FCC PART 15, SUBPART B and C
TEST REPORT

for

2.4 GHz MODULE

MODEL: TR4-V5A

Prepared for

PRESTON CINEMA SYSTEMS
1659 ELEVENTH STREET
SANTA MONICA, CALIFORNIA 90404

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DATE: SEPTEMBER 25, 2017

	REPORT BODY	APPENDICES					TOTAL
		A	***B***	***C***	***D***	***E***	
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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:	2.4 GHz Module Model: TR4-V5A S/N: N/A
Product Description:	The EUT is a transmitter module that will only be used inside F+IZ systems produced by the manufacturer.
Modifications:	The EUT was not modified during the testing.
Customer:	Preston Cinema Systems 1659 Eleventh Street Santa Monica, California 90404
Test Dates:	September 7, 11, 25, and 29, 2017

Test Specifications covered by accreditation:

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CFR Title 47, Part 15, Subpart B; and Subpart C sections 15.205, 15.207, 15.209, and 15.247

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

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz – 30 MHz	The EUT 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 15.207.
2	Spurious Radiated RF Emissions, 30 MHz – 1000 MHz	The EUT 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 15.209
3	Spurious Radiated RF Emissions, 9 kHz – 30 MHz and 1000 MHz – 25000 MHz	The EUT complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; and CFR Title 47, Part 15, Subpart C, section 15.247(d)
4	Fundamental and Emissions produced by the intentional radiator in non-restricted bands, 9 kHz – 25 GHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247(d)
5	Emissions produced by the intentional radiator in restricted bands, 9 kHz – 25 GHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.205, 15.209, and section 15.247 (d)
6	DTS Bandwidth	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(2)
7	Peak Power Output	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(3)
8	RF Conducted Antenna Test	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (d)
9	Peak Power Spectral Density from the Intentional Radiator to the Antenna	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (e)

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the 2.4 GHz Module, Model: TR4-V5A. The emissions measurements were performed according to the measurement procedure described in ANSI C63.10 and ANSI C63.4. The tests were performed in order 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 CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247.

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

Preston Cinema Systems

Howard Preston	CEO

Compatible Electronics Inc.

Kyle Fujimoto	Test Engineer
James Ross	Test Engineer

2.4 Date Test Sample was Received

The test sample was received on June 6, 2017.

2.5 Disposition of the Test Sample

The test sample has not been returned to Preston Cinema Systems as of the date of this test report.

2.6 Abbreviations and Acronyms

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

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
N/A	Not Applicable

3. APPLICABLE DOCUMENTS

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

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules - Radio frequency devices (including digital devices) – Intentional Radiators
ANSI C63.4 2014	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 for Testing Unlicensed Wireless Devices
FCC Title 47, Part 15 Subpart B	FCC Rules - Radio frequency devices (including digital devices) – Unintentional Radiators
KDB 558074 D01 v04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – Emissions

The 2.4 GHz Module Model: TR4-V5A (EUT) was connected to an antenna and a power supply via its antenna and power ports respectively.

The EUT was tested 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 voltage was varied ±15%; the transmitting signal amplitude and frequency did not vary.

The EUT was programmed to cycle to transmit at the low, middle, and high channels by pressing a button on the EUT.

It was determined that the emissions were at their highest level when the EUT was operating in the above configuration. The final emissions data was taken in this mode of operation and any cables were maximized. All initial investigations were performed with the measurement receiver in manual mode scanning the frequency range continuously. Photographs of the test setup are in Appendix D of this report.

4.1.1 Cable Construction and Termination

Description of Test Configuration – Emissions (Continued)

Cable 1 This is a 1-meter unshielded cable connecting the EUT to cable #2. The cable has a 5-pin jumper at the EUT end and a 1/8 inch power connector at the cable #2 end.

Cable 2 This is a 10-centimeter braid shielded cable connecting the EUT to the antenna. The cable as a u.fl connector at each end. The shield of the cable is grounded to the chassis via the connectors.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
2.4 GHZ MODULE (EUT)	PRESTON CINEMA SYSTEMS	TR4-V5A	N/A	NMRTR4V5A
AC POWER SUPPLY	PHIHONG	PSM03A-050	N/A	N/A
ANTENNA	TYCO ELECTRONICS	P/N: 1513504-1	N/A	N/A
FIRMWARE ON MODULE*	PRESTON CINEMA SYSTEMS	1.0	N/A	N/A

*Allows the EUT to change channels by hitting a button on the EUT.

Note: The firmware is stored on the company's drive in the network server.

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CALIBRATION DATE	CAL. CYCLE
TDK TestLab	TDK RF Solutions, Inc.	9.22	700145	N/A	N/A
CombiLog Antenna	Com-Power	AC-220	61060	July 27, 2017	1 Year
Horn Antenna	Com-Power	AH-118	071175	February 26, 2016	2 Year
EMI Receiver, 20 Hz – 40 GHz	Rohde & Schwarz	ESIB40	100194	September 26, 2017	1 Year
EMI Receiver, 20 Hz – 26.5 GHz	Keysight Technologies	N9038A	MY51210150	December 29, 2015	2 Year
Preamplifier	Com-Power	PA-840	711013	May 13, 2016	2 Year
Loop Antenna	Com-Power	AL-130R	121090	February 9, 2017	2 Year
Preamplifier	Com-Power	PAM-118A	551024	May 12, 2016	2 Year
Horn Antenna	Com-Power	AH-826	71957	N/A	N/A
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
Computer	Hewlett Packard	p6716f	MXX1030PX0	N/A	N/A
LCD Monitor	Hewlett Packard	52031a	3CQ046N3MG	N/A	N/A
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
LISN (EUT)	Com-Power	LI-215A	191951	May 17, 2017	1 Year
LISN (ACC)	Com-Power	LI-215A	191952	May 17, 2017	1 Year
Transient Limiter	Com-Power	252A910	N/A	October 26, 2016	1 Year

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1 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.

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Channel Description and Frequencies

The lowest frequency the EUT will use is 2402 MHz and the highest frequency the EUT will use is 2476 MHz. The EUT will have a total of 30 channels.

Low Channel (Channel 0) = 2402 MHz
Mid Channel (Channel 14) = 2440 MHz
High Channel (Channel 29) = 2476 MHz

7.2 Antenna Gain

The EUT utilizes a Tyco Electronics P/N: 1513504-1 antenna with a u.FL connector. The gain is +2 dBi.

8. TEST PROCEDURES

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

8.1 RF Emissions

8.1.1 Conducted Emissions Test

The EMI Receiver was used as a measuring meter. A transient limiter 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 C63.4. 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:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.207.

8.1.2 Radiated Emissions (Spurious and Harmonics) Test

The EMI Receiver was used as the measuring meter. Below 1 GHz, a built-in, internal preamplifier was used to increase the sensitivity of the instrument. At frequencies above 1 GHz, external preamplifiers were used. The Com Power Microwave Preamplifier Model: PAM-118A was used for frequencies above from 1 GHz to 18 GHz, and the Com Power Microwave Preamplifier Model: PA-840 was used for frequencies above 18 GHz. 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. A quasi-peak reading was taken only for those readings, which are marked accordingly on the data sheets.

The frequencies above 1 GHz were averaged by using a duty cycle correction factor.

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 25 GHz	1 MHz	Horn Antenna

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 gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

Test Results:

The EUT 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, Sections 15.209 and 15.247 (d) for radiated emissions. Please see Appendix E for the data sheets.

8.1.3 RF Emissions Test Results

Table 1.0 CONDUCTED EMISSION RESULTS
2.4 GHz Module, Model: TR4-V5A

Frequency MHz	Corrected Reading* dBuV	Specification Limit dBuV	Delta (Cor. Reading – Spec. Limit) dB
0.270 (BL)	45.49	50.66	-5.17
0.650 (BL)	36.06	46.00	-9.94
0.630 (BL)	35.23	46.00	-10.77
0.570 (BL)	32.75	46.00	-13.25
2.310 (BL)	32.18	46.00	-13.82
1.200 (BL)	32.01	46.00	-13.99

Table 2.0 RADIATED EMISSION RESULTS
2.4 GHz Module, Model: TR4-V5A

Frequency MHz	Corrected Reading* dBuV/m	Specification Limit dBuV/m	Delta (Cor. Reading – Spec. Limit) dB
2483.50 (Z-Axis) (H)	51.09 (Avg)	53.97	-2.88
4952 (Z-Axis) (V)	49.55 (Avg)	53.97	-4.42
2390.00 (X-Axis) (H)	45.98 (Avg)	53.97	-7.99
4952 (Y-Axis) (V)	43.64 (Avg)	53.97	-10.33
7428 (Y-Axis) (V)	42.84 (Avg)	53.97	-11.13
7428 (Z-Axis) (V)	42.50 (Avg)	53.97	-11.47

Notes:

*	The complete emissions data is given in Appendix E of this report.		
Pk	Peak Reading	Avg	Average Reading
H	Horizontal Polarization	V	Vertical Polarization
BL	Black Lead	QP	Quasi-Peak Reading

8.2 DTS Bandwidth

The DTS Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from the RF output of the EUT. The following steps were performed for measuring the DTS Bandwidth.

1. Set RBW = 100 kHz
2. Set the video bandwidth (VBW) to equal or greater than 3 times the RBW
3. Detector = Peak
4. Trace Mode = Max Hold
5. Sweep = Auto Couple
6. Allow the trace to stabilize
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(2).

8.3 Peak Output Power

The Peak Output Power was measured using the EMI Receiver. The peak output power was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was 2 MHz and the video bandwidth was 8 MHz. The cable loss was also added back into the reading using the reference level offset. The Peak Output Power was then taken.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b)(3).

8.4 Emissions in Non-Restricted Bands

The emissions in the non-restricted frequency bands measurements were performed using the EMI receiver directly connected to the EUT. The reference level was established by setting the instrument center frequency to DTS channel center frequency. The span was set to ≥ 1.5 times the DTS bandwidth. The RBW was set to 100 kHz and the VBW was set to 300 kHz. A peak detector was used with sweep set to auto. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the level and 20 dB below that was the reference level. For emission level measurement, the center frequency and span were set to encompass the frequency range to be measured. The RBW was set to 100 kHz and the VBW was set to 300 kHz. A peak detector was used with a sweep time set to auto. The number of measurement points were greater than the span/RBW. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the maximum amplitude level. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). Note: The 2390 MHz to 2400 MHz band was also investigated. The three highest emissions in the non-restricted bands were recorded.

8.5 RF Band Edges

The RF band edges were taken at 2390 MHz when the EUT was on the low channel and 2483.5 MHz when the EUT was on the high channel using the EMI Receiver. A preamplifier was used to boost the signal level, with the plots being taken at a 3 meter test distance. The radiated emissions test procedure as describe in section 8.1.2 of this test report was used to maximize the emission.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). The RF power at the restricted bands closest to the band edges at 2390 MHz and 2483.5 MHz also meet the limits of section 15.209. Please see the data sheets located in Appendix E.

8.6 Spectral Density Test

The spectrum density output was measured using the EMI Receiver. The spectral density output was measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The following steps were performed for measuring the spectral density.

1. Set analyzer center frequency to DTS channel center frequency
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 kHz <= RBW <= 100 kHz
4. Set the VBW >= 3 X RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize
9. Use the peak marker function to determine the maximum amplitude level within the RBW
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (e).

8.7 Duty Cycle Calculation

The EMI Receiver was used to obtain the duty cycle. The data sheets are located in Appendix E.

Duty Cycle Correction Factor = -18.00 dB

Where

$$\delta(\mathrm{dB}) = 20\log\left[\sum\left(nt_1 + mt_2 + \ldots + \xi t_x\right)/T\right]$$

n is the number of pulses of duration *t*1
m is the number of pulses of duration *t*2
ξ is the number of pulses of duration *tx*
T is the period of the pulse train or 100 ms if the pulse train length is greater than 100 ms

Pulse Train = 6 ms between each pulse (worst case)

Total On Time = 755 us

755 us / 6 ms = 12.58% duty cycle

The peak to average ratio is -18.00 dB (20 Log [0.1258])

9. CONCLUSIONS

The 2.4 GHz Module, Model: TR4-V5A, as tested, meets all of the specification limits defined in FCC Title 47, Part 15, Subpart B, and Subpart C, sections 15.205, 15.207, 15.209, and 15.247.

APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

LABORATORY ACCREDITATIONS AND RECOGNITIONS

NVLAP® TESTING
NVLAP LAB CODE 200528-0

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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."

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 15.247 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.

The EUT was not modified during the testing.

APPENDIX C

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	2.4 GHz Module Model: TR4-V5A S/N: N/A

There were no additional models covered under this report.

APPENDIX D

DIAGRAMS AND CHARTS

FIGURE 1: LAYOUT OF THE SEMI-ANECHOIC TEST CHAMBER

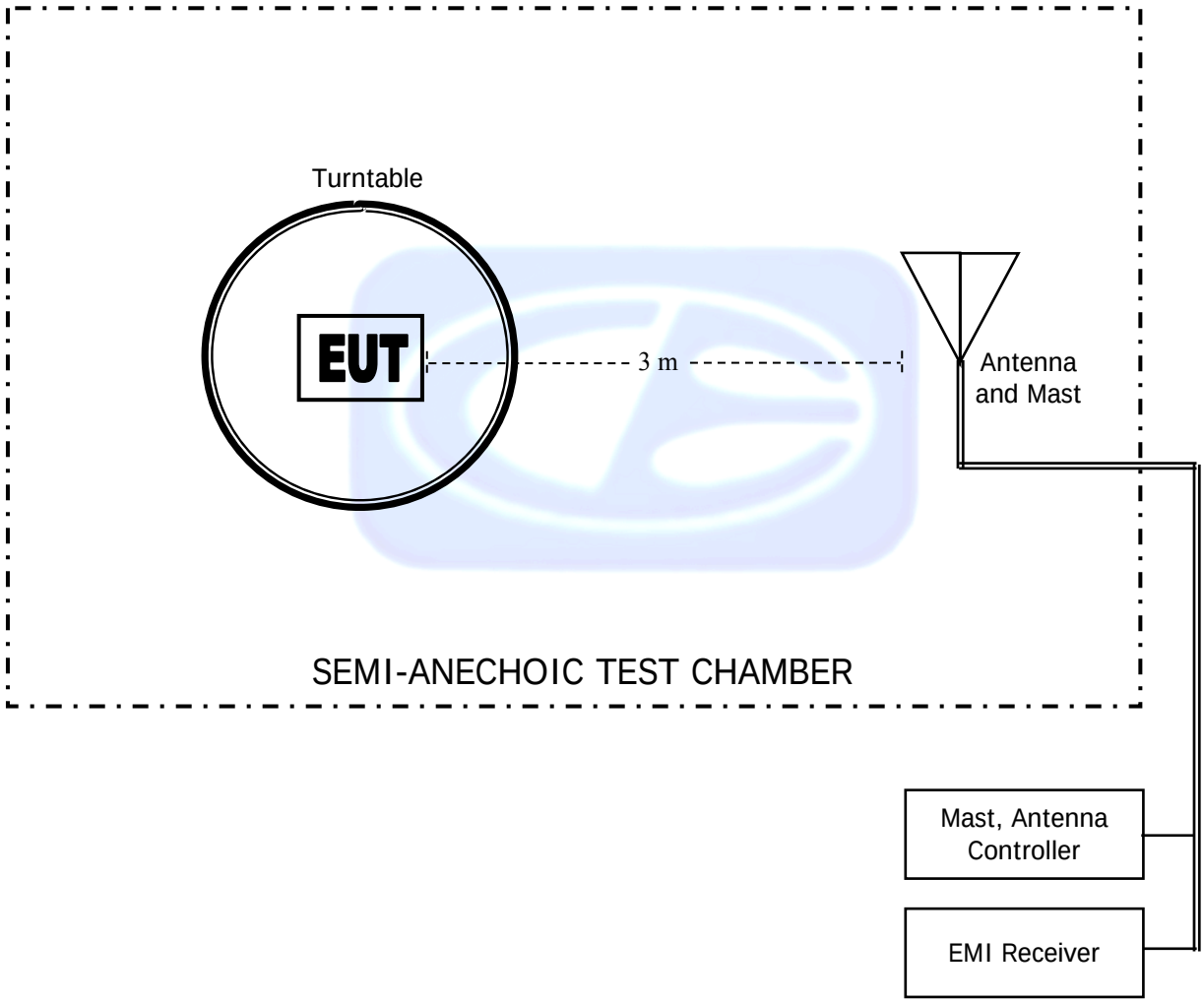
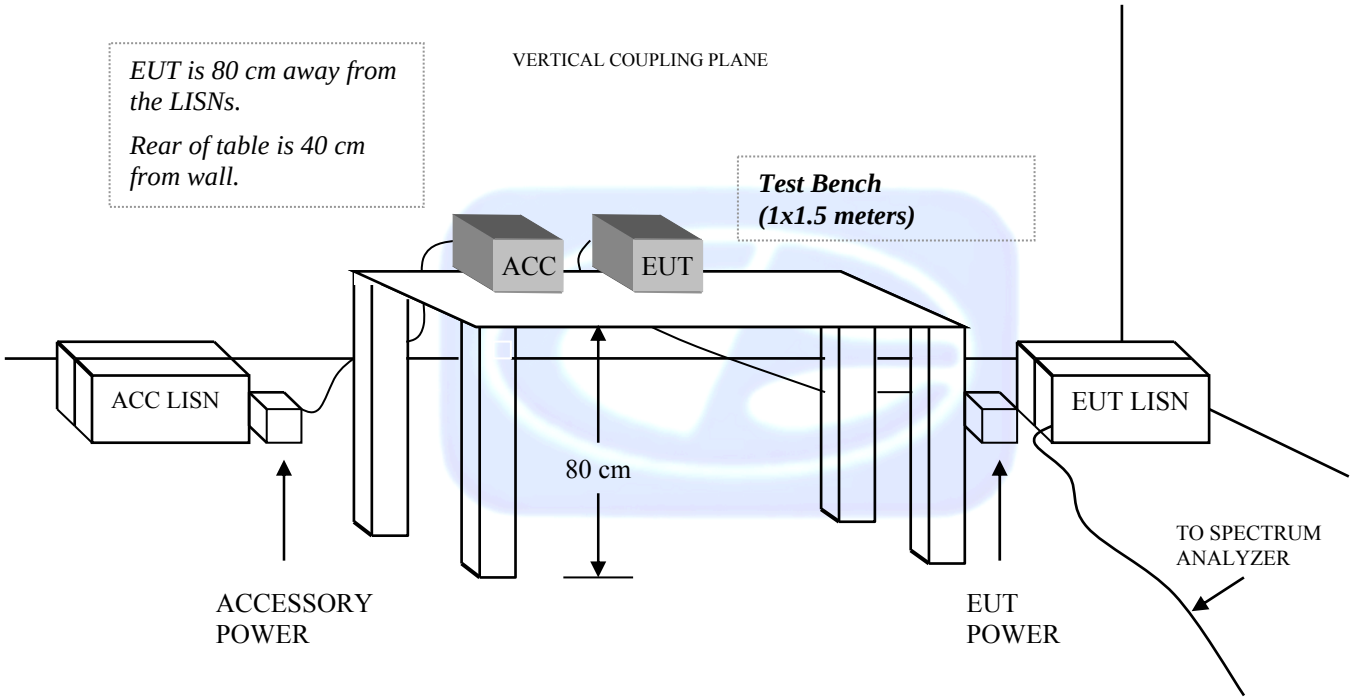


FIGURE 2: CONDUCTED EMISSIONS TEST SETUP



COM-POWER AL-130R

LOOP ANTENNA

S/N: 121090

CALIBRATION DATE: FEBRUARY 9, 2017

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	-36.17	15.33
0.01	-35.86	15.64
0.02	-37.30	14.20
0.03	-36.58	14.92
0.04	-36.99	14.51
0.05	-37.66	13.84
0.06	-37.53	13.97
0.07	-37.64	13.86
0.08	-37.52	13.98
0.09	-37.62	13.88
0.1	-37.59	13.91
0.2	-37.79	13.71
0.3	-37.80	13.70
0.4	-37.70	13.80
0.5	-37.79	13.71
0.6	-37.79	13.71
0.7	-37.69	13.81
0.8	-37.49	14.01
0.9	-37.39	14.11
1	-37.39	14.11
2	-37.09	14.41
3	-37.09	14.41
4	-37.19	14.31
5	-36.98	14.52
6	-37.17	14.33
7	-37.05	14.45
8	-36.85	14.65
9	-36.84	14.66
10	-36.75	14.75
15	-37.16	14.34
20	-36.44	15.06
25	-37.88	13.62
30	-39.14	12.36

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 26, 2016

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	23.93	10.0	39.33
1.5	25.54	10.5	39.64
2.0	28.09	11.0	41.04
2.5	30.21	11.5	44.29
3.0	30.15	12.0	41.22
3.5	30.17	12.5	41.50
4.0	31.90	13.0	41.62
4.5	33.51	13.5	40.63
5.0	33.87	14.0	39.94
5.5	35.08	14.5	41.84
6.0	34.81	15.0	42.69
6.5	34.26	15.5	39.03
7.0	36.33	16.0	39.07
7.5	37.03	16.5	41.40
8.0	37.56	17.0	43.18
8.5	40.07	17.5	47.01
9.0	38.92	18.0	46.48
9.5	38.21		

COM-POWER PAM-118A

PREAMPLIFIER

S/N: 551024

CALIBRATION DATE: MAY 12, 2016

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	39.84	6.0	39.05
1.1	39.40	6.5	38.94
1.2	39.58	7.0	39.25
1.3	39.68	7.5	39.09
1.4	39.91	8.0	39.01
1.5	39.78	8.5	38.60
1.6	39.50	9.0	38.64
1.7	39.81	9.5	39.67
1.8	39.89	10.0	39.30
1.9	39.94	11.0	39.15
2.0	39.57	12.0	39.24
2.5	40.39	13.0	39.49
3.0	40.63	14.0	39.44
3.5	40.80	15.0	39.94
4.0	40.86	16.0	40.09
4.5	39.94	17.0	40.06
5.0	34.47	18.0	39.76
5.5	39.32		

COM-POWER AH-826

HORN ANTENNA

S/N: 71957

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
18.0	33.5	22.5	35.5
18.5	33.5	23.0	35.9
19.0	34.0	23.5	35.7
19.5	34.0	24.0	35.6
20.0	34.3	24.5	36.0
20.5	34.9	25.0	36.2
21.0	34.7	25.5	36.1
21.5	35.0	26.0	36.2
22.0	35.0	26.5	35.7

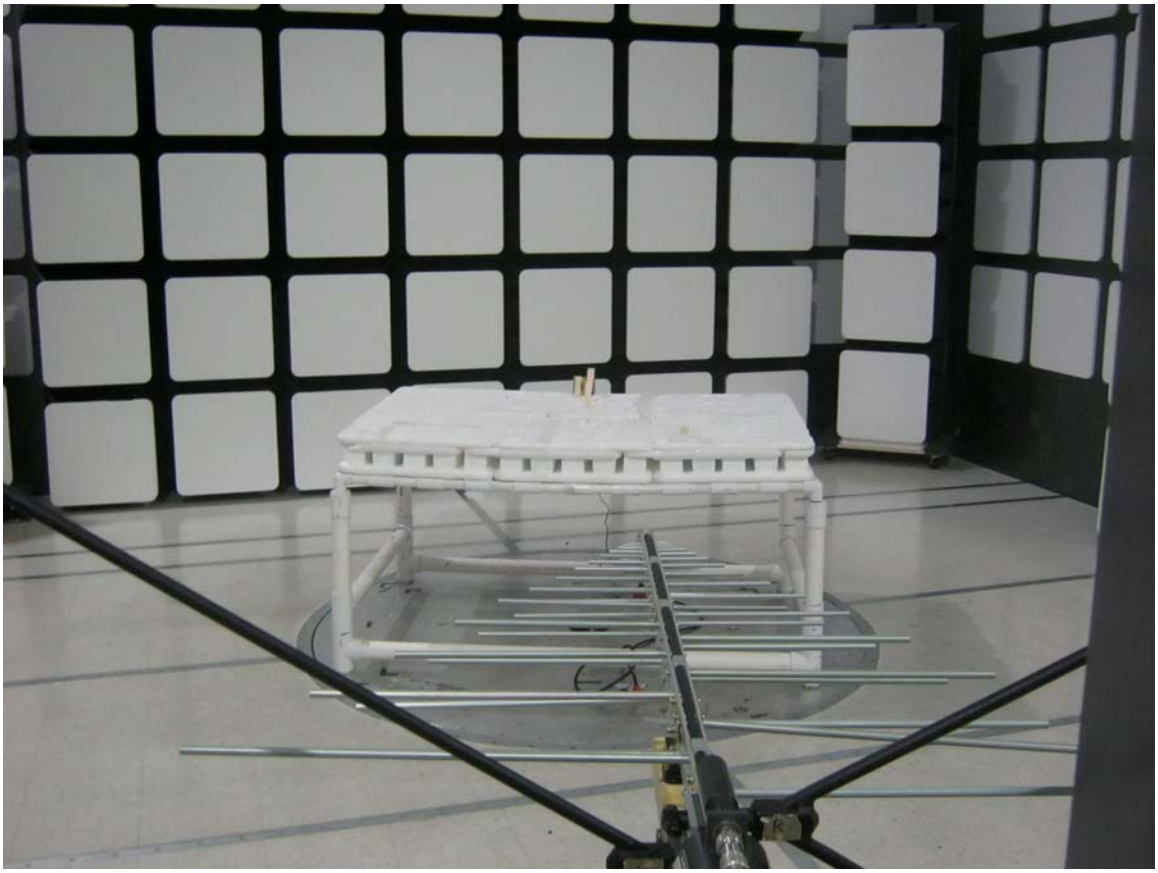
COM-POWER PA-840

MICROWAVE PREAMPLIFIER

S/N: 711013

CALIBRATION DATE: MAY 13, 2016

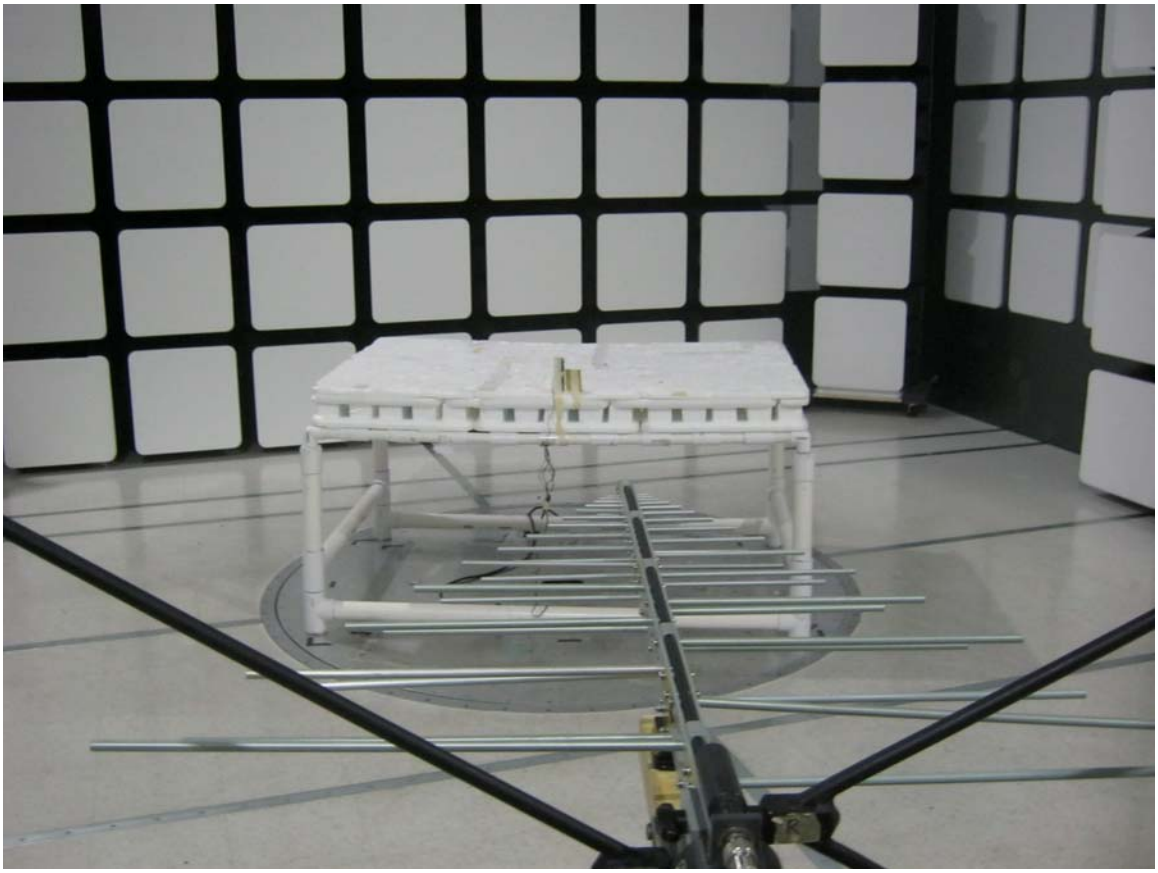
FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
18.0	25.19	31.0	25.69
19.0	24.48	31.5	25.74
20.0	24.39	32.0	26.35
21.0	24.73	32.5	26.64
22.0	23.49	33.0	25.98
23.0	24.23	33.5	24.68
24.0	24.59	34.0	24.61
25.0	25.32	34.5	23.78
26.0	25.66	35.0	24.74
26.5	25.99	35.5	24.39
27.0	26.26	36.0	23.46
27.5	25.33	36.5	23.71
28.0	24.49	37.0	26.35
28.5	24.74	37.5	23.49
29.0	25.93	38.0	25.42
29.5	26.28	38.5	24.87
30.0	26.17	39.0	22.60
30.5	26.11	39.5	20.57
		40.0	19.15



FRONT VIEW

PRESTON CINEMA SYSTEMS
2.4 GHz MODULE
MODEL: TR4-V5A
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

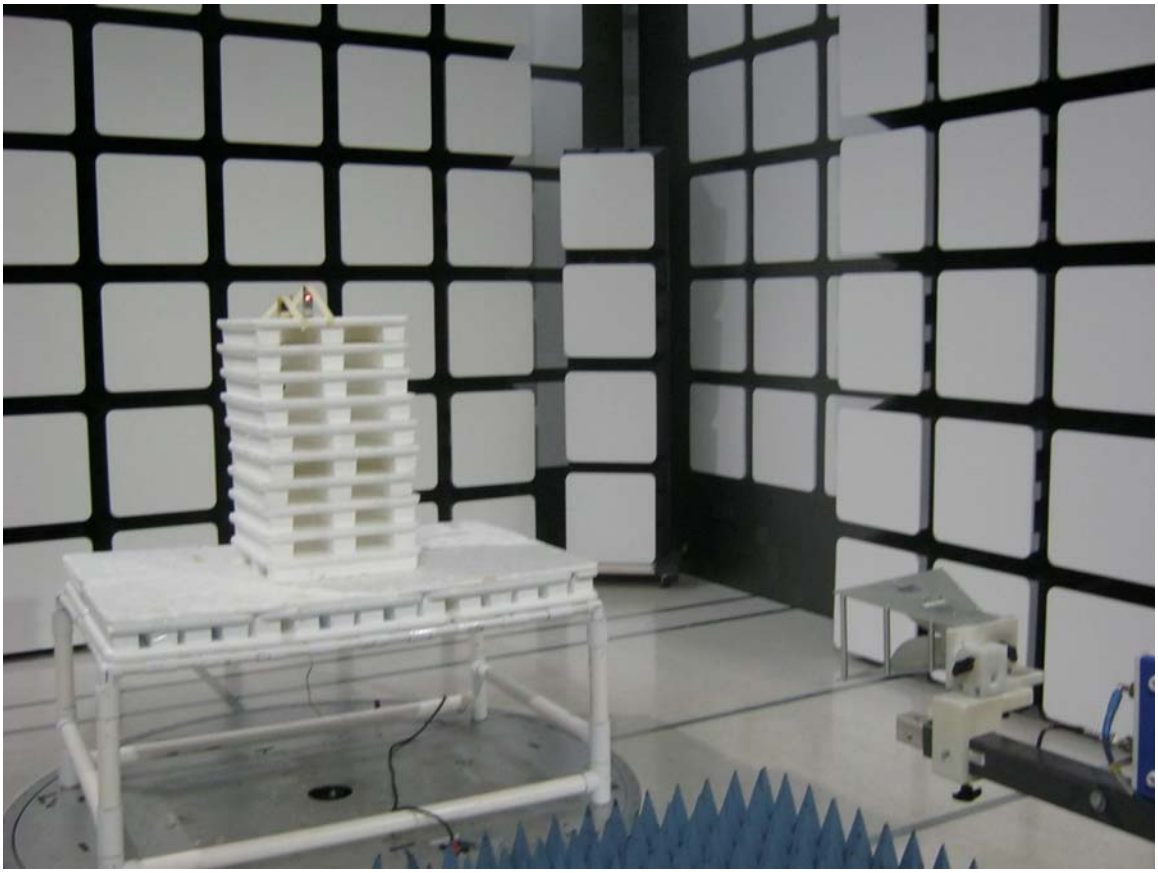
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

PRESTON CINEMA SYSTEMS
2.4 GHz MODULE
MODEL: TR4-V5A
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

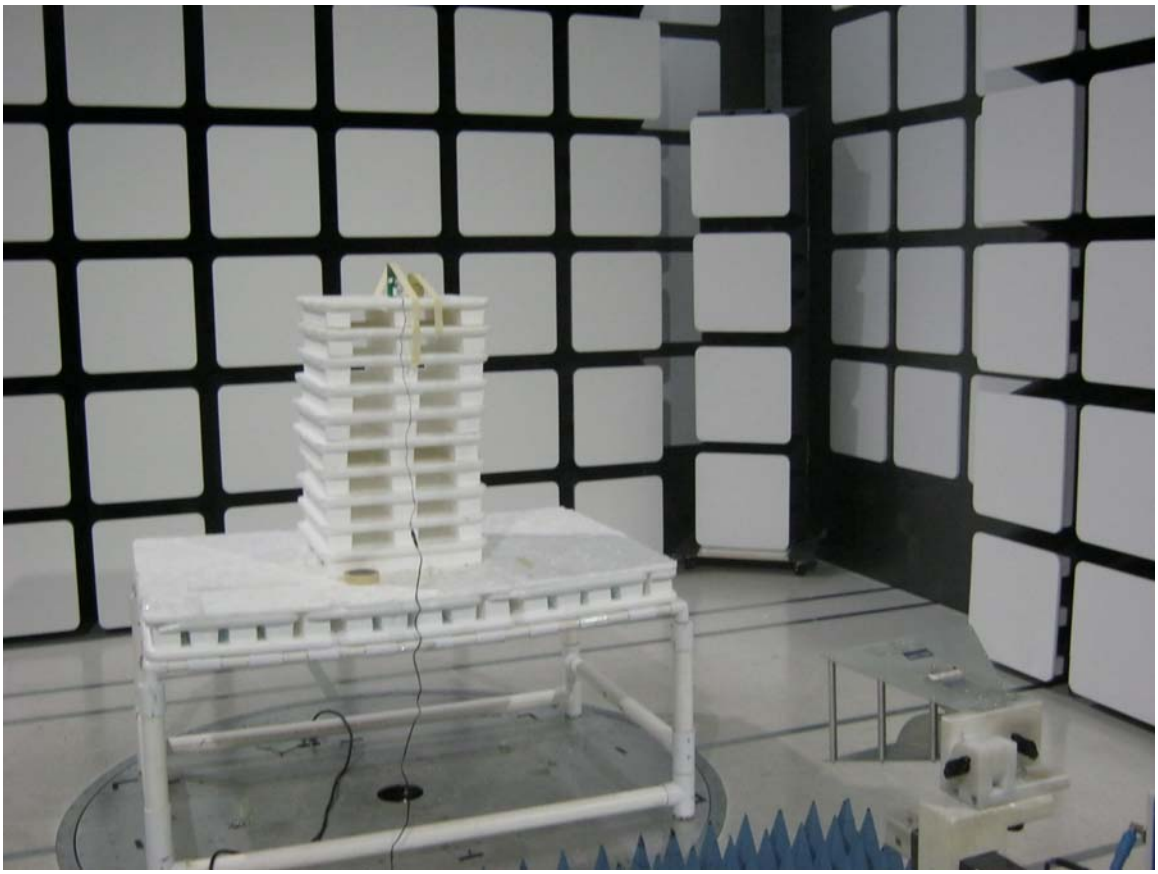
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

PRESTON CINEMA SYSTEMS
2.4 GHz MODULE
MODEL: TR4-V5A
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

PRESTON CINEMA SYSTEMS
2.4 GHz MODULE
MODEL: TR4-V5A
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

PRESTON CINEMA SYSTEMS
2.4 GHz MODULE
MODEL: TR4-V5A
FCC SUBPART B AND C – CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

PRESTON CINEMA SYSTEMS
2.4 GHz MODULE
MODEL: TR4-V5A
FCC SUBPART B AND C – CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

APPENDIX E

DATA SHEETS

RADIATED EMISSIONS

DATA SHEETS

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Low Channel
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	45.72	V	73.97	-28.25	Peak	169.00	133.88	
4804.00	27.72	V	53.97	-26.25	Avg	169.00	133.88	
7206.00	50.83	V	73.97	-23.14	Peak	116.00	107.13	
7206.00	32.83	V	53.97	-21.14	Avg	116.00	107.13	
9608.00								**No Emission Found**
9608.00								**Not in Restricted Band**
12010.00								**No Emission**
12010.00								**Detected**
14412.00								**No Emission Found**
14412.00								**Not in Restricted Band**
16814.00								**No Emission Found**
16814.00								**Not in Restricted Band**
19216.00								**No Emission**
19216.00								**Detected**
21618.00								**No Emission Found**
21618.00								**Not in Restricted Band**
24020.00								**No Emission Found**
24020.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Low Channel
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	46.51	V	73.97	-27.46	Peak	42.00	129.10	
4804.00	28.51	V	53.97	-25.46	Avg	42.00	129.10	
7206.00	49.66	V	73.97	-24.31	Peak	85.25	105.82	
7206.00	31.66	V	53.97	-22.31	Avg	85.25	105.82	
9608.00								**No Emission Found**
9608.00								**Not in Restricted Band**
12010.00								**No Emission**
12010.00								**Detected**
14412.00								**No Emission Found**
14412.00								**Not in Restricted Band**
16814.00								**No Emission Found**
16814.00								**Not in Restricted Band**
19216.00								**No Emission**
19216.00								**Detected**
21618.00								**No Emission Found**
21618.00								**Not in Restricted Band**
24020.00								**No Emission Found**
24020.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Low Channel
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	50.28	V	73.97	-23.69	Peak	345.75	105.52	
4804.00	32.28	V	53.97	-21.69	Avg	345.75	105.52	
7206.00	50.62	V	73.97	-23.35	Peak	65.75	147.67	
7206.00	32.62	V	53.97	-21.35	Avg	65.75	147.67	
9608.00								**No Emission Found**
9608.00								**Not in Restricted Band**
12010.00								**No Emission**
12010.00								**Detected**
14412.00								**No Emission Found**
14412.00								**Not in Restricted Band**
16814.00								**No Emission Found**
16814.00								**Not in Restricted Band**
19216.00								**No Emission**
19216.00								**Detected**
21618.00								**No Emission Found**
21618.00								**Not in Restricted Band**
24020.00								**No Emission Found**
24020.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Low Channel
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	46.25	H	73.97	-27.72	Peak	231.00	162.95	
4804.00	28.25	H	53.97	-25.72	Avg	231.00	162.95	
7206.00	48.63	H	73.97	-25.34	Peak	90.75	111.79	
7206.00	30.63	H	53.97	-23.34	Avg	90.75	111.79	
9608.00								**No Emission Found**
9608.00								**Not in Restricted Band**
12010.00								**No Emission**
12010.00								**Detected**
14412.00								**No Emission Found**
14412.00								**Not in Restricted Band**
16814.00								**No Emission Found**
16814.00								**Not in Restricted Band**
19216.00								**No Emission**
19216.00								**Detected**
21618.00								**No Emission Found**
21618.00								**Not in Restricted Band**
24020.00								**No Emission Found**
24020.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Low Channel
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	45.11	H	73.97	-28.86	Peak	341.75	129.94	
4804.00	27.11	H	53.97	-26.86	Avg	341.75	129.94	
7206.00	51.79	H	73.97	-22.18	Peak	171.75	137.46	
7206.00	33.79	H	53.97	-20.18	Avg	171.75	137.46	
9608.00								**No Emission Found**
9608.00								**Not in Restricted Band**
12010.00								**No Emission**
12010.00								**Detected**
14412.00								**No Emission Found**
14412.00								**Not in Restricted Band**
16814.00								**No Emission Found**
16814.00								**Not in Restricted Band**
19216.00								**No Emission**
19216.00								**Detected**
21618.00								**No Emission Found**
21618.00								**Not in Restricted Band**
24020.00								**No Emission Found**
24020.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Low Channel
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	50.63	H	73.97	-23.34	Peak	141.50	139.67	
4804.00	32.63	H	53.97	-21.34	Avg	141.50	139.67	
7206.00	51.77	H	73.97	-22.20	Peak	130.75	128.56	
7206.00	33.77	H	53.97	-20.20	Avg	130.75	128.56	
9608.00								**No Emission Found**
9608.00								**Not in Restricted Band**
12010.00								**No Emission**
12010.00								**Detected**
14412.00								**No Emission Found**
14412.00								**Not in Restricted Band**
16814.00								**No Emission Found**
16814.00								**Not in Restricted Band**
19216.00								**No Emission**
19216.00								**Detected**
21618.00								**No Emission Found**
21618.00								**Not in Restricted Band**
24020.00								**No Emission Found**
24020.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Middle Channel
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	47.11	V	73.97	-26.86	Peak	139.00	142.05	
4880.00	29.11	V	53.97	-24.86	Avg	139.00	142.05	
7320.00	49.84	V	73.97	-24.13	Peak	168.25	127.13	
7320.00	31.84	V	53.97	-22.13	Avg	168.25	127.13	
9760.00								**No Emission Found**
9760.00								**Not in Restricted Band**
12200.00								**No Emission**
12200.00								**Detected**
14640.00								**No Emission Found**
14640.00								**Not in Restricted Band**
17080.00								**No Emission Found**
17080.00								**Not in Restricted Band**
19520.00								**No Emission**
19520.00								**Detected**
21960.00								**No Emission Found**
21960.00								**Not in Restricted Band**
24400.00								**No Emission Found**
24400.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Middle Channel
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	47.39	V	73.97	-26.58	Peak	168.00	100.68	
4880.00	29.39	V	53.97	-24.58	Avg	168.00	100.68	
7320.00	51.88	V	73.97	-22.09	Peak	250.50	119.73	
7320.00	33.88	V	53.97	-20.09	Avg	250.50	119.73	
9760.00								**No Emission Found**
9760.00								**Not in Restricted Band**
12200.00								**No Emission**
12200.00								**Detected**
14640.00								**No Emission Found**
14640.00								**Not in Restricted Band**
17080.00								**No Emission Found**
17080.00								**Not in Restricted Band**
19520.00								**No Emission**
19520.00								**Detected**
21960.00								**No Emission Found**
21960.00								**Not in Restricted Band**
24400.00								**No Emission Found**
24400.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Middle Channel
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	46.58	V	73.97	-27.39	Peak	249.50	176.62	
4880.00	28.58	V	53.97	-25.39	Avg	249.50	176.62	
7320.00	50.88	V	73.97	-23.09	Peak	58.75	195.13	
7320.00	32.88	V	53.97	-21.09	Avg	58.75	195.13	
9760.00								**No Emission Found**
9760.00								**Not in Restricted Band**
12200.00								**No Emission**
12200.00								**Detected**
14640.00								**No Emission Found**
14640.00								**Not in Restricted Band**
17080.00								**No Emission Found**
17080.00								**Not in Restricted Band**
19520.00								**No Emission**
19520.00								**Detected**
21960.00								**No Emission Found**
21960.00								**Not in Restricted Band**
24400.00								**No Emission Found**
24400.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Middle Channel
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	48.26	H	73.97	-25.71	Peak	202.00	102.25	
4880.00	30.26	H	53.97	-23.71	Avg	202.00	102.25	
7320.00	49.58	H	73.97	-24.39	Peak	152.25	101.11	
7320.00	31.58	H	53.97	-22.39	Avg	152.25	101.11	
9760.00								**No Emission Found**
9760.00								**Not in Restricted Band**
12200.00								**No Emission**
12200.00								**Detected**
14640.00								**No Emission Found**
14640.00								**Not in Restricted Band**
17080.00								**No Emission Found**
17080.00								**Not in Restricted Band**
19520.00								**No Emission**
19520.00								**Detected**
21960.00								**No Emission Found**
21960.00								**Not in Restricted Band**
24400.00								**No Emission Found**
24400.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Middle Channel
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	47.75	H	73.97	-26.22	Peak	129.50	198.23	
4880.00	29.75	H	53.97	-24.22	Avg	129.50	198.23	
7320.00	51.53	H	73.97	-22.44	Peak	154.00	183.07	
7320.00	33.53	H	53.97	-20.44	Avg	154.00	183.07	
9760.00								**No Emission Found**
9760.00								**Not in Restricted Band**
12200.00								**No Emission**
12200.00								**Detected**
14640.00								**No Emission Found**
14640.00								**Not in Restricted Band**
17080.00								**No Emission Found**
17080.00								**Not in Restricted Band**
19520.00								**No Emission**
19520.00								**Detected**
21960.00								**No Emission Found**
21960.00								**Not in Restricted Band**
24400.00								**No Emission Found**
24400.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - Middle Channel
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	52.41	H	73.97	-21.56	Peak	268.50	182.05	
4880.00	34.41	H	53.97	-19.56	Avg	268.50	182.05	
7320.00	50.26	H	73.97	-23.71	Peak	337.75	149.40	
7320.00	32.26	H	53.97	-21.71	Avg	337.75	149.40	
9760.00								**No Emission Found**
9760.00								**Not in Restricted Band**
12200.00								**No Emission**
12200.00								**Detected**
14640.00								**No Emission Found**
14640.00								**Not in Restricted Band**
17080.00								**No Emission Found**
17080.00								**Not in Restricted Band**
19520.00								**No Emission**
19520.00								**Detected**
21960.00								**No Emission Found**
21960.00								**Not in Restricted Band**
24400.00								**No Emission Found**
24400.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - High Channel
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4952.00	58.24	V	73.97	-15.73	Peak	211.75	10.98	
4952.00	40.24	V	53.97	-13.73	Avg	211.75	10.98	
7428.00	59.80	V	73.97	-14.17	Peak	192.00	183.25	
7428.00	41.80	V	53.97	-12.17	Avg	192.00	183.25	
9904.00								**No Emission Found**
9904.00								**Not in Restricted Band**
12380.00								**No Emission**
12380.00								**Detected**
14856.00								**No Emission Found**
14856.00								**Not in Restricted Band**
17332.00								**No Emission Found**
17332.00								**Not in Restricted Band**
19808.00								**No Emission**
19808.00								**Detected**
22284.00								**No Emission Found**
22284.00								**Not in Restricted Band**
24760.00								**No Emission Found**
24760.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - High Channel
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4952.00	61.64	V	73.97	-12.33	Peak	3.00	115.67	
4952.00	43.64	V	53.97	-10.33	Avg	3.00	115.67	
7428.00	60.84	V	73.97	-13.13	Peak	192.75	108.86	
7428.00	42.84	V	53.97	-11.13	Avg	192.75	108.86	
9904.00								**No Emission Found**
9904.00								**Not in Restricted Band**
12380.00								**No Emission**
12380.00								**Detected**
14856.00								**No Emission Found**
14856.00								**Not in Restricted Band**
17332.00								**No Emission Found**
17332.00								**Not in Restricted Band**
19808.00								**No Emission**
19808.00								**Detected**
22284.00								**No Emission Found**
22284.00								**Not in Restricted Band**
24760.00								**No Emission Found**
24760.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - High Channel
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4952.00	67.55	V	73.97	-6.42	Peak	190.50	150.35	
4952.00	49.55	V	53.97	-4.42	Avg	190.50	150.35	
7428.00	60.50	V	73.97	-13.47	Peak	63.75	126.05	
7428.00	42.50	V	53.97	-11.47	Avg	63.75	126.05	
9904.00								**No Emission Found**
9904.00								**Not in Restricted Band**
12380.00								**No Emission**
12380.00								**Detected**
14856.00								**No Emission Found**
14856.00								**Not in Restricted Band**
17332.00								**No Emission Found**
17332.00								**Not in Restricted Band**
19808.00								**No Emission**
19808.00								**Detected**
22284.00								**No Emission Found**
22284.00								**Not in Restricted Band**
24760.00								**No Emission Found**
24760.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - High Channel
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4952.00	63.03	H	73.97	-27.39	Peak	72.00	155.79	
4952.00	45.03	H	53.97	-25.39	Avg	72.00	155.79	
7428.00	62.19	H	73.97	-23.09	Peak	81.75	181.88	
7428.00	44.19	H	53.97	-21.09	Avg	81.75	181.88	
9904.00								**No Emission Found**
9904.00								**Not in Restricted Band**
12380.00								**No Emission**
12380.00								**Detected**
14856.00								**No Emission Found**
14856.00								**Not in Restricted Band**
17332.00								**No Emission Found**
17332.00								**Not in Restricted Band**
19808.00								**No Emission**
19808.00								**Detected**
22284.00								**No Emission Found**
22284.00								**Not in Restricted Band**
24760.00								**No Emission Found**
24760.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - High Channel
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4952.00	58.45	H	73.97	-27.39	Peak	334.50	114.11	
4952.00	40.45	H	53.97	-25.39	Avg	334.50	114.11	
7428.00	57.34	H	73.97	-23.09	Peak	113.75	178.95	
7428.00	39.34	H	53.97	-21.09	Avg	113.75	178.95	
9904.00								**No Emission Found**
9904.00								**Not in Restricted Band**
12380.00								**No Emission**
12380.00								**Detected**
14856.00								**No Emission Found**
14856.00								**Not in Restricted Band**
17332.00								**No Emission Found**
17332.00								**Not in Restricted Band**
19808.00								**No Emission**
19808.00								**Detected**
22284.00								**No Emission Found**
22284.00								**Not in Restricted Band**
24760.00								**No Emission Found**
24760.00								**Not in Restricted Band**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Harmonics - High Channel
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4952.00	63.75	H	73.97	-27.39	Peak	188.50	151.85	
4952.00	45.75	H	53.97	-25.39	Avg	188.50	151.85	
7428.00	62.62	H	73.97	-23.09	Peak	195.25	183.61	
7428.00	44.62	H	53.97	-21.09	Avg	195.25	183.61	
9904.00								**No Emission Found**
9904.00								**Not in Restricted Band**
12380.00								**No Emission**
12380.00								**Detected**
14856.00								**No Emission Found**
14856.00								**Not in Restricted Band**
17332.00								**No Emission Found**
17332.00								**Not in Restricted Band**
19808.00								**No Emission**
19808.00								**Detected**
22284.00								**No Emission Found**
22284.00								**Not in Restricted Band**
24760.00								**No Emission Found**
24760.00								**Not in Restricted Band**

FCC Class B and FCC 15.247

Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

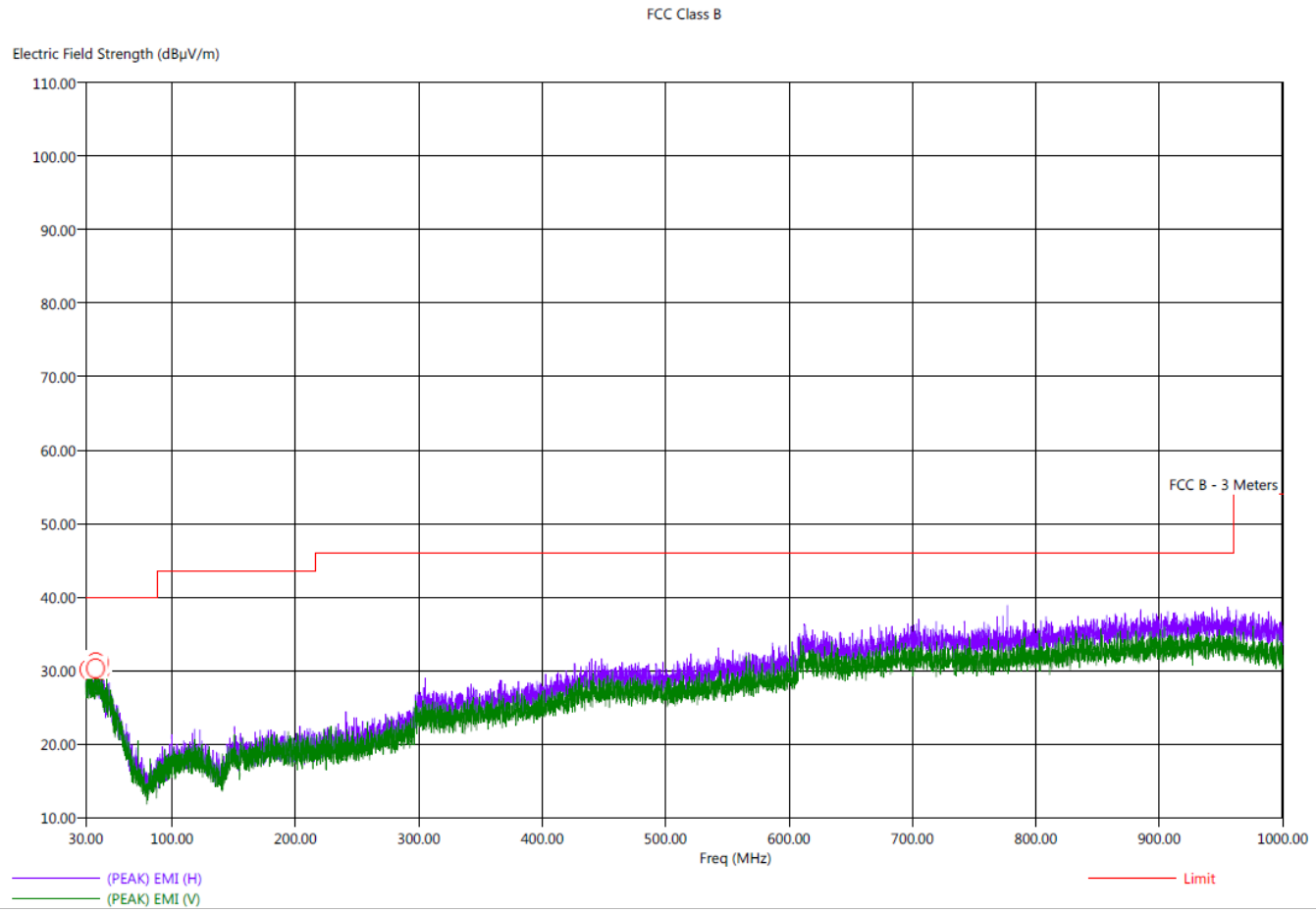
Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

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 25 GHz

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	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 25 GHz
								for the digital portion
								of the EUT
								No Emissions Detected
								from 1 GHz to 25 GHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								Investigated in the X-Axis,
								Y-Axis, and Z-Axis

Title: Pre-Scan - FCC Class B
File: Agilent - Pre-Scan - FCC Class B - 30 MHz to 1000 MHz Z-Axis.set
Operator: Kyle Haag
EUT Type: 2.4 GHz Module
EUT Condition: The EUT was in transmit mode at its high channel Y-Axis
Company: Preston Cinema Systems
Model: TR4-V5A
S/N: N/A

9/11/2017 11:15:56 AM
Sequence: Preliminary Scan



Title: Radiated Final - FCC Class B
File: 1 - Agilent - Final Scan - FCC Class B - 30 MHz to 1000 MHz - 08-07-2017.set
Operator: Kyle Haag
EUT Type: 2.4 GHz Module
EUT Condition: The EUT was in transmit mode at its high channel Y-Axis - Worst Case
Comments: Company: Preston Cinema Systems
Model: TR4-V5A
S/N: N/A

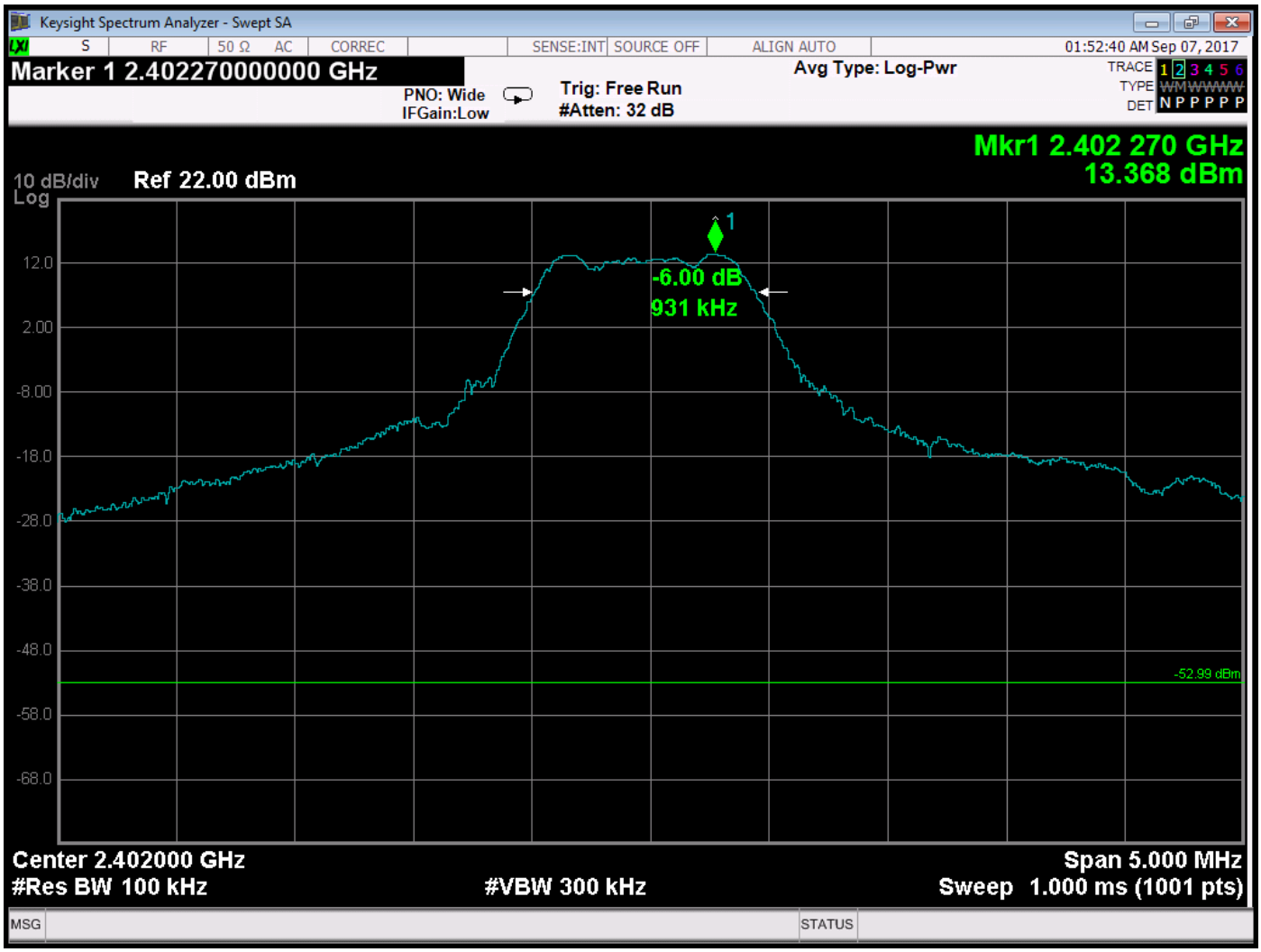
9/11/2017 11:28:03 AM
Sequence: Final Measurements

FCC Class B

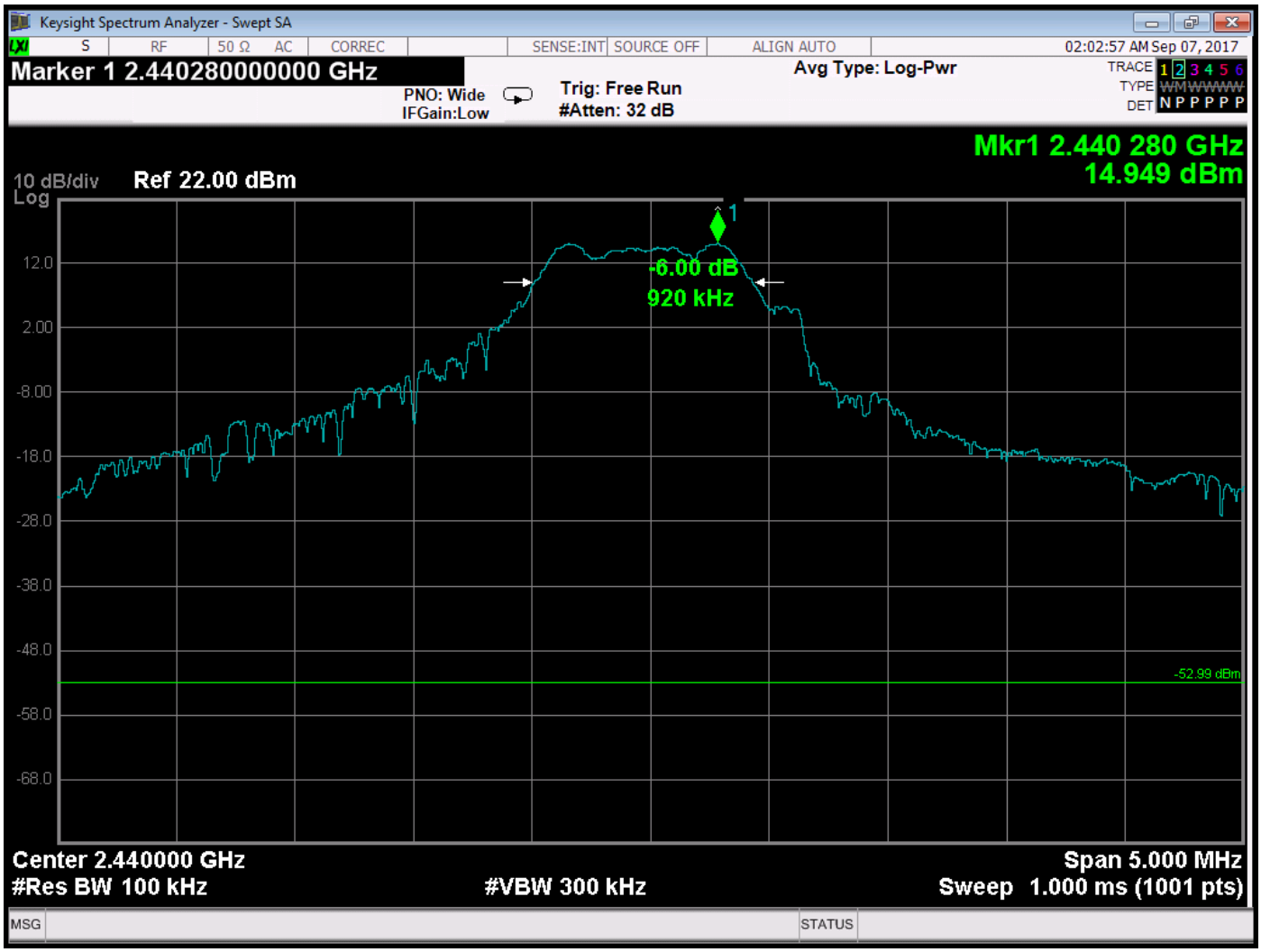
Freq (MHz)	Pol	(PEAK) EMI (dBµV/m)	(QP) EMI (dBµV/m)	(PEAK) Margin (dB)	(QP) Margin (dB)	Limit (dBµV/m)	Transducer (dB)	Cable (dB)	Ttbl Agl (deg)	Twr Ht (cm)
32.70	H	31.71	26.20	-8.29	-13.80	40.00	23.91	0.33	176.50	366.17
38.00	V	31.93	26.87	-8.07	-13.13	40.00	24.46	0.38	50.50	398.11
38.30	V	31.68	26.76	-8.32	-13.24	40.00	24.47	0.38	153.75	174.95
39.30	H	31.57	26.65	-8.43	-13.35	40.00	24.61	0.39	119.75	222.89
41.10	V	32.14	26.40	-7.86	-13.60	40.00	24.22	0.40	76.25	270.23
42.10	H	32.41	26.15	-7.59	-13.85	40.00	23.95	0.40	326.25	254.53

-6 dB BANDWIDTH

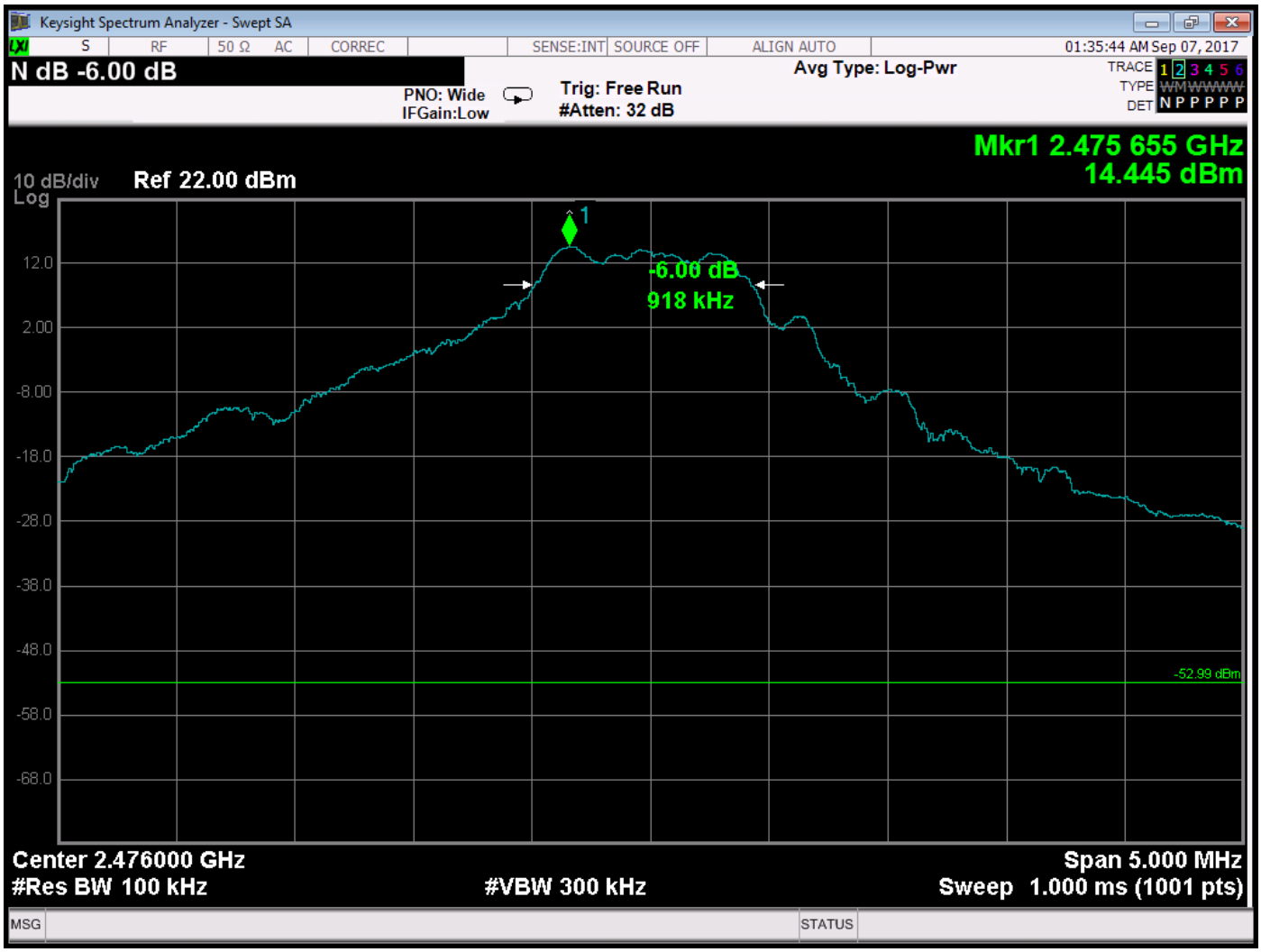
DATA SHEETS



-6 dB Bandwidth – 2402 MHz



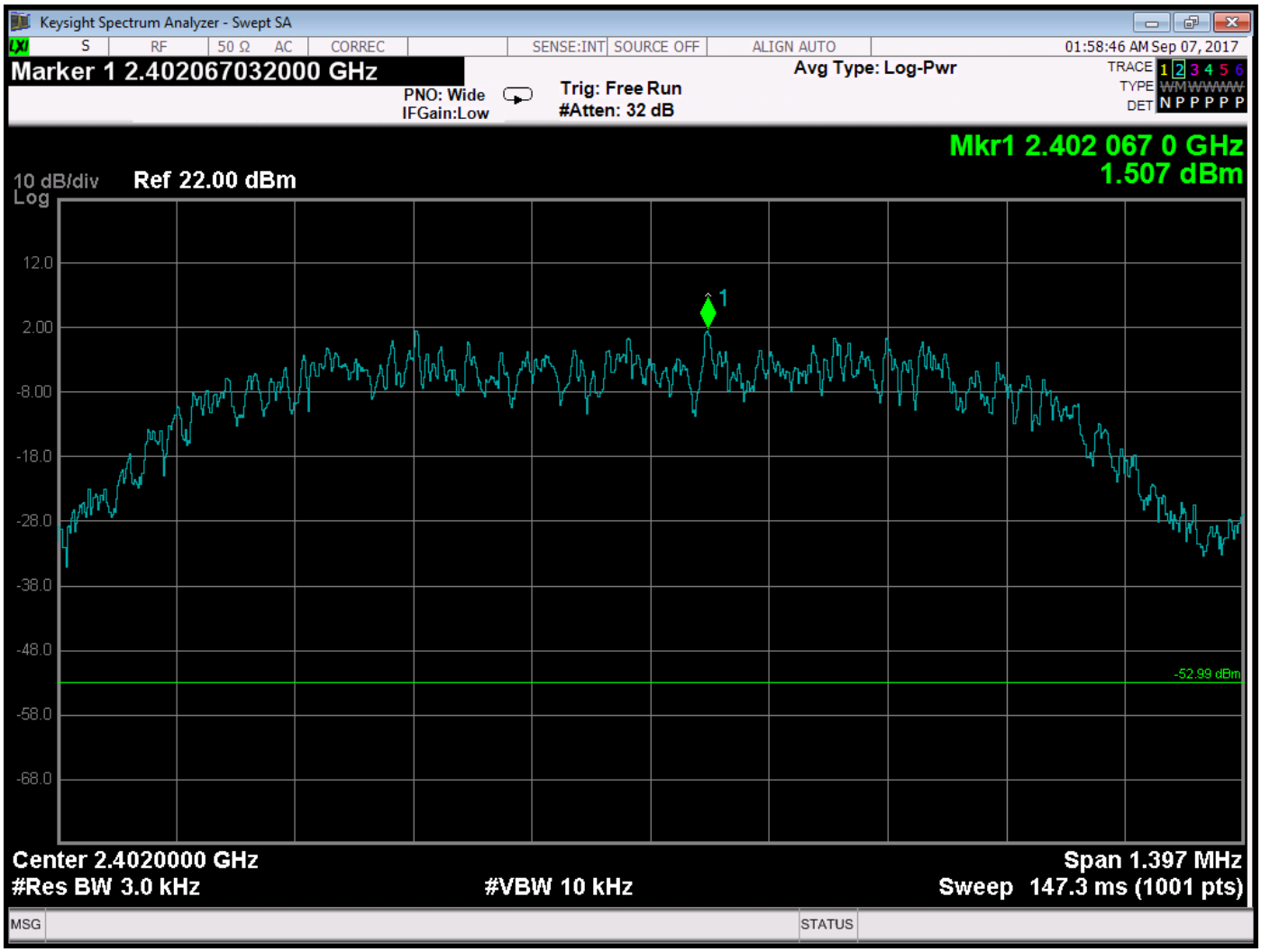
-6 dB Bandwidth – 2440 MHz



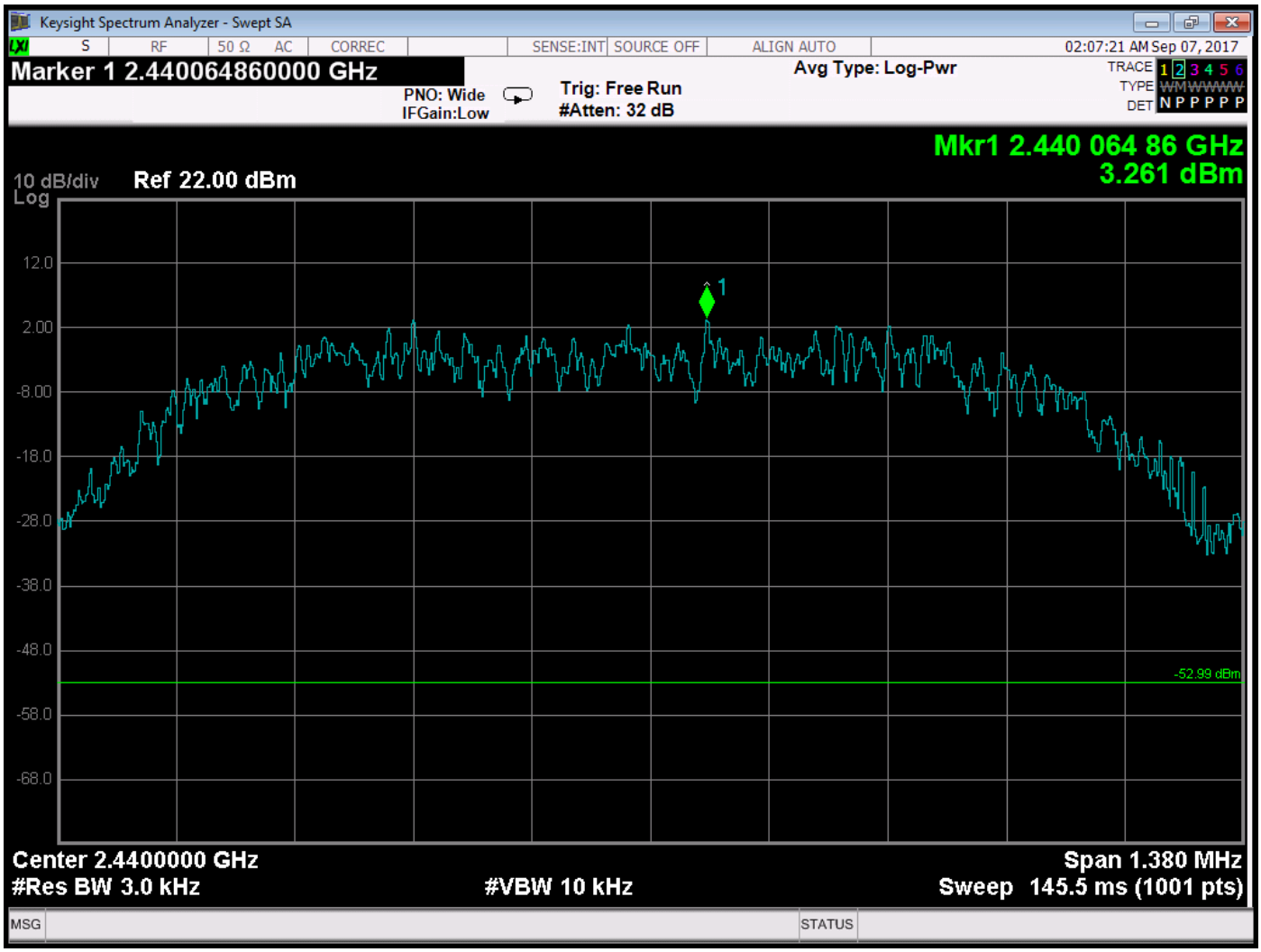
-6 dB Bandwidth – 2476 MHz

SPECTRAL DENSITY OUTPUT

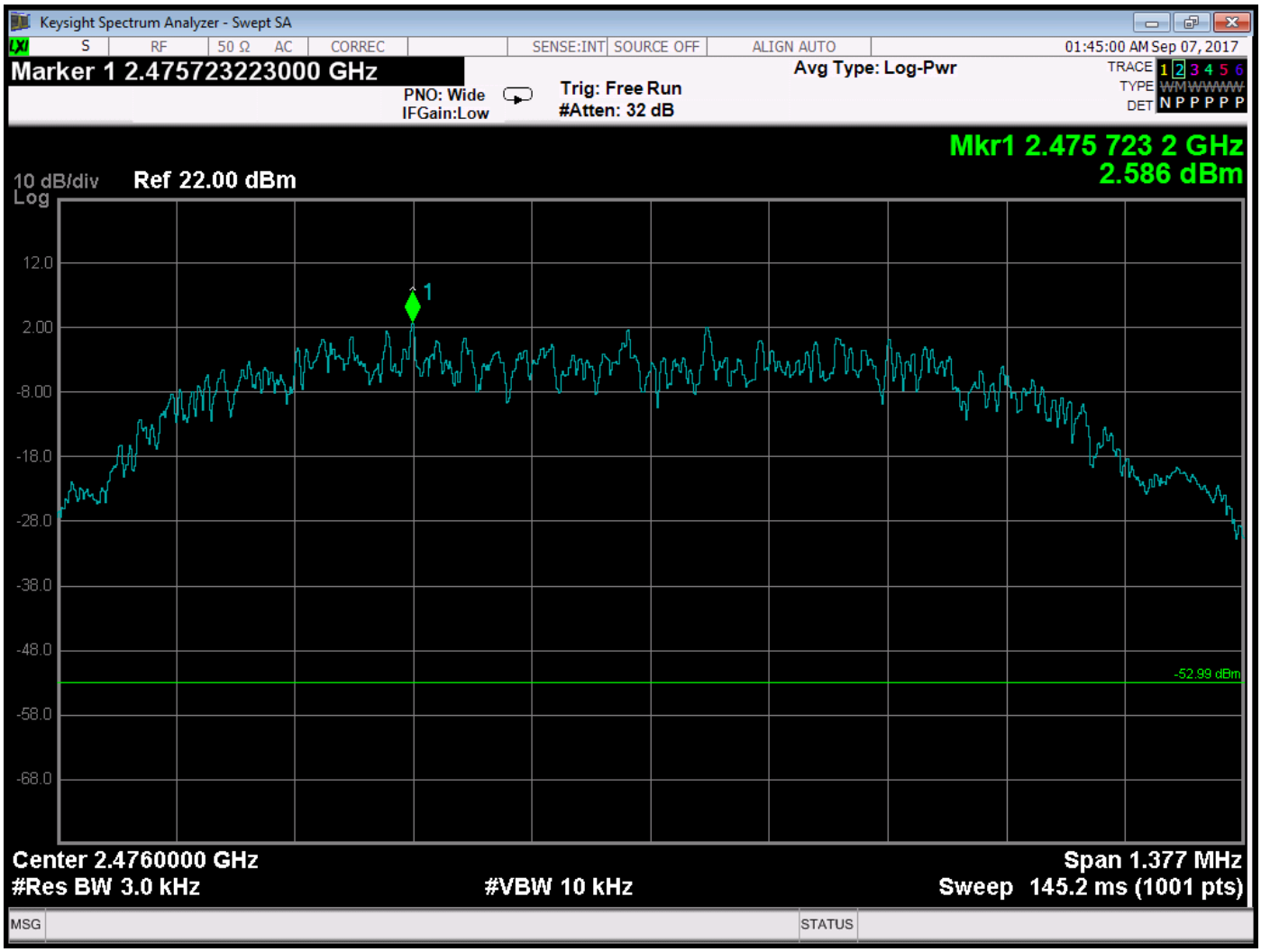
DATA SHEETS



Spectral Density – 2402 MHz



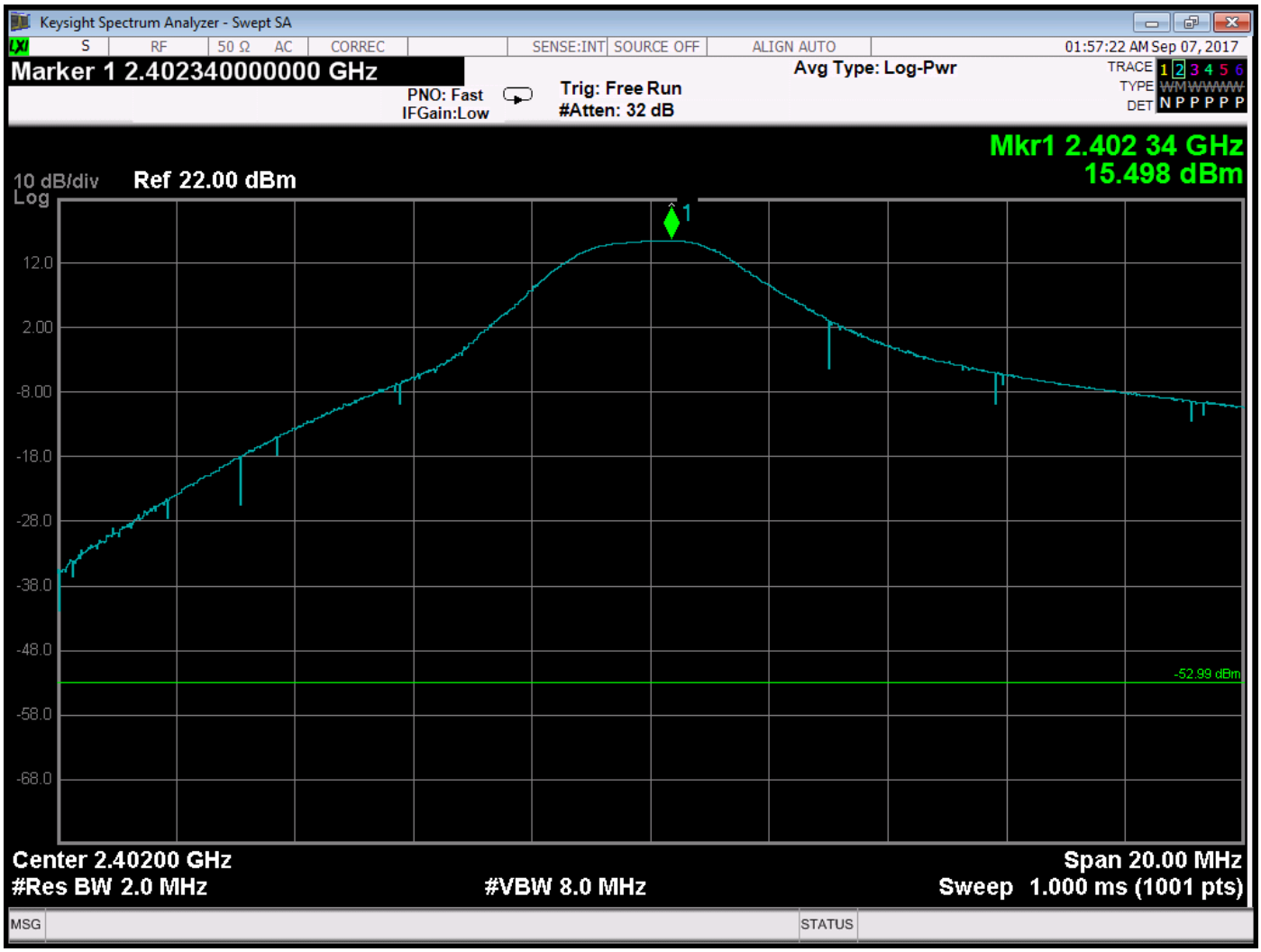
Spectral Density – 2440 MHz



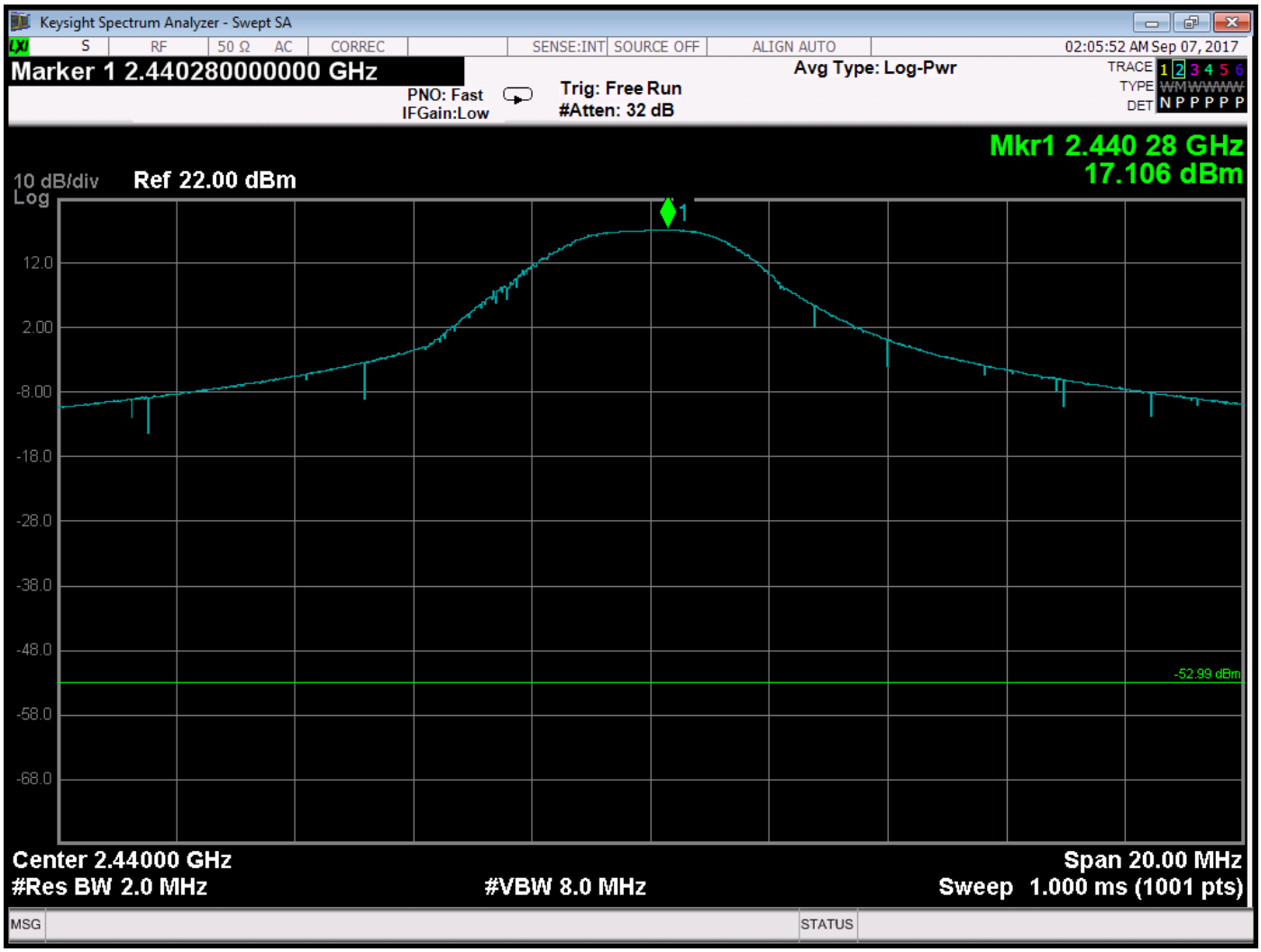
Spectral Density – 2476 MHz

PEAK POWER

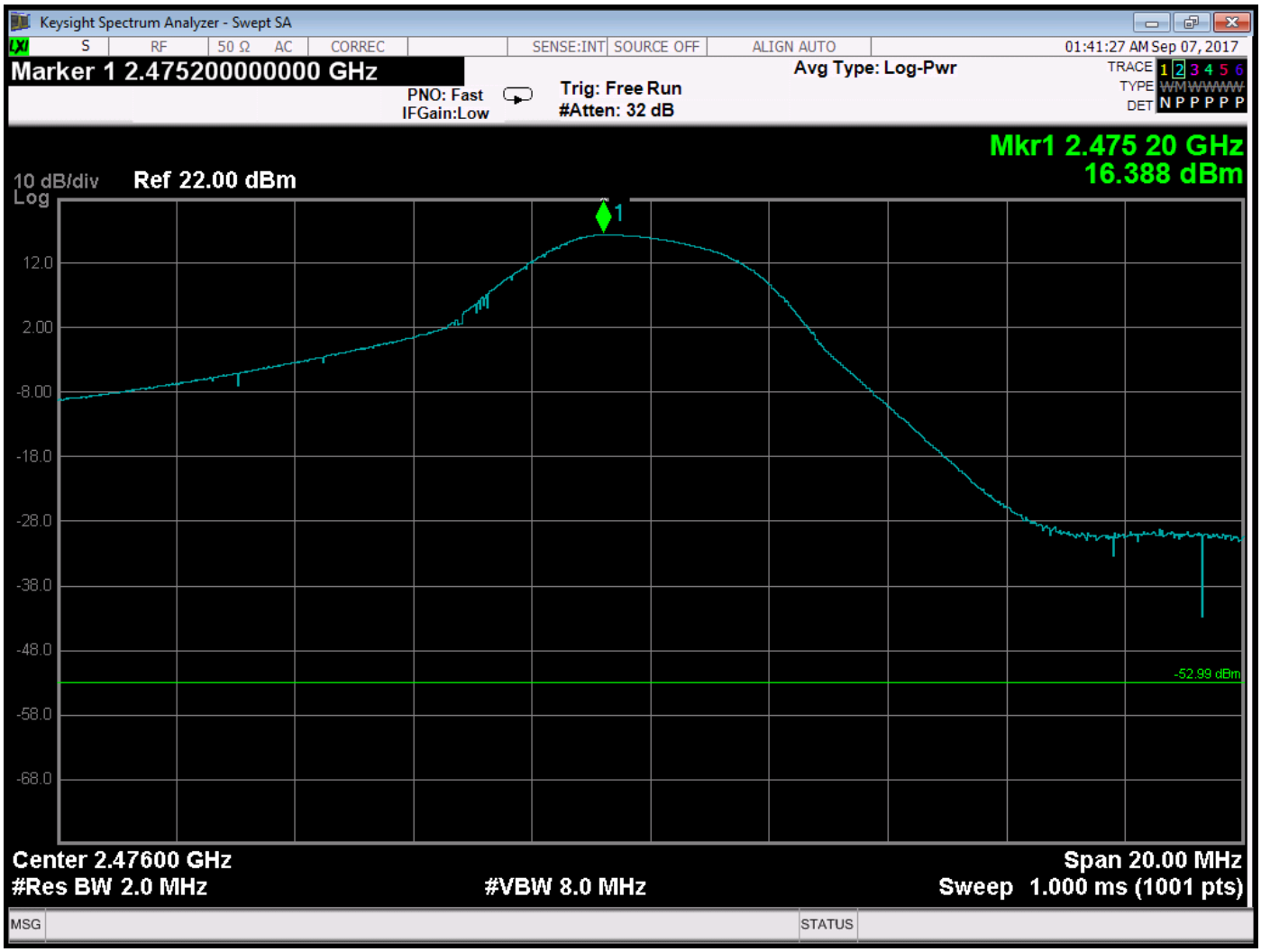
DATA SHEETS



Peak Power Output – 2402 MHz



Peak Power Output – 2440 MHz



Peak Power Output – 2476 MHz

BAND EDGES

DATA SHEETS

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Band Edges

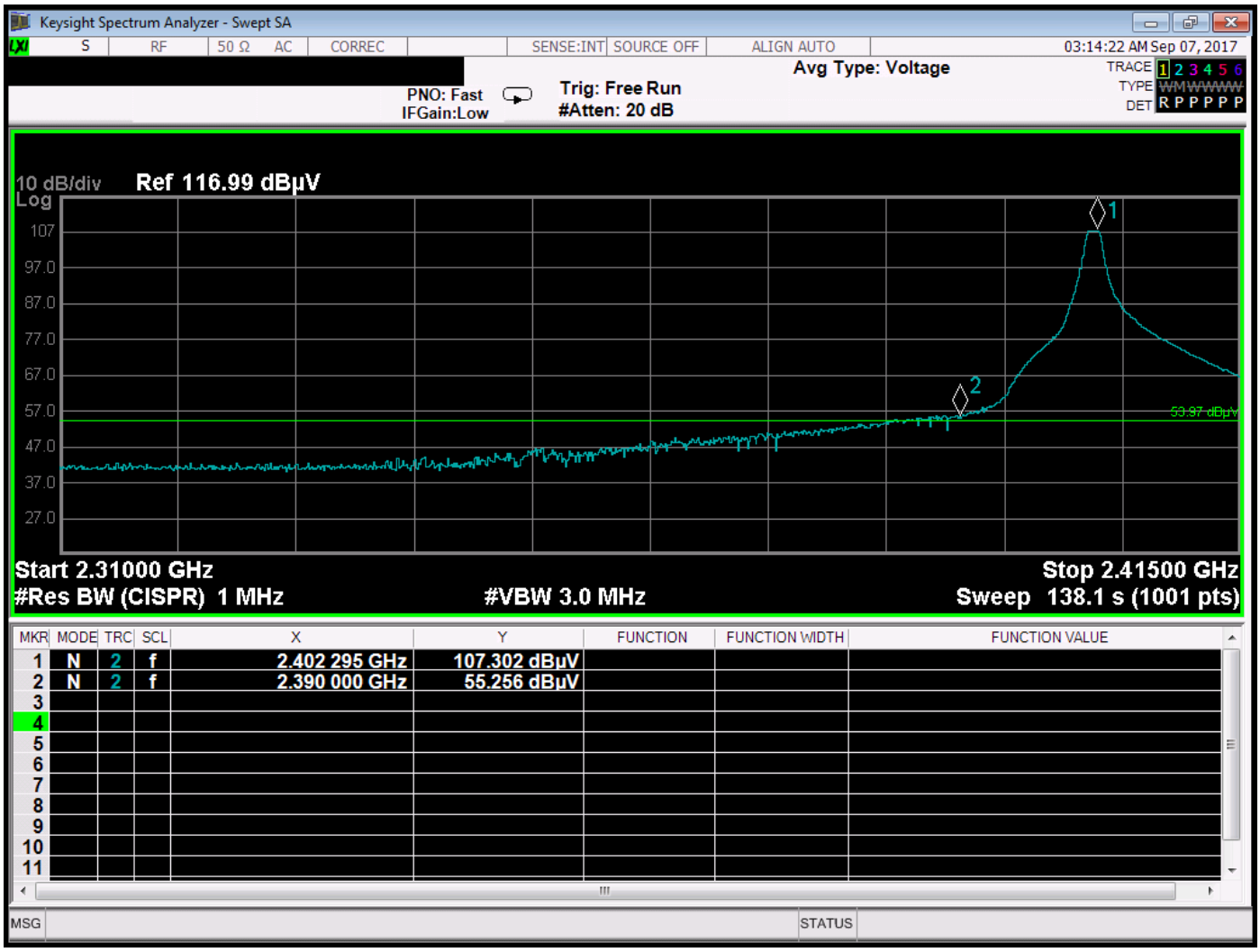
Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
2402.00	108.79	H	--	--	Peak	238.50	181.88	**Fundamental - Low Ch.**
2402.00	90.79	H	--	--	Avg	238.50	181.88	**X-Axis - Worst Case**
2390.00	63.98	H	73.97	-9.99	Peak	238.50	181.88	**Band Edge**
2390.00	45.98	H	53.97	-7.99	Avg	238.50	181.88	**X-Axis - Worst Case**
2402.00	107.30	V	--	--	Peak	16.75	106.83	**Fundamental - Low Ch.**
2402.00	89.30	V	--	--	Avg	16.75	106.83	**Y-Axis - Worst Case**
2390.00	55.26	V	73.97	-18.71	Peak	16.75	106.83	**Band Edge**
2390.00	37.26	V	53.97	-16.71	Avg	16.75	106.83	**Y-Axis - Worst Case**

FCC 15.247
Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A

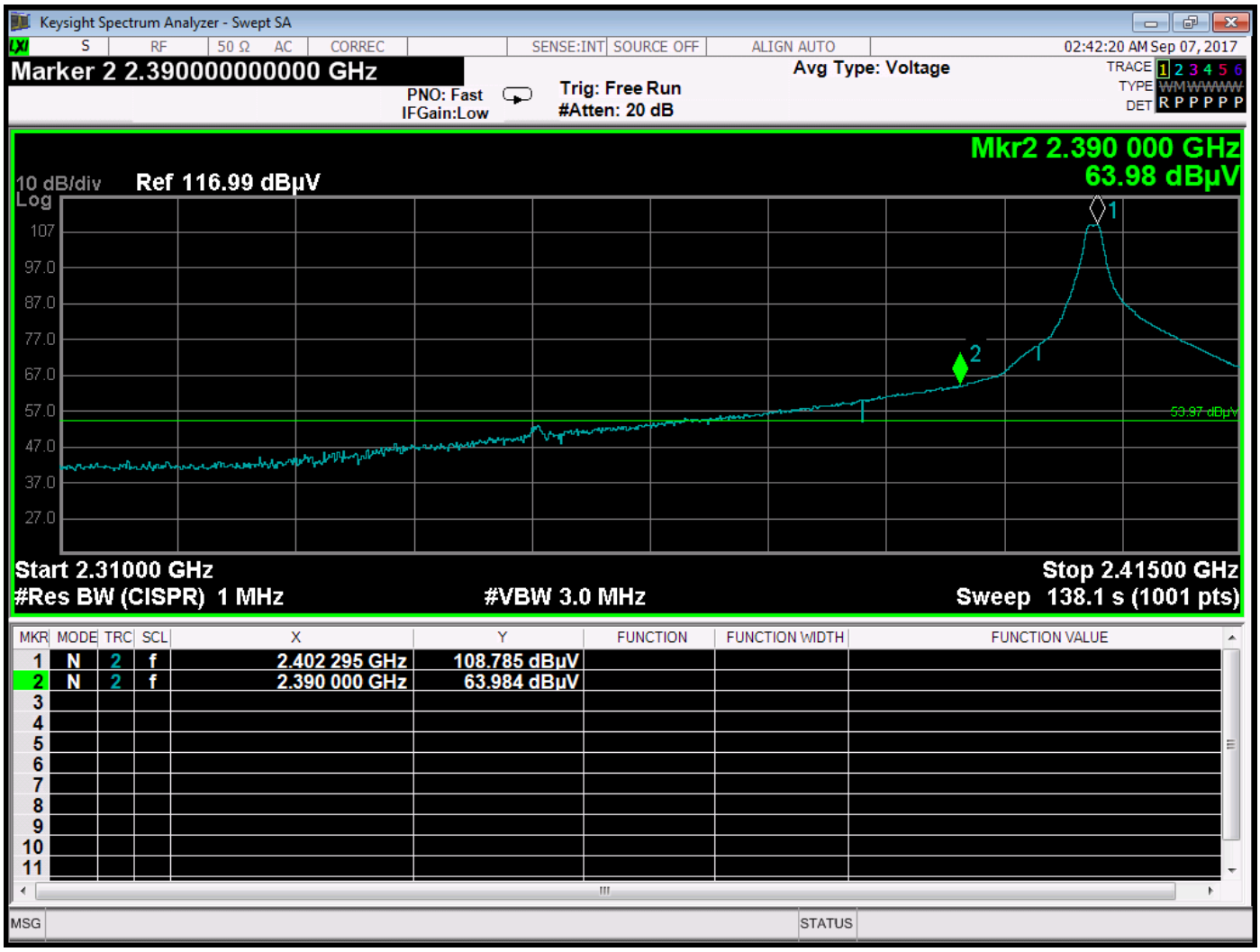
Date: 09/11/2017
Lab: D
Tested By: Kyle Haag

Band Edges

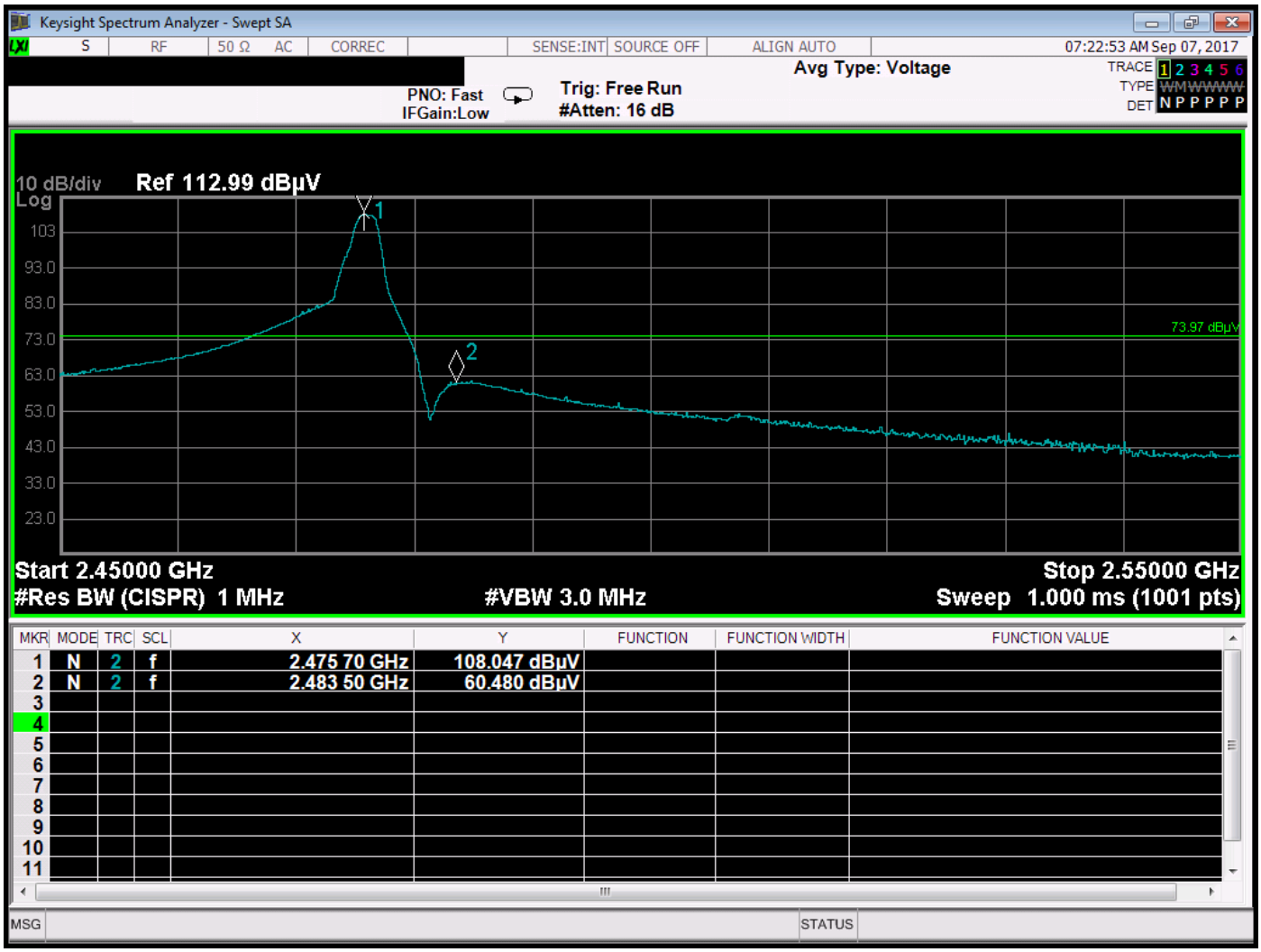
Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
2476.00	109.69	H	--	--	Peak	302.00	157.16	**Fundamental - High Ch.**
2476.00	91.69	H	--	--	Avg	302.00	157.16	**Z-Axis - Worst Case**
2483.50	69.09	H	73.97	-4.88	Peak	302.00	157.16	**Band Edge**
2483.50	51.09	H	53.97	-2.88	Avg	302.00	157.16	**Z-Axis - Worst Case**
2476.00	108.05	V	--	--	Peak	312.50	170.17	**Fundamental - High Ch.**
2476.00	90.05	V	--	--	Avg	312.50	170.17	**Y-Axis - Worst Case**
2483.50	60.48	V	73.97	-13.49	Peak	312.50	170.17	**Band Edge**
2483.50	42.48	V	53.97	-11.49	Avg	312.50	170.17	**Y-Axis - Worst Case**



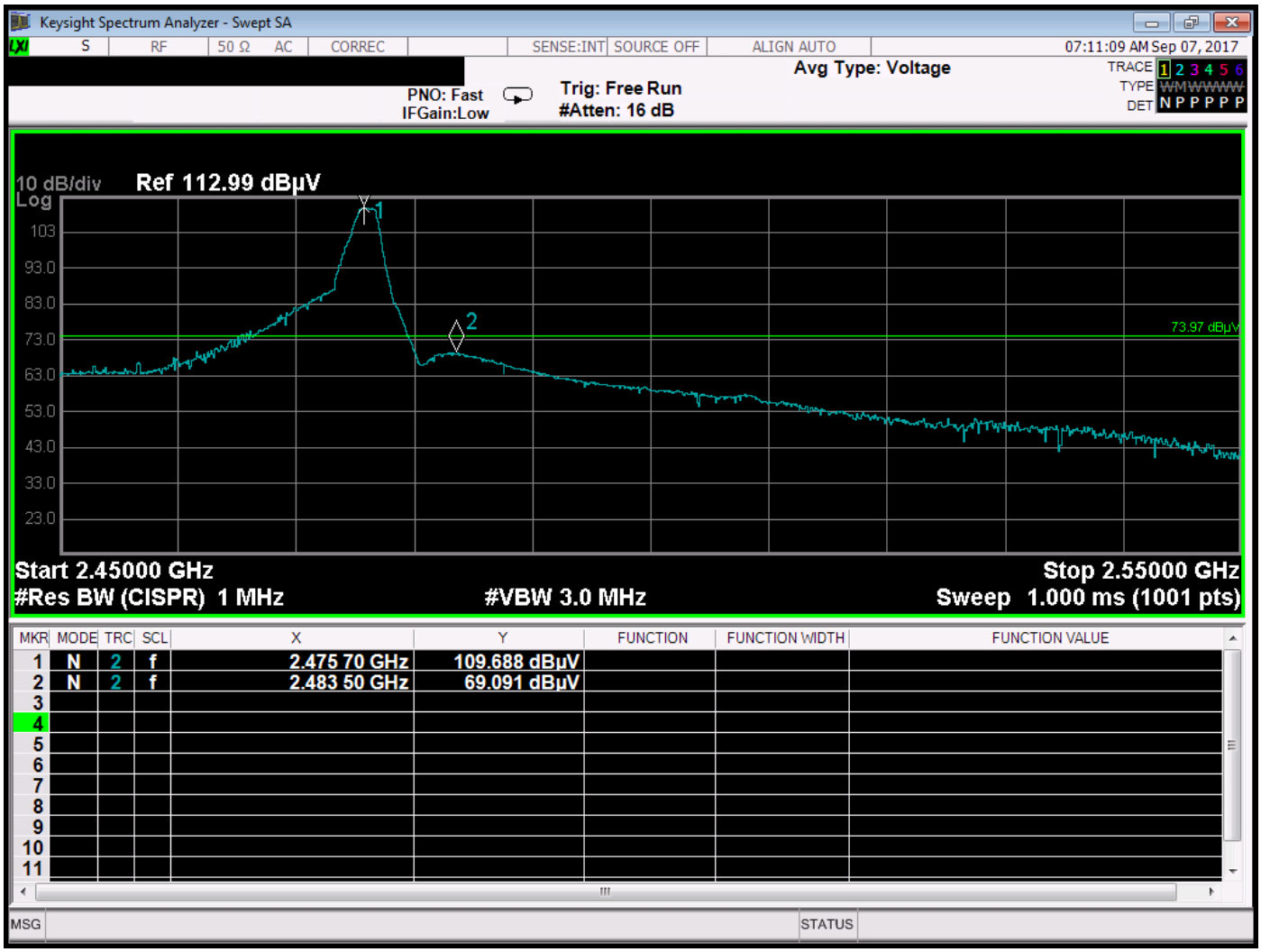
Band Edge – 2402 MHz – Vertical – Y-Axis – Worst Case



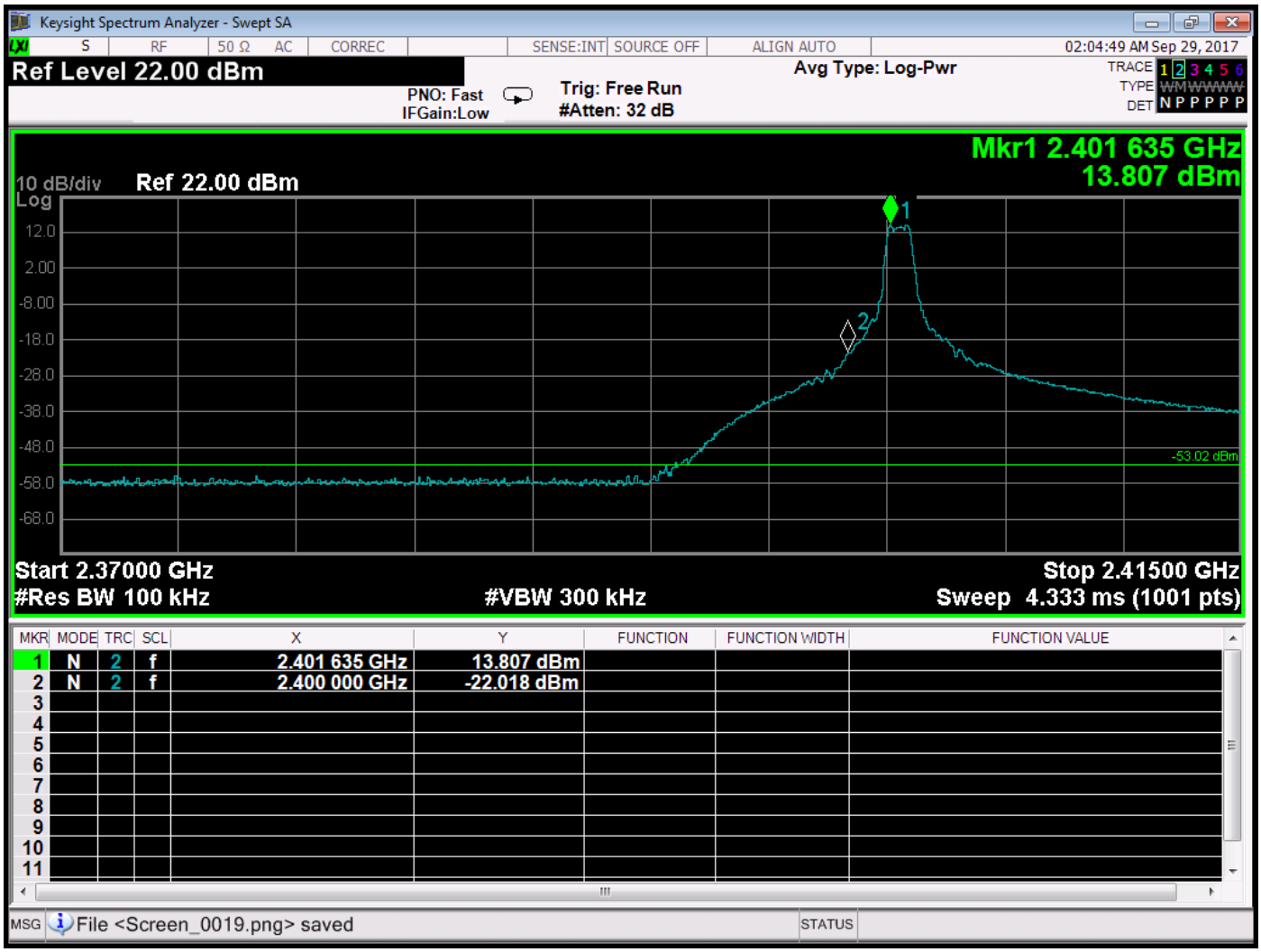
Band Edge – 2402 MHz – Horizontal – X-Axis – Worst Case



Band Edge – 2476 MHz – Vertical – Y-Axis – Worst Case



Band Edge – 2476 MHz – Horizontal – Z-Axis – Worst Case



Band Edge at 2400 MHz

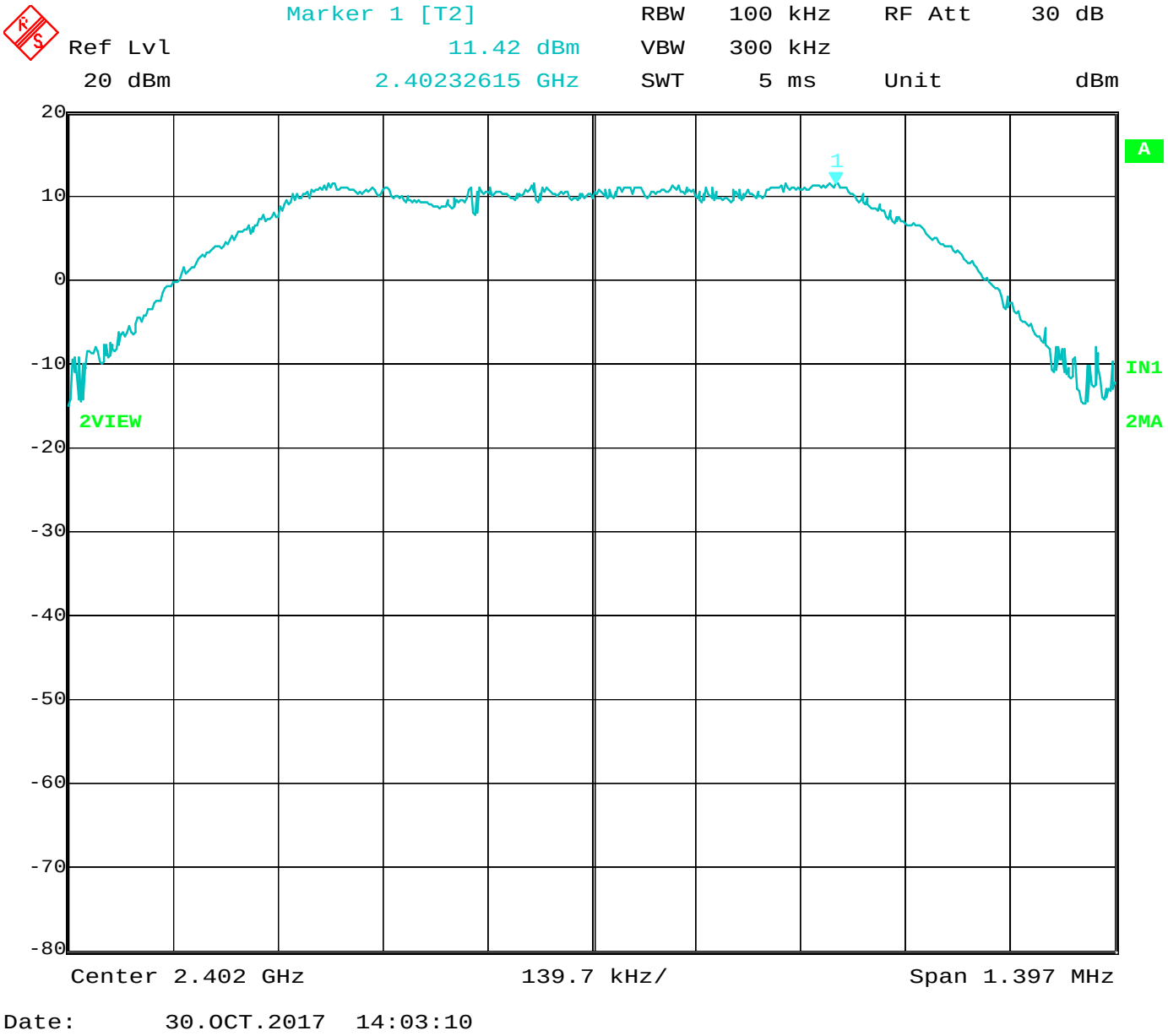
EMISSIONS IN
NON-RESRTICTED BANDS
DATA SHEETS

FCC 15.247 - Emissions in Non-Restricted Bands

Preston Cinema Systems
2.4 GHz Module
Model: TR4-V5A
Configuration: Continuously Transmitting

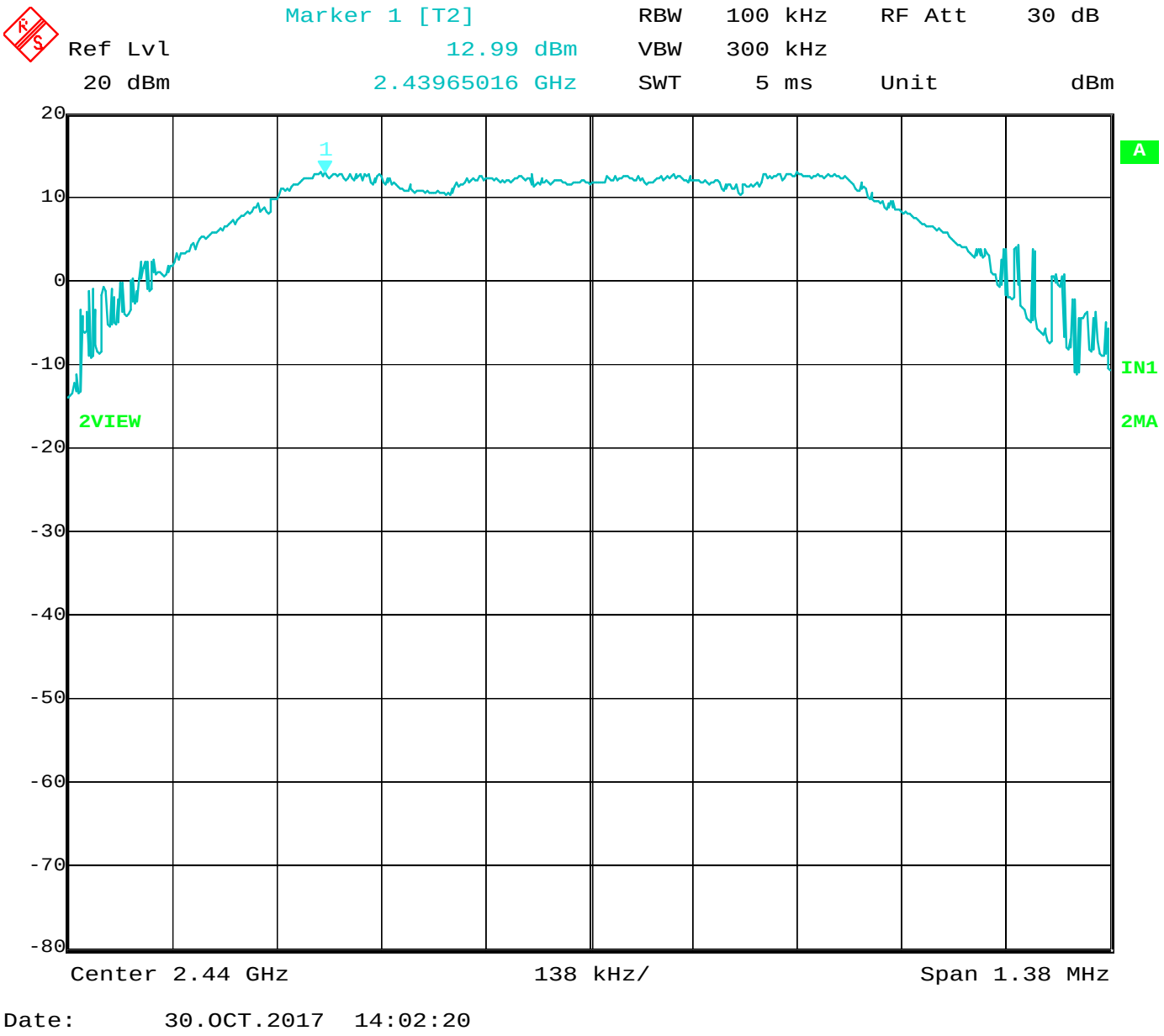
Date: 09/07/17
Lab: D
Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBm)	Limit (dBm)	Margin	Peak / QP / Avg	Comments
24790	-48.204	-7.01	-41.194	Peak	Middle Channel
24805	-48.158	-7.91	-40.248	Peak	High Channel
24850	-47.980	-8.58	-39.400	Peak	Low Channel



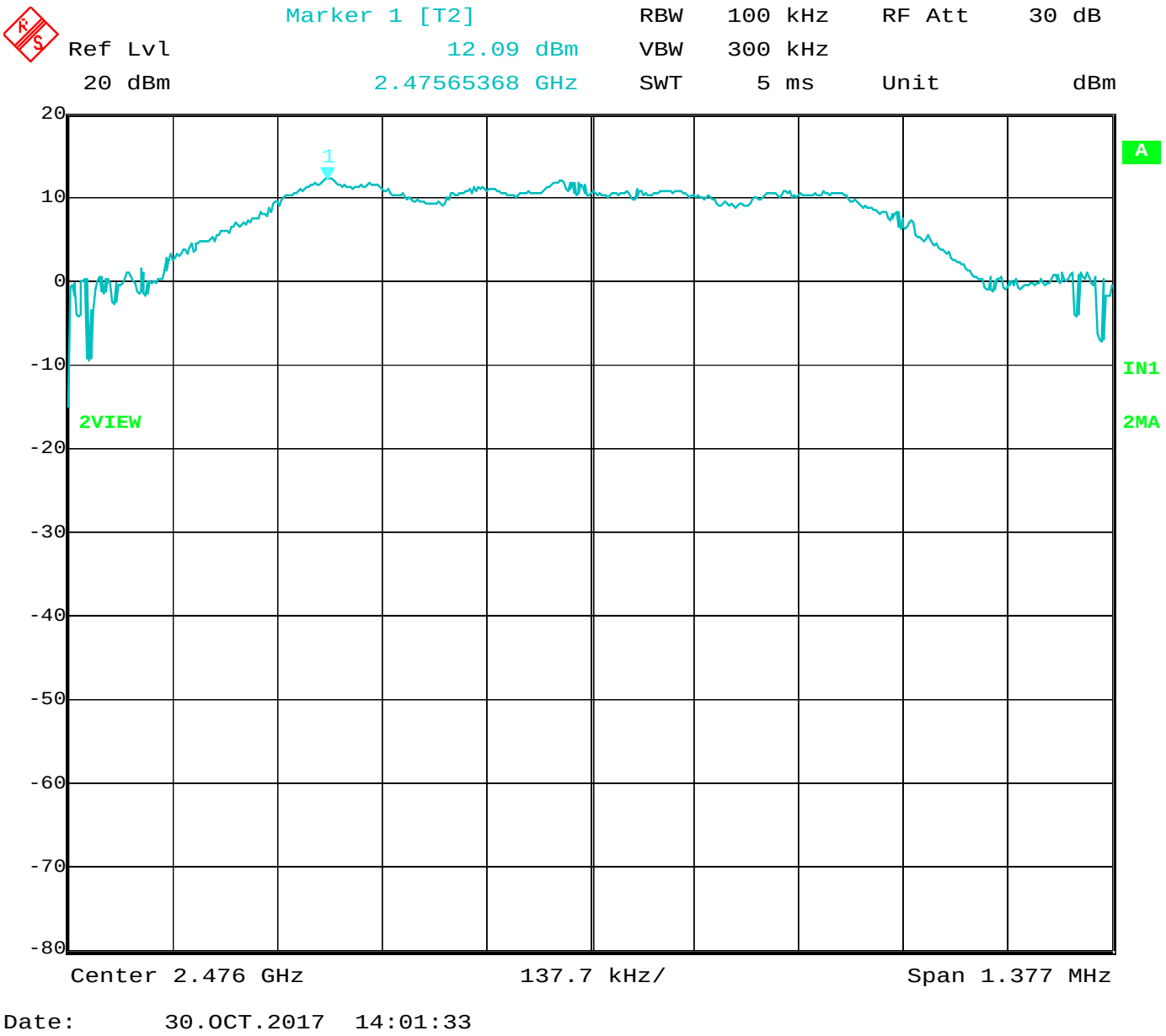
Date: 30.OCT.2017 14:03:10

Reference Level – Low Channel (2402 MHz)



Date: 30.OCT.2017 14:02:20

Reference Level – Middle Channel (2440 MHz)



Date: 30.OCT.2017 14:01:33

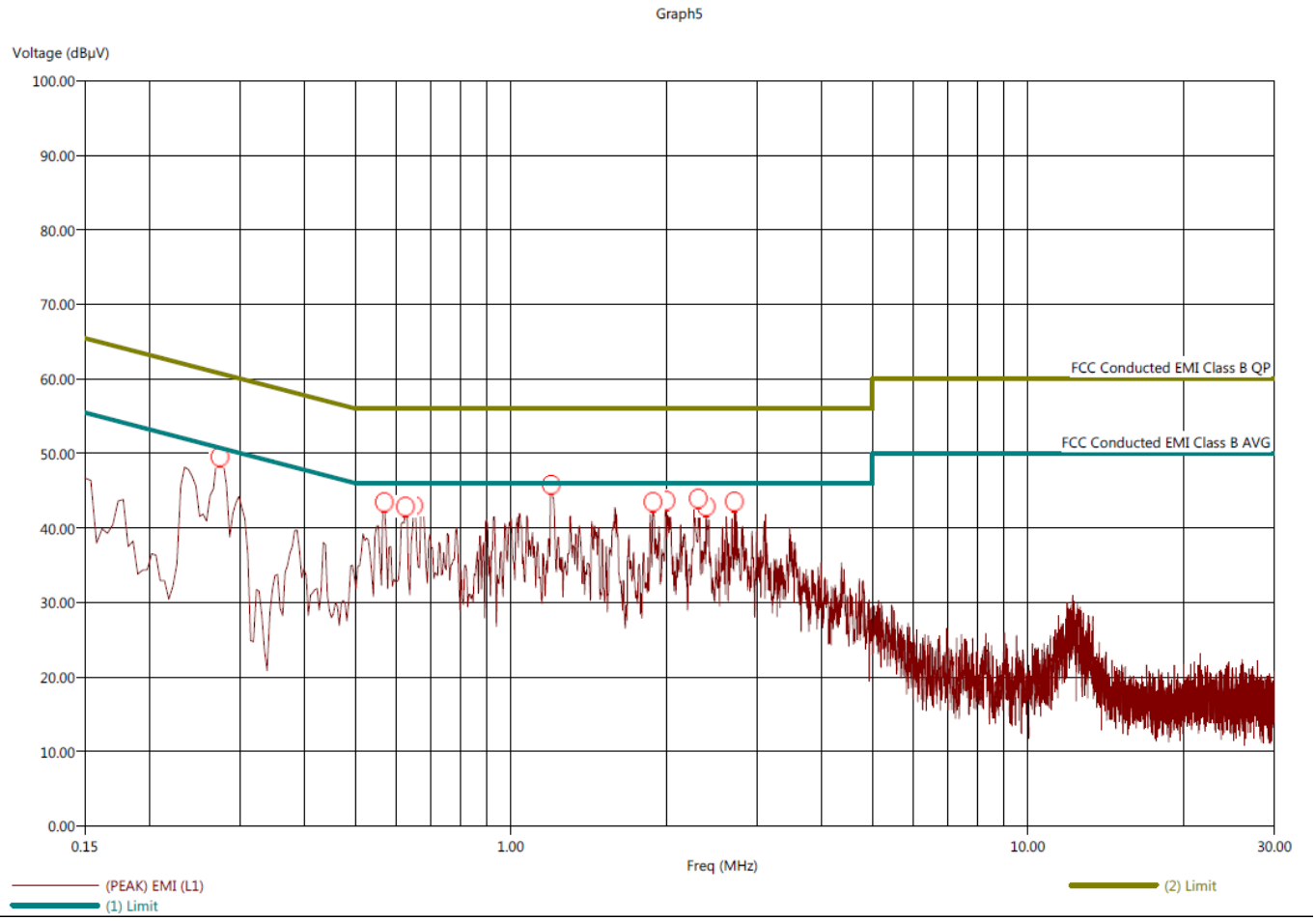
Reference Level – High Channel (2476 MHz)

CONDUCTED EMISSIONS

DATA SHEETS

Title: FCC Class B - Black Lead
File: 2 - Agilent - Pre-Scan - Black Lead - FCC Class B - 9-22-2017.set
Operator: Kyle Haag
EUT Type: 2.4 GHz Module
EUT Condition: The EUT was operating at its high channel - Worst Case
Comments: Company: Preston Cinema Systems
Model: TR4-V5A

9/25/2017 9:21:17 AM
Sequence: Preliminary Scan



Title: FCC Class B - Black Lead
File: 2 - Aligent - Final Scan - Black Lead - FCC Class B -9-22-2017.set
Operator: Kyle Haag
EUT Type: 2.4 GHz Module
EUT Condition: The EUT was operating at its high channel - White Lead
Comments: Company: Preston Cinema Systems
Model: TR4-V5A

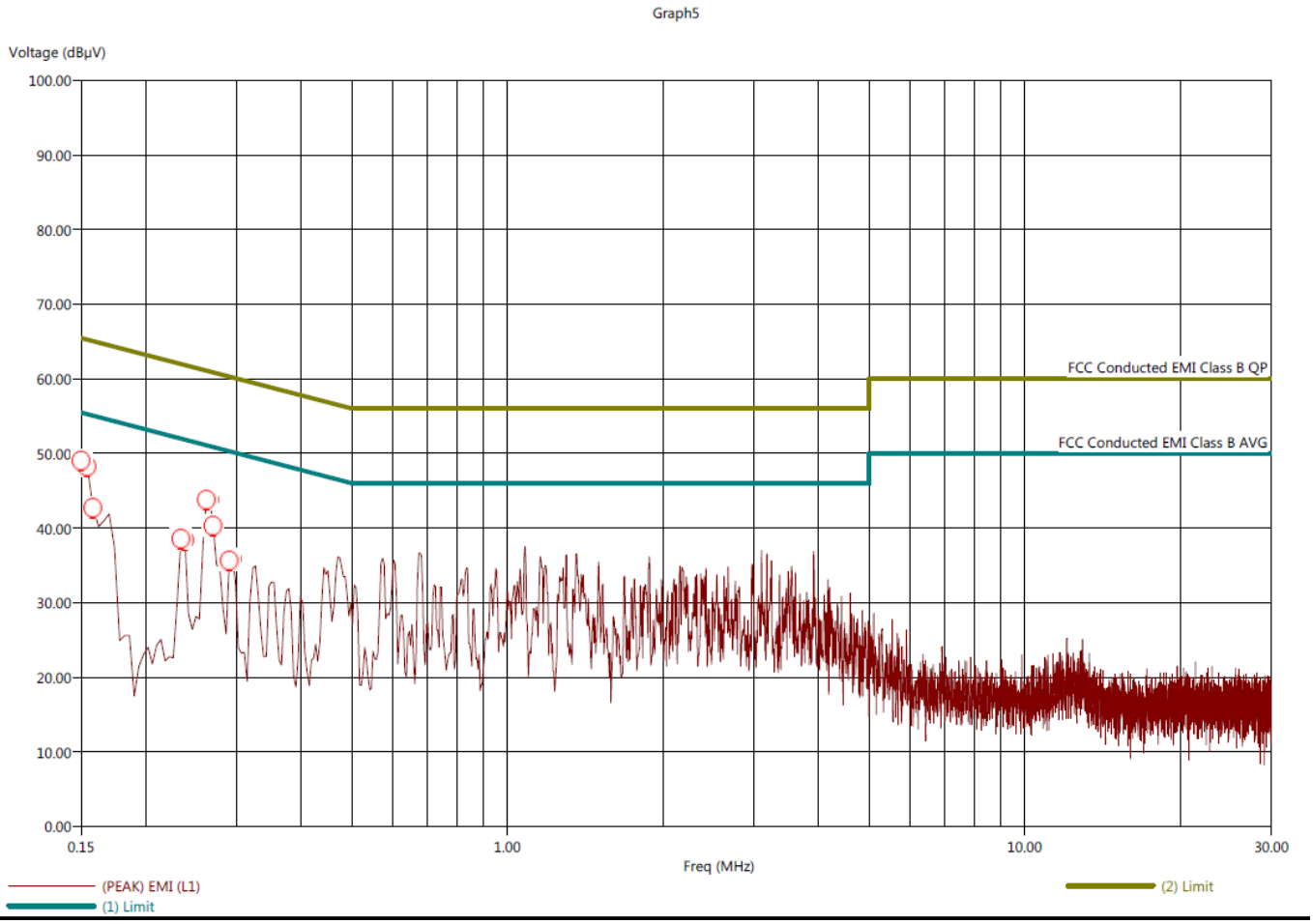
9/25/2017 9:29:02 AM
Sequence: Final Measurements

Table11

Freq (MHz)	(PEAK) EMI (dBµV)	(RMS) EMI (dBµV)	Peak to RMS Margin (dB)	RMS to RMS Margin (dB)	RMS Limit (dBµV)	Cable (dB)	Transducer (dB)
0.27	53.13	45.49	2.47	-5.17	50.66	0.10	0.15
0.57	44.32	32.75	-1.68	-13.25	46.00	0.08	0.03
0.63	44.02	35.23	-1.98	-10.77	46.00	0.07	0.03
0.65	43.73	36.06	-2.27	-9.94	46.00	0.06	0.03
1.20	45.02	32.01	-0.98	-13.99	46.00	0.03	0.04
1.89	43.96	31.49	-2.04	-14.51	46.00	0.09	0.05
2.00	46.10	31.96	0.10	-14.04	46.00	0.10	0.05
2.31	45.68	32.18	-0.32	-13.82	46.00	0.12	0.05
2.39	44.97	31.42	-1.03	-14.58	46.00	0.12	0.05
2.71	44.19	31.06	-1.81	-14.94	46.00	0.13	0.05

Title: FCC Class B - White Lead
File: 2 - Agilent - Pre-Scan - White Lead - FCC Class B - 9-22-2017.set
Operator: Kyle Haag
EUT Type: Transceiver Module
EUT Condition: The EUT was operating at its high channel - Worst Case
Comments: Company: Preston Cinema Systems
Model: TRX4-V5A

9/25/2017 9:37:24 AM
Sequence: Preliminary Scan



Title: FCC Class B - White Lead
File: 2 - Aligent - Final Scan - White Lead - FCC Class B -9-22-2017.set
Operator: Kyle Haag
EUT Type: Transceiver Module
EUT Condition: The EUT was operating at its high channel - Worst Case
Comments: Company: Preston Cinema Systems
Model: TRX4-V5A

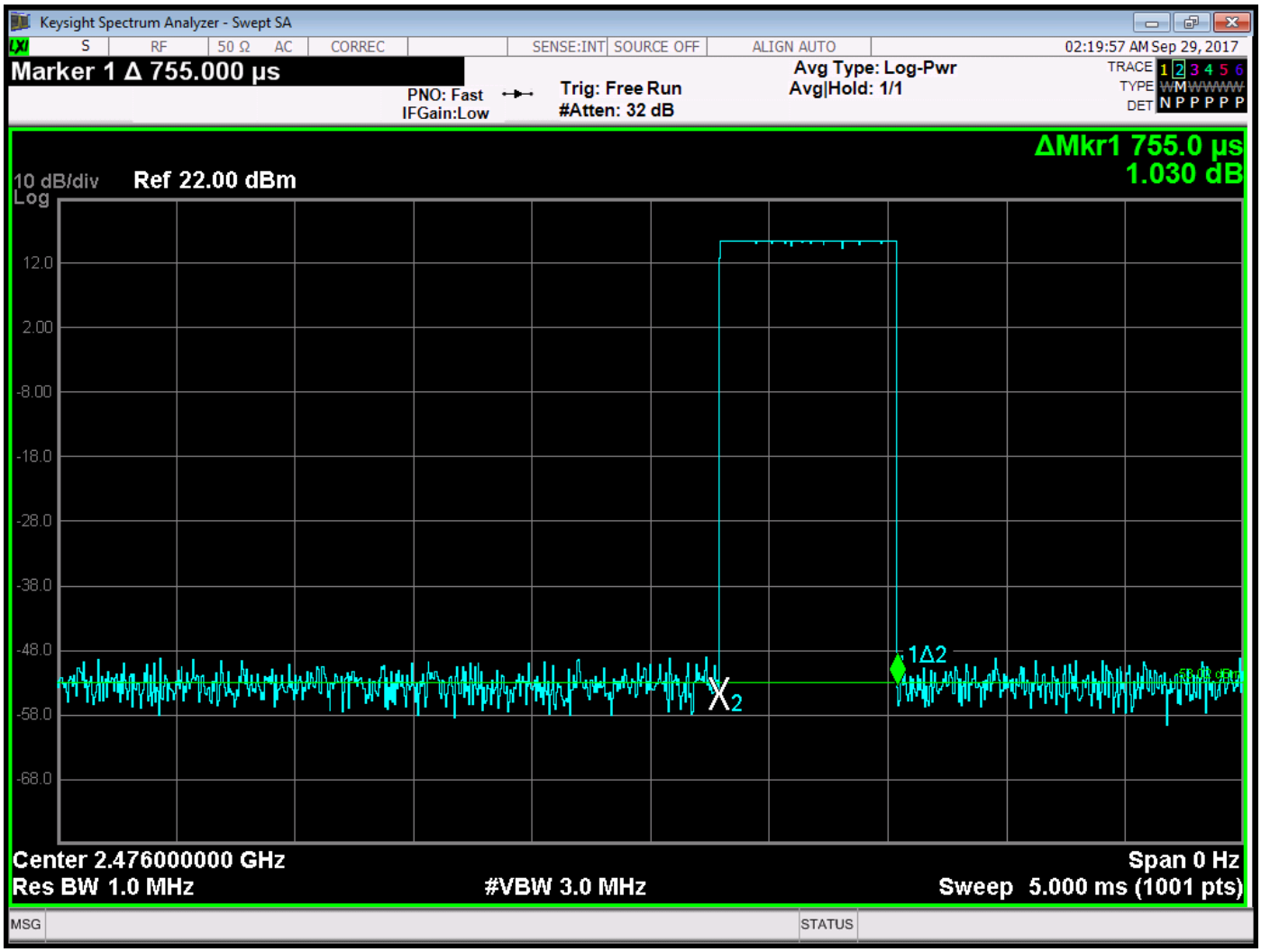
9/25/2017 9:41:31 AM
Sequence: Final Measurements

Table12

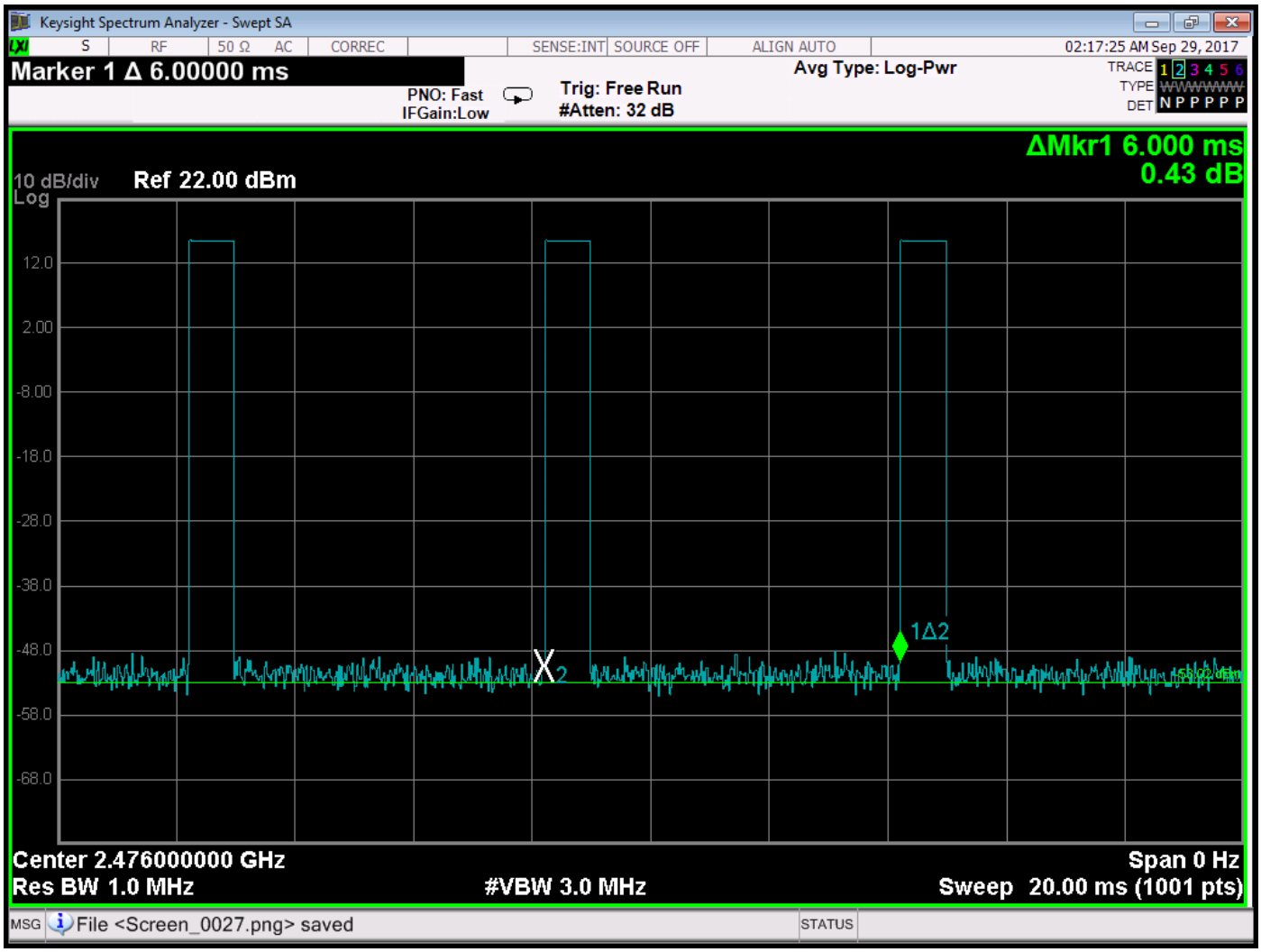
Freq (MHz)	(PEAK) EMI (dBµV)	(RMS) EMI (dBµV)	Peak to RMS Margin (dB)	RMS to RMS Margin (dB)	RMS Limit (dBµV)	Cable (dB)	Transducer (dB)
0.15	50.84	30.60	-4.02	-24.26	54.86	0.00	0.37
0.15	48.76	31.96	-6.39	-23.19	55.15	0.00	0.39
0.16	51.42	33.67	-4.08	-21.83	55.49	0.00	0.41
0.23	44.42	26.55	-7.27	-25.14	51.69	0.00	0.19
0.24	43.26	27.14	-8.27	-24.39	51.53	0.00	0.18
0.26	46.32	32.37	-4.50	-18.45	50.82	0.00	0.14
0.27	46.01	35.10	-4.69	-15.60	50.70	0.00	0.14
0.27	46.04	35.13	-4.61	-15.52	50.66	0.00	0.13
0.29	45.54	30.17	-4.99	-20.36	50.53	0.00	0.13
0.29	43.12	24.37	-7.16	-25.91	50.28	0.00	0.11

DUTY CYCLE

DATA SHEETS



Time of One Pulse = 755 us



Time Between Pulses – 6 ms

Total Duty Cycle = 755 us / 6 ms = 12.58%

The Peak to Average Ratio is -18.00 dB.