

**FCC PART 15, SUBPART B and C; FCC 15.247; and RSS-247 & RSS-GEN
TEST REPORT***for***TIVO S6A BACKLIT RCU 2020****Model: R37022D**

Prepared for

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DATE: SETPEBMER 21, 2020

	REPORT BODY	APPENDICES					TOTAL
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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.

The client must not use this report to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the U.S. government.

Device Tested: TiVo S6A Backlit RCU 2020
Model: R37022D
S/N: N/A

Product Description: The TiVo S6A Backlit RCU 2020 (EUT) is a hand-held custom universal remote control with Bluetooth LE (BLE) and infrared (IR) support.

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

Customer: Universal Electronics, Inc.
201 East Sandpointe Avenue, 8th Floor
Santa Ana, California 92707

Test Dates: July 8 and 9, 2020; and September 28, 2020

Test Specifications covered by accreditation:

Test Specifications: Emissions requirements
CFR Title 47, Part 15, Subpart B;
CFR Title 47, Part 15, Subpart C, Sections 15.205, 15.209, and 15.247;
and RSS-247 and RSS-Gen



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	Conducted RF Emissions, 150 kHz – 30 MHz	This test was not performed because the EUT operates on battery power only and does not connect to the AC public mains.
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; the limits of CFR Title 47, Part 15, Subpart C, Sections 15.209 and 15.247 (d); and RSS-247 and RSS-GEN See section 6.3 for Measurement Uncertainty
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; the limits of CFR Title 47, Part 15, Subpart C, Sections 15.205, 15.209, and 15.247(d); and RSS-247 and RSS-GEN See section 6.3 for Measurement Uncertainty
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, Sections 15.247(d); and RSS-247 and RSS-GEN
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, Sections 15.205, 15.209, section 15.247 (d); RSS-247 and RSS-GEN
6	DTS Bandwidth	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, Section 15.247 (a)(2); and RSS-247
7	Maximum Conducted Output Power	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, Section 15.247 (b)(3); and RSS-247
8	RF Conducted Antenna Test	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, Section 15.247 (d); and RSS-247
9	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); and RSS-247

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the TiVo S6A Backlit RCU 2020, Model: R37022D. 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; and Part 15 Subpart C Sections 15.205, 15.209 and 15.247; RSS-247 and RSS-Gen.

1.1 Decision Rule & Risk

If a measured value exceeds a specification limit it implies non-compliance. If the value is below a specification limit it implies compliance. Measurement uncertainty of the laboratory is reported with all measurement results but generally not taken into consideration unless a standard, rule or law requires it to be considered.

Qualification test reports are only produced for products that are in compliance with the test requirements, therefore results are always in conformity. Otherwise, an engineering report or just the data is provided to the customer.

When performing a measurement and making a statement of conformity, in or out-of-specification to manufacturer's specifications or Pass/Fail against a requirement, there are two possible outcomes:

- The result is reported as conforming with the specification
- The result is reported as not conforming with the specification

The decision rule is defined below.

When the test result is found to be below the limit but within our measurement uncertainty of the limit, it is our policy that the final acceptance decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be exactly on the specification, it is our policy, in the case of unwanted emissions measurements to consider the result non-compliant, however, the final decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be over the specification limit under any condition, it is our policy to consider the result non-compliant.

In terms of uncertainty of measurement, the laboratory is a calibrated and tightly controlled environment and generally exceptionally stable, the measurement uncertainties are evaluated without the considering of the test sample. When it comes to the test sample however, as most testing is performed on a single sample rather than a sample population, and that sample is often a pre-production representation of the final product, that test sample represents a significantly higher source of measurement uncertainty. We advise our customers of this and that when in doubt (small test to limit margins), they may wish to perform statistical sampling on a population to gain a higher confidence in the results. All lab reported results are that of a single sample in any event.

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

Universal Electronics, Inc

Jesse Mendez Staff Engineer, Electrical

Compatible Electronics Inc.

James Ross Test Engineer

Kyle Fujimoto Test Engineer

2.4 Date Test Sample was Received

The test sample was received on July 8, 2020. Received as described in product description.

2.5 Disposition of the Test Sample

The test sample has not been returned to Universal Electronics, 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	Model
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

3. APPLICABLE DOCUMENTS

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

SPEC	TITLE
CFR Title 47, Part 15 Subpart C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
CFR Title 47, Part 15 Subpart B	FCC Rules – Radio frequency devices (including digital devices) – Unintentional Radiators
RSS-247, Issue 2: February 2017	Digital Transmission Systems (DTs), Frequency Hopping Systems (FHs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-Gen, Issue 5: March 2019 + Amendment 1	General Requirements for Compliance of Radio Apparatus
KDB 558074 D01 v05r02	Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules
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 TiVo S6A Backlit RCU 2020, Model: R37022D (EUT) was setup in a stand-alone configuration. The EUT was investigated in all three orthogonal axes. During the testing, the EUT was continuously transmitting at 2402 MHz, 2442 MHz, or 2480 MHz. The EUT was tested from 9 kHz to 25 GHz.

Fresh batteries were installed inside the EUT prior to the testing. The EUT was programmed via the Radio Control Console v4.6.2 firmware.

The firmware is stored in one of the network drives in the company's server.

The final radiated data for the EUT was taken in the mode described above. Please see Appendix E for the data sheets.

4.1.1 Cable Construction and Termination

The EUT had no external cables.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
TIVO S6A BACKLIT RCU 2020 (EUT)	UNIVERSAL ELECTRONICS, INC.	R37022D	N/A	MG3-R37022D
LAPTOP*	HEWLETT PACKARD	HSTNN-C82C	N/A	N/A
AC ADAPTER FOR LAPTOP*	HEWLETT PACKARD	HSTNN-DA40	N/A	N/A
PROGRAM BOARD*	UNIVERSAL ELECTRONICS, INC.	FTD1232	N/A	N/A
FIRMWARE	UNIVERSAL ELECTRONICS, INC.	RADIO CONTROL CONSOLE	v4.6.2	N/A

*Used to program the EUT only and the was removed prior to testing.

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	August 23, 2019	1 Year
EMI Receiver, 20 Hz – 40 GHz	Rohde & Schwarz	ESIB40	100172	July 15, 2020	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	61093	June 5, 2019	2 Year
Horn Antenna	Com-Power	AH-118	10050113	February 4, 2020	2 Year
Preamplifier	Com-Power	PA-118	181653	February 5, 2020	1 Year
Computer	Hewlett Packard	p6716f	MXX1030PX0	N/A	N/A
LCD Monitor	Hewlett Packard	52031a	3CQ046N3MG	N/A	N/A
Preamplifier	Com-Power	PA-840	711013	April 9, 2020	2 Year
Horn Antenna	Com-Power	AH-826	71957	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 0.6 by 1.2 meter non-conductive table 0.8 meters above the ground plane.

For frequencies above 1 GHz: The EUT was mounted on a 0.6 by 1.2 meter non-conductive table 1.5 meters above the ground plane.

The EUT was not grounded.

6.3 Measurement Uncertainty

Compatible Electronics' U_{lab} value is less than U_{cispr} , thus based on this – compliance is deemed to occur if no measured disturbance exceeds the disturbance limit

$$u_c(y) = \sqrt{\sum_i c_i^2 u^2(x_i)}$$

Measurement		U_{cispr}	$U_{lab} = 2 u_c(y)$
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3.4 dB	2.73 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	6.3 dB	3.27 dB (Vertical) 3.19 dB (Horizontal)
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz - 6 GHz)	5.2 dB	3.95 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5.5 dB	3.95 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26.5 GHz)	N/A	4.69 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(26.5 GHz – 40 GHz)	N/A	4.55 dB

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Channel Description and Frequencies

The EUT operates on forty channels using BLE. The channel and frequencies are shown below. The channels are spaced 2 MHz apart. Below is the channel and frequencies of the low, middle, and high channels.

Channel 0 – 2402 MHz
Channel 20 – 2442 MHz
Channel 39 – 2480 MHz

7.2 Antenna Gain

The gain of the PCB trace dipole antenna is +0.05 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 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 plugged into the AC public mains

8.1.2 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 harmonic frequencies above 1 GHz were averaged using a duty cycle correction factor.

All other 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 gunsight method was used when measuring with the horn antenna to ensure accurate results.

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

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

Test Results:

The EUT complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; the limits of CFR Title 47, Part 15, Subpart C Sections 15.205, 15.209 and 15.247; and RSS-Gen and RSS-247 for radiated emissions.

8.1.3 RF Emissions Test Results

Table 1 RADIATED EMISSION RESULTS
TiVo S6A Backlit RCU 2020, Model: R37022D

Frequency MHz	Corrected Reading* dBuV/m	Specification Limit dBuV/m	Delta (Cor. Reading – Spec. Limit) dB
2338.03 (H) (X-Axis)	47.83 (AVG)	53.97	-6.14
2338.12 (V) (Y-Axis)	45.10 (AVG)	53.97	-8.87
781.70 (H) (X-Axis)	31.74 (QP)	46.00	-14.26
2483.50 (V) (Y-Axis)	39.11 (AVG)	53.97	-14.86
2483.50 (H) (X-Axis)	38.84 (AVG)	53.97	-15.13
4884.00 (V) (Y-Axis)	37.91 (AVG)	53.97	-16.06

Notes:

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

8.1.4 Sample Calculations

A correction factor for the antenna, cable and a distance factor (if any) must be applied to the meter reading before a true field strength reading can be obtained. This Corrected Meter Reading is then compared to the specification limit in order to determine compliance with the limits.

Conversion to logarithmic terms: Specification limit ($\mu\text{V/m}$) $\log \times 20$ = Specification Limit in dBuV/m

To correct for distance when measuring at a distance other than the specification

For measurements below 30 MHz: (Specification distance / test distance) $\log \times 40$ = distance factor

For measurements above 30 MHz: (Specification distance / test distance) $\log \times 20$ = distance factor

Note: When using an Active Antenna, the Antenna factor shall be subtracted due to the combination of the internal amplification and antenna loss.

Corrected Meter Reading = meter reading + F – A + C

where: F = antenna factor

A = amplifier gain

C = cable loss

The correction factors for the antenna and the amplifier gain are attached in Appendix D of this report. The data sheets are attached in Appendix E.

The distance factor D is 0 when the test is performed at the required specification distance.

8.2 DTS Bandwidth

The DTS Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from 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 CFR Title 47, Part 15, Subpart C Section 15.247 (a)(2); and RSS-247.

8.3 Maximum Peak Conducted Output Power

The maximum peak conducted output power was measured using the EMI Receiver. The following steps were performed for measuring the maximum peak conducted output power.

1. Set the $RBW \geq$ DTS Bandwidth
2. Set the $VBW \geq [3 \times RBW]$
3. Set span $\geq [3 \times RBW]$
4. Sweep time = auto couple
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use the peak marker function to determine the peak amplitude level

Test Results:

The EUT complies with the relevant requirements of CFR Title 47, Part 15, Subpart C Section 15.247 (b)(3); and RSS-247.

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 CFR Title 47, Part 15, Subpart C Section 15.247 (d); and RSS-247.

8.5 RF Band Edges

The RF band edges were measured using the EMI Receiver. The RF band edges were 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.

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.

The RF band edge was also taken at 2400 MHz when the EUT was on the low channel. The following steps were performed for measuring the band edge at 2400 MHz:

1. Set analyzer center frequency to DTS channel center frequency
2. Set the span wide enough to cover the band edges.
3. Set the RBW to 100 kHz
4. Set the VBW $\geq 3 \times$ RBW
5. Detector = Peak
6. Sweep time = auto couple
7. Allow the trace to stabilize
8. Use the peak marker function to determine the maximum amplitude level

Test Results:

The EUT complies with the relevant requirements of CFR Title 47, Part 15, Subpart C Section 15.205, 15.209, and 15.247 (d) for band edges; and RSS-GEN and RSS-247. 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 at least 1.5 times the OBW.
3. Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
4. Set the VBW $\geq [3 \times \text{RBW}]$
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 requirement, then reduce RBW (but no less than 3 kHz) and repeat.

Test Results:

The EUT complies with the relevant requirements of CFR Title 47, Part 15, Subpart C Section 15.247 (e); and RSS-247.

8.7 Variation of the Input Power

The variation of the input power test was performed using the EMI Receiver. The EUT input power was varied between 85% and 115% of the nominal rated supply voltage. The carrier frequency was monitored for any change in amplitude.

Test Results:

This test was not performed because the EUT is not AC powered.

8.8 Duty Cycle Calculation

The fundamental and harmonics were measured at a 3-meter test distance. The EMI Receiver was used to obtain the final test data and the calculation below was used to obtain the final average reading. The final qualification data sheets are located in Appendix E.

Where

$$\delta(\text{dB}) = 20 \log \left[\frac{\sum (nt_1 + mt_2 + \dots + \xi t_x)}{T} \right]$$

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 t_x

T is the period of the pulse train or 100 ms if the pulse train length is greater than 100 ms

The worst case was when the EUT was in advertising mode.

Duty Cycle Correction Factor = -20.00 dB

Time of Pulse = 220 us = 0.220 ms

Total On Time = 0.220 ms

The time between pulses is 3.780 ms

Duty Cycle = 0.220 us / 3.780 ms = 5.82%

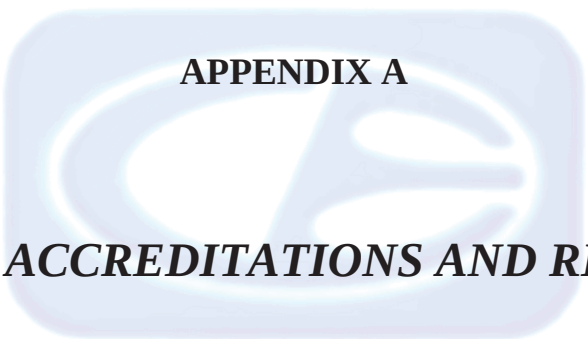
The maximum -20 dB peak to average ratio can be utilized.



9. CONCLUSIONS

The TiVo S6A Backlit RCU 2020, Model: R37022D (EUT), as tested, meets all of the **Class B** specification limits defined in CFR Title 47, Part 15, Subpart B; CFR Title 47, Part 15, Subpart C, Sections 15.205, 15.209 and 15.247; and RSS-Gen and RSS-247.





APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

Brea Division
114 Olinda Drive
Brea, CA 92823
(714) 579-0500

Newbury Park Division
1050 Lawrence Drive
Newbury Park, CA 91320
(805) 480-4044

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400

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."

ISED Test Site Registration Number: 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, FCC 15.247, RSS-247, and RSS-GEN 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

***MODELS COVERED
UNDER THIS REPORT***



MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST

TiVo S6A Backlit RCU 2020

Model: R37022D

S/N: N/A

There are no additional models covered under this report.



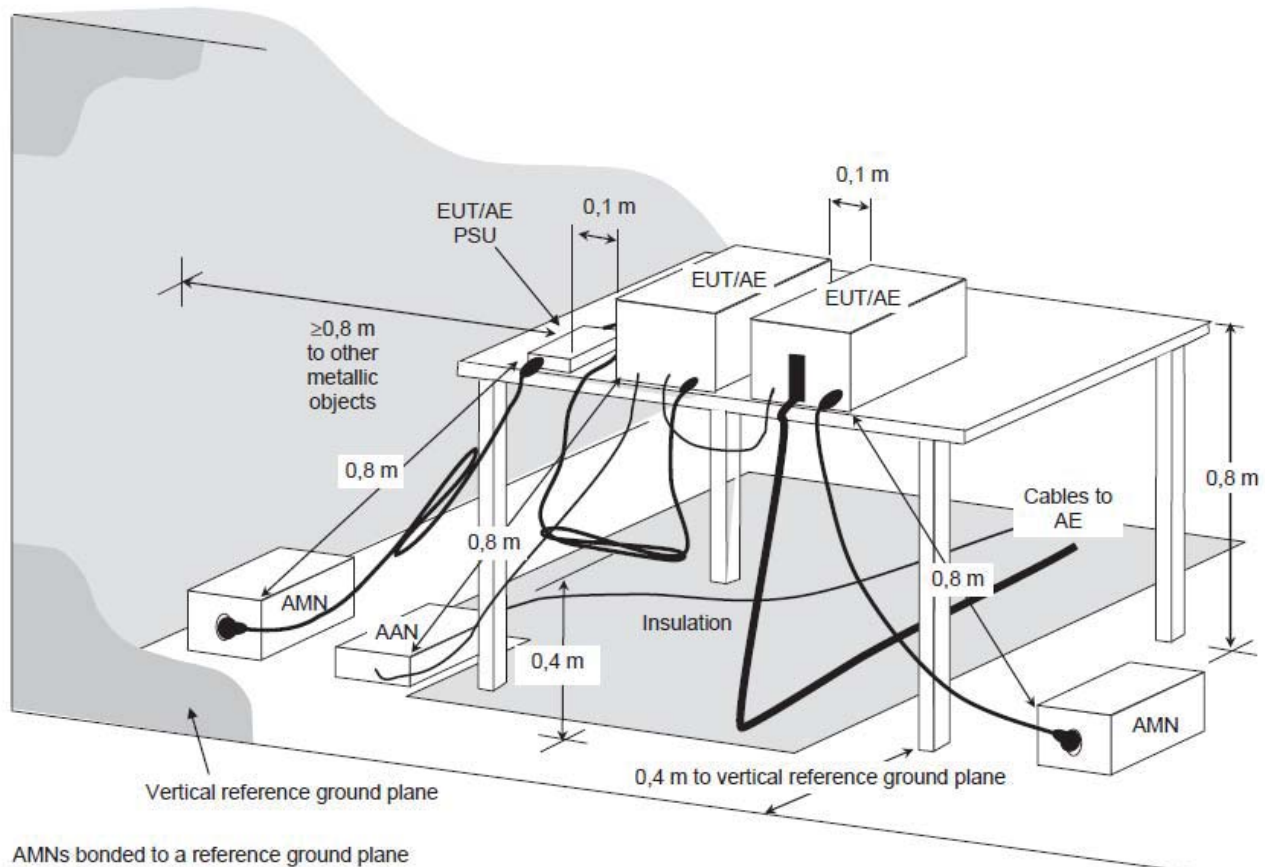


APPENDIX D

DIAGRAMS AND CHARTS

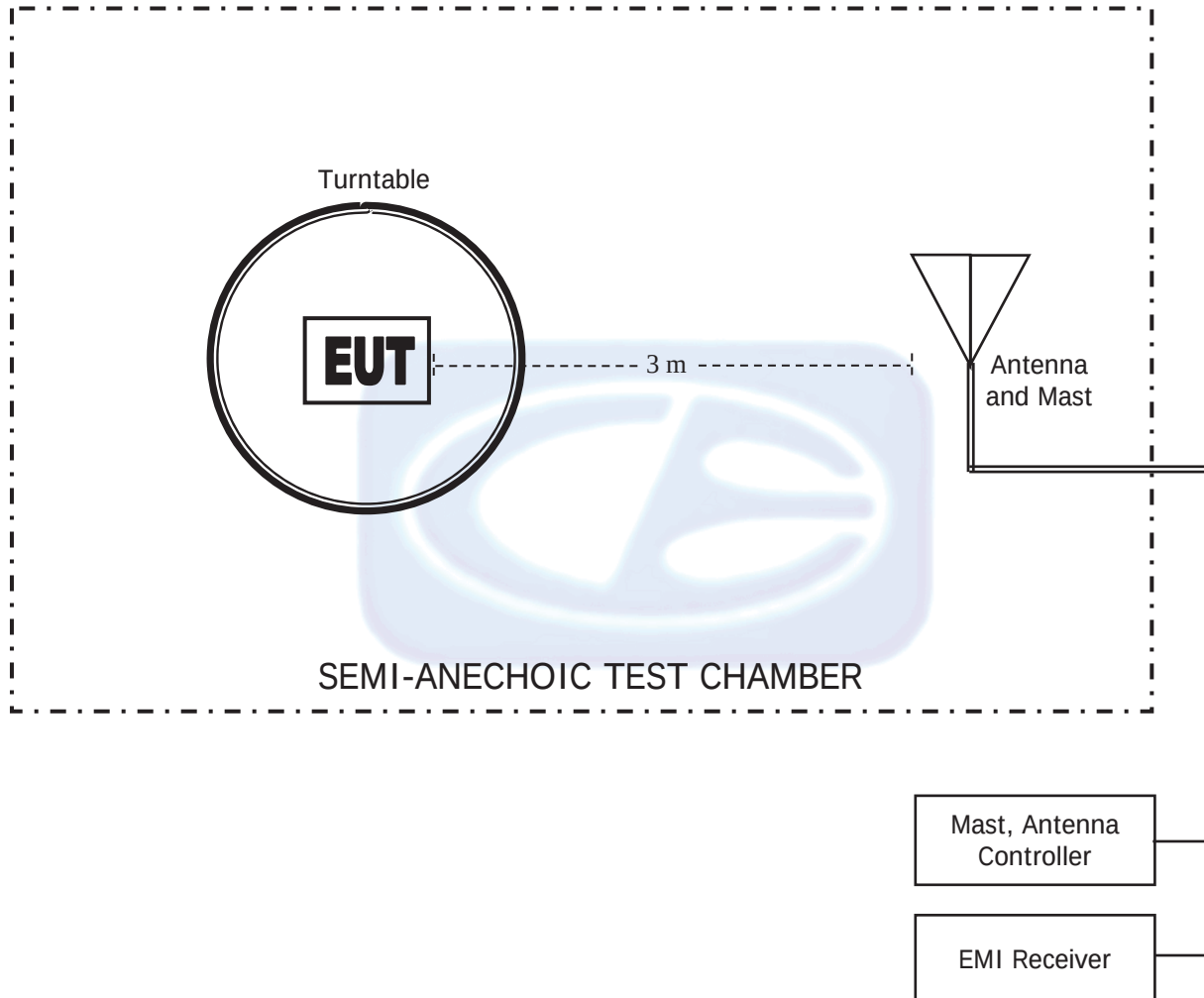


FIGURE 1: CONDUCTED EMISSIONS TEST SETUP





**FIGURE 2: 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: 61093****CALIBRATION DATE: JUNE 5, 2019**

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.10	200	15.30
35	20.90	250	16.80
40	20.10	300	19.00
45	19.40	350	19.60
50	18.40	400	21.70
60	15.10	450	21.60
70	12.00	500	22.20
80	11.60	550	22.70
90	13.50	600	24.20
100	14.70	650	24.40
120	15.90	700	24.50
125	15.90	750	25.40
140	14.80	800	26.30
150	15.50	850	26.70
160	19.80	900	27.50
175	15.20	950	27.80
180	14.90	1000	27.90

COM POWER AH-118**HORN ANTENNA****S/N: 10050113****CALIBRATION DATE: FEBRUARY 4, 2020**

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	24.343	10.0	38.826
1.5	25.419	10.5	39.102
2.0	28.838	11.0	39.259
2.5	28.971	11.5	39.920
3.0	29.919	12.0	40.149
3.5	30.674	12.5	40.576
4.0	31.670	13.0	40.264
4.5	32.437	13.5	40.364
5.0	33.414	14.0	40.424
5.5	34.003	14.5	41.677
6.0	34.799	15.0	43.010
6.5	35.381	15.5	39.799
7.0	37.024	16.0	40.187
7.5	34.403	16.5	40.155
8.0	37.445	17.0	40.507
8.5	37.390	17.5	41.963
9.0	38.076	18.0	43.196
9.5	38.809		

COM-POWER PA-118**PREAMPLIFIER****S/N: 181653****CALIBRATION DATE: FEBRUARY 5, 2020**

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	40.10	6.0	40.60
1.1	40.10	6.5	39.50
1.2	40.00	7.0	39.40
1.3	39.70	7.5	39.30
1.4	39.60	8.0	39.20
1.5	39.90	8.5	40.50
1.6	40.00	9.0	39.60
1.7	39.70	9.5	39.50
1.8	39.50	10.0	38.80
1.9	39.60	11.0	38.70
2.0	39.90	12.0	42.20
2.5	40.10	13.0	40.00
3.0	40.80	14.0	40.30
3.5	40.60	15.0	40.20
4.0	40.50	16.0	41.00
4.5	41.60	17.0	39.70
5.0	39.20	18.0	40.90
5.5	40.00		

COM-POWER PA-840

MICROWAVE PREAMPLIFIER

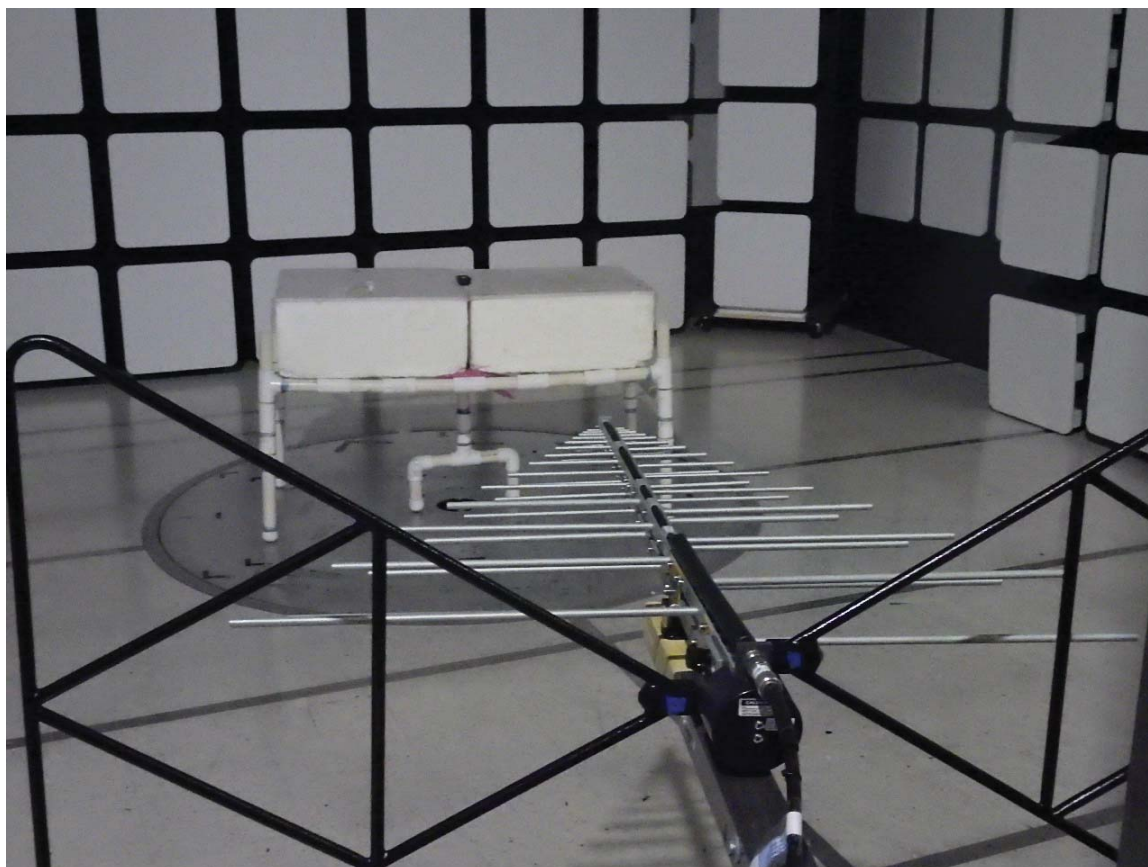
S/N: 711013

CALIBRATION DATE: APRIL 9, 2020

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
18.0	26.88	31.0	24.65
19.0	25.52	31.5	25.92
20.0	26.26	32.0	24.83
21.0	24.96	32.5	26.90
22.0	24.74	33.0	26.27
23.0	25.45	33.5	25.18
24.0	26.65	34.0	23.14
25.0	26.02	34.5	25.81
26.0	27.16	35.0	27.63
26.5	28.08	35.5	26.53
27.0	25.99	36.0	24.41
27.5	25.35	36.5	27.02
28.0	25.77	37.0	25.42
28.5	27.22	37.5	24.71
29.0	28.38	38.0	24.36
29.5	25.63	38.5	23.16
30.0	27.08	39.0	21.44
30.5	26.10	39.5	21.15
		40.0	21.20

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



FRONT VIEW

UNIVERSAL ELECTRONICS, INC.
TIVO S6A BACKLIT RCU 2020
MODEL: R37022D

FCC SUBPART B AND C; RSS-Gen and RSS-247 – RADIATED EMISSIONS – BELOW 1 GHz

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

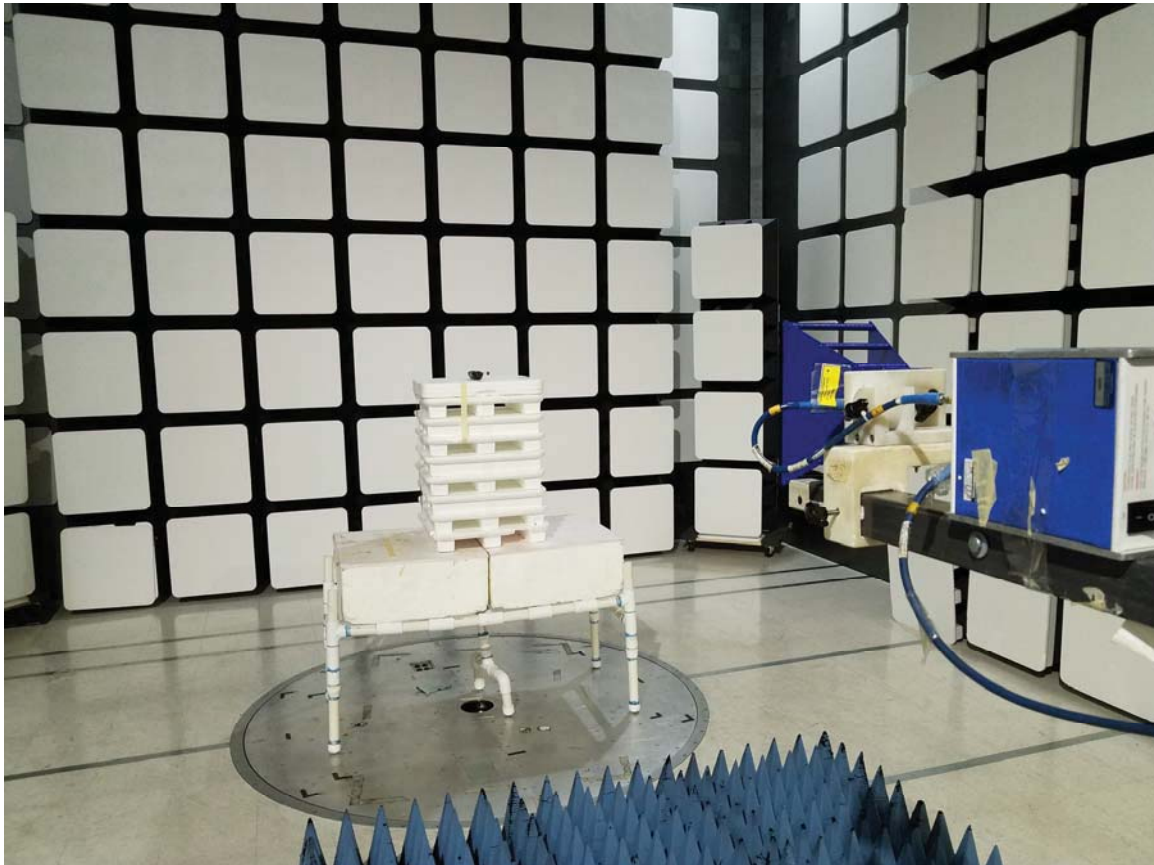


REAR VIEW

UNIVERSAL ELECTRONICS, INC.
TIVO S6A BACKLIT RCU 2020
MODEL: R37022D

FCC SUBPART B AND C; RSS-Gen and RSS-247 – RADIATED EMISSIONS – BELOW 1 GHz

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

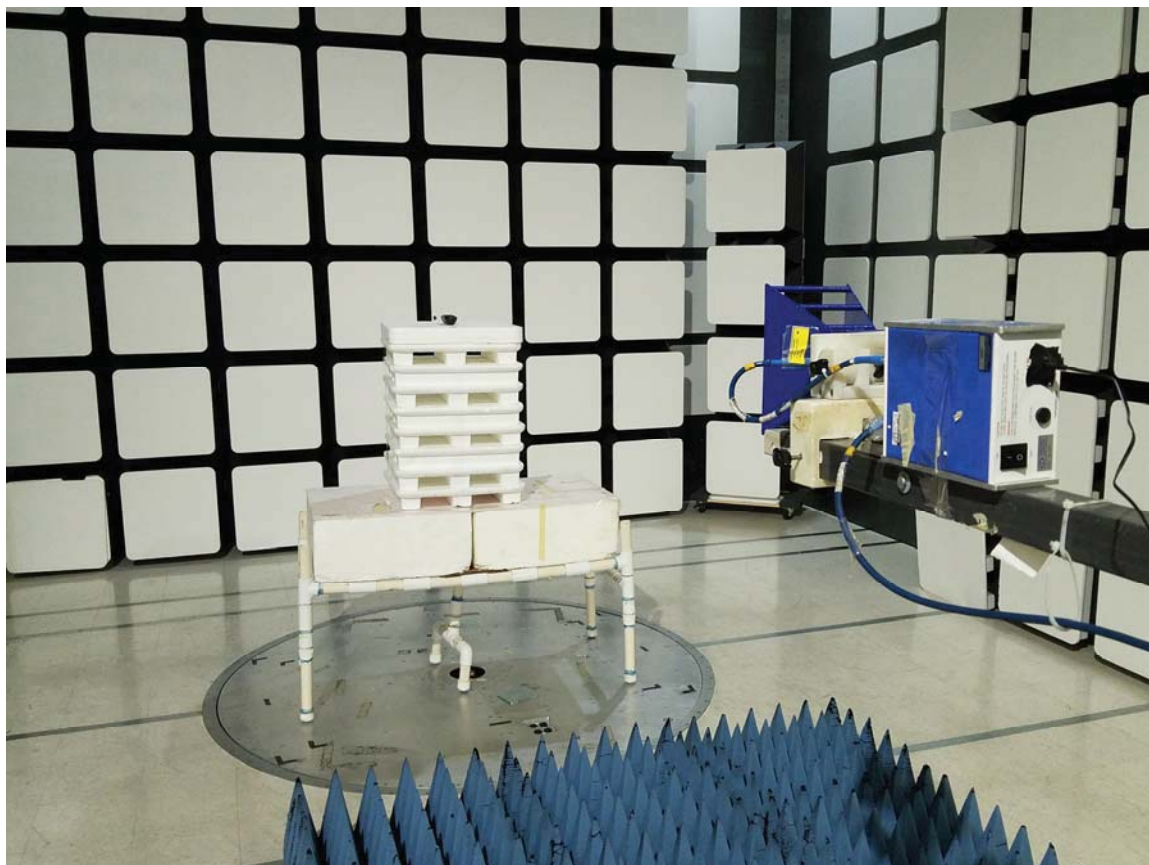


FRONT VIEW

UNIVERSAL ELECTRONICS, INC.
TIVO S6A BACKLIT RCU 2020
MODEL: R37022D

FCC SUBPART B AND C; RSS-Gen and RSS-247 – RADIATED EMISSIONS – ABOVE 1 GHz

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



REAR VIEW

UNIVERSAL ELECTRONICS, INC.
TIVO S6A BACKLIT RCU 2020
MODEL: R37022D

FCC SUBPART B AND C; RSS-Gen and RSS-247 – RADIATED EMISSIONS – ABOVE 1 GHz

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

APPENDIX E

DATA SHEETS

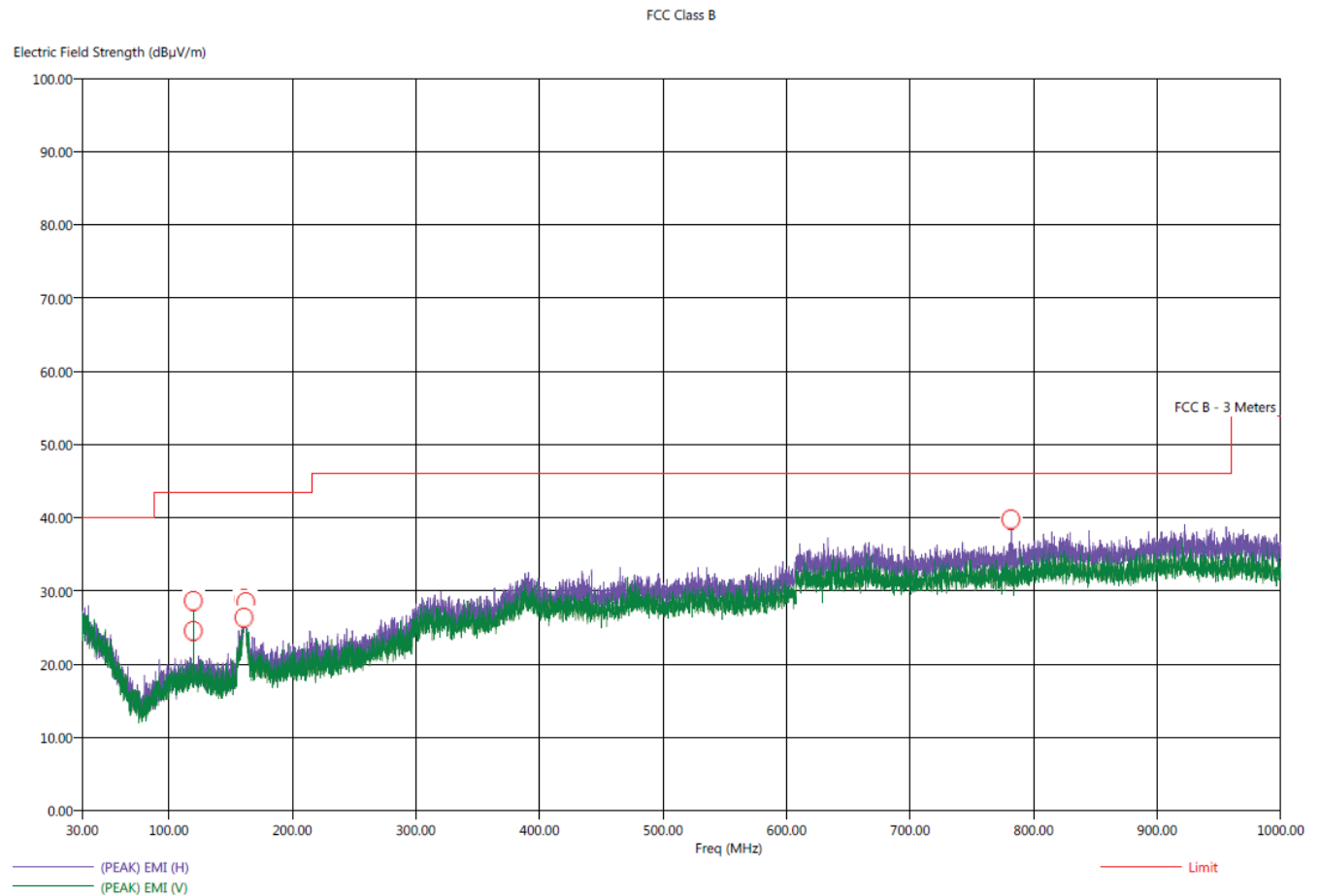
RADIATED EMISSIONS

DATA SHEETS



Title: Radiated Pre-Scan - FCC Class B
File: 1 - Pre-Scan - Low Ch - X-axis - 30 MHz to 1 GHz - 07-09-2020.set
Operator: Kyle Fujimoto
EUT Type: TiVo S6A Backlit RCU 2020
EUT Condition: The EUT is continuously transmitting BLE at 2480 MHz
Company: Universal Electronics, Inc.
Model: R37022D
S/N: N/A
X-Axis (Worst Case)

7/9/2020 8:02:31 AM
Sequence: Preliminary Scan





Title: Radiated Final Scan - FCC Class B
File: 1 - Final Scan - High Ch - X-axis - 30 MHz to 1 GHz - 07-09-2020.set
Operator: Kyle Fujimoto
EUT Type: TiVo S6A Backlit RCU 2020
EUT Condition: The EUT is continuously transmitting BLE at 2480 MHz
Company: Universal Electronics, Inc.
Model: R37022D
S/N: N/A
X-Axis (Worst Case)

7/9/2020 8:16:11 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)	Ttbi Aql (deq)	Twr Ht (cm)
120.00	H	29.71	26.47	-13.79	-17.03	43.50	15.90	0.75	215.75	126.92
120.00	V	27.62	24.61	-15.88	-18.89	43.50	15.90	0.75	4.25	206.86
160.90	H	30.05	24.60	-13.45	-18.90	43.50	21.34	0.88	284.75	400.11
160.90	V	30.15	25.27	-13.35	-18.23	43.50	22.01	0.88	359.75	318.02
162.10	H	30.41	25.01	-13.09	-18.49	43.50	21.82	0.88	28.25	285.61
162.40	V	29.77	25.03	-13.73	-18.47	43.50	21.83	0.88	68.25	270.02
781.70	H	36.75	31.74	-9.25	-14.26	46.00	25.70	2.27	354.00	286.14



Brea Division
114 Olinda Drive
Brea, CA 92823
(714) 579-0500

Newbury Park Division
1050 Lawrence Drive
Newbury Park, CA 91320
(805) 480-4044

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020

Lab: D

Tested By: Kyle Fujimoto

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	52.81	V	73.97	-21.16	Peak	163.00	111.28	
4804.00	32.81	V	53.97	-21.16	Avg	163.00	111.28	
7206.00	43.99	V	73.97	-29.98	Peak	277.75	127.22	
7206.00	23.99	V	53.97	-29.98	Avg	277.75	127.22	
9608.00	56.27	V	--	--	Peak	213.75	127.28	Not in Restricted Band
12010.00	46.13	V	73.97	-27.84	Peak	131.25	249.08	
12010.00	26.13	V	53.97	-27.84	Avg	131.25	249.08	
14412.00								No Emission Detected
14412.00								
16814.00								No Emission Detected
16814.00								
19216.00								No Emission Detected
19216.00								
21618.00								No Emission Detected
21618.00								
24020.00								No Emission Detected
24020.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020

Lab: D

Tested By: Kyle Fujimoto

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	56.59	V	73.97	-17.38	Peak	104.50	159.10	
4804.00	36.59	V	53.97	-17.38	Avg	104.50	159.10	
7206.00	46.94	V	73.97	-27.03	Peak	242.75	222.92	
7206.00	26.94	V	53.97	-27.03	Avg	242.75	222.92	
9608.00	53.98	V	--	--	Peak	89.75	127.16	Not in Restricted Band
12010.00	48.04	V	73.97	-25.93	Peak	181.75	159.16	
12010.00	28.04	V	53.97	-25.93	Avg	181.75	159.16	
14412.00								No Emission Detected
14412.00								
16814.00								No Emission Detected
16814.00								
19216.00								No Emission Detected
19216.00								
21618.00								No Emission Detected
21618.00								
24020.00								No Emission Detected
24020.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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	52.95	V	73.97	-21.02	Peak	165.25	143.28	
4804.00	32.95	V	53.97	-21.02	Avg	165.25	143.28	
7206.00	46.64	V	73.97	-27.33	Peak	283.00	127.22	
7206.00	26.64	V	53.97	-27.33	Avg	283.00	127.22	
9608.00	55.51	V	--	--	Peak	211.00	190.86	Not in Restricted Band
12010.00	46.38	V	73.97	-27.59	Peak	113.00	143.22	
12010.00	26.38	V	53.97	-27.59	Avg	113.00	143.22	
14412.00								No Emission Detected
14412.00								
16814.00								No Emission Detected
16814.00								
19216.00								No Emission Detected
19216.00								
21618.00								No Emission Detected
21618.00								
24020.00								No Emission Detected
24020.00								



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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	55.07	H	73.97	-18.90	Peak	163.00	127.34	
4804.00	35.07	H	53.97	-18.90	Avg	163.00	127.34	
7206.00	44.01	H	73.97	-29.96	Peak	98.50	174.92	
7206.00	24.01	H	53.97	-29.96	Avg	98.50	174.92	
9608.00	53.49	H	--	--	Peak	134.00	136.32	Not in Restricted Band
12010.00	49.03	H	73.97	-24.94	Peak	116.50	158.26	
12010.00	29.03	H	53.97	-24.94	Avg	116.50	158.26	
14412.00								No Emission Detected
14412.00								
16814.00								No Emission Detected
16814.00								
19216.00								No Emission Detected
19216.00								
21618.00								No Emission Detected
21618.00								
24020.00								No Emission Detected
24020.00								



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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	51.83	H	73.97	-22.14	Peak	121.75	127.28	
4804.00	31.83	H	53.97	-22.14	Avg	121.75	127.28	
7206.00	43.83	H	73.97	-30.14	Peak	243.25	111.16	
7206.00	23.83	H	53.97	-30.14	Avg	243.25	111.16	
9608.00	55.17	H	--	--	Peak	240.50	111.40	Not in Restricted Band
12010.00	46.88	H	73.97	-27.09	Peak	175.25	111.28	
12010.00	26.88	H	53.97	-27.09	Avg	175.25	111.28	
14412.00								No Emission Detected
14412.00								
16814.00								No Emission Detected
16814.00								
19216.00								No Emission Detected
19216.00								
21618.00								No Emission Detected
21618.00								
24020.00								No Emission Detected
24020.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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	52.18	H	73.97	-21.79	Peak	305.50	111.16	
4804.00	32.18	H	53.97	-21.79	Avg	305.50	111.16	
7206.00	49.00	H	73.97	-24.97	Peak	284.75	127.16	
7206.00	29.00	H	53.97	-24.97	Avg	284.75	127.16	
9608.00	53.70	H	--	--	Peak	72.50	111.40	Not in Restricted Band
12010.00	48.78	H	73.97	-25.19	Peak	216.25	159.10	
12010.00	28.78	H	53.97	-25.19	Avg	216.25	159.10	
14412.00								No Emission Detected
14412.00								
16814.00								No Emission Detected
16814.00								
19216.00								No Emission Detected
19216.00								
21618.00								No Emission Detected
21618.00								
24020.00								No Emission Detected
24020.00								



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4884.00	54.37	V	73.97	-19.60	Peak	164.75	126.98	
4884.00	34.37	V	53.97	-19.60	Avg	164.75	126.98	
7326.00	46.28	V	73.97	-27.69	Peak	285.50	222.98	
7326.00	26.28	V	53.97	-27.69	Avg	285.50	222.98	
9768.00	57.95	V	--	--	Peak	211.25	159.04	Not in Restricted Band
12210.00	47.07	V	73.97	-26.90	Peak	113.50	158.98	
12210.00	27.07	V	53.97	-26.90	Avg	113.50	158.98	
14652.00								No Emission Detected
14652.00								
17094.00								No Emission Detected
17094.00								
19536.00								No Emission Detected
19536.00								
21978.00								No Emission Detected
21978.00								
24420.00								No Emission Detected
24420.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

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
4884.00	57.91	V	73.97	-16.06	Peak	102.75	126.14	
4884.00	37.91	V	53.97	-16.06	Avg	102.75	126.14	
7326.00	49.86	V	73.97	-24.11	Peak	98.50	222.50	
7326.00	29.86	V	53.97	-24.11	Avg	98.50	222.50	
9768.00	55.31	V	--	--	Peak	305.00	111.16	Not in Restricted Band
12210.00	47.16	V	73.97	-26.81	Peak	116.00	222.86	
12210.00	27.16	V	53.97	-26.81	Avg	116.00	222.86	
14652.00								No Emission Detected
14652.00								
17094.00								No Emission Detected
17094.00								
19536.00								No Emission Detected
19536.00								
21978.00								No Emission Detected
21978.00								
24420.00								No Emission Detected
24420.00								



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4884.00	56.94	V	73.97	-17.03	Peak	95.25	158.92	
4884.00	36.94	V	53.97	-17.03	Avg	95.25	158.92	
7326.00	46.25	V	73.97	-27.72	Peak	240.75	143.16	
7326.00	26.25	V	53.97	-27.72	Avg	240.75	143.16	
9768.00	55.66	V	--	--	Peak	35.25	127.16	Not in Restricted Band
12210.00	49.31	V	73.97	-24.66	Peak	107.75	222.56	
12210.00	29.31	V	53.97	-24.66	Avg	107.75	222.56	
14652.00								No Emission Detected
14652.00								
17094.00								No Emission Detected
17094.00								
19536.00								No Emission Detected
19536.00								
21978.00								No Emission Detected
21978.00								
24420.00								No Emission Detected
24420.00								

**FCC 15.247**

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4884.00	55.71	H	73.97	-18.26	Peak	158.75	111.28	
4884.00	35.71	H	53.97	-18.26	Avg	158.75	111.28	
7326.00	43.78	H	73.97	-30.19	Peak	42.00	191.04	
7326.00	23.78	H	53.97	-30.19	Avg	42.00	191.04	
9768.00	54.27	H	--	--	Peak	210.00	126.98	Not in Restricted Band
12210.00	47.55	H	73.97	-26.42	Peak	116.25	111.34	
12210.00	27.55	H	53.97	-26.42	Avg	116.25	111.34	
14652.00								No Emission Detected
14652.00								
17094.00								No Emission Detected
17094.00								
19536.00								No Emission Detected
19536.00								
21978.00								No Emission Detected
21978.00								
24420.00								No Emission Detected
24420.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4884.00	52.77	H	73.97	-21.20	Peak	119.25	111.40	
4884.00	32.77	H	53.97	-21.20	Avg	119.25	111.40	
7326.00	44.01	H	73.97	-29.96	Peak	236.50	191.04	
7326.00	24.01	H	53.97	-29.96	Avg	236.50	191.04	
9768.00	58.27	H	--	--	Peak	246.75	126.26	Not in Restricted Band
12210.00	47.60	H	73.97	-26.37	Peak	132.00	127.16	
12210.00	27.60	H	53.97	-26.37	Avg	132.00	127.16	
14652.00								No Emission Detected
14652.00								
17094.00								No Emission Detected
17094.00								
19536.00								No Emission Detected
19536.00								
21978.00								No Emission Detected
21978.00								
24420.00								No Emission Detected
24420.00								

FCC 15.247

Universal Electronics, Inc.
 TiVo S6A Backlit RCU 2020
 Model: R37022D

Date: 07/08/2020
 Lab: D
 Tested By: Kyle Fujimoto

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
4884.00	53.16	H	73.97	-20.81	Peak	76.25	127.16	
4884.00	33.16	H	53.97	-20.81	Avg	76.25	127.16	
7326.00	44.43	H	73.97	-29.54	Peak	285.00	143.10	
7326.00	24.43	H	53.97	-29.54	Avg	285.00	143.10	
9768.00	54.88	H	--	--	Peak	2.25	111.34	Not in Restricted Band
12210.00	47.10	H	73.97	-26.87	Peak	215.75	158.98	
12210.00	27.10	H	53.97	-26.87	Avg	215.75	158.98	
14652.00								No Emission Detected
14652.00								
17094.00								No Emission Detected
17094.00								
19536.00								No Emission Detected
19536.00								
21978.00								No Emission Detected
21978.00								
24420.00								No Emission Detected
24420.00								



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4960.00	54.51	V	73.97	-19.46	Peak	160.50	127.10	
4960.00	34.51	V	53.97	-19.46	Avg	160.50	127.10	
7440.00	45.72	V	73.97	-28.25	Peak	329.75	222.80	
7440.00	25.72	V	53.97	-28.25	Avg	329.75	222.80	
9920.00	45.72	V	--	--	Peak	329.75	222.80	Not in Restricted Band
12400.00	48.11	V	73.97	-25.86	Peak	175.75	222.86	
12400.00	28.11	V	53.97	-25.86	Avg	175.75	222.86	
14880.00								No Emission Detected
14880.00								
17360.00								No Emission Detected
17360.00								
19840.00								No Emission Detected
19840.00								
22320.00								No Emission Detected
22320.00								
24800.00								No Emission Detected
24800.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4960.00	56.46	V	73.97	-17.51	Peak	101.25	159.04	
4960.00	36.46	V	53.97	-17.51	Avg	101.25	159.04	
7440.00	45.62	V	73.97	-28.35	Peak	125.25	158.25	
7440.00	25.62	V	53.97	-28.35	Avg	125.25	158.25	
9920.00	55.25	V	--	--	Peak	100.25	156.25	Not in Restricted Band
12400.00	46.25	V	73.97	-27.72	Peak	163.25	154.25	
12400.00	26.25	V	53.97	-27.72	Avg	163.25	154.25	
14880.00								No Emission Detected
14880.00								
17360.00								No Emission Detected
17360.00								
19840.00								No Emission Detected
19840.00								
22320.00								No Emission Detected
22320.00								
24800.00								No Emission Detected
24800.00								



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4960.00	57.01	V	73.97	-16.96	Peak	95.50	126.98	
4960.00	37.01	V	53.97	-16.96	Avg	95.50	126.98	
7440.00	46.13	V	73.97	-27.84	Peak	279.75	175.28	
7440.00	26.13	V	53.97	-27.84	Avg	279.75	175.28	
9920.00	56.09	V	--	--	Peak	30.25	174.80	Not in Restricted Band
12400.00	47.70	V	73.97	-26.27	Peak	129.50	190.80	
12400.00	27.70	V	53.97	-26.27	Avg	129.50	190.80	
14880.00								No Emission Detected
14880.00								
17360.00								No Emission Detected
17360.00								
19840.00								No Emission Detected
19840.00								
22320.00								No Emission Detected
22320.00								
24800.00								No Emission Detected
24800.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020

Lab: D

Tested By: Kyle Fujimoto

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
4960.00	55.98	H	73.97	-17.99	Peak	156.00	159.40	
4960.00	35.98	H	53.97	-17.99	Avg	156.00	159.40	
7440.00	44.15	H	73.97	-29.82	Peak	58.25	175.10	
7440.00	24.15	H	53.97	-29.82	Avg	58.25	175.10	
9920.00	56.07	H	--	--	Peak	210.00	111.40	Not in Restricted Band
12400.00	48.25	H	73.97	-25.72	Peak	116.25	222.98	
12400.00	28.25	H	53.97	-25.72	Avg	116.25	222.98	
14880.00								No Emission Detected
14880.00								
17360.00								No Emission Detected
17360.00								
19840.00								No Emission Detected
19840.00								
22320.00								No Emission Detected
22320.00								
24800.00								No Emission Detected
24800.00								

FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
Lab: D
Tested By: Kyle Fujimoto

**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
4960.00	51.16	H	73.97	-22.81	Peak	143.00	108.35	
4960.00	31.16	H	53.97	-22.81	Avg	143.00	108.35	
7440.00	44.95	H	73.97	-29.02	Peak	164.50	143.16	
7440.00	24.95	H	53.97	-29.02	Avg	164.50	143.16	
9920.00	59.86	H	--	--	Peak	250.75	126.98	Not in Restricted Band
12400.00	47.01	H	73.97	-26.96	Peak	99.75	249.97	
12400.00	27.01	H	53.97	-26.96	Avg	99.75	249.97	
14880.00								No Emission Detected
14880.00								
17360.00								No Emission Detected
17360.00								
19840.00								No Emission Detected
19840.00								
22320.00								No Emission Detected
22320.00								
24800.00								No Emission Detected
24800.00								

FCC 15.247

Universal Electronics, Inc.
 TiVo S6A Backlit RCU 2020
 Model: R37022D

Date: 07/08/2020
 Lab: D
 Tested By: Kyle Fujimoto

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
4960.00	52.76	H	73.97	-21.21	Peak	87.75	111.22	
4960.00	32.76	H	53.97	-21.21	Avg	87.75	111.22	
7440.00	47.14	H	73.97	-26.83	Peak	285.00	127.16	
7440.00	27.14	H	53.97	-26.83	Avg	285.00	127.16	
9920.00	54.55	H	--	--	Peak	73.50	111.16	Not in Restricted Band
12400.00	48.84	H	73.97	-25.13	Peak	216.50	217.22	
12400.00	28.84	H	53.97	-25.13	Avg	216.50	217.22	
14880.00								No Emission Detected
14880.00								
17360.00								No Emission Detected
17360.00								
19840.00								No Emission Detected
19840.00								
22320.00								No Emission Detected
22320.00								
24800.00								No Emission Detected
24800.00								



FCC 15.247

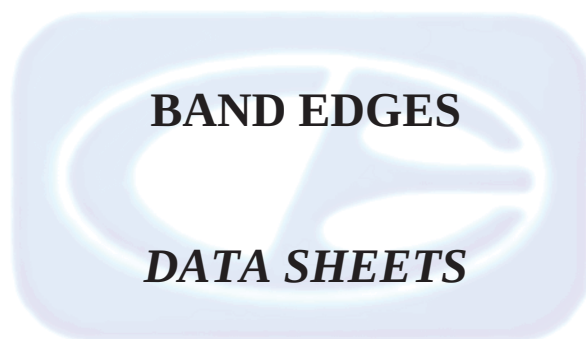
Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020
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 25 GHz

[illegible]



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

Date: 07/08/2020

Lab: D

Tested By: Kyle Fujimoto

Band Edges - Low Channel

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
2402.00	100.83	H	--	--	Peak	318.50	123.58	Fundamental - Low Ch.
2402.00	99.26	H	--	--	Avg	318.50	123.58	X-Axis - Worst Case
2390.00	41.54	H	73.97	-32.43	Peak	318.50	123.58	Band Edge
2390.00	32.39	H	53.97	-21.58	Avg	318.50	123.58	X-Axis - Worst Case
2338.03	53.04	H	73.97	-20.93	Peak	318.50	123.58	Band Edge
2338.03	47.83	H	53.97	-6.14	Avg	318.50	123.58	X-Axis - Worst Case
2402.00	100.60	V	--	--	Peak	344.25	190.38	Fundamental - Low Ch.
2402.00	99.36	V	--	--	Avg	344.25	190.38	Y-Axis - Worst Case
2390.00	41.76	V	73.97	-32.21	Peak	344.25	190.38	Band Edge
2390.00	32.53	V	53.97	-21.44	Avg	344.25	190.38	Y-Axis - Worst Case
2338.12	53.18	V	73.97	-20.79	Peak	344.25	190.38	Band Edge
2338.12	45.10	V	53.97	-8.87	Avg	344.25	190.38	Y-Axis - Worst Case



FCC 15.247

Universal Electronics, Inc.
TiVo S6A Backlit RCU 2020
Model: R37022D

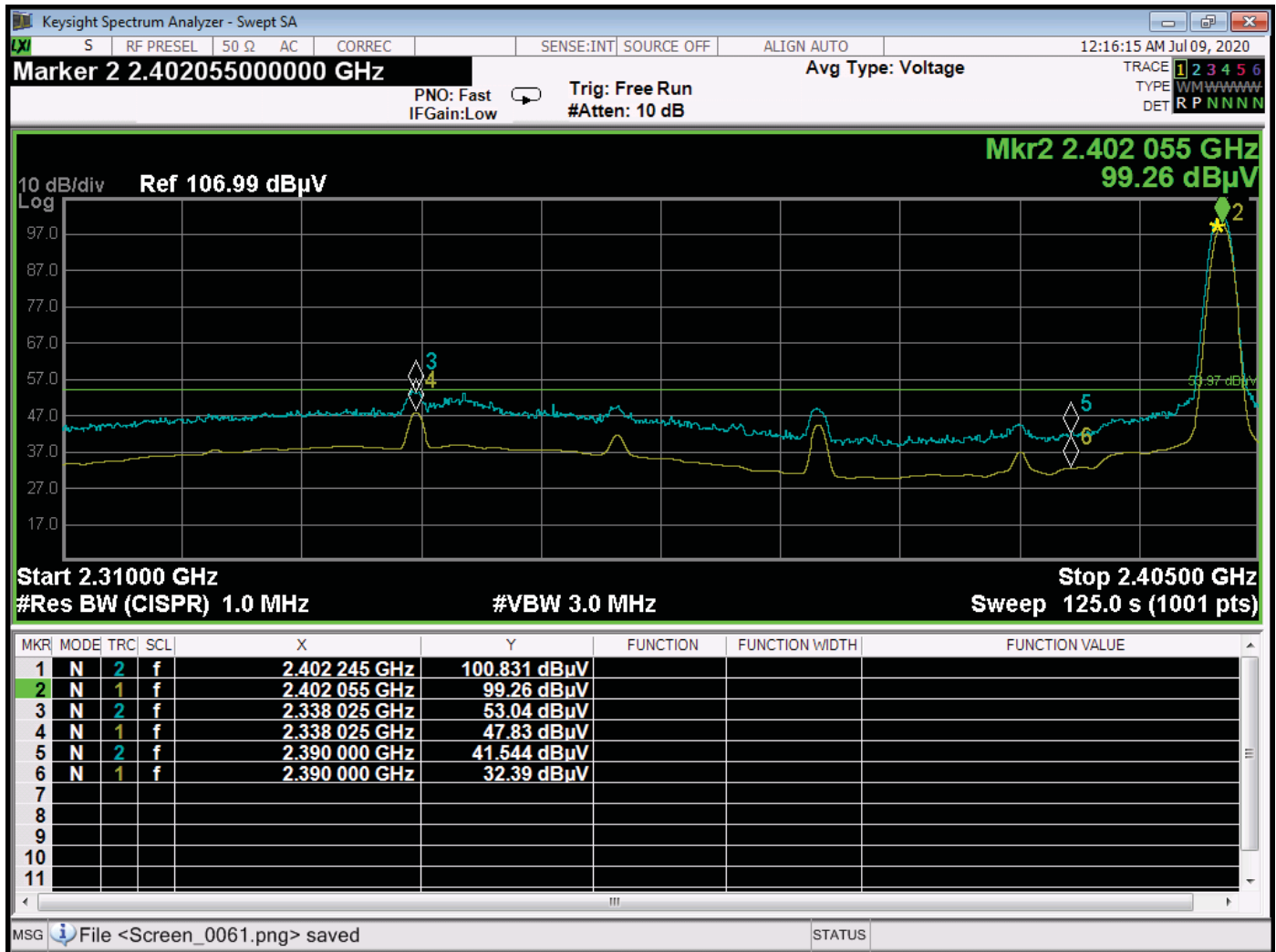
Date: 07/08/2020

Lab: D

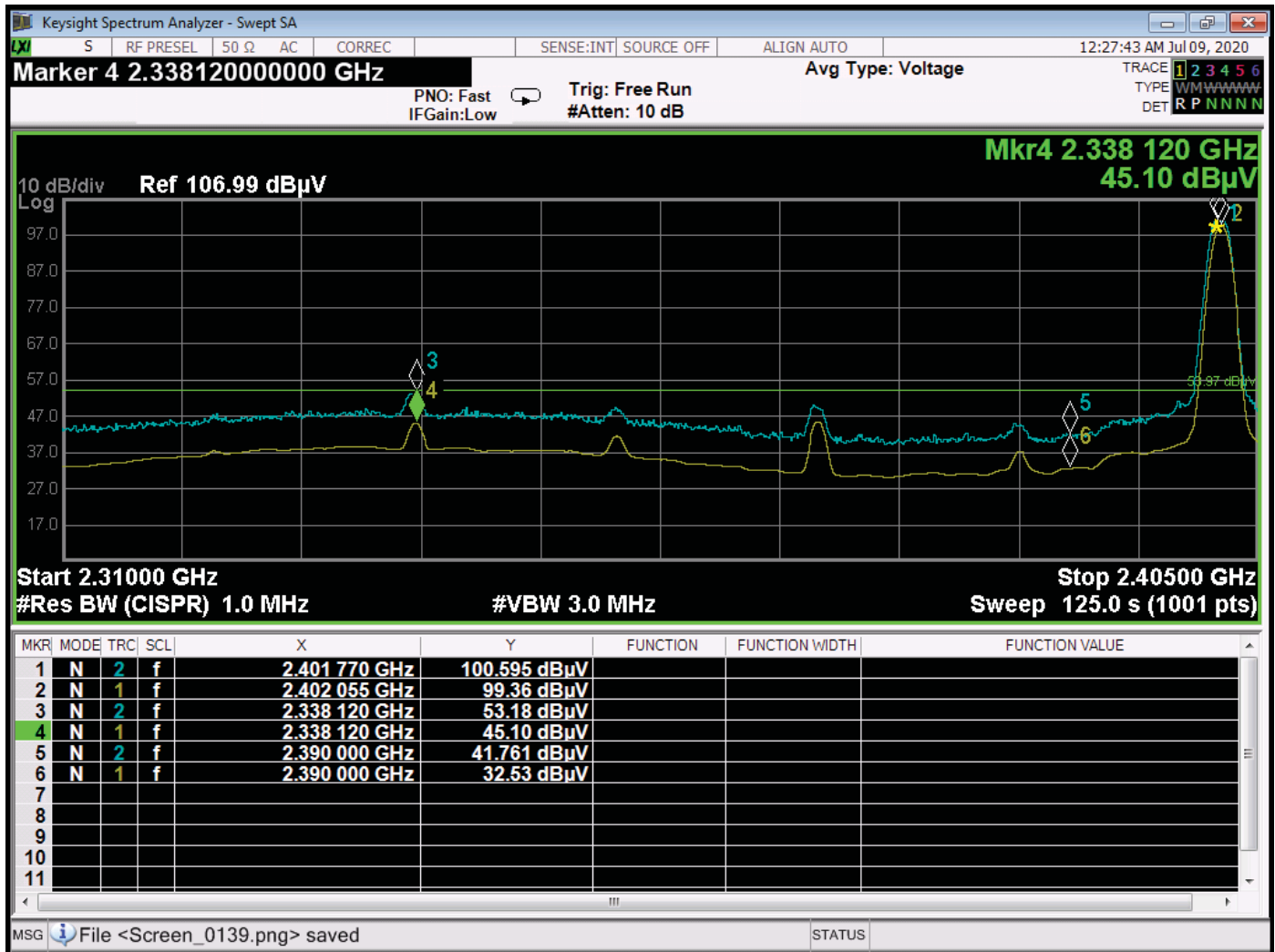
Tested By: Kyle Fujimoto

Band Edges - High Channel

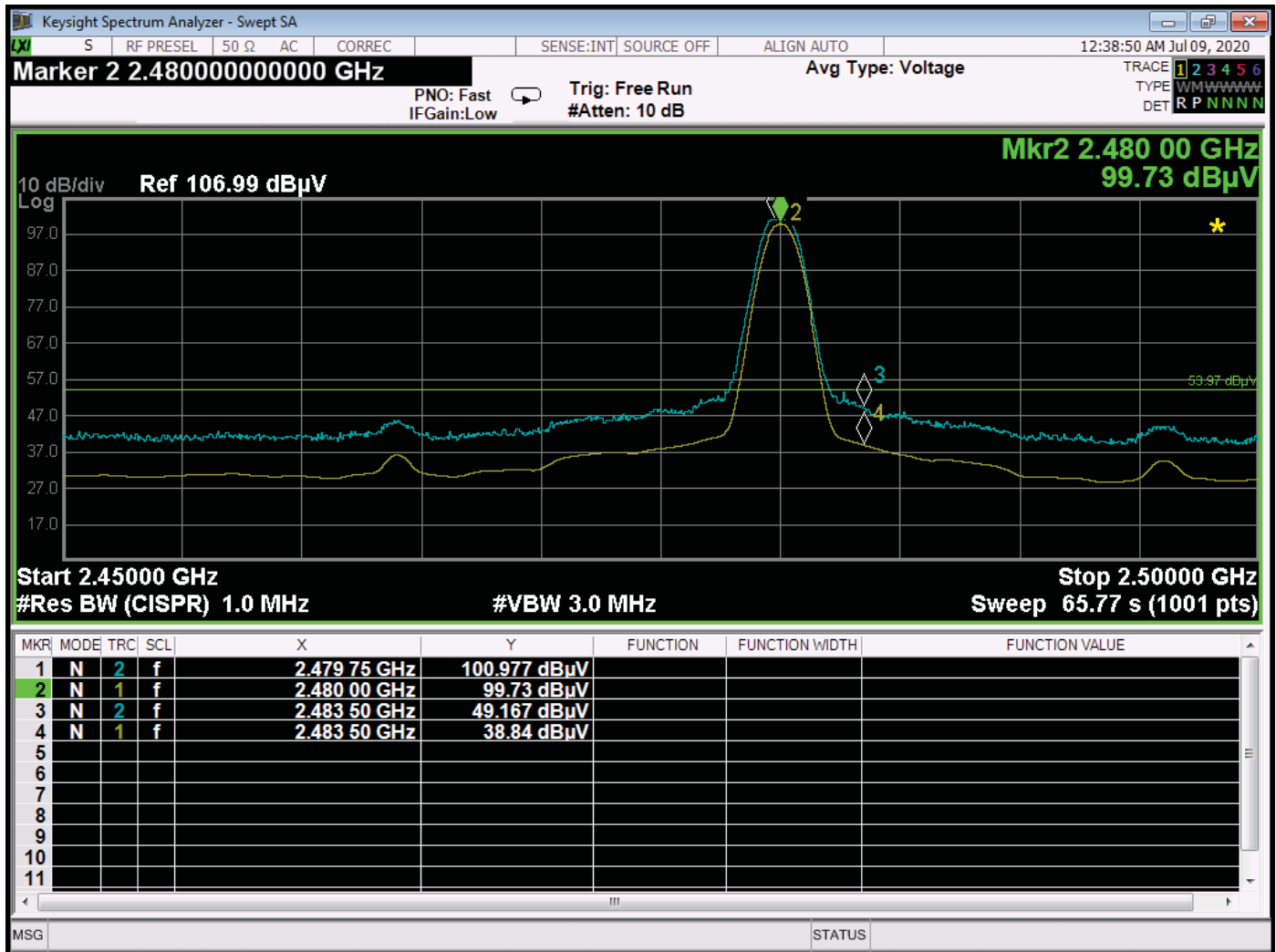
[illegible]



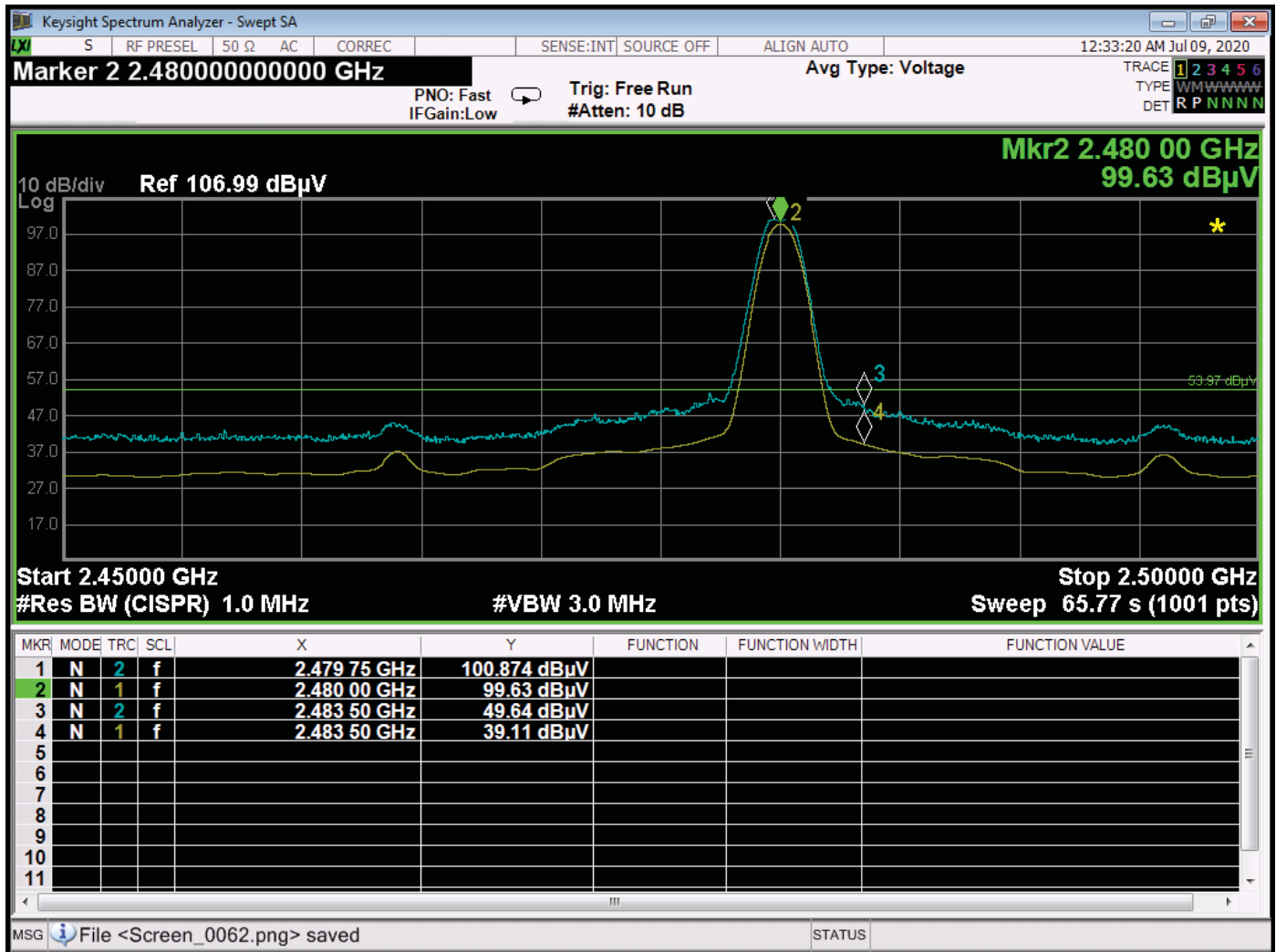
Band Edge – Low Channel – Horizontal Polarization – X-Axis



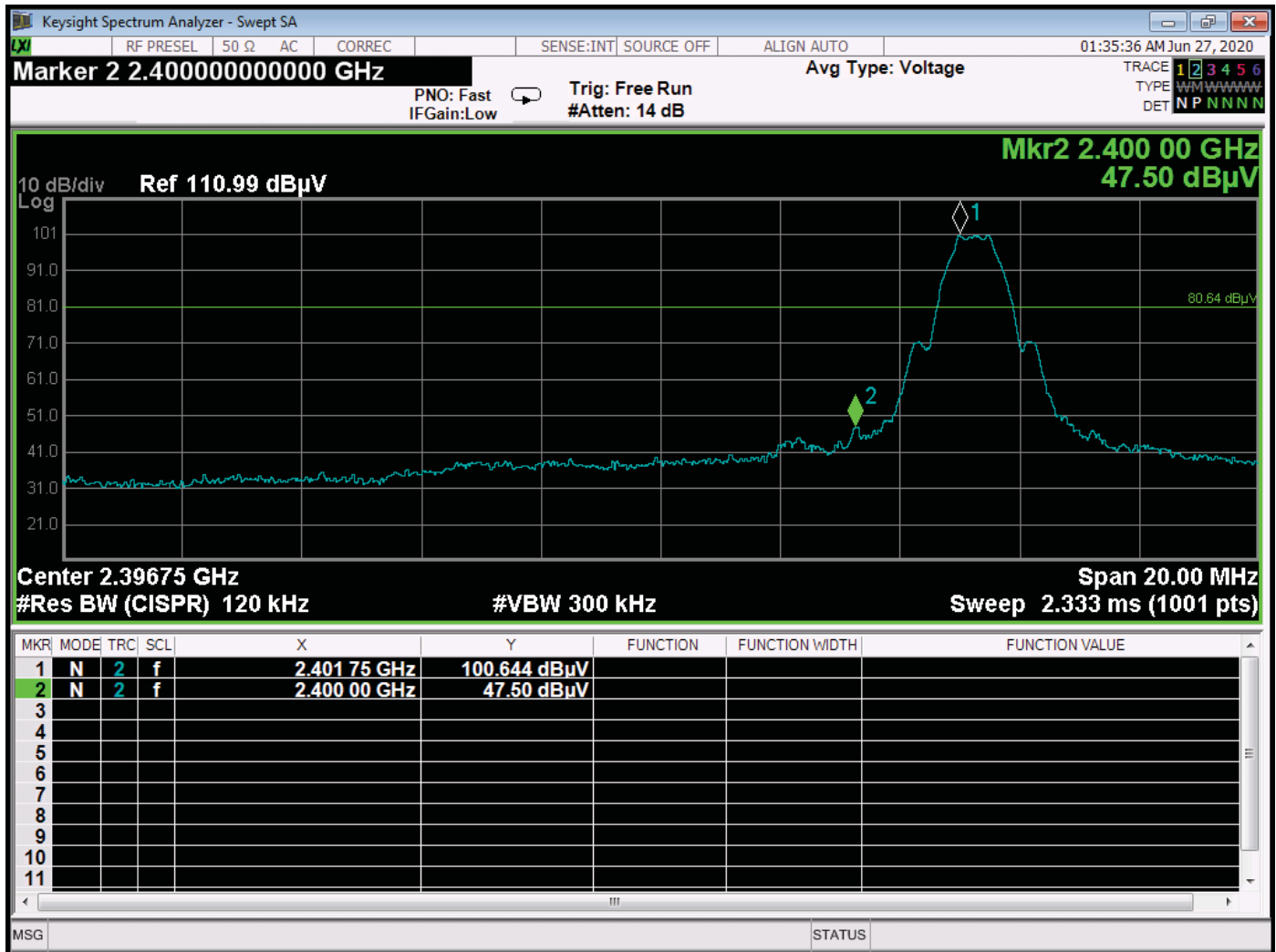
Band Edge – Low Channel – Vertical Polarization – Y-Axis



Band Edge – High Channel – Horizontal Polarization – X-Axis



Band Edge – High Channel – Vertical Polarization – Y-Axis

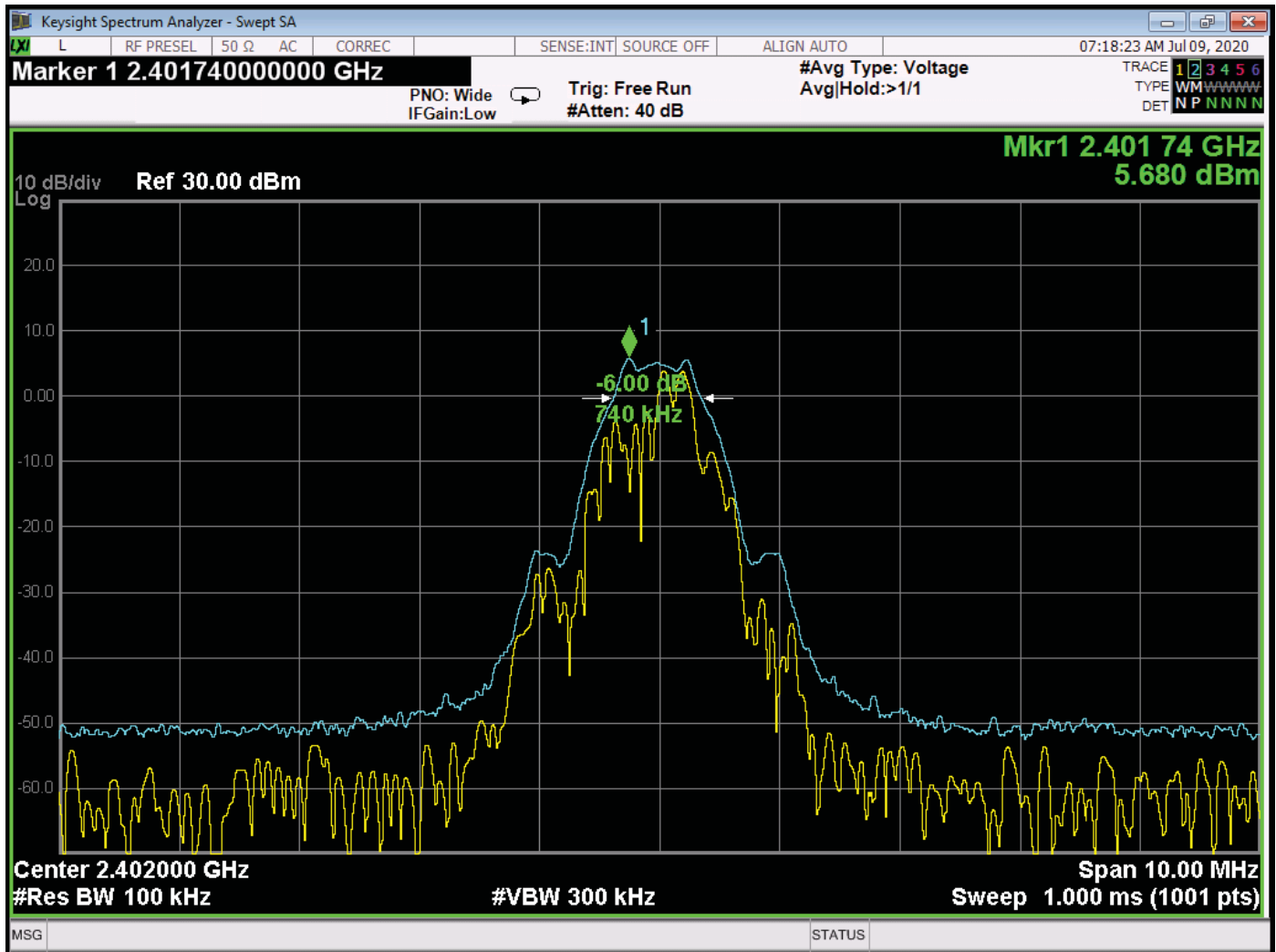


Band Edge at 2400 MHz – Low Channel

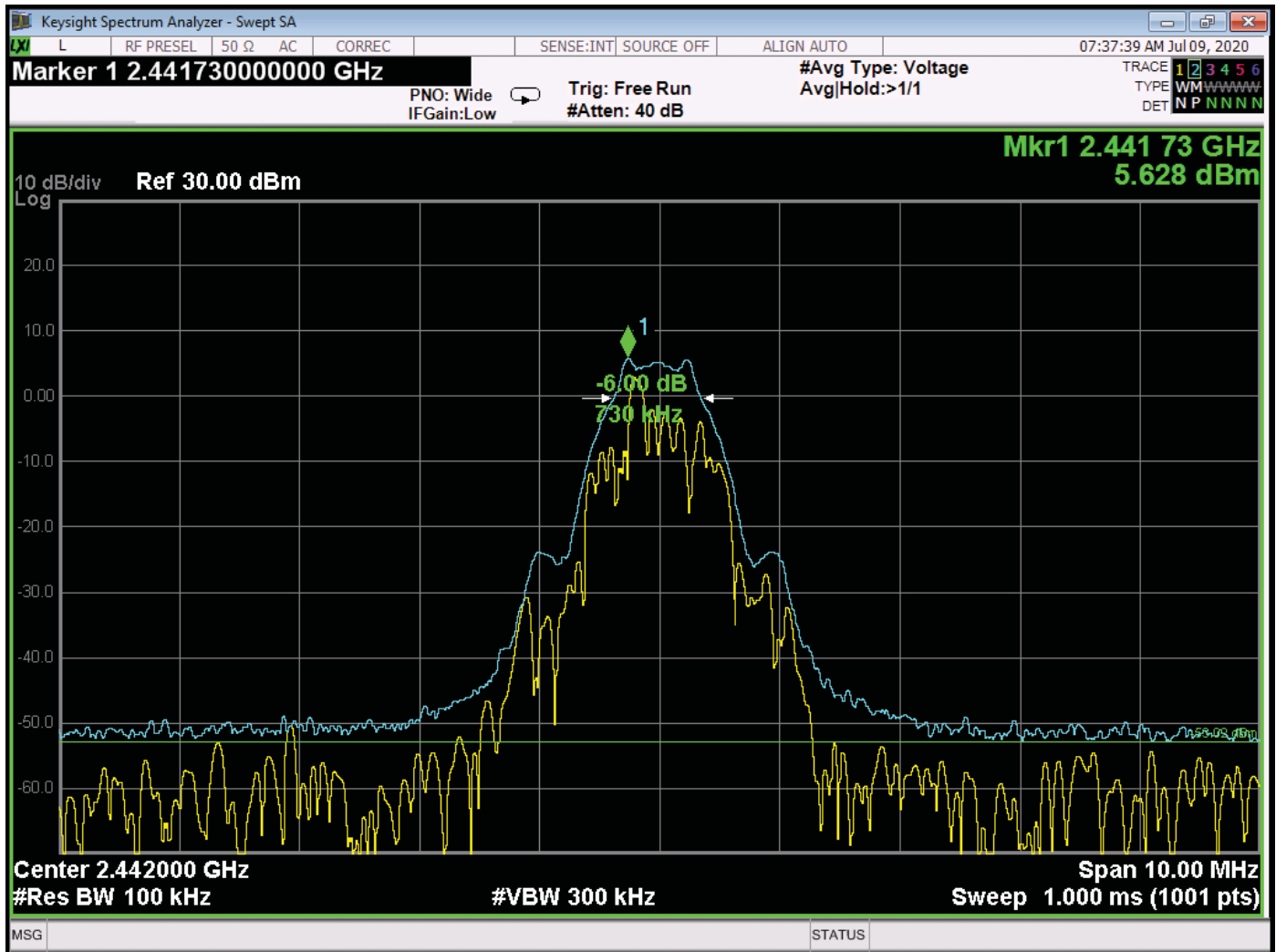


-6 dB BANDWIDTH

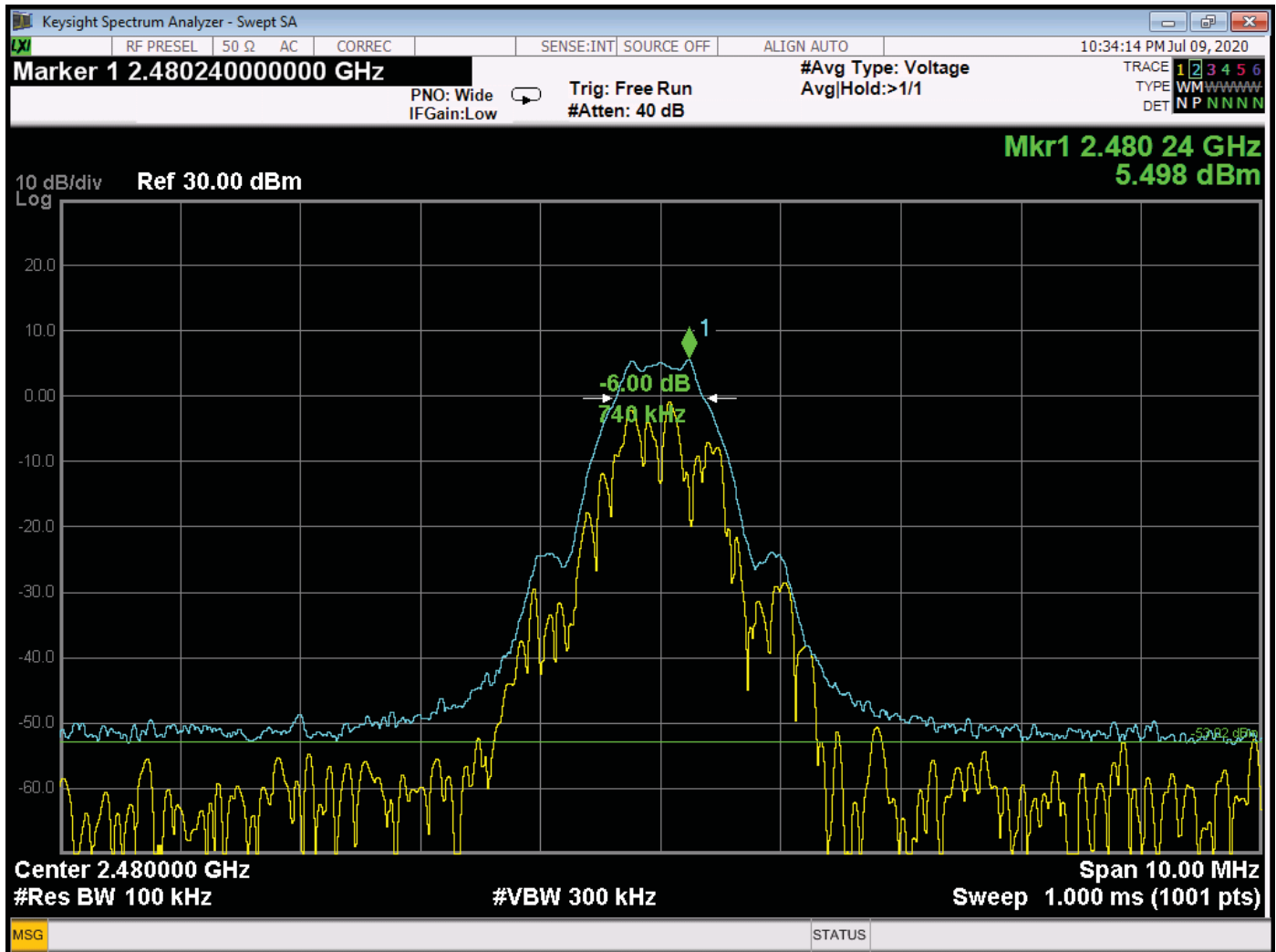
DATA SHEETS



-6 dB Bandwidth – Low Channel



-6 dB Bandwidth – Middle Channel

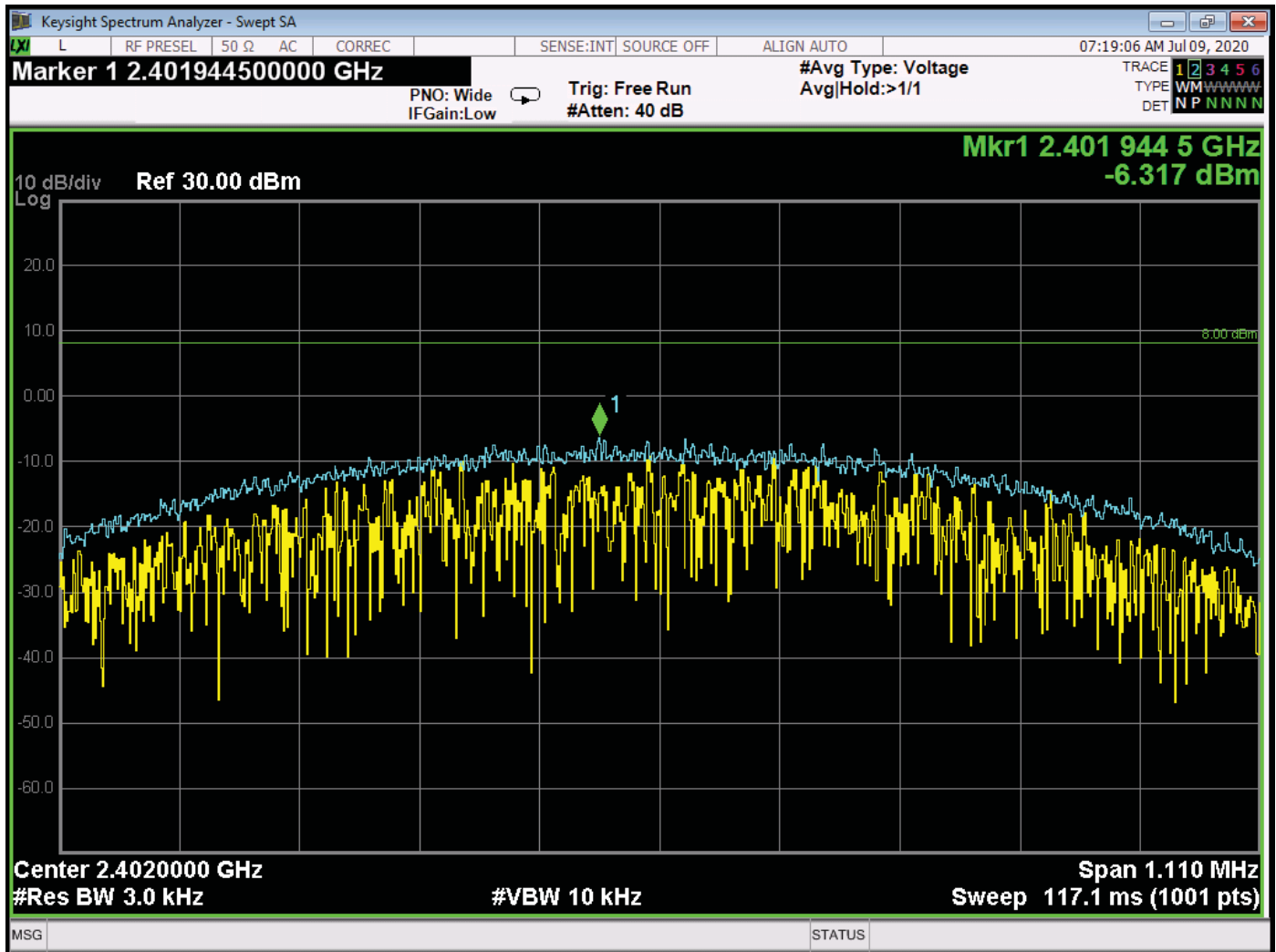


-6 dB Bandwidth – High Channel



SPECTRAL DENSITY OUTPUT

DATA SHEETS



Spectral Density – Low Channel

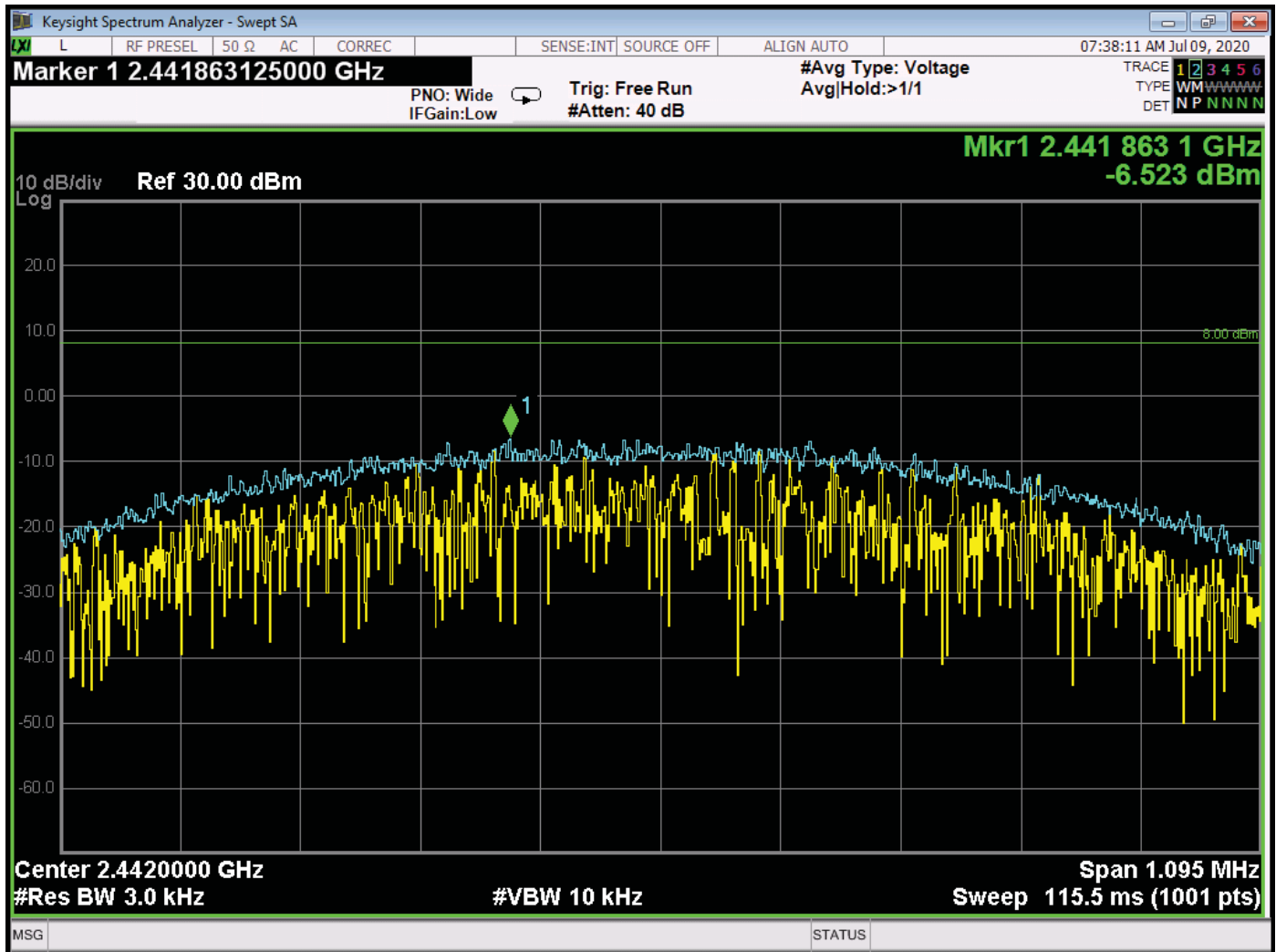


**COMPATIBLE
ELECTRONICS**

FCC Part 15 Subpart B and C; FCC Section 15.247; and RSS-247 & RSS-Gen Test Report

TiVo S6A Backlit RCU 2020

Model: R37022D

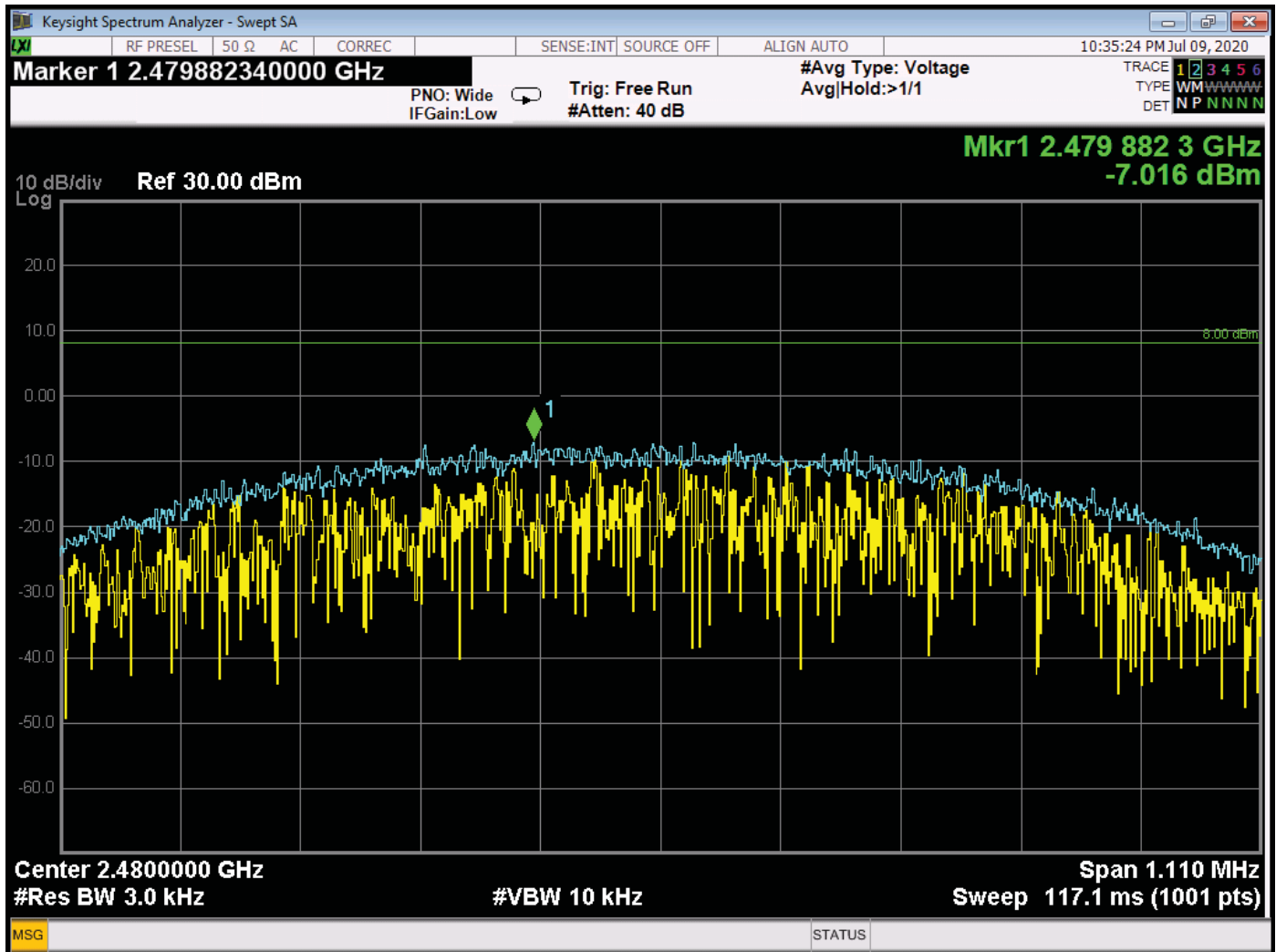


Spectral Density – Middle Channel

Brea Division
114 Olinda Drive
Brea, CA 92823
(714) 579-0500

Newbury Park Division
1050 Lawrence Drive
Newbury Park, CA 91320
(805) 480-4044

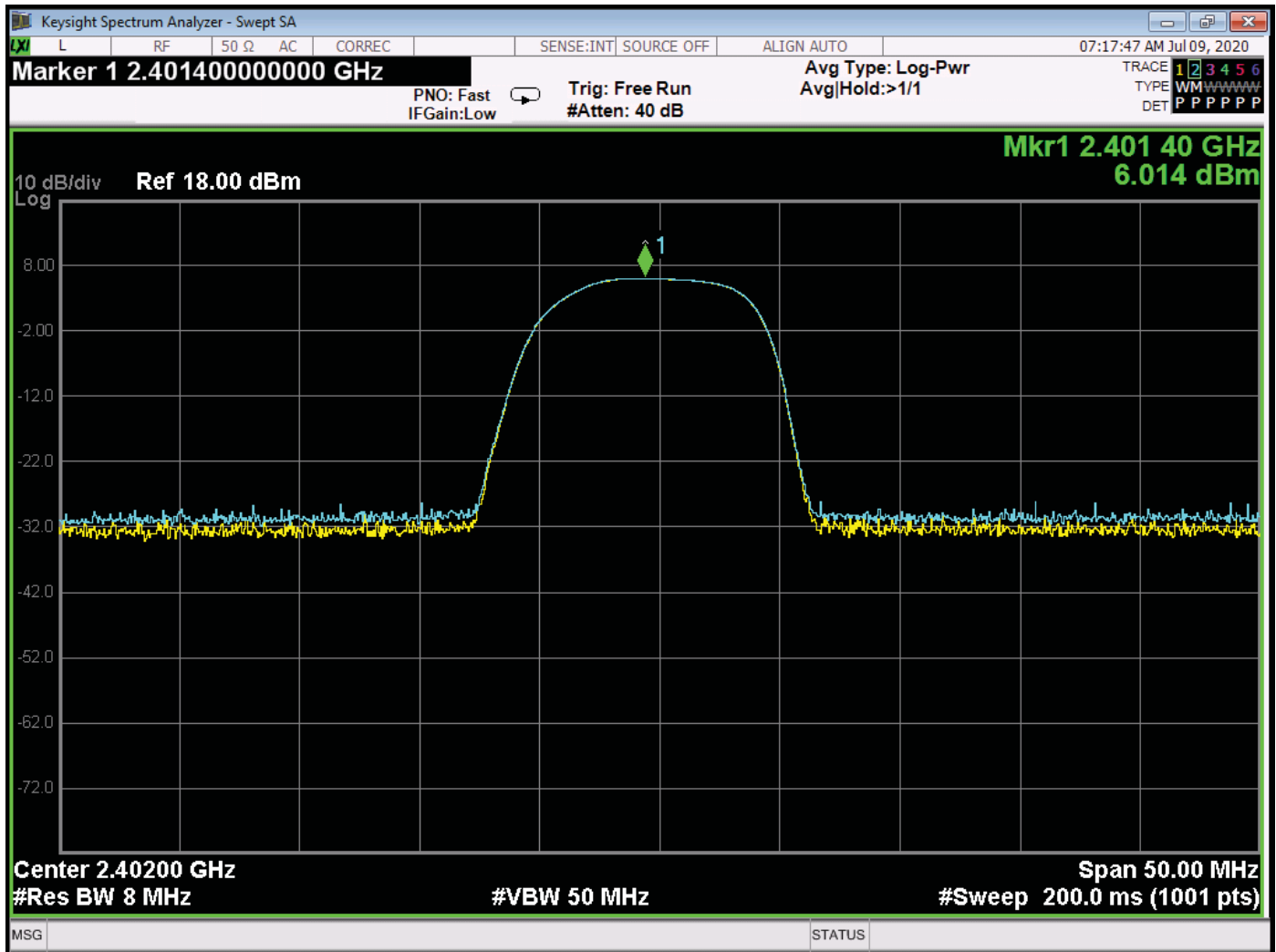
Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400



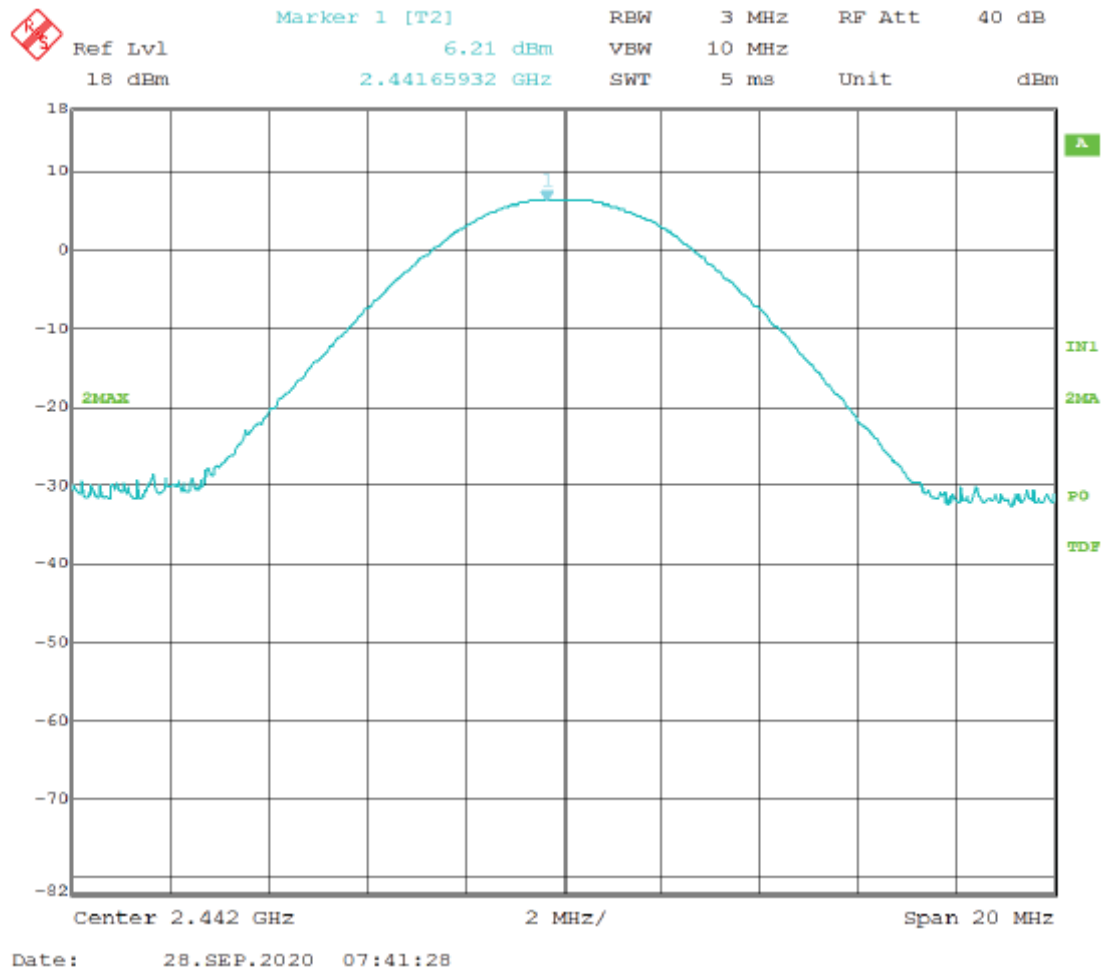
Spectral Density – High Channel

PEAK OUTPUT POWER

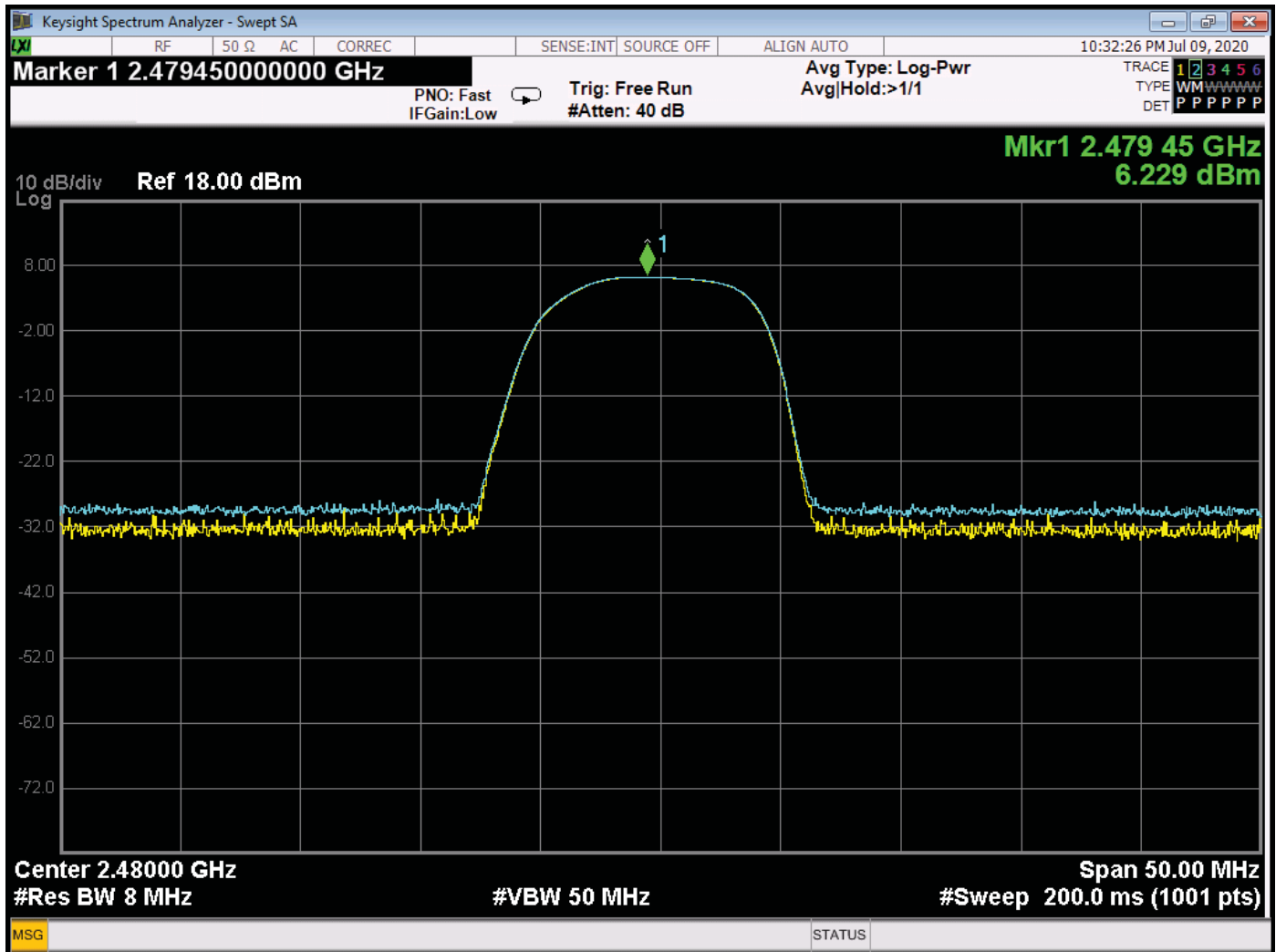
DATA SHEETS



Peak Output Power – Low Channel



Peak Output Power – Middle Channel



Peak Output Power – High Channel



**EMISSIONS IN
NON-RESRTICTED BANDS
*DATA SHEETS***

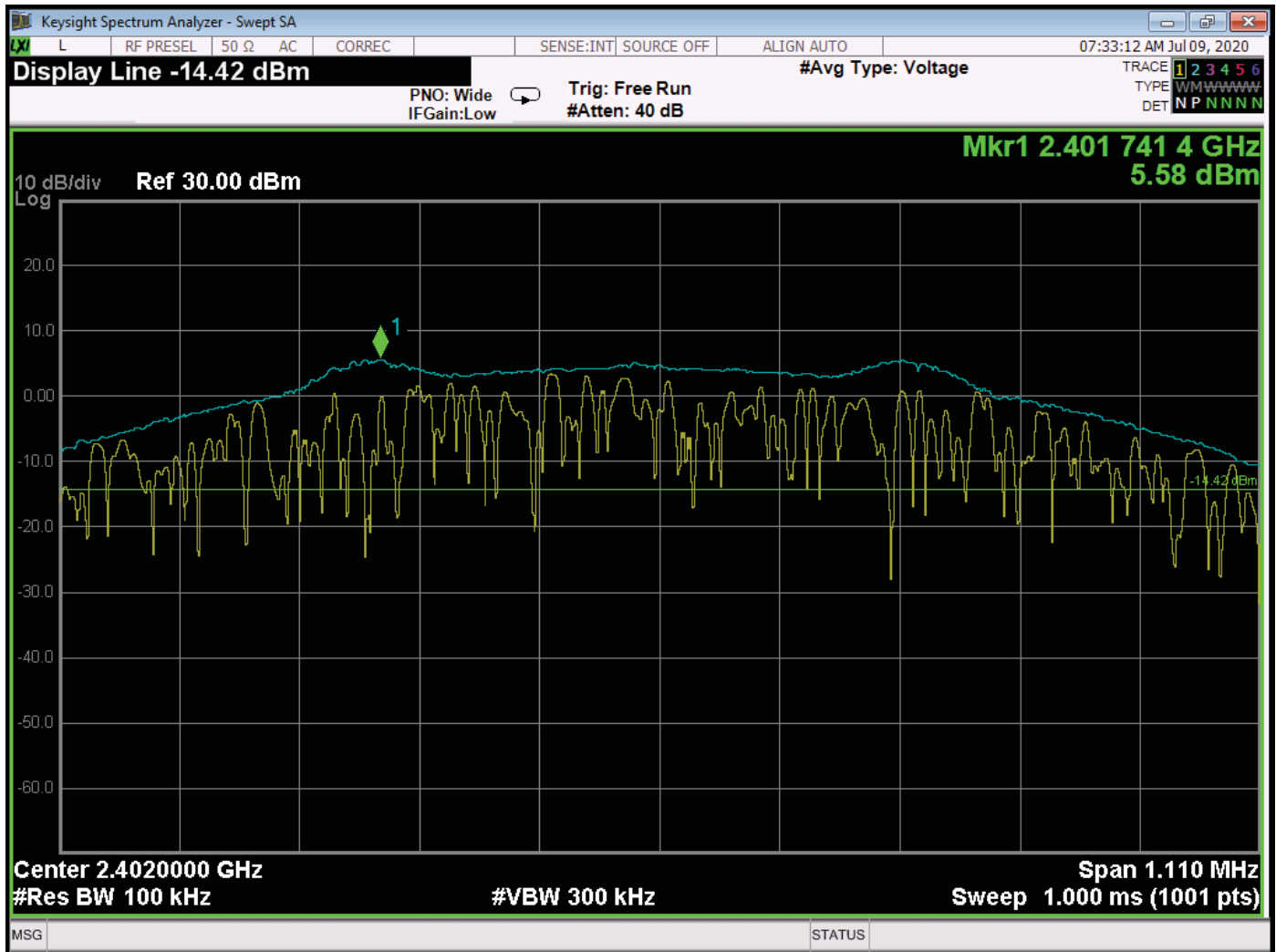


**COMPATIBLE
ELECTRONICS**

FCC Part 15 Subpart B and C; FCC Section 15.247; and RSS-247 & RSS-Gen Test Report

TiVo S6A Backlit RCU 2020

Model: R37022D

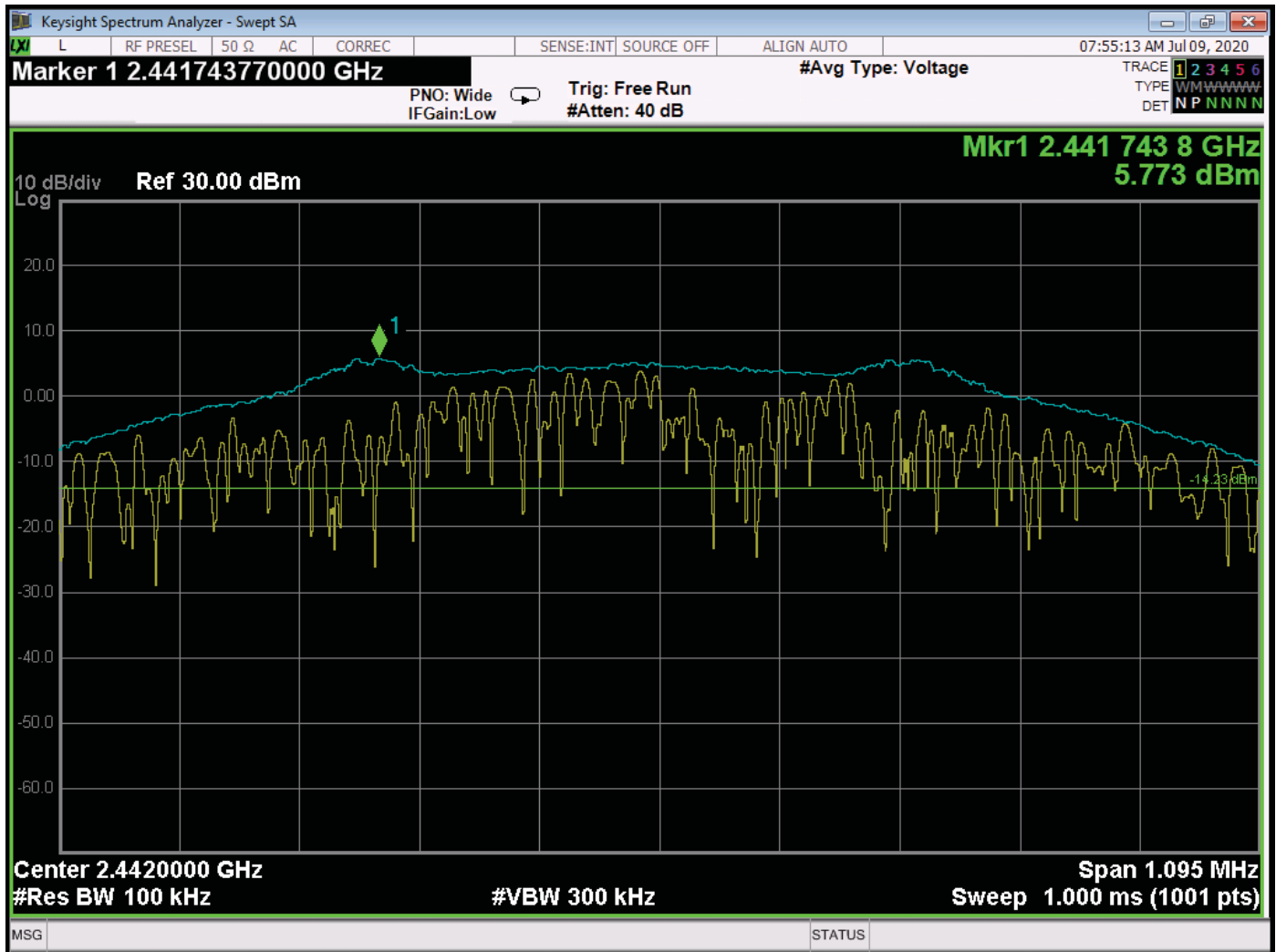


RF Antenna Conducted – Reference Level – Low Channel

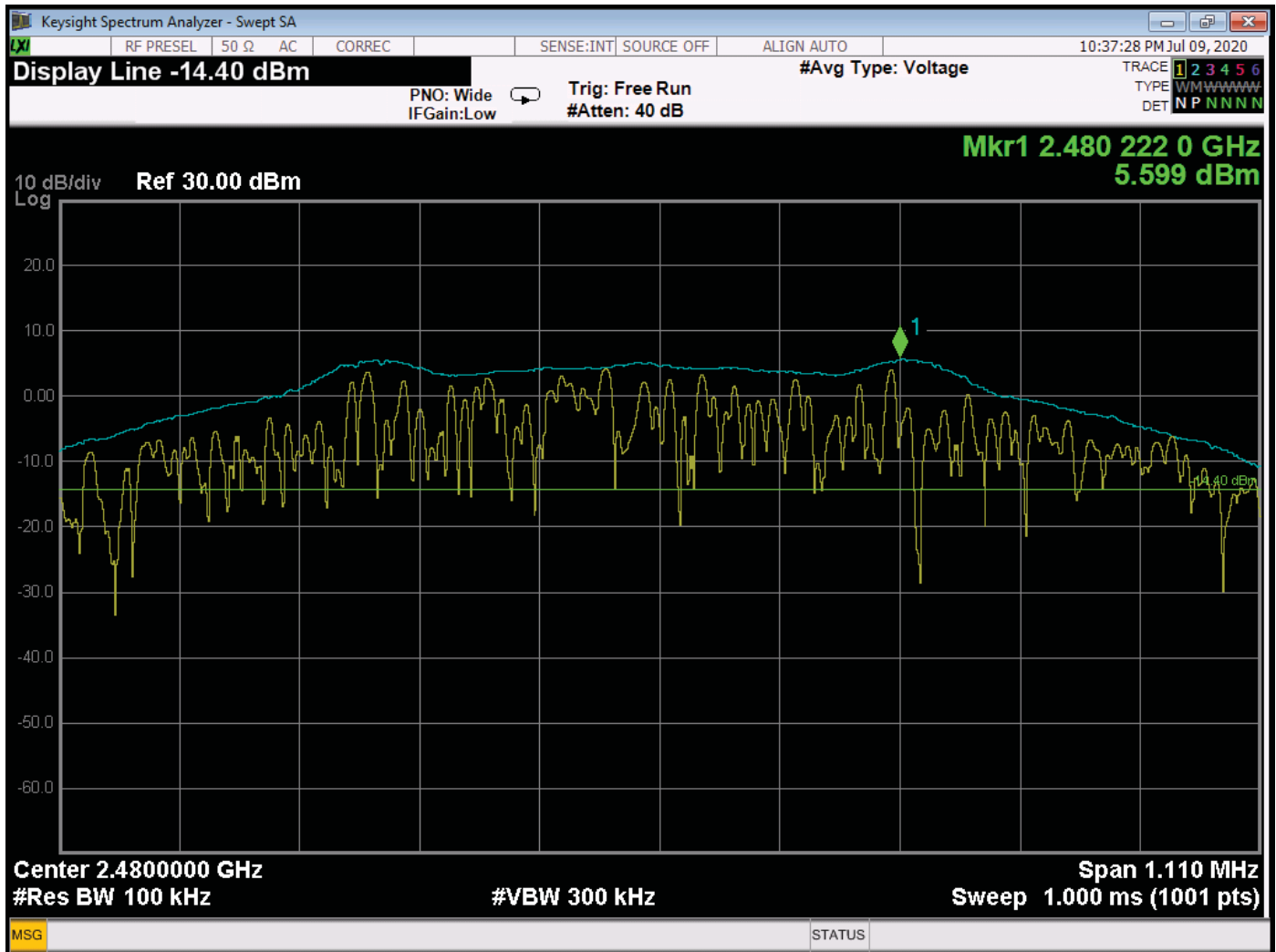
Brea Division
114 Olinda Drive
Brea, CA 92823
(714) 579-0500

Newbury Park Division
1050 Lawrence Drive
Newbury Park, CA 91320
(805) 480-4044

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400



RF Antenna Conducted – Reference Level – Middle Channel



RF Antenna Conducted – Reference Level – High Channel

UNIVERSAL ELECTRONICS, INC.

TIVO S6A BACKLIT RCU 2020

MODEL: R37022D

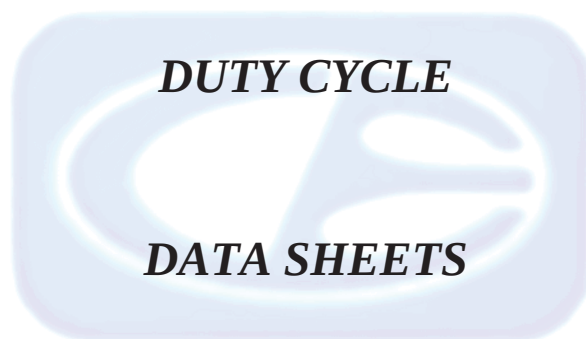
EMISSIONS IN NON-RESTRICTED BANDS

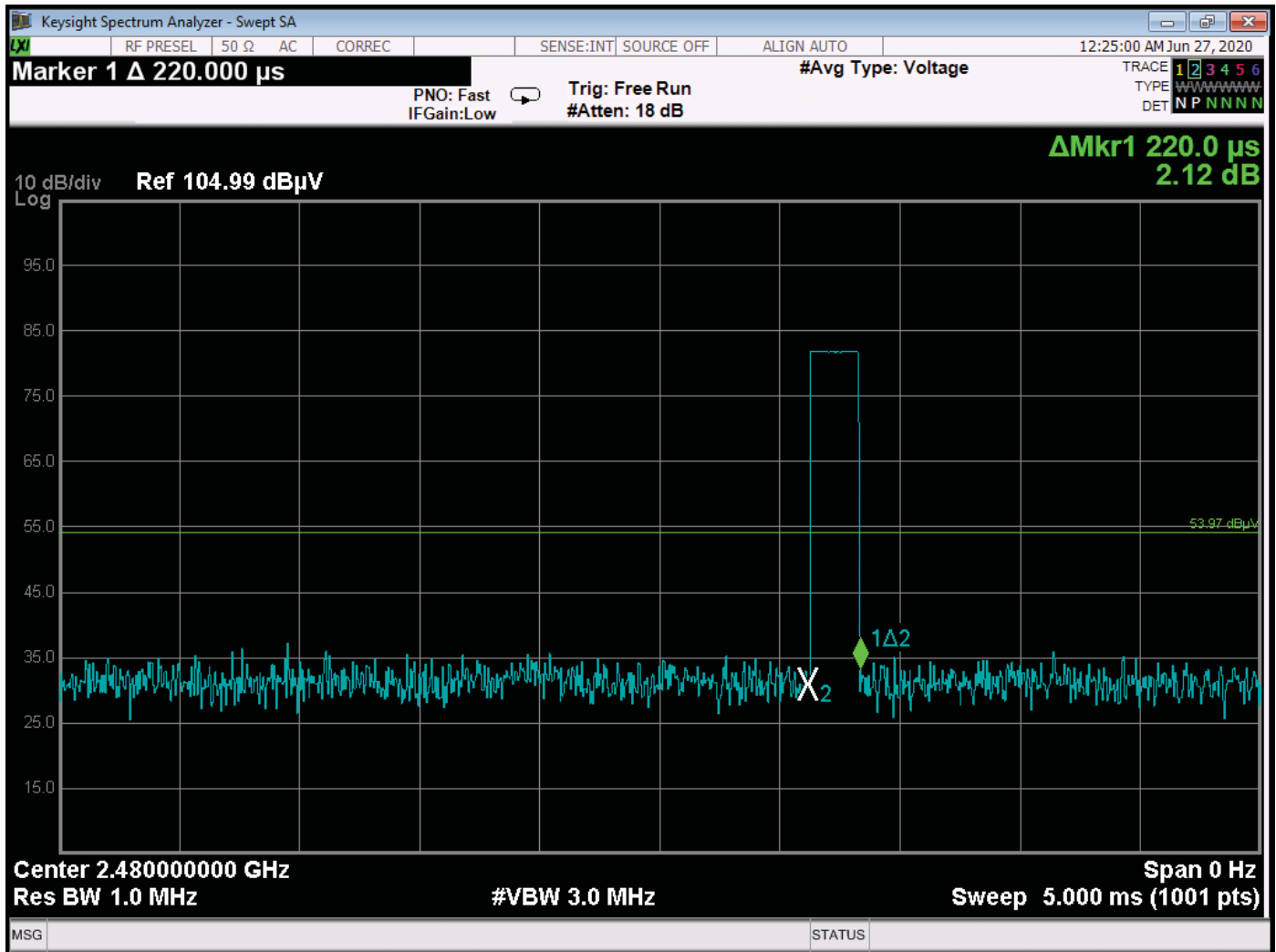
FREQUENCY (MHz)	LEVEL (dBm)	Limit* (dBm)	Margin (dB)
6077.50	-48.433	-14.227	-34.206
6122.50	-46.739	-14.227	-32.512
6166.00	-50.043	-14.227	-35.816

Note: The three highest non-restricted emissions are reported.

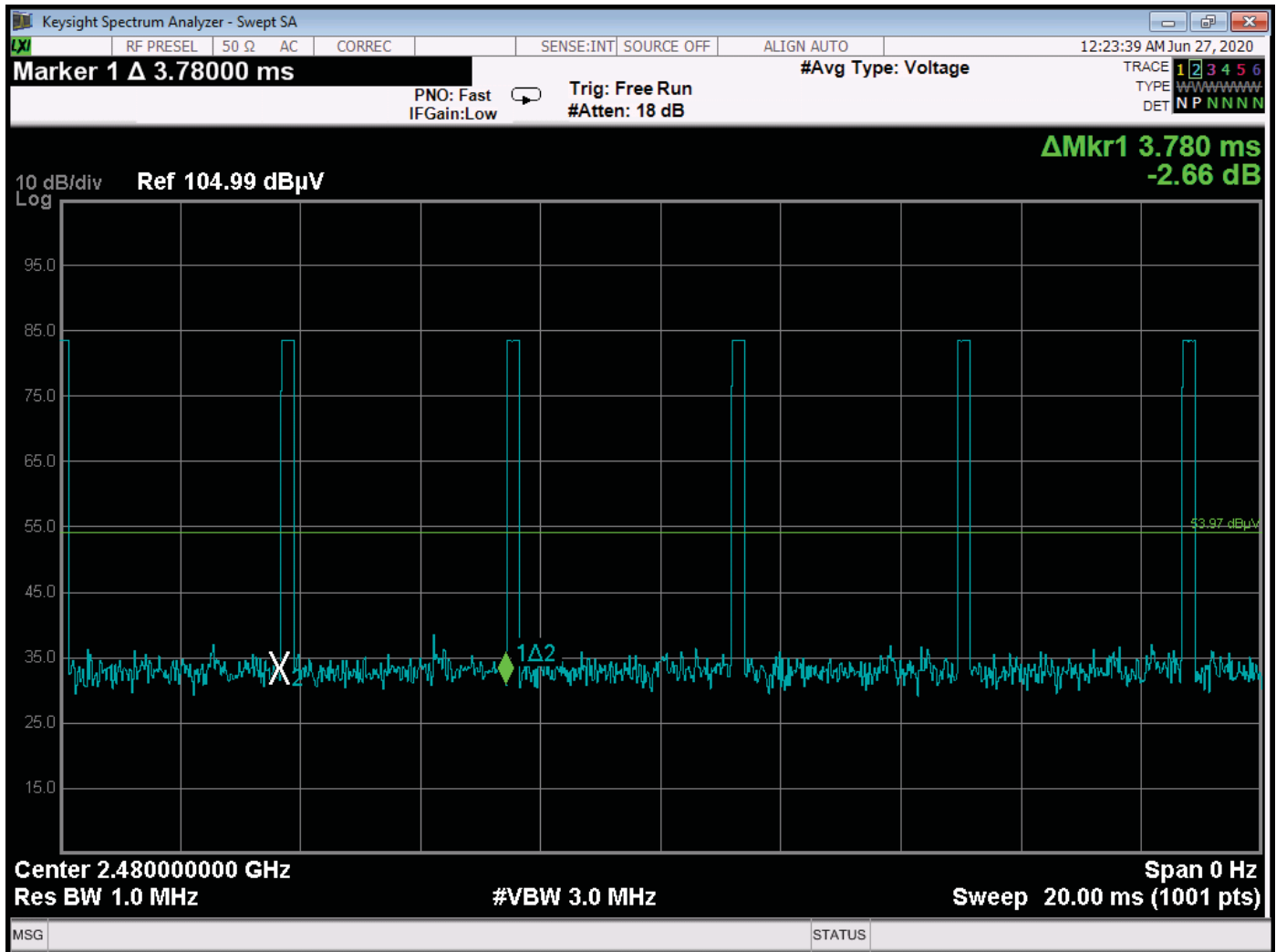
*The Limit is based on 20 dB below the highest reference level obtained on the previous pages per section 11.11.2 of ANSI C63.10.

The channel found to have the maximum level can be used to determine the reference level





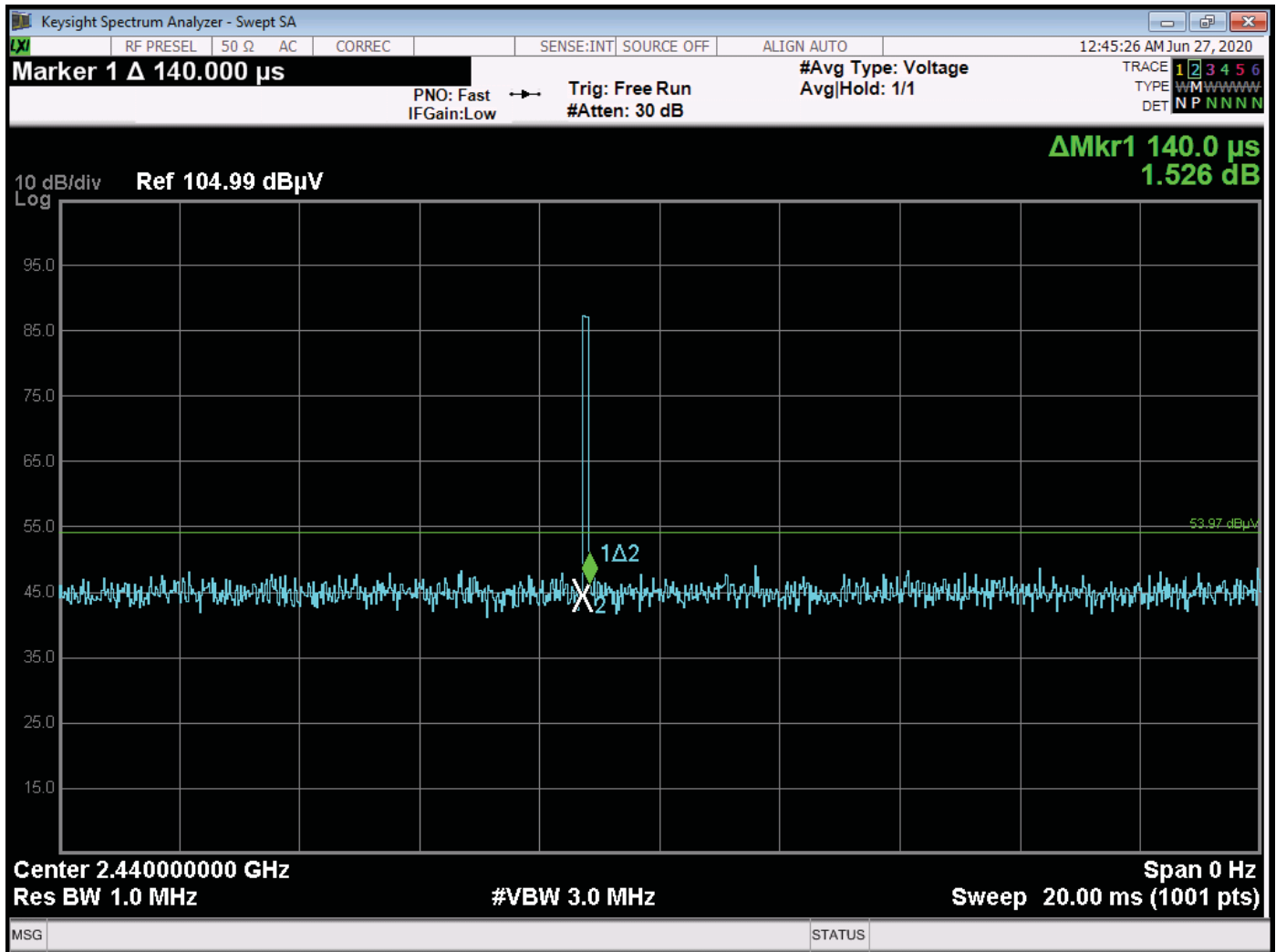
Time of One Pulse = 220 us – Advertising Mode



The pulse train repeats every 3.780 ms – Advertising Mode

Duty Cycle = 220 us / 3780 us = 5.82%

The maximum -20 dB peak to average ratio can be utilized

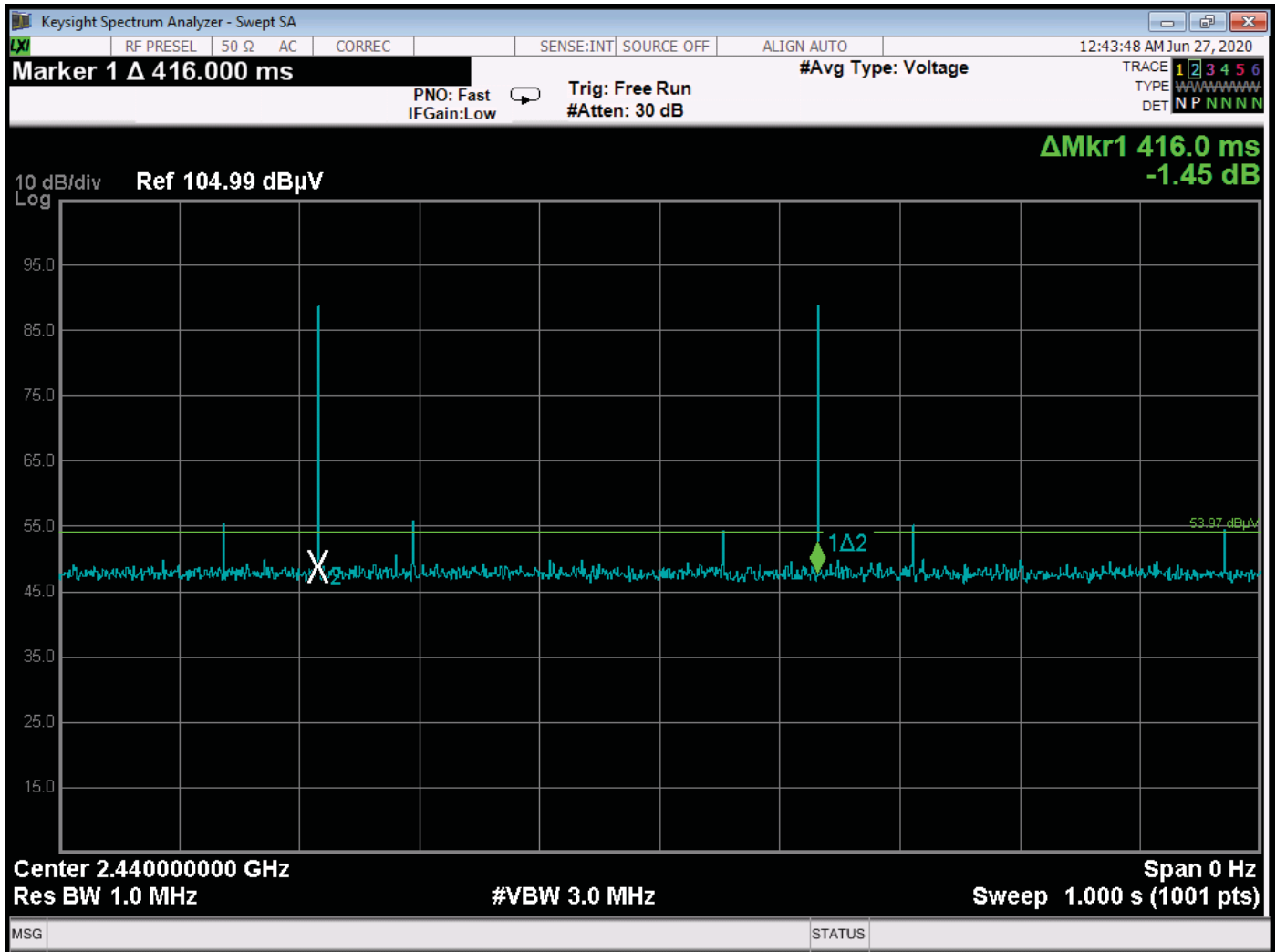


Time of One Pulse = 140 us – Data Mode

Brea Division
114 Olinda Drive
Brea, CA 92823
(714) 579-0500

Newbury Park Division
1050 Lawrence Drive
Newbury Park, CA 91320
(805) 480-4044

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400



The pulse train repeats every 416 ms – Data Mode

$$\text{Duty Cycle} = 140 \text{ us} / 4160 \text{ us} = 3.37\%$$

The maximum -20 dB peak to average ratio can be utilized