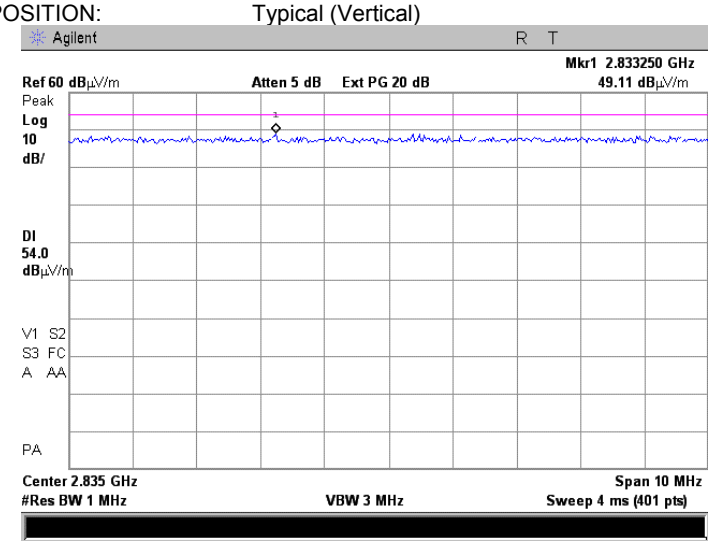
Plot 7.2.22 Radiated emission measurements at the ninth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.23 Radiated emission measurements at the ninth harmonic frequency

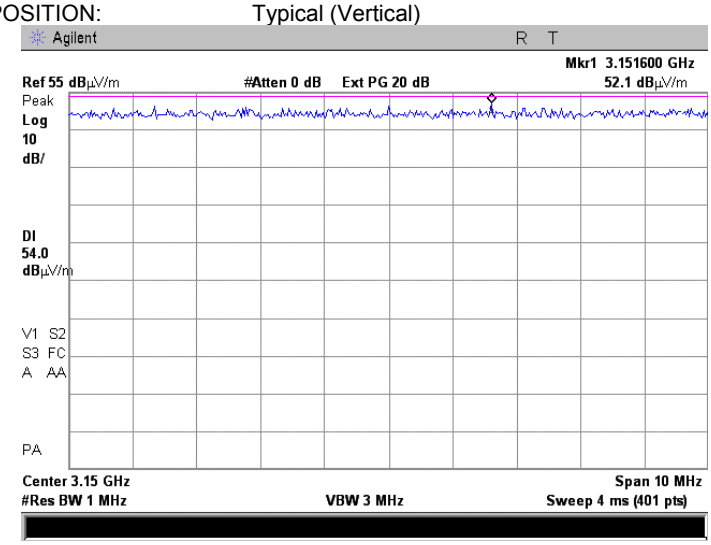
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	**Section 15.231(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/2/2008		
Temperature: 22 ºC	**Air Pressure:** 1003 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

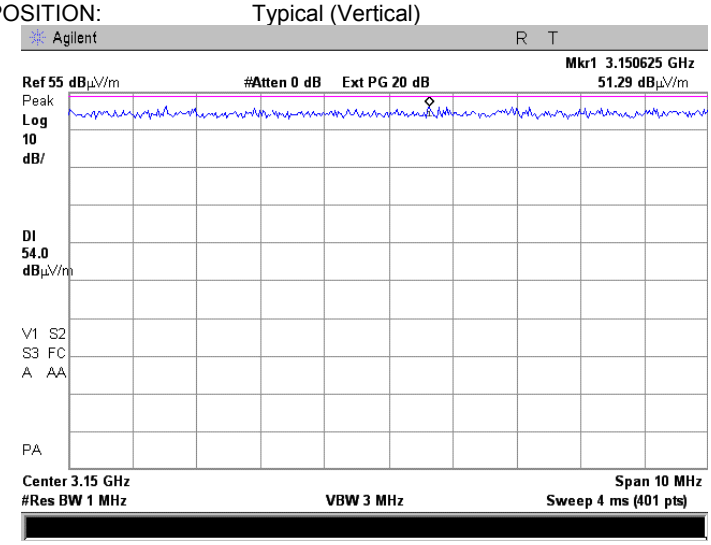
Plot 7.2.24 Radiated emission measurements at the tenth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



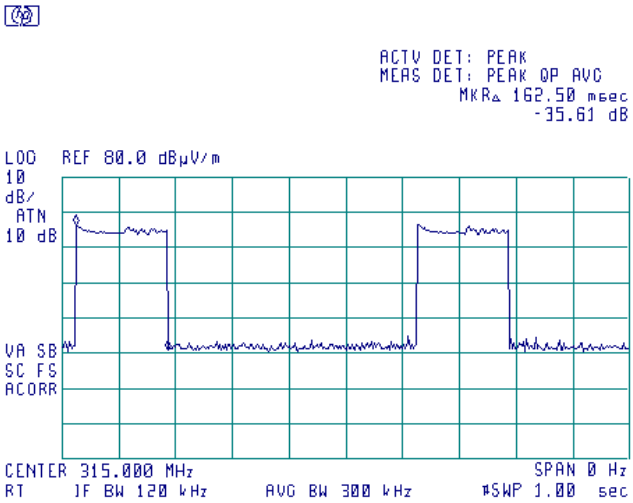
Plot 7.2.25 Radiated emission measurements at the tenth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)

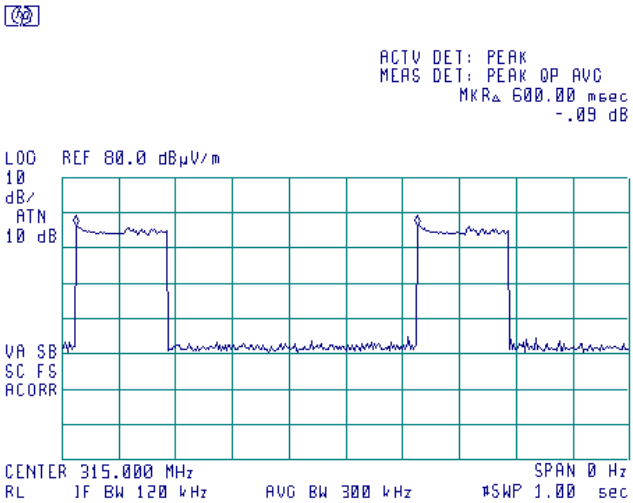


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.26 Transmission duration

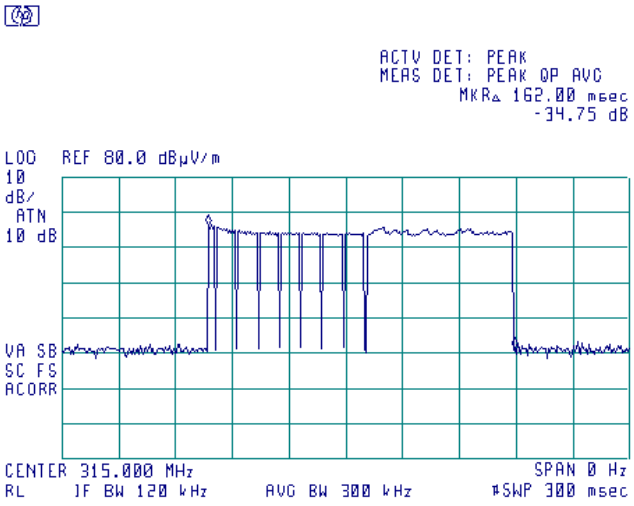


Plot 7.2.27 Transmission period

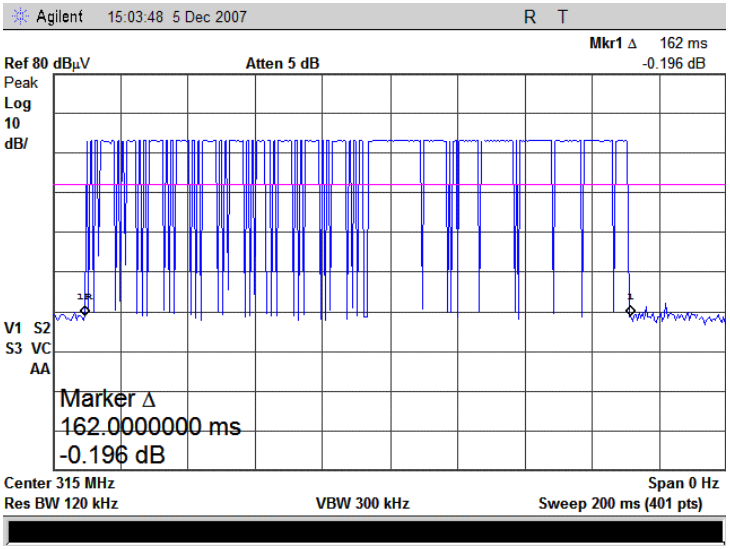


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.28 Transmission train duration

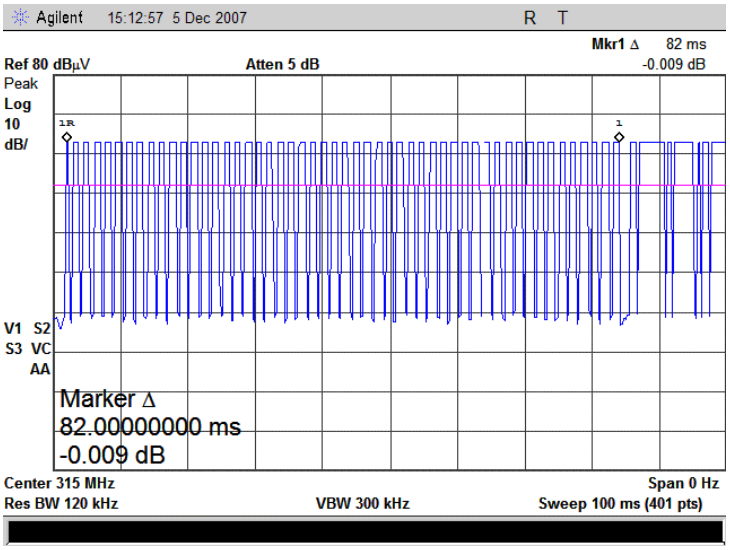


Plot 7.2.29 Burst train duration

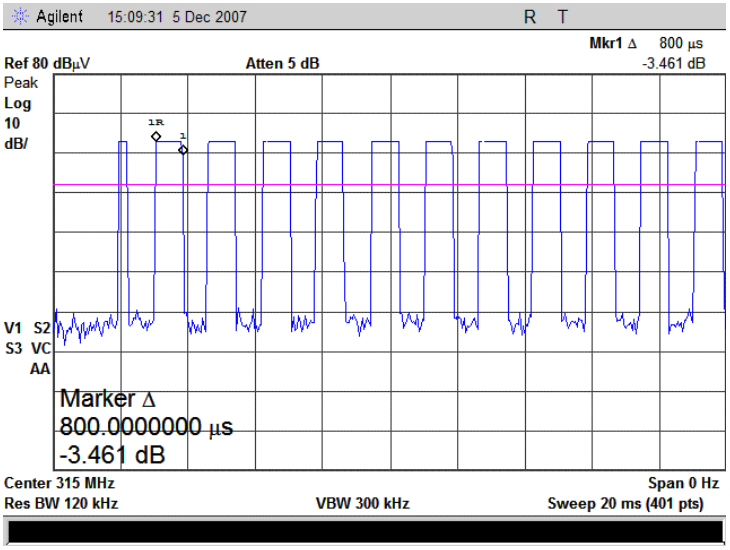


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.30 First burst duration

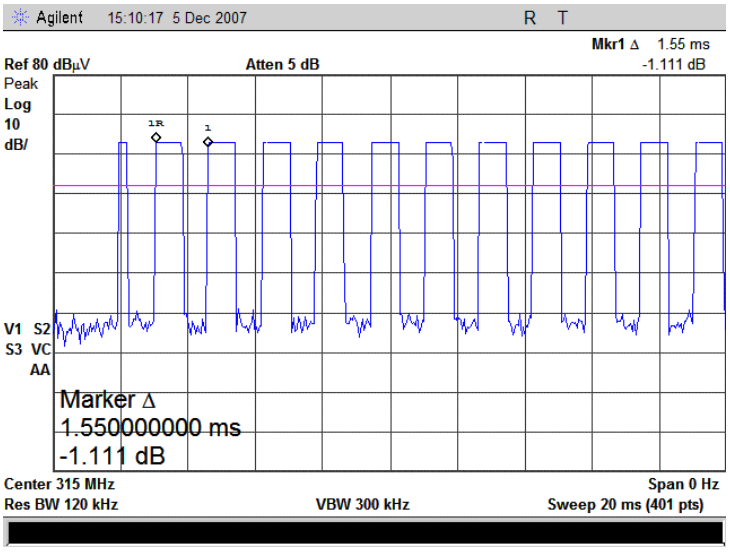


Plot 7.2.31 First pulse duration

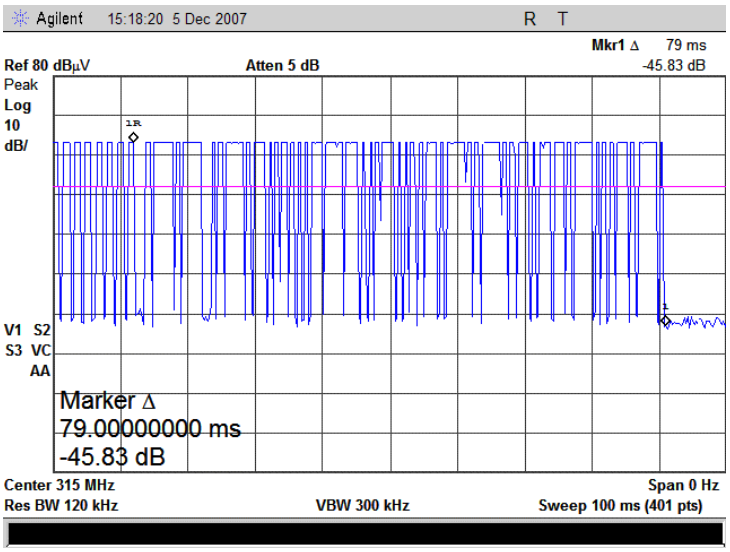


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.32 First pulse period

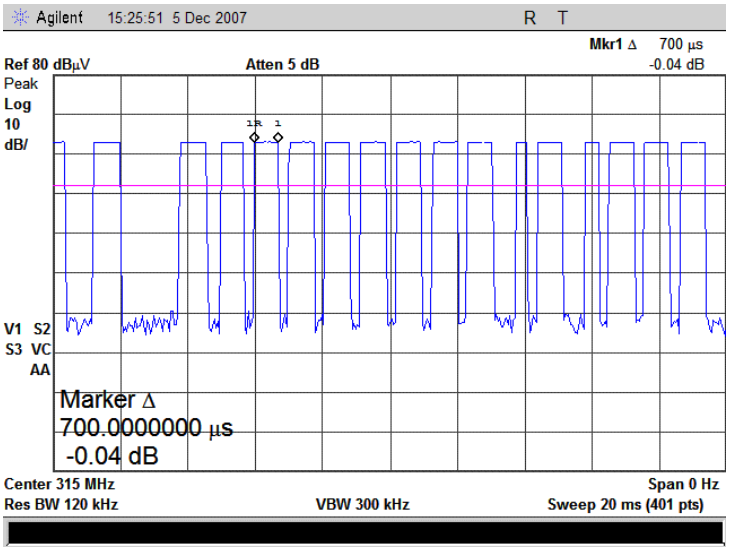


Plot 7.2.33 Second burst duration

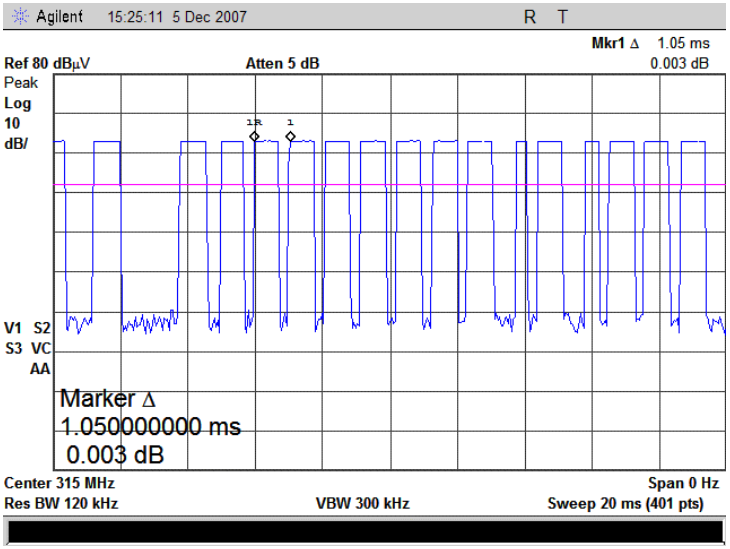


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	1/2/2008		
Temperature: 22 ºC	Air Pressure: 1003 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.34 Second pulse duration



Plot 7.2.35 Second pulse period



Test specification:	**Section 15.231(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/24/2008		
Temperature: 21 ºC	**Air Pressure:** 1018 hPa	**Relative Humidity:** 35 %	**Power Supply:** 120 VAC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, % of the carrier frequency
70 - 900	20.0	0.25
Above 900		0.50

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

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 was set to transmit modulated carrier.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Occupied bandwidth test setup

Test specification:	**Section 15.231(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/24/2008		
Temperature: 21 ºC	**Air Pressure:** 1018 hPa	**Relative Humidity:** 35 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
MODULATION ENVELOPE REFERENCE POINTS:	20 dBc
MODULATION:	ASK
MODULATING SIGNAL:	ID code
BIT RATE:	3 kbps

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
315	537	0.25	787.5	-250.5	Pass

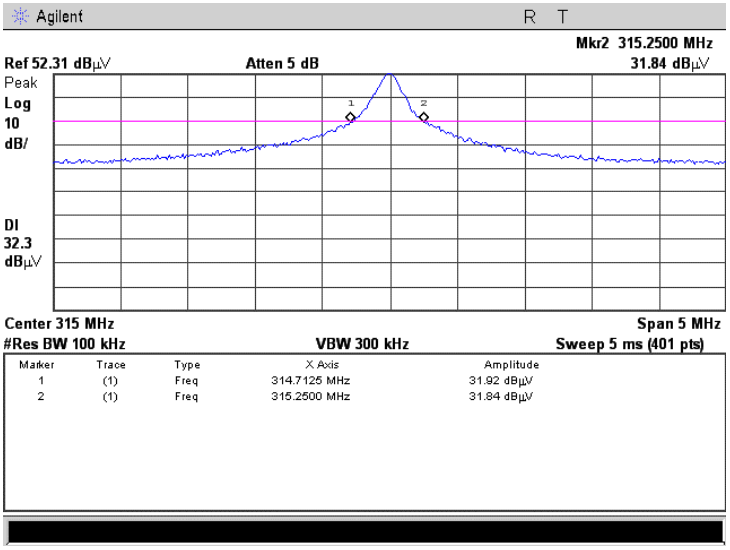
Reference numbers of test equipment used

HL 0337	HL 3001							

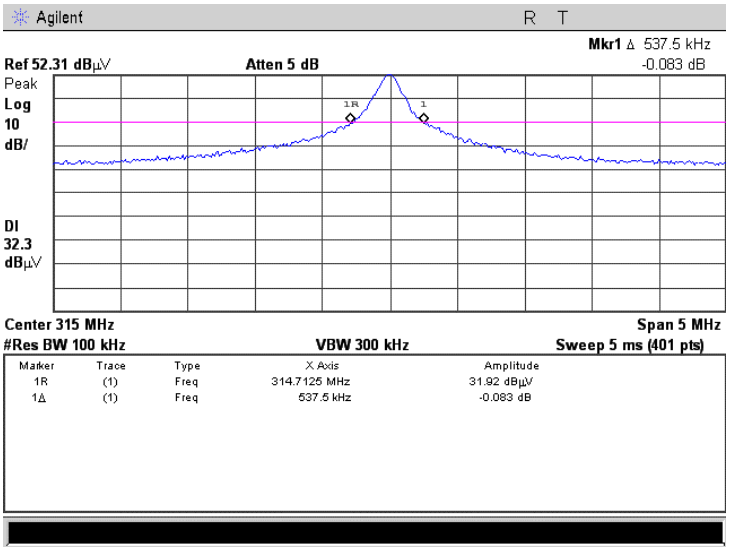
Full description is given in Appendix A.

Test specification:	**Section 15.231(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/24/2008		
Temperature: 21 ºC	**Air Pressure:** 1018 hPa	**Relative Humidity:** 35 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.3.1 Occupied bandwidth test result



Plot 7.3.2 Occupied bandwidth test result



Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	1/29/2008		
Temperature: 24 ºC	Air Pressure: 1013 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

7.4 Conducted emissions

7.4.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

7.4.2 Test procedure

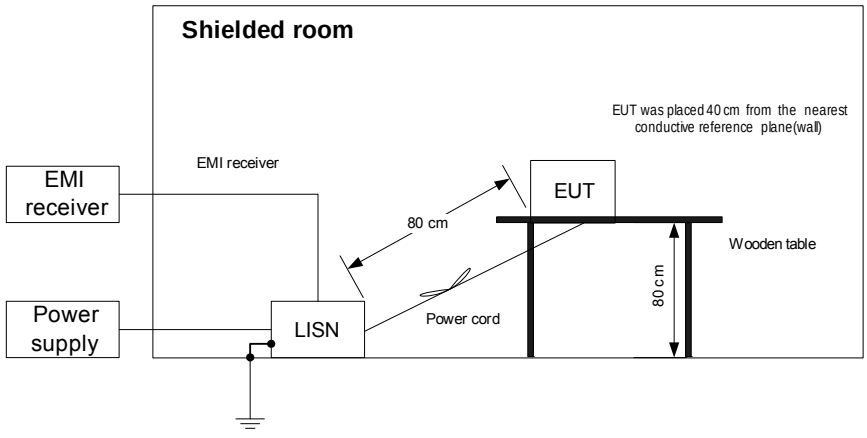
7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

7.4.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.4.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

7.4.2.3 The position of the device cables was varied to determine maximum emission level.

7.4.2.4 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

Figure 7.4.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.207(a), Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/29/2008		
Temperature: 24 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 39 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.4.2 Conducted emission test results

LINE: AC mains
EUT OPERATING MODE: Transmit
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Without rechargeable battery

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.158590	55.29	52.81	65.58	-12.77	40.33	55.58	-15.25	L1	Pass
0.166229	55.13	52.86	65.21	-12.35	42.42	55.21	-12.79		
0.196245	48.60	45.69	63.80	-18.11	27.56	53.80	-26.24		
0.239408	44.75	40.47	62.14	-21.67	26.17	52.14	-25.97		
0.365308	42.81	40.95	58.66	-17.71	33.55	48.66	-15.11		
0.530627	38.41	35.93	56.00	-20.07	28.28	46.00	-17.72		
0.162860	55.69	54.00	65.37	-11.37	42.88	55.37	-12.49	L2	Pass
0.165432	55.90	53.41	65.25	-11.84	41.41	55.25	-13.84		
0.198961	49.39	47.24	63.69	-16.45	32.86	53.69	-20.83		
0.293886	42.63	36.85	60.46	-23.61	23.71	50.46	-26.75		
0.328157	41.52	39.30	59.54	-20.24	27.27	49.54	-22.27		
0.390058	40.79	38.10	58.07	-19.97	25.66	48.07	-22.41		

*****- Margin = Measured emission - specification limit.

With rechargeable battery

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.179986	53.96	51.71	64.54	-12.83	40.29	54.54	-14.25	L1	Pass
0.181262	54.24	51.63	64.48	-12.85	41.40	54.48	-13.08		
0.224167	47.22	44.12	62.72	-18.60	31.57	52.72	-21.15		
0.363842	43.64	40.72	58.69	-17.97	33.98	48.69	-14.71		
0.468429	41.66	39.19	56.59	-17.40	26.96	46.59	-19.63		
1.136518	40.45	36.00	56.00	-20.00	25.34	46.00	-20.66		
0.180247	54.45	52.20	64.52	-12.32	38.01	54.52	-16.51	L2	Pass
0.226877	46.71	44.43	62.62	-18.19	29.85	52.62	-22.77		
0.376616	43.03	40.27	58.39	-18.12	28.93	48.39	-19.46		

*****- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

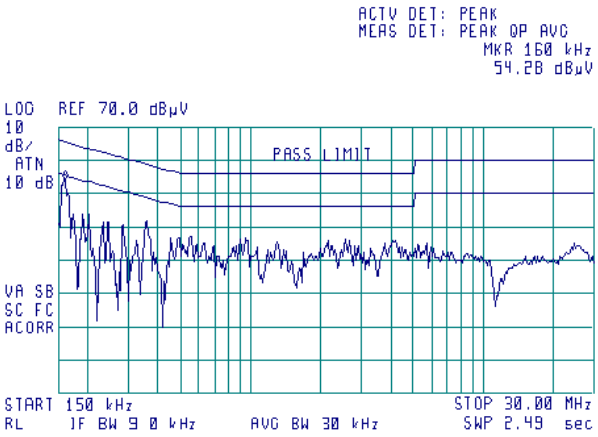
HL 0163	HL 0787	HL 1430	HL 1502	HL 1510			

Full description is given in Appendix A.

Test specification:	**Section 15.207(a), Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/29/2008		
Temperature: 24 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 39 %	**Power Supply:** 120 VAC
Remarks:			

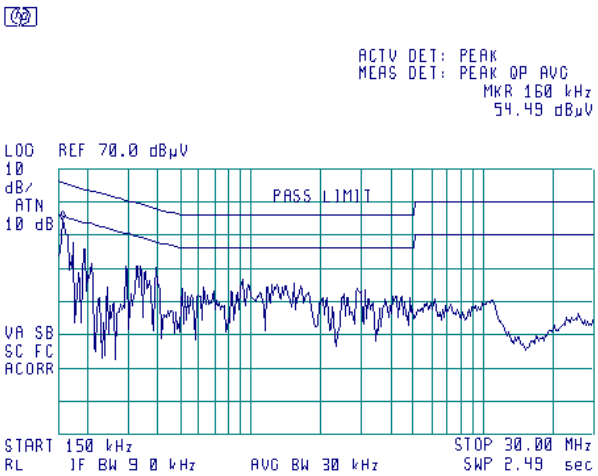
Plot 7.4.1 Conducted emission measurements

LINE:	L1
EUT OPERATING MODE:	Transmit
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK
NOTE	Without battery



Plot 7.4.2 Conducted emission measurements

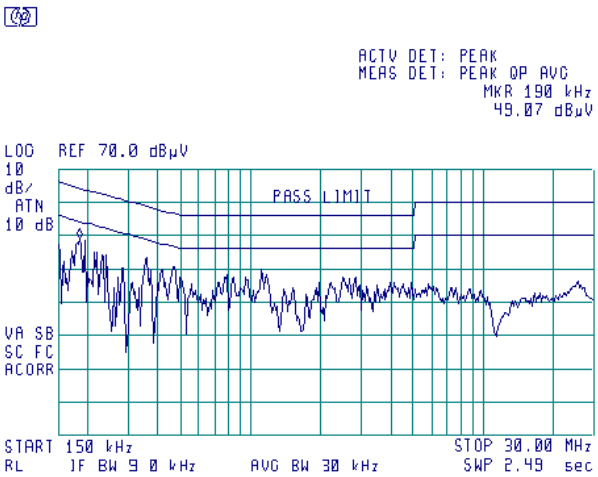
LINE:	L2
EUT OPERATING MODE:	Transmit
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK
NOTE	Without battery



Test specification:	**Section 15.207(a), Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date:	1/29/2008		
Temperature: 24 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 39 %	**Power Supply:** 120 VAC
Remarks:			

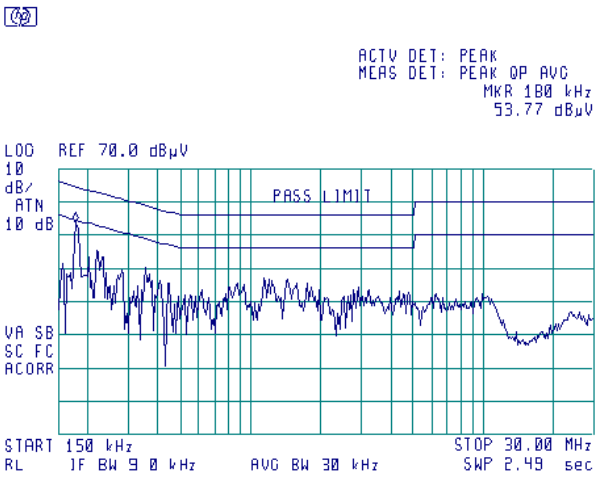
Plot 7.4.3 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK
NOTE With battery



Plot 7.4.4 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK
NOTE With battery



Test specification:	**Section 15.203, Antenna requirement**		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date:	3/27/2008		
Temperature: 21ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 46 %	**Power Supply:** 120 VAC
Remarks:			

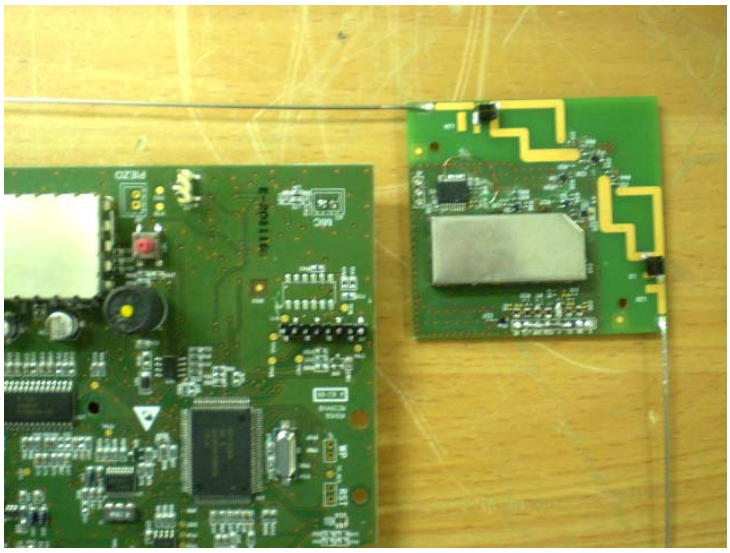
7.5 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.5.1.

Table 7.5.1 Antenna requirements

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

Photograph 7.5.1 Antenna assembly



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.*	Due Cal.*
0034	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	25-Sep-07	25-Sep-08
0163	LISN FCC/VDE/50 Ohm/50 uH + 5 Ohm, MIL-STD-461E, CISPR 16-1	Electro-Metrics	ANS 25/2	1314	20-Nov-07	20-Nov-08
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	08-Jun-07	08-Jun-08
0415	Cable, Coax, RF, RG-214	HL	CC-3	056	02-Dec-07	02-Dec-08
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	28-Jun-07	28-Jun-08
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard Co	11947A	3107A01877	21-Nov-07	21-Nov-08
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	HL	C214-11	148	02-Dec-07	02-Dec-08
1365	Cable Coaxial, S-FLC 12-50, 5 m	HL	C214-5	1365	30-Dec-07	30-Dec-08
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A00222, 3705A00204	31-Aug-07	31-Aug-08
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A00262,3705A00217	31-Aug-07	31-Aug-08
1502	Cable RF, 6 m, BNC/BNC	Belden	M17/167 MIL-C-17	1502	16-Nov-07	16-Nov-08
1510	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1510	30-Dec-07	30-Dec-08
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	22-May-07	22-May-08
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	02-Dec-07	02-Dec-08
1567	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13095/4PE	02-Dec-07	02-Dec-08
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	03-Mar-08	03-Mar-09
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	30-Dec-07	30-Dec-08
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences. Corp. Pleasanton, California USA	JB3	A022805	10-Jan-08	10-Jan-09
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY45102406	11-Jun-07	11-Jun-08
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	11-Feb-08	11-Feb-09
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	07-May-07	07-May-08
3001	EMC Analyzer, 9 kHz to 3 GHz	Agilent Technologies	E7402A	US39440180	22-Nov-07	22-Nov-08

* The calibration was valid at the testing time.

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 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
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.
Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.
In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is US1003.

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11 APPENDIX D Specification references

47CFR part 15: 2010	Radio Frequency Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

12 APPENDIX E Test equipment correction factors

Correction factor
Line impedance stabilization network
Model ANS-25/2, Electro-Metrics, HL 0163

Frequency, MHz	Correction factor, dB	Frequency, MHz	Correction factor, dB
0.01	4.7	3	0.1
0.02	2.1	4	0.1
0.03	1.1	6	0.1
0.04	0.7	10	0.1
0.05	0.5	12	0.1
0.1	0.2	16	0.1
0.2	0.1	18	0.1
0.4	0.1	20	0.1
0.6	0.1	25	0.1
0.8	0.1	28	0.1
1	0.1	30	0.1
2	0.1		

The correction factor in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.

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

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

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

Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988, HL 0034

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	12.6	625	20.4
225	12.2	650	20.9
250	13.4	675	22.0
275	14.3	700	22.2
300	15.2	725	22.7
325	15.7	750	22.5
350	15.9	775	22.7
375	16.4	800	22.8
400	17.0	825	23.2
425	17.4	850	23.5
450	17.9	875	23.9
475	18.6	900	24.0
500	19.1	925	24.0
525	19.3	950	24.2
550	19.6	975	24.7
575	19.8	1000	25.1
600	20.0		

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

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

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

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

Antenna calibration
Sunol Sciences Inc., model JB3, serial number A022805, HL 2697

Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain
30	22.2	-22.5	0.01	620	19.7	6.3	4.27	1215	24.9	7.0	5.05	1810	28.3	7.1	5.08	2405	30.9	6.9	4.93
40	14.7	-12.5	0.06	630	19.6	6.6	4.57	1225	25.1	6.9	4.91	1820	28.6	6.8	4.74	2415	31.0	6.9	4.85
45	11.3	-8.1	0.16	635	19.7	6.5	4.48	1230	25.2	6.8	4.82	1825	28.7	6.8	4.75	2420	31.0	6.8	4.82
45	11.3	-8.1	0.16	640	19.9	6.4	4.40	1235	25.1	7.0	4.96	1830	28.7	6.8	4.76	2425	31.1	6.8	4.81
50	8.9	-4.7	0.34	645	19.9	6.5	4.45	1240	25.0	7.1	5.09	1835	28.7	6.7	4.72	2430	31.0	6.9	4.87
55	7.9	-2.8	0.52	650	19.9	6.5	4.51	1245	25.0	7.1	5.12	1840	28.8	6.7	4.69	2435	31.0	6.9	4.88
60	7.8	-2.1	0.62	655	19.9	6.6	4.60	1250	25.0	7.1	5.15	1845	28.6	6.9	4.90	2440	31.2	6.8	4.74
70	9.0	-1.9	0.64	665	19.9	6.7	4.70	1260	24.9	7.3	5.36	1855	28.5	7.0	5.07	2450	31.0	7.0	4.96
75	8.8	-1.1	0.78	670	20.0	6.7	4.71	1265	25.0	7.3	5.31	1860	28.6	7.0	5.01	2455	31.0	7.0	5.01
80	8.4	-0.2	0.97	675	20.1	6.7	4.71	1270	25.1	7.2	5.26	1865	28.5	7.1	5.17	2460	30.9	7.2	5.19
85	8.0	0.8	1.20	680	20.1	6.7	4.71	1275	25.3	7.0	5.05	1870	28.4	7.3	5.33	2465	31.1	6.9	4.95
90	8.2	1.1	1.29	685	20.1	6.8	4.79	1280	25.5	6.8	4.84	1875	28.4	7.2	5.28	2470	31.3	6.8	4.76
95	9.2	0.5	1.13	690	20.1	6.9	4.88	1285	25.4	7.0	4.97	1880	28.5	7.2	5.22	2475	31.4	6.7	4.69
100	10.6	-0.4	0.92	695	20.2	6.8	4.82	1290	25.3	7.1	5.10	1885	28.5	7.2	5.22	2480	31.3	6.8	4.79
110	12.6	-1.6	0.70	705	20.4	6.8	4.75	1300	25.2	7.3	5.33	1895	28.6	7.2	5.24	2490	31.1	7.0	4.99
115	13.3	-1.9	0.65	710	20.5	6.8	4.75	1305	25.3	7.2	5.21	1900	28.6	7.2	5.27	2495	31.2	7.0	4.99
120	13.9	-2.1	0.62	715	20.5	6.8	4.80	1310	25.5	7.1	5.09	1905	28.5	7.3	5.36	2500	30.9	7.2	5.27
125	14.2	-2.0	0.63	720	20.5	6.9	4.85	1315	25.4	7.2	5.23	1910	28.5	7.4	5.45	2505	31.1	7.1	5.15
130	14.2	-1.7	0.68	725	20.6	6.8	4.81	1320	25.3	7.3	5.36	1915	28.5	7.3	5.38	2510	31.0	7.2	5.22
135	13.8	-1.0	0.79	730	20.7	6.8	4.77	1325	25.5	7.2	5.21	1920	28.6	7.3	5.31	2515	31.0	7.2	5.26
140	13.4	-0.3	0.94	735	20.9	6.7	4.65	1330	25.6	7.0	5.06	1925	28.6	7.3	5.35	2520	31.2	7.0	5.05
150	12.9	0.8	1.21	745	21.0	6.6	4.59	1340	25.7	7.1	5.09	1935	28.5	7.4	5.54	2530	31.0	7.3	5.37
155	12.7	1.3	1.34	750	21.0	6.7	4.64	1345	25.7	7.1	5.13	1940	28.4	7.6	5.70	2535	31.2	7.0	5.06
160	12.7	1.6	1.44	755	21.0	6.8	4.74	1350	25.7	7.1	5.17	1945	28.5	7.5	5.59	2540	31.2	7.1	5.09
165	12.5	2.0	1.59	760	21.0	6.8	4.83	1355	25.8	7.0	5.06	1950	28.6	7.4	5.48	2545	31.0	7.3	5.43
170	12.2	2.6	1.83	765	21.1	6.8	4.73	1360	25.9	6.9	4.95	1955	28.6	7.5	5.57	2550	31.0	7.3	5.39
175	11.8	3.3	2.13	770	21.3	6.7	4.64	1365	26.0	6.9	4.95	1960	28.6	7.5	5.65	2555	31.1	7.2	5.30
180	11.6	3.7	2.36	775	21.3	6.7	4.68	1370	26.0	7.0	4.96	1965	28.7	7.4	5.47	2560	31.0	7.4	5.47
185	11.5	4.0	2.54	780	21.3	6.7	4.72	1375	26.0	7.0	5.01	1970	28.9	7.2	5.29	2565	30.8	7.6	5.70
190	11.6	4.2	2.61	785	21.3	6.8	4.77	1380	26.0	7.0	5.06	1975	28.9	7.2	5.22	2570	31.1	7.3	5.37
195	12.1	3.9	2.47	790	21.3	6.8	4.82	1385	26.0	7.0	4.99	1980	29.0	7.1	5.16	2575	31.5	7.0	4.96
200	13.1	3.2	2.07	795	21.4	6.8	4.79	1390	26.1	6.9	4.92	1985	29.1	7.1	5.11	2580	31.6	6.9	4.87
205	12.0	4.4	2.76	800	21.5	6.8	4.77	1395	26.2	6.9	4.94	1990	29.1	7.0	5.06	2585	31.6	6.8	4.79
210	11.0	5.6	3.66	805	21.6	6.7	4.71	1400	26.2	7.0	4.96	1995	29.1	7.1	5.09	2590	31.6	6.9	4.88
215	11.3	5.6	3.59	810	21.7	6.7	4.65	1405	26.1	7.0	5.02	2000	29.1	7.1	5.11	2595	31.5	7.0	4.97
220	11.6	5.5	3.52	815	21.7	6.7	4.72	1410	26.1	7.1	5.09	2005	29.1	7.1	5.16	2600	31.6	6.9	4.86
225	11.7	5.5	3.55	820	21.7	6.8	4.80	1415	26.2	7.0	5.02	2010	29.1	7.1	5.15	2605	31.3	7.2	5.30
230	11.9	5.5	3.57	825	21.7	6.8	4.82	1420	26.3	7.0	4.96	2015	29.2	7.1	5.13	2610	31.4	7.1	5.15
240	12.3	5.5	3.54	835	21.8	6.8	4.82	1430	26.1	7.2	5.25	2025	29.3	7.1	5.08	2620	31.6	7.0	4.97
245	12.3	5.7	3.71	840	21.9	6.8	4.80	1435	26.1	7.2	5.24	2030	29.3	7.0	5.05	2625	31.4	7.1	5.17
250	12.3	5.9	3.88	845	21.9	6.8	4.83	1440	26.2	7.2	5.24	2035	29.3	7.1	5.07	2630	31.6	7.0	5.00
260	12.7	5.8	3.83	855	22.0	6.8	4.80	1450	26.5	7.0	4.98	2045	29.2	7.2	5.23	2640	31.7	7.0	4.98
265	13.2	5.5	3.54	860	22.1	6.8	4.74	1455	26.4	7.1	5.07	2050	29.2	7.2	5.27	2645	31.7	6.9	4.93
270	13.7	5.2	3.27	865	22.0	6.9	4.92	1460	26.4	7.1	5.17	2055	29.3	7.2	5.21	2650	31.8	6.9	4.85
275	13.7	5.3	3.39	870	21.9	7.1	5.11	1465	26.4	7.2	5.19	2060	29.5	7.0	5.02	2655	31.8	6.9	4.85
280	13.7	5.4	3.50	875	22.0	7.1	5.08	1470	26.4	7.2	5.22	2065	29.4	7.1	5.08	2660	31.7	7.0	5.02
285	13.7	5.6	3.61	880	22.1	7.0	5.05	1475	26.4	7.1	5.17	2070	29.4	7.1	5.10	2665	32.0	6.7	4.71
290	13.7	5.7	3.72	885	22.1	7.0	5.06	1480	26.5	7.1	5.12	2075	29.5	7.0	5.01	2670	32.0	6.7	4.67
295	13.8	5.8	3.77	890	22.1	7.0	5.06	1485	26.5	7.1	5.14	2080	29.8	6.8	4.76	2675	31.9	6.8	4.81
300	13.9	5.8	3.81	895	22.2	7.1	5.09	1490	26.5	7.1	5.17	2085	29.7	6.9	4.89	2680	31.7	7.0	5.04
305	14.0	5.9	3.85	900	22.2	7.1	5.12	1495	26.5	7.2	5.24	2090	29.7	6.9	4.86	2685	31.9	6.8	4.83
310	14.1	5.9	3.88	905	22.3	7.1	5.09	1500	26.5	7.2	5.31	2095	29.8	6.8	4.78	2690	32.1	6.7	4.72
315	14.3	5.9	3.89	910	22.3	7.0	5.05	1505	26.5	7.2	5.27	2100	29.9	6.8	4.75	2695	32.1	6.7	4.71
320	14.4	5.9	3.90	915	22.4	7.0	4.99	1510	26.6	7.2	5.23	2105	29.8	6.8	4.81	2700	32.0	6.8	4.81
325	14.5	5.9	3.92	920	22.6	6.9	4.92	1515	26.6	7.2	5.30	2110	29.9	6.8	4.78	2705	32.0	6.8	4.80
330	14.6	5.9	3.93	925	22.7	6.9	4.85	1520	26.5	7.3	5.38	2115	29.9	6.8	4.76	2710	32.1	6.8	4.79
335	14.7	6.0	4.02	930	22.8	6.8	4.77	1525	26.6	7.3	5.37	2120	29.9	6.8	4.84	2715	32.1	6.7	4.71
340	14.7	6.2	4.12	935	22.8	6.8	4.83	1530	26.6	7.3	5.36	2125	29.9	6.9	4.89	2720	32.4	6.5	4.47
350	15.1	6.0	3.99	945	22.8	6.9	4.87	1540	26.5	7.4	5.53	2135	29.8	6.9	4.94	2730	31.9	7.0	5.05
355	15.3	5.9	3.88	950	22.9	6.9	4.85	1545	26.5	7.5	5.58	2140	29.8	7.1	5.08	2735	31.6	7.4	5.44
360	15.6	5.8	3.78	955	23.0	6.8	4.81	1550	26.5	7.5	5.63	2145	29.9	6.9	4.92	2740	31.6	7.1	5.46
365	15.5	5.9	3.89	960	23.1	6.8	4.77	1555	26.7	7.3	5.39	2150	29.9	7.0	4.98	2745	31.9	7.0	5.06
370	15.5	6.0	4.01	965	23.1	6.7	4.73	1560	26.9	7.1	5.16	2155	29.8	7.1	5.10	2750	32.0	6.9	4.94
375	15.6	6.1	4.03	970	23.2	6.7	4.69	1565	26.9	7.2	5.23	2160	29.8	7.1	5.09	2755	32.0	7.0	4.98
380	15.7	6.1	4.05	975	23.3	6.6	4.62	1570	26.9	7.2	5.30	2165	29.9	7.0	5.00	2760	32.0	7.0	5.06
385	15.7	6.2	4.15	980	23.5	6.6	4.54	1575	27.0	7.2	5.23	2170	29.9	7.1	5.07	2765	32.2	6.8	4.80
390	15.7	6.3	4.25	985	23.5	6.6	4.52	1580	27.0	7.1	5.17	2175	29.8	7.2	5.20	2770	32.3	6.8	4.73
395	15.9	6.3	4.22	990	23.6	6.5	4.50	1585	27.0	7.2	5.20	2180	29.8	7.2	5.27	2775	32.3	6.8	4.77
400	16.0	6.2	4.18	995	23.6	6.5	4.48	1590	27.0	7.2	5.22	2185	29.8	7.2	5.27	2780	32.3	6.8	4.82
405	16.3	6.1	4.07	1000	23.7	6.5	4.46	1595	27.0	7.2	5.29	2190	29.8	7.2	5.28	2785	32.7	6.4	4.41
410	16.5	6.0	3.96	1005	23.7	6.5	4.51	1600	27.0	7.3	5.36	2195	29.8	7.2	5.30	2790	32.8	6.3	4.25
415	16.5	6.0	4.00	1010	23.7	6.6	4.57	1605	27.0	7.3	5.38	2200	29.7	7.3	5.38	2795	32.8	6.4	4.33
420	16.6	6.1	4.03	1015	23.7	6.6	4.55	1610	27.0	7.3	5.41	2205	29.7	7.3	5.41	2800	32.5	6.7	4.66
425	16.6	6.1	4.10	1020	23.8	6.6	4.54	1615	27.1	7.3	5.33	2210	29.7	7.4	5.47	2805	32.5	6.6	4.62
430	16.7	6.2	4.16	1025	23.8	6.6	4.62	1620	27.2	7.2	5.27	2215	29.7	7.4	5.54	2810	32.5	6.7	4.70
435	16.9	6.1	4.05	1030	23.7	6.7	4.70	1625	27.2	7.2	5.30	2220	29.7	7.5	5.57	2815	32.3	6.9	4.85
440	17.1	5.9	3.93	1035	23.7	6.8	4.81	1630	27.2	7.3	5.33	2225	29.8	7.3	5.43	2820	32.2	7.0	5.01
445	17.2	6.0	3.97	1040	23.6	6.9	4.92	1635	27.2	7.3	5.35	2230	29.8	7.4	5.45	2825	32.3	7.0	4.96
450	17.2	6.0	4.00	1045	23.7	6.9	4.91	1640	27.2	7.3	5.36	2235	29.7	7.5	5.61	2830	32.4	6.8	4.80
455	17.3	6.1	4.04	1050	23.7	6.9	4.91	1645	27.3	7.2	5.22	2240	29.5	7.7	5.86	2835	32.5	6.7	4.68
460	17.4	6.1	4.07	1055	23.7	7.0	5.01	1650	27.5	7.1	5.09	2245	29.8	7.4	5.53	2840	32.5	6.8	4.78
465	17.5	6.1	4.05	1060	23.6	7.1	5.11	1655	27.5	7.1	5.11	2250	30.0	7.3	5.35	2845	32.6	6.6	4.62
470	17.6	6.1	4.04	1065	23.7	7.0	5.06	1660	27.5	7.1	5.13	2255	30.0	7.2	5.28	2850	32.6	6.7	4.70
475	17.7	6.0	3.99	1070	23.8	7.0	5.01	1665	27.6	7.0	5.06	2260	30.1	7.2	5.24	2855	32.4	6.9	4.88
480	17.9	5.9	3.93	1075	23.8	7.0	5.01	1670	27.7	7.0	4.99	2265	30.1	7.2	5.20	2860	32.4	7.0	4.98
485	18.0	5.9	3.88	1080	23.9	7.0	5.01	1675	27.7	7.0	5.02	2270	30.2	7.1	5.12	2865	32.8	6.5	4.52
490	18.2	5.8	3.82	1085	24.0	7.0	4.96	1680	27.7	7.0	5.05	2275	30.3	7.0	5.05	2870	33.0	6.3	4.30
495	18.0	6.0	4.02	1090	24.0	6.9	4.91	1685	27.7	7.0	5.01	2280	30.0	7.0	5.06	2875	33.0	6.4	4.38
500	17.9	6.3	4.23	1095	24.1	6.9	4.86	1690	27.8	7.0	4.98	2285	30.3	7.0	5.05	2880	32.5	6.9	4.87
505	17.9	6.3	4.29	1100	24.2	6.8	4.82	1695	27.8	7.0	5.01	2290	30.3	7.1	5.07	2885	33.0	6.4	4.40
510	18.0	6.4	4.36	1105	24.3	6.8	4.80	1700	27.8	7.0	5.03	2295	30.3	7.1	5.13	2890	33.1	6.3	4.28
515	18.1	6.4	4.34	1110	24.3	6.8	4.78	1705	27.8	7.1	5.09	2300	30.2	7.2	5.23	2895	33.1	6.4	4.34
520	18.2	6.4	4.32	1115	24.3	6.8	4.79	1710	27.7	7.1	5.16	2305	30.3	7.2	5.20	2900	33.0	6.4	4.41
525	18.2	6.4	4.36	1120	24.4	6.8	4.80	1715	27.8	7.1	5.08	2310	30.2	7.3	5.35	2905	32.9	6.6	4.58
530	18.3	6.4	4.39	1125	24.3	6.9	4.90	1720	27.9	7.0	5.00	2315	30.1	7.4	5.45	2910	32.9	6.5	4.51
535	18.3	6.4	4.41	1130	24.3	7.0	5.00	1725	28.0	7.0	4.99	2320	30.3	7.2	5.27	2915	33.1	6.4	4.33
540	18.4	6.4	4.41	1135	24.4	6.9	4.90	1730	28.0	7.0	4.98	2325	304	7.2	5.22	2920	33.3	6.2	4.16
545	18.4	6.5	4.47	1140	24.5	6.8	4.81	1735	28.0	7.0	5.02	2330	30.4	7.1	5.13	2925	33.0	6.5	4.45
550	18.4	6.6	4.53	1145	24.6	6.8	4.76	1740	28.0	7.1	5.07	2335	30.5	7.0	5.07	2930	33.0	6.5	4.51
560	18.8	6.4	4.37	1155	24.7	6.8	4.76	1750	28.1	7.0	5.01	2345	30.6	7.0	5.07	2940	33.0	6.5	4.52
565	18.9	6.4	4.33	1160	24.7	6.8	4.80	1755	27.9	7.1	5.17	2350	30.5	7.1	5.12	2945	33.1	6.5	4.42
570	19.0	6.3	4.28	1165	24.7	6.8	4.81	1760	27.8	7.3	5.34	2355	30.6	7.1	5.08	2950	33.2	6.4	4.32
575	19.1	6.3	4.31	1170	24.7	6.8	4.81	1765	27.9	7.3	5.31	2360	30.9	6.8	4.79	2955	33.3	6.3	4.27
580	19.1	6.4	4.33	1175	24.8	6.8	4.84	1770	27.9	7.2	5.28	2365	31.0	6.7	4.66	2960	33.3	6.3	4.30
590	19.1	6.6	4.52	1185	24.8	6.9	4.92	1780	27.9	7.3	5.35	2375	31.1	6.6	4.60	2970	33.3	6.4	4.36
595	19.0	6.6	4.62	1190	24.7	7.0	4.99	1785	28.1	7.2	5.21	2380	31.1	6.6	4.61	2975	33.0	6.6	4.60
600	19.0	6.7	4.72	1195	24.7	7.0	5.02	1790	28.2	7.0	5.07	2385	31.1	6.7	4.62	2980	32.9	6.8	4.74
605	19.1	6.8	4.74	1200	24.7	7.0	5.05	1795	28.2	7.0	5.07	2390	31.2	6.6	4.56	2985	32.8	6.9	4.93
610	19.1	6.8	4.76	1205	24.08	7.1	5.08	1800	28.3	7.0	5.06	2395	31.2	6.6	4.60	2990	32.9	6.8	4.82
615	19.4	6.5	4.51	1210	24.8	7.1	5.11	1805	28.3	7.1	5.07	2400	30.9	6.9	4.93	3000	33.4	6.4	4.33

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

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

Cable loss
Cable coaxial, RG-214, 5m, model: C214-5, HL 1365

No.	Frequency, MHz	Measured, dB	Measured uncertainty dB
1	1000	0.41	±0.12
2	1200	0.44	
3	1400	0.48	
4	1600	0.52	
5	1800	0.55	
6	2000	0.58	
7	2200	0.61	
8	2400	0.64	±0.17
9	2600	0.67	
10	2800	0.7	
11	3000	0.73	
12	3300	0.79	
13	3600	0.84	
14	3900	0.94	
15	4200	1.22	

Cable loss
Cable coaxial, 6 m, model: M17/167 MIL-C-17, HL 1502

Frequency, MHz	Cable loss, dB
0.1	0.02
1	0.07
3	0.15
5	0.17
10	0.26
30	0.43
50	0.57
80	0.72
100	0.81
300	1.48
500	2.00
800	2.70
1000	3.09

Cable loss
Cable M17/167 MIL-C-17, HL 1510

No.	Frequency, MHz	Cable loss, dB
1	0.1	0.05
2	1	0.09
3	3	0.16
4	5	0.18
5	10	0.27
6	30	0.44
7	50	0.58
8	80	0.69
9	100	0.82
10	300	1.48
11	500	2.01
12	800	2.65
13	1000	3.12

Cable loss
RF cable 3.5 m, Alpha Wire, model RG-214, S/N 149, HL 1553

No.	Frequency, MHz	Cable loss, dB	Measurement uncertainty, dB
1	1	0.01	±0.05
2	10	0.07	
3	30	0.12	
4	50	0.22	
5	100	0.26	
6	200	0.40	
7	300	0.52	
8	400	0.60	
9	500	0.70	
10	600	0.77	
11	700	0.84	
12	800	1.00	
13	900	1.00	
14	1000	1.05	
15	2000	1.70	

Cable loss
Cable RF, 2m, model: Sucoflex 104PE, S/N 13094/4PE, HL 1566

No.	Frequency, MHz	Cable loss, dB	Tolerance, dB	Measurement uncertainty, dB
1	30	0.10	≤ 5.0	±0.12
2	50	0.13		
3	100	0.20		
4	300	0.33		
5	500	0.45		
6	800	0.60		
7	1000	0.65		
8	1500	0.91		
9	2000	1.08		
10	2500	1.19		
11	3000	1.28		
12	3500	1.49		
13	4000	1.63		
14	4500	1.63	≤ 5.0	±0.17
15	5000	1.66		
16	5500	1.88		
17	6000	1.96		
18	6500	1.93		
19	7000	2.07		
20	7500	2.37		
21	8000	2.34		
22	8500	2.64		
23	9000	2.68		
24	9500	2.64		
25	10000	2.70		
26	10500	2.84		
27	11000	2.88		
28	11500	3.19		
29	12000	3.15		
30	12500	3.20	≤ 5.0	±0.26
31	13000	3.22		
32	13500	3.47		
33	14000	3.41		
34	14500	3.59		
35	15000	3.79		
36	15500	4.24		
37	16000	4.12		
38	16500	4.46		
39	17000	4.50		
40	17500	4.49		
41	18000	4.45		

Cable loss
Cable RF, 2 m, model: Sucoflex 104PE, s/n 13095/4PE, HL 1567

No.	Frequency, MHz	Cable loss, dB
1	30	0.09
2	50	0.15
3	100	0.23
4	300	0.31
5	500	0.46
6	800	0.63
7	1000	0.67
8	1500	0.89
9	2000	1.05
10	2500	1.18
11	300	1.26
12	5300	1.51
13	4000	1.66
14	4500	1.61
15	5000	1.67
16	5500	1.91
17	6000	1.98
18	6500	1.91
19	7000	2.04
20	7500	2.36
21	8000	2.36
22	8500	2.61
23	9000	2.69
24	9500	2.62
25	10000	2.73
26	10500	2.83
27	11000	2.84
28	11500	3.22
29	12000	3.17
30	12500	3.17
31	13000	3.18
32	13500	3.49
33	14000	3.43
34	14500	3.57
35	15000	3.76
36	15500	4.20
37	16000	4.10
38	16500	4.49
39	17000	4.53
40	17500	4.46
41	18000	4.47

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
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
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
WB	wideband

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