



HERMON LABORATORIES



Electrical

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RADIO TEST REPORT

according to 47CFR Part 15, §15.247 and subpart B
for

Airspan Networks (Israel) Ltd.

EQUIPMENT UNDER TEST:

Base station radio unit

Model: BSR 900 MHz

This report is in conformity with ISO/IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation.
The test results relate only to the items tested. **This test report must not be reproduced in any form except in full with the approval of Hermon Laboratories Ltd.**

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1 Project information

EUT attributes

Test item	Base station radio unit
Type (Model)	BSR 900 MHz
Serial number	0001
Equipment FCC code	DSS

Applicant information

Applicant's responsible person	Mr. Zion Levi, compliance & testing engineer
Applicant/Manufacturer	Airspan Networks (Israel) Ltd.
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Test details

Project number	15694
Location	Hermon Laboratories
Test started	October 2, 2003
Test completed	October 19, 2003
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specifications	47CFR Part 15, §15.247 and subpart B



2 Summary of tests and signatures

The tests listed in the table below were performed.

The EUT was found complying with the limits of 47CFR Part 15, §15.247 and subpart B.

Test description	Specification reference	Tested by	Date tested	Test report paragraph	Verdict
Hybrid system					
Peak power spectral density at frequency hopping operation turned off	15.247(f)	Mr. I. Fershtater, test engineer	October 2, 2003	4.1	Pass
Average time of occupancy at frequency hopping operation turned on	15.247(f)	Mr. Y. Neuman, test engineer	October 15, 2003	4.2	Pass
Maximum peak output power at frequency hopping operation turned off	15.247(b)(3)	Mr. I. Fershtater, test engineer	October 26, 2003	4.3	Pass
Minimum channel separation	15.247(a)(1)	Manufacturer statement	NA	4.4	Pass
6 dB bandwidth	15.247(a)(2)	Mr. I. Fershtater, test engineer	October 2, 2003	4.4	Pass
Spurious emissions (conducted)	15.247(c)	Mr. I. Fershtater, test engineer	October 14, 2003	4.5	Pass
Spurious emissions (radiated) in restricted bands	15.209(a), 15.205(a, c)	Mr. Y. Neuman, test engineer	October 15, 2003	4.6	Pass
Unintentional radiation					
Conducted emissions	15.207, 15.107	Mr. Y. Neuman, test engineer	October 19, 2003	4.7	Pass
Radiated emissions	15.109	Mr. I. Fershtater, test engineer	October 15, 2003	4.8	Pass

Test report prepared by:

Mrs. M. Cherniavsky, MScEE, certification engineer

Test report approved by:

Mr. Michael Nikishin, MScEE, group leader

Mr. Edward Usoskin, PhD, C.E.O.



3 EUT description

3.1 General description

A base station radio, BSR 900 MHz, 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 itself to give high-speed data access. The EUT is a hybrid system transceiver (8FSK digital modulation with frequency hopping, data rate 3 Mbps and 4 Mbps), operating in 903 MHz to 927 MHz range, equipped with an 11 dBi gain omnidirectional or 15.5 dBi gain (dual polarization or vertical polarization) external antenna. It is installed outside the base station site and typically is mounted on a pole.

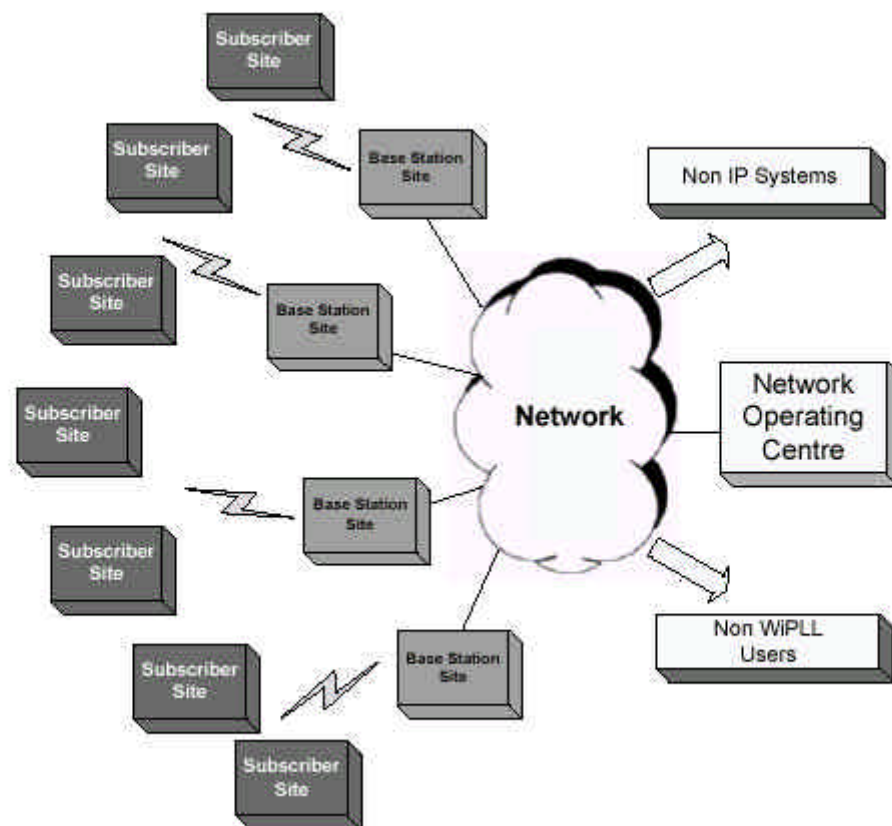
The BSR is powered via a subscriber data adapter (SDA), which provides 48 V DC power.

3.2 EUT test configuration

Throughout testing the communication link with IDR subscriber unit was established. The EUT operating frequencies generated by clocks and oscillators: 350 MHz - first IF, 6 MHz – second IF.

The WipLL system architecture is shown in Figure 3.2.1.

Figure 3.2.1
WipLL system architecture





4 Test results

4.1 Peak power spectral density of a hybrid system according to § 15.247(f),(d)

METHOD OF MEASUREMENTS	FCC Docket No.96-8; FCC 97-114
DATE of TEST:	October 2, 2003
AMBIENT TEMPERATURE:	23°C
RELATIVE HUMIDITY:	46 %
AIR PRESSURE:	1012 hPa
RATED OUTPUT POWER:	18 dBm
OPERATING FREQUENCY RANGE:	903 - 927 MHz
MEASUREMENT UNCERTAINTY:	± 3.5 dB

Frequency hopping function was turned off.

Carrier frequency, MHz	Data transmission rate, Mbit/s	Peak power spectral density, dBm		Verdict	Reference to Plots in Appendix A
		Measured	Limit		
903	4	7.67	8	Pass	A1
903	3	7.00		Pass	A2
915	4	7.17		Pass	A3
915	3	8.00		Pass	A4
927	4	7.67		Pass	A5
927	3	7.00		Pass	A6

LIMIT

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

TEST PROCEDURE

The EUT RF output was connected via attenuator to the spectrum analyzer; the settings are shown in the plots. Spectrum analyzer readings were corrected for external attenuation and cable loss. The measurements were performed in continuous transmission mode of operation for carrier (channel) frequency modulated with PRBS at low and high edges and at the middle of the range according to method #1 for peak power spectral density.

TEST EQUIPMENT USED:

HL 1097	HL 1424	HL 2399				
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4.2 Average time of hopping frequency occupancy according to § 15.247(f), (a)(1)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE of TEST: October 15, 2003
AMBIENT TEMPERATURE: 23°C
RELATIVE HUMIDITY: 44 %
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 903 - 927 MHz
MEASUREMENT UNCERTAINTY: ± 1%

Frequency hopping function was turned on.

Carrier frequency, MHz	Quantity of transmissions at one frequency	Tx ON of 1 transmission at one frequency, ms	Average time of occupancy during 10 s period, ms	Verdict	Reference to Plots in Appendix A
903	8	25.583	204.664	Pass	A7, A8

Average factor calculation according to §15.35(c):
 $20 \log (25.583/100) = -11.84 \text{ dB}$

LIMIT

Operating mode	Limit
Hybrid	With the hopping system operation turned on, an average time of occupancy on any frequency shall not exceed 0.4 s within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4: $25 \times 0.4 = 10 \text{ (sec)}$

TEST PROCEDURE

The EUT RF output was connected via attenuator to spectrum analyzer, which settings are shown in the plots. Spectrum analyzer readings were corrected for external attenuation and cable loss.

TEST EQUIPMENT USED:

HL 1097	HL 1424	HL 2399				
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4.3 Maximum peak output power test according to §15.247(b)(3)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE of TEST: October 2, 2003
AMBIENT TEMPERATURE: 23°C
RELATIVE HUMIDITY: 46 %
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 903 -927 MHz
MEASUREMENT UNCERTAINTY: ± 3.5 dB

Carrier frequency, MHz	Data rate, Mbit/s	Peak output power, dBm	Limit, dBm	Margin, dB	Verdict	Reference to Plots in Appendix A
903	4	18.00	20.5	2.5	Pass	A9
903	3	14.83	20.5	5.67	Pass	A10
915	4	17.83	20.5	2.67	Pass	A11
915	3	15.33	20.5	5.17	Pass	A12
927	4	17.50	20.5	3.0	Pass	A13
927	3	15.67	20.5	4.83	Pass	A14

LIMIT

Operating frequency range, MHz	Number of hopping channels	Maximum peak output power*, W
Hybrid	any admissible	1

* Notes to table

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced below the stated values by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
Antenna gain is 15.5 dBi, peak output power limit is 20.5 dBm.

TEST PROCEDURE

The EUT RF output was connected via attenuator to spectrum analyzer, which settings are shown in the plots. Spectrum analyzer readings were corrected for external attenuation and cable loss.

TEST EQUIPMENT USED:

HL 1097	HL 1424	HL 2399				
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4.4 Minimum channel separation and occupied bandwidth according to § 15.247(a)(1), (2)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.7
DATE of TEST: October 2, 2003
AMBIENT TEMPERATURE: 23°C
RELATIVE HUMIDITY: 46 %
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 903 -927 MHz
MEASUREMENT UNCERTAINTY: ± 2.3 dB

According to applicant statement the minimum channel separation is 1 MHz.

Carrier frequency, MHz	Data rate, Mbit/s	6 dB bandwidth, kHz		Verdict	Reference to Plots in Appendix A
		Measured	Limit		
903	4	808	500	Pass	A15
903	3	525	500	Pass	A16
915	4	808	500	Pass	A17
915	3	515	500	Pass	A18
927	4	800	500	Pass	A19
927	3	515	500	Pass	A20

LIMIT

Operating frequency range, MHz	Allowed bandwidth	Channel carrier frequency separation (minimum)
Hybrid	any admissible	25 kHz or 20 dB bandwidth, which is greater

TEST PROCEDURE

The EUT RF output was connected to the spectrum analyzer, which settings are shown in the plots. Spectrum analyzer readings were corrected for external attenuation and cable loss.

TEST EQUIPMENT USED:

HL 1097	HL 1424	HL 2399				
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4.5 Out of band conducted emissions test according to §15.247(c)

METHOD OF MEASUREMENTS:	ANSI 63.4 §13.1.5
DATE of TEST:	October 2, 2003
AMBIENT TEMPERATURE:	23°C
RELATIVE HUMIDITY:	46 %
AIR PRESSURE:	1012 hPa
OPERATING FREQUENCY RANGE:	903 -927 MHz
RATED RF OUTPUT POWER:	18 dBm
MODULATION TECHNIQUE:	hybrid
FREQUENCY RANGE:	6 MHz – 9.3 GHz
MEASUREMENT UNCERTAINTY:	± 4.3 dB

* The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment (6 MHz) up to 10th harmonic, 9.3 GHz.

All measured emissions were found below specified limit. Test results are shown in Plots A25 to A36.

No effect of the data rate was observed therefore only 4 Mbit/s rate was used for measurements.

Emissions at the lower band edge and at the higher band edge were tested and provided in Plots A21 to A24.

LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

TEST PROCEDURE

The EUT RF output was connected via attenuator to spectrum analyzer, which settings are shown in the plots. Spectrum analyzer readings were corrected for external attenuation and cable loss. Spurious emission measurements were performed at the lowest (903 MHz), the highest (927 MHz) and one of the middle channel (915 MHz) frequencies.

TEST EQUIPMENT USED:

HL 1424	HL 1651	HL 2399				
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4.6 Radiated emissions which fall in restricted bands test according to §15.247(c) and § 15.205, §15.209(a)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4/ §13.1.5
TEST PERFORMED IN: Anechoic chamber, OATS
DATE of TEST: October 14, 15, 2003
AMBIENT TEMPERATURE: 24°C
RELATIVE HUMIDITY: 38 %
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 903 -927 MHz
RATED RF OUTPUT POWER: 18 dBm
ANTENNA GAIN: 15.5 dBi
TEST DISTANCE: 3 m
FREQUENCY RANGE: 150 kHz to 9.3 GHz
MEASUREMENT UNCERTAINTY: ± 4.3 dB

* The frequency spectrum was investigated from 150 kHz to the tenth harmonic of the highest fundamental frequency. All emissions were found below the specified limit. For test results refer to Plots A37 – A81.

LIMIT

Radiated emissions, which fall in the restricted bands, must comply with §15.209(a) limits.

TEST PROCEDURE

The test was performed with transmitter operating at 3 carrier frequencies $F_{\min} = 903$ MHz, $F_{\text{middle}} = 915$ MHz, $F_{\max} = 927$ MHz. The measurements were performed at 3 m test distance from 150 kHz to 9.3 GHz. The EUT was placed on a wooden 80 cm height turntable.

150 kHz – 30 MHz frequency range. The loop antenna was positioned with its plane vertical. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis.

30 MHz – 9.3 GHz frequency range. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

Quasi-peak detector

Frequency, MHz	Antenna type	Antenna height, m	Turntable position, °	Radiated emissions, dB (mV/m)	Limit, dB (mV/m)	Margin, dB	Reference to Plots in Appendix A
110.0	Biconilog	1.0	0	30.65	43.50	12.85	A38
240.0	Biconilog	1.02	51	38.03	46.00	7.97	A38
972.0	Biconilog	1.87	128	43.10	54.00	10.90	A39
985.0	Biconilog	1.84	118	40.91	54.00	13.09	A56

The recorded test results were obtained through measurements with antennas in vertical polarization.
Turntable position: 0° = EUT front panel faces the receiving antenna

**Peak value**

Frequency, MHz	Antenna polarization	Antenna height, m	Turntable position, °	Radiated emissions, dB (mV/m)	Limit, dB (mV/m)	Margin, dB	Reference to Plots in Appendix A
1000.8	Vertical	1.68	141	48.82	74	25.18	A74
1392.0	Vertical	1.50	7	46.59	74	27.41	A42
2710.0	Vertical	1.60	352	50.37	74	23.63	A43
2745.0	Vertical	1.60	344	49.40	74	24.60	A61
2848.0	Vertical	1.00	351	54.46	74	19.54	A45
5012.0	Horizontal	1.00	0	53.67	74	20.33	A48
5060.0	Horizontal	1.00	0	51.67	74	22.33	A65
7518.0	Vertical	1.00	0	53.67	74	20.33	A51
7590.0	Vertical	1.00	0	53.67	74	20.33	A68

Average value

Frequency, MHz	Antenna polarization	Antenna height, m	Turntable position, °	Radiated emissions, dB (mV/m)	Limit, dB (mV/m)	Margin, dB	Reference to Plots in Appendix A
1000.8	Vertical	1.68	141	35.57	54	18.43	A74
1392.0	Vertical	1.50	7	35.78	54	18.22	A42
2710.0	Vertical	1.60	352	26.31	54	27.69	A44
2745.0	Vertical	1.60	344	25.73	54	28.27	A62
2848.0	Vertical	1.00	351	49.26	54	4.74	A45
5012.0	Horizontal	1.00	0	39.83	54	14.17	A49
5060.0	Horizontal	1.00	0	36.33	54	17.67	A66
7518.0	Vertical	1.00	0	32.83	54	21.17	A52
7590.0	Vertical	1.00	0	33.83	54	20.17	A69

The recorded test results were obtained through measurements with double ridged guide antenna.

Table abbreviations:

Margin = dB below (negative if above) specification limit.

Turntable position: 0° = EUT front panel faces the receiving antenna

TEST EQUIPMENT USED AT OATS:

HL 0038	HL 0091	HL 0287	HL 1200	HL 1365	HL 1424	HL 1430
HL 1942	HL 1947	HL 1984	HL 2254	HL 2259		

TEST EQUIPMENT USED IN ANECHOIC CHAMBER:

HL 0446	HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1004	HL 1947	HL 1984	HL 2009		



4.7 Conducted emissions test according to §15.107, 15.207

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.3
DATE of TEST: October 19, 2003
AMBIENT TEMPERATURE: 22°C
RELATIVE HUMIDITY: 44 %
AIR PRESSURE: 1008 hPa
FREQUENCY RANGE: 150 kHz – 30 MHz
OPERATION MODE: Transmit, receive
RESOLUTION BANDWIDTH: 9 kHz
MEASUREMENT UNCERTAINTY, dB
± 3.9 dB in 9 – 150 kHz
± 3.8 dB in 150 kHz – 30 MHz

Quasi-peak detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification QP limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
0.347355	Line 2	44.55	59.09	14.54	Pass	A86, A88
1.239205	Line 1	40.92	56.00	15.08	Pass	A85, A87
1.638965	Line 2	41.47	56.00	14.53	Pass	A86, A88
2.629685	Line 1	43.13	56.00	12.87	Pass	A85, A87
2.925295	Line 2	43.45	56.00	12.55	Pass	A86, A88
4.959983	Line 2	48.81	56.00	7.19	Pass	A86, A88

Average detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification AVRG limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
0.347355	Line 2	37.95	49.09	11.14	Pass	A86, A88
1.239205	Line 1	35.18	46.00	10.82	Pass	A85, A87
1.638965	Line 2	33.13	46.00	12.87	Pass	A86, A88
2.629685	Line 1	32.50	46.00	13.50	Pass	A85, A87
2.925295	Line 2	32.07	46.00	13.93	Pass	A86, A88
4.959983	Line 2	44.23	46.00	1.77	Pass	A86, A88

**Limit**

Frequency, MHz	Class B equipment, dB(mV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5	56	46
5 - 30	60	50

*The limit decreases linearly with the logarithm of frequency.

TEST PROCEDURE

The measurements were performed at mains terminals by means of LISN, connected to spectrum analyzer in the frequency range as referred to in the table above. The unused coaxial connector of the LISN was terminated with 50 Ω . The measurements were made with quasi-peak and average detectors as referred to in the tables. The position of the EUT cables was varied to determine maximum emission level.

TEST EQUIPMENT USED:

HL 0447	HL 0466	HL 0521	HL 0787	HL 1003	HL 1205	HL 1503
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4.8 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT: ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
DATE of TEST: October 14, 2003
AMBIENT TEMPERATURE: 24°C
RELATIVE HUMIDITY: 38 %
AIR PRESSURE: 1012 hPa
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
THE EUT WAS TESTED AS: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 6.5 GHz
RESOLUTION BANDWIDTH: Shown in the plots A82 to A84

Frequency, MHz	Detector type	Antenna type	Antenna height, cm	Turntable position, (°)	Radiated emissions, dB (mV/m)	Limit, dB (mV/m)	Margin, dB	Verdict
110.0	Quai-peak	Biconilog	100	0	30.65	43.50	12.85	Pass
125.0	Quai-peak	Biconilog	100	4	29.02	43.50	14.48	Pass
240.0	Quai-peak	Biconilog	102	51	38.03	46.00	7.97	Pass
288.0	Quai-peak	Biconilog	100	194	31.50	46.00	14.50	Pass
528.0	Quai-peak	Biconilog	100	0	33.60	46.00	12.40	Pass
960.0	Quai-peak	Biconilog	143	3	32.97	46.00	13.03	Pass
1392.0	Average	Double ridged guide	150	7	36.13	54.00	17.87	Pass
1824.3	Average	Double ridged guide	170	13	39.39	54.00	14.61	Pass
2848.0	Average	Double ridged guide	100	351	49.50	54.00	4.50	Pass

The test results recorded in the table were obtained throughout measurements with antennas in vertical polarization.

Table abbreviations:

Turntable position: 0° = EUT front panel faces the receiving antenna

	The EUT highest used frequency (not including operating frequency), MHz	Upper frequency of measurement range, MHz
	Below 1.705	30
	1.705 – 108	1000
X	108 – 500	2000
	500 – 1000	5000
	Above 1000	5 th harmonic of the highest frequency

**LIMIT (§ 15.109)**

Frequency, MHz	Class B equipment @ 3 m dB(mV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 5000	54

TEST PROCEDURE

The test was performed in anechoic chamber in 30 MHz – 1 GHz range and at OATS in 1 GHz – 6.5 GHz. The EUT was placed on a wooden 80 cm height turntable. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antenna polarization was changed from vertical to horizontal.

TEST EQUIPMENT USED IN ANECHOIC CHAMBER:

HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604
HL 1004	HL 1947	HL 1984	HL 2009			

TEST EQUIPMENT USED AT OATS:

HL 0038	HL 0091	HL 0287	HL 1365	HL 1430	HL 1947	HL 1984

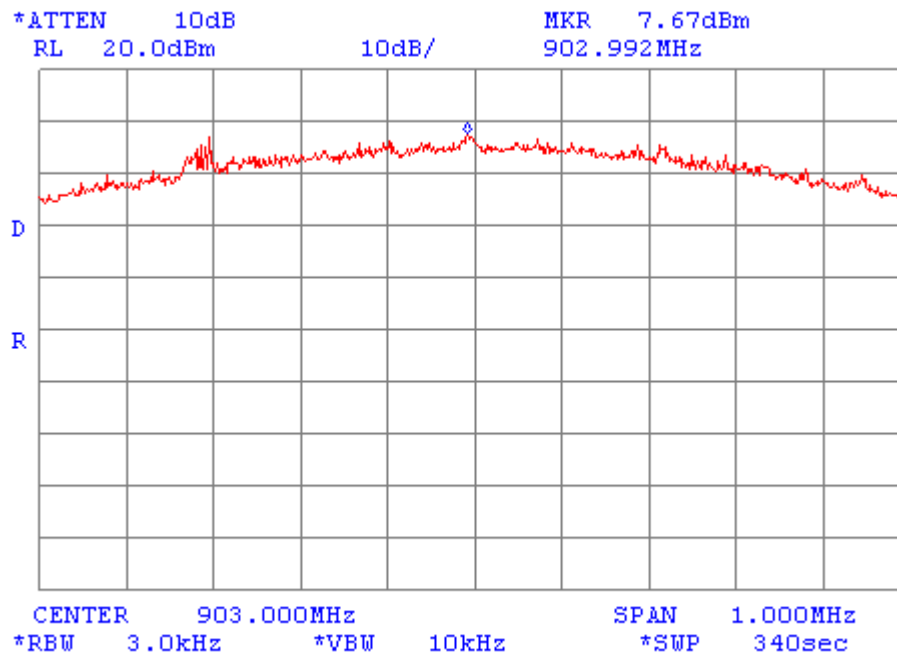


Appendix A Plots

Plot A1

Power density measurements

Mode: Hybrid
F_{Low}: 903 MHz
Bit rate: 4 Mbit/s

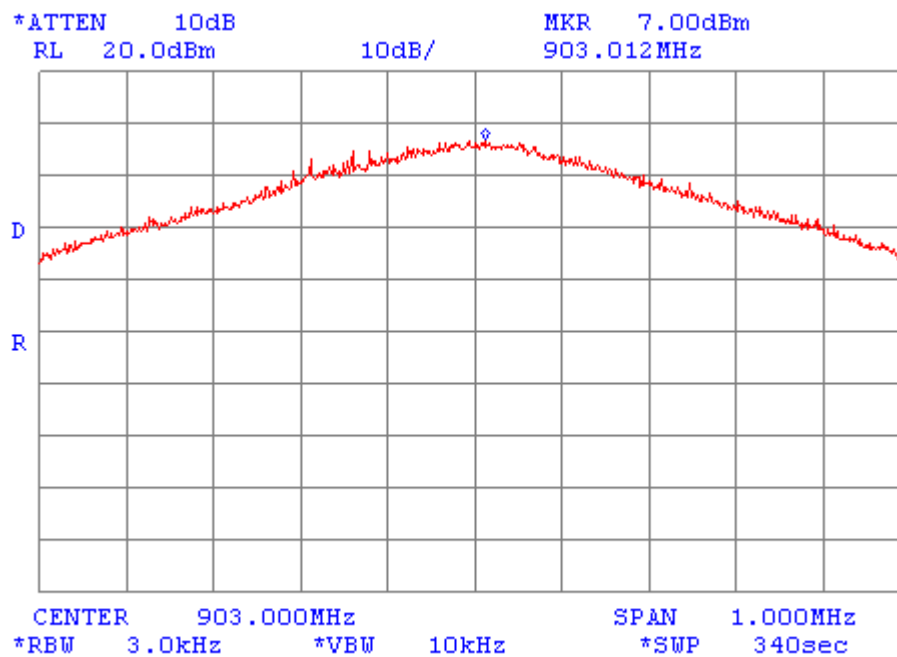




Plot A2

Power density measurements

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 3 Mbit/s

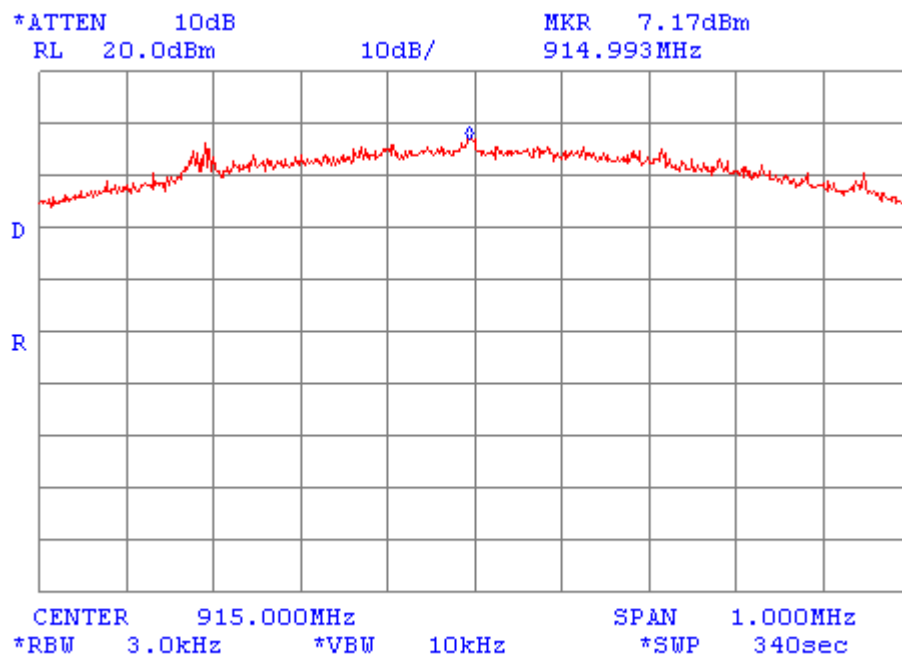




Plot A3

Power density measurements

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 4 Mbit/s

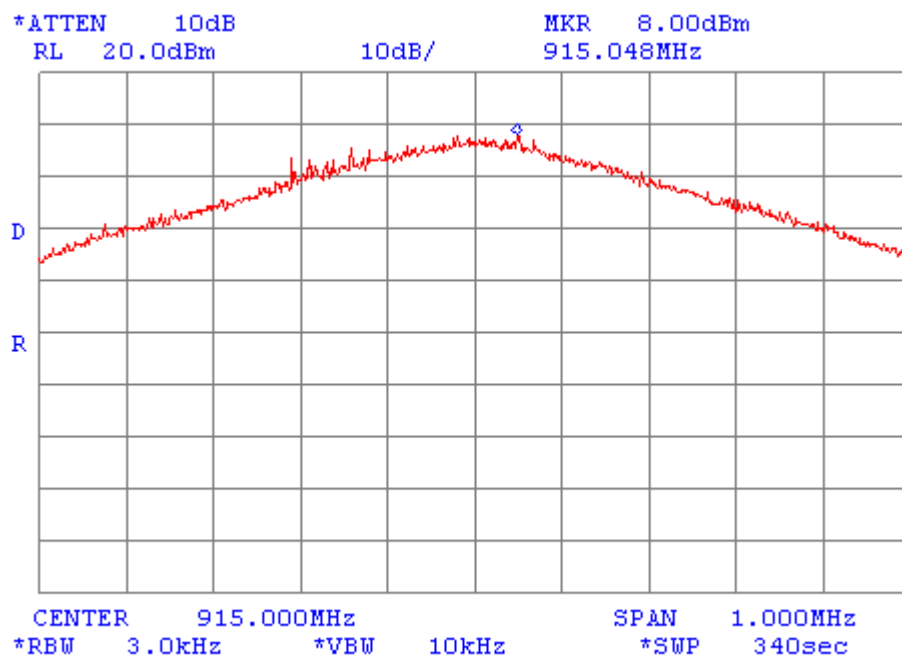




Plot A4

Power density measurements

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 3 Mbit/s

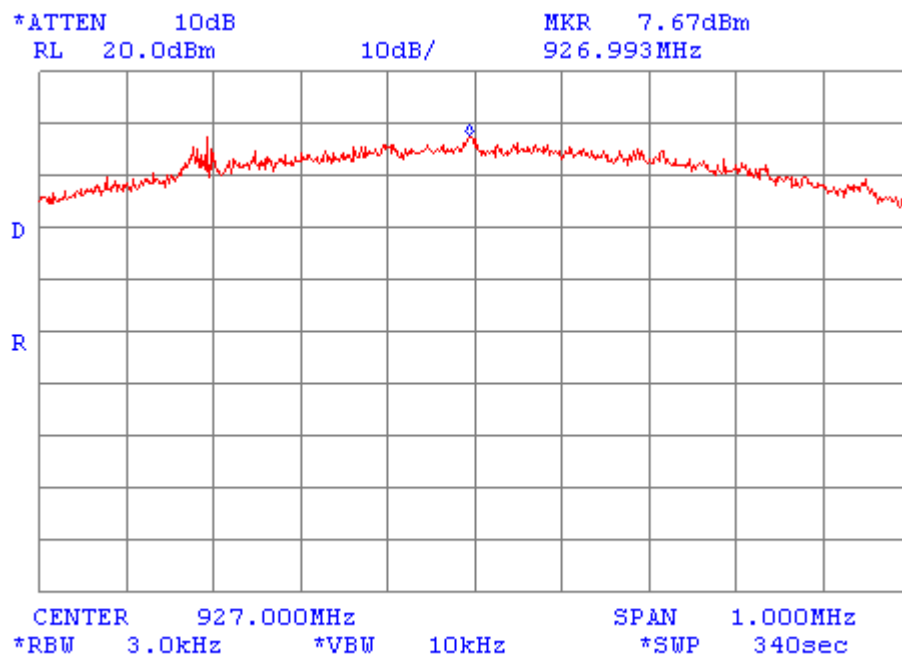




Plot A5

Power density measurements

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s

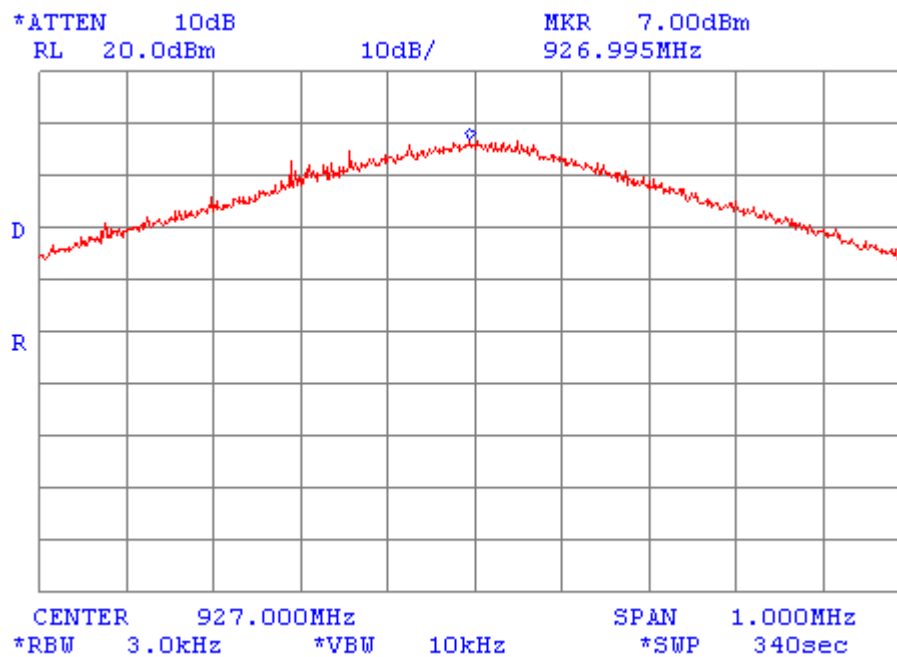




Plot A6

Power density measurements

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 3 Mbit/s

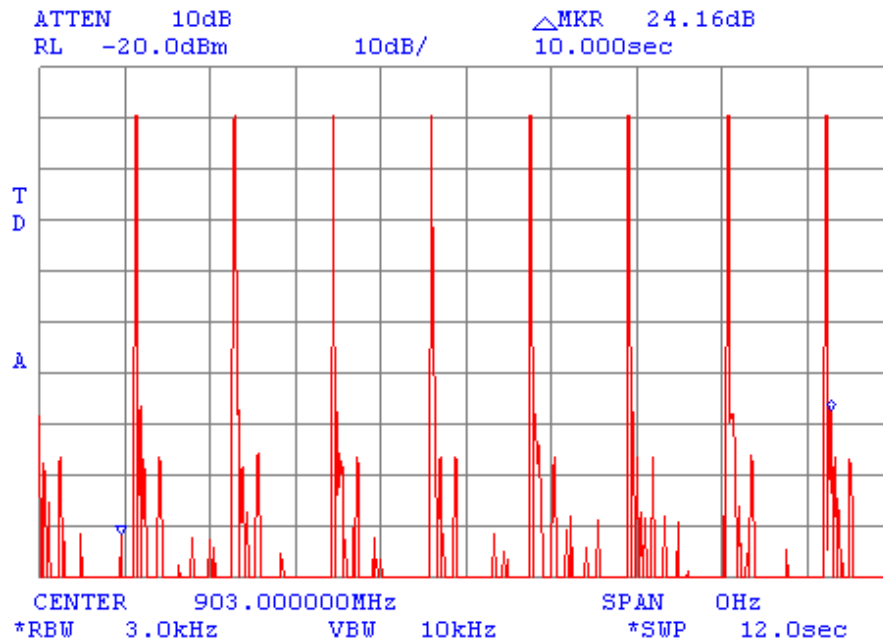




Plot A7

Average time of occupancy

Mode: Hopping turned on



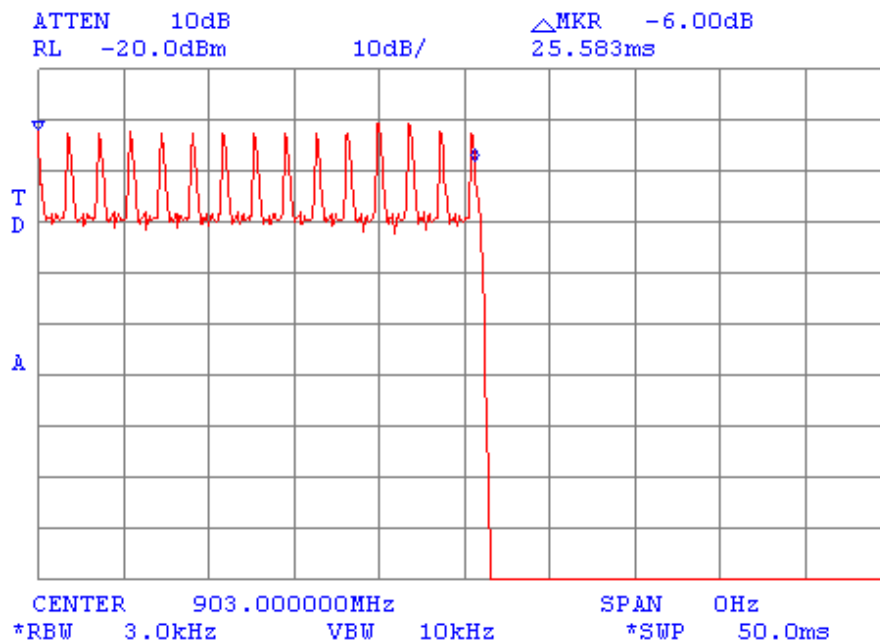
8 transmissions within 10 sec interval



Plot A8

Average time of occupancy

Mode: Hopping turned on



Average time of occupancy calculation:

25.583 ms x 8 times=204.664 ms

204.664 ms <400 ms

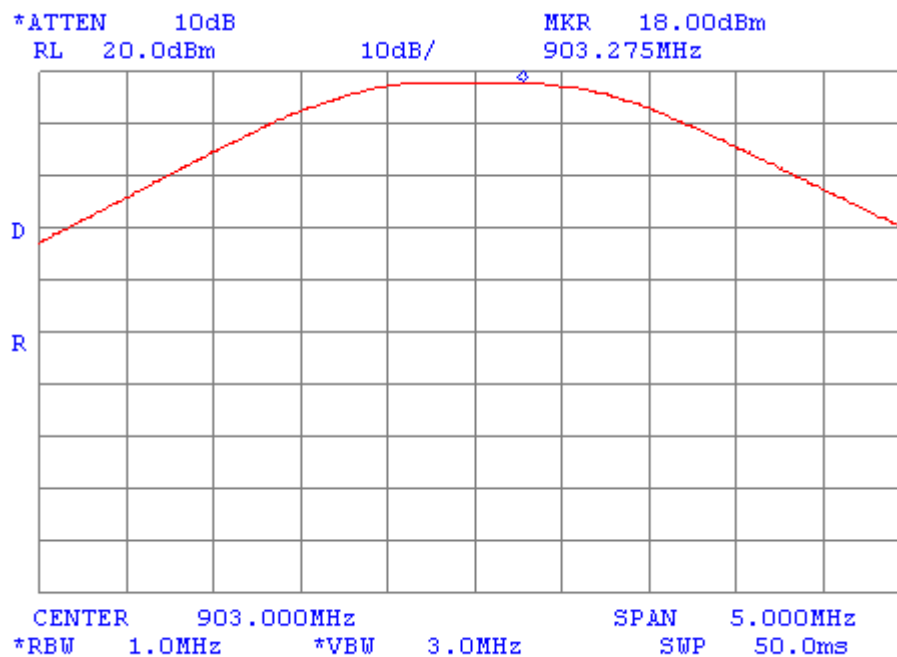
Verdict: PASS



Plot A9

Peak output power

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s

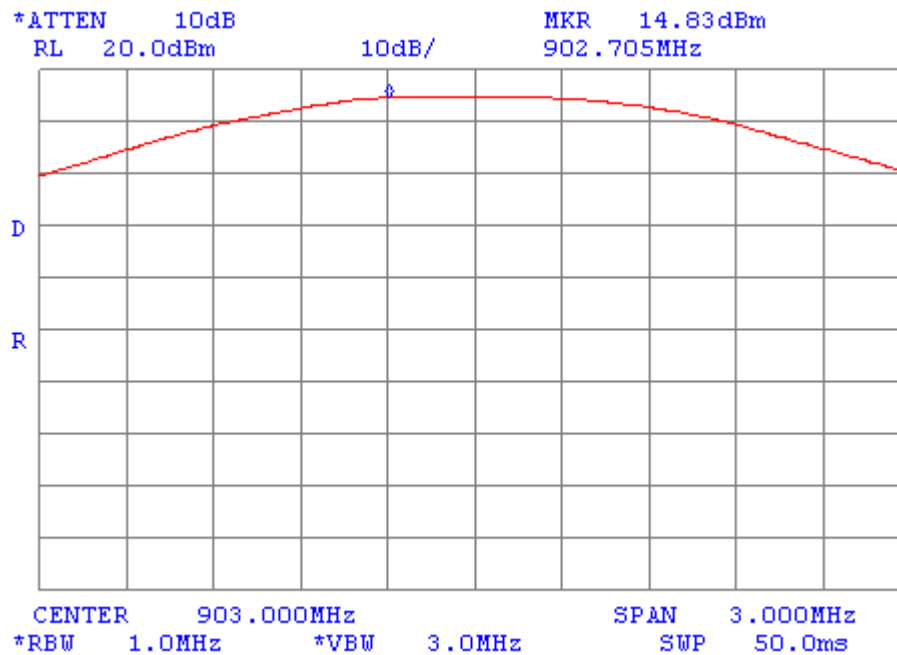




Plot A10

Peak output power

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 3 Mbit/s

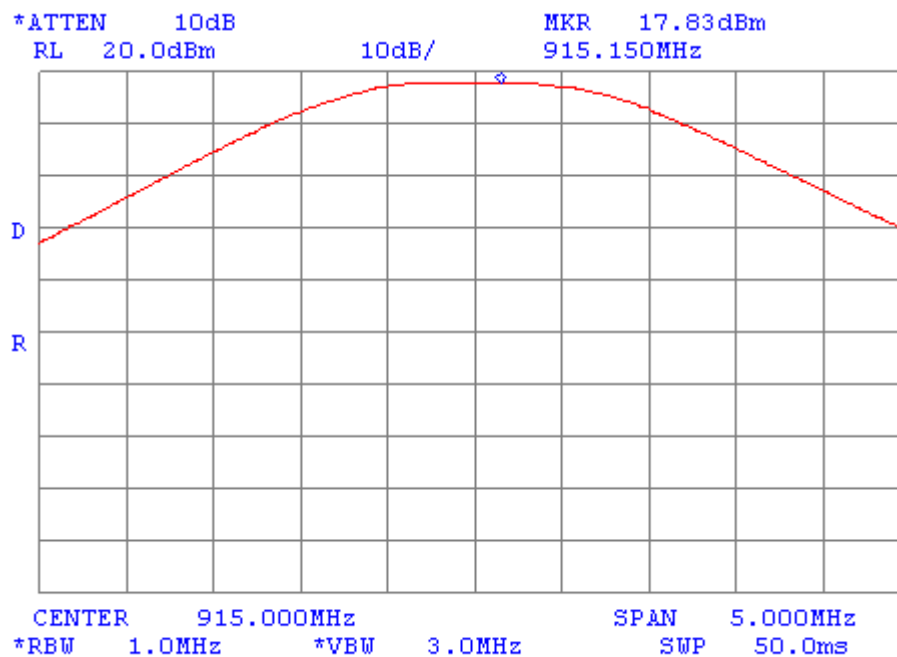




Plot A11

Peak output power

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 4 Mbit/s

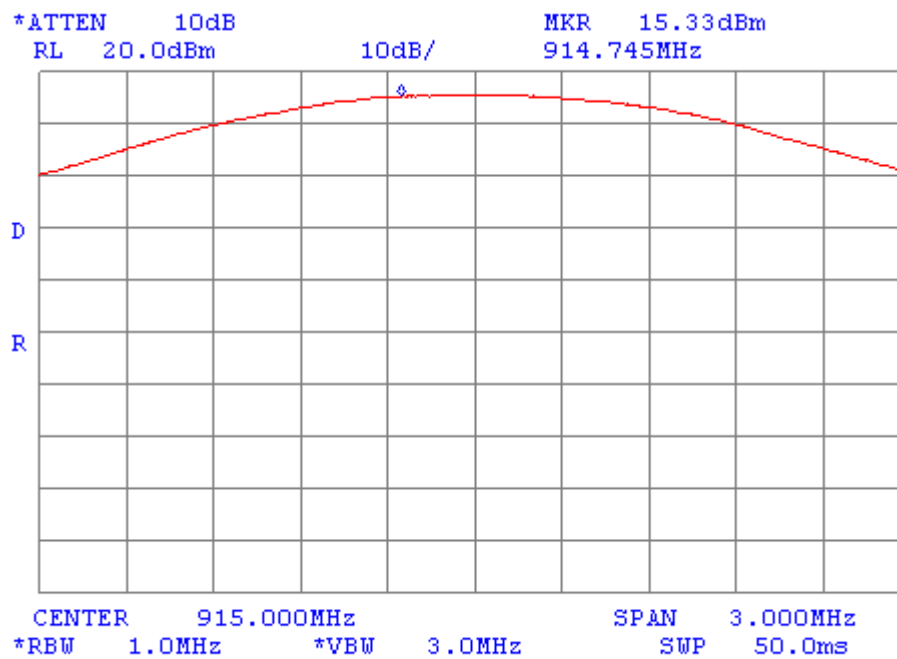




Plot A12

Peak output power

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 3 Mbit/s

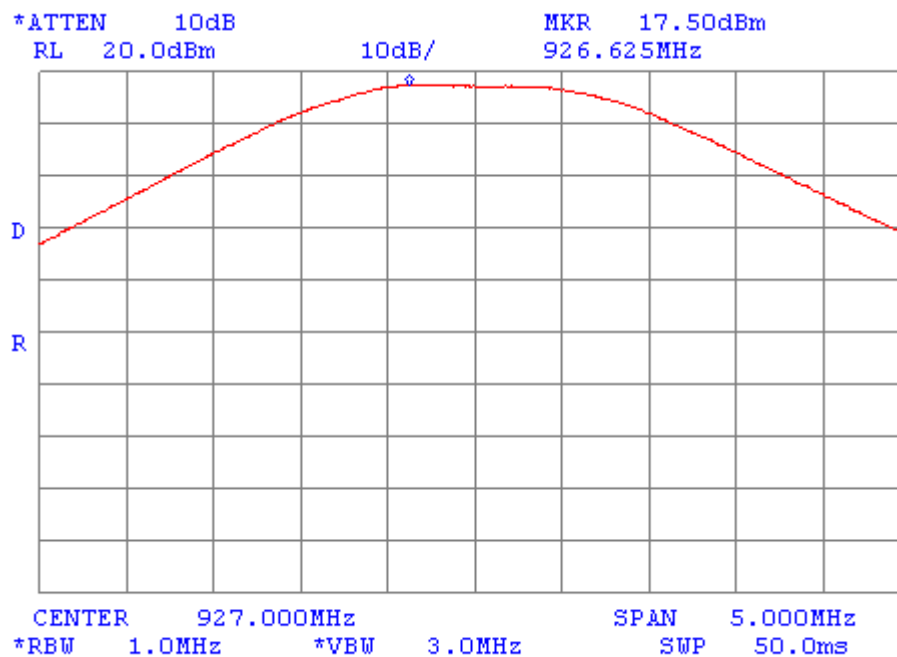




Plot A13

Peak output power

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s

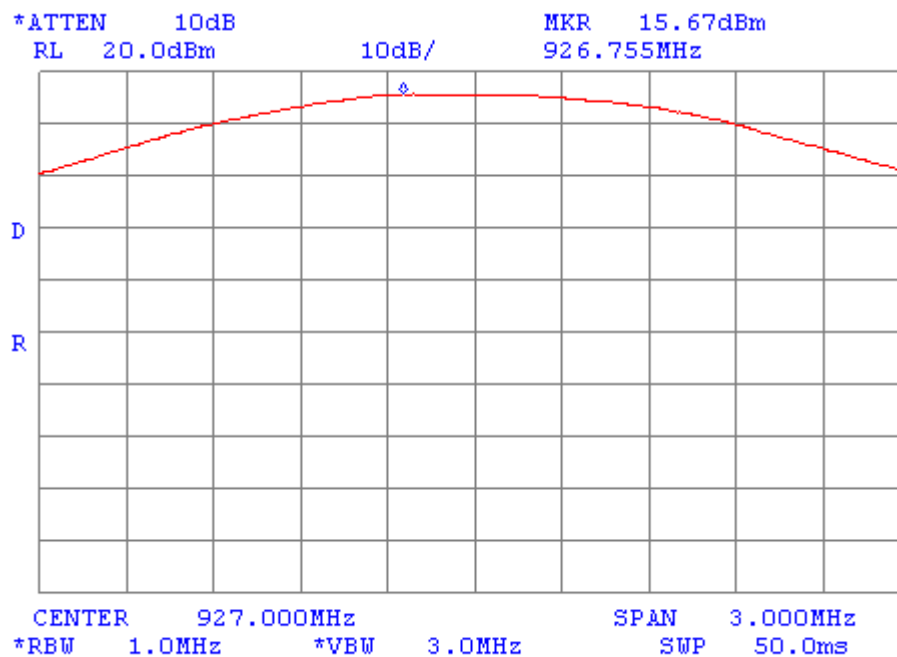




Plot A14

Peak output power

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 3 Mbit/s

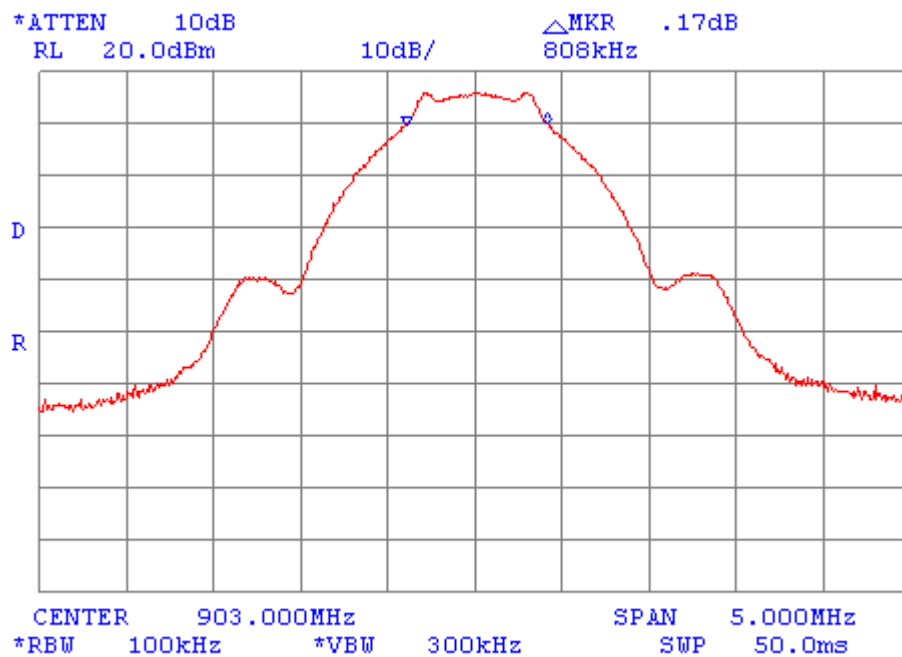




Plot A15

6 dB bandwidth

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s

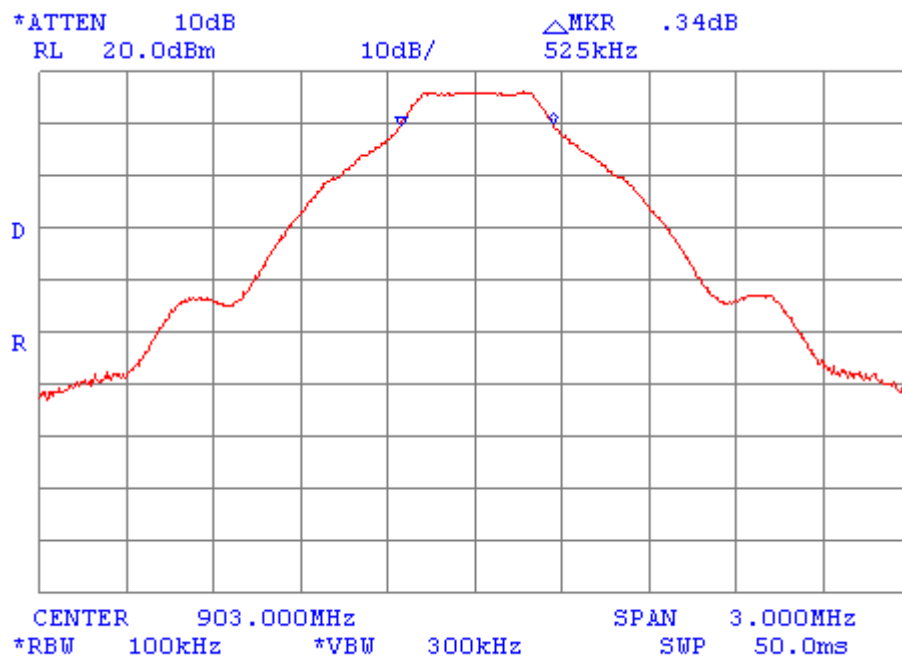




Plot A16

6 dB bandwidth

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 3 Mbit/s

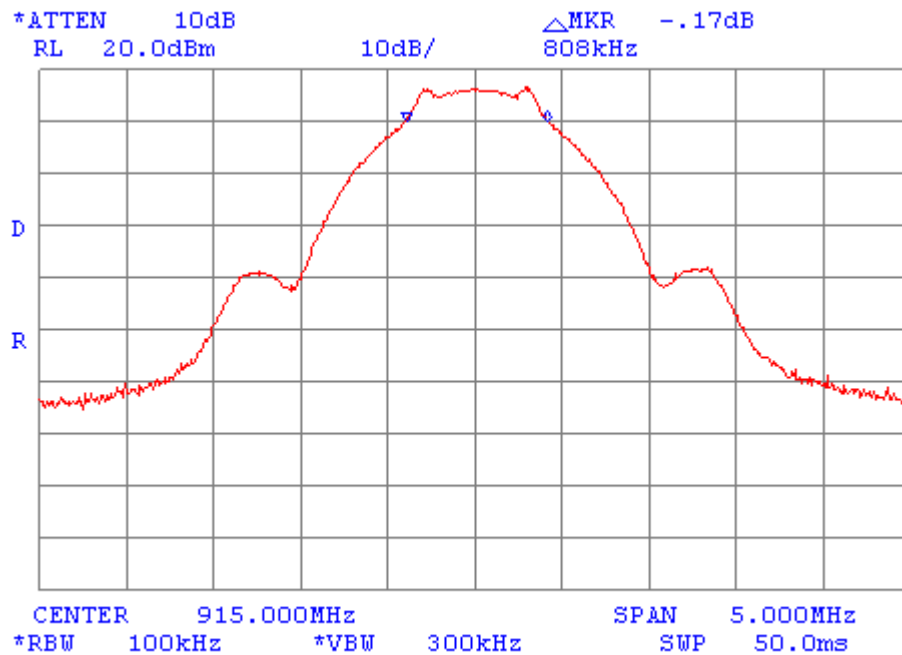




Plot A17

6 dB bandwidth

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 4 Mbit/s

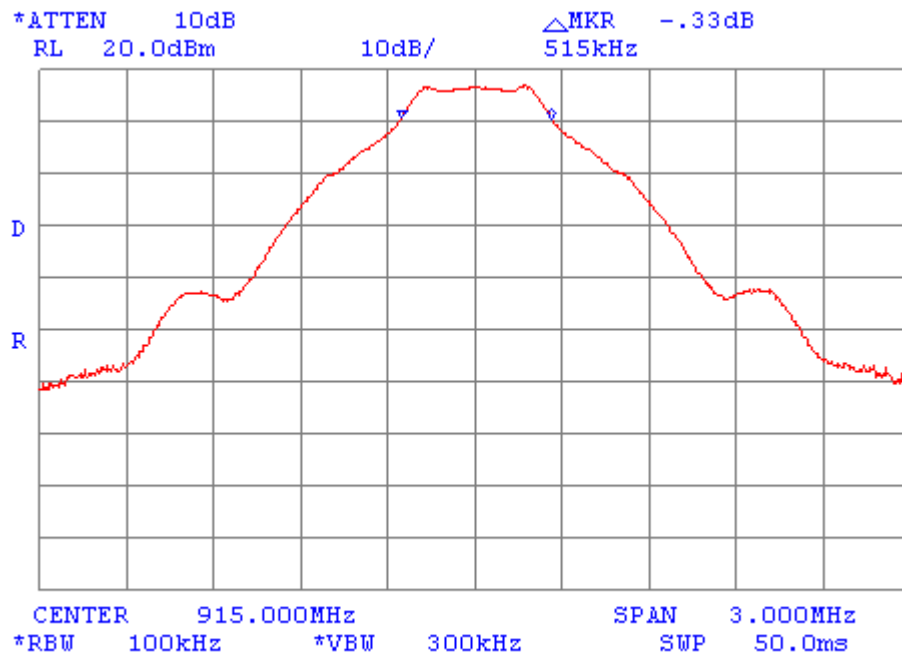




Plot A18

6 dB bandwidth

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 3 Mbit/s

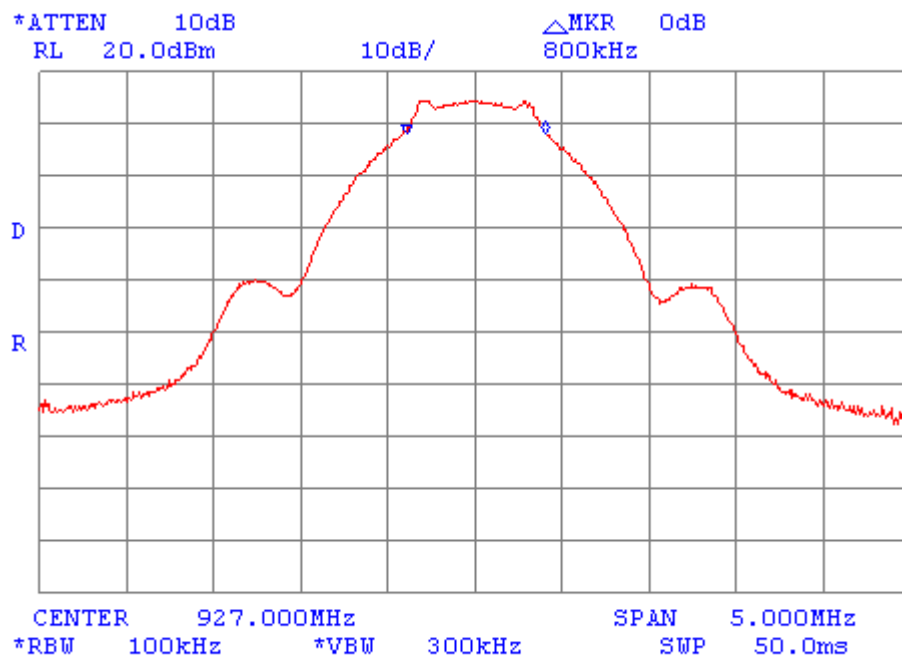




Plot A19

6 dB bandwidth

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s

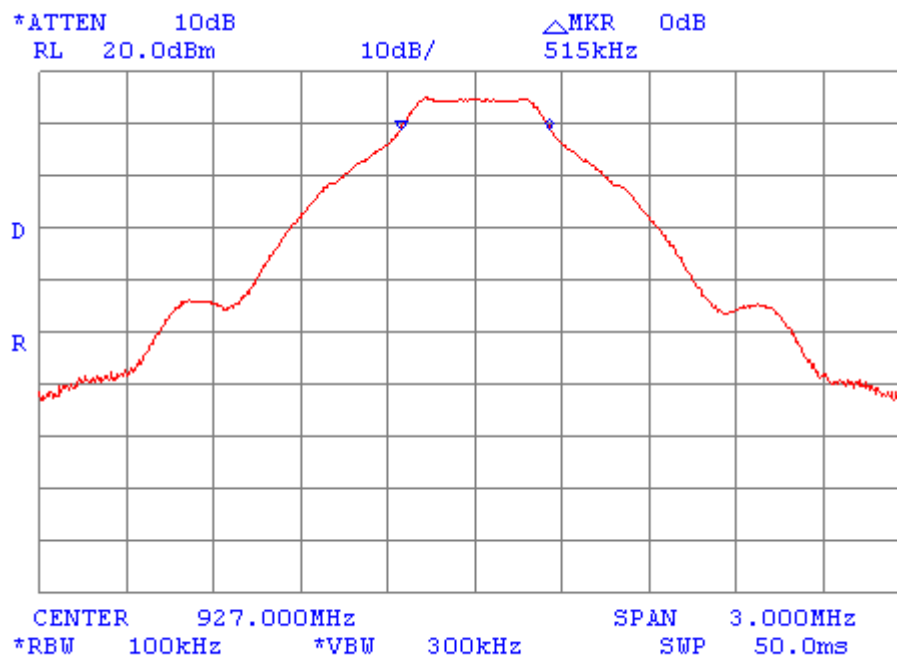




Plot A20

6 dB bandwidth

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 3 Mbit/s



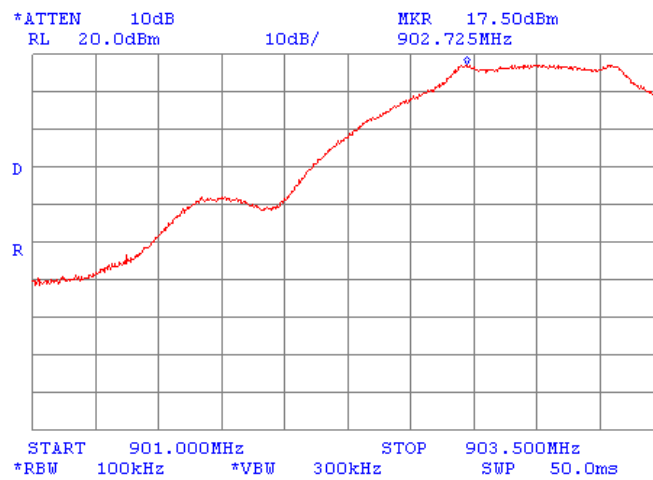


Plot A21

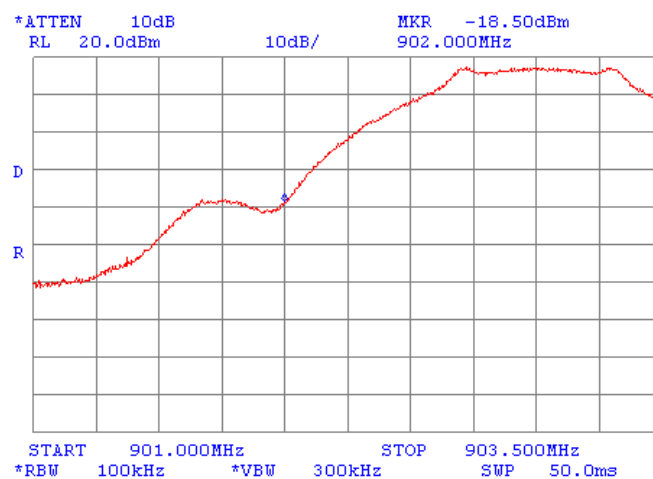
Conducted spurious emission measurements at low band edge

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s

(a)



(b)

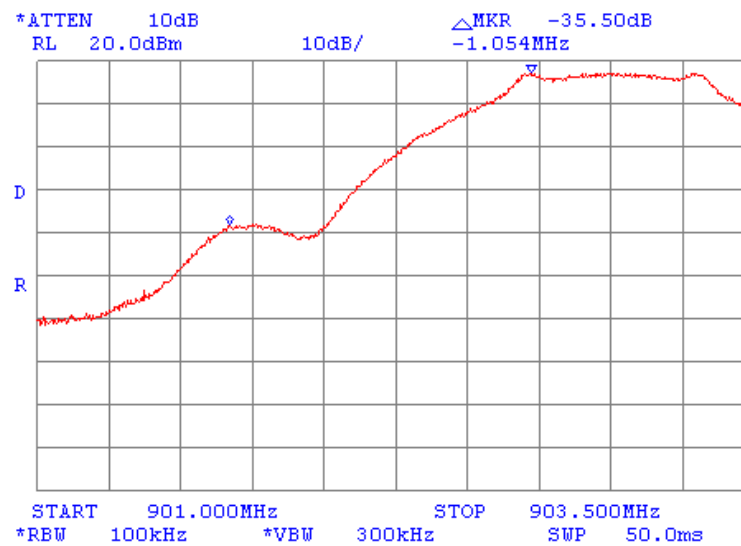




Plot A22

Conducted spurious emission measurements at low band edge

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s



Result: 35.5 dB below carrier

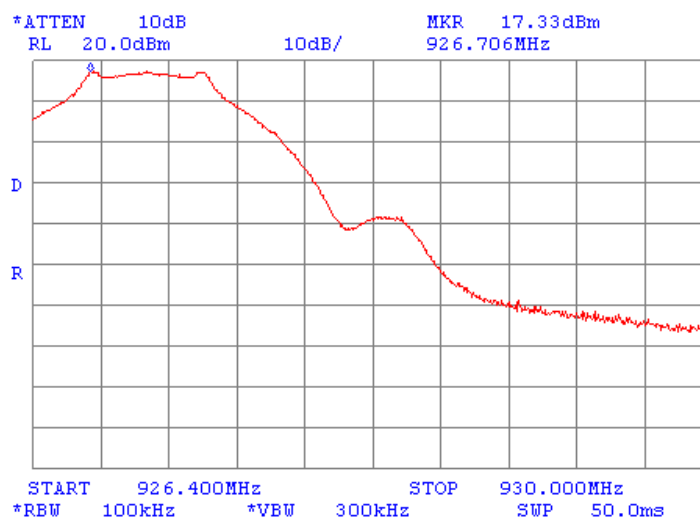


Plot A23

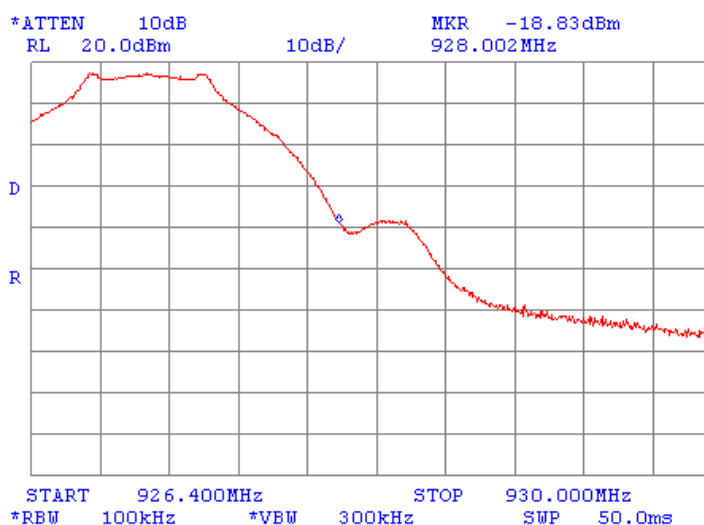
Conducted spurious emission measurements at high band edge

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s

(a)



(b)

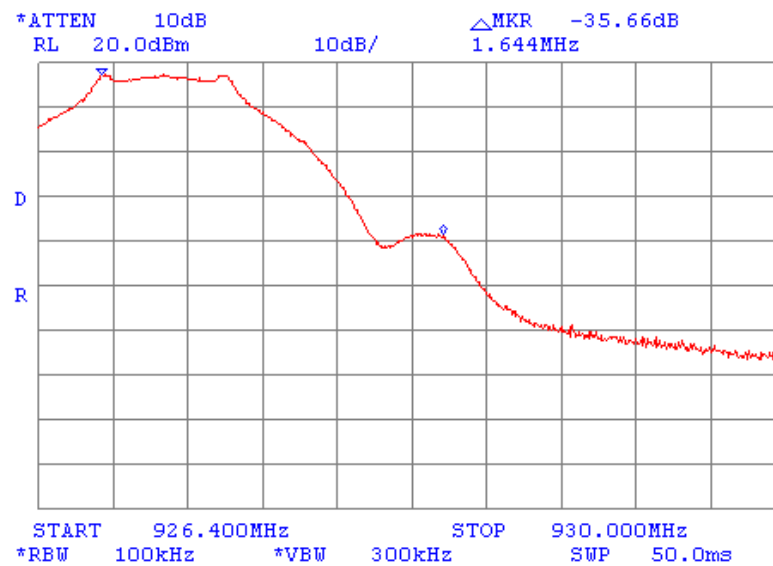




Plot A24

Conducted spurious emission measurements at high band edge

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s



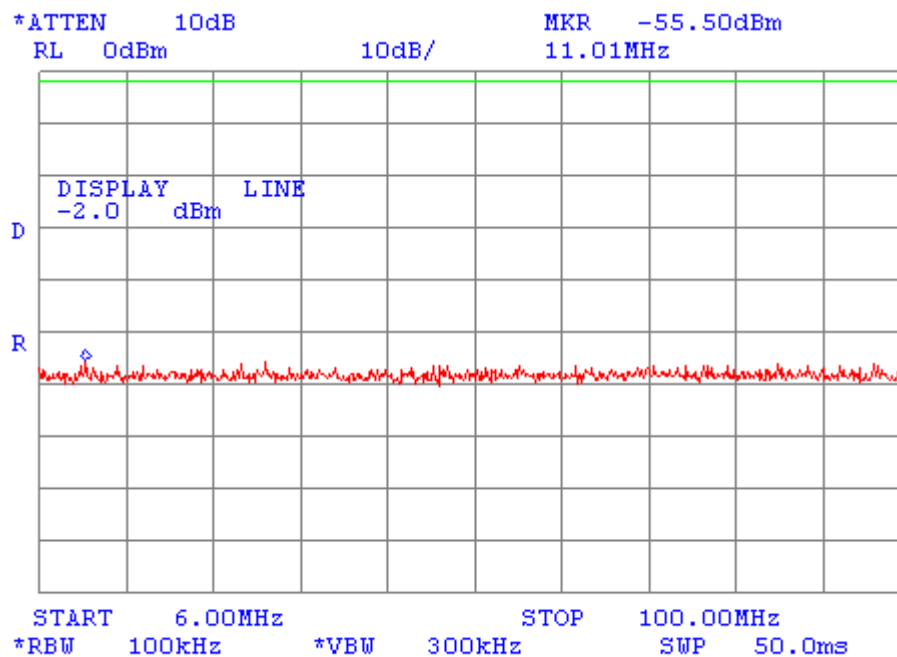
Result: 35.66 dB below carrier



Plot A25

Conducted spurious emission measurements

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s
Frequency range: 6 – 100 MHz



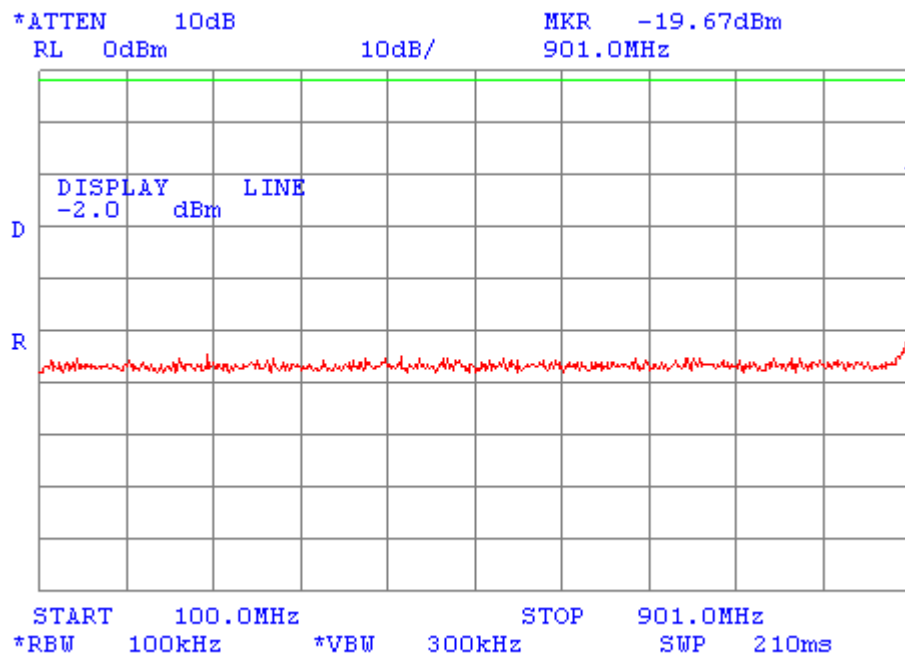
Limit for spurious emissions = 18 dBm - 20 dB = -2 dBm
No spurious emissions were found



Plot A26

Conducted spurious emission measurements

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s
Frequency range: 100 - 901MHz



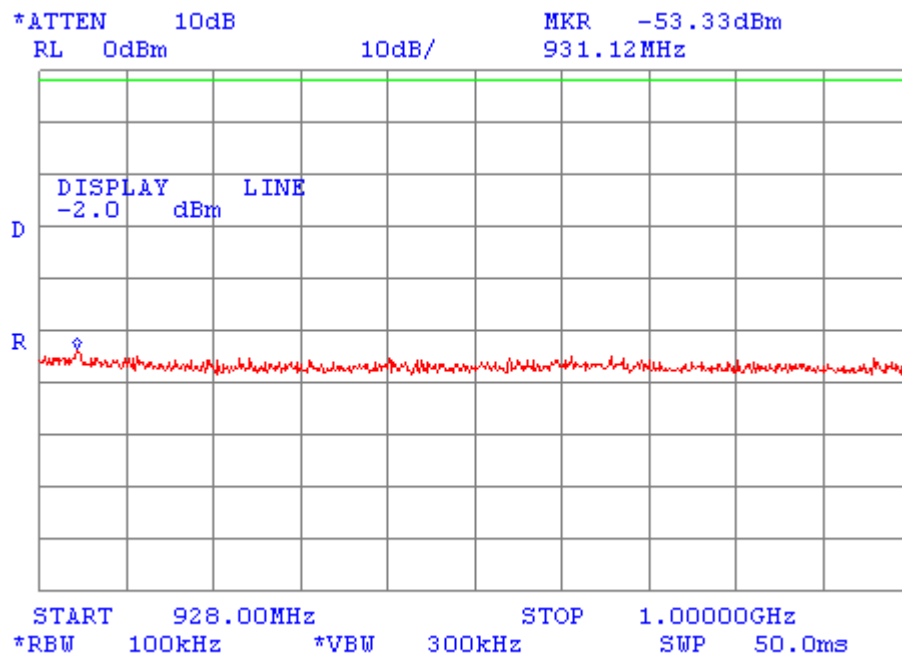
No spurious emissions were found



Plot A27

Conducted spurious emission measurements

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s
Frequency range: 928 MHz - 1 GHz



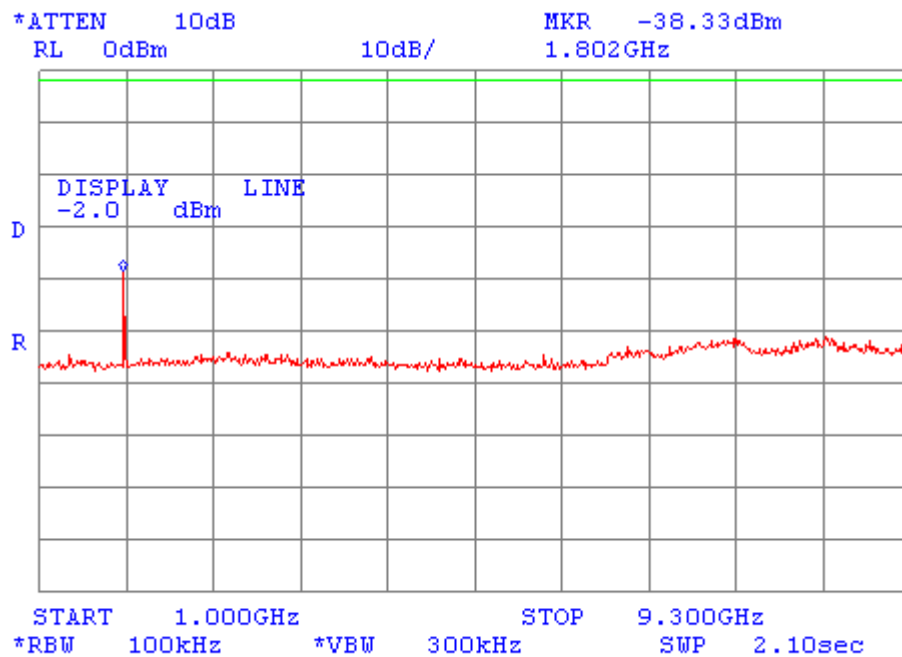
No spurious emissions were found



Plot A28

Conducted spurious emission measurements

Mode: Hybrid
F_{LOW}: 903 MHz
Bit rate: 4 Mbit/s
Frequency range: 1 – 9.3 GHz

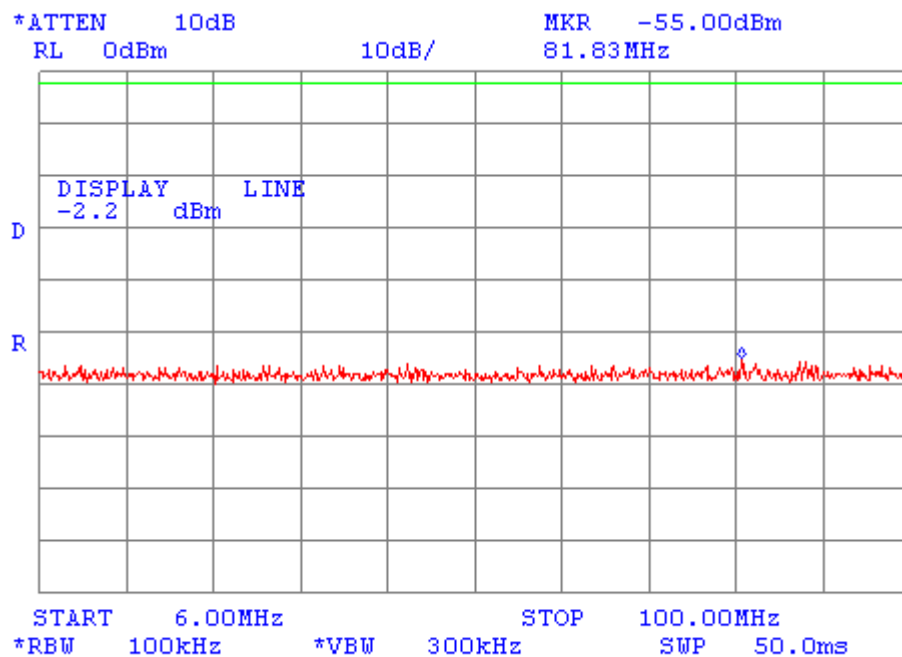




Plot A29

Conducted spurious emission measurements

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 4 Mbit/s
Frequency range: 6 – 100 MHz



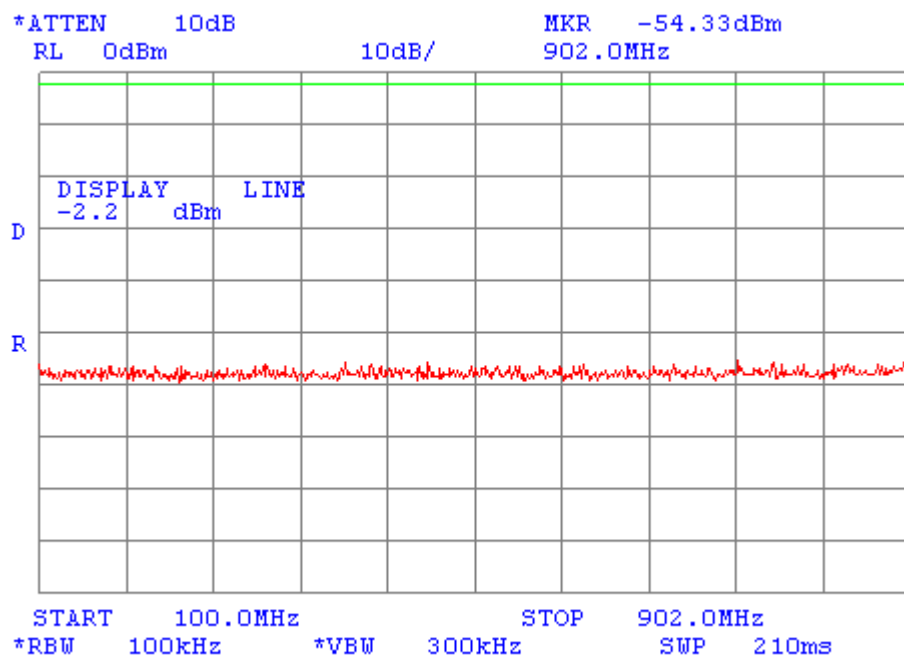
Limit for spurious emissions = 17.83 dBm -20 dB = -2.17 dBm
No spurious emissions were found



Plot A30

Conducted spurious emission measurements

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 4 Mbit/s
Frequency range: 100 – 902 MHz



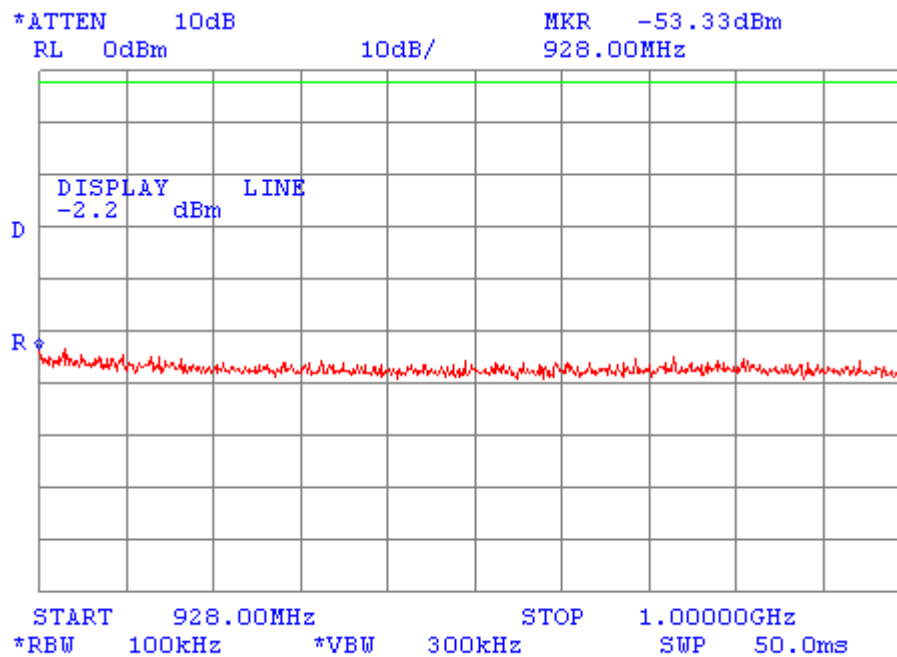
No spurious emissions were found



Plot A31

Conducted spurious emission measurements

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 4 Mbit/s
Frequency range: 928 MHz – 1 GHz



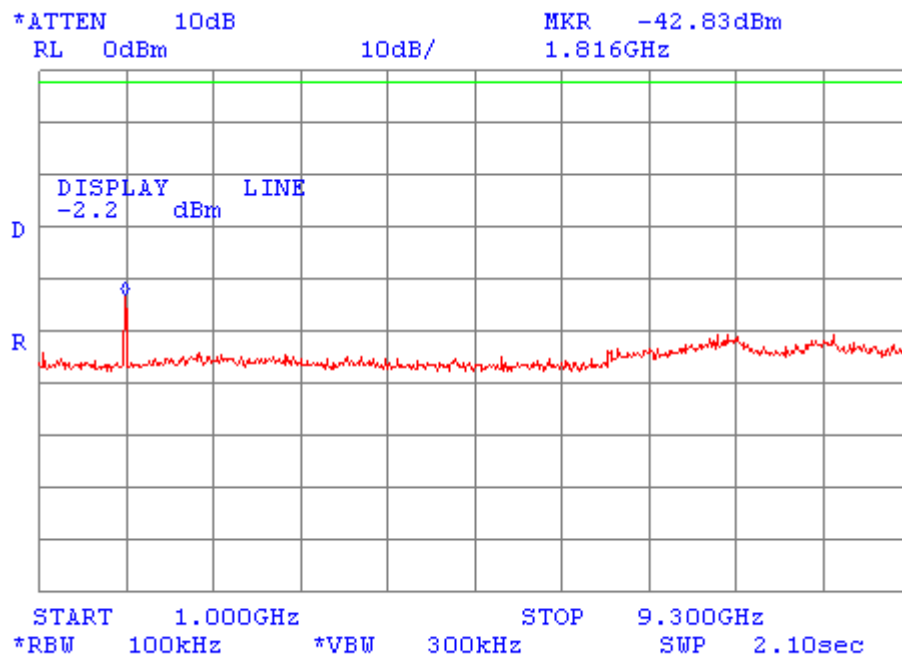
No spurious emissions were found



Plot A32

Conducted spurious emission measurements

Mode: Hybrid
F_{MIDDLE}: 915 MHz
Bit rate: 4 Mbit/s
Frequency range: 1 – 9.3 GHz



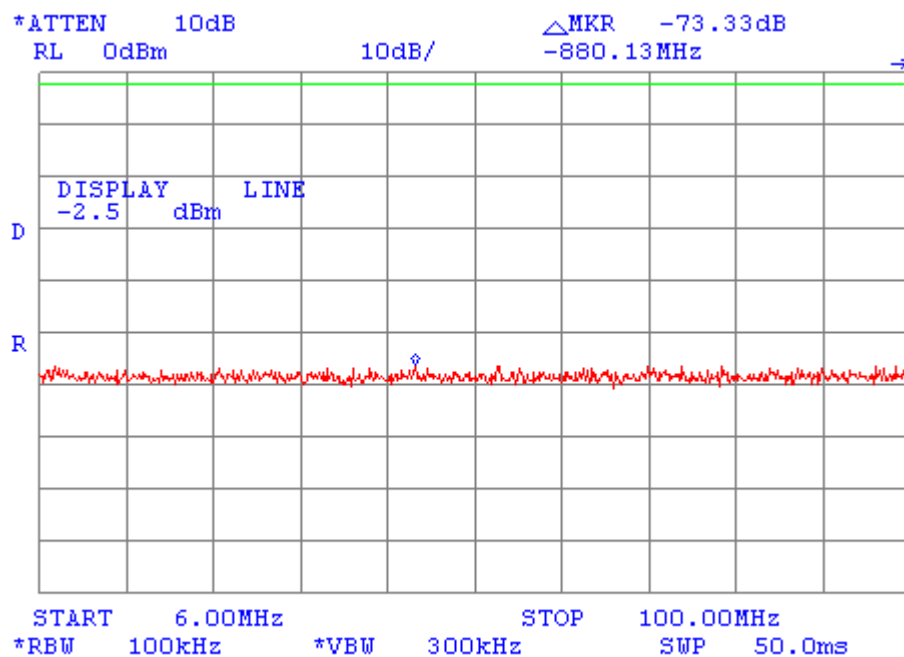
No spurious emissions were found



Plot A33

Conducted spurious emission measurements

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s
Frequency range: 6 – 100 MHz



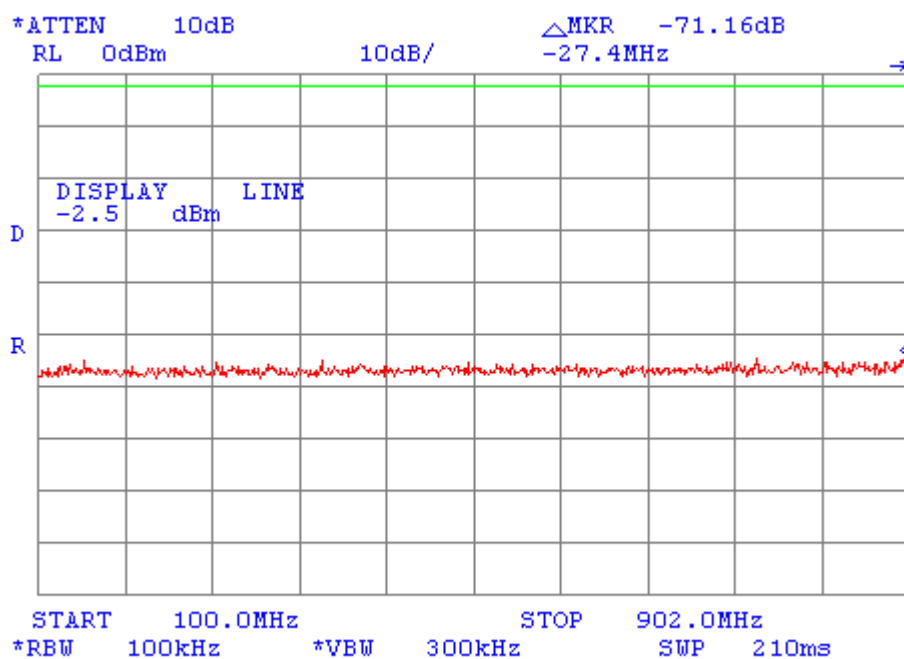
Limit for spurious emissions = 17.50 dBm - 20 dB = -2.5 dBm
No spurious emissions were found



Plot A34

Conducted spurious emission measurements

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s
Frequency range: 100 – 902 MHz



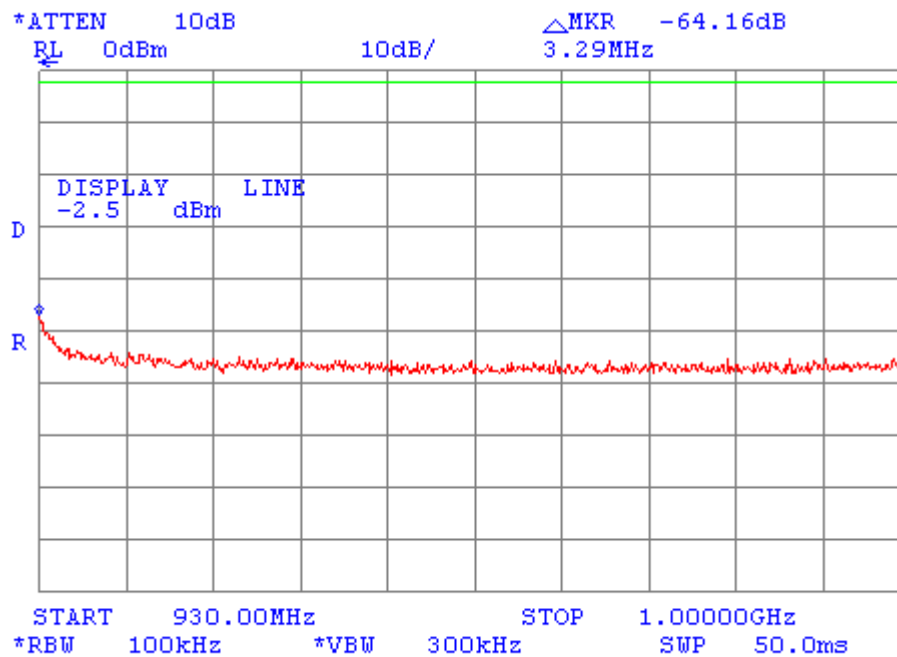
No spurious emissions were found



Plot A35

Conducted spurious emission measurements

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s
Frequency range: 930 – 1000 MHz



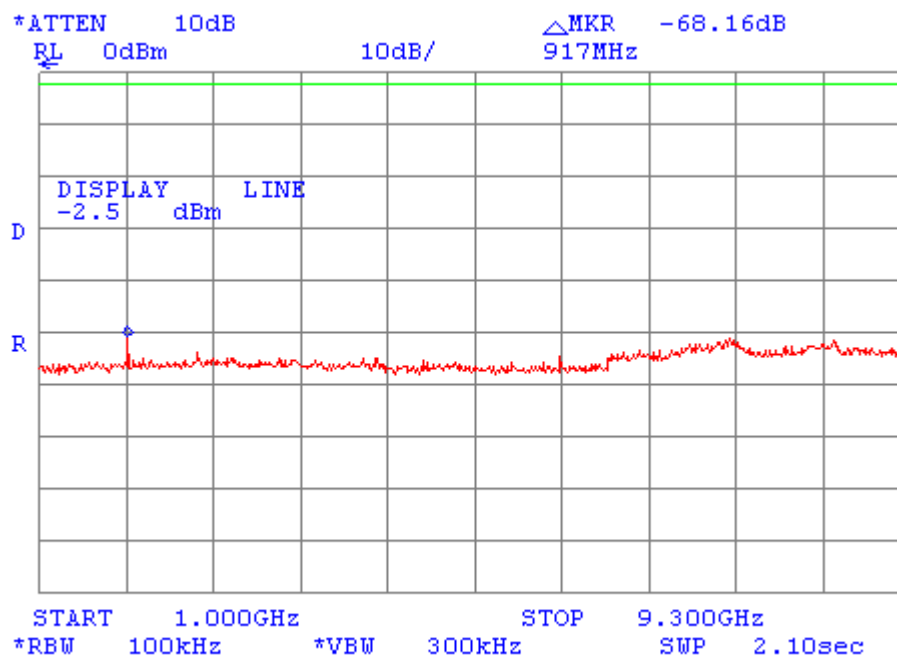
No spurious emissions were found



Plot A36

Conducted spurious emission measurements

Mode: Hybrid
F_{HIGH}: 927 MHz
Bit rate: 4 Mbit/s
Frequency range: 1 – 9.3 GHz



No spurious emissions were found

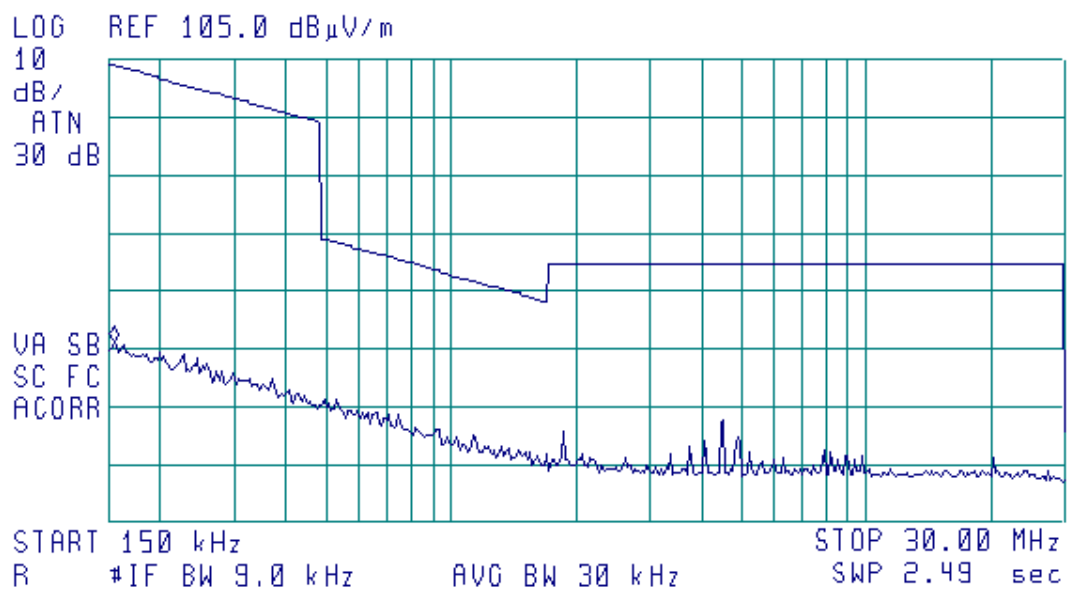


Plot A37

Radiated spurious emission measurements in the anechoic chamber from 150 kHz to 30 MHz,
carrier frequency 903 MHz

16:44:28 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 150 kHz
56.14 dB μ V/m



No spurious emissions were found

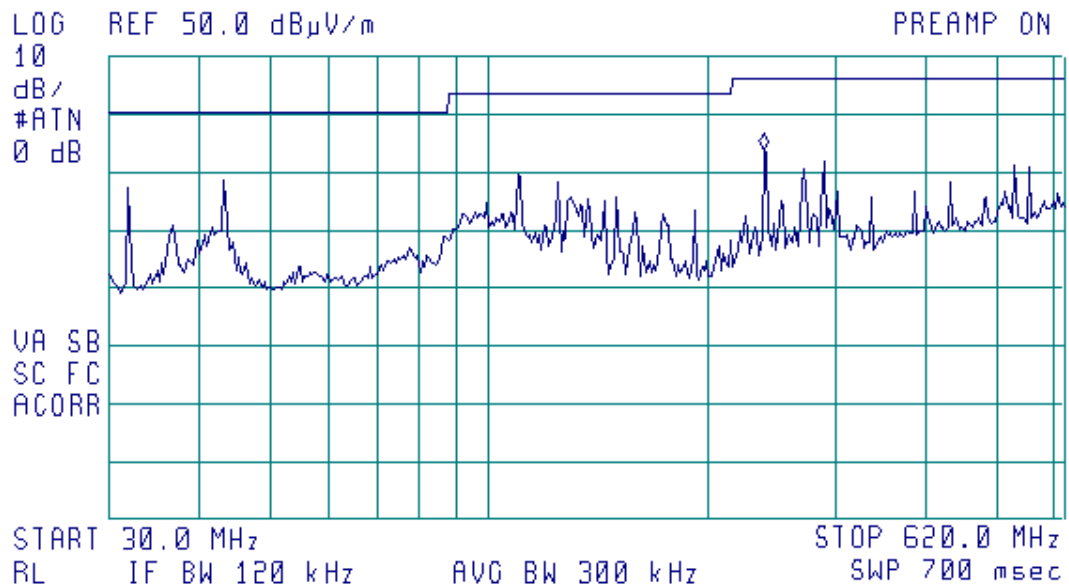


Plot A38

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 903 MHz

 11:24:20 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 239.3 MHz
33.79 dB μ V/m





Plot A39

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 903 MHz

10:43:28 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 973.20 MHz
48.68 dB μ V/m

LOG REF 60.0 dB μ V/m

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR

START 960.00 MHz STOP 1.00000 GHz
RL IF BW 120 kHz AVG BW 300 kHz SWP 37.5 msec



Plot A40

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 903 MHz

16:24:20 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.3915 GHz
48.88 dB μ V/m

LOG REF 60.0 dB μ V/m

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR

START 1.0000 GHz

RL #IF BW 1.0 MHz

AVG BW 3 MHz

STOP 1.7250 GHz

SWP 20.0 msec



Plot A41

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 903 MHz

16:27:18 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.8493 GHz
48.96 dB μ V/m

LOG REF 60.0 dB μ V/m

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR

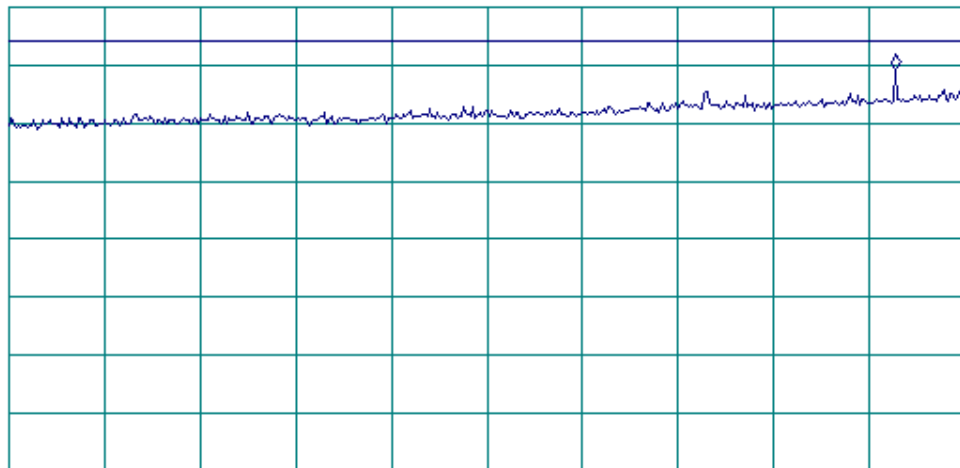
START 2.2000 GHz

RL #IF BW 100 kHz

AVG BW 300 kHz

STOP 2.9000 GHz

SWP 210 msec



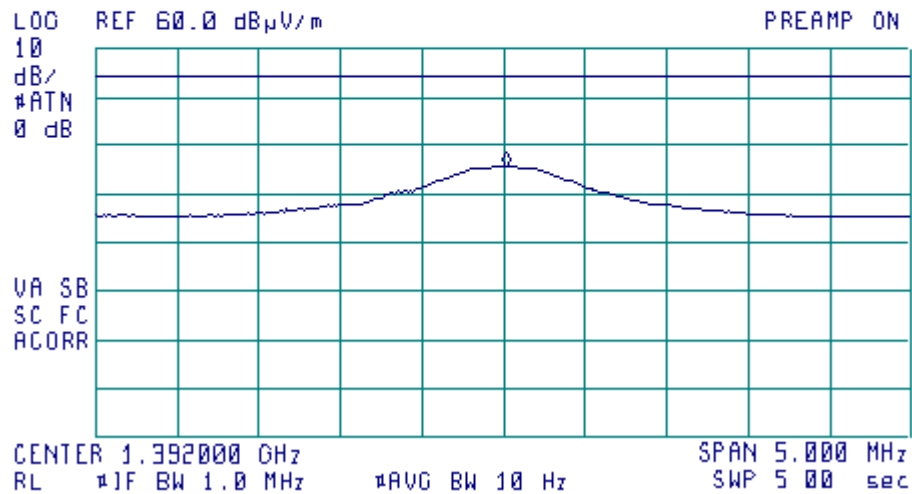


Plot A42

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

11:32:09 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
Mkr 1.392013 GHz
35.78 dB μ V/m



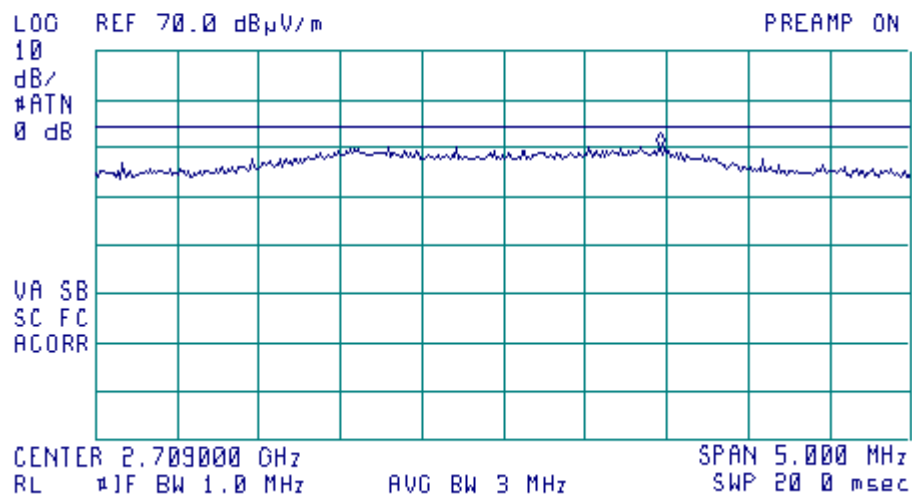


Plot A43

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

12:12:12 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.709963 GHz
50 37 dB μ V/m



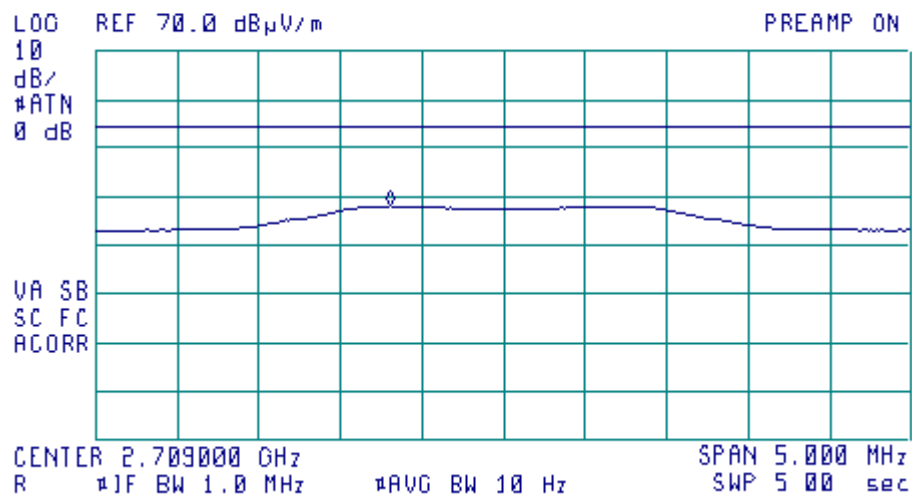


Plot A44

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

12:14:36 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.708300 GHz
38.15 dB μ V/m



Test result: measured value + average factor = 38.15 dB(μ V/m) – 11.84 dB = 26.31 dB(μ V/m)

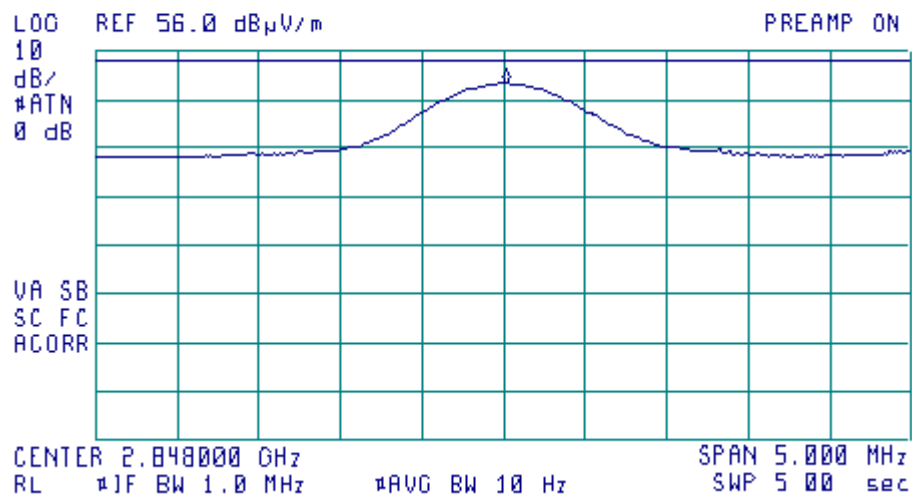


Plot A45

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

11:07:55 OCT 15, 2003

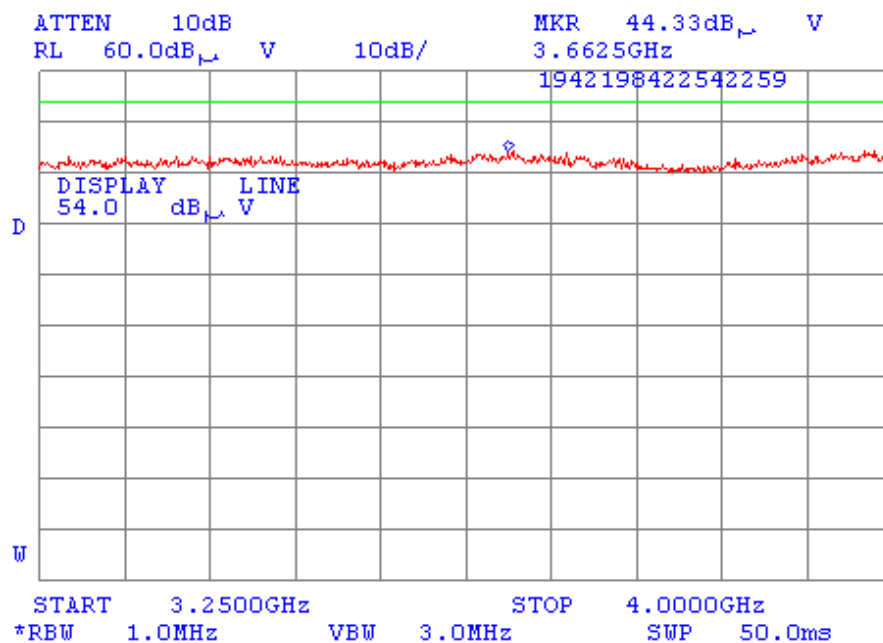
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.848013 GHz
49.26 dB μ V/m





Plot A46

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

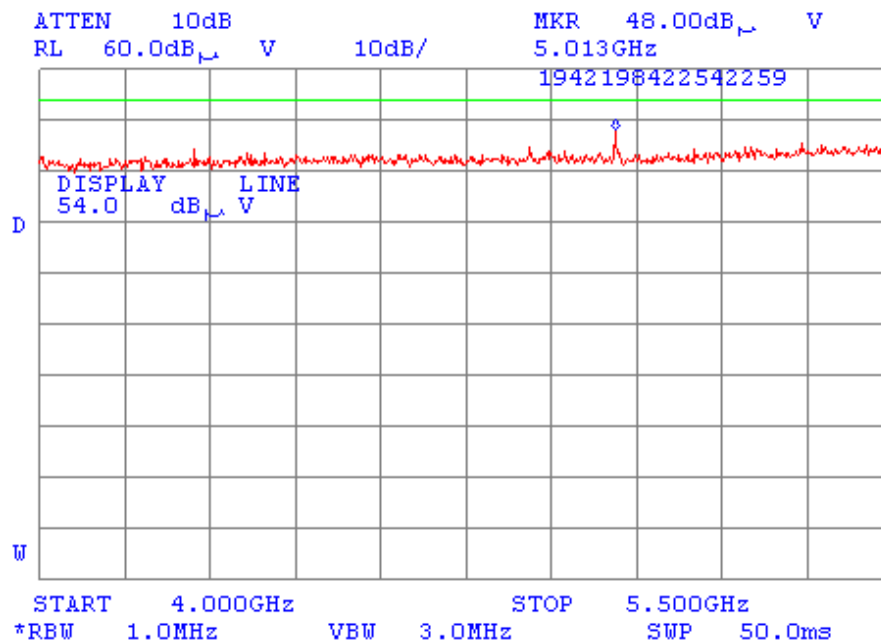


No spurious emissions were found.



Plot A47

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

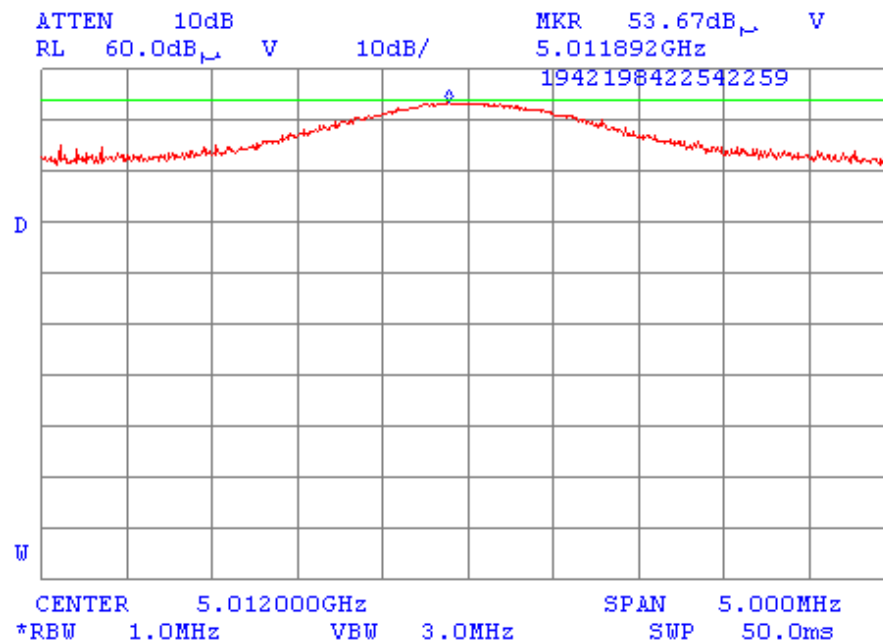


No other spurious except the 4th harmonic of the LO.



Plot A48

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

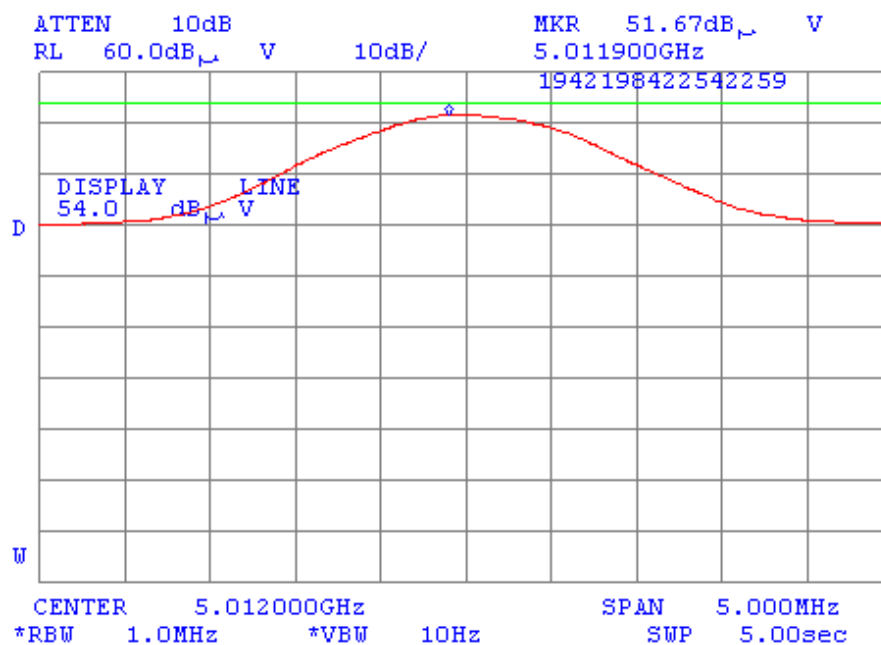


The 4th harmonic of the LO (903+350=1253 MHz)
Peak value.
Horizontal polarization



Plot A49

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz



The 4th harmonic of the LO (903+350=1253 MHz)

Average value.

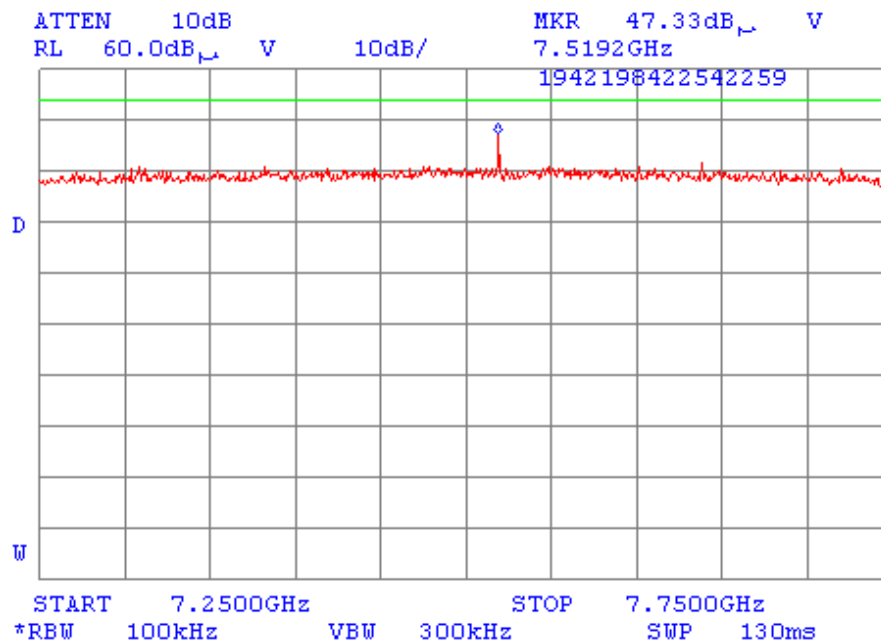
Horizontal polarization

Test result: measured value + average factor = 51.67 dB(μV/m) – 11.84 dB = 26.31 dB(μV/m)



Plot A50

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

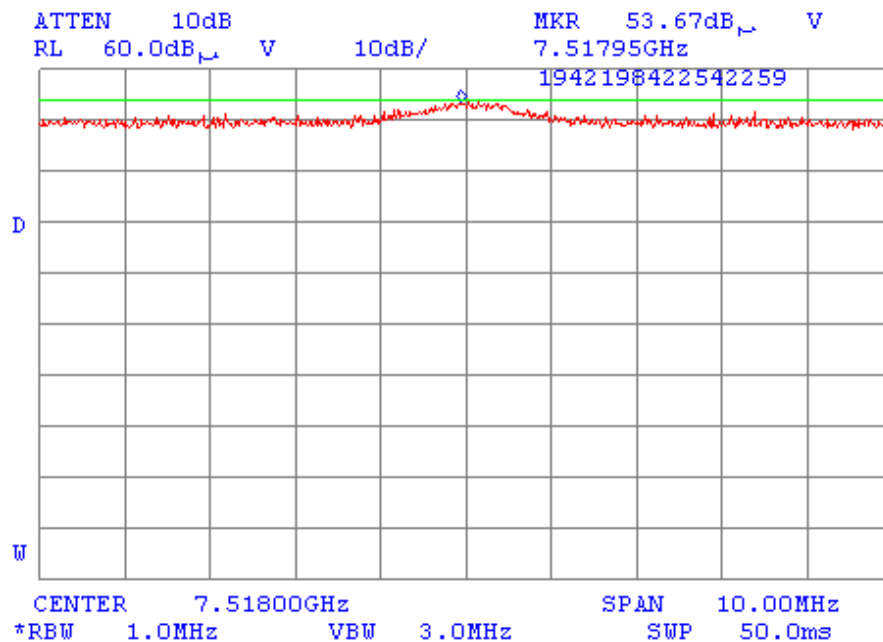


No other spurious except the 6th harmonic of the LO.



Plot A51

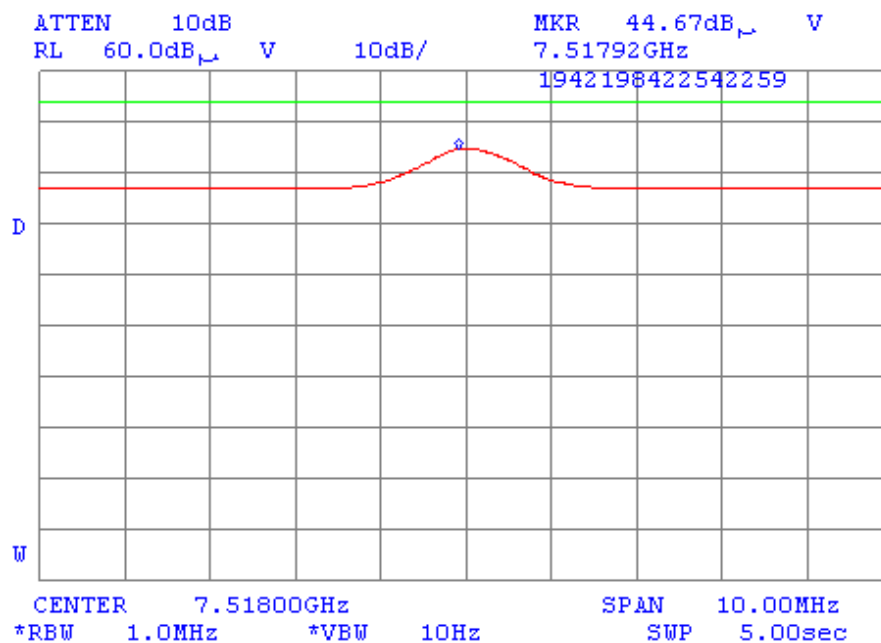
Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz





Plot A52

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz

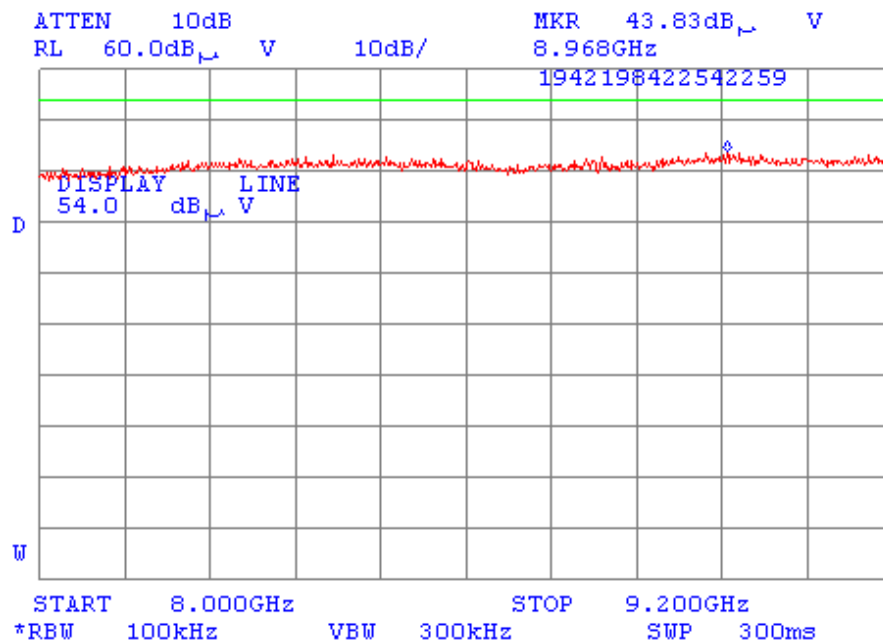


Test result: measured value + average factor = 44.67 dB(μ V/m) – 11.84 dB = 32.83 dB(μ V/m)



Plot A53

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 903 MHz



No spurious emissions were found.

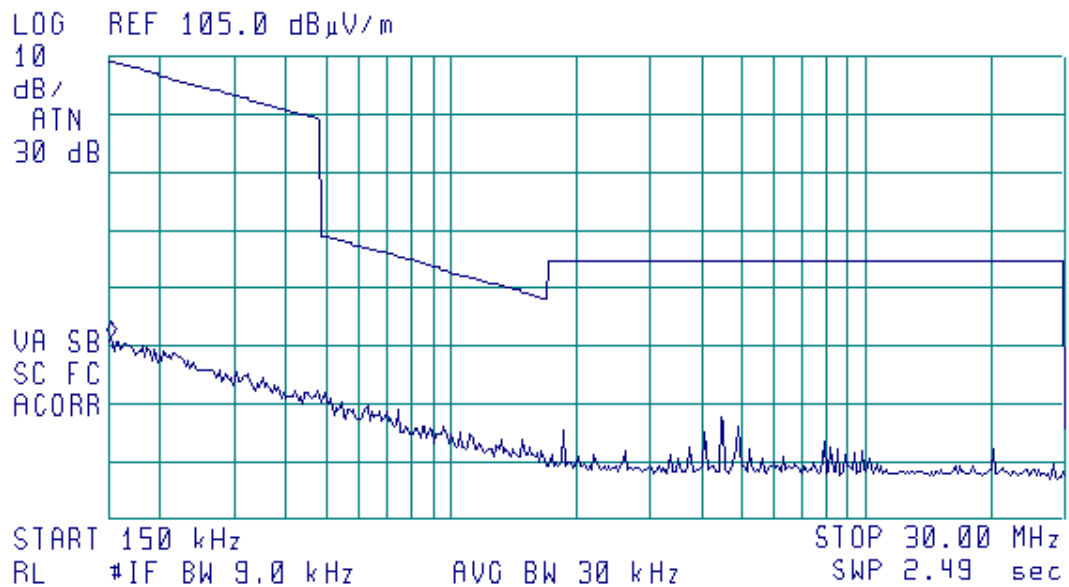


Plot A54

Radiated spurious emission measurements in the anechoic chamber from 150 kHz to 30 MHz,
carrier frequency 915 MHz

(hp) 16:46:49 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 150 kHz
56.26 dB μ V/m



No spurious emissions were found

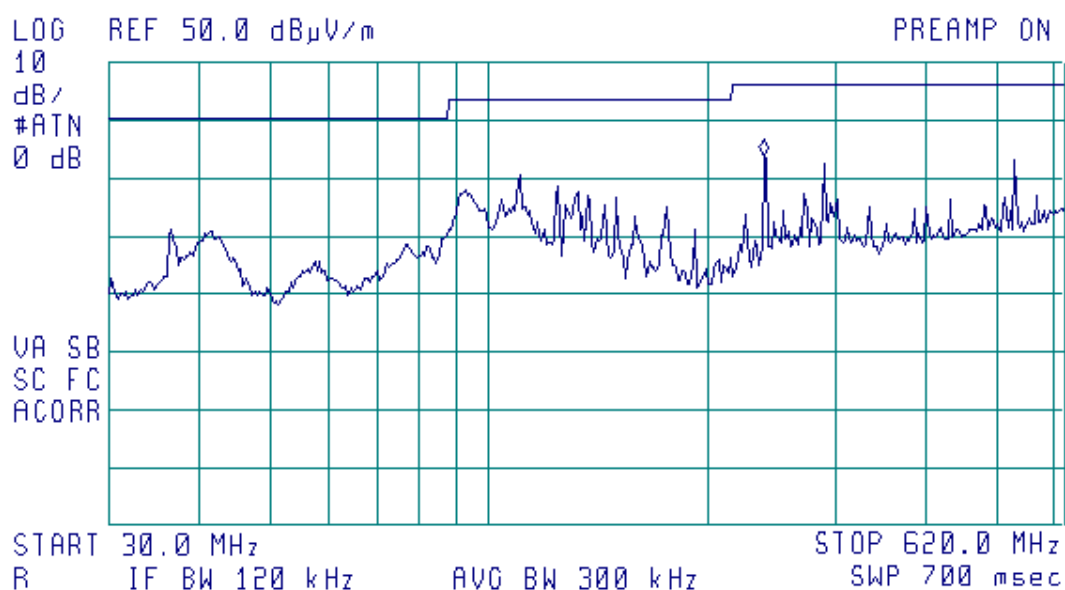


Plot A55

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 915 MHz

12:37:46 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 239.3 MHz
33.75 dB μ V/m





Plot A56

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 915 MHz

12:48:42 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 985.00 MHz
47.38 dB μ V/m

LOG REF 60.0 dB μ V/m

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR

START 960.00 MHz

RL IF BW 120 kHz

AVG BW 300 kHz

STOP 1.00000 GHz

SWP 37.5 msec



Plot A57

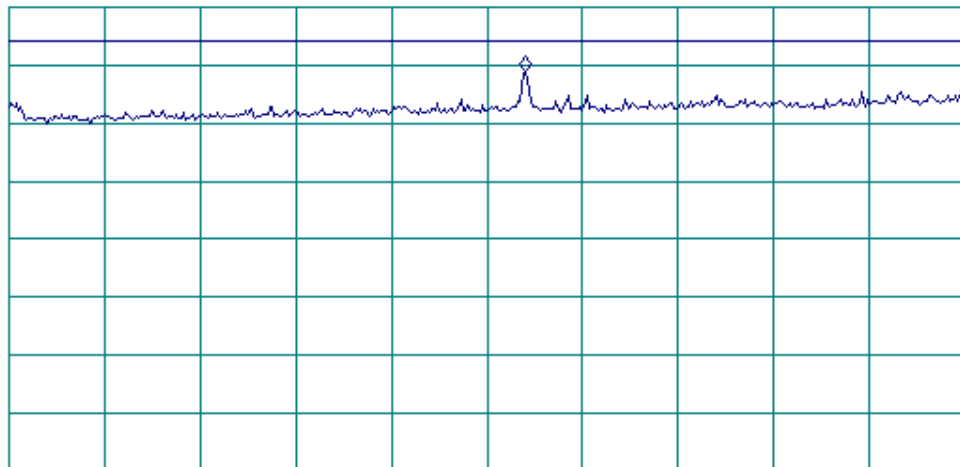
Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 915 MHz

16:15:18 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.3915 GHz
48.90 dB μ V/m

LOG REF 60.0 dB μ V/m

10
dB/
#ATN
0 dB



START 1.0000 GHz STOP 1.7250 GHz
RL #IF BW 1.0 MHz AVG BW 3 MHz SWP 20.0 msec



Plot A58

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 915 MHz

16:09:56 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.8493 GHz
47.34 dB μ V/m

LOG REF 60.0 dB μ V/m

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR

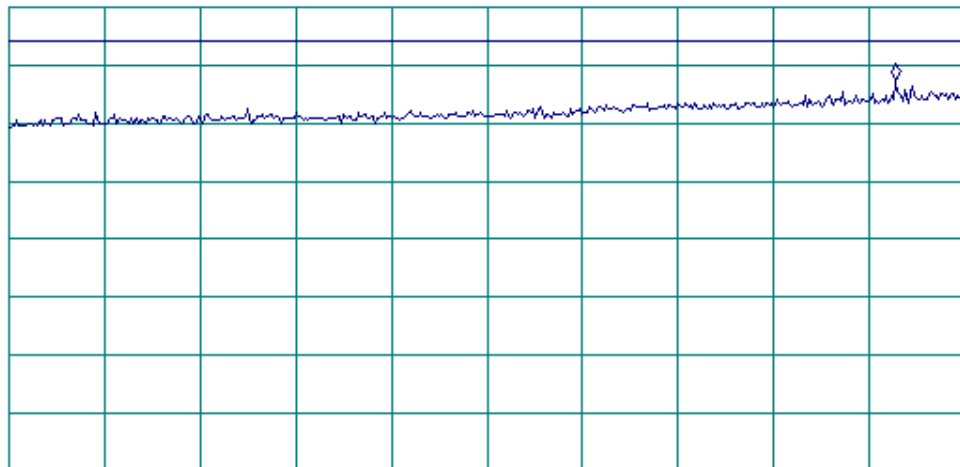
START 2.2000 GHz

RL #IF BW 100 kHz

AVG BW 300 kHz

STOP 2.9000 GHz

SWP 210 msec



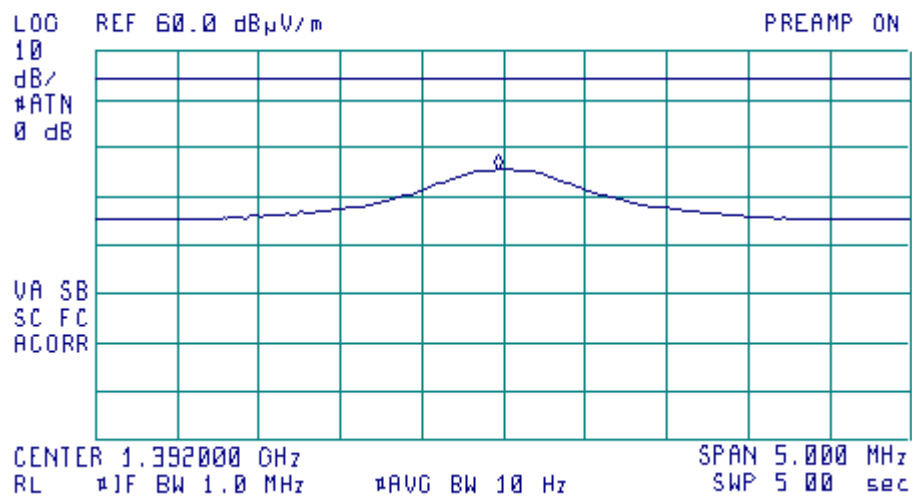


Plot A59

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

11:28:57 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.391963 GHz
35.64 dB μ V/m



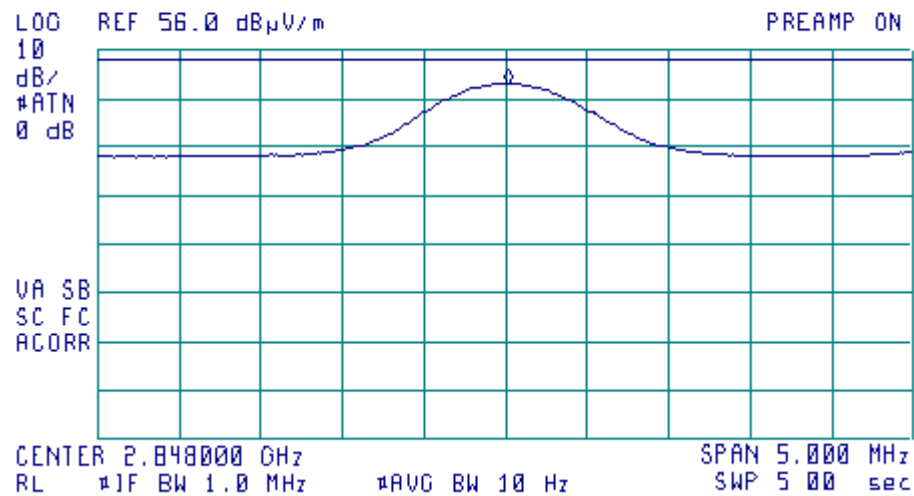


Plot A60

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

11:11:34 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.848013 GHz
49.05 dB μ V/m



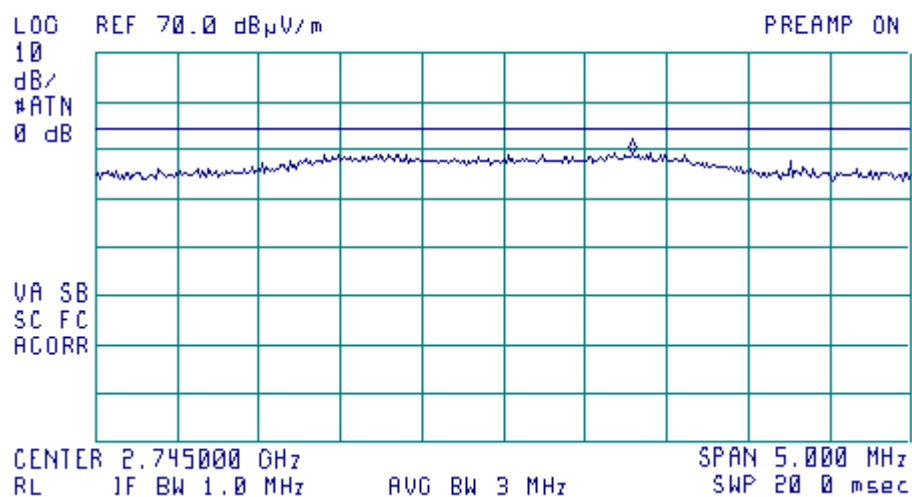


Plot A61

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

12:19:41 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.745700 GHz
49.40 dB μ V/m



The 3rd harmonic, peak value

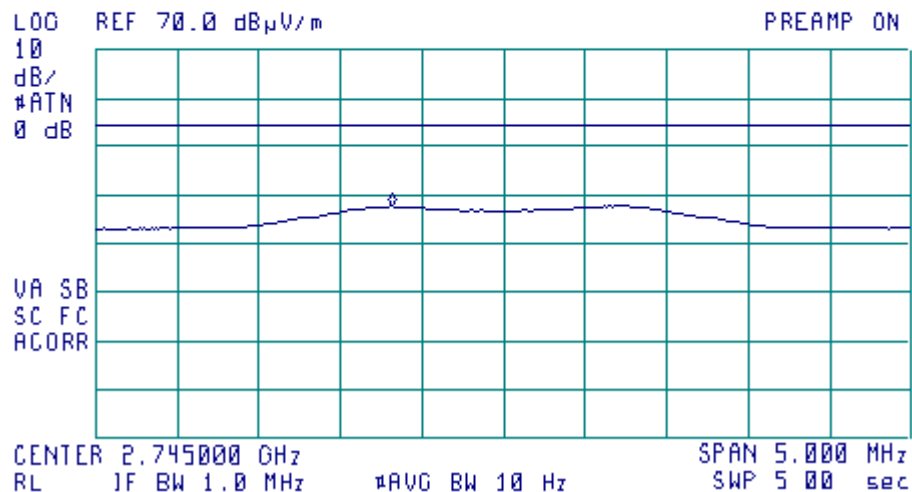


Plot A62

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

12:21:13 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.744313 GHz
37.57 dB μ V/m



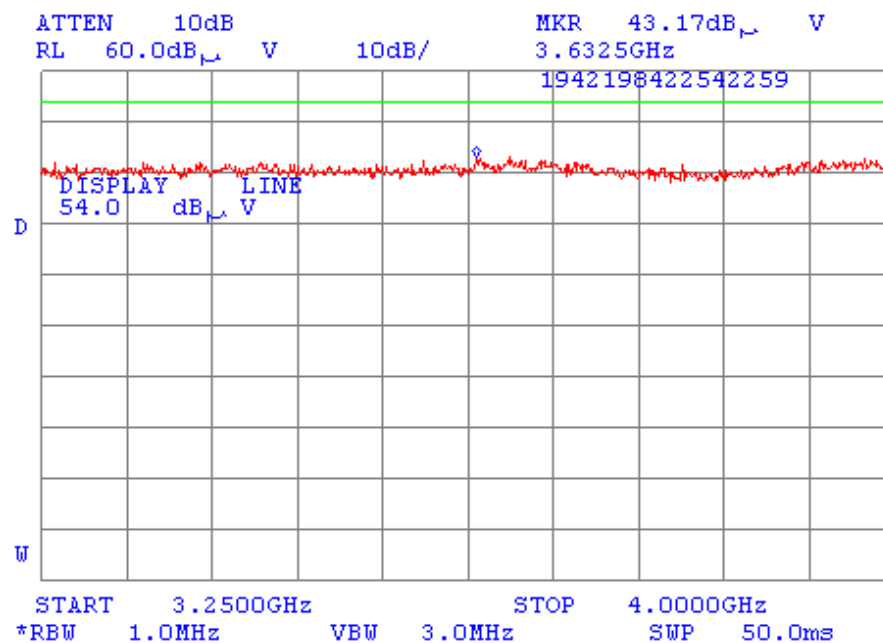
The 3rd harmonic, average value

Test result: measured value + average factor = 37.57 dB(μ V/m) – 11.84 dB = 25.73dB(μ V/m)



Plot A63

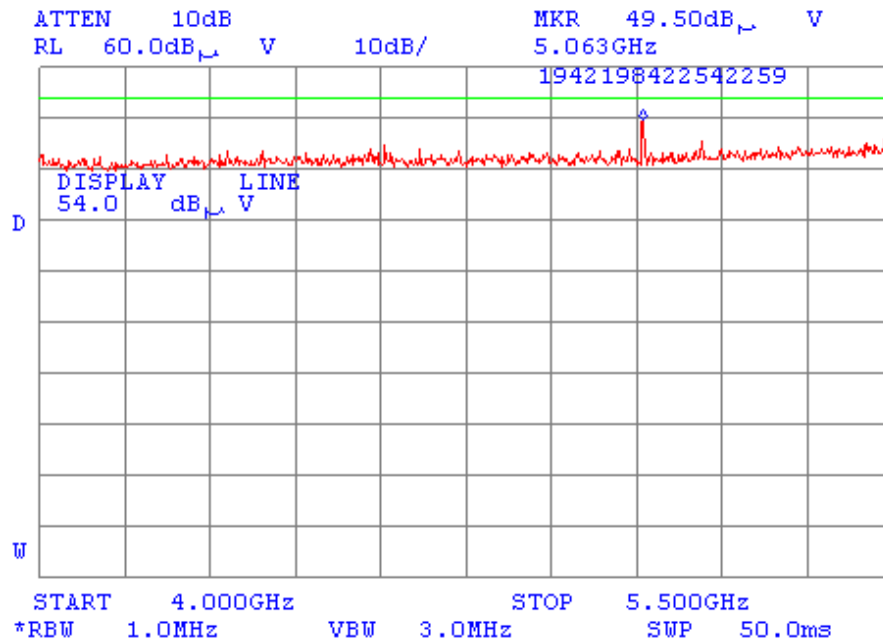
Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz





Plot A64

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

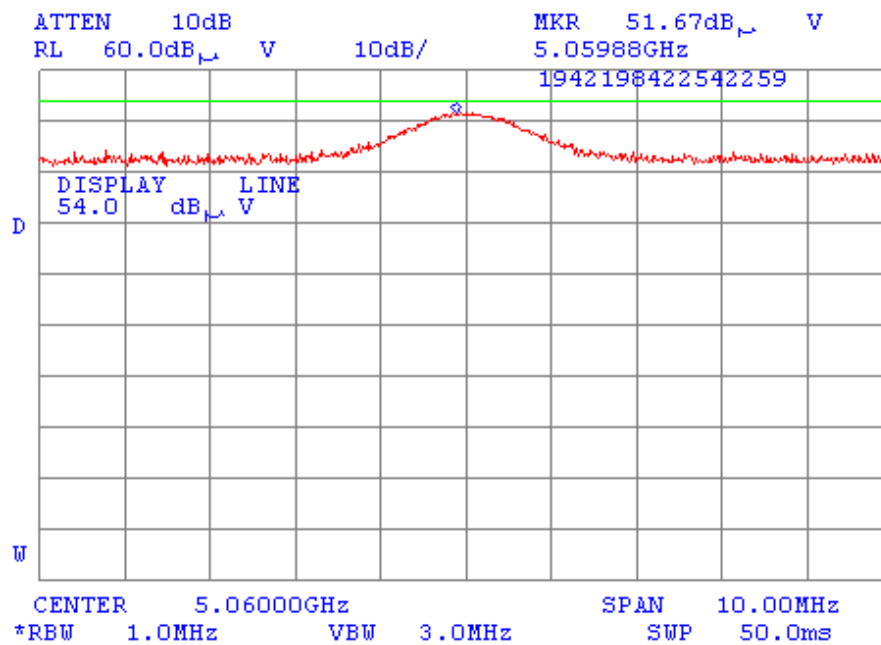


No other spurious except of the 4th harmonic of the LO.



Plot A65

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

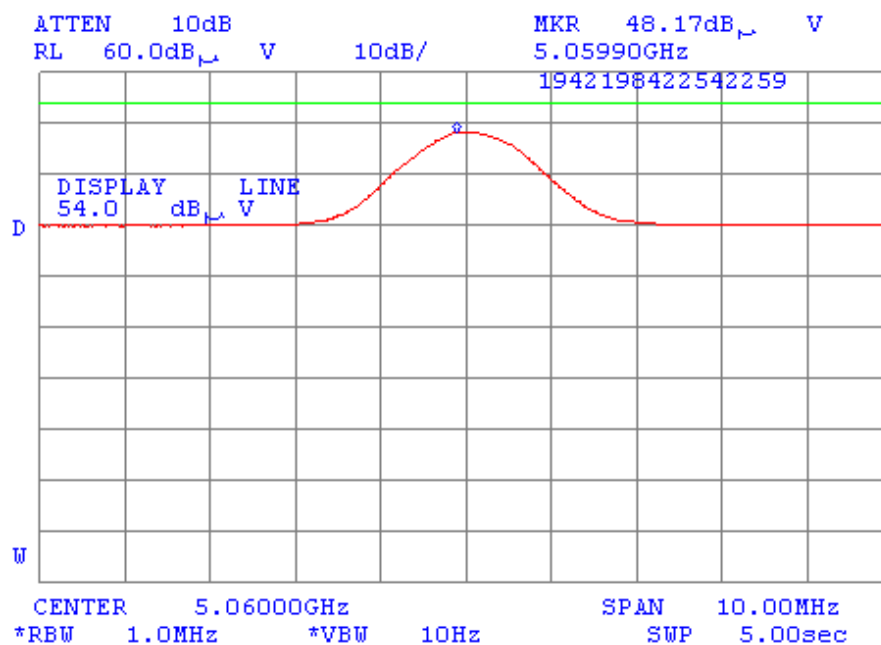


The 4th harmonic of the LO (915+350=1265 MHz)
Peak value.
Horizontal polarization



Plot A66

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz



The 4th harmonic of the LO (915+350=1265 MHz)

Average value.

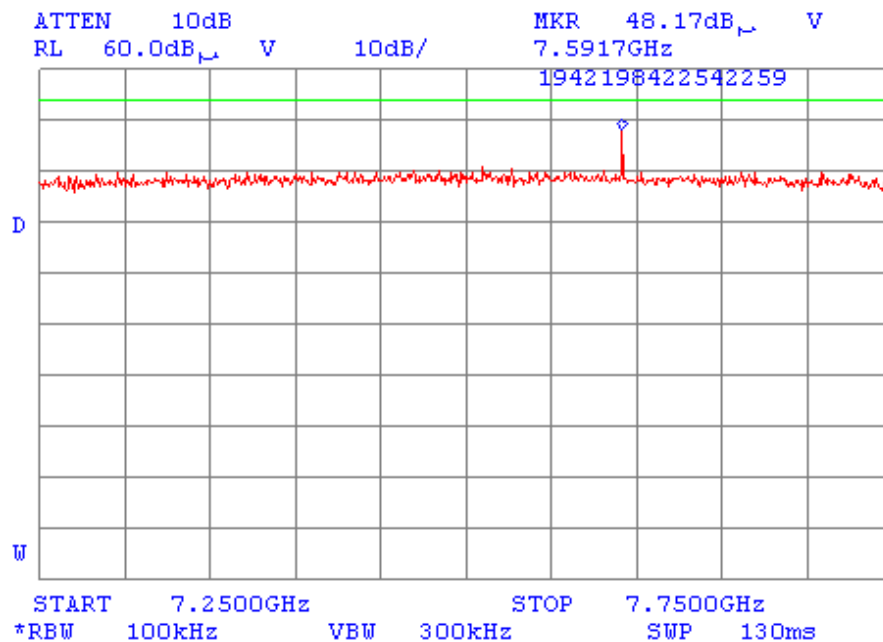
Horizontal polarization

Test result: measured value + average factor = 48.17 dB(μV/m) – 11.84 dB = 36.33 dB(μV/m)



Plot A67

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

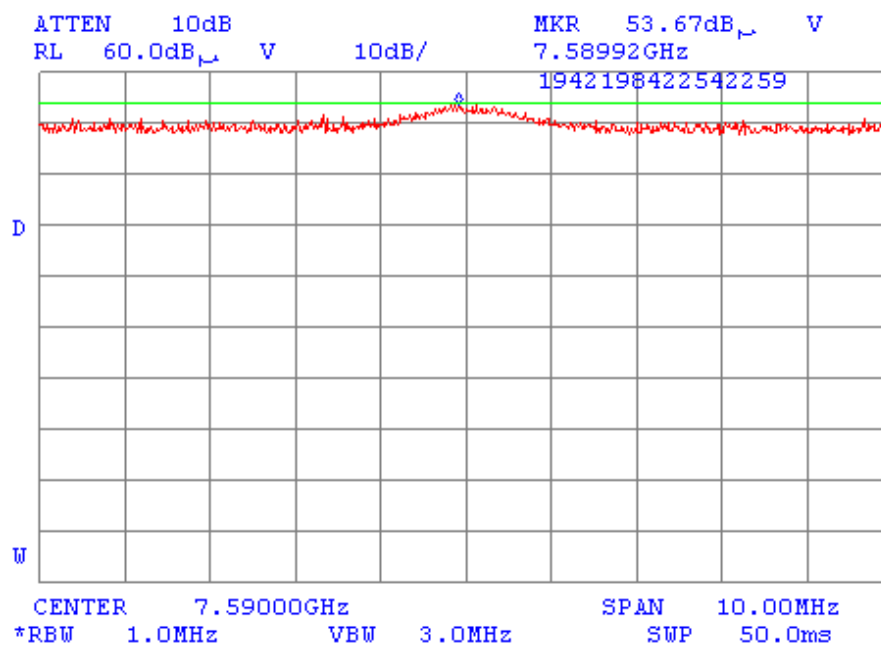


No other spurious except the 6th harmonic of the LO.



Plot A68

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz

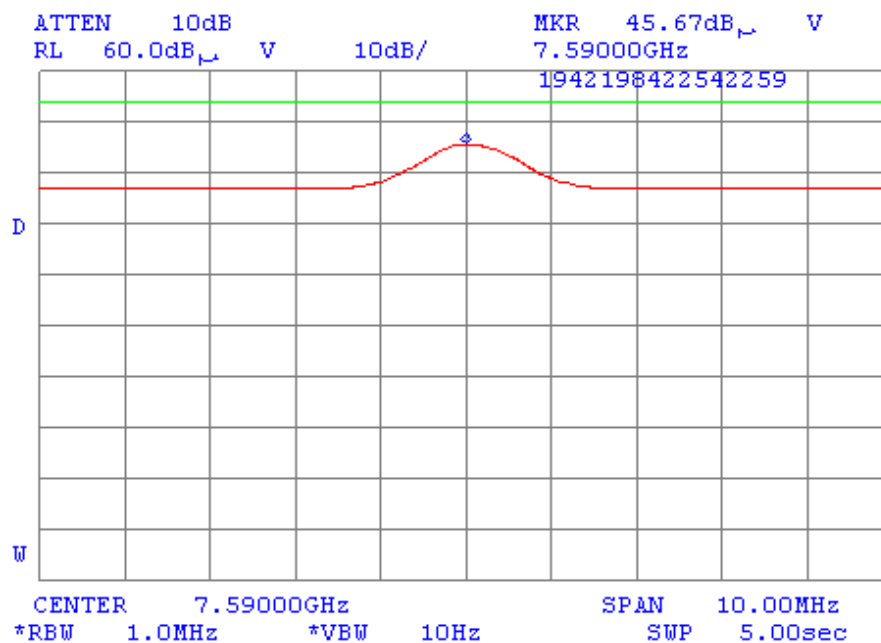


The 6th harmonic of the LO (915+350=1265 MHz)
Peak value.
Vertical polarization



Plot A69

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz



The 6th harmonic of the LO (915+350=1265 MHz)

Average value.

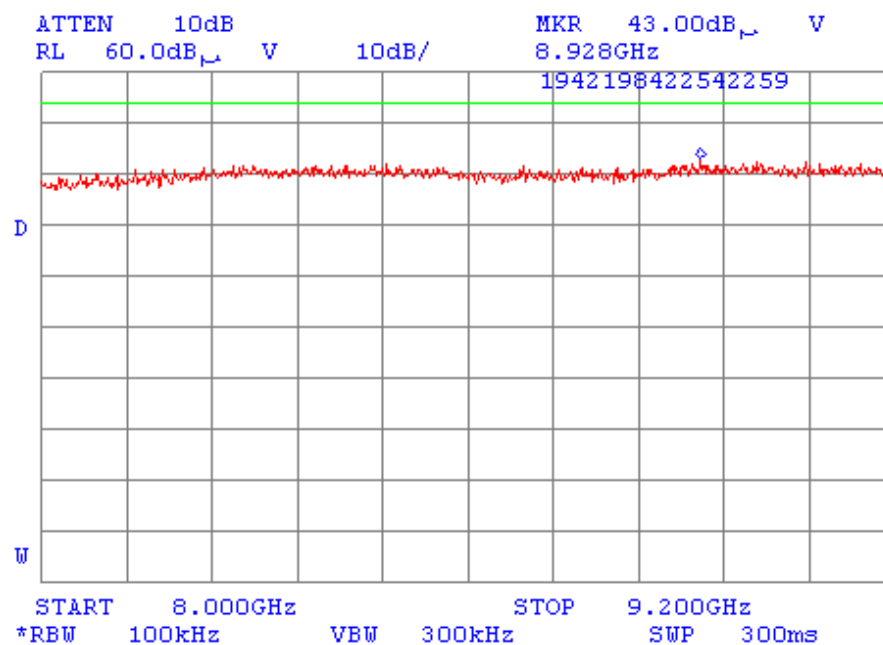
Vertical polarization

Test result: measured value + average factor = 45.67 dB(μV/m) – 11.84 dB = 33.83 dB(μV/m)



Plot A70

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 915 MHz



No spurious emissions were found.

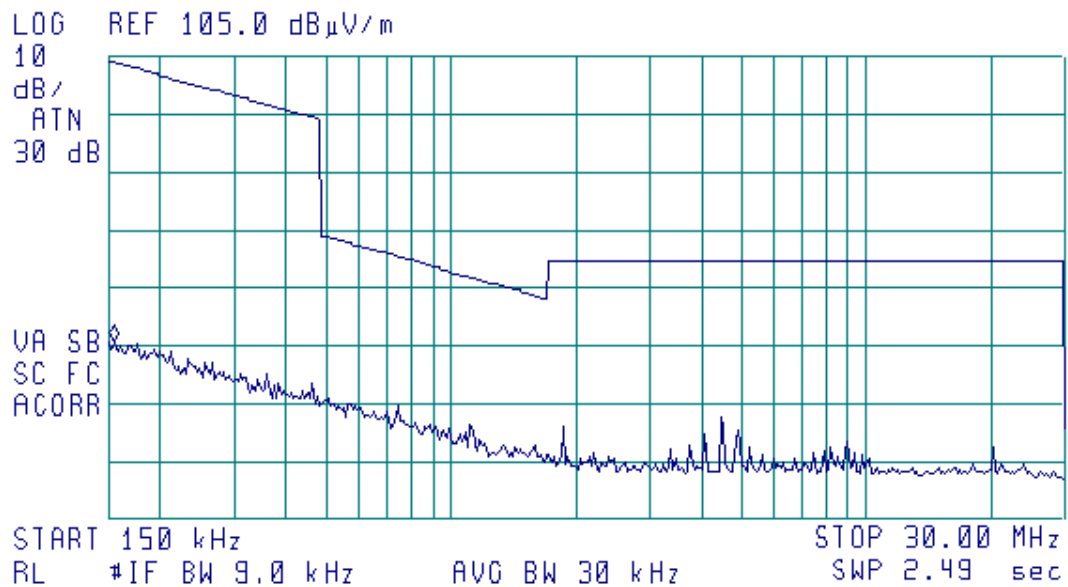


Plot A71

Radiated spurious emission measurements in the anechoic chamber from 150 kHz to 30 MHz,
carrier frequency 927 MHz

16:50:13 OCT 14, 2003

ACTU DET: PEAK
MEAS DET: PEAK QP AVG
MKR 150 kHz
55.67 dB μ V/m



No spurious emissions were found

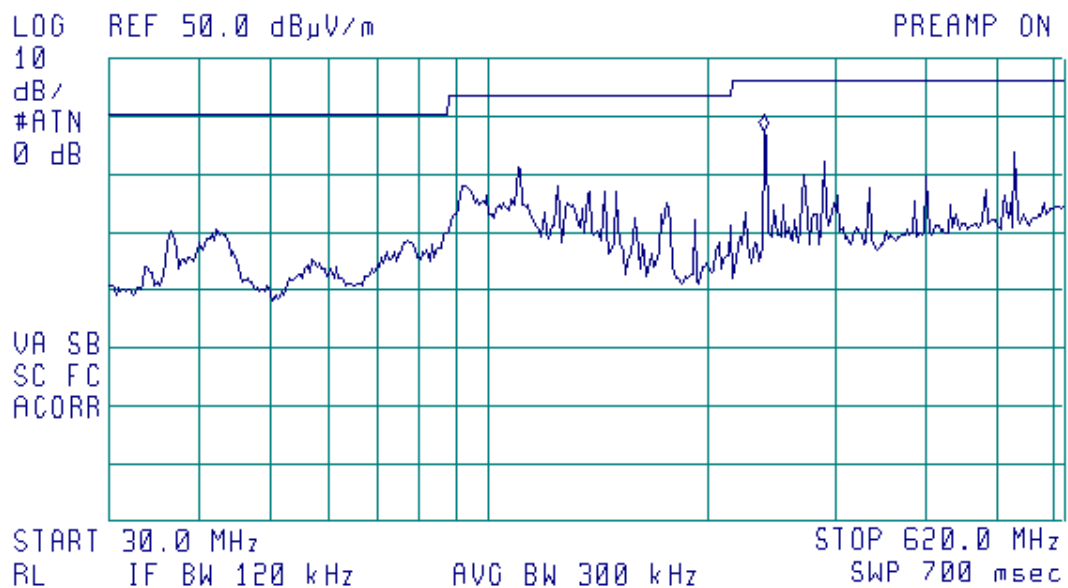


Plot A72

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 927 MHz

13:23:50 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 239.3 MHz
37.31 dB μ V/m





Plot A73

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 927 MHz

13:07:01 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 995.50 MHz
46.59 dB μ V/m

LOG REF 60.0 dB μ V/m

10

dB/

ATN

10 dB

VA SB

SC FC

ACORR

START 960.00 MHz

RL IF BW 120 kHz

AVG BW 300 kHz

STOP 1.00000 GHz

SWP 37.5 msec

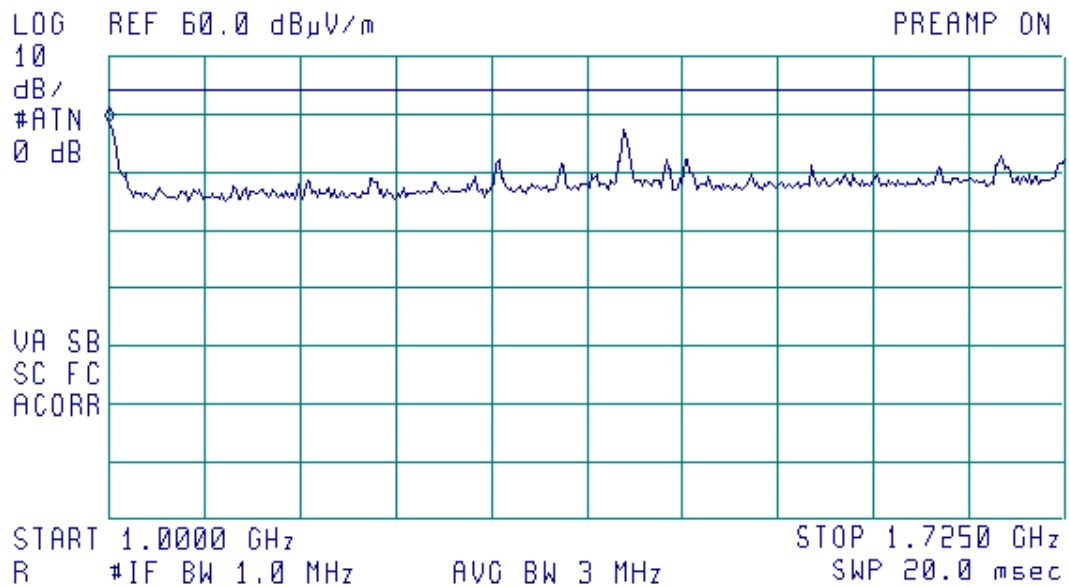


Plot A74

Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 927 MHz

15:51:25 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.0000 GHz
48.23 dB μ V/m





Plot A75

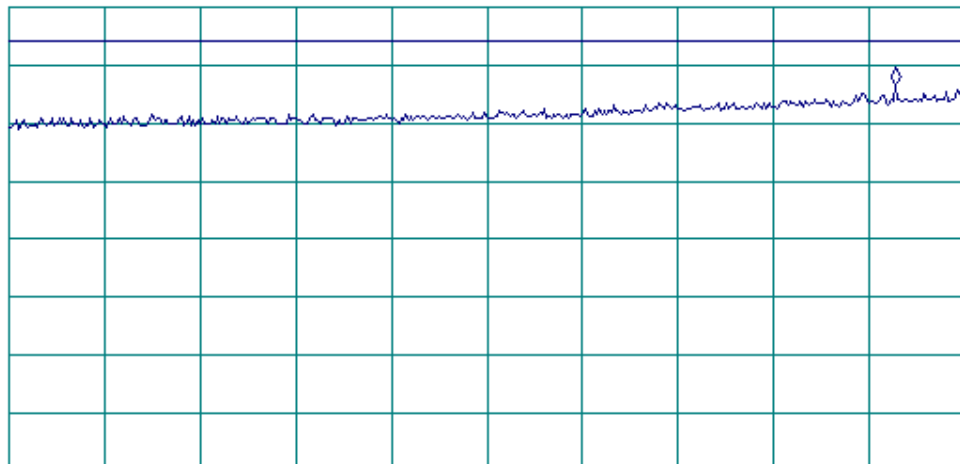
Radiated spurious emission measurements in the anechoic chamber in restricted bands,
carrier frequency 927 MHz

16:05:15 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.8493 GHz
46.57 dB μ V/m

LOG REF 60.0 dB μ V/m

10
dB/
#ATN
0 dB



START 2.2000 GHz

R #IF BW 100 kHz

AVG BW 300 kHz

STOP 2.9000 GHz

SWP 210 msec

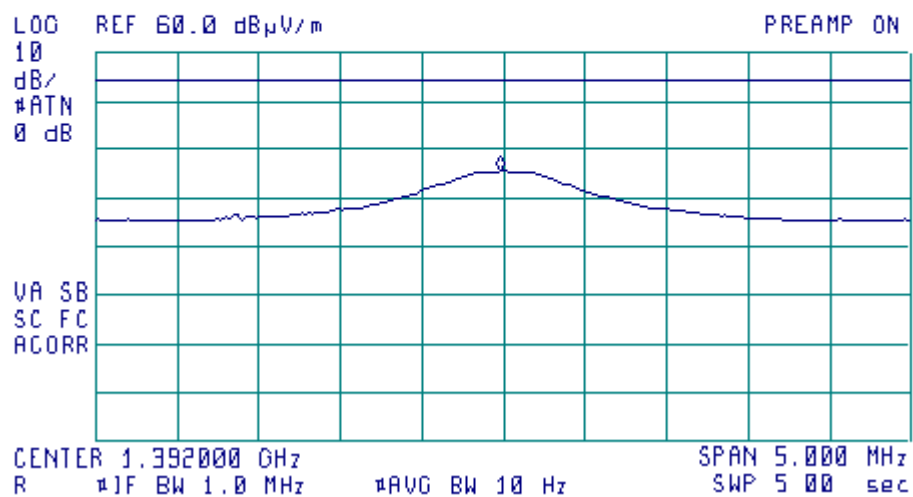


Plot A76

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 927 MHz

11:25:07 OCT 15, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.391975 GHz
35.57 dB μ V/m



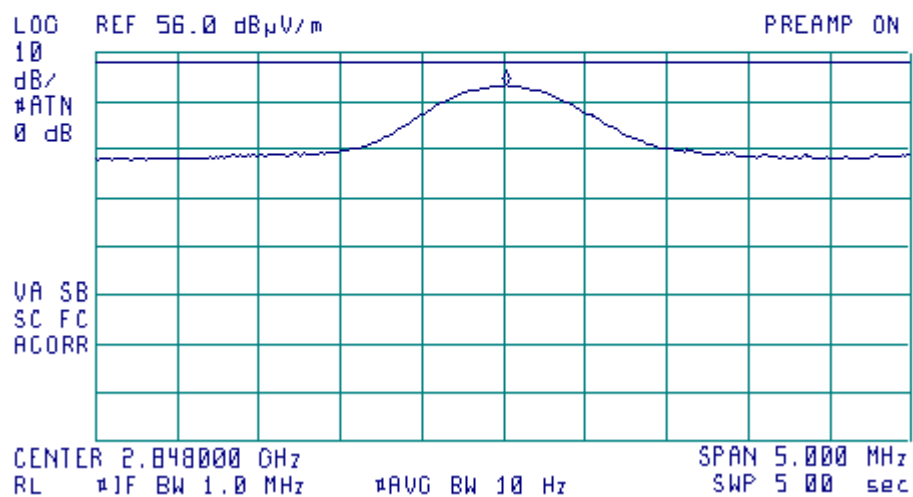


Plot A77

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 927 MHz

11:19:05 OCT 15, 2003

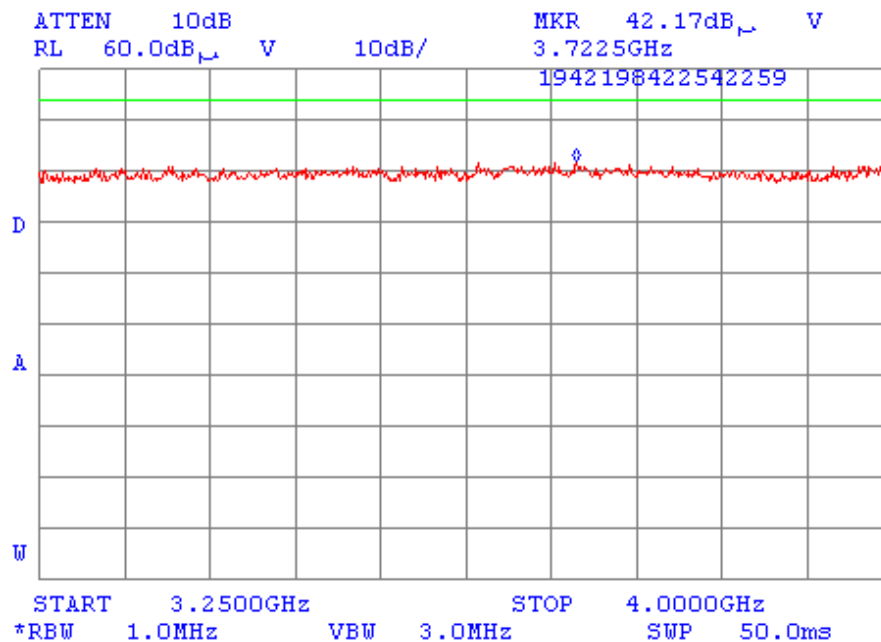
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.848013 GHz
49.12 dB μ V/m





Plot A78

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 927 MHz

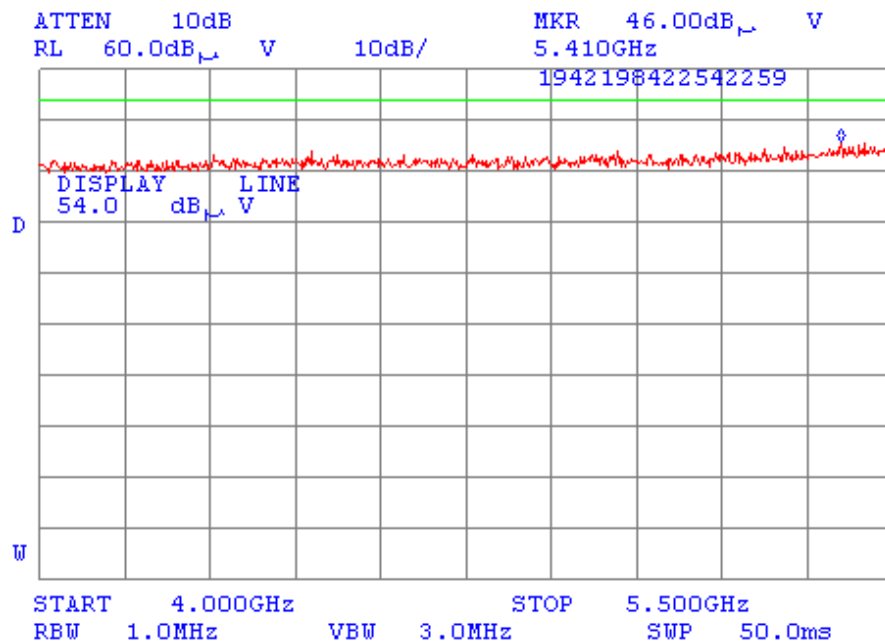


No spurious emissions were found.



Plot A79

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 927 MHz

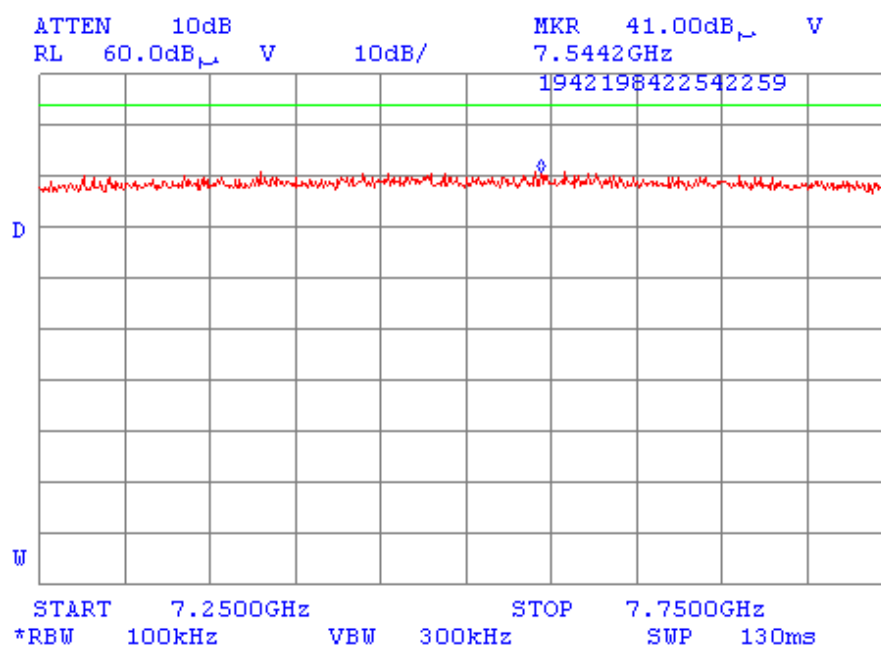


No spurious emissions were found.



Plot A80

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 927 MHz

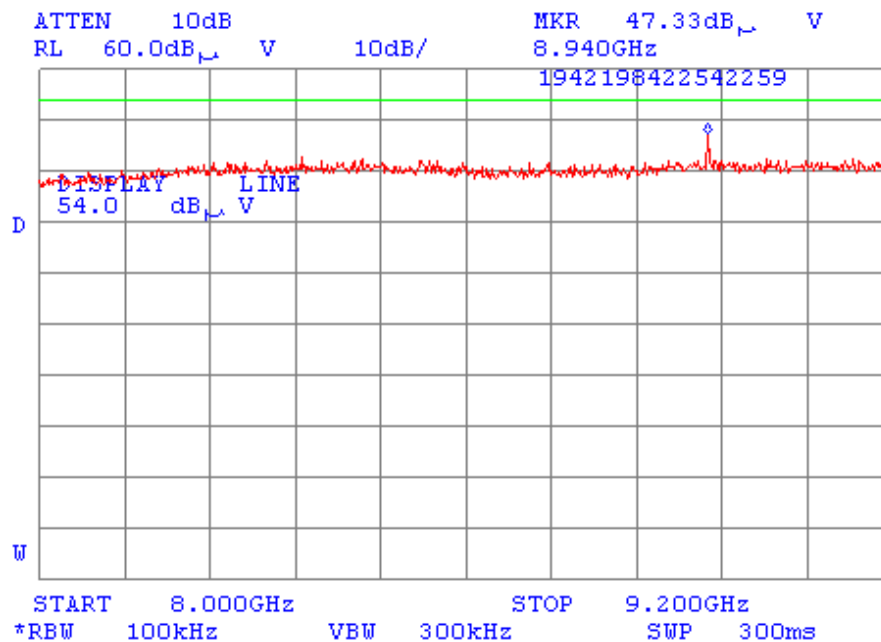


No spurious emissions were found.



Plot A81

Radiated spurious emission measurements at the OATS in restricted bands,
carrier frequency 927 MHz



The 7th harmonic of the LO-not restricted band
LO: 927 + 350 = 1277 (MHz)
1277 x 7 = 8939 (MHz)

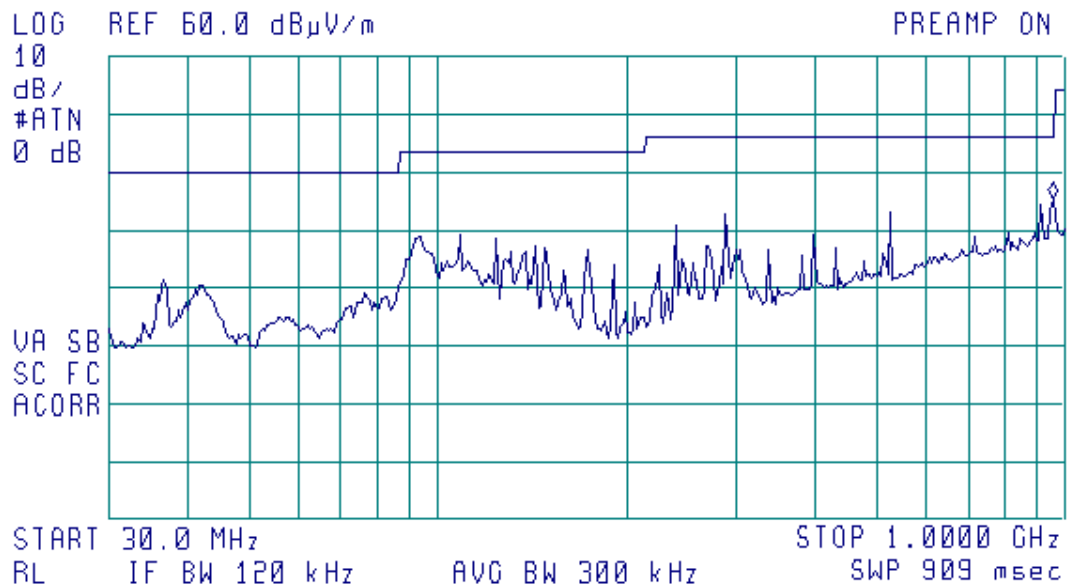


Plot A82

Radiated emission measurements in the anechoic chamber in receive mode

14:10:27 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 952.3 MHz
35.32 dB μ V/m



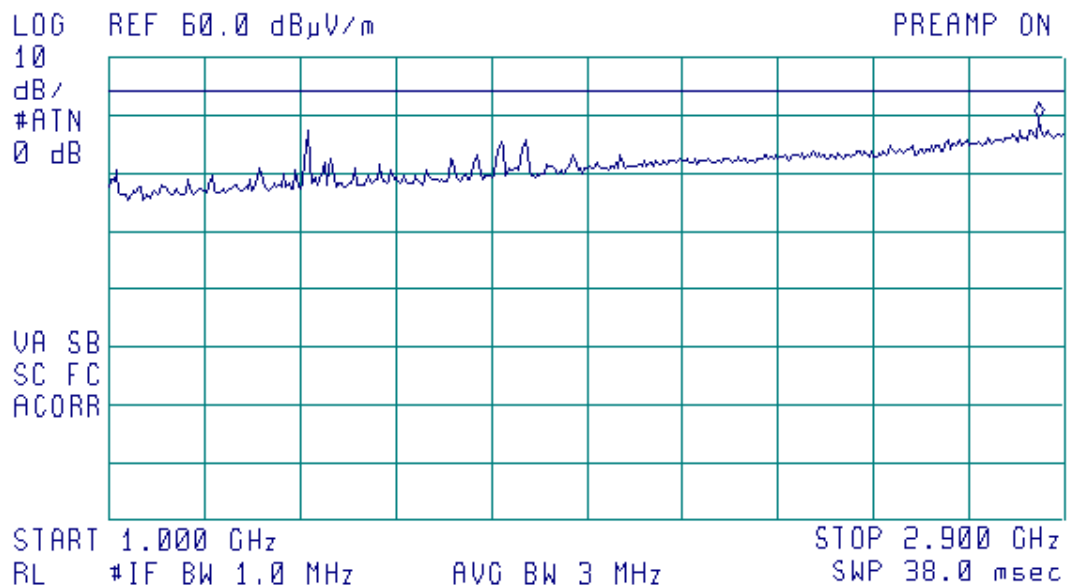


Plot A83

Radiated emission measurements in the anechoic chamber in receive mode

15:11:57 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.848 GHz
49.43 dB μ V/m



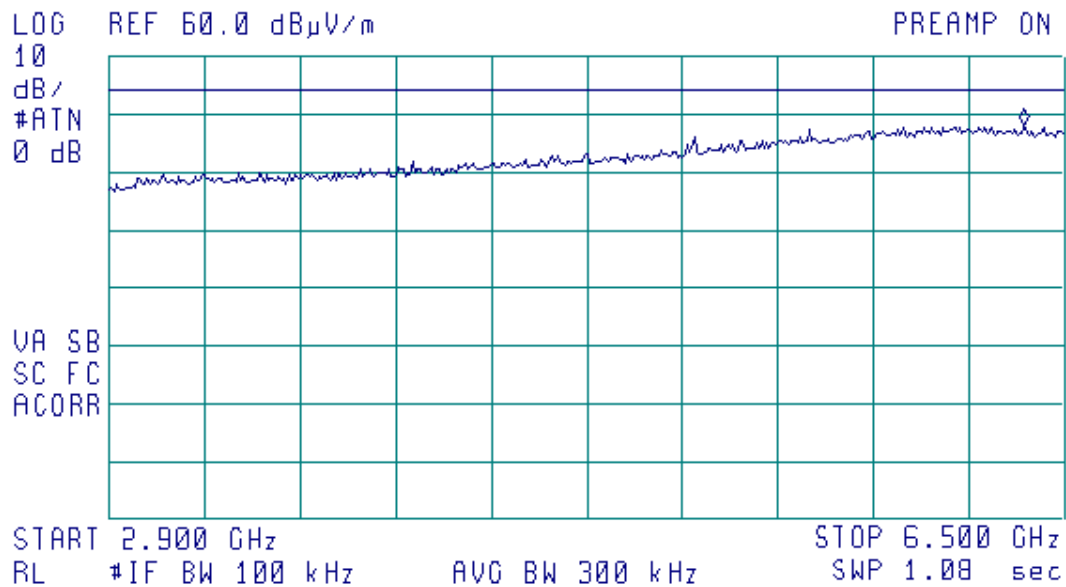


Plot A84

Radiated emission measurements in the anechoic chamber in receive mode

15:39:17 OCT 14, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 6.347 GHz
47.87 dB μ V/m





Plot A85

Conducted emission measurements at AC power line in receive mode

Line identification: Line 1
Limit: Quasi-peak, average

12:05:41 OCT 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 5.04 MHz
45.62 dB μ V/m

LOG REF 70.4 dB μ V/m

10
dB/
ATN
10 dB

PASS LIMIT

VA SB
SC FC
ACORR

START 150 kHz STOP 30.00 MHz
R #IF BW 9.0 kHz AVG BW 30 kHz SWP 2.49 sec



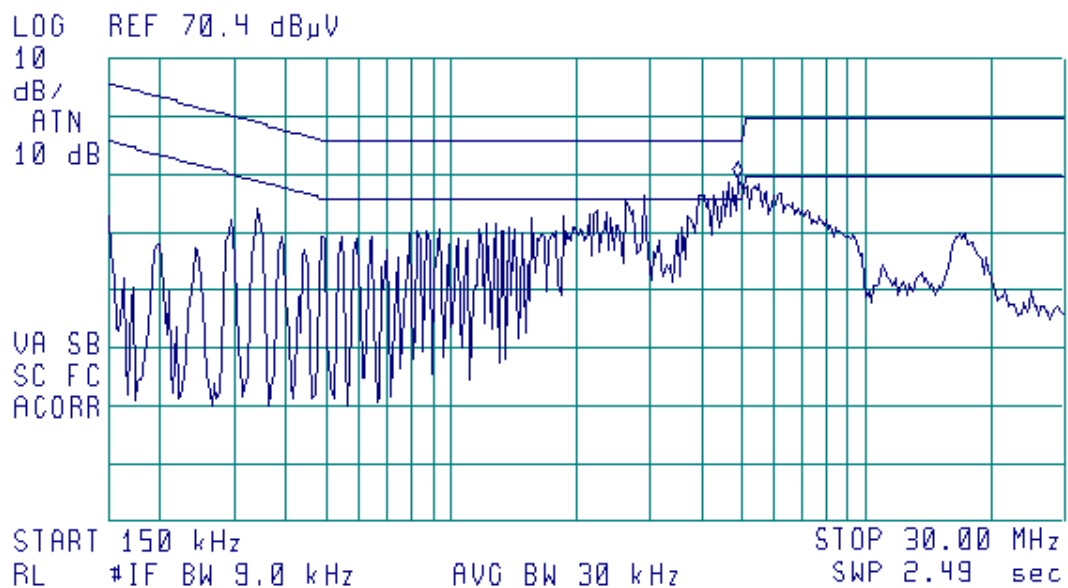
Plot A86

Conducted emission measurements at AC power line in receive mode

Line identification: Line 2
Limit: Quasi-peak, average

12:22:42 OCT 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 4.88 MHz
49.67 dB μ V





Plot A87

Conducted emission measurements at AC power line in transmit mode

Line identification: Line 1
Limit: Quasi-peak, average

12:45:12 OCT 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 4.88 MHz
49.57 dB μ V

LOG REF 70.4 dB μ V

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR

START 150 kHz STOP 30.00 MHz
RL IF BW 9.0 kHz AVG BW 30 kHz SWP 2.49 sec



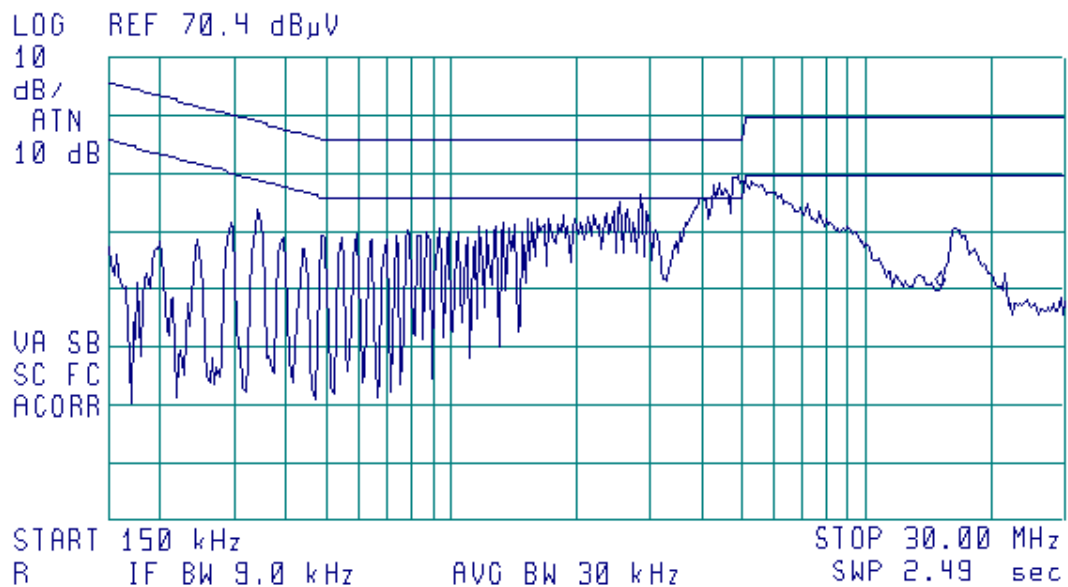
Plot A88

Conducted emission measurements at AC power line in transmit mode

Line identification: Line 2
Limit: Quasi-peak, average

12:37:15 OCT 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 14.99 MHz
30.55 dB μ V





Appendix B Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due calibration Month/ year
		Name	Model No.	Serial No.	
0038	Antenna Mast, 1-4 m	Hermon Labs	AM-1	028	2/04 check
0091	Position controller for antenna mast + turntable, OFTS	Hermon Labs	CRL-2	NA	4/04 check
0287	Turntable, motorized diameter, 2 m	Hermon Labs	TMD-2	042	11/04 check
0446	Active loop antenna 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/04
0447	LISN, 16/2, 300 V RMS	Hermon Labs	LISN 16-1	447	11/04
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/04
0466	Shielded room 3 (L) x 3 (W) x 2.4 (H) m	Hermon Labs	SR-1	024	11/04 check
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	7/04
0589	Cable coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	11/04
0592	Position controller	Hermon Labs	L2-SR3000	100	5/04 check
0593	Antenna Mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	AM-F1	101	2/04 check
0594	Turntable for Anechoic Chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	1/04 check
0604	Antenna biconilog log-periodic/T bow- tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/04
0787	Transient limiter	Hewlett Packard	11947A-8ZE	3107A01877	11/04
1003	Cable coaxial, M17/164, 10 m	Hermon Labs	C17164-10	161	11/04
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/03
1097	Attenuator, 50 Ohm, 2 W, DC to 8 GHz, 20 dB	Midwest Microwave	0793-20-NN- 07	1097	1/04
1200	Quadruplexer	Electronica	UE 84	0240	4/04 check
1205	One phase voltage regulator, 2kVA, 0- 250V	Hermon Labs	TDGC-2	109	6/04 check
1365	Cable coaxial, RG-214, 5 m	Hermon Labs	C214-5	1365	4/04
1424	Spectrum analyzer, 30 Hz - 40 GHz	Agilent Technologies	8564EC	3946A00219	8/04
1430	EMI receiver system, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3807A00262	9/04



HL Serial No.	Description	Manufacturer information			Due calibration Month/ year
		Name	Model No.	Serial No.	
1503	Cable RF, 6 m	Belden	M17/167 MIL-C-17	NA	9/04 check
1651	Attenuators set (2, 3, 5, 20 dB), DC – 18 GHz	M/A –COM	2082	1651	3/04
1942	Cable 18 GHz, 4 m, blue	Rhophase Microwave Ltd	SPS-1803A- 4000-NPS	T4658	10/04
1947	Cable 18 GHz, 6.5 m, blue	Rhophase Microwave Ltd	NPS-1803A- 6500-NPS	T4974	10/04
1984	Antenna, double ridged waveguide horn, 1-18 GHz, 300W, N-type	EMC Test Systems	3115	9911-5964	3/04
2009	Cable RF, 8 m	Alpha Wire	RG-214	2009	12/03
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A- 800-KPS	W4907	11/04
2259	Amplifier low noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	11/04
2399	Cable 40 GHz, 1.5 m, blue	Rhophase Microwave Ltd.	KPS-1503A- 1500-KPS	X2945	6/04



Appendix C Test equipment correction factors

**Antenna factor
Active Loop Antenna
Model 6502
S/N 2857**

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

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



**Antenna factor,
biconilog antenna EMCO, model 3141,
serial number1011 (HL 0604)**

Frequency, MHz	Antenna factor, dB(1/m)
26	7.8
28	7.8
30	7.8
40	7.2
60	7.1
70	8.5
80	9.4
90	9.8
100	9.7
110	9.3
120	8.8
130	8.7
140	9.2
150	9.8
160	10.2
170	10.4
180	10.4
190	10.3
200	10.6
220	11.6
240	12.4
260	12.8
280	13.7
300	14.7
320	15.2
340	15.4
360	16.1
380	16.4
400	16.6
420	16.7
440	17.0
460	17.7
480	18.1
500	18.5
520	19.1
540	19.5
560	19.8
580	20.6
600	21.3
620	21.5
640	21.2
660	21.4
680	21.9
700	22.2
720	22.2
740	22.1
760	22.3
780	22.6
800	22.7
820	22.9
840	23.1
860	23.4
880	23.8
900	24.1
920	24.1

Frequency, MHz	Antenna factor, dB(1/m)
940	24.0
960	24.1
980	24.5
1000	24.9
1020	25.0
1040	25.2
1060	25.4
1080	25.6
1100	25.7
1120	26.0
1140	26.4
1160	27.0
1180	27.0
1200	26.7
1220	26.5
1240	26.5
1260	26.5
1280	26.6
1300	27.0
1320	27.8
1340	28.3
1360	28.2
1380	27.9
1400	27.9
1420	27.9
1440	27.8
1460	27.8
1480	28.0
1500	28.5
1520	28.9
1540	29.6
1560	29.8
1580	29.6
1600	29.5
1620	29.3
1640	29.2
1660	29.4
1680	29.6
1700	29.8
1720	30.3
1740	30.8
1760	31.1
1780	31.0
1800	30.9
1820	30.7
1840	30.6
1860	30.6
1880	30.6
1900	30.6
1920	30.7
1940	30.9
1960	31.2
1980	31.6
2000	32.0

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



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

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

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



Correction factor
Line impedance stabilization network
Model LISN 16 - 1
Hermon Laboratories

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

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

**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		±0.17
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		
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, M17/164, model: C17164-10, s/n 161, HL 1003

No.	Frequency, MHz	Cable loss, dB	Tolerance, dB	Measurement uncertainty, dB
1	30	0.41	12.5	±0.12
2	50	0.52		
3	100	0.75		
4	300	1.45		
5	500	2.01		
6	800	2.71		
7	1000	3.14		
8	1200	3.56		
9	1400	3.93		
10	1600	4.31		
11	1800	4.63		
12	2000	4.97		
13	2200	5.32		
14	2400	5.65		
15	2600	6.01		
16	2800	6.42	12.5	±0.12
17	3000	6.76		
18	3300	7.12		
19	3600	7.53		
20	3900	7.95		
21	4200	8.32		±0.17
22	4500	8.72		
23	4800	9.14		
24	5100	9.59		
25	5400	10.00		
26	5700	10.49		
27	6000	11.07		
28	6500	11.80		



Cable loss
Cable coaxial, RG-214, 5m, model: C214-5, s/n 1365 (HL 1365)

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



Cable loss
Cable coaxial, 6 m, model: M17/167 MIL-C-17, HL 1503

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 18 GHz, 4 m, blue, model: SPS-1803A-4000-NPS, S/N T4658, HL 1942**

Frequency, GHz	Cable loss, dB
0.03	0.21
0.05	0.26
0.10	0.36
0.20	0.50
0.30	0.61
0.40	0.70
0.50	0.78
0.60	0.85
0.70	0.93
0.80	0.99
0.90	1.04
1.00	1.10
1.10	1.16
1.20	1.22
1.30	1.26
1.40	1.31
1.50	1.35
1.60	1.41
1.70	1.45
1.80	1.49
1.90	1.53
2.00	1.57
2.10	1.61
2.20	1.65
2.30	1.69
2.40	1.72
2.50	1.76
2.60	1.79
2.70	1.83
2.80	1.87
2.90	1.90
3.10	1.97
3.30	2.04
3.50	2.11
3.70	2.18
3.90	2.24
4.10	2.31
4.30	2.38
4.50	2.43
4.70	2.53
4.90	2.53
5.10	2.63
5.30	2.65
5.50	2.72
5.70	2.76
5.90	2.79

Frequency, GHz	Cable loss, dB
6.10	2.88
6.30	2.90
6.50	2.97
6.70	3.02
6.90	3.04
7.10	3.07
7.30	3.12
7.50	3.13
7.70	3.19
7.90	3.24
8.10	3.30
8.30	3.36
8.50	3.45
8.70	3.41
8.90	3.45
9.10	3.42
9.30	3.55
9.50	3.48
9.70	3.58
9.90	3.61
10.10	3.66
10.30	3.68
10.50	3.70
10.70	3.70
10.90	3.75
11.10	3.78
11.30	3.86
11.50	3.98
11.70	4.10
11.90	4.12
12.10	4.09
12.40	4.13
13.00	4.23
13.50	4.35
14.00	4.40
14.50	4.44
15.00	4.57
15.50	4.66
16.00	4.64
16.50	4.66
17.00	4.75
17.50	4.85
18.00	4.93

**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, serial number 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, Rhopase 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



Appendix D General information

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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Abbreviations and acronyms

The following abbreviations and acronyms are applicable to this test report:

AC	alternating current
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
DSS	Part 15 spread spectrum transmitter
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
m	meter
MHz	megahertz
NA	not applicable
QP	quasi-peak
RF	radio frequency
RE	radiated emission
rms	root mean square
s	second
V	volt
W	width

Specification references

47CFR part 15: 2003	Radio Frequency Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2001	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.