Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 210 Issue 6:2005

&

FCC Part 15 Subpart C: 2006

Unlicensed Intentional Radiators

on the

Polar Radio Remote

Polar 9900R

Ashwani Malhotra
Global EMC Inc.
180 Brodie Dr, Unit 2
Richmond Hill, ON L4B 3K8
Canada
Ph: (905) 883-3919

Testing produced for

ATLAS POLAR
DELIVERING CUSTOMER SOLUTIONS SINCE 1938

See Appendix A for full customer & EUT details.

Industry Canada
LAB REGISTRATION #6844A-1

FCC REGISTRATION #612361

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2565.01

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Report Scope

This report addresses the EMC verification testing and test results of the Polar 9900 Radio remote, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.

Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	Atlas Polar Company Limited
Product	Polar 9900R
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

Summary

The results contained in this report relate only to the item(s) tested.

EUT FCC Certification #, FCC ID:	WB4 – 9900R
EUT Industry Canada Certification #, IC:	6272A - 90091001
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Ashwani Malhotra

Client	Atlas Polar Company Limited
Product	Polar 9900R
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203 RSS 210 Section 5.5	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 Section 6.3 (Table 2)	Restricted Bands for intentional operation	None within chart	Pass See description
FCC 15.207 RSS 210 Section 6.6	Power line conducted emissions	QuasiPeak Average	Pass See Justification
FCC 15.209 RSS 210 Section 6.2.1 (Tables 3 & 7)	Radiated emissions	QuasiPeak Average	Pass
FCC 15.247(a)(1) RSS 210 6.2.2(o)	Channel Separation	> 20db BW of channels	Pass
FCC 15.247(a)(1)(i) RSS 210 6.2.2(o)	Number of channels	> 25	Pass
FCC 15.247(a)(1)(i) RSS 210 6.2.2(o)	Time of occupancy	< 400 mSec in 10 sec period	Pass
FCC 15.247(b) RSS 210 6.2.2(o)	Max output power	< 1 Watt	Pass
FCC 15.247(b)(4) RSS 210 6.2.2(o)	Antenna Gain	< 6 dBi	Pass See Justification
FCC 15.247(d) RSS 210 6.2.2(d)	Antenna conducted spurious	> 20 dBc	Pass
FCC 15.247(h)	FHSS Intelligence	No coordination	Pass See Justification
FCC 15.247(i) IC Safety code 6	Maximum Permissible Exposure	> 2.50 cm separation.	Pass See justification and calculations
Overall Result			**PASS**

All tests were performed by Ashwani Malhotra.

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a ‘PASS’ grade. If not ‘FAIL’ grade will be

issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '*'.

Justifications, Descriptions, or Deviations

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), the manufacturer has a permanently connected wire antenna on the board.

For the Restricted Bands of operation, the EUT is designed to only operate between 902 to 928 MHz.

For the power line conducted emissions requirements, the EUT is battery powered, and this test does not apply. The battery is charged using the DC outlet of a vehicle.

The EUT uses a wire antenna; gain of this is less than 6 dbi. Acutal gain of wire antenna is -1.8 dbi.

For maximum permissible exposure, this device operates at less then 1 Watt at 902-928 MHz and is designed to operate at greater than 2.50 cm from professionals using this unit. No testing is required, however worst case calculated exposure compliance follows later in this report.

Applicable Standards, Specifications and Methods

ANSI C63.4:2003	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:1997	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ICES-003:2004	- Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS 210:2005	- Issue 6: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices

Sample calculation(s)

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)
Margin = 50.5dBuV/m – (50dBuV + 10dB + 2.5dB – 20dB)
Margin = 8.5 dB

Document Revision Status

Revision 1 - Initial report released May 21, 08

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiallary Equipment.

BW – Bandwidth. Unless otherwise stated, this is refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity

EUT – Equipment Under Test

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line impedance stabilization network

NCR – No Calibration Required

RF – Radio Frequency

Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN.

Calibrations and Accreditations

The measurement site used is registered with Federal Communications Commission (FCC) and Industry Canada (IC). This site is calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The semi-anechoic chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following were the environmental conditions in the facility during time of testing –

Date	Test	Init.	Temperature (ºC)	Humidity (%)	Pressure (kPa)
May 1 – 9, 2008	All	AM	22-24ºC	39-45%	100.2 - 101.9kPa

Detailed Test Results Section

Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limit(s) and Method

The method is as defined in ANSI C63.4:2003.

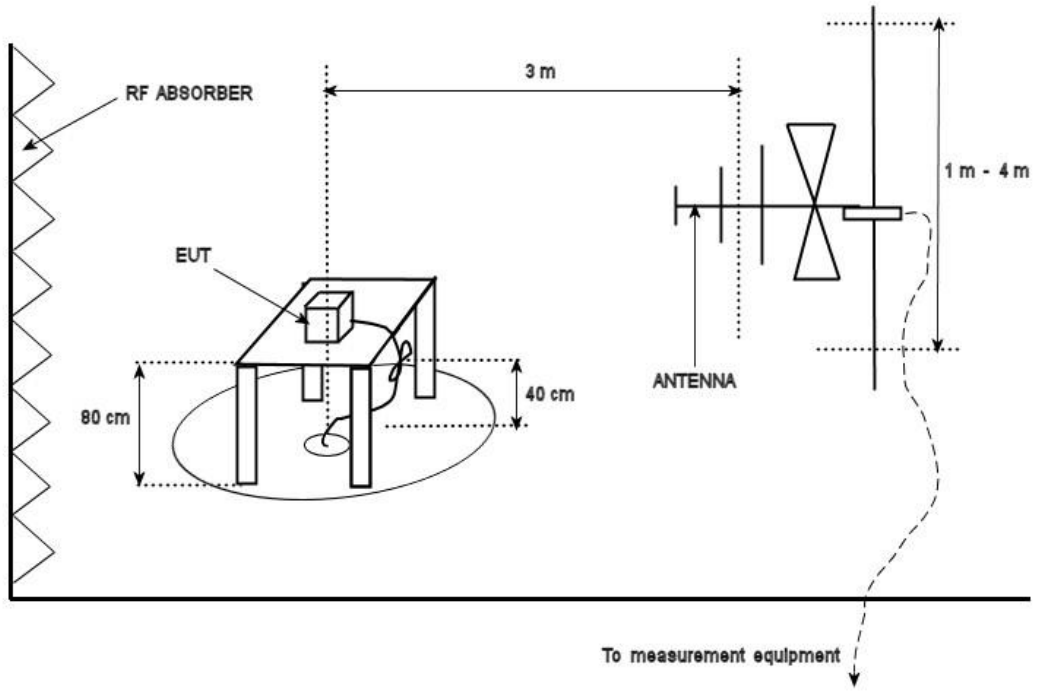
The limits, as defined in 15.247(d) for unintentional radiated emissions apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

All unintentional emissions must also meet the 'Spurious Conducted Emissions' requirements of -20 dBc or greater. See also 'Spurious Conducted Emissions' for further details.

30 MHZ – 88 MHz, 100 uV/m (40.0 dBuV/m[1]) at 3 m
88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m[1]) at 3 m
216 MHz – 960 MHz, 200 uV/m (46.4 dBuV/m[1]) at 3 m
Above 960 MHz, 500 uV/m (54.0 dBuV/m[1]) at 3 m
Above 1000 MHz, 500 uV/m (54.0 dBuV/m[2]) at 3m

[1]Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector, scanned in accordance with 15.33 to above the 10th harmonic (10 GHz).

Typical Radiated Emissions Setup



Measurement Uncertainty

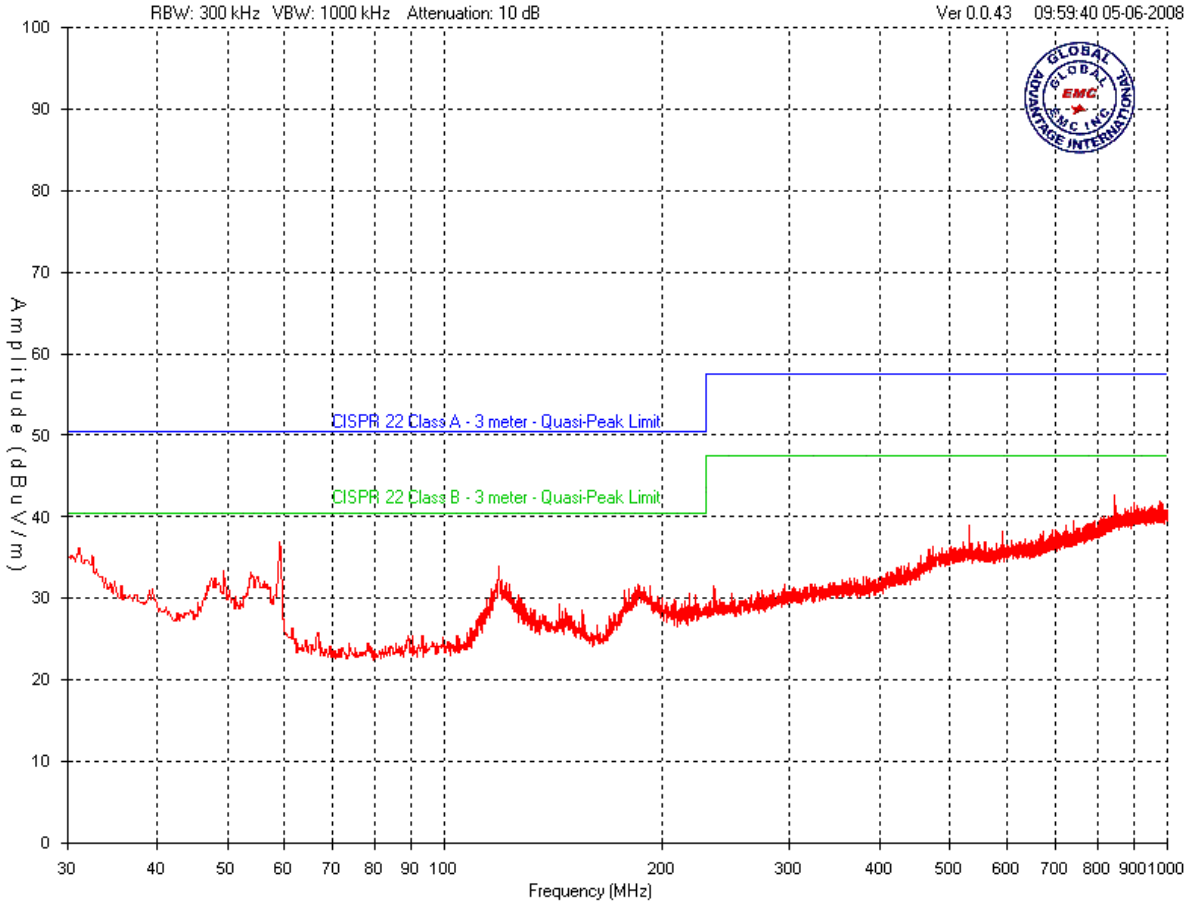
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a %95 confidence level.

Preliminary Graphs

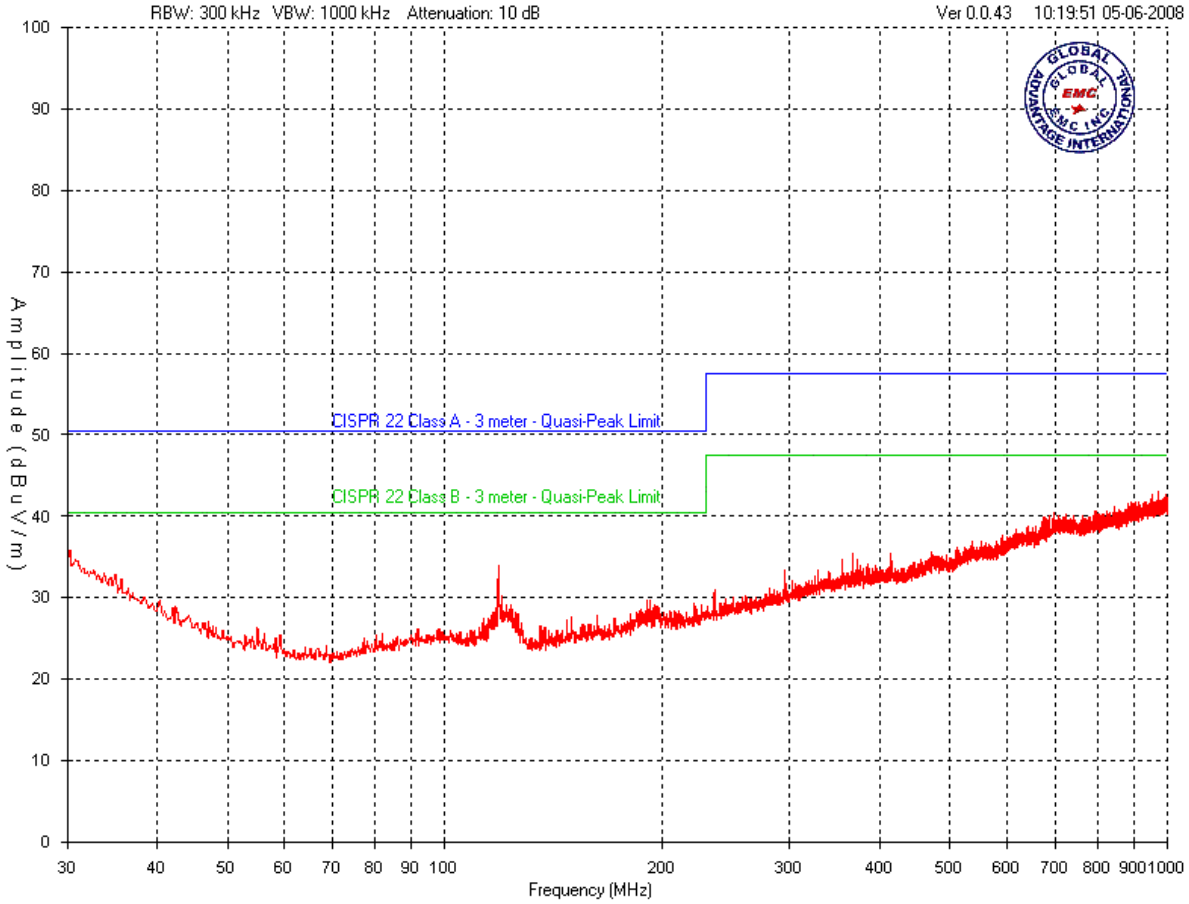
Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater then the final required detector and over a full 0-360 rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to a minimum of a 10 GHz.
Note: Since the receiver has a permanently attached antenna, it was tested for 15.111 → 15.109 limits for radiated emissions. Tests were performed in listen mode to ensure no spurious emissions in 30 MHz – 1000 MHz were emitted from the unit.

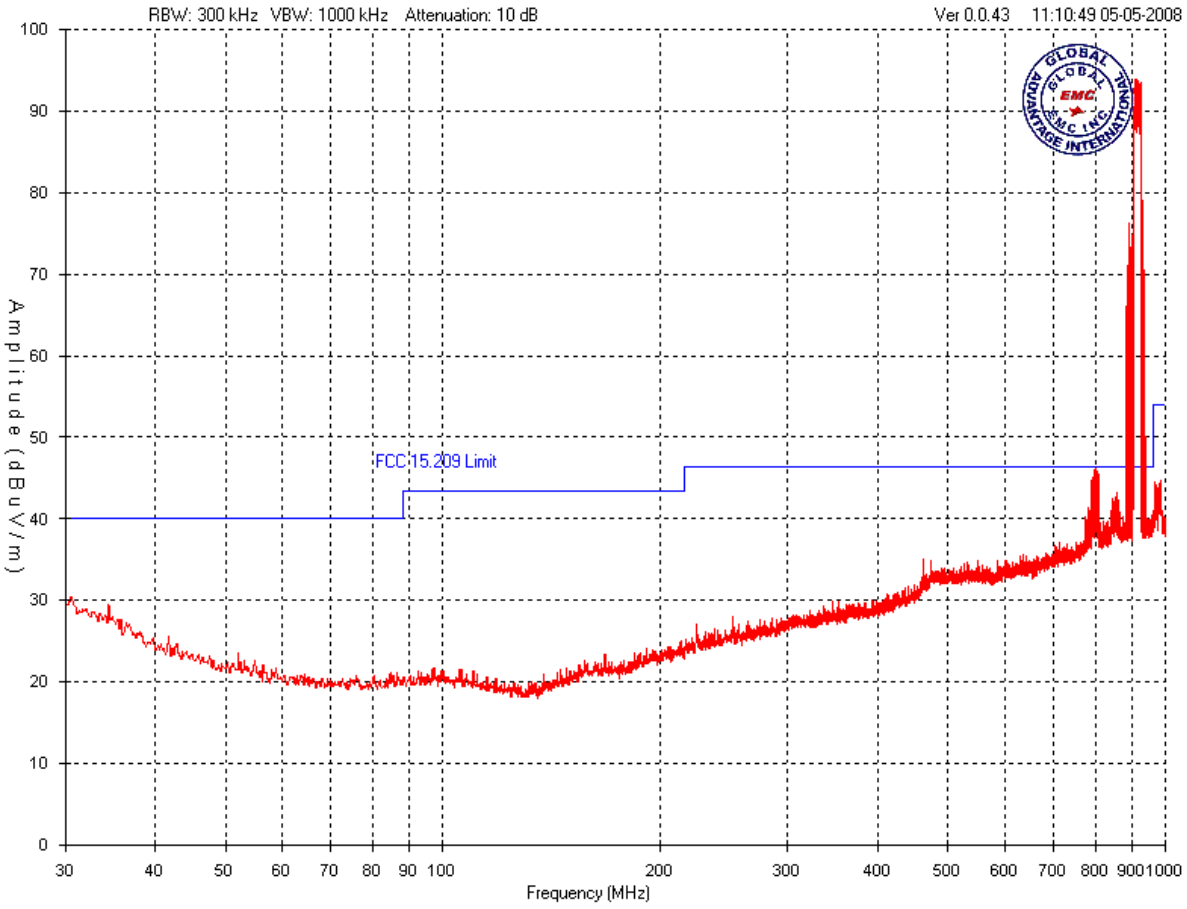
Vertical – Peak Emissions Graph – Receiver



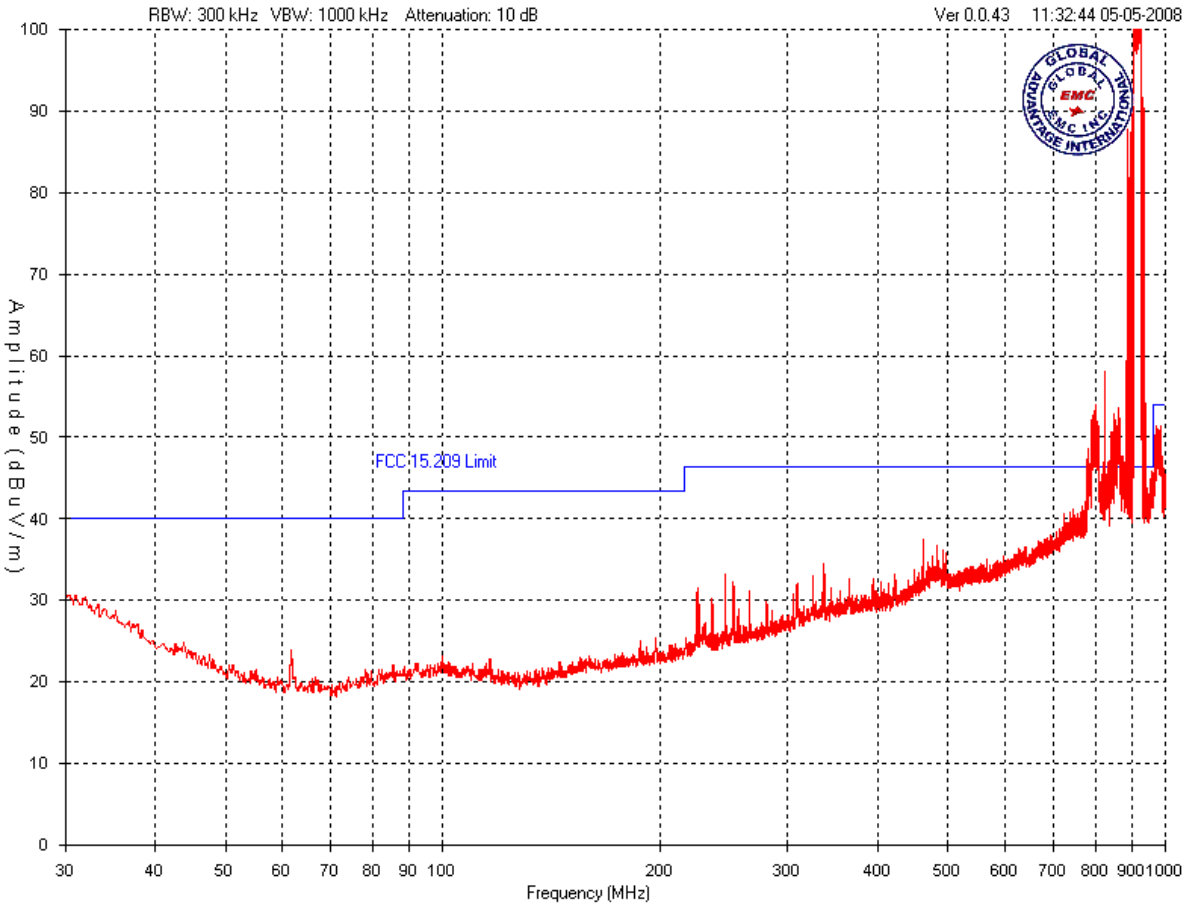
Horizontal – Peak Emissions Graph – Receiver



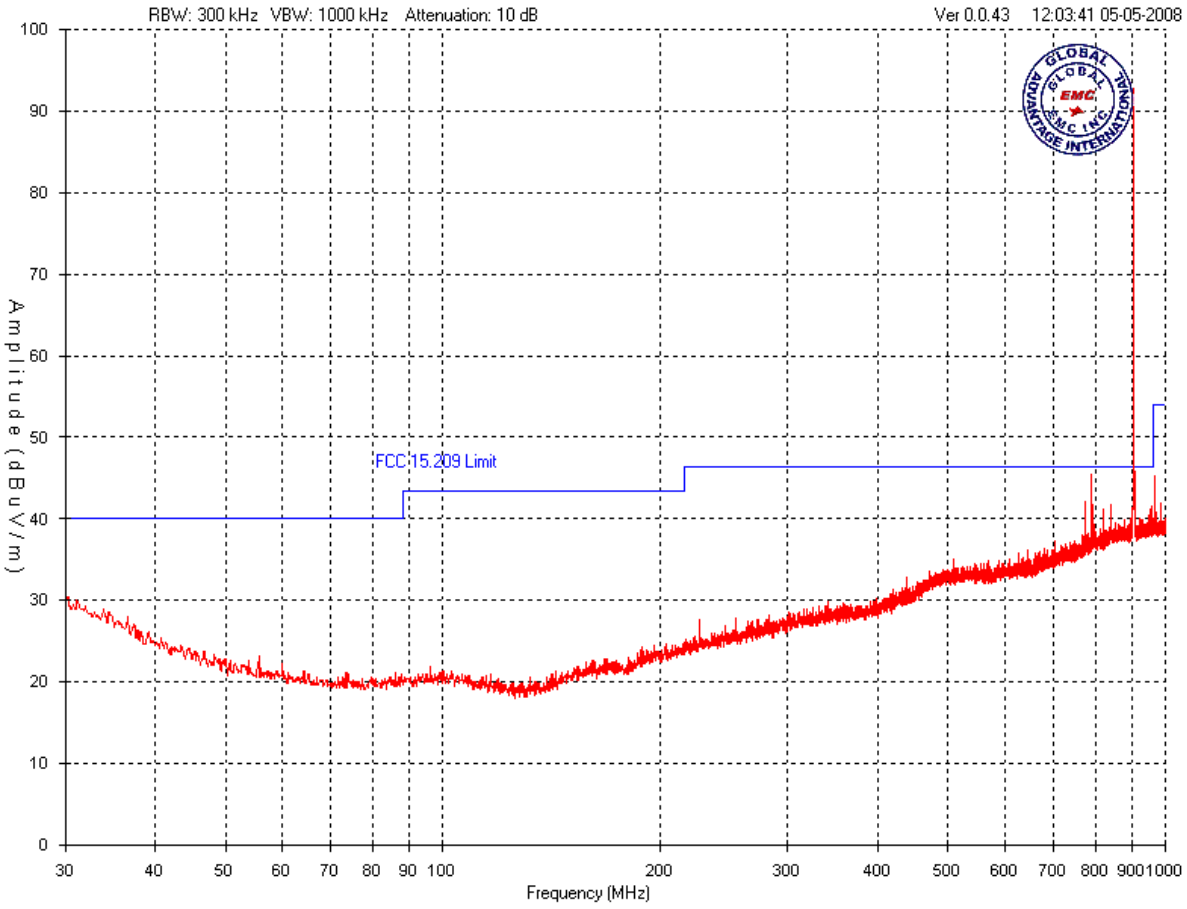
Vertical – Peak Emissions Graph – Frequency Hopping Mode
30 MHz – 1 GHz



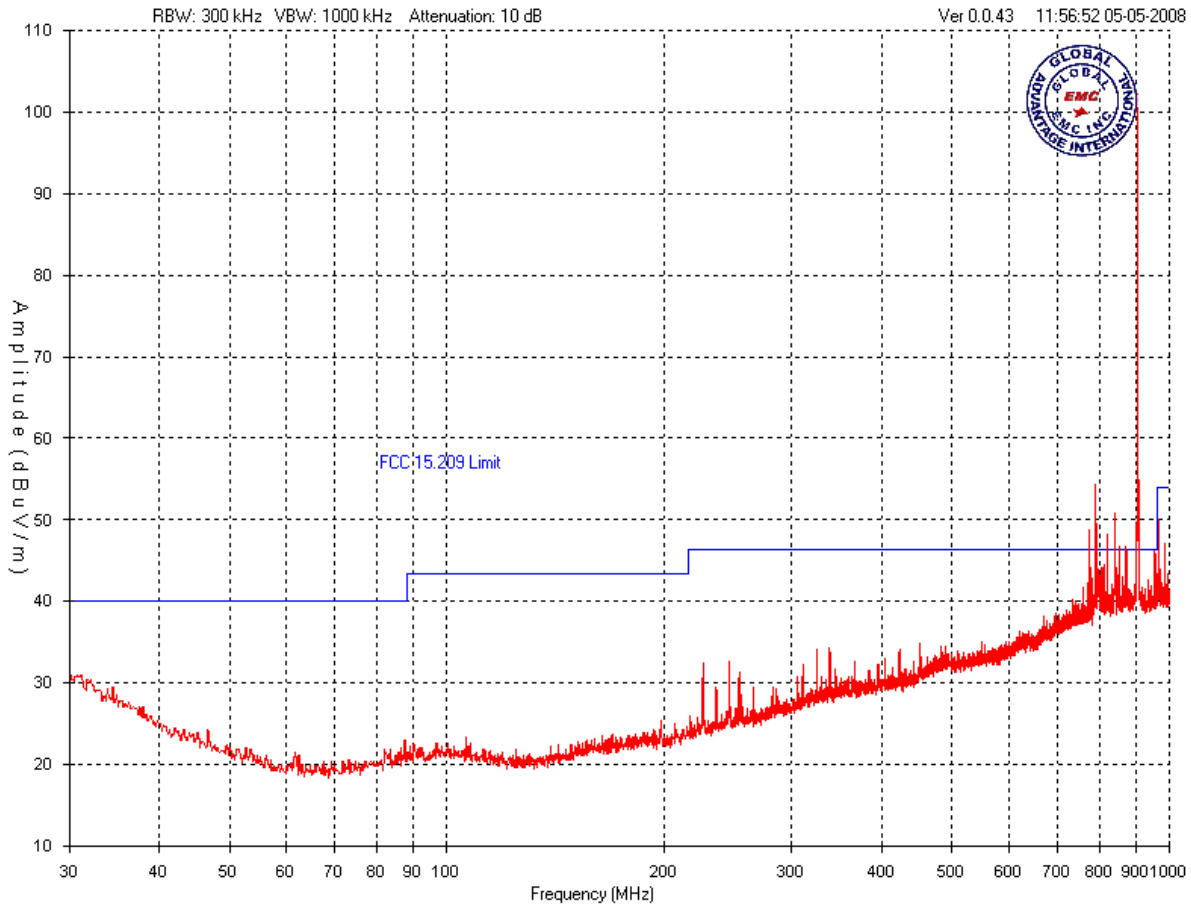
Horizontal – Peak Emissions Graph – Frequency Hopping Mode
30 MHz – 1 GHz



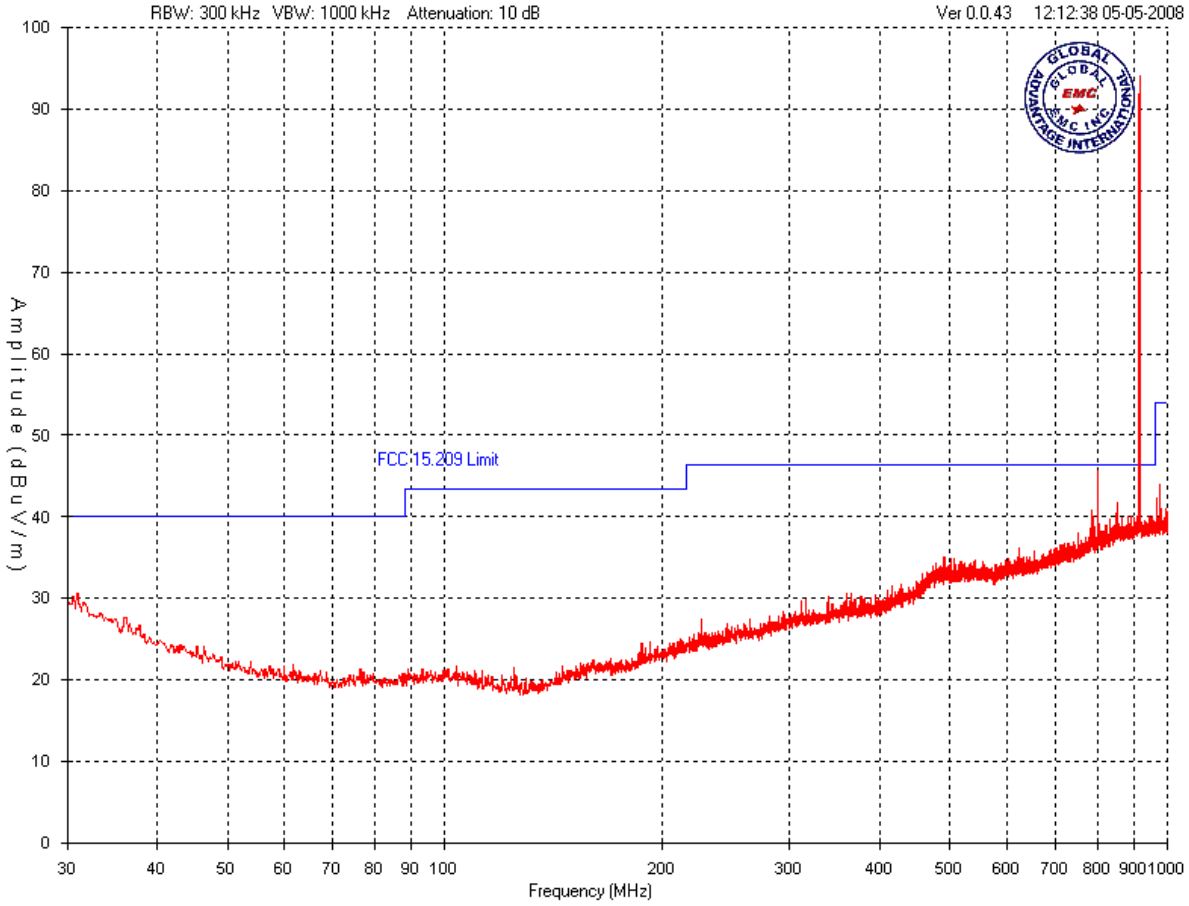
Vertical – Peak Emissions Graph – Low Band (hopping stopped)
30 MHz – 1 GHz



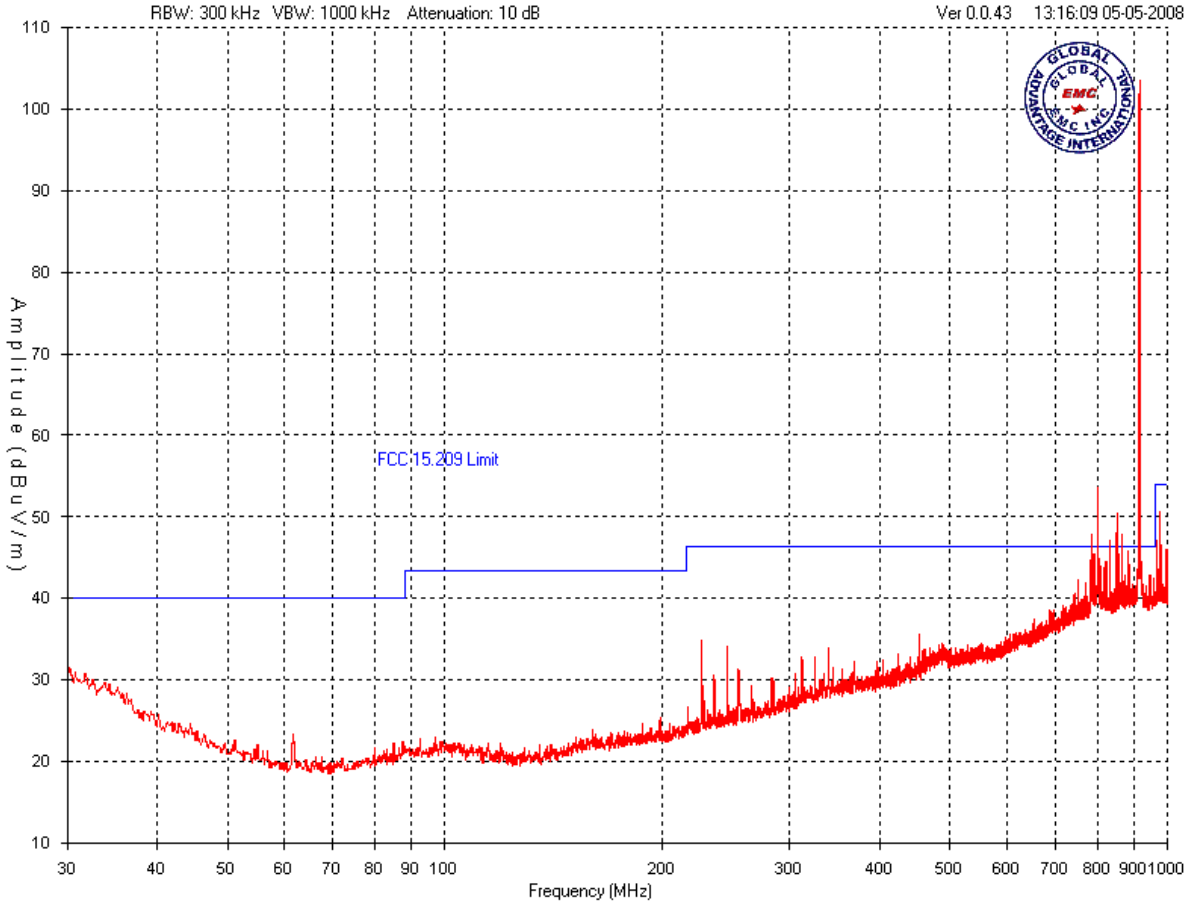
Horizontal – Peak Emissions Graph – Low Band (hopping stopped)
30 MHz – 1 GHz



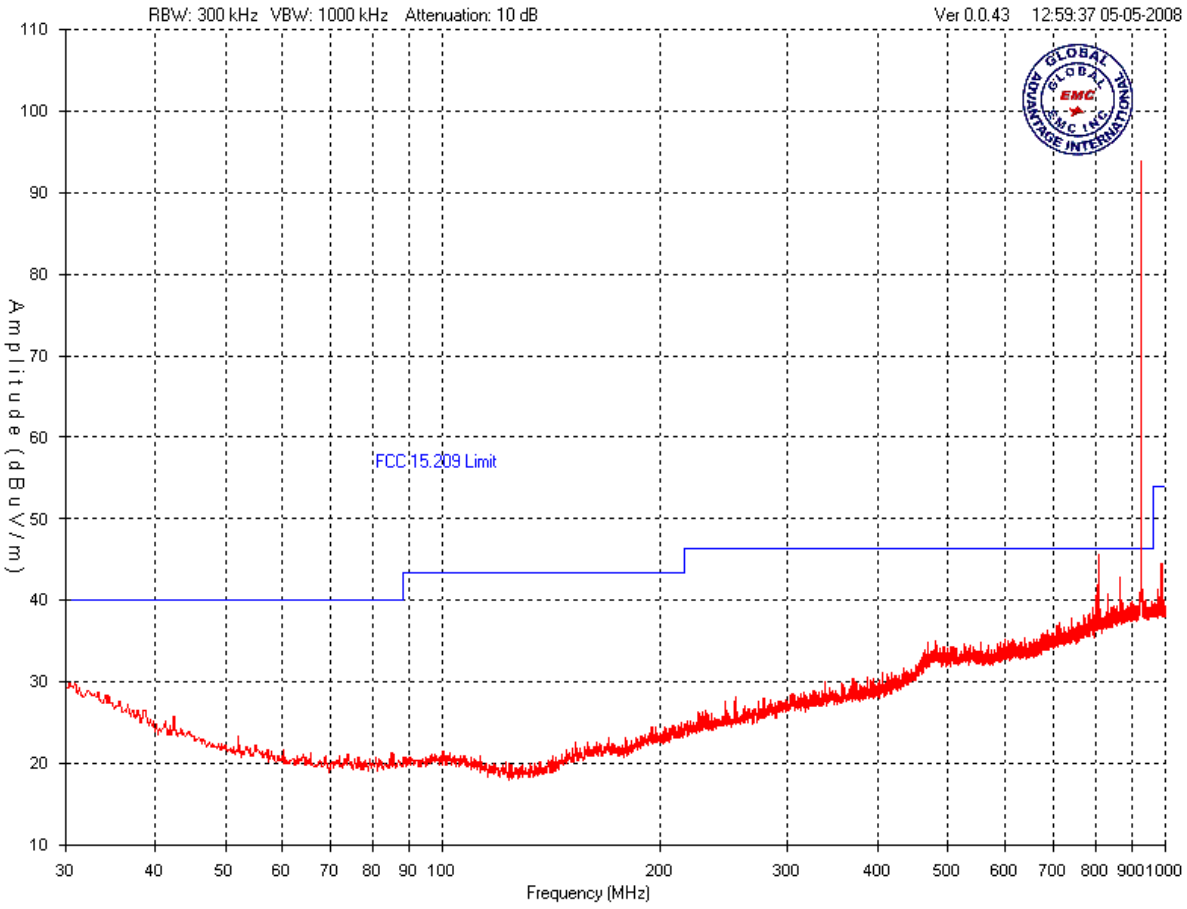
Vertical – Peak Emissions Graph – Mid Band (hopping stopped)
30 MHz – 1 GHz



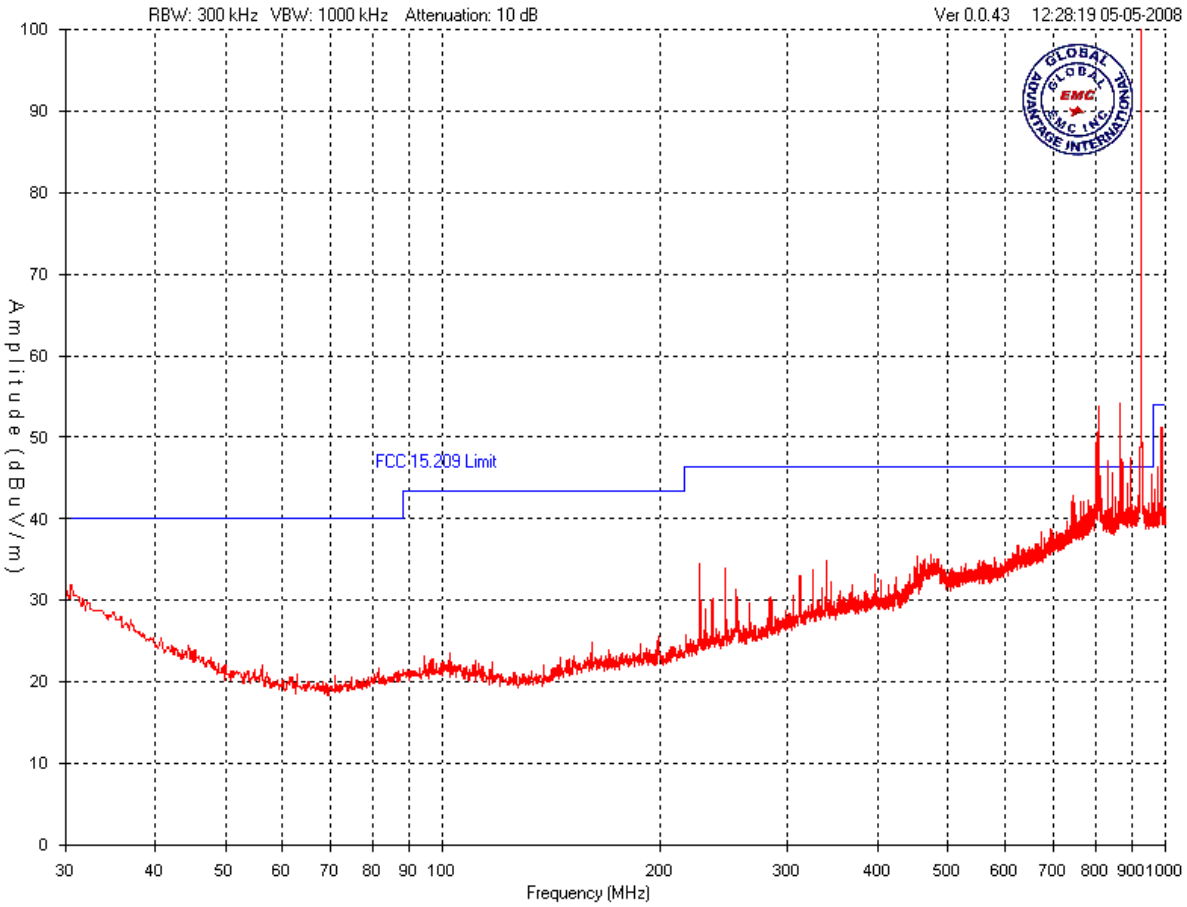
Horizontal – Peak Emissions Graph – Mid Band (hopping stopped)
30 MHz – 1 GHz



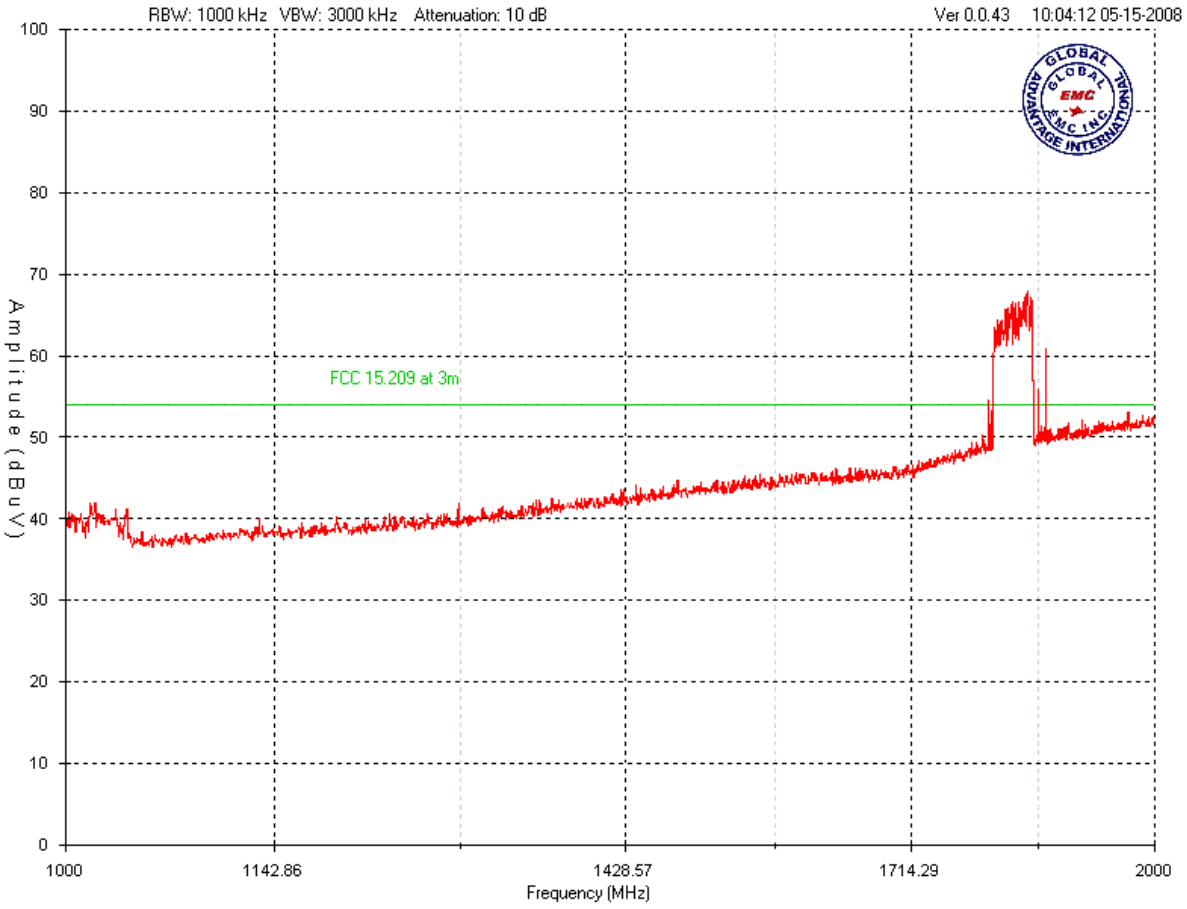
Vertical – Peak Emissions Graph – Hi Band (hopping stopped)
30 MHz – 1 GHz



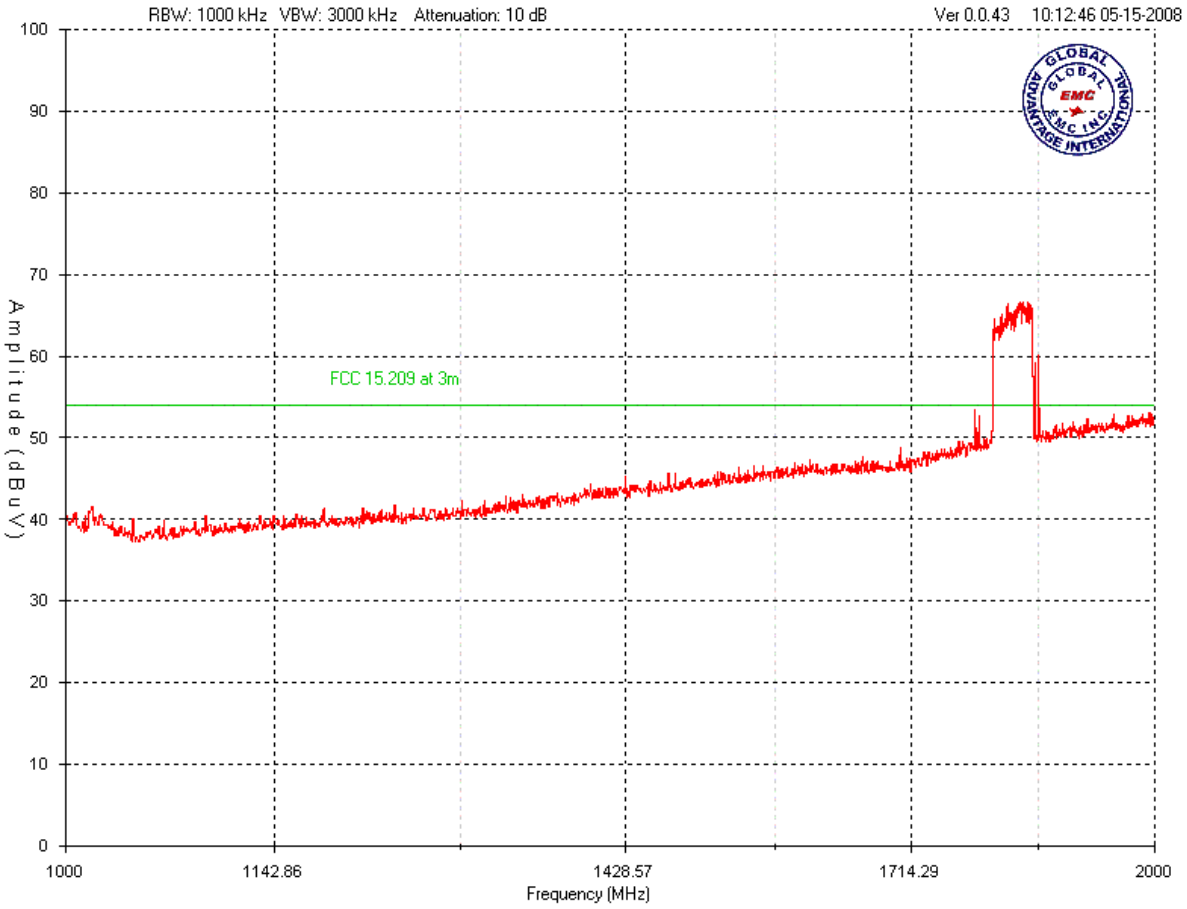
Horizontal – Peak Emissions Graph – Hi Band (hopping stopped)
30 MHz – 1 GHz



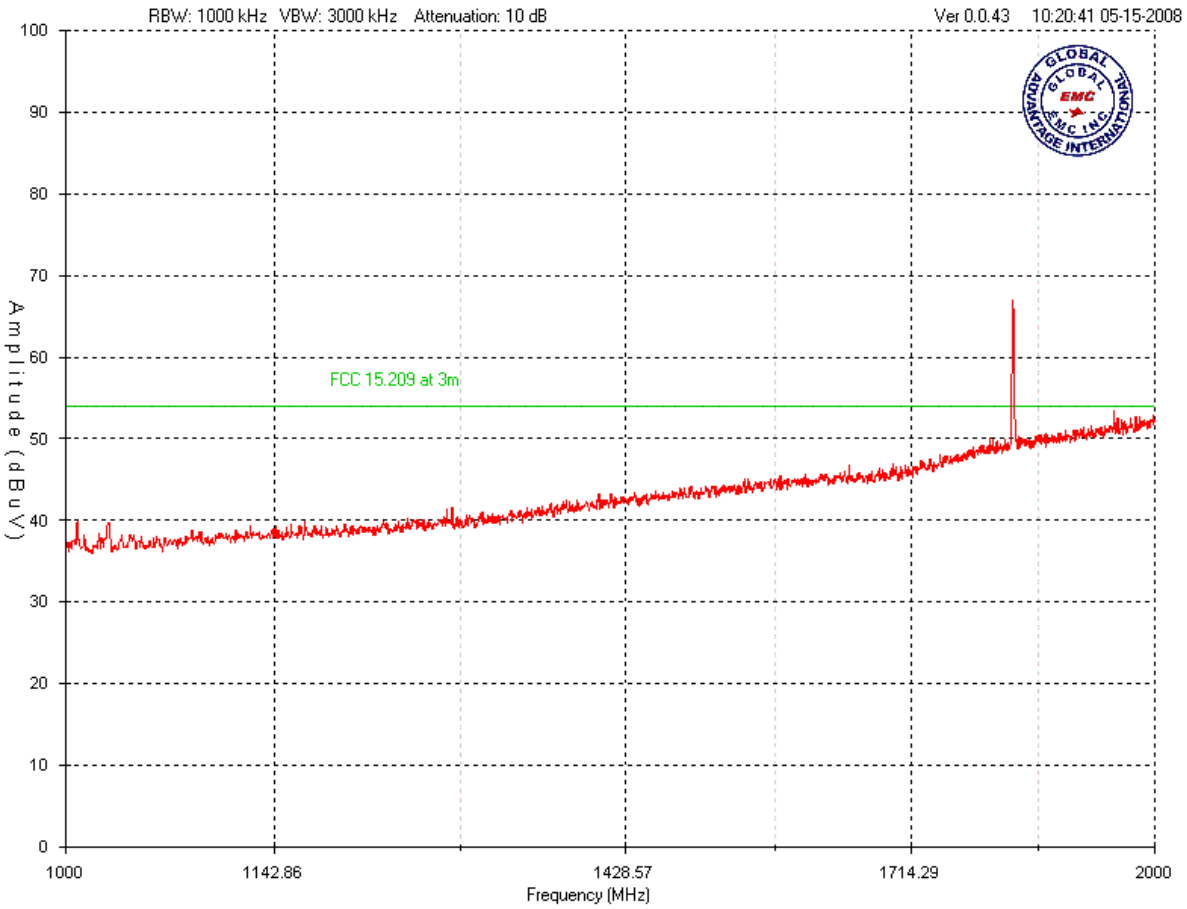
Vertical – Peak Emissions Graph – Hopping mode
1 GHz – 2 GHz



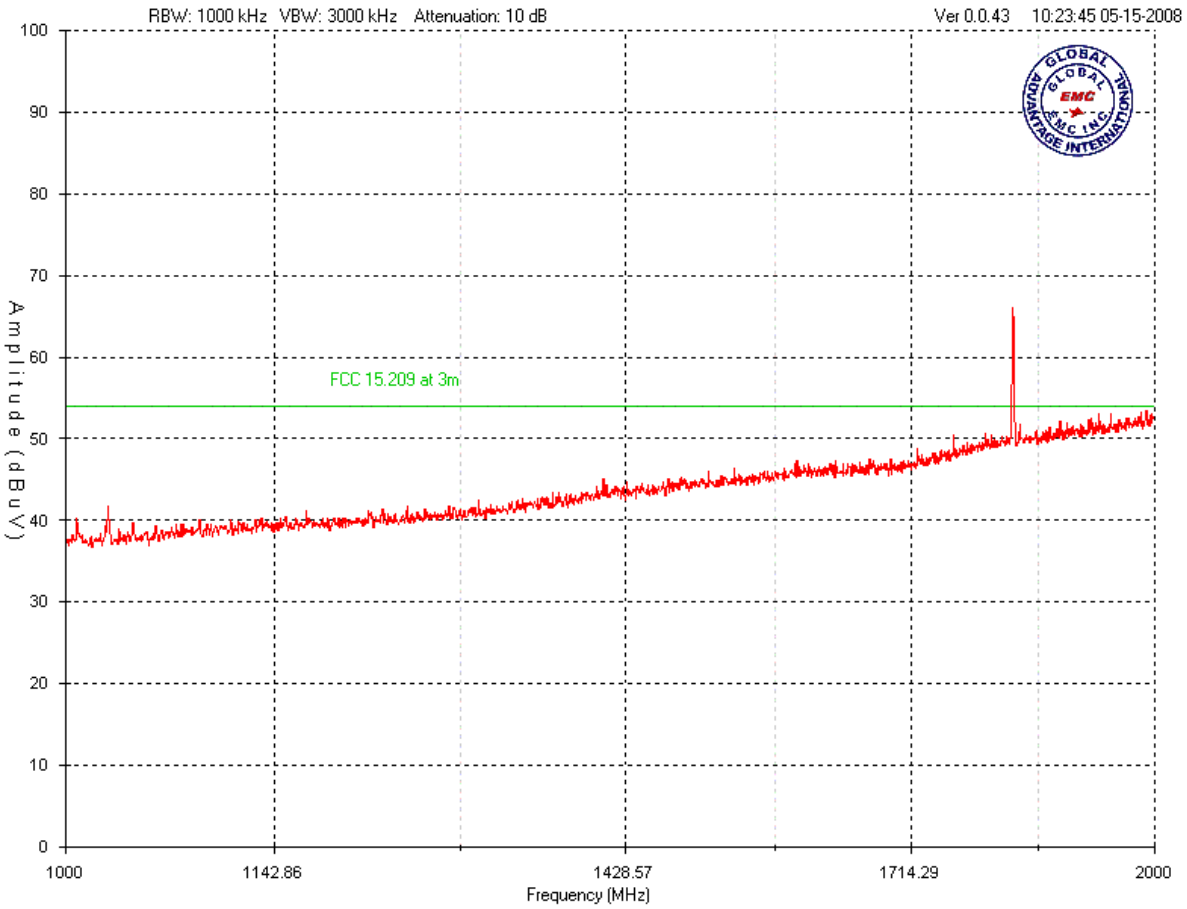
Horizontal – Peak Emissions Graph – Hopping mode
1 GHz – 2 GHz



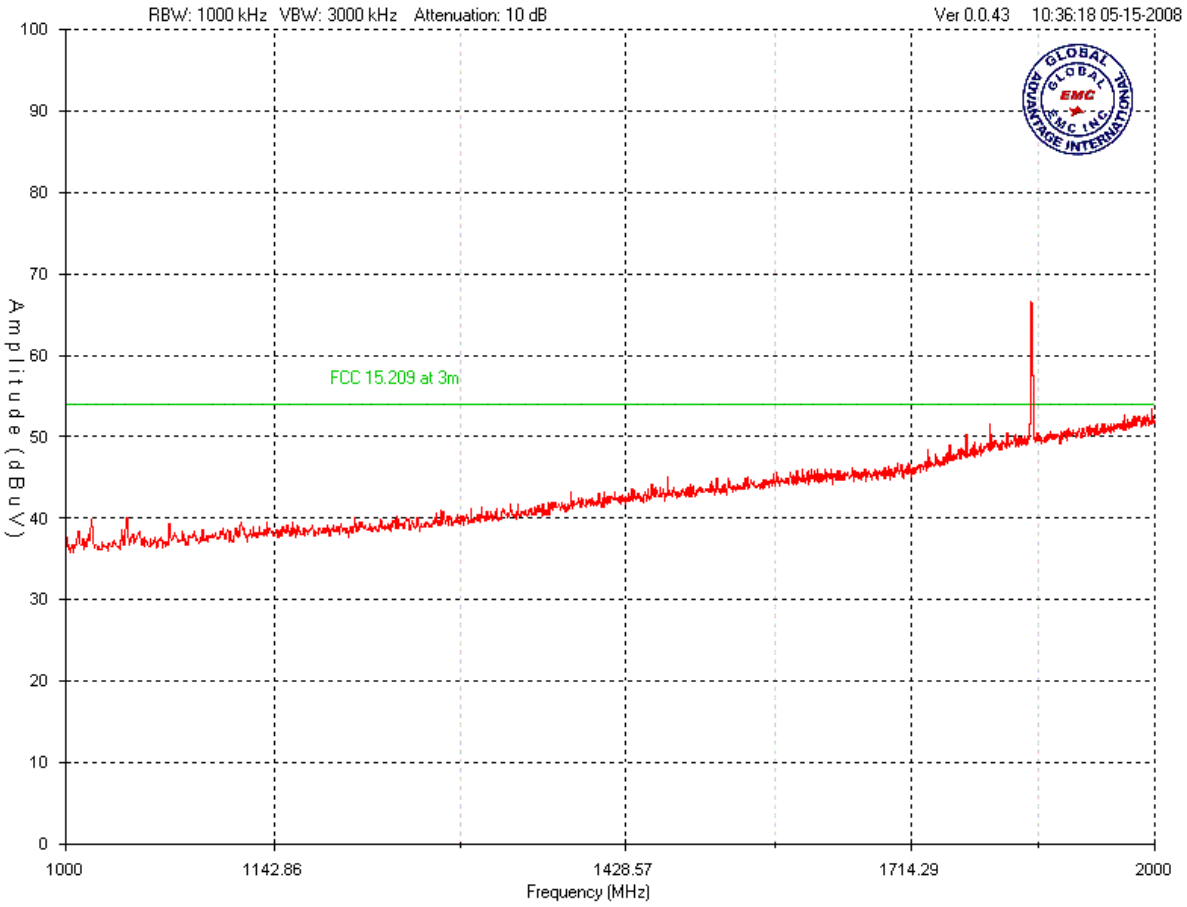
Vertical – Peak Emissions Graph – Mid Band (hopping stopped)
1 GHz – 2 GHz



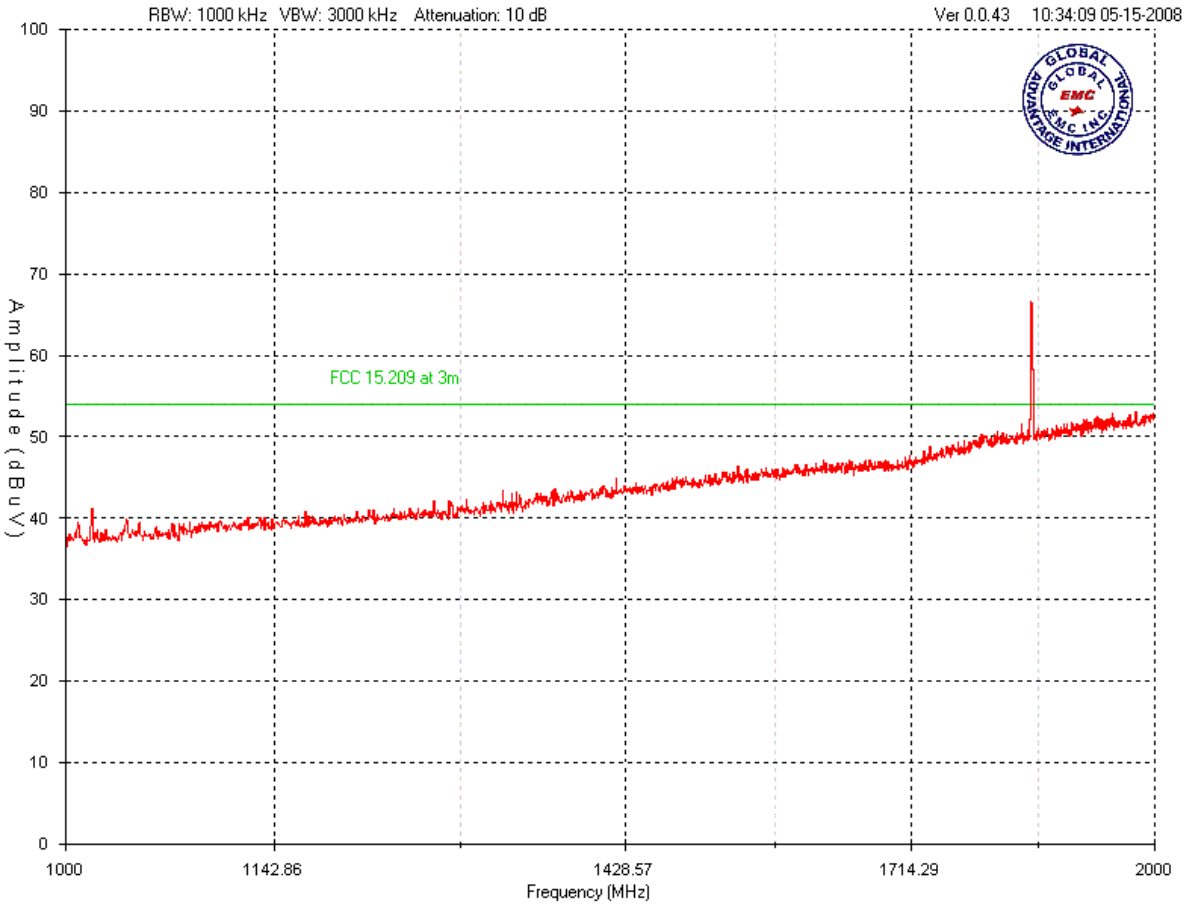
Horizontal – Peak Emissions Graph – Mid Band (hopping stopped)
1 GHz – 2 GHz



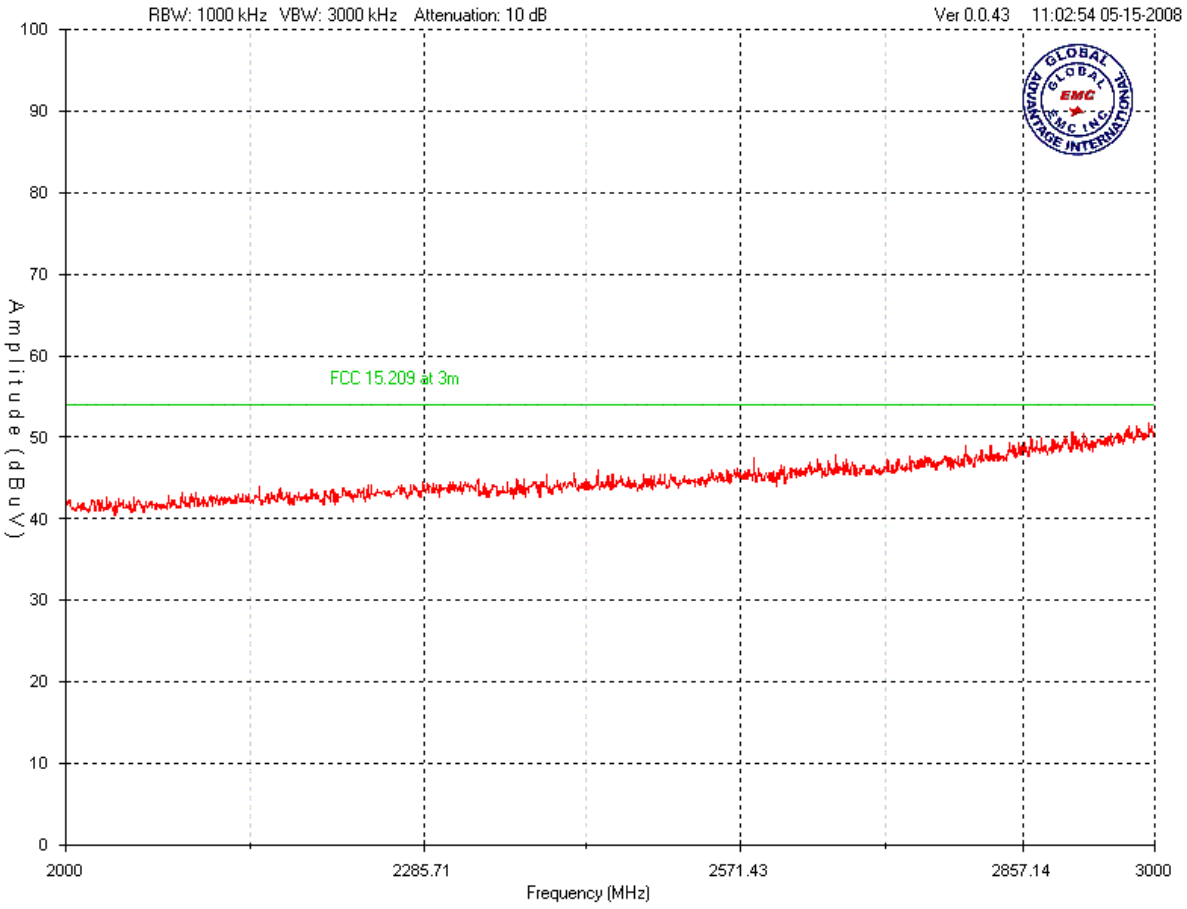
Vertical – Peak Emissions Graph – Hi Band (hopping stopped)
1 GHz – 2 GHz



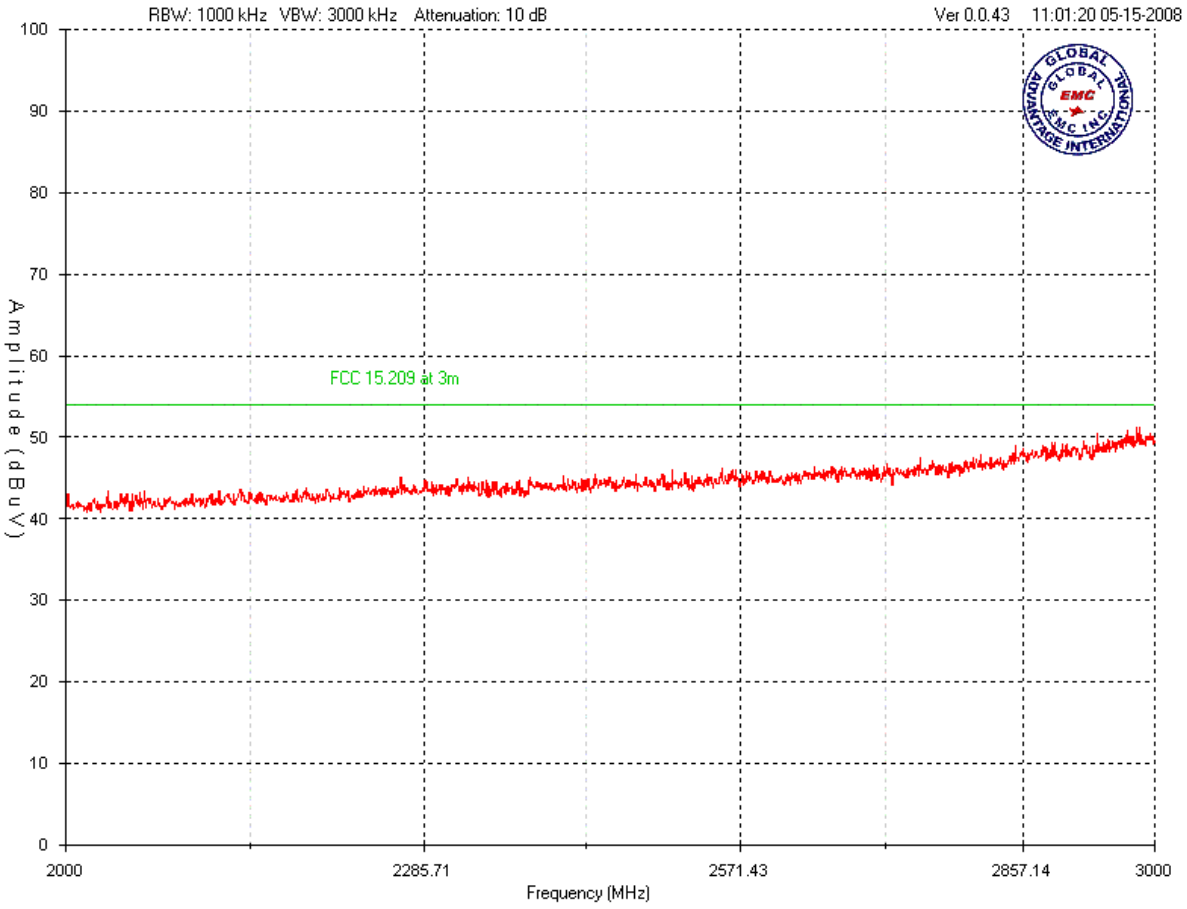
Horizontal – Peak Emissions Graph – Hi Band (hopping stopped)
1 GHz – 2 GHz



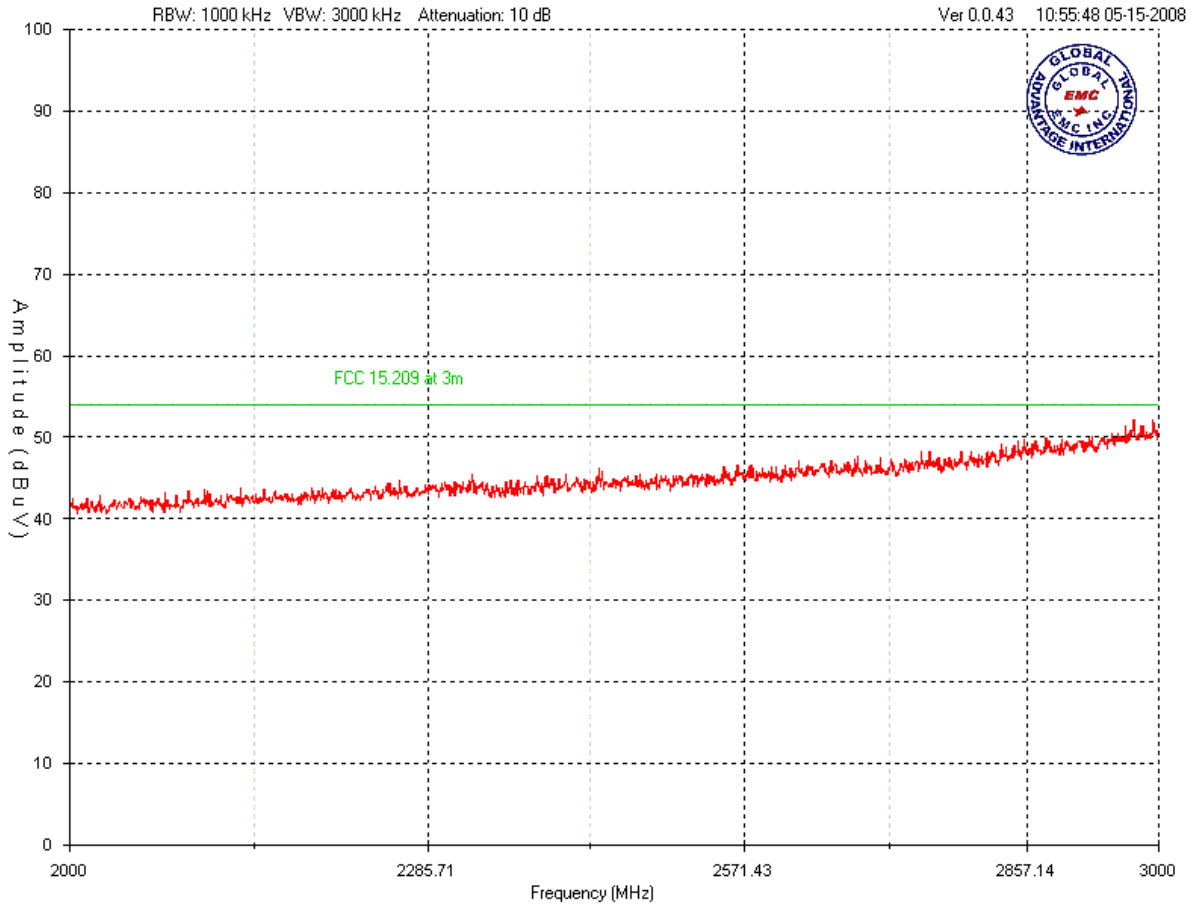
Vertical – Peak Emissions Graph – Hop mode
2 GHz – 3 GHz



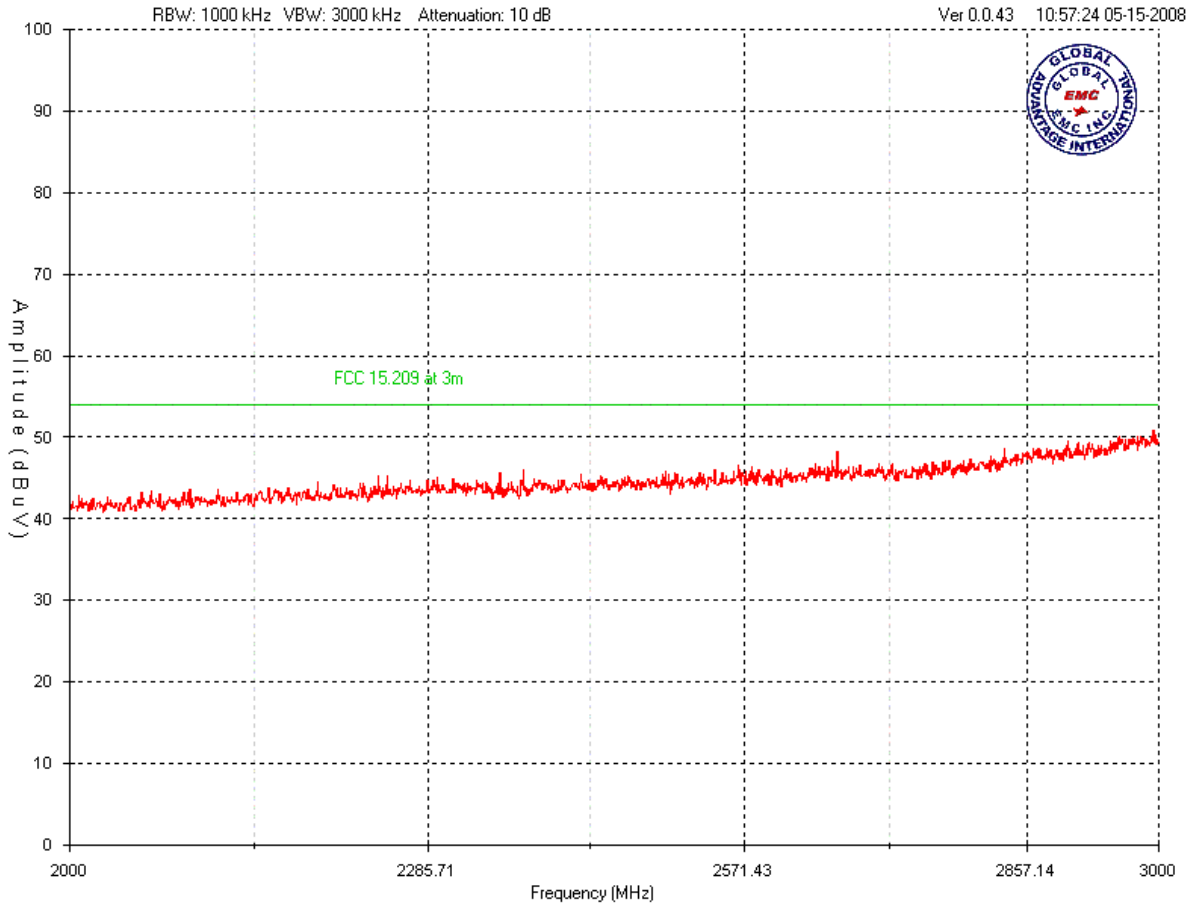
Horizontal – Peak Emissions Graph – Hop mode
2 GHz – 3 GHz



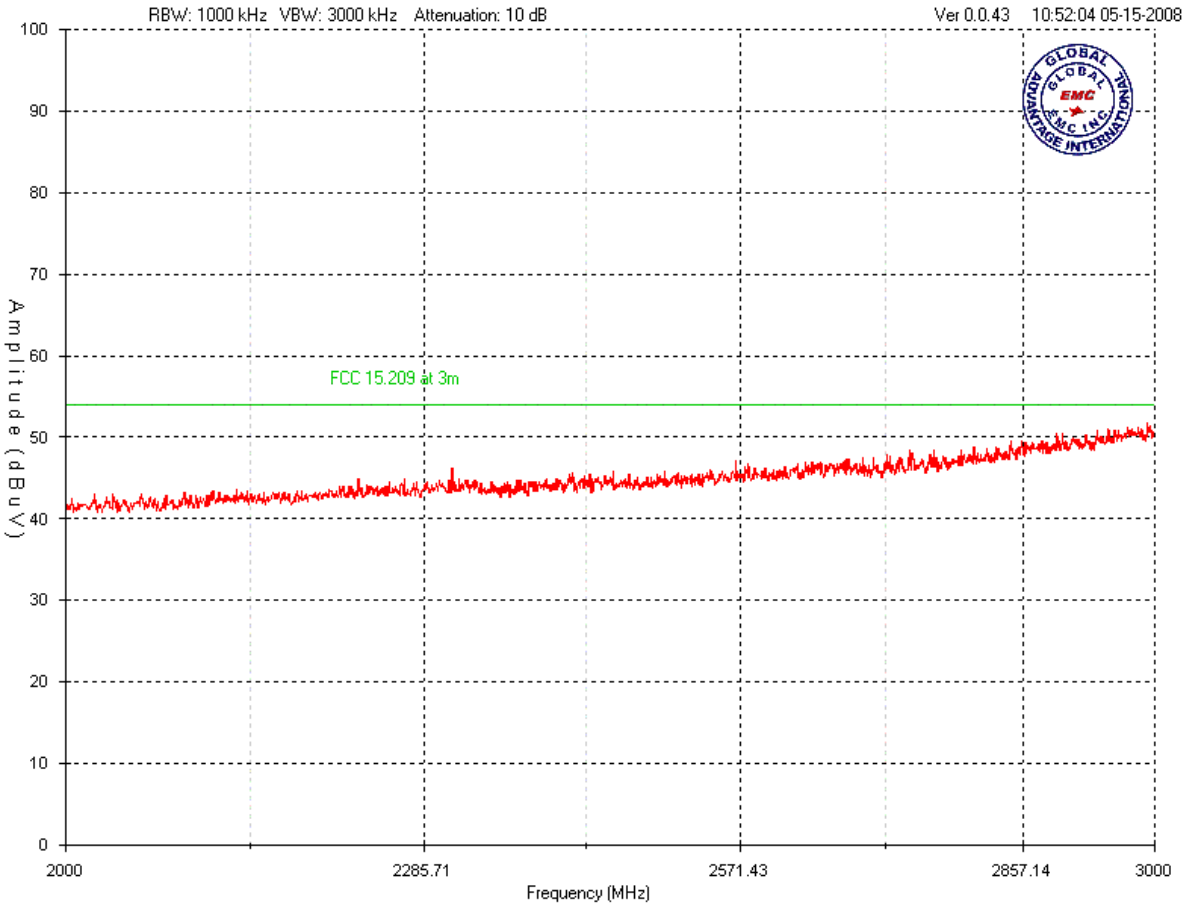
Vertical – Peak Emissions Graph – Low Band (hopping stopped)
2 GHz – 3 GHz



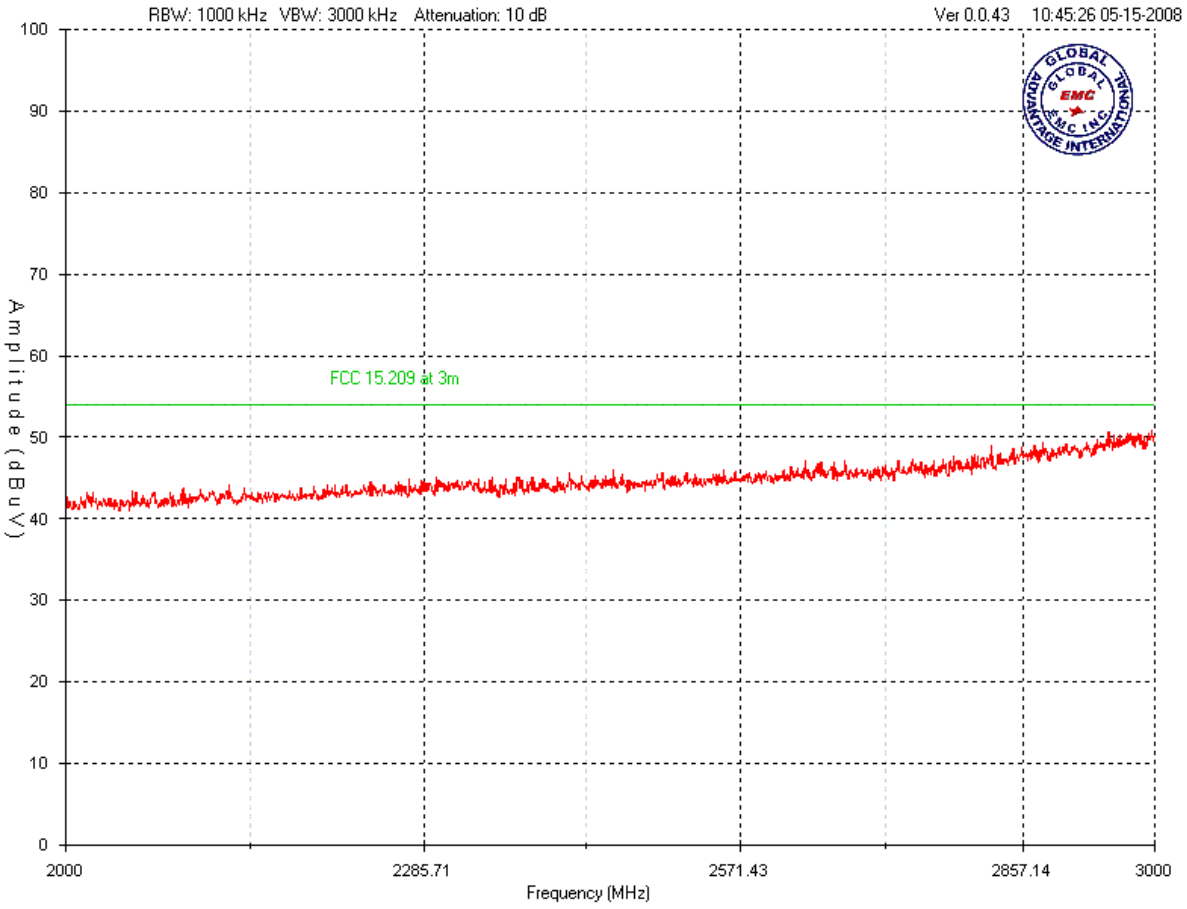
Horizontal – Peak Emissions Graph – Low Band (hopping stopped)
2 GHz – 3 GHz



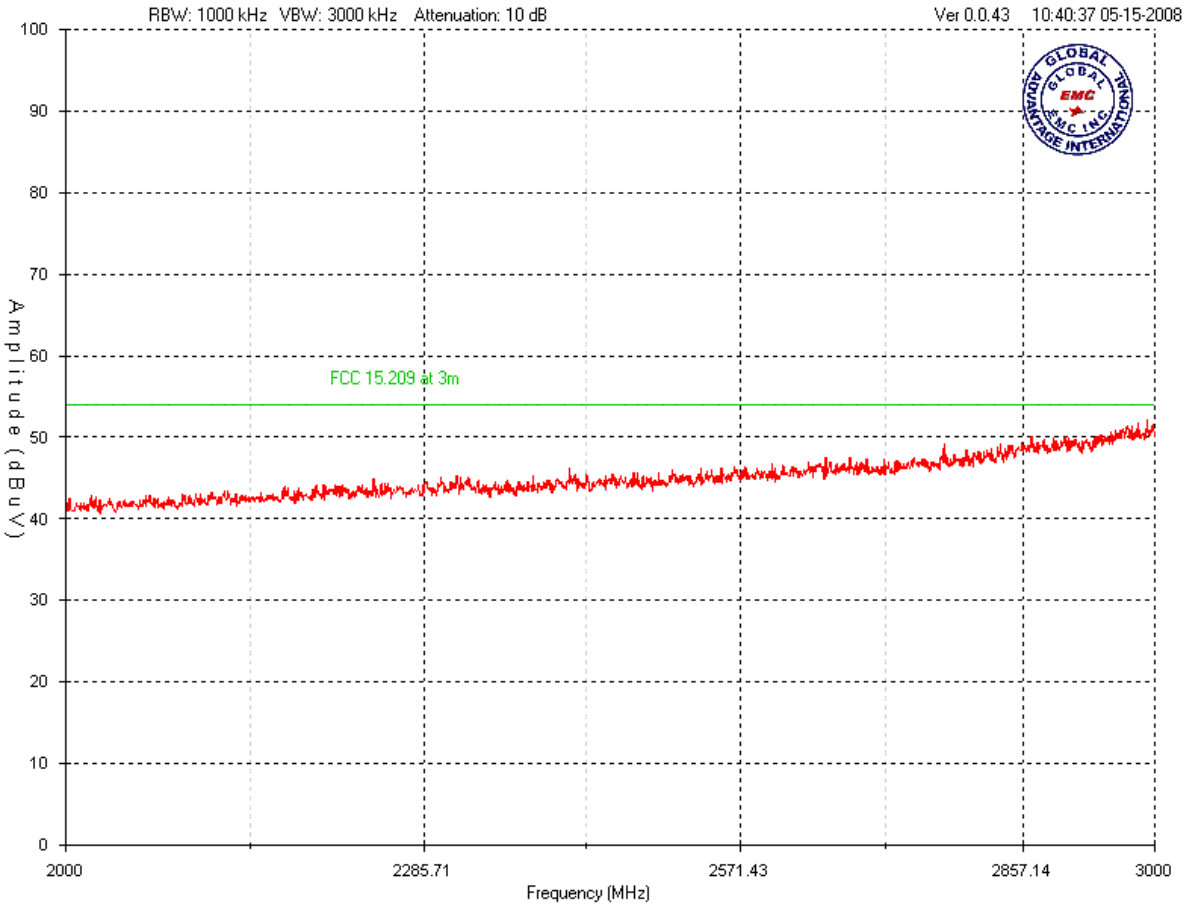
Vertical – Peak Emissions Graph – Mid Band (hopping stopped)
2 GHz – 3 GHz



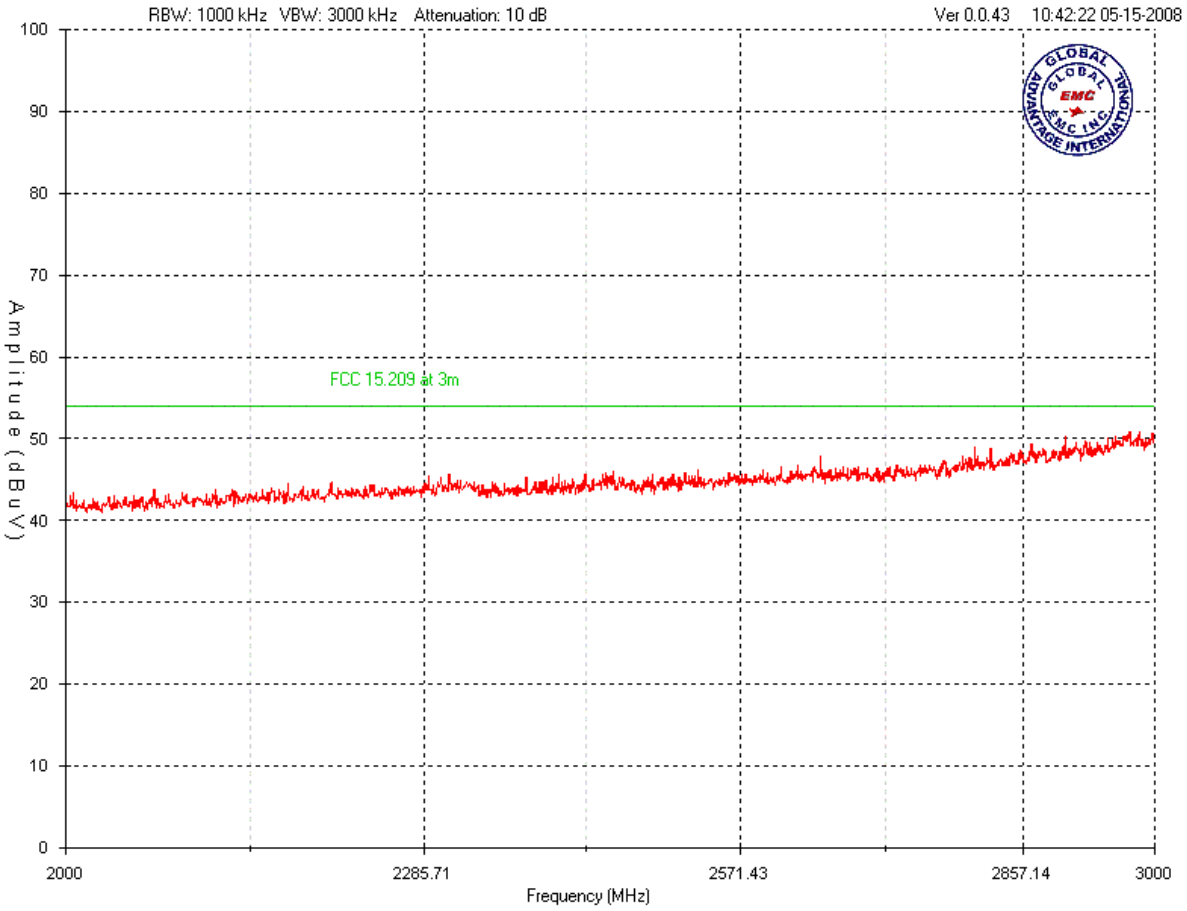
Horizontal – Peak Emissions Graph – Mid Band (hopping stopped)
2 GHz – 3 GHz



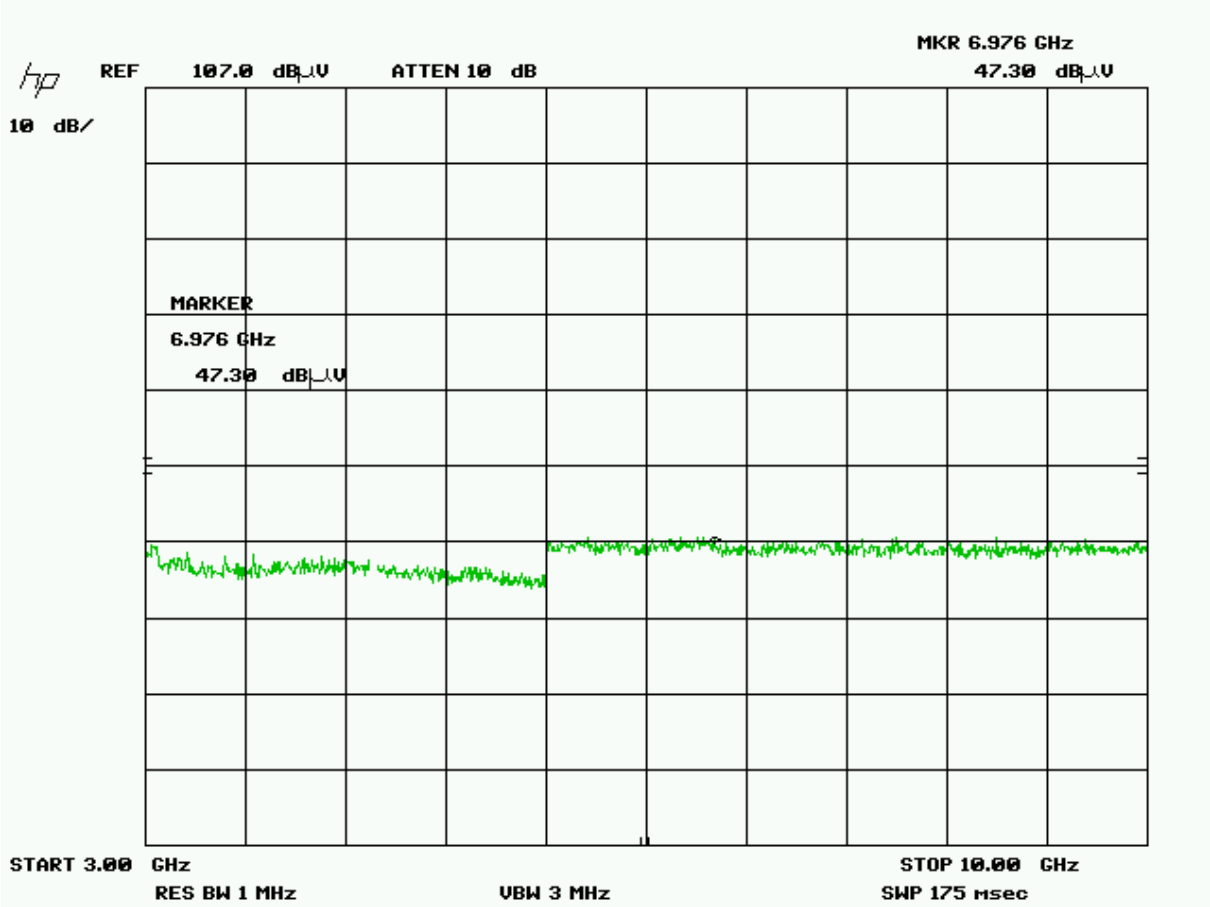
Vertical – Peak Emissions Graph – Hi Band (hopping stopped)
2 GHz – 3 GHz



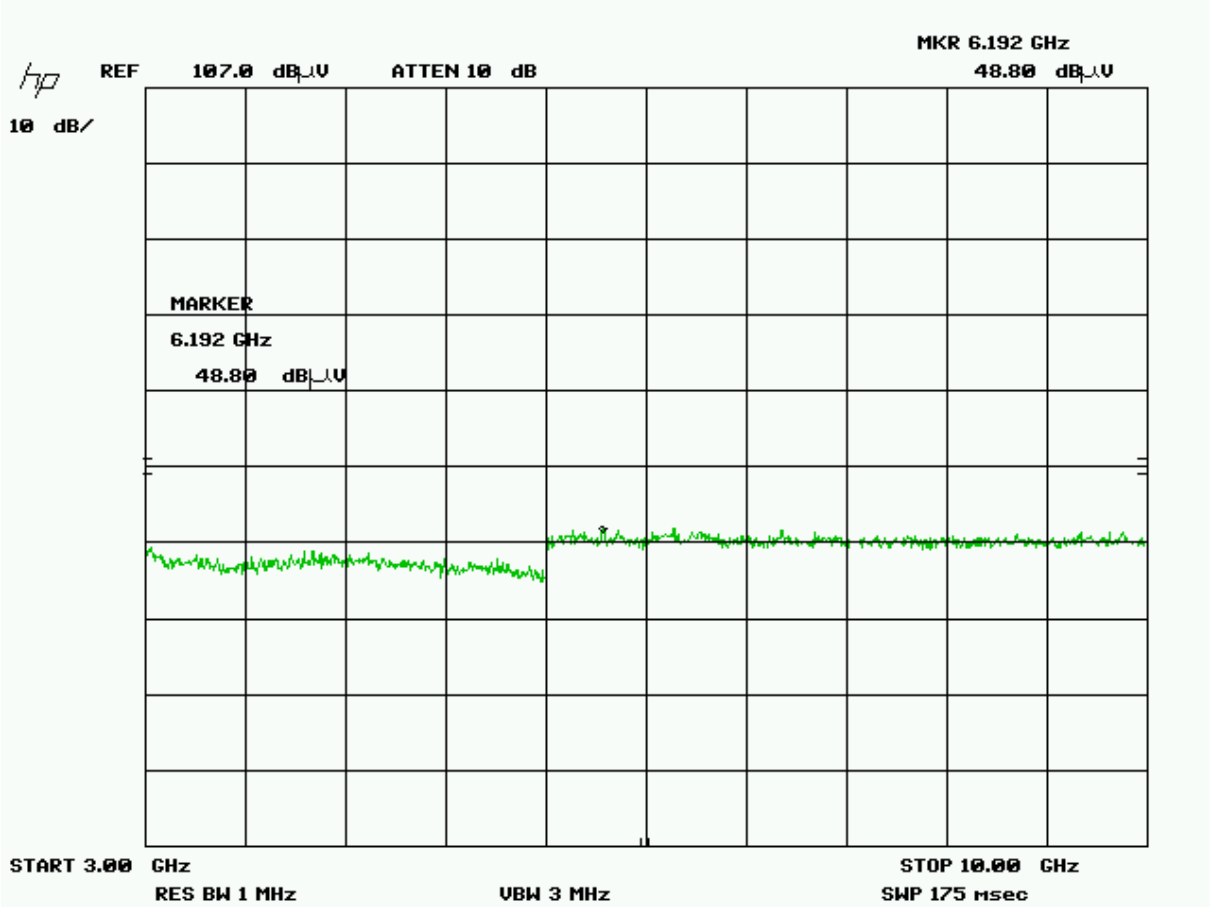
Horizontal – Peak Emissions Graph – Hi Band (hopping stopped)
2 GHz – 3 GHz



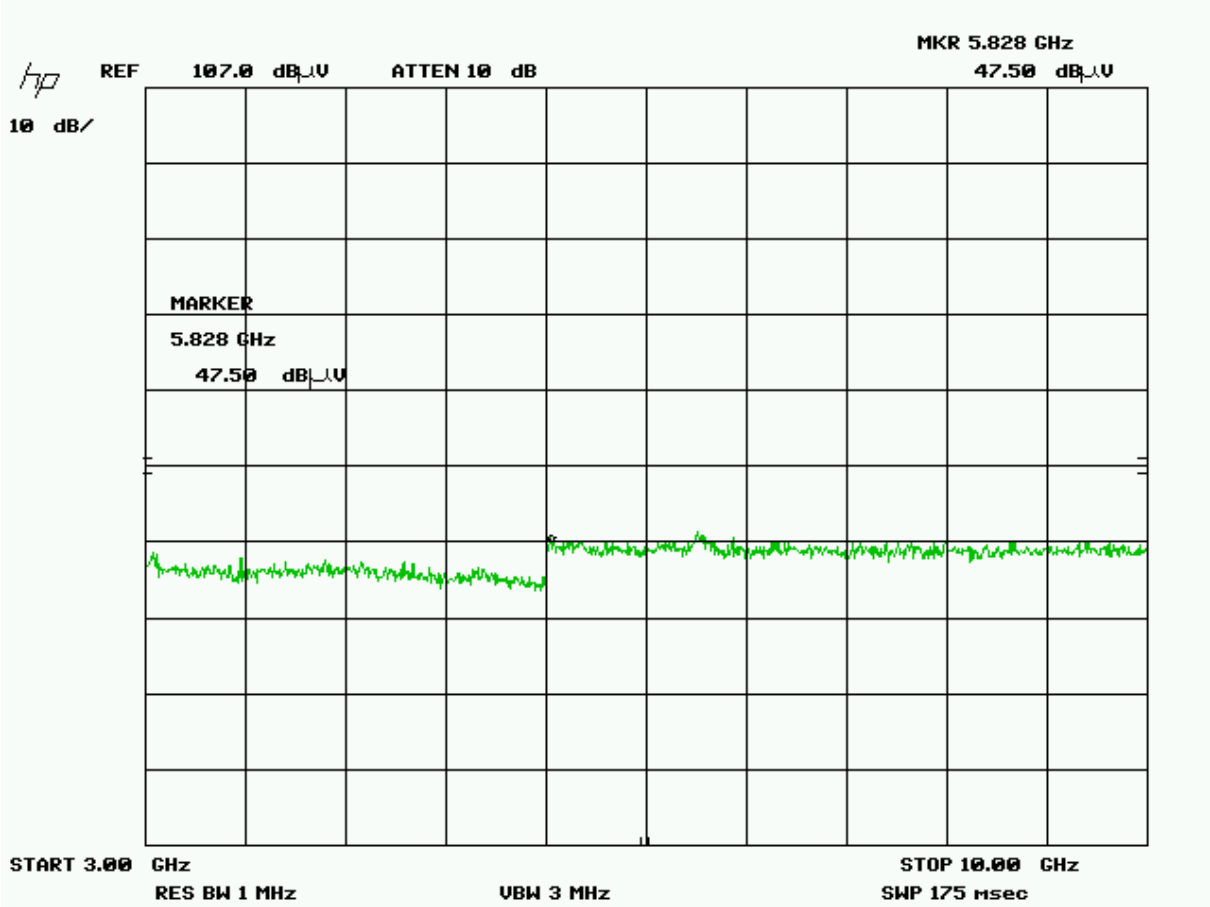
Vertical – Peak Emissions Graph – Hop mode
3 GHz – 10 GHz



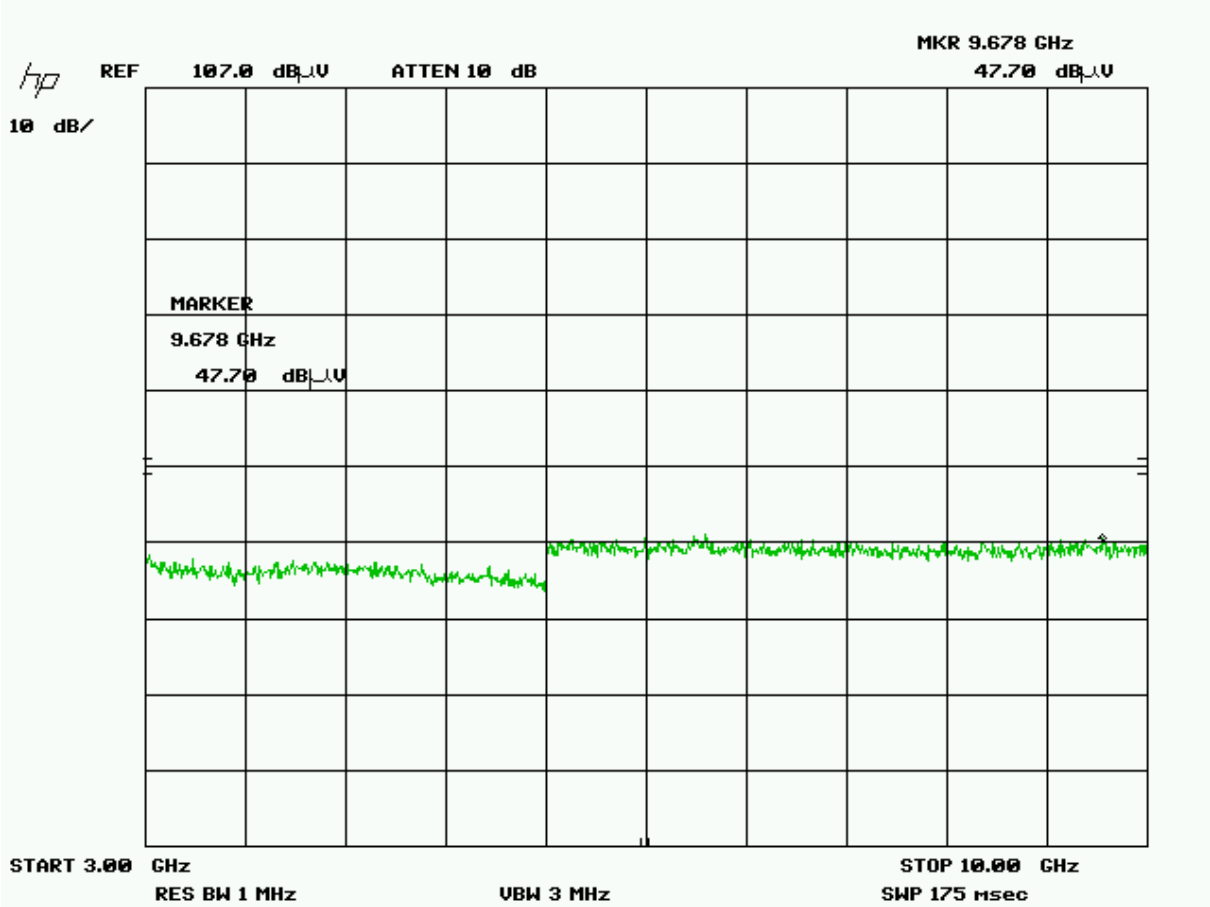
Horizontal – Peak Emissions Graph – Hop mode
3 GHz – 10 GHz



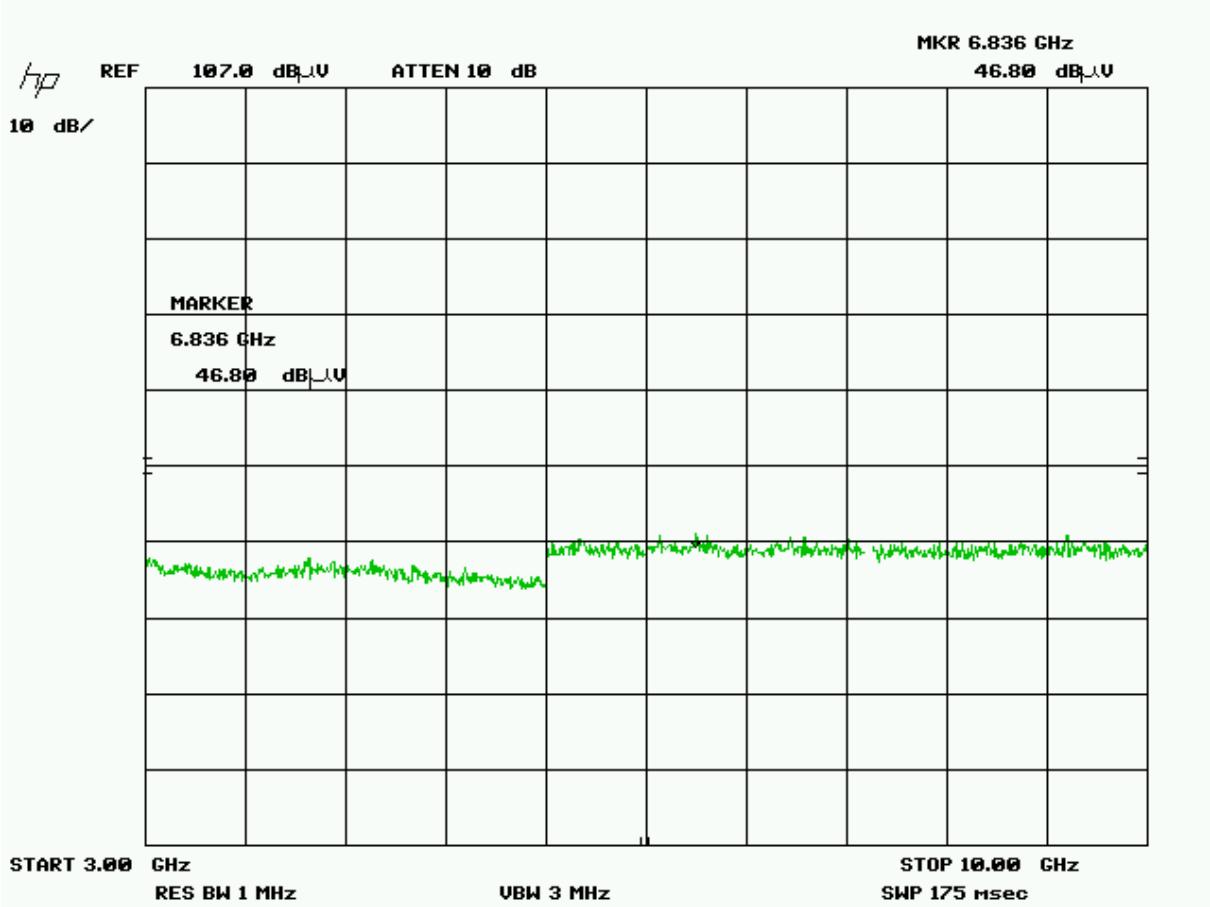
Vertical – Peak Emissions Graph – Low Band (hopping stopped)
3 GHz – 10 GHz



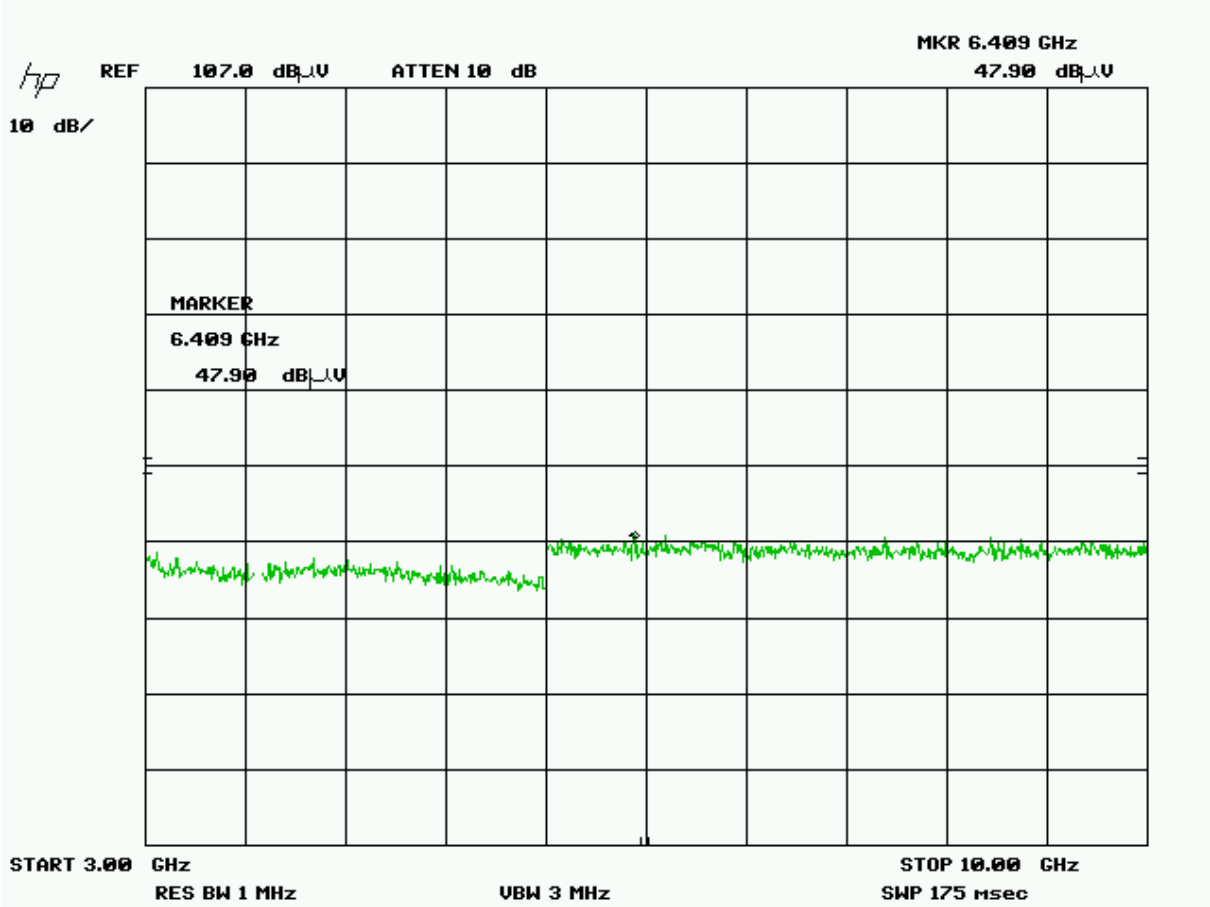
Horizontal – Peak Emissions Graph – Low Band (hopping stopped)
3 GHz – 10 GHz



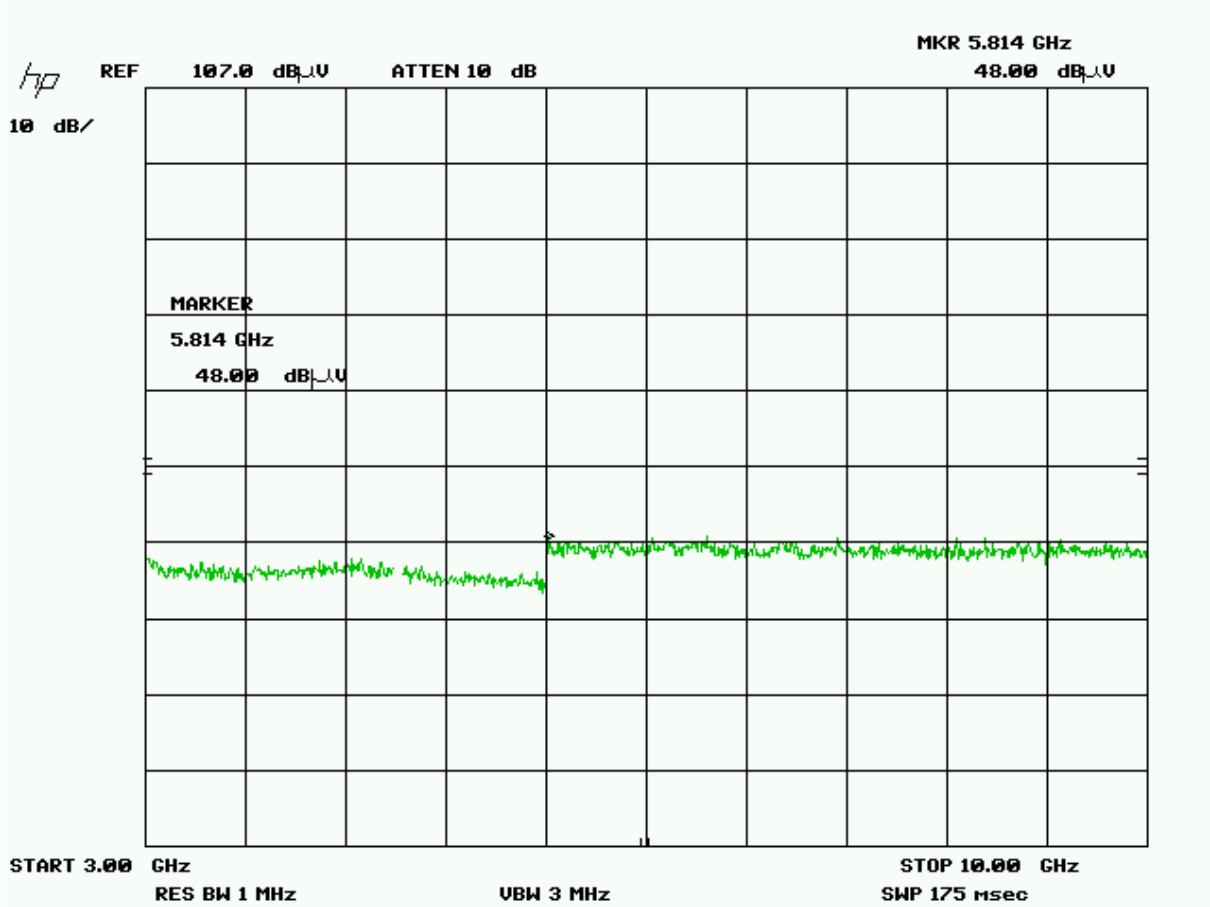
Vertical – Peak Emissions Graph – Mid Band (hopping stopped)
3 GHz – 10 GHz



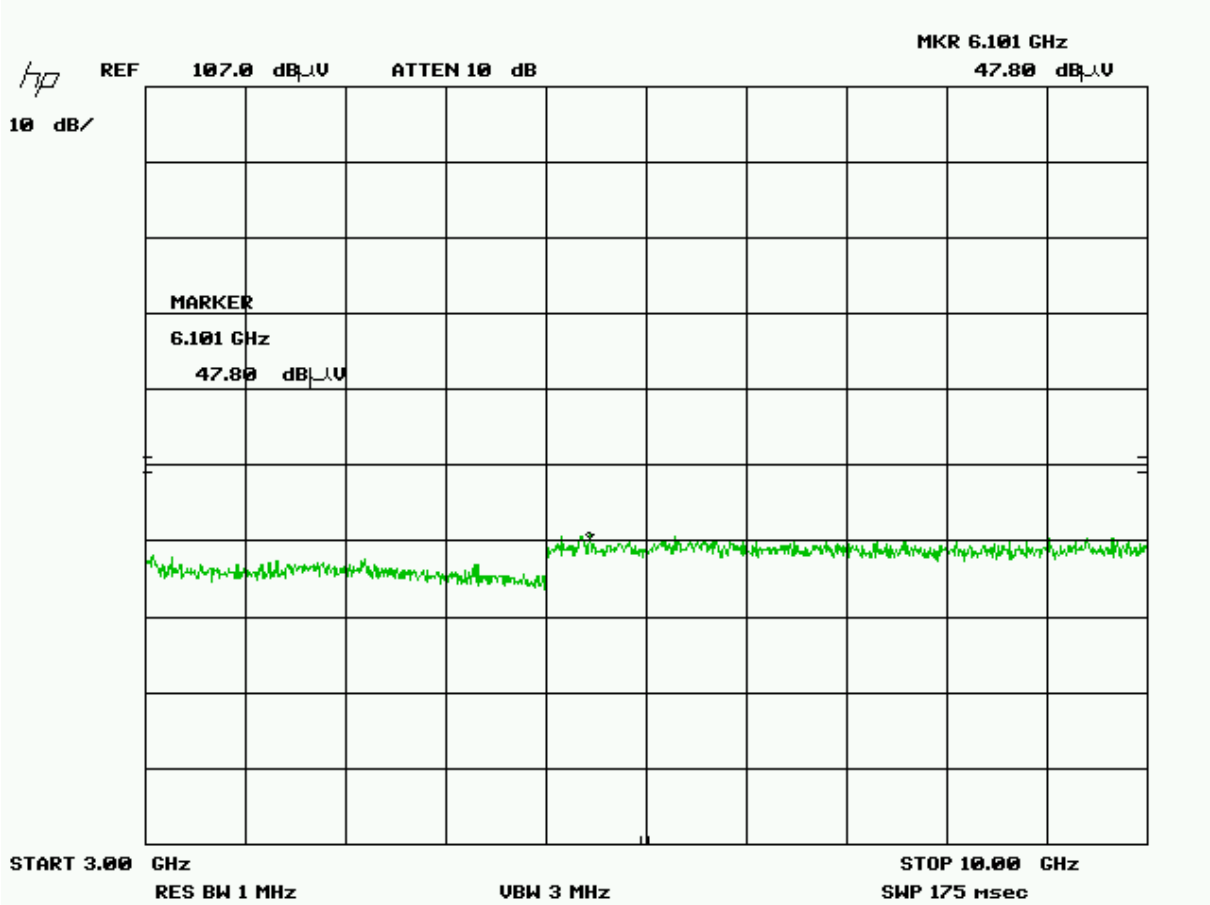
Horizontal – Peak Emissions Graph – Mid Band (hopping stopped)
3 GHz – 10 GHz



Vertical – Peak Emissions Graph – Hi Band (hopping stopped)
3 GHz – 10 GHz



Horizontal – Peak Emissions Graph – Hi Band (hopping stopped)
3 GHz – 10 GHz



Final Measurements

Note: In accordance with 15.247(d), only radiated emissions exceeding the 15.209 limit that occur within the bands listed in 15.205, need to be verified with a quasi-peak detector or an average detector.

The requirement of -20dBc is verified by the conducted method; please see 'Spurious Antenna Conducted Emissions' section of this report.

The frequency shown on the peak graph between does not fall within a restricted band as listed in FCC 15.205 and does not need to be verified.

For information purposes, the fundamental was measured to be 102.5 dbuV/m at 3 meters, and none of the unintentional radiated emissions that fall outside of the restricted bands exceeded the -20dBc (or 82 dbuV/m) requirement.

The following measurements were made at the harmonics shown in the above graphs.

See 'Spurious Antenna Conducted Emissions' measurements for -20 dBc requirements.

Client	Atlas Polar Company Limited
Product	Polar 9900R
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

Radiated Emissions Measurements

Product category	FCC 15 Subpart C - 15.247
Project Name / Number	180321 - FHSS Atlas Polar

Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
920.5	Peak	Horz	99.4	23.5	1.6	10.0	32.0	102.5	Mod On		
965.5	Peak	Horz	45.3	23.8	1.6	10.0	32.0	48.7	74.0	25.3	PASS
965	QP	Horz	27.1	23.8	1.6	10.0	32.0	30.5	54.0	23.5	PASS
902.86	Peak	Horz	98.3	23.4	1.6	10.0	32.0	101.3	Low Chn		
913.96	Peak	Horz	98.9	23.5	1.6	10.0	32.0	102.0	Mid Chn		
924.83	Peak	Horz	99.3	23.5	1.6	10.0	32.0	102.4	Hi Chn		
924.92	Peak	Vert	89.6	23.0	1.6	10.0	32.0	92.2	Hi Chn		
1805	Peak	Vert	53.7	29.1	2.4	0.0	32.0	53.2	Mod On		
1849	Peak	Vert	54.3	29.1	2.4	0.0	32.0	53.8	Mod On		
1805	Peak	Vert	55.0	29.1	2.4	0.0	32.0	54.5	Low Chn		
1805	Peak	Horz	53.1	29.5	2.4	0.0	32.0	53.0	Low Chn		

1828	Peak	Vert	57.9	29.1	2.4	0.0	32.0	57.4	Med Chn		
1828	Peak	Horz	56.7	29.5	2.4	0.0	32.0	56.6	Med Chn		
1849	Peak	Vert	57.2	29.1	2.4	0.0	32.0	56.7	Hi Chn		
1849	Peak	Horz	56.1	29.8	2.4	0.0	32.0	56.3	Hi Chn		
Receiver in standby mode											
118.4	Peak	Vert	46.5	6.4	1.1	3.0	21.6	35.4	50.5	15.1	PASS
118	QP	Vert	40.9	6.4	1.1	3.0	21.6	29.8	50.5	20.7	PASS
58.7	Peak	Vert	46.4	7.5	0.9	3.0	21.6	36.2	50.5	14.3	PASS
59	QP	Vert	42.5	7.5	0.9	3.0	21.6	32.3	50.5	18.2	PASS
54	Peak	Vert	42.6	7.5	0.9	3.0	21.6	32.4	50.5	18.1	PASS
54	QP	Vert	30.0	7.5	0.9	3.0	21.6	19.8	50.5	30.7	PASS
48.5	Peak	Vert	41.1	8.3	0.9	3.0	21.8	31.5	50.5	19.0	PASS
48.5	QP	Vert	29.9	8.3	0.9	3.0	21.8	20.3	50.5	30.2	PASS
155.5	Peak	Vert	37.7	9.0	1.1	3.0	21.6	29.2	50.5	21.3	PASS
154.8	QP	Vert	31.5	9.0	1.1	3.0	21.6	23.0	50.5	27.5	PASS
178.6	Peak	Vert	41.1	10.1	1.1	3.0	21.8	33.5	50.5	17.0	PASS
177	QP	Vert	31.8	10.1	1.1	3.0	21.8	24.2	50.5	26.3	PASS
118	Peak	Horz	43.2	7.7	1.1	3.0	21.6	33.4	50.5	17.1	PASS
118	QP	Horz	39.3	7.7	1.1	3.0	21.6	29.5	50.5	21.0	PASS

Note: Radiated emissions measurements above 3.0 GHz were performed at a 1 meter test distance, and in accordance with FCC 15.31(f)(1) an extrapolation factor of 9.5 dB was applied. No emissions above the 2nd harmonic were detected.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
BiLog Antenna	3142-C	ETS	2006-08-06	2008-08-06	GEMC 8
Horn Antenna	6878/24	Q-Par	On file	2008-08-01	GEMC 65
1-26G pre-amp	HP 8449B	HP	On file	2008-08-01	GEMC 68
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Pre-Amplifier	PA-2.5-26	Vican	2006-09-12	2008-09-12	GEMC 9
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev2.doc"

Channel Carrier Separation for Frequency Hopping Systems

Purpose

The purpose of this test is to ensure that the RF energy of frequency hopping systems is sufficiently spread over a spectrum and that the radio energy is not overly dense. This limit helps allow for other spread spectrum devices to co-exist in the same frequency spectrum. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

Limits

The limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)

	902 to 928 MHz	2.4 to 2.4835 GHz	5.275 to 5.85 GHz
No conditions	25 kHz or 20 dB BW[1]	25 kHz or 20 dB BW[1]	25 kHz or 20 dB BW[1]
< 125 mW	25 kHz or 20 dB BW[1]	25 kHz or 2/3 of 20 dB BW[1]	25 kHz or 20 dB BW[1]

Note 1: Whichever is greater. The 20 dB BW of the system was measured to be 425 kHz, so a limit of 425 kHz applies.

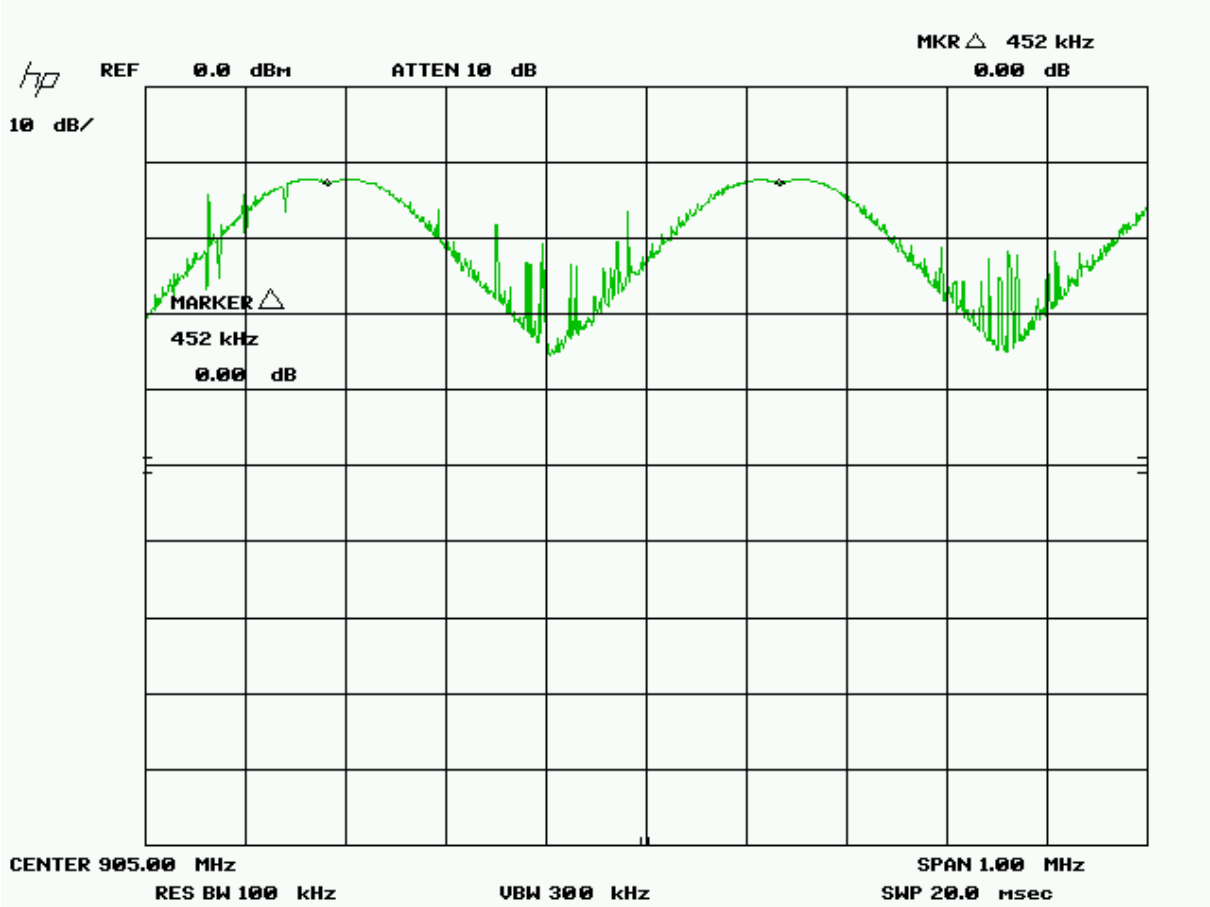
Results

The EUT passed the requirements of channel carrier spacing exceeding the measured 20 dB BW of the EUT. The 20 dB BW previously measured was 425 kHz, and the device had a channel spacing of 452 kHz.

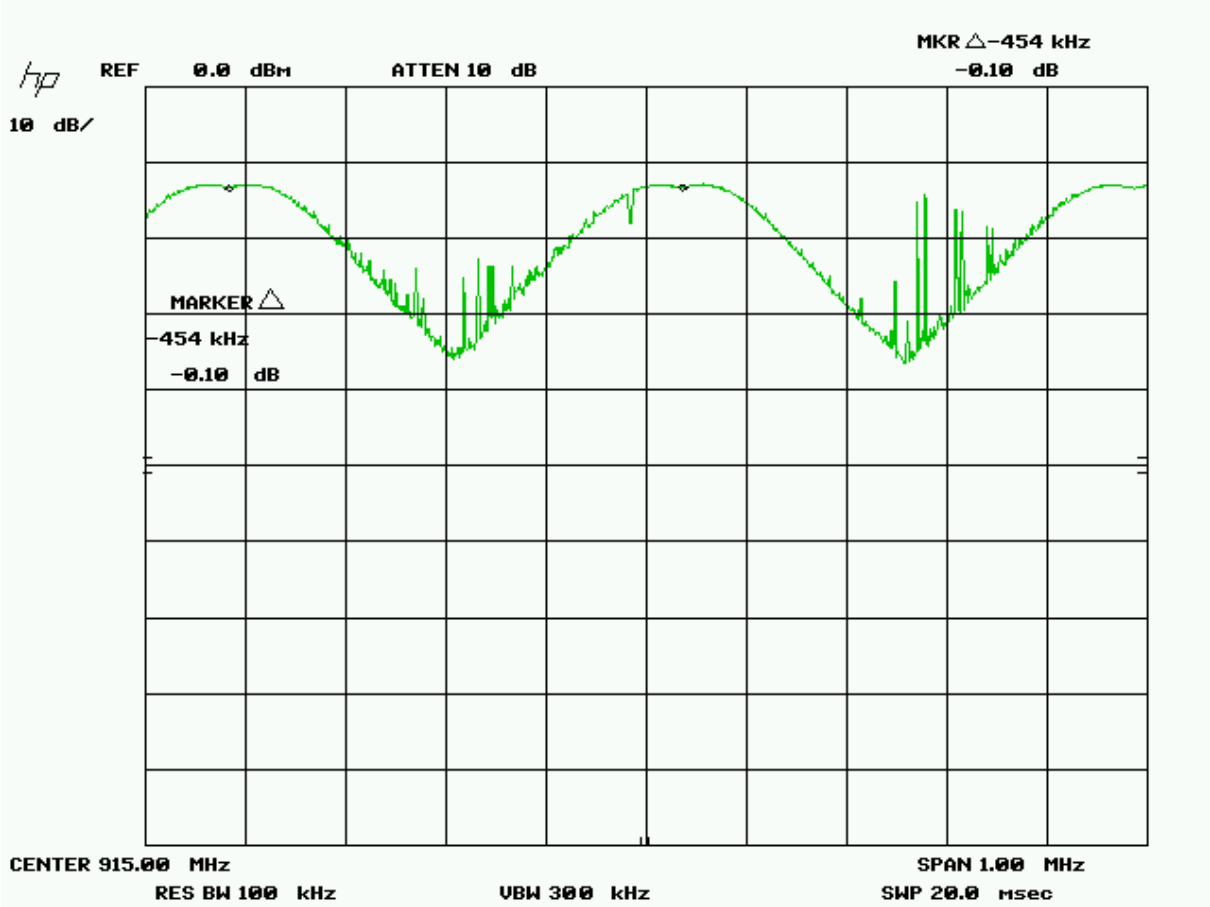
Graph(s)

The graphs below show the channel spacing during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the channel spacing of the signal being measured. This measurement is a peak measurement.

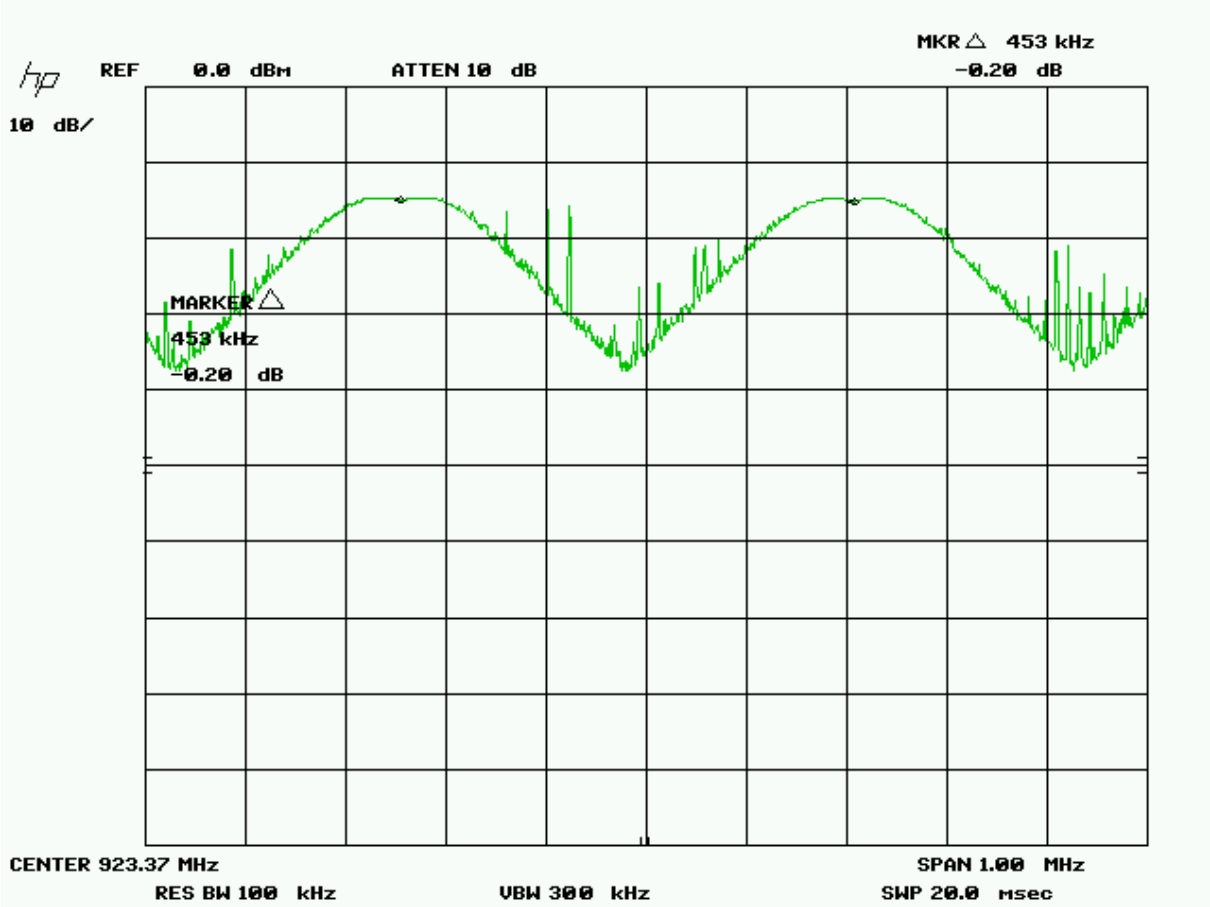
Low Channel



Mid Channel



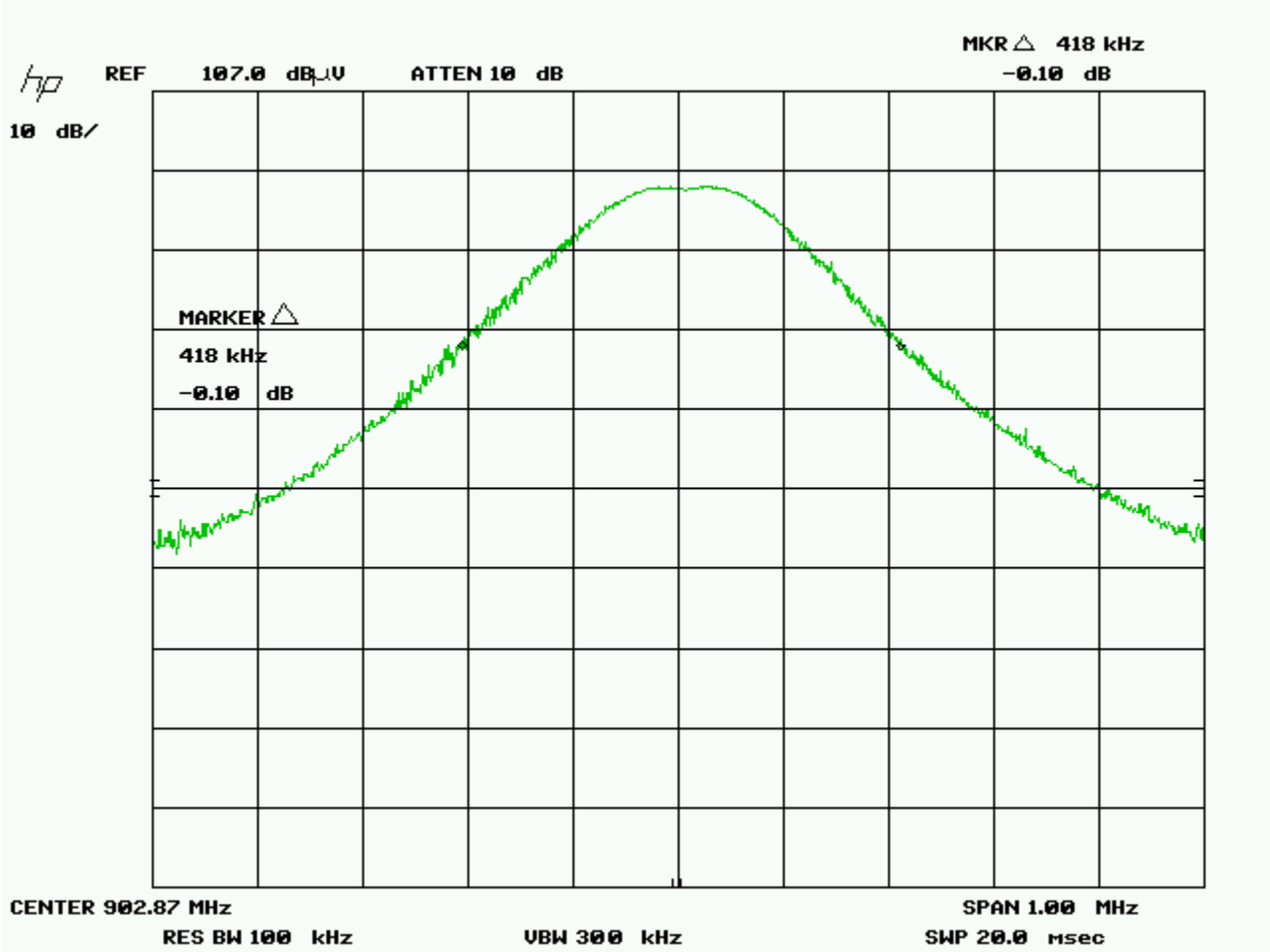
High Channel



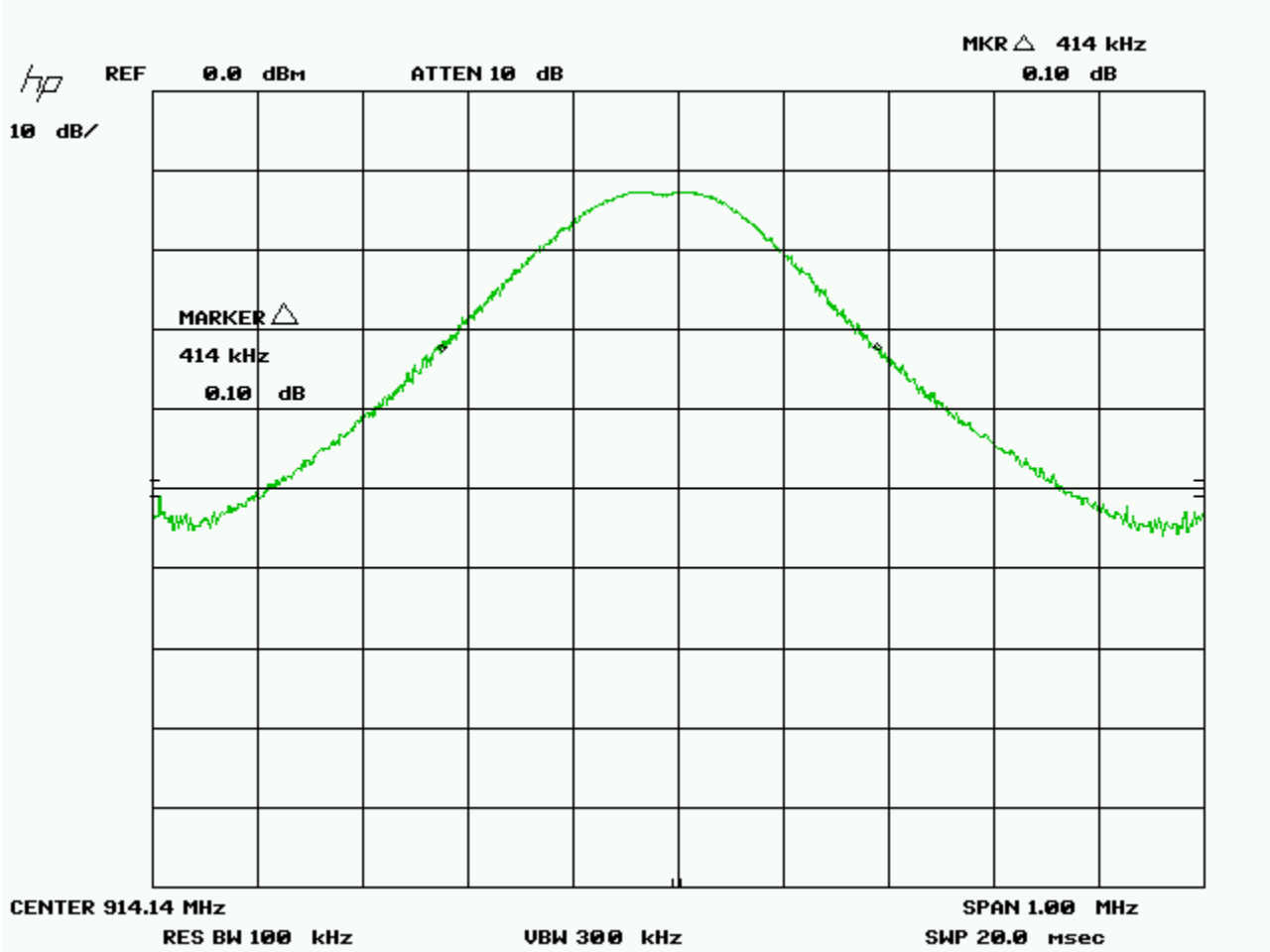
Note:

1. See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.
2. A plot of 20db BW is also attached below. This is to illustrate the measured 20 db BW at Low, Medium and High channels.

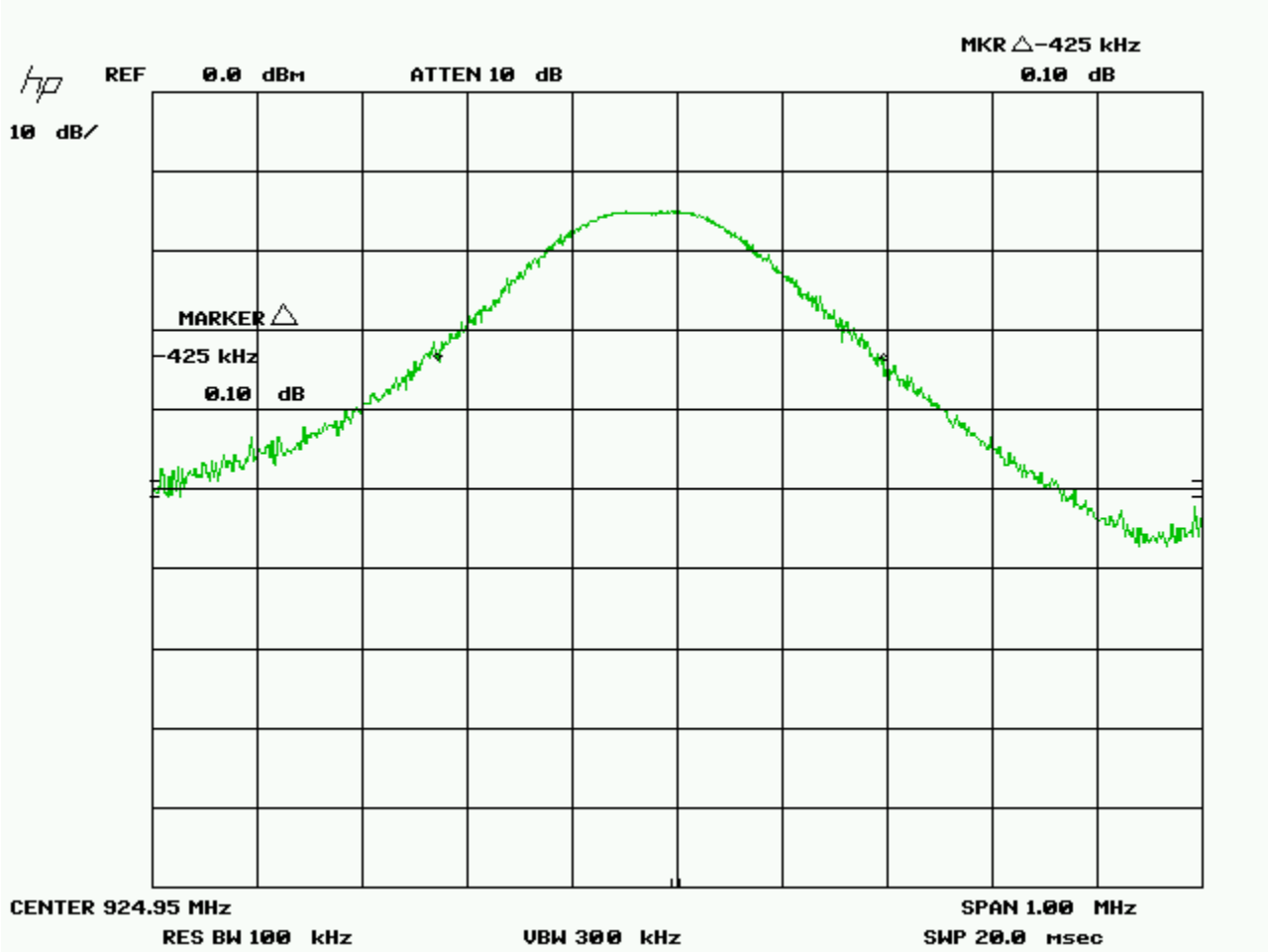
20 db BW Low channel



20 db BW Medium channel



20 db BW High channel



Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Number of Channels for Frequency Hopping Systems

Purpose

The purpose of this test is to ensure that the RF energy of frequency hopping systems is sufficiently spread over a spectrum and that the radio energy is not overly dense. This limit helps allow for other spread spectrum devices to co-exist in the same frequency spectrum. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

Limits

The limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)

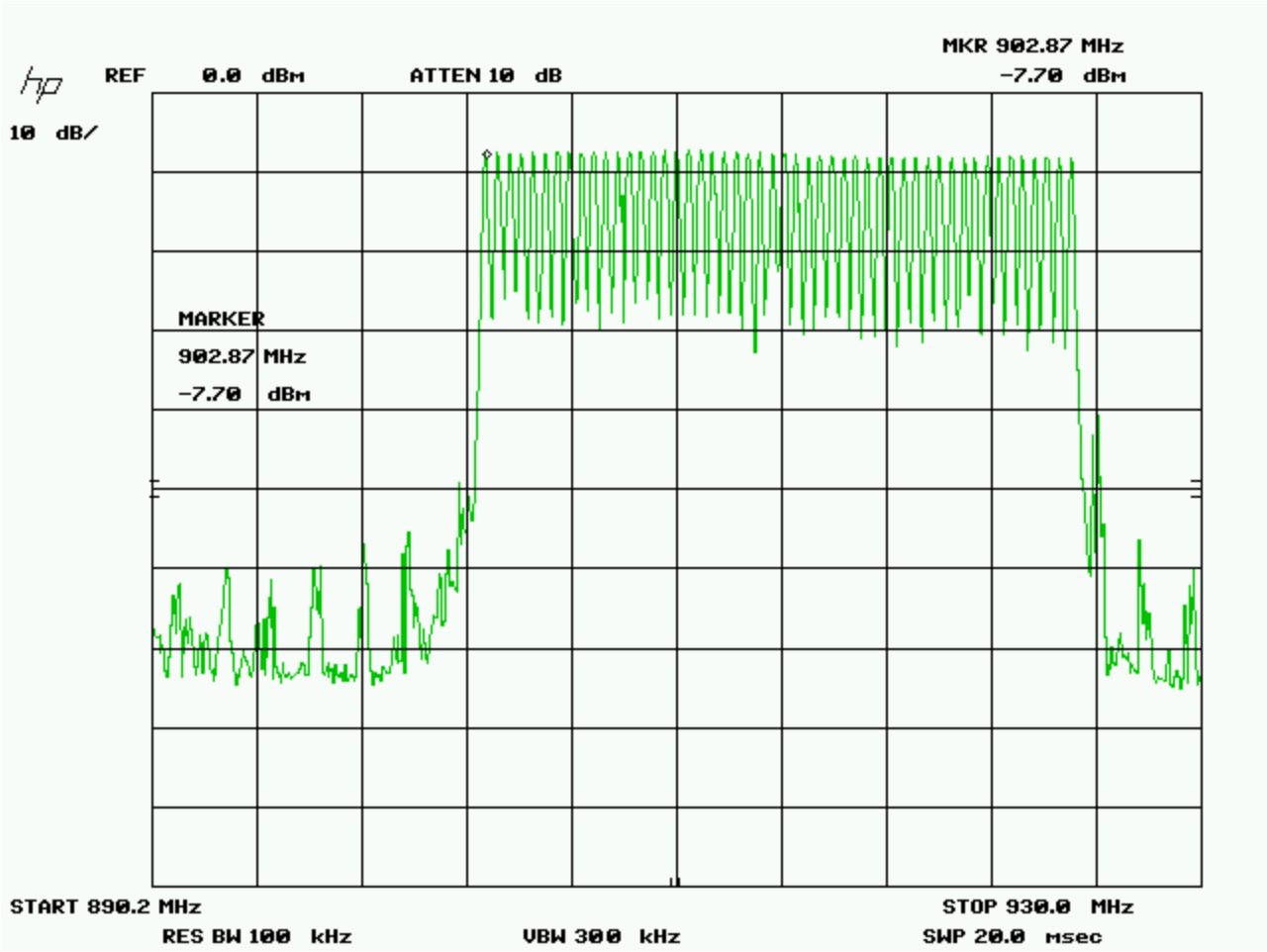
	902 to 928 MHz	2.4 to 2.4835 GHz	5.275 to 5.85 GHz
No conditions	>= 50 channels	>= 15 channels	>= 75 channels
20 dB BW exceeds 250 kHz	>= 25 channels	>= 15 channels	>= 75 channels

Results

Since the 20db BW of the unit exceeds 250 kHz, the channel requirement is a minimum of 25 channels. The EUT passed the requirements of the number of channels. The number of channels the device occupies is 50 in the allocation band of 902 to 928 MHz.

Graph(s)

The graph shown below shows the number of occupied channels during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the channel spacing of the signal being measured. This measurement is a peak measurement.



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Frequency Occupancy for Frequency Hopping Systems

Purpose

The purpose of this test is to ensure that the RF energy of frequency hopping systems is hopping at a minimum defined rate. This helps ensure sufficient time off to enable other frequency hopping devices to co-operate within this allocated band.

Limits

For 902 to 928 MHz systems, the limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)(i).

For systems with a 20 db BW greater than 250 kHz the minimum number of hopping channels is 25, such as this device, the maximum time of occupancy on any channel in a 10 second period should not exceed 400ms.

Results

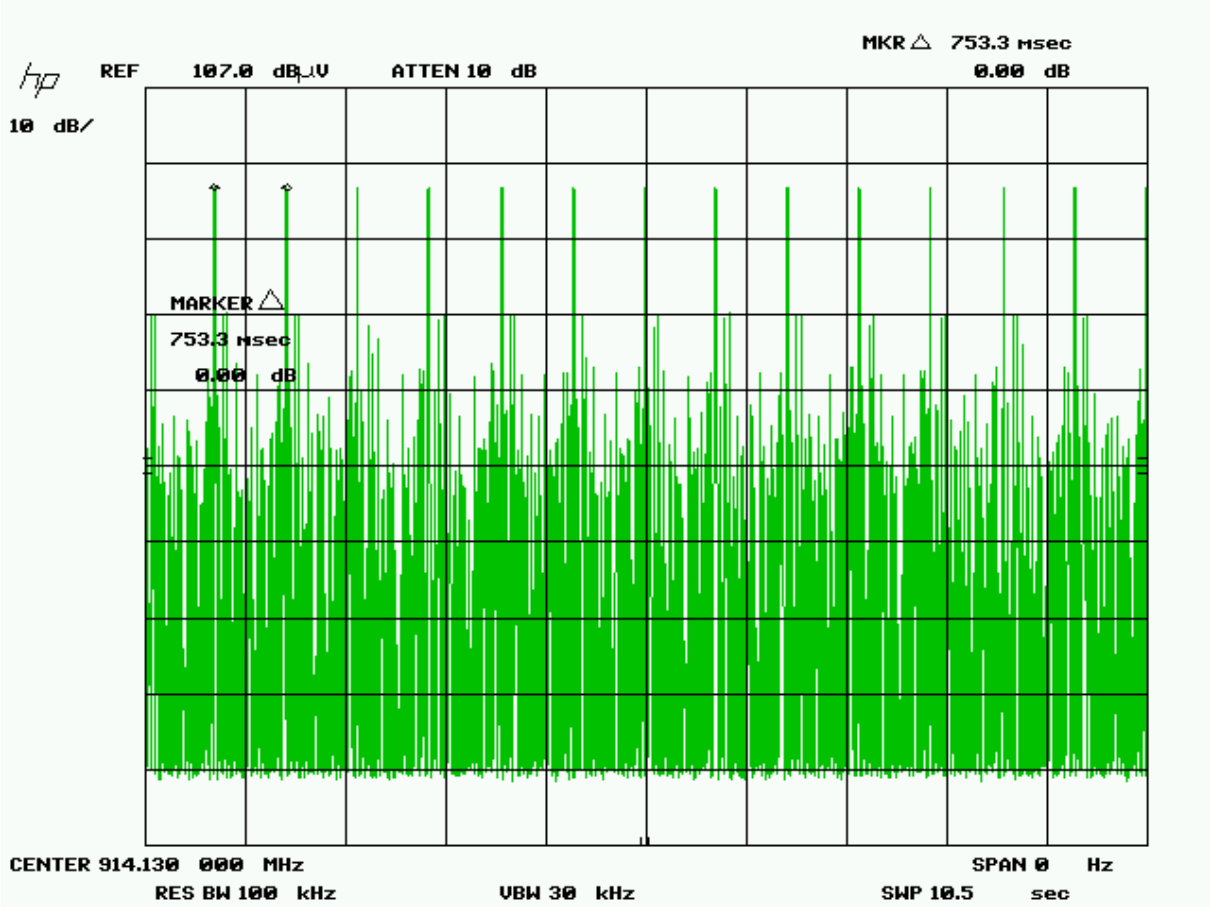
The EUT passed the requirements. The EUT cycles through its pseudo-random generated list of hopping frequencies every 753 ms. The on time duration of each hop is 14.86 msec.

Number of channels	50
Time of occupancy on each channel (ms)	14.86
Time to cycle through a ll channels (ms)	753
Number of complete cycles in 10s period	13.3
Total on time in 10s period (ms) for a frequency	197.5

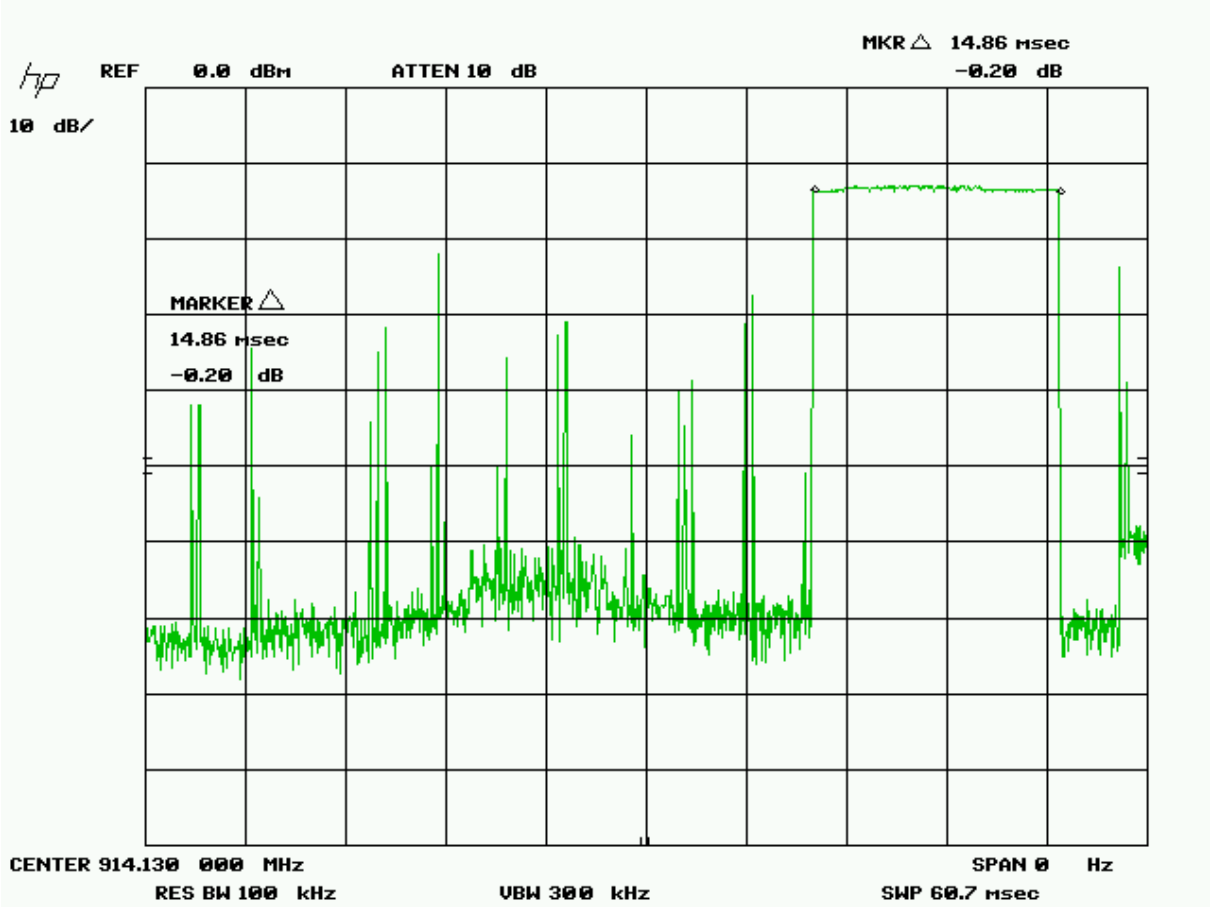
Graph(s)

The first graph shown below shows the repeat time of the pseudorandom generated hopping list. This graph was taken over a period of 10 seconds. Note that in the first graph, the peak represents the 'on' of the frequency being measured. The lower signals are artifacts of nearby channels due to the wide resolution BW used.

Hopping List repeat rate



On time during each channel



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Maximum Peak Envelope Conducted Power

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified.

Limits

The limits are defined in 15.247(b).
For frequency hopping systems operating in the 902-928 MHz band employing atleast 50 hopping channels, the peak limit is 1 watt.

Results

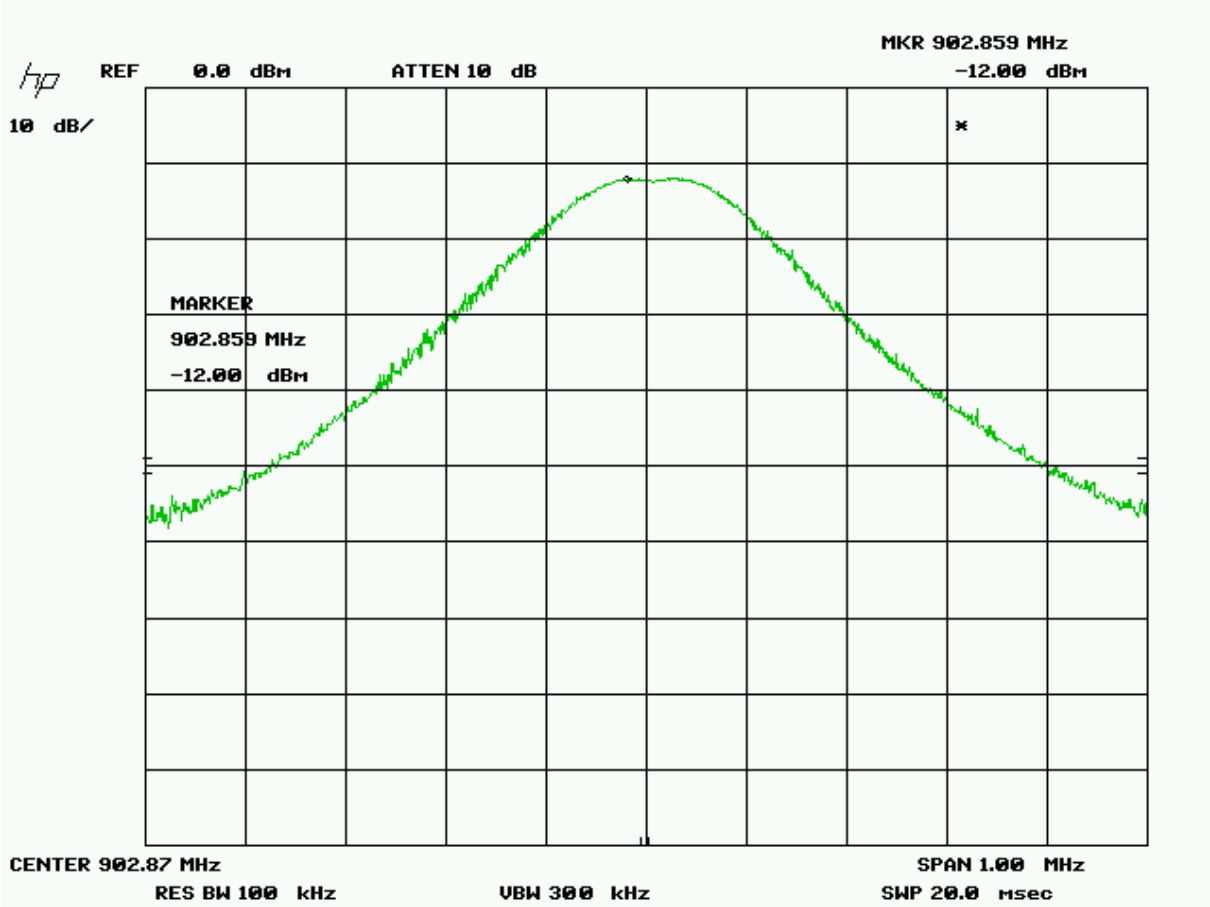
The EUT passed. The peak power measured was 8.0 dbm (6.3 mW)

Graph(s)

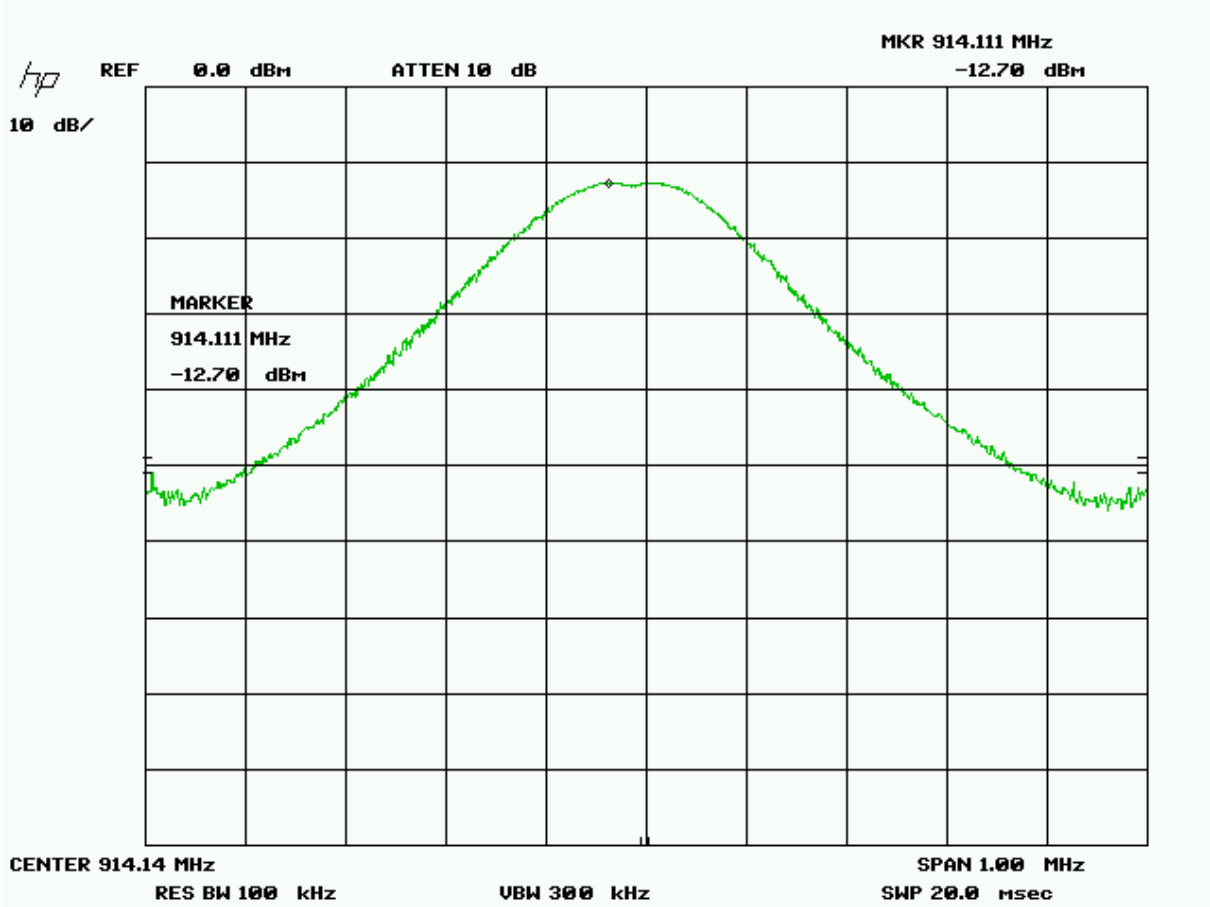
The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB of external attenuation taken during this measurement.

The calculated value is:
-12.0 dBm + 20 dB (attenuator) = 8.0 dbm

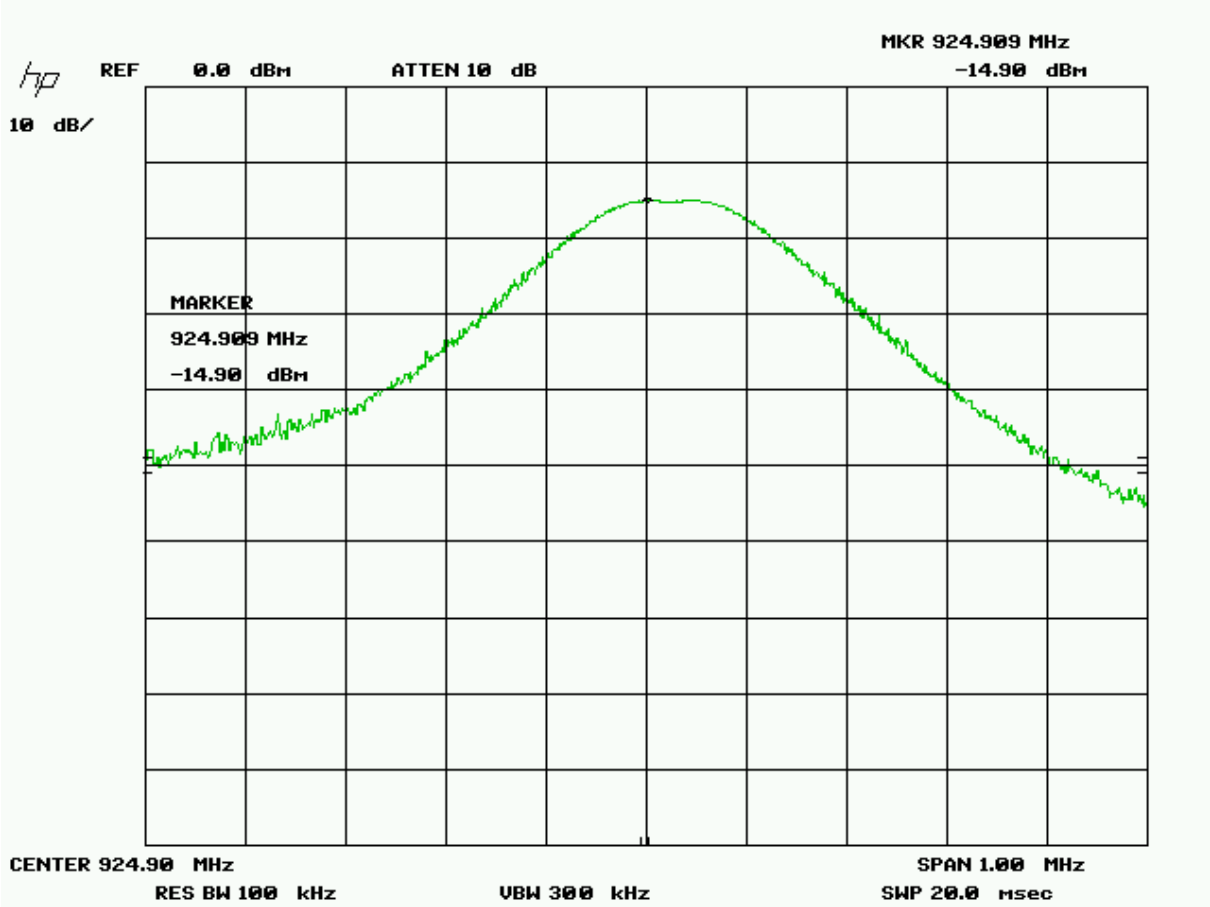
Low channel



Medium channel



High channel



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Spurious Emissions -20 dbc Rule

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified.

Limits

The limits are defined in 15.247(d).
In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental.

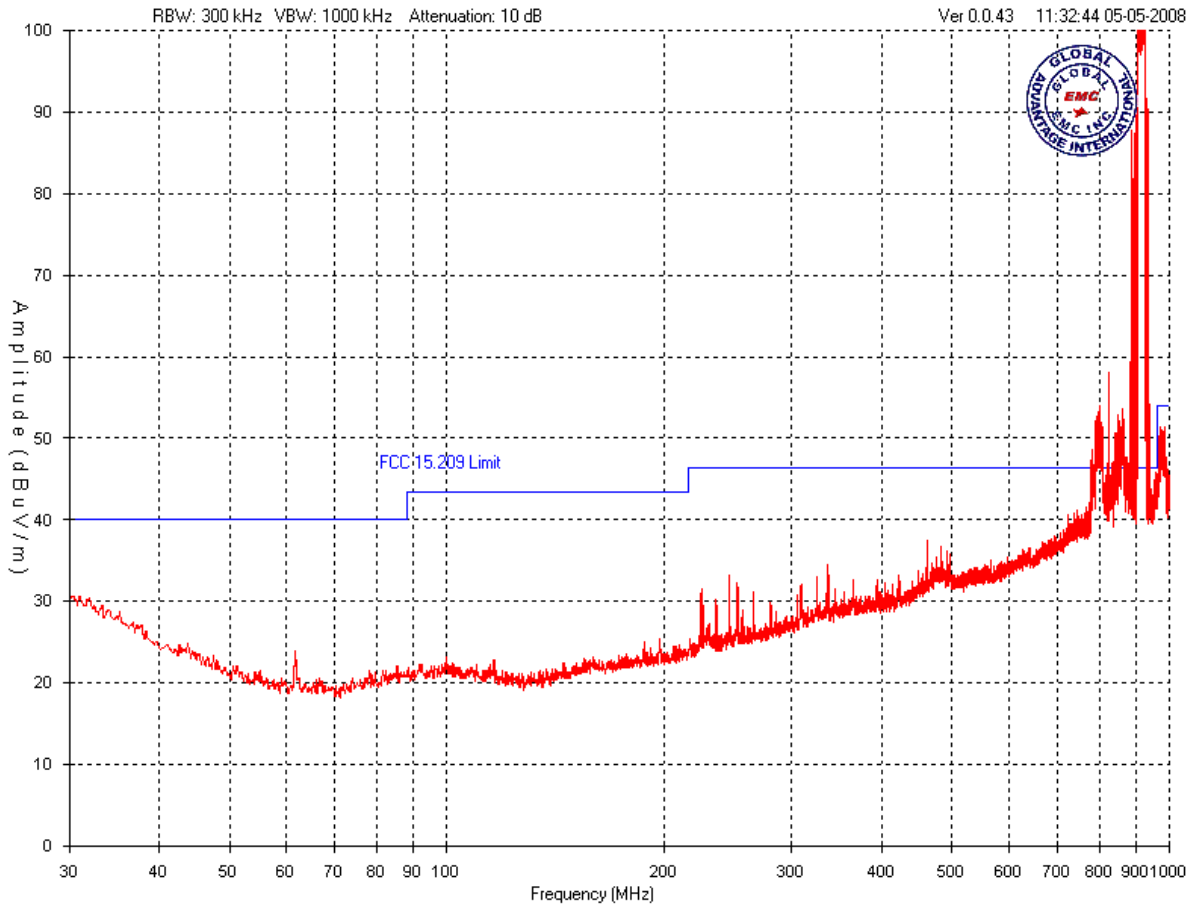
Results

The EUT passed. The peak power measured was 8.0 dBm (6.3 mW). The worst case reading was the 3rd harmonic measured to be -64.2 dbm. Since the peak was measured at -7.7 dbm there is a - 56.5 dbc under this configuration. This is well within the limits of -20 dbc rule.

Graph(s)

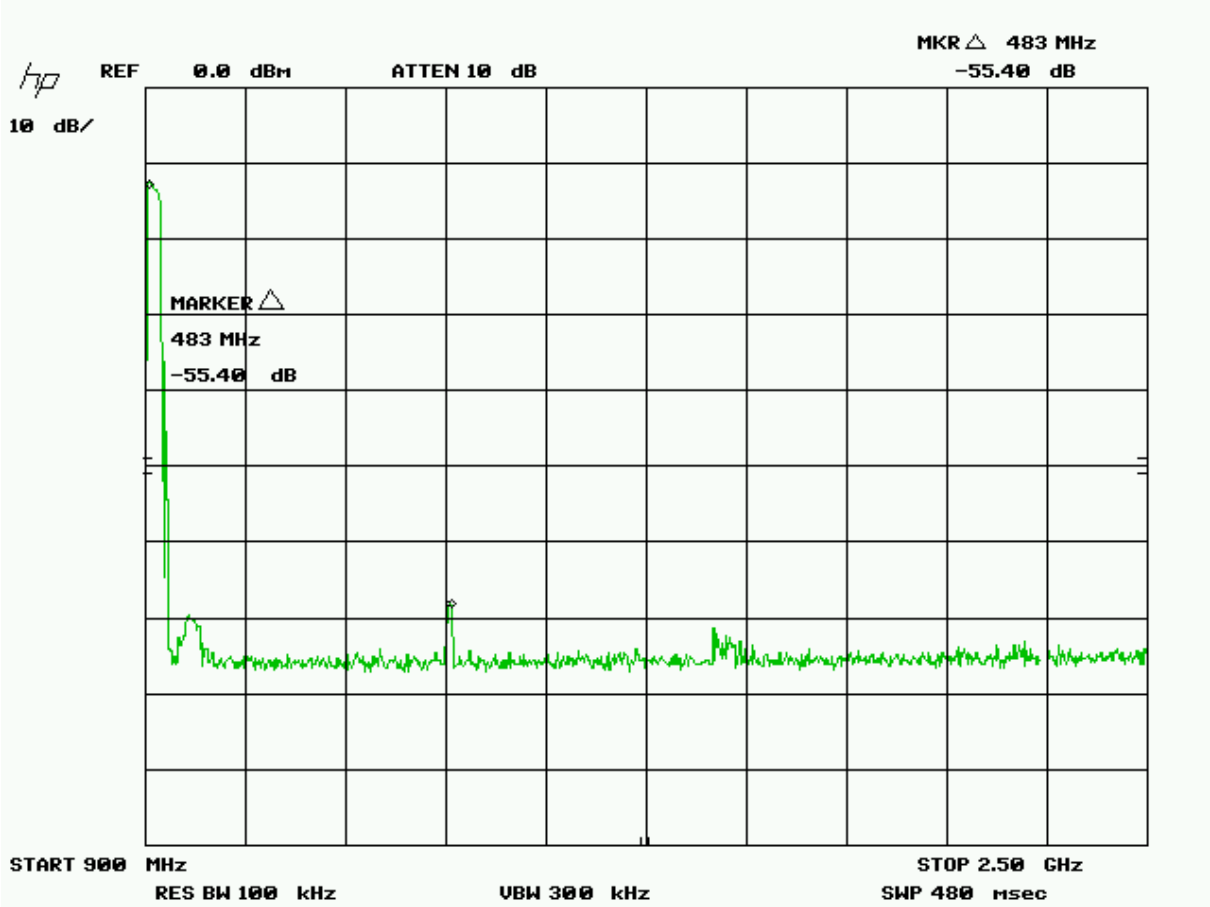
The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB of external attenuation taken during this measurement.

30 MHz – 1000 MHz

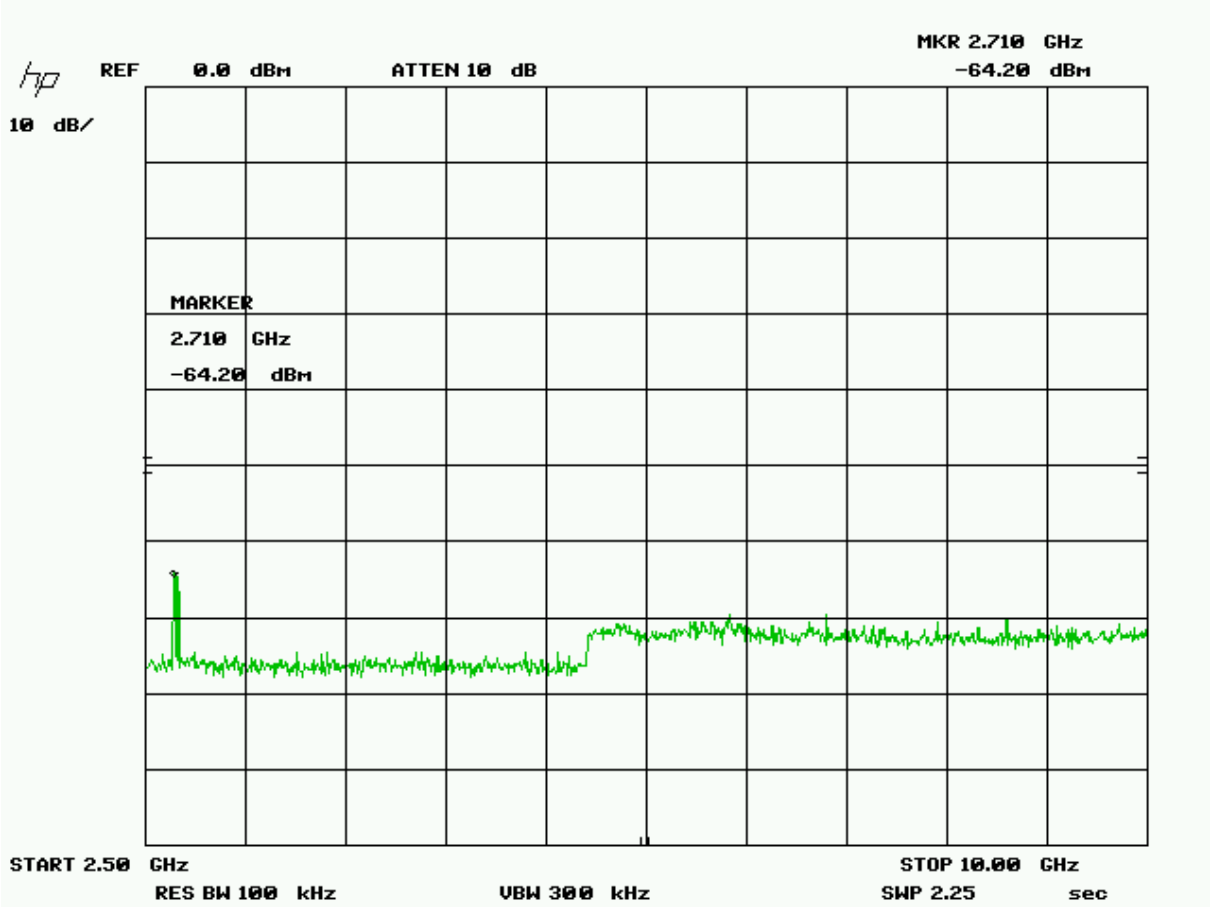


For this range the radiated emissions plot was used. This is a worst case scenario as it is measured with a higher RBW of 300 kHz. All other measurements were conducted in nature with a 20 db external attenuator.

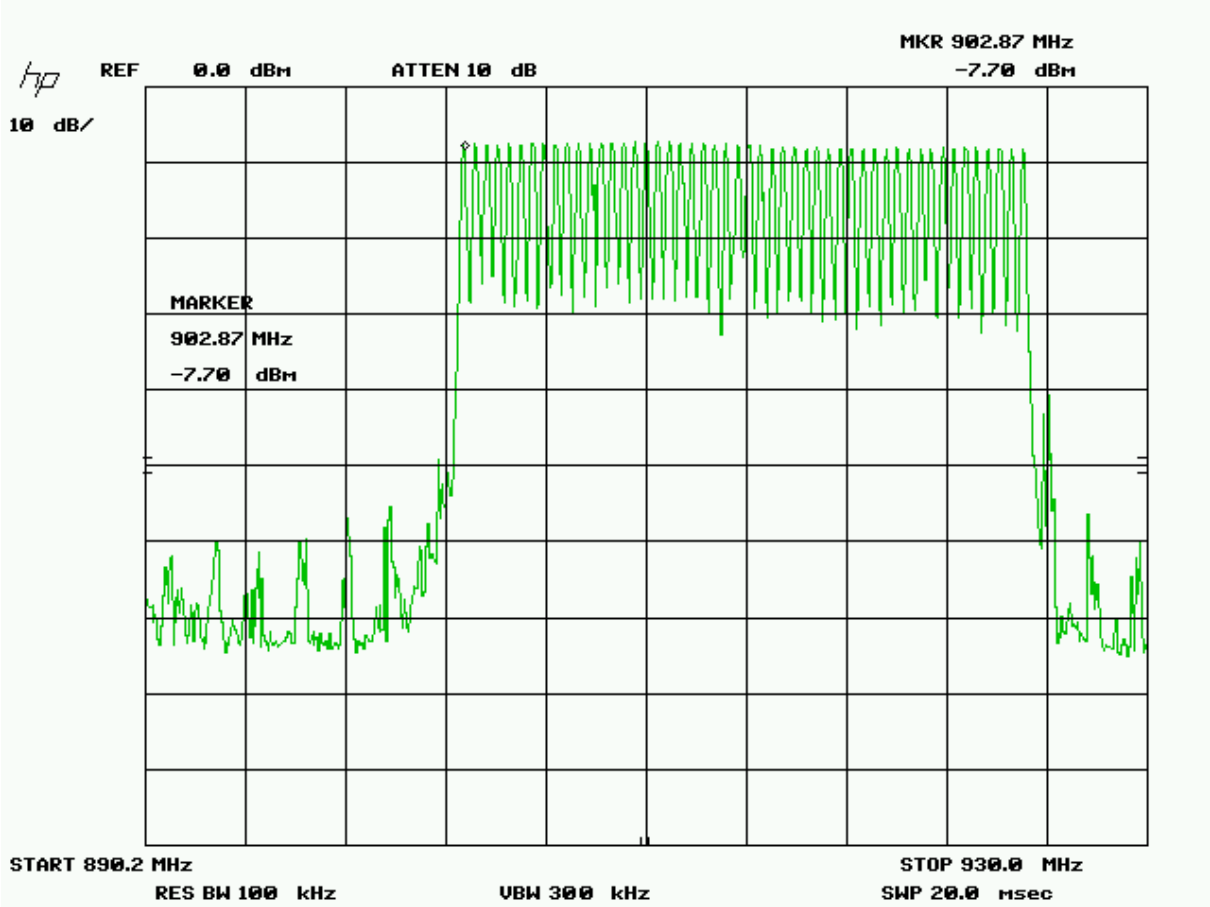
900 MHz – 2.5 GHz



2.5 GHz – 10 GHz



-20 dbc rule for out of band emissions



Note: The peak power shown here is raw data and no factors are applied to the reading.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
IFR Spectrum Analyzer	AN940	IFR	May 4/2006	May 4/2008	GEMC 6350
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Frequency Allocation Use for Frequency Hopping Systems

Purpose

The purpose of this test is to ensure that the RF energy of frequency hopping systems is within the allocated band. If the lowest frequency used is lower then the lower 'band edge' frequency, then band edge measurements must be performed as part of the unintentional radiated limits. If the highest frequency used is higher then the upper 'band edge' frequency, then band edge measurements must be performed as part of the unintentional radiated limits. The upper and lower frequency limit is calculated by using detector BW used to measure the unintentional emissions at the lower and upper frequencies.

This also helps prevent unintentional interference with other devices.

Limits

The limits are as defined in 47 CFR FCC Part 15 Section 15.247

	902 to 928 MHz	2.4 to 2.4835 GHz	5.275 to 5.85 GHz
15.209 Detector BW	120 kHz	1 MHz	1 MHz
Band edge	902.12 to 927.88 MHz	2.401 MHz to 2.4825 GHz	5.276 to 5.849 GHz

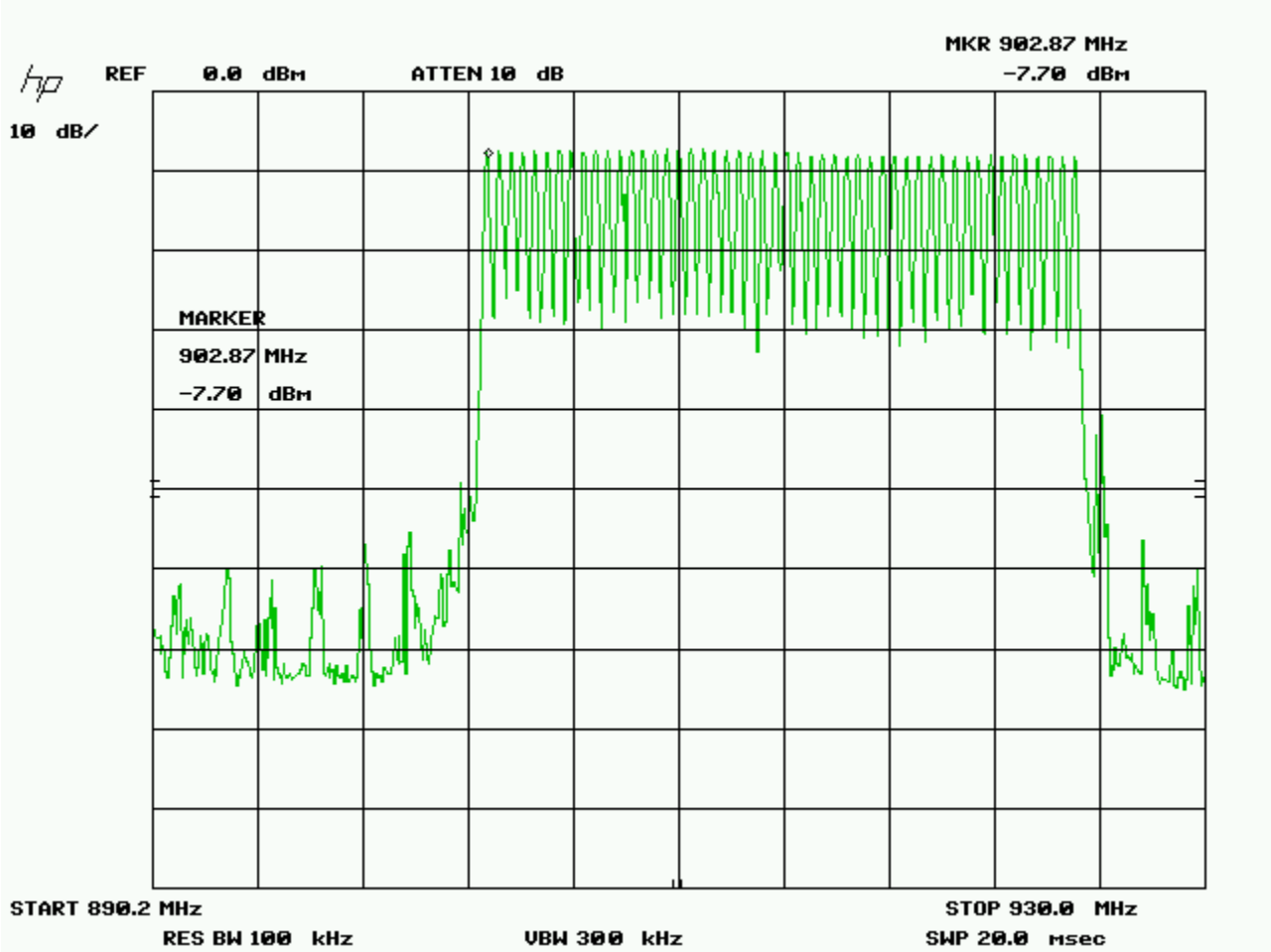
Results

The EUT passed the requirements without requiring radiated emissions band edge measurements.

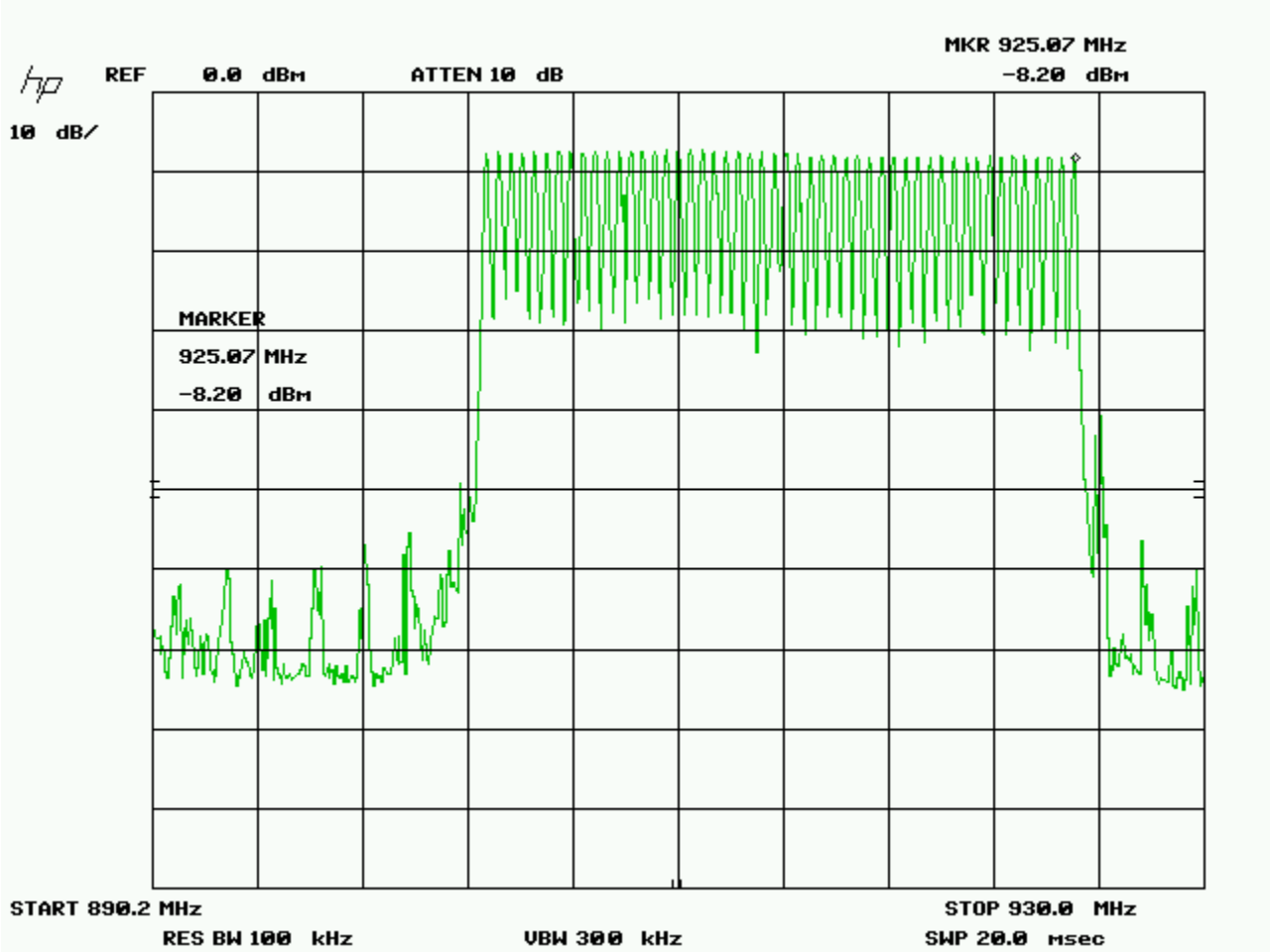
Graph(s)

The graphs shown below show the start frequency and the stop frequency of the occupied channels during normal operation of the EUT.

Start Frequency 902.87 MHz



Stop Frequency 925.07 MHz



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40

Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Maximum Permissible Exposure

Purpose

The purpose of this test is to ensure that the RF energy intentionally transmitted, in terms of power density emitted from the EUT at a stated operating distance does not exceed the limits listed below as defined in the applicable test standard, as calculated based upon readings obtained during testing. This helps protect human exposure to excessive RF fields.

Limit(s) and Method

The limits, as defined in FCC 15.247(i) and FCC 1.1310 Table 1 (A) limits for occupational/controlled exposure was applied. The limit for the frequency range of <300 MHz to 1500 MHz is f/300 mW/cm^2,> where f is the frequency in MHz. For a worst case limit, the lowest frequency used was for limit calculation purposed. The limit was calculated to be 900/300, or 3.0 mW/cm^2. The distance used for calculations was 2.5cm, as this is the minimum distance an operator will be from the EUT during normal operation.

Measurement Uncertainty

Measurement uncertainty does not apply to this requirement, as this is a calculated result based upon readings obtained. The measurement uncertainty of this calculation can be approximated by the measurement uncertainty of the peak power, combined with the measurement uncertainty of the antenna gain, which was not available at the time of evaluation.

Results

The EUT passed the requirements. The worst case calculated power density was 0.059 mW/cm^2 this is under the 3.0 mW/cm^2 requirement.

Calculations

Method 1 (conducted power)

$P_d = (P_t * G) / (4 * pi * R^2)$
Where Pt = 8.0 dBm or 6.3 mW as per Peak power conducted output
Where G = -1.8 dB, or numerically 0.66
Where R = 2.5 cm

$P_d = (6.3 \text{ mW} * 0.66) / (4 * pi * 2.5\text{cm}^2)$
$P_d = 4.158 \text{ mW} / 78.53 \text{ cm}^2$

$P_d = 0.053$ mW/cm^2

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2006-08-09	2007-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2007-08-07	GEMC 7
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Pre-Amplifier	PA-2.5-26	Vican	2006-09-12	2007-09-12	GEMC 9
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev1.doc"

Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

General EUT Description

Manufacturer	Atlas Polar Company Limited 60 Northline Rd., Toronto ON M4B 3E5 Canada
EUT Name	Polar 9900 Radio remote
Equipment Category (Commercial / Residential / Medical)	Industrial use RF transmitter.
Input Voltage and Frequency	Battery operated
Intentional RF (If yes describe)	Yes – 902 to 928 MHz FHSS
Table Top / Wall mount / Floor standing (choose table top if unsure)	Body worn.
I/O Connectors available on EUT	None
Peripherals required for test	No peripherals are needed to exercise the EUT.
Minimum Separation distance from operator	2.5 cm
Types and lengths of all I/O cables	None

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT & Test Setup Photographs'.

EUT Functional Description

EUT Configuration

The unit is battery operated and talks to a receiver in the vicinity. During all testing the transmitter emissions and measurements were verified. FCC 15 Subpart B unintentional radiations were measured for the receiver operating in listening mode. These results are included in the spurious emissions section.

Operational Setup

For medium, low and high channel measurements software was available such that the transmitter could to be tuned to those frequencies.

For spurious emissions, number of channels occupied, frequency allocation radiated tests were performed. For all other tests an SMA connector was provided by the manufacturer on the output of the antenna port and all other tests were carried out using conducted measurements.

RF transmit operation is enabled when battery is connected and unit is powered on.

Test Signals Required For Test

The following patterns or signals were generated during test by the peripherals as described above to exercise the EUT during testing.

None required.

Modifications Required for Compliance

No modifications were required.

Appendix B – EUT and Test Setup Photographs

Note: These photos are for information purposes only. Also refer to PDF files that are separate from this test report.

Figure 1: EUT

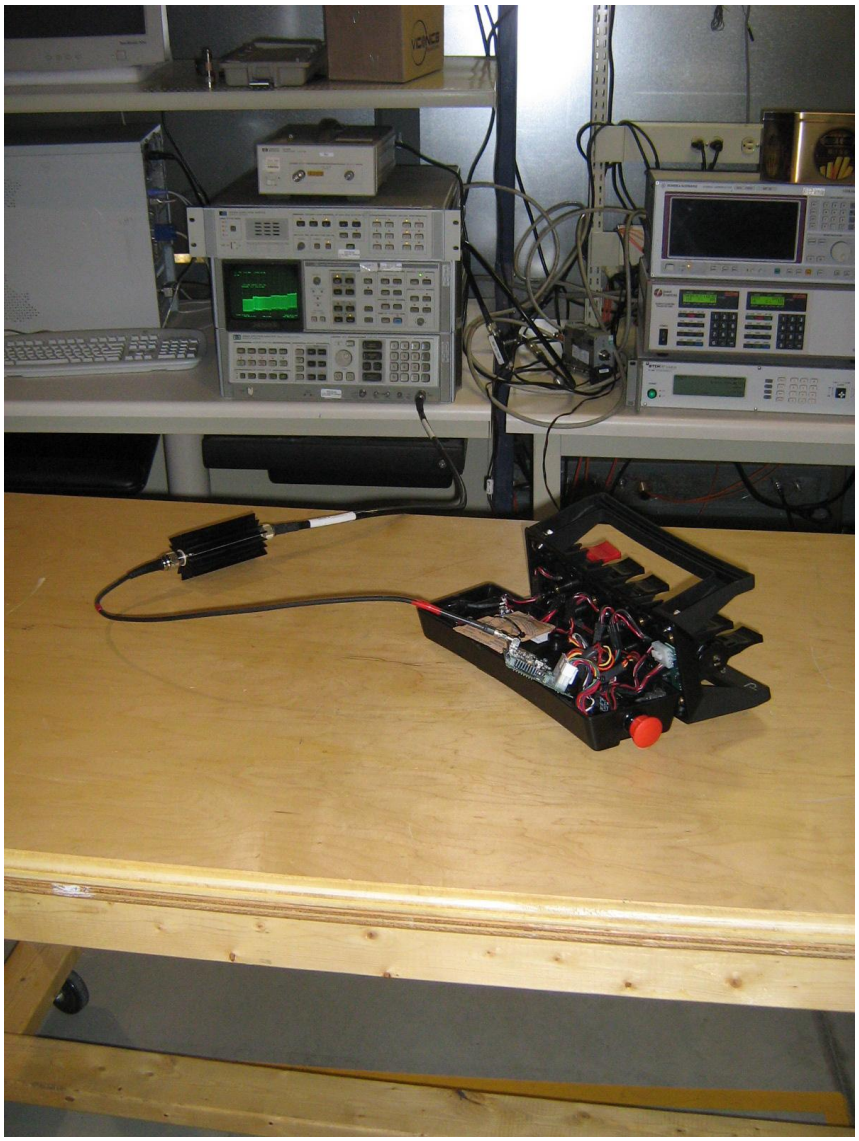


Figure 2: Conducted test setup

Figure 3: Radiated emissions