

**FCC PART 15, SUBPART B and C
TEST REPORT**

for

TT20K SYSTEM TRANSMITTER

Model: TX20K

Prepared for

BINSFELD ENGINEERING INC.
4571 WEST MacFARLANE
MAPLE CITY, MICHIGAN 49664

Prepared by: _____

THOMAS SZYNAL

Approved by: _____

KYLE FUJIMOTO

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DATE: APRIL 19, 2019

	REPORT BODY	APPENDICES					TOTAL
		A	B	C	D	E	
PAGES	17	2	2	2	11	32	66

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TABLE OF CONTENTS

Section / Title	PAGE
GENERAL REPORT SUMMARY	4
SUMMARY OF TEST RESULTS	5
1. PURPOSE	6
2. ADMINISTRATIVE DATA	7
2.1 Location of Testing	7
2.2 Traceability Statement	7
2.3 Cognizant Personnel	7
2.4 Date Test Sample was Received	7
2.5 Disposition of the Test Sample	7
2.6 Abbreviations and Acronyms	7
3. APPLICABLE DOCUMENTS	8
4. DESCRIPTION OF TEST CONFIGURATION	9
4.1 Description of Test Configuration – Emissions	9
4.1.1 Cable Construction and Termination	9
5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT	10
5.1 EUT and Accessory List	10
5.2 Emissions Test Equipment	11
6. TEST SITE DESCRIPTION	12
6.1 Test Facility Description	12
6.2 EUT Mounting, Bonding and Grounding	12
6.3 Measurement Uncertainty	12
7. TEST PROCEDURES	13
7.1 RF Emissions	13
7.1.1 Conducted Emissions Test	13
7.1.2 Radiated Emissions Test	13
7.1.3 RF Emissions Test Results	16
8. CONCLUSIONS	17

LIST OF APPENDICES

APPENDIX	TITLE
A	Laboratory Accreditations and Recognitions
B	Modifications to the EUT
C	Additional Model Covered Under This Report
D	Diagrams and Charts • Test Setup Diagrams • Antenna and Effective Gain Factors
E	Data Sheets

LIST OF FIGURES

FIGURE	TITLE
1	Conducted Emissions Test Setup
2	Layout of the Semi-Anechoic Test Chamber

LIST OF TABLES

TABLE	TITLE
1	Radiated Emission Results

GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the federal government.

Device Tested: TT20K System Transmitter
Model: TX20K
S/N: N/A

Product Description: The equipment under test is a wireless torque sensor used in a torque telemetry system.

Modifications: The EUT was not modified to meet the specifications.

Customer: Binsfeld Engineering Inc.
4571 MacFarlane
Maple City, Michigan 49664

Test Dates: April 8 – 12, 2019

Test Specifications covered by accreditation:

Test Specifications: Emissions requirements
CFR Title 47, Part 15, Subpart B; and Subpart C, Sections 15.205, 15.209, and 15.249



Test Procedures: ANSI C63.4: 2014 and ANSI C63.10: 2013

Test Deviations: The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Spurious Radiated RF Emissions, 9 kHz –9300 MHz (Transmitter, Receiver, and Digital portion)	Complies with the Class B limits of CFR Title 47, Part 15 Subpart B; and the limits of CFR Title 47, Part 15 Subpart C, section 15.205, 15.209 and 15.249 Highest reading in relation to spec limit 53.80 dBuV/m (Avg) @ 4568.90 MHz (*U = 3.67 dB)

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the TT20K System Transmitter, Model: TX20K. The emissions measurements were performed according to the measurement procedure described in ANSI C63.4 and ANSI C63.10. The tests were performed to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the Class B specification limits defined by Code of Federal Regulations Title 47, Part 15 Subpart B sections 15.107, 15.109, & Part 15 Subpart C sections 15.205, 15.207, 15.209 and 15.249.



2. ADMINISTRATIVE DATA

2.1 Location of Testing

The emissions tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Binsfeld Engineering Inc.

Stephen Tarsa	CEO
Dave Tietz	R&D Director

Compatible Electronics Inc.

Thomas Szynal	Test Technician
Kyle Fujimoto	Test Engineer

2.4 Date Test Sample was Received

The test sample was received prior to the date of this report.

2.5 Disposition of the Test Sample

The test sample has not been returned to Binsfeld Engineering Inc. as of the date of this test report.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
ITE	Information Technology Equipment
DoC	Declaration of Conformity
N/A	Not Applicable
Tx	Transmit
Rx	Receive
Inc.	Incorporated
RF	Radio Frequency
BLE	Bluetooth Low Energy
IoT	Internet of Things
CEO	Chief Executive Officer
N/A	Not Applicable
DC	Direct Current

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this emission Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
FCC Title 47, Part 15 Subpart B	FCC Rules – Radio frequency devices (including digital devices) –Unintentional Radiators
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10: 2013	American National Standard of procedure for compliance testing of unlicensed wireless devices

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – Emissions

The TT20K System Transmitter, Model: TX20K (EUT) was connected to a battery and bridge simulator. During the testing, the EUT was continuously transmitting or receiving.

The EUT was tested for emissions at the low, middle, and high channels while in the X, Y and Z axis. The X orientation is when the EUT is parallel to the ground. The Y orientation is when the EUT is perpendicular to the ground mounted vertically. The Z orientation is when the EUT is perpendicular to the ground mounted horizontally.

The EUT was tested with a new battery.

The final radiated emissions data for the EUT was taken in the X-axis (worst case). Please see Appendix E for the data sheets.

4.1.1 Cable Construction and Termination

Cable 1 This is a 10-centimeter unshielded cable connecting the EUT's +B port to the battery. The cable is hard wired at each end.

Cable 2 This is a 10-centimeter unshielded cable connecting the EUT's –B port to the battery. The cable is hard wired at each end.

Cable 3 This is a 1-meter unshielded cable connecting the EUT's +E port to the bridge simulator. The cable is hard wired at each end.

Cable 4 This is a 1-meter unshielded cable connecting the EUT's –E port to the bridge simulator. The cable is hard wired at each end.

Cable 5 This is a 1-meter unshielded cable connecting the EUT's +S port to the bridge simulator. The cable is hard wired at each end.

Cable 6 This is a 1-meter unshielded cable connecting the EUT's –S port to the bridge simulator. The cable is hard wired at each end.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT**5.1 EUT and Accessory List**

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
TT20K SYSTEM TRANSMITTER (EUT)	BINSFELD ENGINEERING INC.	TX20K	N/A	HWN-TX20K
9 VOLT BATTERY	ULTRALIFE	N/A	N/A	N/A
BRIDGE SIMULATOR	BINSFELD ENGINEERING, INC.	BS900	N/A	N/A
TT20K SYSTEM RECEIVER	BINSFELD ENGINEERING INC.	RX20K	N/A	HWN-RX20K

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. CYCLE
RF RADIATED EMISSIONS TEST EQUIPMENT					
TDK TestLab	TDK RF Solutions, Inc.	9.22	700145	N/A	N/A
EMI Receiver, 20 Hz – 26.5 GHz	Keysight Technologies	N9038A	MY51210150	July 26, 2018	1 Year
System Controller	Sunol Sciences Corporation	SC110V	112213-1	N/A	N/A
Turntable	Sunol Sciences Corporation	2011VS	N/A	N/A	N/A
Antenna-Mast	Sunol Sciences Corporation	TWR95-4	112213-3	N/A	N/A
Loop Antenna	Com-Power	AL-130R	121090	February 5, 2019	2 Year
CombiLog Antenna	Com-Power	AC-220	61060	July 27, 2017	2 Year
Horn Antenna	Com-Power	AH-118	071175	February 22, 2018	2 Year
Preamplifier	Com-Power	PAM-118A	551024	May 10, 2018	1 Year
Computer	Hewlett Packard	p6716f	MXX1030PX0	N/A	N/A
LCD Monitor	Hewlett Packard	52031a	3CQ046N3MG	N/A	N/A

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 of this report for emissions test location.

6.2 EUT Mounting, Bonding and Grounding

For frequencies 1 GHz and below: The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

For frequencies above 1 GHz: The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 1.5 meters above the ground plane.

The EUT was not grounded.

6.3 Measurement Uncertainty

The uncertainty values are in the table below.

The uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level, using a coverage factor of $k=2$

MEASUREMENT TYPE	PARTICULAR CONFIGURATION	UNCERTAINTY VALUES
RADIATED EMISSIONS	3-METER CHAMBER, COMBILOG ANTENNA	3.26 dB (Vertical) 3.19 dB (Horizontal)
RADIATED EMISSIONS	3-METER CHAMBER, HORN ANTENNA	3.67 dB (Both Vertical and Horizontal)
AC LINE CONDUCTED EMISSIONS	3-METER CHAMBER, COM-POWER LISN	2.72 dB

7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1 RF Emissions

7.1.1 Conducted Emissions Test

The EMI Receiver was used as a measuring meter. A quasi-peak and/or average reading was taken only where indicated in the data sheets. A 10 dB attenuator was used for the protection of the EMI Receiver input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the EMI Receiver. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI 63:4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by computer software. The final qualification data is located in Appendix E.

Test Results:

This test was not performed because the EUT operates on battery power only and cannot be connected to the AC public mains.

7.1.2 Radiated Emissions Test

The EMI Receiver was used as the measuring meter. Preamplifiers were used to increase the sensitivity of the instrument. The EMI Receiver was initially used with the Analyzer mode feature activated. In this mode, the EMI receiver can then record the actual frequency to be measured. This final reading is then taken accurately in the EMI Receiver mode, which takes into account the cable loss, amplifier gain and antenna factors, so that a true reading is compared to the true limit. The effective measurement bandwidth used for the radiated emissions test was according to the frequency measured.

The frequencies below 1 GHz were quasi-peaked using the quasi-peak detector of the EMI Receiver.

All frequencies above 1 GHz were averaged using the average detector of the EMI Receiver.

The EMI test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI C63.4. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength).

The EUT was tested at a 3-meter test distance. The six highest emissions are listed in Table 1.

Radiated Emissions Test (Continued)

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
9 kHz to 150 kHz	200 Hz	Loop Antenna
150 kHz to 30 MHz	9 kHz	Loop Antenna
30 MHz to 1 GHz	120 kHz	CombiLog Antenna
1 GHz to 9.3 GHz	1 MHz	Horn Antenna

Test Results:

The EUT complies with the **Class B** limits of **CFR** Title 47, Part 15, Subpart B; and Subpart C sections 15.205, 15.209 and 15.249 for radiated emissions.

7.1.3 RF Emissions Test ResultsTable 1 RADIATED EMISSION RESULTS
TT20K SYSTEM TRANSMITTER
Model: TX20K

Frequency (MHz)	EMI Reading (dBuV/m)	Specification Limit (dBuV/m)	Delta (Cor. Reading – Spec. Limit) (dB)
4568.90 (H) (Z-Axis) (Middle Channel)	53.80 (AV)	53.97	-0.17
4568.90 (H) (Y-Axis) (Middle Channel)	53.71 (AV)	53.97	-0.26
4629.35 (H) (Y-Axis) (High Channel)	53.58 (AV)	53.97	-0.39
4629.35 (V) (X-Axis) (High Channel)	52.99 (AV)	53.97	-0.98
8224.02 (V) (Y-Axis) (Middle Channel)	52.78 (AV)	53.97	-1.19
7310.24 (V) (Y-Axis) (Middle Channel)	52.77 (AV)	53.97	-1.20

Notes:

- * The complete emissions data is given in Appendix E of this report.
- (V) Vertical Polarization
- (H) Horizontal Polarization
- (AV) Average Reading
- (QP) Quasi-Peak Reading



8. CONCLUSIONS

The TT20K System Transmitter, Model: TX20K (EUT), as tested, meets all of the specification limits defined in the **Class B** specification limits defined in FCC Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209 and 15.249.



APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

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Lake Forest, CA 92630
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LABORATORY ACCREDITATIONS AND RECOGNITIONS



For US, Canada, Australia/New Zealand, Japan, Taiwan, Korea, and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025.

For the most up-to-date version of our scopes and certificates please visit
<http://celectronics.com/quality/scope/>

Quote from ISO-ILAC-IAF Communiqué on 17025:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 Quality Management Systems — Requirements."

Innovation, Science and Economic Development Canada
Lab Code 2154A



APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC Subpart B and FCC 15.249 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

No modifications were made to the EUT during the testing.



APPENDIX C

***ADDITIONAL MODEL COVERED
UNDER THIS REPORT***

ADDITIONAL MODEL COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST

TT20K SYSTEM TRANSMITTER
Model: TX20K
S/N: N/A

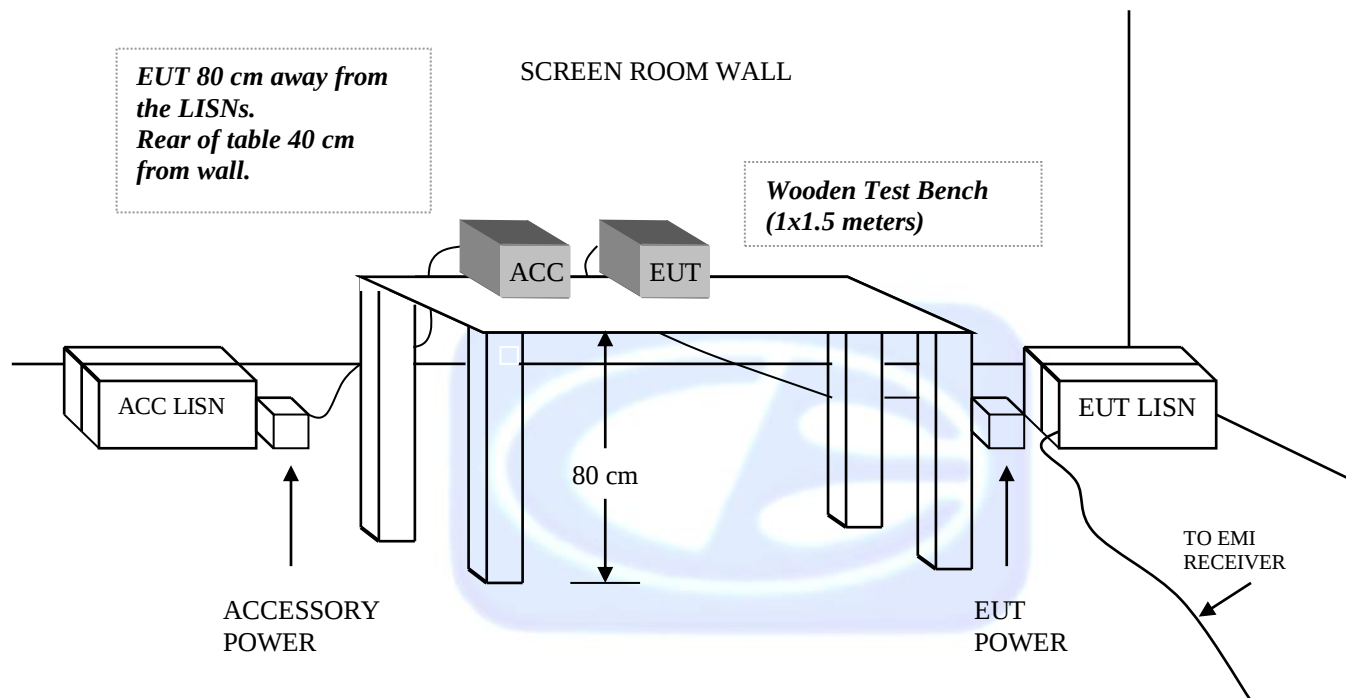
There are no additional models covered under this report.



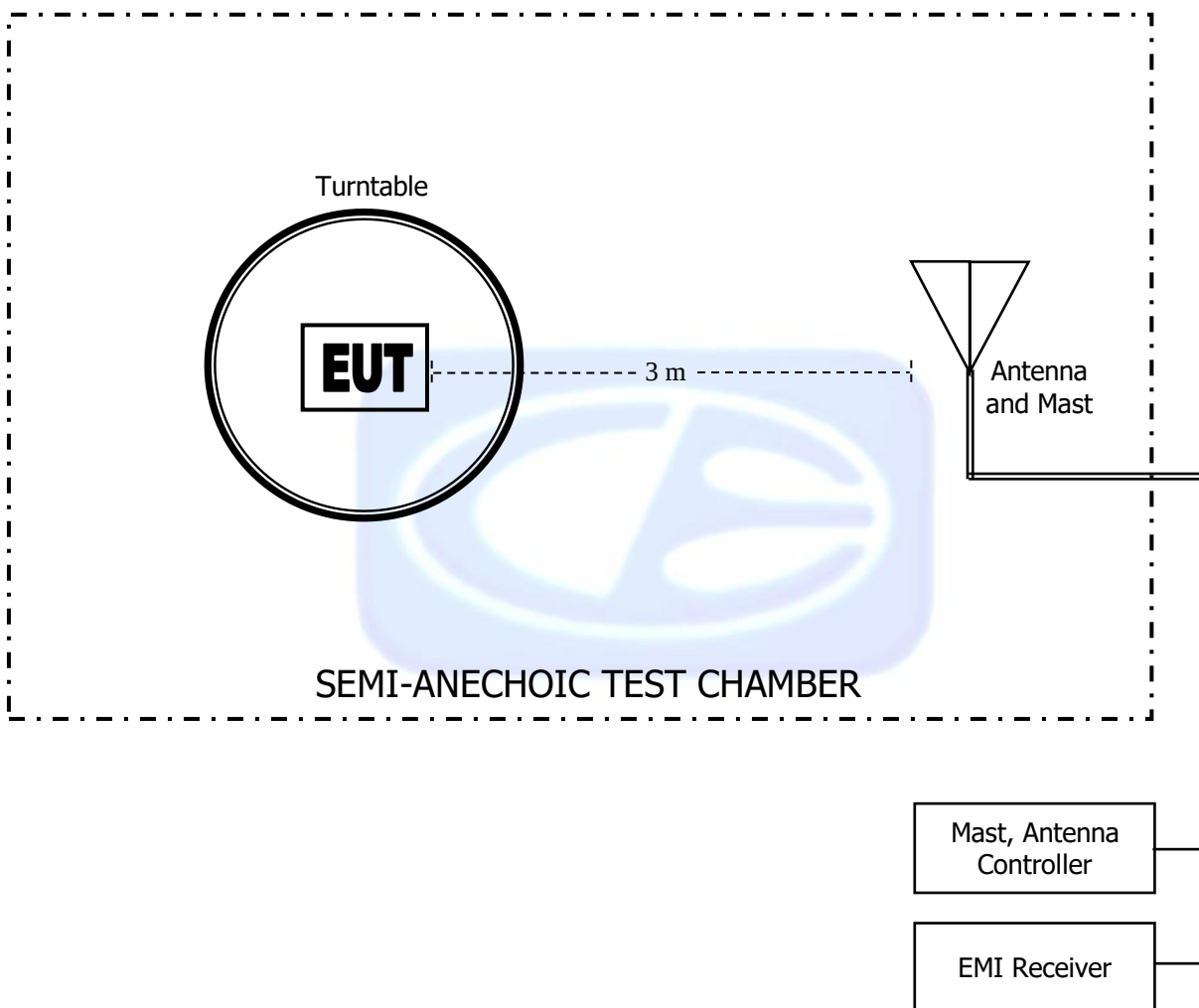
APPENDIX D

DIAGRAMS AND CHARTS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP



**FIGURE 1: LAYOUT OF THE SEMI -ANECHOIC
TEST CHAMBER**



COM-POWER AL-130R**LOOP ANTENNA****S/N: 121090****CALIBRATION DATE: FEBRUARY 5, 2019**

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.01	15.6	-35.9
0.02	14.8	-36.7
0.03	15.6	-35.9
0.04	15.1	-36.4
0.05	14.4	-37.0
0.06	14.6	-36.9
0.07	14.4	-37.1
0.08	14.3	-37.1
0.09	14.5	-36.9
0.10	14.1	-37.3
0.20	14.1	-37.3
0.30	14.0	-37.4
0.40	14.0	-37.4
0.50	14.2	-37.2
0.60	14.2	-37.2
0.70	14.2	-37.2
0.80	14.2	-37.3
0.90	14.3	-37.2
1.00	14.5	-37.0
2.00	14.5	-36.9
3.00	14.5	-36.9
4.00	14.7	-36.8
5.00	14.6	-36.9
6.00	14.6	-36.9
7.00	14.6	-36.9
8.00	14.6	-36.9
9.00	14.6	-36.9
10.00	14.8	-36.6
11.00	14.9	-36.6
12.00	14.8	-36.6
13.00	14.8	-36.7
14.00	14.6	-36.8
15.00	14.5	-36.9
16.00	14.5	-37.0
17.00	14.6	-36.9
18.00	14.7	-36.7
19.00	14.8	-36.6
20.00	14.9	-36.6
21.00	14.6	-36.8
22.00	14.2	-37.2
23.00	13.7	-37.7
24.00	13.3	-38.2
25.00	13.0	-38.5
26.00	12.9	-38.6
27.00	13.0	-38.5
28.00	13.1	-38.4
29.00	13.1	-38.4
30.00	12.9	-38.5

COM-POWER AC-220**COMBILOG ANTENNA****S/N: 61060****CALIBRATION DATE: JULY 27, 2017**

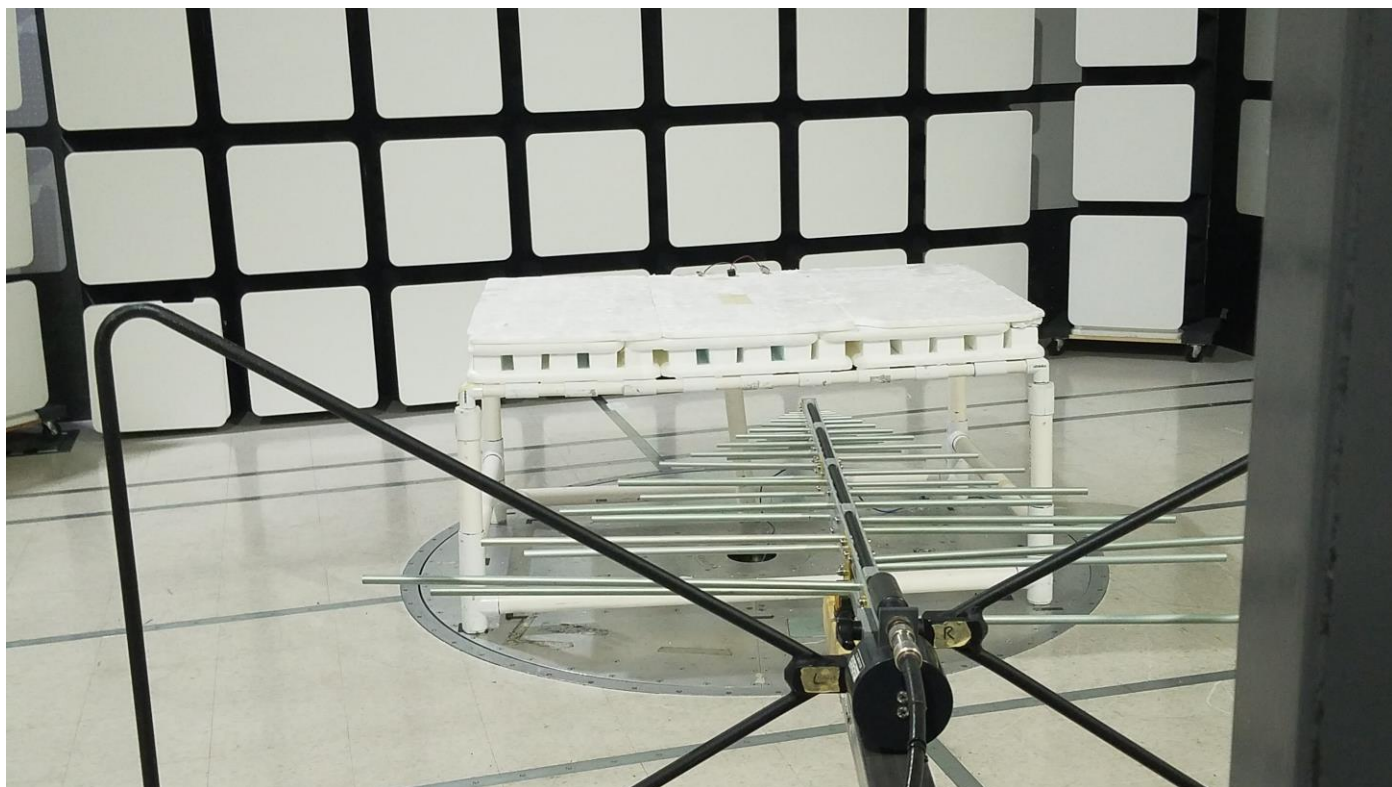
FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	23.80	200	14.10
35	24.00	250	15.30
40	24.70	300	17.70
45	22.90	350	17.70
50	22.10	400	19.00
60	17.60	450	21.30
70	12.70	500	21.00
80	11.20	550	22.30
90	13.10	600	23.40
100	14.40	650	22.90
120	15.30	700	24.60
125	15.00	750	24.50
140	12.80	800	25.40
150	16.50	850	26.40
160	12.90	900	27.20
175	14.30	950	27.80
180	14.50	1000	26.80

COM POWER AH-118**HORN ANTENNA****S/N: 071175****CALIBRATION DATE: FEBRUARY 22, 2018**

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	23.71	10.0	40.08
1.5	25.46	10.5	40.75
2.0	29.26	11.0	41.78
2.5	27.95	11.5	41.02
3.0	29.03	12.0	40.32
3.5	29.70	12.5	40.96
4.0	30.71	13.0	40.29
4.5	31.62	13.5	39.48
5.0	33.23	14.0	39.89
5.5	35.07	14.5	42.75
6.0	34.43	15.0	40.98
6.5	34.98	15.5	38.54
7.0	36.75	16.0	39.40
7.5	37.10	16.5	39.40
8.0	37.66	17.0	41.74
8.5	39.29	17.5	42.58
9.0	37.75	18.0	44.68
9.5	38.23		

COM-POWER PAM-118A**PREAMPLIFIER****S/N: 551024****CALIBRATION DATE: MAY 10, 2018**

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	40.99	6.0	39.01
1.1	39.77	6.5	39.00
1.2	39.02	7.0	39.69
1.3	39.44	7.5	38.96
1.4	39.64	8.0	38.57
1.5	40.23	8.5	39.17
1.6	40.17	9.0	38.82
1.7	40.23	9.5	39.30
1.8	39.48	10.0	38.90
1.9	39.85	11.0	38.86
2.0	39.99	12.0	39.87
2.5	40.38	13.0	39.55
3.0	40.64	14.0	38.92
3.5	40.68	15.0	39.33
4.0	40.87	16.0	39.60
4.5	40.04	17.0	40.28
5.0	39.54	18.0	39.58
5.5	39.58		



FRONT VIEW

**BINSFELD ENGINEERING INC.
TT20K SYSTEM TRANSMITTER
MODEL: TX20K**

FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**

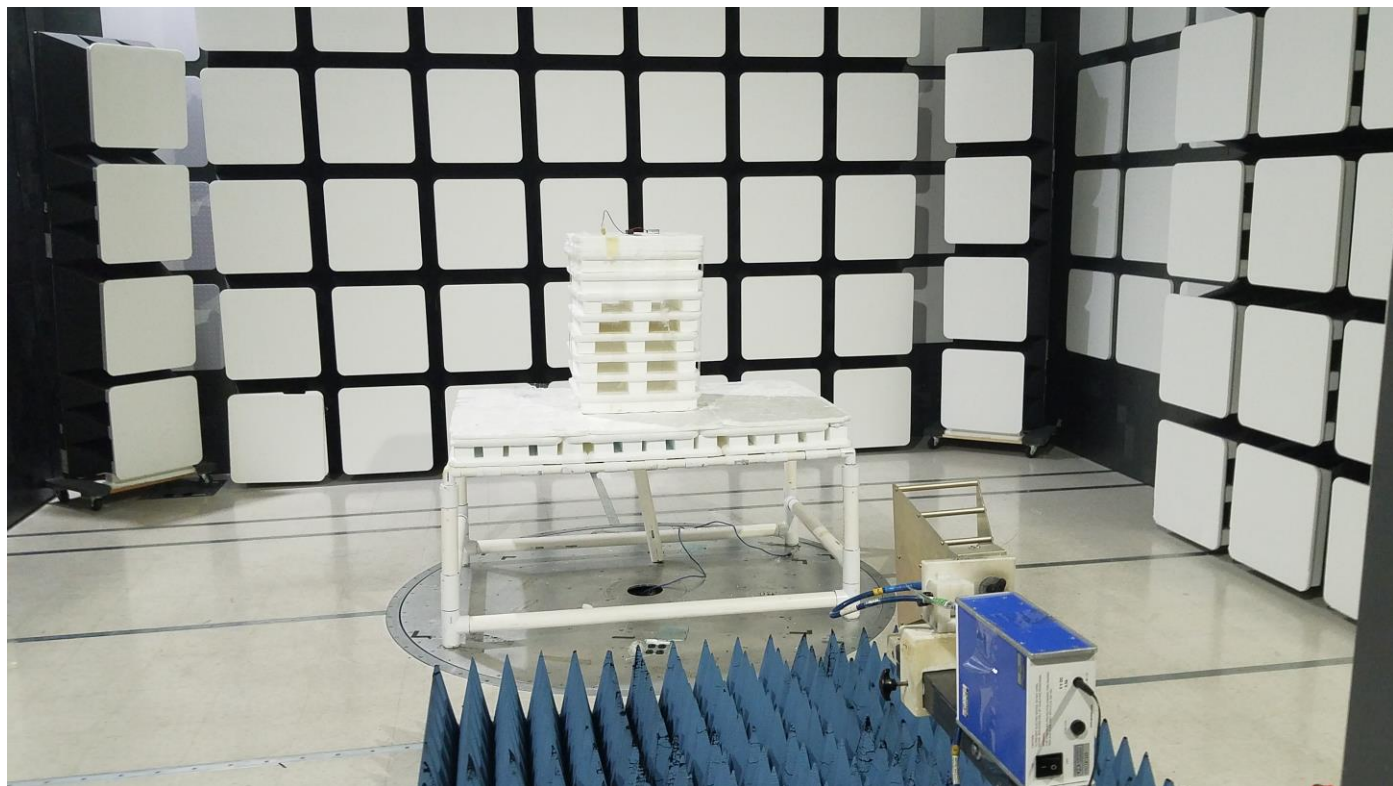


REAR VIEW

BINSFELD ENGINEERING INC.
TT20K SYSTEM TRANSMITTER
MODEL: TX20K

FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**

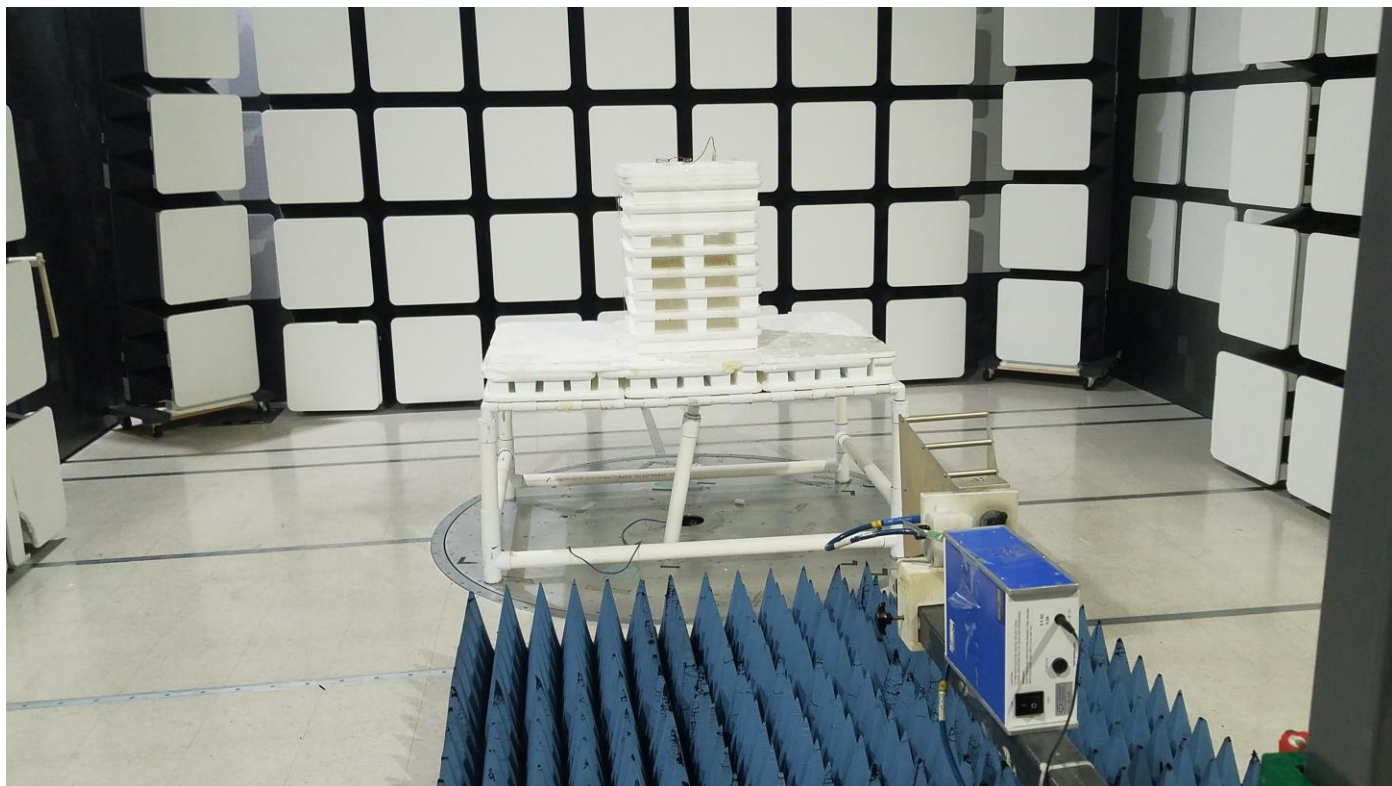


FRONT VIEW

BINSFELD ENGINEERING INC.
TT20K SYSTEM TRANSMITTER
MODEL: TX20K

FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



REAR VIEW

BINSFELD ENGINEERING INC.
TT20K SYSTEM TRANSMITTER
MODEL: TX20K

FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONs**

APPENDIX E

DATA SHEETS

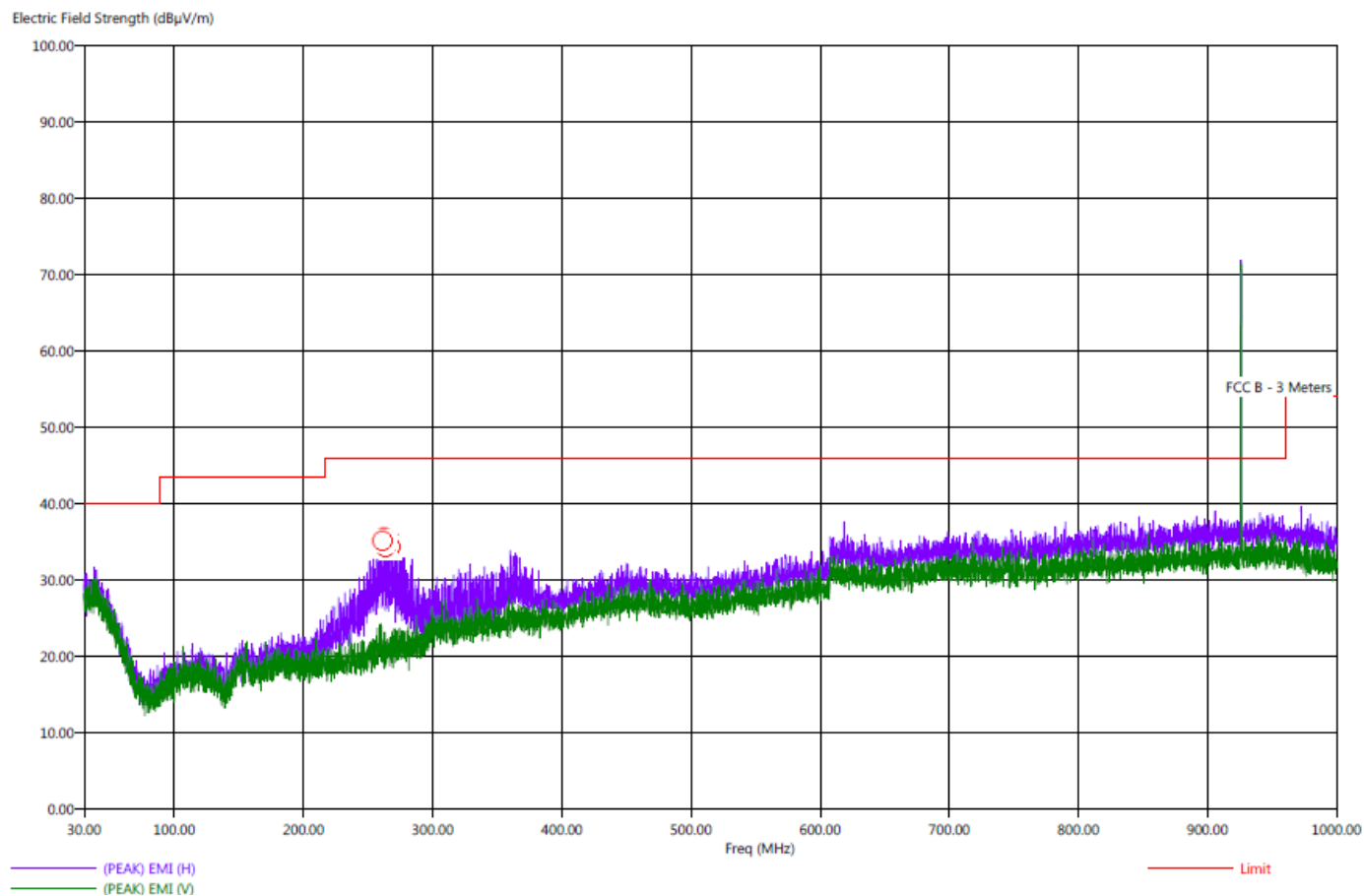
RADIATED EMISSIONS

DATA SHEETS

Title: Radiated Emissions - FCC Class B
File: 3 - Agilent - Tx Mode - Pre-Scan - X-Axis - 04-10-2019.set
Operator: Kyle Fujimoto
EUT Type: TT20K System Transmitter
EUT Condition: The EUT is continuously transmitting at the high channel - X-Axis
Company: Binsfeld Engineering Inc.
M/N: TX20K
S/N: N/A
X-Axis Worst Case
The emission at 925.87 MHz is the fundamental emission and subject to the limits in 15.249

4/10/2019 1:35:30 PM
Sequence: Preliminary Scan

FCC Class B



Title: Radiated Emissions - FCC Class B
File: 4 - Agilent - Tx Mode - Final Scan - X-Axis - 04-10-2019.set
Operator: Kyle Fujimoto
EUT Type: TT20K System Transmitter
EUT Condition: The EUT is continuously transmitting at the high channel - X-Axis
Company: Binsfeld Engineering Inc.
M/N: TX20K
S/N: N/A
X-Axis Worst Case

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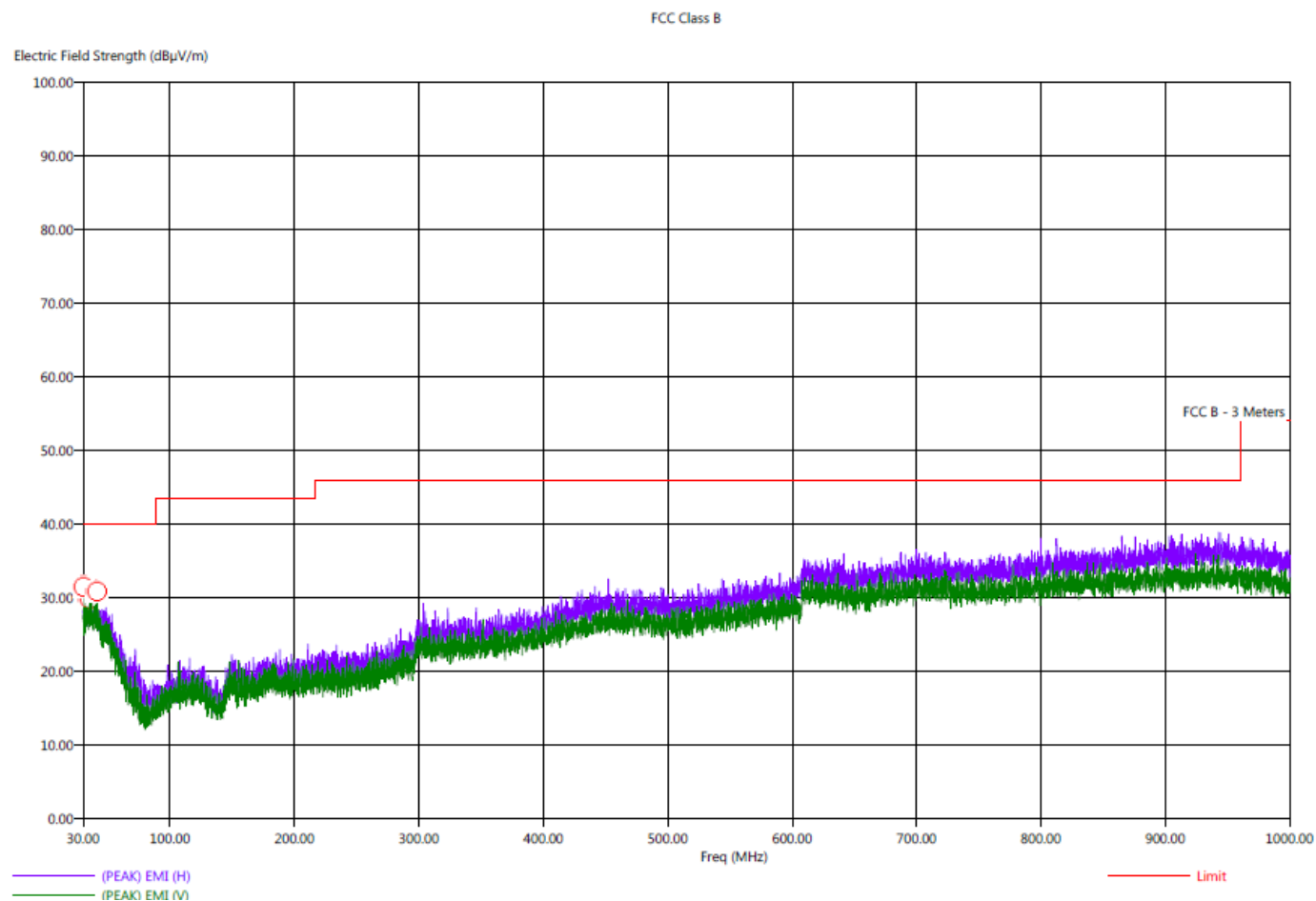
FCC Class B

Freq (MHz)	Pol	(PEAK) EMI (dBμV/m)	(QP) EMI (dBμV/m)	(PEAK) Margin (dB)	(QP) Margin (dB)	Limit (dBμV/m)	Transducer (dB)	Cable (dB)	Ttbi Aql (deq)	Twr Ht (cm)
261.00	H	32.44	28.82	-13.56	-17.18	46.00	15.87	1.65	122.50	111.38
263.00	H	31.89	28.62	-14.11	-17.38	46.00	15.97	1.65	143.50	111.32
264.00	H	32.22	28.03	-13.78	-17.97	46.00	16.02	1.66	120.00	127.26
267.00	H	30.97	26.99	-15.03	-19.01	46.00	16.17	1.67	105.00	143.26
268.00	H	31.47	28.17	-14.53	-17.83	46.00	16.22	1.67	136.25	111.44
269.00	H	31.26	27.82	-14.74	-18.18	46.00	16.26	1.68	126.50	127.26



Title: Radiated Emissions - FCC Class B
File: 1 - Agilent - Rx Mode - Pre-Scan - X-Axis - 04-10-2019.set
Operator: Kyle Fujimoto
EUT Type: TT20K System Transmitter
EUT Condition: The EUT is continuously receiving at the high channel - X-Axis
Company: Binsfeld Engineering Inc.
M/N: TX20K
S/N: N/A
X-Axis Worst Case

4/10/2019 12:39:00 PM
Sequence: Preliminary Scan



No emissions found above 1 GHz

Title: Radiated Emissions - FCC Class B
File: 2 - Agilent - Rx Mode - Final Scan - X-Axis - 04-10-2019.set
Operator: Kyle Fujimoto
EUT Type: TT20K System Transmitter
EUT Condition: The EUT is continuously receiving at the high channel - X-Axis
Company: Binsfeld Engineering Inc.
M/N: TX20K
S/N: N/A
X-Axis Worst Case

4/10/2019 1:19:32 PM
Sequence: Final Measurements

FCC Class B										
Freq (MHz)	Pol	(PEAK) EMI (dBµV/m)	(QP) EMI (dBµV/m)	(PEAK) Margin (dB)	(QP) Margin (dB)	Limit (dBµV/m)	Transducer (dB)	Cable (dB)	Ttbl Aql (deq)	Twr Ht (cm)
30.70	H	31.74	26.59	-8.26	-13.41	40.00	23.82	0.81	329.50	398.49
34.80	H	31.55	26.64	-8.45	-13.36	40.00	24.00	0.85	295.75	318.73
38.50	H	32.02	26.96	-7.98	-13.04	40.00	24.50	0.89	295.00	318.55
40.10	H	32.44	27.18	-7.56	-12.82	40.00	24.70	0.90	164.00	111.32
40.40	H	32.51	27.06	-7.49	-12.94	40.00	24.57	0.90	166.75	366.73
40.90	V	32.39	27.64	-7.61	-12.36	40.00	24.43	0.90	167.75	191.38

No emissions found above 1 GHz



FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20K

Dates: 4/8/2019 and 4/12/2019

Lab: D

Tested By: Kyle Fujimoto

**Low Channel
X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
903.37	78.32	V	93.97	-15.65	Peak	348.00	122.61	
903.37	78.00	V	93.97	-15.98	Avg	348.00	122.61	
1806.74	47.45	V	73.97	-26.52	Peak	0.25	238.91	
1806.74	43.13	V	53.97	-10.84	Avg	0.25	238.91	
2710.11	48.80	V	73.97	-25.17	Peak	172.00	111.32	
2710.11	43.90	V	53.97	-10.07	Avg	172.00	111.32	
3613.48	54.35	V	73.97	-19.62	Peak	178.00	143.20	
3613.48	47.01	V	53.97	-6.96	Avg	178.00	143.20	
4516.85	58.28	V	73.97	-15.69	Peak	175.50	127.14	
4516.85	50.83	V	53.97	-3.14	Avg	175.50	127.14	
5420.22	49.80	V	73.97	-24.17	Peak	212.50	175.02	
5420.22	43.67	V	53.97	-10.30	Avg	212.50	175.02	
6323.59	56.53	V	73.97	-17.44	Peak	284.25	127.20	
6323.59	52.73	V	53.97	-1.24	Avg	284.25	127.20	
7226.96	56.24	V	73.97	-17.73	Peak	350.00	139.62	
7226.96	46.50	V	53.97	-7.47	Avg	350.00	139.62	
8130.33	57.14	V	73.97	-16.83	Peak	359.50	111.38	
8130.33	48.13	V	53.97	-5.85	Avg	359.50	111.38	
9033.70	48.09	V	73.97	-25.88	Peak	158.75	190.91	
9033.70	38.06	V	53.97	-15.91	Avg	158.75	190.91	

FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20K

Dates: 4/8/2019 and 4/12/2019

Lab: D

Tested By: Kyle Fujimoto

**Low Channel
X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
903.37	84.95	H	93.97	-9.02	Peak	171.25	109.95	
903.37	84.56	H	93.97	-9.41	Avg	171.25	109.95	
1806.74	46.64	H	73.97	-27.33	Peak	210.25	206.37	
1806.74	43.97	H	53.97	-10.00	Avg	210.25	206.37	
2710.11	41.37	H	73.97	-32.60	Peak	68.00	125.53	
2710.11	34.41	H	53.97	-19.56	Avg	68.00	125.53	
3613.48	45.87	H	73.97	-28.10	Peak	255.75	111.02	
3613.48	39.81	H	53.97	-14.16	Avg	255.75	111.02	
4516.85	52.63	H	73.97	-21.34	Peak	253.25	143.20	
4516.85	49.12	H	53.97	-4.85	Avg	253.25	143.20	
5420.22	47.87	H	73.97	-26.10	Peak	105.75	127.26	
5420.22	43.99	H	53.97	-9.98	Avg	105.75	127.26	
6323.59	57.31	H	73.97	-16.66	Peak	262.00	127.20	
6323.59	52.66	H	53.97	-1.31	Avg	262.00	127.20	
7226.96	57.62	H	73.97	-16.35	Peak	251.00	143.20	
7226.96	50.26	H	53.97	-3.71	Avg	251.00	143.20	
8130.33	59.70	H	73.97	-14.27	Peak	94.25	127.26	
8130.33	51.69	H	53.97	-2.28	Avg	94.25	127.26	
9033.70	49.27	H	73.97	-24.70	Peak	290.00	127.26	
9033.70	41.68	H	53.97	-12.29	Avg	290.00	127.26	

FCC 15.249

Binsfeld Engineering Inc.
 TT20K System Transmitter
 Model: TX20K

Dates: 4/8/2019 and 4/12/2019
 Lab: D
 Tested By: Kyle Fujimoto

**Low Channel
Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
903.37	80.54	V	93.97	-13.43	Peak	109.75	121.89	
903.37	80.36	V	93.97	-13.61	QP	109.75	121.89	
1806.74	46.94	V	73.97	-27.03	Peak	232.75	143.26	
1806.74	44.15	V	53.97	-9.82	Avg	232.75	143.26	
2710.11	41.31	V	73.97	-32.66	Peak	151.75	159.08	
2710.11	34.24	V	53.97	-19.73	Avg	151.75	159.08	
3613.48	48.54	V	73.97	-25.43	Peak	227.75	175.02	
3613.48	44.35	V	53.97	-9.62	Avg	227.75	175.02	
4516.85	54.68	V	73.97	-19.29	Peak	155.50	111.38	
4516.85	46.80	V	53.97	-7.17	Avg	155.50	111.38	
5420.22	49.46	V	73.97	-24.51	Peak	186.00	143.08	
5420.22	45.95	V	53.97	-8.02	Avg	186.00	143.08	
6323.59	50.79	V	73.97	-23.18	Peak	295.75	249.95	
6323.59	45.30	V	53.97	-8.67	Avg	295.75	249.95	
7226.96	53.78	V	73.97	-20.19	Peak	187.75	111.38	
7226.96	44.77	V	53.97	-9.20	Avg	187.75	111.38	
8130.33	58.75	V	73.97	-15.22	Peak	134.50	111.38	
8130.33	50.63	V	53.97	-3.34	Avg	134.50	111.38	
9033.70	49.34	V	73.97	-24.63	Peak	103.50	127.08	
9033.70	40.49	V	53.97	-13.48	Avg	103.50	127.08	

FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20K

Dates: 4/8/2019 and 4/12/2019

Lab: D

Tested By: Kyle Fujimoto

**Low Channel
Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
903.37	81.95	H	93.97	-12.02	Peak	225.50	125.25	
903.37	81.87	H	93.97	-12.10	QP	225.50	125.25	
1806.74	50.49	H	73.97	-23.48	Peak	154.75	142.97	
1806.74	48.65	H	53.97	-5.32	Avg	154.75	142.97	
2710.11	46.93	H	73.97	-27.04	Peak	254.75	238.67	
2710.11	41.65	H	53.97	-12.32	Avg	254.75	238.67	
3613.48	52.69	H	73.97	-21.28	Peak	263.75	111.32	
3613.48	45.43	H	53.97	-8.54	Avg	263.75	111.32	
4516.85	58.75	H	73.97	-15.22	Peak	232.25	111.14	
4516.85	51.57	H	53.97	-2.40	Avg	232.25	111.14	
5420.22	49.53	H	73.97	-24.44	Peak	292.25	127.20	
5420.22	44.09	H	53.97	-9.88	Avg	292.25	127.20	
6323.59	58.25	H	73.97	-15.72	Peak	300.25	143.26	
6323.59	49.40	H	53.97	-4.58	Avg	300.25	143.26	
7226.96	58.42	H	73.97	-15.55	Peak	111.25	232.94	
7226.96	48.81	H	53.97	-5.16	Avg	111.25	232.94	
8130.33	56.95	H	73.97	-17.02	Peak	27.25	225.35	
8130.33	47.04	H	53.97	-6.93	Avg	27.25	225.35	
9033.70	52.16	H	73.97	-21.81	Peak	0.00	175.08	
9033.70	48.14	H	53.97	-5.83	Avg	0.00	175.08	

FCC 15.249

Binsfeld Engineering Inc.
 TT20K System Transmitter
 Model: TX20K

Dates: 4/8/2019 and 4/12/2019
 Lab: D
 Tested By: Kyle Fujimoto

**Low Channel
Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
903.37	79.68	V	93.97	-14.29	Peak	323.50	111.62	
903.37	79.52	V	93.97	-14.45	QP	323.50	111.62	
1806.74	42.49	V	73.97	-31.48	Peak	352.25	159.20	
1806.74	35.21	V	53.97	-18.76	Avg	352.25	159.20	
2710.11	42.23	V	73.97	-31.74	Peak	195.75	127.20	
2710.11	35.50	V	53.97	-18.47	Avg	195.75	127.20	
3613.48	51.43	V	73.97	-22.54	Peak	179.50	111.44	
3613.48	47.03	V	53.97	-6.94	Avg	179.50	111.44	
4516.85	57.49	V	73.97	-16.48	Peak	322.75	127.26	
4516.85	49.56	V	53.97	-4.41	Avg	322.75	127.26	
5420.22	51.26	V	73.97	-22.71	Peak	42.75	127.14	
5420.22	48.83	V	53.97	-5.14	Avg	42.75	127.14	
6323.59	58.58	V	73.97	-15.39	Peak	148.75	231.14	
6323.59	48.76	V	53.97	-5.21	Avg	148.75	231.14	
7226.96	59.61	V	73.97	-14.36	Peak	126.25	197.35	
7226.96	49.73	V	53.97	-4.24	Avg	126.25	197.35	
8130.33	60.30	V	73.97	-13.67	Peak	61.75	127.32	
8130.33	51.45	V	53.97	-2.52	Avg	61.75	127.32	
9033.70	51.70	V	73.97	-22.27	Peak	0.00	127.26	
9033.70	41.32	V	53.97	-12.65	Avg	0.00	127.26	

FCC 15.249

Binsfeld Engineering Inc.
 TT20K System Transmitter
 Model: TX20K

Dates: 4/8/2019 and 4/12/2019

Lab: D

Tested By: Kyle Fujimoto

**Low Channel
Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
903.37	82.65	H	93.97	-11.32	Peak	182.50	111.25	
903.37	82.56	H	93.97	-11.41	Avg	182.50	111.25	
1806.74	50.90	H	73.97	-23.07	Peak	138.50	159.20	
1806.74	49.25	H	53.97	-4.72	Avg	138.50	159.20	
2710.11	42.54	H	73.97	-31.43	Peak	274.50	159.08	
2710.11	36.29	H	53.97	-17.68	Avg	274.50	159.08	
3613.48	44.11	H	73.97	-29.86	Peak	243.25	111.26	
3613.48	37.67	H	53.97	-16.30	Avg	243.25	111.26	
4516.85	53.05	H	73.97	-20.92	Peak	5.50	143.32	
4516.85	49.04	H	53.97	-4.93	Avg	5.50	143.32	
5420.22	51.63	H	73.97	-22.34	Peak	264.50	127.32	
5420.22	49.20	H	53.97	-4.77	Avg	264.50	127.32	
6323.59	53.76	H	73.97	-20.21	Peak	260.50	111.38	
6323.59	46.93	H	53.97	-7.04	Avg	260.50	111.38	
7226.96	56.88	H	73.97	-17.09	Peak	99.75	111.20	
7226.96	50.95	H	53.97	-3.02	Avg	99.75	111.20	
8130.33	53.46	H	73.97	-20.51	Peak	72.75	126.25	
8130.33	46.22	H	53.97	-7.75	Avg	72.75	126.25	
9033.70	45.59	H	73.97	-28.38	Peak	79.50	127.20	
9033.70	34.99	H	53.97	-18.98	Avg	79.50	127.20	

FCC 15.249

Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20K

Date: 4/8/2019
Lab: D
Tested By: Kyle Fujimoto

**Middle Channel
X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
913.78	76.99	V	93.97	-16.98	Peak	172.00	100.70	
913.78	76.64	V	93.97	-17.33	QP	172.00	100.70	
1827.56	47.17	V	73.97	-26.80	Peak	0.00	206.85	
1827.56	44.87	V	53.97	-9.10	Avg	0.00	206.85	
2741.34	48.37	V	73.97	-25.60	Peak	0.00	143.26	
2741.34	42.11	V	53.97	-11.86	Avg	0.00	143.26	
3655.12	52.66	V	73.97	-21.31	Peak	0.00	127.20	
3655.12	50.80	V	53.97	-3.17	Avg	0.00	127.20	
4568.90	58.63	V	73.97	-15.34	Peak	0.00	190.79	
4568.90	51.51	V	53.97	-2.46	Avg	0.00	190.79	
5482.68	50.50	V	73.97	-23.47	Peak	213.25	127.20	
5482.68	45.89	V	53.97	-8.08	Avg	213.25	127.20	
6396.46	57.96	V	73.97	-16.01	Peak	145.25	168.16	
6396.46	48.86	V	53.97	-5.11	Avg	145.25	168.16	
7310.24	60.62	V	73.97	-13.35	Peak	156.00	237.65	
7310.24	52.03	V	53.97	-1.94	Avg	156.00	237.65	
8224.02	55.70	V	73.97	-18.27	Peak	358.50	127.26	
8224.02	46.33	V	53.97	-7.64	Avg	358.50	127.26	
9137.80	46.38	V	73.97	-27.59	Peak	175.75	158.91	
9137.80	35.09	V	53.97	-18.88	Avg	175.75	158.91	

FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20KDate: 4/8/2019
Lab: D
Tested By: Kyle Fujimoto**Middle Channel
X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
913.78	81.13	H	93.97	-12.84	Peak	349.75	101.25	
913.78	80.92	H	93.97	-13.05	QP	349.75	101.25	
1827.56	46.89	H	73.97	-27.08	Peak	271.75	207.14	
1827.56	44.14	H	53.97	-9.83	Avg	271.75	207.14	
2741.34	41.45	H	73.97	-32.52	Peak	116.50	127.02	
2741.34	33.68	H	53.97	-20.29	Avg	116.50	127.02	
3655.12	47.45	H	73.97	-26.52	Peak	64.50	127.14	
3655.12	44.87	H	53.97	-9.10	Avg	64.50	127.14	
4568.90	56.40	H	73.97	-17.57	Peak	176.75	158.97	
4568.90	49.04	H	53.97	-4.93	Avg	176.75	158.97	
5482.68	48.56	H	73.97	-25.41	Peak	199.75	190.91	
5482.68	42.80	H	53.97	-11.17	Avg	199.75	190.91	
6396.46	60.20	H	73.97	-13.78	Peak	143.75	197.65	
6396.46	51.19	H	53.97	-2.78	Avg	143.75	197.65	
7310.24	58.65	H	73.97	-15.32	Peak	22.00	127.08	
7310.24	50.61	H	53.97	-3.36	Avg	22.00	127.08	
8224.02	56.36	H	73.97	-17.61	Peak	332.75	111.26	
8224.02	48.49	H	53.97	-5.48	Avg	332.75	111.26	
9137.80	49.98	H	73.97	-23.99	Peak	186.75	159.08	
9137.80	43.45	H	53.97	-10.52	Avg	186.75	159.08	

FCC 15.249

Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20K

Date: 4/8/2019
Lab: D
Tested By: Kyle Fujimoto

**Middle Channel
Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
913.78	76.42	V	93.97	-17.55	Peak	214.75	101.71	
913.78	75.97	V	93.97	-18.00	QP	214.75	101.71	
1827.56	47.31	V	73.97	-26.66	Peak	250.00	142.97	
1827.56	43.29	V	53.97	-10.68	Avg	250.00	142.97	
2741.34	36.36	V	73.97	-37.61	Peak	1.25	159.08	
2741.34	25.52	V	53.97	-28.45	Avg	1.25	159.08	
3655.12	48.64	V	73.97	-25.33	Peak	303.50	143.02	
3655.12	45.99	V	53.97	-7.98	Avg	303.50	143.02	
4568.90	54.44	V	73.97	-19.53	Peak	250.25	111.38	
4568.90	50.61	V	53.97	-3.36	Avg	250.25	111.38	
5482.68	49.23	V	73.97	-24.74	Peak	274.50	127.20	
5482.68	45.47	V	53.97	-8.50	Avg	274.50	127.20	
6396.46	53.48	V	73.97	-20.49	Peak	60.00	127.02	
6396.46	50.95	V	53.97	-3.02	Avg	60.00	127.02	
7310.24	57.27	V	73.97	-16.70	Peak	256.75	111.32	
7310.24	52.77	V	53.97	-1.20	Avg	256.75	111.32	
8224.02	55.03	V	73.97	-18.94	Peak	213.50	111.14	
8224.02	52.78	V	53.97	-1.19	Avg	213.50	111.14	
9137.80	49.42	V	73.97	-24.55	Peak	191.00	127.02	
9137.80	43.48	V	53.97	-10.49	Avg	191.00	127.02	

FCC 15.249

Binsfeld Engineering Inc.
 TT20K System Transmitter
 Model: TX20K

Date: 4/8/2019
 Lab: D
 Tested By: Kyle Fujimoto

**Middle Channel
Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
913.78	78.34	H	93.97	-15.64	Peak	51.75	100.95	
913.78	77.62	H	93.97	-16.35	QP	51.75	100.95	
1827.56	50.64	H	73.97	-23.33	Peak	171.00	144.64	
1827.56	49.06	H	53.97	-4.91	Avg	171.00	144.64	
2741.34	50.07	H	73.97	-23.90	Peak	256.75	175.20	
2741.34	44.04	H	53.97	-9.93	Avg	256.75	175.20	
3655.12	53.33	H	73.97	-20.64	Peak	271.25	143.20	
3655.12	52.05	H	53.97	-1.92	Avg	271.25	143.20	
4568.90	60.80	H	73.97	-13.17	Peak	42.75	143.26	
4568.90	53.71	H	53.97	-0.26	Avg	42.75	143.26	
5482.68	48.21	H	73.97	-25.76	Peak	48.25	249.99	
5482.68	43.87	H	53.97	-10.10	Avg	48.25	249.99	
6396.46	59.15	H	73.97	-14.82	Peak	349.75	191.20	
6396.46	50.04	H	53.97	-3.93	Avg	349.75	191.20	
7310.24	59.81	H	73.97	-14.16	Peak	117.50	202.25	
7310.24	50.50	H	53.97	-3.48	Avg	117.50	202.25	
8224.02	56.12	H	73.97	-17.85	Peak	290.75	110.73	
8224.02	47.03	H	53.97	-6.94	Avg	290.75	110.73	
9137.80	53.11	H	73.97	-20.86	Peak	7.00	206.85	
9137.80	43.14	H	53.97	-10.83	Avg	7.00	206.85	

FCC 15.249

Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20K

Date: 4/8/2019
Lab: D
Tested By: Kyle Fujimoto

**Middle Channel
Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
913.78	74.79	V	93.97	-19.19	Peak	350.00	101.38	
913.78	74.58	V	93.97	-19.39	QP	350.00	101.38	
1827.56	36.34	V	73.97	-37.63	Peak	282.50	191.08	
1827.56	25.54	V	53.97	-28.43	Avg	282.50	191.08	
2741.34	41.11	V	73.97	-32.86	Peak	251.25	250.07	
2741.34	33.48	V	53.97	-20.49	Avg	251.25	250.07	
3655.12	48.80	V	73.97	-25.17	Peak	116.75	143.32	
3655.12	44.41	V	53.97	-9.56	Avg	116.75	143.32	
4568.90	60.12	V	73.97	-13.85	Peak	307.25	143.14	
4568.90	52.71	V	53.97	-1.26	Avg	307.25	143.14	
5482.68	52.81	V	73.97	-21.16	Peak	306.00	126.97	
5482.68	48.66	V	53.97	-5.31	Avg	306.00	126.97	
6396.46	60.78	V	73.97	-13.19	Peak	156.25	196.94	
6396.46	51.45	V	53.97	-2.52	Avg	156.25	196.94	
7310.24	58.27	V	73.97	-15.70	Peak	279.50	111.32	
7310.24	52.12	V	53.97	-1.85	Avg	279.50	111.32	
8224.02	56.16	V	73.97	-17.81	Peak	12.75	111.26	
8224.02	46.96	V	53.97	-7.01	Avg	12.75	111.26	
9137.80	53.49	V	73.97	-20.48	Peak	267.75	127.20	
9137.80	47.28	V	53.97	-6.69	Avg	267.75	127.20	

FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20KDate: 4/8/2019
Lab: D
Tested By: Kyle Fujimoto**Middle Channel
Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
913.78	81.54	H	93.97	-12.43	Peak	62.25	101.38	
913.78	81.33	H	93.97	-12.64	QP	62.25	101.38	
1827.56	49.29	H	73.97	-24.68	Peak	174.75	158.91	
1827.56	47.27	H	53.97	-6.70	Avg	174.75	158.91	
2741.34	46.13	H	73.97	-27.84	Peak	185.75	159.14	
2741.34	39.10	H	53.97	-14.87	Avg	185.75	159.14	
3655.12	49.79	H	73.97	-24.18	Peak	160.00	175.02	
3655.12	43.39	H	53.97	-10.58	Avg	160.00	175.02	
4568.90	56.31	H	73.97	-17.66	Peak	259.75	111.32	
4568.90	53.80	H	53.97	-0.17	Avg	259.75	111.32	
5482.68	50.12	H	73.97	-23.85	Peak	232.00	127.20	
5482.68	47.00	H	53.97	-6.97	Avg	232.00	127.20	
6396.46	52.66	H	73.97	-21.31	Peak	0.25	175.08	
6396.46	49.58	H	53.97	-4.39	Avg	0.25	175.08	
7310.24	57.28	H	73.97	-16.69	Peak	223.75	110.31	
7310.24	46.75	H	53.97	-7.23	Avg	223.75	110.31	
8224.02	51.16	H	73.97	-22.81	Peak	0.25	158.85	
8224.02	46.00	H	53.97	-7.97	Avg	0.25	158.85	
9137.80	47.99	H	73.97	-25.98	Peak	289.00	189.02	
9137.80	39.29	H	53.97	-14.68	Avg	289.00	189.02	

FCC 15.249

Binsfeld Engineering Inc.
 TT20K System Transmitter
 Model: TX20K

Date: 4/9/2019
 Lab: D
 Tested By: Kyle Fujimoto

**High Channel
X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
925.87	73.30	V	93.97	-20.67	Peak	37.50	100.02	
925.87	72.27	V	93.97	-21.70	QP	37.50	100.02	
1851.74	36.43	V	73.97	-37.54	Peak	66.25	127.38	
1851.74	25.70	V	53.97	-28.27	Avg	66.25	127.38	
2777.61	49.41	V	73.97	-24.56	Peak	90.00	175.02	
2777.61	43.45	V	53.97	-10.52	Avg	90.00	175.02	
3703.48	55.73	V	73.97	-18.24	Peak	284.50	158.01	
3703.48	48.11	V	53.97	-5.86	Avg	284.50	158.01	
4629.35	60.53	V	73.97	-13.44	Peak	283.00	126.13	
4629.35	52.99	V	53.97	-0.98	Avg	283.00	126.13	
5555.22	49.25	V	73.97	-24.72	Peak	303.00	127.08	
5555.22	41.42	V	53.97	-12.55	Avg	303.00	127.08	
6481.09	56.53	V	73.97	-17.44	Peak	118.50	191.02	
6481.09	47.08	V	53.97	-6.89	Avg	118.50	191.02	
7406.96	61.21	V	73.97	-12.76	Peak	87.00	127.32	
7406.96	52.00	V	53.97	-1.97	Avg	87.00	127.32	
8332.83	52.12	V	73.97	-21.85	Peak	112.25	160.28	
8332.83	45.35	V	53.97	-8.62	Avg	112.25	160.28	
9258.70	53.63	V	73.97	-20.34	Peak	268.75	127.26	
9258.70	47.09	V	53.97	-6.88	Avg	268.75	127.26	

FCC 15.249

Binsfeld Engineering Inc.
 TT20K System Transmitter
 Model: TX20K

Date: 4/9/2019
 Lab: D
 Tested By: Kyle Fujimoto

**High Channel
X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
925.87	78.83	H	93.97	-15.14	Peak	46.00	102.25	
925.87	77.98	H	93.97	-15.99	QP	46.00	102.25	
1851.74	46.93	H	73.97	-27.04	Peak	264.00	174.97	
1851.74	44.24	H	53.97	-9.73	Avg	264.00	174.97	
2777.61	36.28	H	73.97	-37.69	Peak	57.00	111.44	
2777.61	25.51	H	53.97	-28.46	Avg	57.00	111.44	
3703.48	49.69	H	73.97	-24.28	Peak	69.75	111.38	
3703.48	44.27	H	53.97	-9.70	Avg	69.75	111.38	
4629.35	56.68	H	73.97	-17.29	Peak	59.25	159.14	
4629.35	48.49	H	53.97	-5.48	Avg	59.25	159.14	
5555.22	50.15	H	73.97	-23.82	Peak	178.00	175.08	
5555.22	44.50	H	53.97	-9.47	Avg	178.00	175.08	
6481.09	58.95	H	73.97	-15.03	Peak	147.00	128.25	
6481.09	49.90	H	53.97	-4.07	Avg	147.00	128.50	
7406.96	57.65	H	73.97	-16.32	Peak	121.75	127.26	
7406.96	48.79	H	53.97	-5.18	Avg	121.75	127.26	
8332.83	53.26	H	73.97	-20.71	Peak	333.00	127.32	
8332.83	45.62	H	53.97	-8.35	Avg	333.00	127.32	
9258.70	51.59	H	73.97	-22.38	Peak	240.50	249.99	
9258.70	43.84	H	53.97	-10.13	Avg	240.50	249.99	

FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20KDate: 4/9/2019
Lab: D
Tested By: Kyle Fujimoto**High Channel
Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
925.87	76.36	V	93.97	-17.61	Peak	306.25	102.25	
925.87	75.41	V	93.97	-18.56	QP	306.25	102.25	
1851.74	45.24	V	73.97	-28.73	Peak	247.75	128.52	
1851.74	41.72	V	53.97	-12.25	Avg	247.75	128.52	
2777.61	36.11	V	73.97	-37.86	Peak	92.75	143.20	
2777.61	25.42	V	53.97	-28.55	Avg	92.75	143.20	
3703.48	48.65	V	73.97	-25.32	Peak	54.00	111.50	
3703.48	46.03	V	53.97	-7.94	Avg	54.00	111.50	
4629.35	53.55	V	73.97	-20.42	Peak	318.50	159.14	
4629.35	49.51	V	53.97	-4.46	Avg	318.50	159.14	
5555.22	47.87	V	73.97	-26.10	Peak	226.75	127.26	
5555.22	40.15	V	53.97	-13.82	Avg	226.75	127.26	
6481.09	52.46	V	73.97	-21.51	Peak	169.00	143.26	
6481.09	49.45	V	53.97	-4.52	Avg	169.00	143.26	
7406.96	58.08	V	73.97	-15.89	Peak	317.75	111.38	
7406.96	49.06	V	53.97	-4.91	Avg	317.75	111.38	
8332.83	51.87	V	73.97	-22.10	Peak	30.75	143.32	
8332.83	48.09	V	53.97	-5.88	Avg	30.75	143.32	
9258.70	49.87	V	73.97	-24.10	Peak	264.75	127.38	
9258.70	40.99	V	53.97	-12.98	Avg	264.75	127.38	

FCC 15.249

Binsfeld Engineering Inc.
 TT20K System Transmitter
 Model: TX20K

Date: 4/9/2019
 Lab: D
 Tested By: Kyle Fujimoto

**High Channel
Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
925.87	75.17	H	93.97	-18.80	Peak	307.75	151.20	
925.87	74.39	H	93.97	-19.58	QP	307.75	151.20	
1851.74	46.20	H	73.97	-27.77	Peak	244.25	126.43	
1851.74	43.33	H	53.97	-10.64	Avg	244.25	126.43	
2777.61	46.49	H	73.97	-27.48	Peak	215.00	190.19	
2777.61	37.90	H	53.97	-16.07	Avg	215.00	190.19	
3703.48	55.62	H	73.97	-18.35	Peak	34.75	142.97	
3703.48	47.84	H	53.97	-6.13	Avg	34.75	142.97	
4629.35	60.38	H	73.97	-13.59	Peak	135.50	111.38	
4629.35	53.58	H	53.97	-0.39	Avg	135.50	111.38	
5555.22	46.66	H	73.97	-27.31	Peak	64.00	159.08	
5555.22	39.23	H	53.97	-14.74	Avg	64.00	159.08	
6481.09	59.44	H	73.97	-14.53	Peak	246.25	225.35	
6481.09	50.34	H	53.97	-3.64	Avg	246.25	225.35	
7406.96	60.19	H	73.97	-13.78	Peak	115.50	232.58	
7406.96	50.56	H	53.97	-3.41	Avg	115.50	232.58	
8332.83	54.52	H	73.97	-19.45	Peak	62.25	127.02	
8332.83	49.82	H	53.97	-4.15	Avg	62.25	127.02	
9258.70	54.62	H	73.97	-19.35	Peak	113.25	190.91	
9258.70	51.37	H	53.97	-2.60	Avg	113.25	190.91	

FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20KDate: 4/9/2019
Lab: D
Tested By: Kyle Fujimoto**High Channel
Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
925.87	77.19	V	93.97	-16.78	Peak	238.50	100.25	
925.87	76.37	V	93.97	-17.60	QP	238.50	100.25	
1851.74	41.88	V	73.97	-32.09	Peak	85.00	111.08	
1851.74	36.10	V	53.97	-17.87	Avg	85.00	111.08	
2777.61	36.81	V	73.97	-37.16	Peak	61.50	190.43	
2777.61	27.45	V	53.97	-26.52	Avg	61.50	190.43	
3703.48	50.48	V	73.97	-23.49	Peak	72.25	143.02	
3703.48	47.97	V	53.97	-6.00	Avg	72.25	143.02	
4629.35	60.54	V	73.97	-13.43	Peak	85.75	143.26	
4629.35	52.75	V	53.97	-1.22	Avg	85.75	143.26	
5555.22	52.78	V	73.97	-21.19	Peak	57.25	159.68	
5555.22	50.54	V	53.97	-3.43	Avg	57.25	159.68	
6481.09	60.72	V	73.97	-13.25	Peak	155.00	249.99	
6481.09	51.54	V	53.97	-2.43	Avg	155.00	249.99	
7406.96	61.26	V	73.97	-12.71	Peak	126.75	124.34	
7406.96	51.78	V	53.97	-2.19	Avg	126.75	124.34	
8332.83	54.92	V	73.97	-19.06	Peak	103.75	100.00	
8332.83	45.35	V	53.97	-8.63	Avg	103.75	100.00	
9258.70	52.10	V	73.97	-21.87	Peak	277.25	123.80	
9258.70	37.84	V	53.97	-16.13	Avg	277.25	123.80	

FCC 15.249Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20KDate: 4/9/2019
Lab: D
Tested By: Kyle Fujimoto**High Channel
Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
925.87	81.71	H	93.97	-12.26	Peak	42.75	100.25	
925.87	80.91	H	93.97	-13.06	QP	42.75	100.25	
1851.74	46.79	H	73.97	-27.18	Peak	202.50	158.97	
1851.74	44.51	H	53.97	-9.46	Avg	202.50	158.97	
2777.61	46.13	H	73.97	-27.84	Peak	191.25	143.14	
2777.61	38.72	H	53.97	-15.25	Avg	191.25	143.14	
3703.48	51.71	H	73.97	-22.26	Peak	208.50	159.02	
3703.48	48.37	H	53.97	-5.60	Avg	208.50	159.02	
4629.35	53.17	H	73.97	-20.80	Peak	219.25	111.32	
4629.35	49.56	H	53.97	-4.41	Avg	219.25	111.32	
5555.22	48.84	H	73.97	-25.13	Peak	134.25	159.14	
5555.22	43.14	H	53.97	-10.83	Avg	134.25	159.14	
6481.09	54.87	H	73.97	-19.10	Peak	211.50	159.14	
6481.09	51.56	H	53.97	-2.41	Avg	211.50	159.14	
7406.96	56.37	H	73.97	-17.60	Peak	233.50	247.02	
7406.96	46.81	H	53.97	-7.16	Avg	233.50	247.02	
8332.83	52.80	H	73.97	-21.17	Peak	164.50	111.38	
8332.83	48.46	H	53.97	-5.51	Avg	164.50	111.38	
9258.70	52.65	H	73.97	-21.32	Peak	67.75	249.20	
9258.70	43.78	H	53.97	-10.19	Avg	67.75	249.20	

FCC 15.249 and 15.209Binsfeld Engineering Inc.
TT20K System Transmitter
Model: TX20K

Dates: 4/8/2019 and 4/12/2019

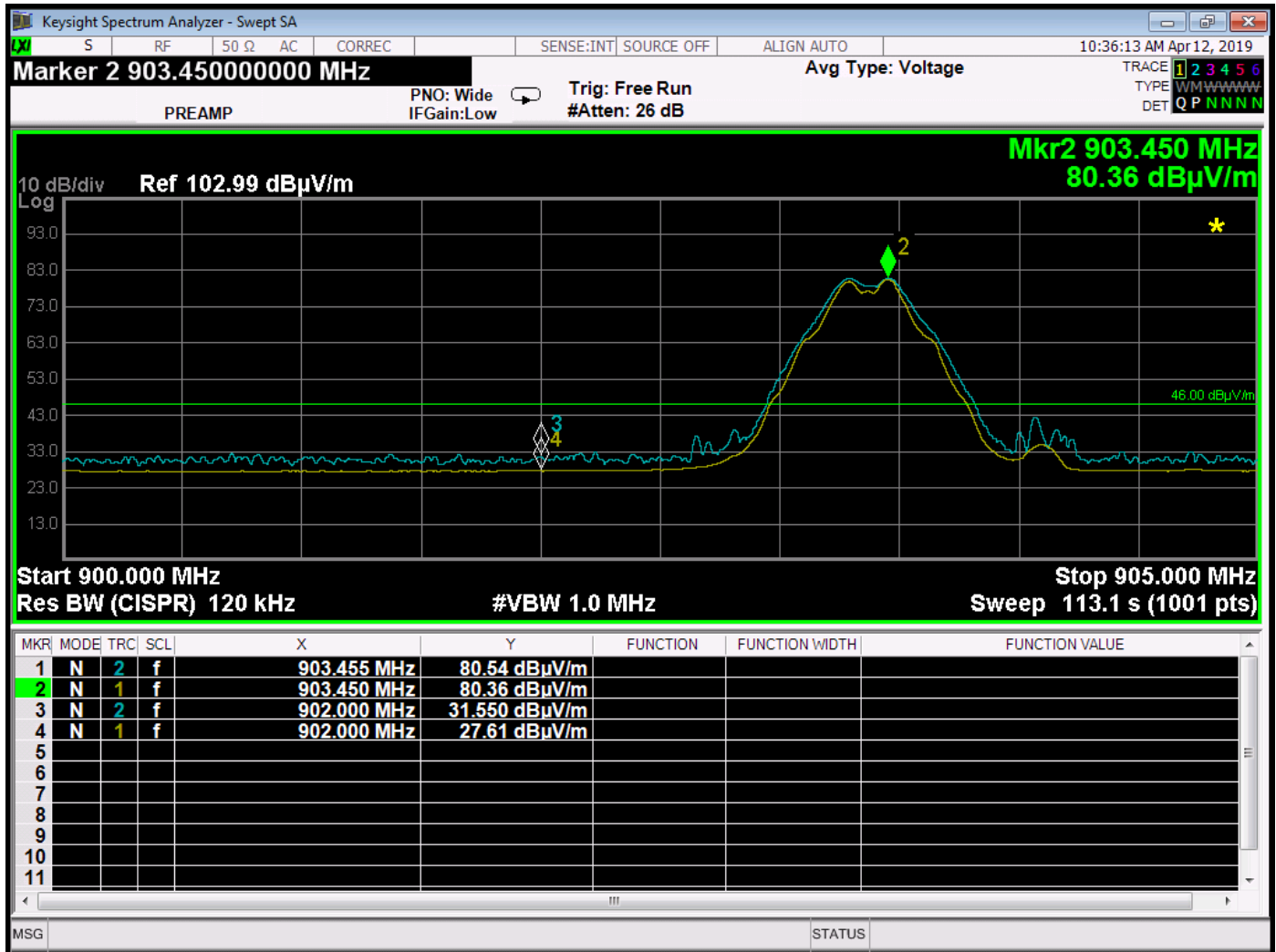
Lab: D

Tested By: Kyle Fujimoto

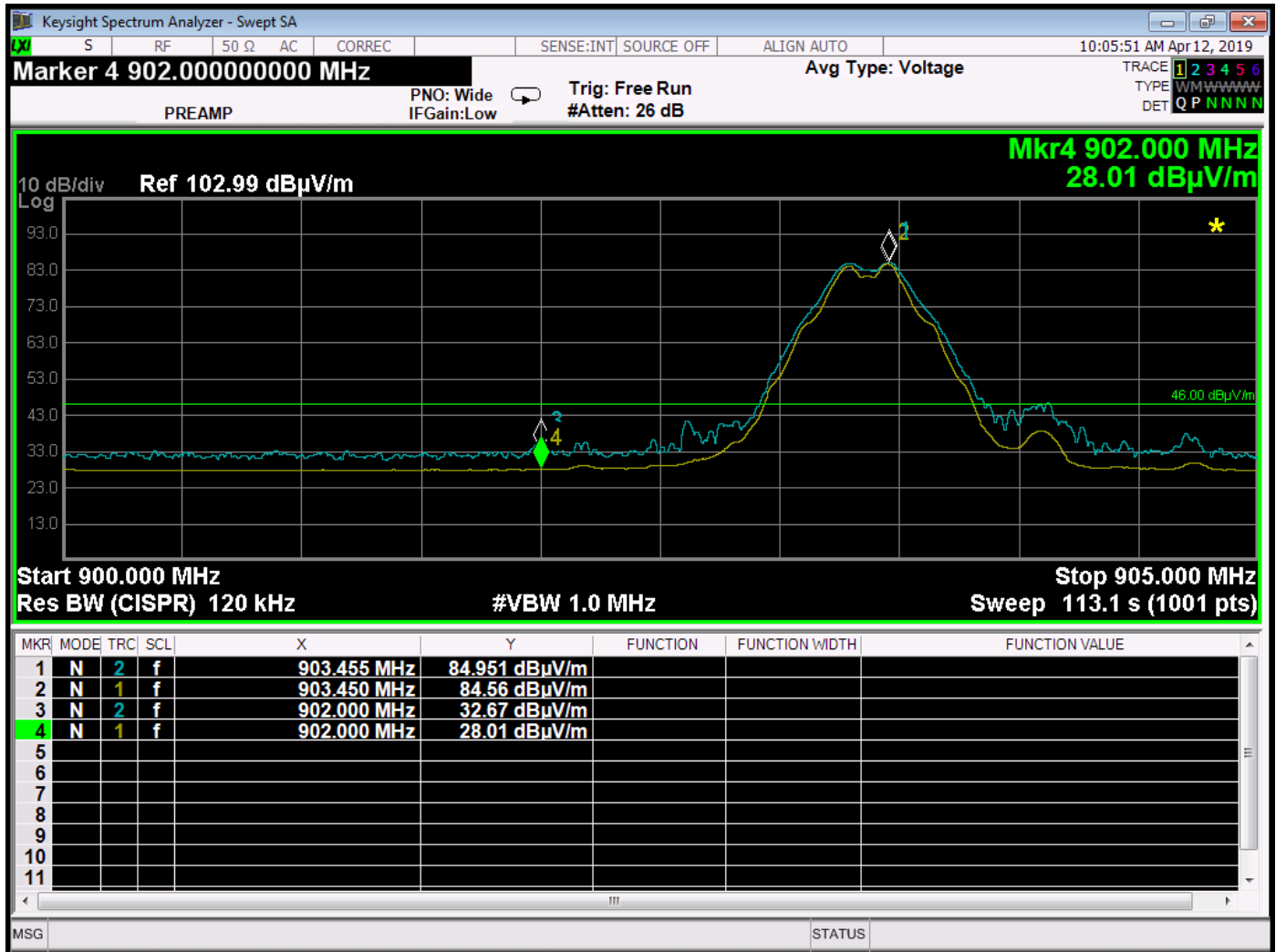
Non Harmonic Emissions from the Tx and Digital Portion - 9 kHz to 30 MHz**Non Harmonic Emissions from the Tx and Digital Portion - 1 GHz to 9.3 GHz**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
								No Emissions Detected
								from 9 kHz to 30 MHz
								for the digital portion
								of the EUT
								No Emissions Detected
								from 9 kHz to 30 MHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								No Emissions Detected
								from 1 GHz to 9.3 GHz
								for the digital portion
								of the EUT
								No Emissions Detected
								from 1 GHz to 9.3 GHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								Investigated in the X-Axis,
								Y-Axis, and Z-Axis

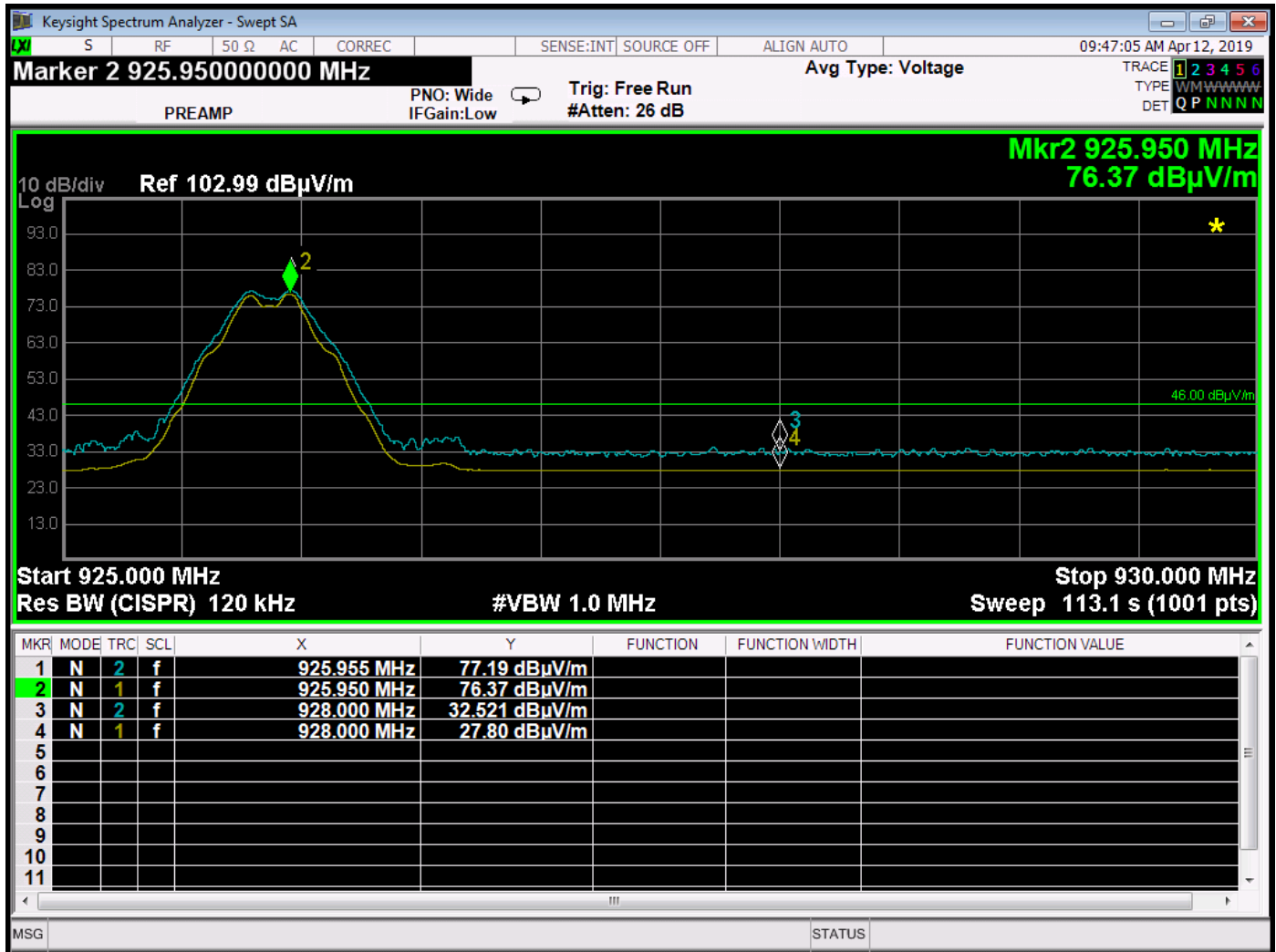




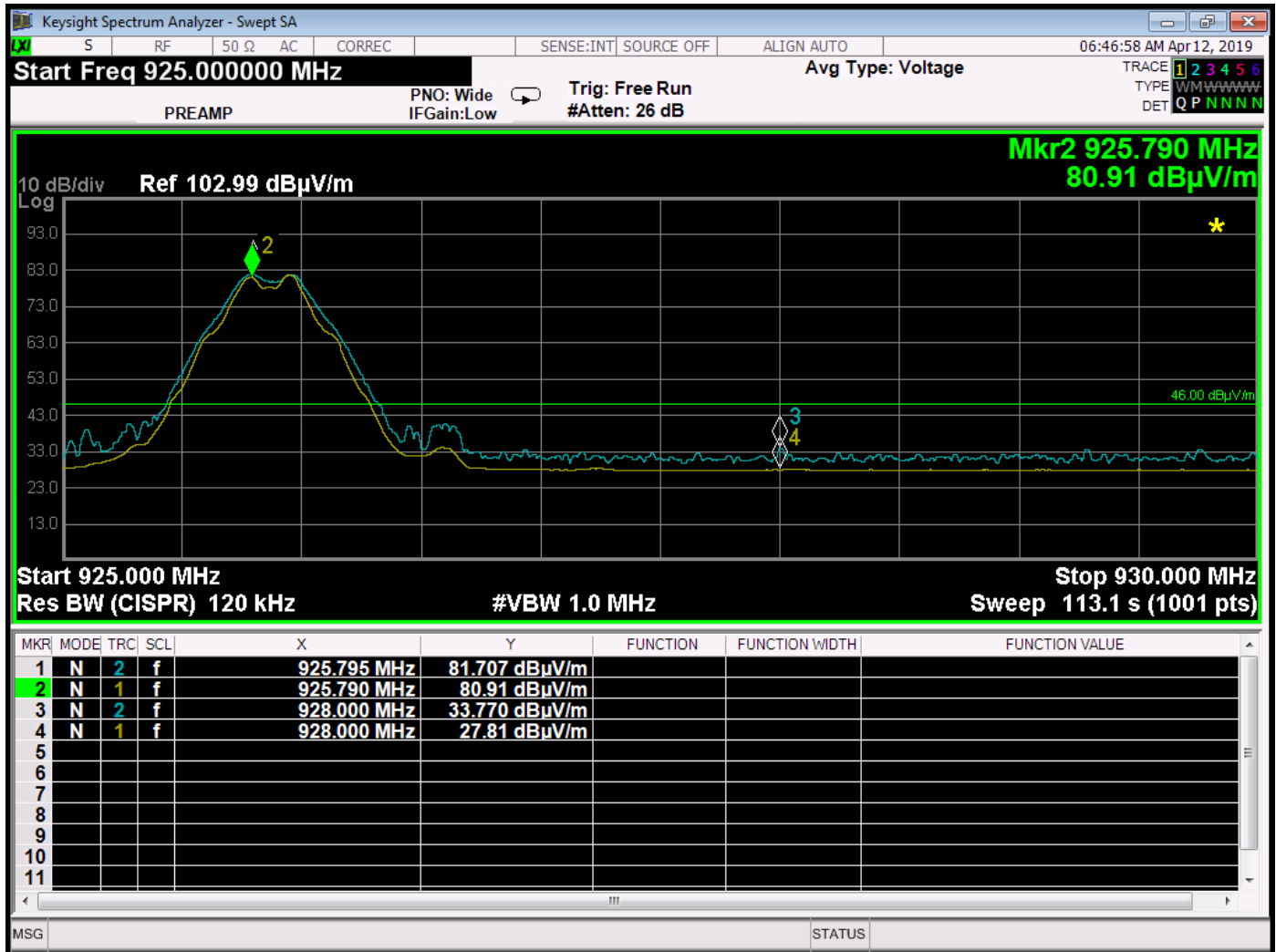
Low Band Edge – Vertical – Y-Axis



Low Band Edge – Horizontal – X-Axis



High Band Edge – Vertical – Z-Axis



High Band Edge – Horizontal – Z-Axis