Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 210 Issue 7:2007

&

FCC Part 15 Subpart C:2008

Unlicensed Intentional Radiators

On the

AV Shadow – AV8001

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Testing produced for

Unify4life

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 AV Shadow AV8001 Bluetooth module, 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 7:2007/ FCC Part 15 Subpart C 15:2008

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	Unify4Life
Product	AV8001
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2008

Summary

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

EUT FCC Certification #, FCC ID:	WOQAV8001
EUT Industry Canada Certification #, IC:	7987AAV8001
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Ashwani Malhotra

Client	Unify4Life
Product	AV8001
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2008

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 (Table 1)	Restricted Bands for intentional operation	QuasiPeak Average	Pass
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-210 (Table 2)	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.247(a)1 RSS-210 A8.2(a)	Channel Separation	2/3 of 20 dB Bandwidth or 25 kHz	Pass
FCC 15.247(a)1(iii) RSS-210 A8.2(a)	Number of channels and Occupancy time	Minimum 15 channels and 0.4s X number of channels	Pass
FCC 15.247(b)1 RSS-210 A8.4(4)	Max output power	< 125 mW	Pass
FCC 15.247(b)(4) RSS-210 A8.4(5)	Antenna Gain	< 6 dBi	Pass
FCC 15.247(d) RSS-210 A8.5	Antenna conducted spurious	< 20 dBc	Pass
FCC 15.247(f) RSS-210	Hybrid System requirements.	NA	Pass See justification and calculations
FCC 15.247(i) IC Safety code 6	Maximum Permissible Exposure	> 20 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 unit uses and internal PCB antenna.

For the Restricted Bands of operation, the EUT is designed to only operate between 2402 – 2480.0MHz.

For the Antenna gain, the EUT uses a 1.5 dbi antenna. For the scope of this testing the antenna with the maximum emissions as tested in both horizontal and vertical orientation was used. The EUT was also flipped vertically and horizontally in order to obtain the maximum emissions.

For maximum permissible exposure, this device operates at less than 1 Watt at 2402 – 2480.0 MHz and is designed to operate greater than 20 cm from personnel during normal operation. No testing is required, however worst case calculated exposure compliance follows later in this report.

The EUT is not a hybrid system and FCC 15.247 (f) does not apply to it. However the 15.247 (d) requirement of power density were met and are detailed in this test report.

Test software as provided by manufacturer was set to an output power level of ``63``. This translated to an output power of 6.9 dbm conducted power.

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 - January 28th, 2009
Revision 2- February 2nd, 2009 – Included more information on Marker Delta Fail readings.
Note – This version 2 of 180620 GEMC report supersedes the report issued on January 28th in its entirety.

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)
January 12 - 16, 2009	All	AM	23-25.5ºC	39-44%	101.0 -101.2 kPa

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.

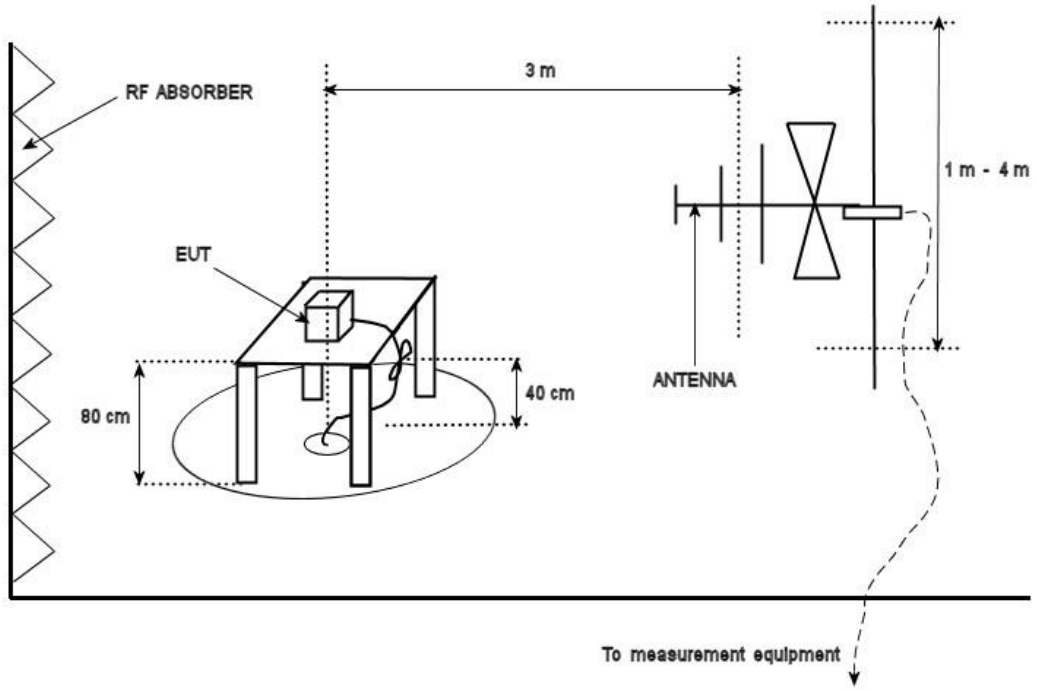
The limits, as defined in 15.247(d) for unintentional radiated emissions apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

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.

Typical Radiated Emissions Setup



Measurement Uncertainty

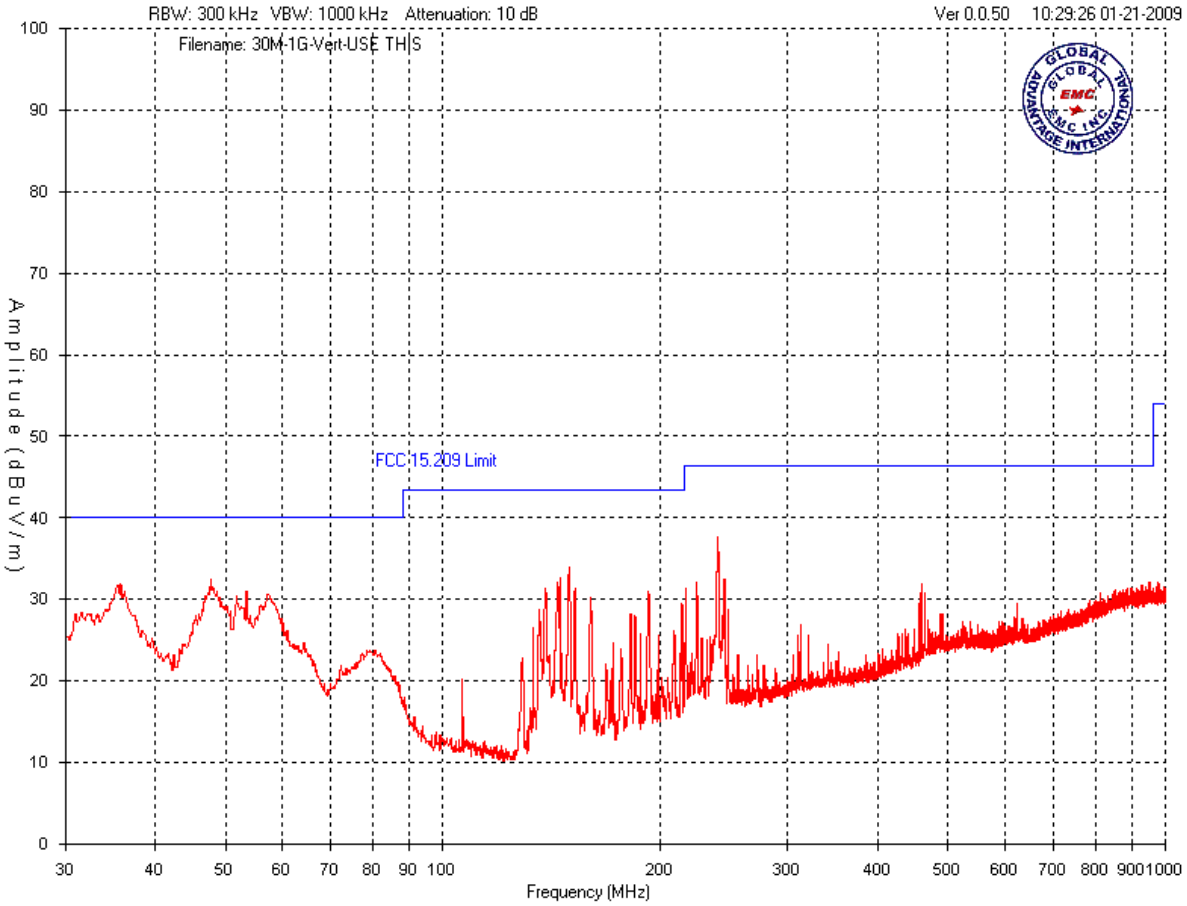
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a %95 confidence level.

Preliminary Graphs

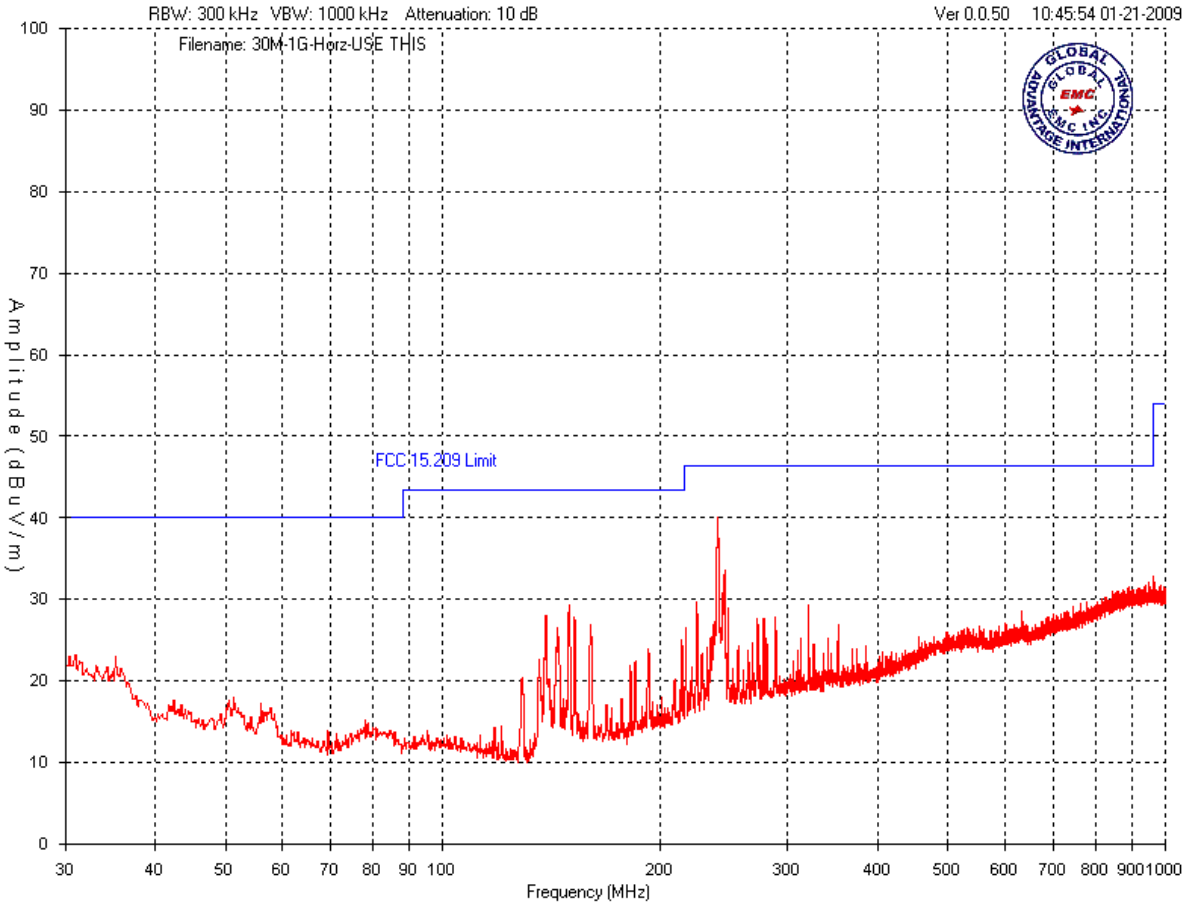
Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater then the final 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 25 GHz.

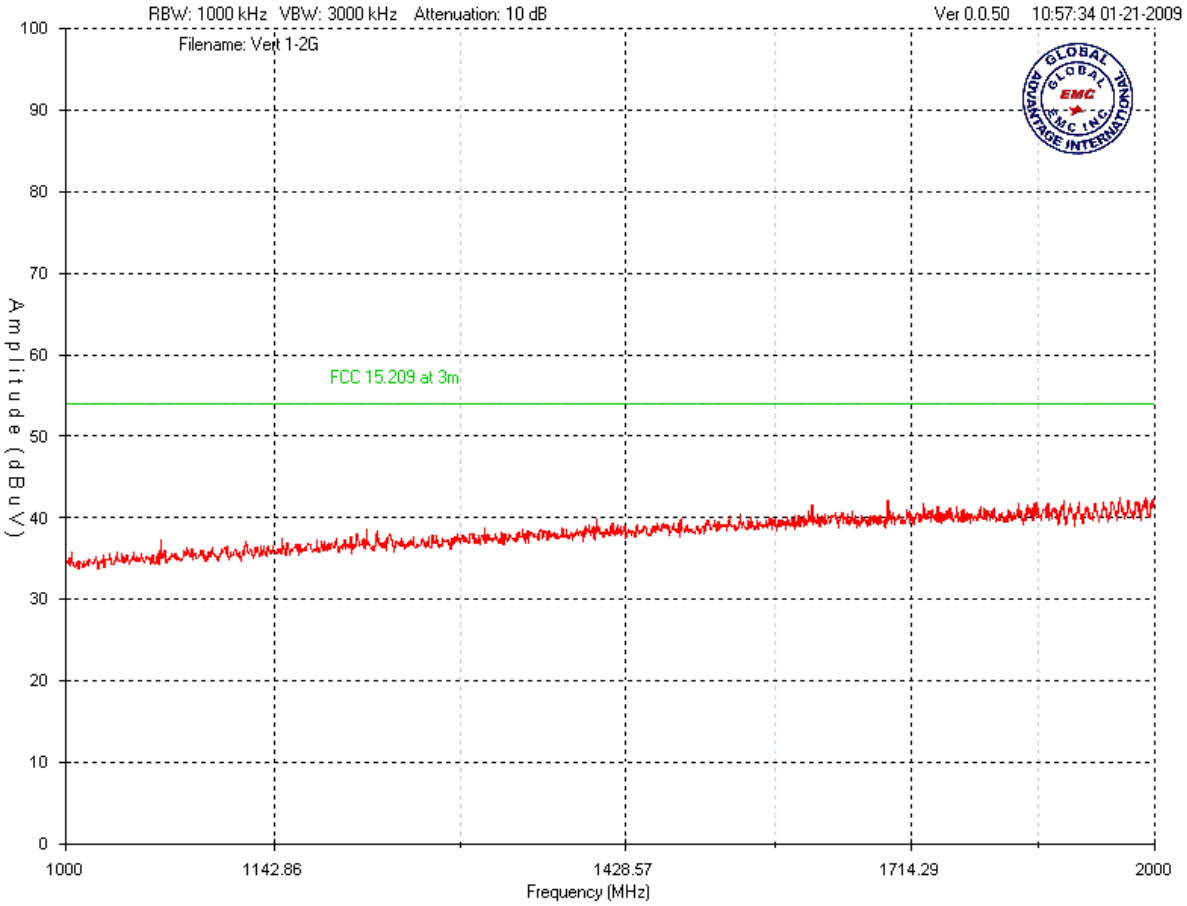
Low Channel – 30MHz – 1 GHz
Vertical – Peak Emissions Graph



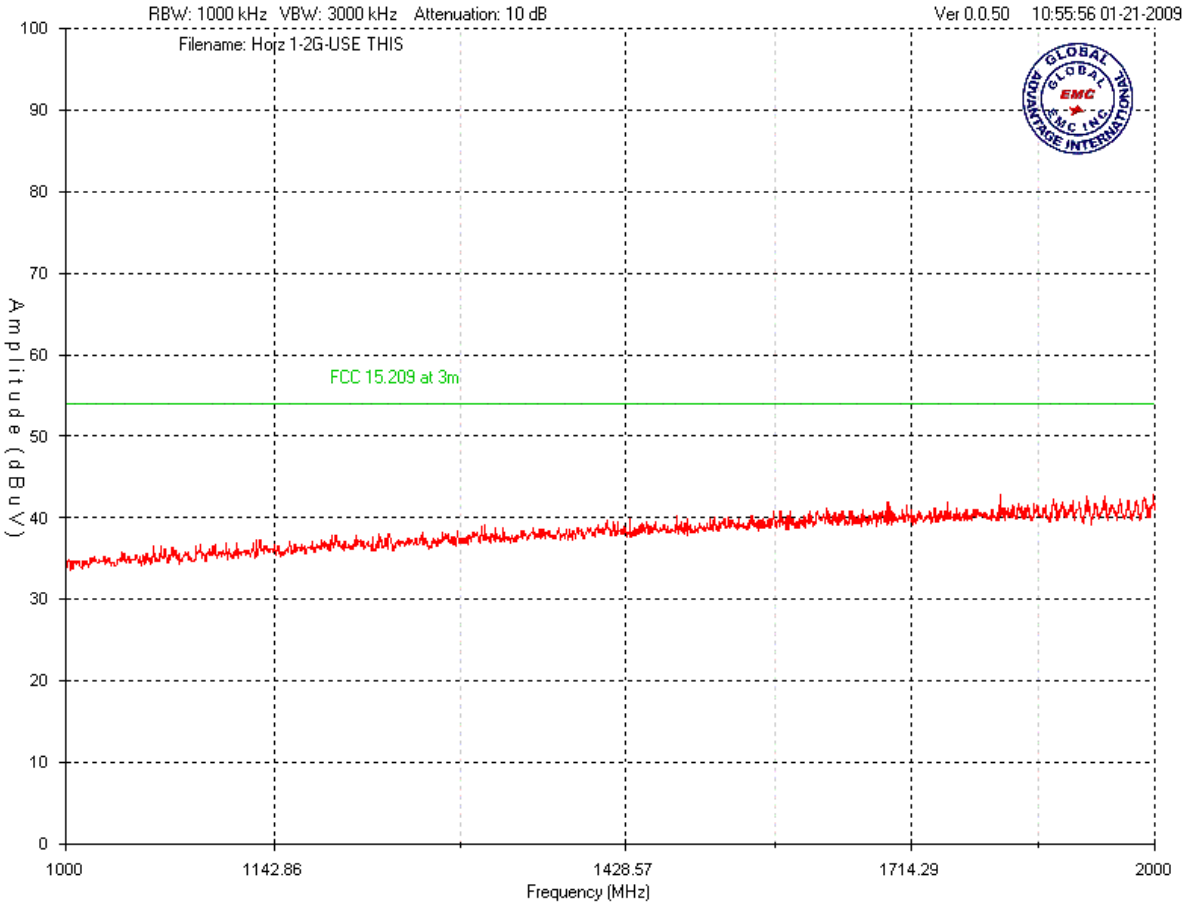
Low Channel – 30MHz – 1 GHz
Horizontal – Peak Emissions Graph



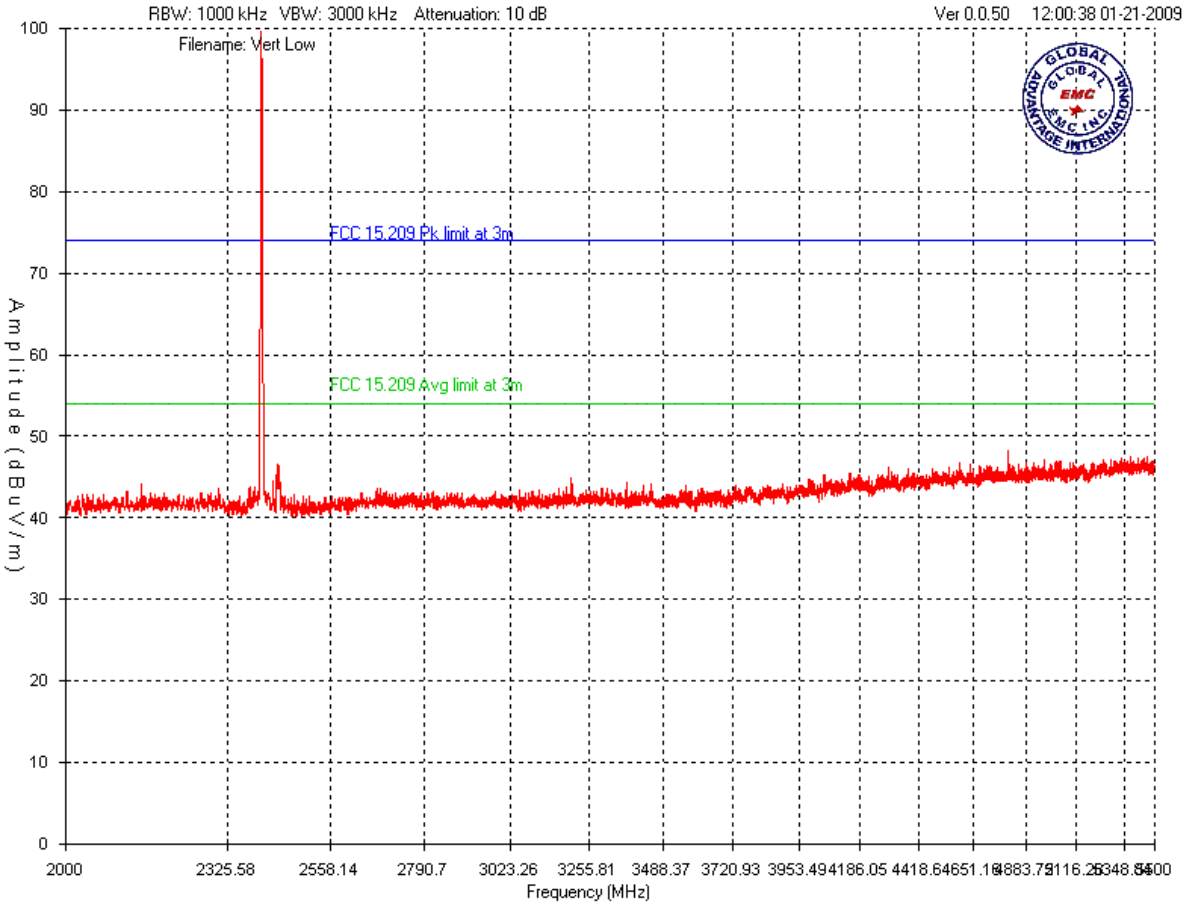
Low Channel – 1 – 2 GHz
Vertical – Peak Emissions Graph



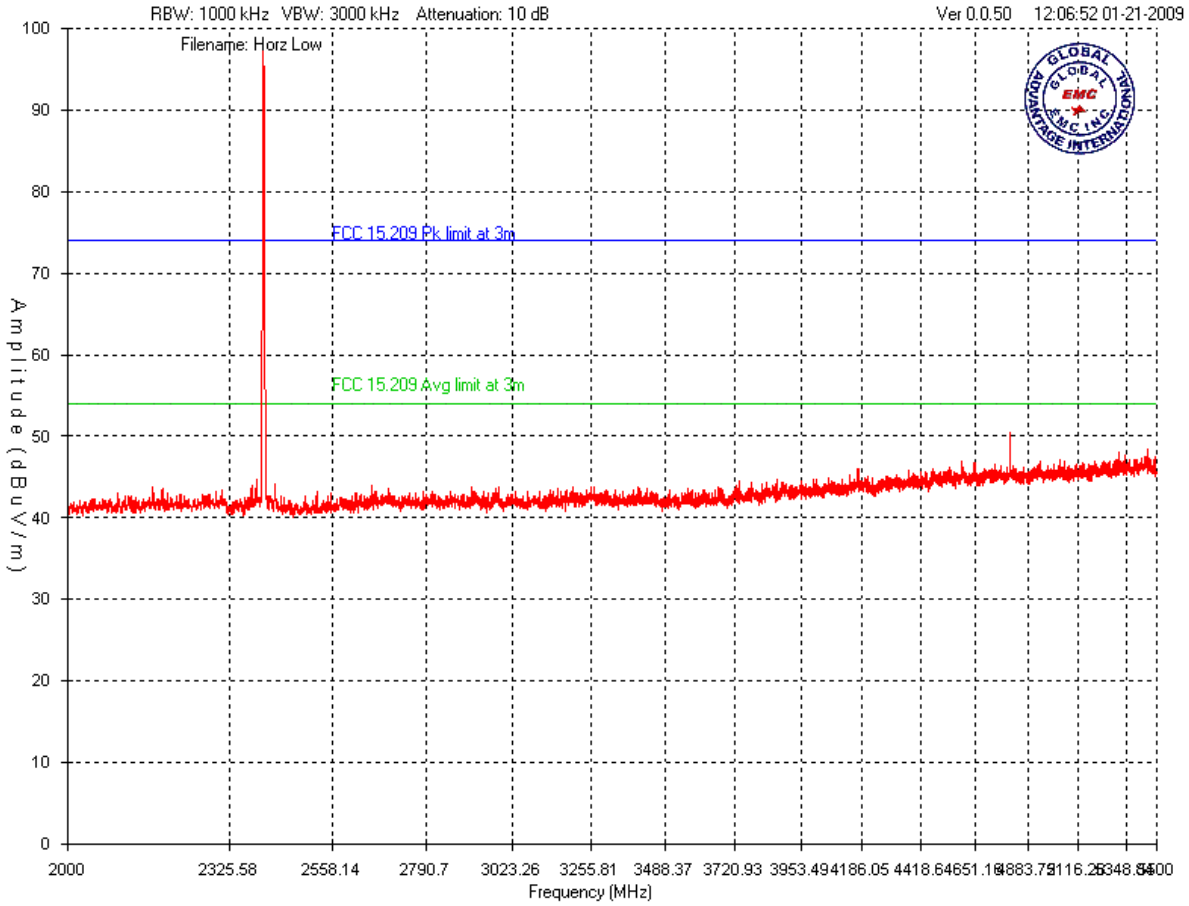
Low Channel – 1 – 2 GHz
Horizontal – Peak Emissions Graph



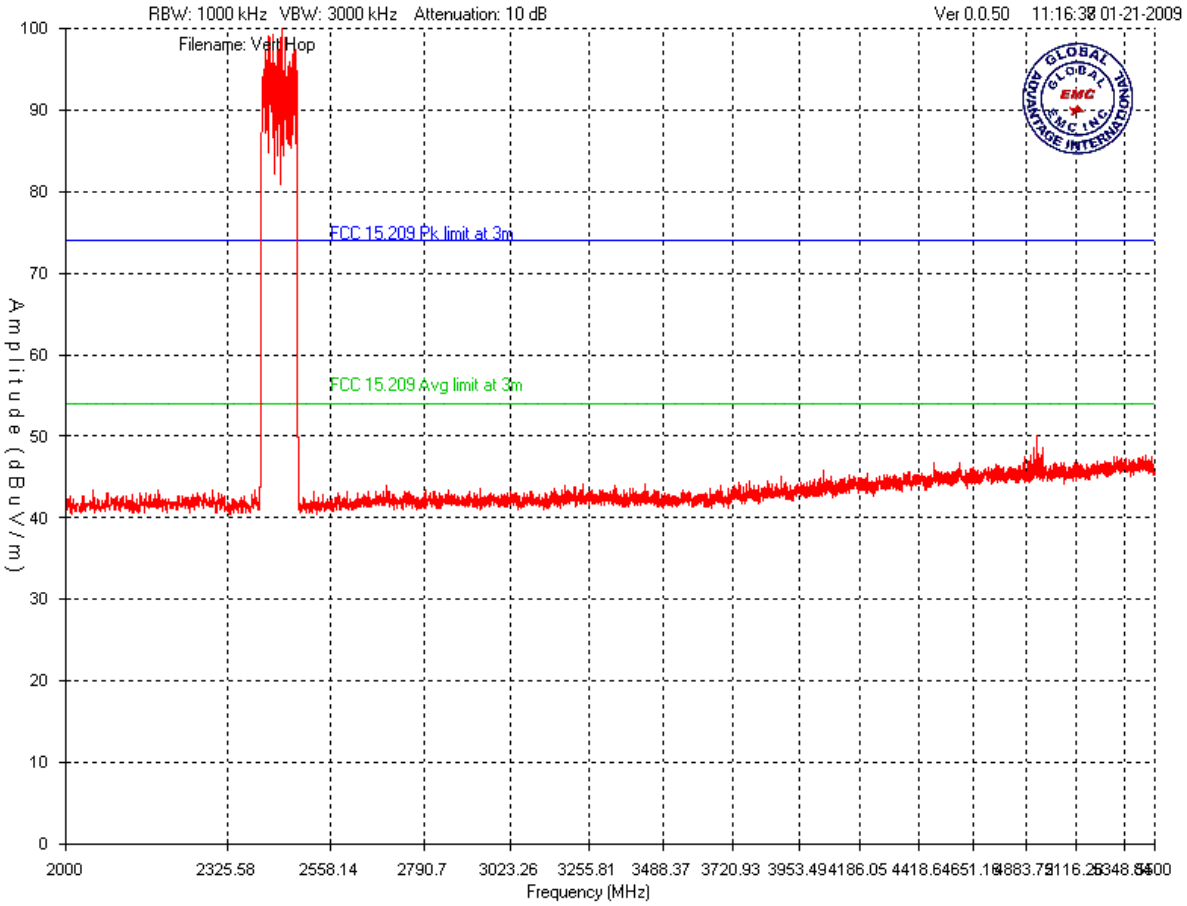
Low Channel – 2-5 GHz
Vertical – Peak Emissions Graph



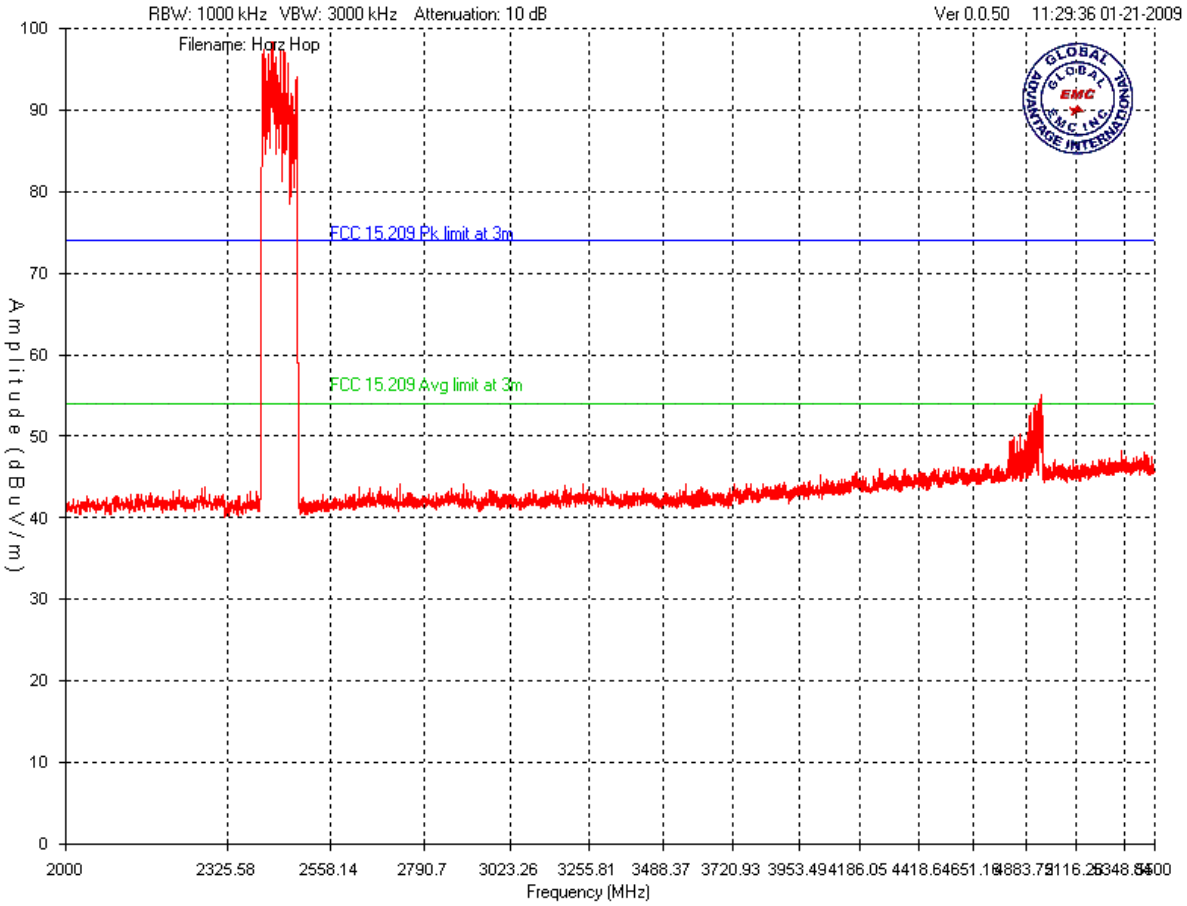
Low Channel – 2-5 GHz
Horizontal – Peak Emissions Graph



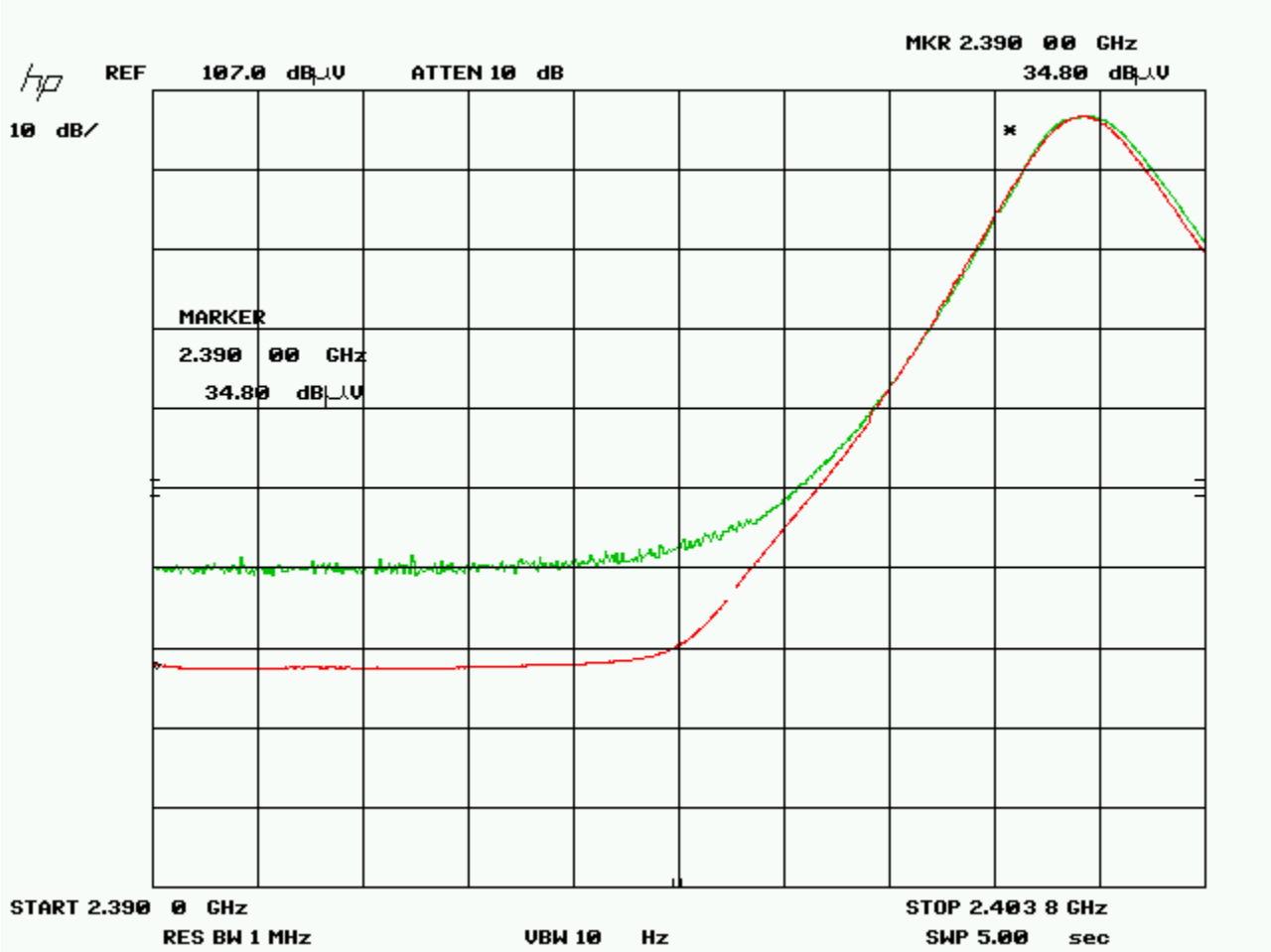
Hop mode – 2-5 GHz
Vertical – Peak Emissions Graph



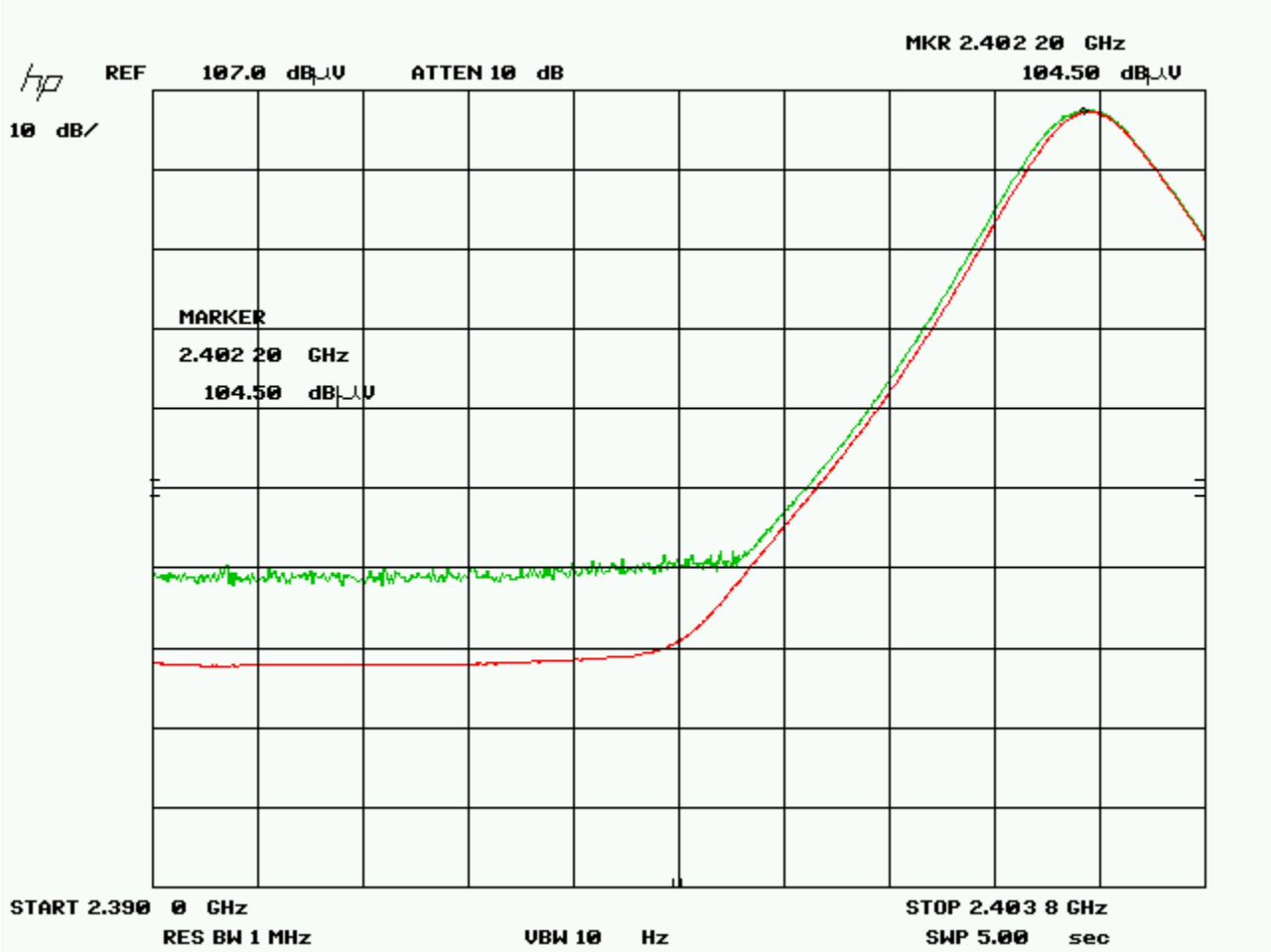
Hop mode – 2-5 GHz
Horizontal – Peak Emissions Graph



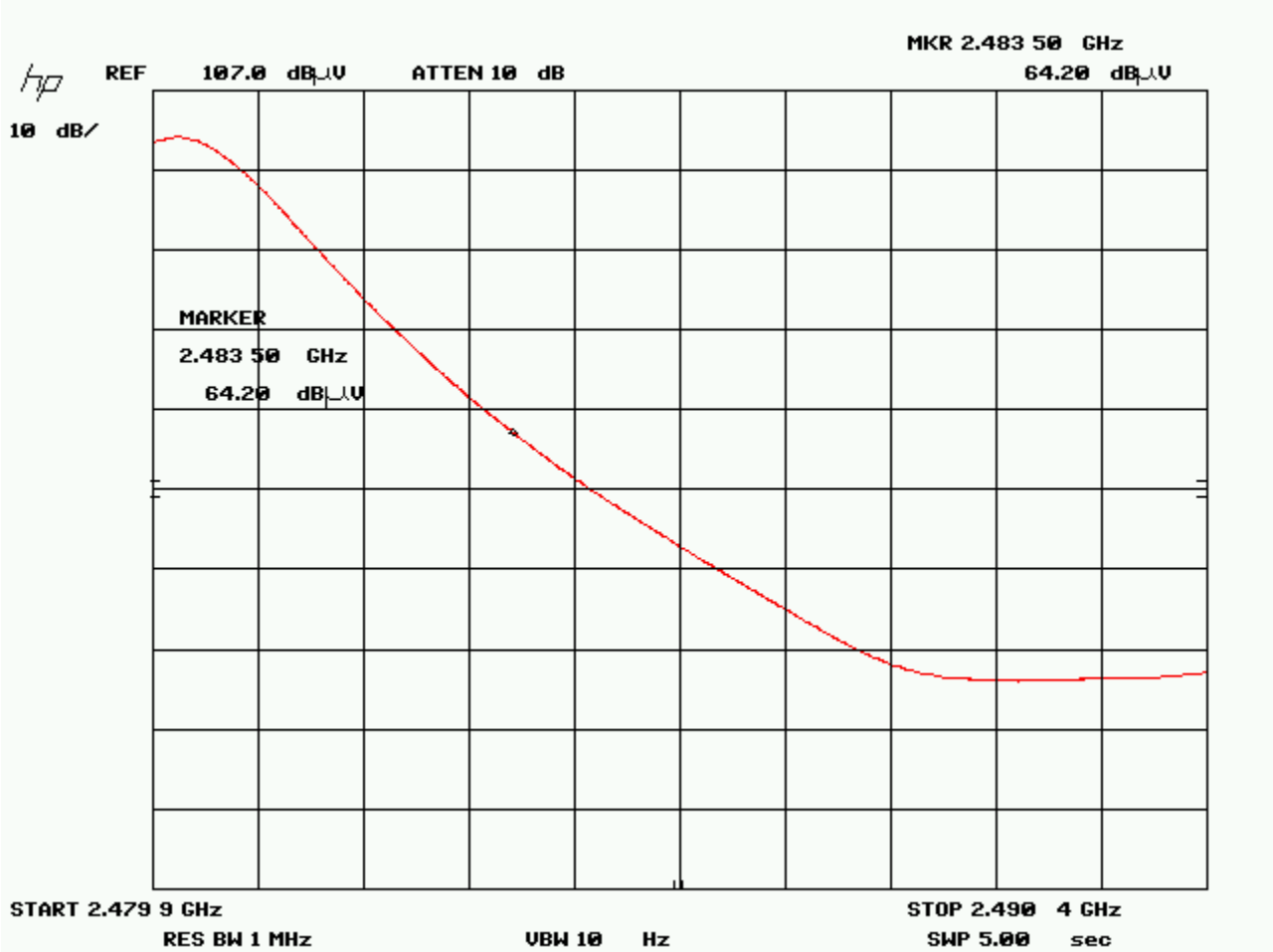
Band Edge – Low channel
Vertical peak and Avg emissions



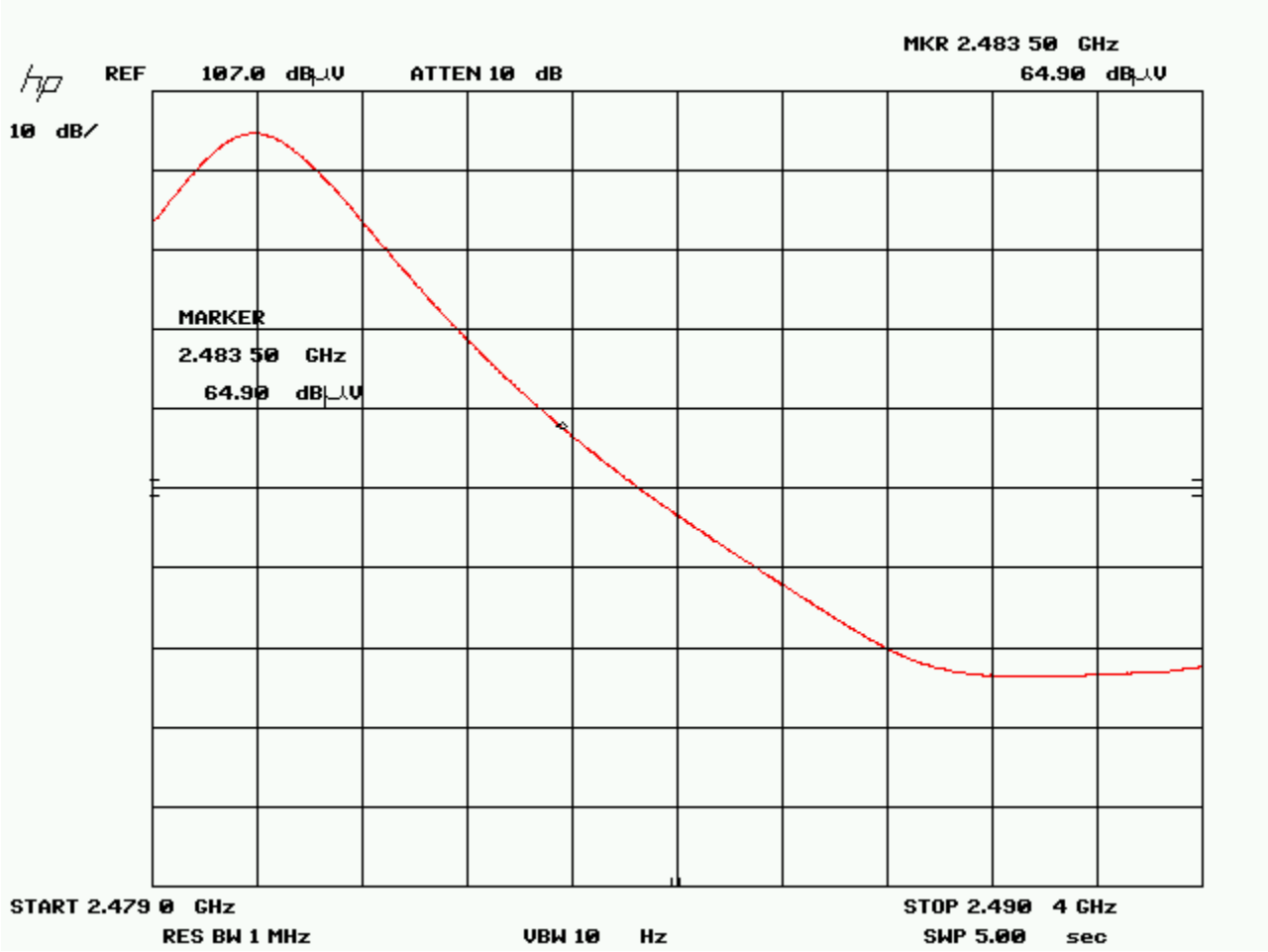
Band Edge – Low channel
Horizontal peak and Avg emissions



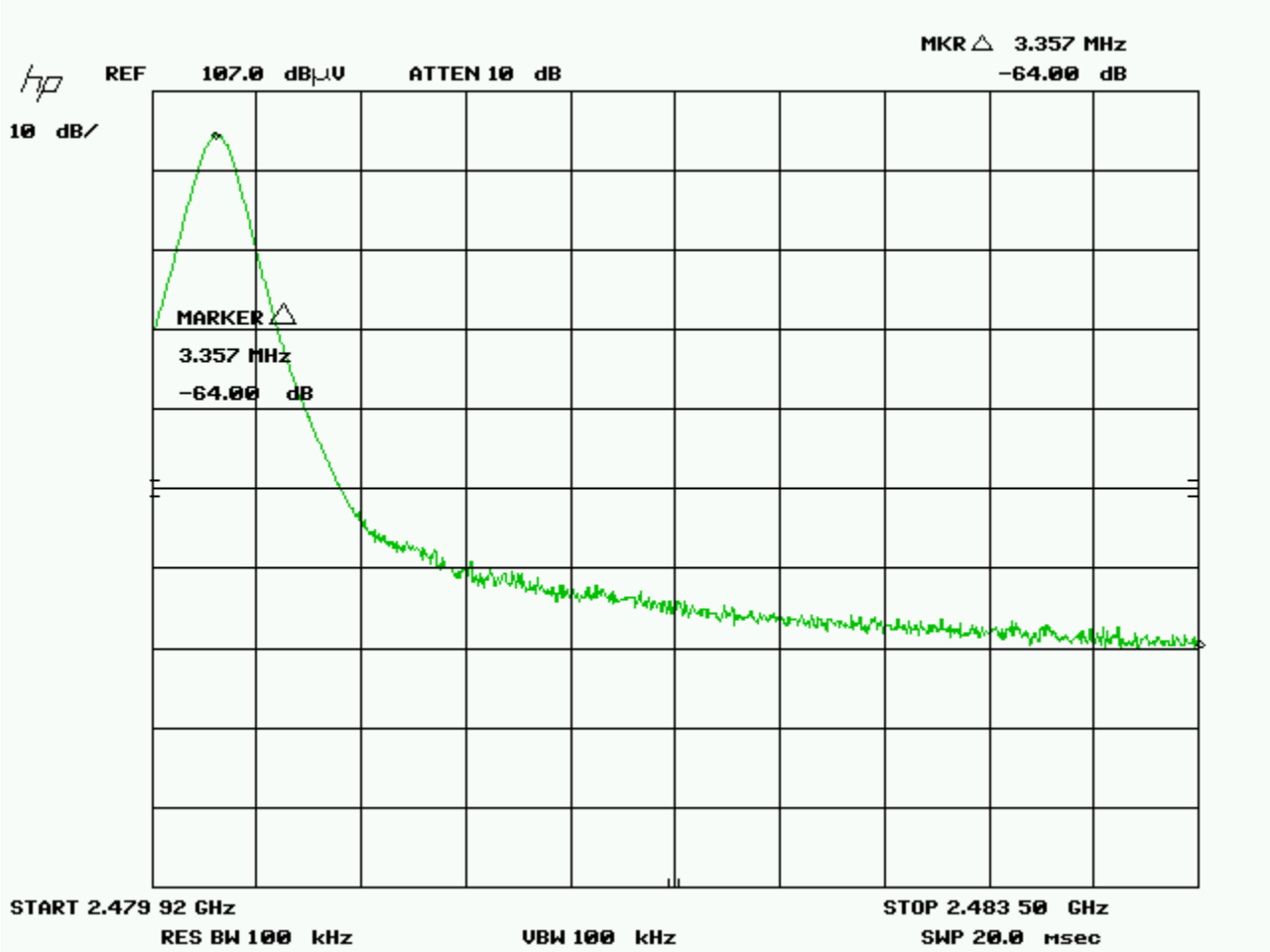
Band Edge – Hi channel
Horizontal Avg emissions
Conventional method



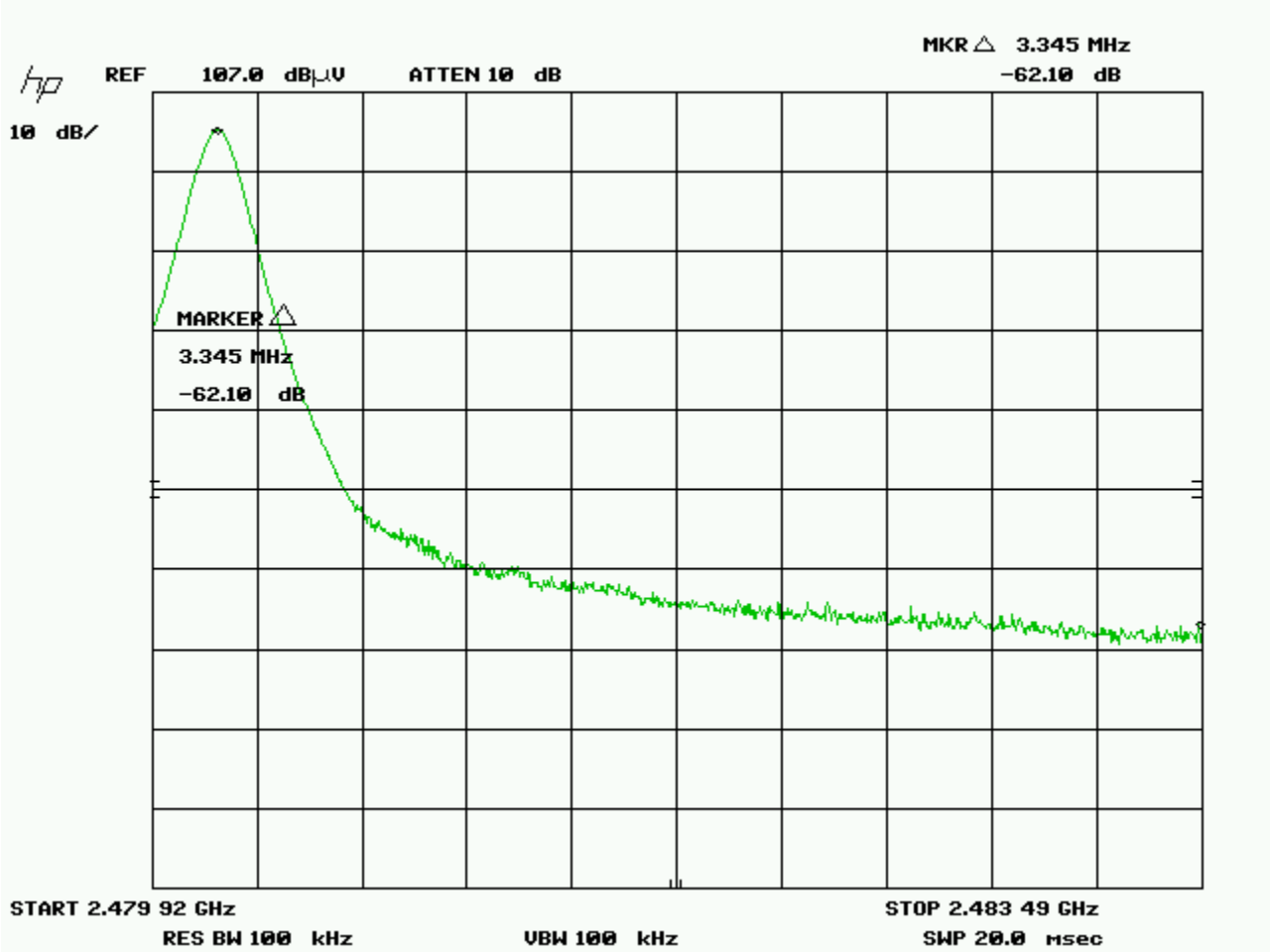
Band Edge – Hi channel
Vertical Avg emissions



Band Edge – Hi channel
Horizontal Avg emissions
Marker Delta (Delta)

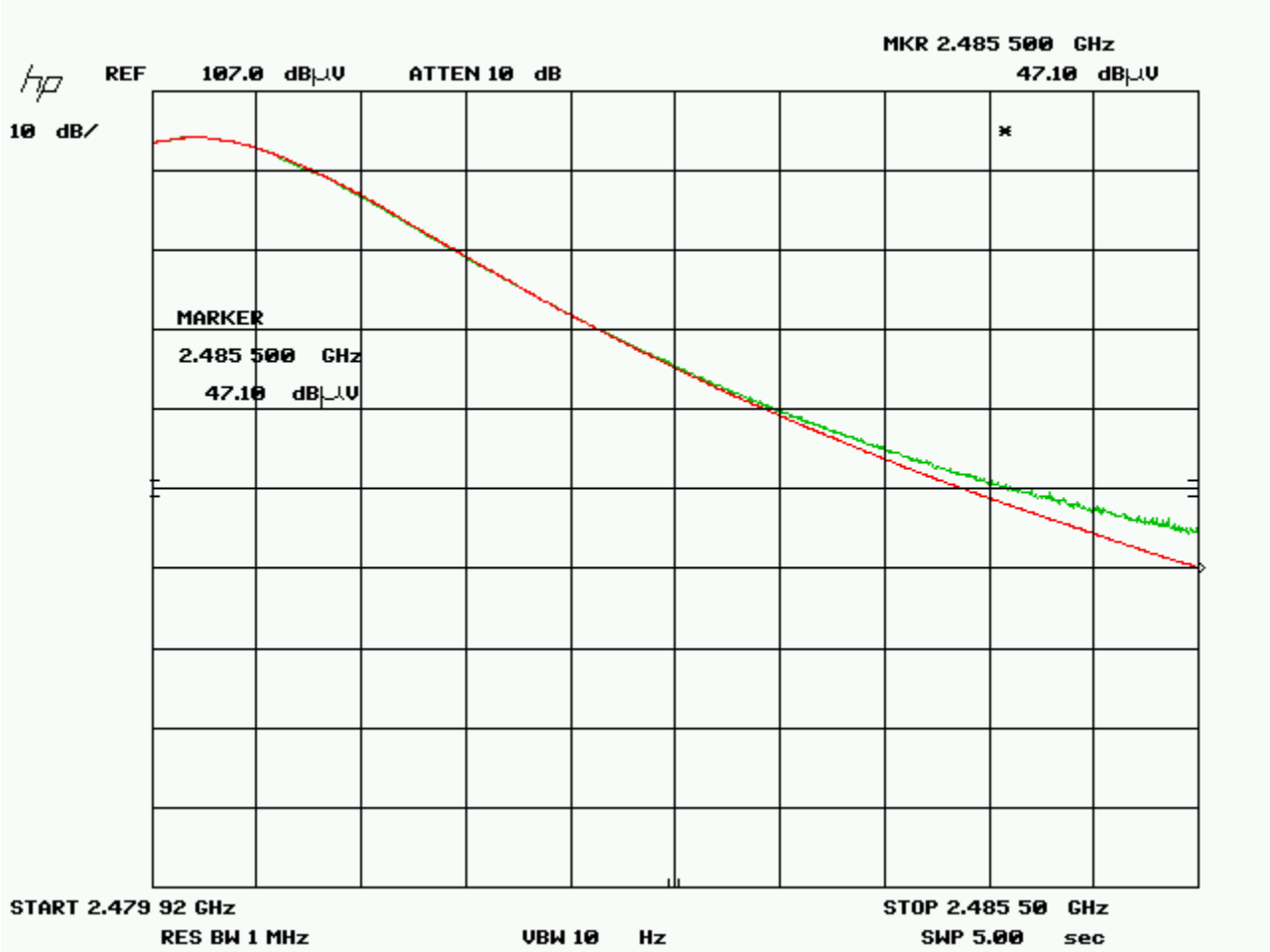


Band Edge – Hi channel
Vertical Avg emissions
Marker Delta (Delta)



Band Edge – Hi channel
Vertical peak and avg emissions
2485.5 MHz

Band Edge – Hi channel
Horizontal peak and avg emissions
2485.5 MHz



Final Measurements

Note:

1. For emissions at hi channel the unit did not meet the band edge requirements using conventional measurement technique. In vertical orientation an averaged raw signal of 64.9 dbuV was recorded which results in a field strength of 63.9 dbuV/m i.e. 9.9 db Fail. In horizontal orientation an averaged signal of 64.2 dbuV was recorded which results in a field strength of 63.2 dbuV/m i.e. 9.2 db Fail. As a result the Marker Delta method was used and the test data is shown below. Peak and Average measurements were also verified at 2MHz outside the band edge i.e. at 2485.5 MHz using the conventional method in order to show compliance.
2. 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.

Marker Delta tests –

1. For radiated emissions vertical orientation the marker delta method was used for band edge measurements. The average emission recorded resulted in violation of limit.
2. The delta between peak and band edge at RBW = 100 kHz was 64.0 db. This lead to a measured signal of 100.2 – 64.0 = 36.2 dbuV/m i.e. 17.8 db margin.

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

Some of the frequencies shown on the peak graph do 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 103.5 dBuV/m at 3 meters, and none of the unintentional radiated emissions that fall outside of the restricted bands exceeded the -20dBc (or 83.5 dBuV/m) requirement.

Worst case plots are shown above. Highest readings were recorded in Low channel and Hop mode is also shown in the above plots.

See 'Spurious Antenna Conducted Emissions' measurements for -20 dBc requirements. No other emissions above the 2nd harmonic were detected.

Client	Unify4Life
Product	AV8001
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2008

Radiated Emissions Measurements

Product category	Class A Group 1
Project Name / Number	Bluetooth Module

Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Preselecor	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Hi Channel - EUT Vertical Tested at 63 setting in sw											
2480	Peak	Horz	101.7	31.0	4.0	0.0	36.0	100.7			PASS
2480	Avg	Horz	101.2	31.0	4.0	0.0	36.0	100.2			PASS
2480	Peak	Vert	102.7	31.0	4.0	0.0	36.0	101.7			PASS
2480	Avg	Vert	101.7	31.0	4.0	0.0	36.0	100.7			PASS
2483.5	Peak	Horz Conventional method	65.2	31.0	4.0	0.0	36.0	64.2	74.0	9.8	PASS
2483.5	Avg	Horz Conventional method	64.2	31.0	4.0	0.0	36.0	63.2	54	-9.2	FAIL
2483.5	Peak	Vert	66.2	31.0	4.0	0.0	36.0	65.2	74.0	8.8	PASS

		Conventional method									
2483.5	Avg	Vert Conventional method	64.9	31.0	4.0	0.0	36.0	63.9	54	-9.9	FAIL
2483.5	Peak	Horz Using Marker Delta	37.7	31.0	4.0	0.0	36.0	36.7	74.0	37.3	PASS
2483.5	Avg	Horz Using Marker Delta	37.2	31.0	4.0	0.0	36.0	36.2	54	17.8	PASS
2483.5	Peak	Vert Using Marker Delta	40.6	31.0	4.0	0.0	36.0	39.6	74.0	34.4	PASS
2483.5	Avg	Vert Using Marker Delta	39.6	31.0	4.0	0.0	36.0	38.6	54	15.4	PASS
2485.5	Peak	Horz	52.1	31.0	4.0	0.0	36.0	51.1	74.0	22.9	PASS
2485.5	Avg	Horz	47.1	31.0	4.0	0.0	36.0	46.1	54	7.9	PASS
2485.5	Peak	Vert	52.6	31.0	4.0	0.0	36.0	51.6	74.0	22.4	PASS
2485.5	Avg	Vert	47.6	31.0	4.0	0.0	36.0	46.6	54	7.4	PASS
4960	Peak	Horz	55.4	31.6	4.0	0.0	35.7	55.3	74.0	18.7	PASS
4960	Avg	Horz	50.9	31.6	4.0	0.0	35.7	50.8	54.0	3.2	PASS
4960	Peak	Vert	47.9	31.6	4.0	0.0	35.7	47.8	74.0	26.2	PASS
4960	Avg	Vert	38.7	31.6	4.0	0.0	35.7	38.6	54.0	15.4	PASS
Hopping - EUT Vertical Tested at 63 setting in sw											
2480	Peak	Horz	101.1	31.0	4.0	0.0	36.0	100.1			PASS
2480	Avg	Horz	38.0	31.0	4.0	0.0	36.0	37.0			PASS

2480	Peak	Vert	102.2	31.0	4.0	0.0	36.0	101.2			PASS
2480	Avg	Vert	37.6	31.0	4.0	0.0	36.0	36.6			PASS
2483.5	Peak	Horz	67.7	31.0	4.0	0.0	36.0	66.7	74.0	7.3	PASS
2483.5	Avg	Horz	33.0	31.0	4.0	0.0	36.0	32.0	54	22.0	PASS
2483.5	Peak	Vert	68.7	31.0	4.0	0.0	36.0	67.7	74.0	6.3	PASS
2483.5	Avg	Vert	33.6	31.0	4.0	0.0	36.0	32.6	54	21.4	PASS
4955	Peak	Horz	54.8	31.6	4.0	0.0	35.7	54.7	74.0	19.3	PASS
4960	Avg	Horz	32.4	31.6	4.0	0.0	35.7	32.3	54.0	21.7	PASS
4948	Peak	Vert	46.9	31.6	4.0	0.0	35.7	46.8	74.0	27.2	PASS
4960	Avg	Vert	34.8	31.6	4.0	0.0	35.7	34.7	54.0	19.3	PASS
2402	Peak	Horz	101.0	31.0	4.0	0.0	36.0	100.0			PASS
2402	Avg	Horz	37.5	31.0	4.0	0.0	36.0	36.5			PASS
2402	Peak	Vert	102.8	31.0	4.0	0.0	36.0	101.8			PASS
2402	Avg	Vert	36.4	31.0	4.0	0.0	36.0	35.4			PASS
2390	Peak	Horz	47.4	31.0	4.0	0.0	36.0	46.4	74.0	27.6	PASS
2390	Avg	Horz	33.0	31.0	4.0	0.0	36.0	32.0	54.0	22.0	PASS
2390	Peak	Vert	46.5	31.0	4.0	0.0	36.0	45.5	74.0	28.5	PASS
2390	Avg	Vert	33.1	31.0	4.0	0.0	36.0	32.1	54.0	21.9	PASS
Low Channel - EUT Vertical Tested at 63 setting in sw											
2402	Peak	Horz	104.5	31.0	4.0	0.0	36.0	103.5			PASS
2402	Avg	Horz	104.3	31.0	4.0	0.0	36.0	103.3			PASS
2402	Peak	Vert	103.8	31.0	4.0	0.0	36.0	102.8			PASS

Client	Unify4Life
Product	AV8001
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2008

2402	Avg	Vert	103.7	31.0	4.0	0.0	36.0	102.7			PASS
2390	Peak	Horz	45.5	31.0	4.0	0.0	36.0	44.5	74.0	29.5	PASS
2390	Avg	Horz	35.2	31.0	4.0	0.0	36.0	34.2	54.0	19.8	PASS
2390	Peak	Vert	46.8	31.0	4.0	0.0	36.0	45.8	74.0	28.2	PASS
2390	Avg	Vert	34.8	31.0	4.0	0.0	36.0	33.8	54.0	20.2	PASS
4804	Peak	Horz	48.9	31.6	4.0	0.0	35.7	48.8	74.0	25.2	PASS
4804	Avg	Horz	43.3	31.6	4.0	0.0	35.7	43.2	54.0	10.8	PASS
4804	Peak	Vert	45.8	31.6	4.0	0.0	35.7	45.7	74.0	28.3	PASS
4804	Avg	Vert	36.0	31.6	4.0	0.0	35.7	35.9	54.0	18.1	PASS
Mid Channel - EUT Vertical Tested at 63 setting in sw											
2440	Peak	Horz	103.9	31.0	4.0	0.0	36.0	102.9			PASS
2440	Avg	Horz	103.5	31.0	4.0	0.0	36.0	102.5			PASS
2440	Peak	Vert	99.8	31.0	4.0	0.0	36.0	98.8			PASS
2440	Avg	Vert	99.6	31.0	4.0	0.0	36.0	98.6			PASS
4880	Peak	Horz	49.7	31.6	4.0	0.0	35.7	49.6	74.0	24.4	PASS
4804	Avg	Horz	41.8	31.6	4.0	0.0	35.7	41.7	54.0	12.3	PASS
4804	Peak	Vert	46.2	31.6	4.0	0.0	35.7	46.1	74.0	27.9	PASS
4804	Avg	Vert	31.3	31.6	4.0	0.0	35.7	31.2	54.0	22.8	PASS

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2007-08-09	2009-10-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2007-08-07	2009-10-07	GEMC 7
BiLog Antenna	3142-C	ETS	2007-08-06	2009-10-06	GEMC 8
Horn Antenna	6878/24	Q-Par	On file	2009-10-01	GEMC 65
1-26G pre-amp	HP 8449B	HP	On file	2009-10-01	GEMC 68
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Pre-Amplifier	PA-2.5-26	Vican	2007-09-12	2009-10-12	GEMC 9
IFR Spectrum Analyzer	AN940	IFR	2007-4-4	2009-10-4	GEMC 6350
Horn Antenna	SAS-572	AH	NCR	NCR	GEMC 6371
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 664 kHz, so a limit of 443 kHz (2/3 X 664 kHz) applies.

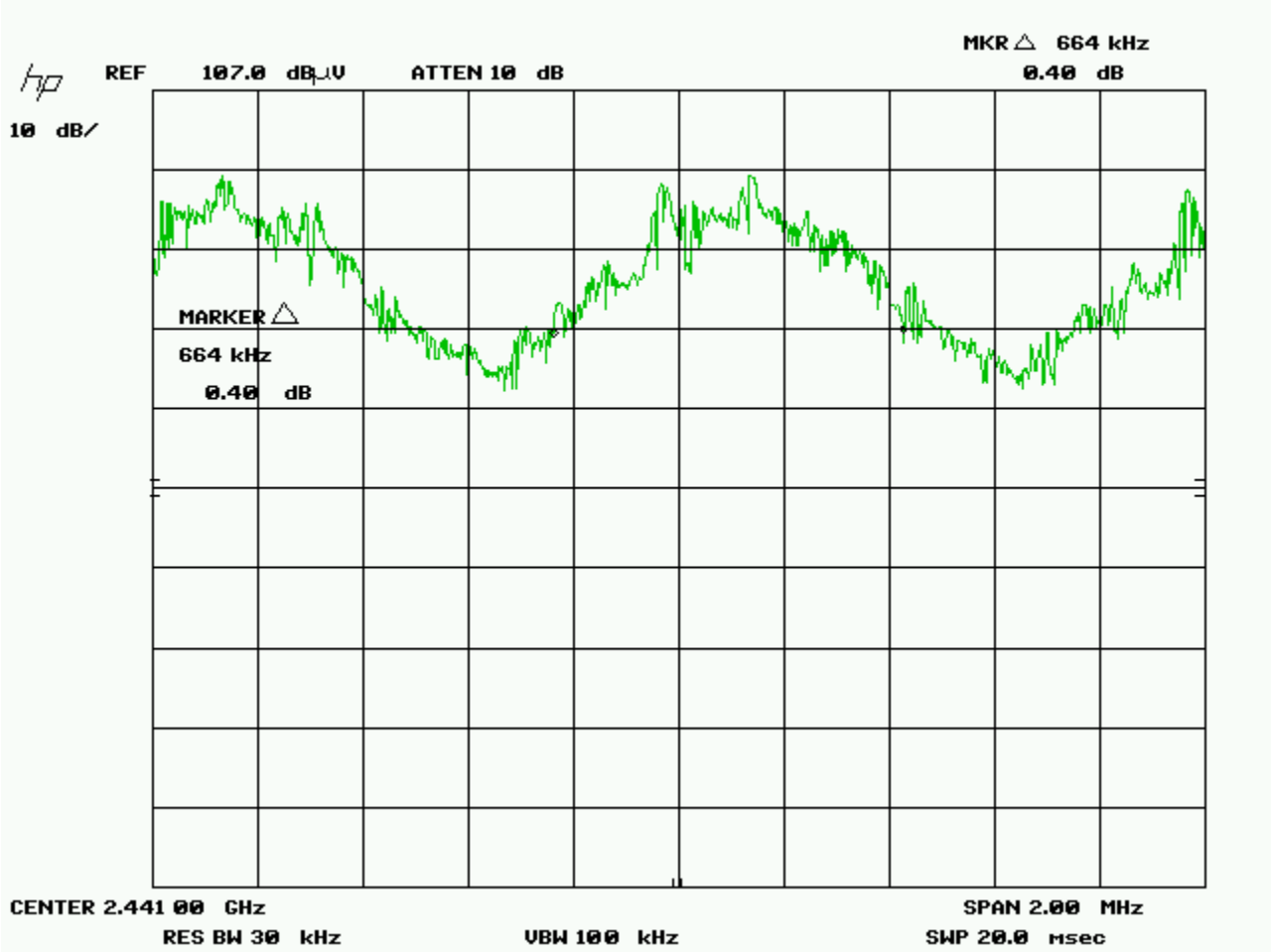
Results

The EUT passed the requirements of channel carrier spacing exceeding the measured 2/3 x 20 dB BW of the EUT. The 2/3 x 20 dB BW previously measured was 443 kHz, and the device had a channel spacing of 992 kHz.

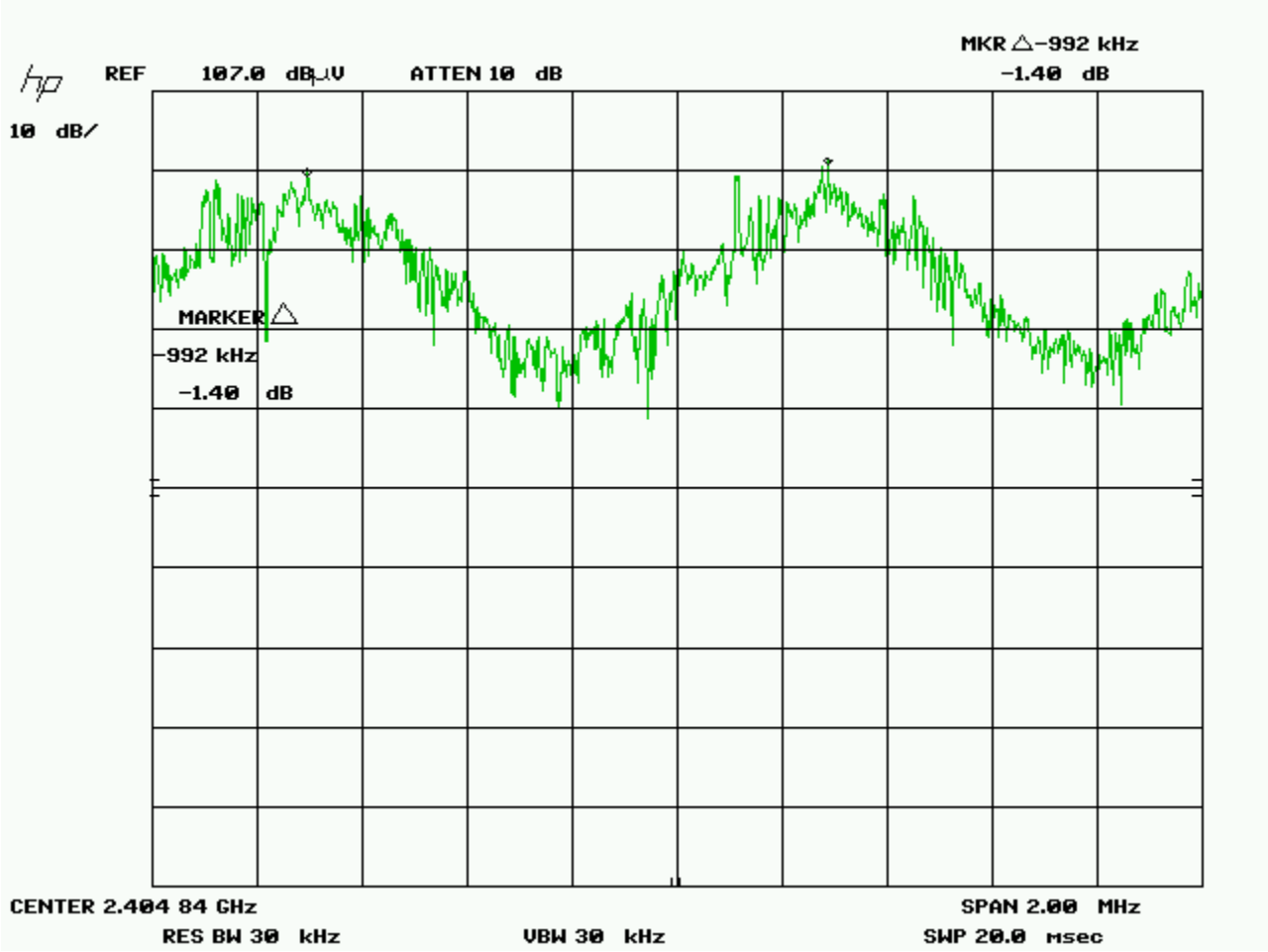
Graph(s)

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. Max hold is performed for a duration of not less than 1 minute.

20 db Bandwidth



Channel Separation



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	2007-08-09	2009-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2007-08-07	2009-08-07	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. This ensures that if the end-user replaces the antenna, that the maximum power does not exceed an amount which may create an excessive power level.

Limits

The limits are defined in 15.247(b).
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt.

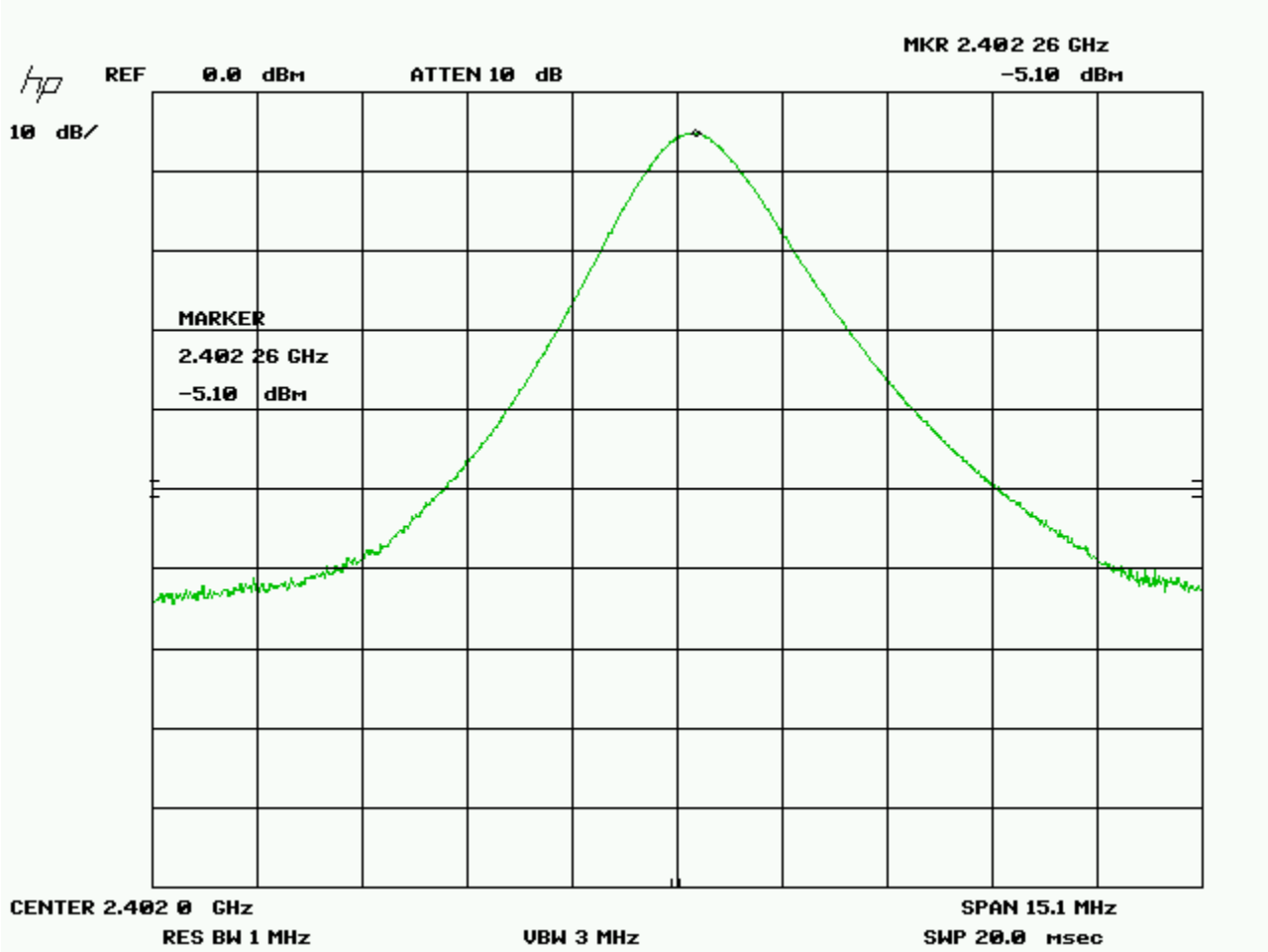
Results

The EUT passed. The peak power measured was -5.1 dbm + 10 db (att) + 2db (loss) = 6.9 dbm (4.9 mW).

Table(s)

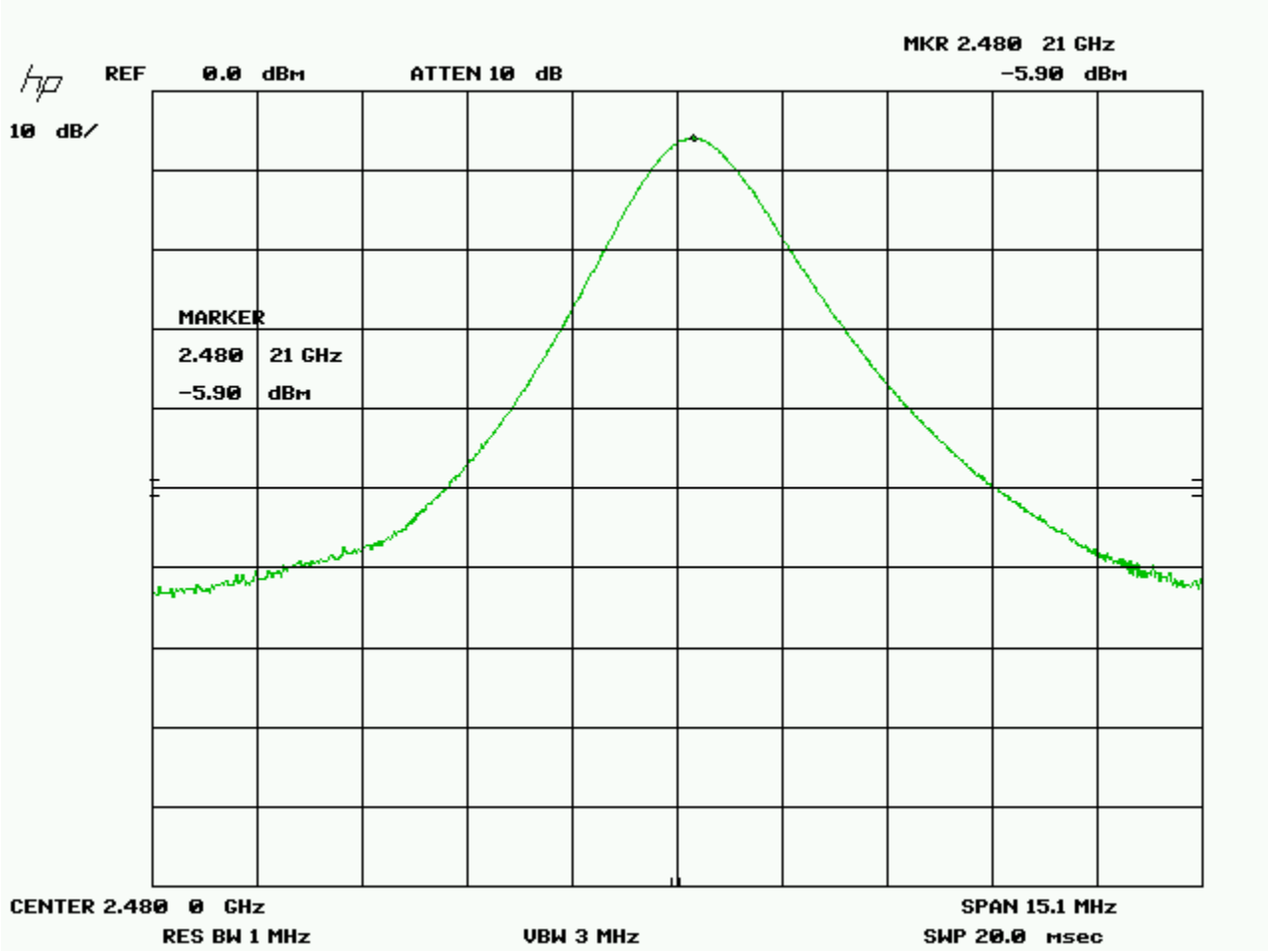
The tables shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 10 dB of external attenuation taken during this measurement.

Low channel

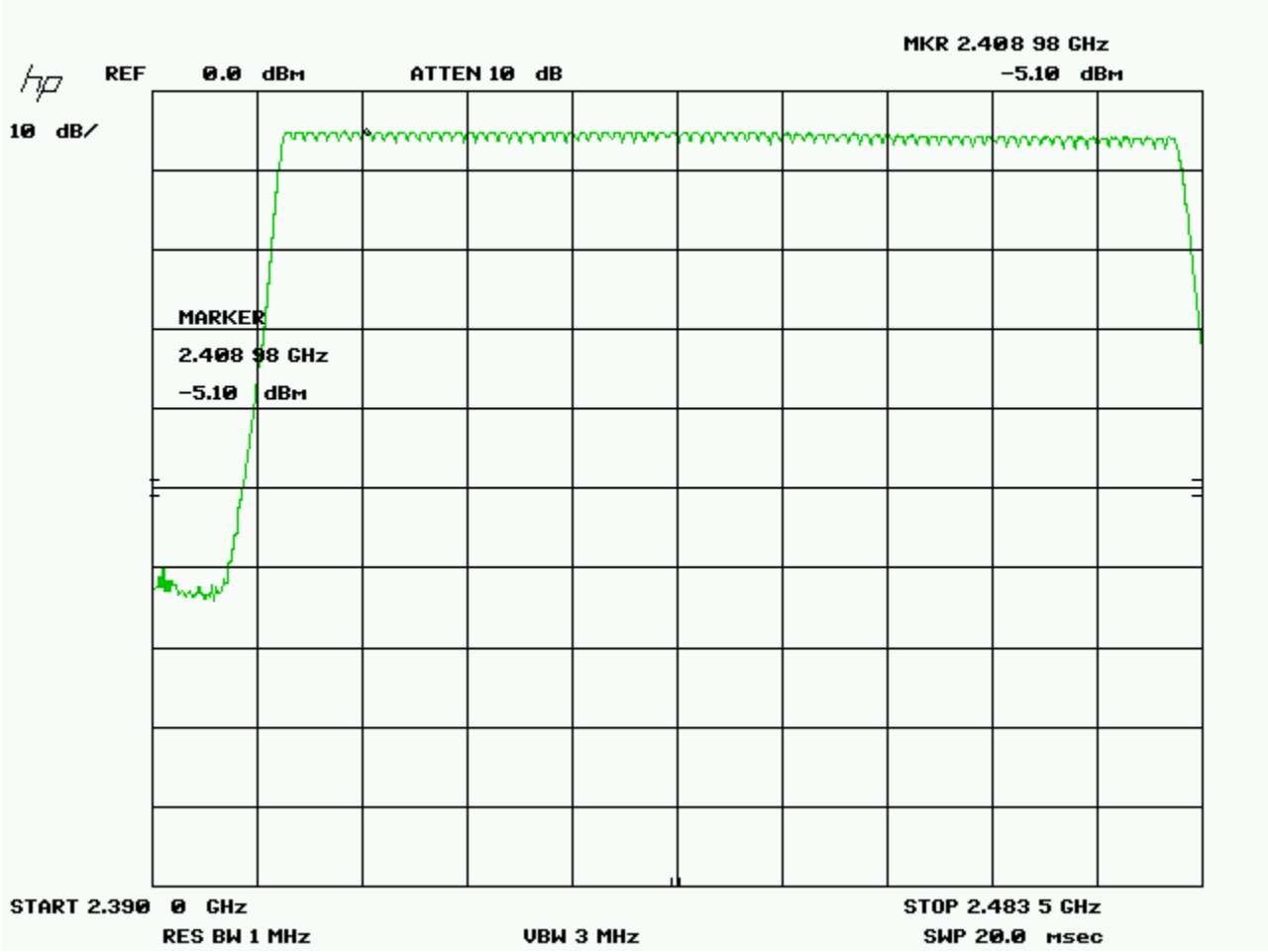


Medium channel

High channel



Hop mode



The calculated value is:
-5.1 dBm + 10 dB (attenuator) + 2 db cable losses
= 6.9 dbm
= 4.9 mW

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 #
Power Head	PH 2000	AR	2007-10-13	2009-10-13	GEMC 15
Power meter	PM 2002	AR	2007-10-13	2009-10-13	GEMC 16
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"

Antenna Spurious Radiated and Conducted Emissions (- 20 dbc Requirement)

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.

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. Spurious Conducted emissions are to be evaluated up to the 10^{th} harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

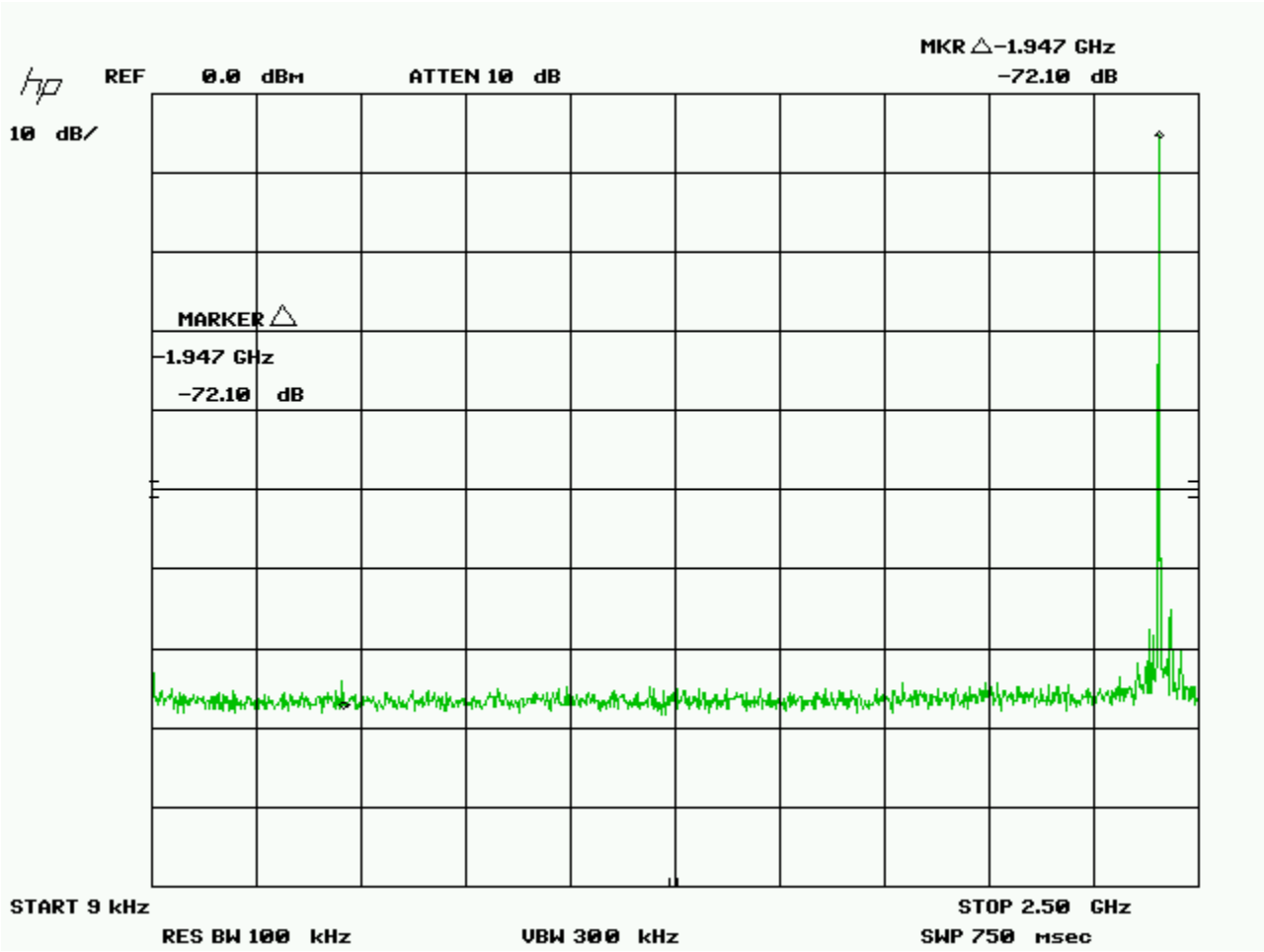
Results

The EUT passed the limits. Low, middle and high band was measured. The worst case for each mode is presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band.
The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band.

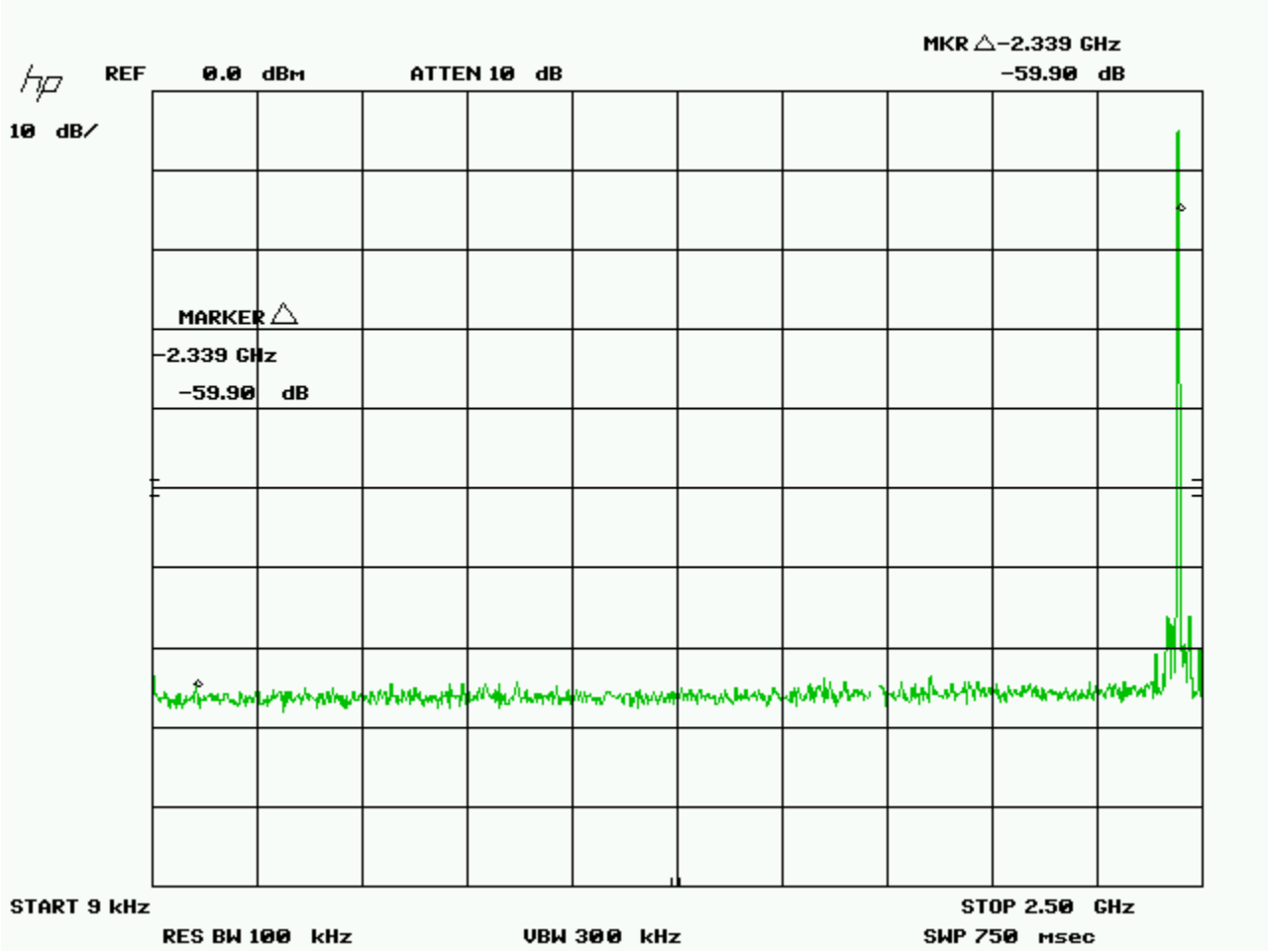
Graph(s)

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.

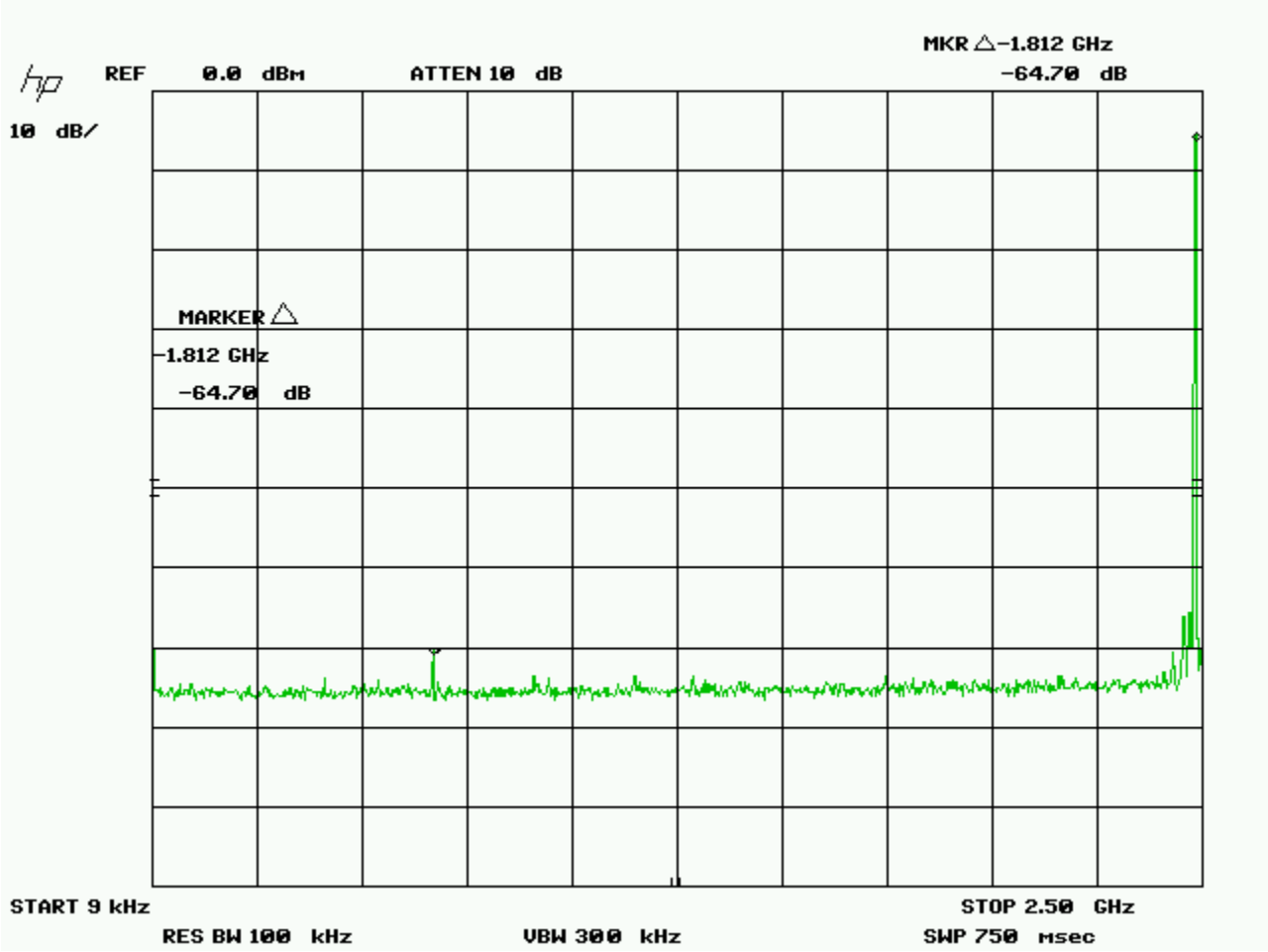
9 kHz – 2.5 GHz Lo



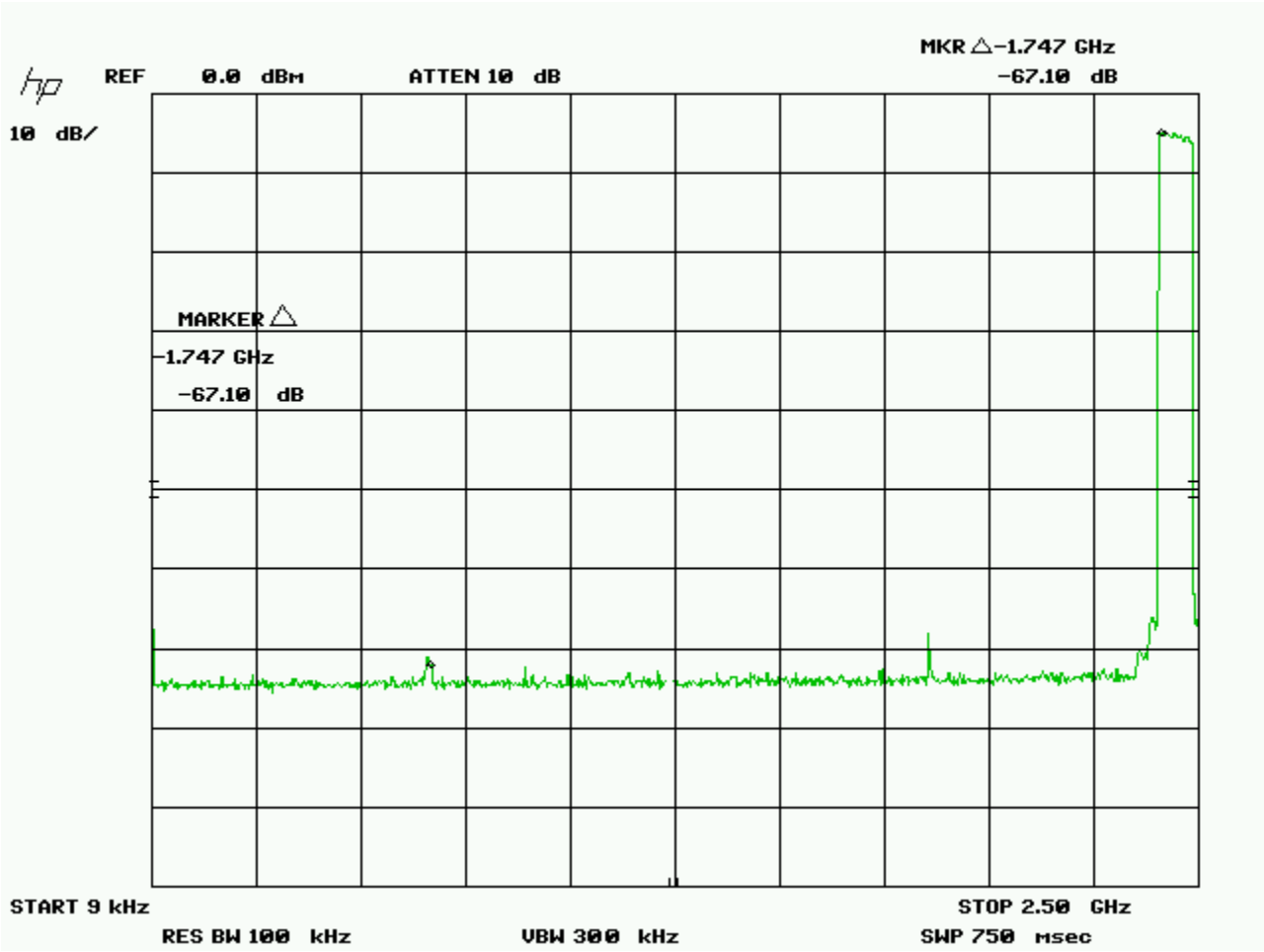
9 kHz – 2.5 GHz Med



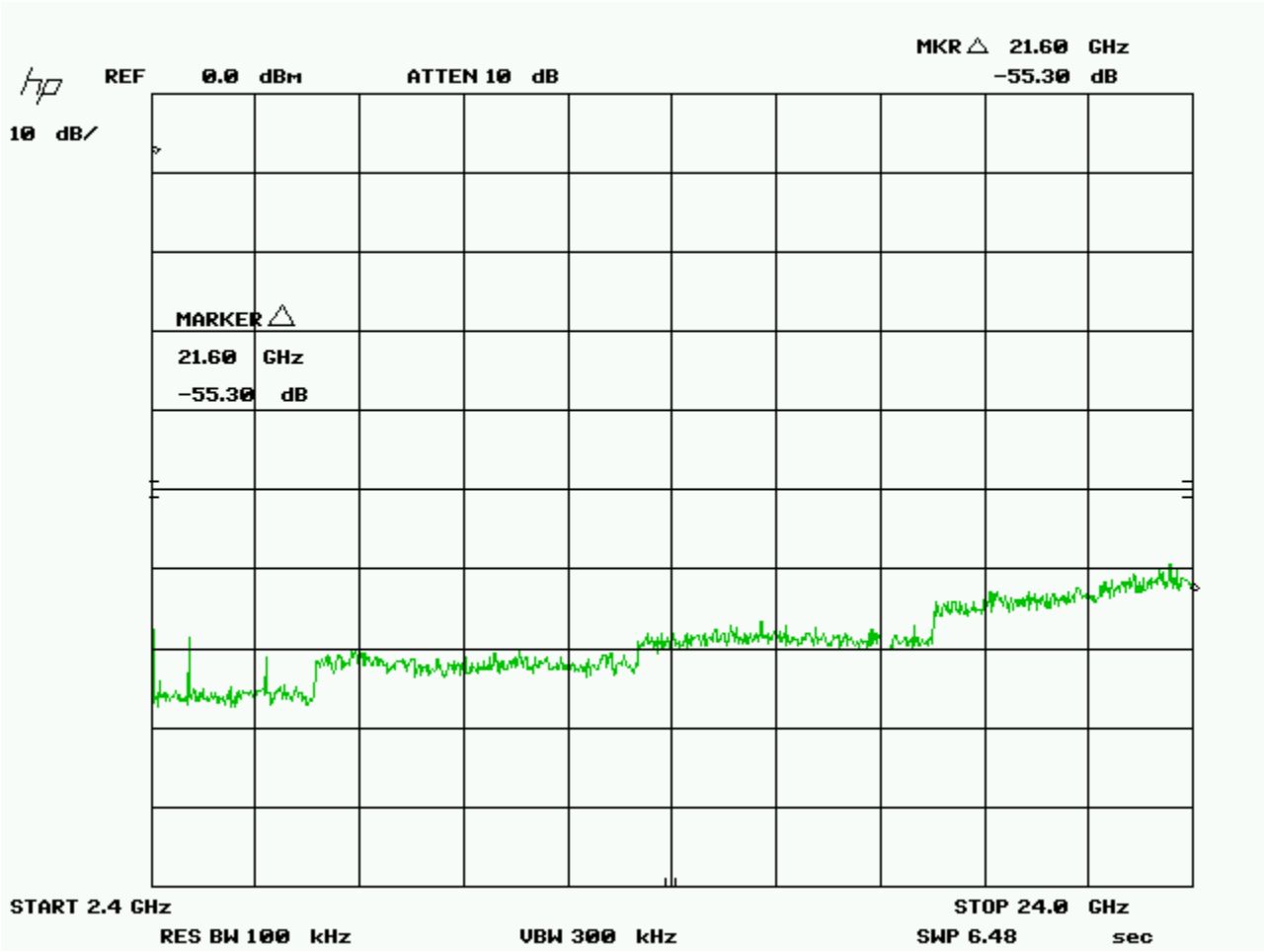
9 kHz – 2.5 GHz Hi



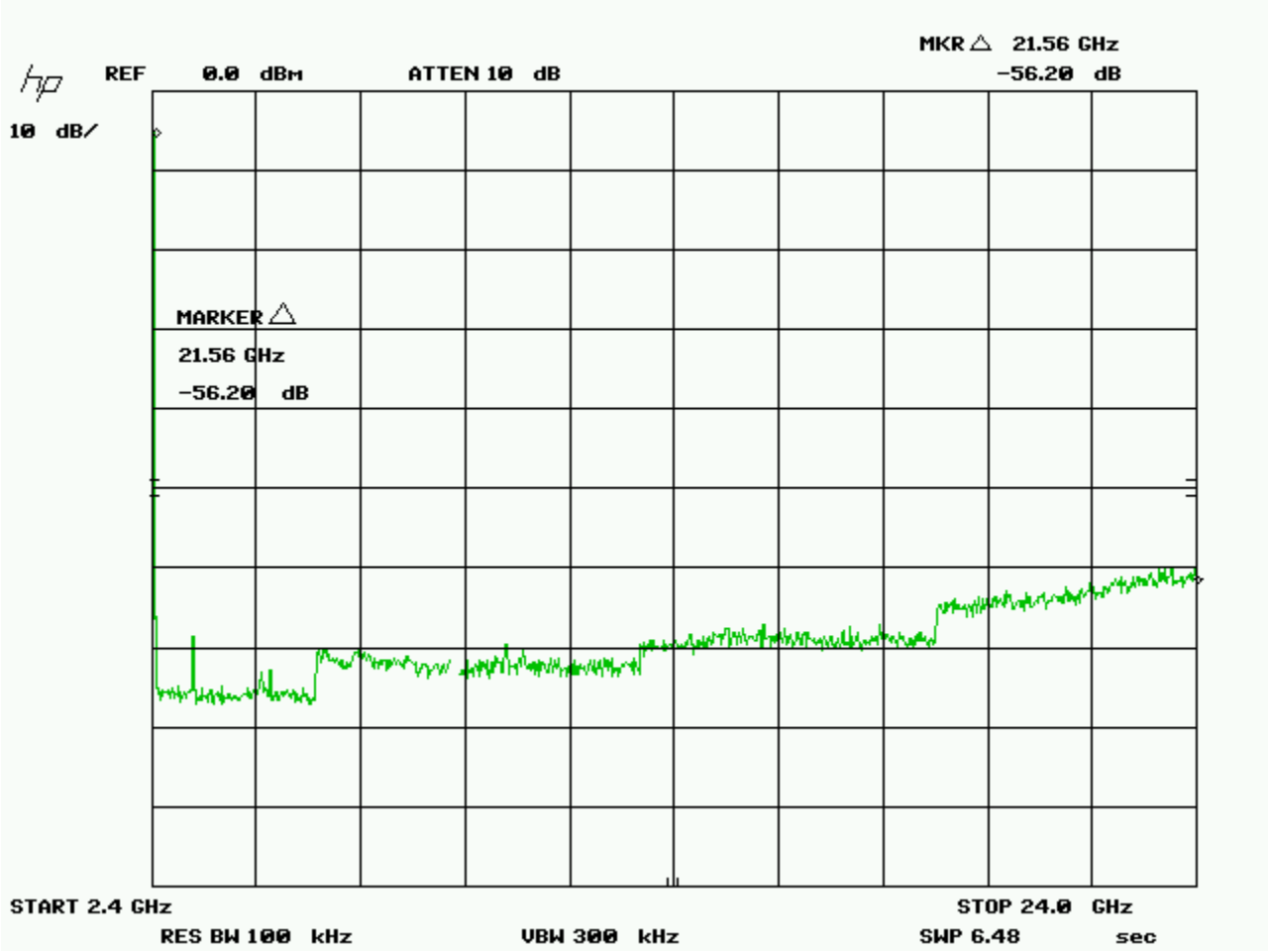
9 kHz – 2.5 GHz Hop



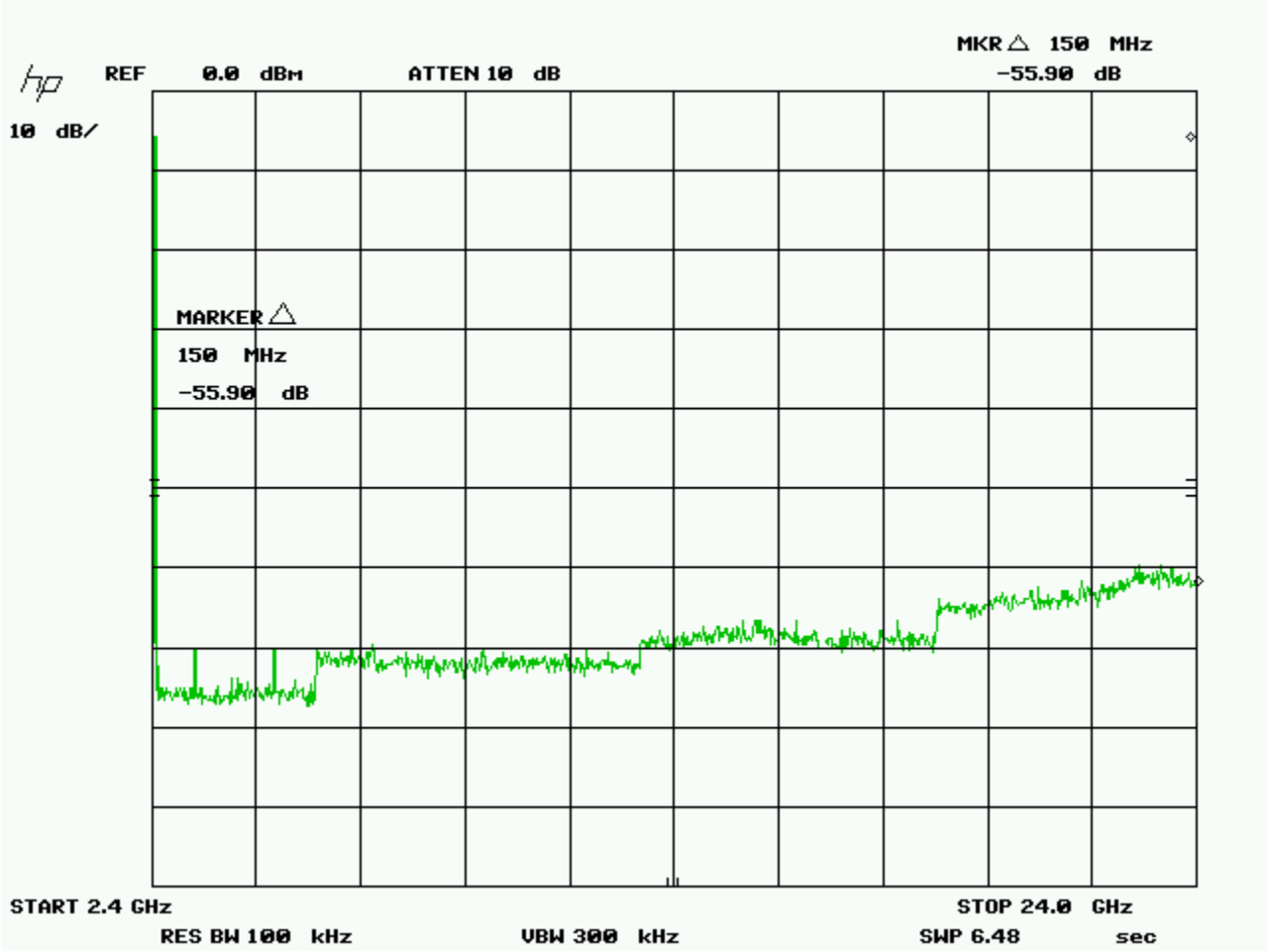
2.4 GHz – 24.0 GHz Lo



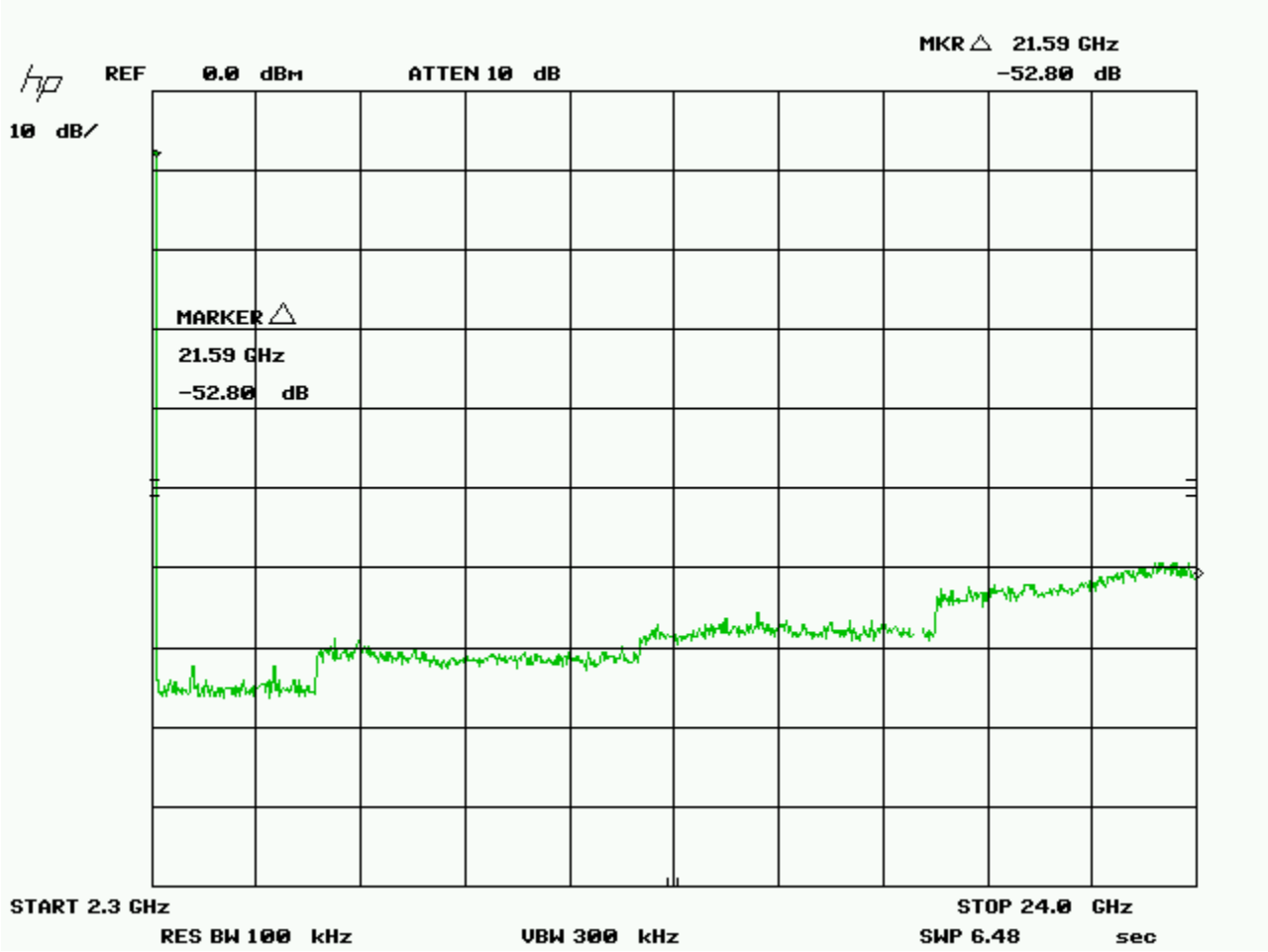
2.4 GHz – 24.0 GHz Med



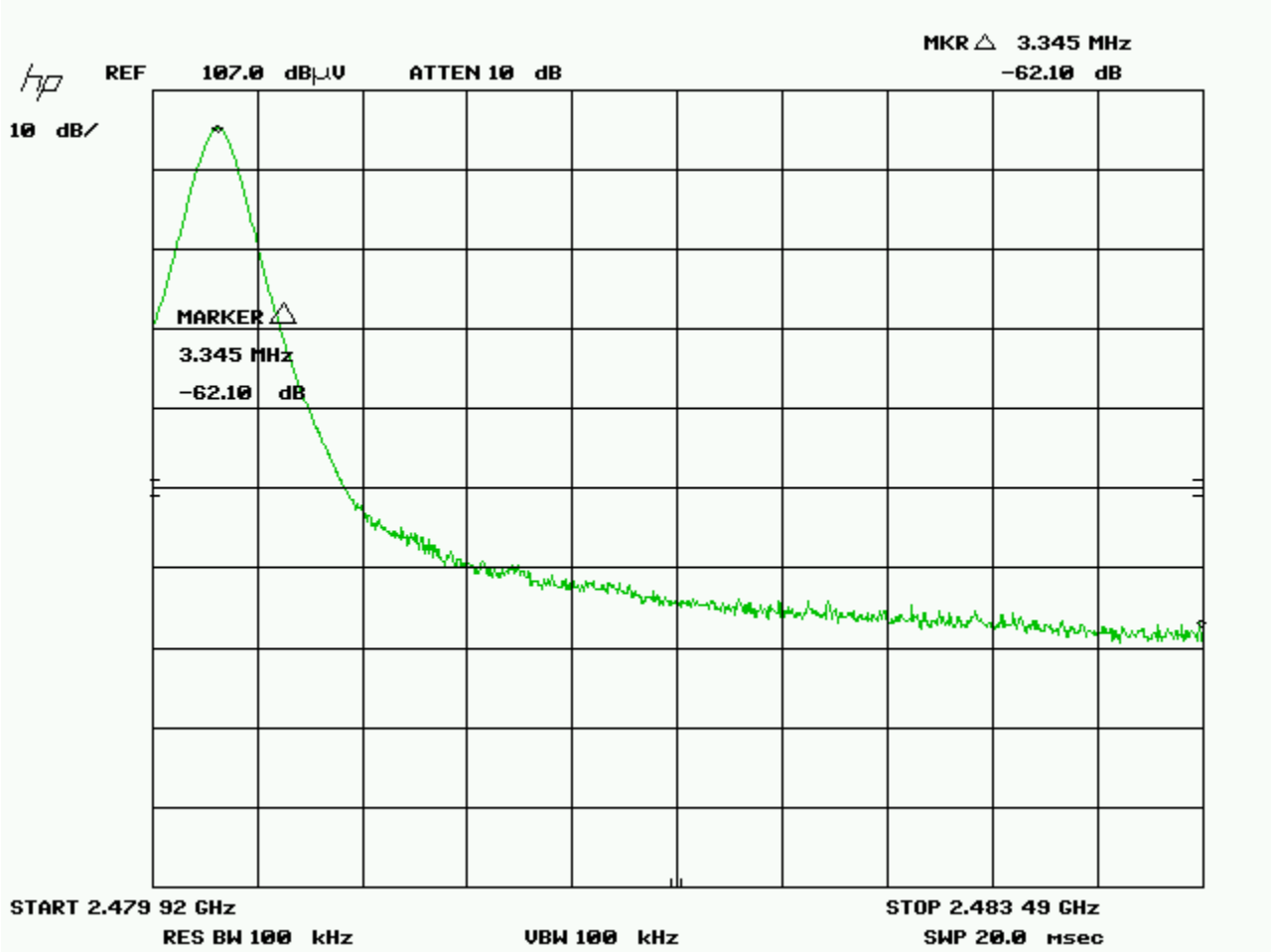
2.4 GHz – 24.0 GHz Hi



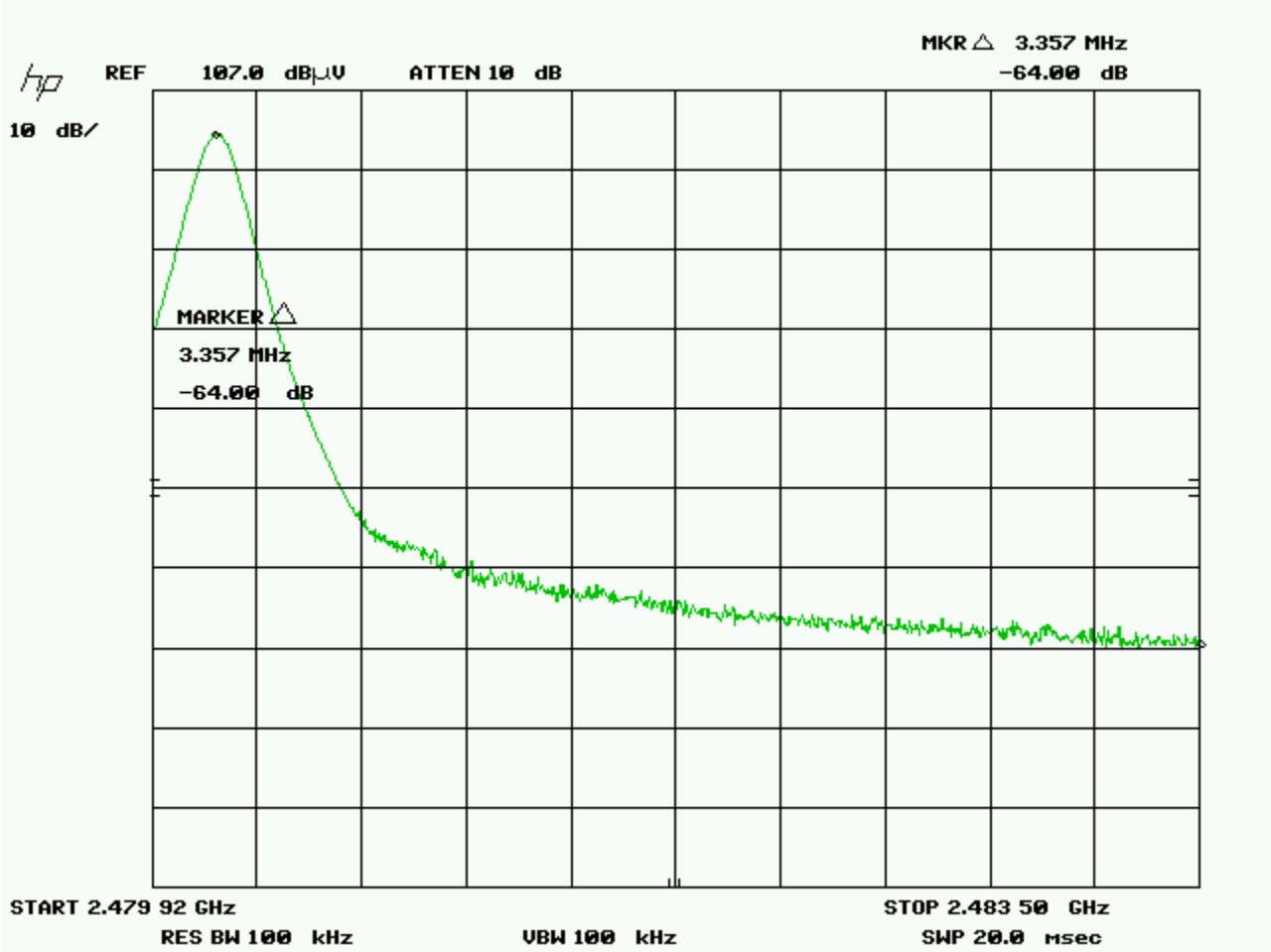
2.3 GHz – 24.0 GHz Hop



2483.5 MHz Band edge
Vertical peak emissions

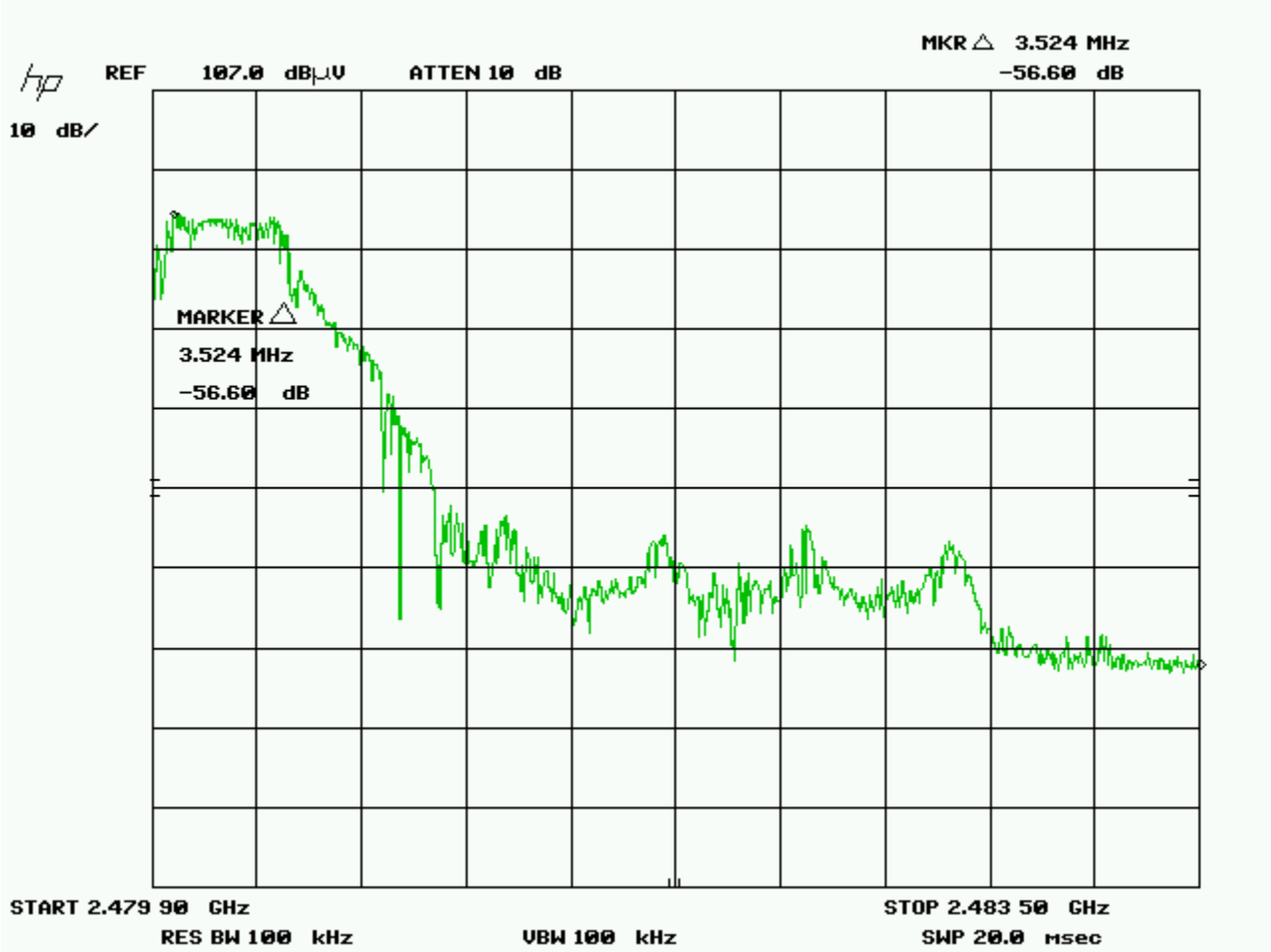


2483.5 MHz Band edge
Horizontal peak emissions

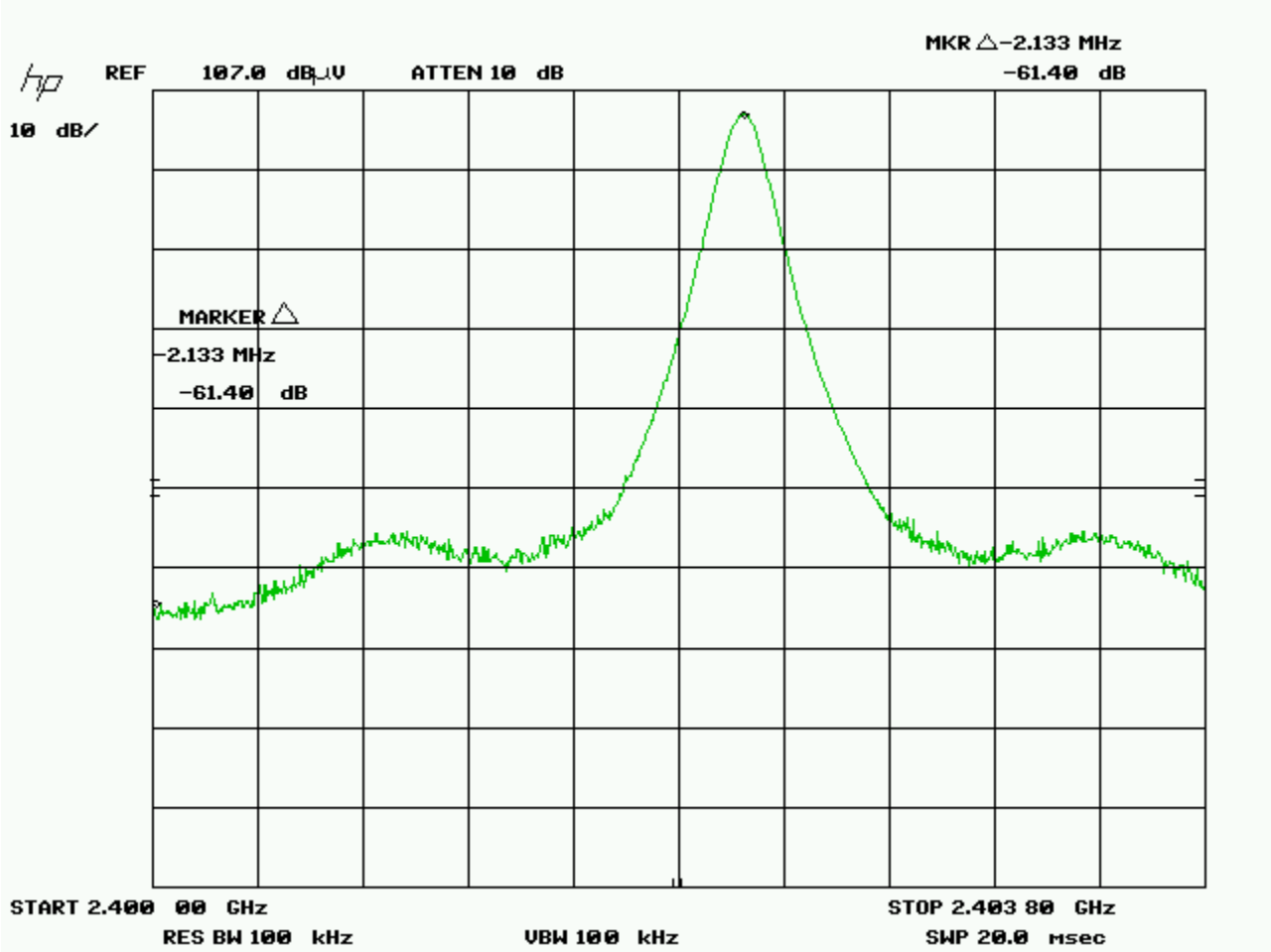


2483.5 MHz Band edge Hop Mode
Vertical peak emissions

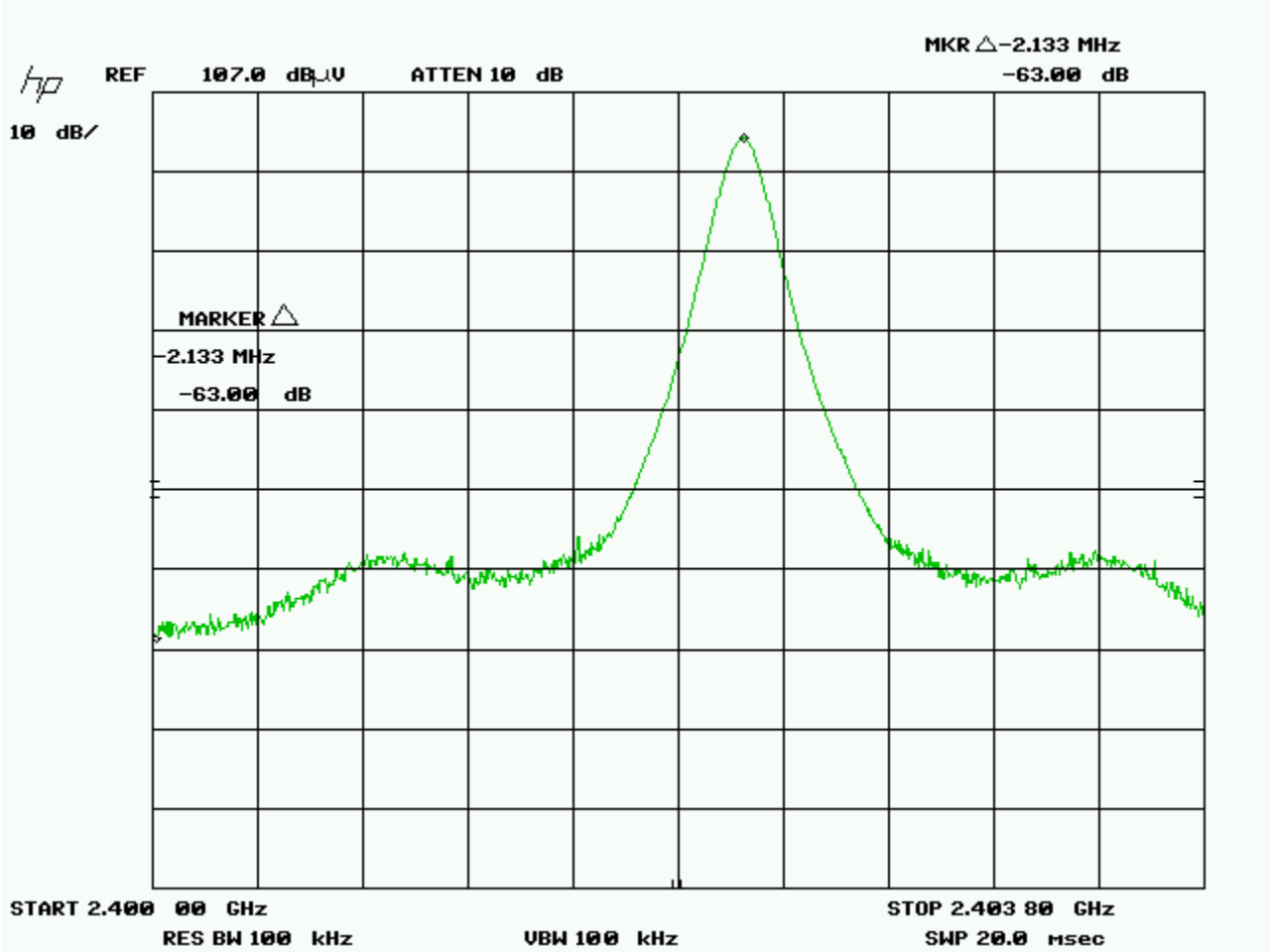
2483.5 MHz Band edge Hop mode
Horizontal peak emissions



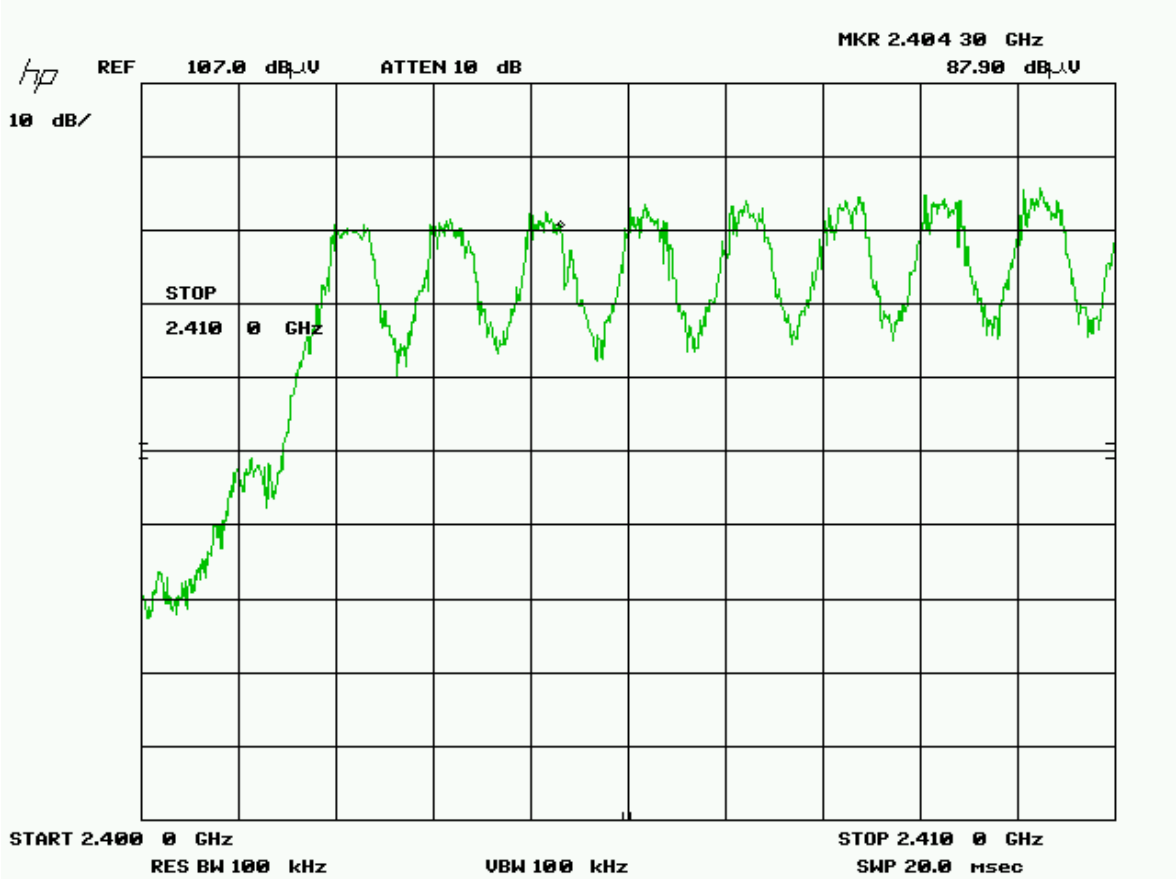
2390 MHz Band edge
Vertical peak emissions



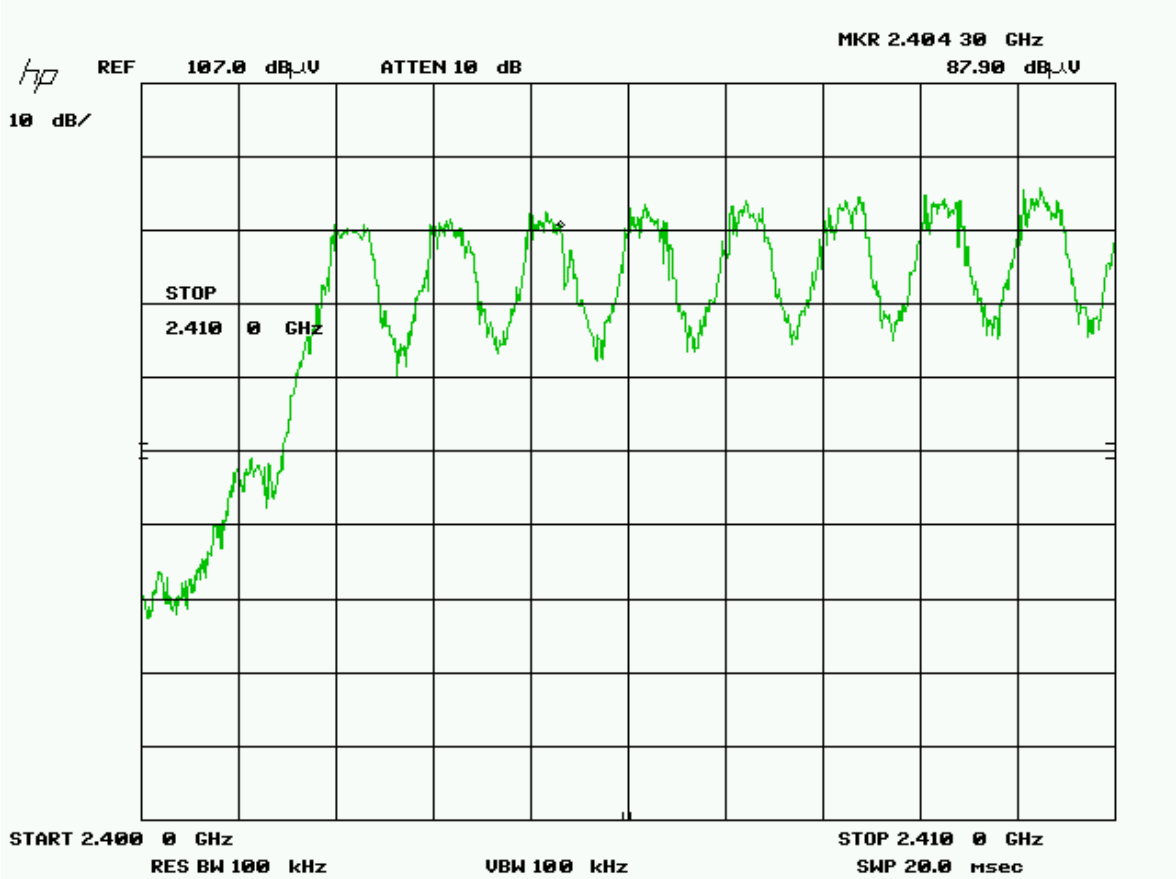
2390 MHz Band edge
Horizontal peak emissions



2402.0 MHz Band edge Hop Mode
Vertical peak emissions



2402.0 MHz Band edge Hop mode
Horizontal peak emissions



The frequency range of 22.5 – 25 GHz, the 10th harmonic and 9th harmonic where applicable, was additionally scanned using an alternate spectrum analyzer, in low, middle and high band for each mode. No emissions were detected at the 9th and 10th harmonic.

The plots show raw data and no correction factors are applied. They simply show a 20dbc differential between the peak and the band edge

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last	Next	Asset #

			calibration date	calibration due date	
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	2007-08-09	2009-10-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2007-08-07	2009-10-07	GEMC 7
IFR Spectrum Analyzer	AN940	IFR	2007-4-4	2009-10-4	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 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 2400 – 2483.5 MHz systems, the limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)(iii).

For frequency hopping systems in 2400 – 2483.5 MHz, the unit shall use at least 15 channels. The average time of occupancy shall not be greater than 0.4s in a period of 0.4s X # of channels occupied.

Results

The EUT passed the requirements. The EUT cycles through its pseudo-random generated list of hopping frequencies. There are 79 channels occupied in total. The average occupancy time is 0.38 ms per channel and each channel is repeated every 98.18 ms.
The complete observation time is
= # of channels x 400 ms
= 79 x 400 ms
= 31,600 ms
= 31.6 s

Number of time a channel is occupied in 31.6s = 31.6s / 98.18ms
= 36100 ms / 98.18ms
= 321.85 times.

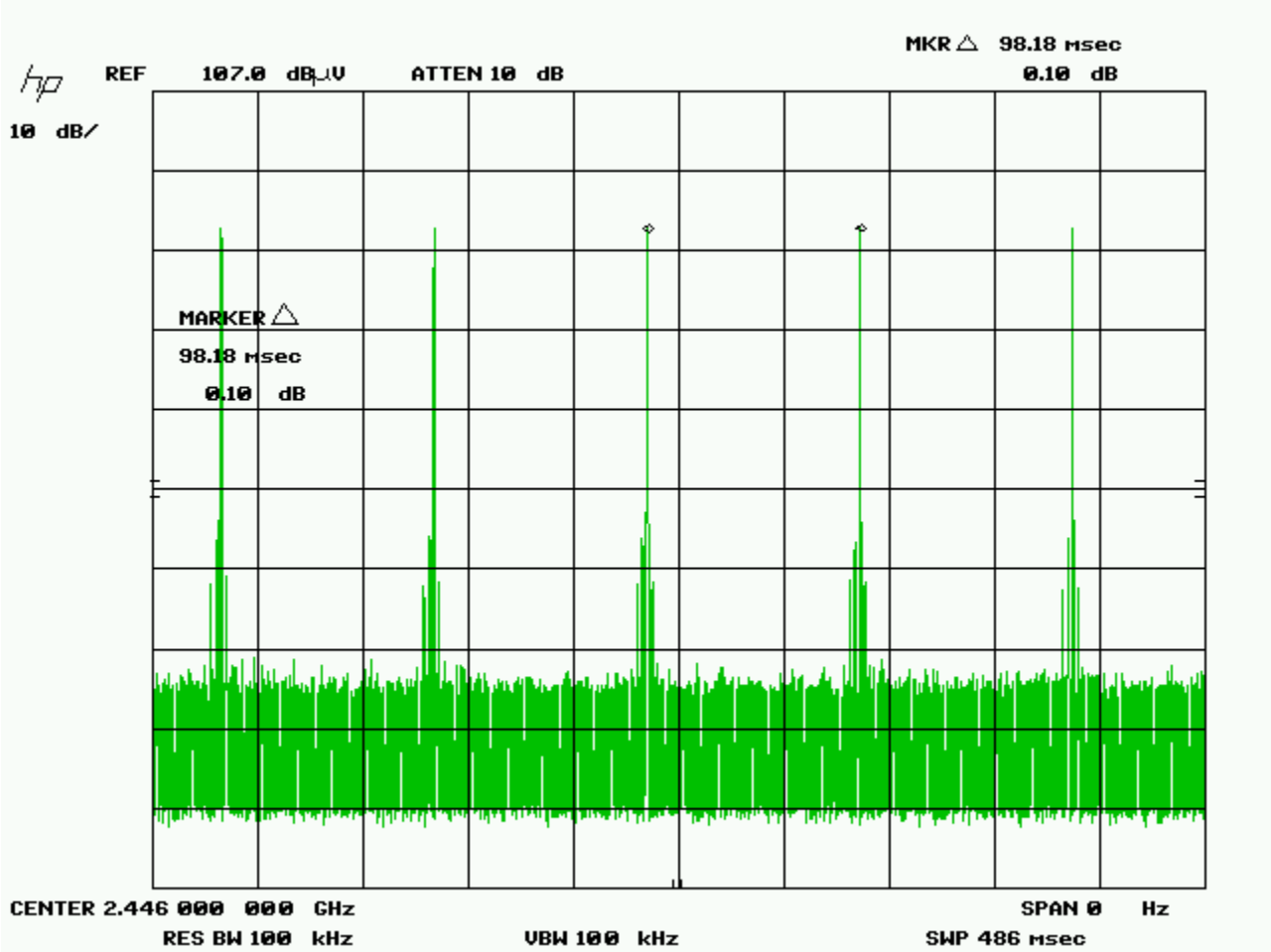
Total occupancy time in 31.6 s is
= 321.85 x 0.38 ms
= 122.31 ms

The EUT has an average occupancy of 122.31 msec within a 31.6 second period. This is under the 400 msec limit as per 15.247 (a) 1 (iii)

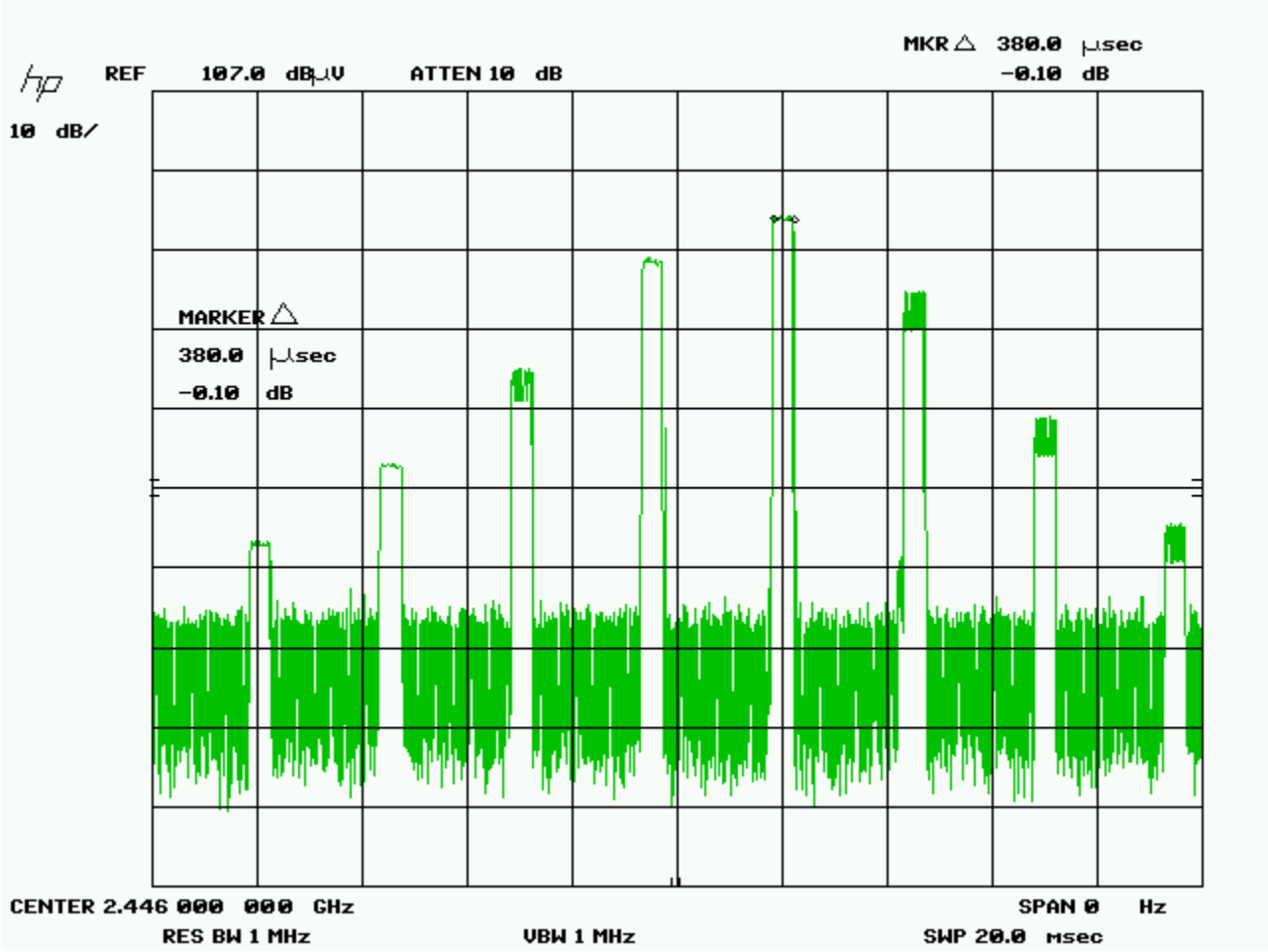
Graph(s)

The first graph shown below shows the repeat time of the pseudorandom generated hopping list.

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	2007-08-09	2009-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2007-08-07	2009-08-07	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

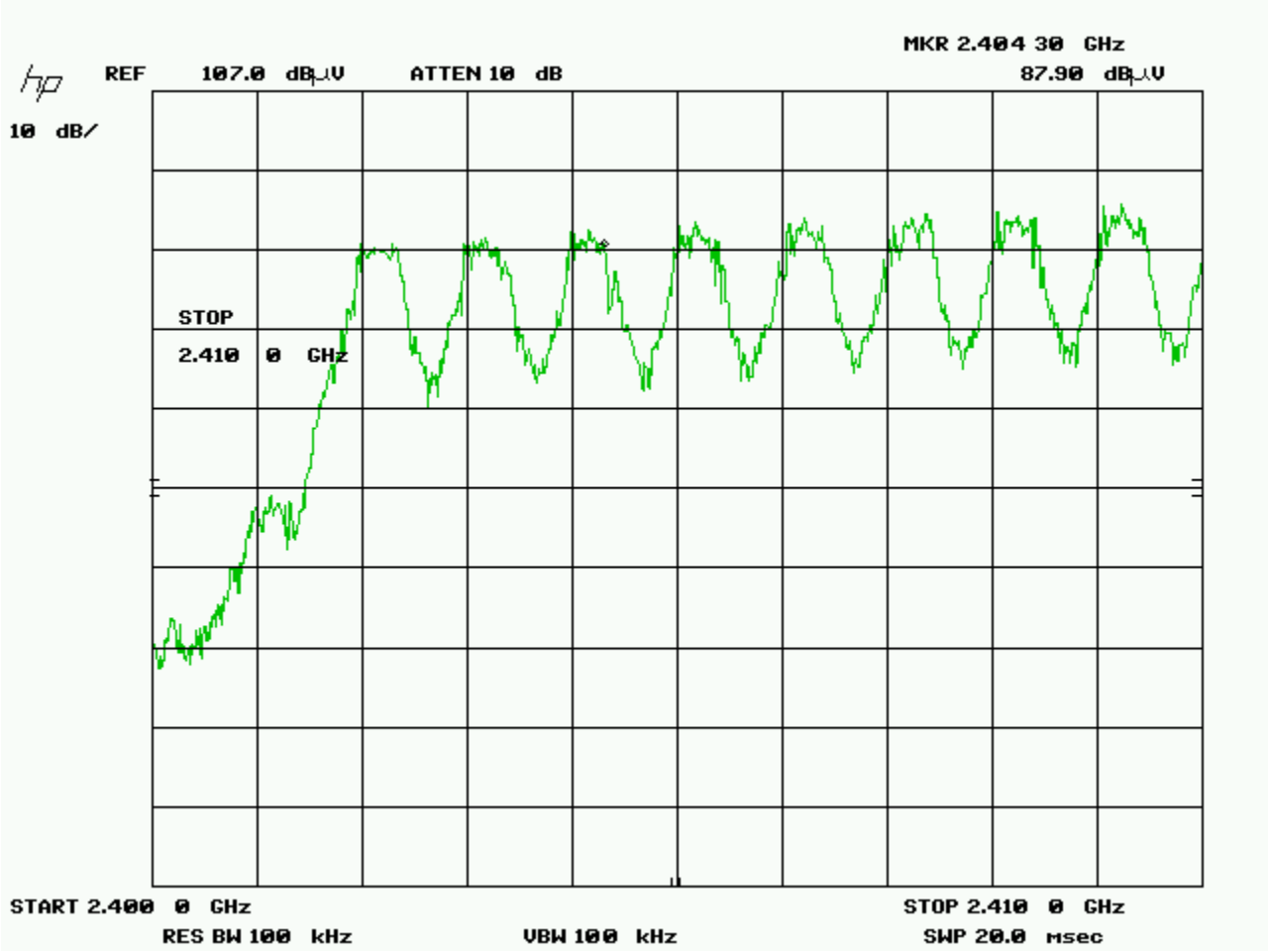
Results

The EUT passed the requirements of the number of channels. The number of channels the device occupies is 79 channels in the allocation band of 2402 MHz – 2480 MHz.

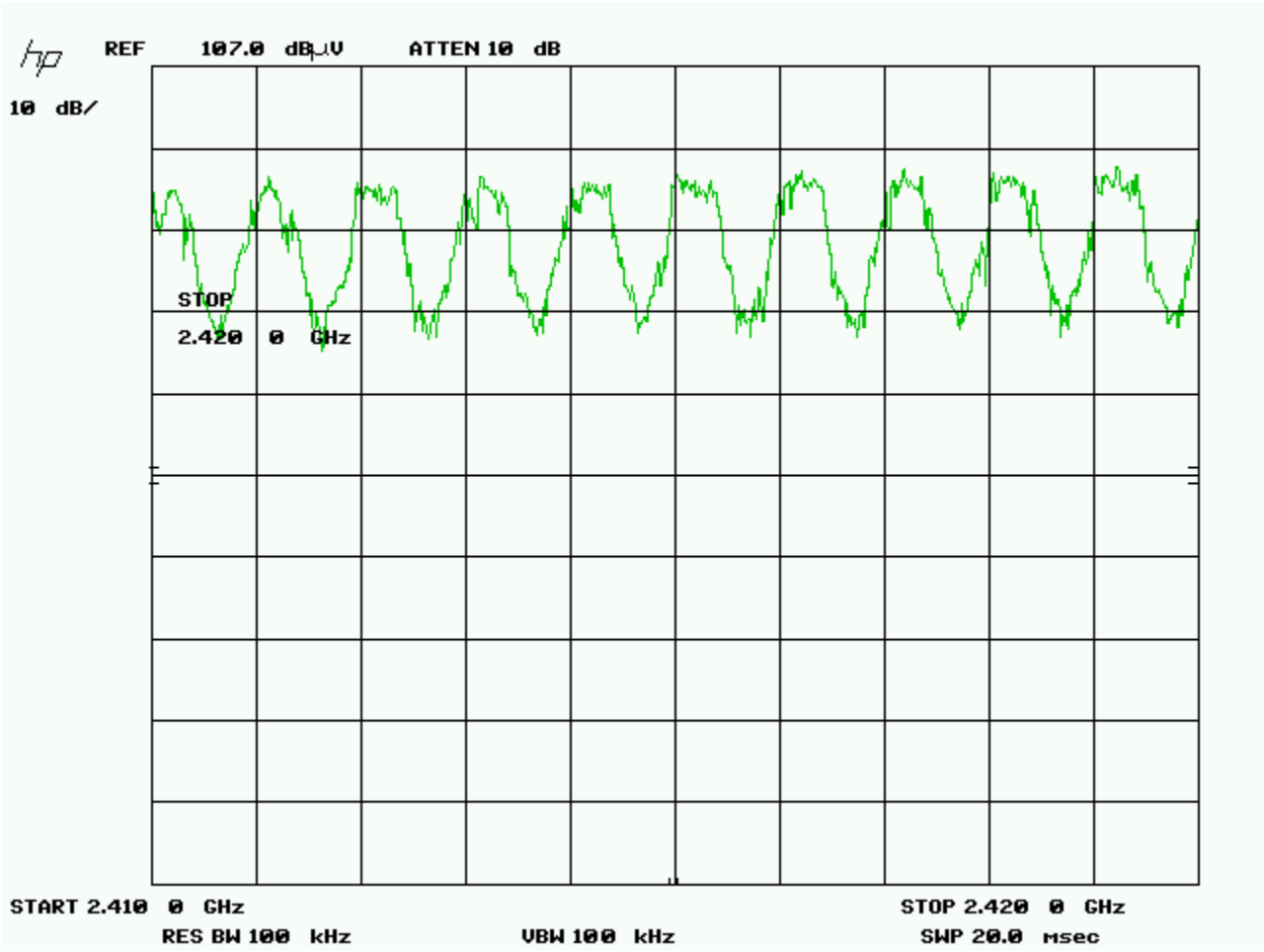
Graph(s)

The graphs below show 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.

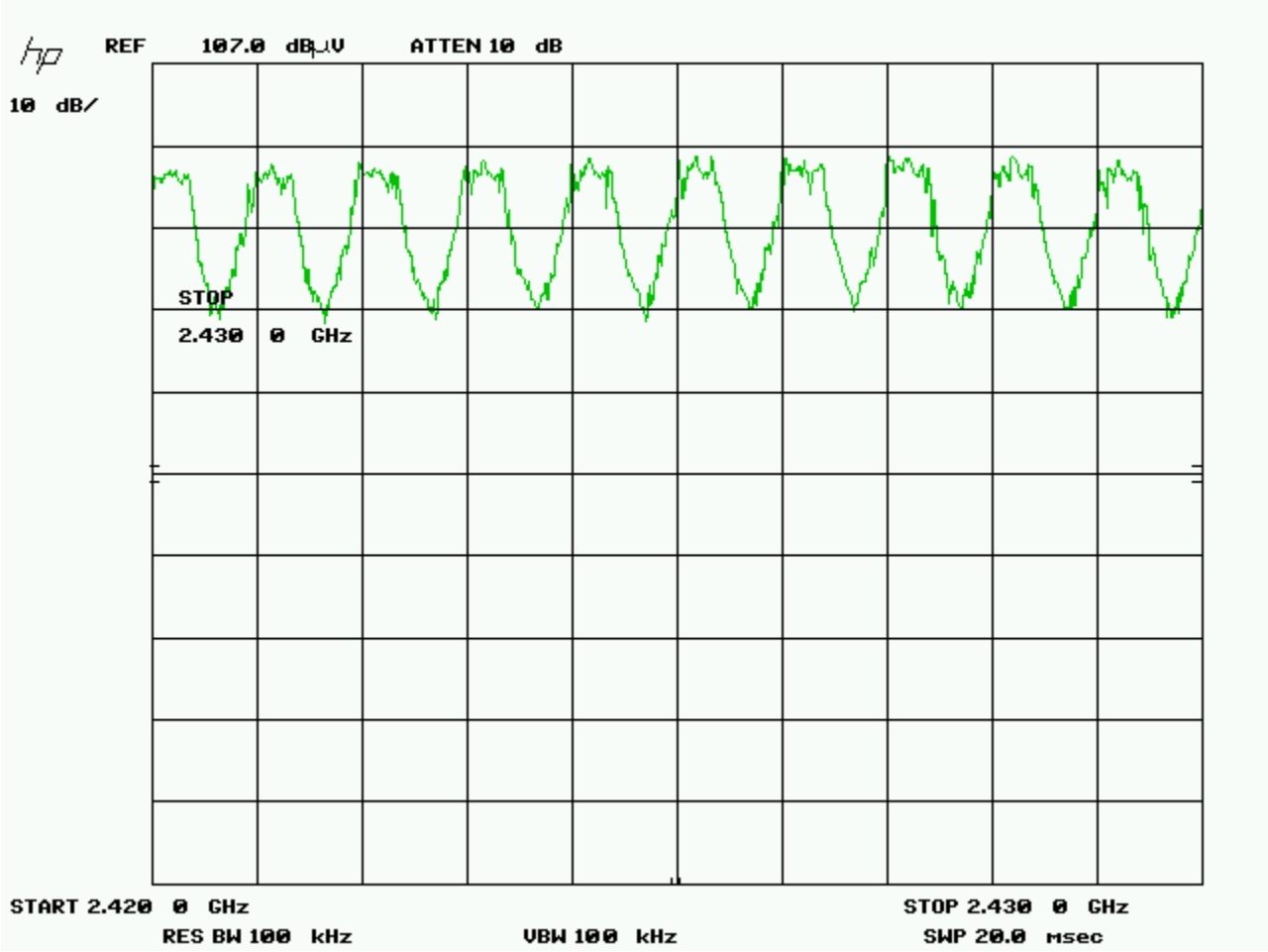
Channel 1 – 8



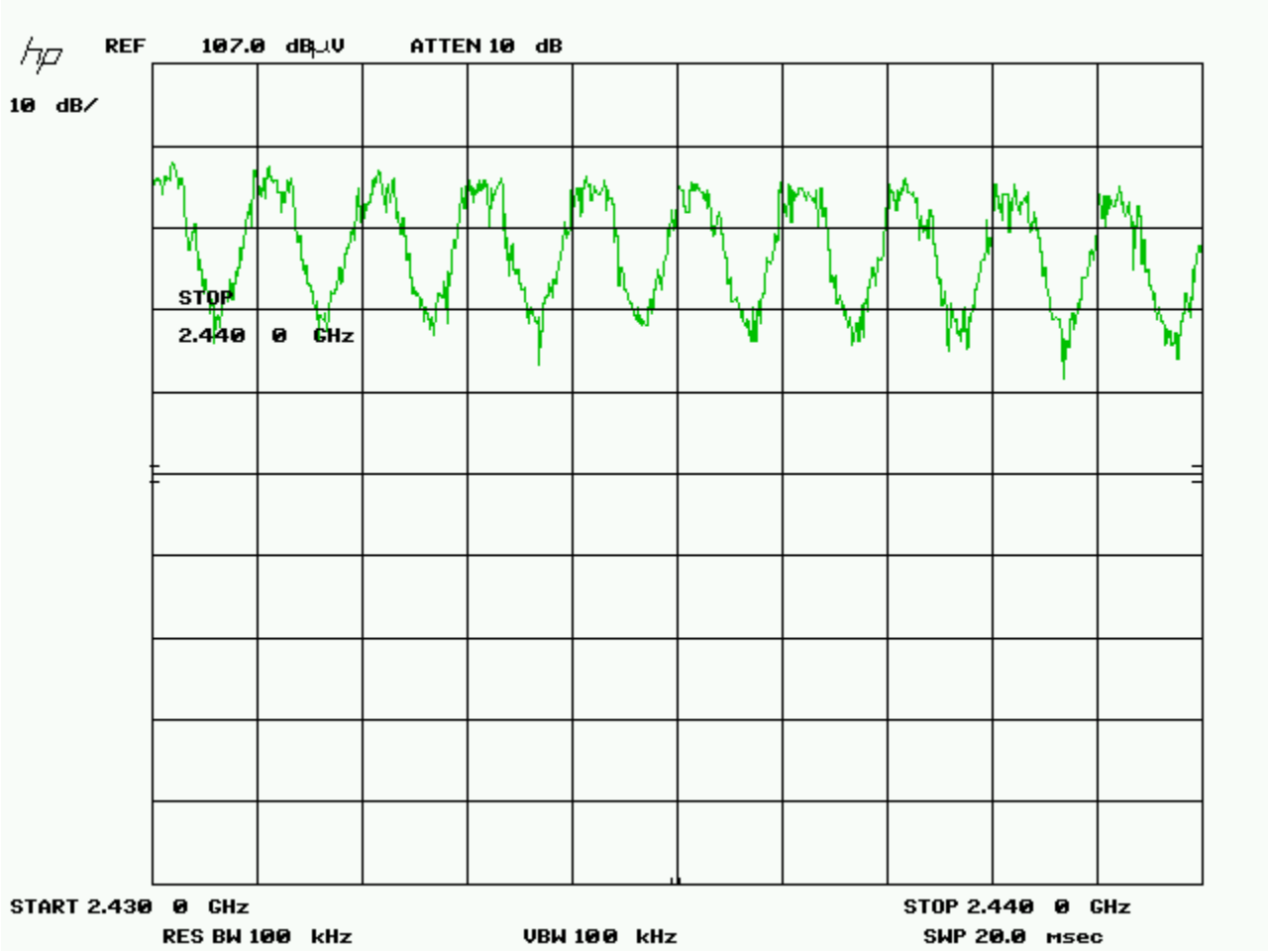
Channel 9 – 18



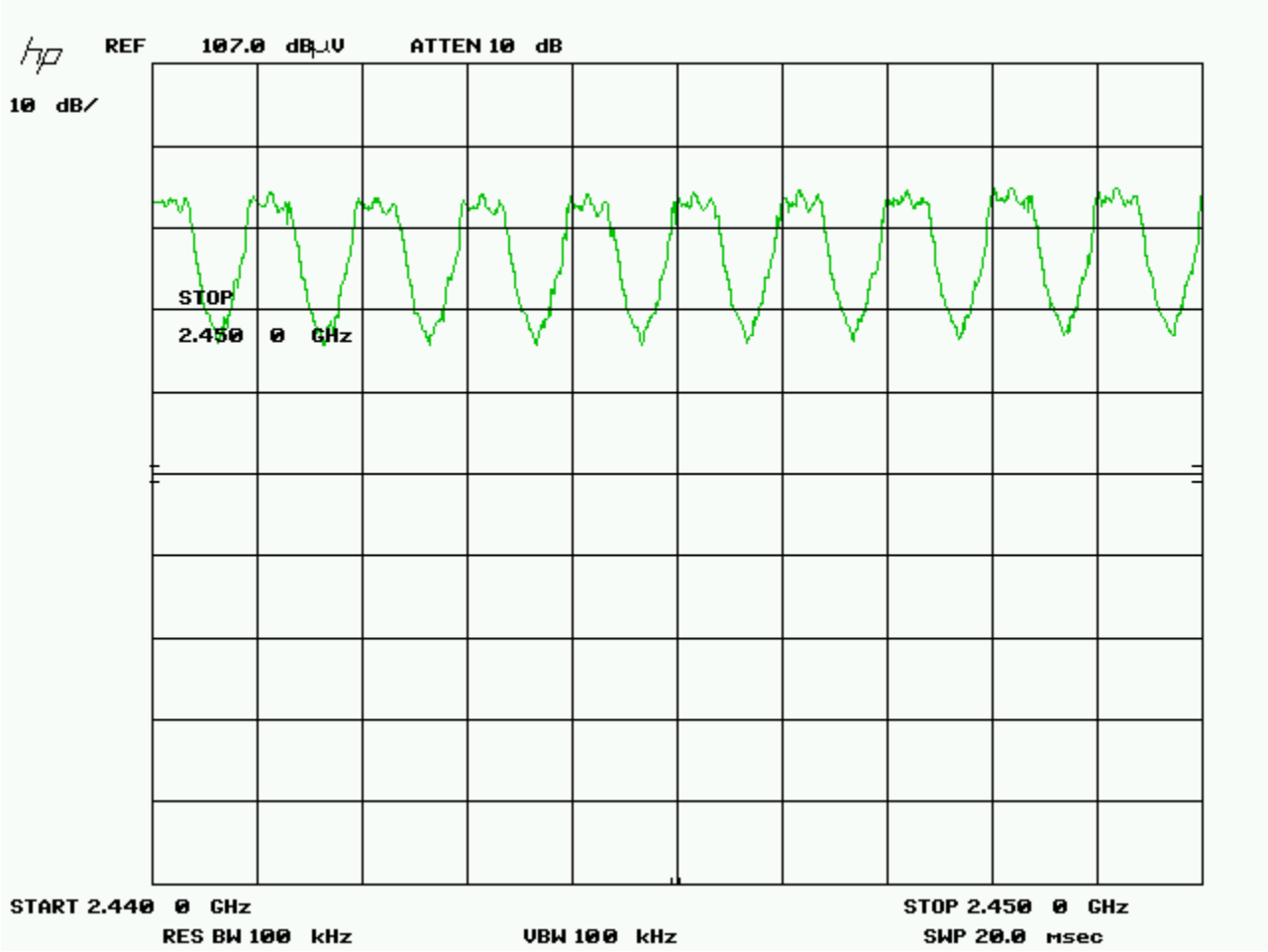
Channel 19 – 28



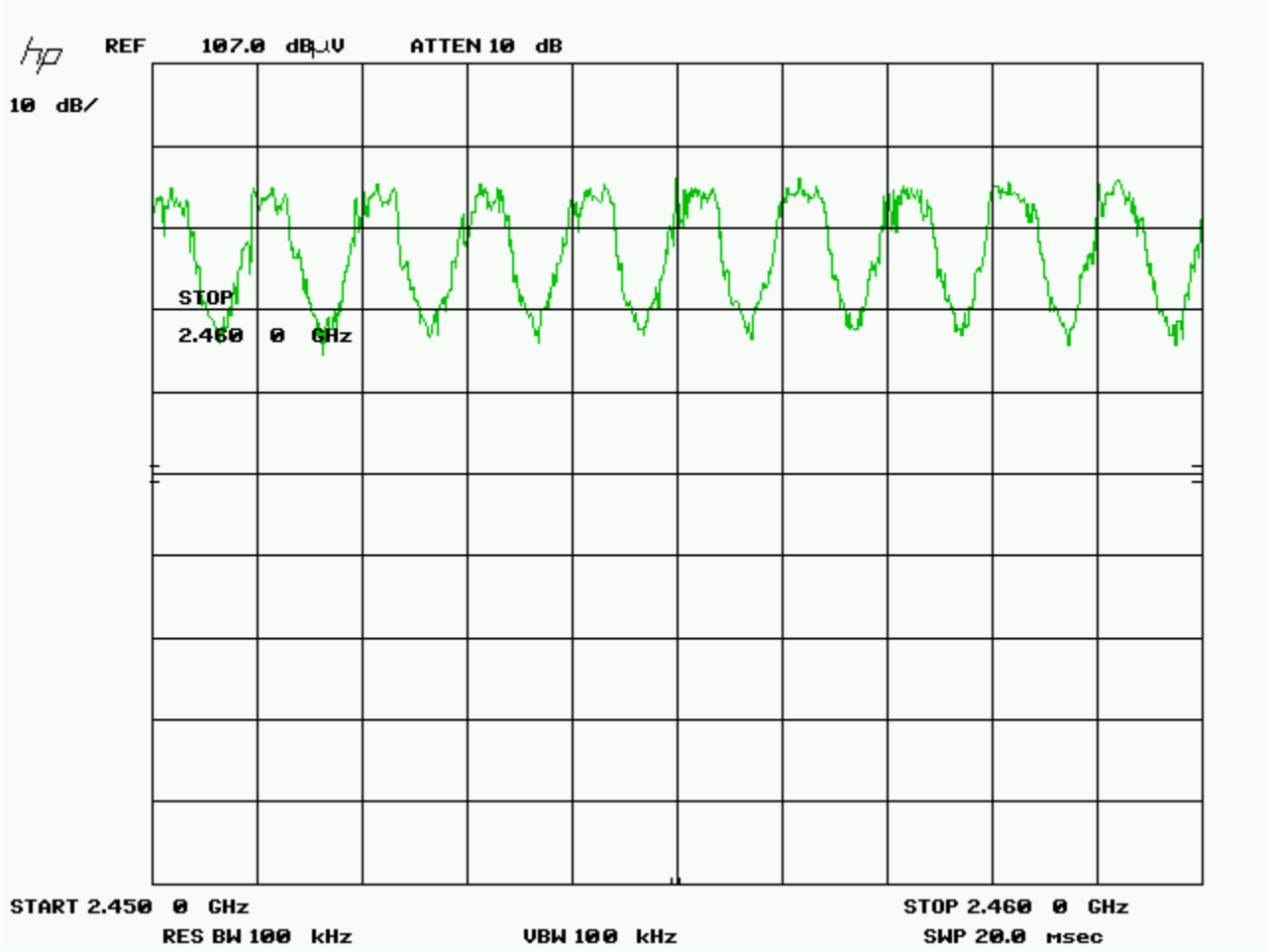
Channel 29 – 38



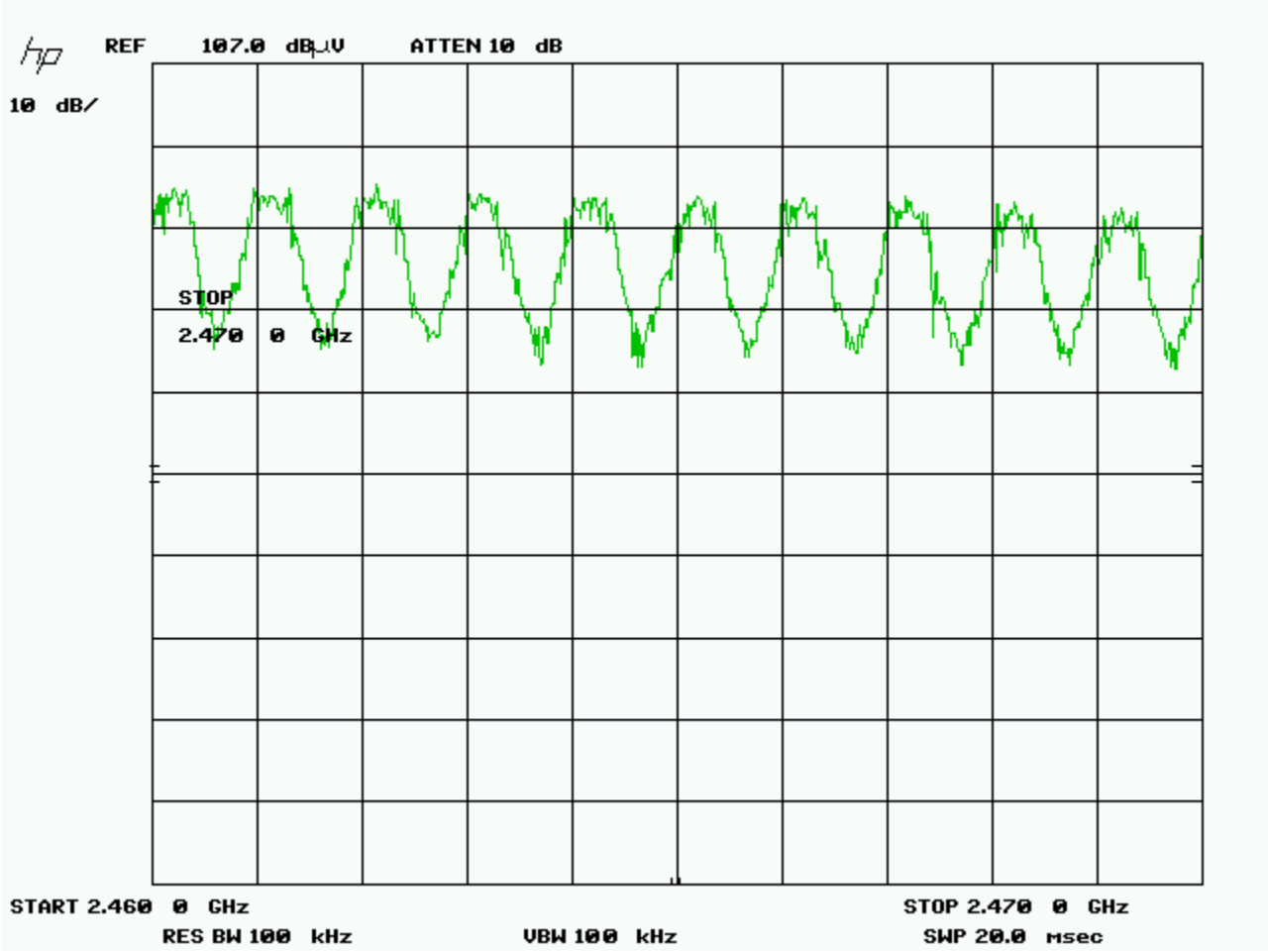
Channel 39 – 48



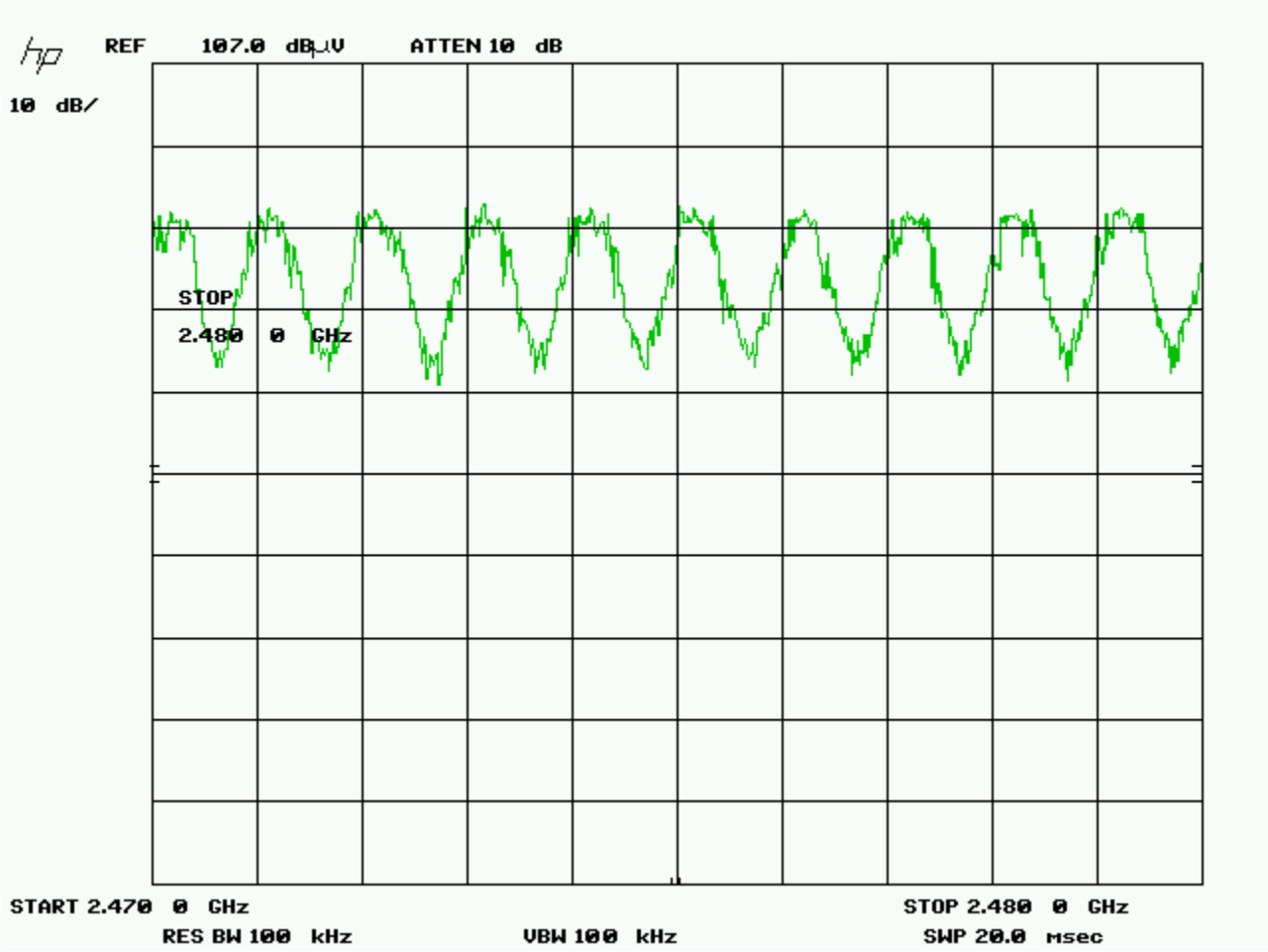
Channel 49 – 58



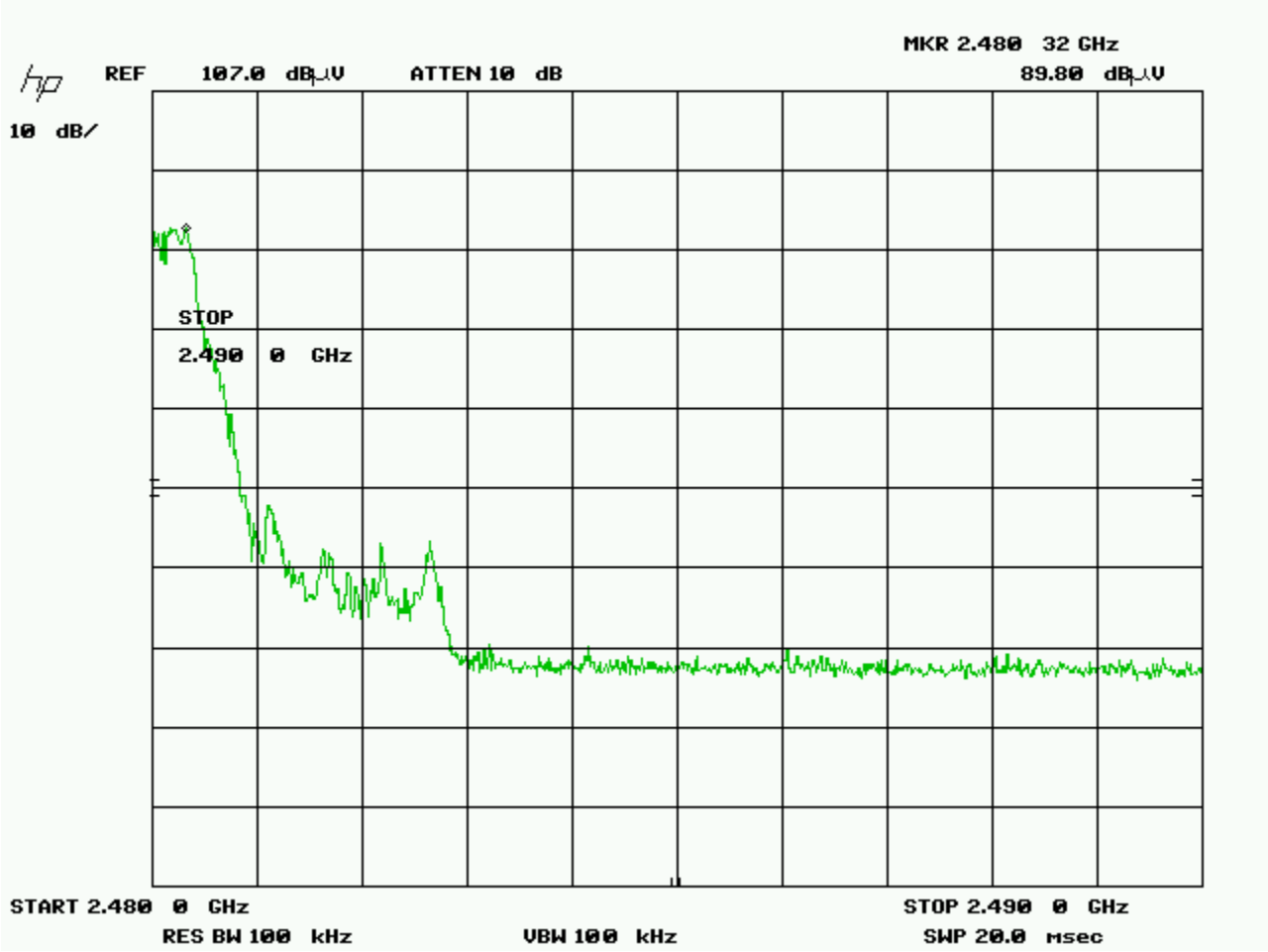
Channel 59 – 68



Channel 69 – 78



Channel 79



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	2007-08-09	2009-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2007-08-07	2009-08-07	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 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

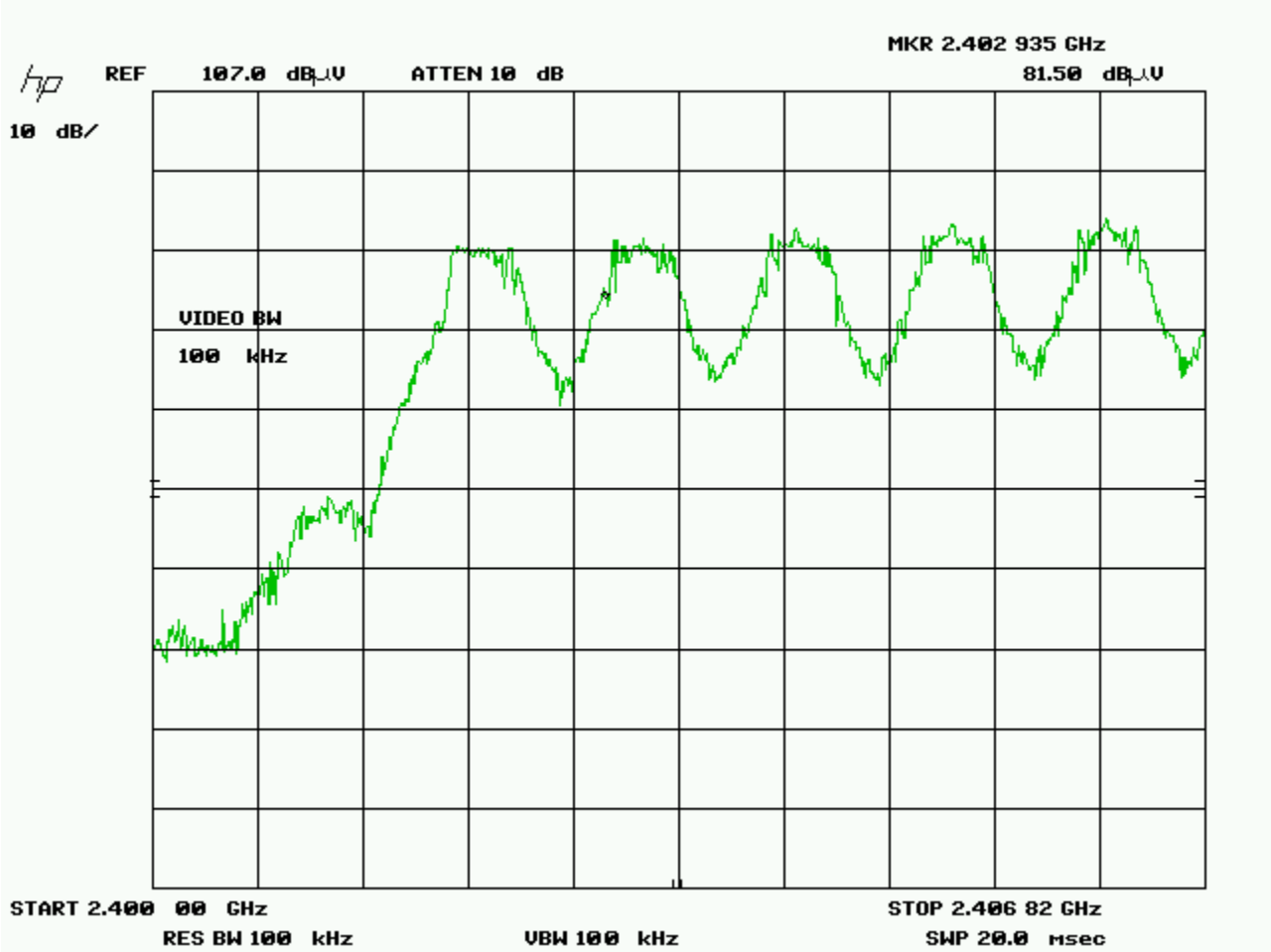
Results

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

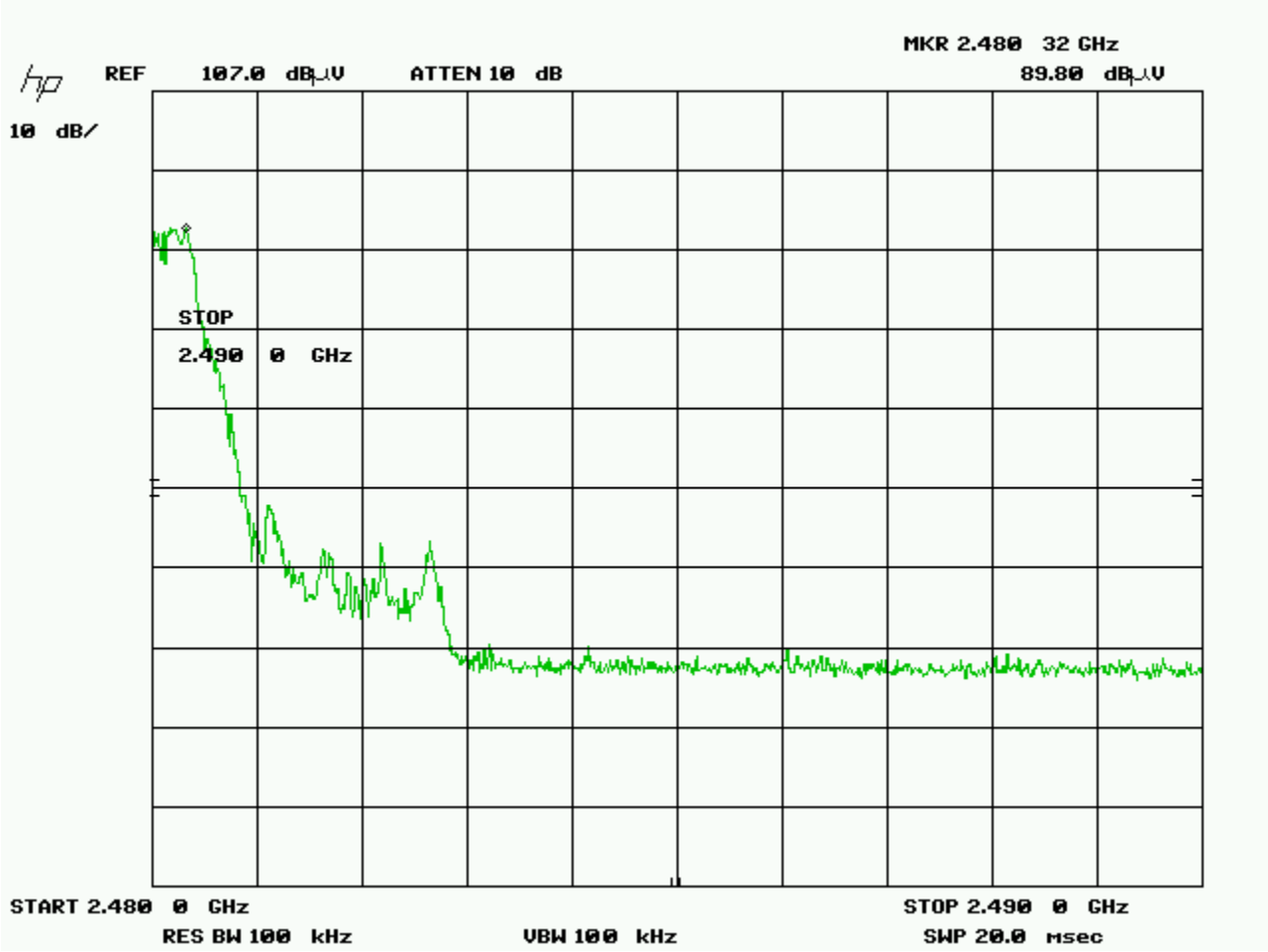
Graph(s)

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

Start Frequency 2402.0 MHz



Stop Frequency 2480.0 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	2007-08-09	2009-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2007-08-07	2009-08-07	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 (B) limits for general public exposure was applied. The limit for the frequency range of 1.5 GHz to 100 GHz was applied. This is a limit of 1.0 mW/ cm^2. The distance used for calculations was 20cm, as this is the minimum distance an operator will be from the EUT during normal operation, as stated by the manufacturer.

Results

The EUT passed the requirements. The worst case calculated power density was 0.0014mW/cm^2; this is significantly under the 1.0 mW/cm^2 requirement.

Calculations

The maximum conducted output power as measured = 6.9dbm.

$P_d = (P_t * G) / (4 * pi * R^2)$
Where Pt = 6.9 dbm or 4.9 mW as per Peak power conducted output
Where G = 1.5 dBi, or numerically 1.41
Where R = 20 cm

$P_d = (4.9 \times 1.41) / (4 \times pi \times 20cm^2)$
$P_d = 6.9$ mW / 5026 cm^2
$P_d = 0.0014$ mW/cm^2

Power Line Conducted Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

Limits & Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207
Method is as defined in ANSI C64:2003

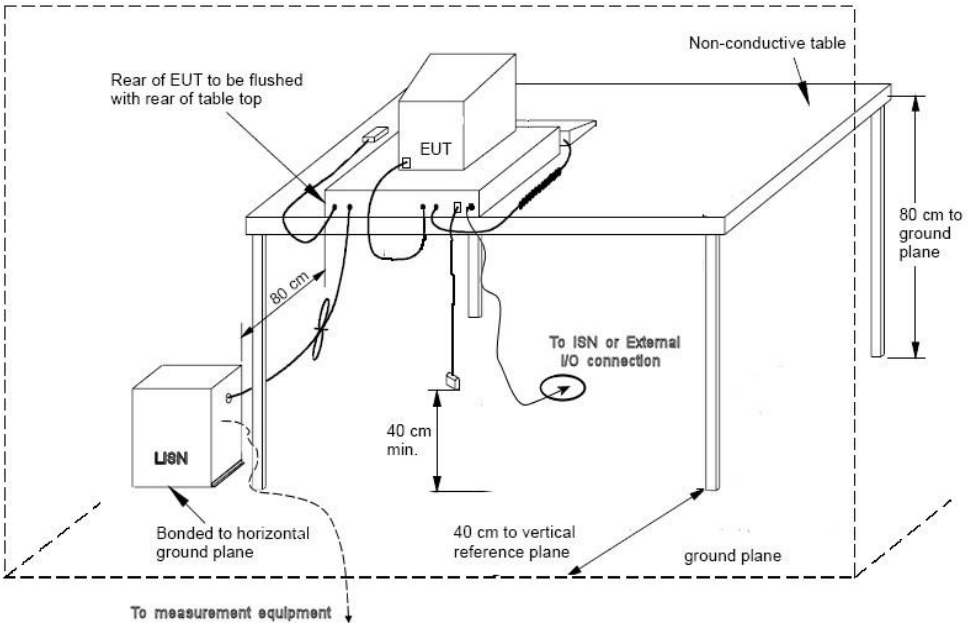
Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Note: If the Peak or Quasi Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Both limits are applicable, and each is specified as being measured with a 9 kHz measurement bandwidth.

Typical Setup Diagram



Note: The vertical reference plane is optional as per ANSI C63.4 section 5.2.2

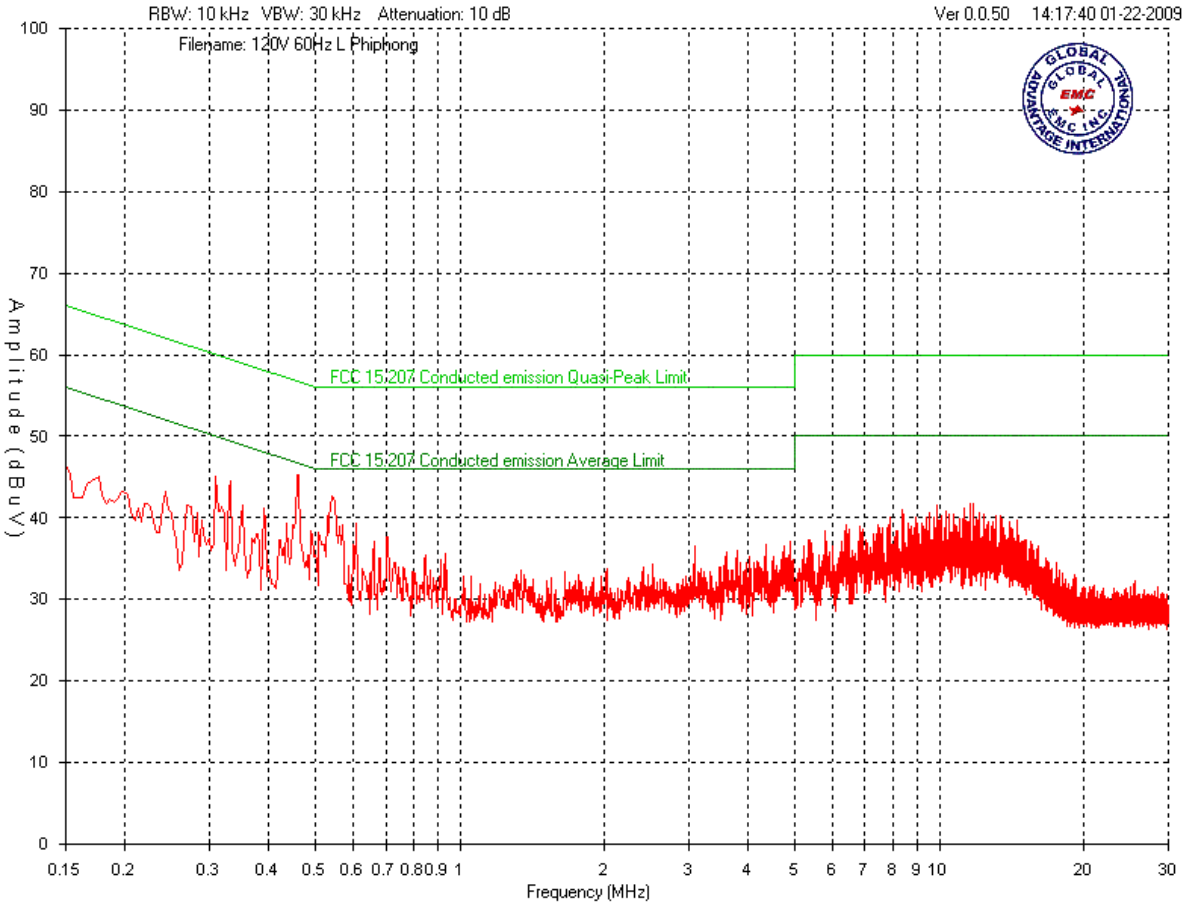
Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-3.6 dB with a 'k=2' coverage factor and a %95 confidence level.

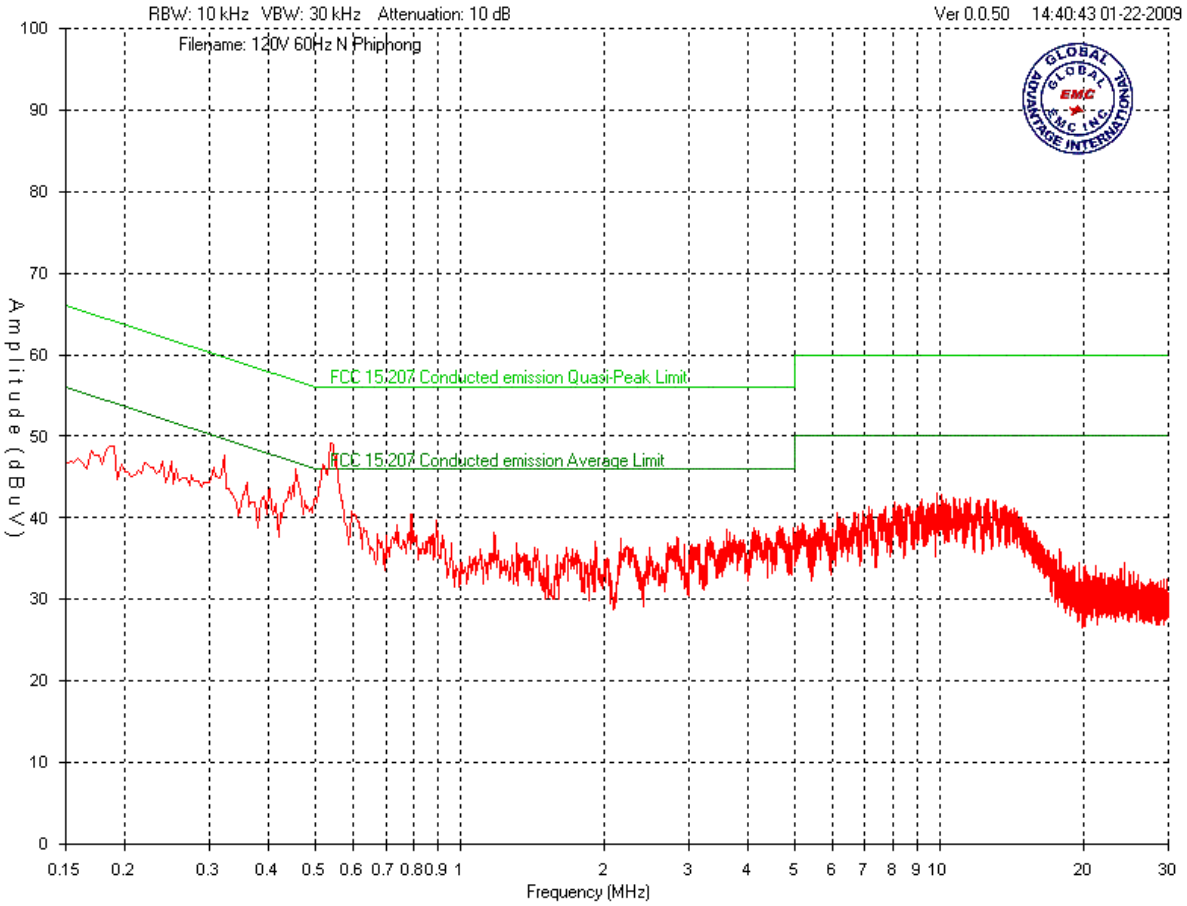
Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector where applicable, please refer to the table. The graph shown below is a peak measurement graph, measured with a resolution bandwidth greater then or equal to the final required detector. These graphs are performed as a worst case measurement to enable the detection of frequencies of concern and for considerable time savings.

120V 60Hz Line
Peak emissions



120V 60Hz Neutral
Peak emissions



Client	Unify4Life
Product	AV8001
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2008

Final Measurements

Average Emissions Table

Product category	Class B Avg								
Project	PhiPhong PS								
Phase									
Test Frequency (MHz)	**Detection mode (Q-Peak / Avg)**	**Raw signal (dBuV)**	**Cable loss (dB)**	**Attenuator (dB)**	**LISN factor (dB)**	**Received signal (dBuV)**	**Emission limit (dBuV)**	**Margin (dBuV)**	**Result**
120V 60Hz Neutral									
0.531	Avg	27.1	0.2	10	0.4	37.7	46	8.3	PASS
0.17	Avg	18.7	0.2	10	1.75	30.65	56	25.35	PASS
0.45	Avg	17.3	0.2	10	0.4	27.9	48	20.1	PASS
120V 60Hz Line									
0.534	Avg	32.3	0.2	10	0.4	42.9	46	3.1	PASS
0.17	Avg	26	0.2	10	1.75	37.95	56	18.05	PASS
0.45	Avg	25.9	0.2	10	0.4	36.5	48	11.5	PASS

QP Emissions Table

Product category	Class B QP								
Project	PhiPhong PS								
Phase									
Test Frequency (MHz)	**Detection mode (Q-Peak / Avg)**	**Raw signal (dBuV)**	**Cable loss (dB)**	**Attenuator (dB)**	**LISN factor (dB)**	**Received signal (dBuV)**	**Emission limit (dBuV)**	**Margin (dBuV)**	**Result**
120V 60Hz Neutral									
0.528	QP	29	0.2	10	0.4	39.6	56	16.4	PASS
0.17	QP	29.2	0.2	10	1.75	41.15	66	24.85	PASS
0.5	QP	23.8	0.2	10	0.4	34.4	56	21.6	PASS

120V 60Hz Line									
0.534	QP	35.8	0.2	10	0.4	46.4	56	9.6	PASS
0.17	QP	32.5	0.2	10	1.75	44.45	66	21.55	PASS
0.45	QP	31.4	0.2	10	0.4	42	58	16	PASS

Note:

1. See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up for the highest line conducted emission

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2007-08-09	2009-10-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2007-08-07	2009-10-07	GEMC 7
LISN	LISN 275-25-1	Vican	2007-09-12	2009-10-12	GEMC 12
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
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42

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

Appendix A – EUT Summary

General EUT Description

Client	
Organization	Unify4Life
Contact	Ziad Al Wakeel
Phone	905 940 1117
EUT Details	
EUT Model number	AV8001
Equipment Category	Wireless module for remotely controlling various energy management applications.
Basic EUT Functionality	The AV8001 easily transforms your BlackBerry® smartphone into a universal remote giving you complete control over all of your home's audio/video equipment. Just like your regular remotes, use your BlackBerry® to quickly change channels on your TV, skip to the next chapter of your DVD, adjust the volume on your audio receiver or navigate through the guide on your set top box. Our intuitive interface makes it easy to access any and every button on your devices. So go ahead and reduce your clutter put away those old remotes.
Input Voltage and Frequency	120V 60Hz
Connectors available on EUT	None.
Peripherals Required for Test	None.
Release type	Final
Intentional Radiator Frequency	2402 – 2480.0 MHz for Bluetooth protocol.

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'.

Appendix B – EUT and Test Setup Photographs

Figure 1 – Radiated emission setup

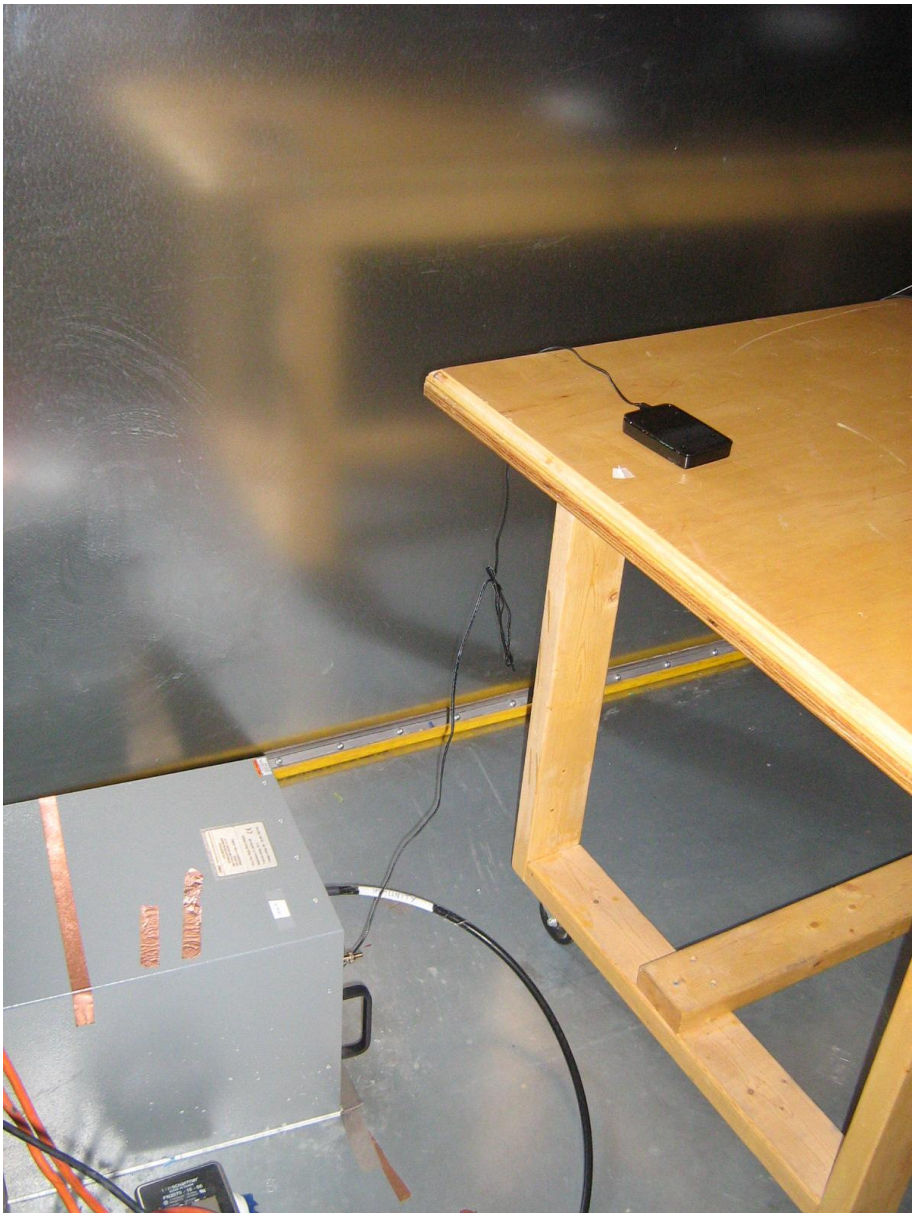


Figure 2 – Power line conducted emissions

Figure 3 – Conducted power emissions

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