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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:

Subscriber premises radio unit
Model: SPR 5.8 GHz TDD

Document ID: AIRRAD_FCC.15528_1.doc
Date of Issue: July 2003

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Contents

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1 Project information

EUT attributes

Test item	Subscriber premises radio unit
Equipment serial number	079A350005
Type (Model)	SPR 5.8 GHz TDD
Software revision of radio unit	2.59
Hardware revision of the unit	A0
Equipment FCC code	DSS

Applicant information

Applicant's responsible person	Mr. Zion Levi, compliance & testing engineer
Applicant/Manufacturer	Airspan Networks (Israel) Ltd.
Address	1, Hamelacha street
City	Lod
Postal code	71293
Country	Israel
Telephone number	+972 8 9777 046
Telefax number	+972 8 9777 080

Test details

Project number	15528
Location	Hermon Laboratories
Receipt date	June 15, 2003
Test started	June 15, 2003
Test completed	July 8, 2003
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specifications	47CFR Part 15, §15.247 and subpart B

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2 Summary of tests

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.

Parameter	Subclause	Tested by	Date tested	Verdict	Remarks
Transmitter characteristics, §15.247					
Frequency hopping system					
Occupied bandwidth of hopping channel	(a)(1) (i – iii)	Mrs. E. Pitt, test engineer	June 15, 2003	Pass	
Hopping channels frequency separation	(a)(1)	Mrs. E. Pitt, test engineer	June 15, 2003	Pass	
Number of hopping channels	(a)(1) (i – iii)	Mrs. E. Pitt, test engineer	June 15, 2003	Pass	
Average time of occupancy	(a)(1) (i – iii)	Mrs. E. Pitt, test engineer	June 15, 2003	Pass	
Maximum peak output power	b(1), b(2), b(3)	Mrs. E. Pitt, test engineer	June 15, 2003	Pass	
Spurious emissions (conducted)	c	Mrs. E. Pitt, test engineer	June 15, July 1, 2003	Pass	
Spurious emissions (radiated) in restricted bands	15.209, 15.205(a,c)	Mrs. E. Pitt, test engineer	June 16, 2003	Pass	
Conducted emission on AC power line	15.207	Mrs. E. Pitt, test engineer	July 1, 2003	Pass	
Hybrid system					
Peak power spectral density at frequency hopping operation turned off	f	Mrs. E. Pitt, test engineer	July 8, 2003	Pass	
Average time of occupancy at frequency hopping operation turned on	f	Mrs. E. Pitt, test engineer	July 8, 2003	Pass	
Maximum peak output power at frequency hopping operation turned off		Mrs. E. Pitt, test engineer	July 8, 2003	Pass	

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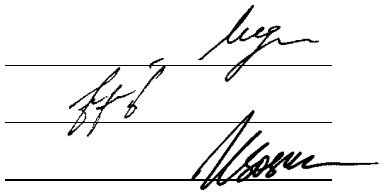
Parameter	Subclause	Tested by	Date tested	Verdict	Remarks
Minimum channel separation		Mrs. E. Pitt, test engineer	July 8, 2003	Pass	
Spurious emissions (conducted)	c	Mrs. E. Pitt, test engineer	July 8, 2003	Pass	
Spurious emissions (radiated) in restricted bands	15.209, 15.205(a,c)	Mrs. E. Pitt, test engineer	June 16, 2003	Pass	Tested in hopping mode (worst case)
Unintentional radiation, §15.107, §15.109					
Conducted emissions	15.107	Mrs. E. Pitt, test engineer	July 1, 2003	Pass	Tested in Tx mode
Radiated emissions	15.109	Mrs. E. Pitt, test engineer	June 16, 2003	Pass	Tested in Tx mode

Test report prepared by: Mrs. V. Mednikov, certification engineer

Test report approved by: Mr. M. Nikishin, MSc, EMC group leader

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



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3 EUT description

3.1 General description

A subscriber premises radio, SPR 5.8 GHz TDD, is a part of a broadband fixed cellular wireless access system WipLL. 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 an outdoor unit comprising two modes of operation:

1) frequency hopping:

OR

2) hybrid system (digital modulation with frequency hopping) .

The transceiver operates in 5726 MHz to 5849 MHz range and is equipped with an 16 dBi gain flat plane internal antenna.

The SPR is connected to a subscriber data adapter (SDA), which provides also 48 V DC power.

3.2 EUT test configuration

EUT operating frequencies generated by clocks and oscillators are provided in Table 3.2.1 and system/test configuration is shown in Figures 3.2.1, 3.2.2.

Table 3.2.1

EUT operating frequencies

Frequency	Description	
	BSR/ SPR RF board	BSR/SPR digital board
5726 MHz to 5849 MHz -operating frequency	■	
20 MHz - clock		■
5376 MHz to 5499 MHz - LO	■	
350 MHz - IF	■	
48 MHz - clock		■
356 MHz – LO	■	
6 MHz - IF	■	

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Figure 3.2.1

General WipLL system configuration

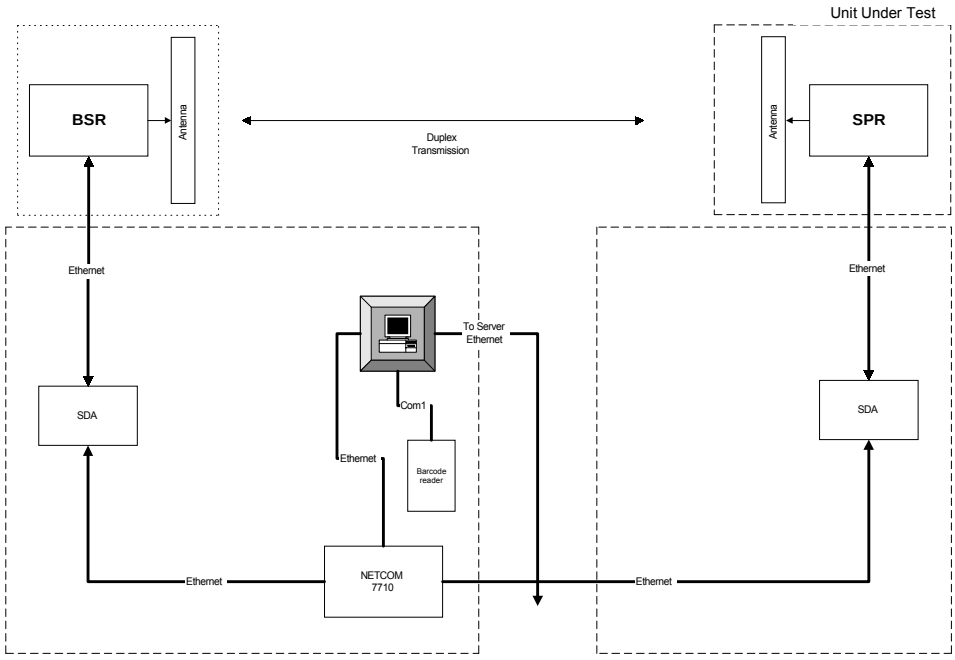
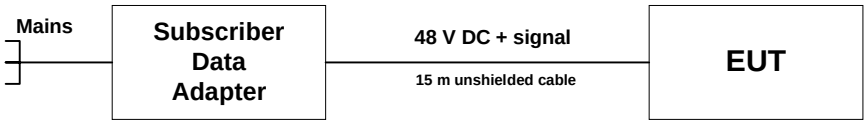


Figure 3.2.2

EUT test configuration for conducted emission at AC line measurements



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3.3 Transmitter description

a) Frequency hopping mode

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)					
	Other:					
Operating frequency range	5726 - 5849 MHz					
Spread spectrum technique used						
X	Frequency hopping (FHSS)					
	Digitally modulated					
	Combined					
Spread spectrum parameters						
Dig. Mod.	chip sequence length (bits)					
	spectrum width (MHz)					
FHSS	total number of hops (units)	79				
	dwell time (milliseconds)	360				
	bandwidth per hop (MHz)	1				
	max. separation of hops (MHz)	1				
Transmitter aggregate data rate (bits per second)			1, 2, 3 Mbit/s			
Normal test signal			PRBS			
Maximum rated output power						
At transmitter permanent external 50 Ω rf output connector (dBm)			20			
Effective radiated power (for equipment with integral antenna) (dBm)						
Is transmitter output power variable?	**X**	No				
		Yes		continuous variable		
				stepped variable		
				stepsize (dB):.....		
				minimum RF power (dBm):.....		
				maximum RF power (dBm):.....		
Transmitter power source						
	Battery	**Nominal rated voltage (VDC)**	**X**			
	Nickel Cadmium					
	Lithium					
	Other					
	DC	**Nominal rated voltage (VDC)**	48			
	AC mains	**Nominal rated voltage (VAC)**				
Is there common power source for transmitter and receiver			X	yes		no

Antenna technical characteristics						
			Type	**Manufacturer**	**Model number**	**Gain**
Integral	X	with temporary RF connector	Flat panel	Airspan OEM	NA	16
		without temporary RF connector				
External						

External antenna connection - NA			
	standard connector		unique coupling

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b) Hybrid mode

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)				
	Other:				
Operating frequency range	5726 - 5849 MHz				
Spread spectrum technique used					
	Frequency hopping (FHSS)				
	Digitally modulated				
X	Combined				
Spread spectrum parameters					
Dig. Mod.	chip sequence length (bits)				
	spectrum width (MHz)				
FHSS	total number of hops (units)	61			
	dwell time (milliseconds)	380			
	bandwidth per hop (MHz)	1.5			
	max. separation of hops (MHz)	2			
Transmitter aggregate data rate (bits per second)		1.33 and 4 Mbit/s			
Normal test signal		PRBS			
Maximum rated output power					
At transmitter permanent external 50 Ω rf output connector (dBm)		18			
Effective radiated power (for equipment with integral antenna) (dBm)					
Is transmitter output power variable?	**X**	No			
		Yes		continuous variable	
				stepped variable	
				stepsize (dB):.....	
				minimum RF power (dBm):.....	
				maximum RF power (dBm):.....	
Transmitter power source					
	Battery	**Nominal rated voltage (VDC)**	**X**		
	Nickel Cadmium				
	Lithium				
	Other				
	DC	**Nominal rated voltage (VDC)**	48 V		
	AC mains	**Nominal rated voltage (VAC)**			
Is there common power source for transmitter and receiver			X	yes	no

Antenna technical characteristics						
			Type	**Manufacturer**	**Model number**	**Gain**
Integral	X	with temporary RF connector	Flat panel	Airspan OEM	NA	16
		without temporary RF connector				
External						
External antenna connection - NA						
	standard connector			unique coupling		

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4 Test results

4.1 Occupied bandwidth of hopping channels and channel carrier frequencies separation according to § 15.247(a)(1)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.7
DATE: June 15, July 8, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 5725-5850 MHz
MODULATION TECHNIQUE: FHSS/hybrid

Hopping mode, data rate 1 Mbit/s; 2 Mbit/s; 3 Mbit/s

Carrier frequency, MHz	Measured 20 dB bandwidth, kHz	Reference to Plots in Appendix A
5.726	990	A1
5.800	990	A2
5.849	975	A3
Measurement uncertainty, dB	± 2.3	

Frequency, MHz	Channel carrier frequency separation, MHz	Reference to Plots in Appendix A
Near the upper band edge	1.000	A4
Near the lower band edge	1.017	A5
Measurement uncertainty, dB	± 2.3	

Hybrid

Carrier frequency, MHz	Data rate, Mbit/s	Measured 20 dB bandwidth, MHz	Reference to Plots in Appendix A
5.726	4	1.533	A6
5.726	1.33	1.500	A7
Measurement uncertainty, dB	± 2.3		

Frequency, MHz	Channel carrier frequency separation, MHz	Reference to Plots in Appendix A
In the middle of the band	2.00	A8
Measurement uncertainty, dB	± 2.3	

TEST EQUIPMENT USED:

HL 1424	HL 1650	HL 1651	HL 2254			

LIMIT

Operating frequency range, MHz	Allowed bandwidth	Channel carrier frequency separation (minimum)
902-928, hopping	≤ 500 kHz @ 20 dBc	25 kHz or 20 dB bandwidth, which is greater
2400-2483.5; 5725-5850, hopping	≤ 1 MHz @ 20 dBc	
2400-2483.5, hopping	> 1 MHz @ 20 dBc	
Hybrid	any admissible	

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.

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4.2 Number of hopping channels according to § 15.247(a)(1)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE: June 15, July 8, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 5725-5850 MHz
MODULATION TECHNIQUE: FHSS/hybrid

Hopping mode

Occupied frequency range	Measured 20 dB bandwidth, kHz	Number of channels	Reference to Plots in Appendix A
5726 - 5849	990	124*	A9 to A13

* According to customer declaration, only 79 channels (randomly chosen and factory programmed for each particular system) will be used for transmission.

Hybrid mode

Occupied frequency range	Measured 20 dB bandwidth, kHz	Number of channels	Reference to Plots in Appendix A
5726 - 5849	1500	61	A14

TEST EQUIPMENT USED:

HL 1424	HL 1650	HL 1651	HL 2254			

LIMIT

Operating frequency range, MHz	20 dB bandwidth	Number of frequencies
902-928, hopping	< 250 kHz	≥ 50
	≥ 250 kHz	≥ 25
2400-2483.5; 5725-5850, hopping	≤ 1 MHz	≥ 75
2400-2483.5, hopping	> 1 MHz	≥ 15 non-overlapping channels with total span ≥ 75 MHz
Hybrid	No requirements	

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.

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4.3 Average time of hopping frequency occupancy according to § 15.247(a)(1), (f)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE: June 15, July 8, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 5725-5850 MHz
MODULATION TECHNIQUE: FHSS/hybrid

Hopping mode

Carrier frequency, MHz	Total time of 1 transmission at one frequency	Tx ON of 1 transmission at one frequency	Average time of occupancy during 30 s period	Reference to Plots in Appendix A
5800	52 ms	49.5 ms	362 ms	A15, A16
Measurement uncertainty, ppm		± 0.21		

Hybrid mode

Carrier frequency, MHz	Total time of 1 transmission at one frequency	Tx ON of 1 transmission at one frequency	Average time of occupancy during 24.4 s period	Reference to Plots in Appendix A
5800	52 ms	49.8 ms	383 ms	A17, A18
Measurement uncertainty, ppm		± 0.21		

TEST EQUIPMENT USED:

HL 1424	HL 1650	HL 1651	HL 2254			

LIMIT

Operating frequency range, MHz	Number of frequencies	Average time of occupancy
902-928, hopping	≥ 50	≤ 0.4 s within 20 s period
	≥ 25	≤ 0.4 s within 10 s period
2400-2483.5; 5725-5850, hopping	≥ 75	≤ 0.4 s within 30 s period
2400-2483.5, hopping	≥ 15 non-overlapping channels with total span ≥ 75 MHz	≤ 0.4 s within the time required to hop through all channels
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.	

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.

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4.4 Maximum peak output power test according to §15.247 (b)(1), (b)(2), (b)(3)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE: June 15, July 8, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 5725-5850 MHz
MODULATION TECHNIQUE: FHSS/hybrid

Hopping mode

Carrier frequency, MHz	Data rate, Mbit/s	Peak output power, dBm	Limit, dBm	Margin, dB	Reference to Plots in Appendix A
5800	1	19.8	21.0	1.2	A19
5800	2	19.8	21.0	1.2	A20
5800	3	19.8	21.0	1.2	A21
5726	3	20.0	21.0	1.0	A22
5849	3	19.3	21.0	1.7	A23
Measurement uncertainty, dB			± 2.3		

Hybrid mode

Carrier frequency, MHz	Data rate, Mbit/s	Peak output power, dBm	Limit, dBm	Margin, dB	Reference to Plots in Appendix A
5726	1.33	18.0	18.0	0	A24
5726	4	18.0	18.0	0	A25
5800	1.33	17.8	18.0	0.2	A26
5800	4	17.7	18.0	0.3	A27
5849	1.33	17.5	18.0	0.5	A28
5849	4	17.3	18.0	0.7	A29
Measurement uncertainty, dB			± 2.3		

TEST EQUIPMENT USED:

HL 1424	HL 1650	HL 1651	HL 2254			

LIMIT

Operating frequency range, MHz	Number of hopping channels	Maximum peak output power*, W
902-928 (hopping)	≥ 50	1
	< 50	0.25
2400-2483.5 (hopping)	≥ 75	1
	other admissible	0.125
5725-5850 (hopping)	any admissible	1
902-928; 2400-2483.5; 5725-5850 (direct sequence)	NA	1
Hybrid	any admissible	1

* For more details see 15.247 (b)(3).

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.

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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:	June 15 and July 8, 2003
RELATIVE HUMIDITY:	44 %
AMBIENT TEMPERATURE:	23 °C
AIR PRESSURE:	1012 hPa
RATED RF OUTPUT POWER:	20 dBm (hopping), 18 dBm (hybrid)
OPERATING FREQUENCY RANGE:	5725-5850 MHz
MODULATION TECHNIQUE:	FHSS/hybrid
FREQUENCY RANGE:	9 kHz – 40 GHz

Hopping mode

Spurious emission measurements were performed at the lowest (5.726 GHz), the highest (5.849 GHz) and one of the middle (5.800 GHz) frequencies. Test results are shown in Plots A30 to A57.
No spurious emissions were found throughout the testing. No effect of the data rate was observed (Plots A53 to A55) therefore only 3 Mbit/s rate was used for measurements.

Hybrid mode

The output power was decreased by 3 dB for this mode. Spurious emission testing in hopping mode at 21 dBm output power was considered the worst case, therefore the measurements in hybrid mode in the whole range were not performed, as the hardware is exactly the same. Emissions at the lower band edge (see Plots A62 to A65) and at the higher band edge (see Plots A58 to A61) were examined.

TEST EQUIPMENT USED:

HL 1424	HL 1650	HL 1651	HL 2254			

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.

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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
DATE:	June 16, 2003
RELATIVE HUMIDITY:	44 %
AMBIENT TEMPERATURE:	23 °C
AIR PRESSURE:	1011 hPa
RATED RF OUTPUT POWER:	20 dBm (hopping); 18 dBm (hybrid)
ANTENNA GAIN:	16 dBi (hopping); 16 dBi (hybrid)
TEST DISTANCE	3 m
OPERATING FREQUENCY RANGE:	5725-5850 MHz
MODULATION TECHNIQUE:	FHSS/hybrid
FREQUENCY RANGE:	9 kHz to 40 GHz

Hopping mode

Spurious emission measurements were performed at the lowest (5.726 GHz), the highest (5.849 GHz) and one of the middle (5.800 GHz) frequencies. Test results are shown in Plots A66 to A103.

Hybrid mode

The output power was decreased by 2 dB for this mode. Spurious emission testing in hopping mode at 20 dBm output power was considered the worst case, therefore the measurements in hybrid mode were not performed, as the hardware is exactly the same.

Hopping mode

a) F carrier: 5.726 GHz

Peak detector, RBW = VBW = 1 MHz

Frequency, MHz	Antenna type	Radiated emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
1515	Double ridged guide	43.6	54.0*	10.4	A70
22903	Horn	56.0	74.0**	18.0	A82
Measurement uncertainty, dB		± 4.5			

*** average limit**
**** peak limit**

Average detector, RBW = 1 MHz; VBW = 10 Hz

Frequency, MHz	Antenna type	Radiated emission, dB (μV/m)	Average limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
22903	Horn	52.7	54.0	1.3	A83
Measurement uncertainty, dB		± 4.5			

Notes to table:

Margin = dB below (negative if above) specification limit.
RBW = resolution bandwidth;
VBW = video bandwidth.

The test results recorded in the tables were obtained throughout the measurements with antennas in vertical polarization at 1 m height.

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b) F carrier: 5.800 GHz

Peak detector, VBW = 1 MHz

Frequency, MHz	RBW, MHz	Antenna type	Radiated emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
240	0.12	Biconilog	24.6*	46.0**	21.4	A69
280	0.12	Biconilog	26.5*	46.0**	19.5	A69
1515	1	Double ridged guide	43.0	54.0***	11.0	A86
23199	1	Horn	51.5	54.0***	2.5	A96
Measurement uncertainty, dB			± 4.5			

*** quasi-peak value**
**** quasi-peak limit**
***** average limit**

c) F carrier: 5.849 GHz

Peak detector, RBW = VBW = 1 MHz

Frequency, MHz	Antenna type	Radiated emission, dB(μV/m)	Average limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
1513	Double ridged guide	43.0	54.0	11.0	A99
23395	Horn	45.5	54.0	8.5	A109
Measurement uncertainty, dB		± 4.5			

Notes to tables:

Margin = dB below (negative if above) specification limit.
RBW = resolution bandwidth;
VBW = video bandwidth.

The test results recorded in the tables were obtained throughout the measurements with antennas in vertical polarization at 1 m height.

TEST EQUIPMENT USED:

HL 0041	HL 0446	HL 0465	HL 0521	HL 0589	HL 0604	HL 0768
HL 0769	HL 1004	HL 1424	HL 1566	HL 1940	HL 1942	HL 2009
HL 2259	HL 2260	HL 2273	HL 2274			

LIMIT

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

TEST PROCEDURE

9 kHz – 30 MHz frequency range. The EUT was placed on a wooden 80 cm height turntable. 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 – 40 GHz frequency range. 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 antennas polarization was changed from vertical to horizontal.

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4.7 Peak power spectral density of a hybrid systems according to § 15.247(d)

DATE: July 8, 2003
RELATIVE HUMIDITY: 45 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
RATED OUTPUT POWER: 18 dBm
OPERATING FREQUENCY RANGE: 5725-5850 MHz
MODULATION TECHNIQUE: Hybrid

Carrier frequency, GHz	Data transmission rate, Mbit/s	Measured peak power spectral density, MHz	Reference to Plots in Appendix A
5.726	1.33	7.3	A112
5.726	4	7.7	A113
5.800	1.33	6.7	A114
5.800	4	7.0	A115
5.849	1.33	6.3	A116
5.849	4	6.3	A117
Measurement uncertainty, dB		± 2.3	

TEST EQUIPMENT USED:

HL 1424	HL 1650	HL 1651	HL 2254			

LIMIT

The peak power spectral density shall be not 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.

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4.8 Conducted emissions test according to §15.107, 15.207

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.3
DATE: July 1, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 24 °C
AIR PRESSURE: 1011 hPa
DETECTOR USED: QUASI-PEAK, AVERAGE
FREQUECNY RANGE: 150 kHz – 30 MHz
OPERATION MODE: TRANSMITTING
RESOLUTION BANDWIDTH: 9 kHz

Quasi-peak detector

Frequency, MHz	Line identification	Measured emissions, dB (µV)	Specification limit, dB (µV)	Margin, dB	Reference to Plots in Appendix A
0.180670	Neutral	55.6	56.0	8.9	A119
0.180771	Phase	55.6	64.4	8.8	A118
4.200023	Neutral	45.3	56.0	10.7	A119
4.207961	Phase	44.8	56.0	11.2	A118
4.582186	Neutral	43.1	56.0	12.9	A119
4.963644	Neutral	42.2	56.0	13.8	A119
Conducted emissions with HP 8542E/HP8546A receiver		9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB			

Average detector

Frequency, MHz	Line identification	Measured emissions, dB (µV)	Specification limit, dB (µV)	Margin, dB	Reference to Plots in Appendix A
3.825606	Phase	38.9	46.0	7.1	A118
4.200023	Neutral	44.7	46.0	1.3	A119
4.207961	Phase	44.5	46.0	1.5	A118
4.582186	Neutral	42.4	46.0	3.6	A119
4.963644	Neutral	41.6	46.0	4.4	A119
4.973320	Phase	41.2	46.0	4.8	A118
Conducted emissions with HP 8542E/HP8546A receiver		9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB			

TEST EQUIPMENT USED:

HL 0163	HL 0672	HL 0787	HL 1430	HL 1502	HL 1510	

LIMIT

Frequency, MHz	Class B equipment, dB(µV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases 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 table.
The position of the EUT cables was varied to determine maximum emission level.

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4.9 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT:	ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFROMED IN:	ANECHOIC CHAMBER
DATE:	June 16, 2003
RELATIVE HUMIDITY	44 %
AMBIENT TEMPERATURE:	23°
AIR PRESSURE	1011 hPa
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP
FREQUECNY RANGE:	30 – 1000 MHz
DETECTOR TYPE:	QUASI-PEAK
RESOLUTION BANDWIDTH:	120 kHz

	The EUT highest used frequency (not including operating frequency), MHz	**Upper frequency of measurement range, MHz**
	Below 1.705	30
X	1.705 – 108	1000
	108 – 500	2000
	500 – 1000	5000
	Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

The emission measurements were performed in transmitting mode. All emissions were found below the specified 15.109 class B limit, refer to § 4.6 and Plot A69.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0604	HL 1004	HL 2009	

LIMIT (§ 15.109)

Frequency, MHz	**Class A equipment @ 10 m dB(μV/m)**	**Class B equipment @ 3 m dB(μV/m)**
30 - 88	39.0	40
88 - 216	43.5	43.5
216 - 960	46.4	46
960 - 5000	49.5	54

TEST PROCEDURE

30 MHz – 1 GHz frequency range. 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.

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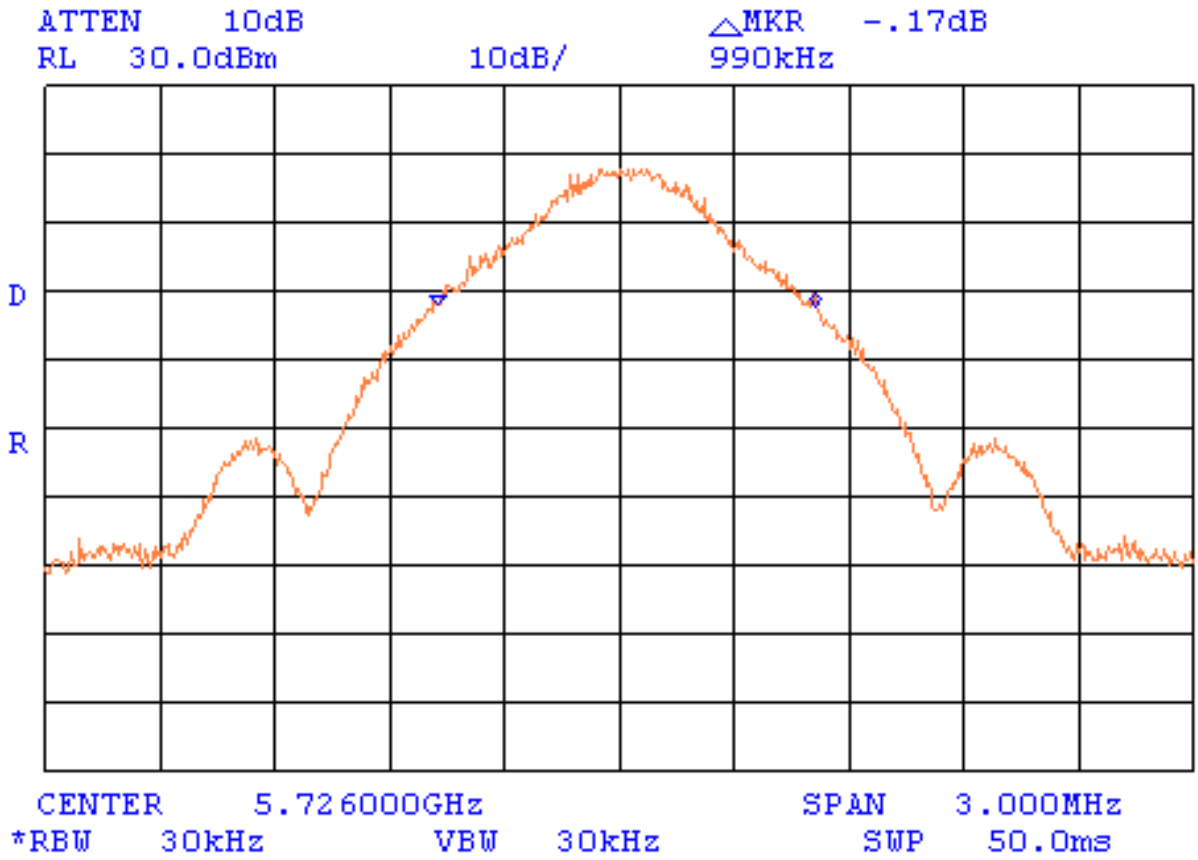
Appendix A Plots

Plot A1

20 dB bandwidth

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s



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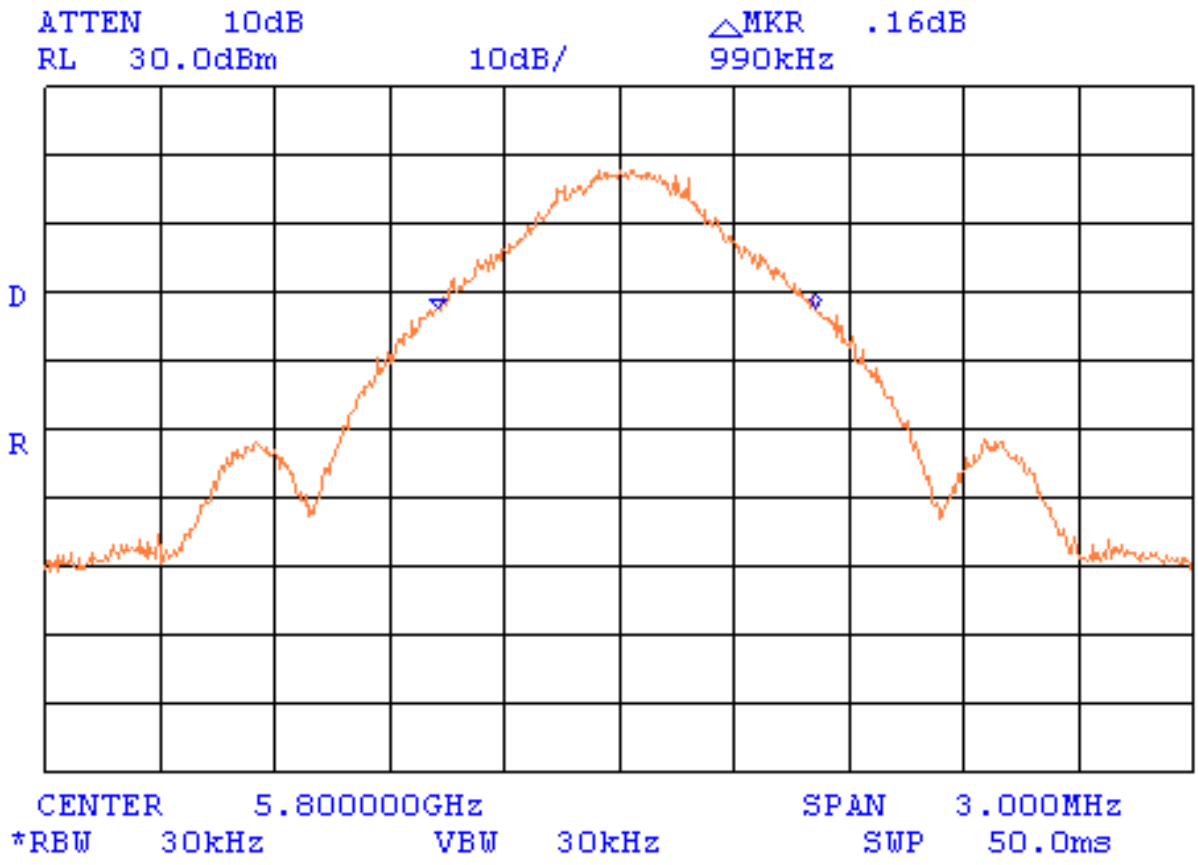
Plot A2

20 dB bandwidth

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s



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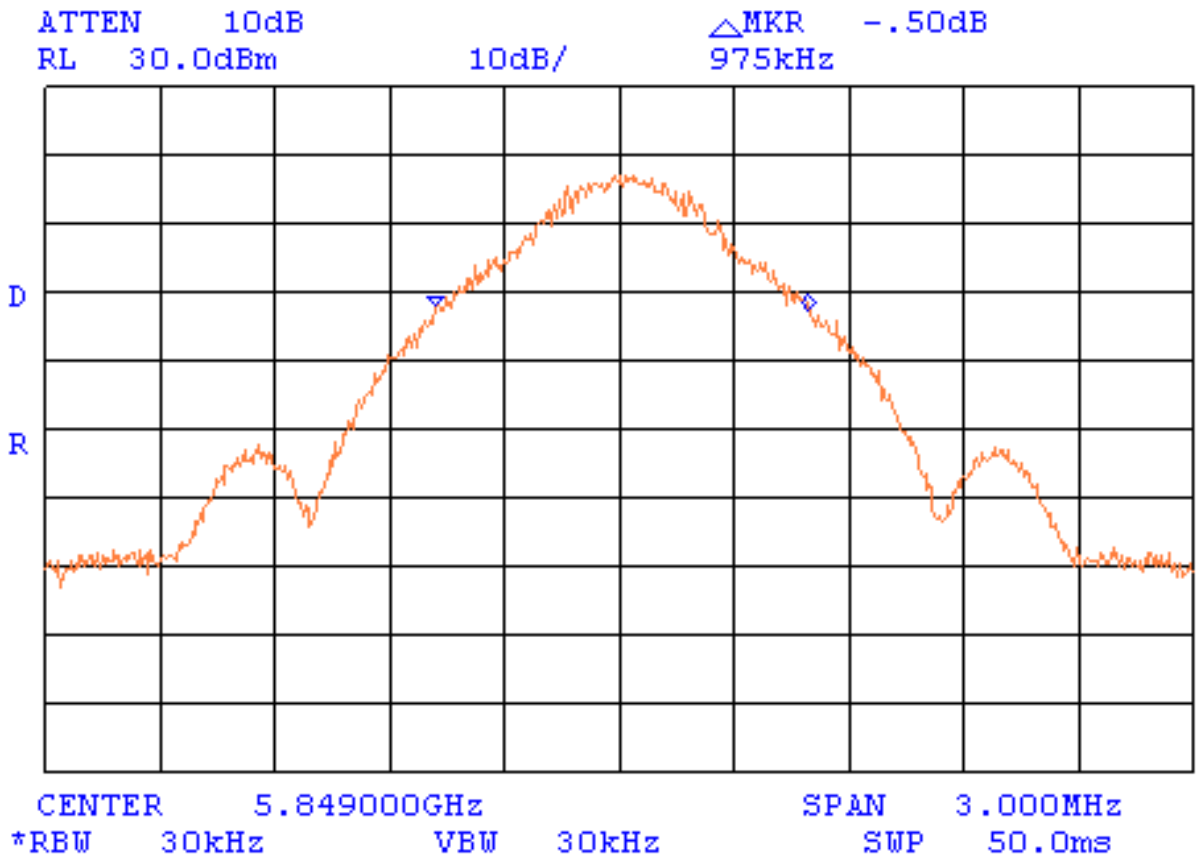
Plot A3

20 dB bandwidth

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s



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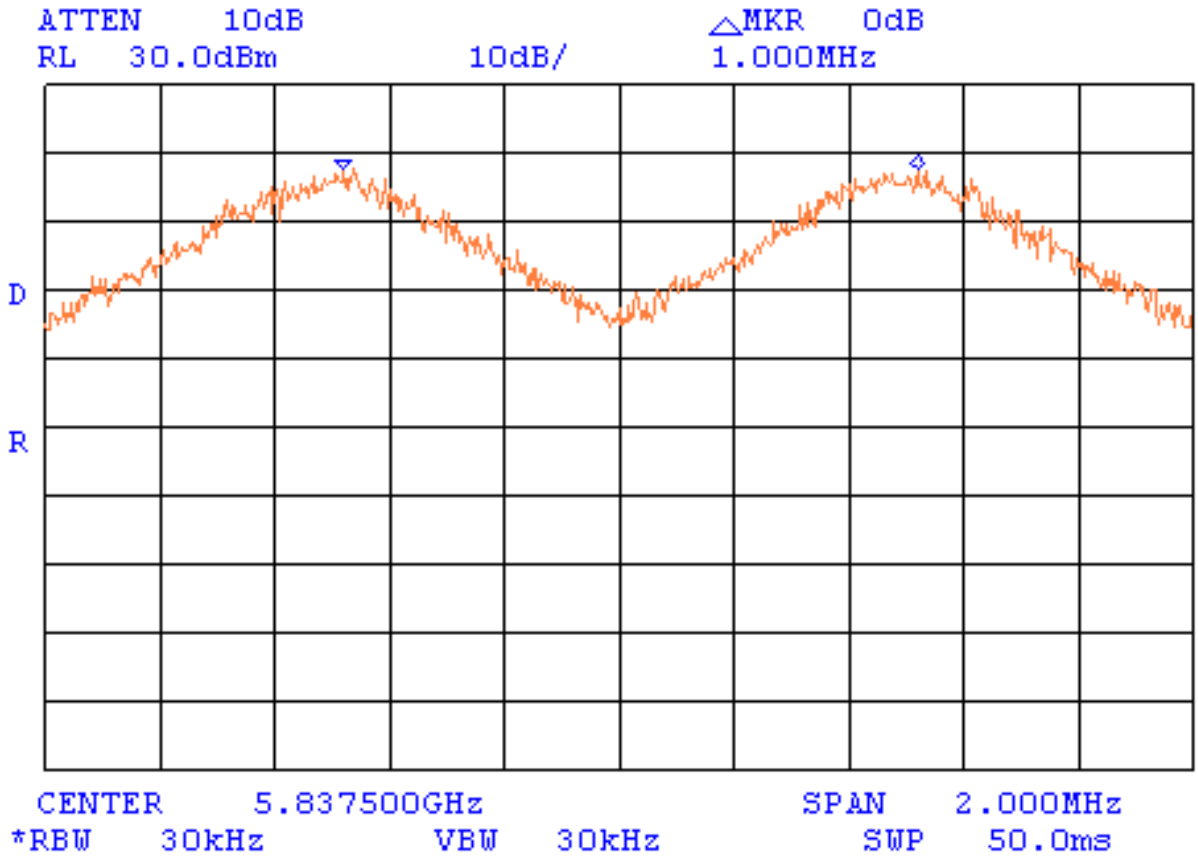
Plot A4

Channel carrier frequencies separation

Mode: Hopping



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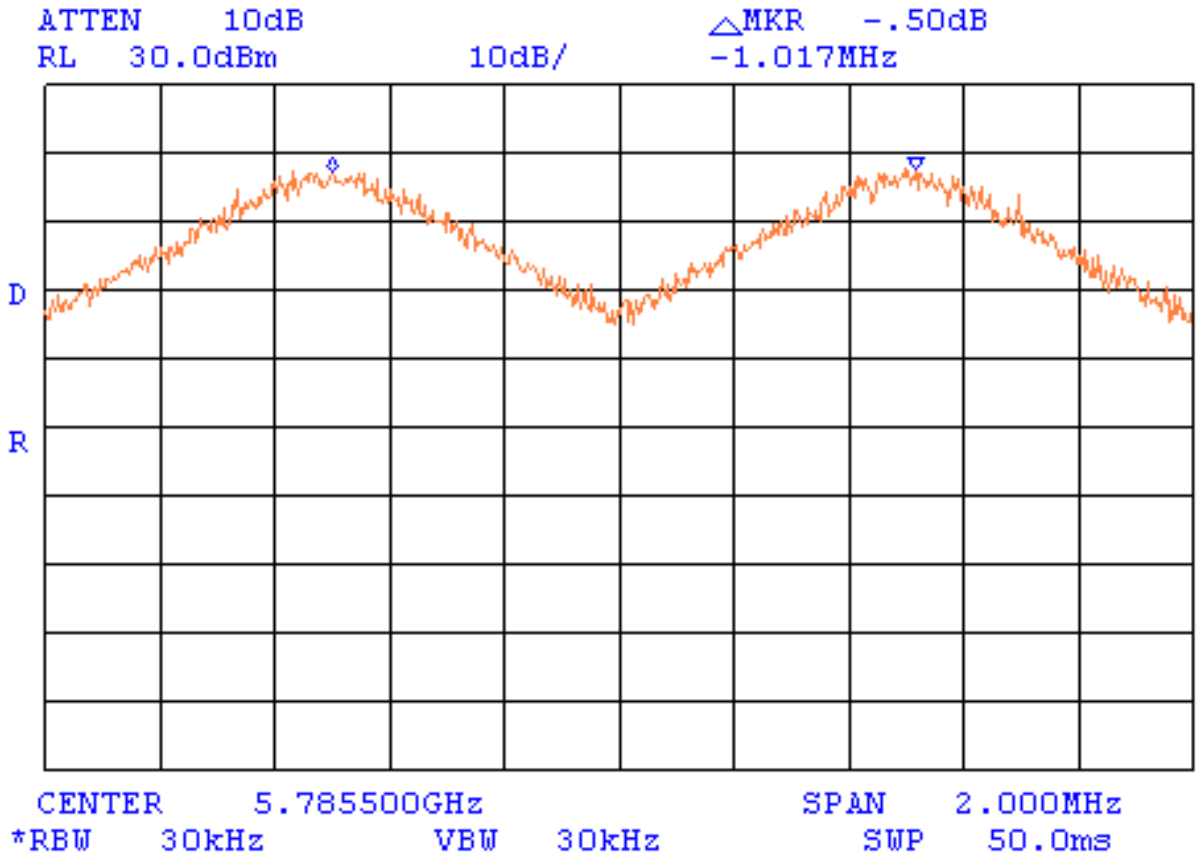
Plot A5

Channel carrier frequencies separation

Mode: Hopping



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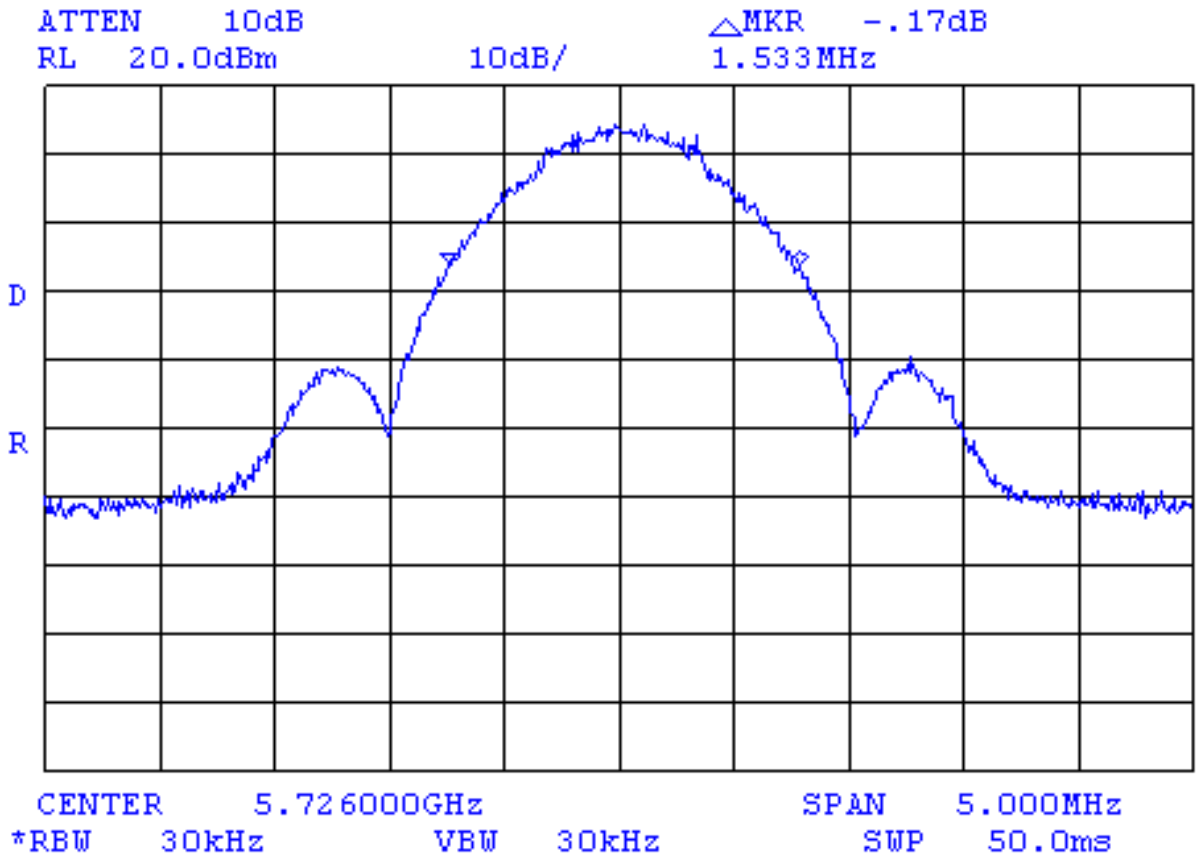
Plot A6

20 dB bandwidth

Mode:	Hybrid
Bit rate:	4 Mbit/s



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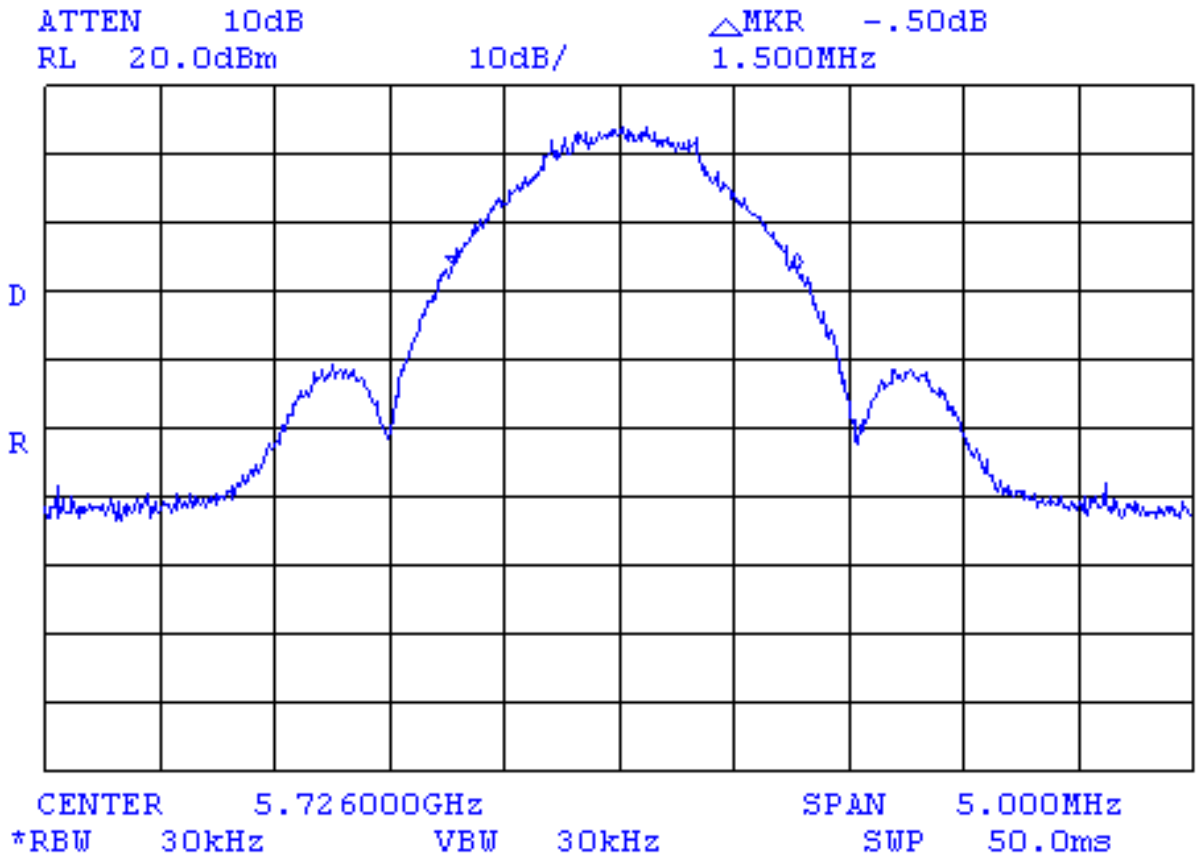
Plot A7

20 dB bandwidth

Mode:	Hybrid
Bit rate:	1.33 Mbit/s



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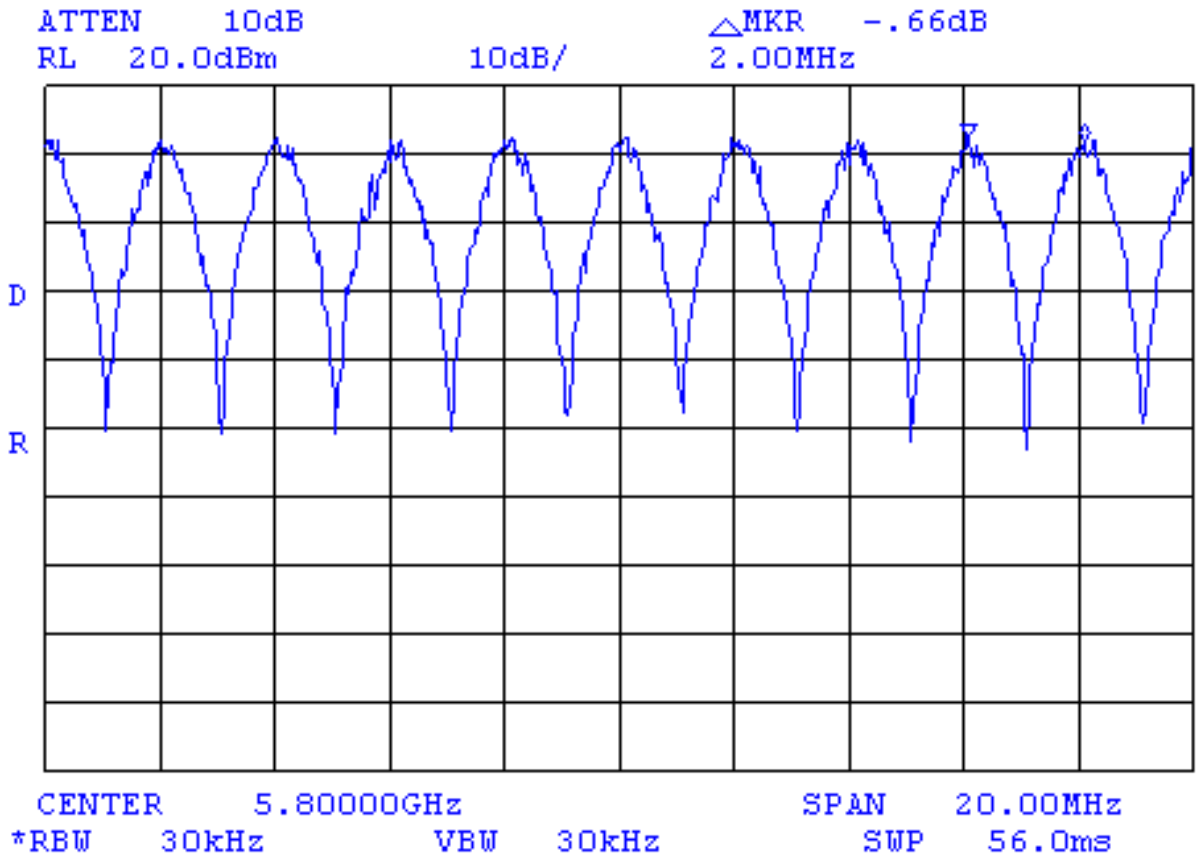
Plot A8

Channel carrier frequencies separation

Mode:	Hybrid
Bit rate:	4 Mbit/s



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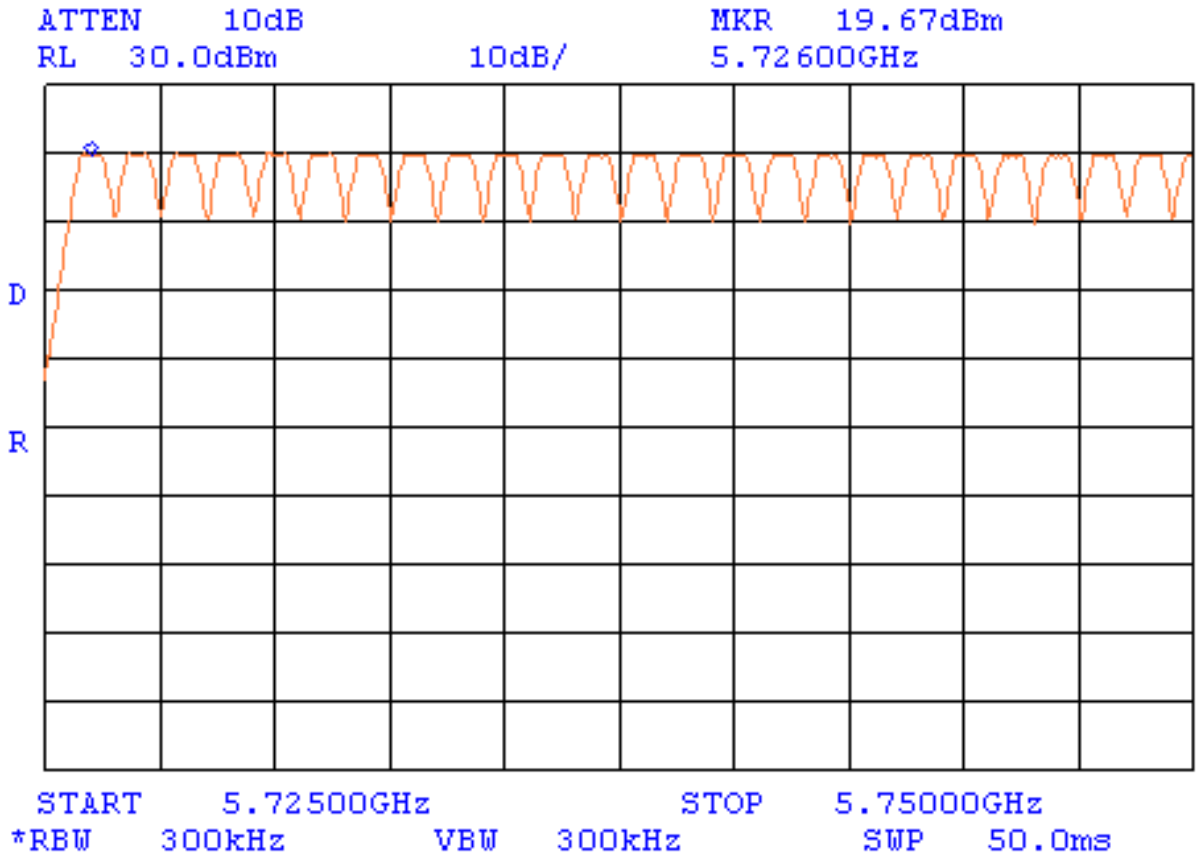
Plot A9

Number of hopping channels

Mode: Hopping



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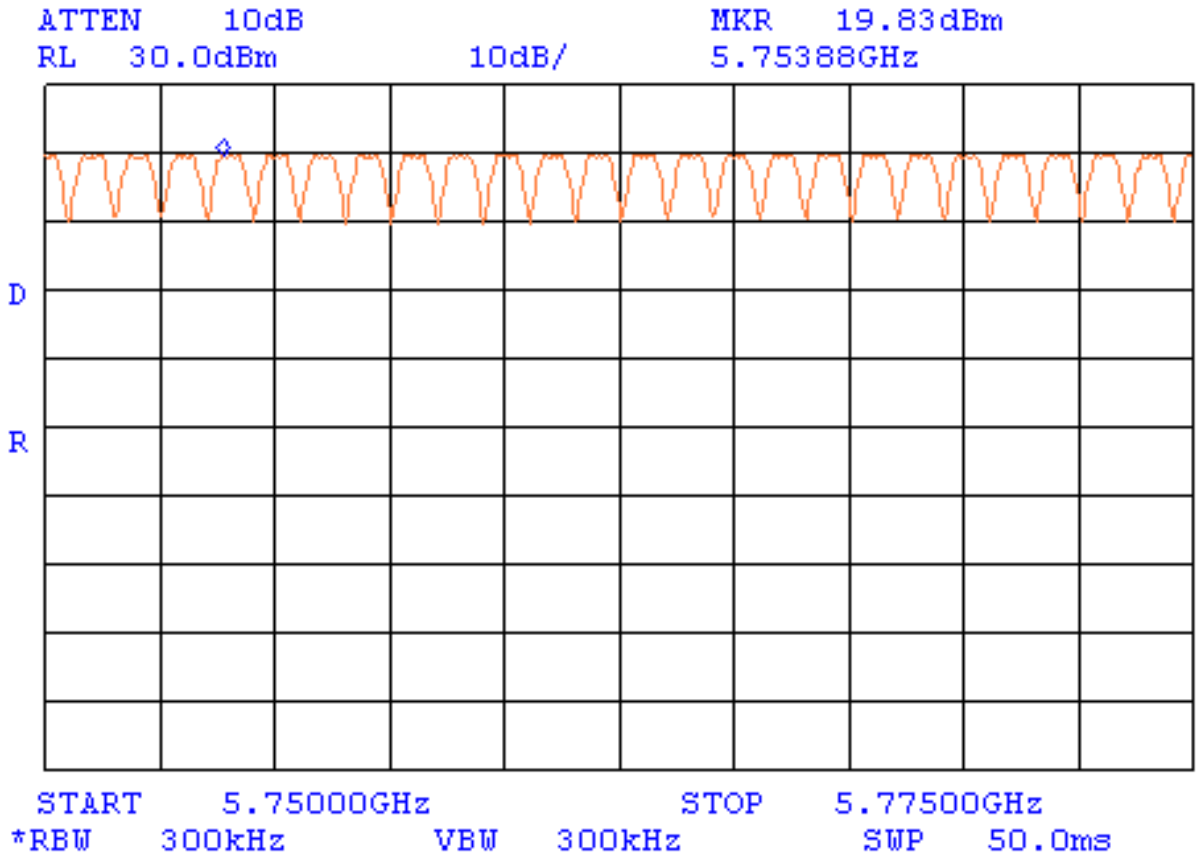
Plot A10

Number of hopping channels (continued)

Mode: Hopping



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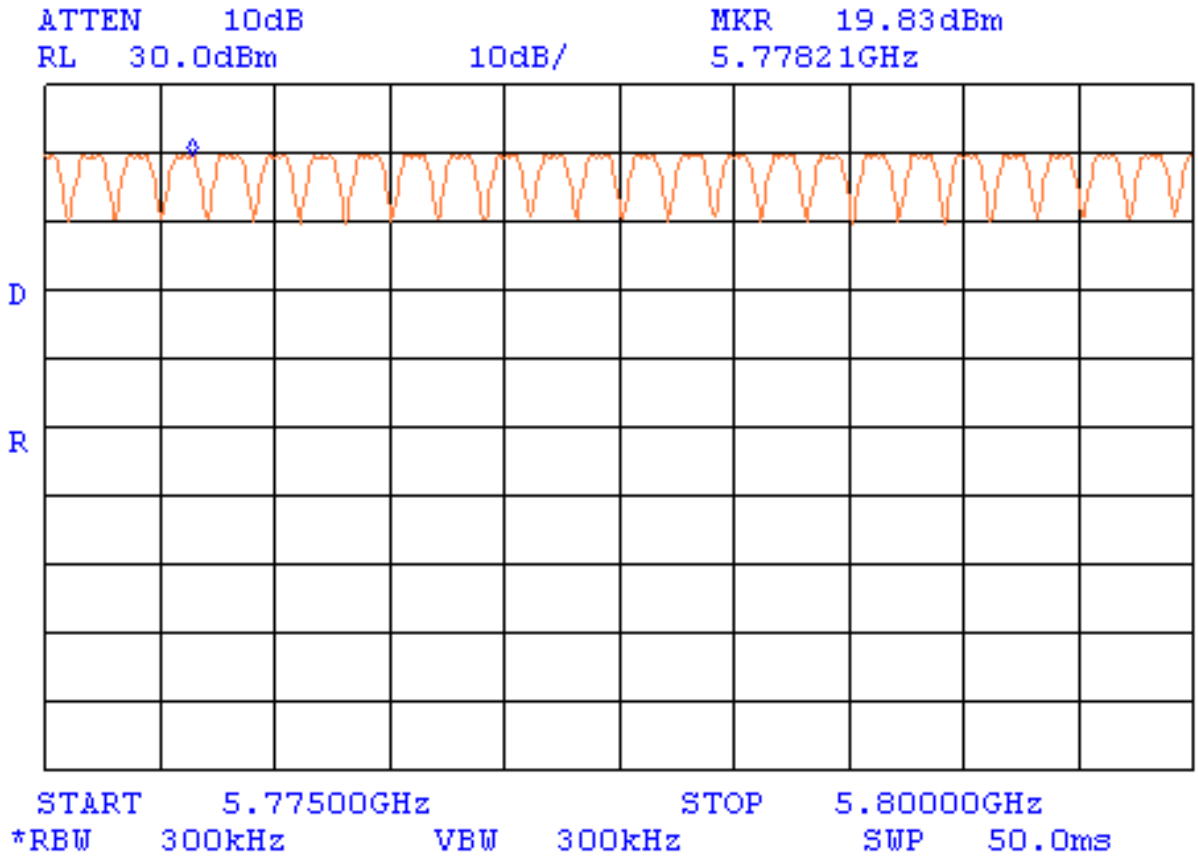
Plot A11

Number of hopping channels (continued)

Mode: Hopping



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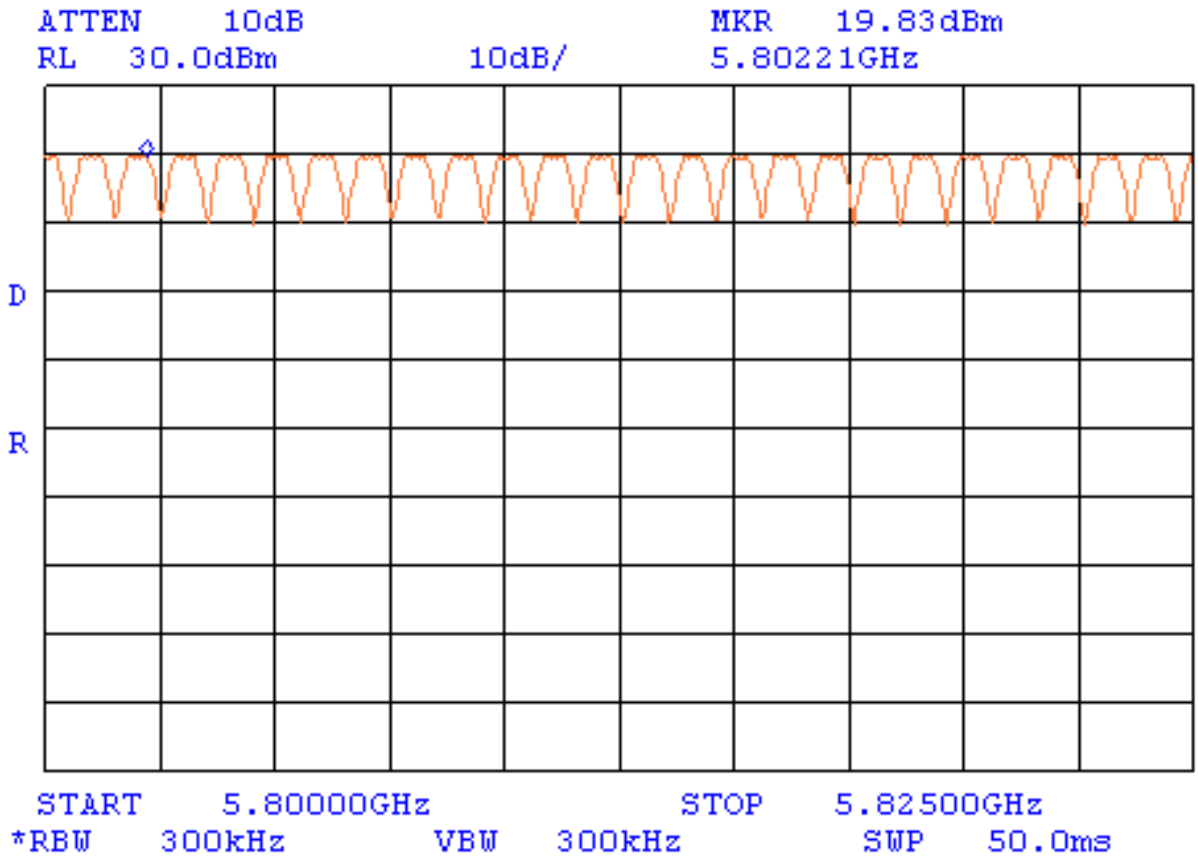
Plot A12

Number of hopping channels (continued)

Mode: Hopping



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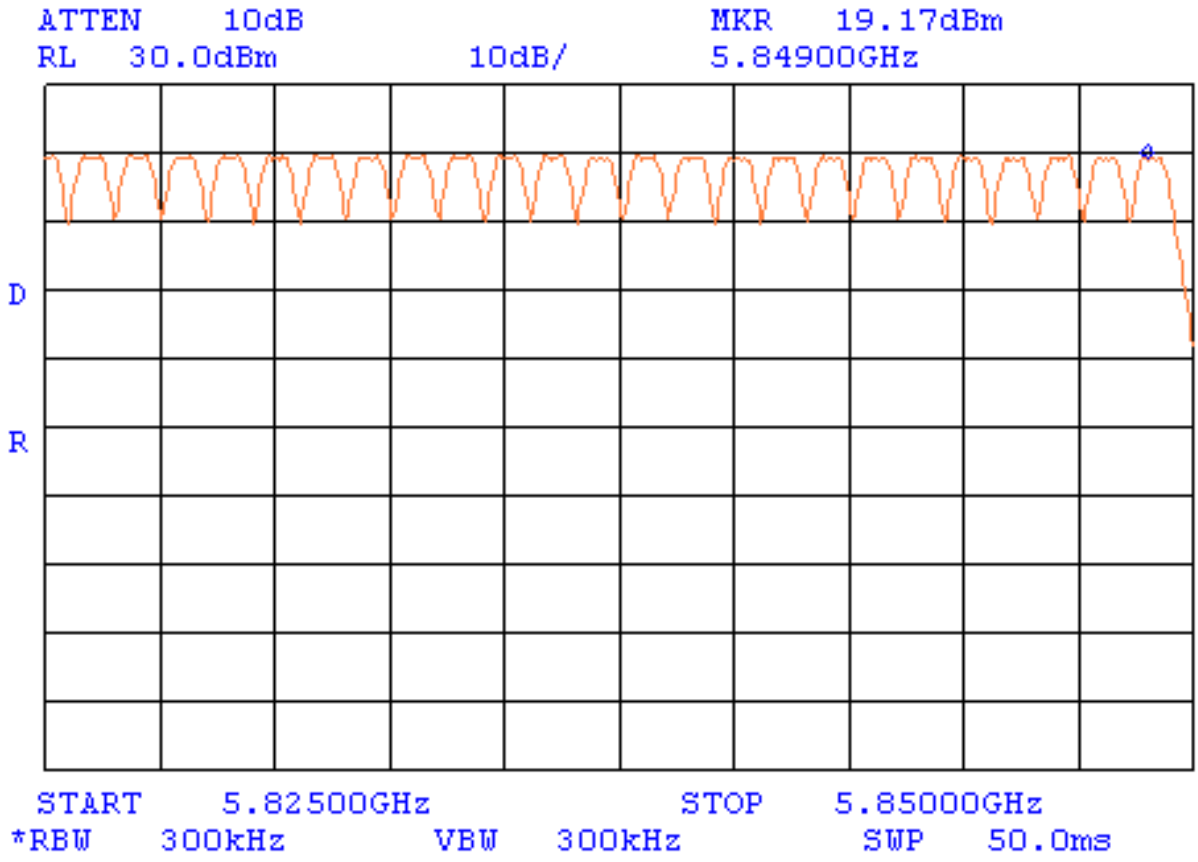
Plot A13

Number of hopping channels (continued)

Mode: Hopping



124 channels

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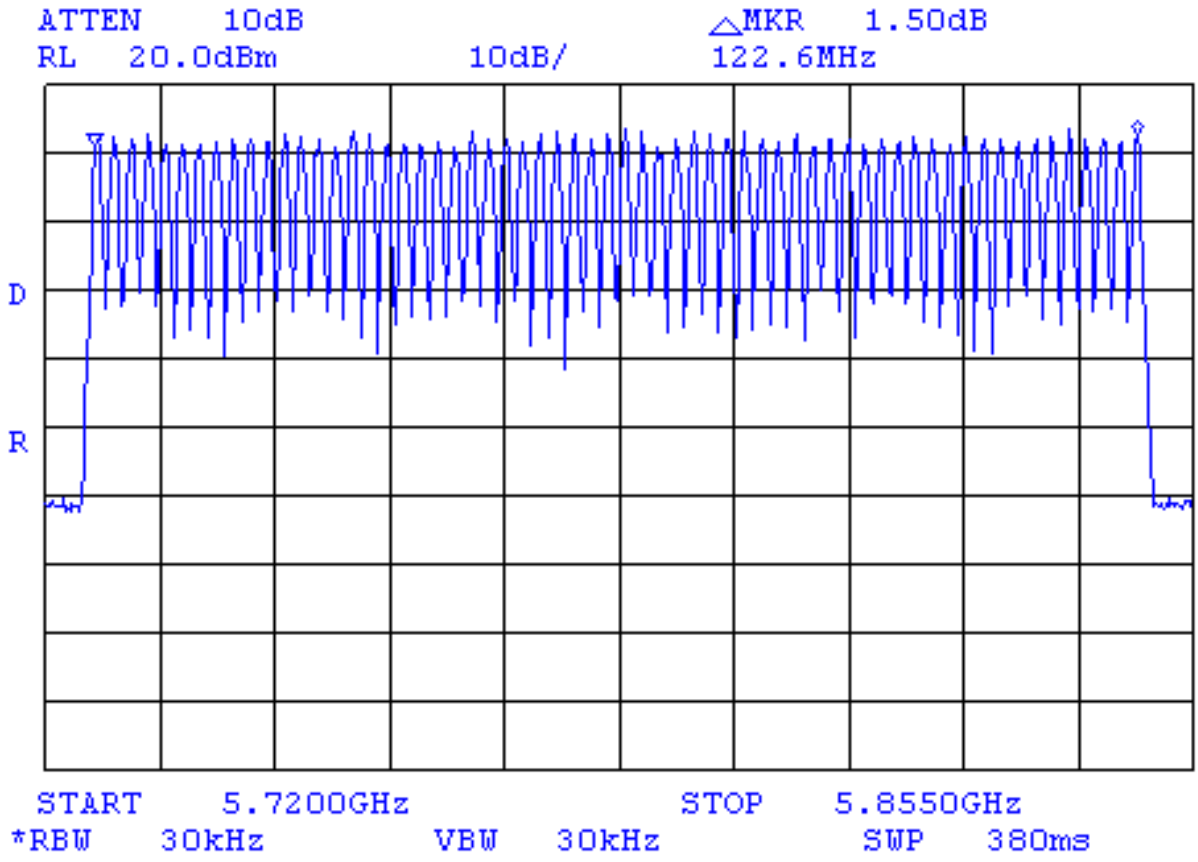
Plot A14

Number of hopping channels

Mode: Hybrid



61 channels

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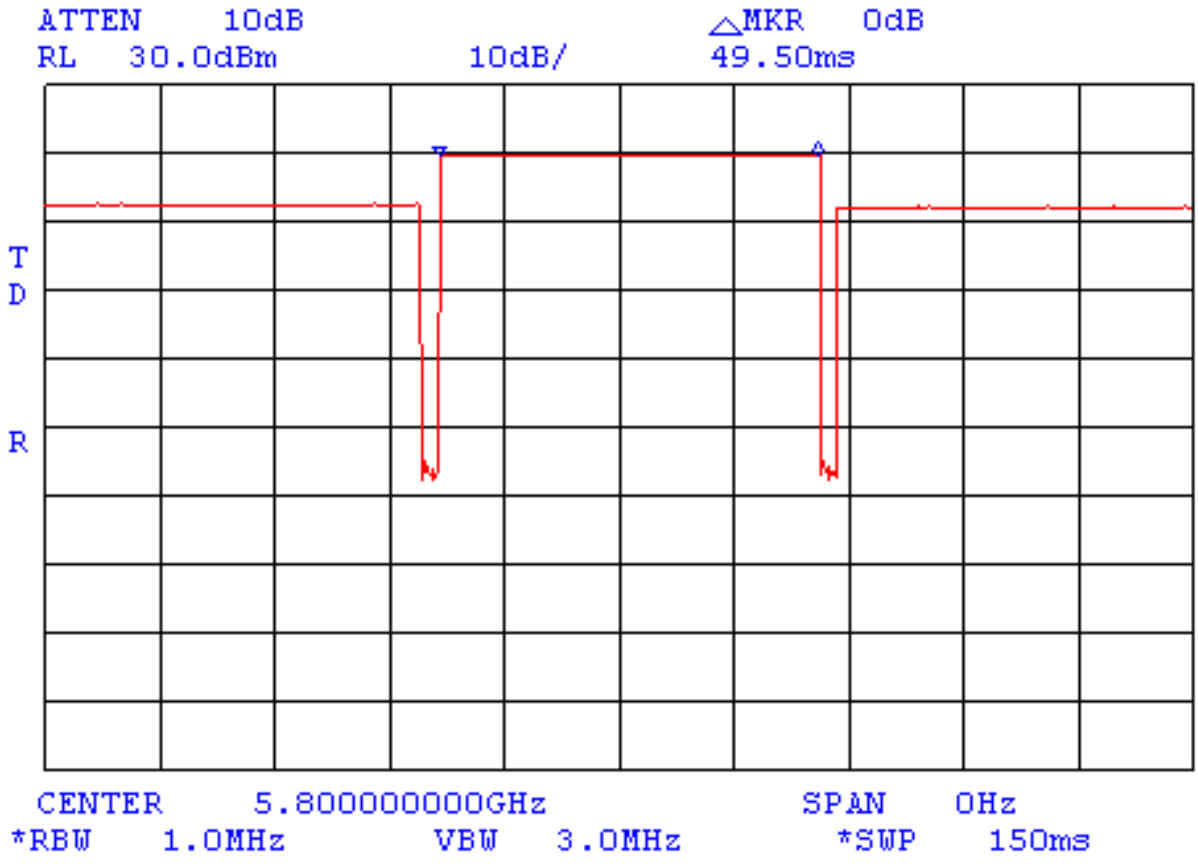
Plot A15

Average time of occupancy

Mode: Hopping



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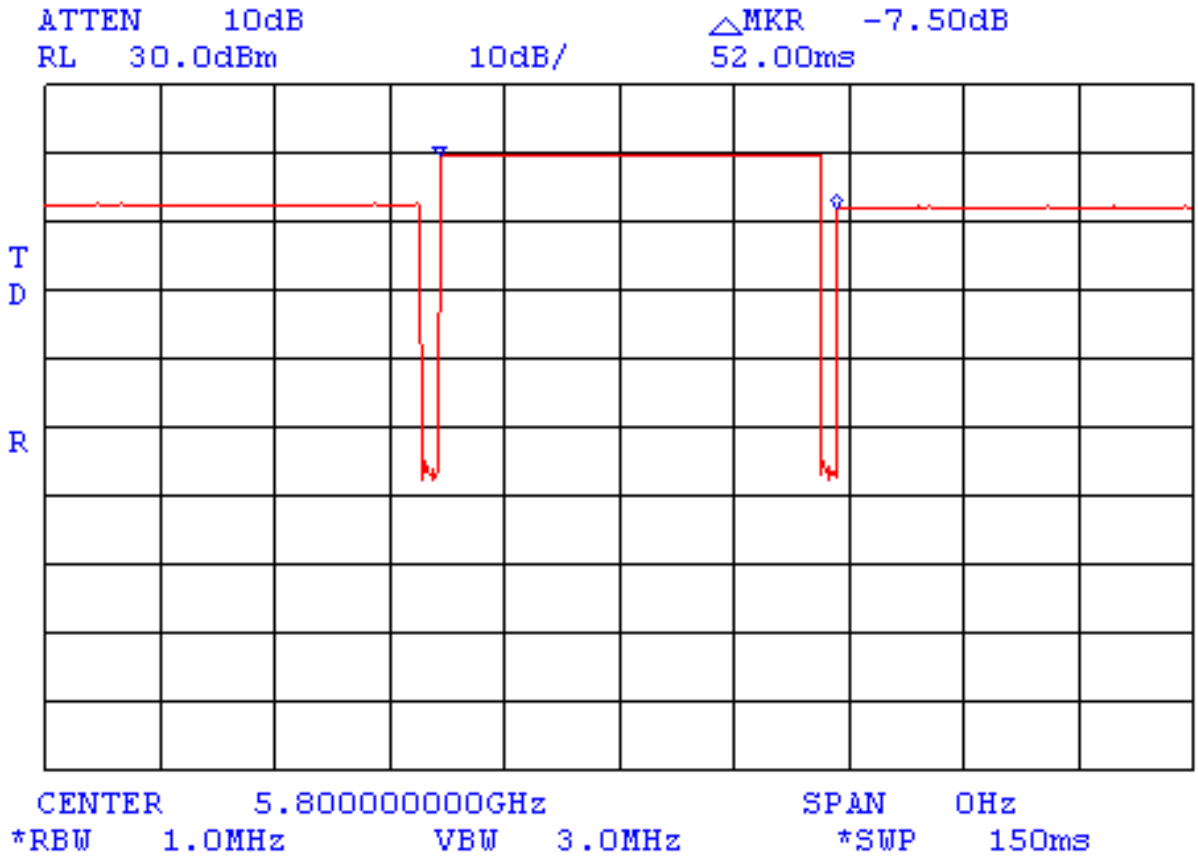
Plot A16

Average time of occupancy

Mode: Hopping



Average time of occupancy calculation:
(30000/79/52)x49.5 = 362 (ms)

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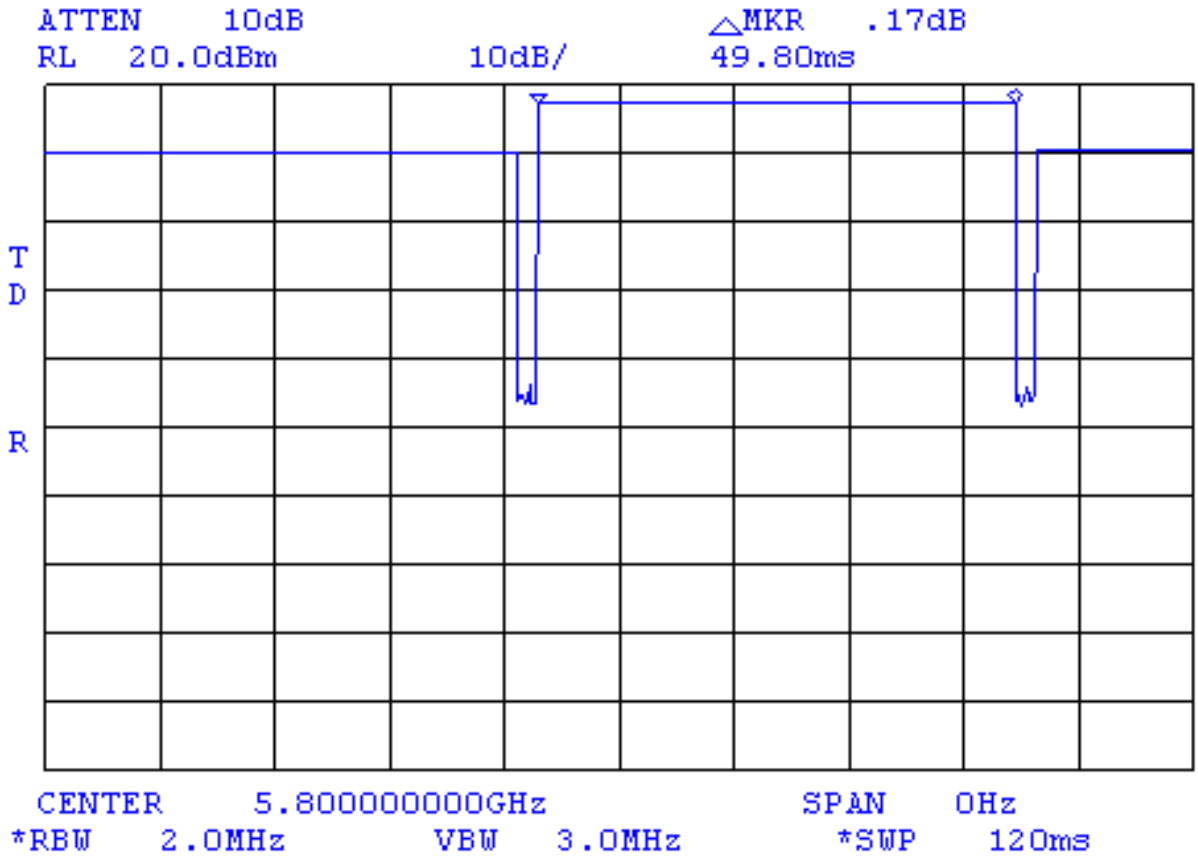
Plot A17

Average time of occupancy

Mode: Hybrid



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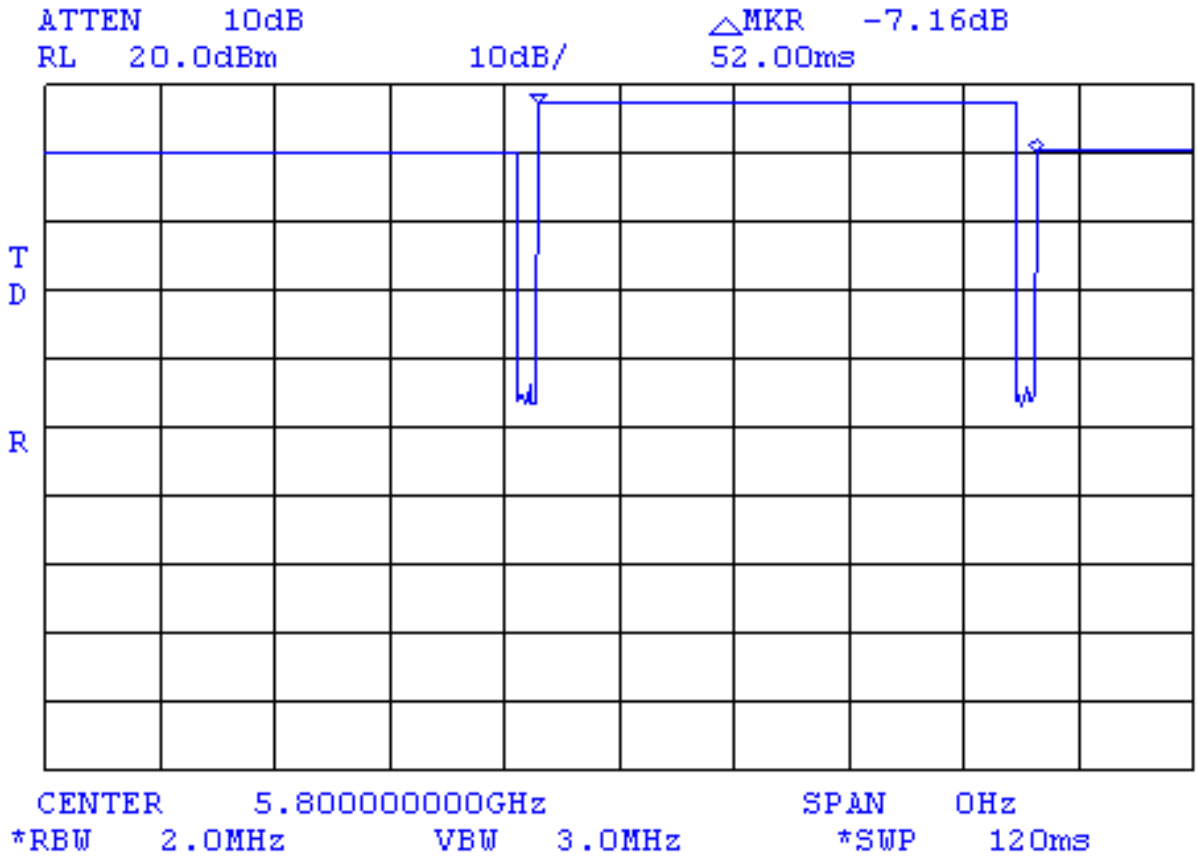
Plot A18

Average time of occupancy

Mode: Hybrid



Average time of occupancy calculation:
((61x0.4)/61/52)x49.8 = 383 (ms)

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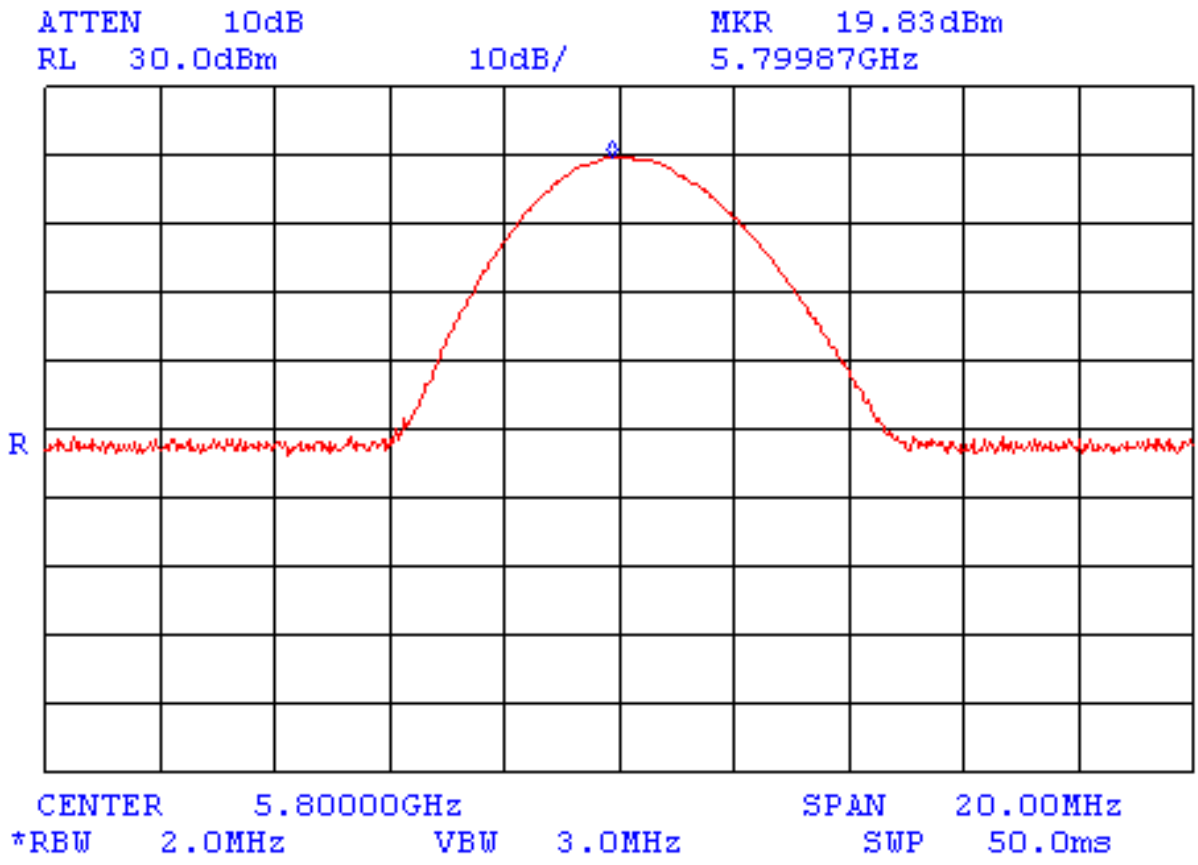
Plot A19

Peak output power

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	1 Mbit/s



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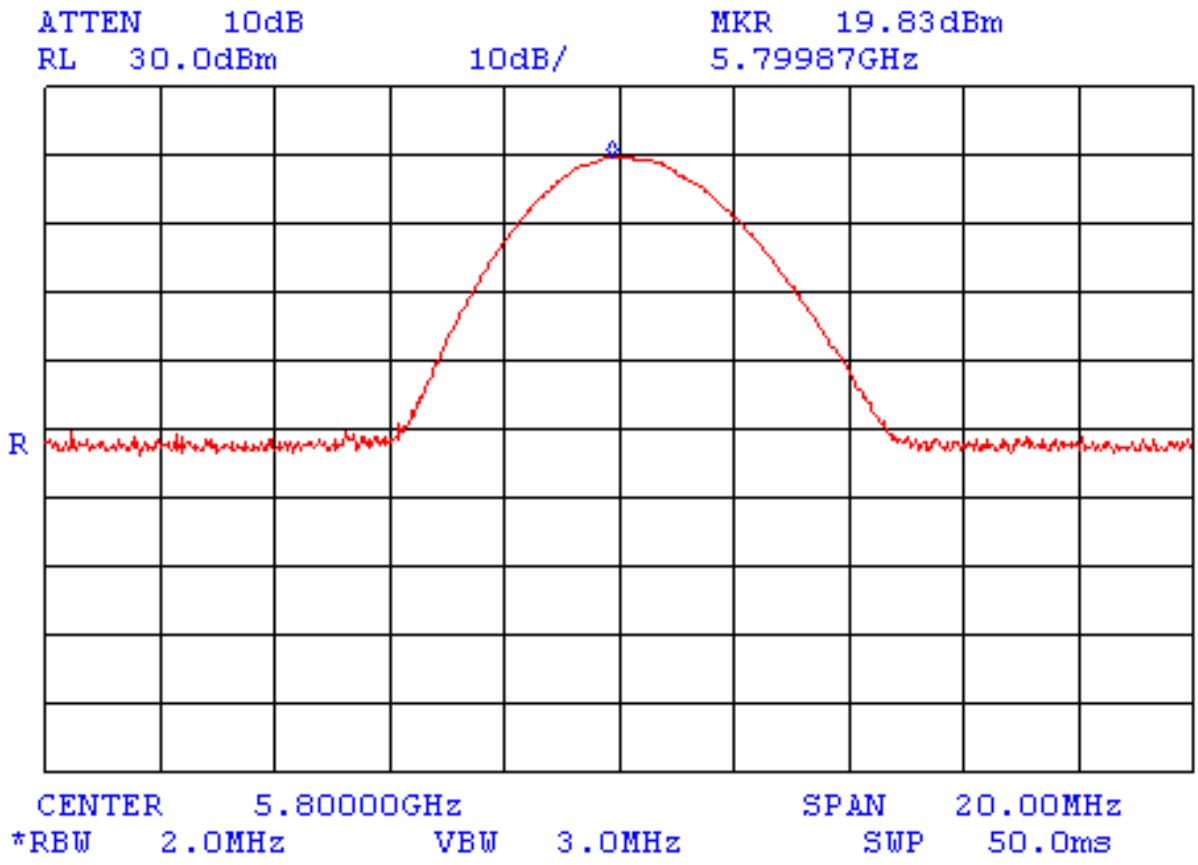
Plot A20

Peak output power

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	2 Mbit/s



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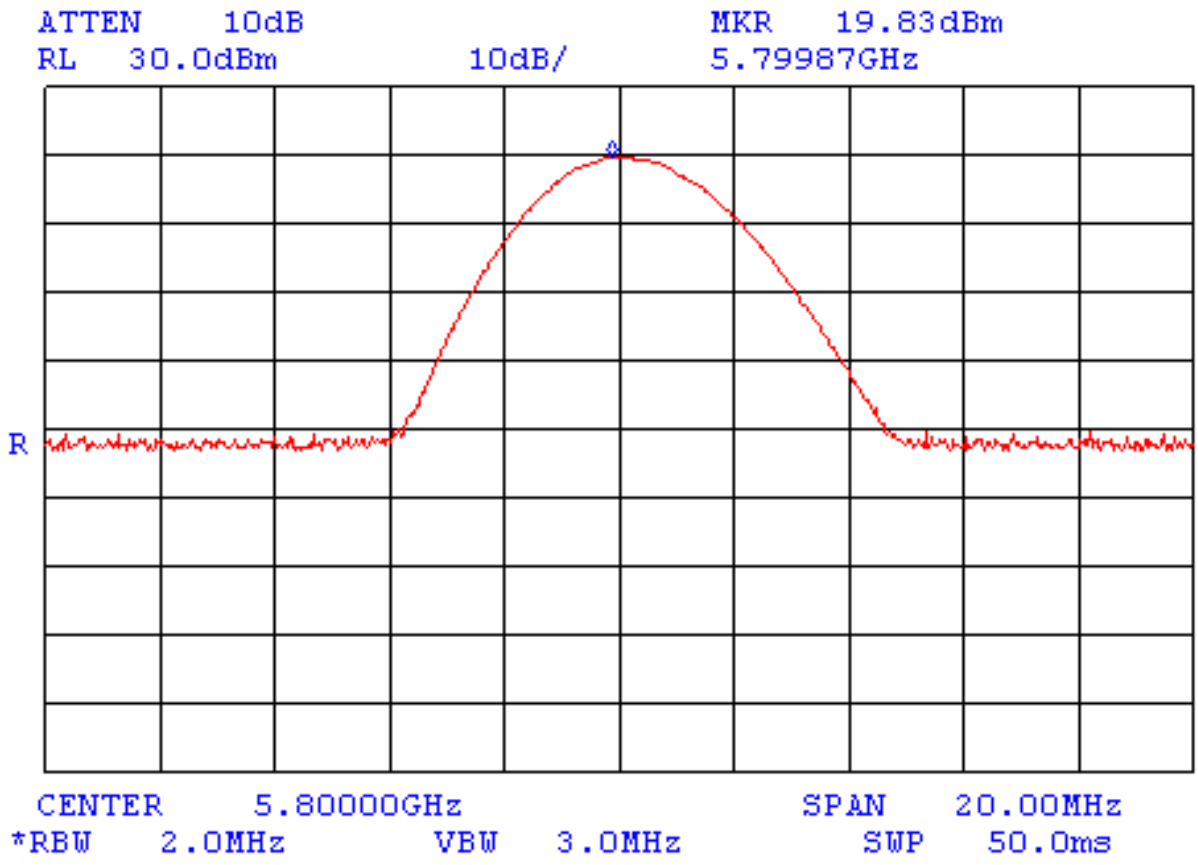
Plot A21

Peak output power

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s



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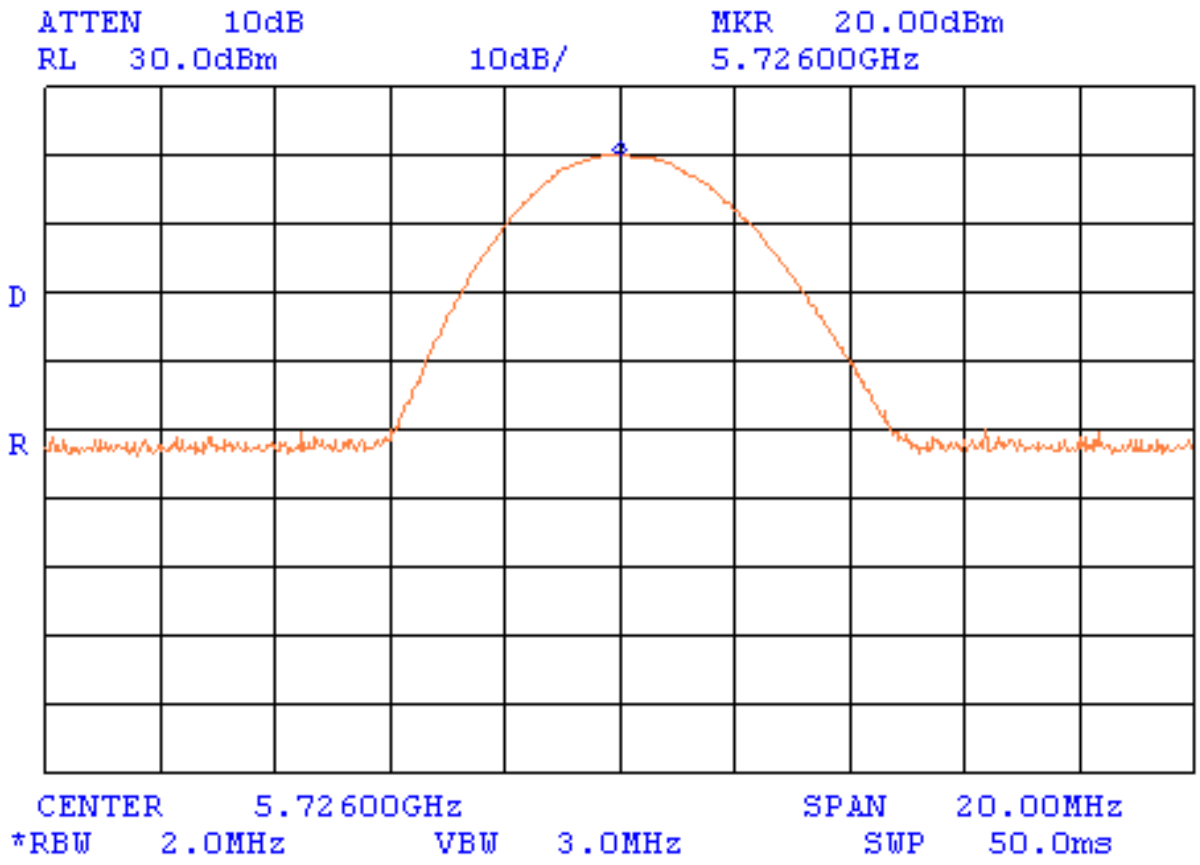
Plot A22

Peak output power

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s



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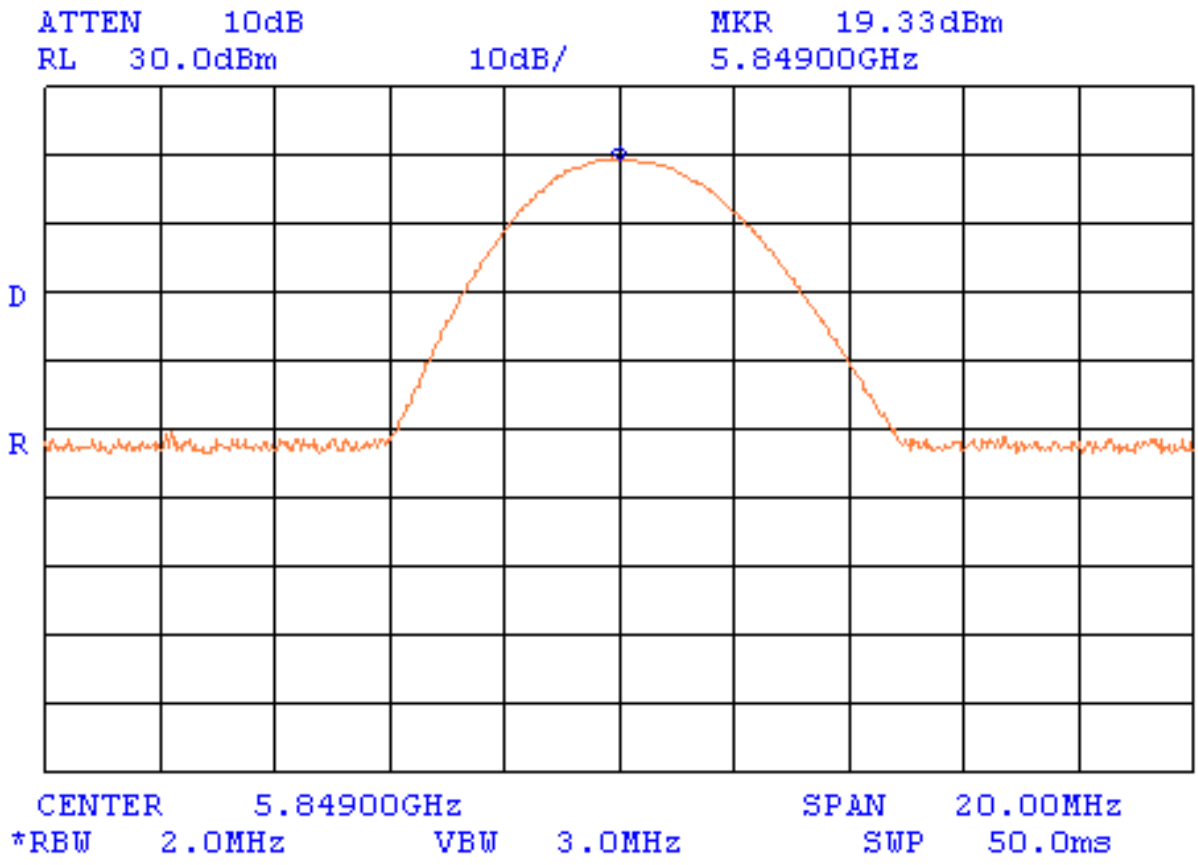
Plot A23

Peak output power

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s



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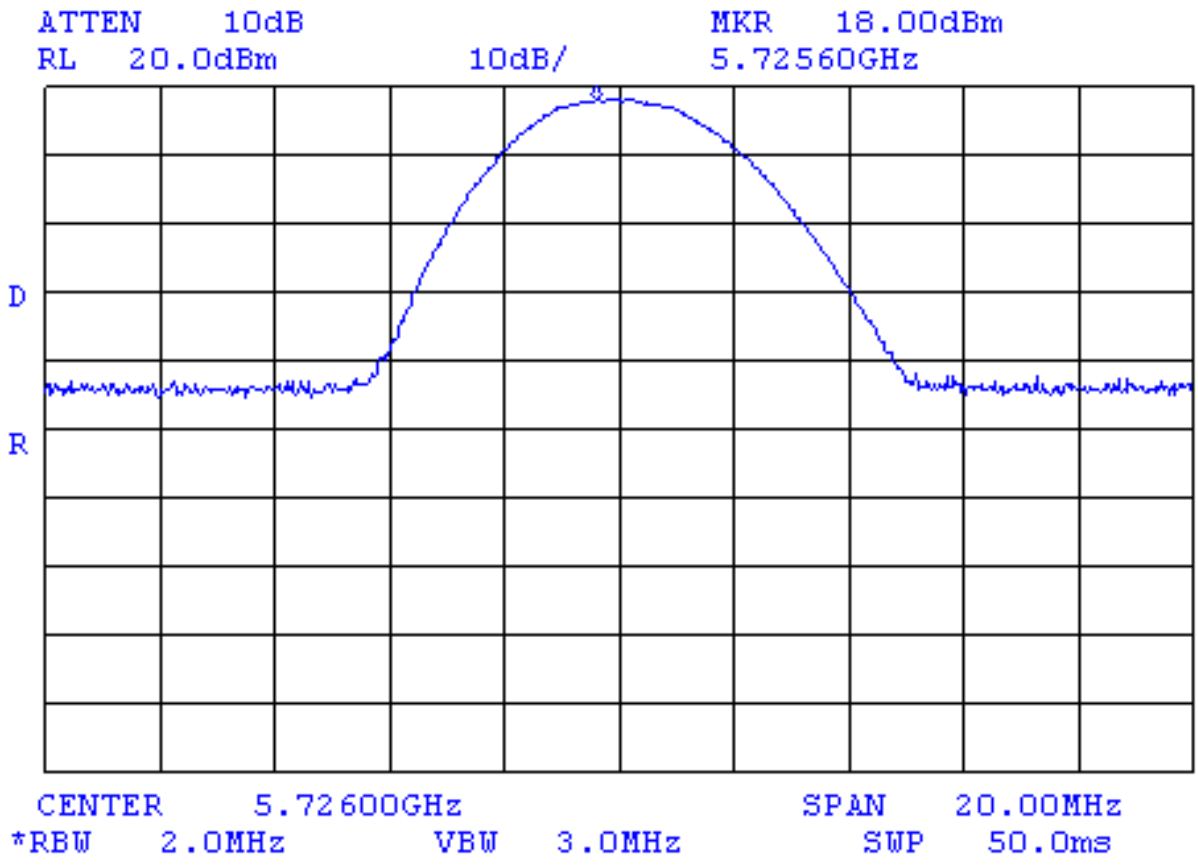
Plot A24

Peak output power

Mode:	Hybrid
F_{LOW}:	5.726 GHz
Bit rate:	1.33 Mbit/s



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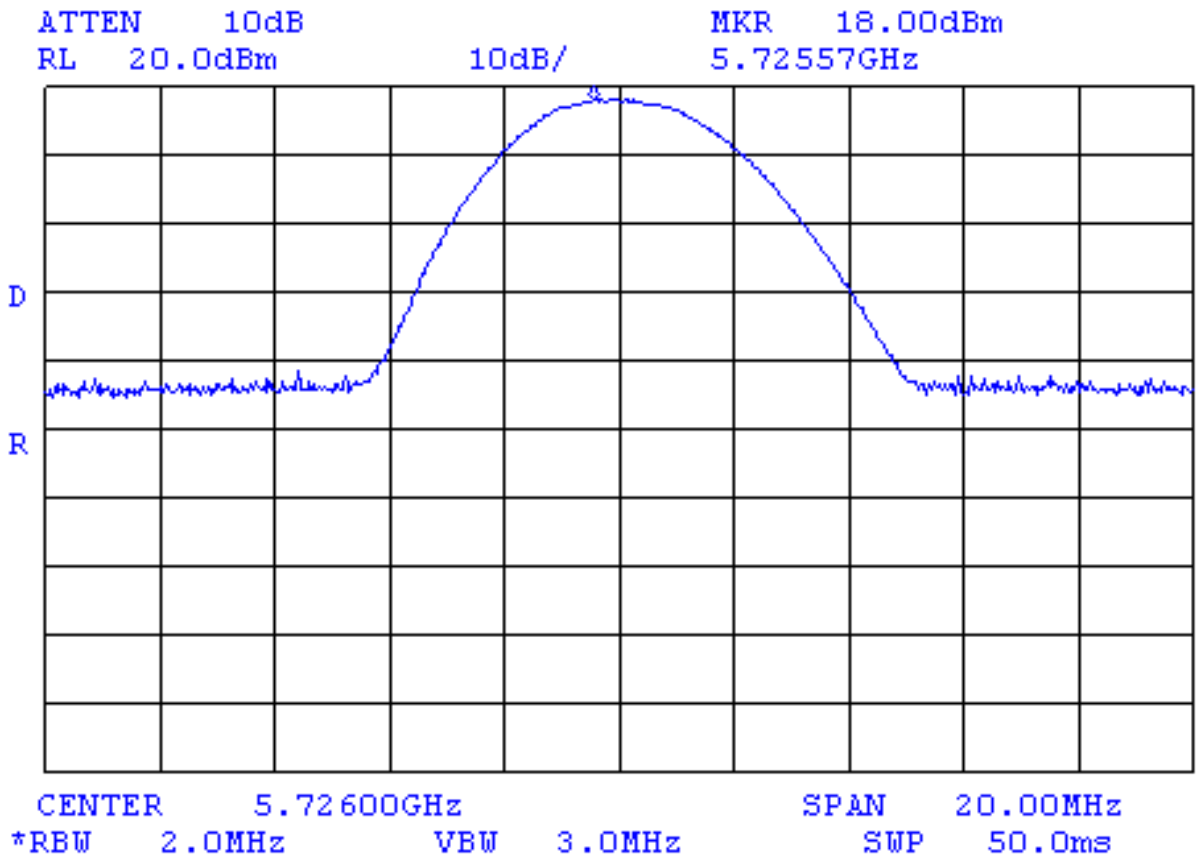
Plot A25

Peak output power

Mode:	Hybrid
F_{LOW}:	5.726 GHz
Bit rate:	4 Mbit/s



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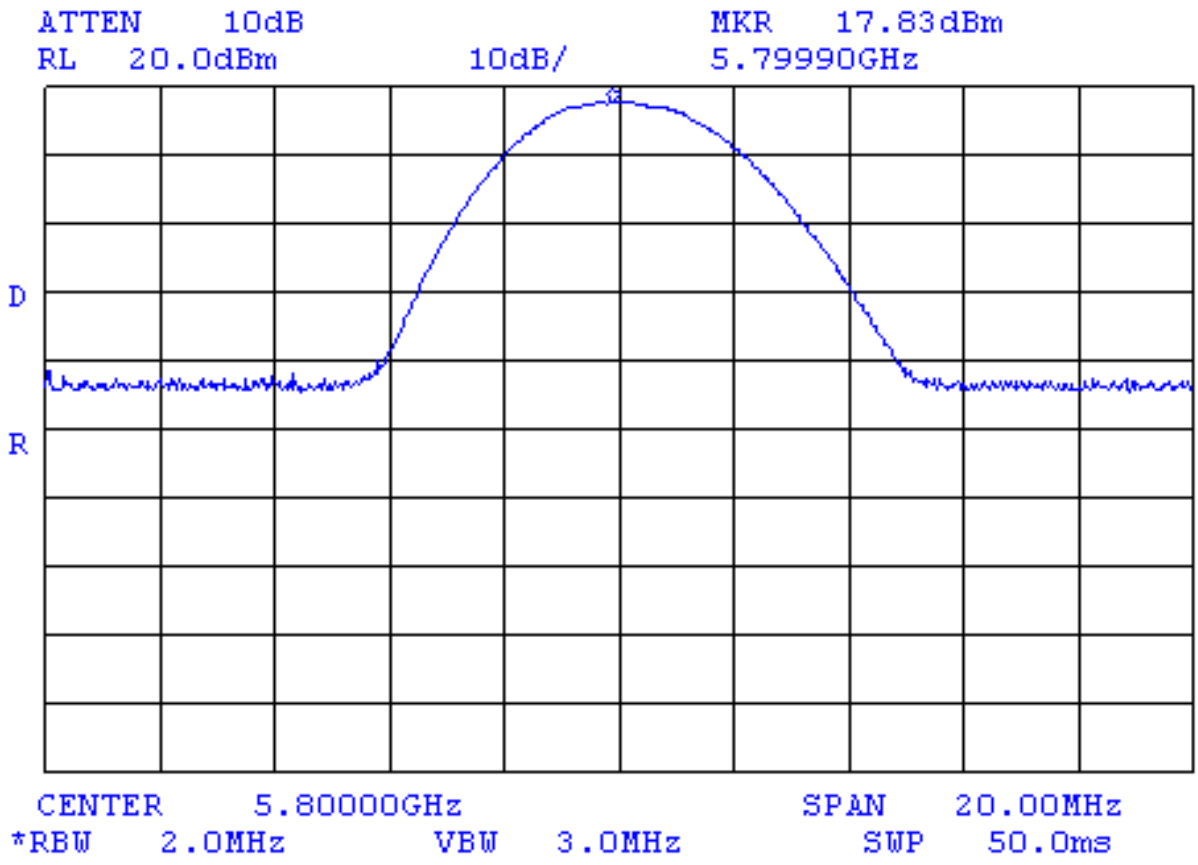
Plot A26

Peak output power

Mode:	Hybrid
F_{MIDDLE}:	5.8 GHz
Bit rate:	1.33 Mbit/s



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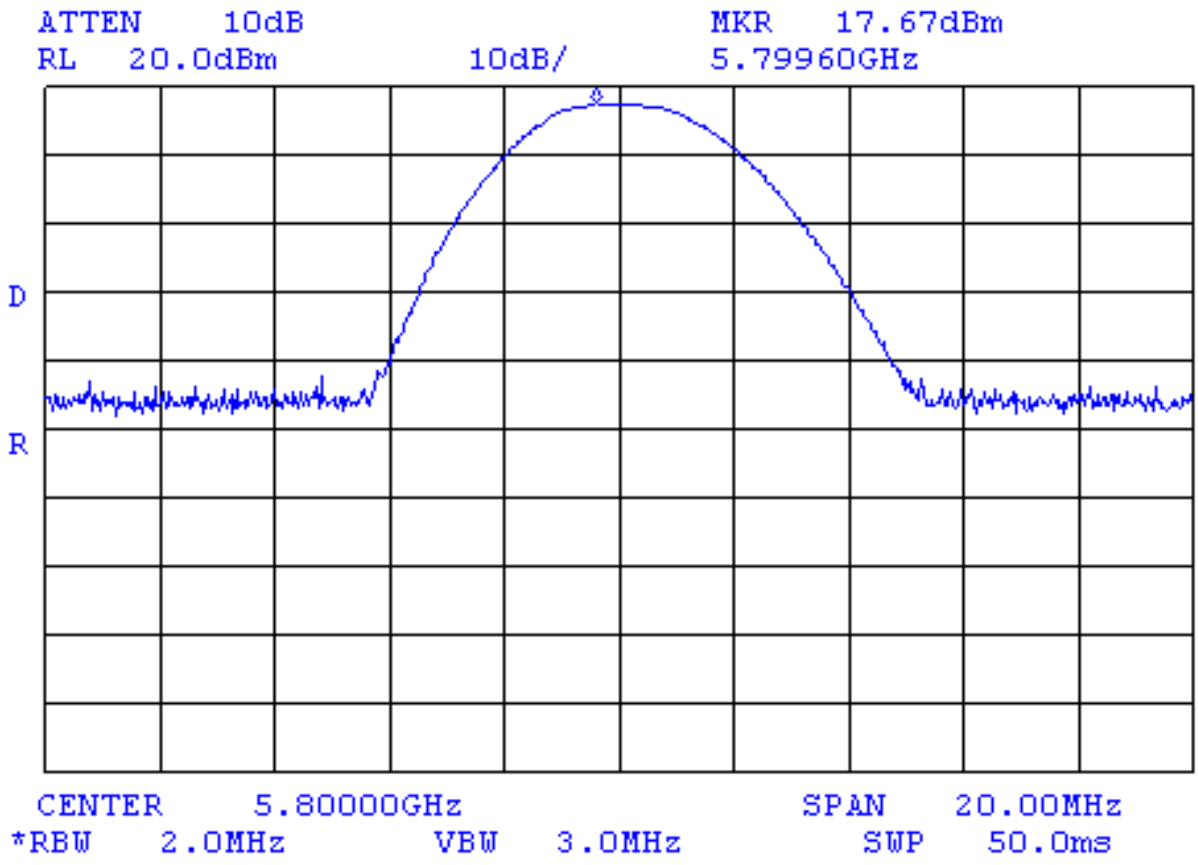
Plot A27

Peak output power

Mode:	Hybrid
F_{MIDDLE}:	5.8 GHz
Bit rate:	4 Mbit/s



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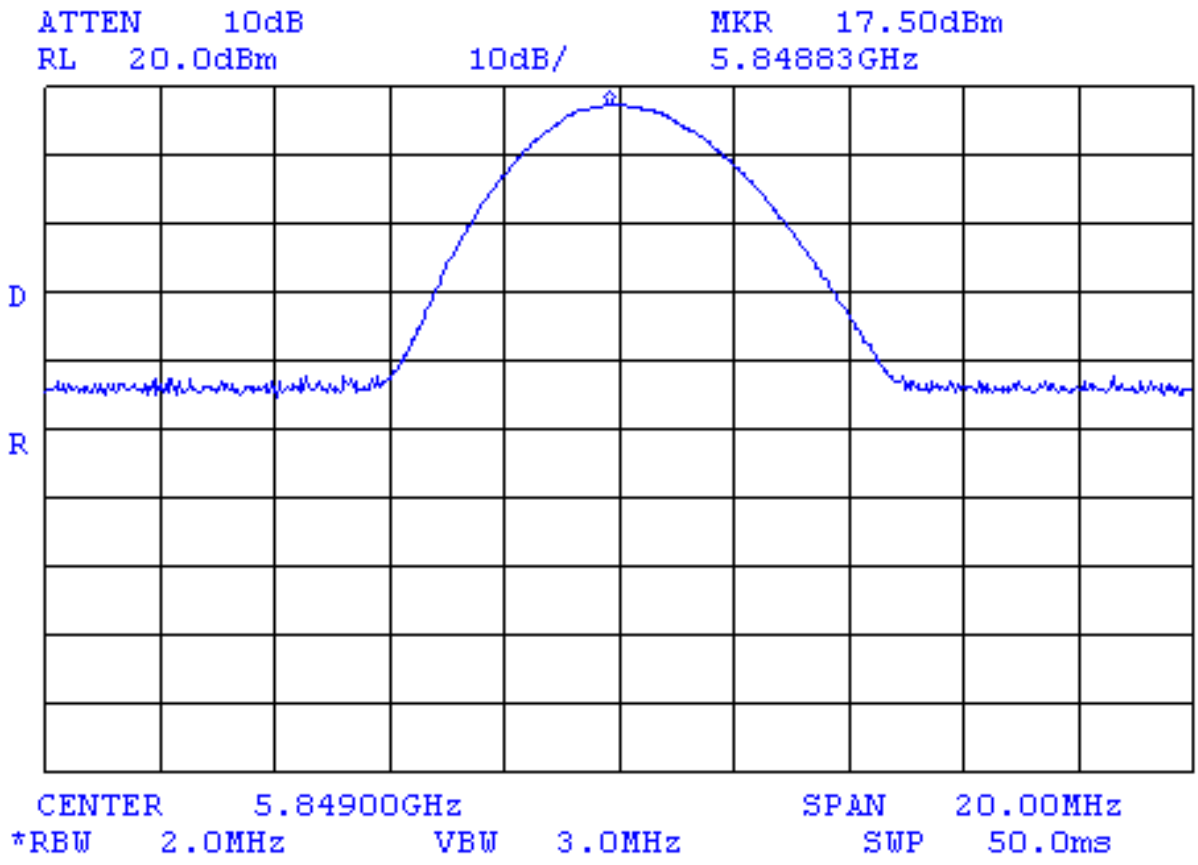
Plot A28

Peak output power

Mode:	Hybrid
F_{HIGH}:	5.849 GHz
Bit rate:	1.33 Mbit/s



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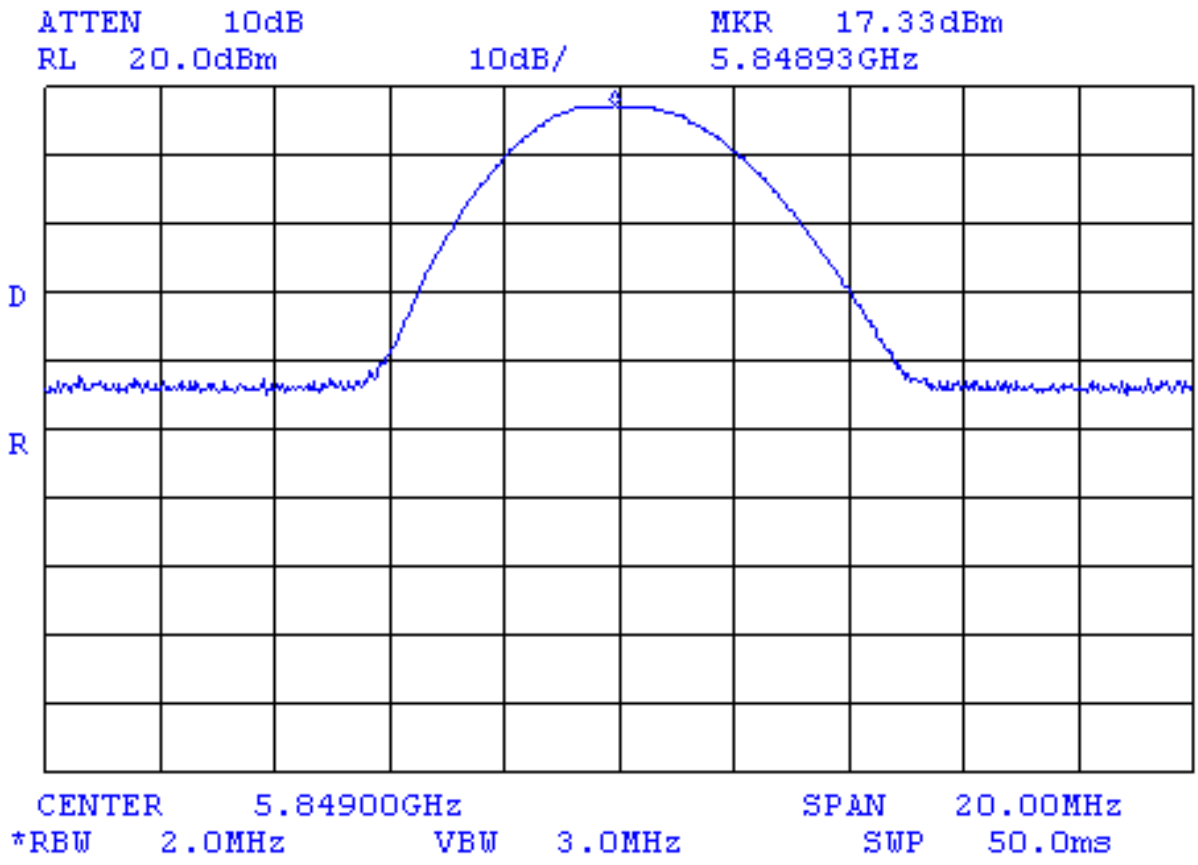
Plot A29

Peak output power

Mode:	Hybrid
F_{HIGH}:	5.849 GHz
Bit rate:	4 Mbit/s



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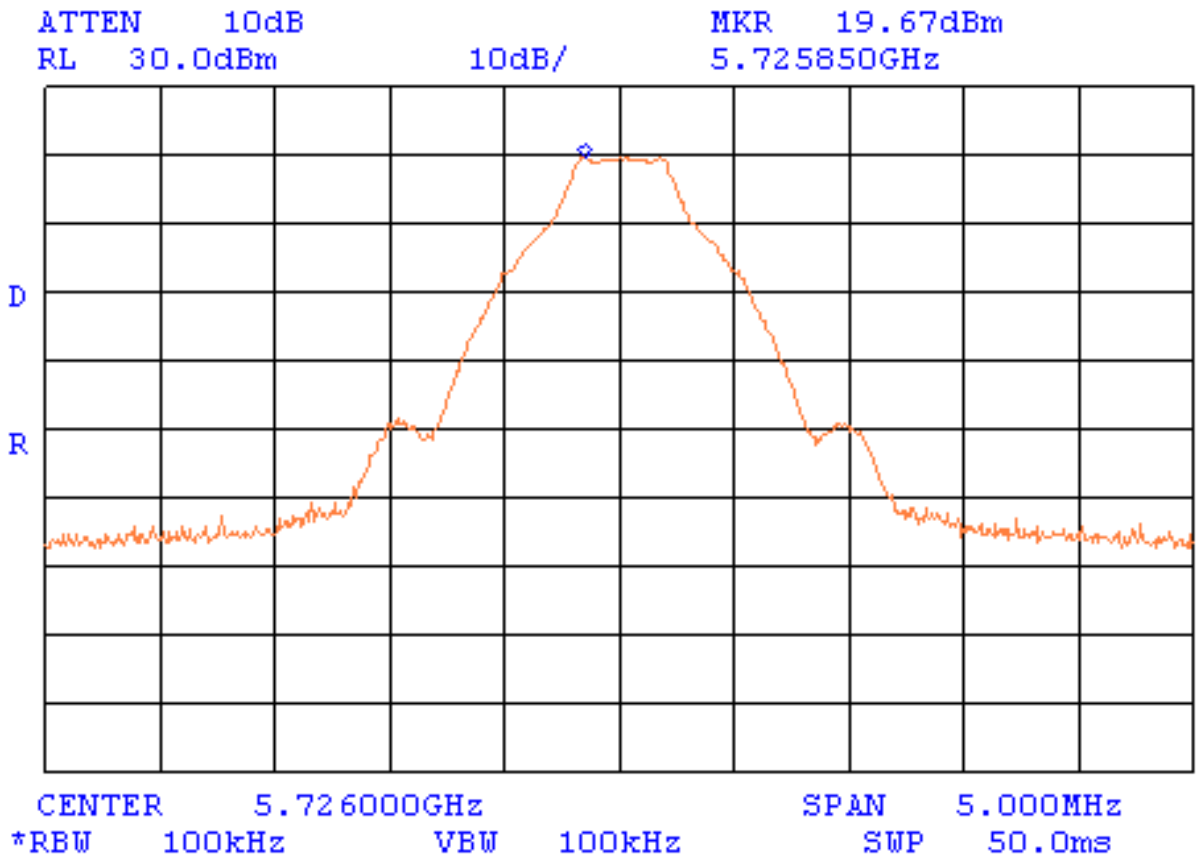
Plot A30

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s



Limit for spurious emissions = 19.67 dBm – 20 dB = – 0.33 dBm

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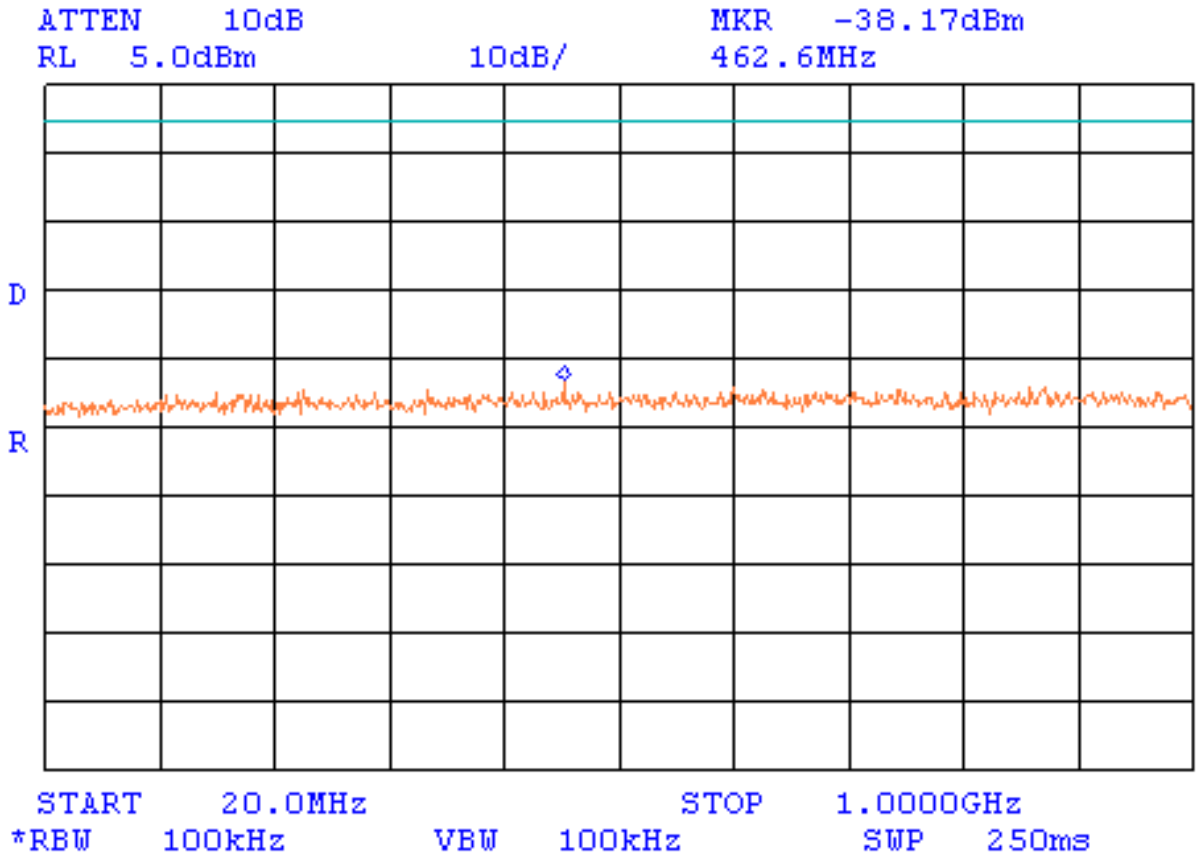
Plot A31

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	20 MHz – 1 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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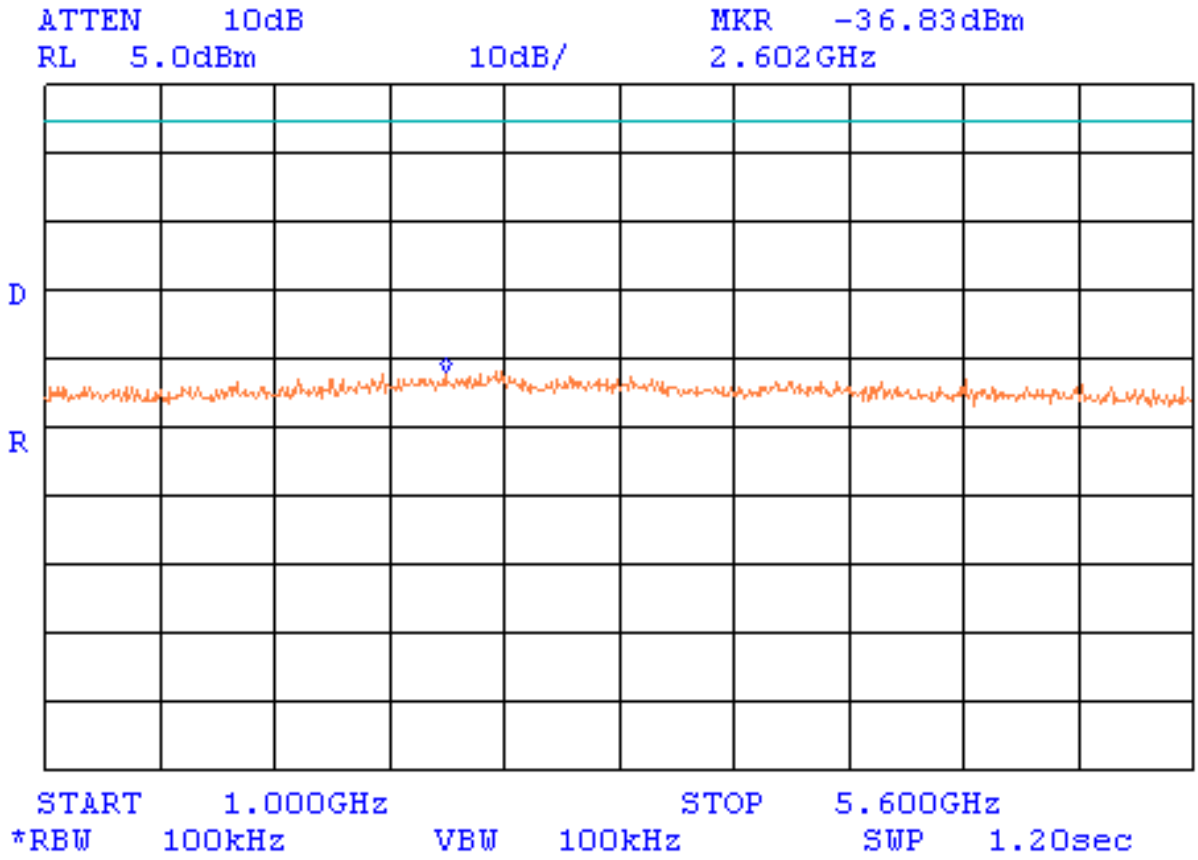
Plot A32

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	1 – 5.6 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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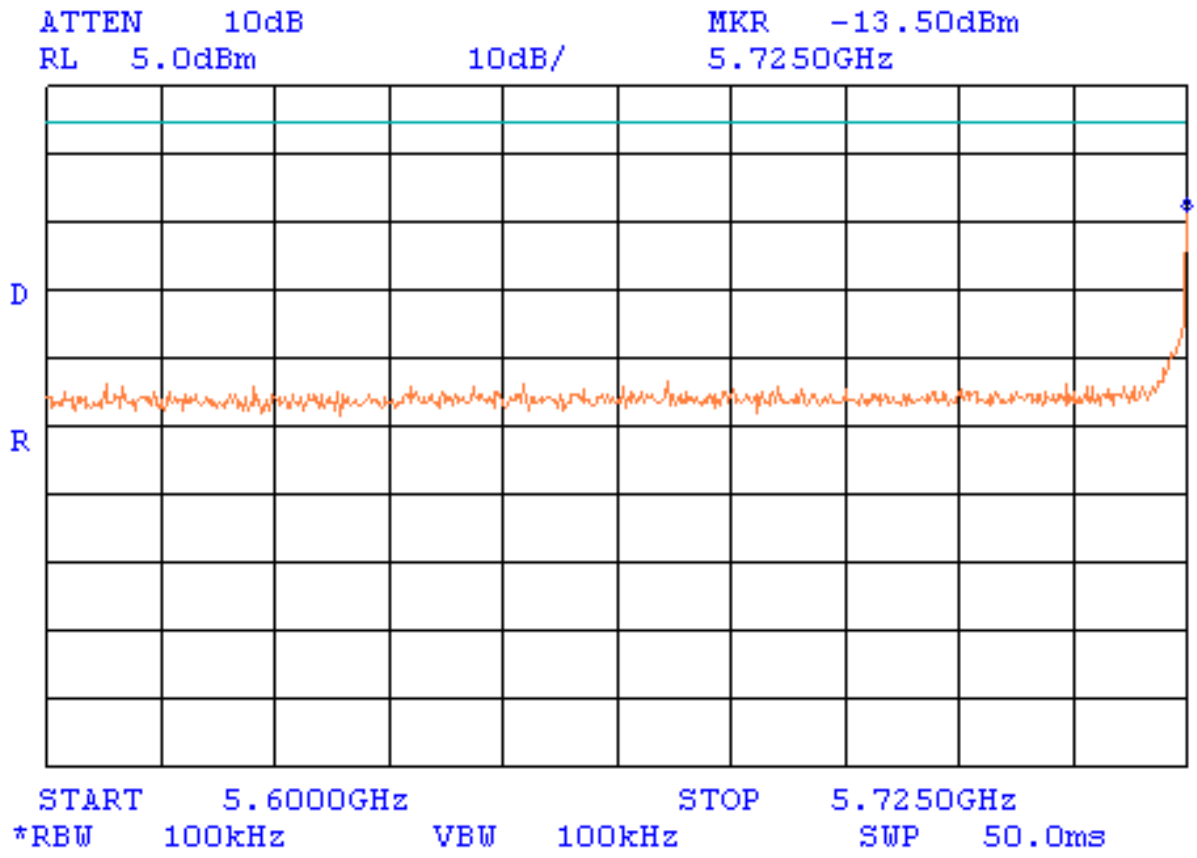
Plot A33

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	5.6 – 5.725 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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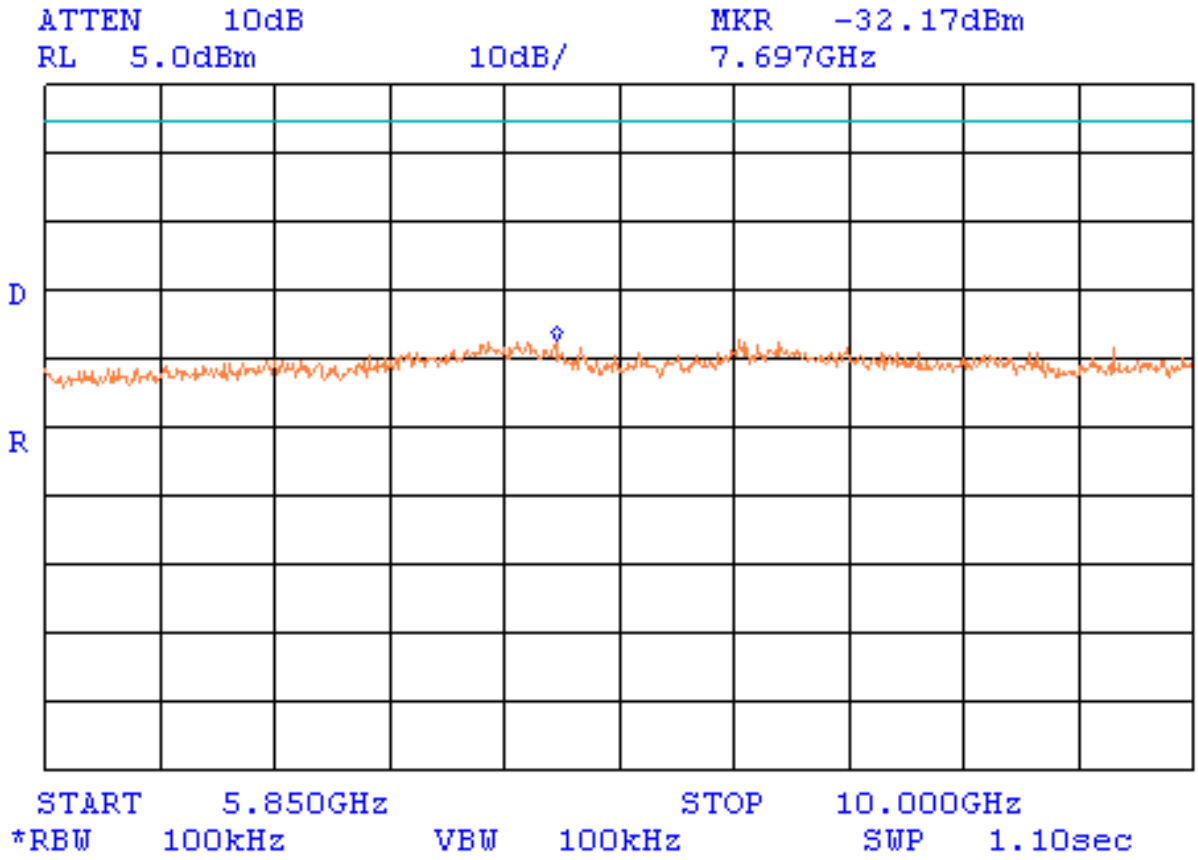
Plot A34

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	5.85 – 10 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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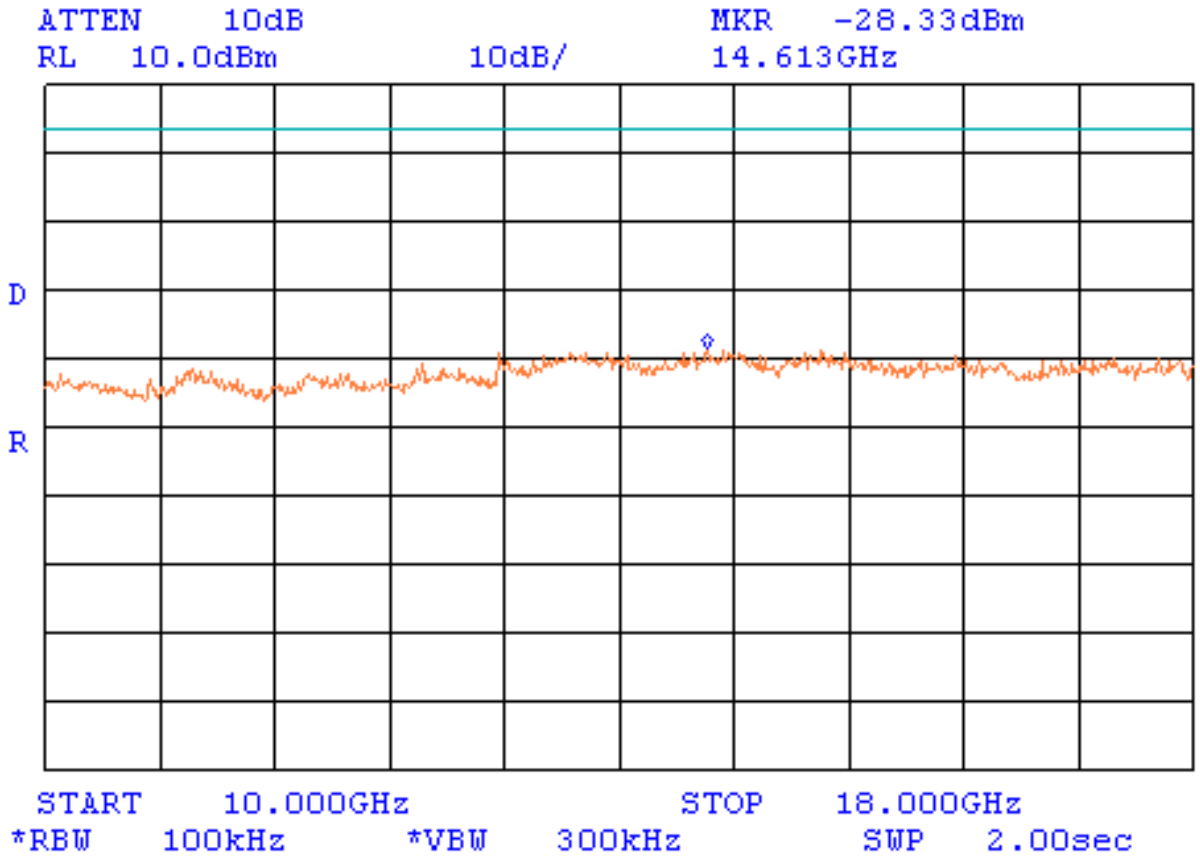
Plot A35

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	10 – 18 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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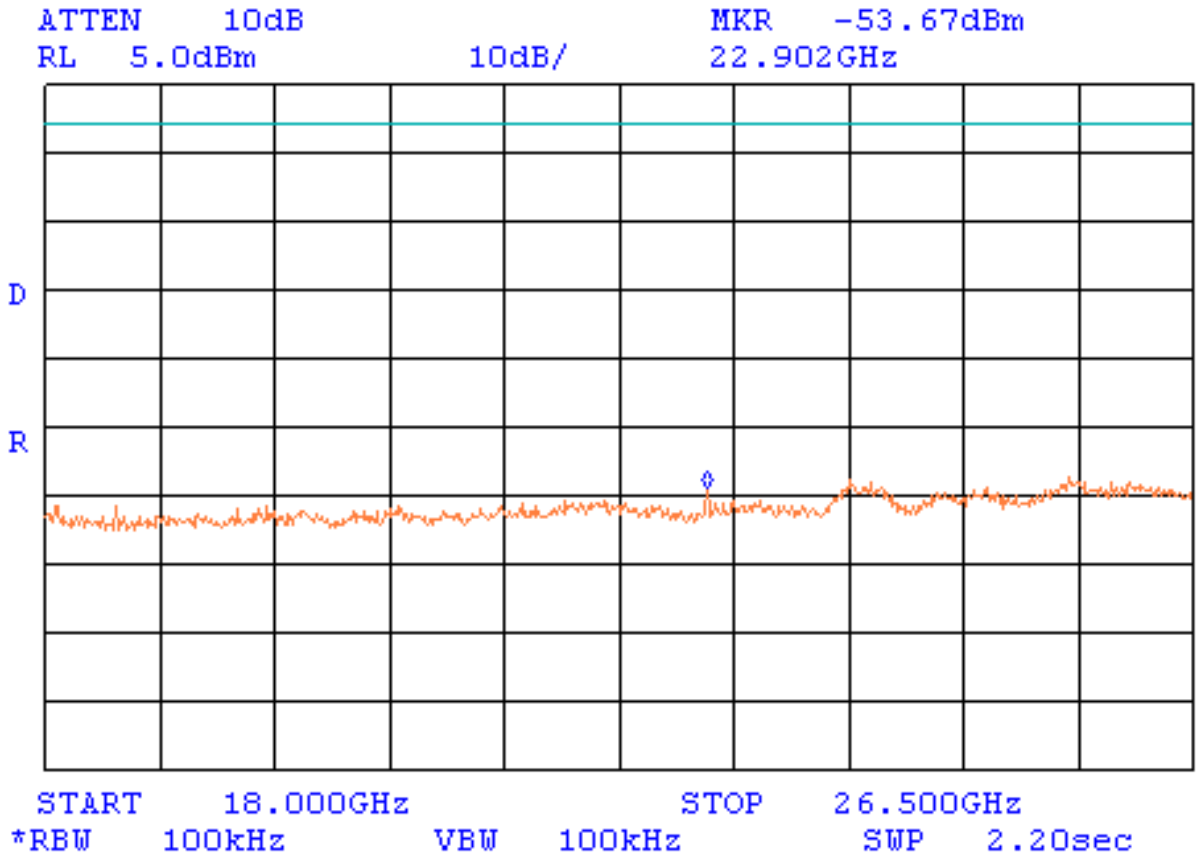
Plot A36

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	18 – 26.5 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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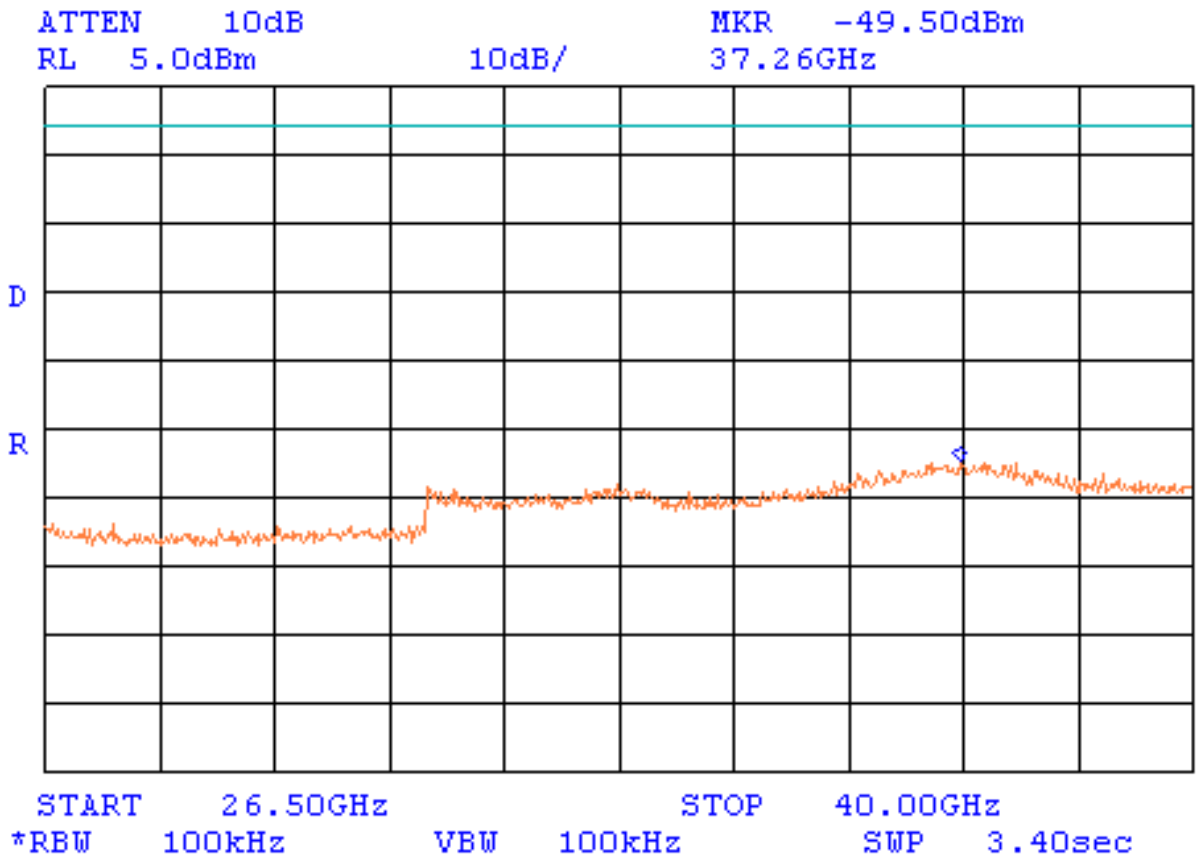
Plot A37

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	26.5 – 40 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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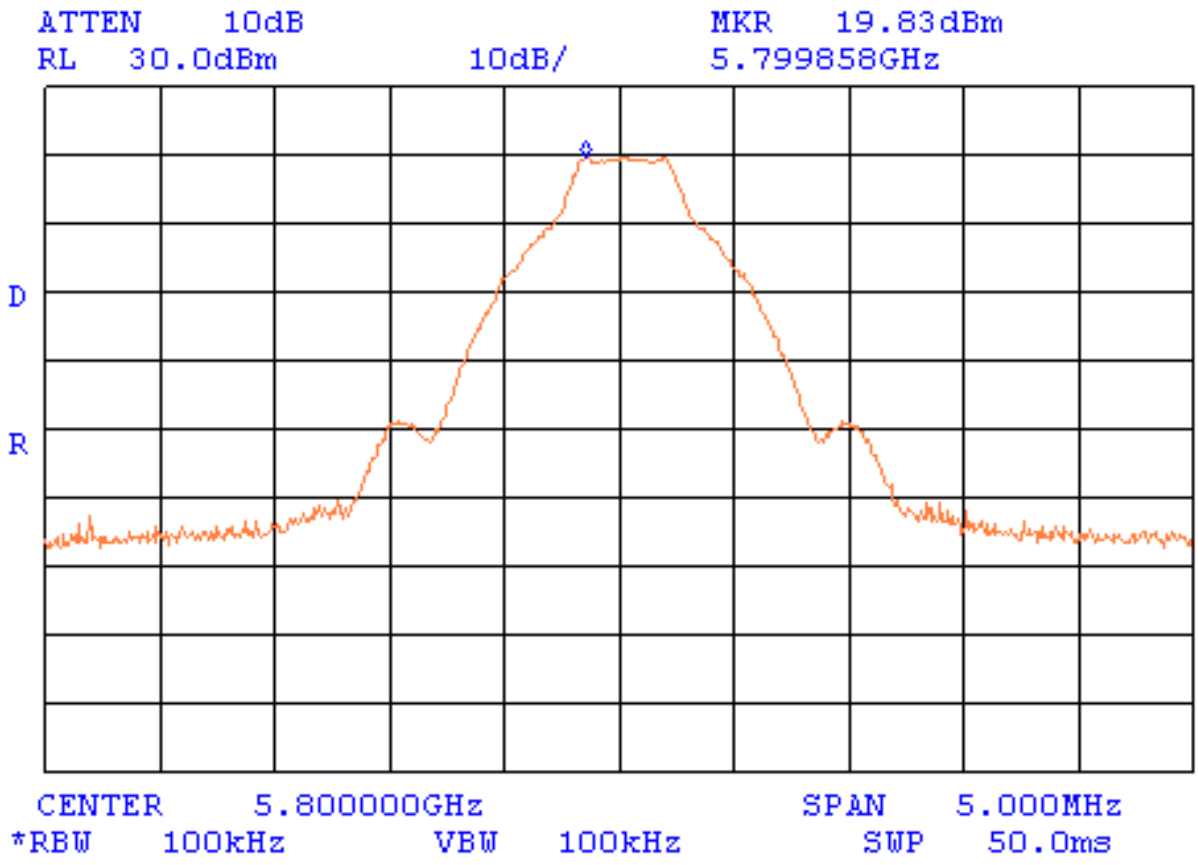
Plot A38

Conducted spurious emission measurements

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s



Limit for spurious emissions =19.83 dBm – 20 dB = – 0.17 dBm

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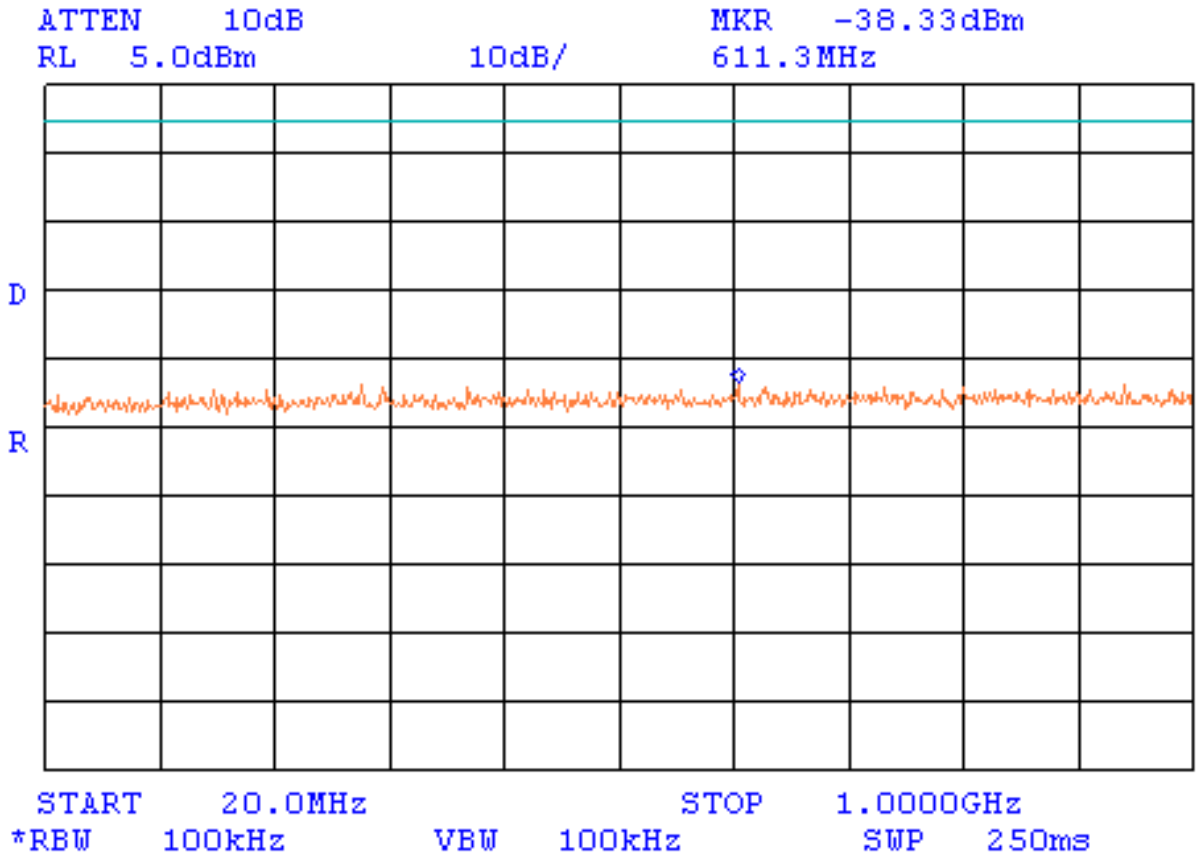
Plot A39

Conducted spurious emission measurements

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	20 MHz – 1 GHz



Limit for spurious emissions = – 0.17 dBm
No spurious emissions were found

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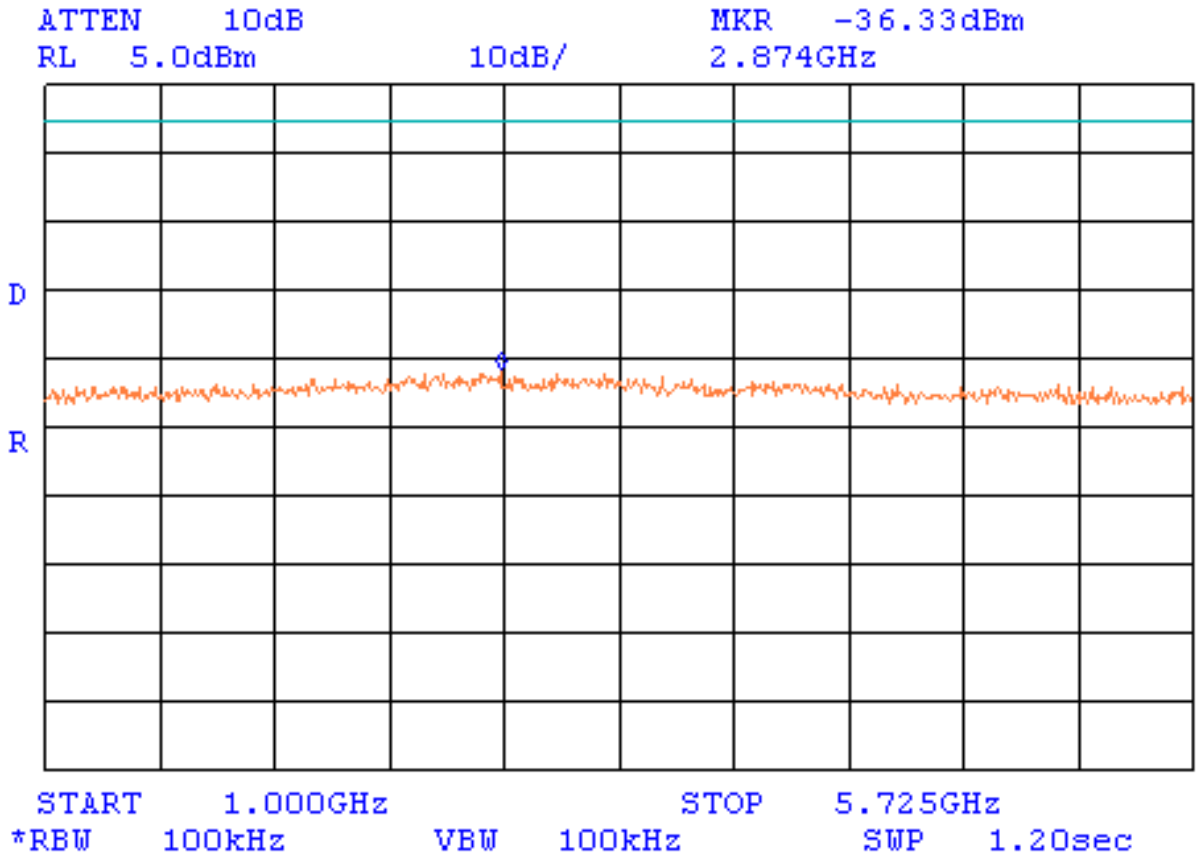
Plot A40

Conducted spurious emission measurements

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	1 – 5.725 GHz



Limit for spurious emissions = – 0.17 dBm
No spurious emissions were found

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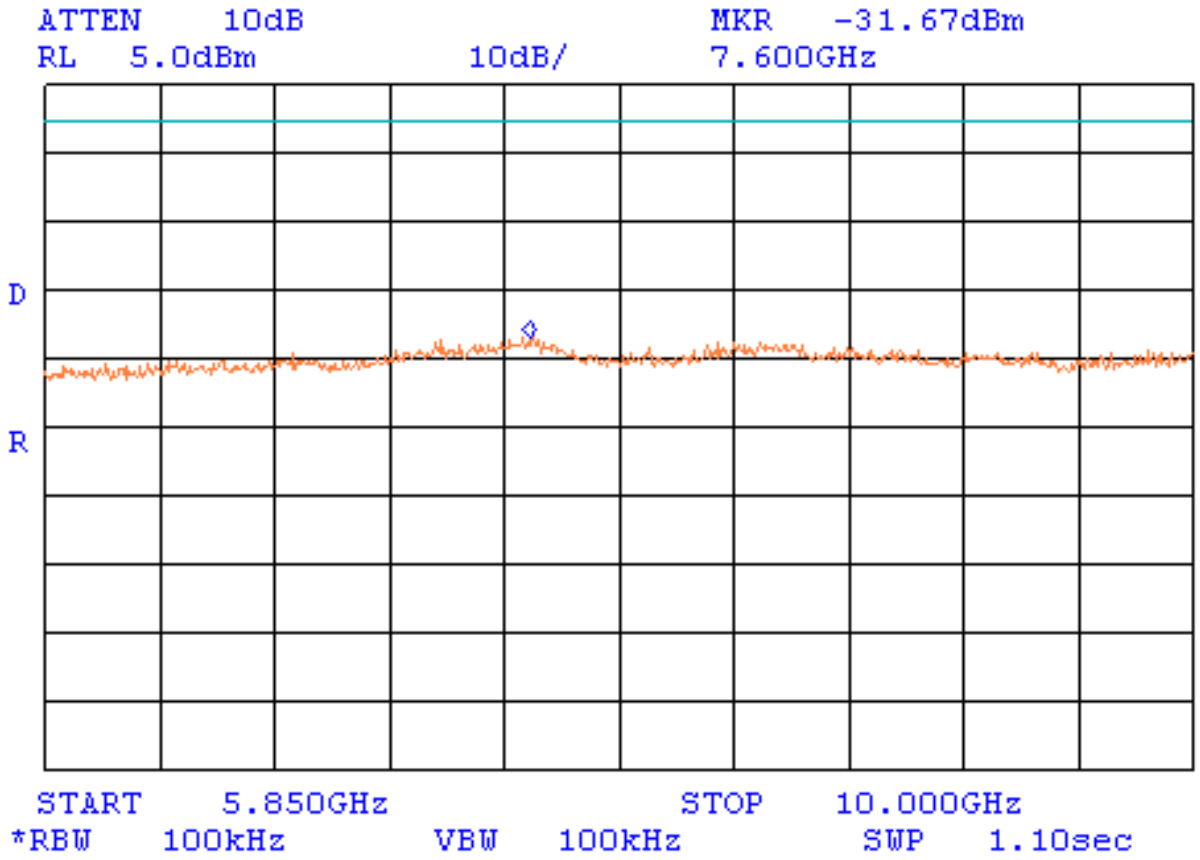
Plot A41

Conducted spurious emission measurements

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	5.85 – 10 GHz



Limit for spurious emissions = – 0.17 dBm
No spurious emissions were found

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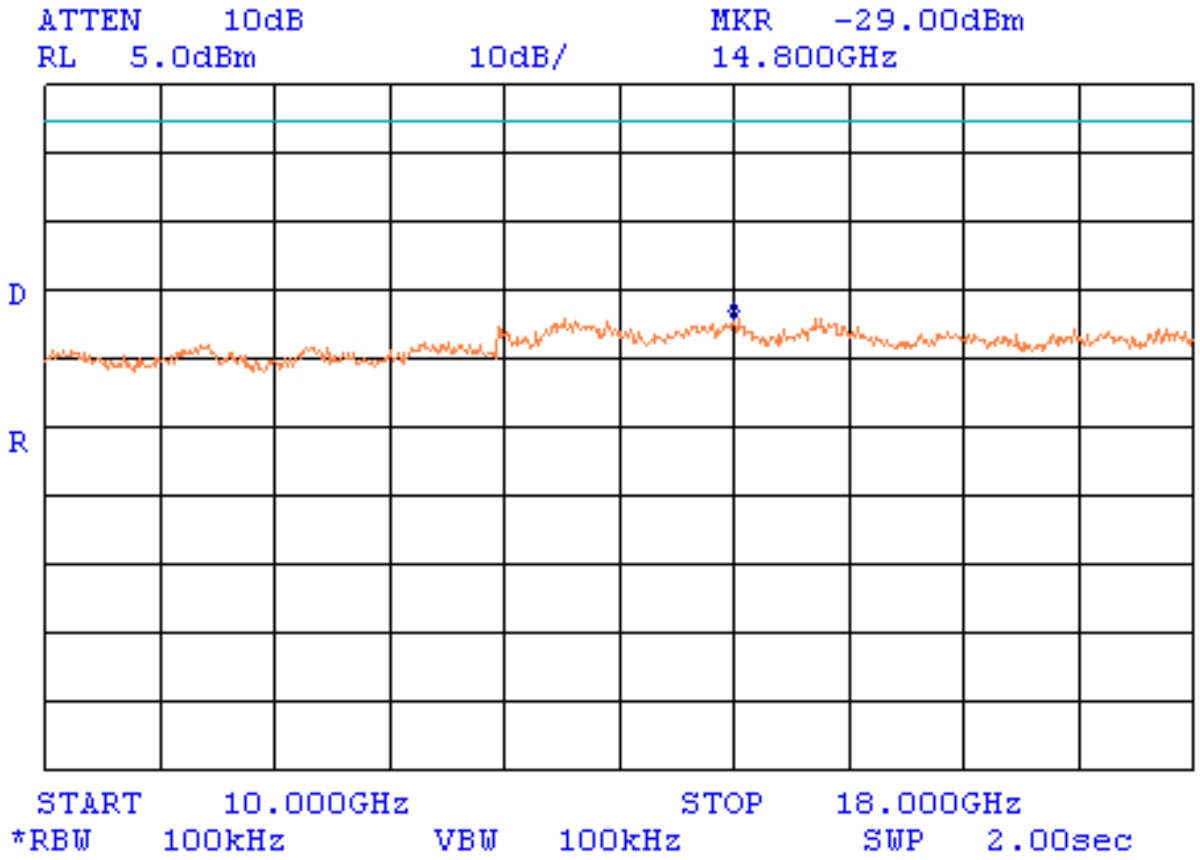
Plot A42

Conducted spurious emission measurements

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	10 – 18 GHz



Limit for spurious emissions = – 0.17 dBm
No spurious emissions were found

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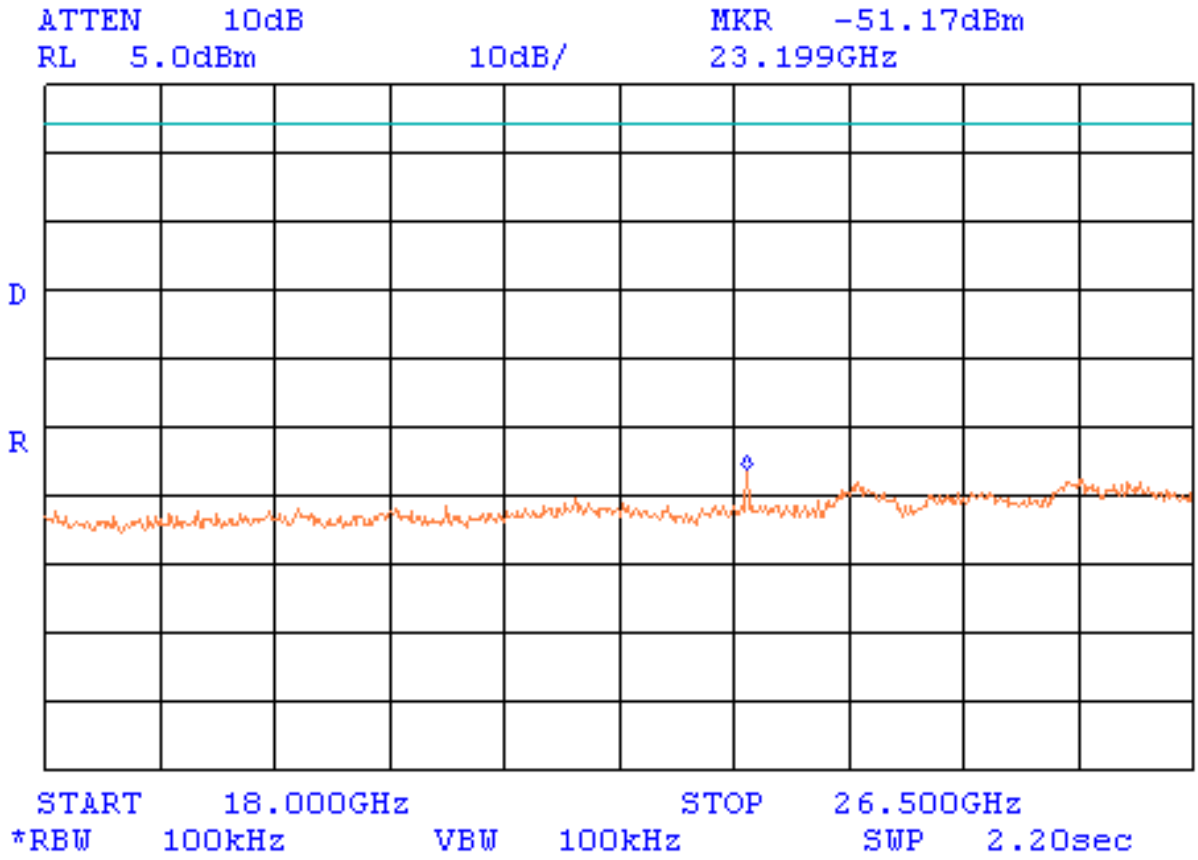
Plot A43

Conducted spurious emission measurements

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	18 – 26.5 GHz



Limit for spurious emissions = – 0.17 dBm
No spurious emissions were found

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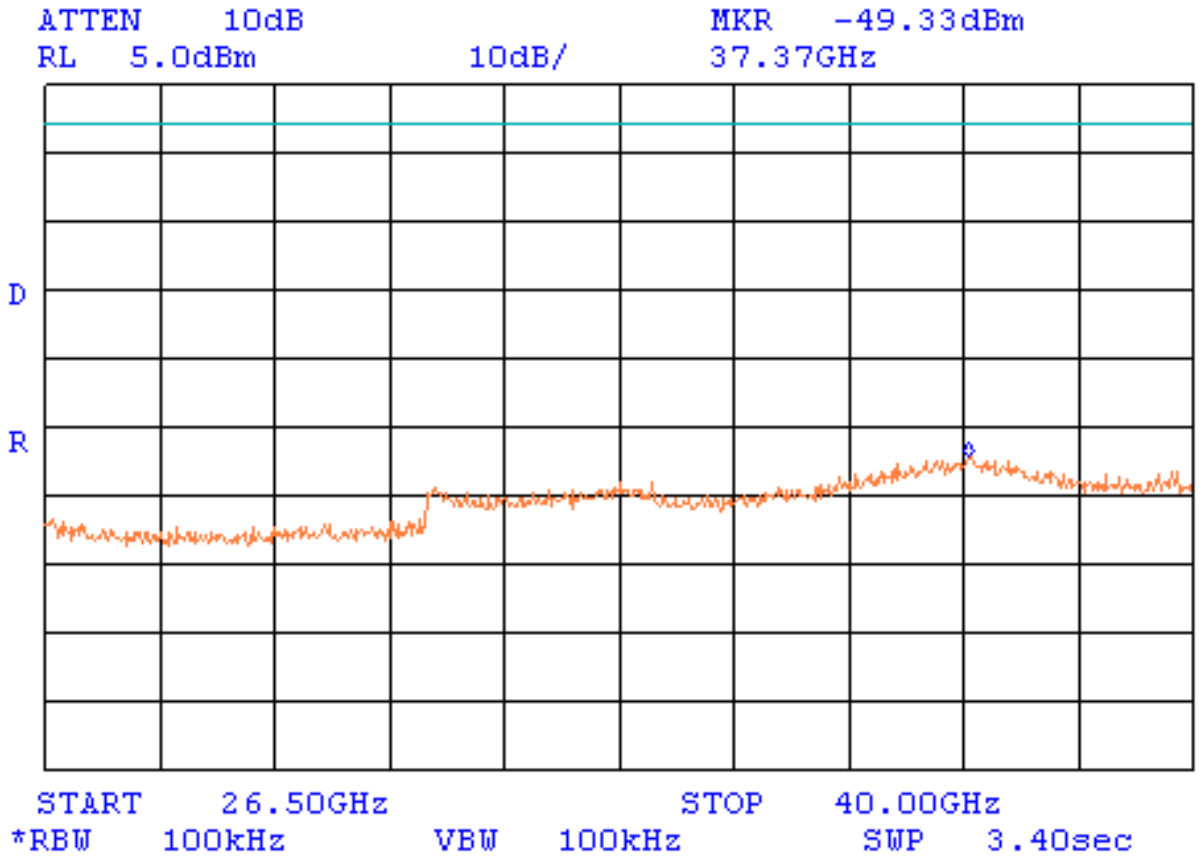
Plot A44

Conducted spurious emission measurements

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	26.5 – 40 GHz



Limit for spurious emissions = – 0.17 dBm
No spurious emissions were found

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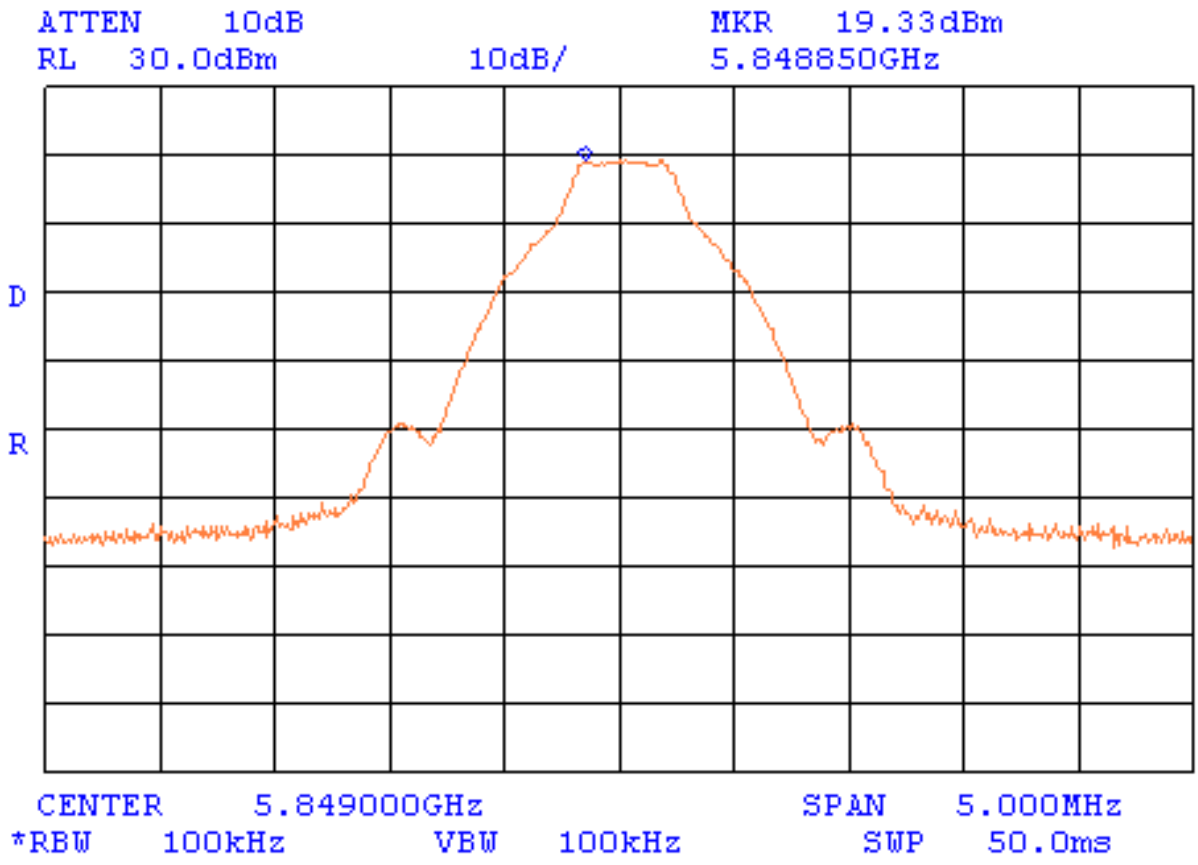
Plot A45

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s



Limit for spurious emissions = 19.33 dBm – 20 dB = – 0.67 dBm

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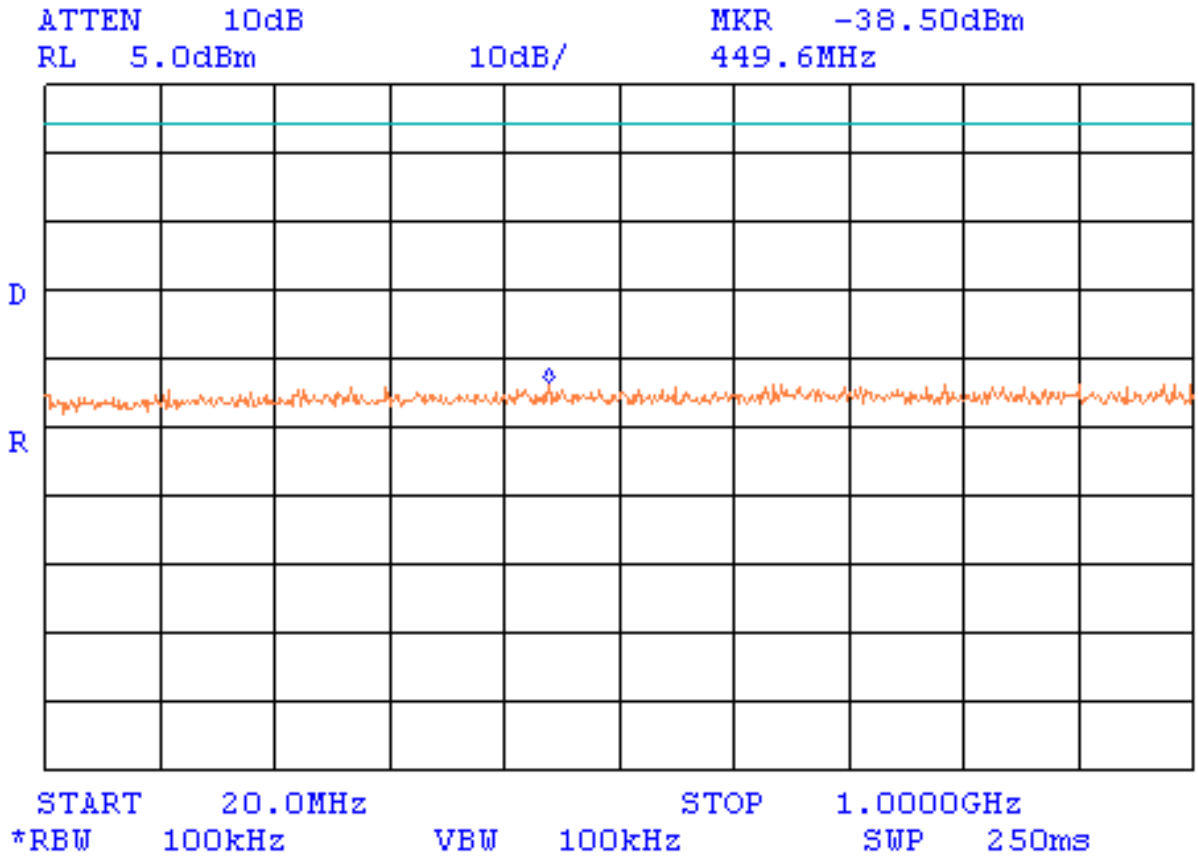
Plot A46

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	20 MHz – 1 GHz



Limit for spurious emissions = – 0.67 dBm
No spurious emissions were found

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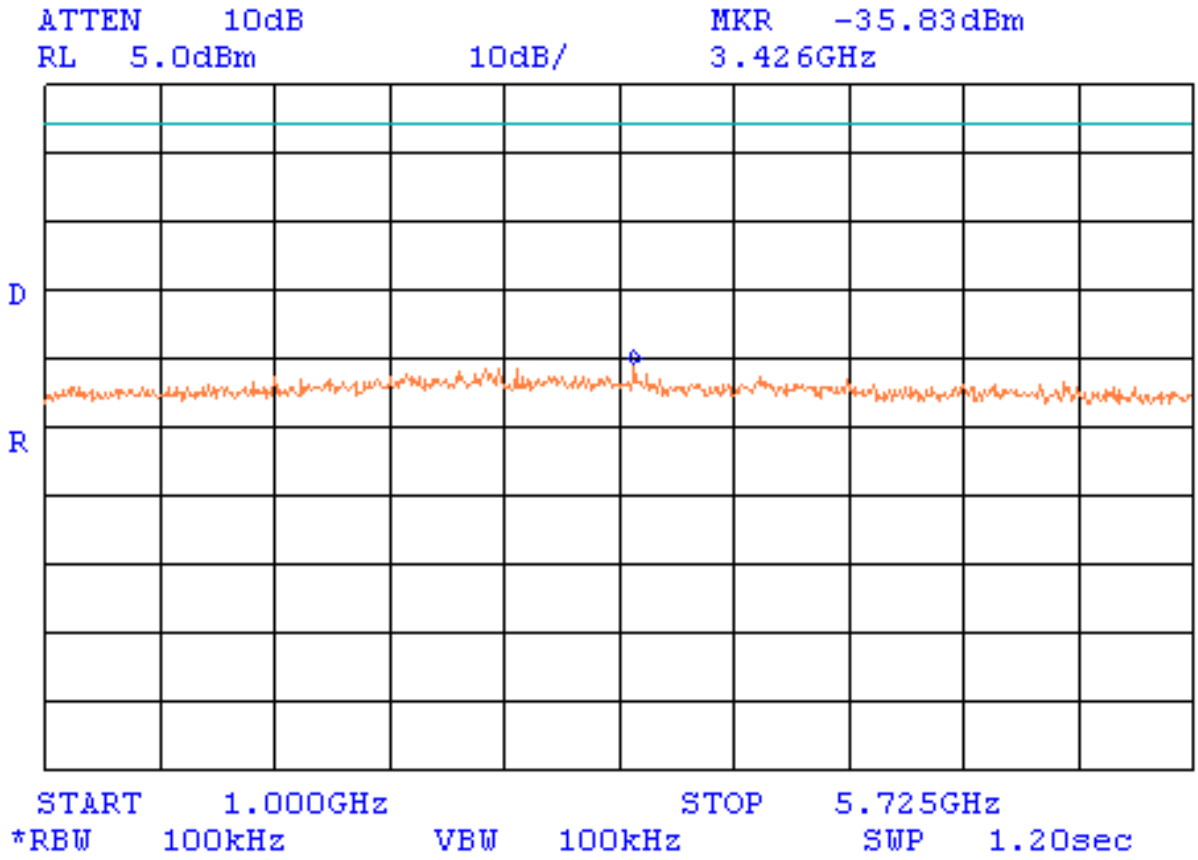
Plot A47

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	1 – 5.725 GHz



Limit for spurious emissions = – 0.67 dBm
No spurious emissions were found

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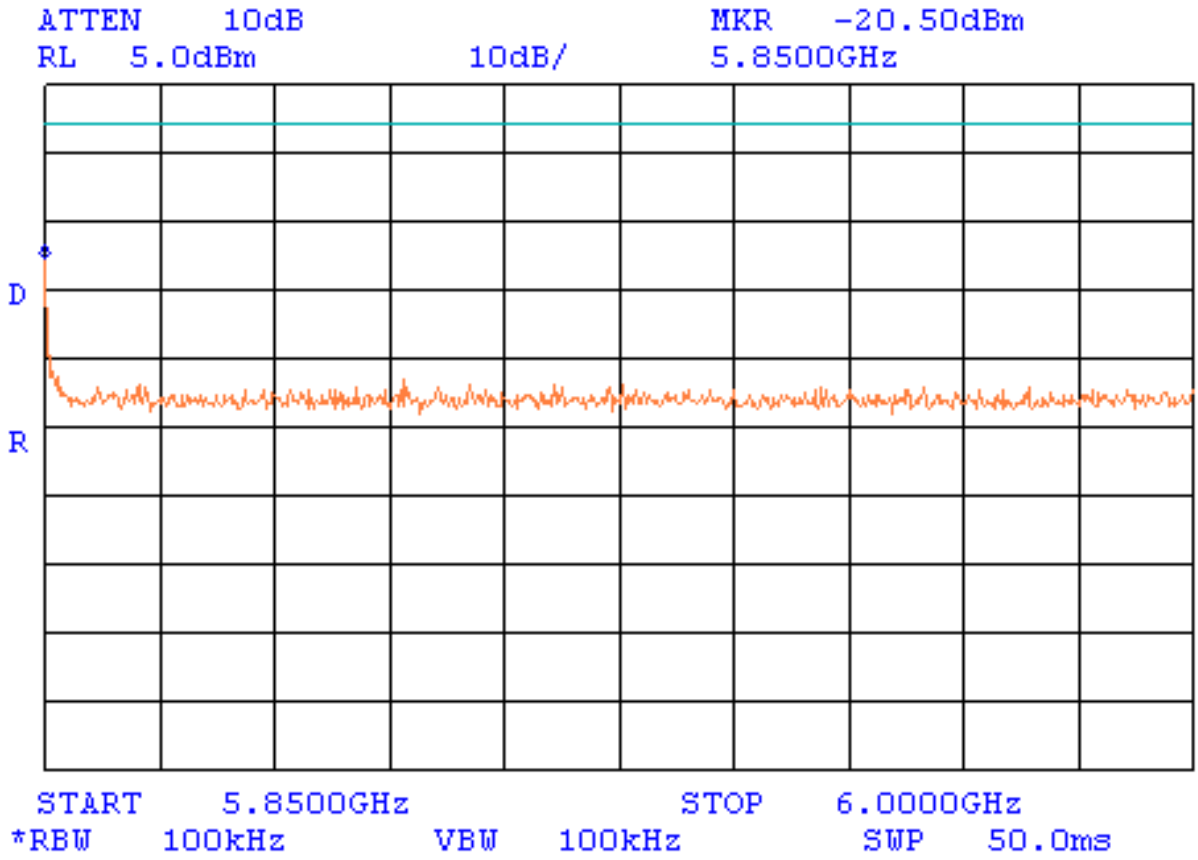
Plot A48

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	5.85 – 6 GHz



Limit for spurious emissions = – 0.67 dBm
No spurious emissions were found

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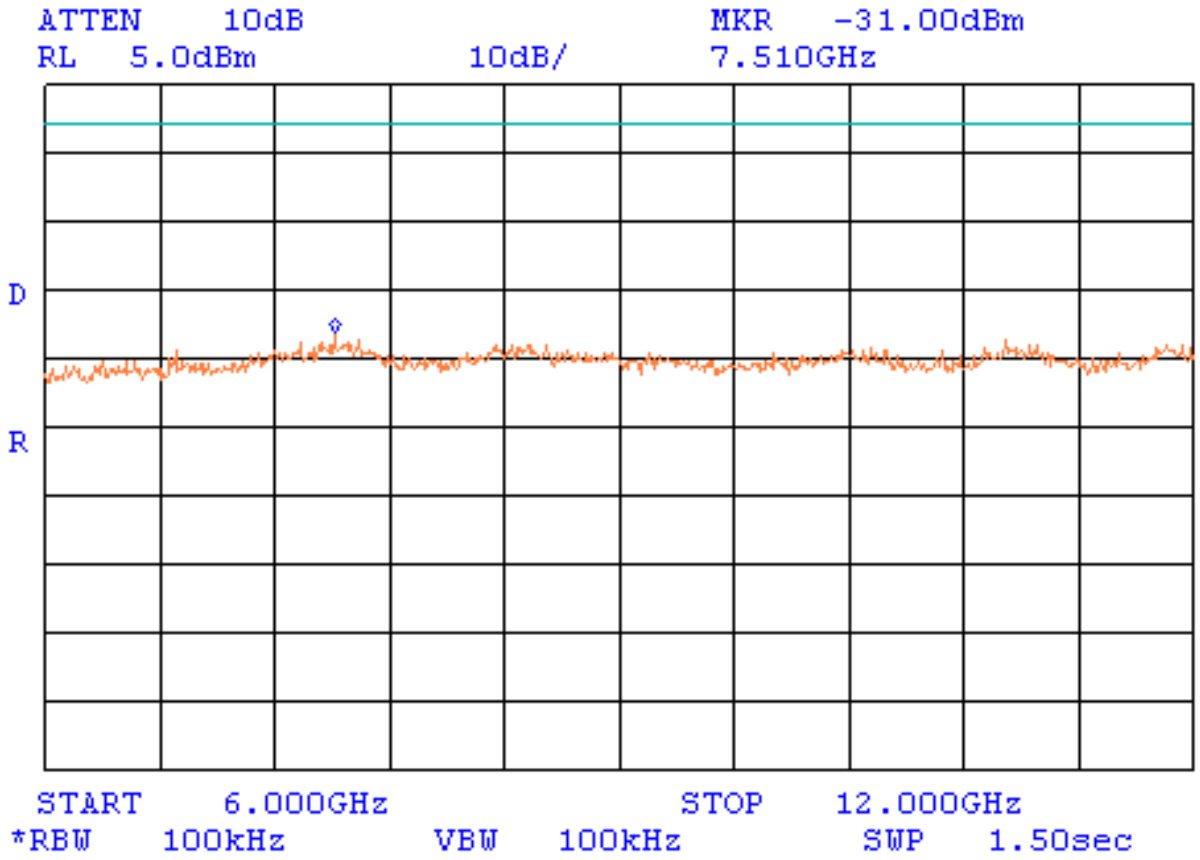
Plot A49

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	6 – 12 GHz



Limit for spurious emissions = – 0.67 dBm
No spurious emissions were found

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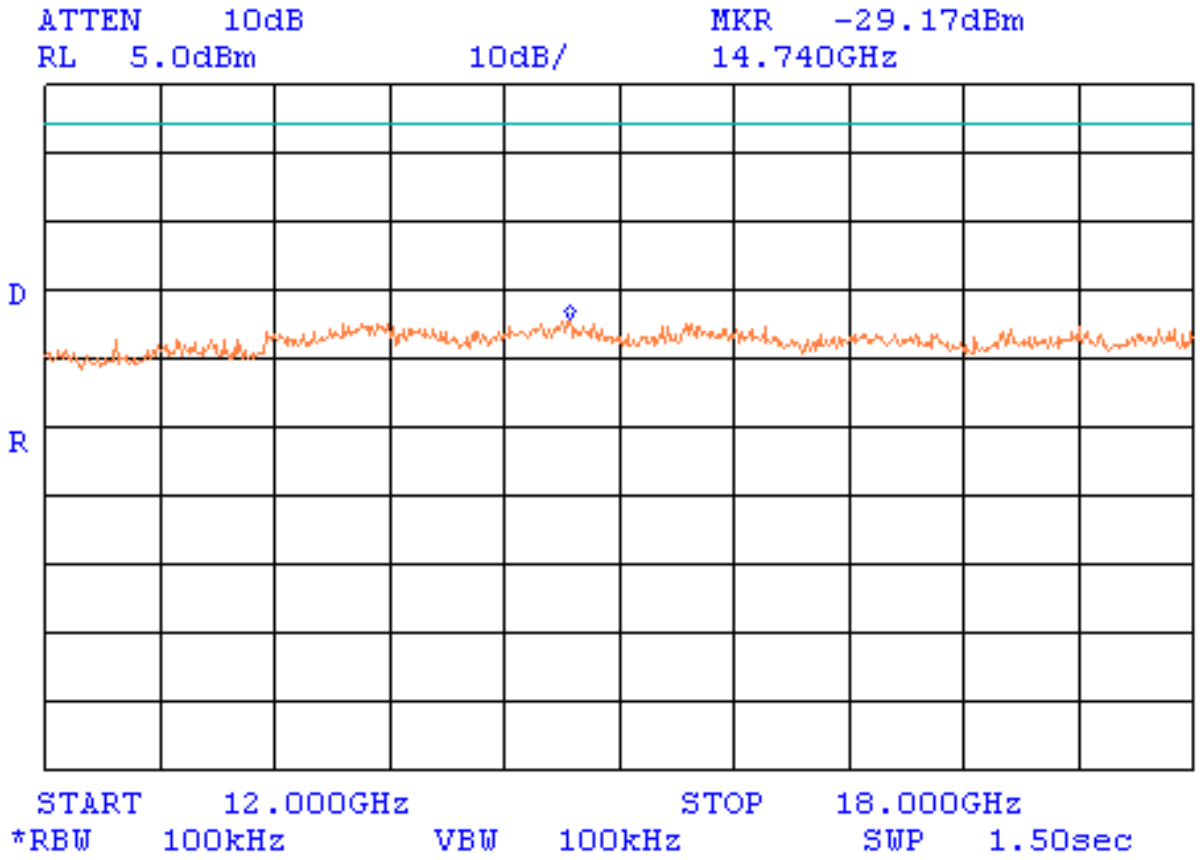
Plot A50

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	12 – 18 GHz



Limit for spurious emissions = – 0.67 dBm
No spurious emissions were found

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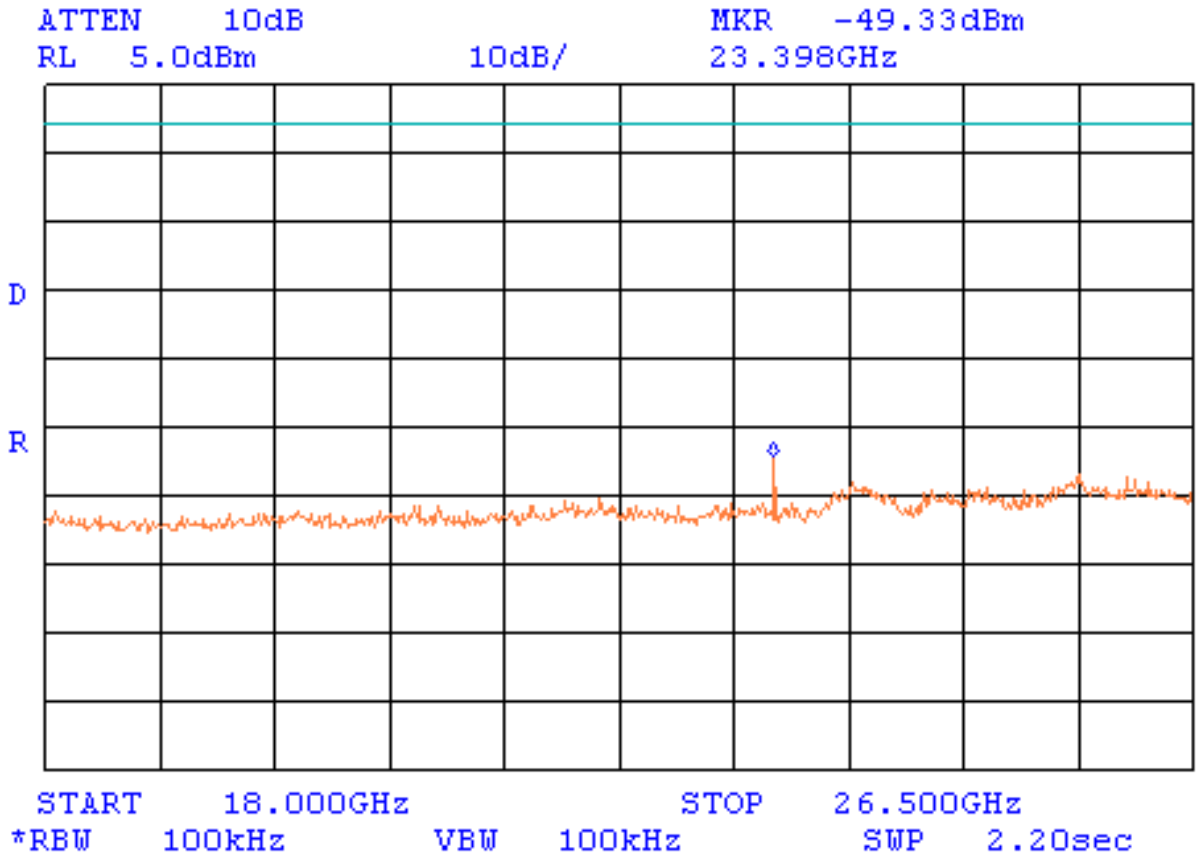
Plot A51

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	18 – 26.5 GHz



Limit for spurious emissions = – 0.67 dBm
No spurious emissions were found except 4th harmonic of fundamental

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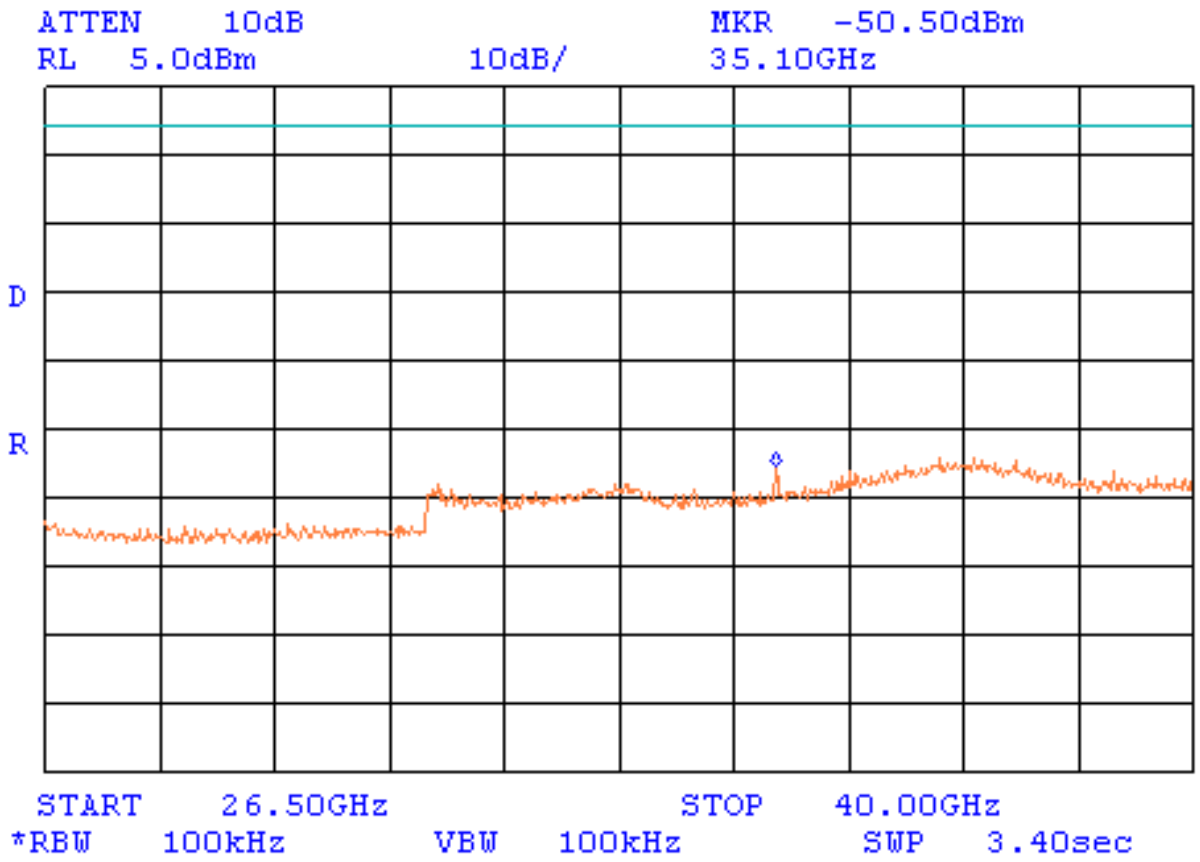
Plot A52

Conducted spurious emission measurements

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	26.5 – 40 GHz



Limit for spurious emissions = – 0.67 dBm
No spurious emissions were found

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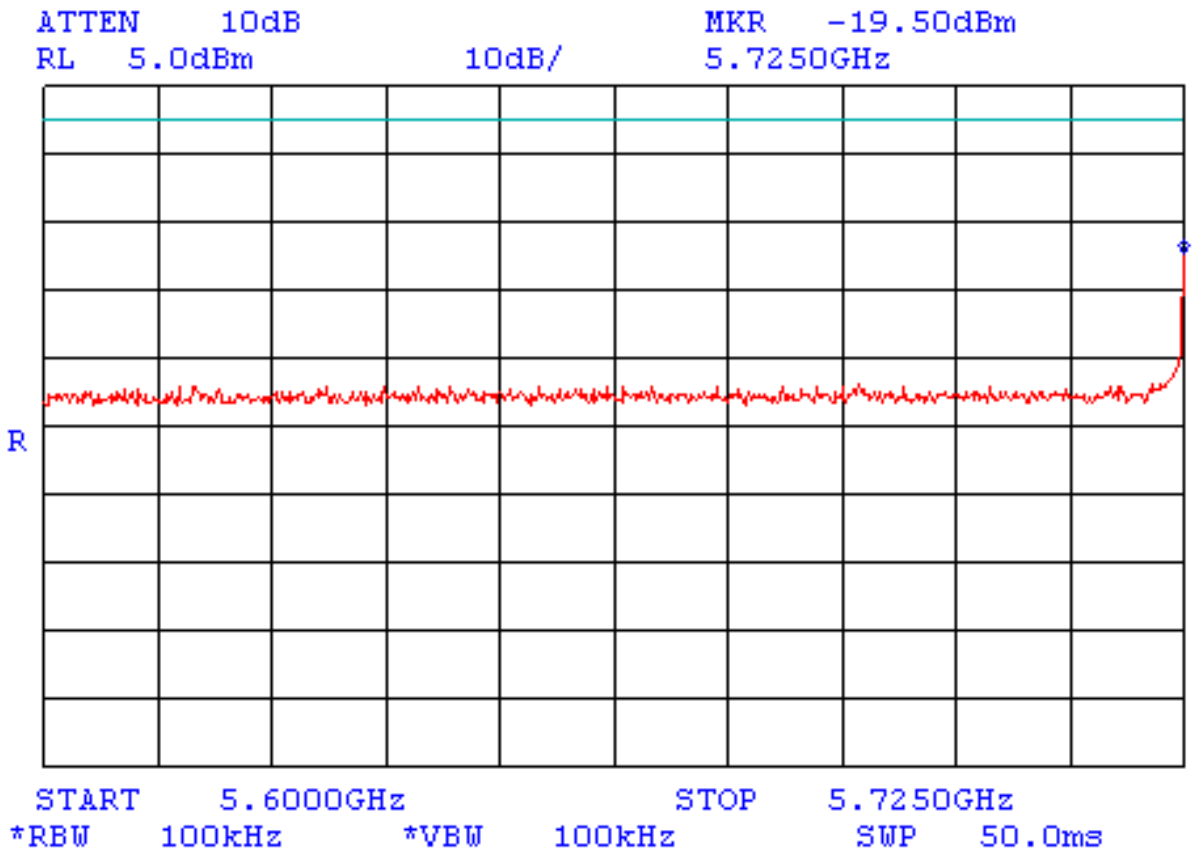
Plot A53

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	1 Mbit/s
Frequency range:	5.6 – 5.725 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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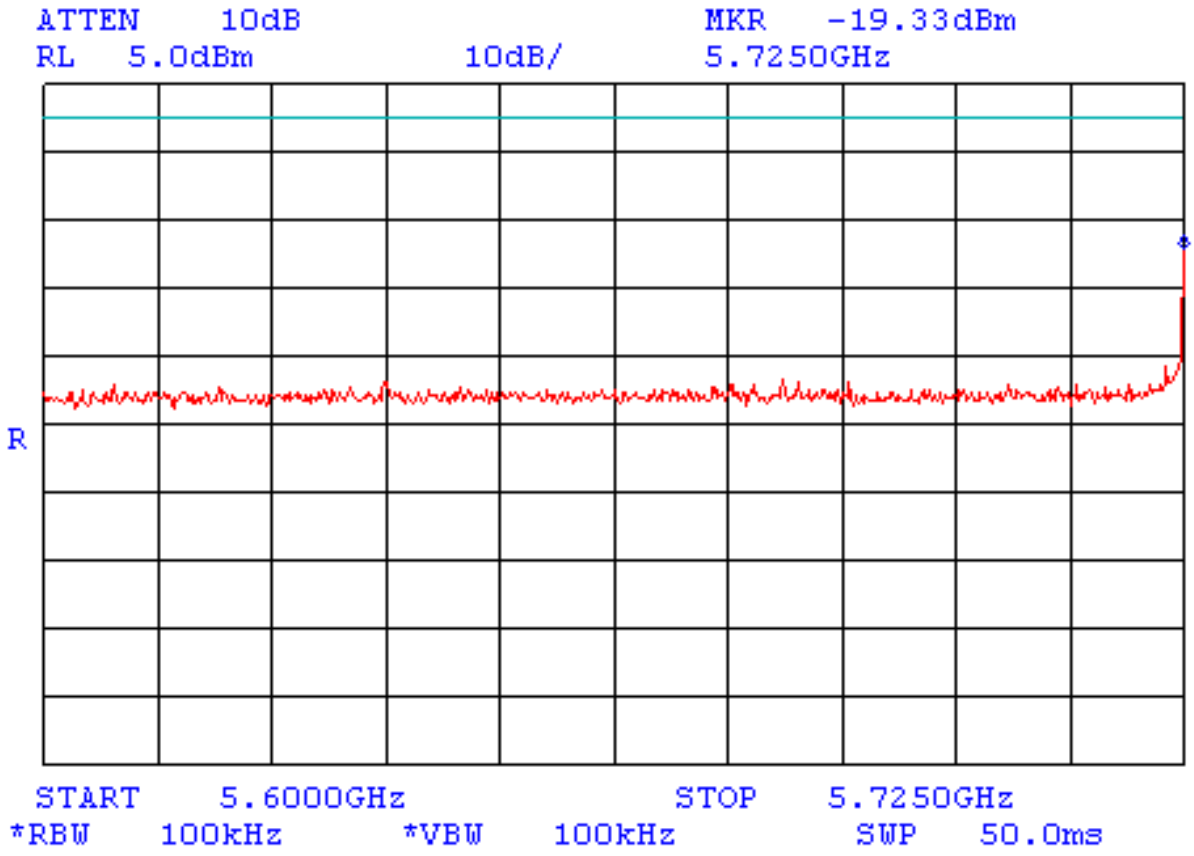
Plot A54

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	2 Mbit/s
Frequency range:	5.6 – 5.725 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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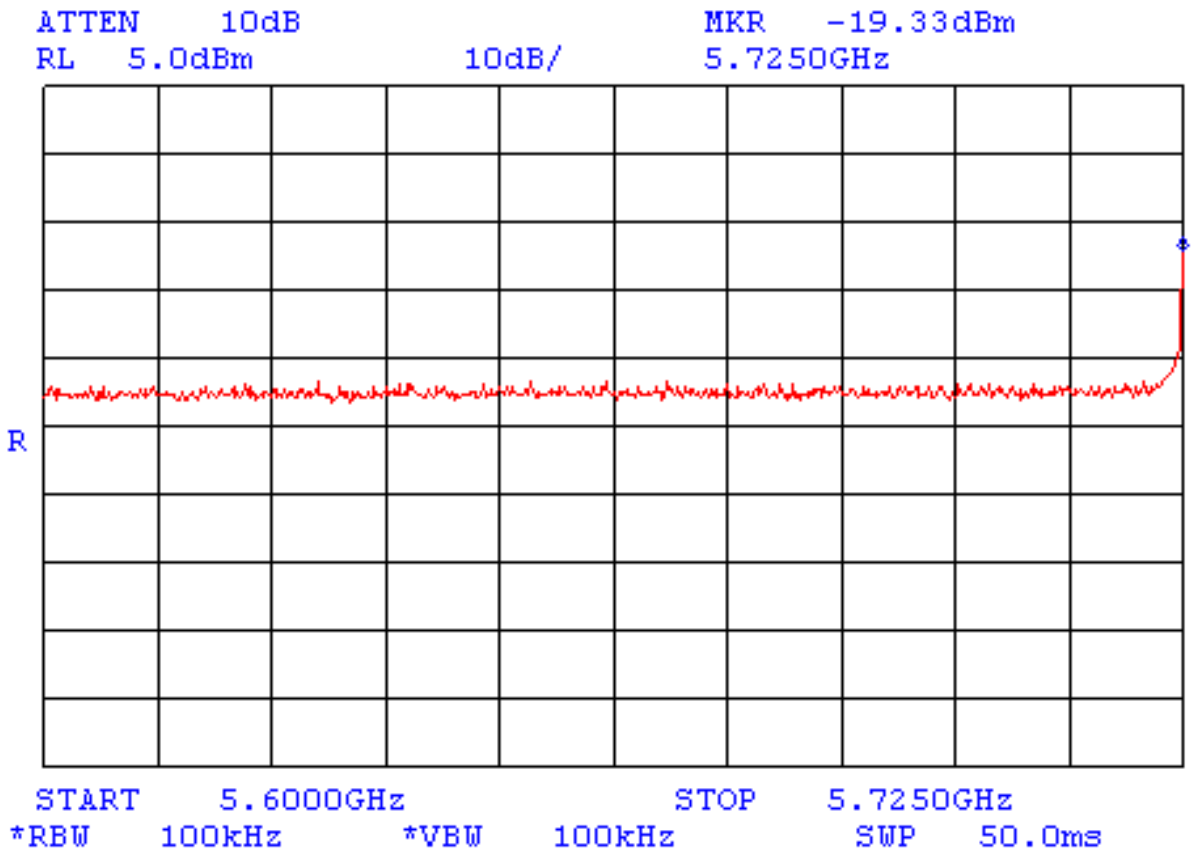
Plot A55

Conducted spurious emission measurements

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	5.6 – 5.725 GHz



Limit for spurious emissions = – 0.33 dBm
No spurious emissions were found

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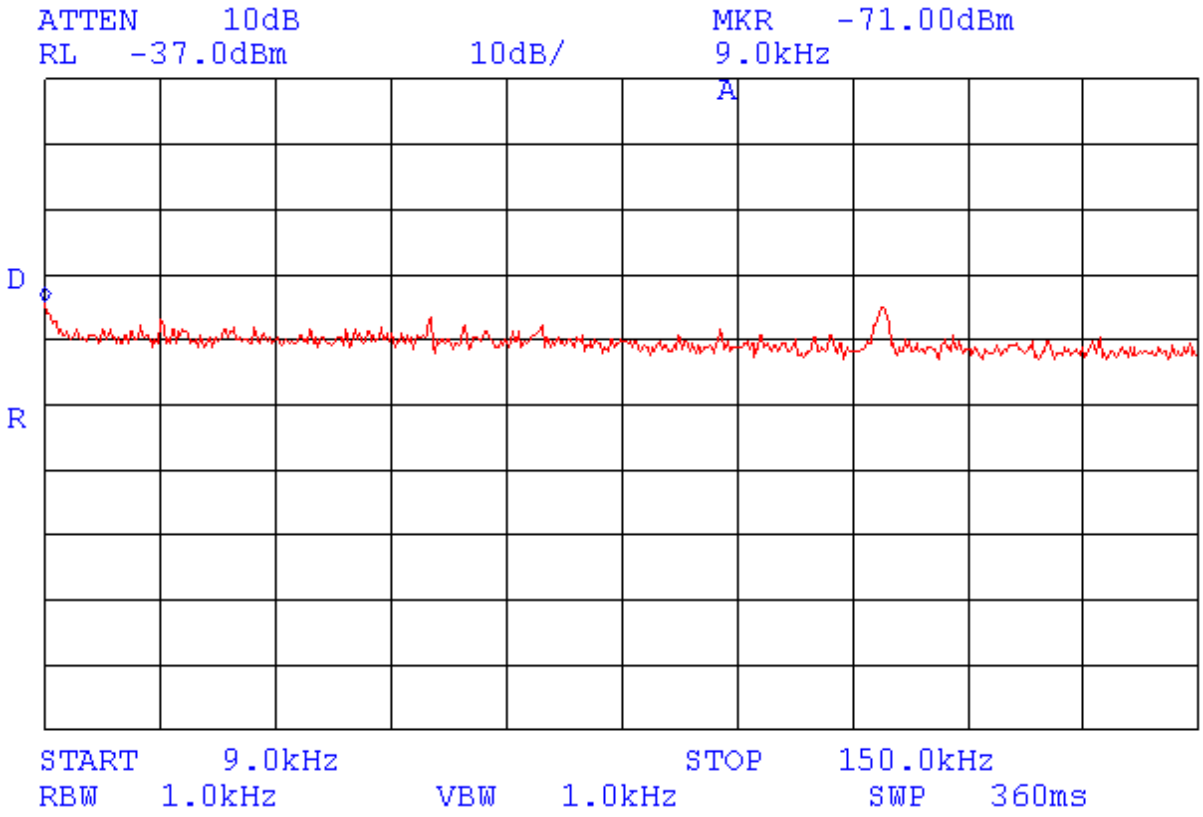
Plot A56

Conducted spurious emission measurements

Mode:	Hopping
Carrier frequencies:	5.726 GHz (low), 5.8 GHz (middle); 5.849 GHz (high)
Bit rate:	3 Mbit/s
Frequency range:	9 – 150 kHz



Limit for spurious emissions = –0.67 dBm
No spurious emissions were found

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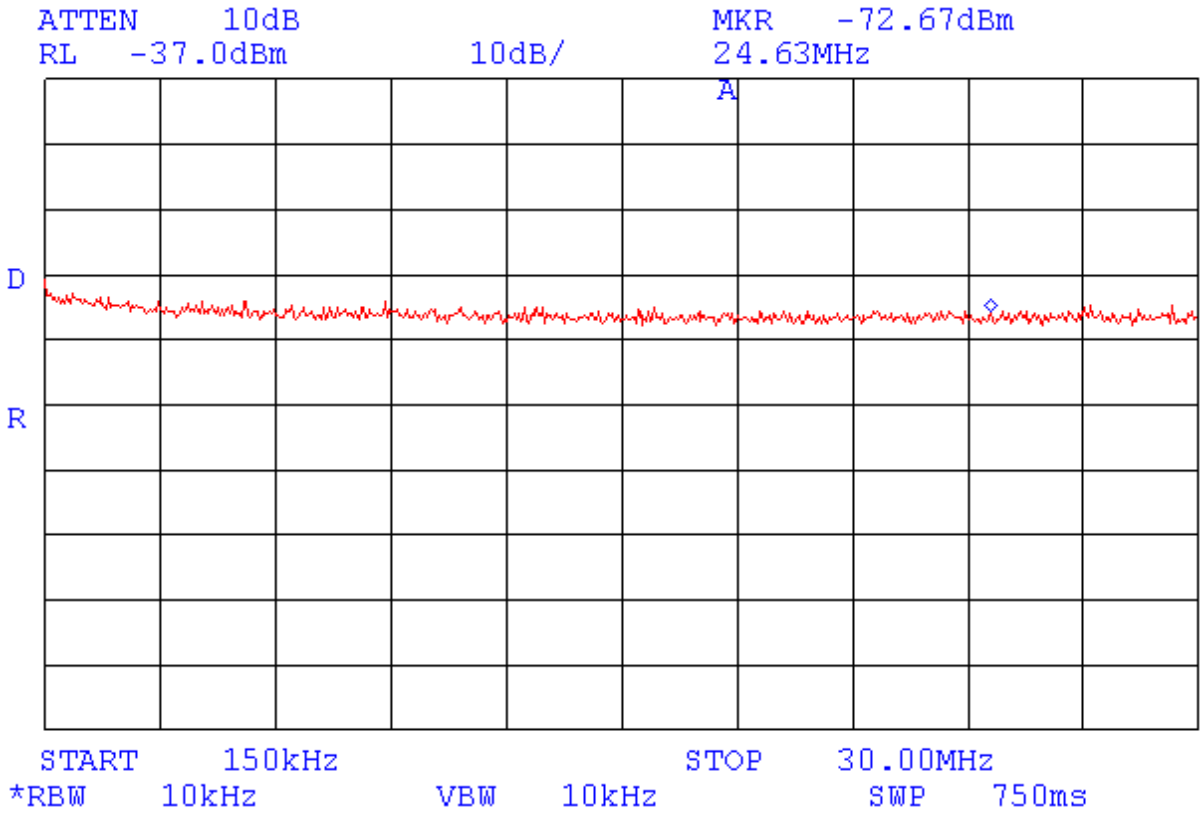
Plot A57

Conducted spurious emission measurements

Mode:	Hopping
Carrier frequencies:	5.726 GHz (low), 5.8 GHz (middle); 5.849 GHz (high)
Bit rate:	3 Mbit/s
Frequency range:	150 kHz – 30 MHz



Limit for spurious emissions = –0.67 dBm
No spurious emissions were found

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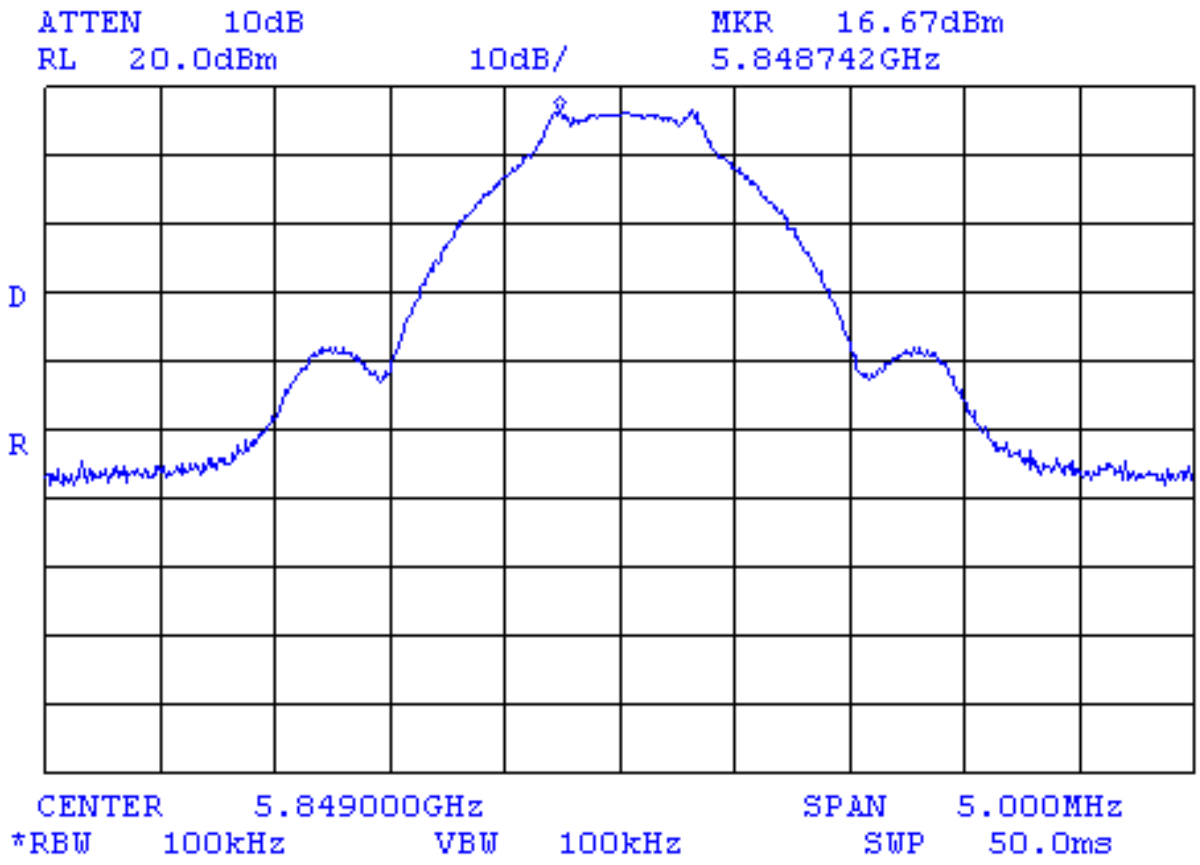
Plot A58

Conducted spurious emission measurements

Mode:	Hybrid
F_{HIGH}:	5.849 GHz
Bit rate:	4 Mbit/s



Limit for spurious emissions = 16.67 dBm – 20 dB = – 3.33 dBm

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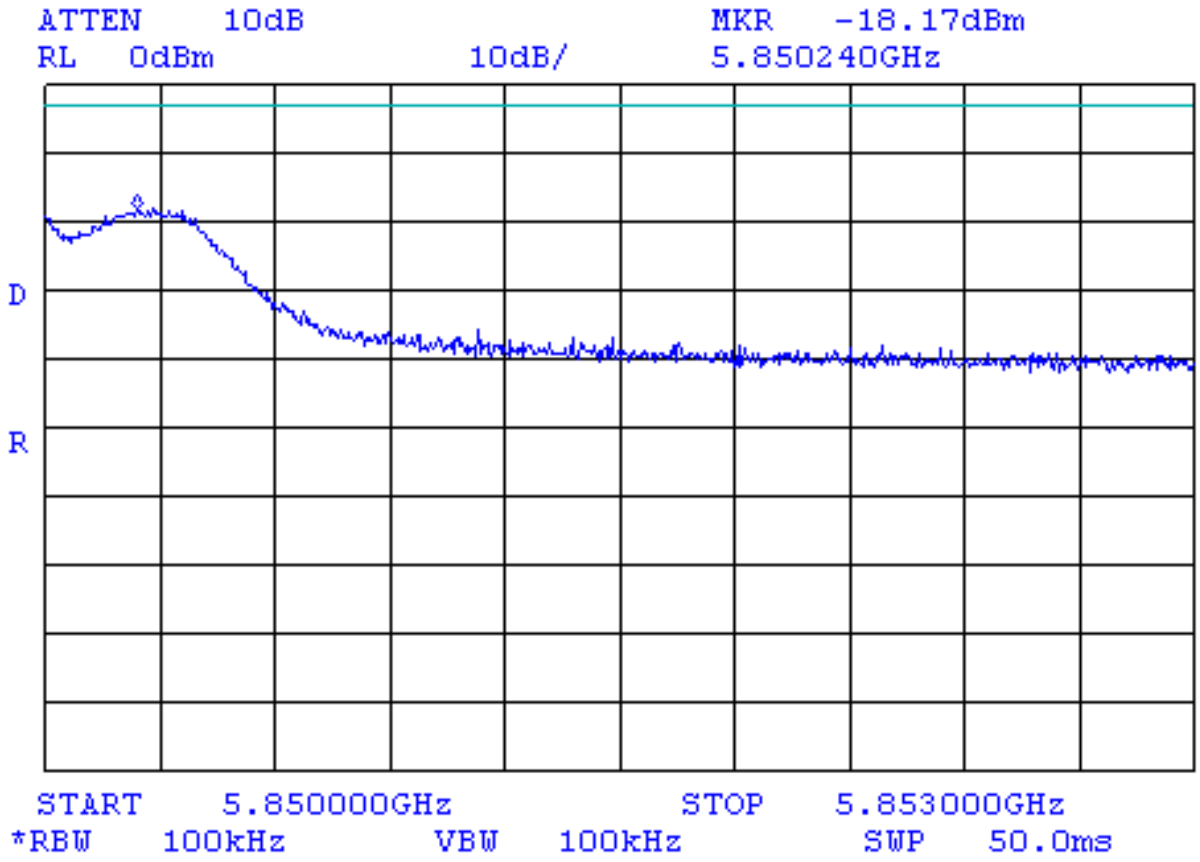
Plot A59

Conducted spurious emission measurements

Mode:	Hybrid
F_{HIGH}:	5.849 GHz
Bit rate:	4 Mbit/s
Frequency range:	5.850 – 5.853 GHz



Limit for spurious emissions = –3.33 dBm

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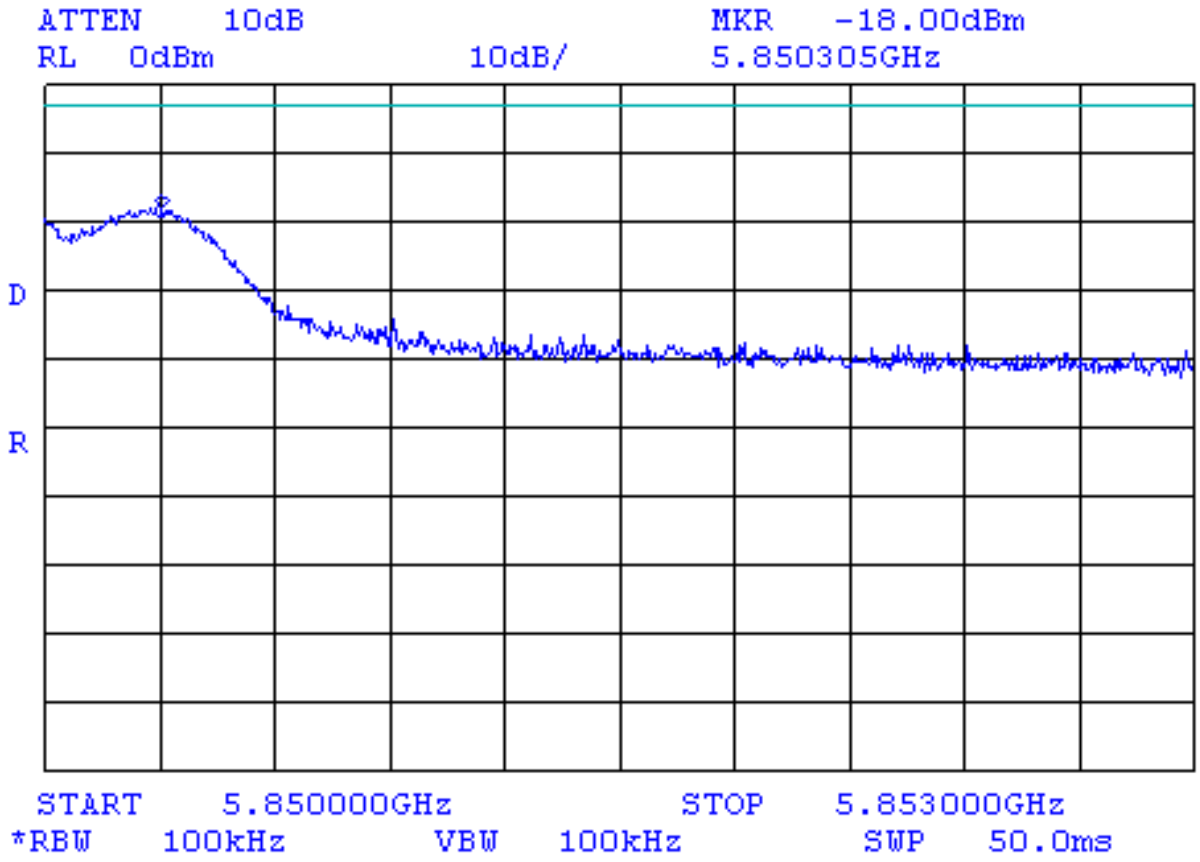
Plot A60

Conducted spurious emission measurements

Mode:	Hybrid
F_{HIGH}:	5.849 GHz
Bit rate:	1.33 Mbit/s
Frequency range:	5.850 – 5.853 GHz



Limit for spurious emissions = –3.33 dBm

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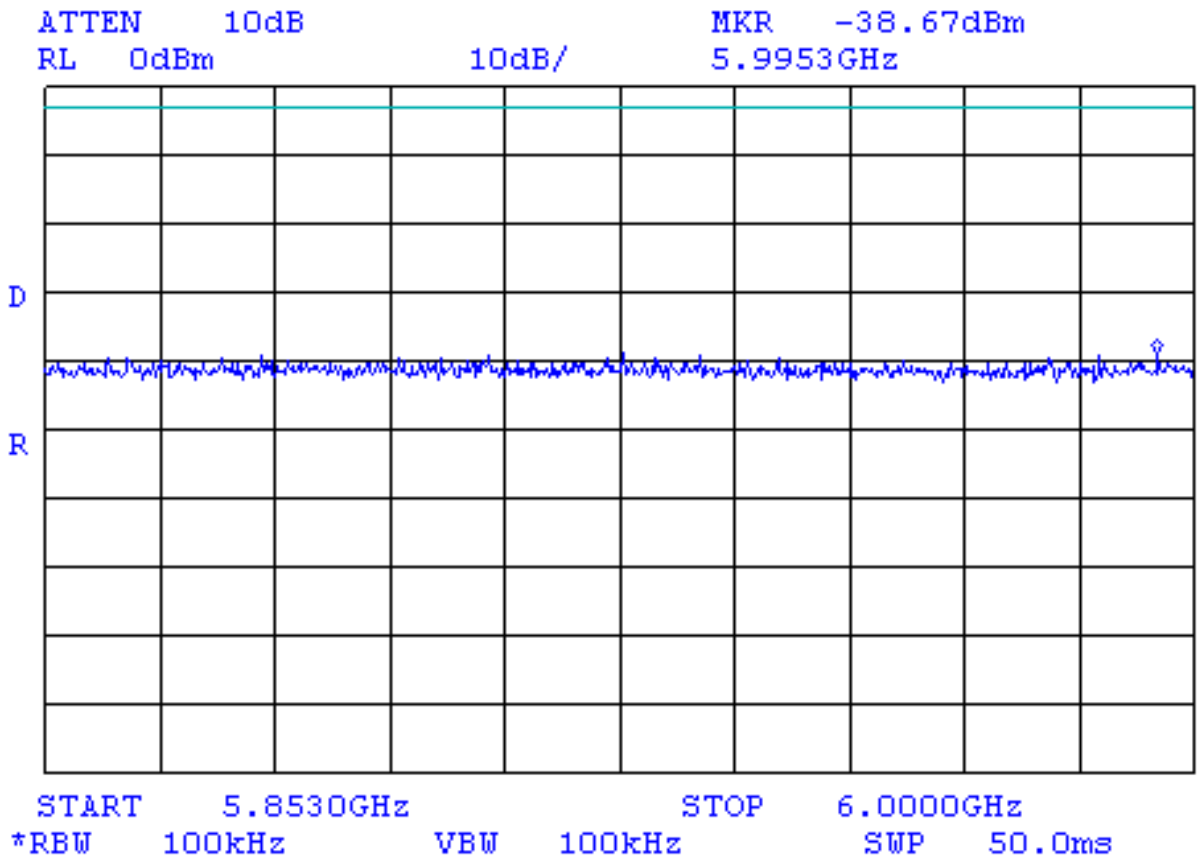
Plot A61

Conducted spurious emission measurements

Mode:	Hybrid
F_{HIGH}:	5.849 GHz
Bit rate:	4 Mbit/s
Frequency range:	5.853 – 6.000 GHz



Limit for spurious emissions = –3.33 dBm
No spurious emissions were found

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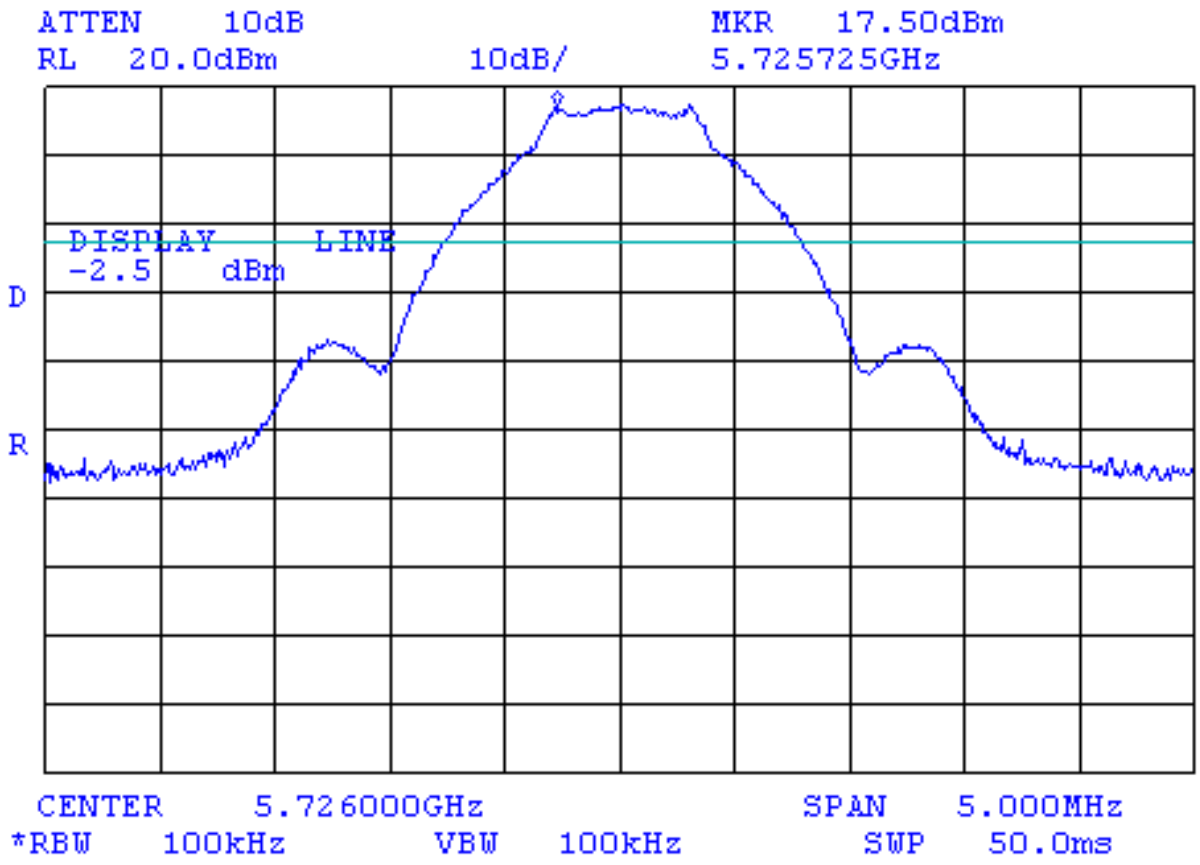
Plot A62

Conducted spurious emission measurements

Mode:	Hybrid
F_{LOW}:	5.726 GHz
Bit rate:	1.33 Mbit/s



Limit for spurious emissions = 17.5 dBm – 20 dB = – 2.5 dBm

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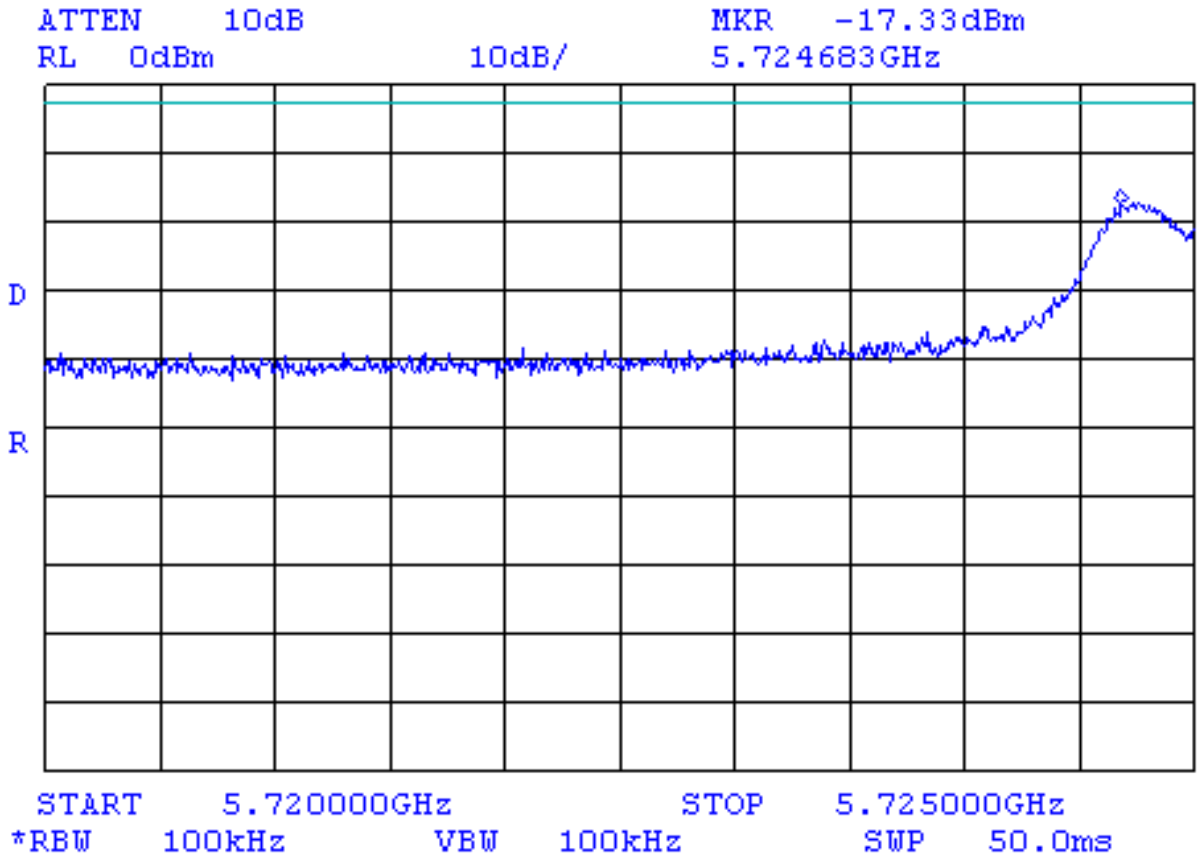
Plot A63

Conducted spurious emission measurements

Mode:	Hybrid
F_{LOW}:	5.726 GHz
Bit rate:	1.33 Mbit/s
Frequency range:	5.720 – 5.725 GHz



Limit for spurious emissions = –2.5 dBm

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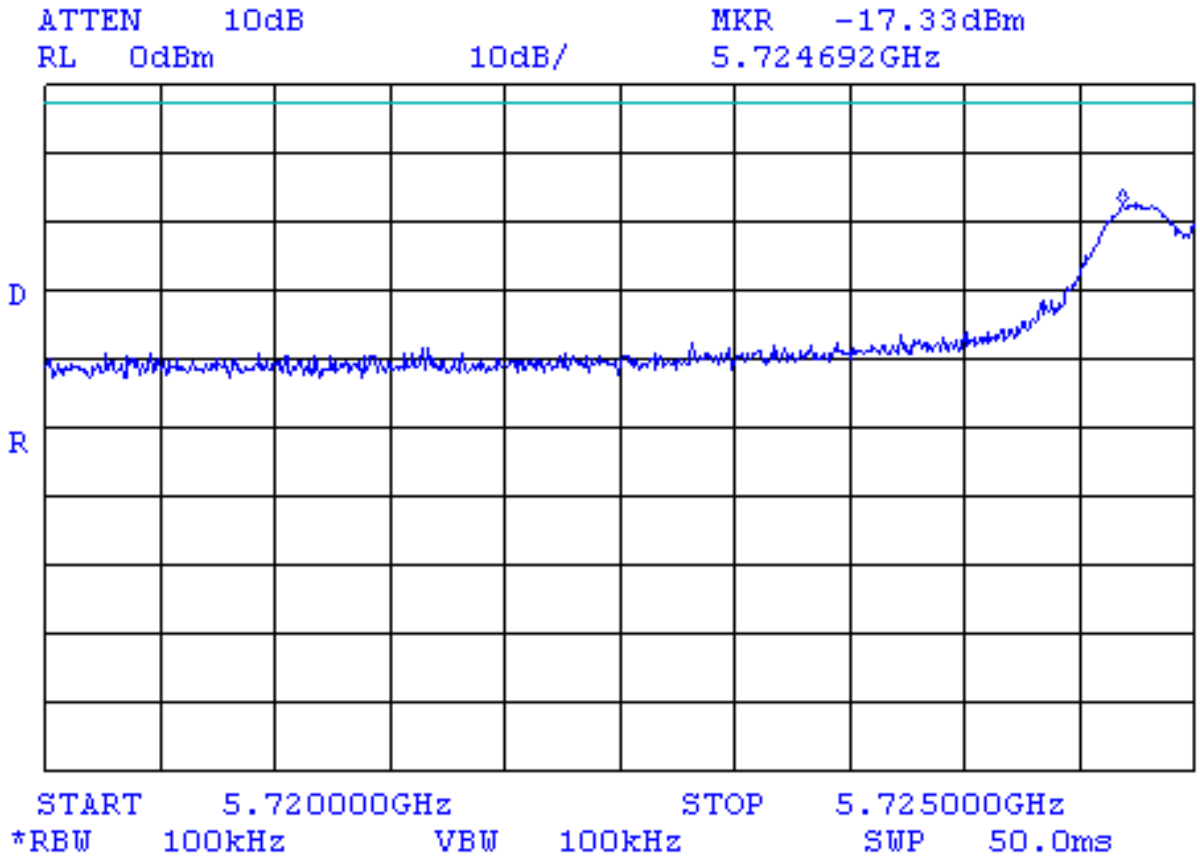
Plot A64

Conducted spurious emission measurements

Mode:	Hybrid
F_{LOW}:	5.726 GHz
Bit rate:	4 Mbit/s
Frequency range:	5.720 – 5.725 GHz



Limit for spurious emissions = –2.5 dBm

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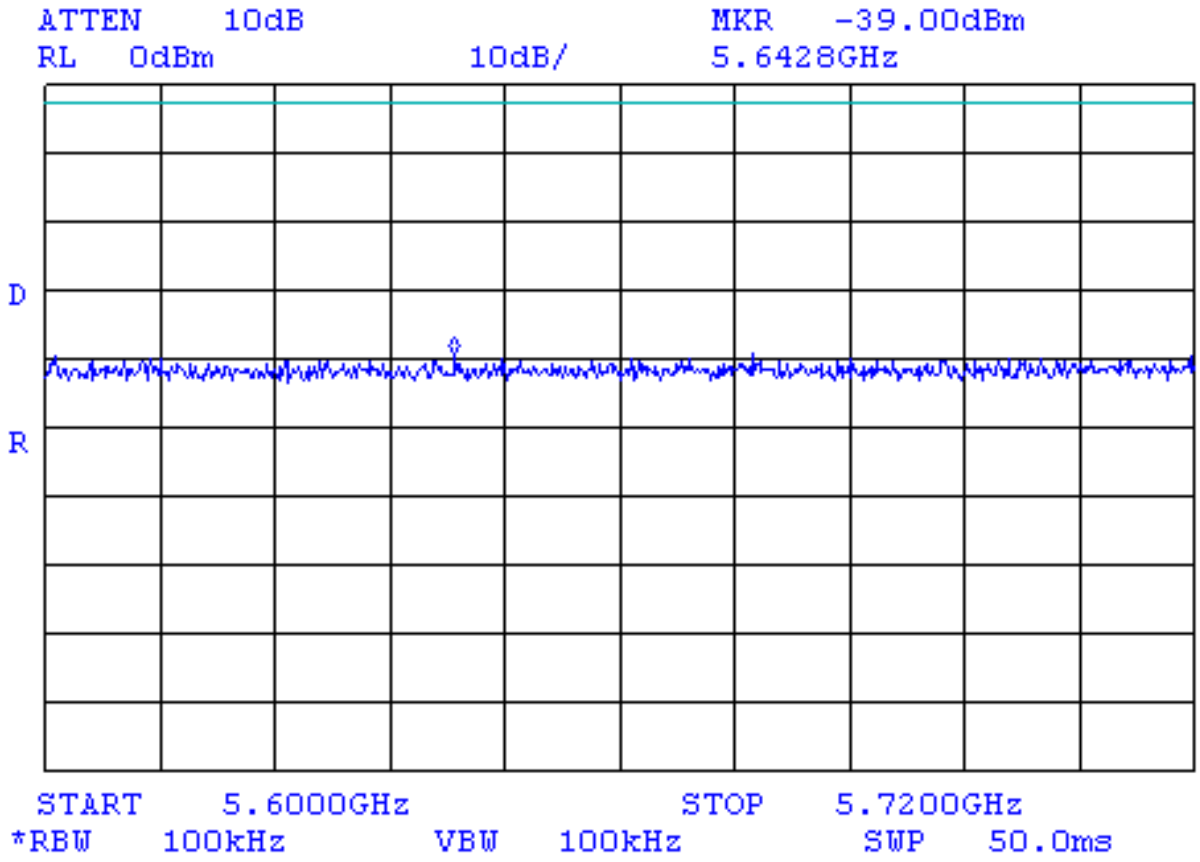
Plot A65

Conducted spurious emission measurements

Mode:	Hybrid
F_{LOW}:	5.726 GHz
Bit rate:	4 Mbit/s
Frequency range:	5.600 – 5.720 GHz



Limit for spurious emissions = –2.5 dBm
No spurious emissions were found

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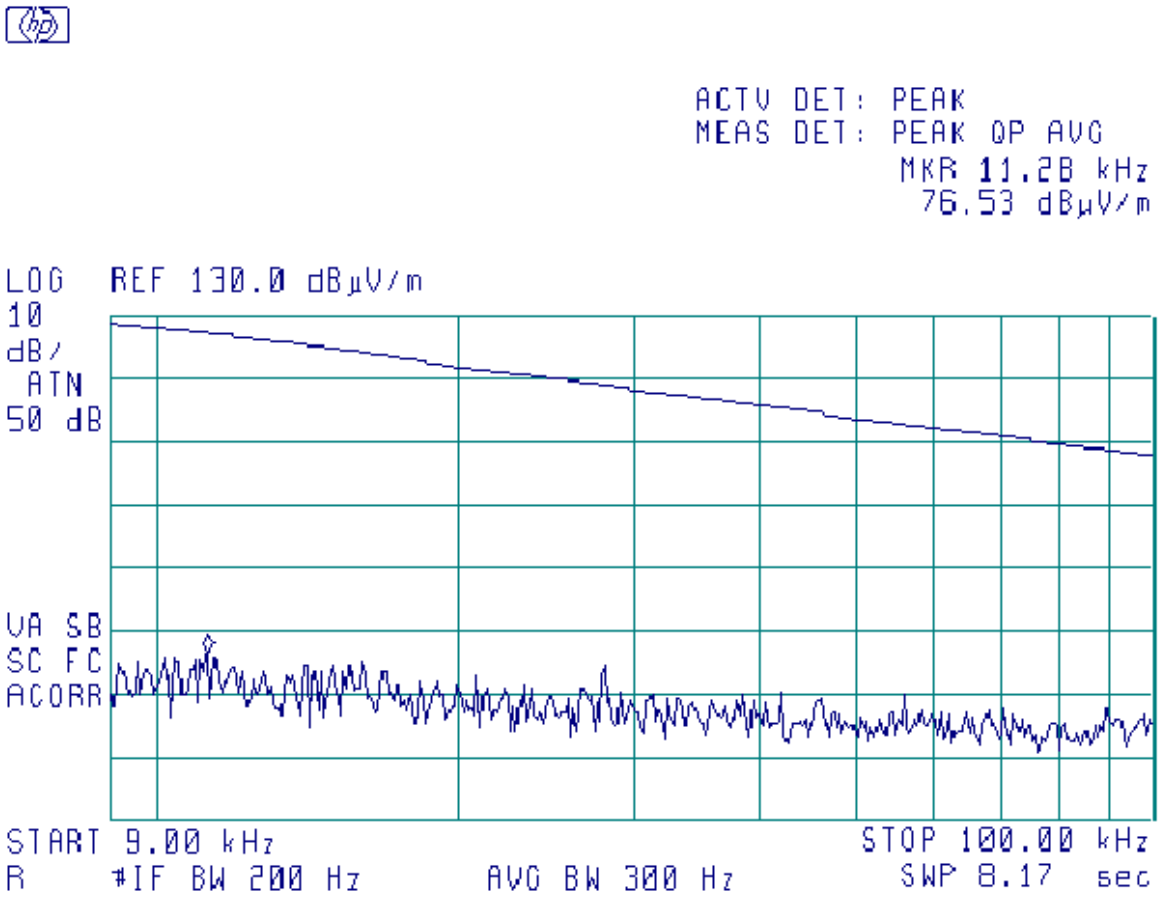
Plot A66

Radiated spurious emission measurements

Mode:	Hopping
Carrier frequencies:	5.726 GHz (low), 5.8 GHz (middle); 5.849 GHz (high)
Bit rate:	3 Mbit/s
Frequency range:	9 – 100 kHz



No spurious emissions were found

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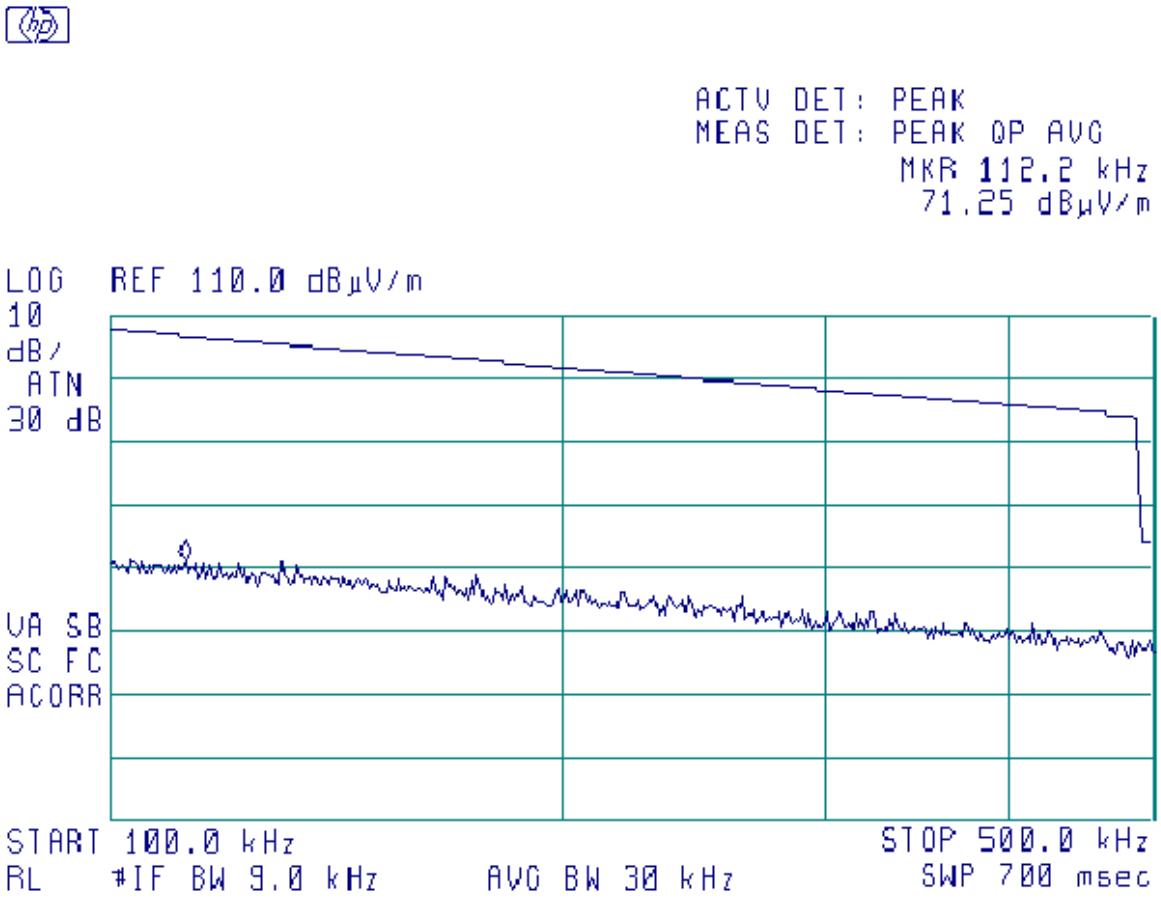
Plot A67

Radiated spurious emission measurements

Mode:	Hopping
Carrier frequencies:	5.726 GHz (low), 5.8 GHz (middle); 5.849 GHz (high)
Bit rate:	3 Mbit/s
Frequency range:	100 – 500 kHz



No spurious emissions were found

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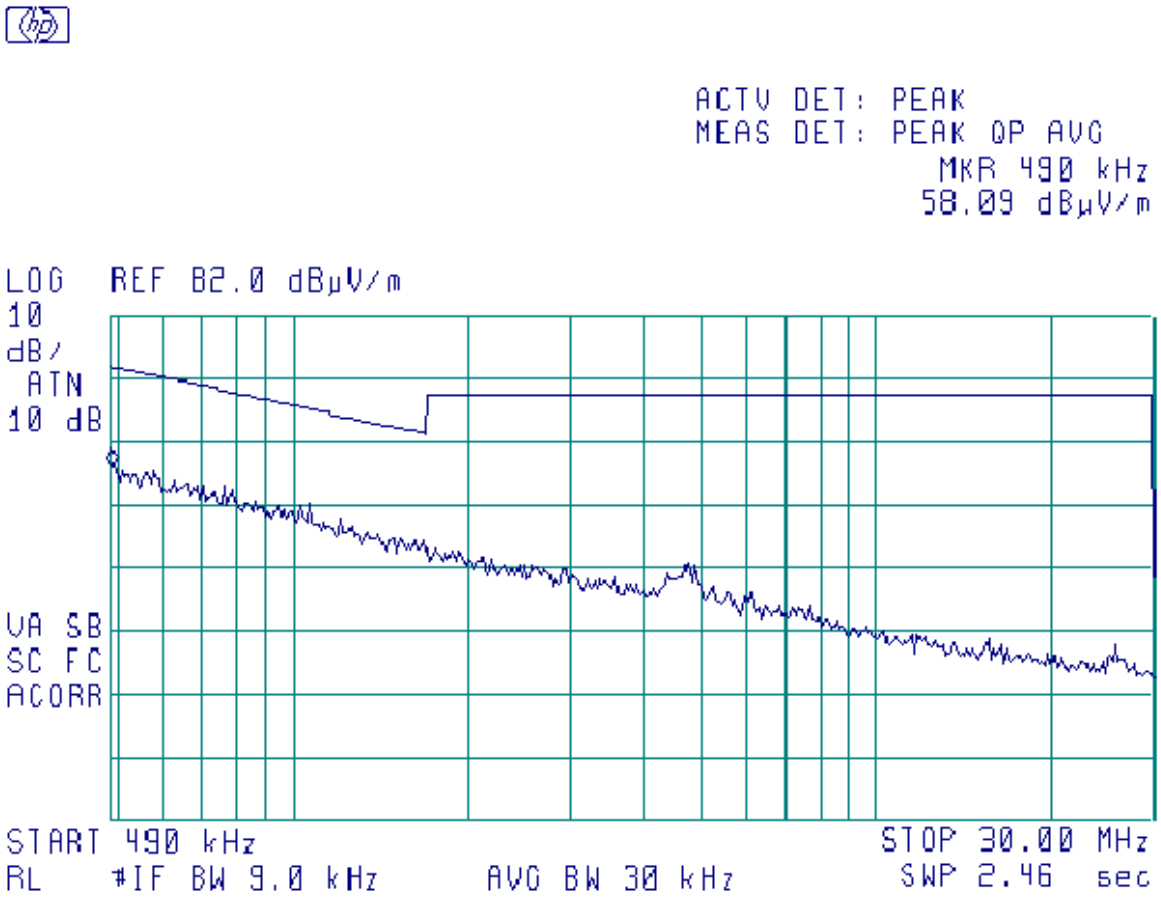
Plot A68

Radiated spurious emission measurements

Mode:	Hopping
Carrier frequencies:	5.726 GHz (low), 5.8 GHz (middle); 5.849 GHz (high)
Bit rate:	3 Mbit/s
Frequency range:	490 kHz – 30 MHz



No spurious emissions were found

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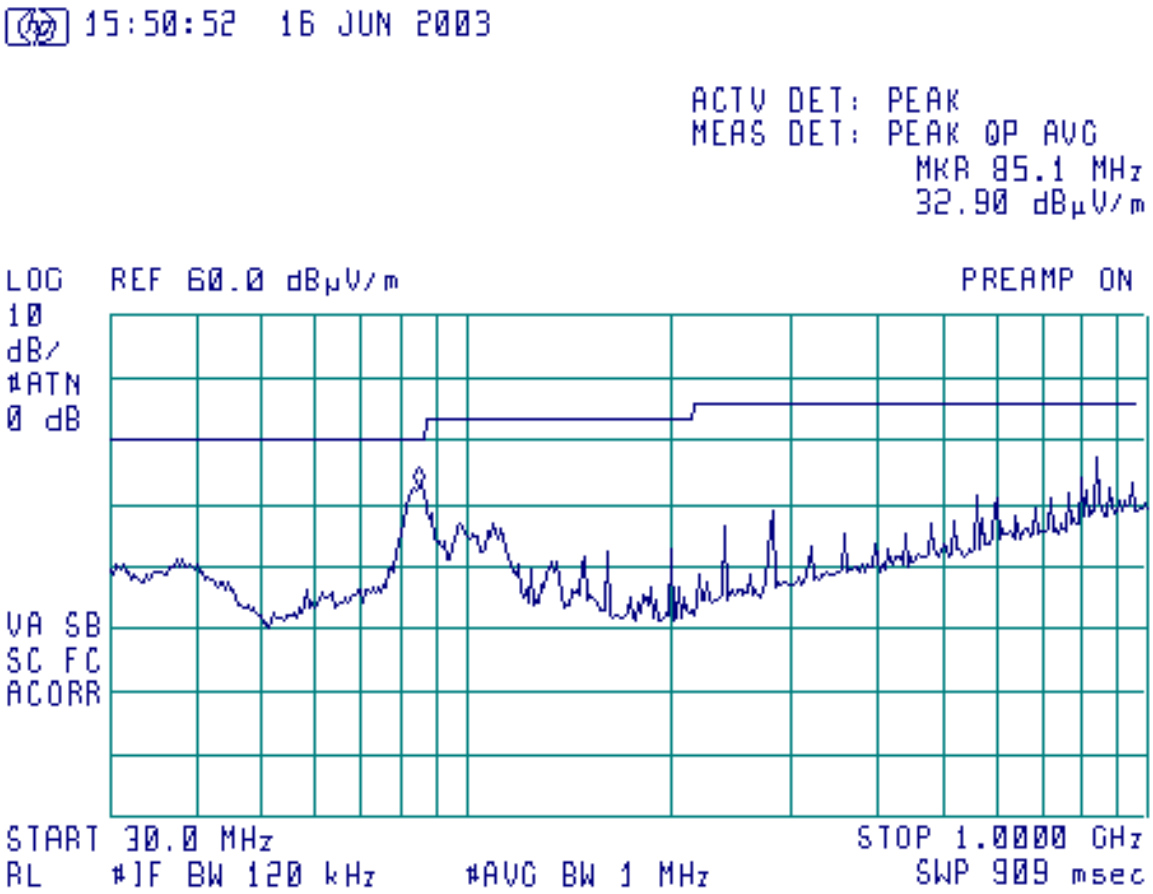
Plot A69

Radiated spurious emission measurements

Mode:	Hopping
Carrier frequencies:	5.726 GHz (low), 5.8 GHz (middle); 5.849 GHz (high)
Bit rate:	3 Mbit/s
Frequency range:	30 MHz– 1 GHz



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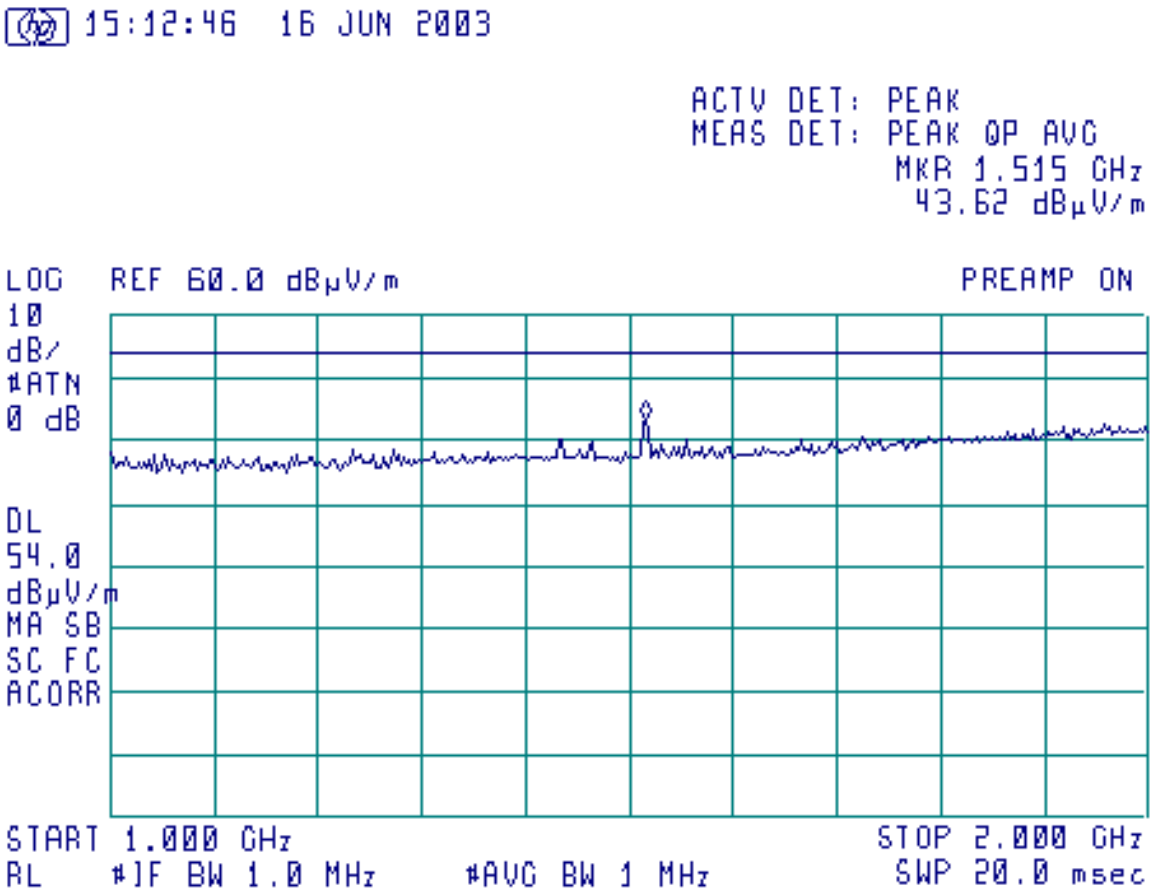
Plot A70

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	1 – 2 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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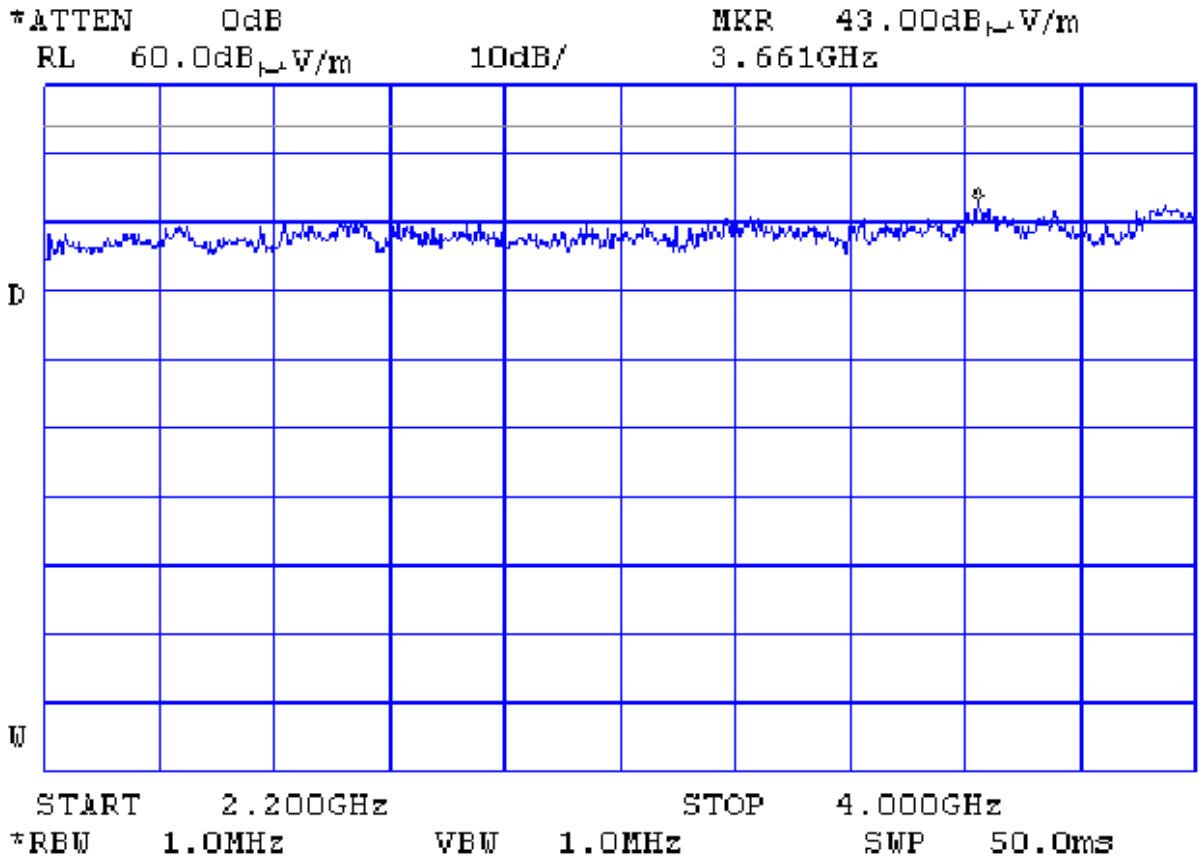
Plot A71

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	2.2 – 4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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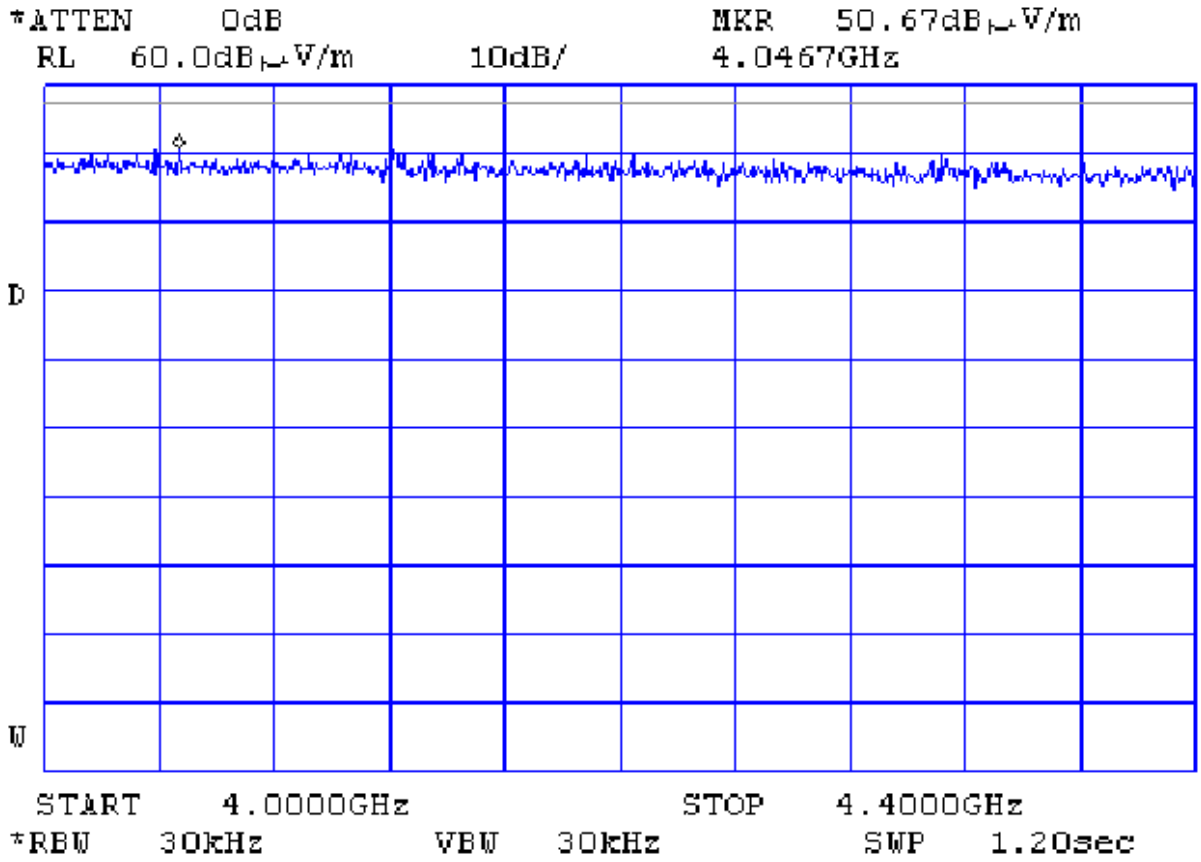
Plot A72

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	4 – 4.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 57.5 dB(µV/m) at 2 m test distance
No spurious emissions were found

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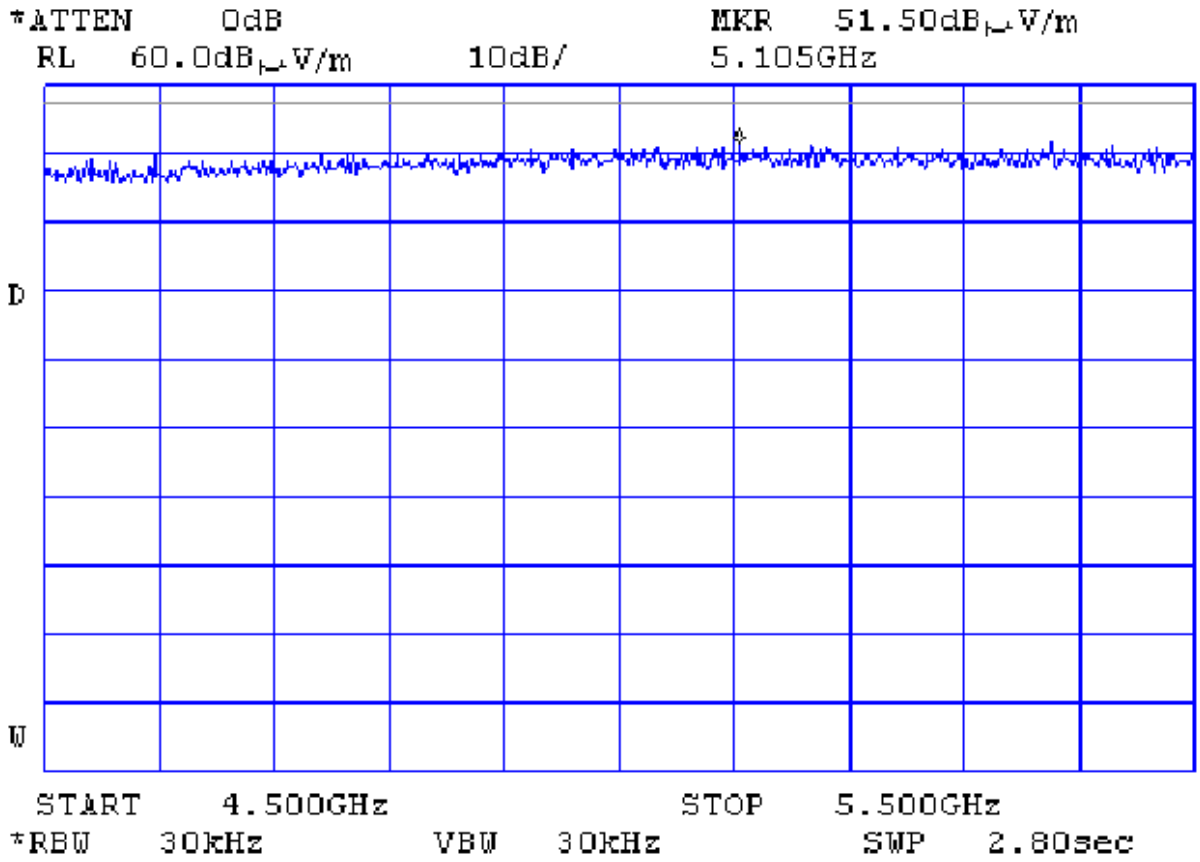
Plot A73

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	4.5 – 5.5 GHz



Limit (average) for radiated spurious emissions in restricted bands is 57.5 dB(µV/m) at 2 m test distance
No spurious emissions were found

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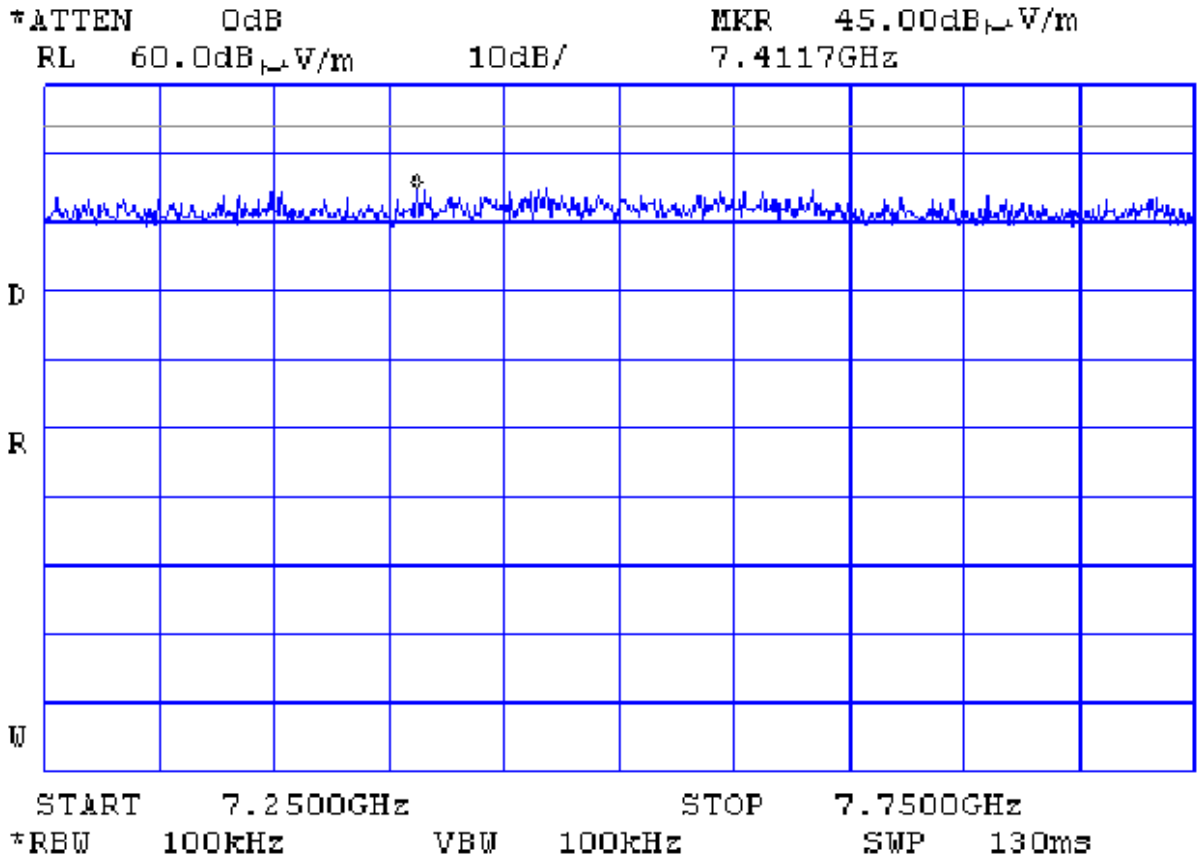
Plot A74

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	7.25 – 7.75 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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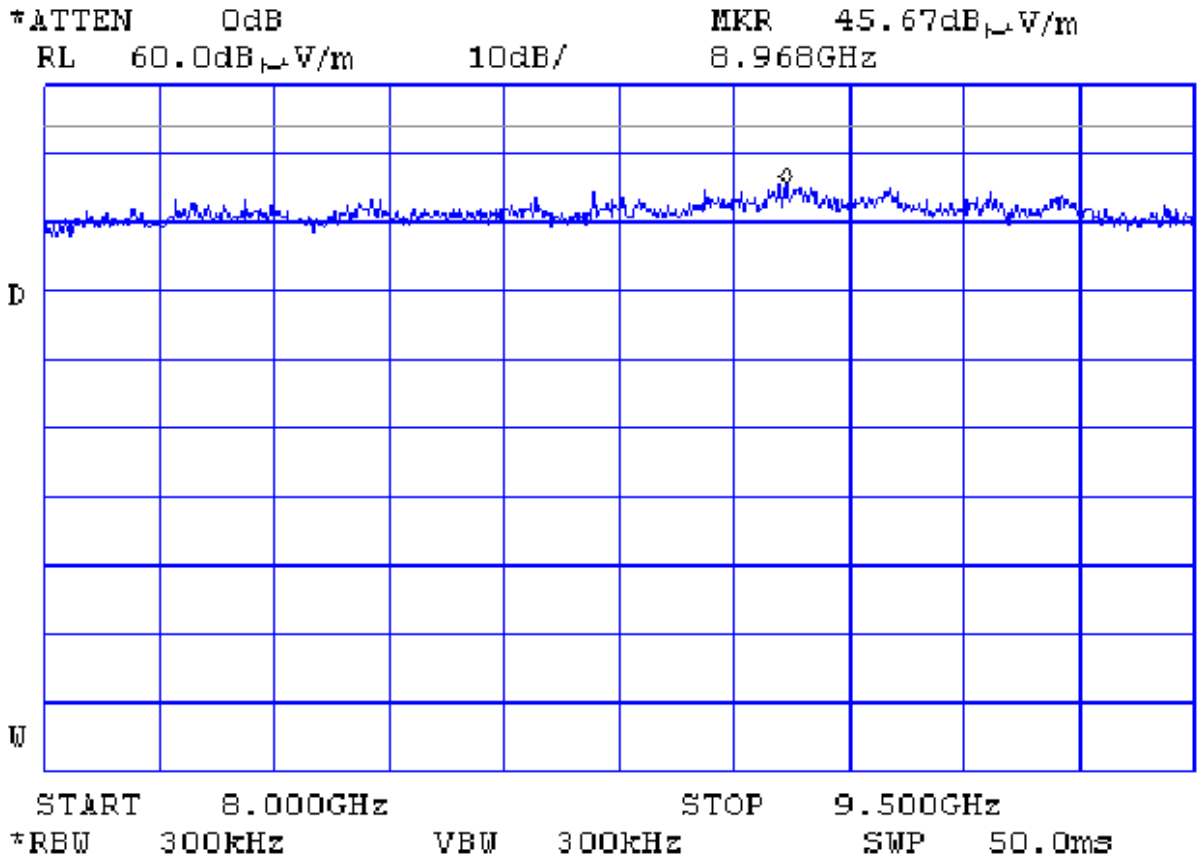
Plot A75

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	8 – 9.5 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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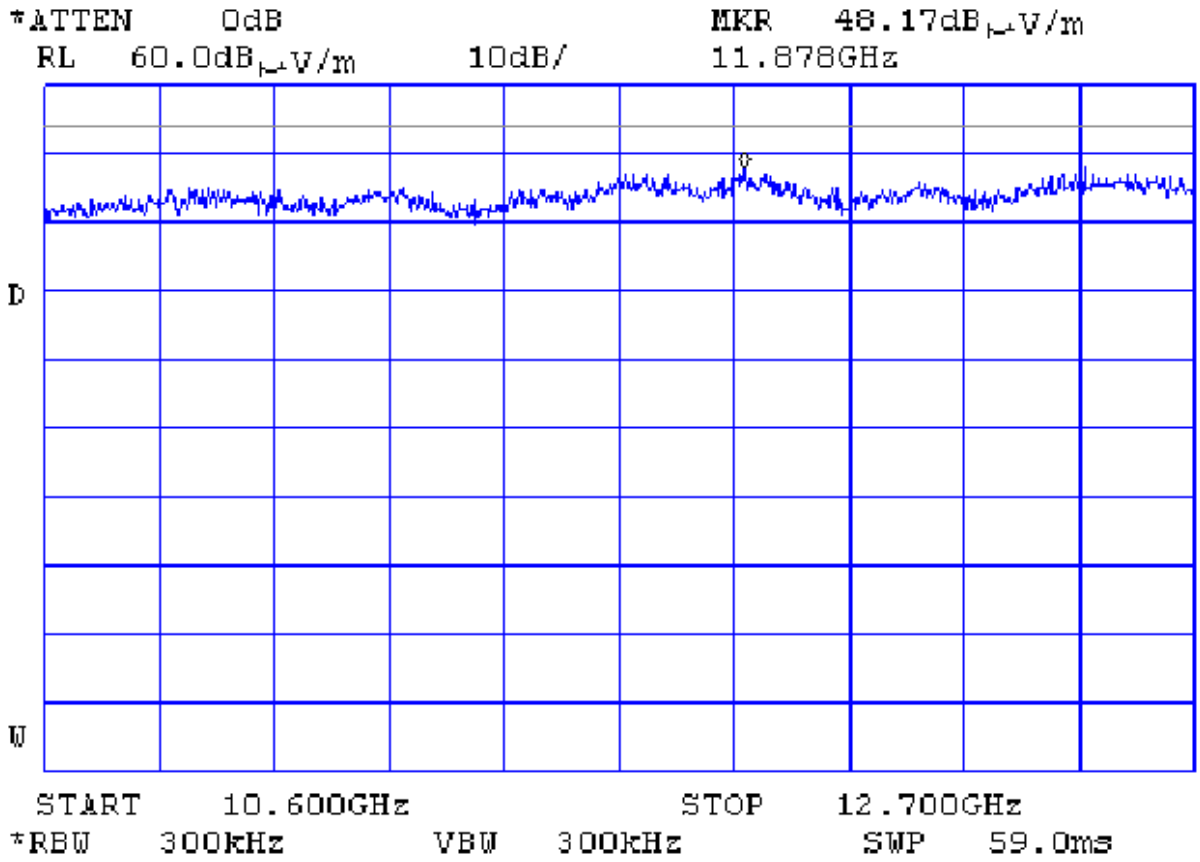
Plot A76

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	10.6 – 12.7 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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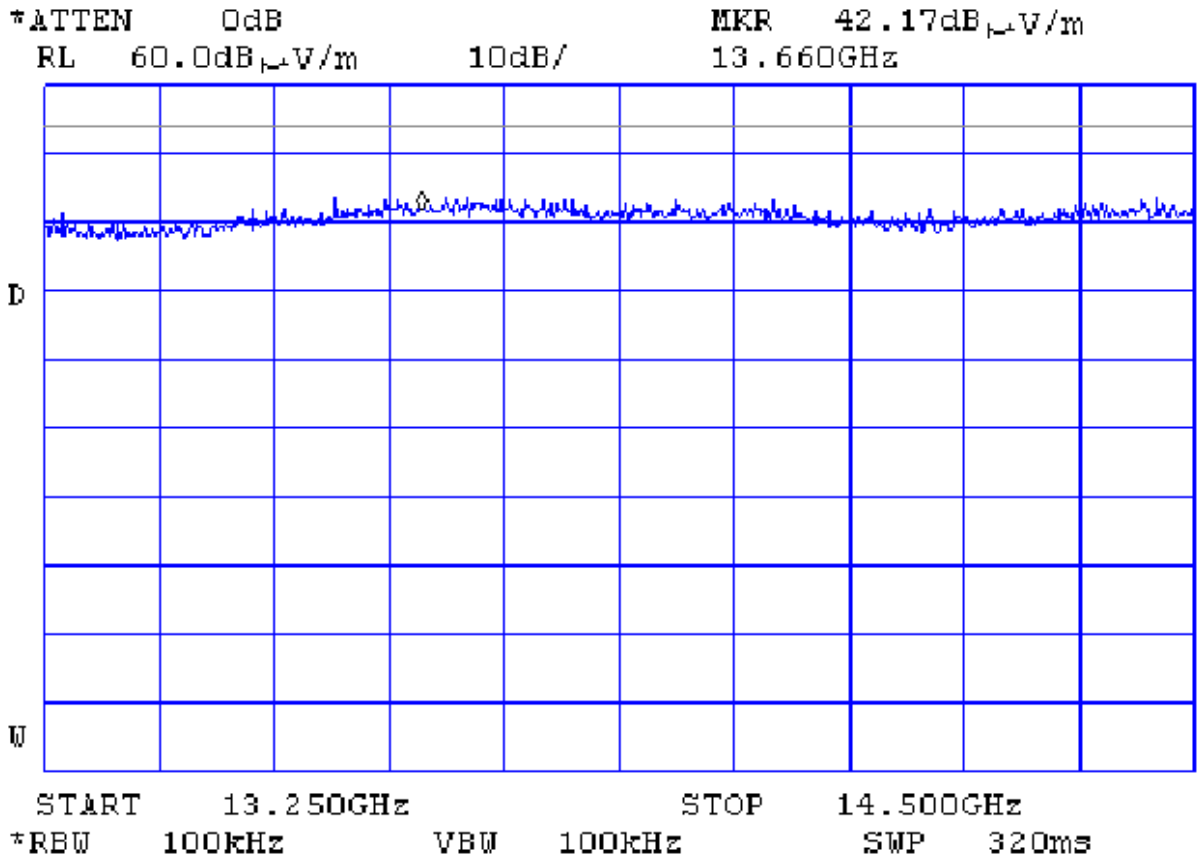
Plot A77

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	13.25 – 14.5 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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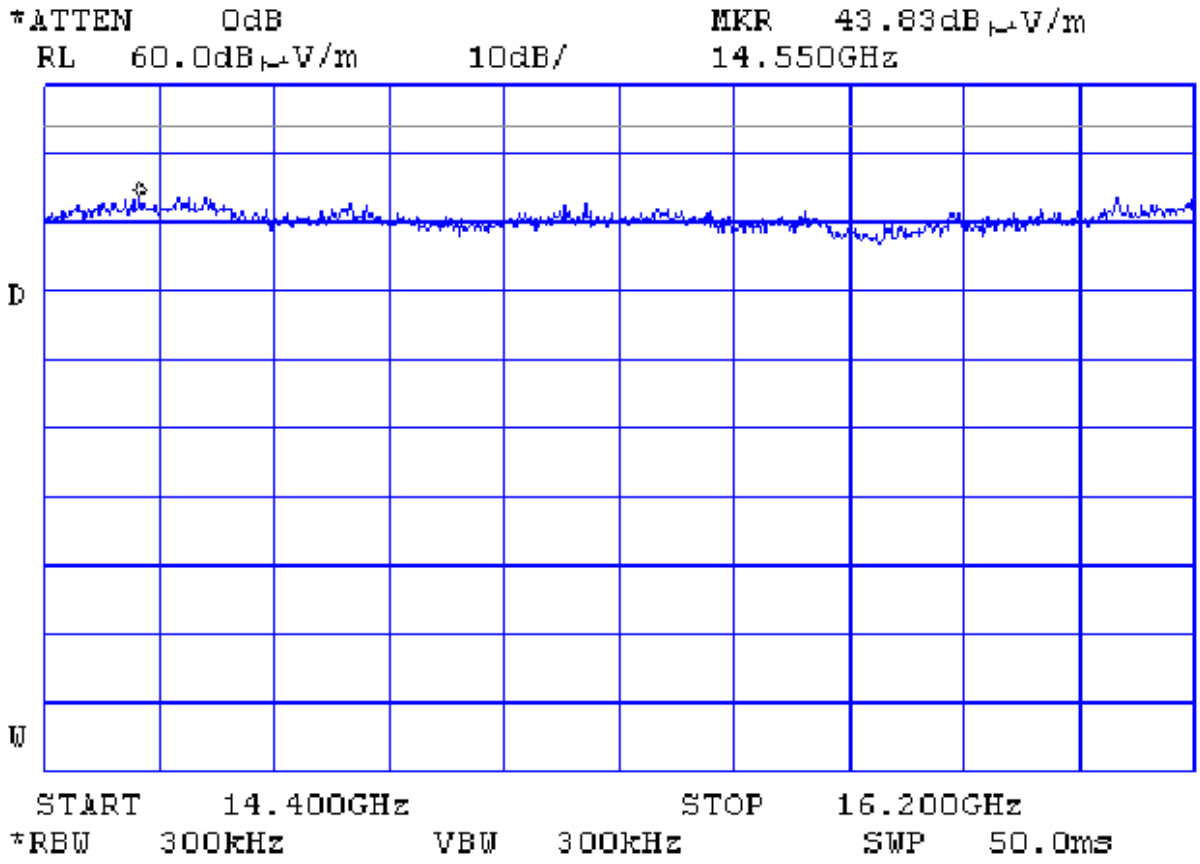
Plot A78

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	14.4 – 16.2 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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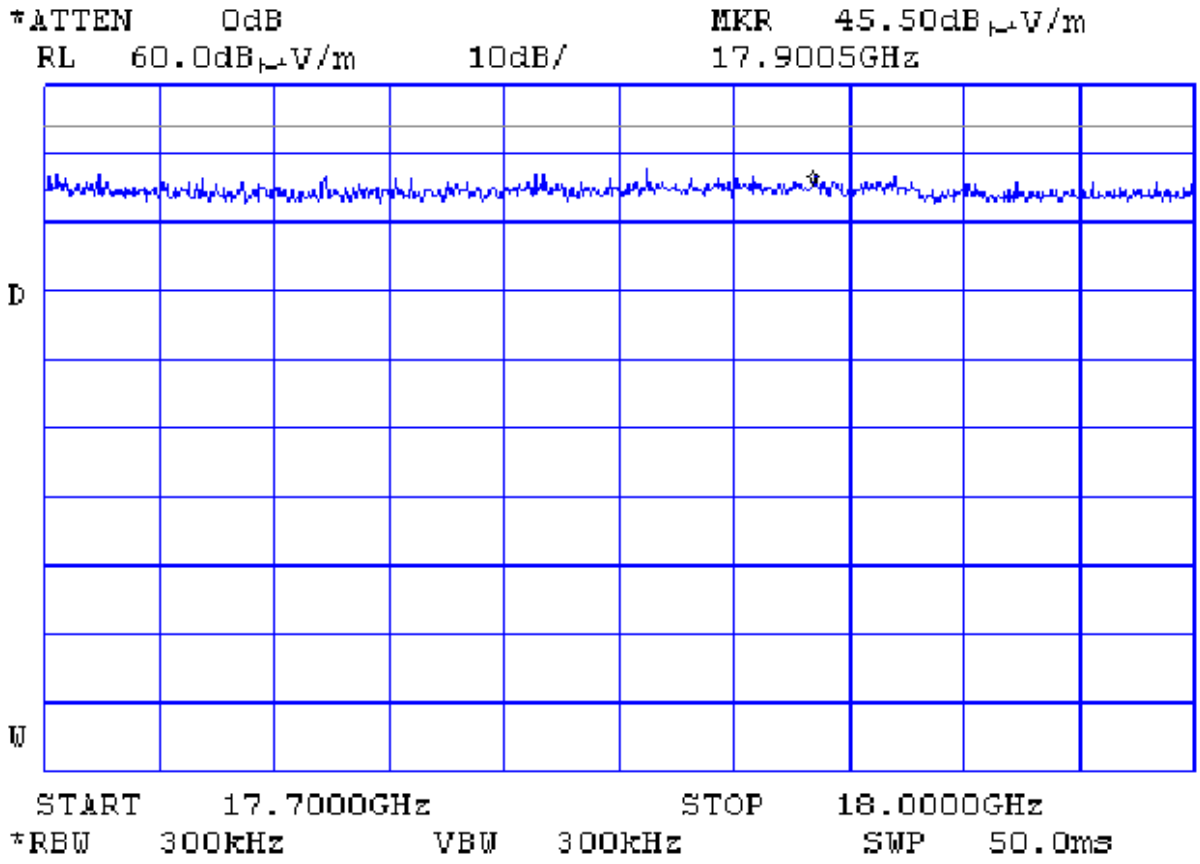
Plot A79

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	17.7 – 18 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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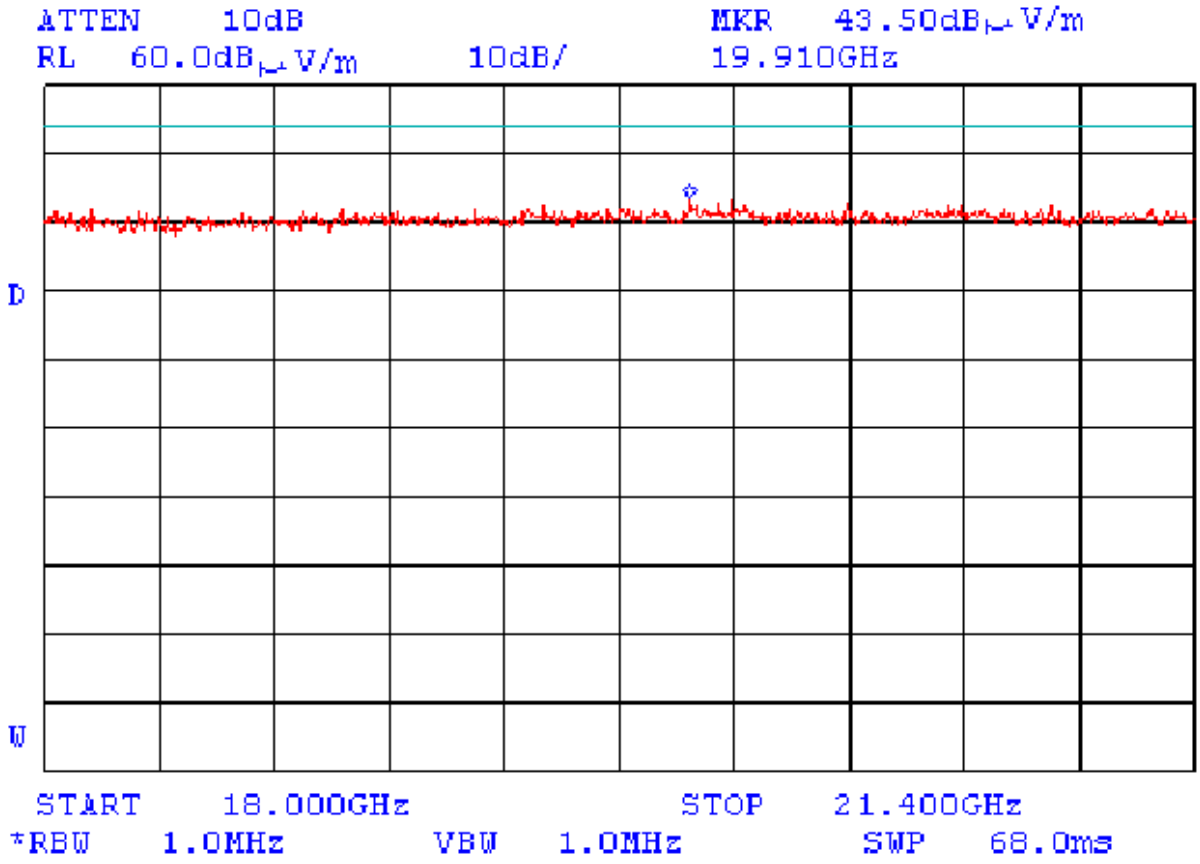
Plot A80

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	18 – 21.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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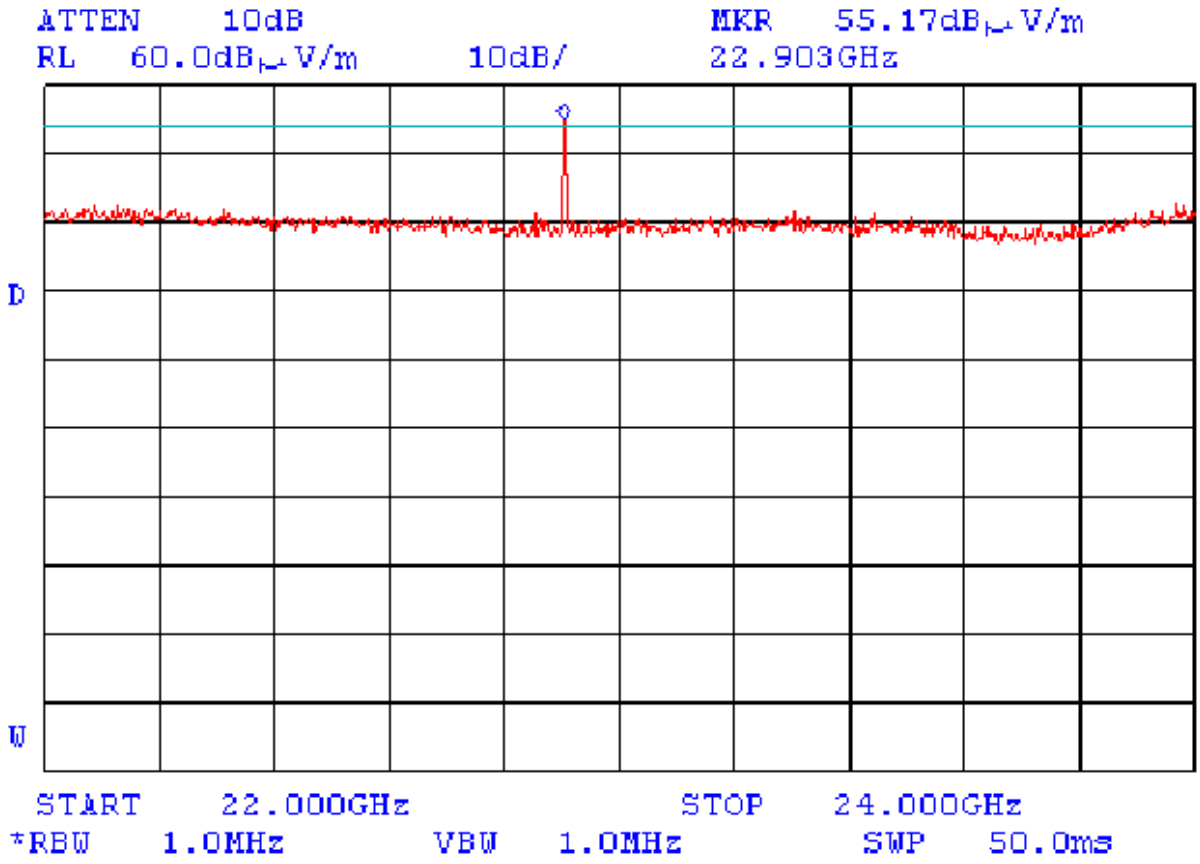
Plot A81

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	22 – 24 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions except 4th harmonic were found

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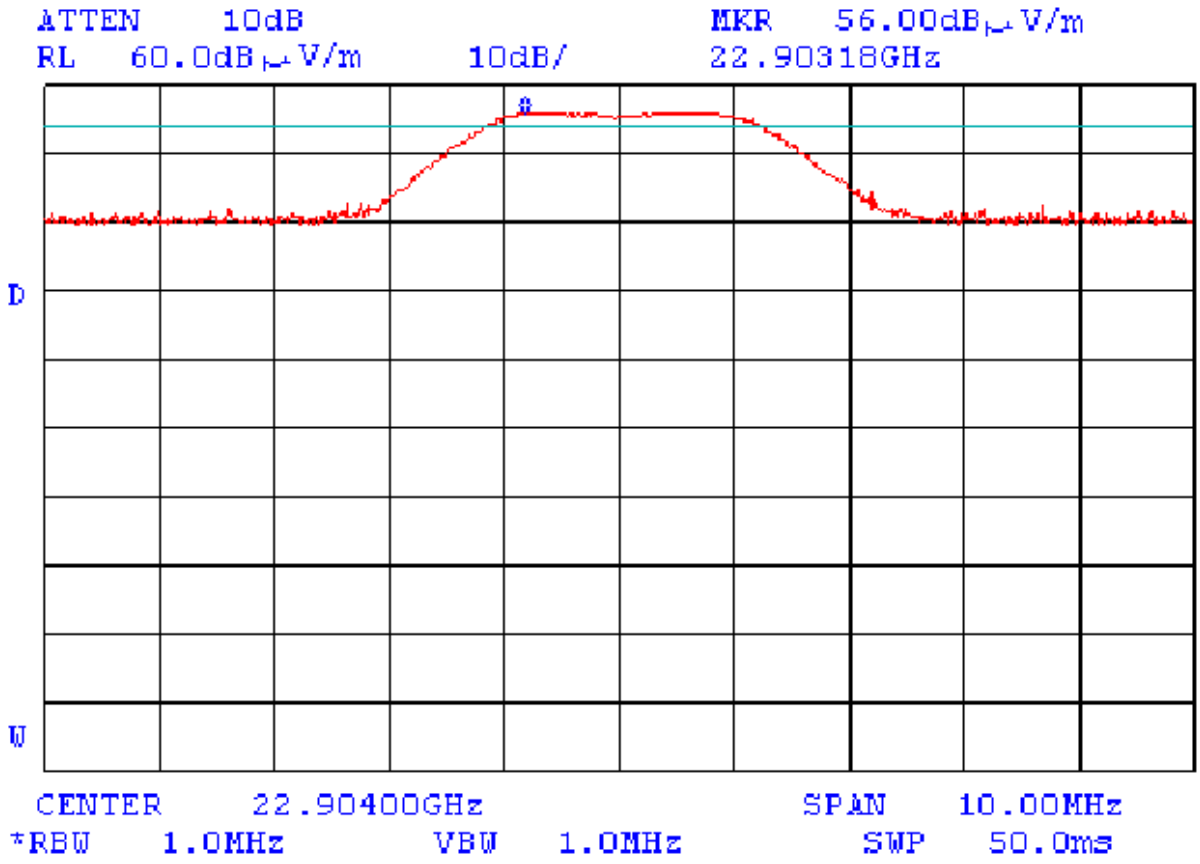
Plot A82

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Center frequency:	22.904 GHz



Peak limit for radiated emission is 74 dB(µV/m)
E_{peak} = 56 dB(µV/m)

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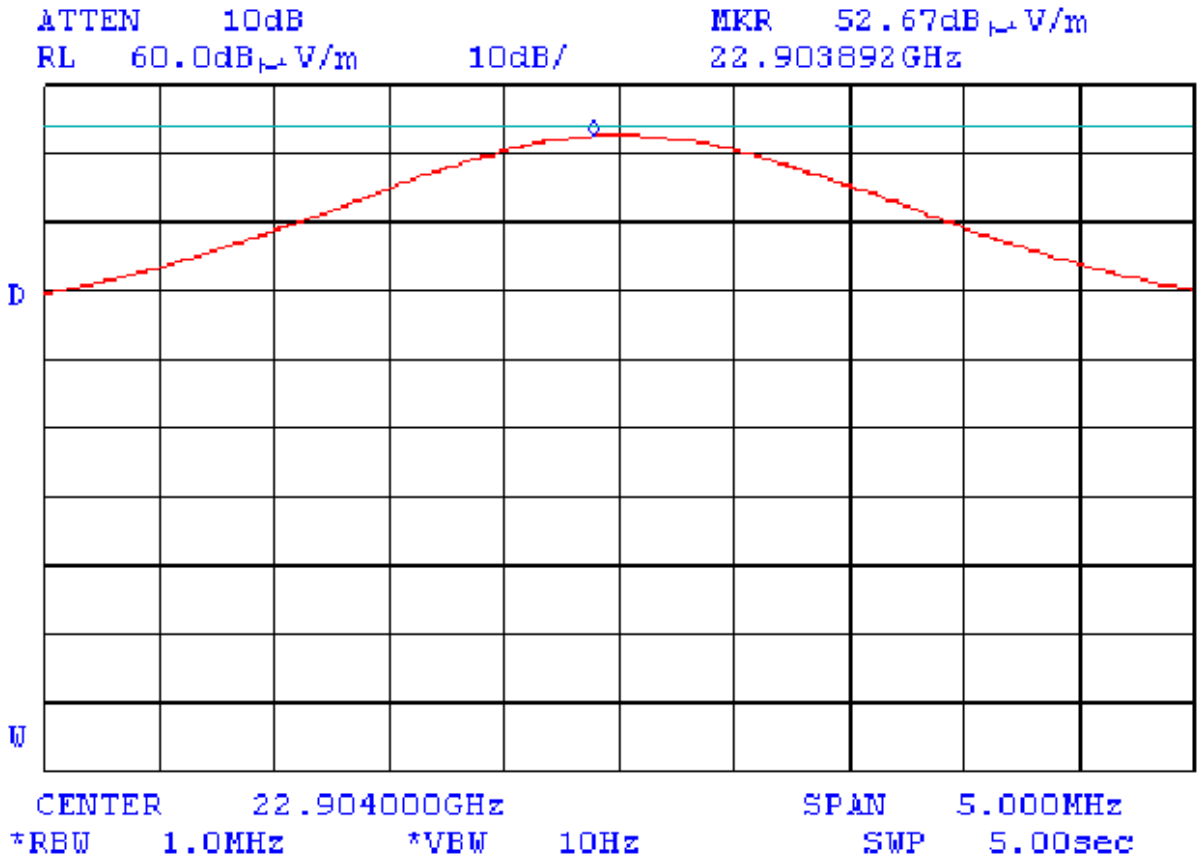
Plot A83

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Center frequency:	22.904 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
E_{aver} = 52.67 dB(µV/m)

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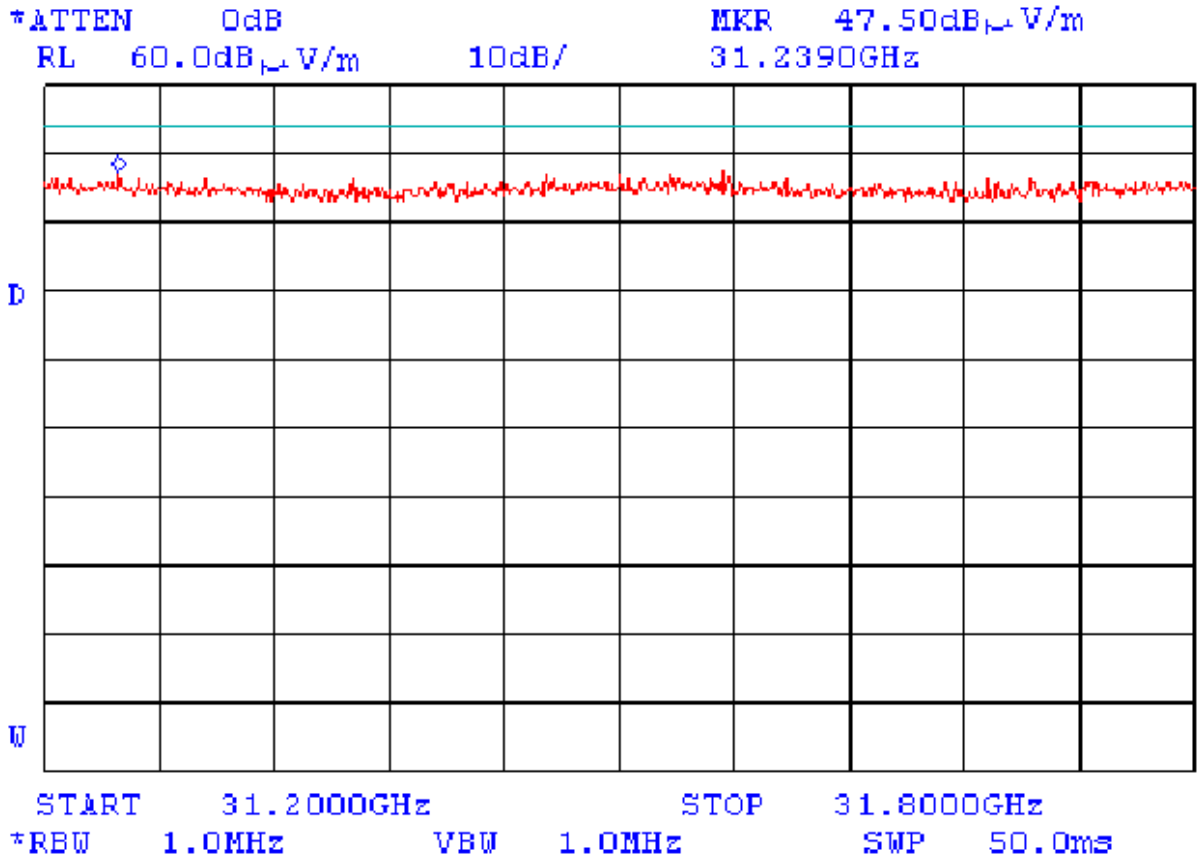
Plot A84

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	31.2 – 31.8 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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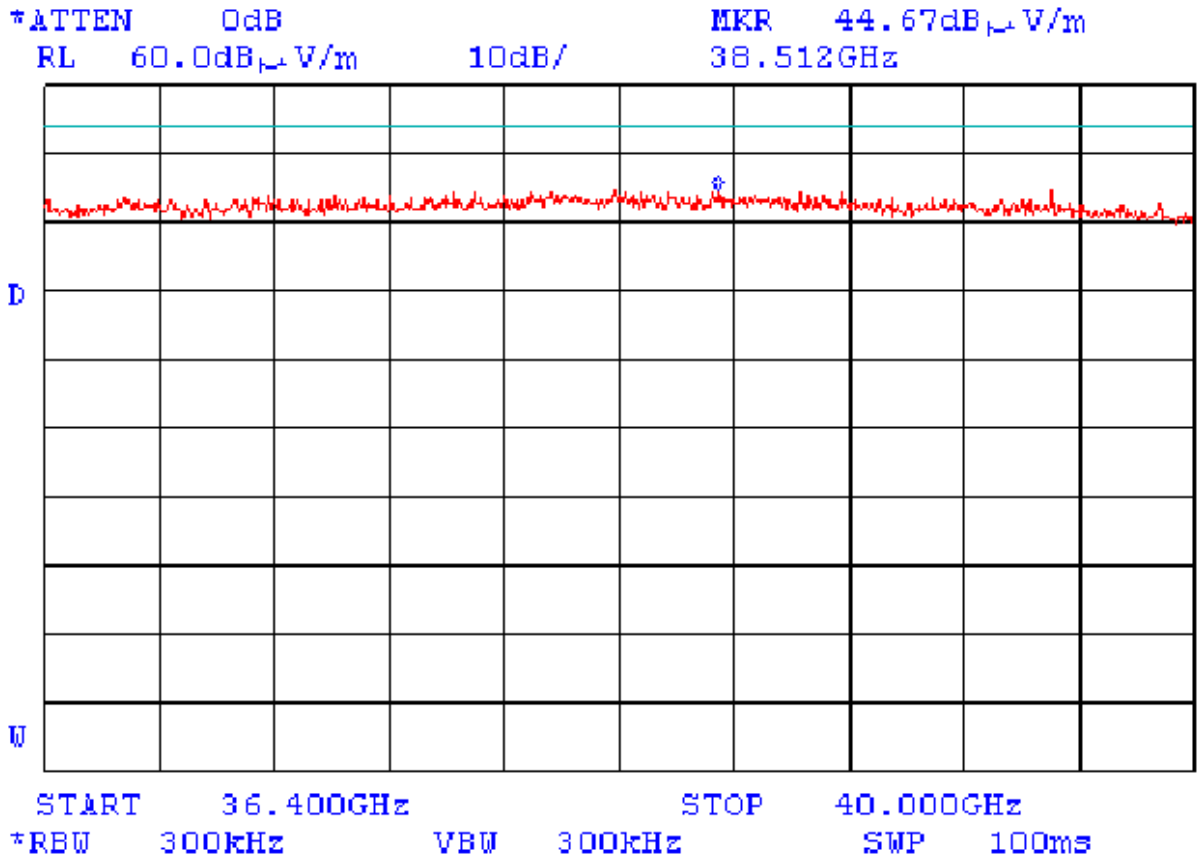
Plot A85

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{LOW}:	5.726 GHz
Bit rate:	3 Mbit/s
Frequency range:	36.4 – 40 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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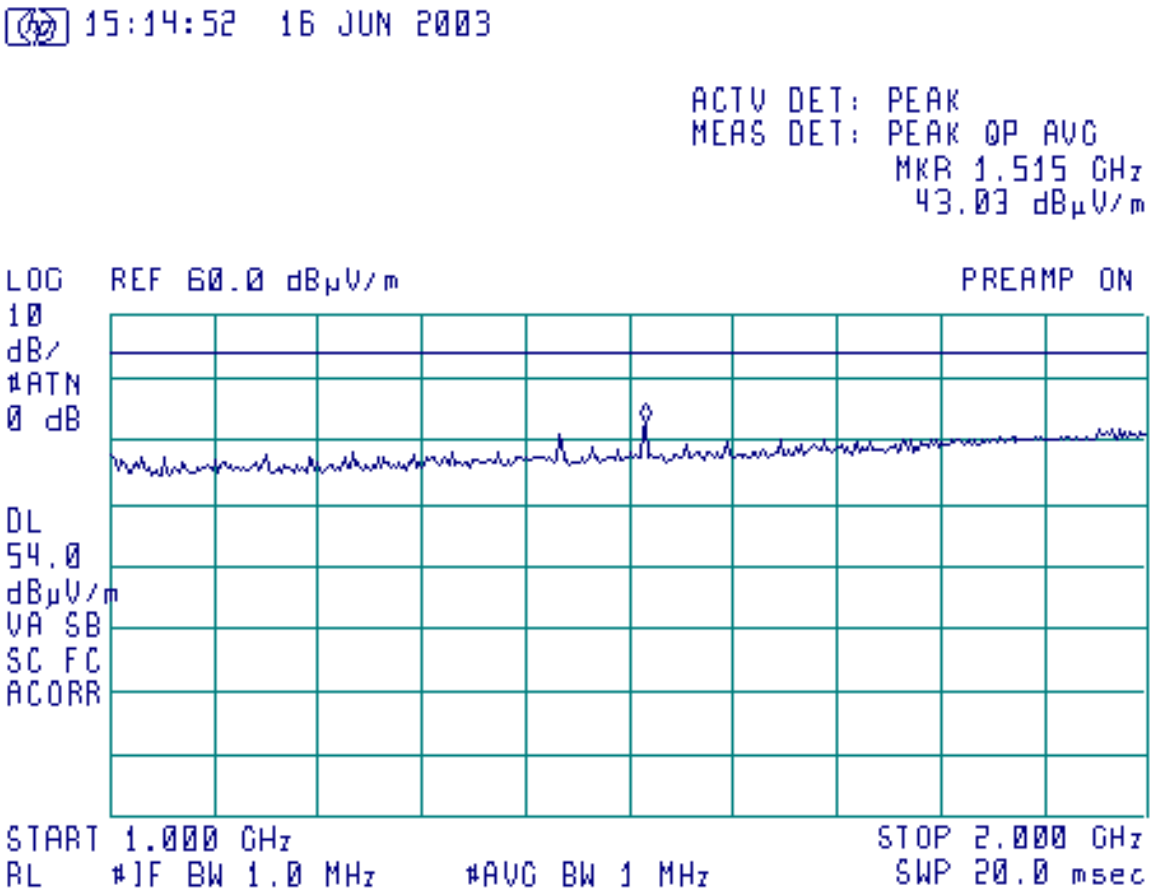
Plot A86

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	1 – 2 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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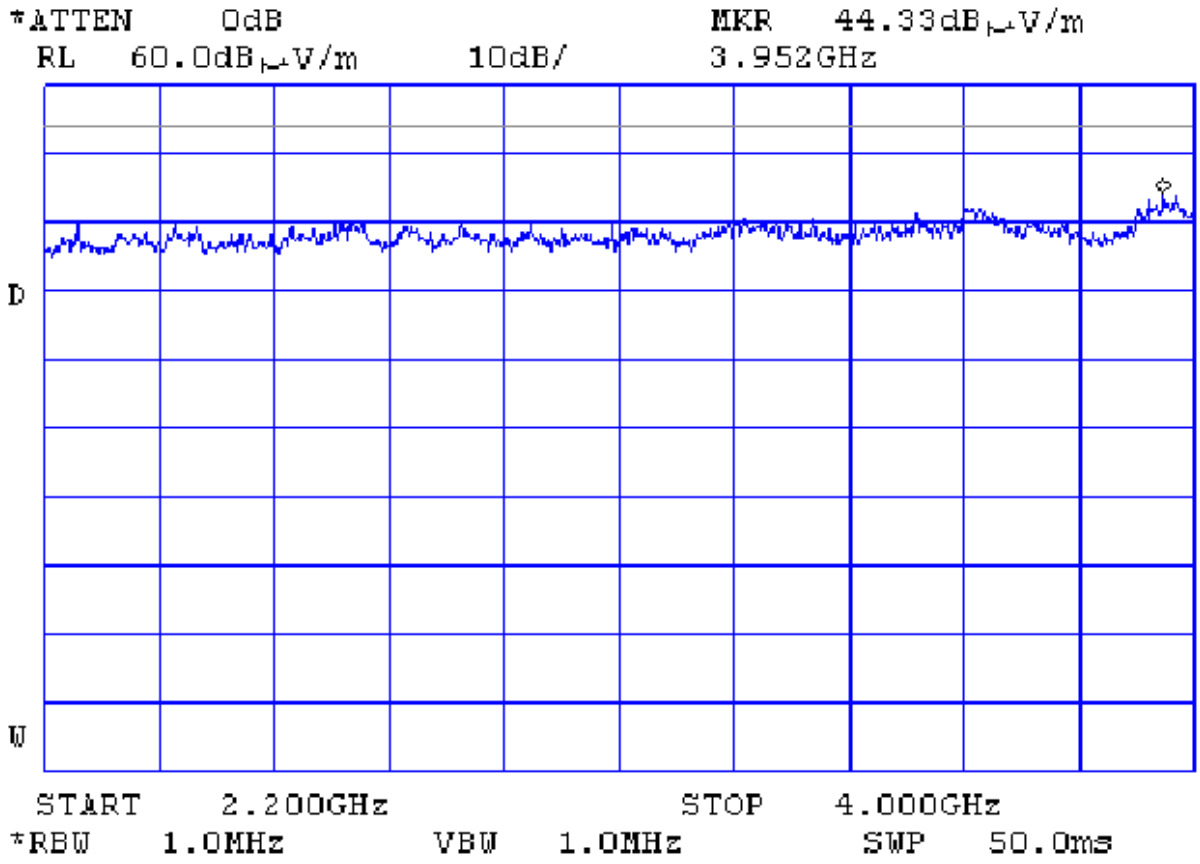
Plot A87

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	2.2 – 4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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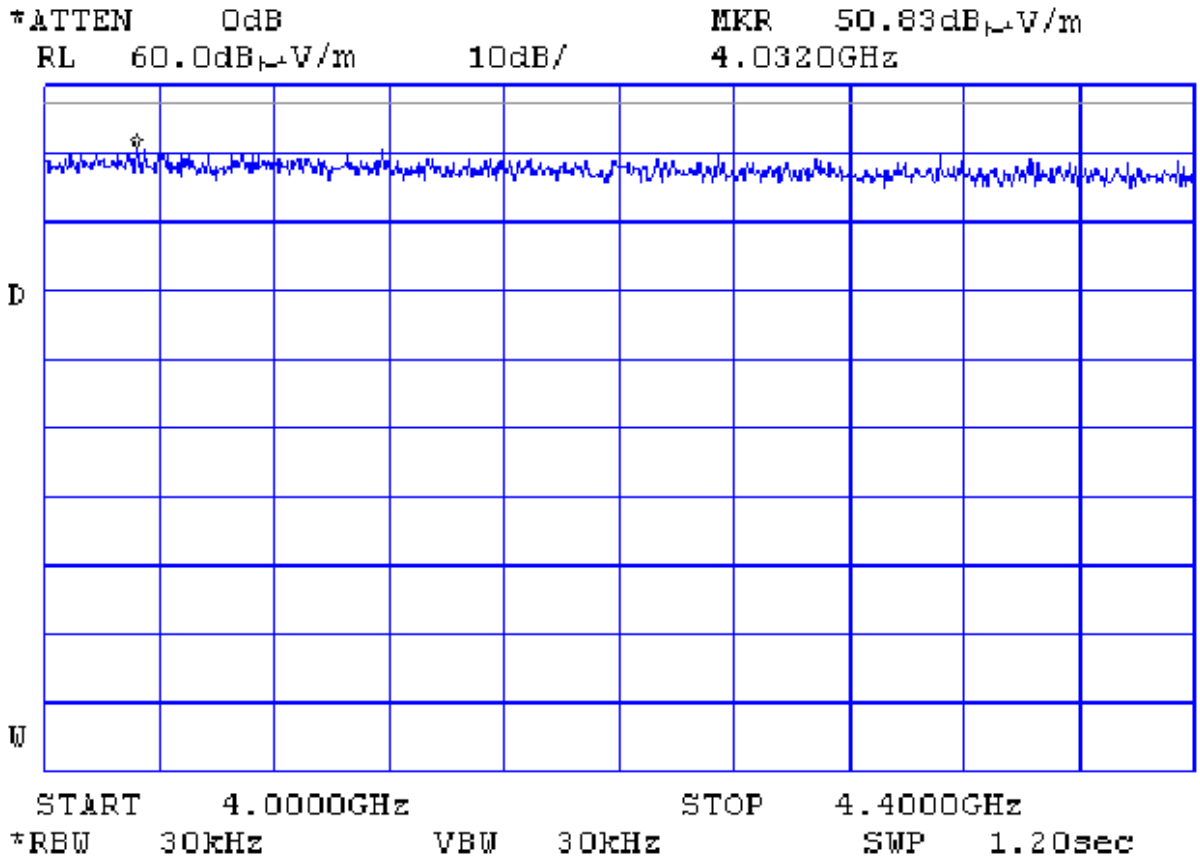
Plot A88

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	4 – 4.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 57.5 dB(µV/m) at 2 m test distance
No spurious emissions were found

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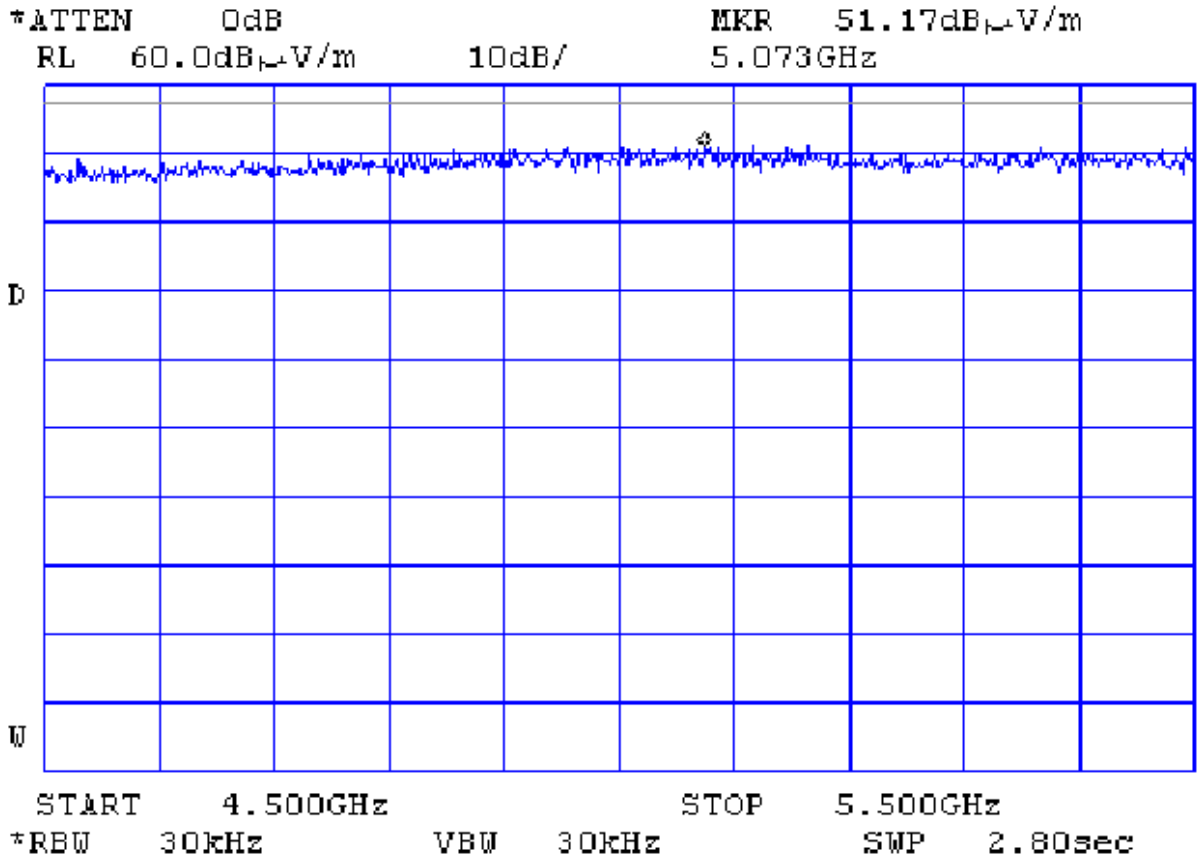
Plot A89

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	4.5 – 5.5 GHz



Limit (average) for radiated spurious emissions in restricted bands is 57.5 dB(µV/m) at 2 m test distance
No spurious emissions were found

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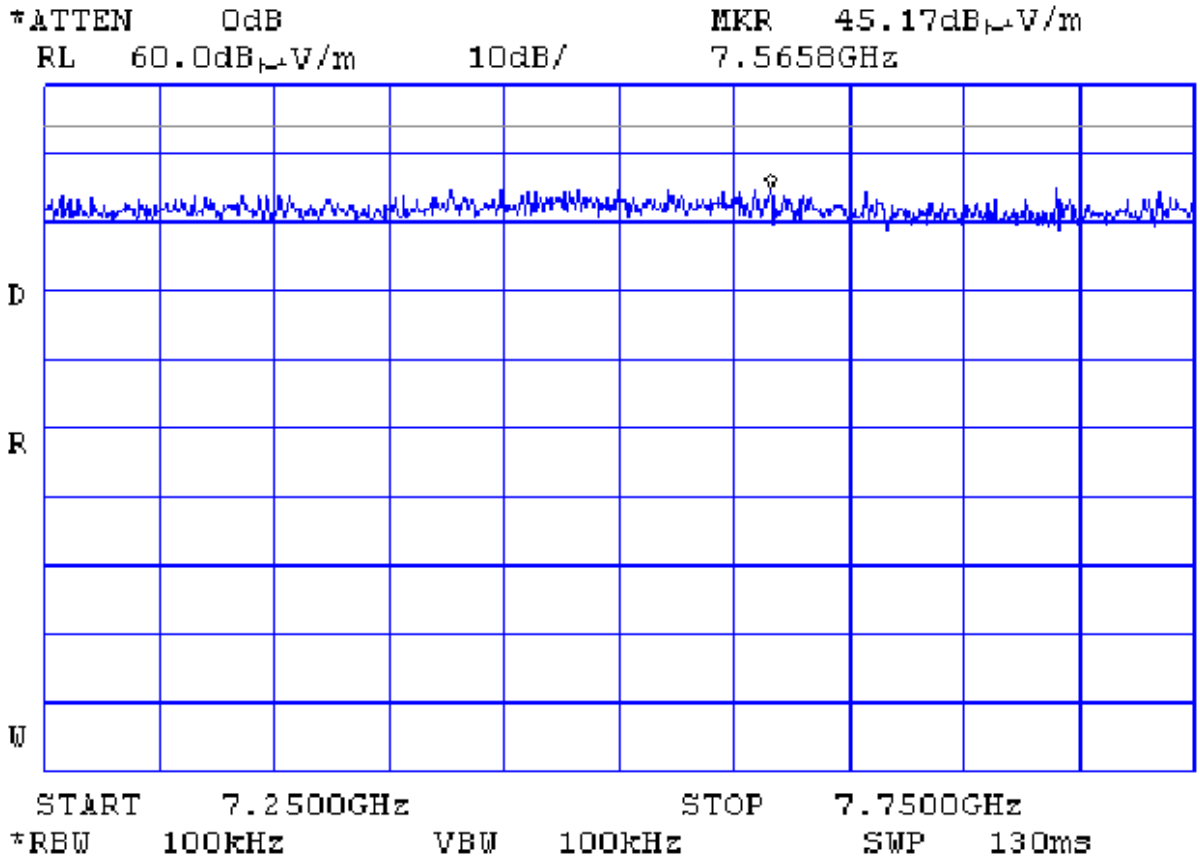
Plot A90

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	7.25 – 7.75 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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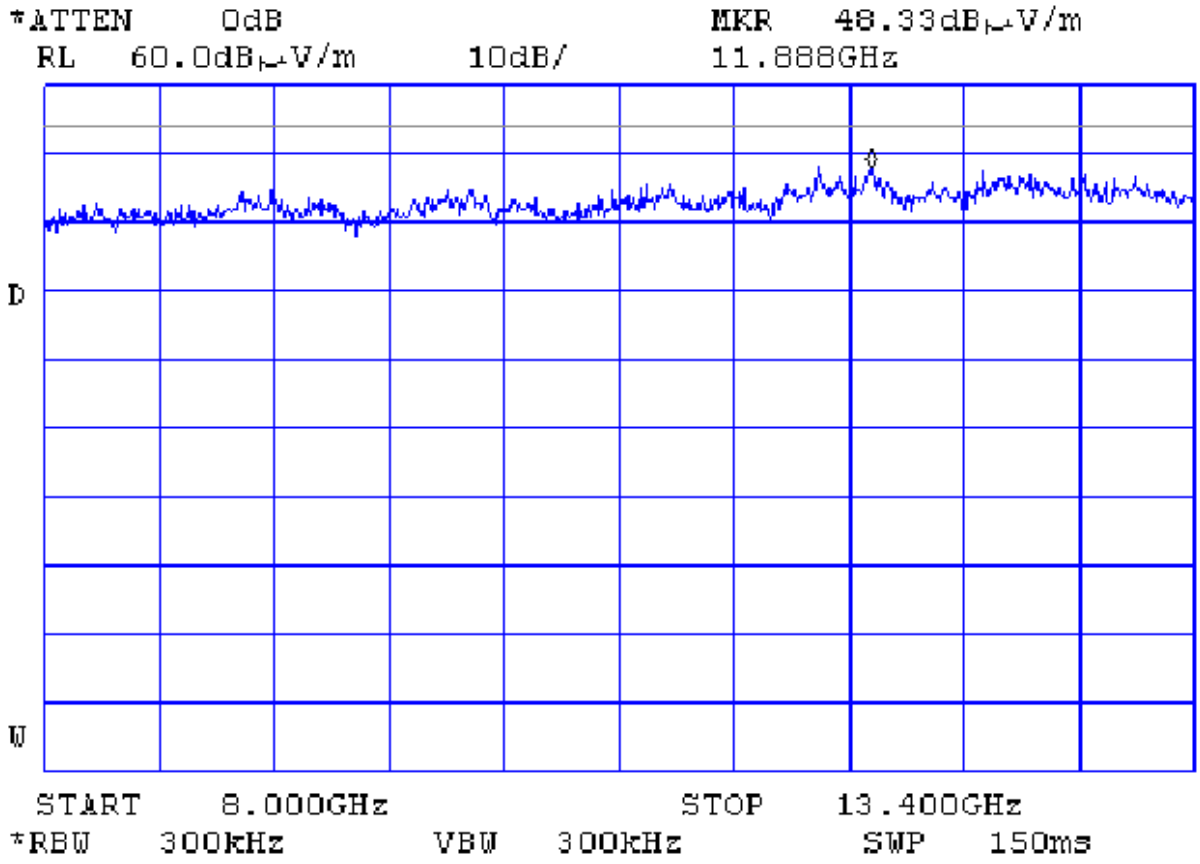
Plot A91

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	8 – 13.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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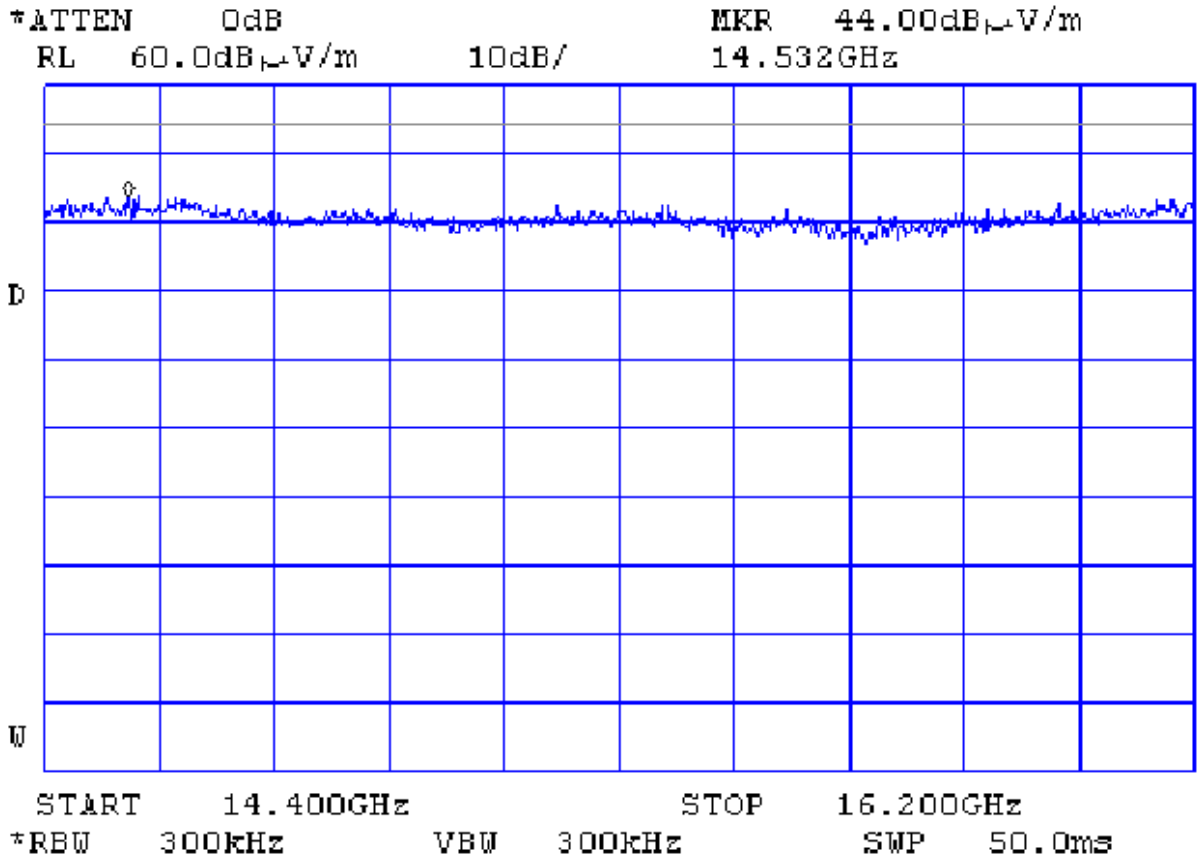
Plot A92

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	14.4 – 16.2 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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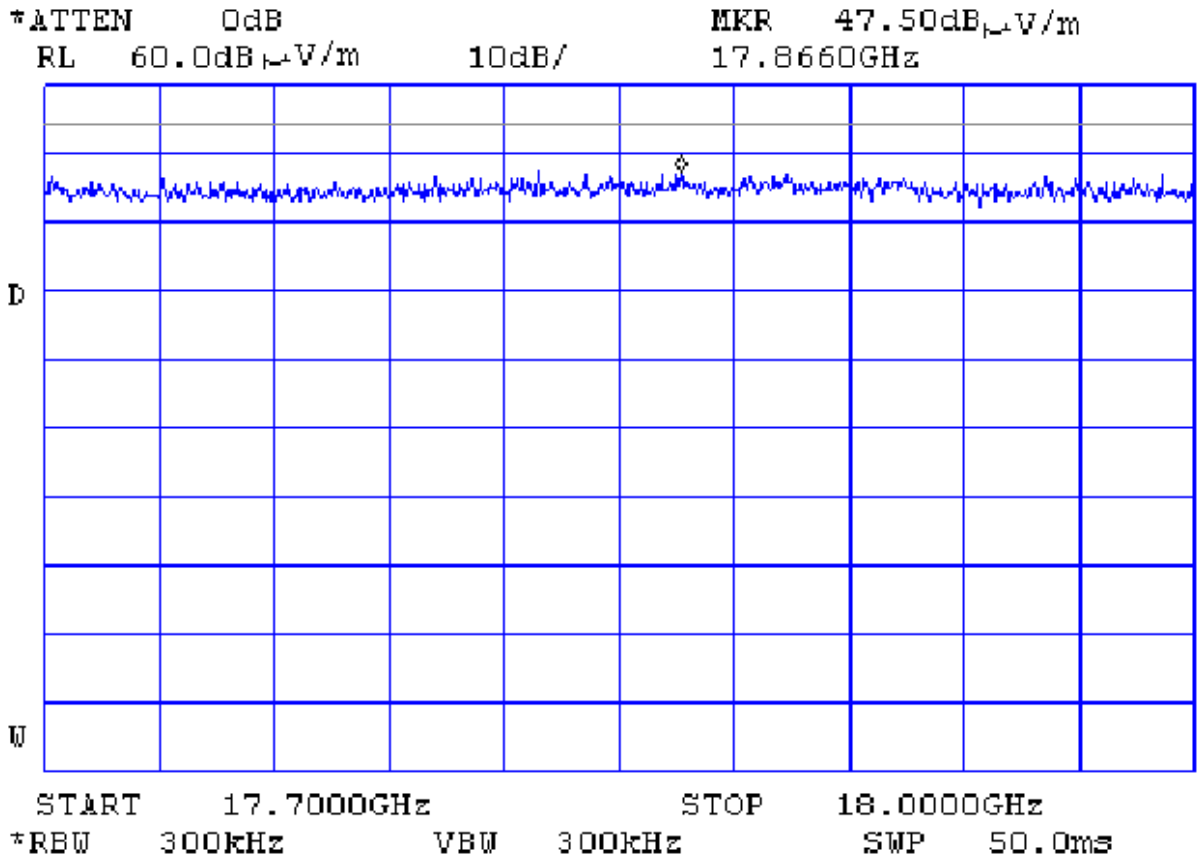
Plot A93

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	17.7 – 18 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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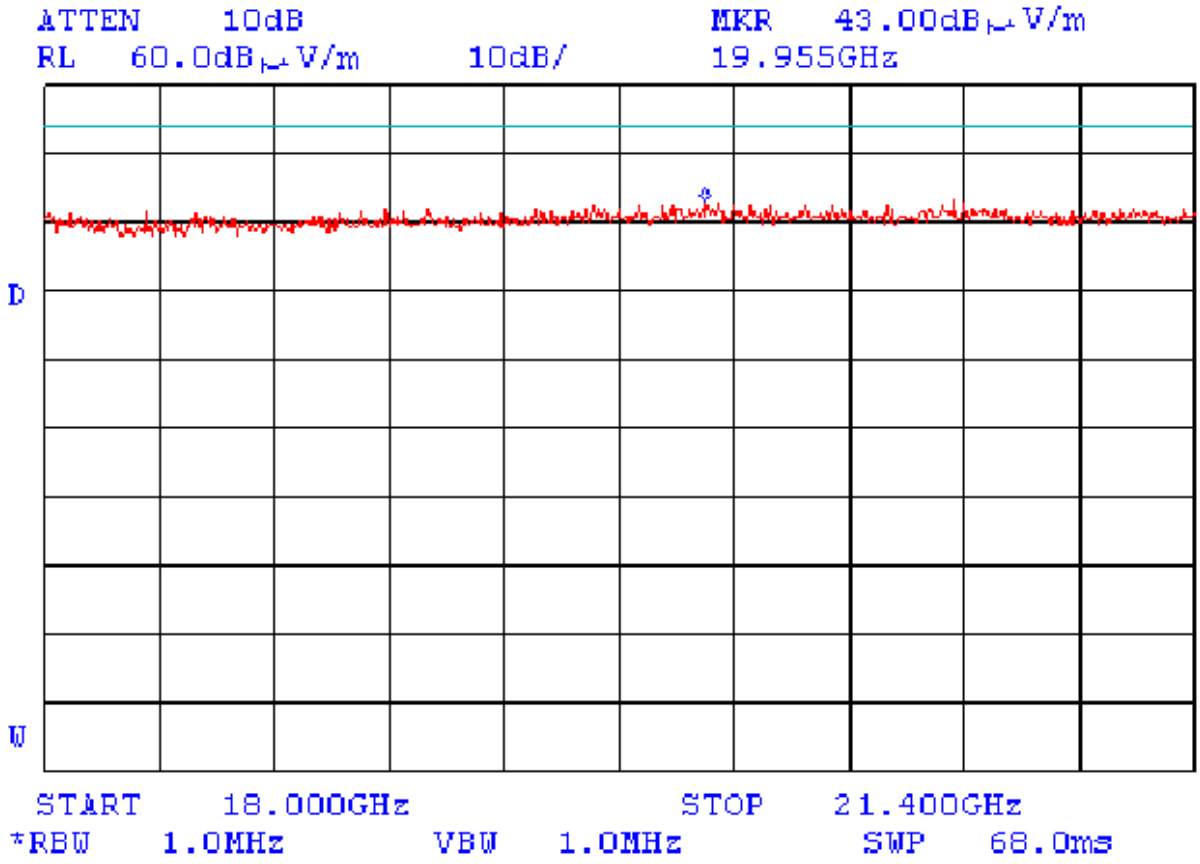
Plot A94

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	18 – 21.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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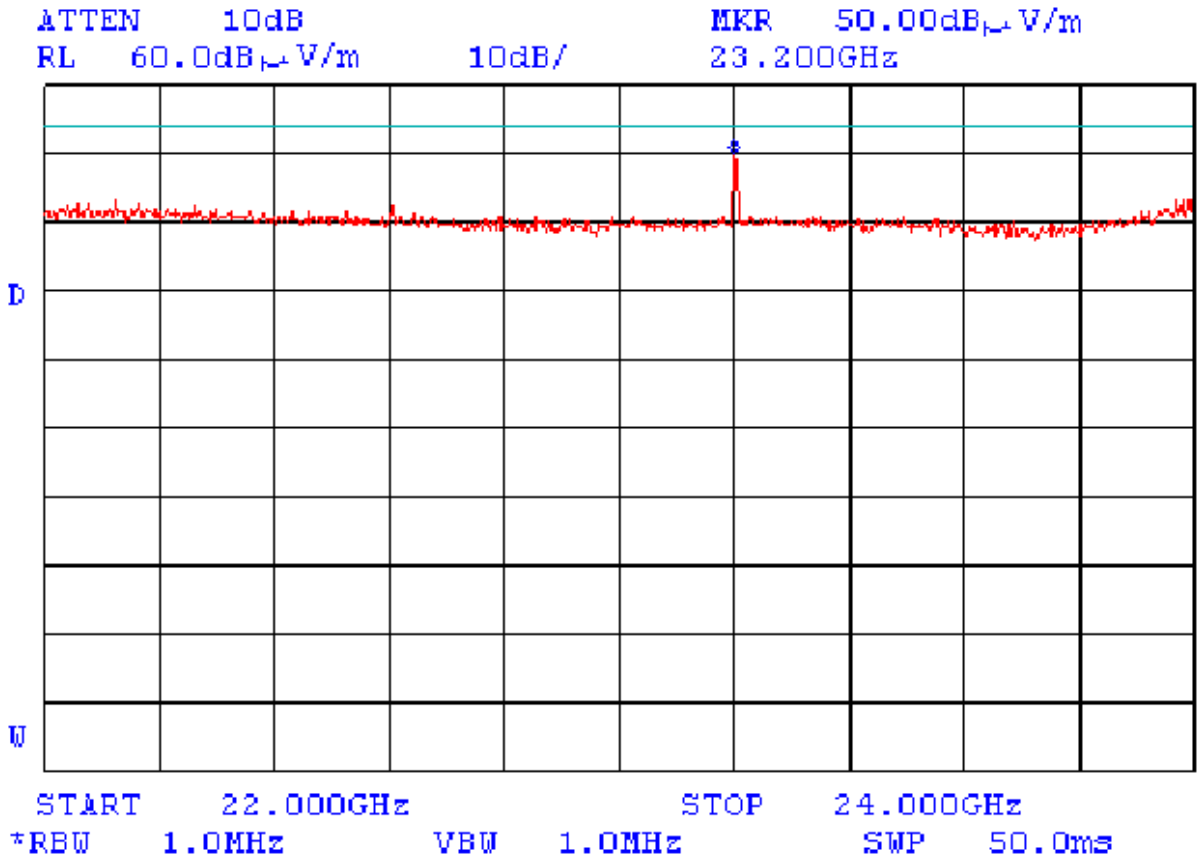
Plot A95

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	22 – 24 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions except 4th harmonic were found

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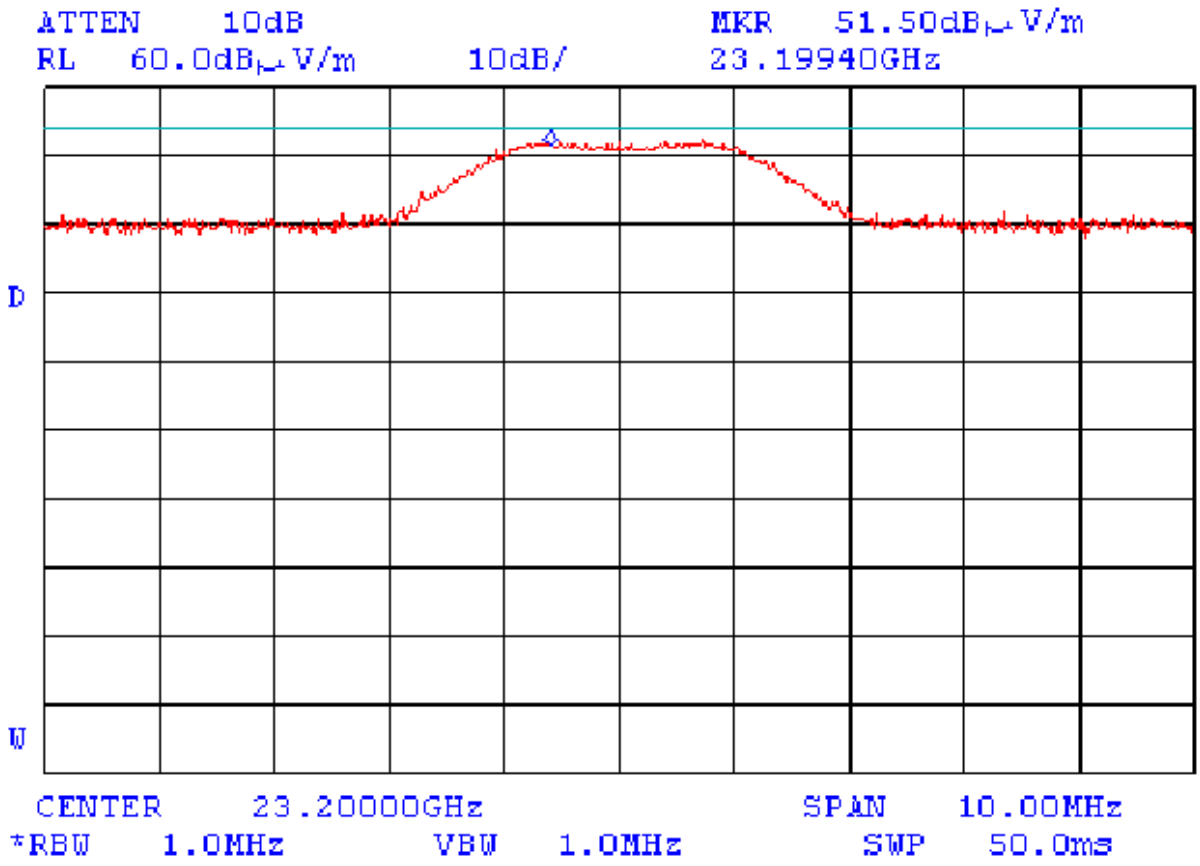
Plot A96

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Center frequency:	23.2 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
E_{peak} = 51.5 dB(µV/m)

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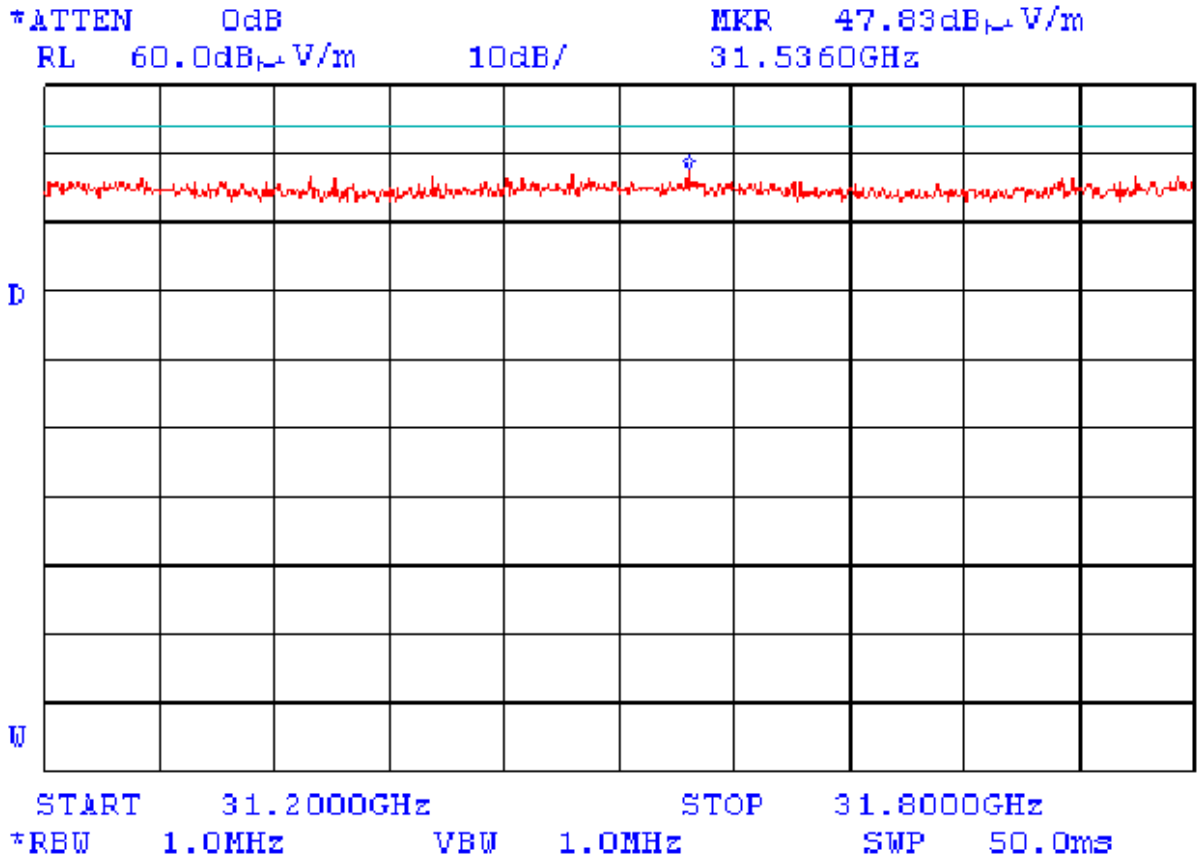
Plot A97

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	31.2 – 31.8 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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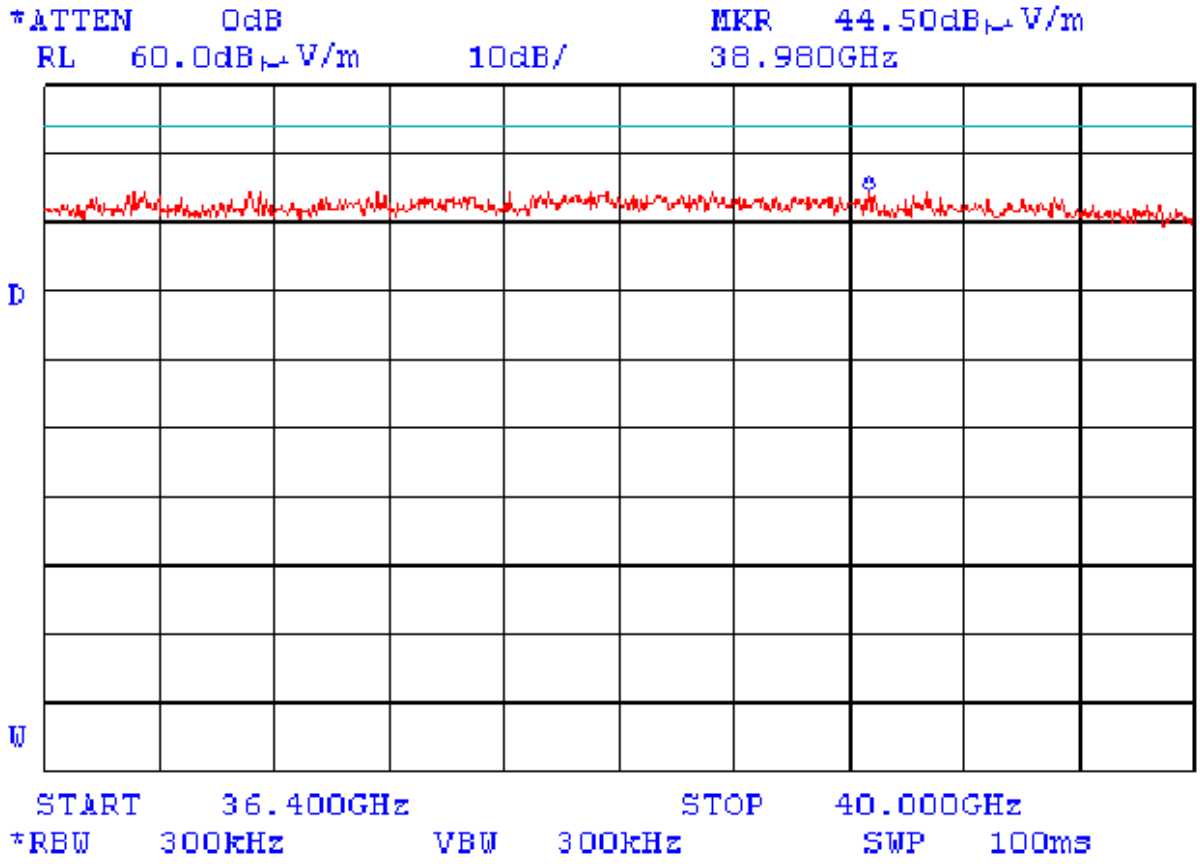
Plot A98

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{MIDDLE}:	5.8 GHz
Bit rate:	3 Mbit/s
Frequency range:	36.4 – 40 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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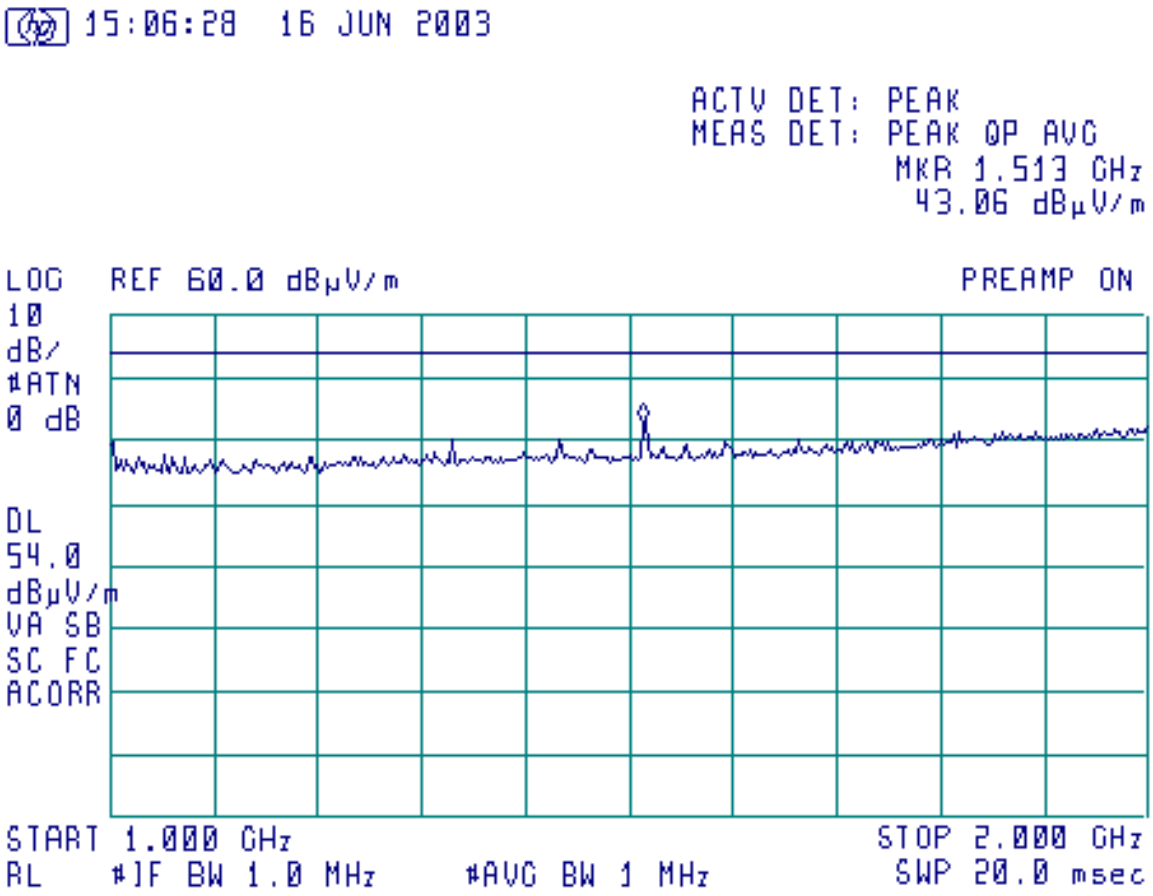
Plot A99

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	1 – 2 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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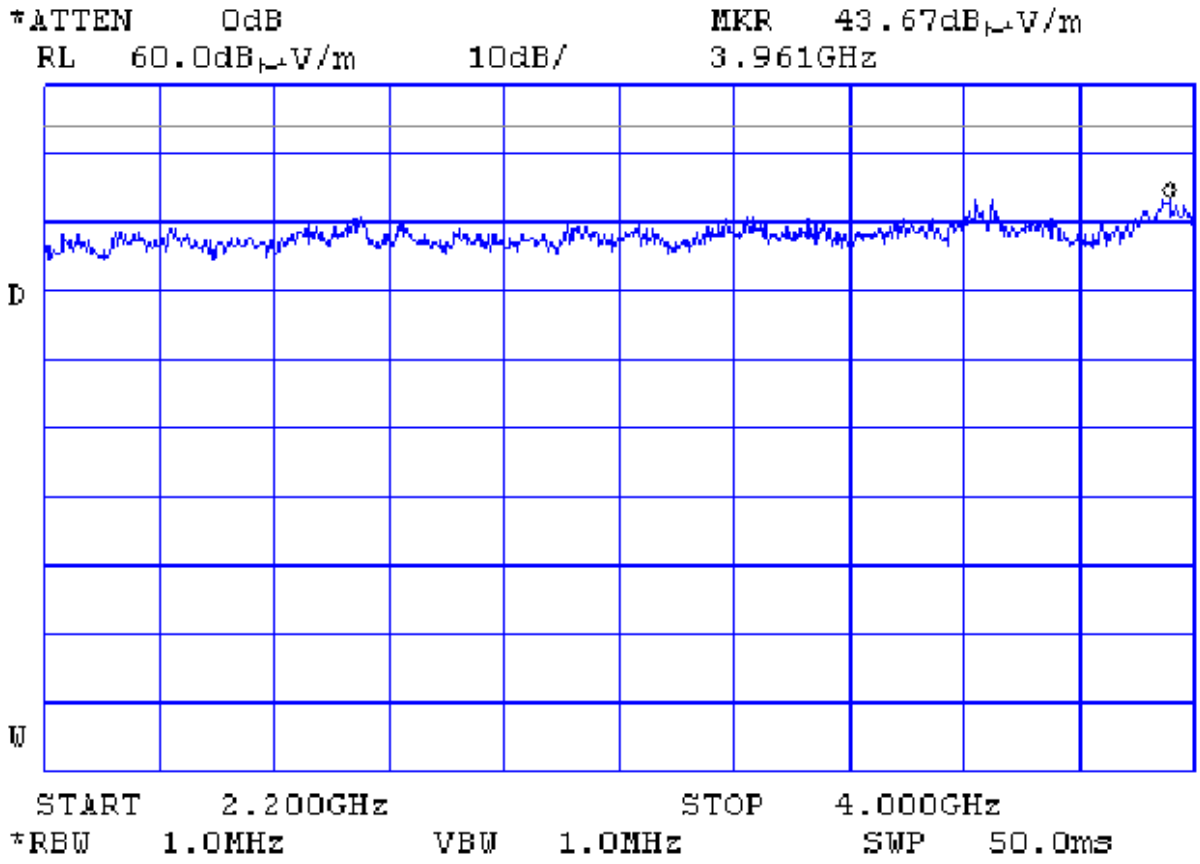
Plot A100

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	2.2 – 4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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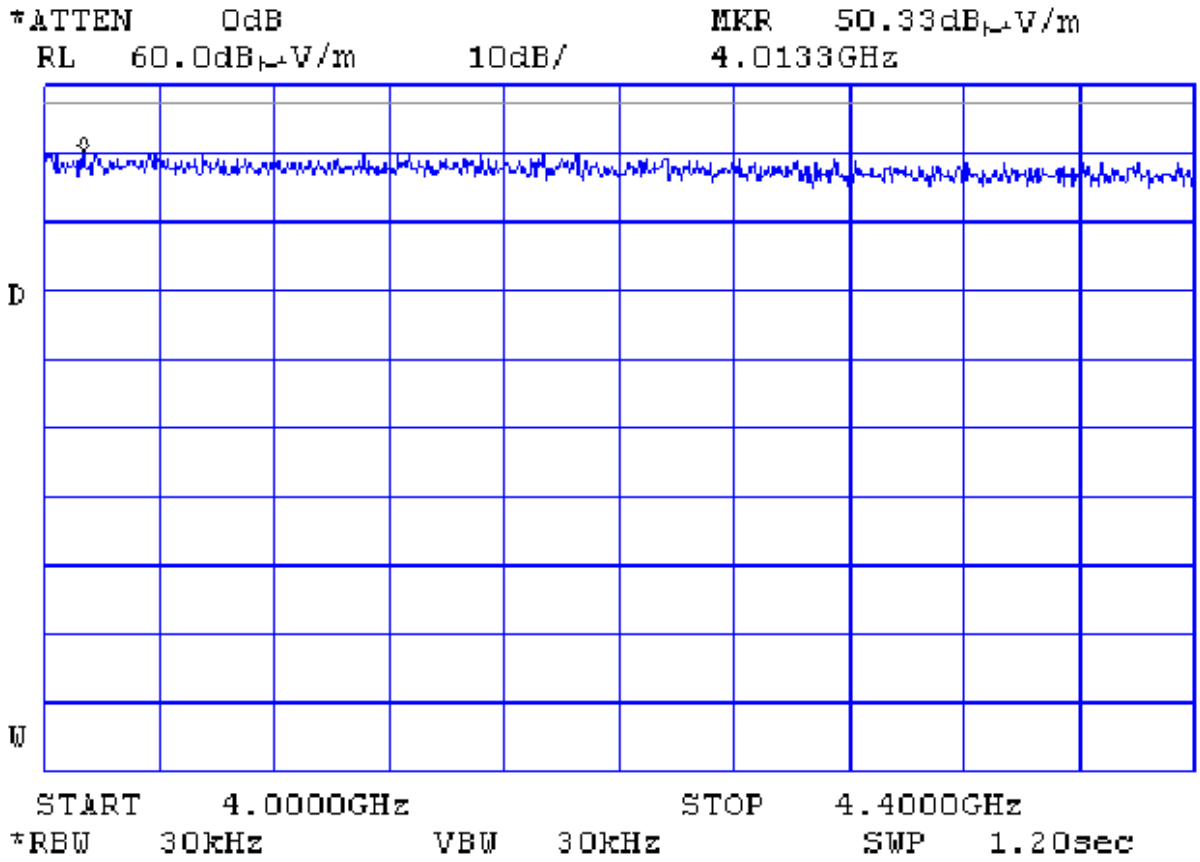
Plot A101

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	4 – 4.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 57.5 dB(µV/m) at 2 m test distance
No spurious emissions were found

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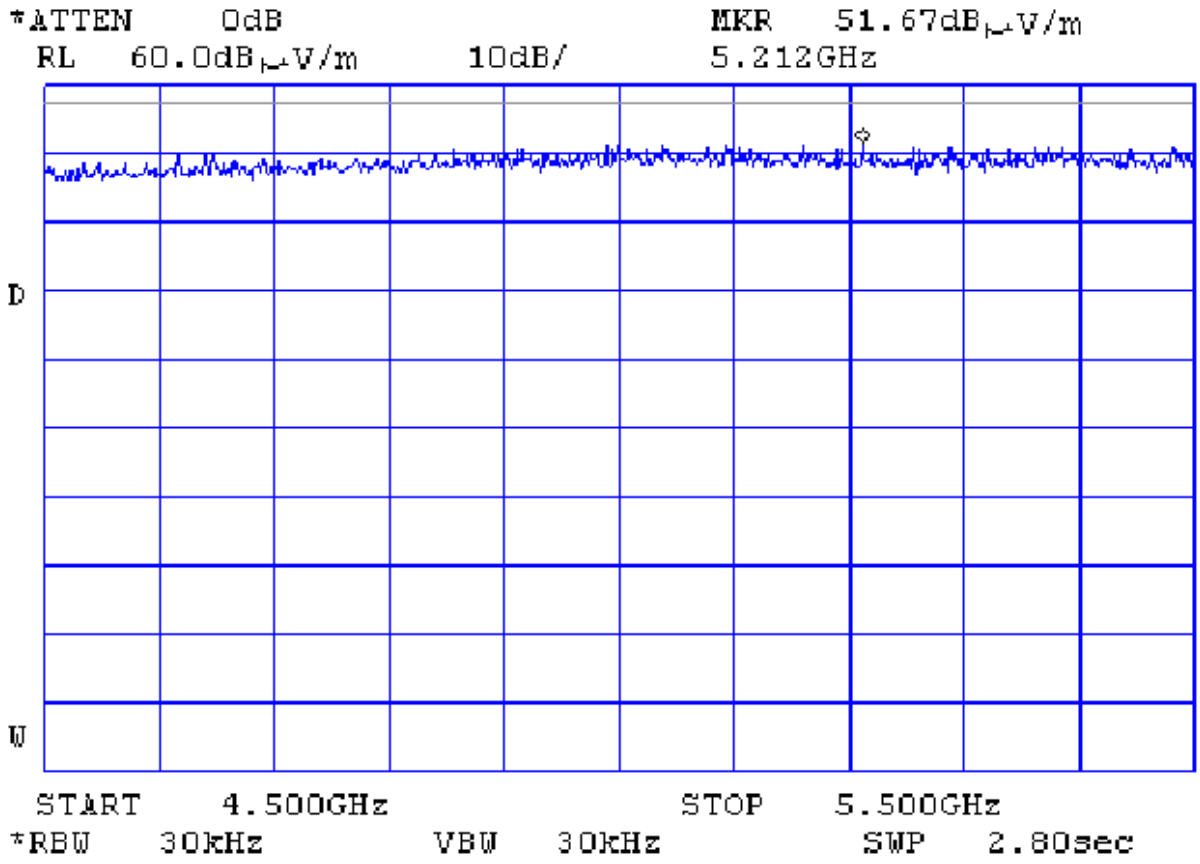
Plot A102

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	4.5 – 5.5 GHz



Limit (average) for radiated spurious emissions in restricted bands is 57.5 dB(µV/m) at 2 m test distance
No spurious emissions were found

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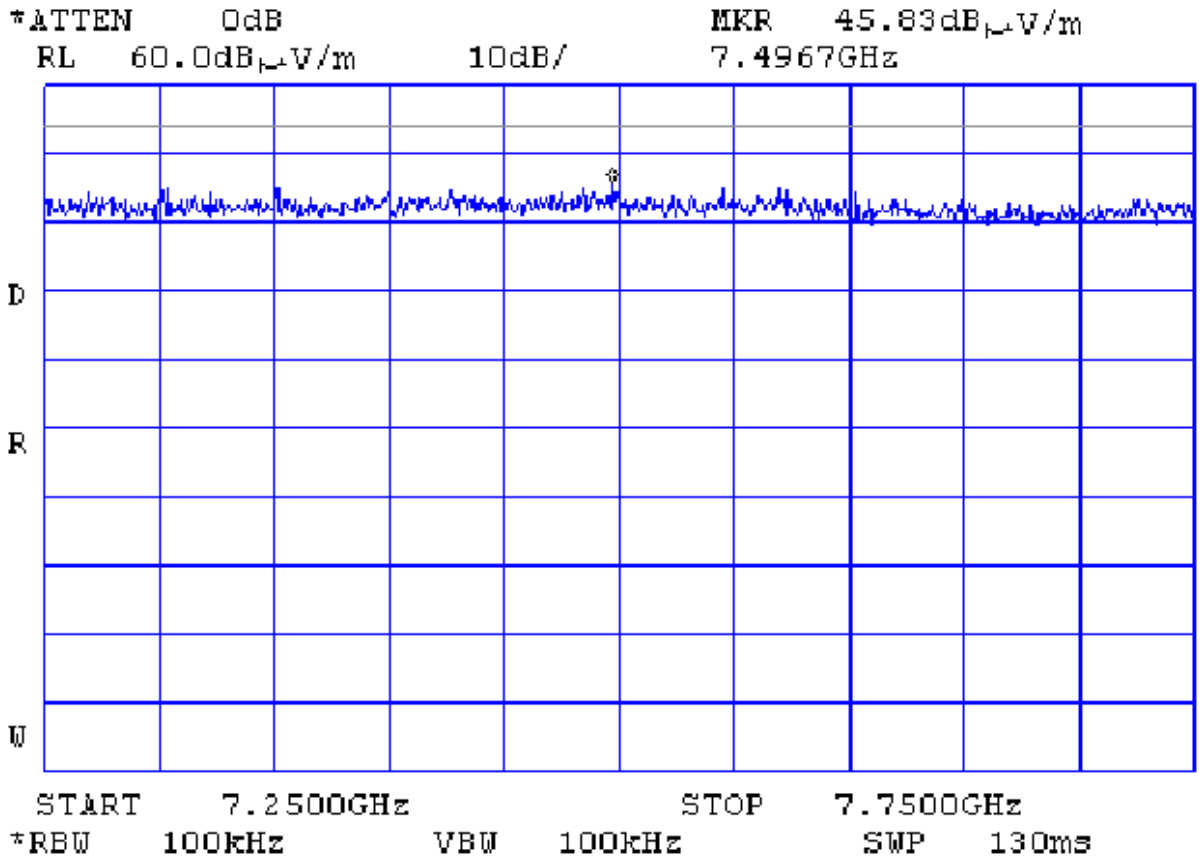
Plot A103

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	7.25 – 7.75 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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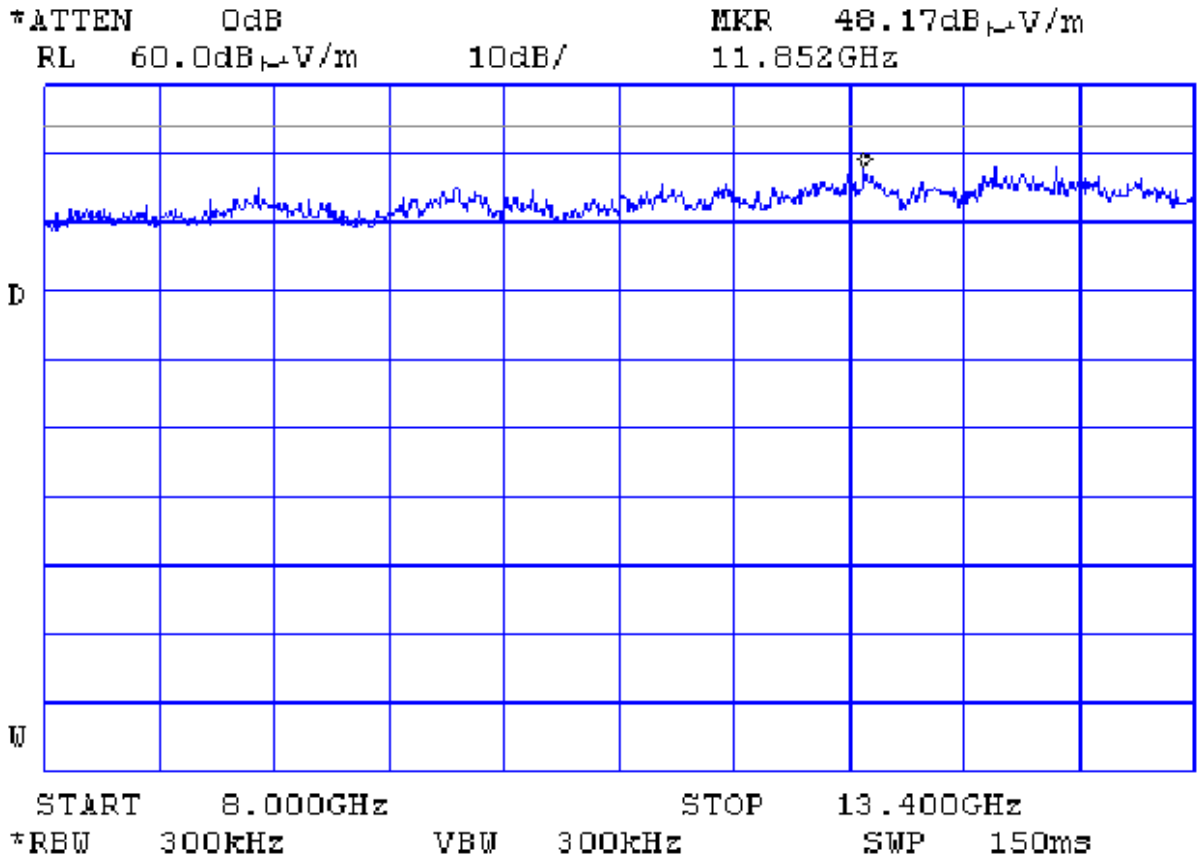
Plot A104

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	8 – 13.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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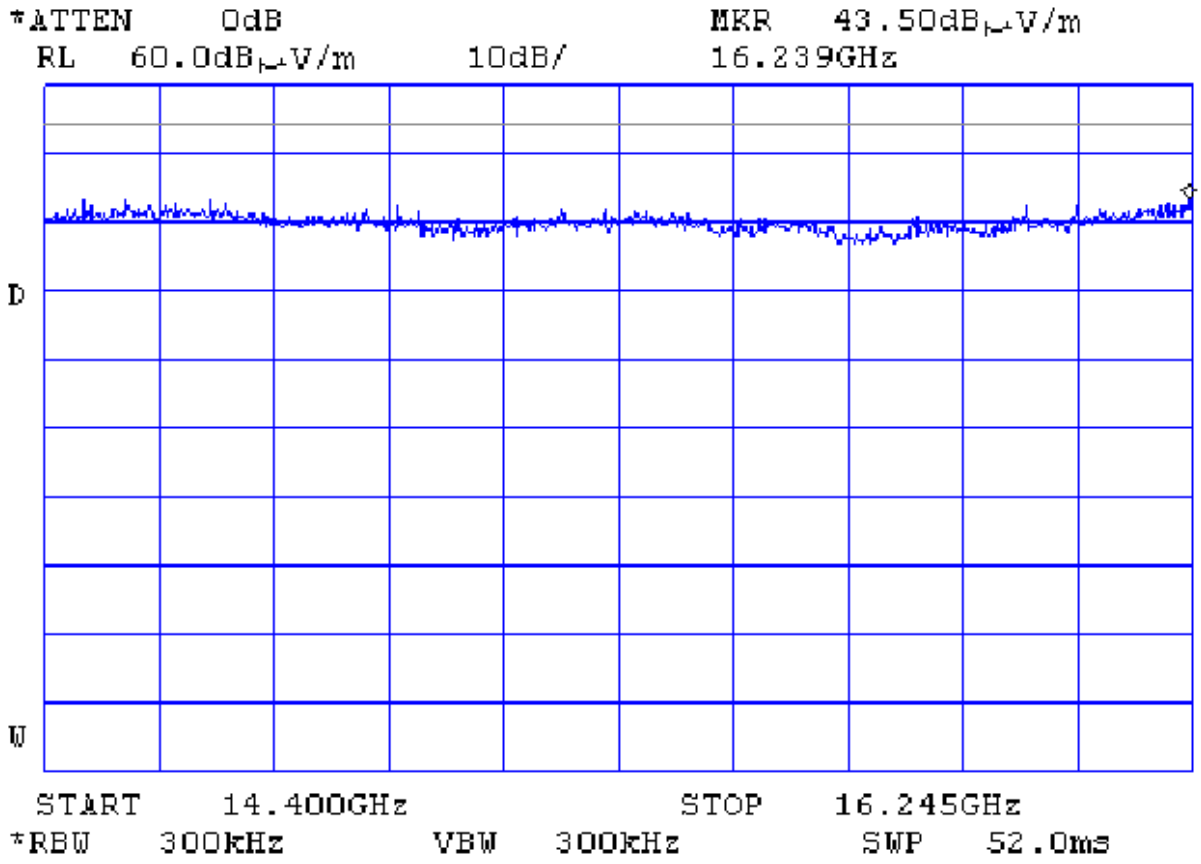
Plot A105

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	14.4 – 16.245 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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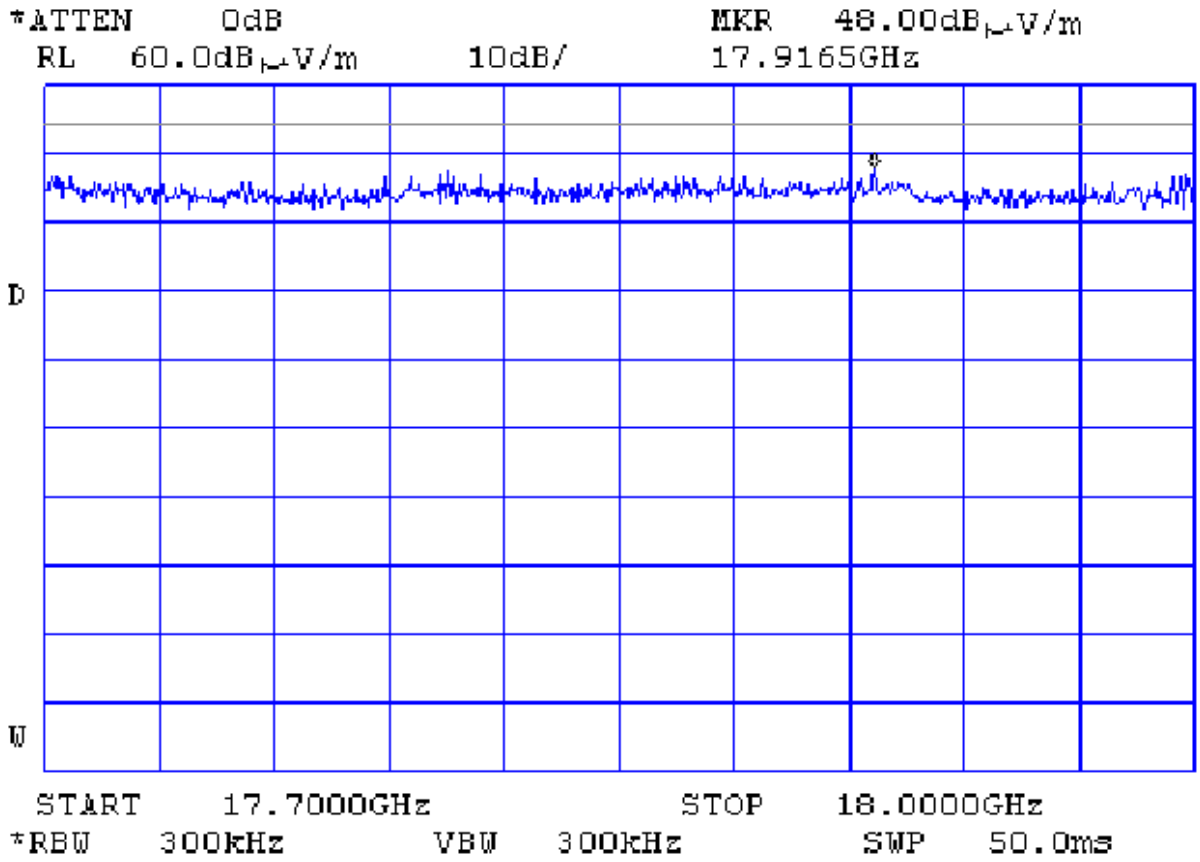
Plot A106

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	17.7 – 18 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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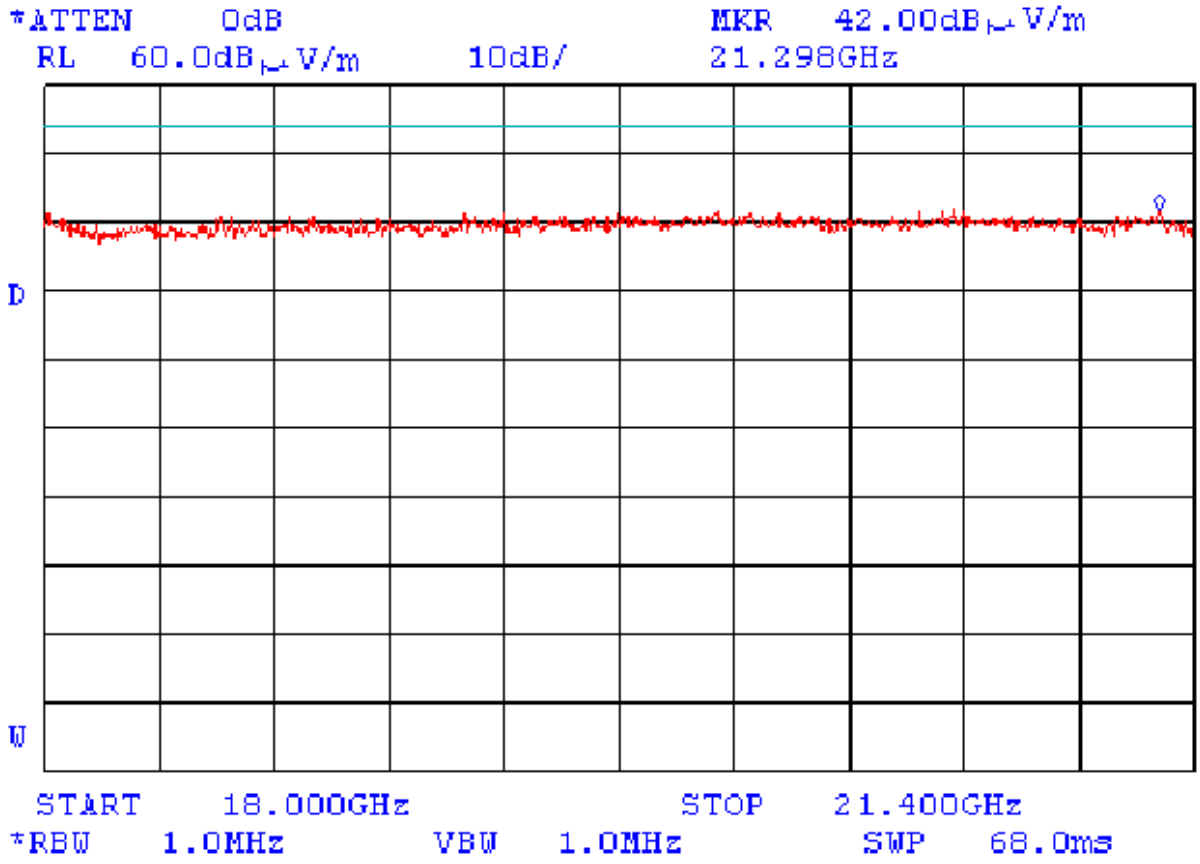
Plot A107

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	18 – 21.4 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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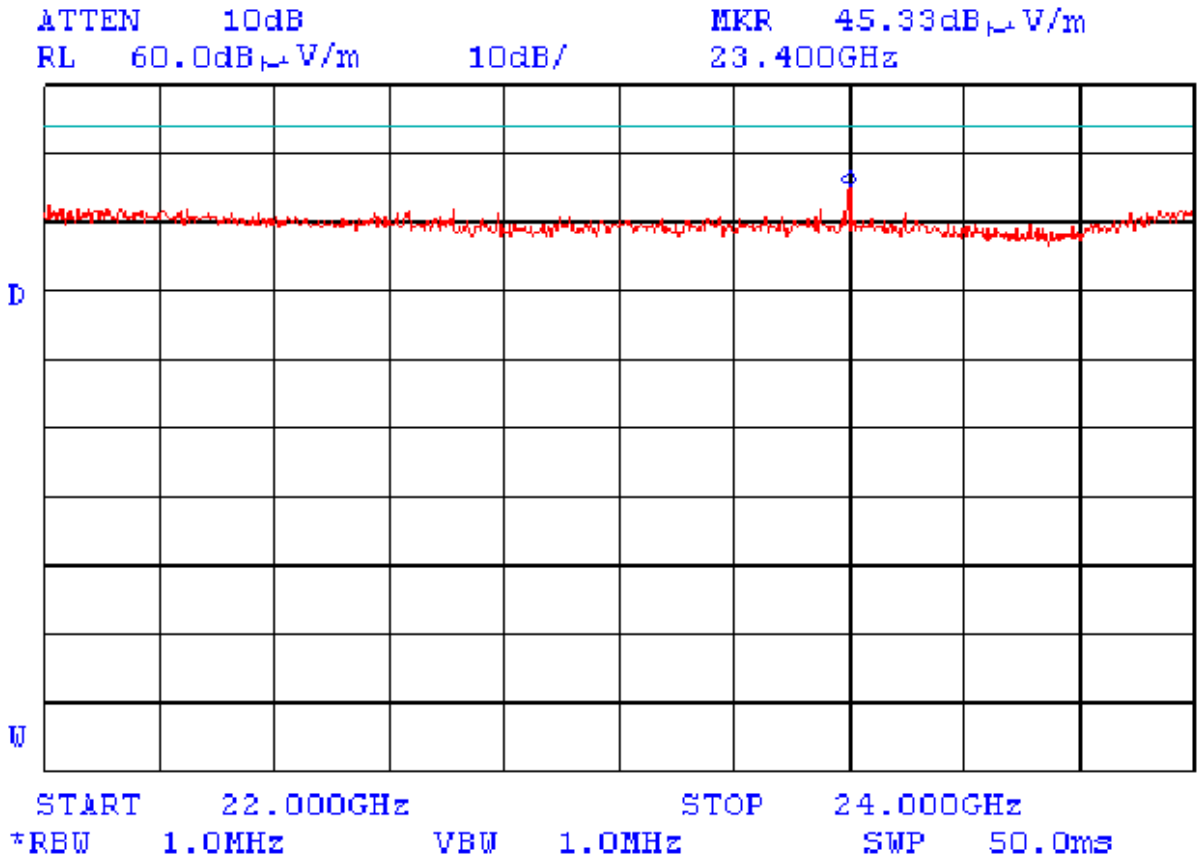
Plot A108

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	22 – 24 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions except 4th harmonic were found

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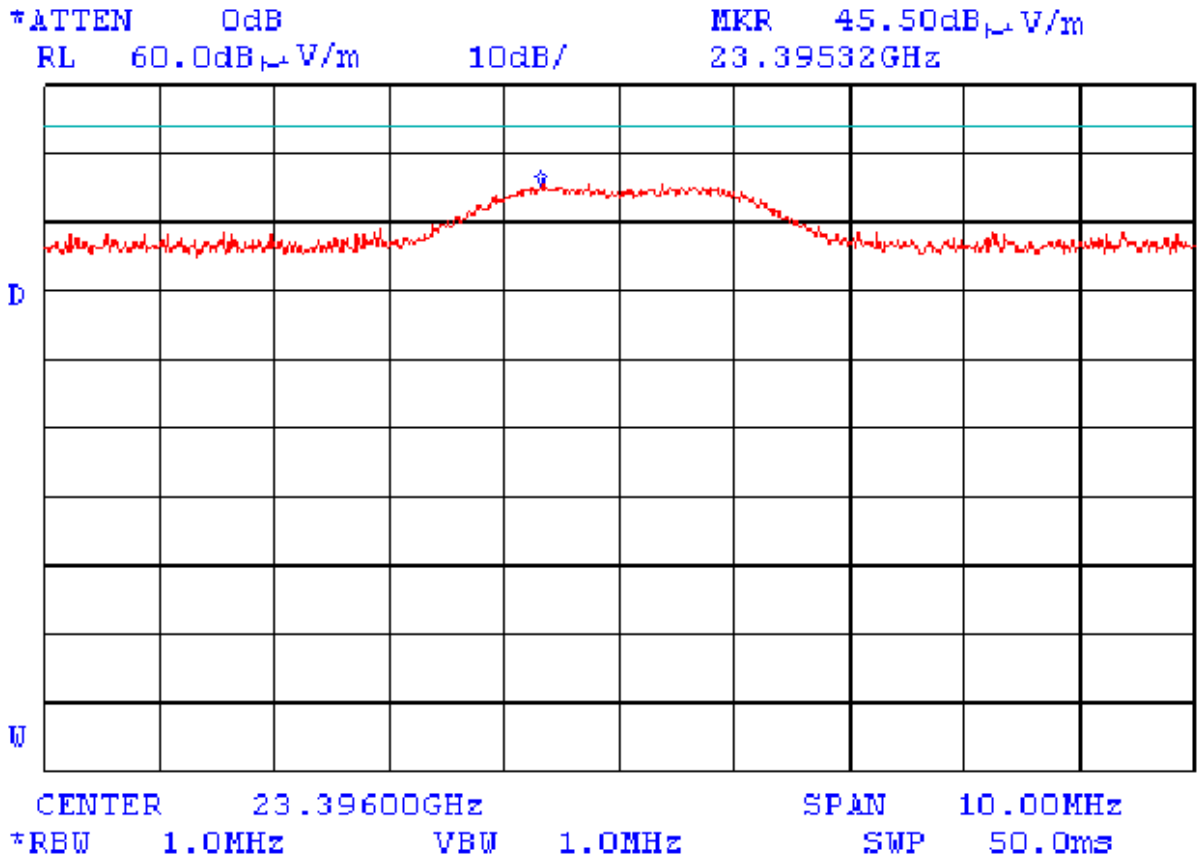
Plot A109

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Center frequency:	23.396 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
E_{peak} = 45.5 dB(µV/m)

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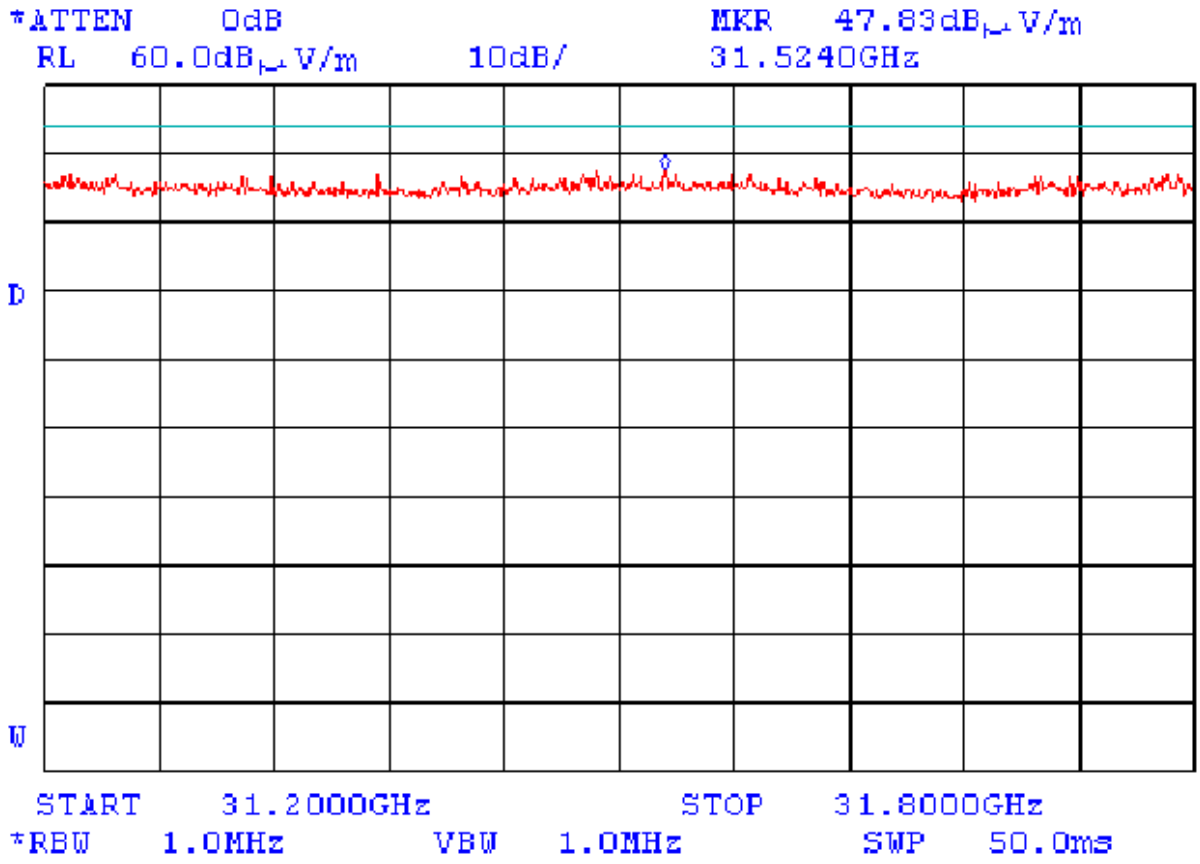
Plot A110

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	31.2 – 31.8 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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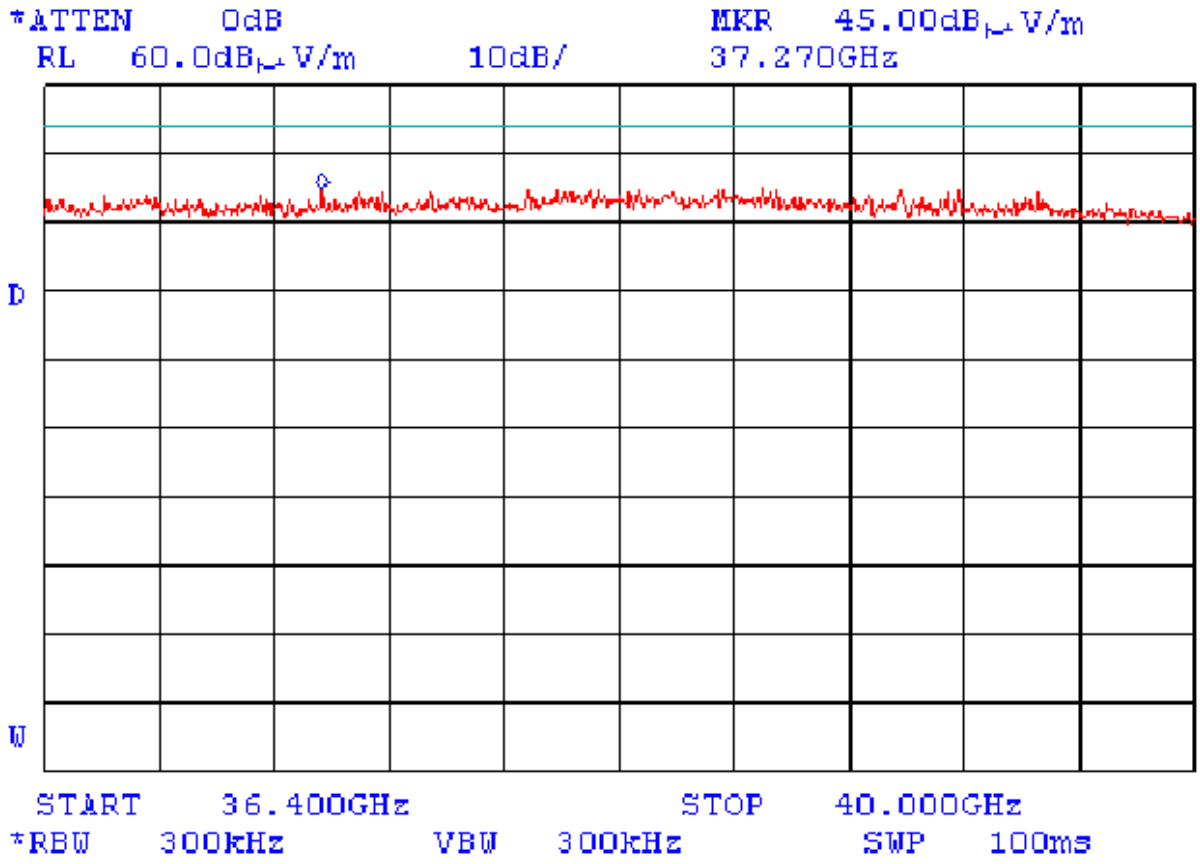
Plot A111

Radiated spurious emission measurements in restricted bands

Mode:	Hopping
F_{HIGH}:	5.849 GHz
Bit rate:	3 Mbit/s
Frequency range:	36.4 – 40 GHz



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)
No spurious emissions were found

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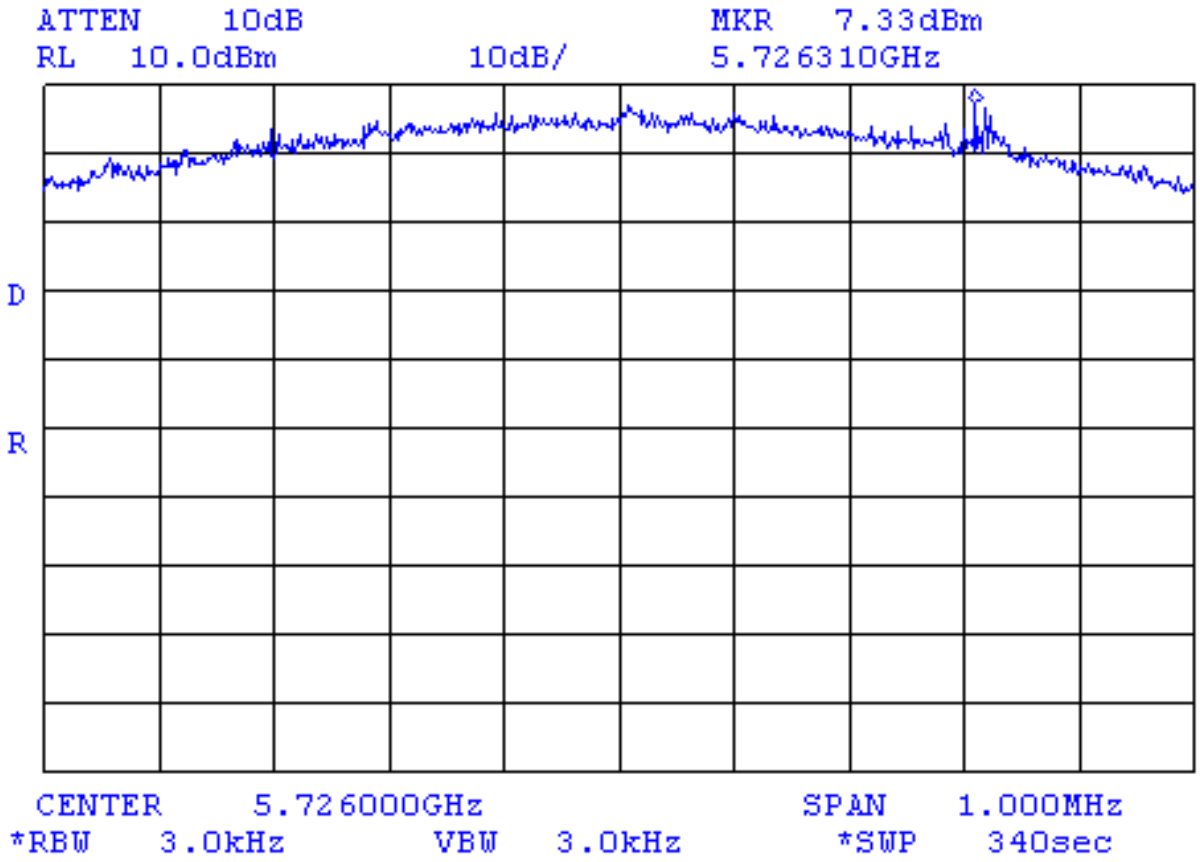
Plot A112

Power density measurements

Mode:	Hybrid (hopping turned off)
F_{HIGH}:	5.726 GHz
Bit rate:	1.33 Mbit/s



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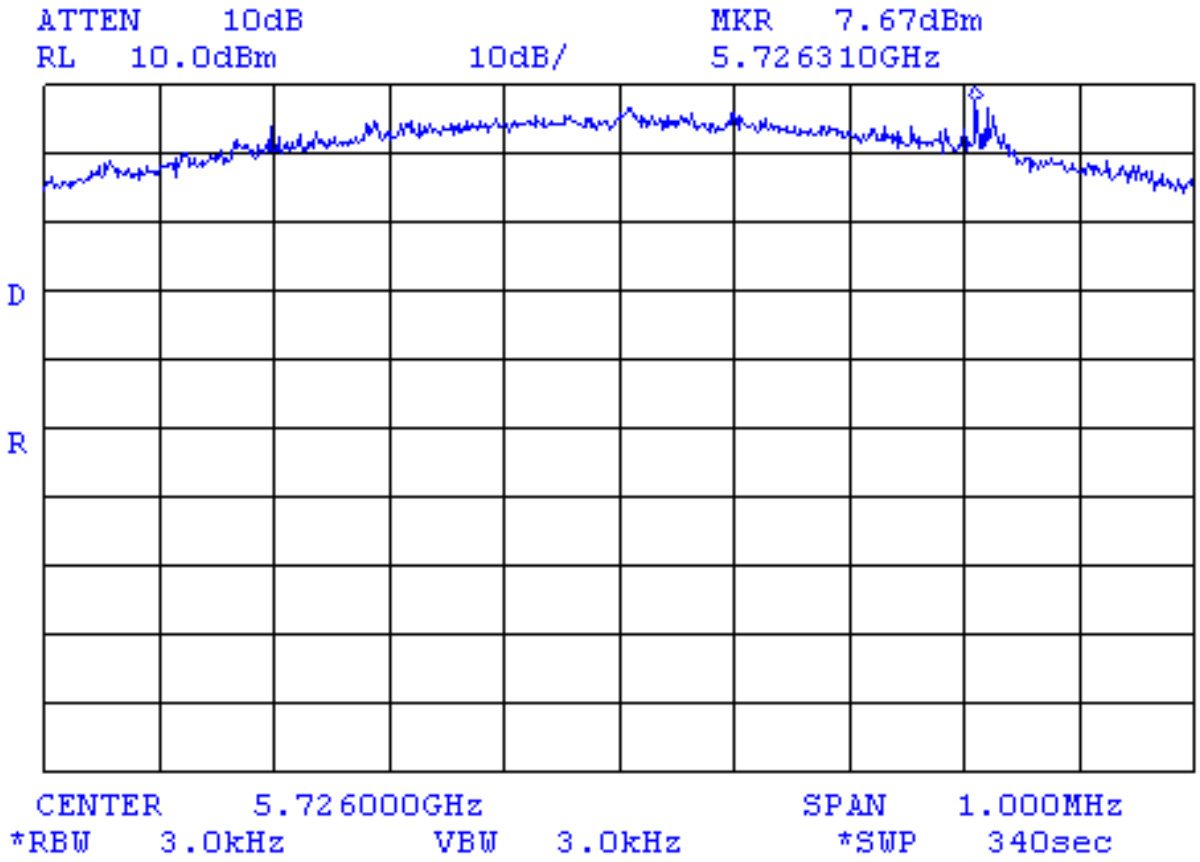
Plot A113

Power density measurements

Mode:	Hybrid (hopping turned off)
F_{HIGH}:	5.726 GHz
Bit rate:	4 Mbit/s



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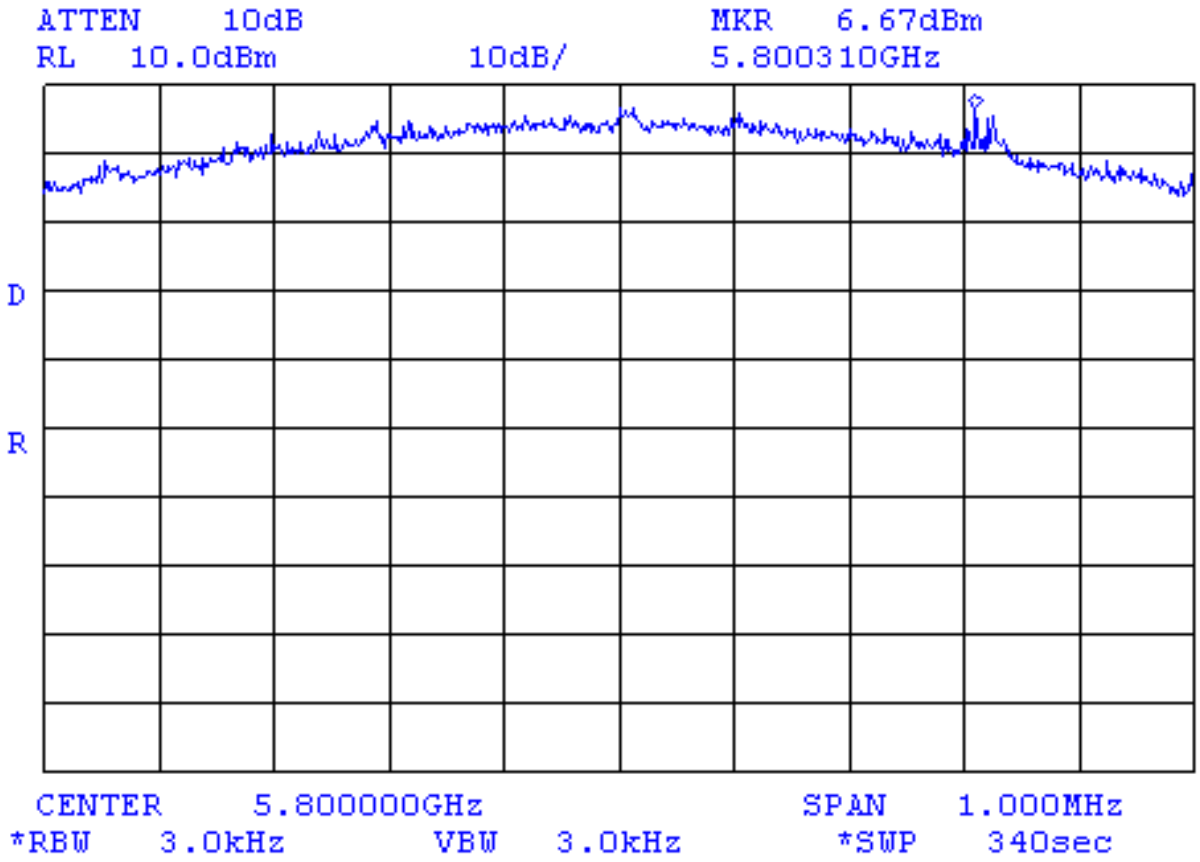
Plot A114

Power density measurements

Mode:	Hybrid (hopping turned off)
F_{HIGH}:	5.8 GHz
Bit rate:	1.33 Mbit/s



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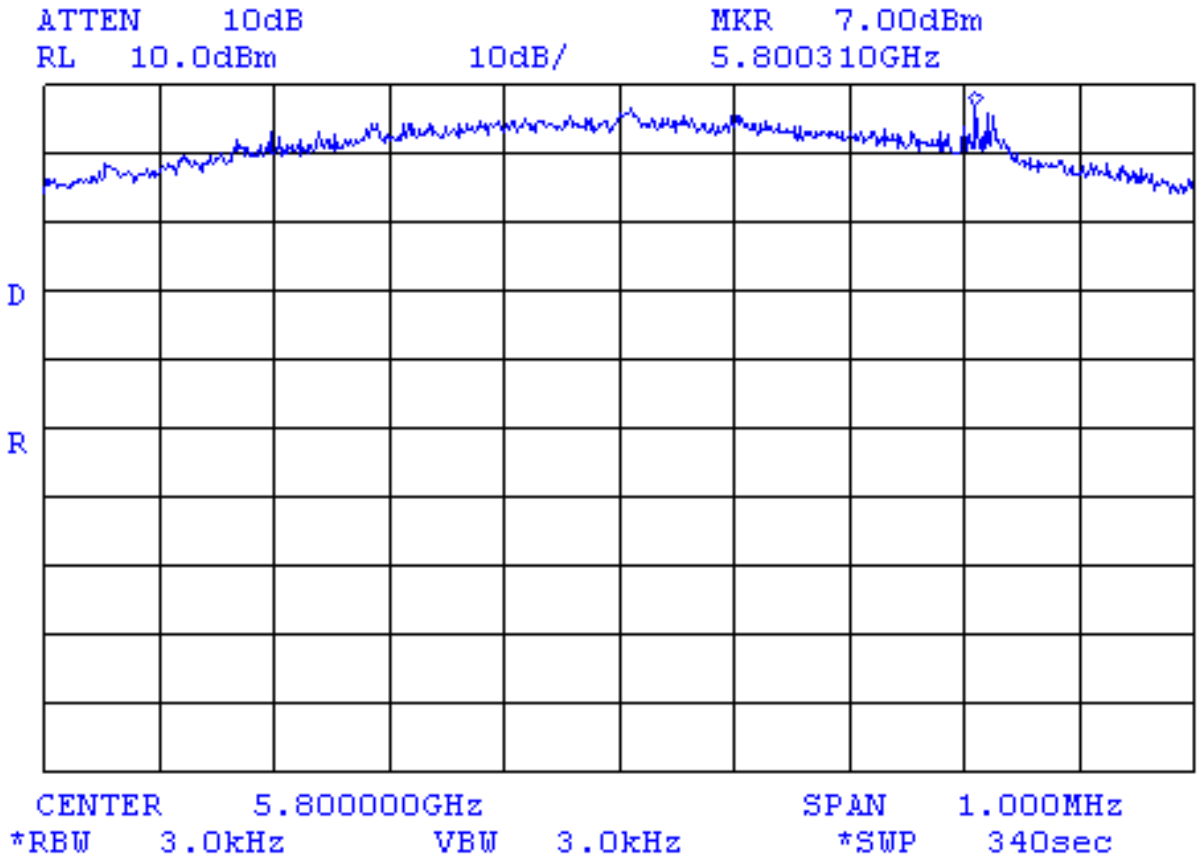
Plot A115

Power density measurements

Mode:	Hybrid (hopping turned off)
F_{HIGH}:	5.8 GHz
Bit rate:	4 Mbit/s



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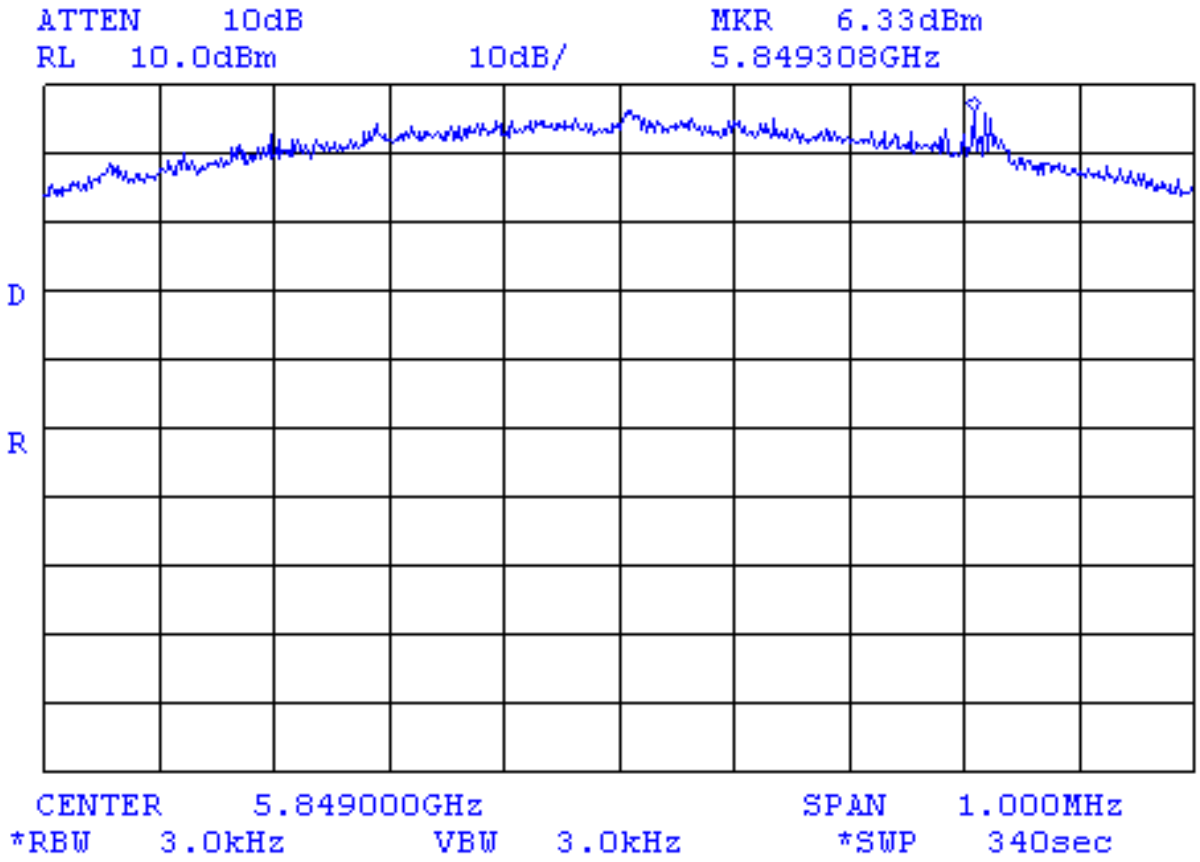
Plot A116

Power density measurements

Mode:	Hybrid (hopping turned off)
F_{HIGH}:	5.849 GHz
Bit rate:	1.33 Mbit/s



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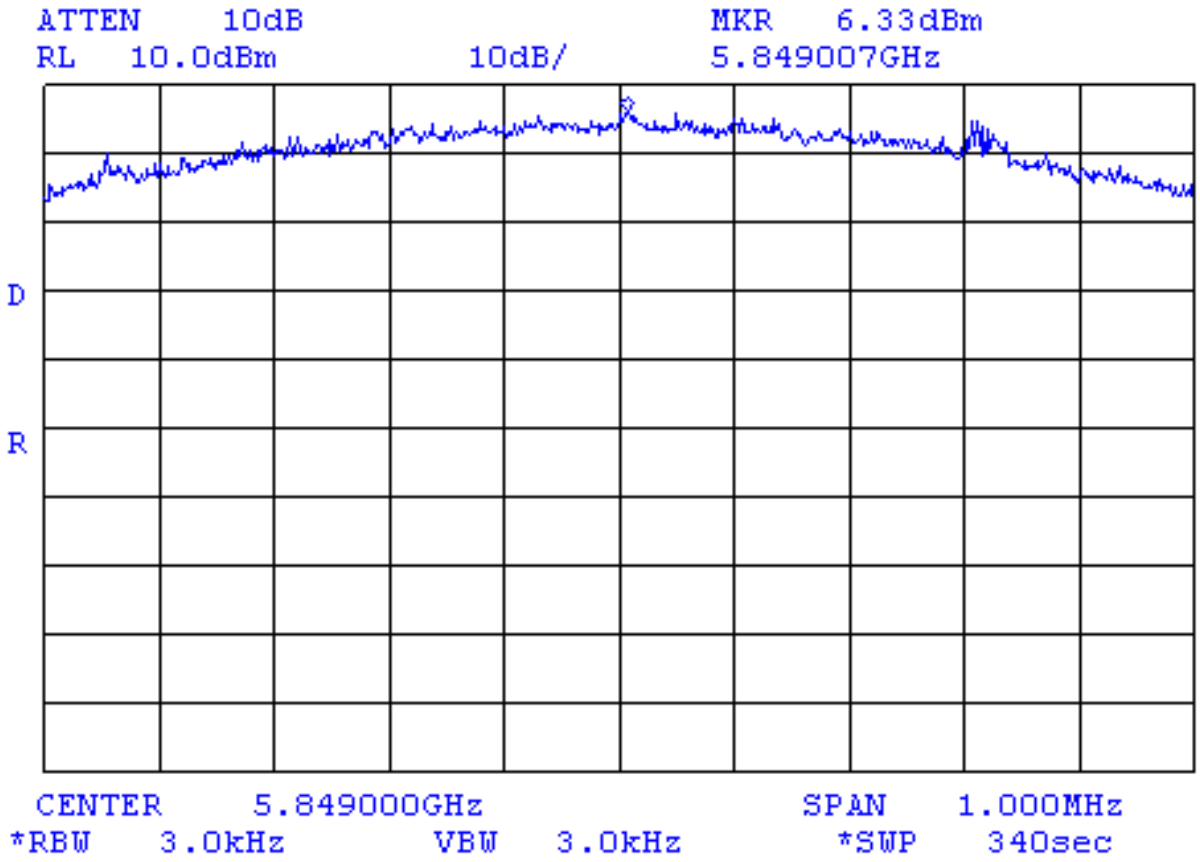
Plot A117

Power density measurements

Mode:	Hybrid (hopping turned off)
F_{HIGH}:	5.849 GHz
Bit rate:	4 Mbit/s



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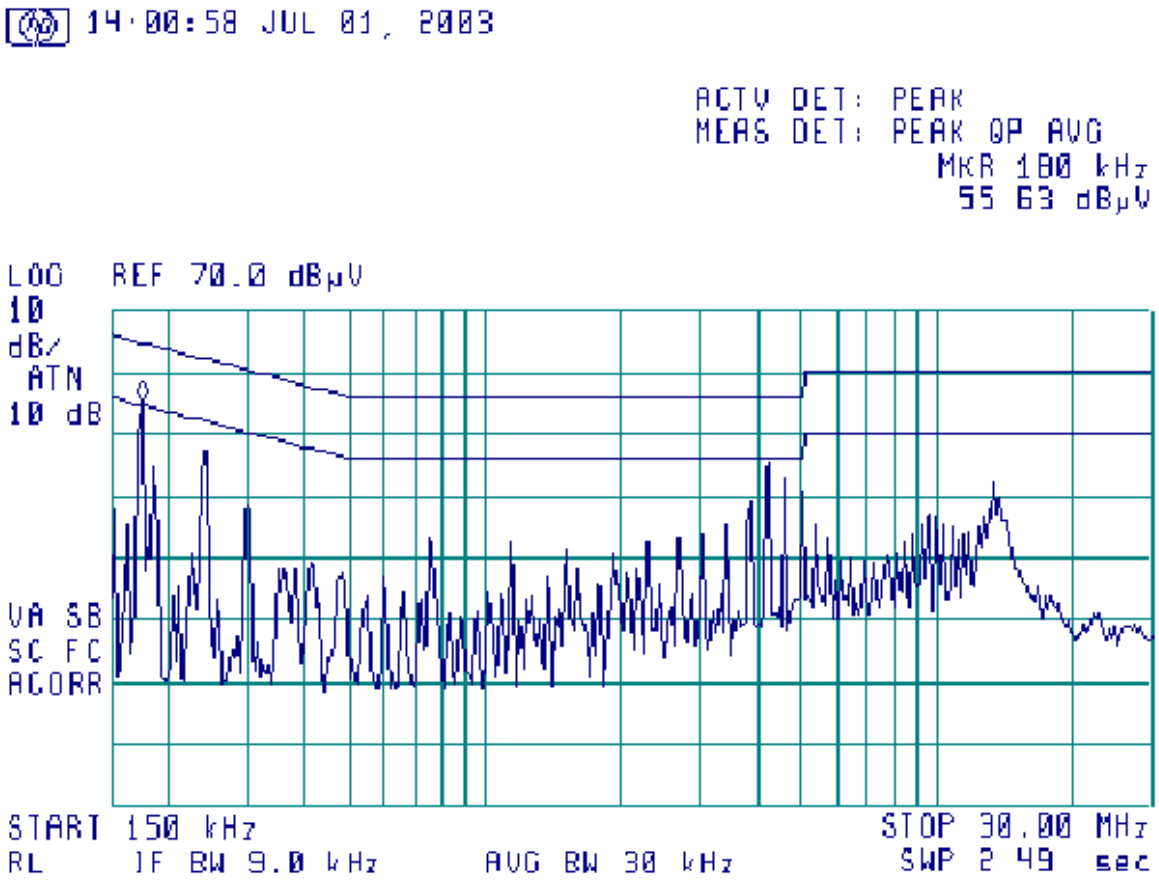
Plot A118

Conducted emission measurements at AC power line

Line identification:	Phase
Limit:	Quasi-peak, average
Detector used:	Peak



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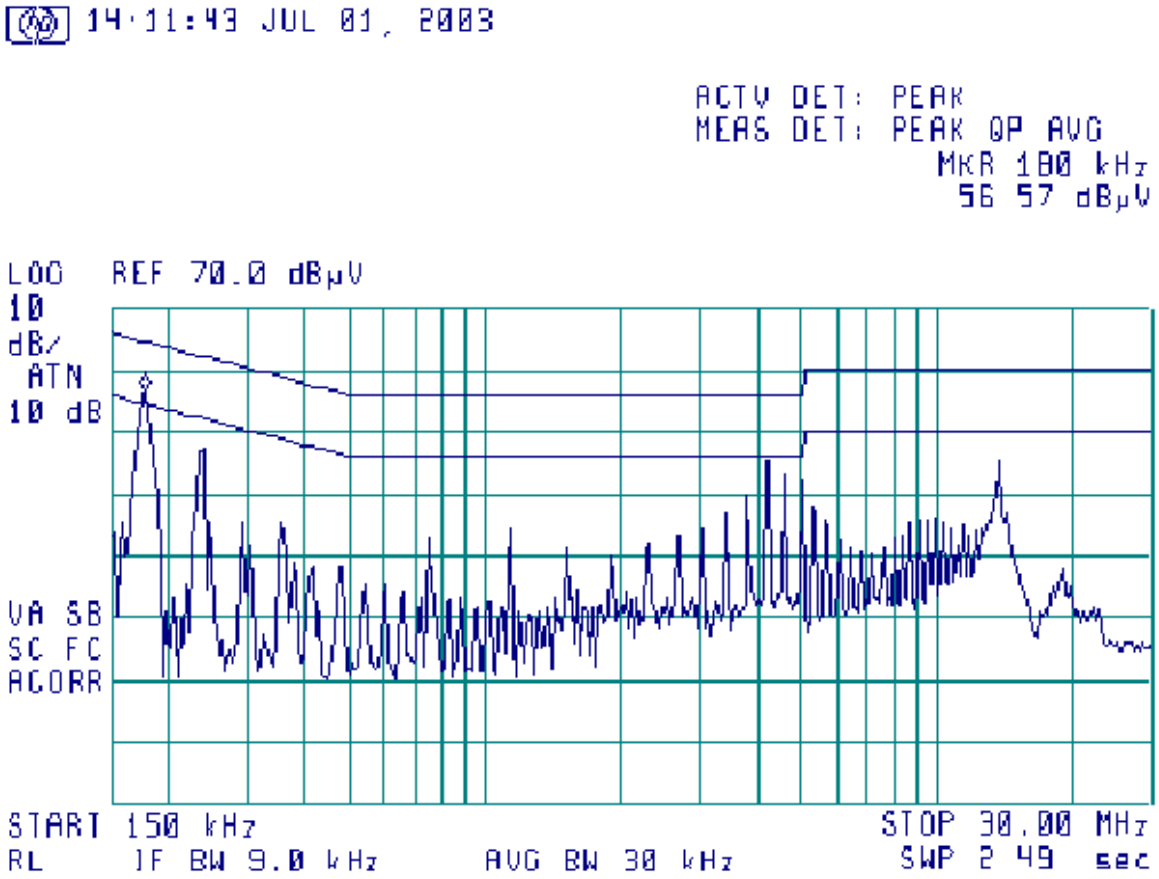
Plot A119

Conducted emission measurements at AC power line

Line identification:	Neutral
Limit:	Quasi-peak, average
Detector used:	Peak



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Appendix B Test setup photographs

Photograph 1

Setup for conducted measurements

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Photograph 2

Spurious emission measurement setup in anechoic chamber,

double ridged guide antenna in vertical polarization

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Photograph 3

Spurious emission measurement setup at OATS,

double ridged guide antenna in vertical polarization

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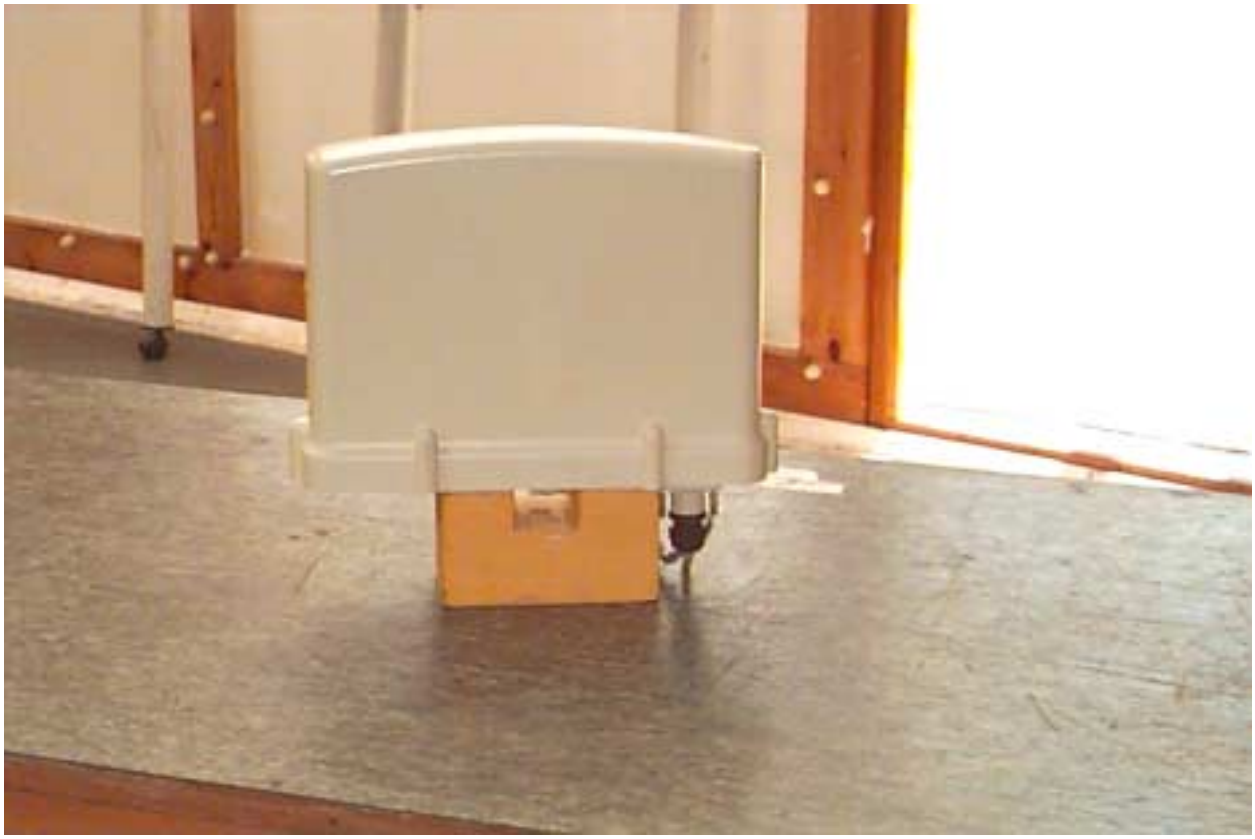
Photograph 4

Spurious emission measurement setup at OATS,

EUT view



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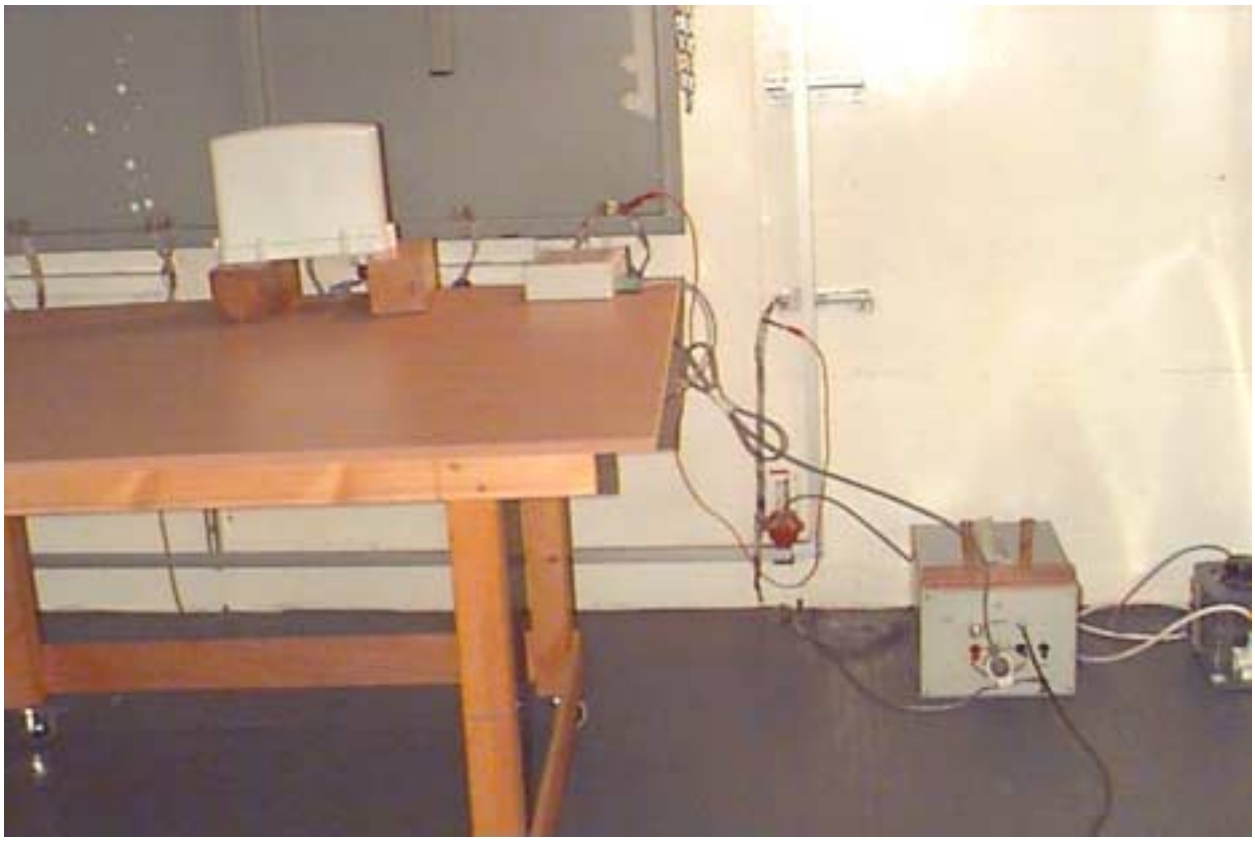
Photograph 5

Conducted emission at AC line measurement setup



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Appendix C Example of hopping frequency

Table 1: Example of frequency hopping mode

Frequency assignment	Frequency, MHz	Frequency assignment	Frequency, MHz	Frequency assignment	Frequency, MHz
F1	5726	F35	5760	F69	5794
F2	5727	F36	5761	F70	5795
F3	5728	F37	5762	F71	5796
F4	5729	F38	5763	F72	5797
F5	5730	F39	5764	F73	5798
F6	5731	F40	5765	F74	5799
F7	5732	F41	5766	F75	5800
F8	5733	F42	5767	F76	5801
F9	5734	F43	5768	F77	5802
F10	5735	F44	5769	F78	5803
F11	5736	F45	5770	F79	5804
F12	5737	F46	5771		
F13	5738	F47	5772		
F14	5739	F48	5773		
F15	5740	F49	5774		
F16	5741	F50	5775		
F17	5742	F51	5776		
F18	5743	F52	5777		
F19	5744	F53	5778		
F20	5745	F54	5779		
F21	5746	F55	5780		
F22	5747	F56	5781		
F23	5748	F57	5782		
F24	5749	F58	5783		
F25	5750	F59	5784		
F26	5751	F60	5785		
F27	5752	F61	5786		
F28	5753	F62	5787		
F29	5754	F63	5788		
F30	5755	F64	5789		
F31	5756	F65	5790		
F32	5757	F66	5791		
F33	5758	F67	5792		
F34	5759	F68	5793		

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Table 2: Example of a frequency hybrid mode

Frequency assignment	Frequency, MHz	Frequency assignment	Frequency, MHz
F1	5726	F32	5788
F2	5728	F33	5790
F3	5730	F34	5792
F4	5732	F35	5794
F5	5734	F36	5796
F6	5736	F37	5798
F7	5738	F38	5800
F8	5740	F39	5802
F9	5742	F40	5804
F10	5744	F41	5806
F11	5746	F42	5808
F12	5748	F43	5810
F13	5750	F44	5812
F14	5752	F45	5814
F15	5754	F46	5816
F16	5756	F47	5818
F17	5758	F48	5820
F18	5760	F49	5822
F19	5762	F50	5824
F20	5764	F51	5826
F21	5766	F52	5828
F22	5768	F53	5830
F23	5770	F54	5832
F24	5772	F55	5834
F25	5774	F56	5836
F26	5776	F57	5838
F27	5778	F58	5840
F28	5780	F59	5842
F29	5782	F60	5844
F30	5784	F61	5846
F31	5786		

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Appendix D Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibration Month/ year
		Name	Model No.	Serial No.	
0041	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	2811	8/03
0163	LISN FCC/VDE/MIL -STD	Electro-Metrics	ANS-25/2	1314	10/03
0446	Active loop antenna 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/03
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/05
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	11/03
0604	Antenna biconilog log-periodic/T bow-tie, 26 - 2000 MHz	EMCO	3141	9611-1011	01/04
0672	Shielded room 4.6(L) x 4.2(W) x 2.4(H) m	Hermon Labs	SR-3	027	11/03 Check
0768	Antenna standard gain horn 18-26.5 GHz, WR-42, K-band, gain – 25 dB	Quinstar Technology	QWH-4200-BA	110	7/04 Check
0769	Antenna standard gain horn 26.5 - 40GHz, WR-42, K-band, gain – 25 dB	Quinstar Technology	QWH-2800-BA	112	7/04 Check
0787	Transient limiter	Hewlett Packard	11947A-8ZE	3107A01877	11/03
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/03
1424	Spectrum analyzer, 30 Hz - 40 GHz	Agilent Technologies	8564EC	3946A00219	8/03
1430	EMI receiver system, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3807A00262	9/03
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	12/03 Check
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	12/03
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	12/03
1650	Attenuators set (2, 3, 5, 20 dB), DC – 18 GHz	M/A –COM	2082	1650	3/04
1651	Attenuators set (2, 3, 5, 20 dB), DC – 18 GHz	M/A –COM	2082	1651	3/04
1940	Cable 40 GHz, 1.5 m, blue	Rhophase Microwave Ltd.	KPS-1503A-1500-KPS	T4663	10/03
1942	Cable 18 GHz, 4 m, blue	Rhophase Microwave Ltd	SPS-1803A-4000-NPS	T4658	10/03
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	11/03
2259	Amplifier low noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	11/03
2260	Amplifier low noise 14-33 GHz	Sophia Wireless	LNA28-B	0233	11/03
2273	Power supply 11V for HL2258, HL2259, HL2260	Hermon Labs	S-11	2273	12/03
2274	Power supply 11V for HL2258, HL2259, HL2260, HL2261	Hermon Labs	S-11	2274	12/03 Check

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Appendix E Test equipment correction factors

**Antenna factor,
active loop antenna,
model 6502,
serial number 2857 (HL 0446)**

Frequency, MHz	Antenna factor, dB
0.009	-32.8
0.010	-33.8
0.020	-38.3
0.050	-41.1
0.075	-41.3
0.100	-41.6
0.150	-41.7
0.250	-41.6
0.500	-41.8
0.750	-41.9
1.000	-41.4
2.000	-41.5
3.000	-41.4
4.000	-41.4
5.000	-41.5
10.000	-41.9
15.000	-41.9
20.000	-42.2
25.000	-42.8
30.000	-44.0

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

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

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

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Antenna factor,
double ridged guide antenna,
model RGA-50/60,
serial number 2811 (HL 0041)

Frequency, MHz	Antenna factor, dB
1000	24.3
1500	25.4
2000	28.4
2500	29.2
3000	30.5
3500	31.6
4000	33.7
4500	32.2
5000	34.5
5500	34.5
6000	34.6
6500	35.3
7000	35.5
7500	35.9
8000	36.6
8500	37.3
9000	37.7
9500	37.7
10000	38.2
10500	38.5
11000	39.0
11500	40.1
12000	40.2
12500	39.3
13000	39.9
13500	40.6
14000	41.1
14500	40.5
15000	39.9
15500	37.8
16000	39.1
16500	41.1
17000	41.7
17500	45.1
18000	44.3

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).

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**Correction factor,
line impedance stabilization network,
model ANS-25/2,
serial number 1314 (HL 0163)**

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.

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Cable coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, serial number 176 (HL 0589)
+ Cable coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, serial number 163 (HL 1004)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion loss	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	Insertion loss	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	-		

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Cable RF, 6 m, model: M17/167 MIL-C-17, serial number 1502 (HL 1502)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Meas. Uncert. dB
1	Attenuation	0.1	0.02	±0.12
2		1	0.07	
3		3	0.15	
4		5	0.17	
5		10	0.26	
6		30	0.43	
7		50	0.57	
8		80	0.72	
9		100	0.81	
10		300	1.48	
11		500	2.00	
12		800	2.70	
13		1000	3.09	

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Cable RF, 8m, model: M17/167 MIL-C-17, serial number 1510 (HL 1510)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Meas. Uncert. dB
1	Attenuation	0.1	0.05	±0.12
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	

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Cable RF, 2m, model: Sucoflex 104PE, serial number 13094/4PE (HL 1566)
Calibration data

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

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Cable 40 GHz, 1.5 m, blue, model: KPS-1503A-1500-KPS, serial number T4663 (HL 1940)
Calibration data

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.13	5.10	1.33	15.00	2.27
0.05	0.14	5.30	1.33	15.50	2.32
0.10	0.19	5.50	1.38	16.00	2.39
0.20	0.25	5.70	1.41	16.50	2.41
0.30	0.31	5.90	1.43	17.00	2.36
0.40	0.37	6.10	1.50	17.50	2.42
0.50	0.41	6.30	1.47	18.00	2.50
0.60	0.46	6.50	1.56	18.50	2.89
0.70	0.49	6.70	1.50	19.00	2.86
0.80	0.53	6.90	1.53	19.50	2.84
0.90	0.56	7.10	1.53	20.00	2.77
1.00	0.59	7.30	1.56	20.50	2.73
1.10	0.62	7.50	1.59	21.00	3.05
1.20	0.65	7.70	1.62	21.50	3.07
1.30	0.68	7.90	1.68	22.00	2.97
1.40	0.70	8.10	1.67	22.50	2.91
1.50	0.73	8.30	1.70	23.00	3.02
1.60	0.76	8.50	1.69	23.50	3.29
1.70	0.77	8.70	1.70	24.00	3.31
1.80	0.80	8.90	1.68	24.50	3.49
1.90	0.82	9.10	1.70	25.00	3.37
2.00	0.84	9.30	1.70	25.50	3.56
2.10	0.85	9.50	1.77	26.00	3.56
2.20	0.87	9.70	1.80	26.50	3.33
2.30	0.88	9.90	1.88	27.00	3.52
2.40	0.90	10.10	1.93	28.00	3.38
2.50	0.91	10.30	1.94	29.00	3.34
2.60	0.93	10.50	1.99	30.00	3.33
2.70	0.95	10.70	1.91	31.00	3.48
2.80	0.97	10.90	2.00	32.00	3.63
2.90	0.98	11.10	1.92	33.00	3.69
3.10	1.02	11.30	1.97	34.00	3.79
3.30	1.05	11.50	1.98	35.00	3.77
3.50	1.09	11.70	1.99	36.00	3.92
3.70	1.12	11.90	2.06	37.00	3.94
3.90	1.15	12.10	2.01	38.00	3.80
4.10	1.18	12.40	2.08	39.00	4.15
4.30	1.21	13.00	2.05	40.00	4.03
4.50	1.24	13.50	2.15		
4.70	1.29	14.00	2.25		
4.90	1.27	14.50	2.26		

HERMON LABORATORIES

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Cable 18GHz, 4 m, blue, model: SPS-1803A-4000-NPS, serial number T4658 (HL 1942)
Calibration data

Frequency, GHz	Insertion 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	Insertion 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

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Cable RF, 8 m, model:RG-214, serial number C-56 (HL 2009)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Meas. Uncert., dB
1	Insertion loss	1	0.10	±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	

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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		

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Appendix F 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(μV)	decibel referred to one microvolt
dB(μV/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: 1992	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.