

**Advanced
Compliance Laboratory**

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ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

of

WIRELESS I/O MODULE
MODEL: CSI-RM650
FCC ID: 2ARIX-CSI-RM650

October 30, 2018

This report concerns (check one): Original grant <input checked="" type="checkbox"/> Class II change <input type="checkbox"/>	
Equipment type: <u>Low Power Intentional Radiator</u>	
Deferred grant requested per 47 CF 0.457(d)(1)(ii)? yes <input type="checkbox"/> no <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> no <input checked="" type="checkbox"/>	
If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision.	
Report prepared for:	DATAONLINE LLC
Report prepared by:	Advanced Compliance Lab
Report number:	0048-180920-01-FCC



Lab Code: 200101

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

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1. GENERAL INFORMATION

1.1 Verification of Compliance

EUT: Wireless I/O Module

Model: CSI-RM650

Applicant: DATAONLINE LLC

Test Type: FCC Part 15C Sec. 15.249 CERTIFICATION

Result: PASS

Tested by: ADVANCED COMPLIANCE LABORATORY

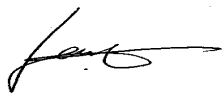
Test Date: October 15, 2018 ~ October 30, 2018

Report Number: 0048-180920-01-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 10/30/2018

1.2 Equipment Modifications

N/A

1.3 Product Information

System Configuration

ITEM	DESCRIPTION	ID	CABLE
Product	Wireless I/O Module CSI-RM650 (1)	FCC ID: 2ARIX-CSI-RM650	
Housing	Plastic		
Power Supply	5V~24V AC/DC provided by Optional adapter with rated input:100-240V~/50-60Hz		
Operation Freq.	915MHz		
Receiver	CSI-RM650(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	25/09/19
Agilent	E4440A	US40420700	3Hz-26.5GHz Spectrum Analyzer	17/06/19
R &S	ESPI	100018	9KHz-7GHz EMI Receiver	25/08/19
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	12/11/18
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	13/11/18

EMCO	3115	49225	Double Ridge Guide Horn Antenna	28/11/18
Electro-Meterics	ALR-25M/30	289	10KHz-30MHz Active Loop Antenna	28/05/19
COM-POWER	L1215A	191994	Line Impedance Stabilization Networks	24/03/19
Fischer Custom	LISN-2	900-4-0009	Line Impedance Stabilization Networks	18/03/19

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 Wireless I/O Module
Model No.: CSI-RM650
FCC ID: 2ARIX-CSI-RM650

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

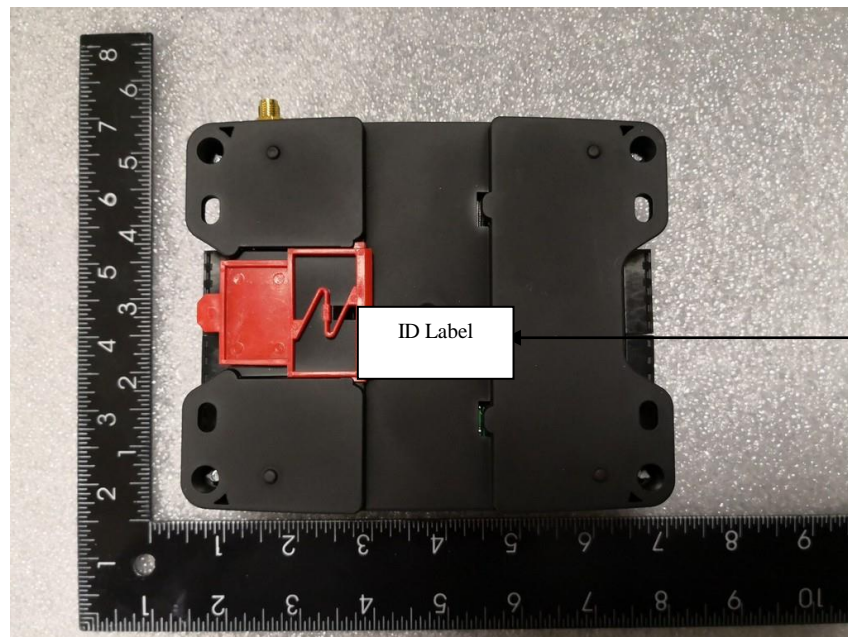


Figure 2.2 Location of Label on EUT

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). The following antenna was connected to EUT R-SMA antenna port:

Taoglas ISM 915MHz omni-direction antenna: Parts # IS.05.B.301111 with 3dBi gain.
Specifications available on the web at: <https://cdn.taoglas.com/datasheets/IS.05.B.301111.pdf>

Testing was performed as EUT was continuously operated at the following frequency channel(s):

Fc= 915MHz

3.2 Special Accessories

N/A

3.3 Configuration of Tested System

Figure 3.1 to Figure 3.3 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 (Optional AC/DC adaptor was used for data collection).

	Highest Data for AC Line Conducted Emissions							
Frequency (MHz)	0.180 (Line)	0.200 (Line)	0.600 (Line)	15.45 (Line)	0.170 (Neutral)	0.590 (Neutral)	15.68 (Neutral)	28.31 (Neutral)
Peak Reading (dBuV)	38.69	39.21	33.24	46.64	41.86	36.63	55.09	37.19
Average Reading (dBuV*)							17.39	
Under Limit	Y	Y	Y	Y	Y	Y	Y	Y

* if Peak reading is under the QP / average limit, no need to show its QP/Average level data.

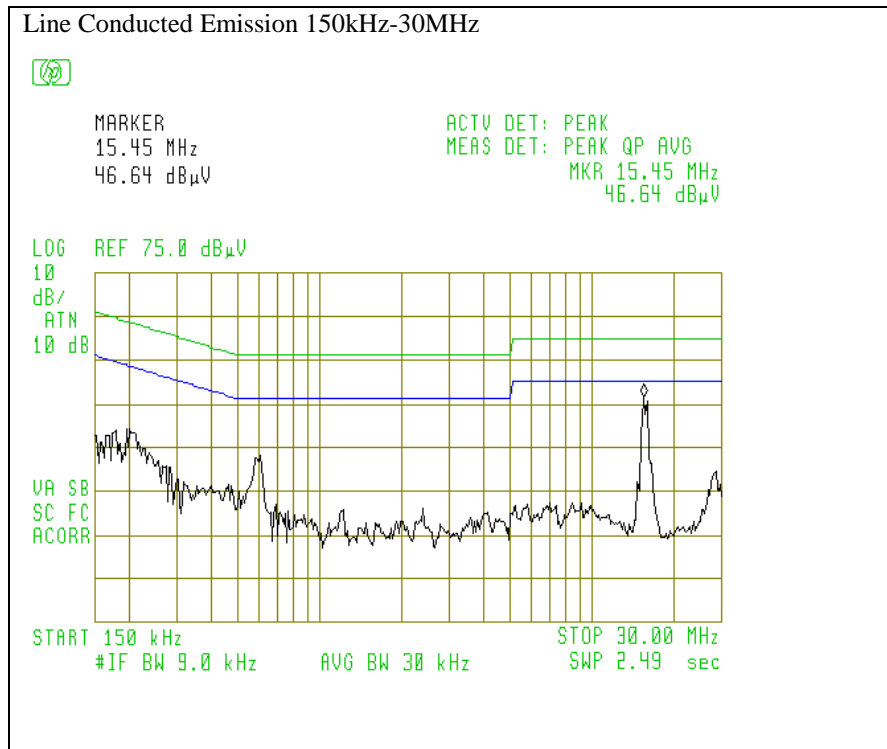
The following conducted test data shows the worst case emissions are still below FCC Part 15 /IECS-003 Class B limits.

Test Personnel:

Tester Signature: David Tu

Date: 07/12/2016

Typed/Printed Name: David Tu

**Figure 5.1 Line Conducted Emission**

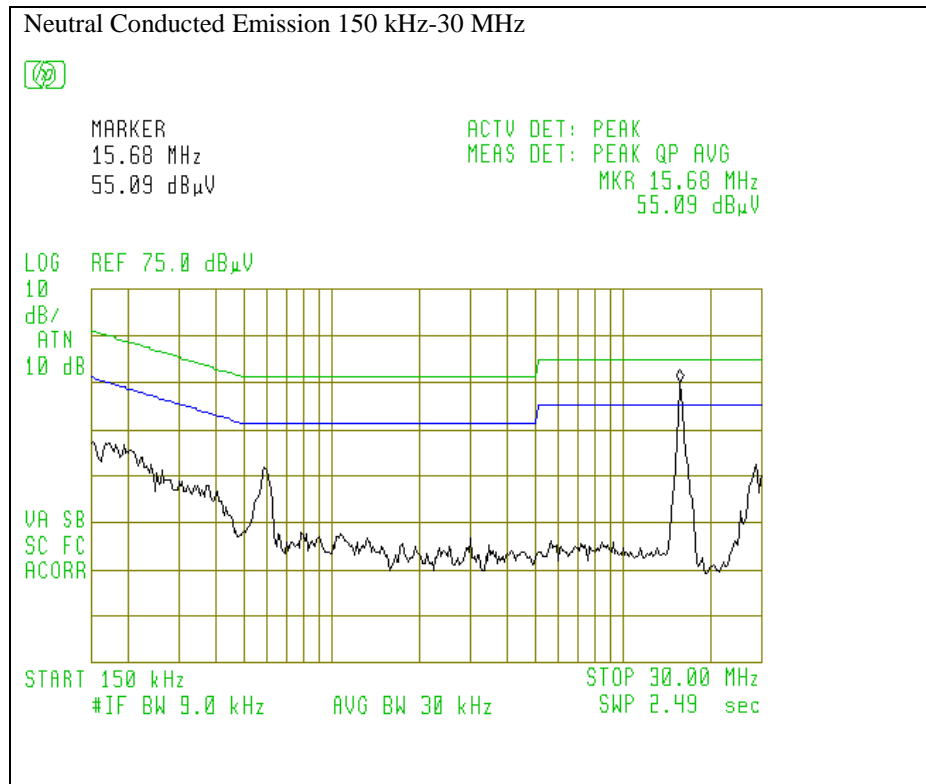


Figure 5.2 Neutral Conducted Emission

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: David Tu

Date: 10/30/2018

Radiated Test Data for 900 Band Transmitter

CH-915MHz & Harmonics

Frequency (MHz)	Polarity (V,H) Position (Zup,Zdown)	Antenna Height (m)	Azimuth (Degree)	Peak/QP Reading at 3m (2) (dBuV/m)	Reading After Correction (3) (dBuV/m)	FCC/IC 3m Limit (1) (dBuV/m)	Difference (dBuV/m)
915.0	V	1.1	000	93.1		94	-0.9
1830.0	V	1.2	020	51.3	46.5	54	-15.3
2745.0	V	1.1	010	48.2	43.4	54	-7.5
915.0	H	1.3	340	93.2		94	-0.8
1830.0	H	1.1	330	52.4	46.6	54	-7.4
2745.0	H	1.2	345	49.6	44.8	54	-9.2

- (1) The limit for emissions within the 902-928MHz band is 50mV(94dB) per Sec. 15.249. 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, 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. In this case, all peak reading is below the peak limit of 74dBuV/m.
- (3) Each max transmission duration is 57.5ms per 30s. So the duty cycle factor within 100ms is 57.5%, i.e, -4.8dB, which can be applied to average reading for harmonics.

Other Spurious outside of the band 902-928MHz*

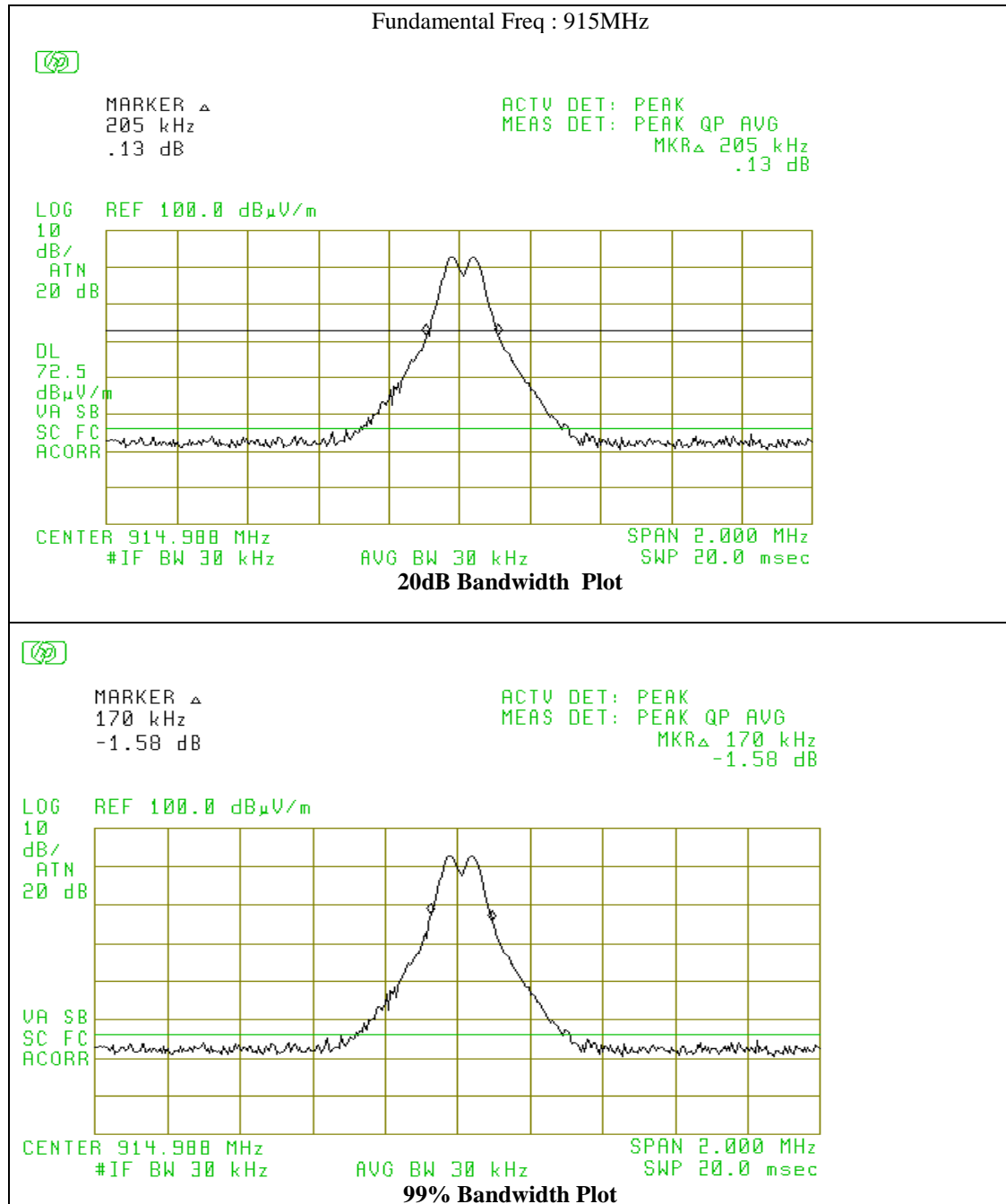
Frequency (MHz)(3)	Polarity (H or V)	Antenna Height (m)	Azimuth (Degree)	Peak/QP* Reading at 3m(2) (dBuV/m)	FCC 3m Limit(1) (dBuV/m)	Difference (dBuV/m)
41.9*	V	1.2	170	30.84	40.0	-9.16
48.2*	V	1.2	130	32.45	40.0	-7.55
56.4*	V	1.2	135	30.53	40.0	-9.47
58.5*	V	1.2	135	31.20	40.0	-8.8
64.9	V	1.1	135	36.35	40.0	-3.65
80.2*	V	1.1	150	31.8	40.0	-8.2
112.9*	V	1.0	170	29.46	43.5	-14.04
128.6*	V	1.1	180	40.49	43.5	-3.01
144.7*	V	1.1	180	32.90	43.5	-10.6
164.5*	V	1.1	180	33.20	43.5	-10.3
177.9	V	1.1	190	40.05	43.5	-3.45
204.7*	V	1.1	180	40.70	43.5	-2.8
704.8*	V	1.2	170	37.18	46.5	-9.32
713.3*	V	1.1	195	35.03	46.5	-11.47
48.3*	H	1.4	335	30.38	40.0	-9.62
57.6	H	1.5	330	34.40	40.0	-5.6
80.8	H	1.4	350	35.70	40.0	-4.3
112.5	H	1.3	270	35.11	43.5	-8.39
146.0	H	1.4	280	33.32	43.5	-10.18
205.6*	H	1.2	120	41.94	43.5	-1.56
240.0	H	1.3	140	37.72	46.5	-8.78
274.1	H	1.3	290	35.93	46.5	-10.57

(1) Comparing to the limit defined in Sec. 15.209, emissions below the limit by 20dB were not recorded.

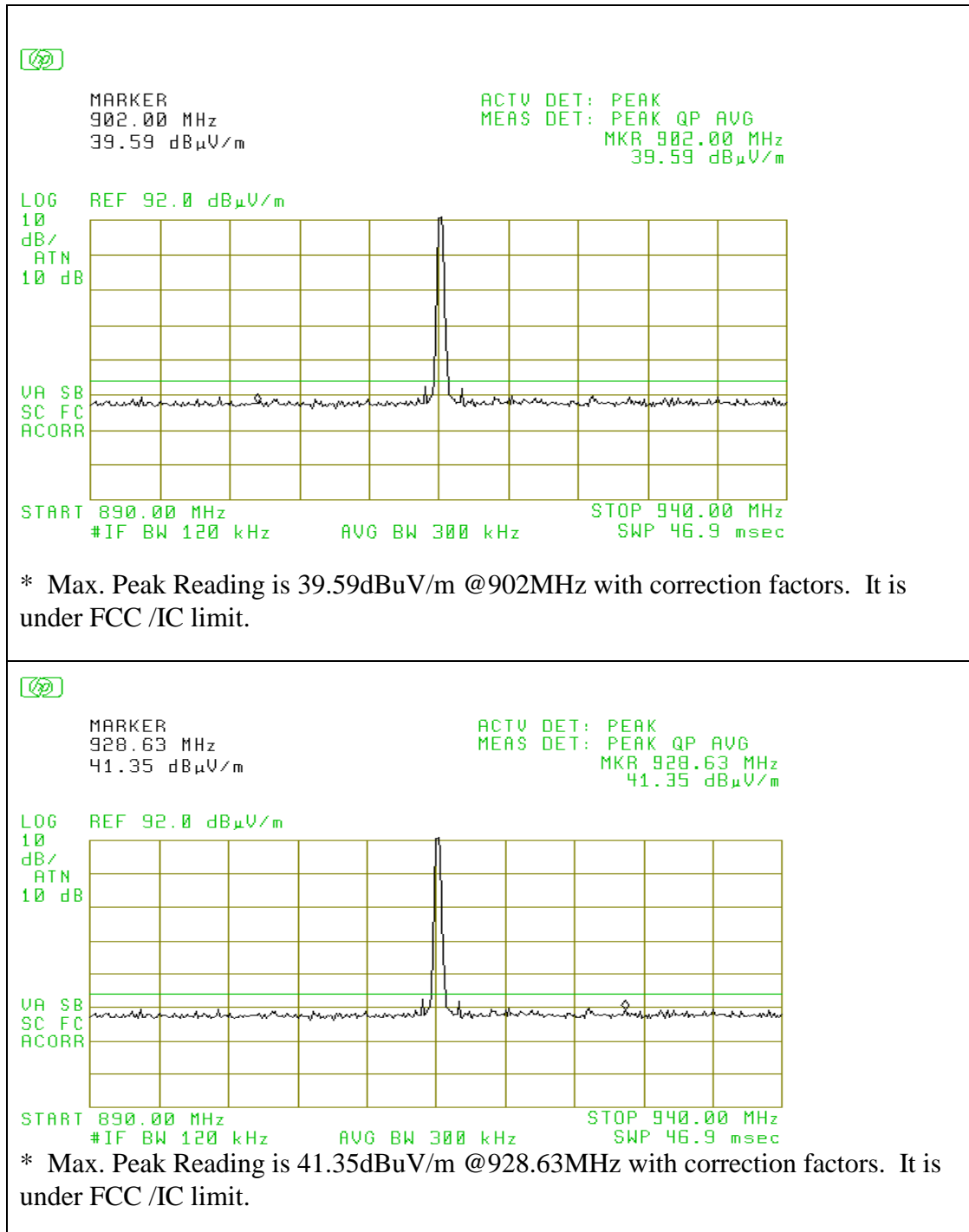
(2) If each peak reading is less than the FCC average limit, it'll be not necessary to show the measured/ calculated average reading. Emissions with * are QP reading.

(3) Emissions from digital circuitry (non-intentional radiator), if any, are excluded.

Signal Bandwidth in 900MHz Band



900MHz Band-edge Spurious



7. EUT RECEIVING MODE VERIFICATION

Radiated Test Data for Receiving Mode

Frequency (MHz)(3)	Polarity (H or V)	Antenna Height (m)	Azimuth (Degree)	Peak/QP* Reading at 3m(2) (dBuV/m)	FCC 3m Limit(1) (dBuV/m)	Difference (dBuV/m)
48.3*	V	1.2	125	31.73	40.0	-8.27
80.2*	V	1.1	140	30.20	40.0	-9.8
128.4*	V	1.1	180	40.20	43.5	-3.3
144.4*	V	1.1	170	33.50	43.5	-10
166.8*	V	1.1	180	32.90	43.5	-10.6
205.0*	V	1.1	170	39.49	43.5	-4.01
706.9*	V	1.2	170	33.18	46.5	-13.32
48.2*	H	1.4	350	29.12	40.0	-10.88
80.8	H	1.4	350	33.20	40.0	-6.8
114.2	H	1.3	270	34.71	43.5	-8.79
205.6*	H	1.3	130	39.13	43.5	-4.37
240.7	H	1.3	130	38.17	46.5	-8.33

- (1) Receiving mode spurious emissions shall be lower than the limit defined in Sec. 15.209
 (2) If each peak reading is less than the FCC average limit, it'll be not necessary to show the measured/ calculated average reading. Emissions with * are QP reading.
 (3) Emissions from digital circuitry (non-intentional radiator) are excluded.