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Electrical

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TEST REPORT

ACCORDING TO: FCC part 24 and part 15 subpart B

FOR:

Airspan Networks (Israel) Ltd.

Base Station Radio

Model:BSR 1.9GHz FDD

Table of contents

1 Applicant information

Client name:	Airspan Networks (Israel) Ltd.
Address:	1, Harava street, "Unitronics" building, POB 199, Airport City, 70100, Israel
Telephone:	+972 3977 7482
Fax:	+972 3977 7400
E-mail:	vkvartenko@Airspan.com
Contact name:	Mr. Vladimir Kvartenko

2 Equipment under test attributes

Product name:	Base Station Radio
Model(s):	BSR 1.9GHz FDD Ext
Receipt date	07/19/2005

3 Manufacturer information

Manufacturer name:	Airspan Networks (Israel) Ltd.
Address:	1, Harava street, "Unitronics" building, POB 199, Airport City, 70100, Israel
Telephone:	+972 3977 7482
Fax:	+972 3977 7400
E-Mail:	vkvartenko@Airspan.com
Contact name:	Mr. Vladimir Kvartenko

4 Test details

Project ID:	16484
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started:	07/19/2005
Test completed:	09/01/2005
Test specification(s):	FCC 47 CFR part 24:2004, part 15:2005 subpart B, §§15.107, 15.109

5 Tests summary

Test	Status
Transmitter characteristics	
Section 24.232, RF output power	Pass
Section 24.238(b), Occupied bandwidth	Pass
Section 24.238, Spurious emissions at antenna terminal	Pass
Section 24.238, Emissions at band edges	Pass
Section 24.238, Radiated spurious emissions	Pass
Section 24.235, Frequency stability	Pass
Section 24.52, RF exposure	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass

Testing was completed against all relevant requirements of the test standard. 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. A. Adelberg, test engineer	September 1, 2005	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	September 4, 2005	
Approved by:	Mr. M. Nikishin, EMC group leader	September 4, 2005	

6 EUT description

6.1 General information

The EUT, base station radio, BSR 1.9 GHz FDD Ext., is a part of a WipLL broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The BSR is a transceiver/receiver (FSK digital modulation, data rate up to 4 Mbps), using TDM and operating in FDD duplexing mode (1850 to 1910 MHz Rx and 1930 to 1990 MHz Tx range), equipped with a 16 dBi gain external panel antenna or 11 dBi internal antenna.
The BSR is installed outdoors and typically is mounted on a pole. The BSR transmits and receives traffic to and from the end-user (i.e. SPR) respectively. The BSR provides subscribers with "always-on" Internet, high speed data only, or data and voice (VoIP) services.
The BSR is powered via a subscriber data adapter (SDA), which provides 48 VDC power.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length
		From	To				
Signal	48 V DC& Ethernet	EUT	SDA	D-type 15 pin	1	UTP	100 m
RF	Antenna	EUT	Termination	N-type	1	NA	NA
Signal	RS232	Not connected, used for debug only		D-type 9 pin	1	NA	NA

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Subscriber data adaptor	Airspan	SDA-4H	09200011 C0
Laptop	DELL	TS30G	7407346BYK

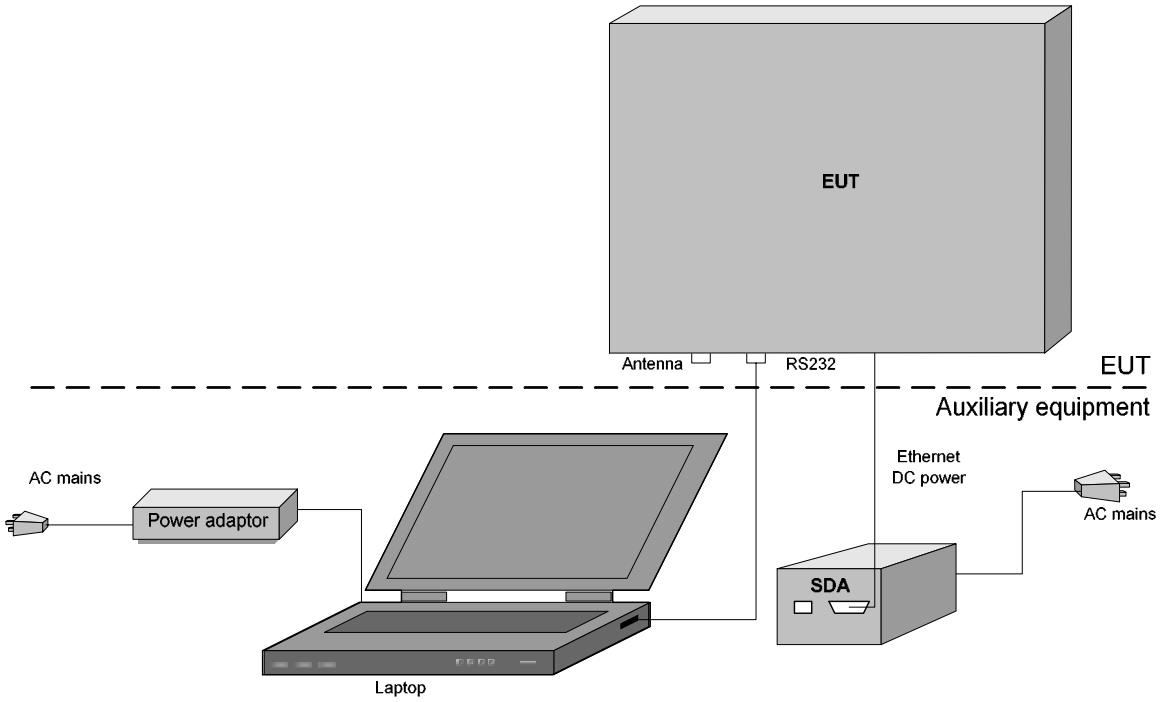
6.4 Operating frequencies

Source	Frequency, MHz	
Digital portion	20	48
Receiver	350	1850 - 1910
Transmitter	350	1930 - 1990

6.5 Changes made in the EUT

No changes were implemented.

6.6 Test configuration



6.7 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**
X	Fixed (base station)	Always at a distance more than 2 m from all people
	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	1930 -1990 MHz
Operating frequency range	1931 -1989 MHz
RF channel spacing	1&1.33 MHz

Maximum rated output power	At transmitter 50 Ω RF output connector	30.91 dBm
	Effective radiated power (for equipment with no RF connector)	

Is transmitter output power variable?		No			
	X			continuous variable	
			X	stepped variable with stepsize	1 dB
				minimum RF power	9 dBm
				maximum RF power	30.91 dBm

Antenna connection							
	unique coupling	N-type	standard connector		external		with temporary RF connector
							without temporary RF connector

External antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Panel	MARS	MA-WC19-5X	16 dBi
Integral	MARS	MA-WC19-AS11	11 dBi

Transmitter 99% power bandwidth	1 MHz, 1.33 MHz
Transmitter aggregate data rate/s	1, 2, 3, 4 Mbps
Type of modulation	4FSK, 8FSK
Type of multiplexing	TDMA
Modulating test signal (baseband)	PRBS

Transmitter power source					
	Battery	Nominal rated voltage	…….VDC	Battery type	Ni- Cd, Lithium, Lead- Acid, other
X	DC	Nominal rated voltage	…48 VDC		
	AC mains	Nominal rated voltage	…….VAC	Frequency	…….Hz

Is there common power source for transmitter and receiver	X	yes	no

Test specification:	Section 24.232(b), Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 3:46:51 PM		
Temperature: 22ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 24 requirements

7.1 Peak output power

7.1.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.1.1.

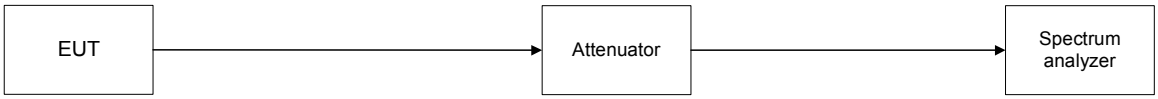
Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Maximum peak output power	
	W	dBm
1930 - 1990	100.0	50.0

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
7.1.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.
7.1.2.3 The peak output power was measured with spectrum analyzer as provided in Table 7.1.2 and associated plots.

Figure 7.1.1 Peak output power test setup



Test specification:	**Section 24.232(b), Peak output power**		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 3:46:51 PM		
Temperature: 22ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 46 %	**Power Supply:** 48 VDC
Remarks:			

Table 7.1.2 Peak output power test results

DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 5000 kHz
VIDEO BANDWIDTH: 3000 kHz

OPERATING FREQUENCY RANGE: 1931 - 1989 MHz
MODULATION: 4FSK
MODULATING SIGNAL: PRBS
BIT RATE: 3 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	Cable loss, dB	RF output power, dBm	Limit, dBm	Margin, dB	Verdict
1931	30.91	Included	Included	30.91	50.00	-19.09	Pass
1960	30.34	Included	Included	30.34	50.00	-19.66	Pass
1989	29.61	Included	Included	29.61	50.00	-20.39	Pass

OPERATING FREQUENCY RANGE: 1932 - 1988 MHz
MODULATION: 8FSK
MODULATING SIGNAL: PRBS
BIT RATE: 4 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	Cable loss, dB	RF output power, dBm	Limit, dBm	Margin, dB	Verdict
1932	30.86	Included	Included	30.86	50.00	-19.14	Pass
1960	30.32	Included	Included	30.32	50.00	-19.68	Pass
1988	29.67	Included	Included	29.67	50.00	-20.33	Pass

Note: maximum external antenna gain is 16 dBi.
The 4FSK modulation with 3 Mbps rate as the worst case was used for the spurious emissions measurements.

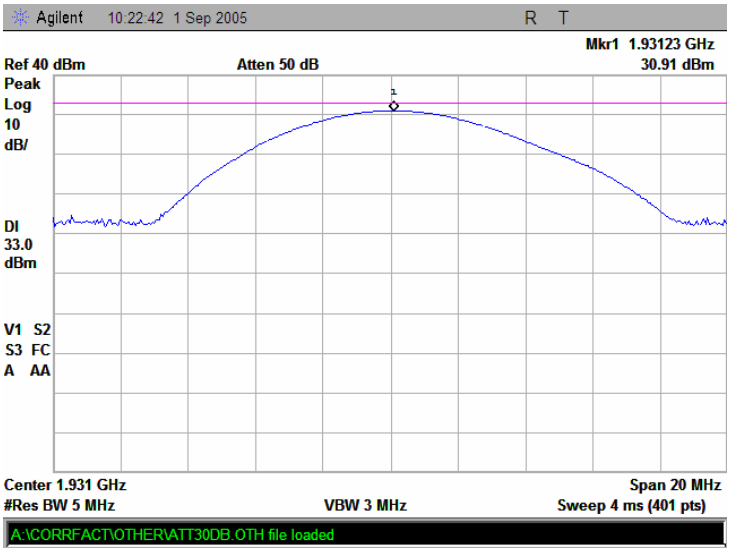
Reference numbers of test equipment used

HL 1424	HL 2254	HL 2524					

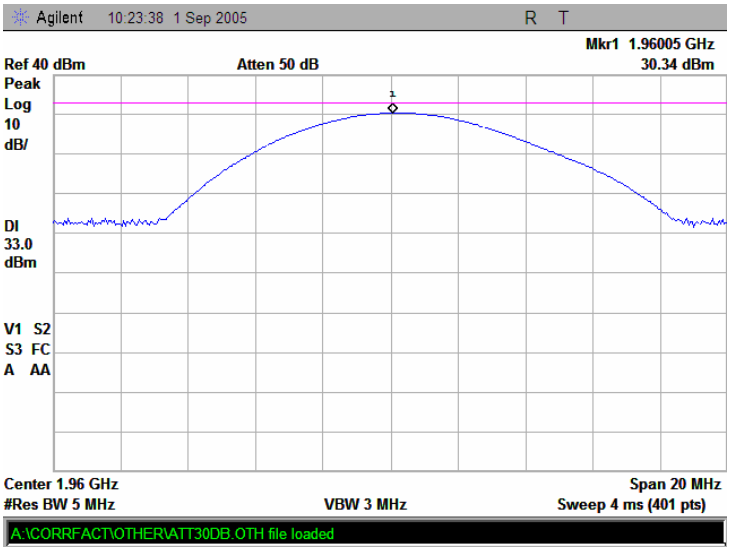
Full description is given in Appendix A.

Test specification:	Section 24.232(b), Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 3:46:51 PM		
Temperature: 22ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.1 Peak output power test results at low frequency and 4FSK modulation

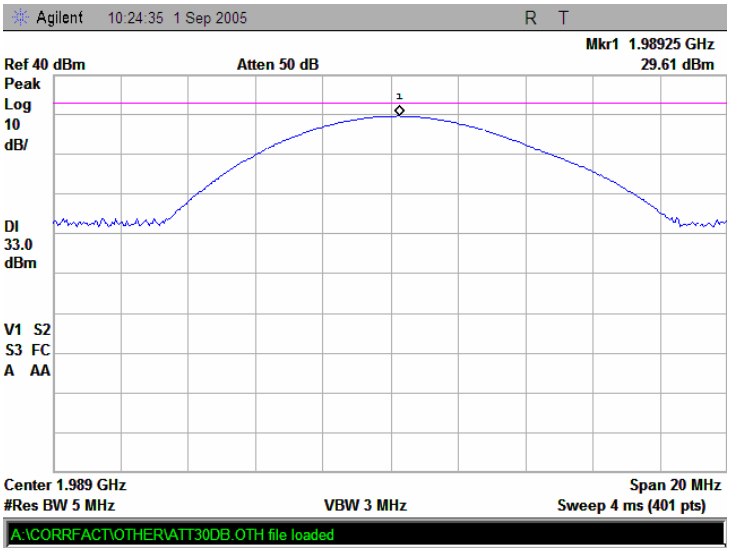


Plot 7.1.2 Peak output power test results at mid frequency and 4FSK modulation

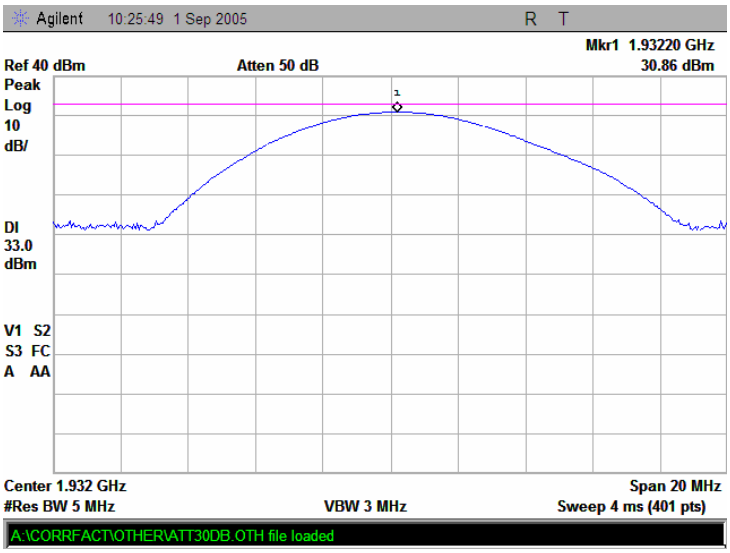


Test specification:	Section 24.232(b), Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 3:46:51 PM		
Temperature: 22ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.3 Peak output power test results at high frequency and 4FSK modulation

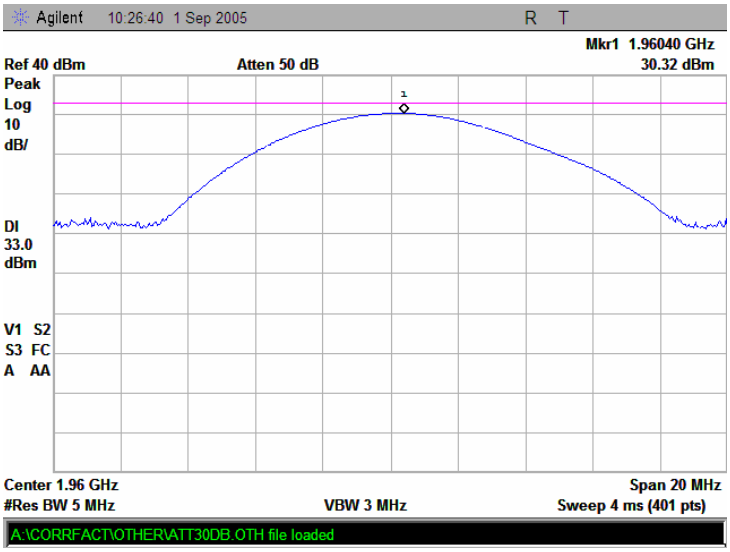


Plot 7.1.4 Peak output power test results at low frequency and 8FSK modulation

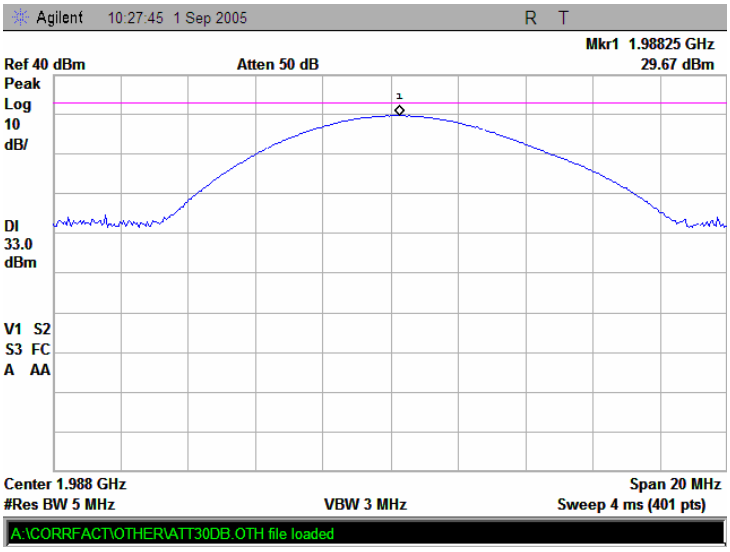


Test specification:	Section 24.232(b), Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 3:46:51 PM		
Temperature: 22ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.5 Peak output power test results at mid frequency and 8FSK modulation



Plot 7.1.6 Peak output power test results at high frequency and 8FSK modulation



Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
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.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc
1930 – 1990	26

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

7.2.2 Test procedure

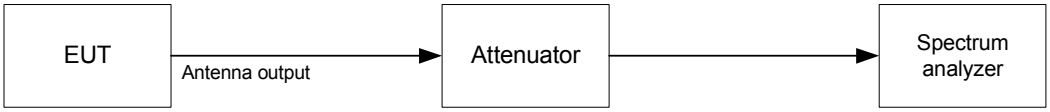
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

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

7.2.2.3 The EUT was set to transmit the normally modulated carrier.

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

Figure 7.2.1 Occupied bandwidth test setup



Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 300 kHz*
VIDEO BANDWIDTH: 1000 kHz
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
MODULATION: 4FSK
MODULATING SIGNAL: PRBS
BIT RATE: 3 Mbps

Carrier frequency, MHz	Lower reference point, MHz	Upper reference point, MHz	Occupied bandwidth, MHz
1931	1930.1000	1931.9000	1.8
1960	1959.1000	1960.9000	1.8
1989	1988.1000	1989.9000	1.8

RESOLUTION BANDWIDTH: 300 kHz*
VIDEO BANDWIDTH: 1000 kHz
MODULATION: 8FSK
MODULATING SIGNAL: PRBS
BIT RATE: 4 Mbps

Carrier frequency, MHz	Lower reference point, MHz	Upper reference point, MHz	Occupied bandwidth, MHz
1932	1930.9000	1933.1000	2.2
1960	1958.9000	1961.1000	2.2
1988	1986.9000	1989.1000	2.2

*- RBW ≥ 1% of OBW. OBW = 1.80 MHz, 1% of OBW = 180 kHz hence RBW was set to 300 kHz
**- RBW ≥ 1% of OBW. OBW = 2.20 MHz, 1% of OBW = 220 kHz hence RBW was set to 300 kHz

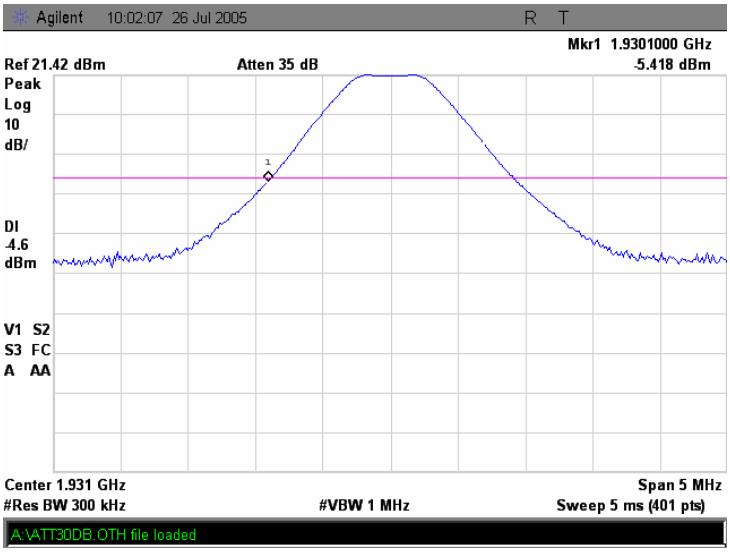
Reference numbers of test equipment used

HL 1424	HL 2254	HL 2524				

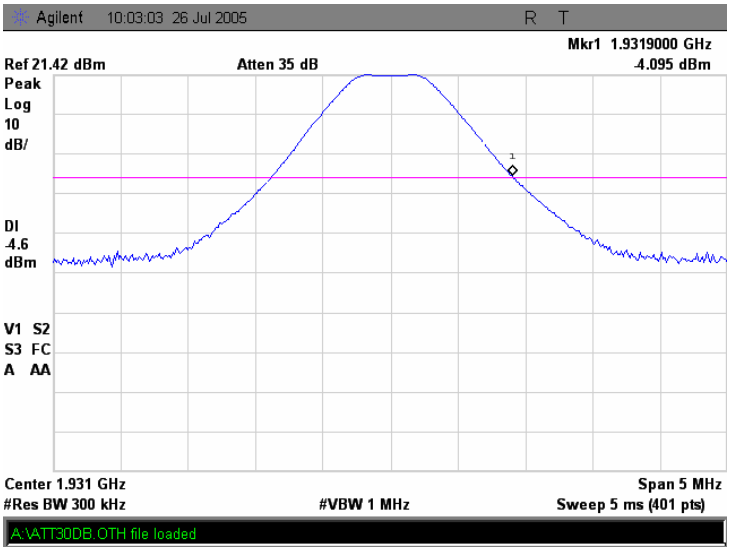
Full description is given in Appendix A.

Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
Remarks:			

Plot 7.2.1 Occupied bandwidth test result at low frequency, at 4FSK modulation, lower reference point

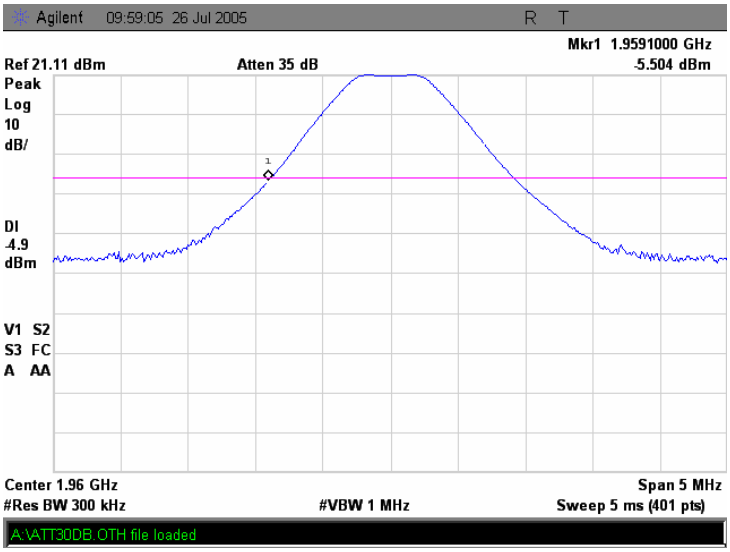


Plot 7.2.2 Occupied bandwidth test result at low frequency, at 4FSK modulation, higher reference point

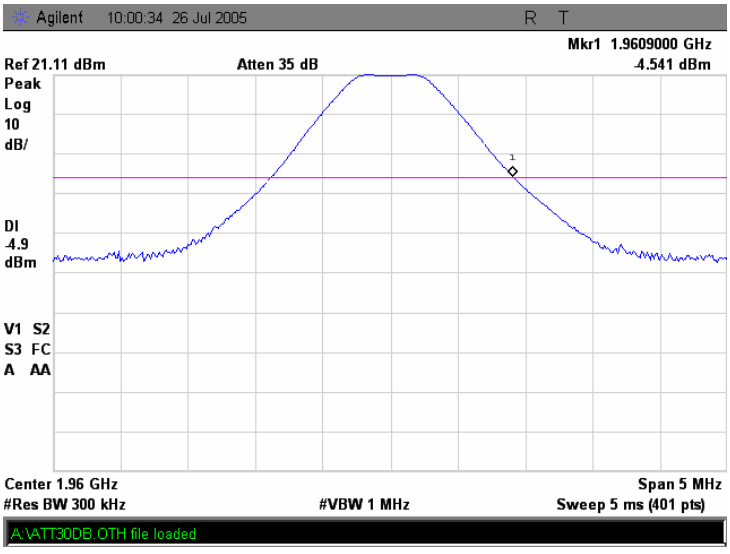


Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
Remarks:			

Plot 7.2.3 Occupied bandwidth test result at mid frequency, at 4FSK modulation, lower reference point

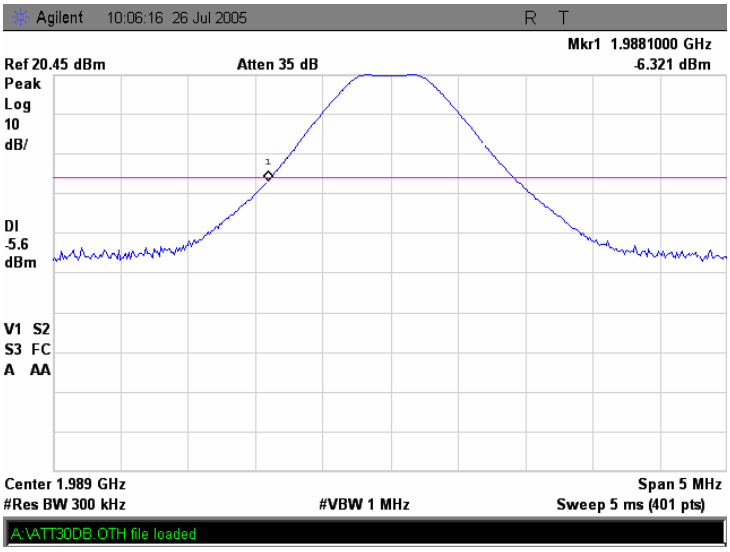


Plot 7.2.4 Occupied bandwidth test result at mid frequency, at 4FSK modulation, higher reference point

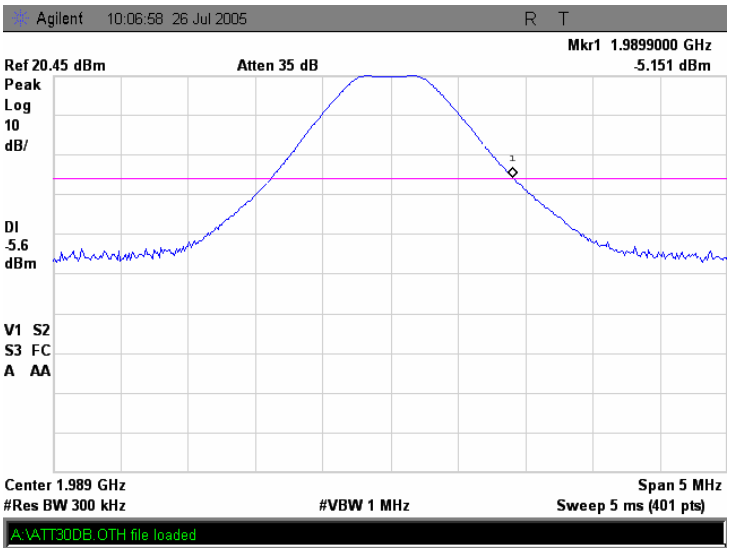


Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
Remarks:			

Plot 7.2.5 Occupied bandwidth test result at high frequency, at 4FSK modulation, lower reference point

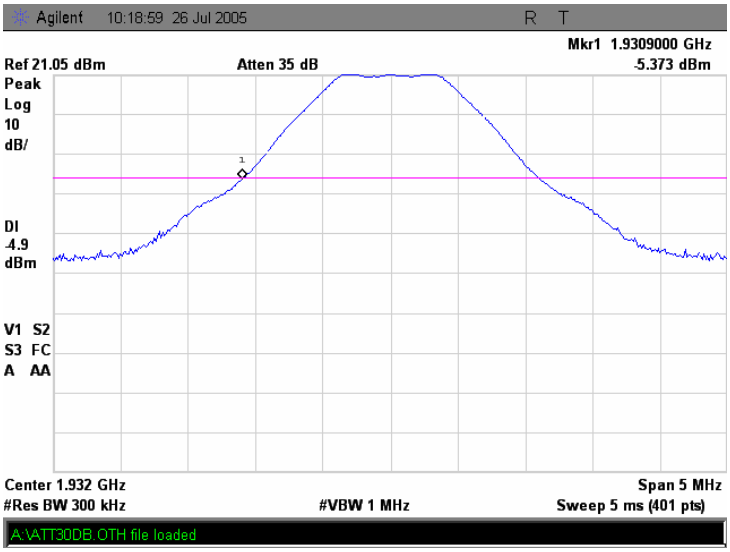


Plot 7.2.6 Occupied bandwidth test result at high frequency, at 4FSK modulation, higher reference point

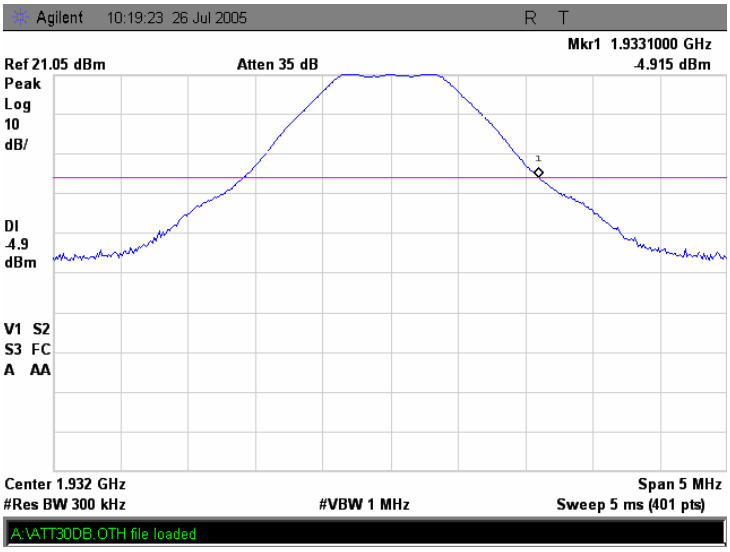


Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
Remarks:			

Plot 7.2.7 Occupied bandwidth test result at low frequency, at 8FSK modulation, lower reference point

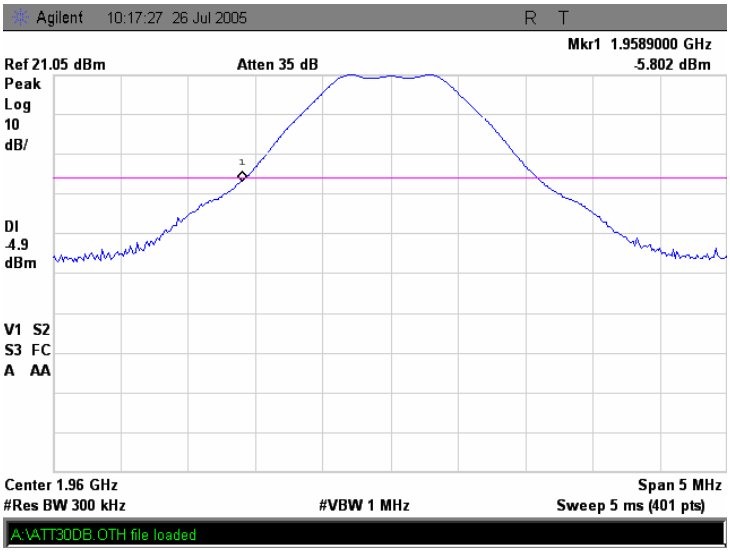


Plot 7.2.8 Occupied bandwidth test result at low frequency, at 8FSK modulation, higher reference point

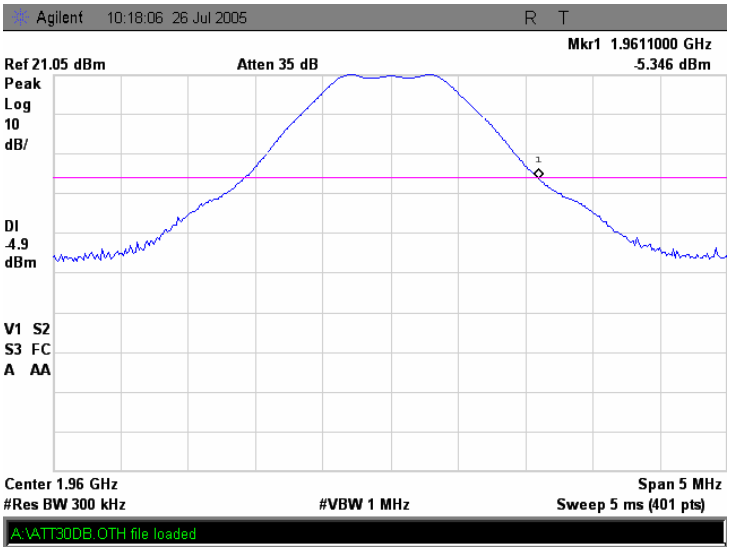


Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
Remarks:			

Plot 7.2.9 Occupied bandwidth test result at mid frequency, at 8FSK modulation, lower reference point

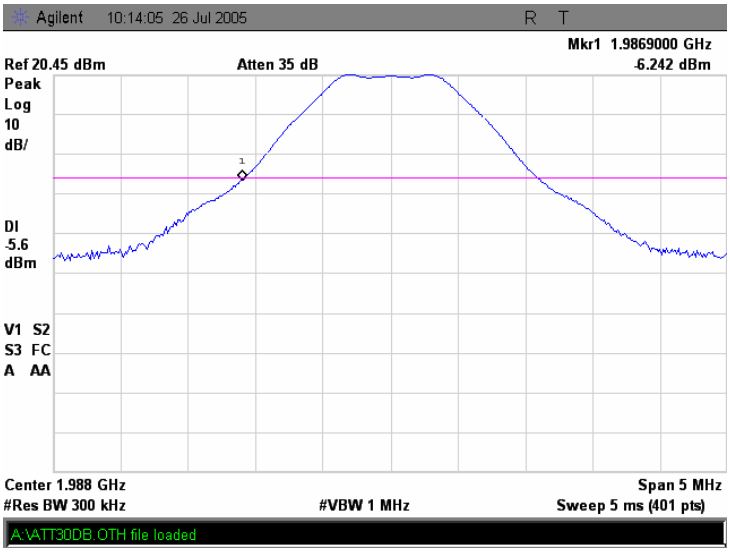


Plot 7.2.10 Occupied bandwidth test result at mid frequency, at 8FSK modulation, higher reference point

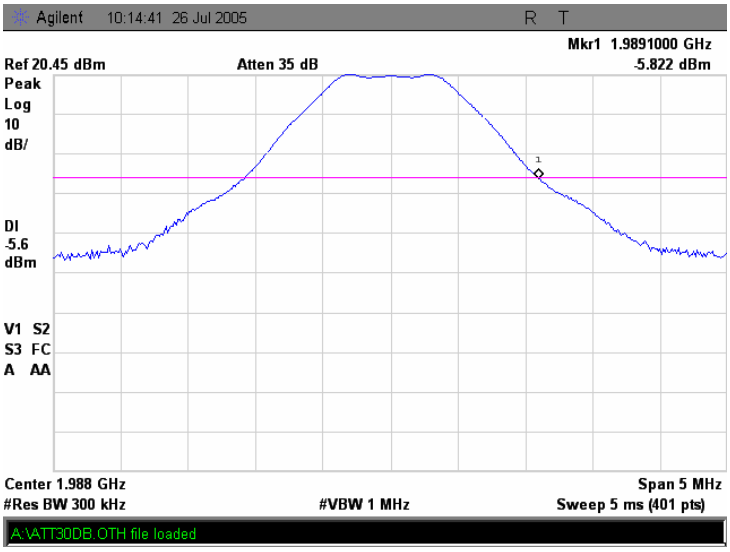


Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 9:39:03 AM		
Temperature: 23ºC	Air Pressure: 1007 hPa	Relative Humidity: 40%	Power Supply: 48 V DC
Remarks:			

Plot 7.2.11 Occupied bandwidth test result at high frequency, at 8FSK modulation, lower reference point



Plot 7.2.12 Occupied bandwidth test result at high frequency, at 8FSK modulation, higher reference point



Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

7.3 Spurious emissions at RF antenna connector test

7.3.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Spurious emission limits

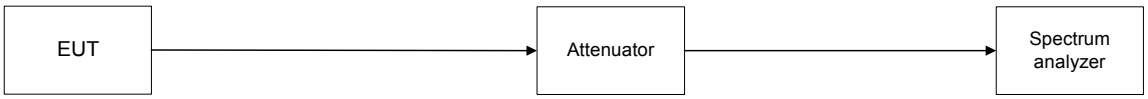
Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0.009 – 10th harmonic*	43+10logP*	-13.0

- - spurious emission limits do not apply to the in band emission within ± 250 % of the authorized bandwidth from the carrier; investigated in course of emission mask testing

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 adjusted to produce maximum available for end user RF output power.
7.3.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.3.2 and associated plots.

Figure 7.3.1 Spurious emission test setup



Test specification:	**Section 24.238, Spurious emission at antenna terminal**		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 46 %	**Power Supply:** 48 VDC
Remarks:			

Table 7.3.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 1930 - 1990 MHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 20000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATION: 4FSK
MODULATING SIGNAL: PRBS
BIT RATE: 3 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
TRANSMITTER OUTPUT POWER: 30.91 dBm at low frequency
30.34 dBm at mid frequency
29.61 dBm at high frequency

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency									
3862.000	-14.44	Included	Included	1000	-14.44	45.35	43.91	1.44	Pass
Mid carrier frequency									
3920.000	-18.07	Included	Included	1000	-18.07	48.41	43.34	5.07	Pass
High carrier frequency									
28.2960	-26.30	Included	Included	1000	-26.30	55.91	42.61	13.30	Pass
1290.300	-31.86	Included	Included	1000	-31.86	61.47		18.86	Pass
3978.000	-20.20	Included	Included	1000	-20.20	49.81		7.20	Pass

*****- Margin = Attenuation below carrier – limit.

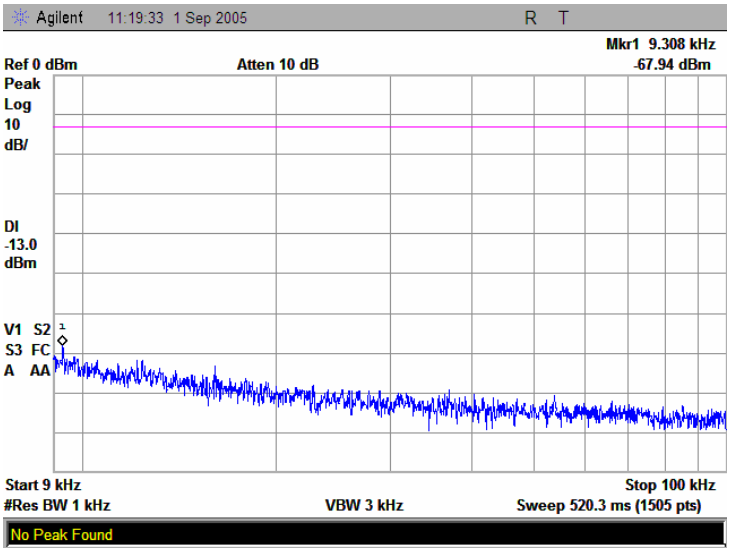
Reference numbers of test equipment used

HL 1424	HL 2254	HL 2524				

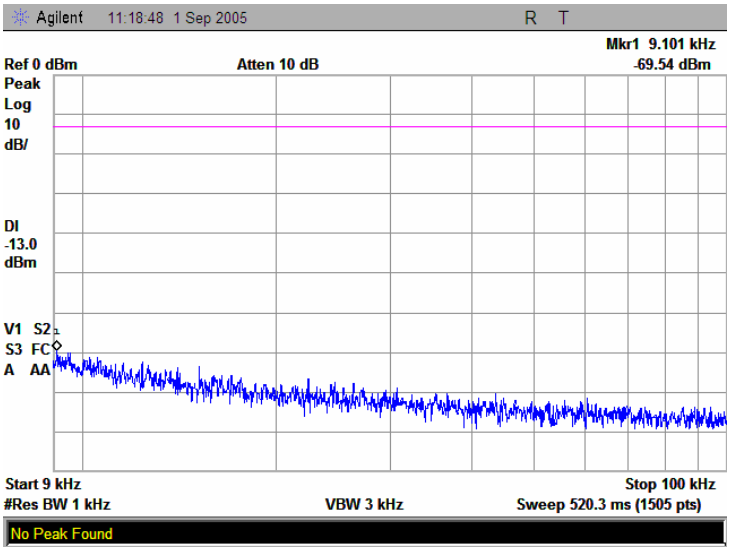
Full description is given in Appendix A.

Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.1 Spurious emission measurements in 9 - 100 kHz range at low carrier frequency

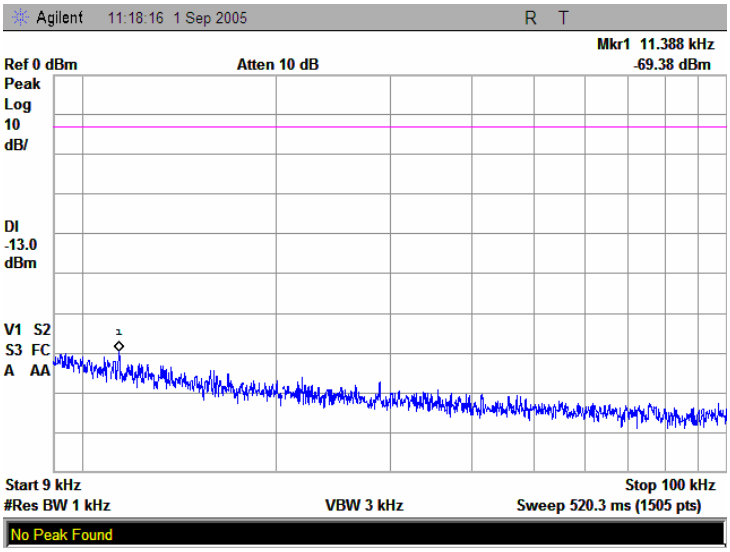


Plot 7.3.2 Spurious emission measurements in 9 - 100 kHz range at mid carrier frequency

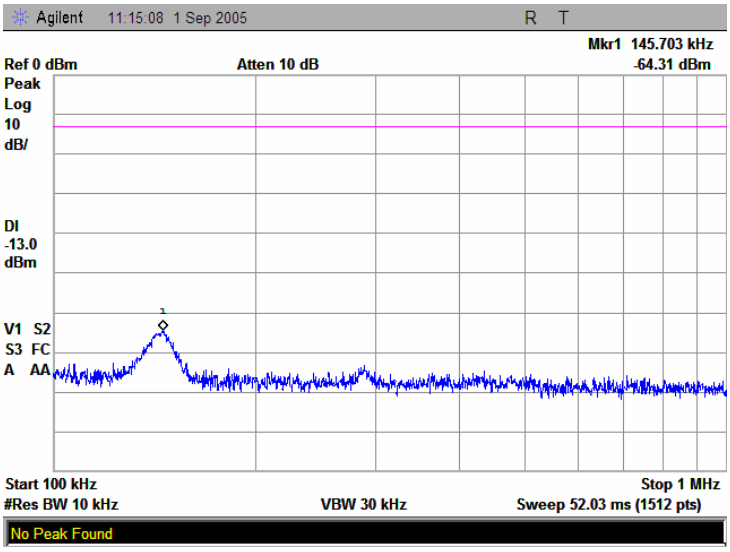


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.3 Spurious emission measurements in 9 - 100 kHz range at high carrier frequency

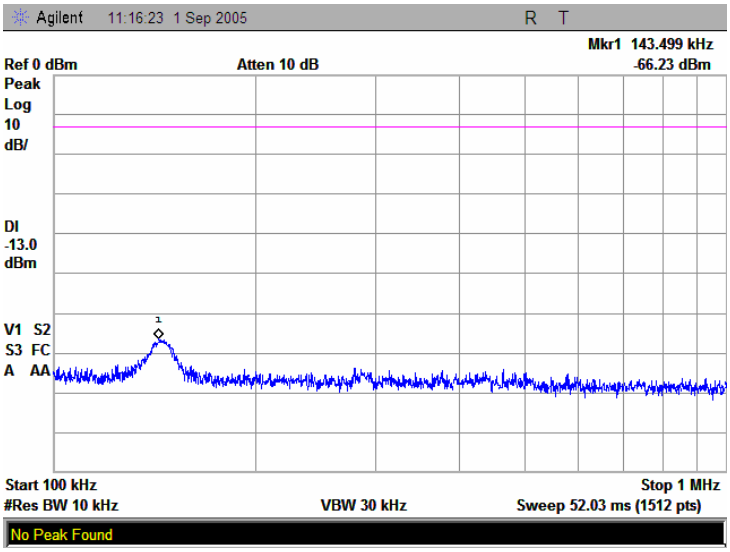


Plot 7.3.4 Spurious emission measurements in 0.10 - 1.0 MHz range at low carrier frequency

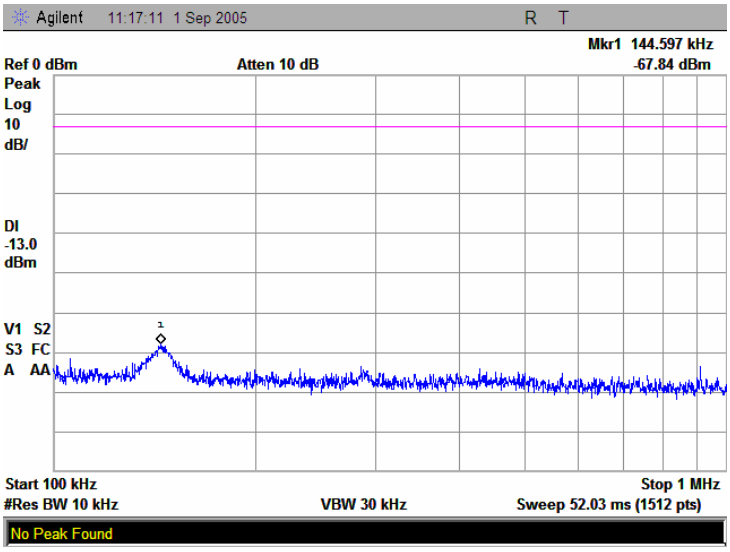


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.5 Spurious emission measurements in 0.10 - 1.0 MHz range at mid carrier frequency

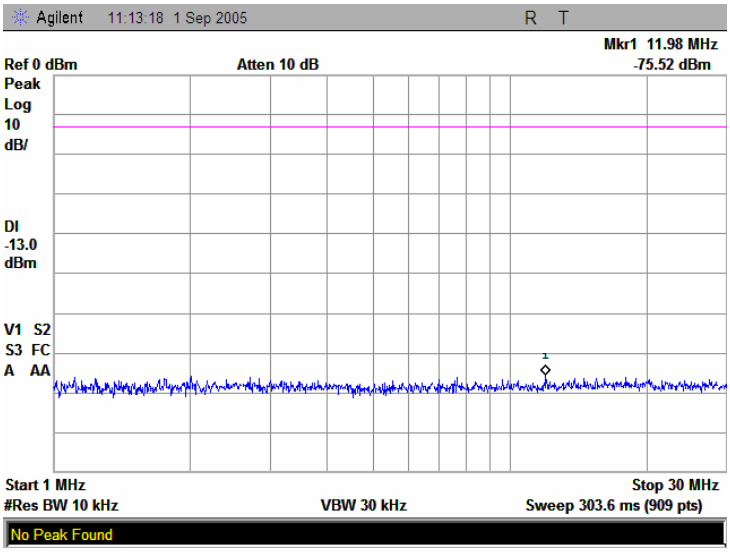


Plot 7.3.6 Spurious emission measurements in 0.10 – 1.0 MHz range at high carrier frequency

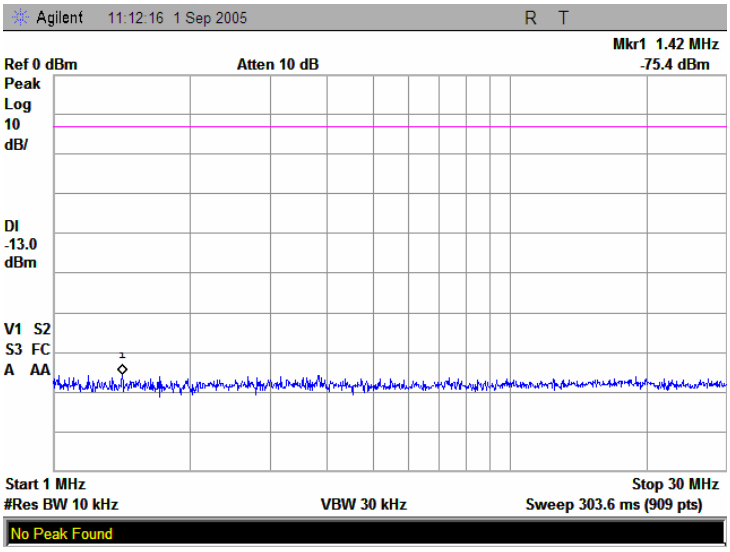


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.7 Spurious emission measurements in 1.0 – 30.0 MHz range at low carrier frequency

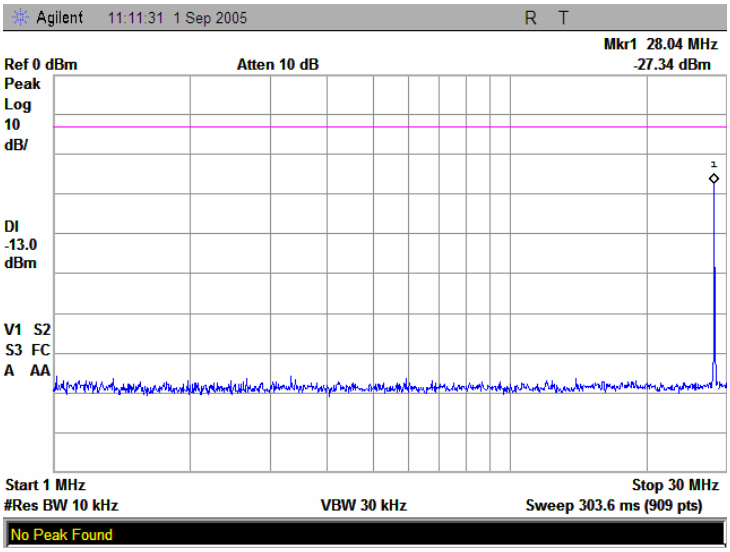


Plot 7.3.8 Spurious emission measurements in 1.0 – 30.0 MHz range at mid carrier frequency

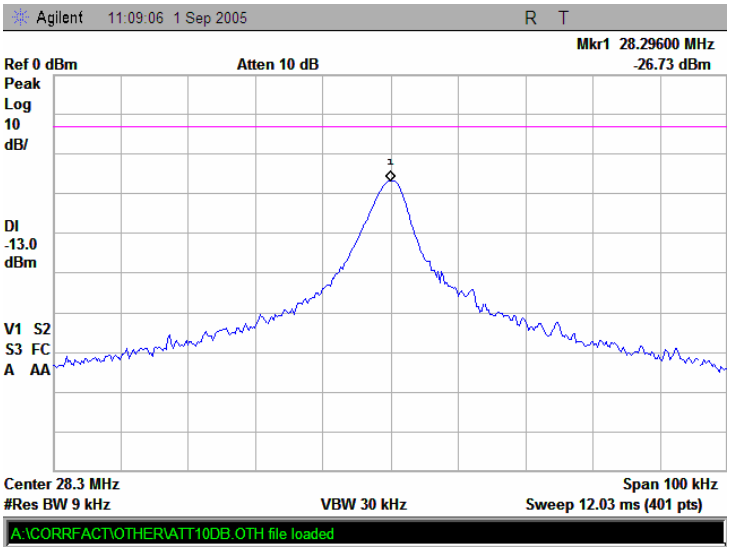


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.9 Spurious emission measurements in 1.0 – 30.0 MHz range at high carrier frequency

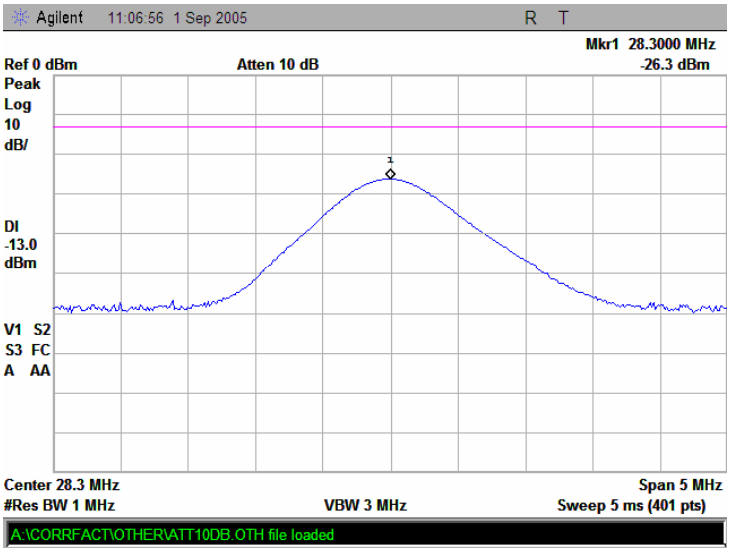


Plot 7.3.10 Spurious emission measurement at 28 MHz at high carrier frequency



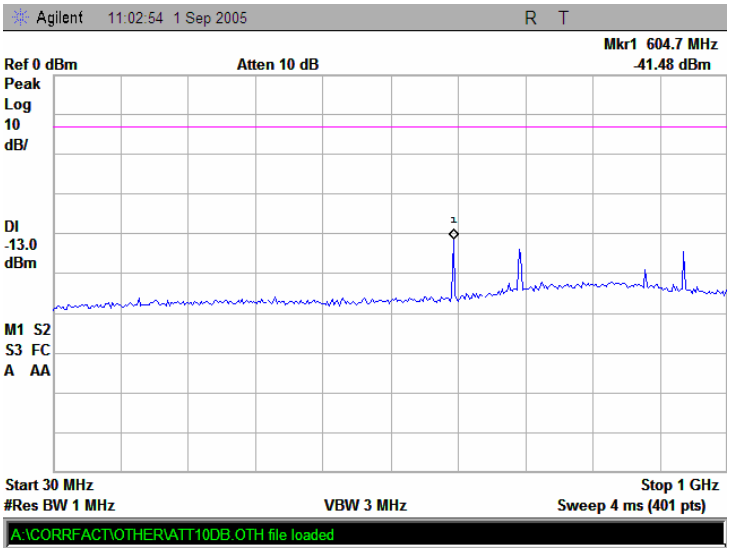
Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.11 Spurious emission measurement at 28 MHz at high carrier frequency

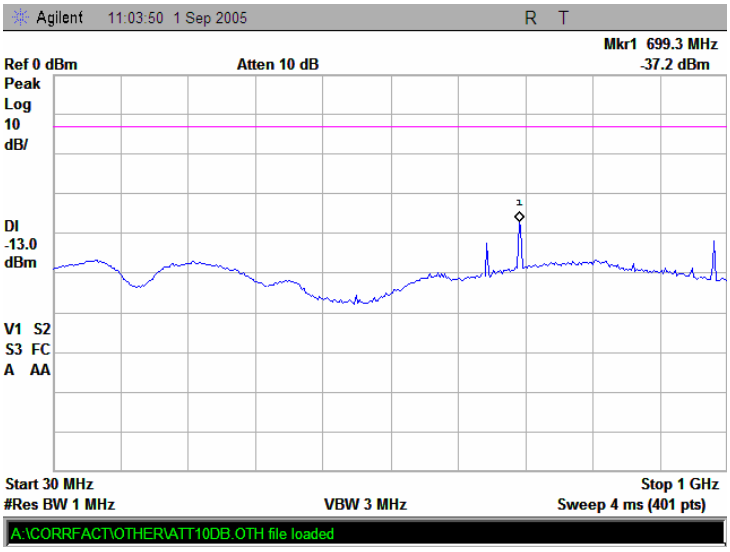


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.12 Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency

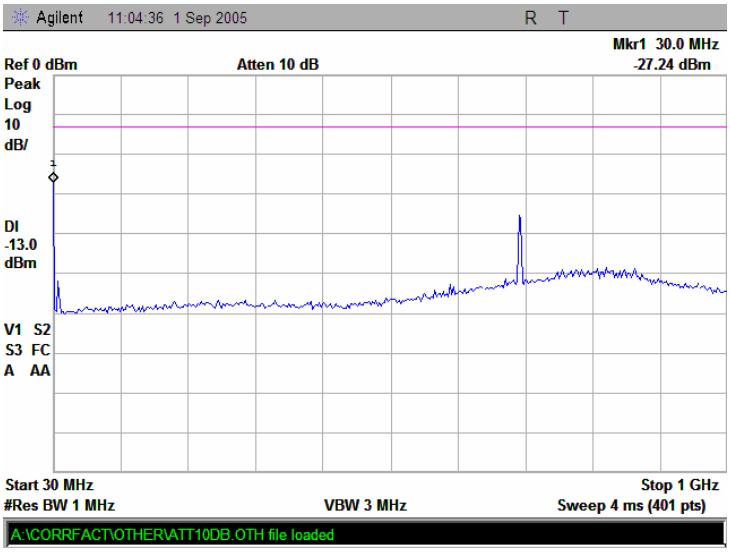


Plot 7.3.13 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency

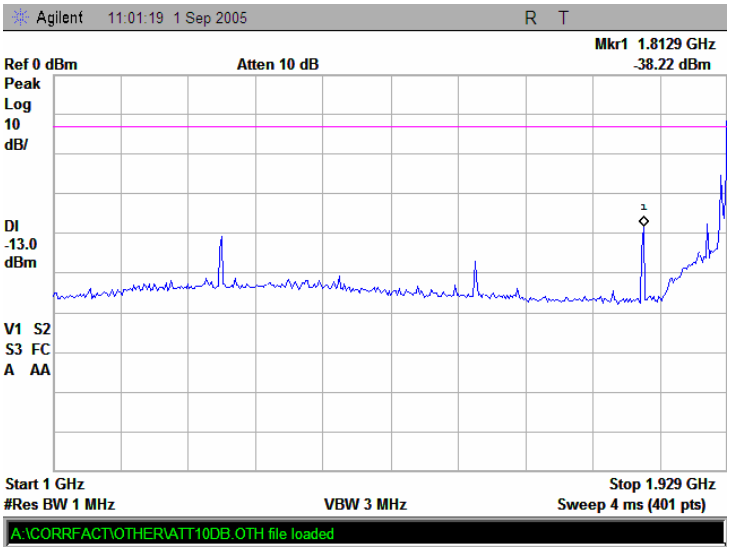


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.14 Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency

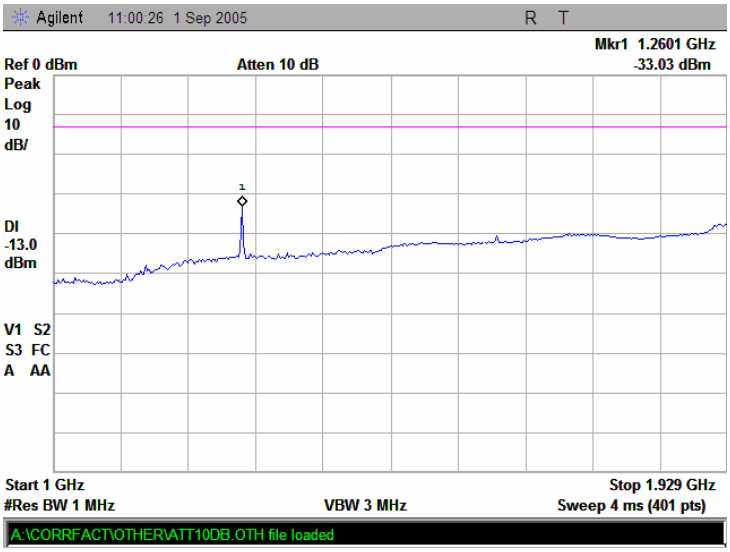


Plot 7.3.15 Spurious emission measurements in 1000 - 1929 MHz range at low carrier frequency

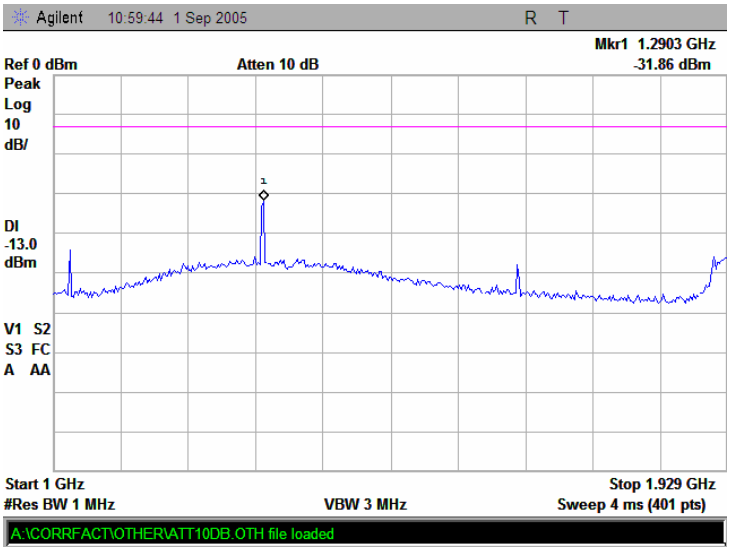


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.16 Spurious emission measurements in 1000 - 1929 MHz range at mid carrier frequency

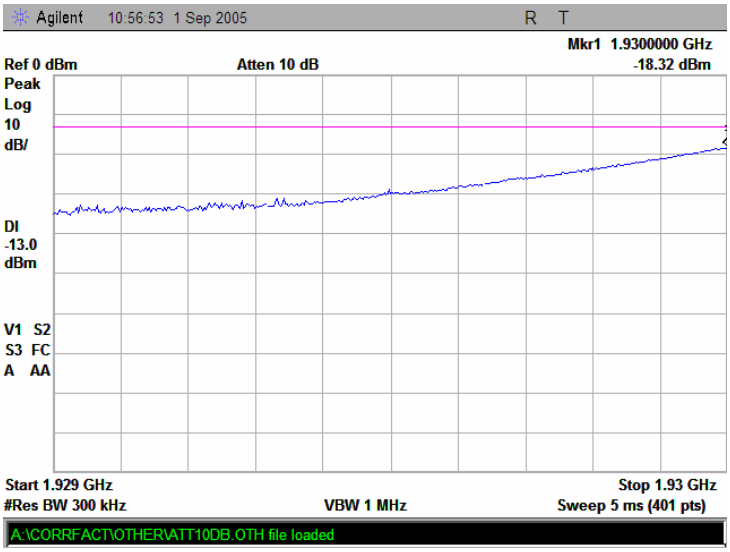


Plot 7.3.17 Spurious emission measurements in 1000 - 1929 MHz range at high carrier frequency

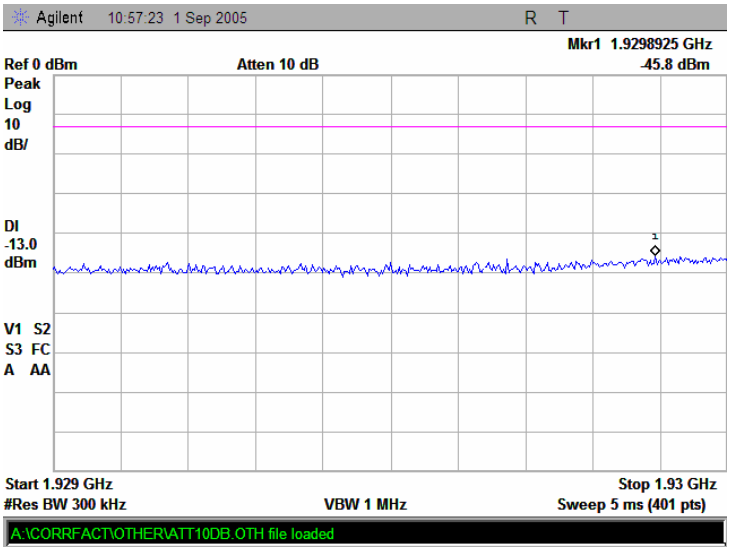


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.18 Spurious emission measurements in 1929 - 1930 MHz range at low carrier frequency

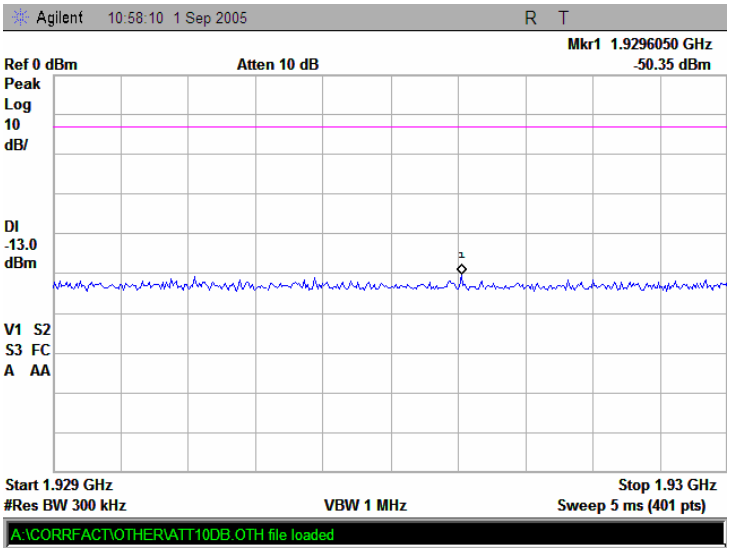


Plot 7.3.19 Spurious emission measurements in 1929 - 1930 MHz range at mid carrier frequency

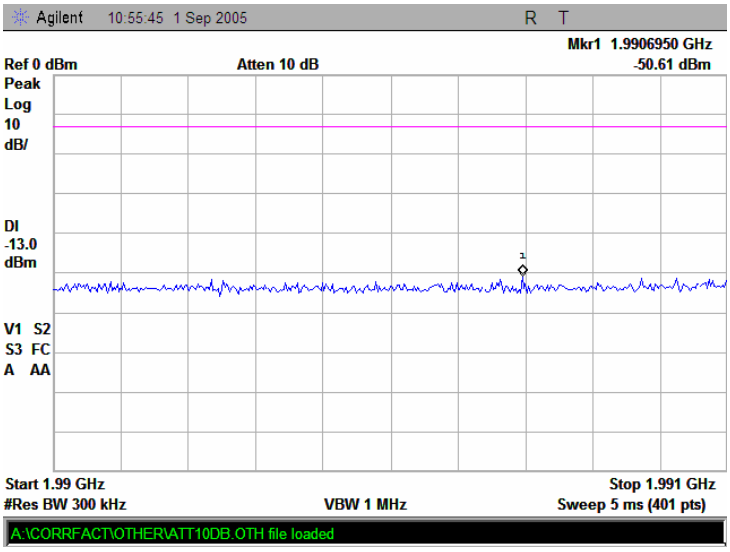


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.20 Spurious emission measurements in 1929 - 1930 MHz range at high carrier frequency

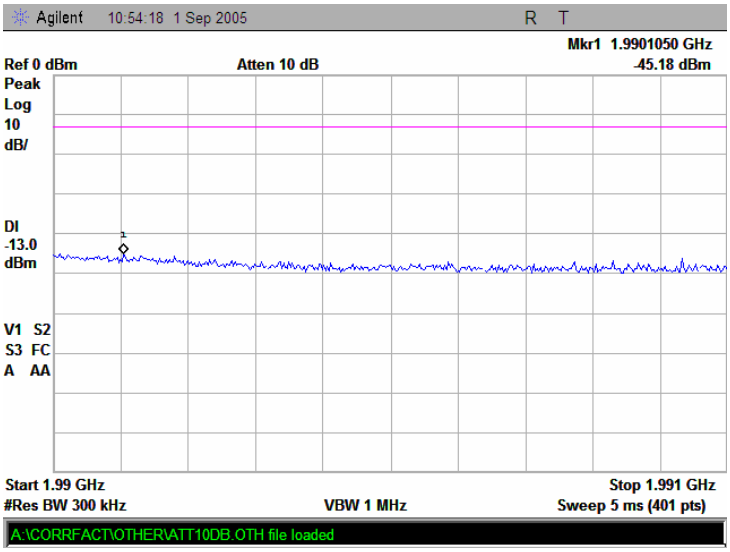


Plot 7.3.21 Spurious emission measurements in 1990 - 1991 MHz range at low carrier frequency

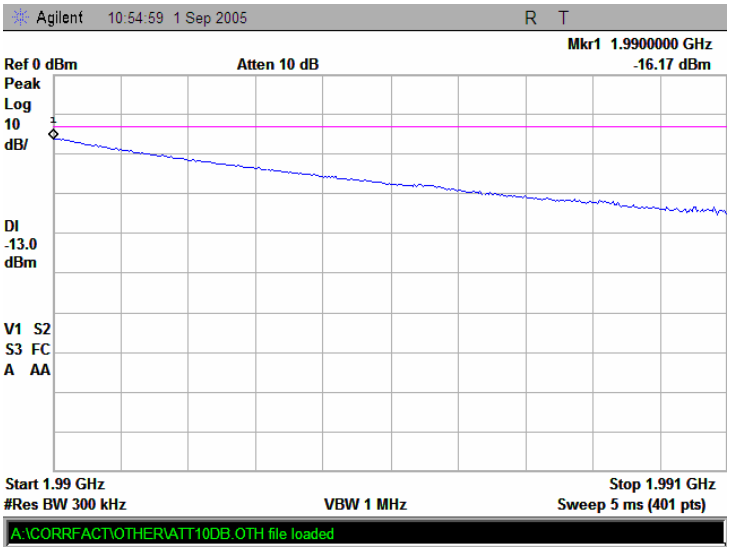


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.22 Spurious emission measurements in 1990 - 1991 MHz range at mid carrier frequency

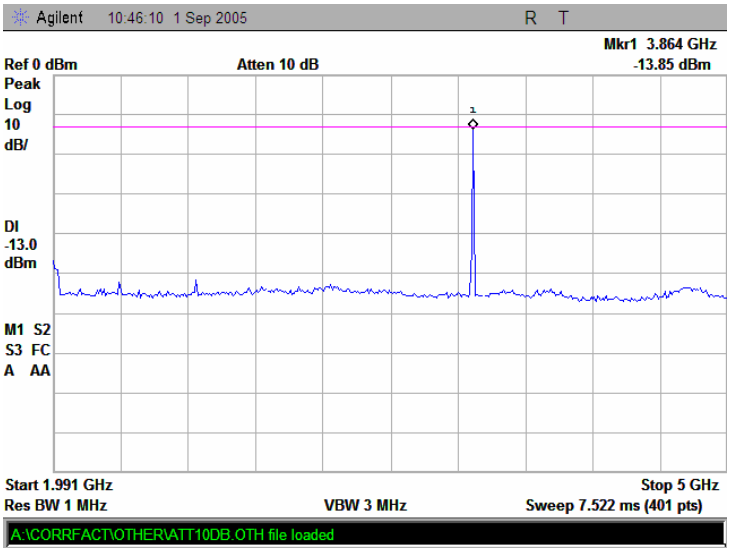


Plot 7.3.23 Spurious emission measurements in 1990 - 1991 MHz range at high carrier frequency

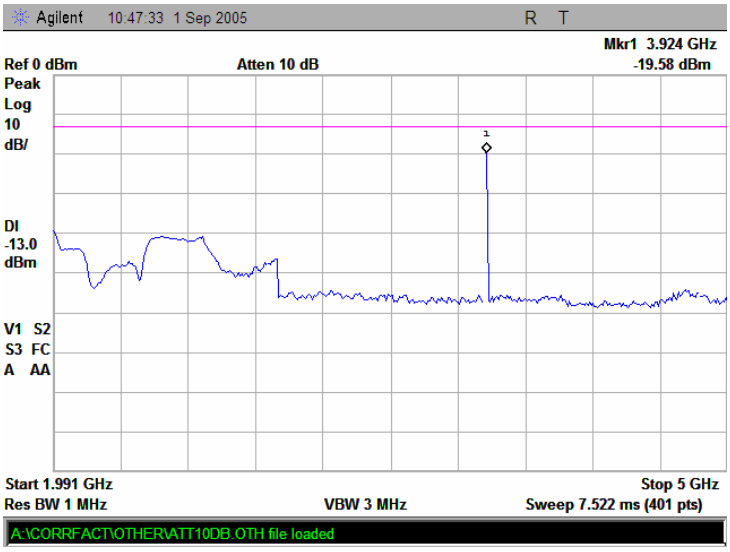


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.24 Spurious emission measurements in 1991 - 5000 MHz range at low carrier frequency

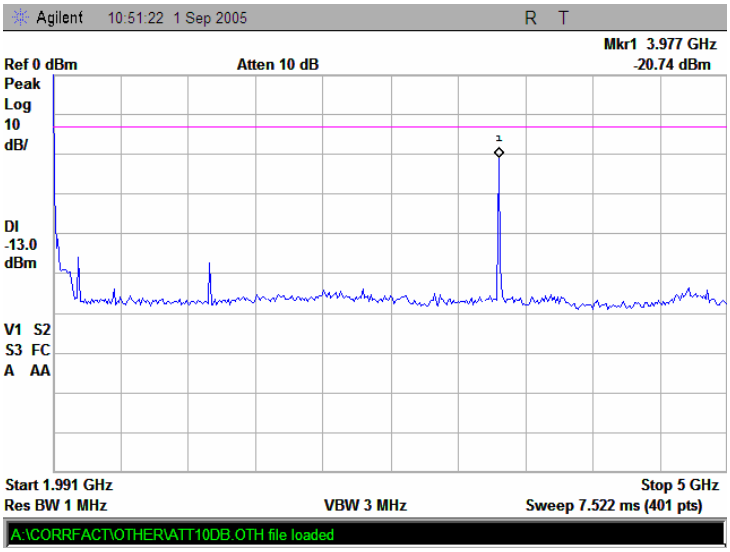


Plot 7.3.25 Spurious emission measurements in 1991 - 5000 MHz range at mid carrier frequency

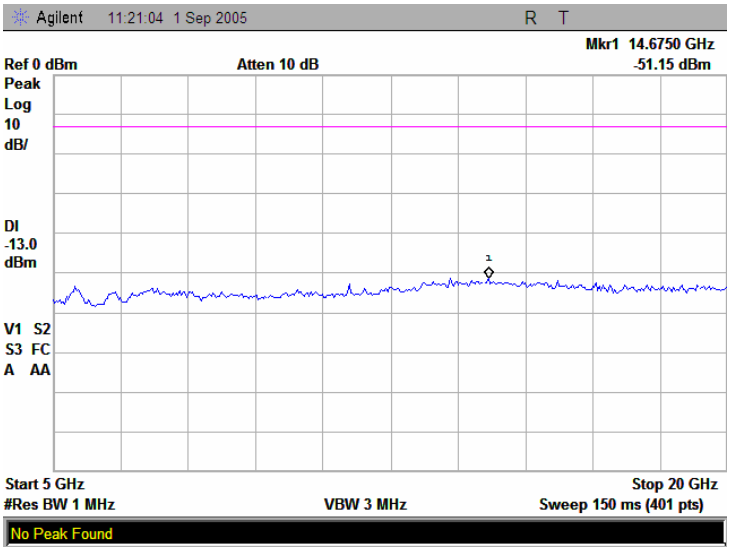


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.26 Spurious emission measurements in 1995 - 5000 MHz range at high carrier frequency

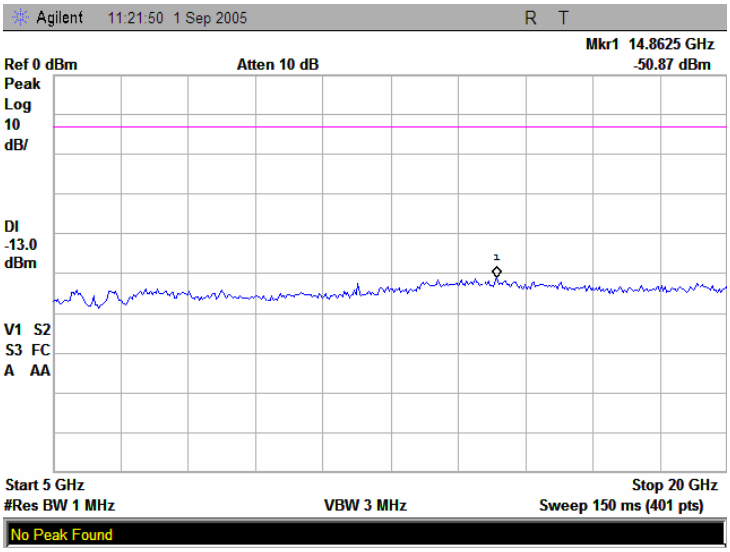


Plot 7.3.27 Spurious emission measurements in 5000 - 20000 MHz range at low carrier frequency

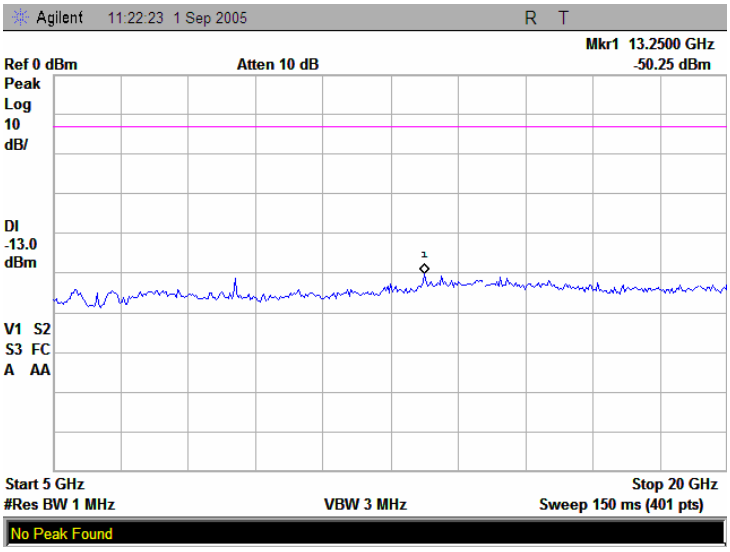


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.28 Spurious emission measurements in 5000 - 20000 MHz range at mid carrier frequency

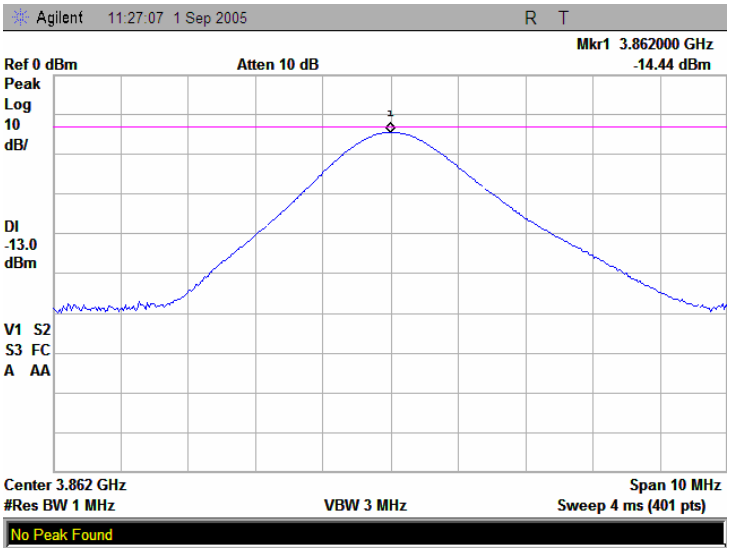


Plot 7.3.29 Spurious emission measurements in 5000 - 20000 MHz range at high carrier frequency

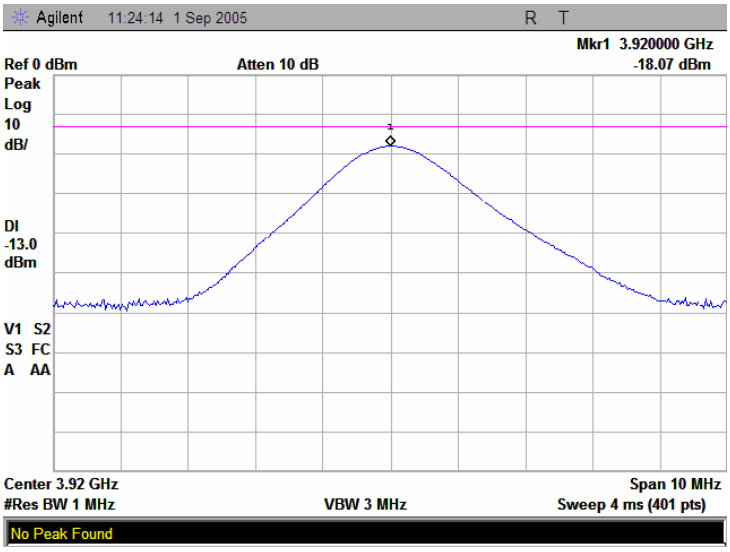


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.30 Conducted spurious emission measurements at the 2nd harmonic of low carrier frequency

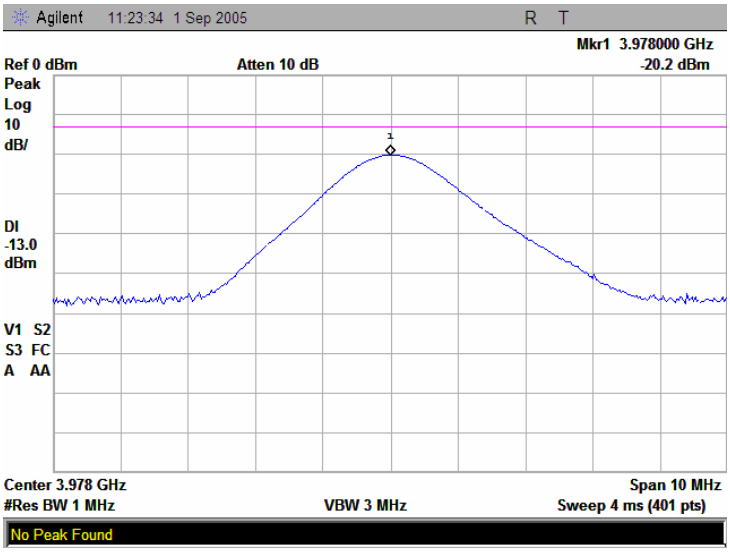


Plot 7.3.31 Conducted spurious emission measurements at the 2nd harmonic of mid carrier frequency

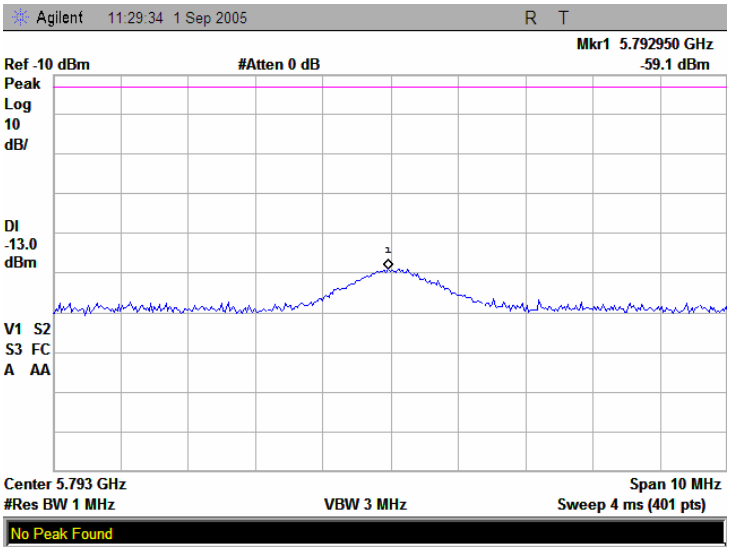


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.32 Conducted spurious emission measurements at the 2nd harmonic of high carrier frequency

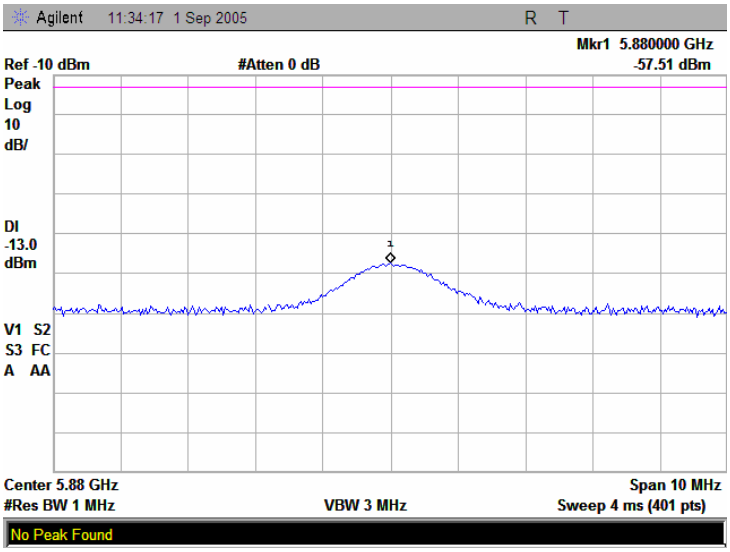


Plot 7.3.33 Conducted spurious emission measurements at the 3rd harmonic of low carrier frequency

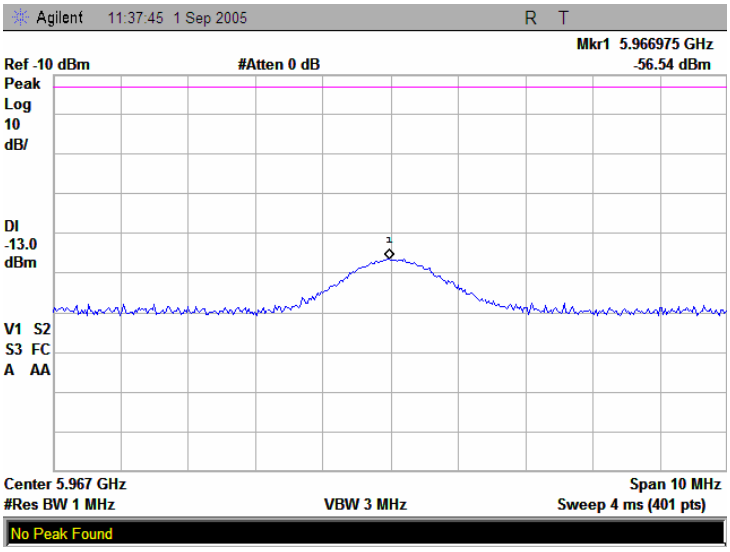


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.34 Conducted spurious emission measurements at the 3rd harmonic of mid carrier frequency

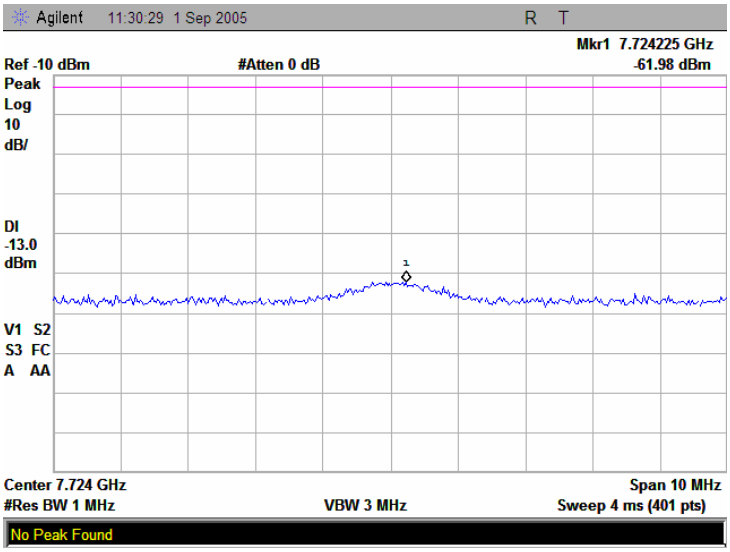


Plot 7.3.35 Conducted spurious emission measurements at the 3rd harmonic of high carrier frequency

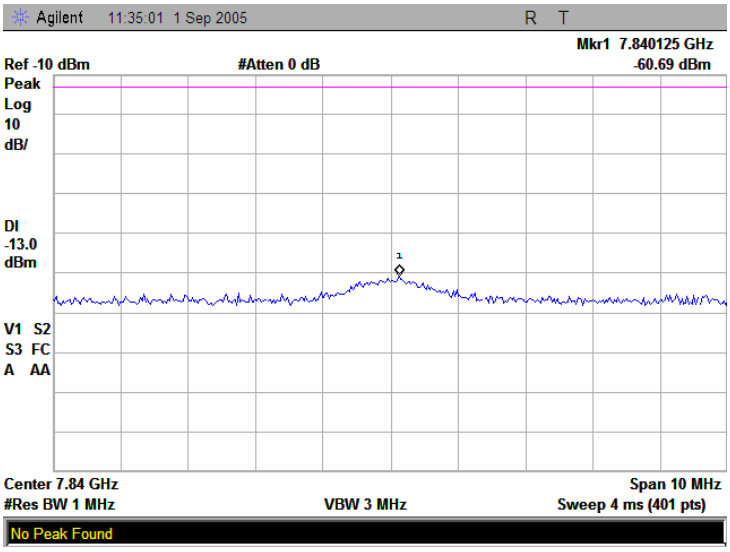


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.36 Conducted spurious emission measurements at the 4th harmonic of low carrier frequency

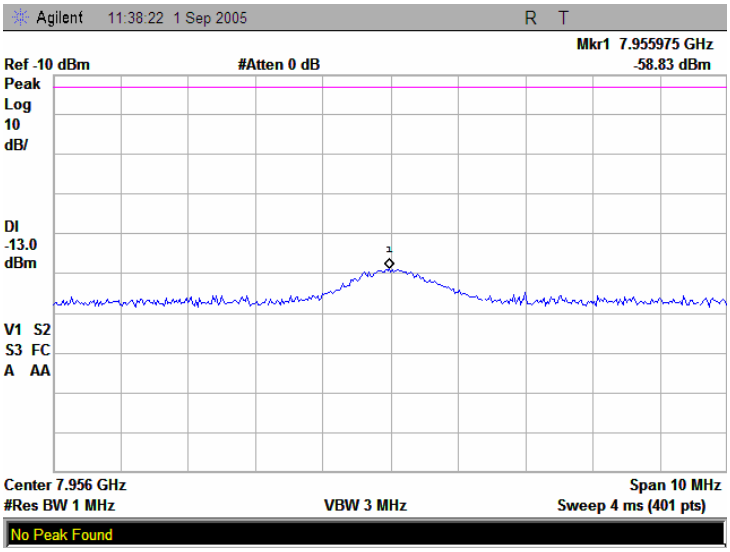


Plot 7.3.37 Conducted spurious emission measurements at the 4th harmonic of mid carrier frequency

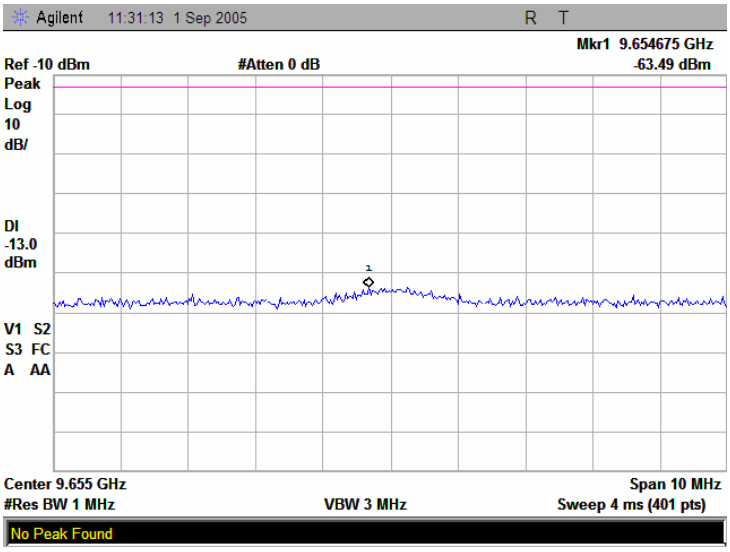


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.38 Conducted spurious emission measurements at the 4th harmonic of high carrier frequency

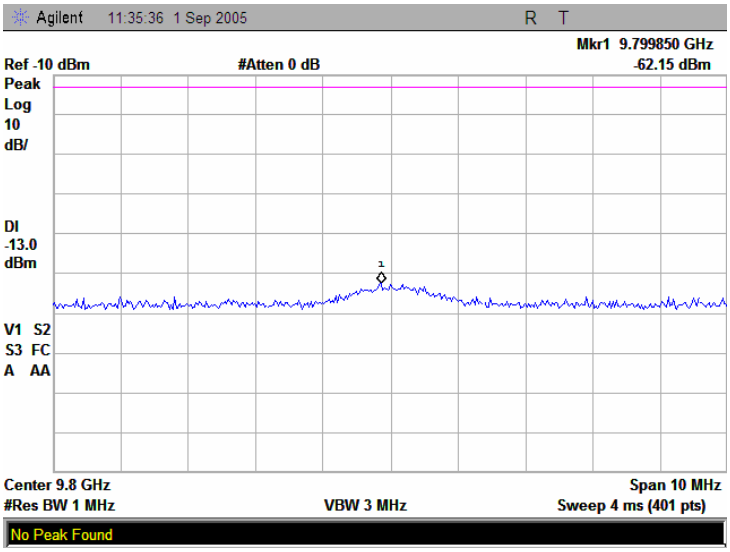


Plot 7.3.39 Conducted spurious emission measurements at the 5th harmonic of low carrier frequency

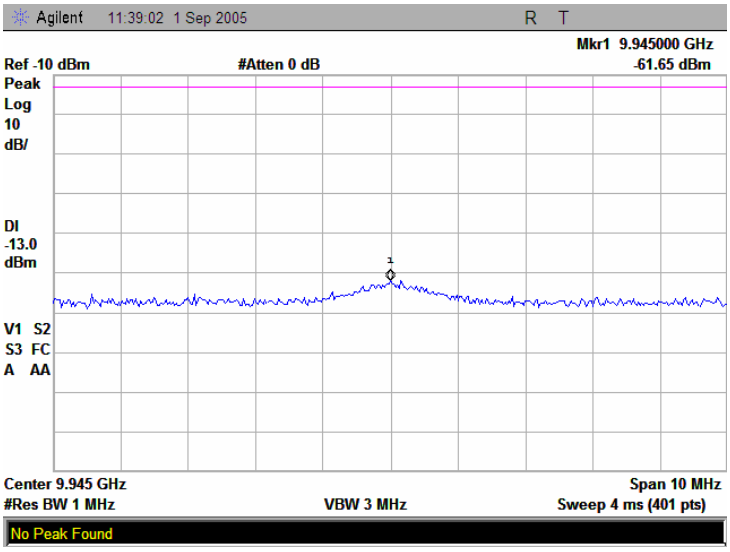


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.40 Conducted spurious emission measurements at the 5th harmonic of mid carrier frequency

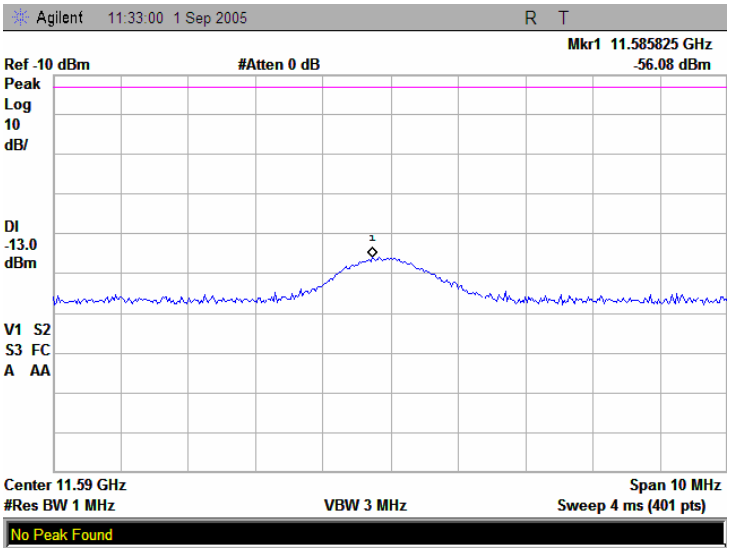


Plot 7.3.41 Conducted spurious emission measurements at the 5th harmonic of high carrier frequency

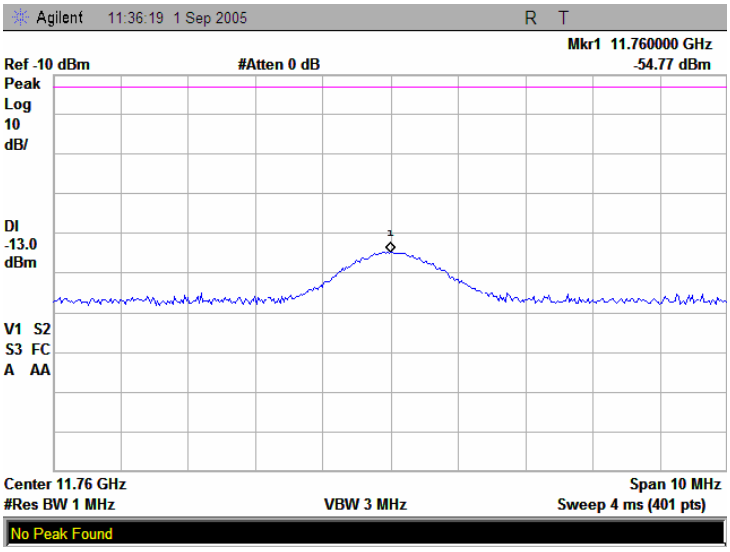


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.42 Conducted spurious emission measurements at the 6th harmonic of low carrier frequency

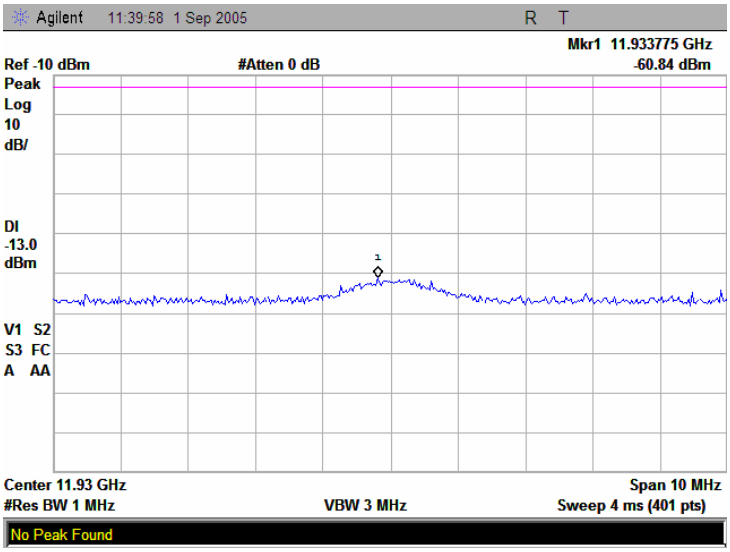


Plot 7.3.43 Conducted spurious emission measurements at the 6th harmonic of mid carrier frequency

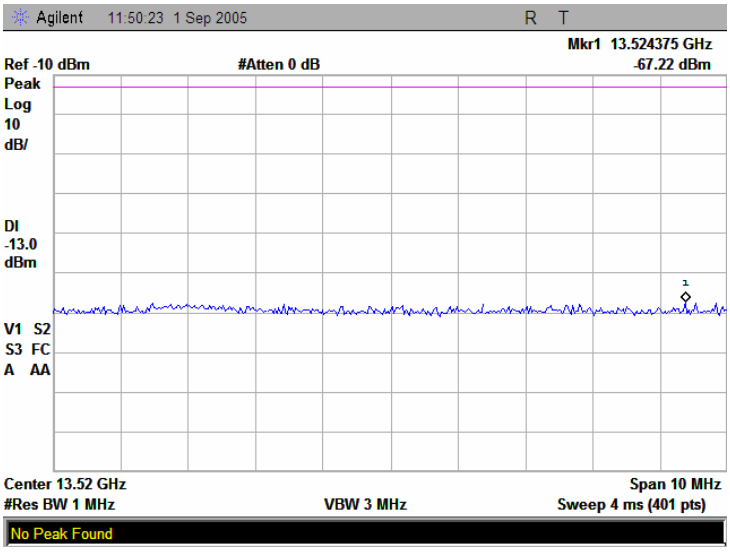


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.44 Conducted spurious emission measurements at the 6th harmonic of high carrier frequency

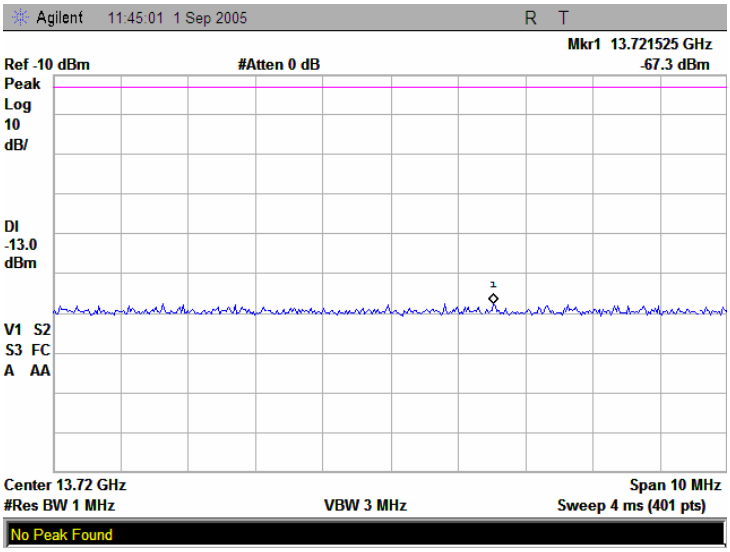


Plot 7.3.45 Conducted spurious emission measurements at the 7th harmonic of low carrier frequency

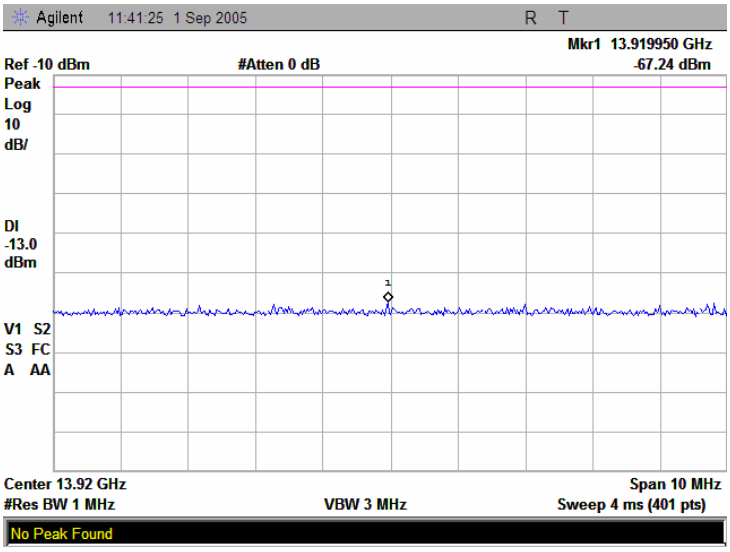


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.46 Conducted spurious emission measurements at the 7th harmonic of mid carrier frequency

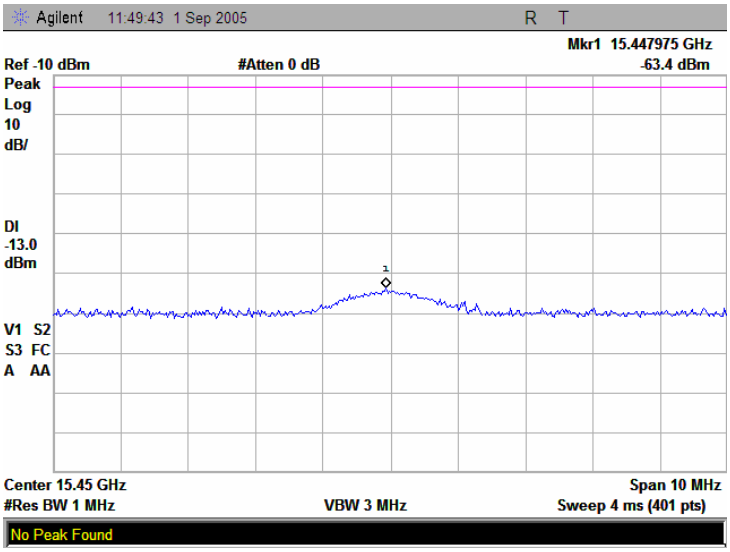


Plot 7.3.47 Conducted spurious emission measurements at the 7th harmonic of high carrier frequency

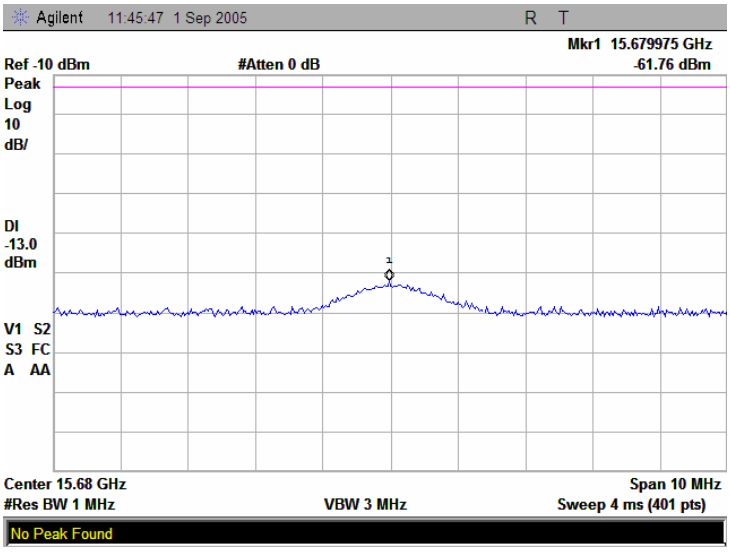


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.48 Conducted spurious emission measurements at the 8th harmonic of low carrier frequency

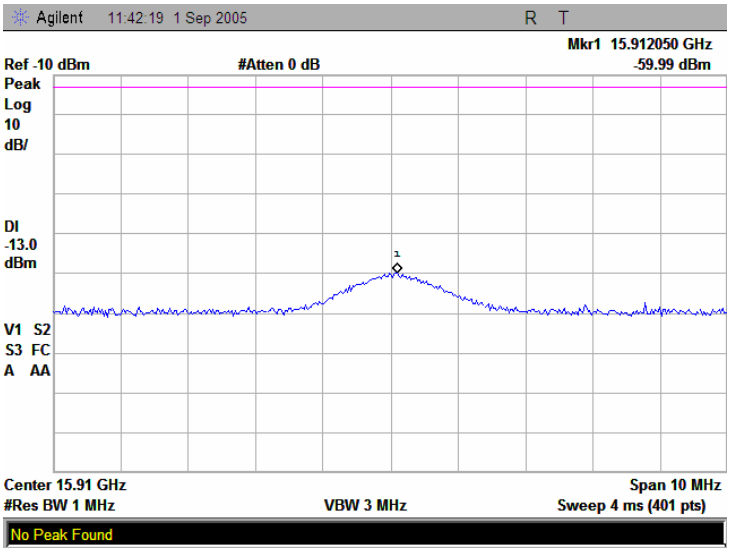


Plot 7.3.49 Conducted spurious emission measurements at the 8th harmonic of mid carrier frequency

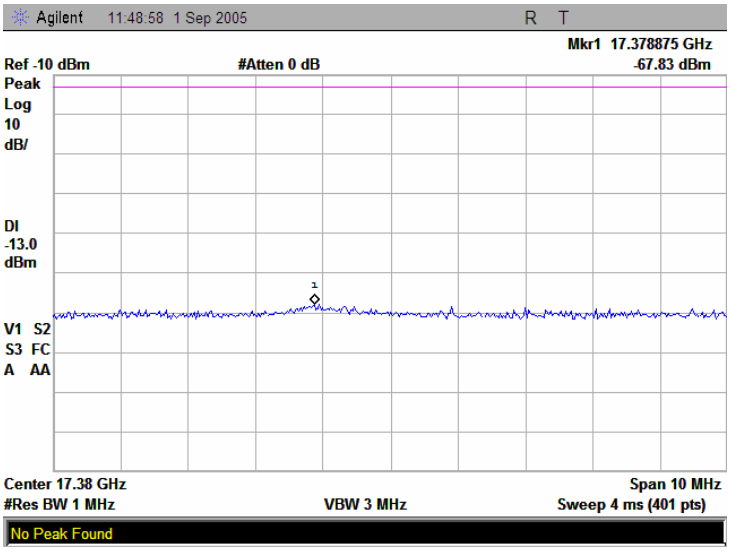


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.50 Conducted spurious emission measurements at the 8th harmonic of high carrier frequency

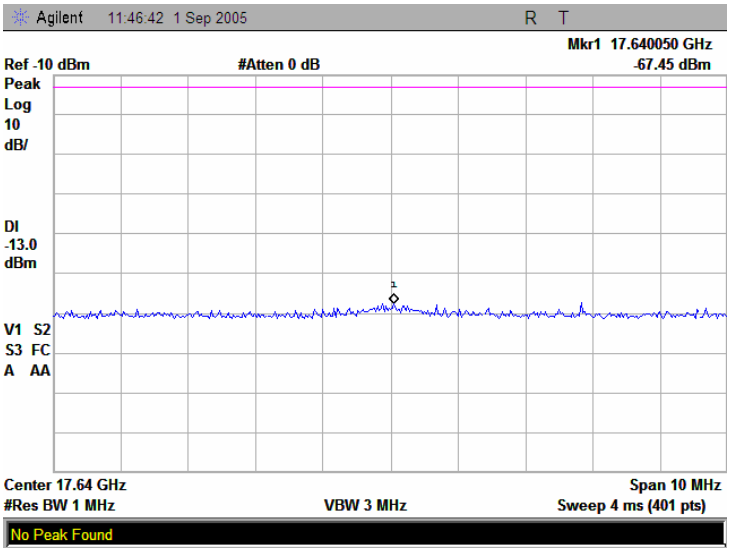


Plot 7.3.51 Conducted spurious emission measurements at the 9th harmonic of low carrier frequency

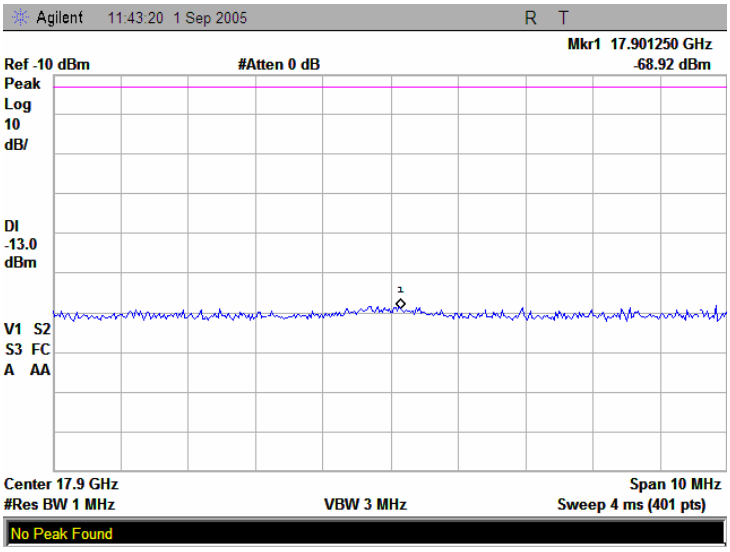


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.52 Conducted spurious emission measurements at the 9th harmonic of mid carrier frequency

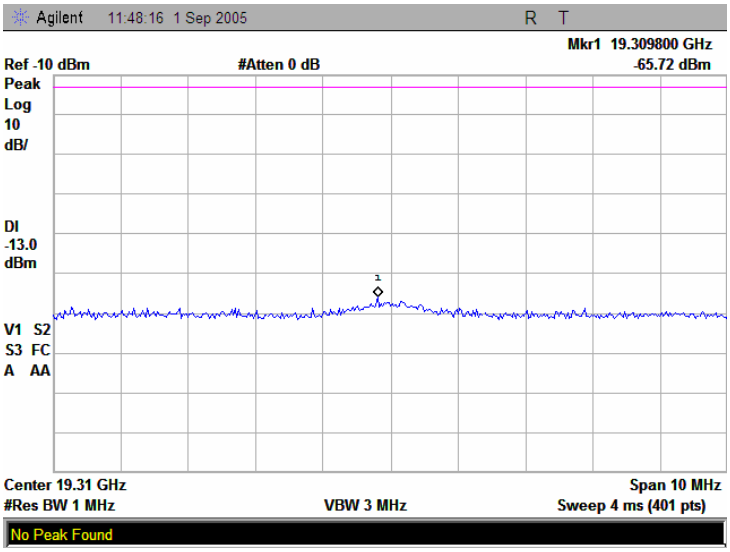


Plot 7.3.53 Conducted spurious emission measurements at the 9th harmonic of high carrier frequency

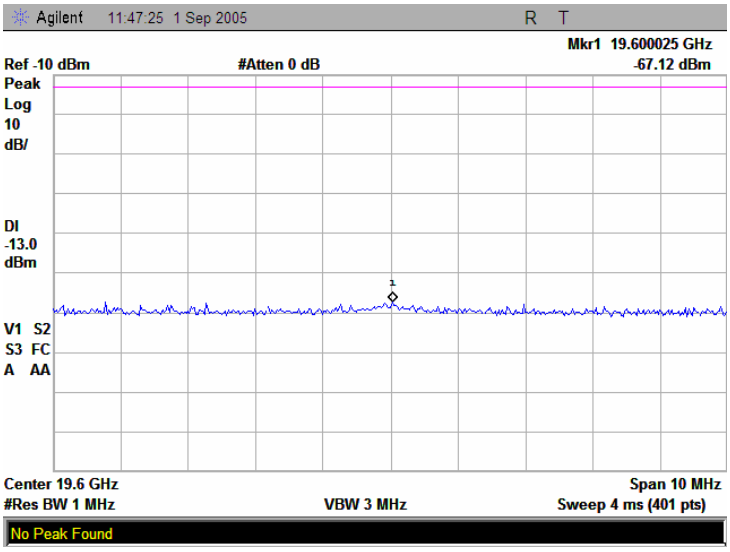


Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.54 Conducted spurious emission measurements at the 10th harmonic of low carrier frequency

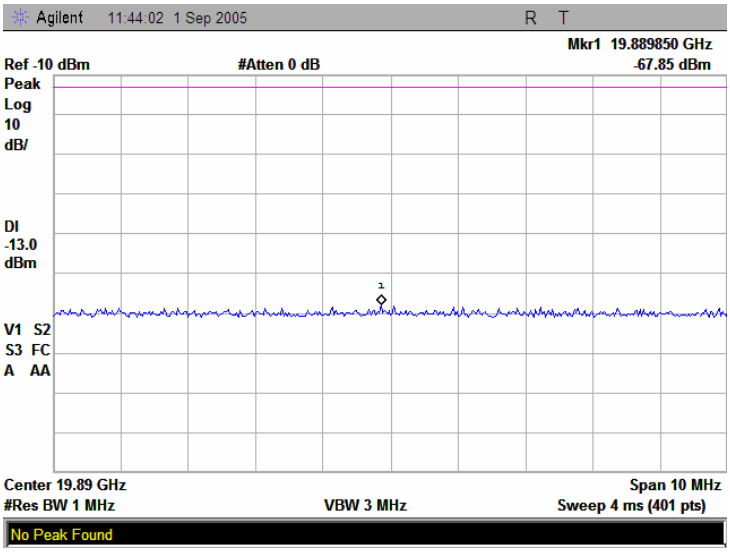


Plot 7.3.55 Conducted spurious emission measurements at the 10th harmonic of mid carrier frequency



Test specification:	Section 24.238, Spurious emission at antenna terminal		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/1/2005 4:03:01 PM		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.56 Conducted spurious emission measurements at the 10th harmonic of high carrier frequency



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 ºC	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

7.4 Field strength of spurious emissions

7.4.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limit according to FCC part 24 is given in Table 7.4.1.

Table 7.4.1 Radiated spurious emissions limits

Frequency, MHz	Attenuation below carrier
0.009 – 20000	43+10log(P)

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

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 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.

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

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

7.4.3.1 The EUT was set up as shown in Figure 7.4.2, energized and the performance check was conducted.

7.4.3.2 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.

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

Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 ºC	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Figure 7.4.1 Setup for spurious emission field strength measurements below 30 MHz

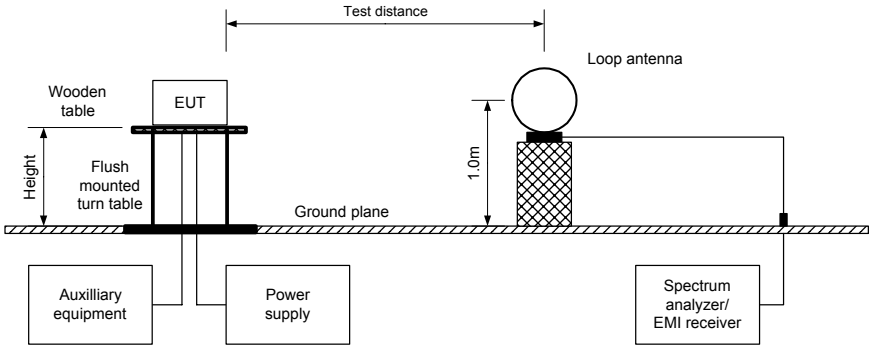
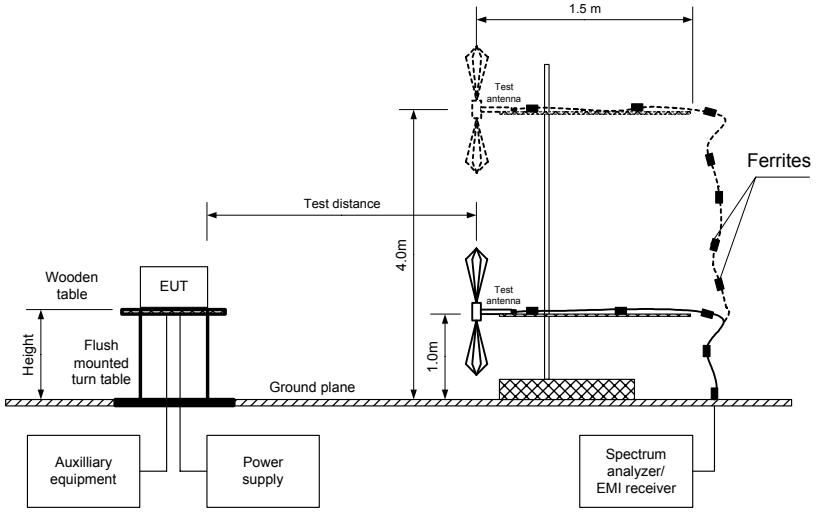


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 45 %	**Power Supply:** 48 VDC
Remarks:			

Table 7.4.2 Field strength of emissions

ASSIGNED FREQUENCY RANGE:	1930 - 1990 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 20000 MHz
TEST DISTANCE:	3 m
MODULATION:	4FSK
MODULATING SIGNAL:	PRBS
BIT RATE:	3 Mbps
DUTY CYCLE:	100 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
TRANSMITTER OUTPUT POWER:	26.83 dBm at low carrier frequency 26.50 dBm at mid carrier frequency 26.50 dBm at high carrier frequency
DETECTOR USED:	Peak
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength of spurious, dB(μV/m)	Limit, dB(μV/m)	Margin, dB	Antenna polarization	Antenna height, m	Azimuth, degrees*
Low carrier frequency						
3861.880	57.99	82.23	-24.24	Vertical	1.1	123
7723.820	59.97	82.23	-22.26	Horizontal	1.0	57
9654.920	65.17	82.23	-17.06	Vertical	1.0	120
11585.830	65.83	82.23	-16.40	Vertical	1.2	160
13516.920	63.00	82.23	-19.23	Vertical	1.0	161
Mid carrier frequency						
3919.930	58.16	82.23	-24.07	Vertical	1.3	124
7839.900	54.47	82.23	-27.76	Horizontal	1.1	67
9799.920	64.67	82.23	-17.56	Vertical	1.0	132
11759.820	69.83	82.23	-12.40	Vertical	1.2	170
13719.730	63.83	82.23	-18.40	Vertical	1.0	160
High carrier frequency						
3977.820	56.32	82.23	-25.91	Vertical	1.0	113
7955.980	56.47	82.23	-25.76	Horizontal	1.0	60
9944.900	58.67	82.23	-23.56	Vertical	1.1	120
11933.850	69.67	82.23	-12.56	Vertical	1.2	170
13923.130	57.33	82.23	-24.90	Vertical	1.1	155

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = Attenuation below carrier – specification limit.

Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 45 %	**Power Supply:** 48 VDC
Remarks:			

Table 7.4.3 Substitution method

ASSIGNED FREQUENCY: 1930 - 1990 MHz
INVESTIGATED FREQUENCY RANGE: 1000 – 20000 MHz
TEST DISTANCE: 3 m
RESOLUTION BANDWIDTH: 1 MHz (abobe 1000 MHz)
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Double ridged guide (above1000 MHz)

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Atten. below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency										
3861.880	57.99	Vertical	-42.03	7.99	1.31	-35.35	62.18	39.83	22.35	Pass
7723.820	59.97	Horizontal	-45.97	8.51	1.84	-39.30	66.13	39.83	26.30	Pass
9654.920	65.17	Vertical	-50.09	9.44	2.00	-42.65	69.48	39.83	29.65	Pass
11585.830	65.83	Vertical	-47.70	9.83	2.28	-40.15	66.98	39.83	27.15	Pass
13516.920	63.00	Vertical	-51.48	9.87	2.54	-44.15	70.98	39.83	31.15	Pass
Mid carrier frequency										
3919.930	58.16	Vertical	-39.96	8.12	1.31	-33.15	59.65	39.50	20.15	Pass
7839.900	54.47	Horizontal	-44.75	8.64	1.84	-37.95	64.45	39.50	24.95	Pass
9799.920	64.67	Vertical	-49.22	9.57	2.00	-41.65	68.15	39.50	28.65	Pass
11759.820	69.83	Vertical	-51.03	9.96	2.28	-43.35	69.85	39.50	30.35	Pass
13719.730	63.83	Vertical	-50.61	10.00	2.54	-43.15	69.65	39.50	30.15	Pass
High carrier frequency										
3977.820	56.32	Vertical	-43.28	8.24	1.31	-36.35	62.85	39.50	23.35	Pass
7955.980	56.47	Horizontal	-44.27	8.76	1.84	-37.35	63.85	39.50	24.35	Pass
9944.900	58.67	Vertical	-50.05	9.70	2.00	-42.35	68.85	39.50	29.35	Pass
11933.850	69.67	Vertical	-51.46	10.09	2.28	-43.65	70.15	39.50	30.65	Pass
13923.130	57.33	Vertical	-51.73	10.12	2.54	-44.15	70.65	39.50	31.15	Pass

*****- Margin = Attenuation below carrier - limit.

Reference numbers of test equipment used

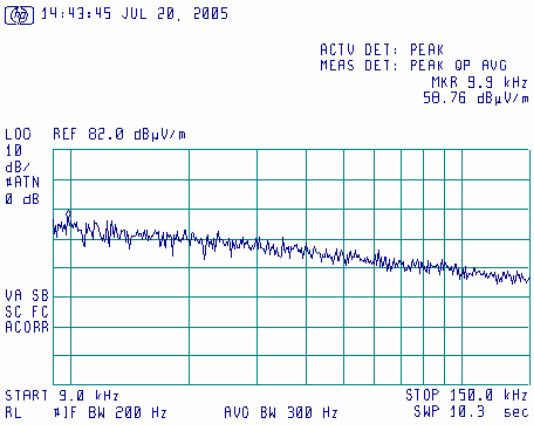
HL 0410	HL 0446	HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 0661	HL 0786	HL 1200	HL 1424	HL 1941	HL 1984	HL 2009
HL 2259	HL 2399	HL 2400	HL 2432				

Full description is given in Appendix A.

Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

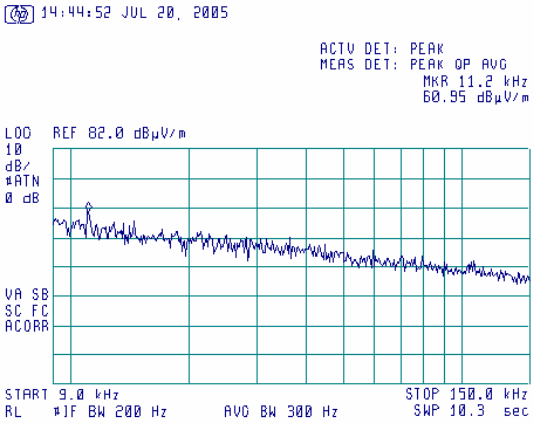
Plot 7.4.1 Radiated emission measurements from 9 to 150 kHz at the low carrier frequency

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



Plot 7.4.2 Radiated emission measurements from 9 to 150 kHz at the mid carrier frequency

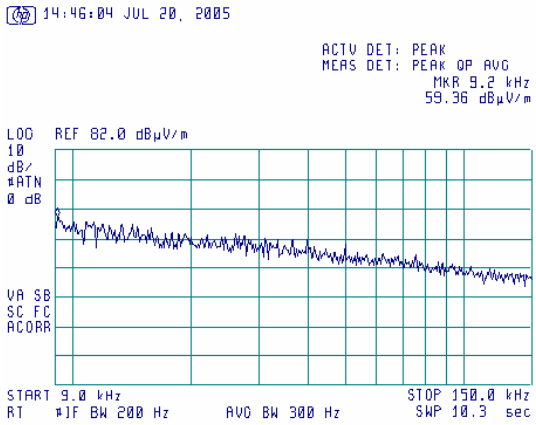
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

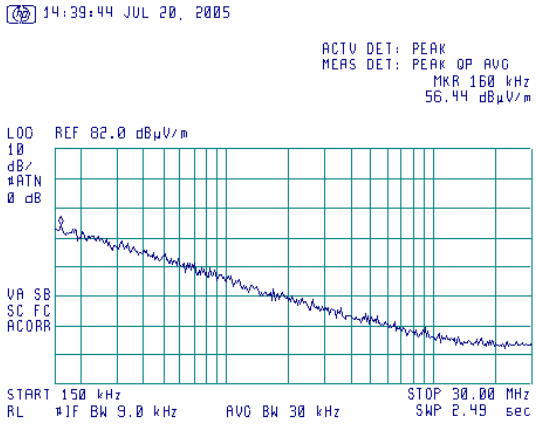
Plot 7.4.3 Radiated emission measurements from 9 to 150 kHz at the high carrier frequency

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



Plot 7.4.4 Radiated emission measurements from 0.15 to 30 MHz at the low carrier frequency

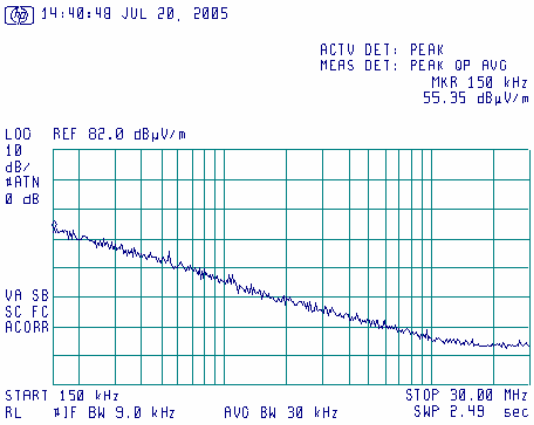
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

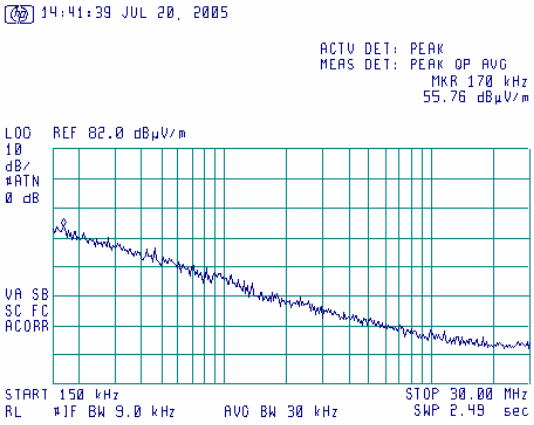
Plot 7.4.5 Radiated emission measurements from 0.15 to 30 MHz at the mid carrier frequency

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



Plot 7.4.6 Radiated emission measurements from 0.15 to 30 MHz at the high carrier frequency

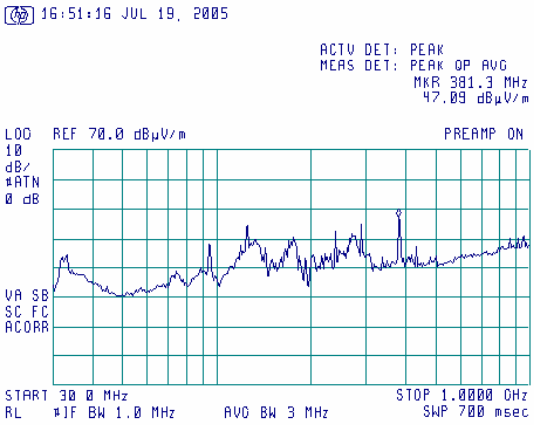
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

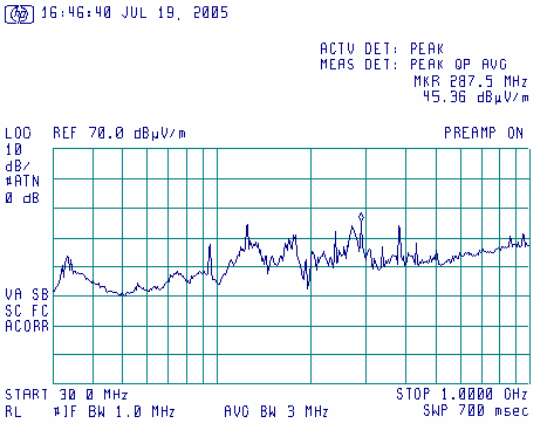
Plot 7.4.7 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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



Plot 7.4.8 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency

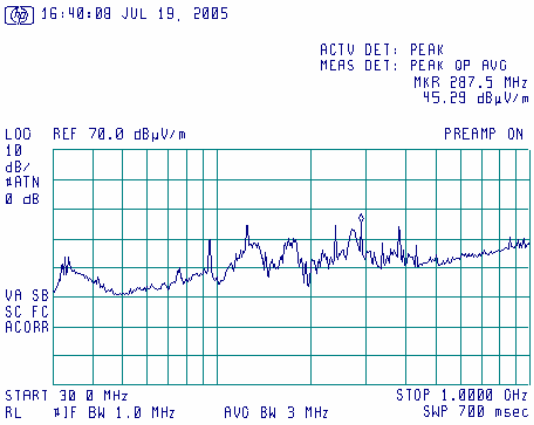
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

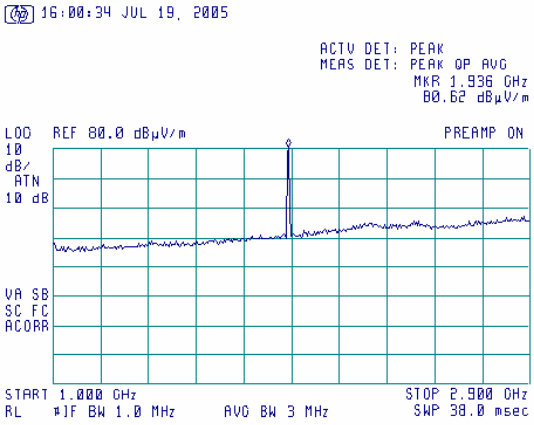
Plot 7.4.9 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

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



Plot 7.4.10 Radiated emission measurements from 1000 to 2900 MHz at the low carrier frequency

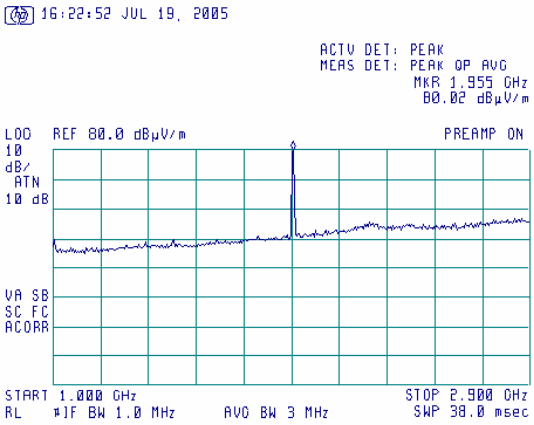
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

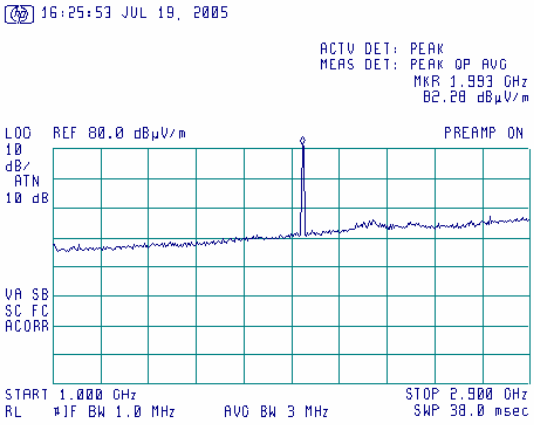
Plot 7.4.11 Radiated emission measurements from 1000 to 2900 MHz at the mid carrier frequency

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



Plot 7.4.12 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency

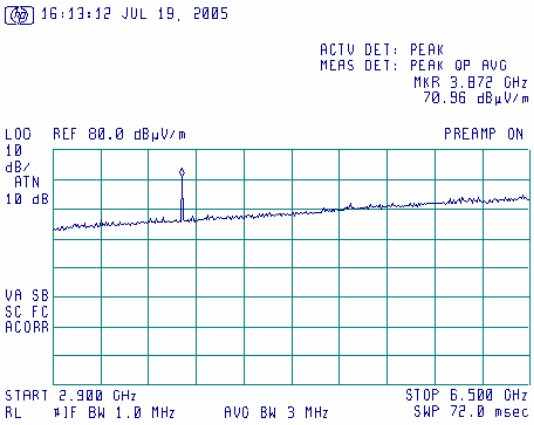
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

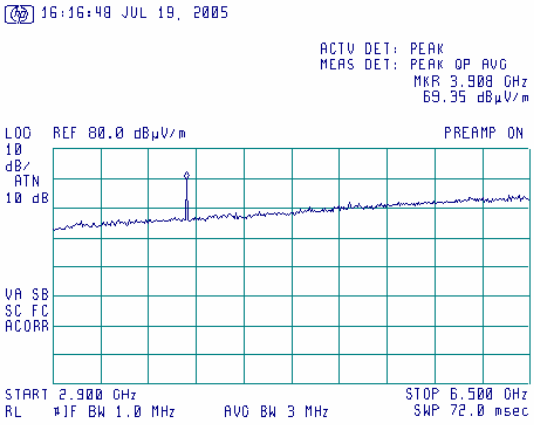
Plot 7.4.13 Radiated emission measurements from 2900 to 6500 MHz at the low carrier frequency

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



Plot 7.4.14 Radiated emission measurements from 2900 to 6500 MHz at the mid carrier frequency

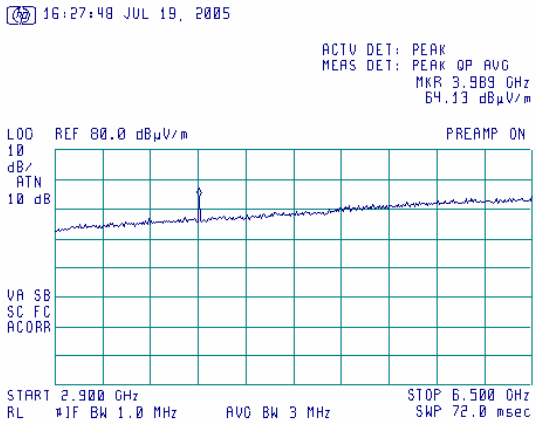
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

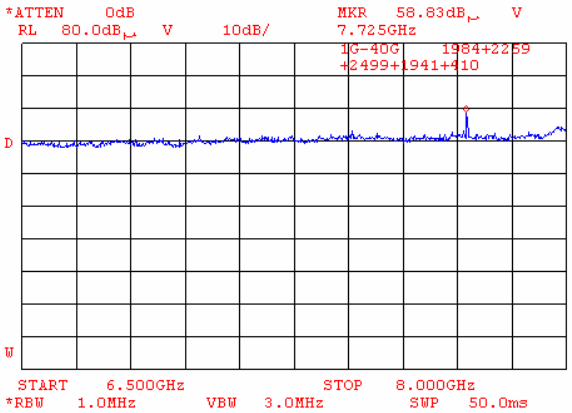
Plot 7.4.15 Radiated emission measurements from 2900 to 6500 MHz at the high carrier frequency

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



Plot 7.4.16 Radiated emission measurements from 6.5 to 8 GHz at the low carrier frequency

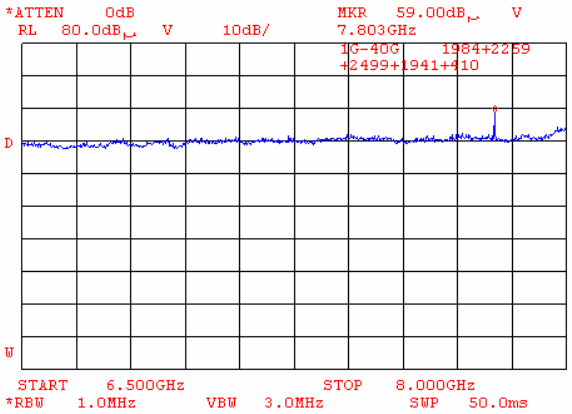
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

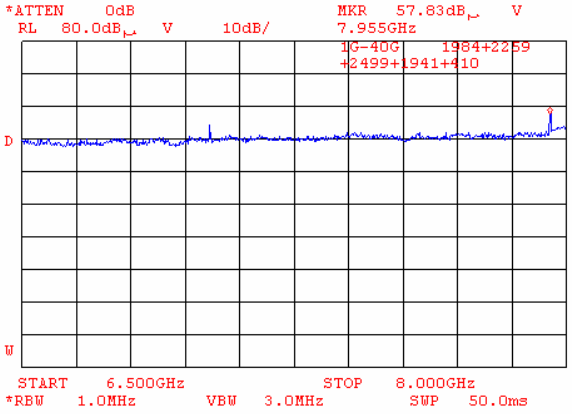
Plot 7.4.17 Radiated emission measurements from 6.5 to 8 GHz at the mid carrier frequency

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



Plot 7.4.18 Radiated emission measurements from 6.5 to 8 GHz at the high carrier frequency

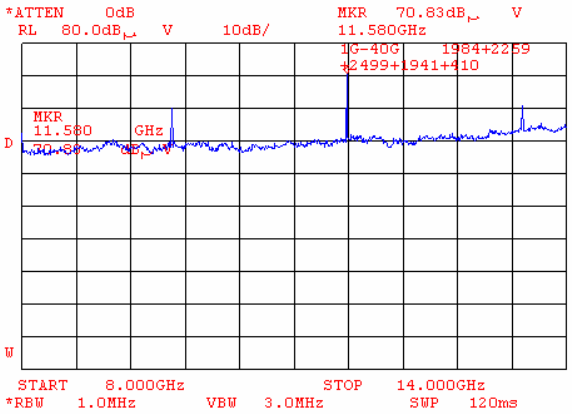
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

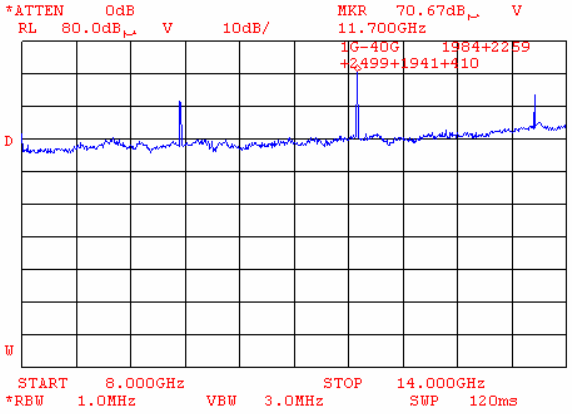
Plot 7.4.19 Radiated emission measurements from 8 to 14 GHz at the low carrier frequency

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



Plot 7.4.20 Radiated emission measurements from 8 to 14 GHz at the mid carrier frequency

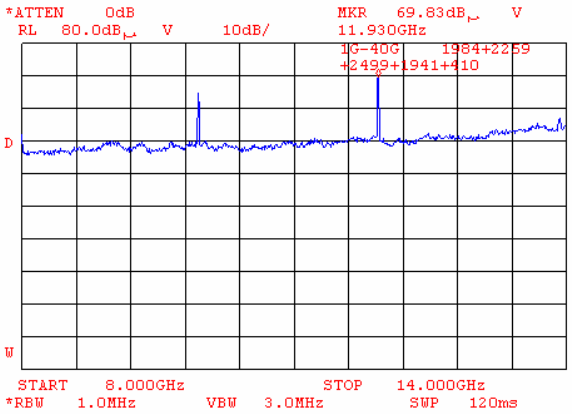
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

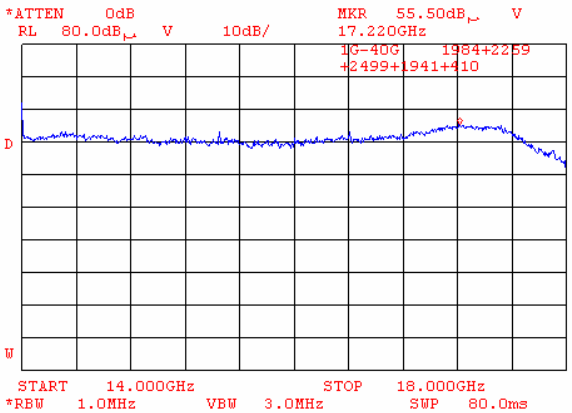
Plot 7.4.21 Radiated emission measurements from 8 to 14 GHz at the high carrier frequency

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



Plot 7.4.22 Radiated emission measurements from 14 to 18 GHz at the low carrier frequency

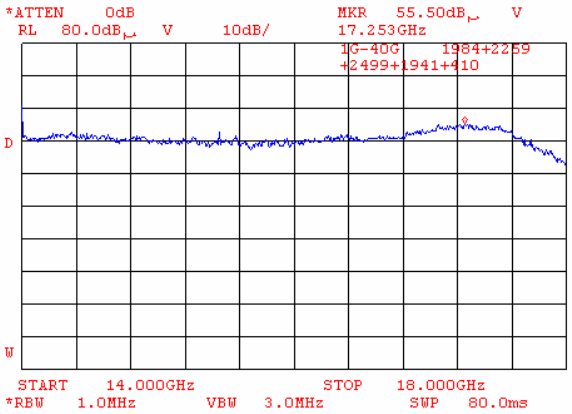
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

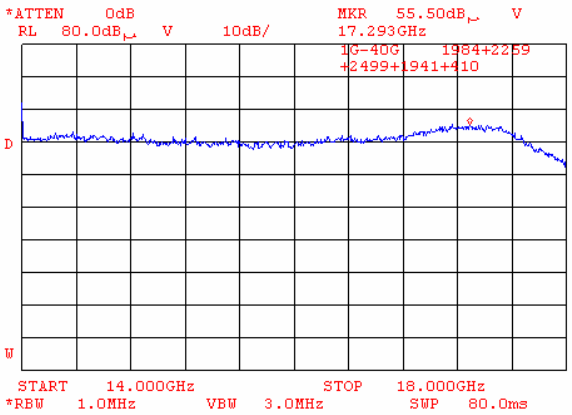
Plot 7.4.23 Radiated emission measurements from 14 to 18 GHz at the mid carrier frequency

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



Plot 7.4.24 Radiated emission measurements from 14 to 18 GHz at the high carrier frequency

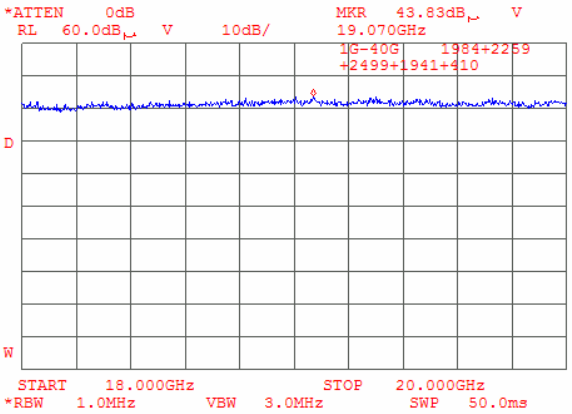
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

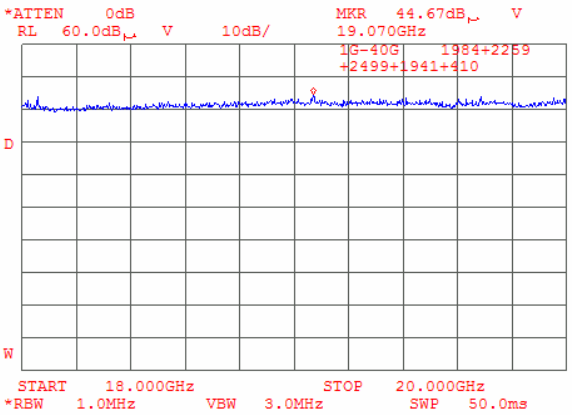
Plot 7.4.25 Radiated emission measurements from 18 to 20 GHz at the low carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Plot 7.4.26 Radiated emission measurements from 18 to 20 GHz at the mid carrier frequency

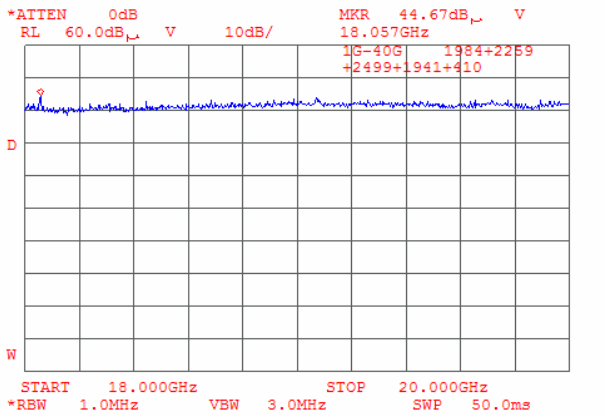
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.27 Radiated emission measurements from 18 to 20 GHz at the high carrier frequency

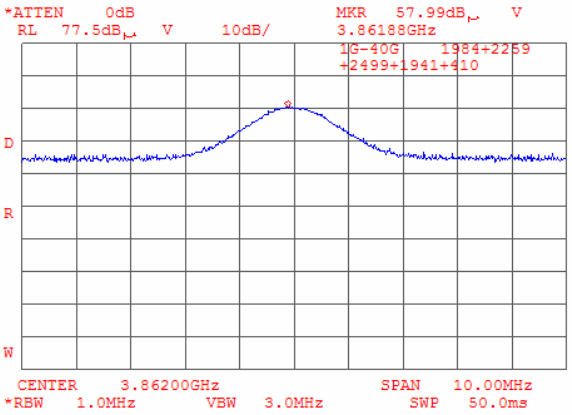
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

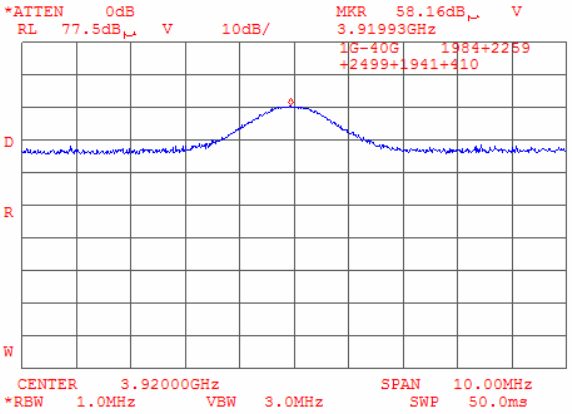
Plot 7.4.28 Radiated emission measurements at the second harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.4.29 Radiated emission measurements at the second harmonic of mid carrier frequency

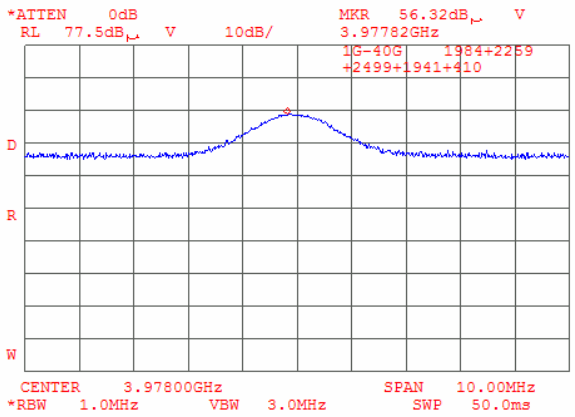
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

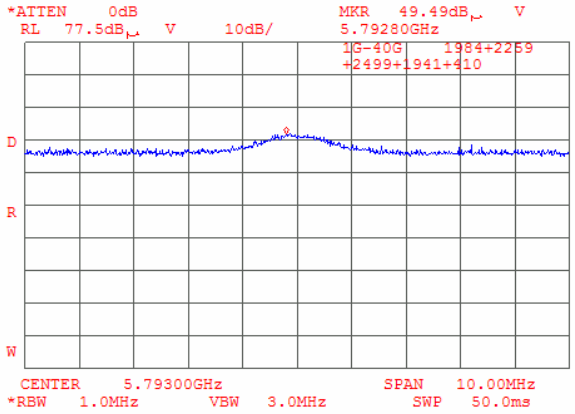
Plot 7.4.30 Radiated emission measurements at the second harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.4.31 Radiated emission measurements at the third harmonic of low carrier frequency

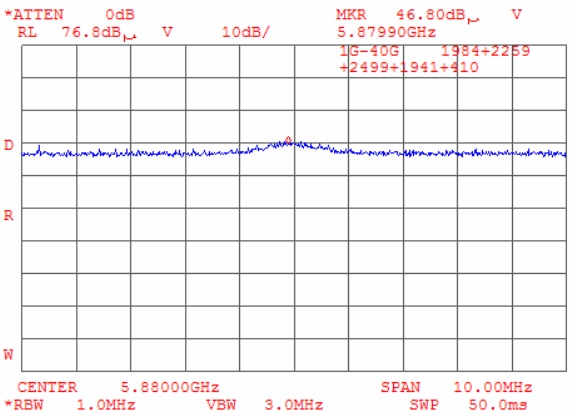
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

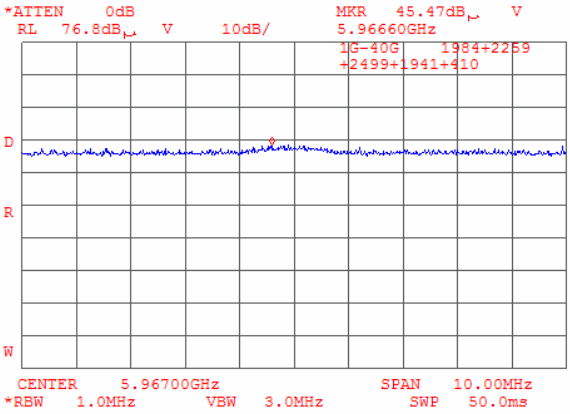
Plot 7.4.32 Radiated emission measurements at the third harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.33 Radiated emission measurements at the third harmonic of high carrier frequency

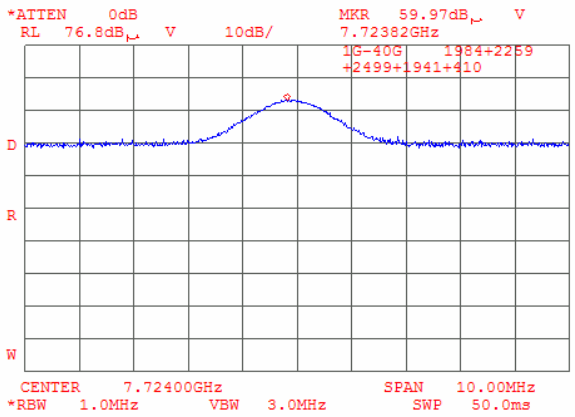
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

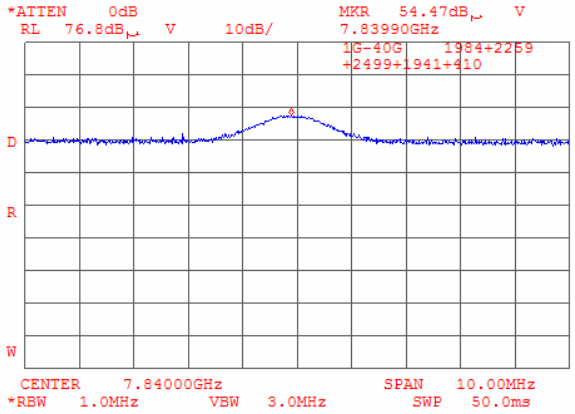
Plot 7.4.34 Radiated emission measurements at the forth harmonic of low carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.35 Radiated emission measurements at the forth harmonic of mid carrier frequency

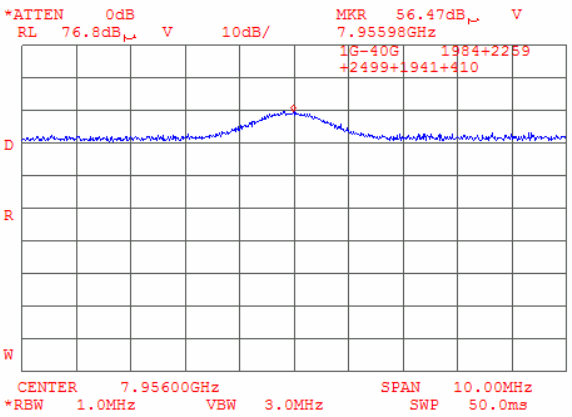
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

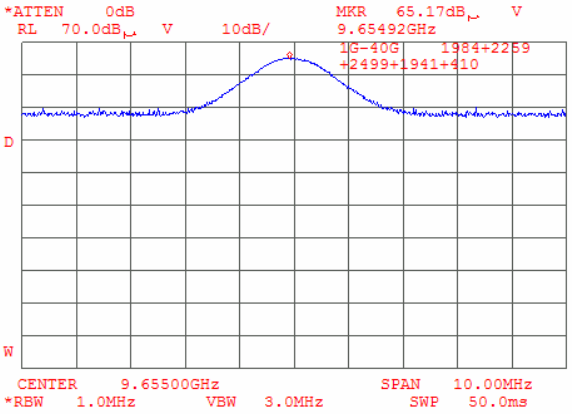
Plot 7.4.36 Radiated emission measurements at the forth harmonic of high carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.37 Radiated emission measurements at the fifth harmonic of low carrier frequency

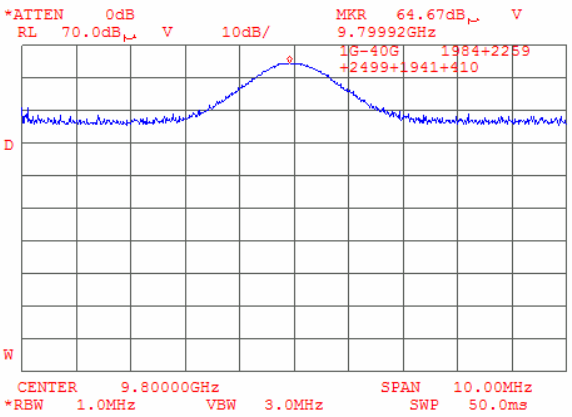
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

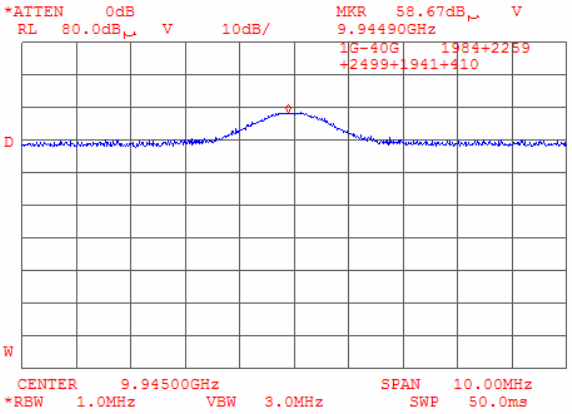
Plot 7.4.38 Radiated emission measurements at the fifth harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.39 Radiated emission measurements at the fifth harmonic of high carrier frequency

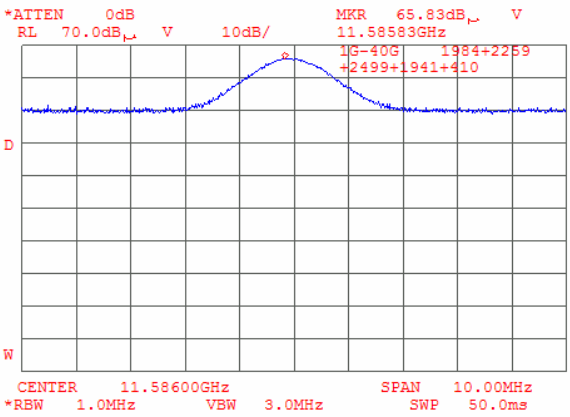
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

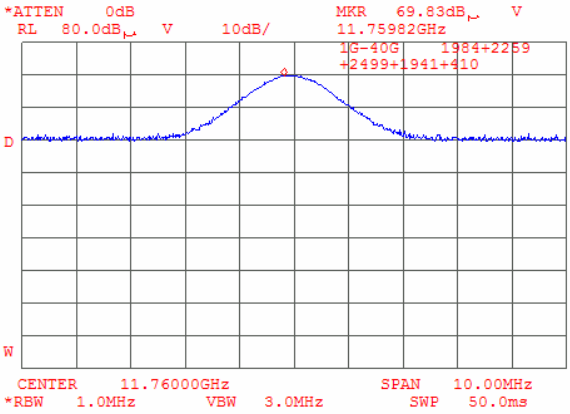
Plot 7.4.40 Radiated emission measurements at the sixth harmonic of low carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.41 Radiated emission measurements at the sixth harmonic of mid carrier frequency

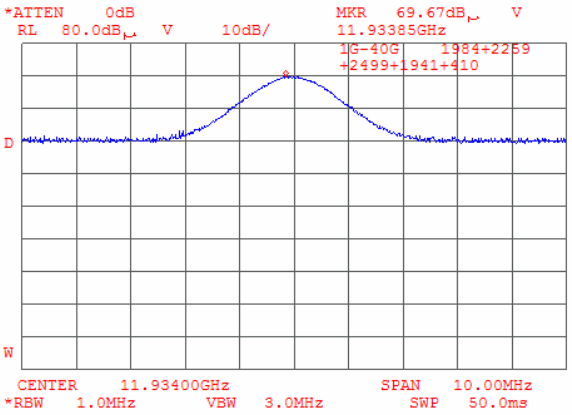
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

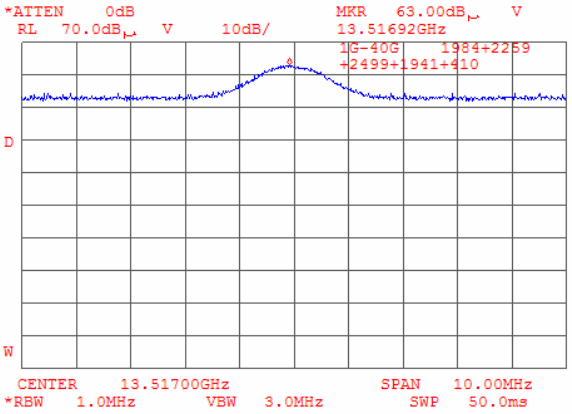
Plot 7.4.42 Radiated emission measurements at the sixth harmonic of high carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.43 Radiated emission measurements at the seventh harmonic of low carrier frequency

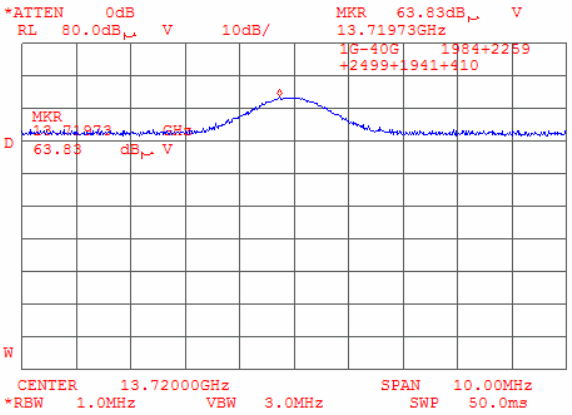
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

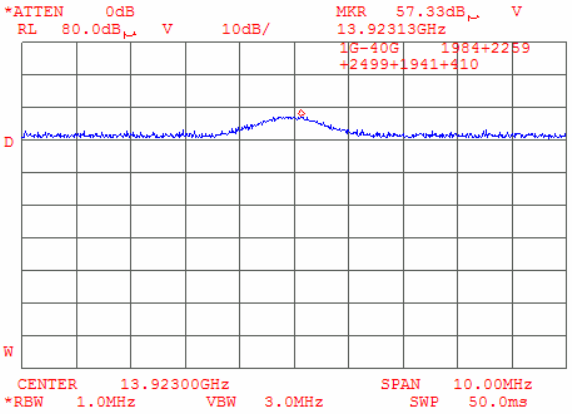
Plot 7.4.44 Radiated emission measurements at the seventh harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.45 Radiated emission measurements at the seventh harmonic of high carrier frequency

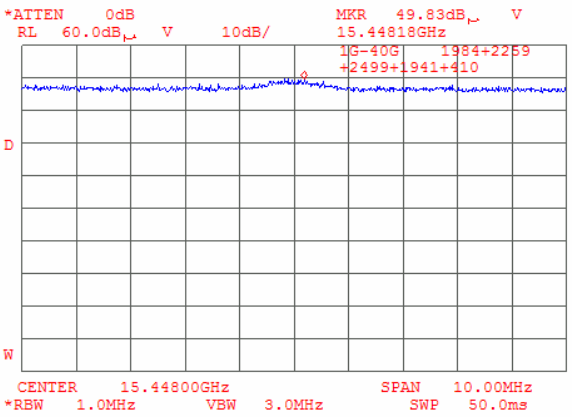
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

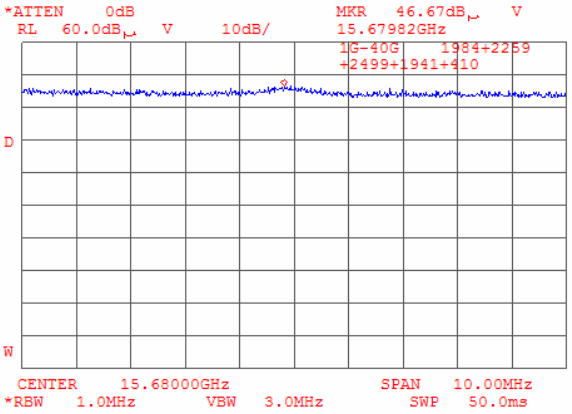
Plot 7.4.46 Radiated emission measurements at the eighth harmonic of low carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.47 Radiated emission measurements at the eighth harmonic of mid carrier frequency

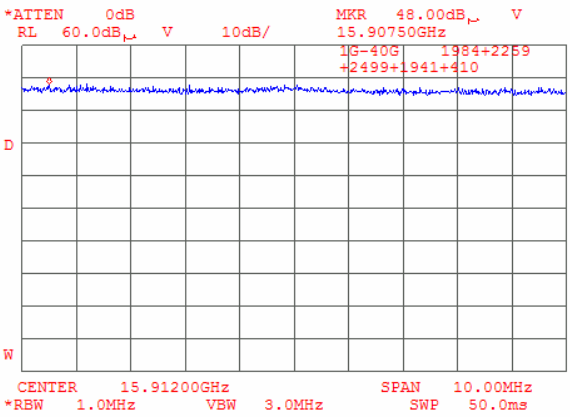
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

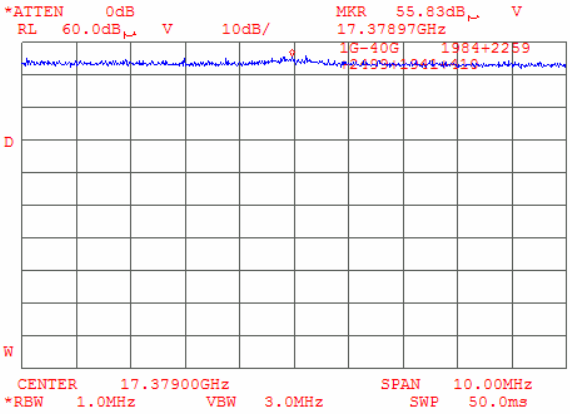
Plot 7.4.48 Radiated emission measurements at the eighth harmonic of high carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.49 Radiated emission measurements at the ninth harmonic of low carrier frequency

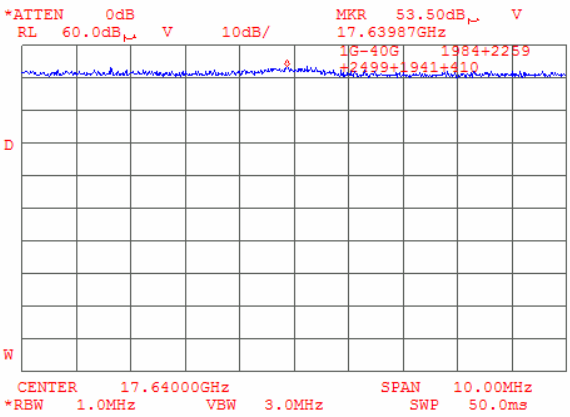
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

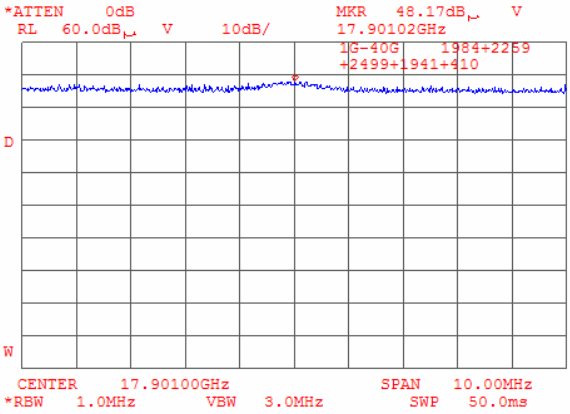
Plot 7.4.50 Radiated emission measurements at the ninth harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.51 Radiated emission measurements at the ninth harmonic of high carrier frequency

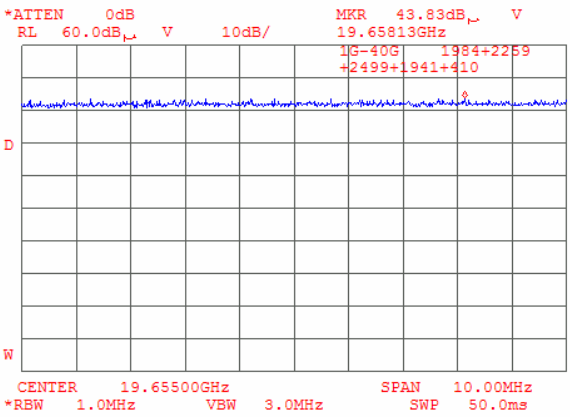
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

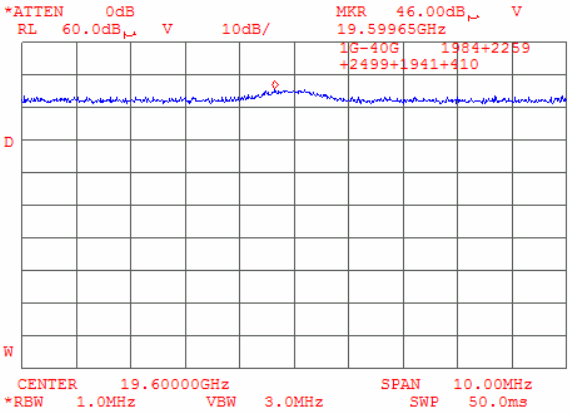
Plot 7.4.52 Radiated emission measurements at the tenth harmonic of low carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.53 Radiated emission measurements at the tenth harmonic of mid carrier frequency

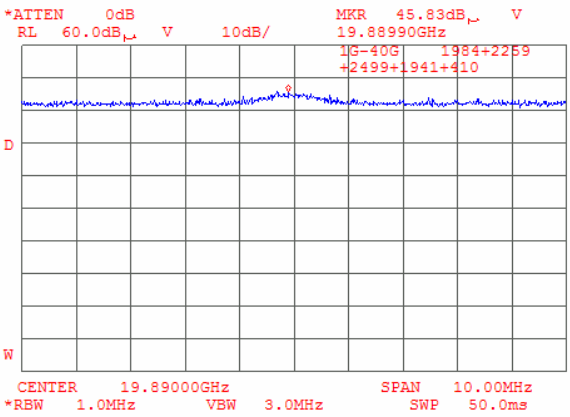
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/26/2005 3:30:32 PM		
Temperature: 24 °C	**Air Pressure:** 1012 hPa	**Relative Humidity:** 45 %	**Power Supply:** 48 VDC
Remarks:			

Plot 7.4.54 Radiated emission measurements at the tenth harmonic of high carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 24.235, Frequency stability test		
Test procedure:	FCC part 24, Section 24.235, part 2 section 2.1055		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/01/2005 13:48:01 PM		
Temperature: 24 ºC	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

7.5 Frequency stability test

7.5.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.5.1. The test results are provided in Table 7.5.2.

Table 7.5.1 Frequency stability limits

Assigned frequency, MHz	Limits
1931	26 dBc points including frequency tolerance shall remain within the authorized frequency block
1960	
1989	

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

7.5.2.2 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.

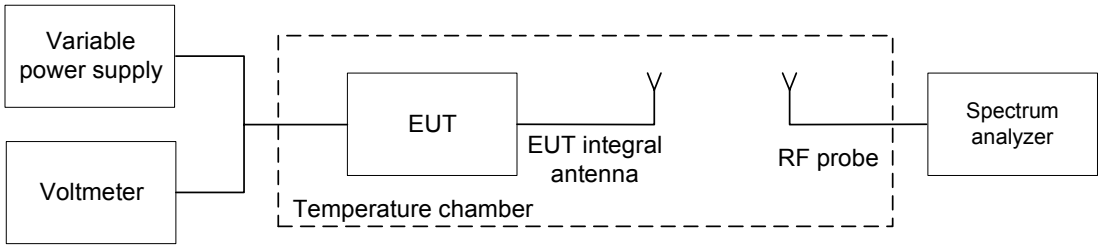
7.5.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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

7.5.2.5 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.

7.5.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.5.2

Figure 7.5.1 Frequency stability test setup



Test specification:	**Section 24.235, Frequency stability test**		
Test procedure:	FCC part 24, Section 24.235, part 2 section 2.1055		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/01/2005 13:48:01 PM		
Temperature: 24 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 45 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.5.2 Frequency stability test results

OPERATING FREQUENCY: 1931 – 1989 MHz
NOMINAL POWER VOLTAGE: 120 V
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Counter
RESOLUTION BANDWIDTH: 10 kHz
VIDEO BANDWIDTH: 10 kHz
MODULATION: Unmodulated

T, ºC	Voltage, V	Frequency, MHz							Max frequency drift, Hz	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative
Low carrier frequency										
-30	nominal	1930.996161	1930.996175	1930.996176	1930.996155	1930.996097	1930.996078	1930.995769	3041	0
-20	nominal	1930.998442	NA	NA	NA	NA	NA	1930.998119	5307	0
-10	nominal	1930.998505	NA	NA	NA	NA	NA	1930.999039	5904	0
0	nominal	1930.989994	1930.990021	1930.990052	1930.990084	1930.990107	1930.990139	1930.990233	0	-3141
10	nominal	1930.995237	NA	NA	NA	NA	NA	1930.995210	2102	0
20	nominal	1930.992839	NA	NA	NA	NA	NA	1930.993135*	0	-296
30	nominal	1930.997095	NA	NA	NA	NA	NA	1930.996408	3960	0
40	nominal	1930.990904	1930.990880	1930.990866	1930.990865	1930.990838	1930.990827	1930.990851	0	-2308
50	nominal	1930.991207	NA	NA	NA	NA	NA	1930.991177	0	-1958
Mid carrier frequency										
-30	nominal	1959.995593	1959.995526	1959.995418	1959.995341	1959.995253	1959.995197	1959.994847	2975	0
-20	nominal	1959.999092	NA	NA	NA	NA	NA	1959.998697	6474	0
-10	nominal	1959.991192	NA	NA	NA	NA	NA	1959.991424	0	-1426
0	nominal	1959.989440	1959.989479	1959.989511	1959.989549	1959.989594	1959.989650	1959.989889	0	-3178
10	nominal	1959.995172	NA	NA	NA	NA	NA	1959.995493	2875	0
20	nominal	1959.991853	NA	NA	NA	NA	NA	1959.992618*	0	-765
30	nominal	1959.988067	NA	NA	NA	NA	NA	1959.987557	0	-5061
40	nominal	1959.990756	1959.990782	1959.990797	1959.990815	1959.990826	1959.990839	1959.990910	0	-1862
50	nominal	1959.991298	NA	NA	NA	NA	NA	1959.991089	0	-1529
High carrier frequency										
-30	nominal	1988.994674	1988.994611	1988.994520	1988.994468	1988.994390	1988.994336	1988.994070	3030	0
-20	nominal	1988.999476	NA	NA	NA	NA	NA	1988.999184	7832	0
-10	nominal	1988.991276	NA	NA	NA	NA	NA	1988.991399	0	-368
0	nominal	1988.996550	1988.996591	1988.996650	1988.996723	1988.996809	1988.996901	1988.997221	5577	0
10	nominal	1988.987396	NA	NA	NA	NA	NA	1988.987725	0	-4248
20	nominal	1988.991170	NA	NA	NA	NA	NA	1988.991644*	0	-474
30	nominal	1988.991101	NA	NA	NA	NA	NA	1988.994760	3116	-543
40	nominal	1988.990802	1988.990808	1988.990820	1988.990832	1988.990847	1988.990850	1988.990906	0	-842
50	nominal	1988.991363	NA	NA	NA	NA	NA	1988.991182	0	-462

* - Reference frequency

Test specification:	**Section 24.235, Frequency stability test**		
Test procedure:	FCC part 24, Section 24.235, part 2 section 2.1055		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/01/2005 13:48:01 PM		
Temperature: 24 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 45 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.5.3 Transmitter operating range including frequency drift

4FSK

Carrier frequency, MHz	Lower reference point, MHz	Upper reference point, MHz	Maximum negative drift, kHz	Maximum positive drift, kHz	Band edge frequency, MHz	Limit, MHz	Margin, MHz	Verdict
1931	1930.1	1931.9	3.141	5.904	1930.09686	1930	0.096859	Pass
1960	1959.1	1960.9	5.061	6.474	NA	NA	NA	NA
1989	1988.1	1989.9	4.248	7.832	1989.90783	1990	-0.09217	Pass

8FSK

Carrier frequency, MHz	Lower reference point, MHz	Upper reference point, MHz	Maximum negative drift, kHz	Maximum positive drift, kHz	Band edge frequency, MHz	Limit, MHz	Margin, MHz	Verdict
1932	1930.9	1933.1	3.141	5.904	1930.89686	1930	0.896859	Pass
1960	1958.9	1961.1	5.061	6.474	NA	NA	NA	NA
1988	1986.9	1989.1	4.248	7.832	1989.10783	1990	-0.89217	Pass

Reference numbers of test equipment used

HL 0278	HL 0493	HL 1097	HL 1204	HL 1653			

Full description is given in Appendix A.

Test specification:	Section 24.52, RF hazard		
Test procedure:	FCC part 1 section 1.1307(b)		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/24/2005 4:03:01 PM		
Temperature: 24 ºC	Air Pressure: 1012 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

7.6 RF exposure

7.6.1 General

This test was performed to determine the minimum safe distance between the transmitter antenna and human to avoid public exposure in excess of limits for general population (uncontrolled exposure). Specification test limits are given in Table 7.6.1.

Table 7.6.1 RF exposure limits

Frequency range, MHz	Power density*		Electric field strength**, V/m
	mW/cm^2	W/m^2	
150.0 – 170.0	0.2	2.0	27.5
450.0 – 470.0	0.3 – 0.31	3.0 – 3.1	33.6 – 34.2
700.0	0.47	4.7	42.1
902.0 – 928.0	0.60 – 0.62	6.0 – 6.2	47.6 – 48.3
1500 - 100000	1.00	10.0	61.4

* - Power density limit within 300 - 1500 MHz was calculated according to the following equation: S = F / 1500, where S is power density in mW/cm^2 and F is frequency in MHz

** - Electric field strength limit was calculated from power density as follows: $E = \sqrt{(S \times 120 \times \pi)}$, where E is electric field strength in V/m and S is power density in W/m^2

7.6.2 Test procedure for E-field strength measurements

7.6.2.1 The EUT, connected to the antenna providing the maximum directional gain, was set up as shown in Figure 7.6.1.

7.6.2.2 The E-field probe was pointed to the EUT antenna zero azimuth at a 3 m distance, the maximum field strength reading was recorded in Table 7.6.2.

7.6.2.3 The E-field probe was slowly moved toward the EUT until E-field equivalent to the maximum permitted power density was measured.

7.6.2.4 The obtained antenna to probe distance was recorded in Table 7.6.2 as a minimum separation distance.

7.6.2.5 The test was repeated at the rest of test distances according to Table 7.6.2.

Test specification:	**Section 24.52, RF hazard**		
Test procedure:	FCC part 1 section 1.1307(b)		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/24/2005 4:03:01 PM		
Temperature: 24 °C	**Air Pressure:** 1012 hPa	**Relative Humidity:** 45 %	**Power Supply:** 48 VDC
Remarks:			

Figure 7.6.1 Maximum permissible exposure (MPE) measurement set up

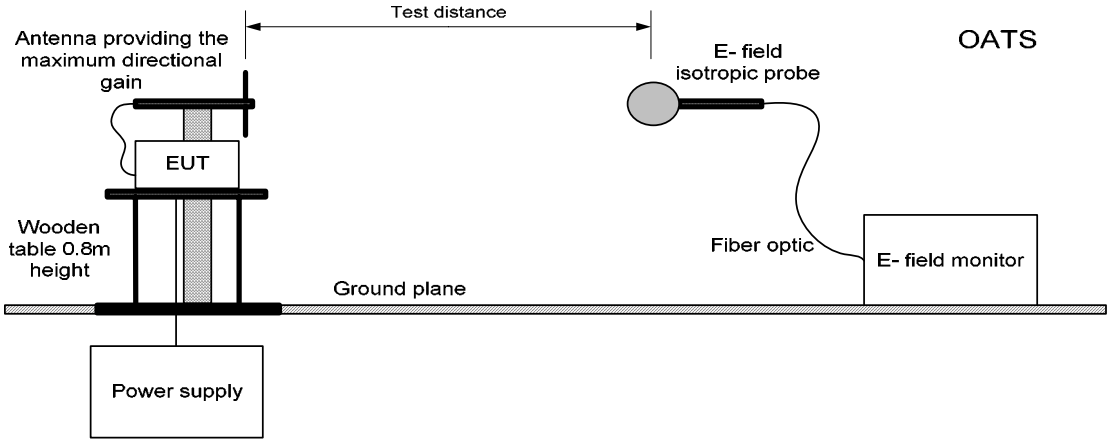


Table 7.6.2 Maximum permissible exposure (MPE) measurement

Test distance, m	Field strength, V/m	Equivalent power density*, mW/cm^2	Limit, mW/cm^2	Margin, mW/cm^2	Verdict
3.0	3.7	0.0036314	1	-0.9963686	Pass
2.5	5.8	0.0089233	1	-0.9910767	Pass
2.0	6.9	0.0126289	1	-0.9873711	Pass
1.5	7.3	0.0141356	1	-0.9858644	Pass
1.0	5.1	0.0068994	1	-0.9931006	Pass
0.5	10	0.0265258	1	-0.9734742	Pass
0.3	18.9	0.0947529	1	-0.9052471	Pass
0.2	19.4	0.0998326	1	-0.9001674	Pass
0.1	24.3	0.1566323	1	-0.8433677	Pass
0.05	26.1	0.1806966	1	-0.8193034	Pass

* - Equivalent power density was calculated from electric field strength as follows: $S = 0.1 \times E^2/(120 \times \pi)$, where E is electric field strength in V/m and S is power density in mW/cm^2

Reference numbers of test equipment used

HL 0174	HL 2078						

Full description is given in Appendix A.

Test specification:	Section 15.107 Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3; Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 4:03:01 PM		
Temperature: 24 ºC	Air Pressure: 1011 hPa	Relative Humidity: 44 %	Power Supply: 120 V AC
Remarks:			

8 Unintentional radiation tests according to 47CFR part 15 subpart B requirements

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 8.1.1. The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Table 8.1.1 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.

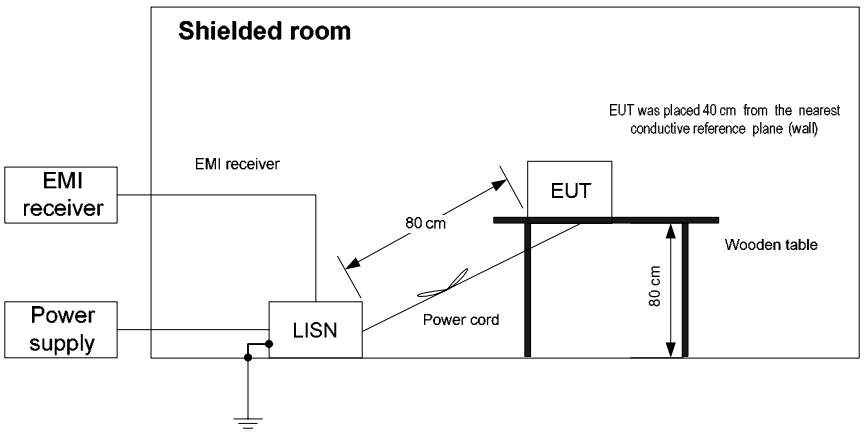
8.1.2 Test procedure

8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

Figure 8.1.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.107 Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3; Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/26/2005 4:03:01 PM		
Temperature: 24 ºC	**Air Pressure:** 1011 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 V AC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains
LIMIT: Class B
EUT OPERATING MODE: Transmit and Receive / Stand-by
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

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*		
Receive / Stand-by									
0.232594	28.70	27.71	62.40	-34.69	26.44	52.40	-25.96	L1	Pass
0.280156	32.09	31.21	60.87	-29.66	31.13	50.87	-19.74		
0.977065	26.91	26.17	56.00	-29.83	25.92	46.00	-20.08		
0.977615	26.77	26.00	56.00	-30.00	25.75	46.00	-20.25		
1.256350	26.53	26.05	56.00	-29.95	25.88	46.00	-20.12		
16.614840	32.18	29.07	60.00	-30.93	10.38	50.00	-39.62		
0.186399	35.52	34.48	64.22	-29.74	33.93	54.22	-20.29	L2	Pass
0.232720	38.55	38.14	62.40	-24.26	38.09	52.40	-14.31		
0.372006	34.09	33.45	58.50	-25.05	33.41	48.50	-15.09		
0.418491	33.72	33.51	57.52	-24.01	33.50	47.52	-14.02		
0.651241	33.96	33.50	56.00	-22.50	33.43	46.00	-12.57		
16.661575	31.78	28.47	60.00	-31.53	12.81	50.00	-37.19		
Transmit									
0.232208	31.19	29.52	62.42	-32.90	27.97	52.42	-24.45	L1	Pass
0.279106	33.15	32.51	60.91	-28.40	32.34	50.91	-18.57		
1.115630	28.10	27.59	56.00	-28.41	27.45	46.00	-18.55		
1.348052	28.19	27.56	56.00	-28.44	27.25	46.00	-18.75		
15.723769	30.77	27.67	60.00	-32.33	9.78	50.00	-40.22		
17.165803	32.80	29.37	60.00	-30.63	11.60	50.00	-38.40		
0.185791	37.73	36.65	64.25	-27.60	36.19	54.25	-18.06	L2	Pass
0.232083	38.05	37.45	62.42	-24.97	37.39	52.42	-15.03		
0.325537	35.25	34.93	59.61	-24.68	34.89	49.61	-14.72		
0.371783	35.20	34.99	58.51	-23.52	34.98	48.51	-13.53		
0.604473	34.78	34.53	56.00	-21.47	34.51	46.00	-11.49		
0.837145	34.60	34.28	56.00	-21.72	34.22	46.00	-11.78		

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

Reference numbers of test equipment used

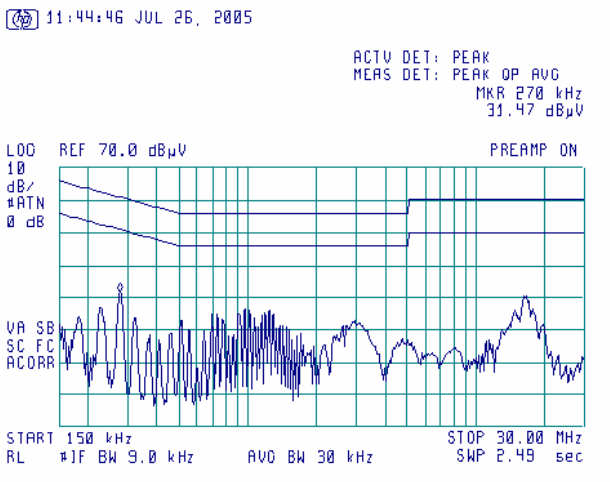
HL 0163	HL 0466	HL 0787	HL 1430	HL 1502	HL 1510		

Full description is given in Appendix A.

Test specification:	**Section 15.107 Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3; Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/26/2005 4:03:01 PM		
Temperature: 24 °C	**Air Pressure:** 1011 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 V AC
Remarks:			

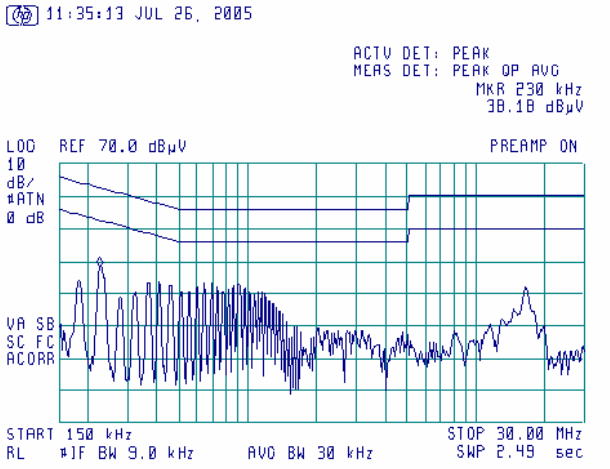
Plot 8.1.1 Conducted emission measurements

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.2 Conducted emission measurements

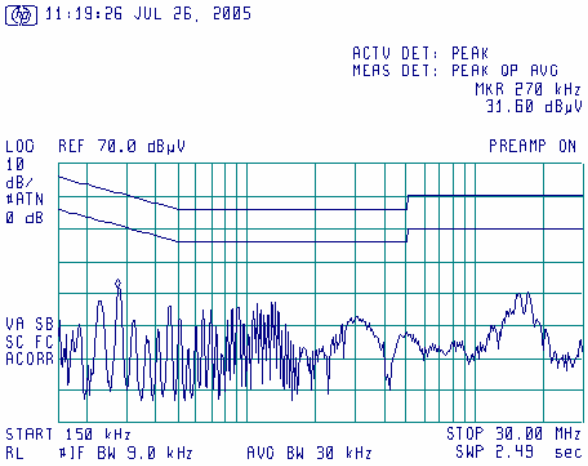
LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Section 15.107 Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3; Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2005 4:03:01 PM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 44 %	Power Supply: 120 V AC
Remarks:			

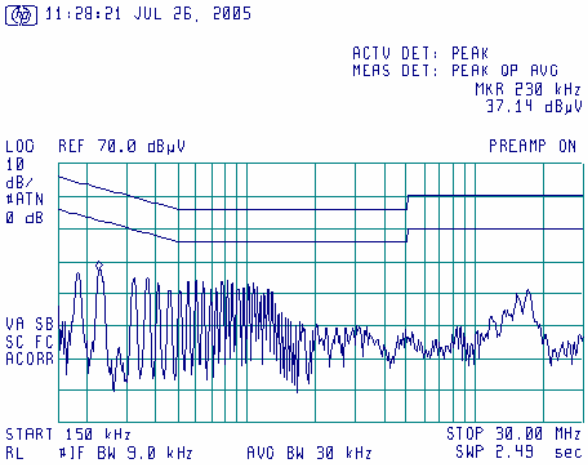
Plot 8.1.3 Conducted emission measurements

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.4 Conducted emission measurements

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



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:	7/19/2005 3:24:17 PM		
Temperature: 24 ºC	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

8.2 Radiated emissions

8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.2.1.

Table 8.2.1 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.

8.2.2 Test procedure for measurements in semi-anechoic chamber

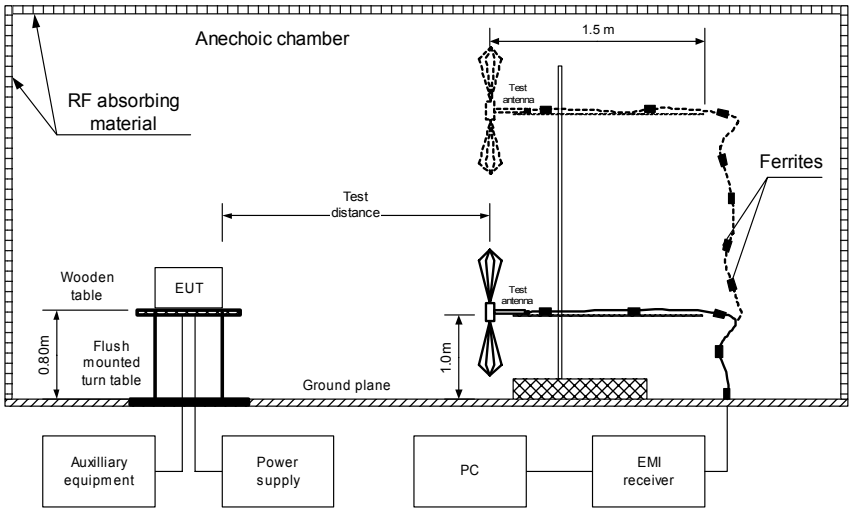
8.2.2.1 The EUT was set up as shown in Figure 8.2.1 and associated photograph/s, energized and the performance check was conducted.

8.2.2.2 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.

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.2 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:	7/19/2005 3:24:17 PM		
Temperature: 24 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 39 %	**Power Supply:** 120 VAC
Remarks:			

Figure 8.2.1 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:	7/19/2005 3:24:17 PM		
Temperature: 24 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 39 %	**Power Supply:** 120 VAC
Remarks:			

Table 8.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

DETECTORS USED: PEAK / QUASI-PEAK
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

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*				
125.010000	29.83	28.26	43.50	-15.24	Vertical	1.0	360	Pass
144.000000	30.04	27.98	43.50	-15.52	Vertical	1.0	32	
288.000743	37.09	35.13	46.00	-10.87	Horizontal	1.1	164	
304.012500	29.33	27.26	46.00	-18.74	Horizontal	1.0	202	
336.000000	31.20	28.70	46.00	-17.30	Vertical	1.0	153	
384.001000	32.71	30.93	46.00	-15.07	Horizontal	1.0	97	

DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 20 GHz
RESOLUTION BANDWIDTH: 1000 kHz/10 Hz

Frequency, MHz	Peak emission, dB(µV/m)	Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
7018.00	56.00	51.50	54.00	-2.50	V	1	45	Pass

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

Reference numbers of test equipment used

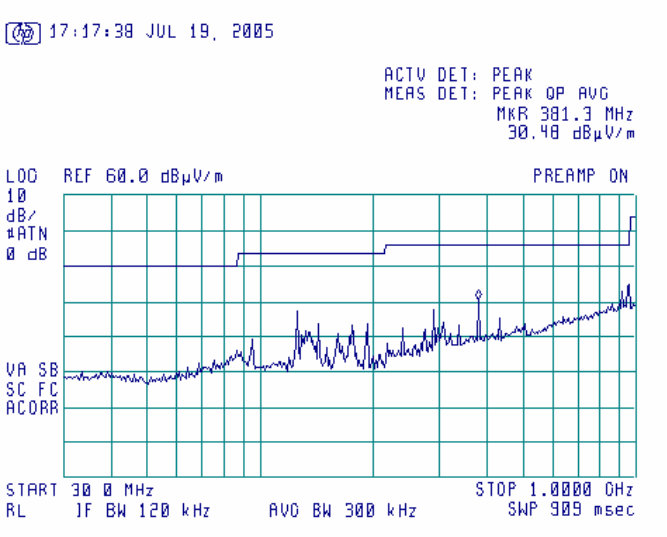
HL 0410	HL 0465	HL 0589	HL 0604	HL 1947	HL 1984	HL 2009	HL 2432

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:	7/19/2005 3:24:17 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

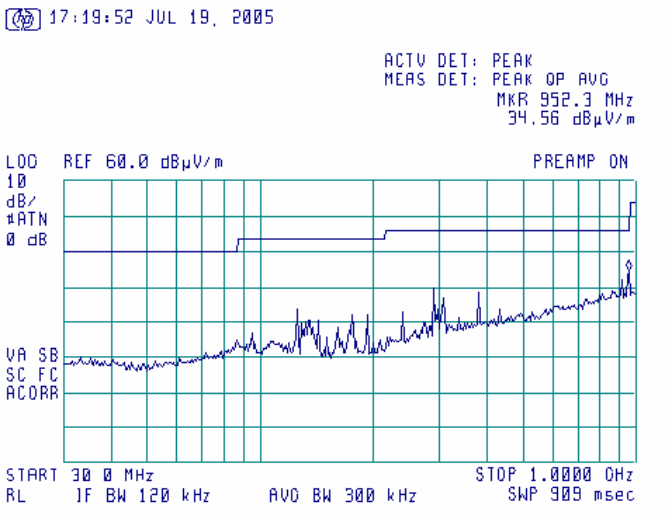
Plot 8.2.1 Radiated emission measurements in 30- 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.2 Radiated emission measurements in 30- 1000 MHz range, horizontal antenna polarization

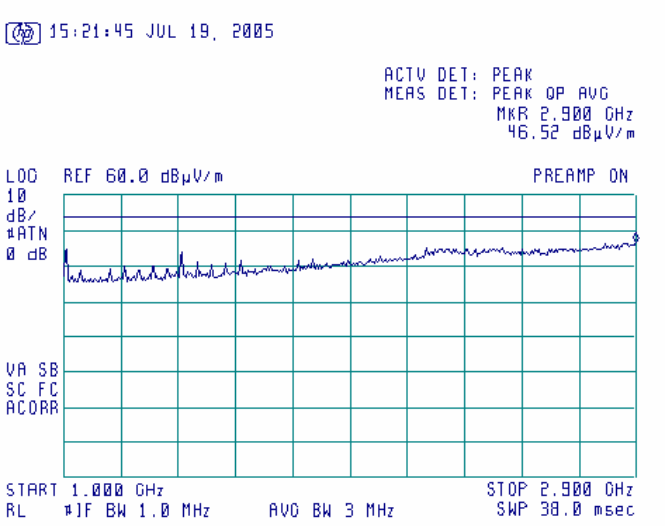
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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:	7/19/2005 3:24:17 PM		
Temperature: 24 ºC	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

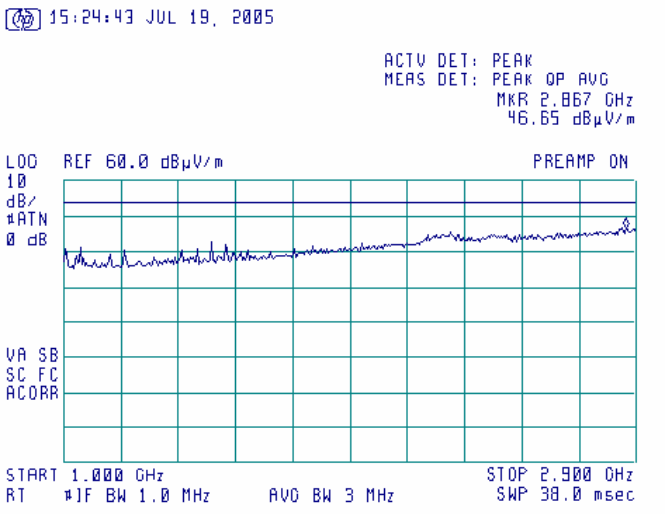
Plot 8.2.3 Radiated emission measurements in 1000- 2900 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.4 Radiated emission measurements in 1000- 2900 MHz range, horizontal antenna polarization

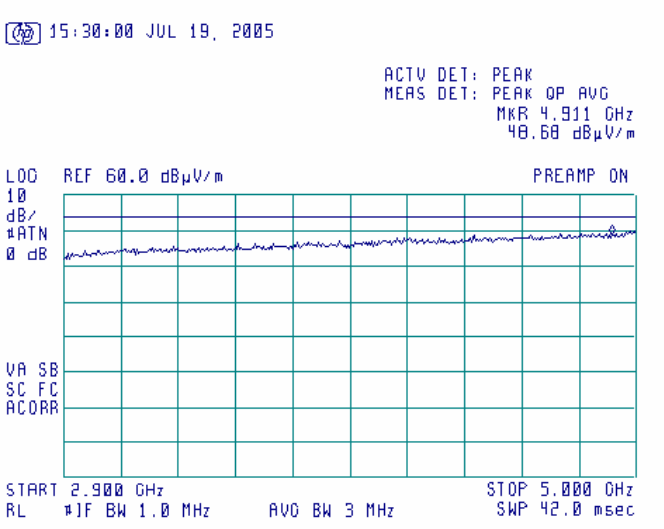
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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:	7/19/2005 3:24:17 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

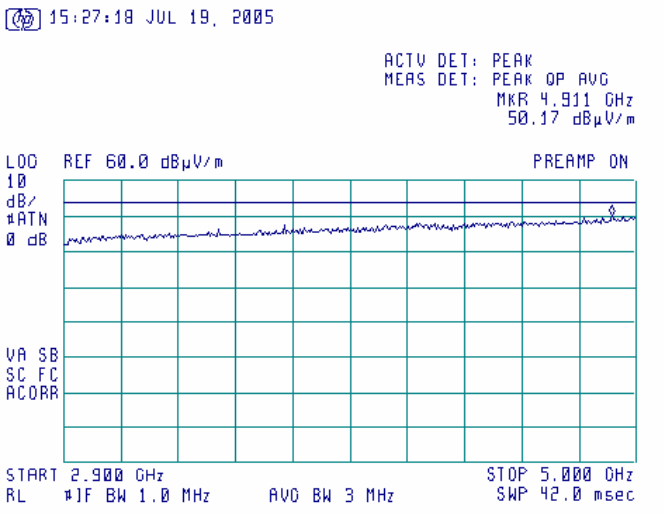
Plot 8.2.5 Radiated emission measurements in 2.9 - 5 GHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.6 Radiated emission measurements in 2.9 - 5 GHz range, horizontal antenna polarization

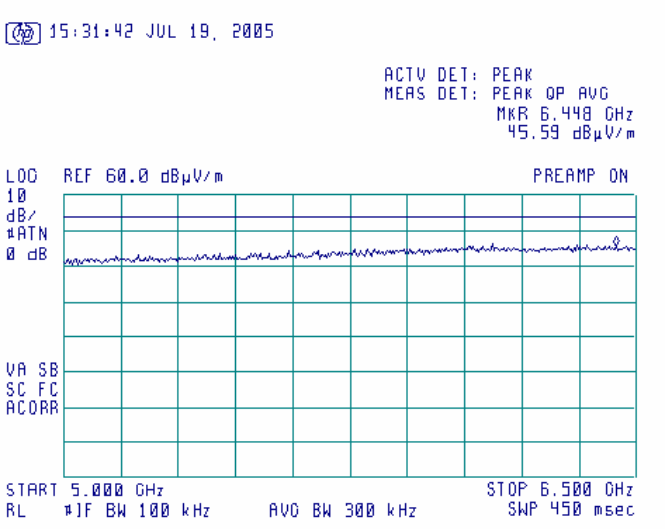
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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:	7/19/2005 3:24:17 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

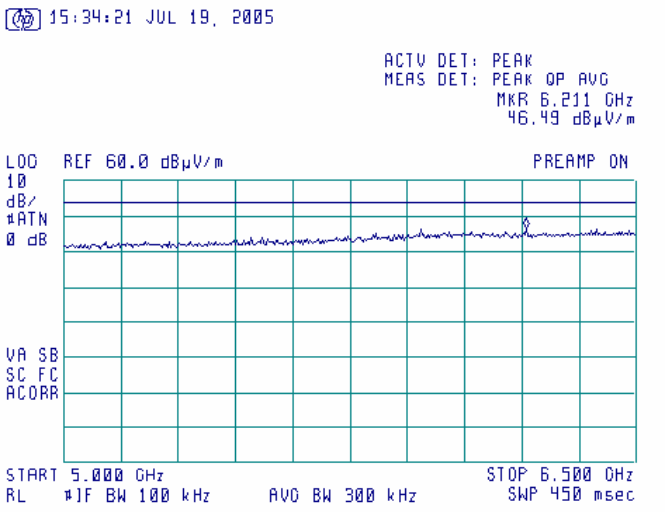
Plot 8.2.7 Radiated emission measurements in 5 – 6.5 GHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.8 Radiated emission measurements in 5 - 6.5 GHz range, horizontal antenna polarization

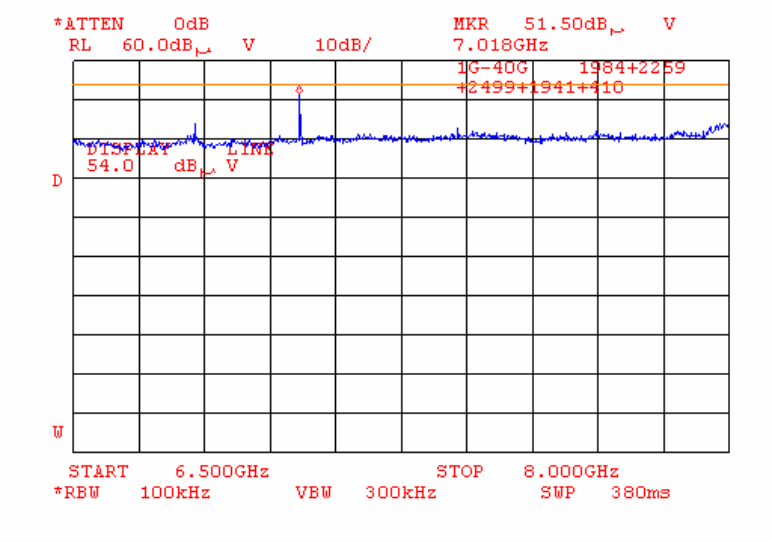
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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:	7/19/2005 3:24:17 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

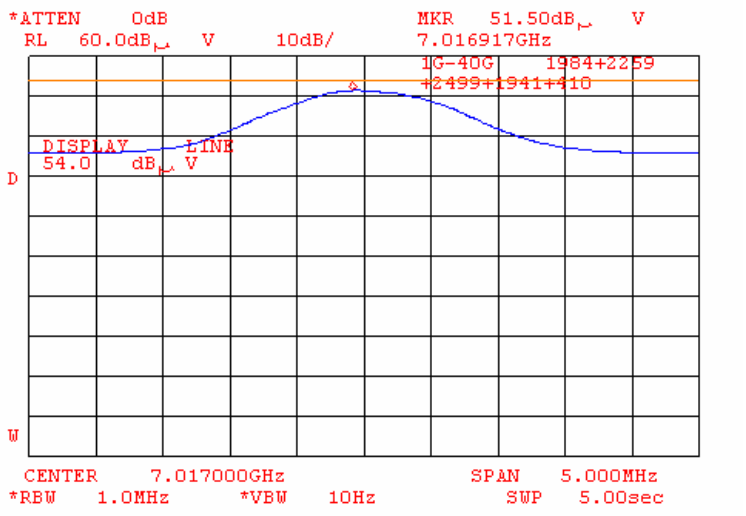
Plot 8.2.9 Radiated emission measurements in 6.5 – 8 GHz range, vertical and horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.10 Radiated emission measurements at 7.017 GHz, vertical and horizontal antenna polarization

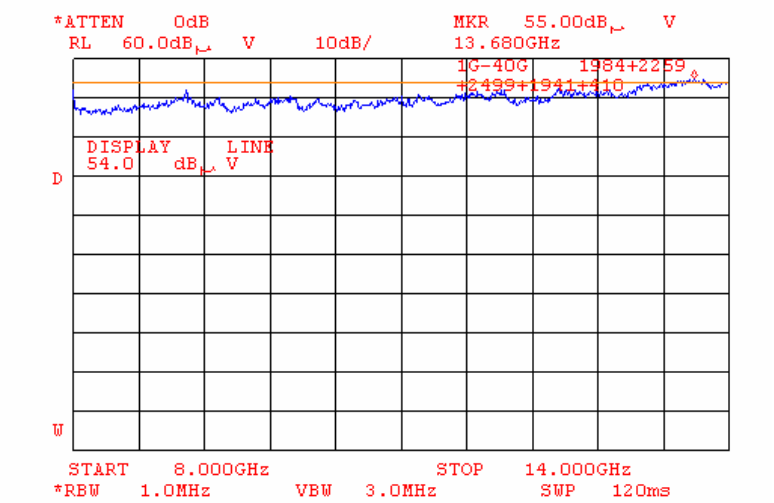
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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:	7/19/2005 3:24:17 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

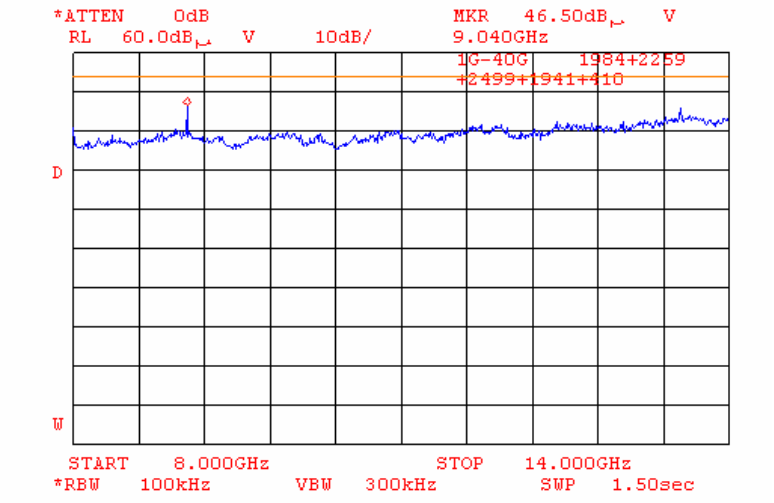
Plot 8.2.11 Radiated emission measurements in 8 – 14 GHz range, vertical and horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.12 Radiated emission measurements in 8 – 14 GHz range, vertical and horizontal antenna polarization

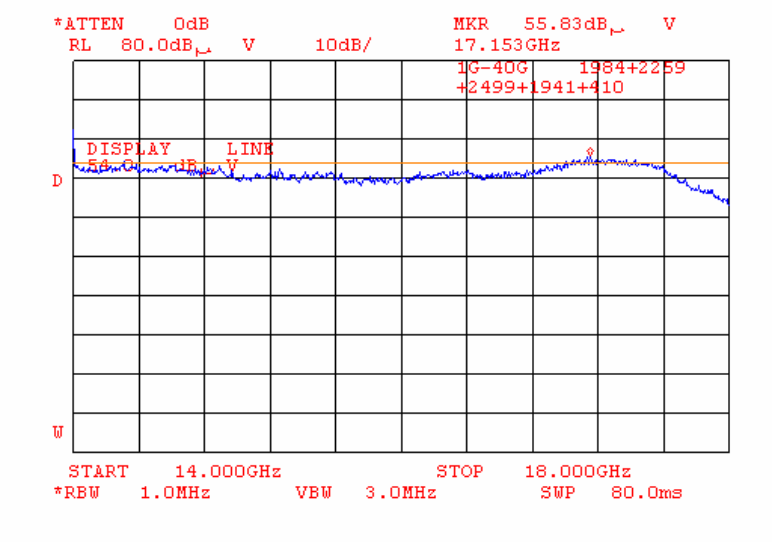
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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:	7/19/2005 3:24:17 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

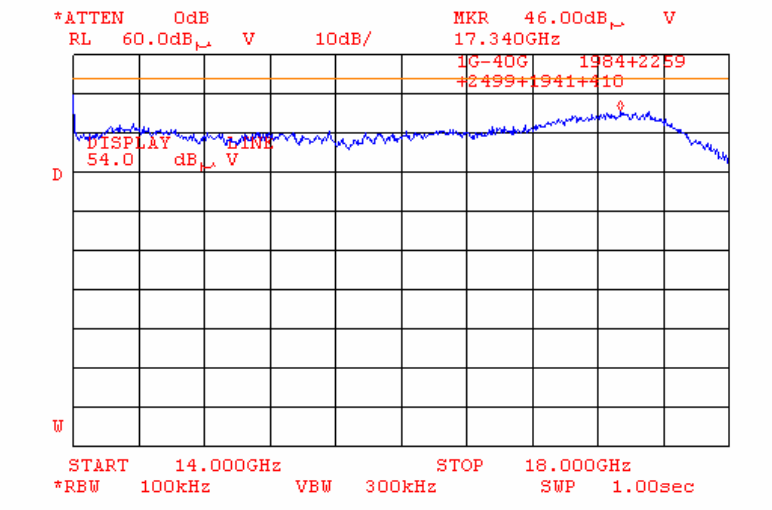
Plot 8.2.13 Radiated emission measurements in 14 – 18 GHz range, vertical and horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.14 Radiated emission measurements in 14 – 18 GHz range, vertical and horizontal antenna polarization

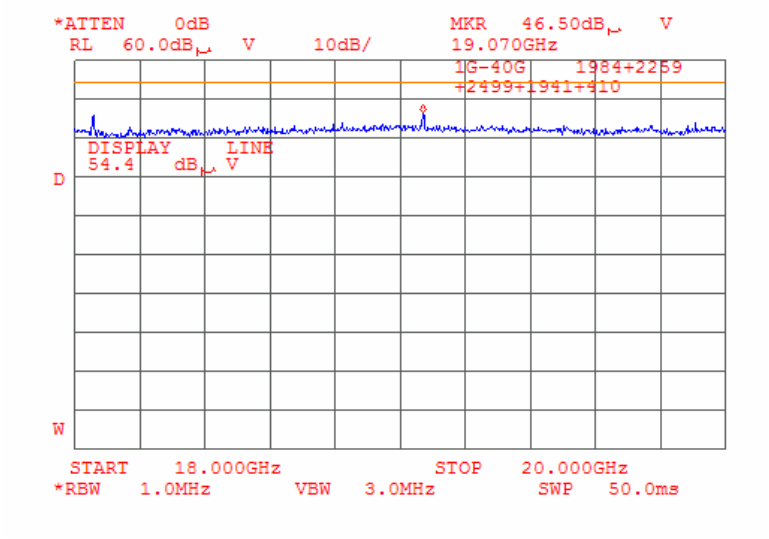
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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:	7/19/2005 3:24:17 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

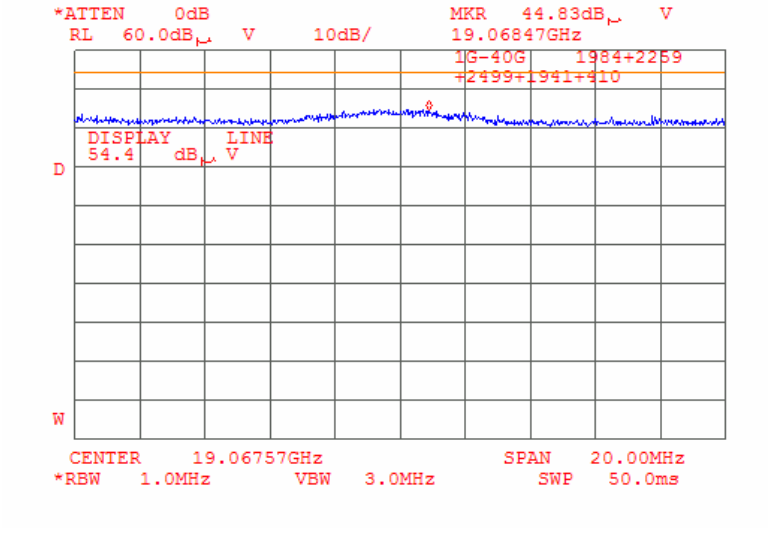
Plot 8.2.15 Radiated emission measurements in 18 – 20 GHz range, vertical and horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.16 Radiated emission measurements at 19.068 GHz, vertical and horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0163	LISN FCC/VDE/MIL-STD	Electro-Metrics	ANS 25/2	1314	01-Oct-04	01-Oct-05
0174	Monitor, Field, 10kHz-1GHz, 1-300 V/m, w/fiberoptic	Amplifier Research	FM1000	60525	13-Feb-05	13-Feb-06
0278	Thermometer, -200 - +760C	Fluke	51K/J	5045468	28-Apr-05	28-Apr-06
0410	Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m	Gore	PFP01P0 1039.4	9338767	13-Feb-05	13-Feb-06
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-05	28-Jun-06
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	28-Jun-05	28-Jun-06
0466	Shielded Room 3(L) x 3(W) x 2.4(H) m	HL	SR - 1	024	28-Jun-05	28-Jun-06
0493	Oven temperature -45…175 deg C	Thermotron	S-1.2 Mini-Max	14016	23-Sep-04	23-Sep-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-04	26-Sep-05
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-04	02-Dec-05
0592	Position Controller	HL	L2-SR3000 (HL CRL-3)	100	18-May-05	18-May-06
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-05	03-Feb-06
0594	Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	27-Jan-05	27-Jan-06
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	27-Jan-05	27-Jan-06
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A002 66	27-Jan-05	27-Jan-06
0787	Transient Limiter	Hewlett Packard	11947A	3107A018 77	27-Jan-05	27-Jan-06
1097	Attenuator, 50 Ohm, 5 W, DC to 8 GHz, 20 dB	Midwest Microwave	0793-20-NN-07	1097	27-Jan-05	27-Jan-06
1200	Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)	Elettronica S.p.A. - Roma	UE 84	D/00240	10-Feb-05	10-Feb-06
1204	One phase Voltage regulator, 2kVA, 0-250V	HL	TDGC-2	99	04-Jun-05	04-Jun-06
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies (HP)	8564EC	3946A002 19	04-Jun-05	04-Jun-06
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies (HP)	8542E	3807A002 62,3705A0 0217	04-Jun-05	04-Jun-06
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	04-Jun-05	04-Jun-06
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	04-Jun-05	04-Jun-06
1653	Analyzer EMC 9 kHz - 1.5 GHz	Agilent Technologies (HP)	E7401A	US394402 81	04-Jun-05	04-Jun-06
1941	Cable 18GHz, 4 m, green	Rhophase Microwave Limited	SPS-1803A-4000-NPS	T4657	04-Jun-05	04-Jun-06

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	04-Jun-05	04-Jun-06
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	04-Jun-05	04-Jun-06
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	04-Jun-05	04-Jun-06
2078	Isotropic Field Probe 80 MHz - 40 GHz	Amplifier Research	FP2080	302541	04-Jun-05	04-Jun-06
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	24-Jun-05	24-Jun-06
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	04-Jun-05	04-Jun-06
2399	Cable 40GHz, 1.5 m, blue	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2945	24-Jun-05	24-Jun-06
2400	Cable 40GHz, 1.5 m, green	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2946	24-Jun-05	24-Jun-06
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	04-Jun-05	04-Jun-06
2524	Attenuator, 10 dB, DC-18 GHz	Midwest Microwave	263-10	2524	04-Jun-05	04-Jun-06

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: ± 1.7 dB 12.4 GHz to 40 GHz: ± 2.3 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
Occupied bandwidth	± 8.0 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
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.

11 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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12 APPENDIX D Specification references

47CFR part 24: 2004	Personal Communications Services
47CFR part 15: 2004	Radio Frequency Devices
Public notice DA 00- 705: 2000	Filing and measurement guidelines for frequency hopping spread spectrum systems.
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.

13 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
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
DTS	digital transmission system
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
FHSS	frequency hopping spread spectrum
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
NT	not tested
OATS	open area test site
Ω	Ohm
PCB	printed circuit board
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
VA	volt-ampere

14 APPENDIX F 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	0.1
0.02	2.1	4.0	0.1
0.03	1.1	5.0	0.1
0.04	0.7	6.0	0.1
0.05	0.5	10.0	0.1
0.1	0.2	12.0	0.1
0.2	0.1	16.0	0.1
0.4	0.1	18.0	0.1
0.6	0.1	20.0	0.1
0.8	0.1	25.0	0.1
1.0	0.1	28.0	0.1
2.0	0.1	30.0	0.1

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

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
Double-ridged guide horn antenna
Model 3115, serial number: 00027177, HL2432

Frequency, MHz	Antenna factor. dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.8
2500.0	28.9
3000.0	30.7
3500.0	31.8
4000.0	33.0
4500.0	32.8
5000.0	34.2
5500.0	34.9
6000.0	35.2
6500.0	35.4
7000.0	36.3
7500.0	37.3
8000.0	37.5
8500.0	38.0
9000.0	38.3
9500.0	38.3
10000.0	38.7
10500.0	38.7
11000.0	38.9
11500.0	39.5
12000.0	39.5
12500.0	39.4
13000.0	40.5
13500.0	40.8
14000.0	41.5
14500.0	41.3
15000.0	40.2
15500.0	38.7
16000.0	38.5
16500.0	39.8
17000.0	41.9
17500.0	45.8
18000.0	49.1

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

Cable loss
Cable GORE, HL 0410

No.	Frequency, GHz	Cable loss, dB
1	0.5	0.16
2	1	0.28
3	2	0.38
4	4	0.55
5	6	0.85
6	8	0.90
7	10	1.07
8	12	1.11
9	14	1.29
10	16	1.41
11	18	1.73

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 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
Cable 18 GHz, 4 m, green, model: SPS-1803A-4000-NPS, S/N T4657, HL 1941

Frequency, GHz	Cable loss, dB
0.03	0.39
0.05	0.49
0.1	0.68
0.2	0.95
0.3	1.30
0.5	1.58
0.7	1.84
0.9	2.08
1.1	2.28
1.3	2.56
1.5	2.91
1.7	2.95
1.9	3.17
2.1	3.22
2.3	3.25
2.5	3.39
2.7	3.51
2.9	3.67
3.1	3.81
3.3	3.92
3.5	4.05
3.7	4.14
3.9	4.30
4.1	4.44
4.3	4.55
4.5	4.68
4.7	4.75
4.9	4.84
5.1	4.86
5.3	4.89
5.5	5.00
5.7	5.05
5.9	5.19
6.1	5.28
7.7	5.58

Frequency, GHz	Cable loss, dB
7.9	5.63
8.1	5.67
8.3	5.70
8.5	5.74
8.7	5.78
8.9	5.84
9.1	5.89
9.3	5.94
9.5	6.02
9.7	6.10
9.9	6.12
10.1	6.09
10.3	6.03
10.5	6.01
10.7	6.05
10.9	6.08
11.1	6.10
11.3	6.18
11.5	6.23
11.7	6.20
11.9	6.16
12.1	6.18
12.4	6.33
13.0	6.51
13.5	6.51
14.0	6.75
14.5	6.82
15.0	6.93
15.5	7.16
16.0	7.10
16.5	7.18
17.0	7.67
17.5	7.71
18.0	7.61

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 40 GHz, 0.8 m, blue, model: KPS-1503A-800-KPS, S/N W4907, HL 2254

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.04	5.10	0.80	15.00	1.49
0.05	0.07	5.30	0.83	15.50	1.49
0.10	0.09	5.50	0.83	16.00	1.46
0.20	0.15	5.70	0.84	16.50	1.47
0.30	0.19	5.90	0.87	17.00	1.50
0.40	0.25	6.10	0.86	17.50	1.57
0.50	0.29	6.30	0.89	18.00	1.63
0.60	0.33	6.50	0.90	18.50	1.57
0.70	0.37	6.70	0.89	19.00	1.63
0.80	0.41	6.90	0.93	19.50	1.65
0.90	0.44	7.10	0.92	20.00	1.64
1.00	0.45	7.30	0.95	20.50	1.75
1.10	0.48	7.50	0.96	21.00	1.72
1.20	0.51	7.70	0.97	21.50	1.78
1.30	0.53	7.90	1.01	22.00	1.76
1.40	0.54	8.10	1.00	22.50	1.72
1.50	0.57	8.30	1.05	23.00	1.83
1.60	0.59	8.50	1.04	23.50	1.80
1.70	0.04	8.70	1.07	24.00	1.90
1.80	0.07	8.90	1.11	24.50	1.81
1.90	0.09	9.10	1.09	25.00	1.98
2.00	0.15	9.30	1.14	25.50	1.91
2.10	0.19	9.50	1.12	26.00	2.02
2.20	0.25	9.70	1.15	26.50	1.92
2.30	0.29	9.90	1.16	27.00	1.97
2.40	0.33	10.10	1.16	28.00	2.02
2.50	0.37	10.30	1.19	29.00	1.95
2.60	0.41	10.50	1.14	30.00	1.94
2.70	0.44	10.70	1.19	31.00	2.11
2.80	0.45	10.90	1.17	32.00	2.17
2.90	0.48	11.10	1.13	33.00	2.27
3.10	0.61	11.30	1.20	34.00	2.27
3.30	0.64	11.50	1.13	35.00	2.29
3.50	0.65	11.70	1.20	36.00	2.35
3.70	0.68	11.90	1.18	37.00	2.37
3.90	0.69	12.10	1.14	38.00	2.40
4.10	0.71	12.40	1.19	39.00	2.57
4.30	0.73	13.00	1.34	40.00	2.36
4.50	0.75	13.50	1.33		
4.70	0.77	14.00	1.48		
4.90	0.79	14.50	1.45		

Cable loss
Cable coaxial, 40GHz, 1.5 m, Blue, Rhophase Microwave Limited, model: KPS-1503A-1500-KPS, HL 2399

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.07	6.5	1.57	15.50	2.50
0.05	0.10	6.7	1.60	16.00	2.51
0.1	0.16	6.9	1.55	16.50	2.58
0.2	0.26	7.1	1.65	17.00	2.65
0.3	0.33	7.3	1.65	17.50	2.73
0.5	0.38	7.5	1.70	18.00	2.74
0.7	0.41	7.7	1.71	18.50	2.67
0.9	0.58	7.9	1.73	19.00	2.67
1.1	0.64	8.1	1.79	19.50	2.74
1.3	0.70	8.3	1.81	20.00	2.69
1.5	0.75	8.5	1.84	20.50	2.80
1.7	0.79	8.7	1.85	21.00	2.82
1.9	0.83	8.9	1.90	21.50	2.87
2.1	0.88	9.1	1.95	22.00	2.87
2.3	0.93	9.3	1.93	22.50	2.92
2.5	0.97	9.5	1.98	23.50	3.04
2.7	1.01	9.7	1.96	24.00	3.05
2.9	1.04	9.9	2.03	24.50	3.03
3.1	1.08	10.1	1.99	25.00	3.11
3.3	1.14	10.30	2.02	25.50	3.10
3.5	1.17	10.50	2.02	26.00	3.17
3.7	1.21	10.70	2.02	26.50	3.11
3.9	1.24	10.90	2.08	27.00	3.16
4.1	1.26	11.10	2.02	28.00	3.19
4.3	1.26	11.30	2.09	29.00	3.19
4.5	1.29	11.50	2.05	30.00	3.30
4.7	1.34	11.70	2.11	31.00	3.31
4.9	1.34	11.90	2.11	32.00	3.35
5.1	1.40	12.10	2.12	33.00	3.46
5.3	1.43	12.40	2.17	34.00	3.45
5.5	1.45	13.00	2.29	35.00	3.49
5.7	1.47	13.50	2.31	36.00	3.54
5.9	1.40	14.00	2.43	37.00	3.62
6.1	1.53	14.50	2.43	39.00	3.69
6.3	1.55	15.00	2.46	40.00	3.75

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