

**Advanced
Compliance Laboratory**

210 Cougar court
Hillsborough, NJ 08844
Tel: (908) 927 9288
Fax: (908) 927 0728

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

of

SAMPLE BOX SCANNER
MODEL: BOXMAPPER II
FCC ID: 2AMHY-BM02

July 12th , 2017

This report concerns (check one): Original grant ☒ Class II change ☐
Equipment type: Low Power Intentional Radiator

Deferred grant requested per 47 CF 0.457(d)(1)(ii)? yes ☐ no ☒
If yes, defer until: _____ (date)
Company agrees to notify the Commission by _____ (date)
of the intended date of announcement of the product so that the grant can be
issued on that date.

Transition Rules Request per 15.37? yes ☐ no ☒
If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR
[10-1-90 Edition] provision.

Report prepared for: BIOTILLION LLC.
Report prepared by: Advanced Compliance Lab
Report number: 0048-170607-01-FCC



Lab Code: 200101

The test result in this report IS supported and covered by the NVLAP accreditation

Table of Contents

Report Cover Page.....	1
Table of Contents	2
Figures.....	3
1. GENERAL INFORMATION	4
1.1 Verification of Compliance.....	4
1.2 Equipment Modifications	5
1.3 Product Information	6
1.4 Test Methodology	6
1.5 Test Facility	6
1.6 Test Equipment	6
1.7 Statement for the Document Use	8
2. PRODUCT LABELING	9
3. SYSTEM TEST CONFIGURATION	10
3.1 Justification	10
3.2 Special Accessories.....	10
3.3 Configuration of Tested System	10
4. SYSTEM SCHEMATICS	14
5. CONDUCTION EMISSION DATA	15
5.1 Field Strength Calculation	18
5.2 Test Methods and Conditions	18
5.3 Test Data	18
6. RADIATED EMISSION DATA	15
6.1 Field Strength Calculation	18
6.2 Test Methods and Conditions	18
6.3 Test Data	18
7. EUT RECEIVING MODE VERIFICATION.....	24
8. PHOTOS OF TESTED EUT	28

Figures

Figure 2.1 ID Label	9
Figure 2.2 Location of Label on Back of the EUT	9
Figure 3.1 Radiated Test Setup	11
Figure 3.2 Radiated Configuration Test Setup	12
Figure 3.3 Conducted Test Setup	11
Figure 4.1 EUT Schematics	15
Figure 5.1 Line Conducted Emission	18
Figure 5.2 Neutral Conducted Emission	19
Figure 8.1 Top (Size) View	29
Figure 8.2 Front View	30
Figure 8.3 Rear (Ports) View	31
Figure 8.4 Bottom View	32
Figure 8.5 Sides View	33
Figure 8.6 EUT Inside View	34
Figure 8.7 UHF Motherboard Components Side View	35
Figure 8.8 UHF Motherboard Foil Side View	36
Figure 8.9 UHF Daughter Board Components Side View	37
Figure 8.10 UHF Daughter Board Foil Side View	38
Figure 8.11 HF Board Front Side View	39
Figure 8.12 HF Board Back Side View	40
Figure 8.13 AC/DC Adaptor	41

1. GENERAL INFORMATION

1.1 Verification of Compliance

EUT: Sample Box Scanner

Model: BoxMapper II

Applicant: BIOTILLION LLC.

Test Type: FCC Part 15C Sec. 15.249 CERTIFICATION

Result: PASS

Tested by: ADVANCED COMPLIANCE LABORATORY

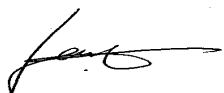
Test Date: June 07, 2017 ~ July 12, 2017

Report Number: 0048-170607-01-FCC

The above equipment was tested by Compliance Laboratory, Advanced Technologies, Inc. for compliance with the requirement set forth in the FCC rules and regulations Part 15 subpart C. This said equipment in the configuration described in the report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	± 2.36	± 2.99	± 1.83



Wei Li
Lab Manager
Advanced Compliance Lab

Date 07/12/2017

1.2 Equipment Modifications

N/A

1.3 Product Information

System Configuration

ITEM	DESCRIPTION	ID	CABLE
Product	Sample Box Scanner BOXMAPPER II ⁽¹⁾	FCC ID: 2AMHY-BM02	
Housing	Plastic w / metal bottom		
Power Supply	AC/DC Adaptor Input:100-240V~/0.3A,50-60Hz Output: 6.0Vdc/2.0A		
Operation Freq.	902MHz ~ 927MHz ,		
Receiver	BOXMAPPER II(RX)	Verification	

(1) EUT submitted for grant.

1.4 Test Methodology

Radiated tests were performed according to the procedures in ANSI C63.4-2014 & & ANSI C63.10-2013 at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at Hillsborough, New Jersey, which is designated by IC as “ site IC 3130A” This site has been accepted by FCC to perform measurements under Part 15 or 18 in a letter dated May 19, 1997 (Refer to: 31040/PRV 1300F2). The NVLAP Lab code for accreditation of FCC EMC Test Method is: 200101-0.

1.6 Test Equipment

Manufacture	Model	Serial No.	Description	Cal Due dd/mm/yy
Hewlett-Packard	HP8546A	3448A00290	EMI Receiver	25/09/17
Agilent	E4440A	US40420700	3Hz-26.5GHz Spectrum Analyzer	17/06/18
R &S	ESPI	100018	9KHz-7GHz EMI Receiver	25/08/17
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	12/11/17
EMCO	3146	9008-2860	200-1000MHz Log-Periodic	13/11/17

			Antenna	
ARA	MWH-1826/B	1013	18-26GHZ Horn Antena	10/02/18
EMCO	3115	49225	Double Ridge Guide Horn Antenna	28/11/17
Electro-Meterics	ALR-25M/30	289	10KHz-30MHz Active Loop Antenna	28/05/18
ARA	MWH-1826/B	1013	18-26GHZ Horn Antena	10/02/18
COM-POWER	L1215A	191994	Line Impedance Stabilization Networks	24/03/18
Fischer Custom	LISN-2	900-4-0009	Line Impedance Stabilization Networks	18/03/18

All Test Equipment Used are Calibrated Traceable to NIST Standards. Calibration Interval: 2 Years

1.7 Statement for the Document Use

This report shall not be reproduced except in full, without the written approval of the laboratory. And this report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

2. PRODUCT LABELING

BioTillion Sample Box Scanner
Model No.: BoxMapper II
FCC ID: 2AMHY-BM02

This device complies with part 15 of the FCC Rules. Operating is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Figure 2.1 ID Label



Figure 2.2 Location of Label on EUT

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). And the antennas were permanently attached/mounted to the EUT PCB:

PCB trace antenna with +1dB gain for 900MHz Band

Testing was performed as EUT was continuously operated at the following frequency channels:

Low=902.74MHz, Middle= 914.75MHz, High=927.24MHz

USB ports are for design diagnostic only. Not USB protocol port. No Data transfer

3.2 Special Accessories

N/A

3.3 Configuration of Tested System

Figure 3.1 to Figure 3.2 illustrate this system, which is tested standing along.



Figure 3.1 Radiated Test Setup



Figure 3.2 Radiated Configuration Test Setup



Fig. 3.3 Conducted Emission Test Setup

4. SYSTEM SCHEMATICS

See Attachment.

Figure 4.1 System Schematics

5. CONDUCTED EMISSION DATA

5.1 Test Methods and Conditions

The EUT was under normal operational mode during the conducted emission test. EMI Receiver was scanned from 150KHz to 30MHz with maximum hold mode for maximum emission. Recorded data was sent to the plotter to generate output in linear format. At the input of the spectrum analyzer, a HP transient limiter is inserted for protective purpose. This limiter has a 10 dB attenuation in the range of 150KHz to 30MHz. That factor was automatically compensated by the receiver, so the readings are the corrected readings. The reference of the plot is the FCC Part 15 limit in Figure 5.1 through Figure 5.2.

Conducted Emission Technical Requirements				
Frequency Range	CLASS A		Class B	
	Quasi-Peak dBuV	Average dBuV	Quasi-Peak dBuV	Average dBuV
150kHz -0.5MHz	79 (8912uV)	66 (1995uV)	66-56	56-46
0.5MHz-30MHz	73 (4467uV)	60 (1000uV)	---	---
0.5MHz- 5MHz	---	---	56	46
5MHz-30MHz	---	---	60	50

Emissions that have peak values close to the specification limit (if any) are also measured in the quasi-peak mode to determine compliance.

5.2 Test Data

Figure 5.1 through Figure 5.4 show the neutral and line conducted emissions for the defined operation modes.

Highest Data for AC Line Conducted Emissions, 120Vac Battery Charging Mode						
Frequency (MHz)	0.400 (Line)	1.400 (Line)	2.000 (Line)	0.480 (Neutral)	1.840 (Neutral)	3.510 (Neutral)
Peak/QP Reading (dBuV)*	51.05	46.85	47.01	47.25	45.03	45.44
Average Reading (dBuV)*	33.99	29.44	31.75	33.48		

* Peak reading is under the average limit. No need to shows peak/QP level.

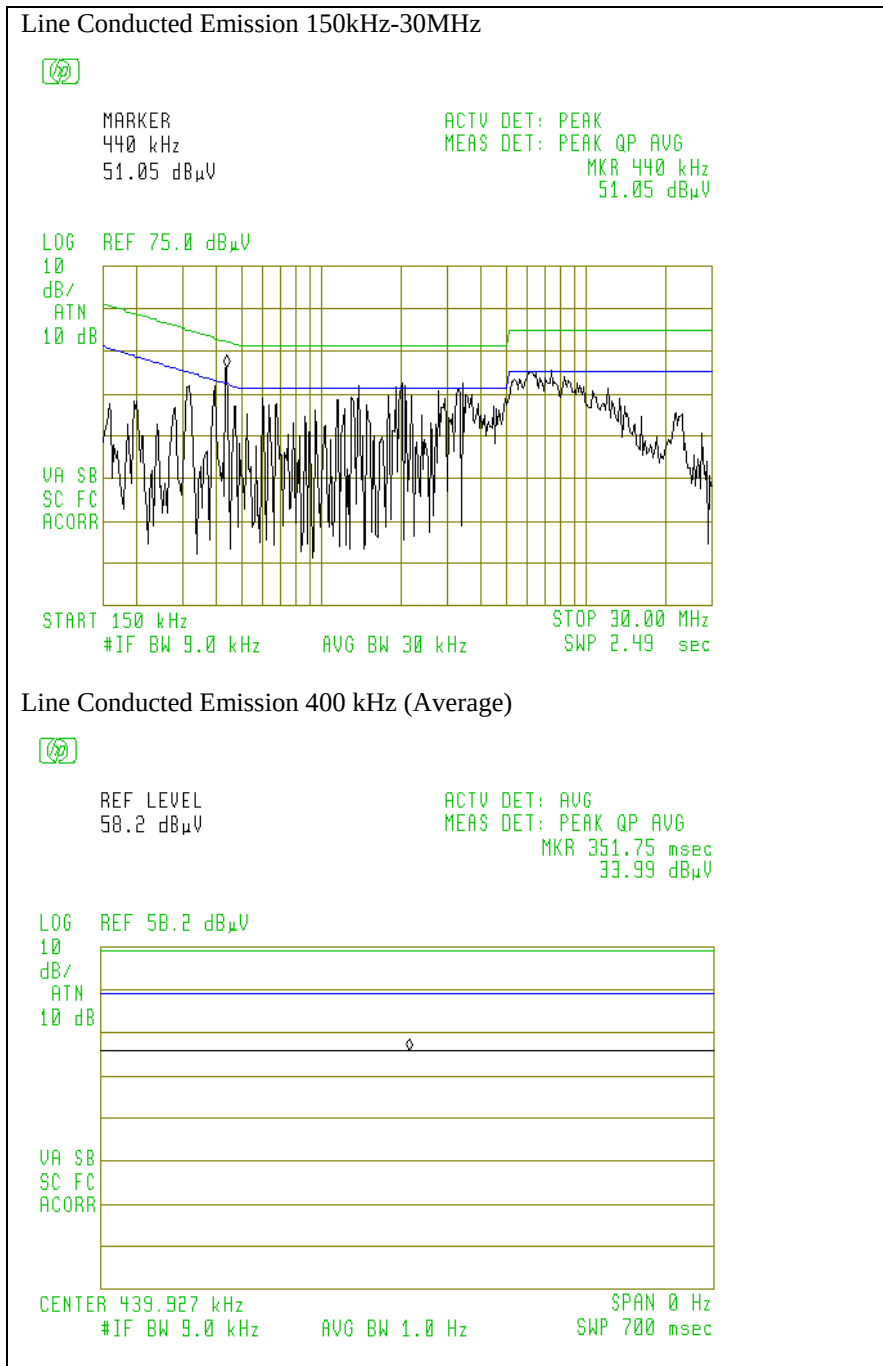
The following conducted test data shows the worst case emissions are still below FCC Part 15/IECS-003 CLASS B limits.

Test Personnel:

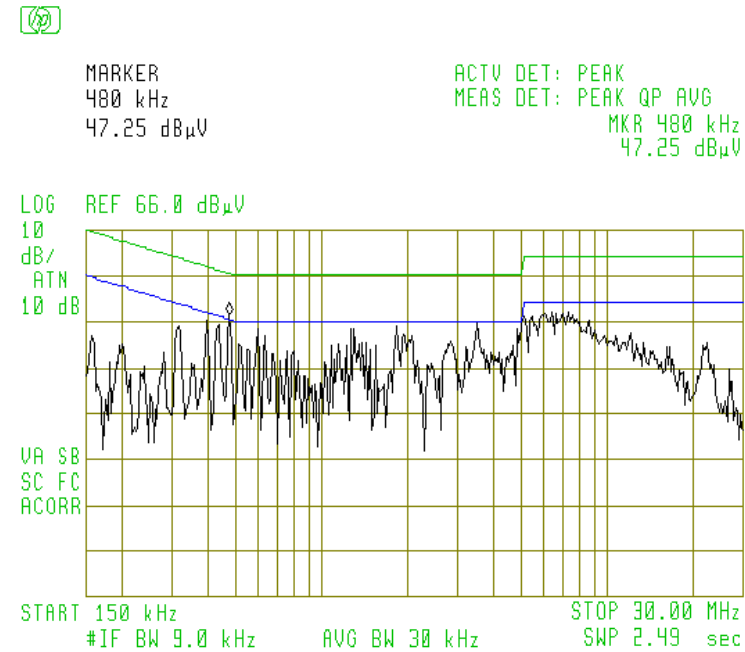
Tester Signature: David Tu

Date: 07/12/2016

Typed/Printed Name: David Tu

**Figure 5.1 Line Conducted Emission**

Neutral Conducted Emission 150 kHz-30 MHz



Neutral Conducted Emission 480kHz (Average)

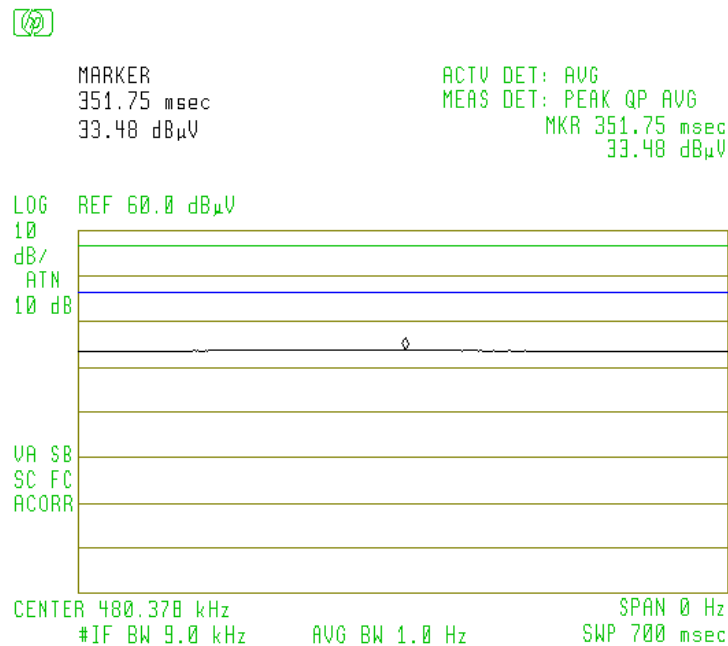


Figure 5.2 Neutral Conducted Emission

6. RADIATED EMISSION DATA

6.1 Field Strength Calculation

The corrected field strength is automatically calculated by EMI Receiver using following:

$$FS = RA + AF + CF + AG$$

where FS: Corrected Field Strength in dB μ V/m

RA: Amplitude of EMI Receiver before correction in dB μ V

AF: Antenna Factor in dB/m

CF: Cable Attenuation Factor in dB

AG: Built-in Preamplifier Gain in dB (Stored in receiver as part of the calibration data)

6.2 Test Methods and Conditions

The initial step in collecting radiated data is a EMI Receiver scan of the measurement range below 30MHz using peak detector and 9KHz IF bandwidth / 30KHz video bandwidth. For the range 30MHz - 1GHz, 100KHz IF bandwidth / 100KHz video bandwidth are used. Both bandwidths are 1MHz for above 1GHz measurement. Frequency range from EUT's lowest crystal frequency to 10th harmonics of fundamental was investigated.

6.3 Test Data

The following data lists the significant emission frequencies, polarity and position, peak reading of the EMI Receiver, the FCC limit, and the difference between the peak reading and the limit. Explanation of the correction and calculation are given in section 5.1.

Test Personnel: _____



Typed/Printed Name: Edward Lee

Date: 07/12/2017

Radiated Test Data for 900 Band (CH-902MHz/914MHz/927MHz & Harmonics)

Frequency (MHz)	Polarity (V,H) Position (Zup,Zdown)	Antenna Height (m)	Azimuth (Degree)	Peak Reading at 3m (2) (dBuV/m)	Reading After Correction (dBuV/m)	FCC/IC 3m Limit (1) (dBuV/m)	Difference (dBuV/m)
902.75	V	1.1	000	77.7		94	-16.3
1805.5	V	1.5	000	38.7		54	-15.3
2708.25	V	1.5	000	42.6		54	-11.4
902.75	H	1.0	235	72.2		94	-21.8
1805.5	H	1.5	235	39.4		54	-14.6
2708.25	H	1.5	235	42.8		54	-11.2
914.75	V	1.1	010	76.3		94	-17.7
1829.5	V	1.5	010	40.1		54	-13.9
2744.25	V	1.5	010	42.1		54	-11.9
914.75	H	1.0	180	73.5		94	-20.5
1829.5	H	1.5	180	39.7		54	-14.3
2744.25	H	1.5	180	42.4		54	-11.6
927.24	V	1.1	045	76.7		94	-17.3
1854.48	V	1.5	045	38.5		54	-15.5
2781.72	V	1.5	045	42.1		54	-11.9
927.24	H	1.0	200	74.1		94	-19.9
1854.48	H	1.5	200	38.7		54	-15.3
2781.72	H	1.5	200	42.6		54	-11.4

(1) The limit for emissions within the 902-928MHz band is 50mV(94dB) per Sec. 15.249 & RSS-210. The limit for its harmonics is 500uV (54dB). Other spurious emissions shall be lower than either its fundamental by 50dB or the limit defined in Sec. 15.209 & RSS-210, whichever is higher.

(2) If each peak reading is less than the FCC average limit, it'll be not necessary to show the measured/ calculated average reading.

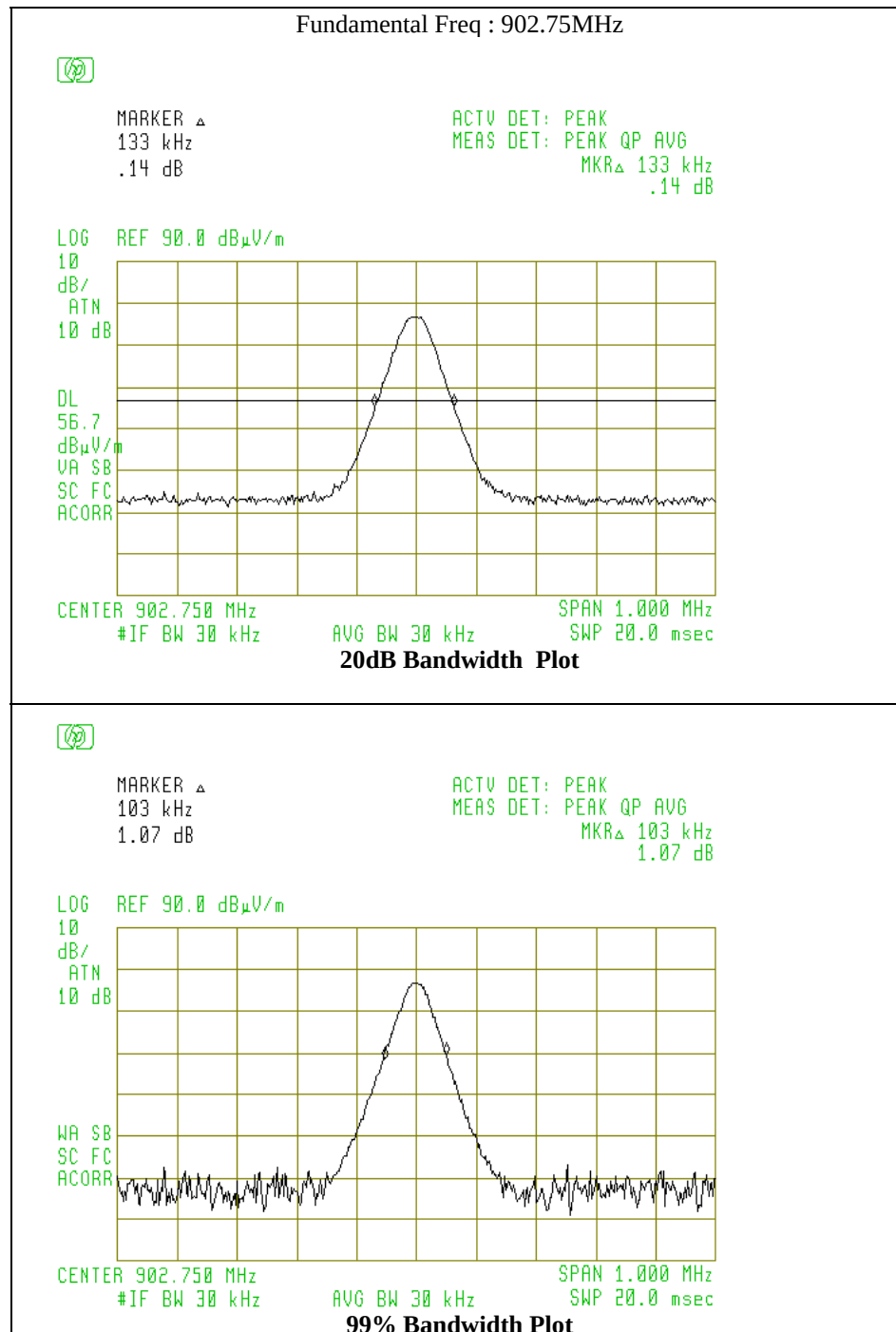
Other Spurious outside of the band 902-928MHz*

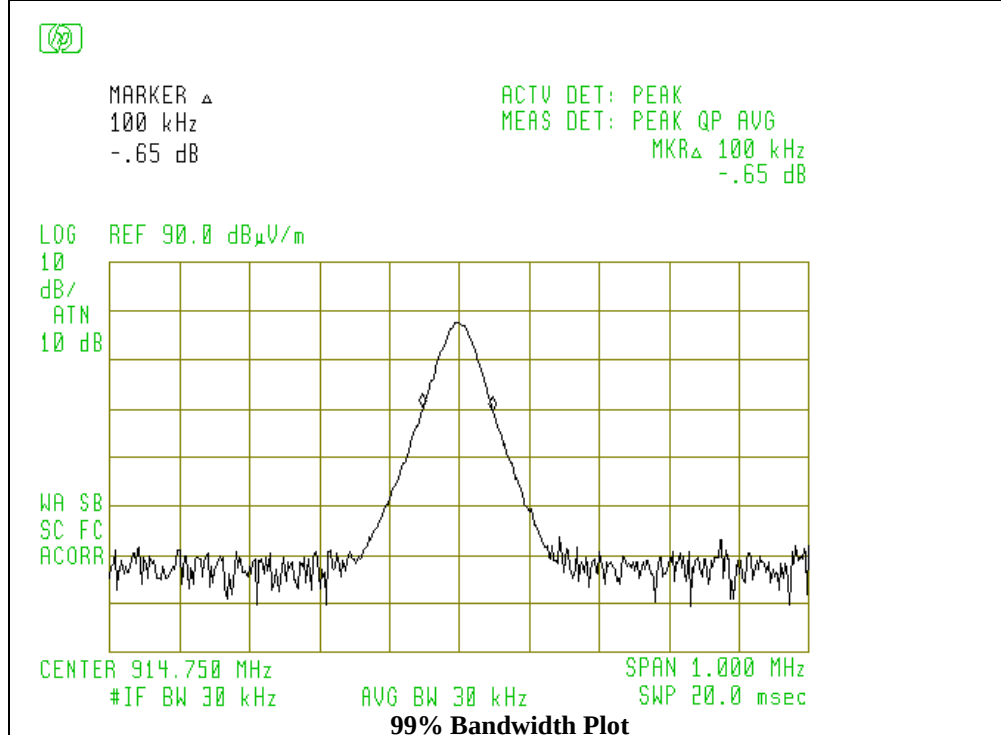
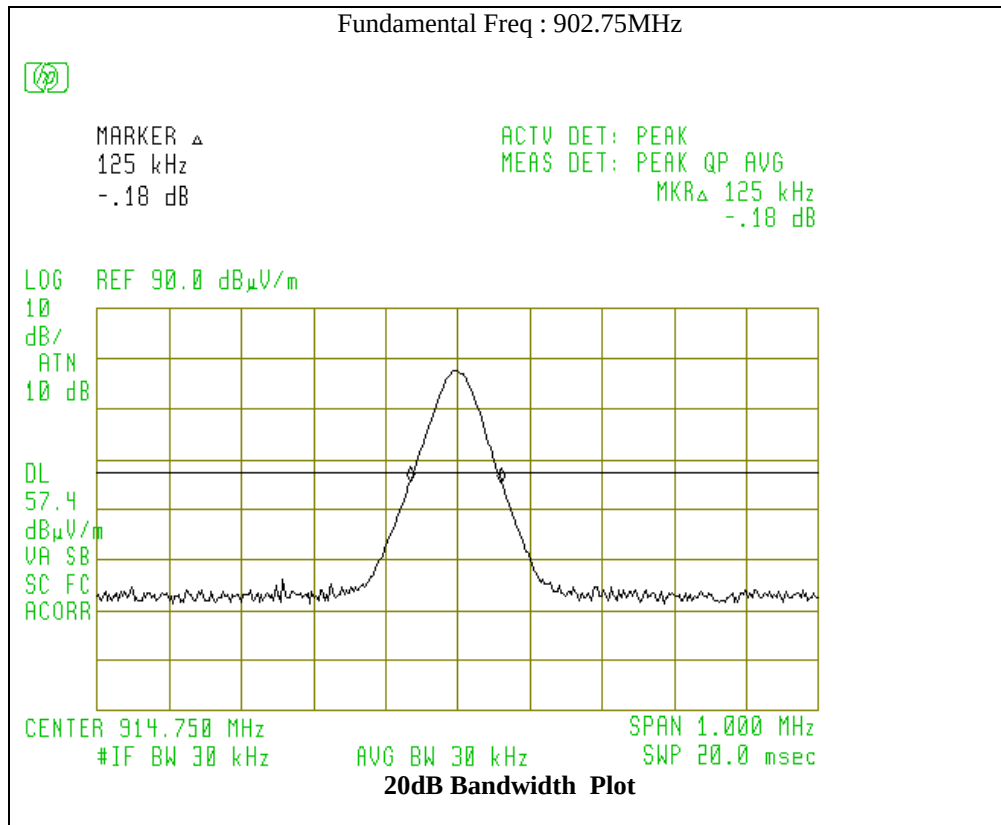
Frequency (MHz)*	Polarity (V,H) Position (Z- down)	Antenna Height (m)	Azimuth (Degree)	Peak Reading at 3m (dBuV/m)	FCC/IC 3m Limit (dBuV/m)	Difference (dBuV/m)
714.0	V	1.1	000	45.5*	46.5	-1.0
860.1	V	1.1	045	45.0*	46.5	-1.5
714.0	H	1.0	190	44.7*	46.5	-1.8
860.0	H	1.0	235	45.3*	46.5	-1.2

* Emissions from digital circuitry (non-intentional radiator) are excluded.

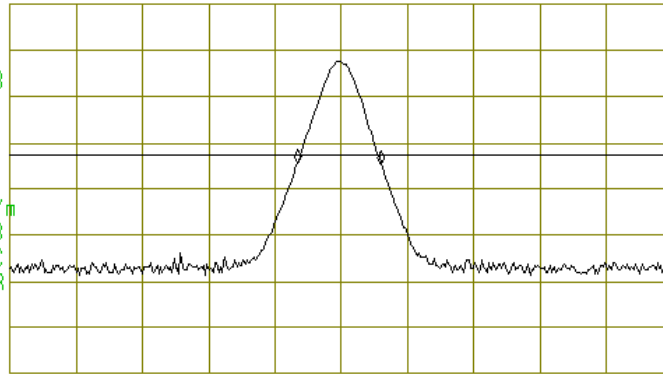
Comparing to the limit defined in Sec. 15.209 & RSS-Gen, emissions below the limit by 20dB were not recorded.

20 dB Bandwidth : 900MHz Band

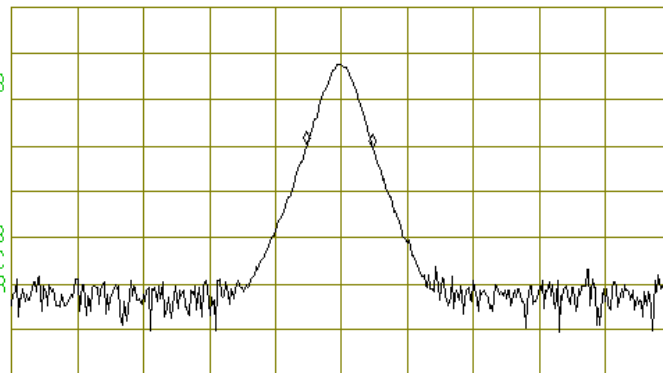




Fundamental Freq : 914.75MHz

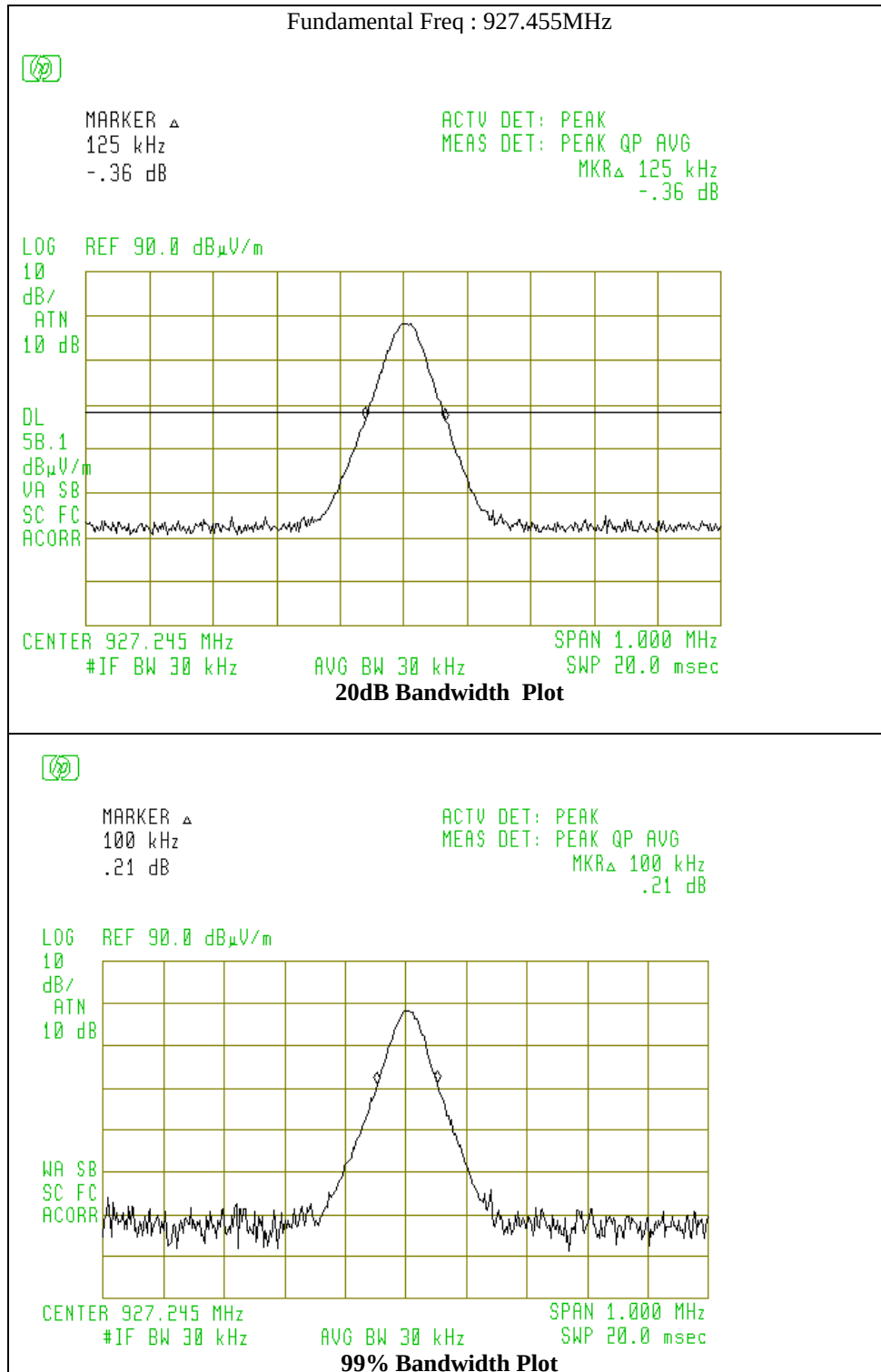
MARKER Δ
125 kHz
-1.18 dBACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 125 kHz
-1.18 dBLOG REF 90.0 dB μ V/m10
dB/
ATTN
10 dBDL
57.4
dB μ V/m
WA SB
SC FC
ACORRCENTER 914.750 MHz
#IF BW 30 kHz

AVG BW 30 kHz

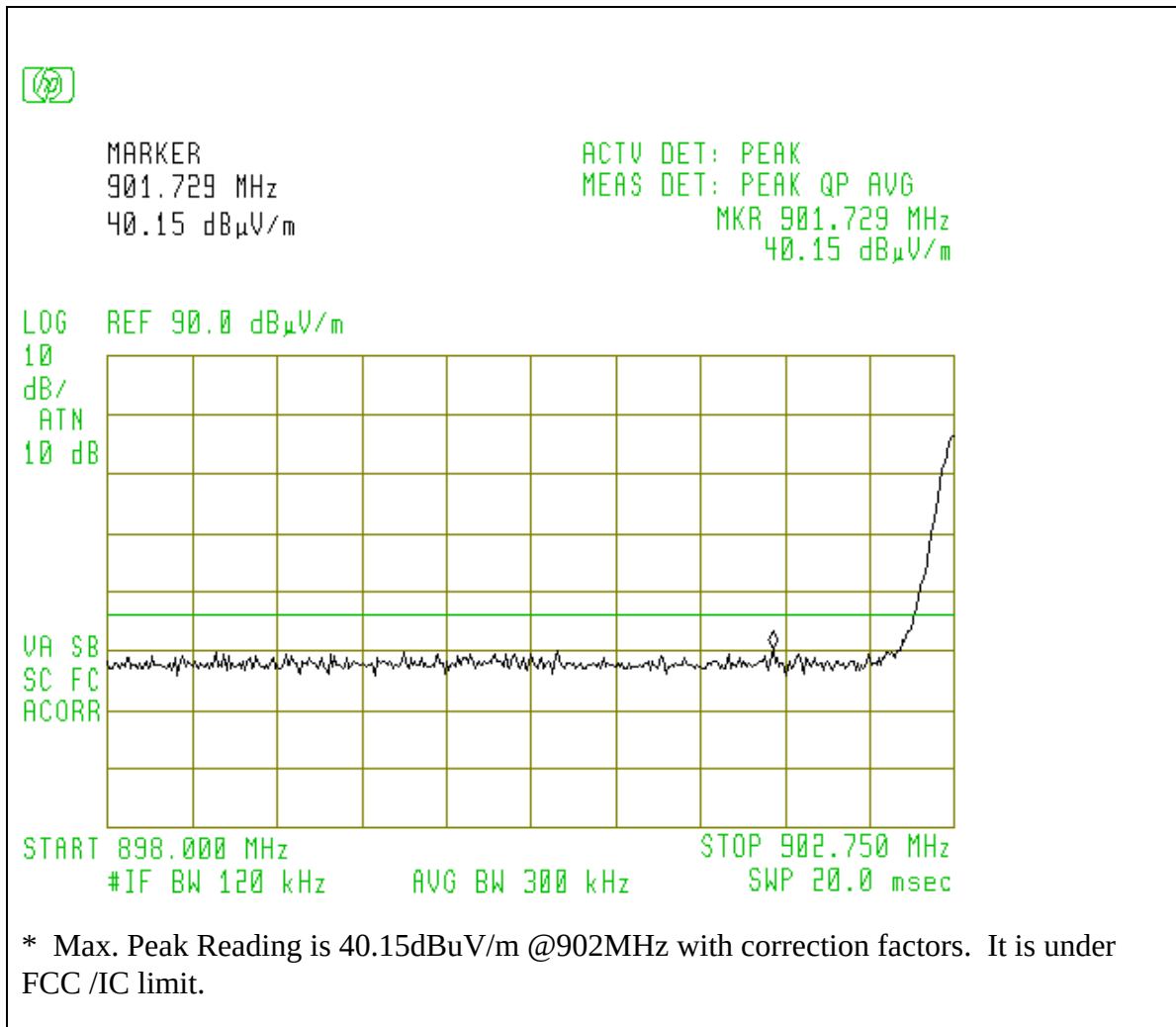
SPAN 1.000 MHz
SWP 20.0 msec**20dB Bandwidth Plot**MARKER Δ
100 kHz
-1.65 dBACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 100 kHz
-1.65 dBLOG REF 90.0 dB μ V/m10
dB/
ATTN
10 dBWA SB
SC FC
ACORRCENTER 914.750 MHz
#IF BW 30 kHz

AVG BW 30 kHz

SPAN 1.000 MHz
SWP 20.0 msec**99% Bandwidth Plot**



900MHz Band-edge Spurious





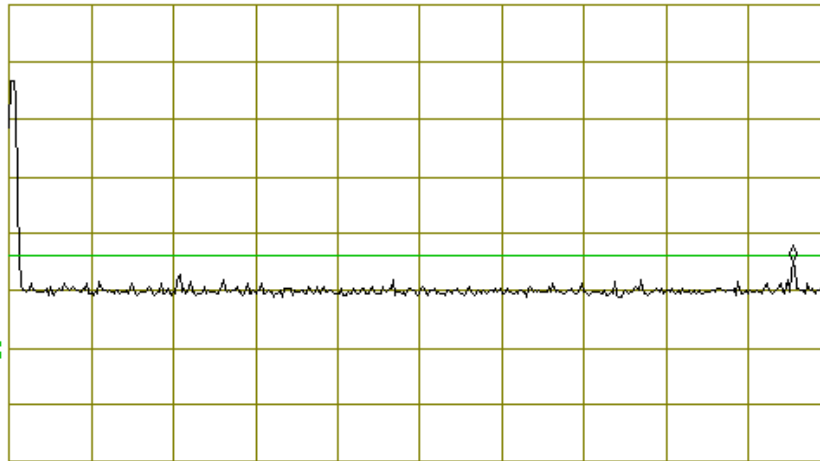
MARKER
958.53 MHz
45.05 dB μ V/m

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 958.53 MHz
45.05 dB μ V/m

LOG REF 90.0 dB μ V/m

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR



START 927.24 MHz

#IF BW 120 kHz

AVG BW 300 kHz

STOP 960.00 MHz

SWP 30.7 msec

* * Max. Peak Reading is 45.1dBuV/m @958MHz with correction factors. It is under FCC /IC limit.