FCC PART 15, SUBPART B and C; RSS-247, RSS-GEN
TEST REPORT

for

INTELLIGENT WATER MONITORING BRIDGE

MODEL NUMBER: F2700

Prepared for

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DATE: MARCH 24, 2023

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GENERAL REPORT SUMMARY

This electromagnetic emission 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 in any form except in full, without the written permission of Compatible Electronics.

This report must not be used by the client to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the U.S. Government.

Device Tested:	Intelligent Water Monitoring Bridge Model: F2700 S/N: None
Product Description:	This system remotely monitors water usage in real time by utilizing a Flume Sensor attached to a water meter. The Bridge interfaces with the sensor and the customer's WiFi network. It contains a pre-certified module (FCC ID: 2AC7Z-ESP32WROOM32E, IC ID: 21098-ESPWROOM32E). Highest Frequency: 927 MHz (Dimensions: 1.5" x 2.5" x 3.3")
Modifications:	The EUT was not modified during the testing in order to comply with the specifications.
Manufacturer:	Flume Inc. 75 Higuera St., STE 120 San Luis Obispo, CA 93401
Test Dates:	March 1, 2, 3, 6 and June 15 & 30, 2023

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Innovation, Science and Economic Development Canada

Lab Code 22209

Test Specifications covered by accreditation:

Emissions requirements
CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, 15.247, RSS Gen Issue 5 2018 + A1: 2019 & A2: 2021 and RSS 247 Issue 2 2017
Test Procedure: ANSI C63.4: 2014, ANSI C63.10: 2013 and KDB 558074 D01 v05r02

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz	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	Radiated RF Emissions, 9 kHz – 24.8 GHz	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, 15.205, 15.209 and 15.247 (d)
3	20 dB Bandwidth	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
4	Peak Power Output	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (b)(2)
5	RF Conducted Antenna Test	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (d)
6	Carrier Frequency Separation	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)
7	Average Time of Occupancy	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
8	Number of Hopping Frequencies	Complies with the requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
9	Variation of Input Power	Complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.31 (e), RSS-247 and RSS-GEN.

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the Intelligent Water Monitoring Bridge, Model Number: F2700. 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; 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 consideration 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, 1050 Lawrence Drive, Newbury Park, California 91320.

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

Flume Inc.

Alan Beverly	Engineering Manager

Compatible Electronics Inc.

Reynald O. Ramirez	Sr. Test Engineer
Ruby Hall	Lab Manager

2.4 Date Test Sample Was Received

The test sample was received on March 3, 2023. Received as described in product description.

2.5 Disposition of the Test Sample

The test sample remains at Compatible Electronics.

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
NCR	No Calibration Required

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
RSS Gen, Issue 5: 2018 + A1: 2019 & A2: 2021	General Requirements for Compliance of Radio Apparatus
RSS-247, Issue 2: 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices
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 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
EN 50147-2: 1997	Anechoic chambers. Alternative test site suitability with respect to site attenuation

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – Emissions

The EUT was tested in a tabletop configuration. The Bridge (EUT) communicates with the Sensor using frequency hopping across 902-928 MHz. This channel is used for Sensor configuration and data reporting. The Bridge, in turn, interfaces with the custormer's WiFi network at 2.4 GHz. During the testing an application was used to change the low, mid and high channel parameters. Once selected the EUT transmits only at the selected channel.

During single channel spurious emissions testing, all three channels of the 900 MHz FHSS were tested, and the final data was set on the worst-case channel (915 MHz). Please see Appendix E for the data sheets.

During conducted emissions testing, the 900 MHz FHSS was tested, and the final data was set on the worst case emissions channel (915 MHz). Please see Appendix E for the data sheets.

During spurious emissions co-location testing, the Bridge and the Sensor were tested together operating at its normal condition to show compliance with FCC rules. In this configuration, the 900 MHz FHSS, RX mode and WiFi were enabled. Please Appendix E for the data sheets.

The EUT was also checked in receive mode on the low, mid and high channels for the 900 MHz FHSS.

For direct measurement portion of the test – The EUT was directly connected to the EMI receiver. A special program was used to control the channel of the transmitter.

The radiated final as well as the conducted data for the EUT were taken in the worst-case configuration described above. Please see Appendix E for the data sheets.

4.1.1 Cable Construction and Termination

Cable 1

This is a 1.5-meter, round cable that connects the EUT to the AC adapter. The cable has a micro-USB connector at the EUT end and is hardwired at the AC adapter end.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
INTELLIGENT WATER MONITORING BRIDGE (EUT)	FLUME INC.	F2700	N/A	FCC ID: 2AOX8-F2700 IC: 26125-F2700
PRE-CERTIFIED MODULE	ESPRESSIF INC.	ESP32-WROOM-32E	NONE	FCC ID: 2AC7Z-ESP32WROOM32E IC: 21098-ESPWROOM32E
AC ADAPTER	GENERIC (NO NAME)	GEO151UB-6025	NONE	N/A

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
TDK Emissions Lab Software	TDK RF Solutions, Inc.	TDK Emissions Lab	Version: 10.78	NCR	NCR
EMI Receiver	Agilent	N9038A	MY51100115	Jan 11, 2023	Jan 11, 2025
LISN (EUT)	Com-Power	LI-215A	191989	Jan. 24, 2023	Jan. 24, 2025
LISN (ACC)	Com-Power	LI-215A	191983	Jan. 24, 2023	Jan. 24, 2025
10 dB Attenuator	Weinschel Corp.	2	BH8161	Jul. 05, 2022	Jul. 05, 2023
Active Loop Antenna	Com-Power	AL-130R	10160065	Aug. 03, 2021	Aug. 03, 2023
Combi-Log Antenna	Com-Power	AC-220	10030030	Jan. 29, 2022	Jan. 29, 2024
Antenna Cable	Belden	RG-214/U	A/N: 6014	Feb. 08, 2022	Feb. 08, 2024
Horn Antenna	Com-Power	AH-118	071370	Jun. 20, 2022	Jun. 20, 2024
Preamplifier	Com-Power	PAM-118A	551015	Jan. 20, 2022	Jan. 20, 2024
Preamplifier	Com-Power	PAM-118	443009	Jan. 04, 2022	Jan. 04, 2024
Horn Antenna	Com-Power	AH-826	081081	NCR	NCR
Preamplifier(backup)	Com-Power	PA-840	711883	Jan. 17, 2022	Jan. 17, 2024
Preamplifier	Com-Power	PAM-840	461268	Jan. 17, 2022	Jan. 17, 2024

5.3 Emissions Test Equipment (continued)

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
High Freq. Antenna Cables	SucoFlex	102_EA	A/N: 6012 & 6013	Feb. 07, 2022	Feb. 07, 2024
902-928 MHz 60 dB Notch Filter	Microwave Circuits	N0309154	495405-495406	NCR	NCR
3-20 GHz Highpass Filter	Microwave Circuits	H3G020G4	495523-	NCR	NCR
Turntable	EMCO	2088-2.03	None	NCR	NCR
Antenna Mast	EMCO	2075-2	None	NCR	NCR
Multi-Device Controller	ETS EMCO	2090	9511-1095	NCR	NCR
Temperature and Humidity Indicator	Abbeon	HTAB169B	3428	Sep. 09, 2022	Sep. 09, 2023
Barometer	Maximum	Predictor	3429	May 20, 2022	May 20, 2023
Computer	Dell	Vostro 3900	Asset# 3423	NCR	NCR

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1.2 of this report for test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5-meter non-conductive table 0.8 meters above the ground plane.

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

The EUT was not grounded.

6.3 Measurement Uncertainty

"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}	$U_{lab} = 2\,uc\,(y)$
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	3.12 dB (Vertical) 3.07 dB (Horizontal)
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz - 6 GHz)	5.2 dB	3.13 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5.5 dB	3.13 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26 GHz)	N/A	3.57 dB

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Channel Description and Frequencies

The EUT operates on 50 channels. The low channel is 902.5 MHz, the middle channel is 915 MHz and the high channel is 927 MHz. The EUT also uses a pre-certified 2.4 GHz WiFi module.

7.2 Antenna

The antenna is an inverted F with a gain of 0.9 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. The data was collected with the EMI Receiver in the peak detect mode with the "Max Hold" feature activated. The quasi-peak or average was used only were indicated in the data sheets. A 10-dB attenuation pad was used for the protection of the EMI Receiver input stage, and the EMI Receiver offset was adjusted accordingly to read the actual data measured. The EMI Receiver read the LISN output. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for the conducted emissions 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 initial test data was taken in manual mode while scanning the frequency ranges of 0.15 MHz to 1.6 MHz, 1.6 MHz to 5 MHz and 5 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable placement. Once a predominant frequency (within 12 dB of the limit) was found, it was more closely examined with the EMI Receiver span adjusted to 1 MHz.

The final data was collected under program control by the computer in several overlapping sweeps by running the EMI Receiver at a minimum scan rate of 10 seconds per octave. The six highest emissions are listed in Table 1.0.

Test Results:

The EUT complied with the requirements as specified in the Summary of Test Results starting on page 5.

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 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 frequencies above 1 GHz were averaged by using the linear average detector function on the EMI Receiver.

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.

The six highest readings are listed in Table 2.

Test Results:

The EUT complied with the requirements as specified in the Summary of Test Results starting on page 5.

8.1.3 RF Emissions Test Results

Table 1.0 CONDUCTED EMISSION RESULTS 120V AC Intelligent Water Monitoring Bridge
Model Number: F2700

Frequency MHz	Emission Level* dBuV	Average Specification Limit dBuV	Delta (Emission-Spec limit) dB
0.15	37.75**A**	55.87	-18.12
0.23	33.99**A**	52.76	-18.77
0.32	30.24**A**	49.69	-19.45
0.39	25.30**A**	48.07	-22.77
0.50	27.53**A**	46.14	-18.61
0.77	22.21**A**	46.00	-23.70

Table 2.0 RADIATED EMISSION RESULTS Intelligent Water Monitoring Bridge
Model Number: F2700
(worst case findings)

Frequency MHz	Corrected Reading* dBuV/m	Specification Limit dBuV/m	Delta (Cor. Reading – Spec. Limit) dB
54.80	33.91#	40.00	-6.09
56.40	35.15#	40.00	-4.85
65.90	32.56#	40.00	-7.44
1854.00	47.47A	54.93	-7.46
2745.00	51.66A	54.93	-3.27
2781.00	51.44A	54.93	-3.49

Notes:

* The complete emissions data is given in Appendix E of this report.

** The factors for the antenna and preamplifier gain are attached in Appendix D of this report.

\# Quasi-Peak Reading
A Average Reading

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 (μV/m) log x 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 x 40 = distance factor

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

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.

9 TEST PROCEDURES

9.1 20 dB Bandwidth

The 20 dB Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from the RF output of the EUT.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
d) Steps a) through c) might require iteration to adjust within the specified tolerances.
e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
f) Set detection mode to peak and trace mode to max hold.
g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
h) Determine the "−xx dB down amplitude" using [(reference value) − xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.
i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "−xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "−xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(i), RSS-247 and RSS-GEN. The 20 dB bandwidth is less than 500 kHz. Please see the data sheets located in Appendix E.

9.2 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 greater than the 20 dB bandwidth and the video bandwidth was ≥ RBW. The cable loss was also added back into the reading using the reference level offset.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b)(2), RSS-247 and RSS-GEN. The maximum peak output power is less than 1 watt. Please see the data sheets located in Appendix E.

9.3 RF Antenna Conducted Test

The RF antenna conducted test was performed using the EMI Receiver. The RF antenna conducted test measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The resolution bandwidth was 100 kHz, and the video bandwidth was 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d), RSS-247 and RSS-GEN. Please see the data sheets located in Appendix E.

9.4 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (902 MHz when the EUT was on the low channel and 928 MHz when the EUT was on the high channel) using the EMI Receiver. The RBW was set to 100 kHz and the VBW was set to 300 kHz. Plots of the fundamental were taken to ensure the amplitude at the band edges were at least 20 dB down from the peak of the fundamental emission. The plots were taken in both frequency hopping mode and single channel mode.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d), RSS-247 and RSS-GEN. Please see the data sheets located in Appendix E.

9.5 Carrier Frequency Separation

The Channel Hopping Separation Test was measured using the EMI Receiver. The EUTs hopping function was enabled.

a) Span: Wide enough to capture the peaks of two adjacent channels.
b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
c) Video (or average) bandwidth (VBW) ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1), RSS-247 and RSS-GEN. The Channel Hopping Separation is greater than the 20 dB bandwidth. Please see the data sheets located in Appendix E.

9.6 Number of Hopping Frequencies

The Number of Hopping Frequencies was measured using the EMI Receiver. The EUTs hopping function was enabled.

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
c) VBW ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1) and 15.247 (a)(1)(i), RSS-247 and RSS-GEN. Please see the data sheets located in Appendix E.

9.7 Average Time of Occupancy Test

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / *T*, where *T* is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.
Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.
Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:
(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)
The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.
The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

Test Results:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(i), RSS-247 and RSS-GEN. Please see the data sheets located in Appendix E.

9.8 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:

The EUT complies with the requirements of FCC Title 47, Part 15, Subpart C section 15.31 (e), RSS-247 and RSS-GEN.

9.9 Occupied Bandwidth

The following steps were performed for measuring the Occupied Bandwidth.

a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
d) Step a) through step c) might require iteration to adjust within the specified range.
e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data maybe reported in addition to the plot(s).

Test Results:

Please note that this was only used to determine the emission bandwidth and that there are no limits or pass/fail criteria for this test. Please see the data sheets located in Appendix E.

10 CONCLUSIONS

The Intelligent Water Monitoring Bridge , Model Number: F2700 (EUT), 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; RSS-247 and RSS-Gen.

APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

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/

NVLAP TESTING
NVLAP LAB CODE 200063-0

ilac-MRA

Quote from ISO-ILAC-IAF Communiqué on the Management Systems Requirements of ISO/IEC 17025, General Requirements for the competence of testing and calibration laboratories:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025 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 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001"

Innovation, Science and Economic Development Canada Lab Code 22209

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

There were no modifications made to the EUT.

APPENDIX C

ADDITIONAL MODELS

ADDITIONAL MODELS

Used for the Primary Test: Intelligent Water Monitoring Bridge
Model: F2700
S/N: None

No Additional models.

APPENDIX D

DIAGRAMS AND CHARTS

FIGURE 1: LAYOUT OF THE SEMI-ANECHOIC TEST CHAMBER

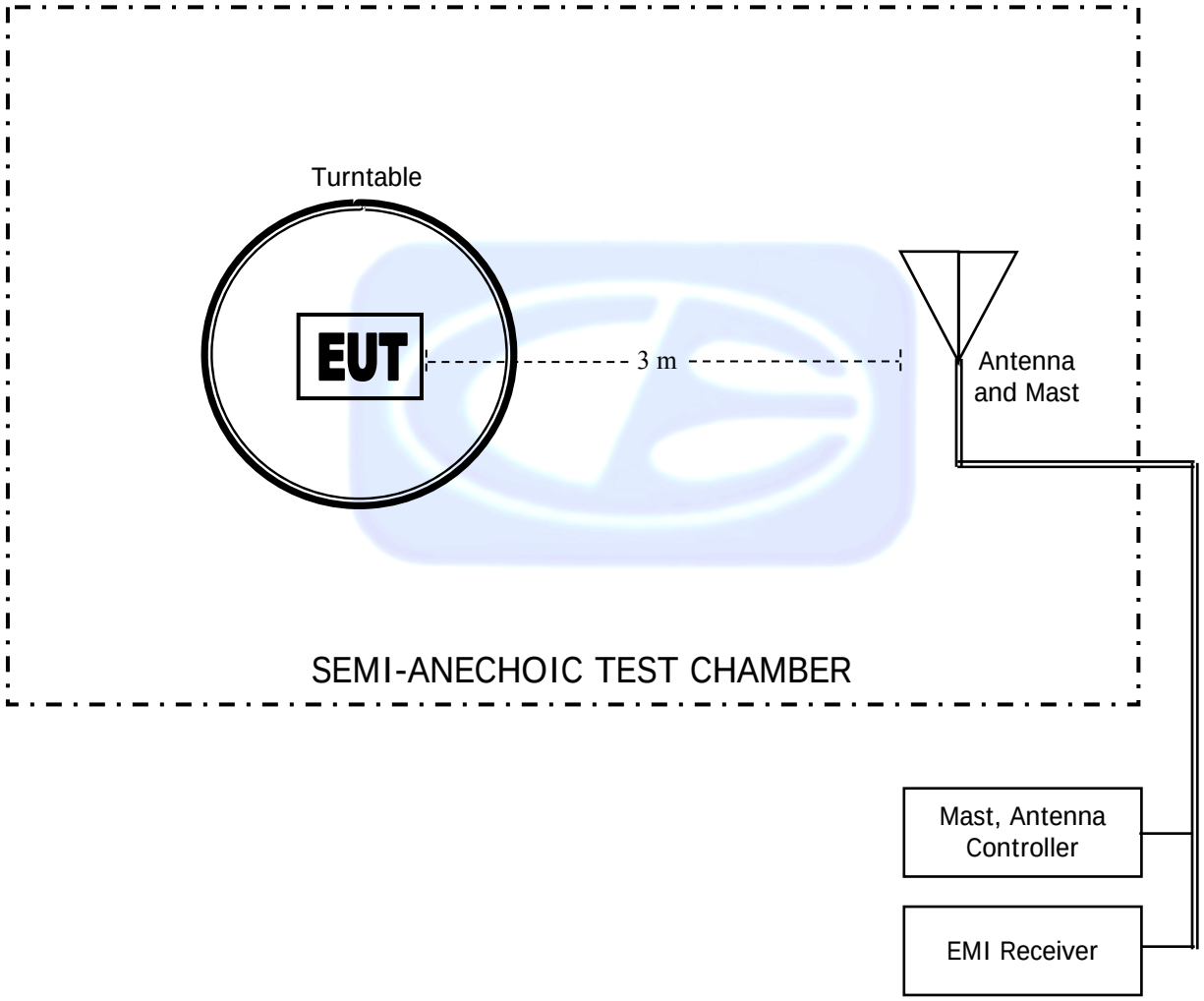
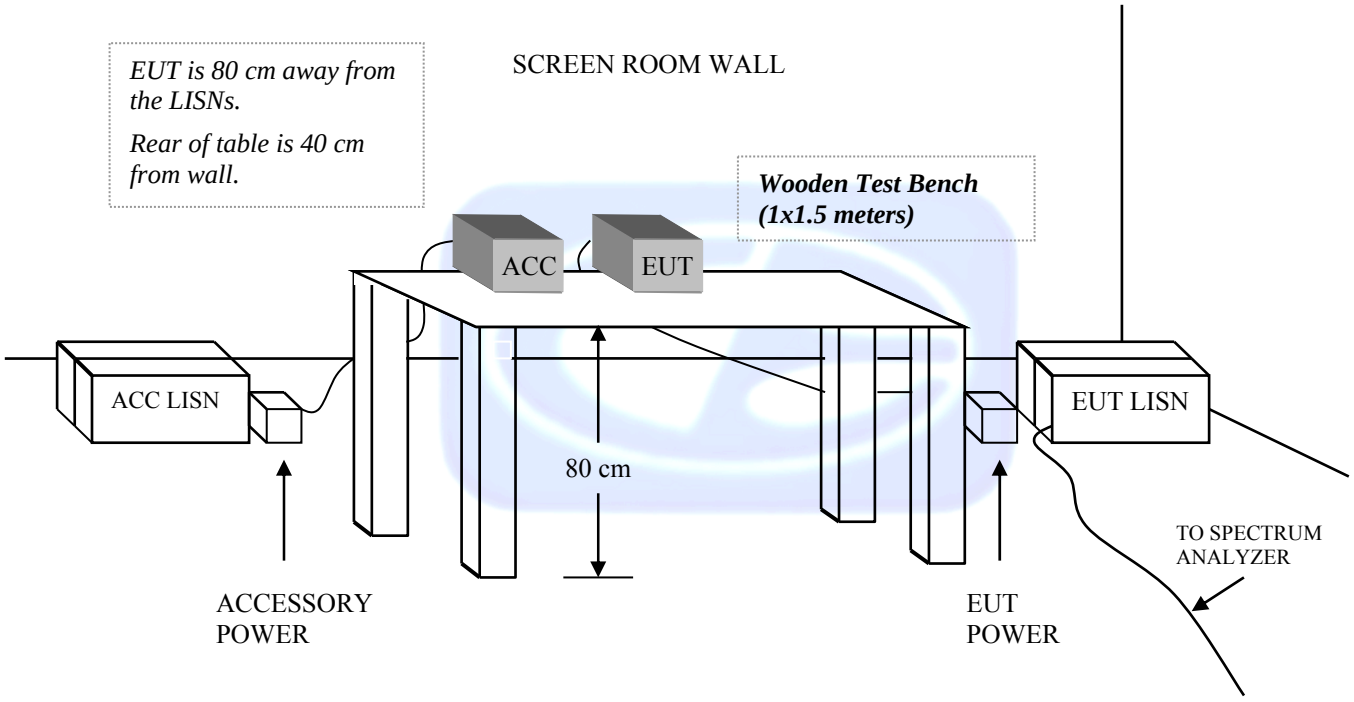


FIGURE 2: CONDUCTED EMISSIONS TEST SETUP



COM-POWER AL-130R

ACTIVE LOOP ANTENNA

S/N: 10160065

CALIBRATION DATE: AUGUST 3, 2021

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
0.009	15.68	1	14.54
0.01	15.33	2	14.53
0.02	14.77	3	14.53
0.03	15.69	4	14.64
0.04	15.17	5	14.65
0.05	14.52	6	14.55
0.06	14.71	7	14.56
0.07	14.42	8	14.56
0.08	14.44	9	14.56
0.09	14.52	10	14.88
0.1	14.12	15	14.56
0.2	14.13	20	14.90
0.3	14.04	25	13.06
0.4	14.04	30	13.03
0.5	14.23		
0.6	14.23		
0.7	14.23		
0.8	14.14		
0.9	14.34		

COM-POWER AC-220

COMBI-LOG ANTENNA

S/N: 10030030
ASSET: 6037

CALIBRATION DATE: JANUARY 29, 2022

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.3	450	21.5
35	21.3	500	22.1
40	20.5	550	22.8
45	19.7	600	24.3
50	18.6	650	24.4
60	14.9	700	24.4
70	11.8	750	26.1
80	11.8	800	26.3
90	13.6	850	26.0
100	14.4	900	27.6
120	15.6	950	28.5
140	14.2	1000	28.3
160	14.1		
180	14.8		
200	15.3		
225	15.8		
250	16.7		
275	18.4		
300	18.5		
350	19.5		
400	20.7		

AH-118

DOUBLE RIDGE HORN ANTENNA

S/N: 071370

CALIBRATION DATE: JUNE 20, 2022

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
1000	24.06	10000	39.24
1500	25.16	10500	39.47
2000	28.25	11000	39.21
2500	28.54	11500	39.96
3000	29.67	12000	40.49
3500	30.58	12500	40.04
4000	31.56	13000	40.25
4500	32.17	13500	40.19
5000	33.40	14000	40.72
5500	33.88	14500	42.04
6000	34.29	15000	41.29
6500	34.89	15500	39.52
7000	36.92	16000	39.58
7500	37.40	16500	39.31
8000	37.65	17000	41.01
8500	37.97	17500	43.31
9000	37.92	18000	45.26
9500	38.63		

AH-826

HORN ANTENNA

S/N: 081081

FREQUENCY (MHz)	FACTOR (dB)
18000	36.6
18500	36.0
19000	36.1
19500	19.0
20000	38.6
20500	37.2
21000	37.6
21500	37.6
22000	37.4
22500	37.9
23000	37.4
23500	36.7
24000	37.4
24500	37.7
25000	38.3
25500	38.0
26000	38.2
26500	38.1

COM-POWER PAM-118A

PREAMPLIFIER

S/N: 551015

CALIBRATION DATE: JANUARY 20, 2022

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
500	39.86	7500	37.03
1000	39.80	8000	36.06
1100	40.25	8500	36.09
1200	39.77	9000	35.68
1300	40.12	9500	37.53
1400	39.93	10000	36.66
1500	40.05	11000	36.94
1600	40.00	12000	37.06
1700	40.03	13000	36.88
1800	40.40	14000	36.33
1900	40.02	15000	37.06
2000	39.74	16000	38.32
2500	39.95	17000	38.32
3000	39.99	18000	38.17
3500	39.92		
4000	39.58		
4500	39.00		
5000	38.28		
5500	37.42		
6000	37.18		
6500	37.00		
7000	36.95		

COM-POWER PAM-118

PREAMPLIFIER

S/N: 443009

CALIBRATION DATE: JANUARY 4, 2022

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
500	25.6	9500	21.5
1000	24.0	10000	21.8
1100	24.3	11000	21.3
1200	25.0	12000	21.0
1300	25.2	13000	19.8
1400	24.9	14000	19.0
1500	24.5	15000	19.8
1600	24.8	16000	20.1
1700	24.8	17000	19.3
1800	24.5	18000	18.5
1900	25.2		
2000	24.9		
2500	24.9		
3000	24.9		
3500	24.7		
4000	24.6		
4500	23.8		
5000	23.6		
5500	22.5		
6000	21.5		
6500	20.6		
7000	20.3		
7500	20.7		
8000	21.4		
8500	22.1		
9000	22.5		

COM-POWER PAM-840

PREAMPLIFIER

S/N: 461268

CALIBRATION DATE: JANUARY 17, 2022

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
18000	22.3	31500	20.8
19000	22.0	32000	21.0
20000	23.2	32500	20.4
21000	24.5	33000	20.3
22000	24.2	33500	20.3
23000	23.1	34000	18.6
24000	23.7	34500	20.3
25000	22.2	35000	19.7
26000	20.6	35500	19.2
26500	21.3	36000	20.9
27000	21.3	36500	21.4
27500	21.5	37000	20.4
28000	21.9	37500	20.7
28500	21.7	38000	20.6
29000	21.6	38500	19.6
29500	21.5	39000	19.7
30000	21.3	39500	20.0
30500	21.0	40000	19.6
31000	21.0		

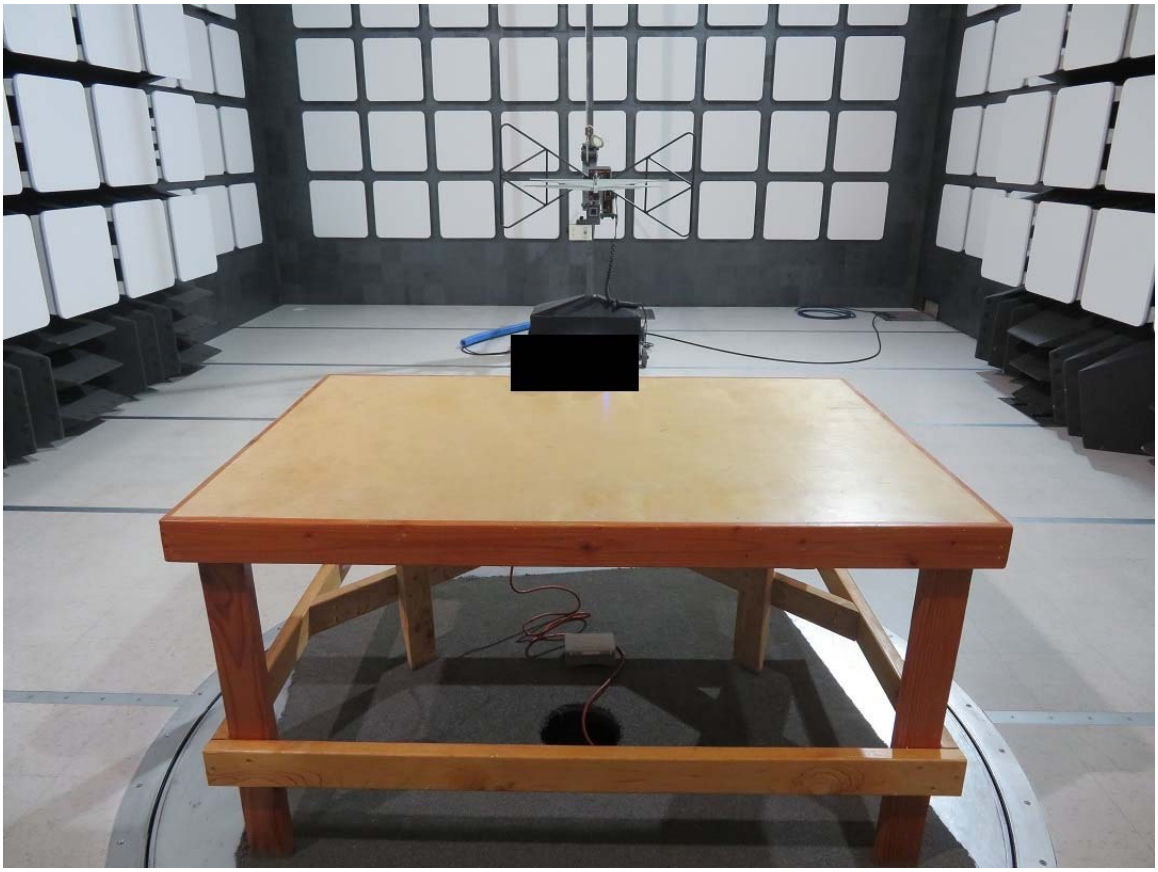
COM-POWER PA-840

PREAMPLIFIER

S/N: 711883

CALIBRATION DATE: JANUARY 17, 2022

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
18000	28.9	33500	25.3
19000	29.0	34000	25.2
20000	28.7	34500	25.7
21000	27.4	35000	25.8
22000	26.8	35500	26.8
23000	27.0	36000	27.4
24000	27.3	36500	27.2
25000	28.8	37000	29.0
26000	28.9	37500	29.6
26500	28.3	38000	29.5
27000	28.4	38500	27.7
27500	27.9	39000	28.2
28000	27.7	39500	27.4
28500	27.8	40000	27.4
29000	27.8		
29500	27.5		
30000	26.8		
30500	27.3		
31000	26.1		
31500	26.2		
32000	26.4		
32500	26.5		
33000	25.0		



FRONT VIEW

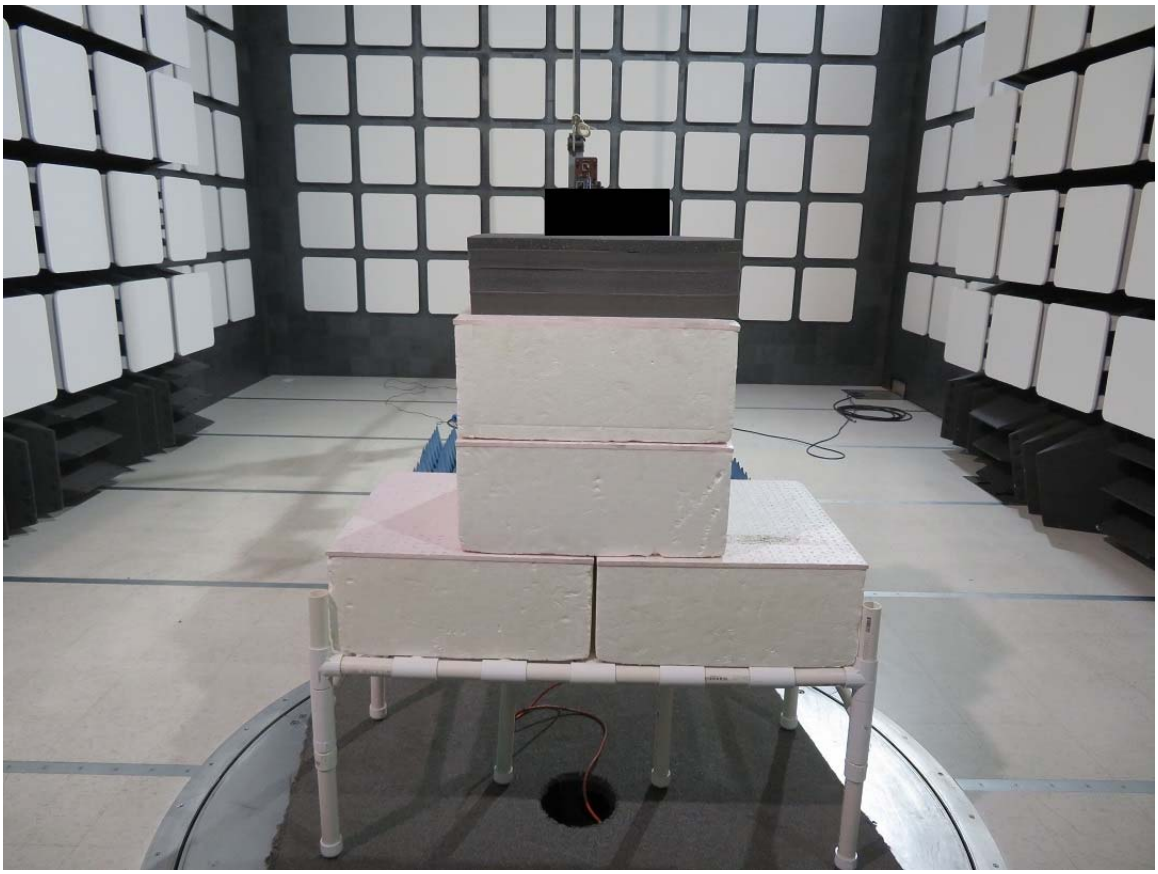
FLUME INC.
INTELLIGENT WATER MONITORING BRIDGE
MODEL NUMBER: F2700
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

FLUME INC.
INTELLIGENT WATER MONITORING BRIDGE
MODEL NUMBER: F2700
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

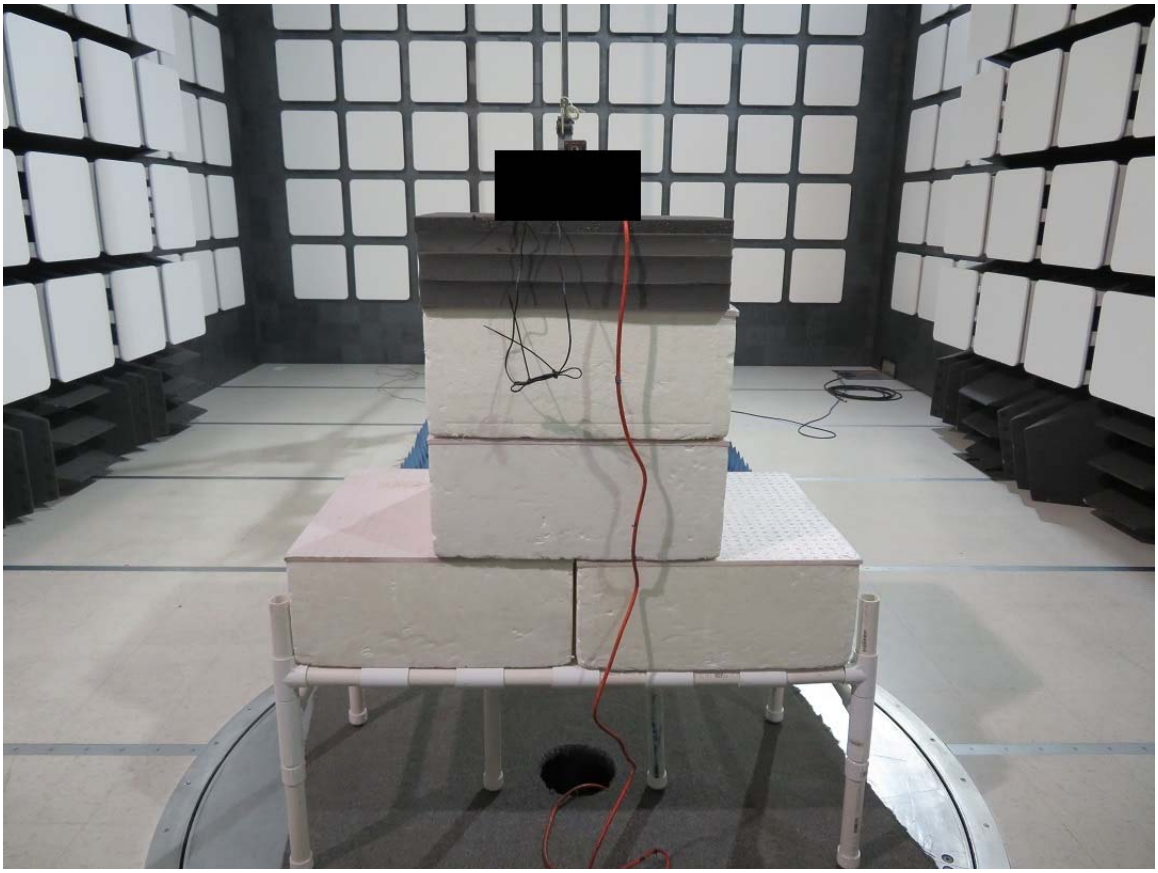
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

FLUME INC.
INTELLIGENT WATER MONITORING BRIDGE
MODEL NUMBER: F2700
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

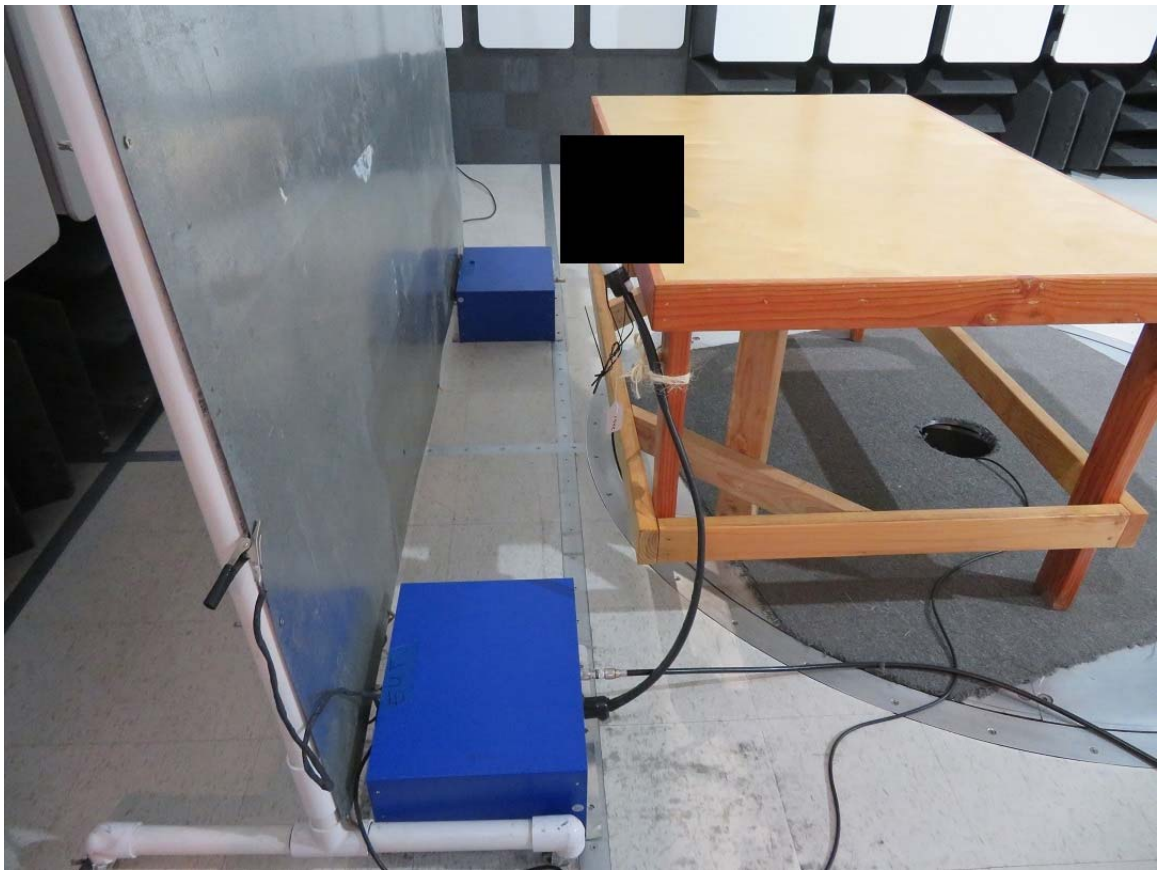
FLUME INC.
INTELLIGENT WATER MONITORING BRIDGE
MODEL NUMBER: F2700
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

FLUME INC.
INTELLIGENT WATER MONITORING BRIDGE
MODEL NUMBER: F2700
FCC SUBPART B - CONDUCTED EMISSIONS – 3-3-23

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

FLUME INC.
INTELLIGENT WATER MONITORING BRIDGE
MODEL NUMBER: F2700
FCC SUBPART B - CONDUCTED EMISSIONS – 3-3-23

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

APPENDIX E

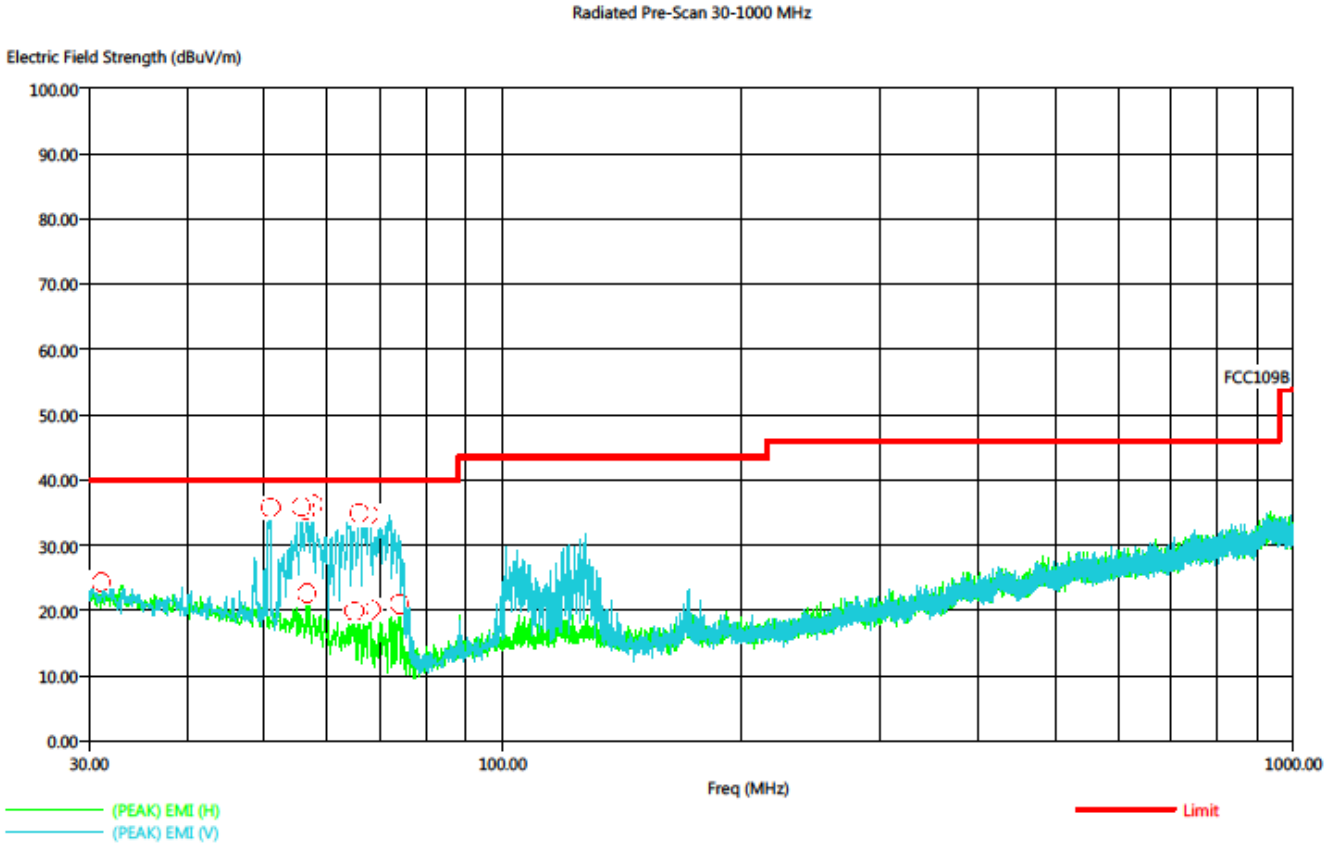
DATA SHEETS

RADIATED EMISSIONS

DATA SHEETS
(hopping and WiFi enabled)

Title: Radiated Pre-Scan 30-1000 MHz
File: Radiated Pre-Scan 30-1000 MHz Bridge hopping
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge (hopping), WiFi enabled
Comments: Lab T
Clock Oscillators: 915 MHz & 2.4 GHz
Company: Flume Inc.
Model: F2700
Temperature: 52 F Humidity: 62 % Pressure: 29.2 inHg
Tested to: 24 GHz (no frequencies found above 1 GHz)

3/1/2023 8:34:29 AM
Sequence: Preliminary Scan



Title: Radiated Final 30-1000 MHz
File: Radiated Final 30-1000 MHz Bridge hopping
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge (hopping), WiFi enabled
Comments: Lab T
Clock Oscillators: 915 MHz & 2.4 GHz
Company: Flume Inc.
Model: F2700
Temperature: 52 F Humidity: 62 % Pressure: 29.2 inHg
Tested to: 24 GHz (no frequencies found above 1 GHz)

3/1/2023 8:44:58 AM
Sequence: Final Measurements

Data

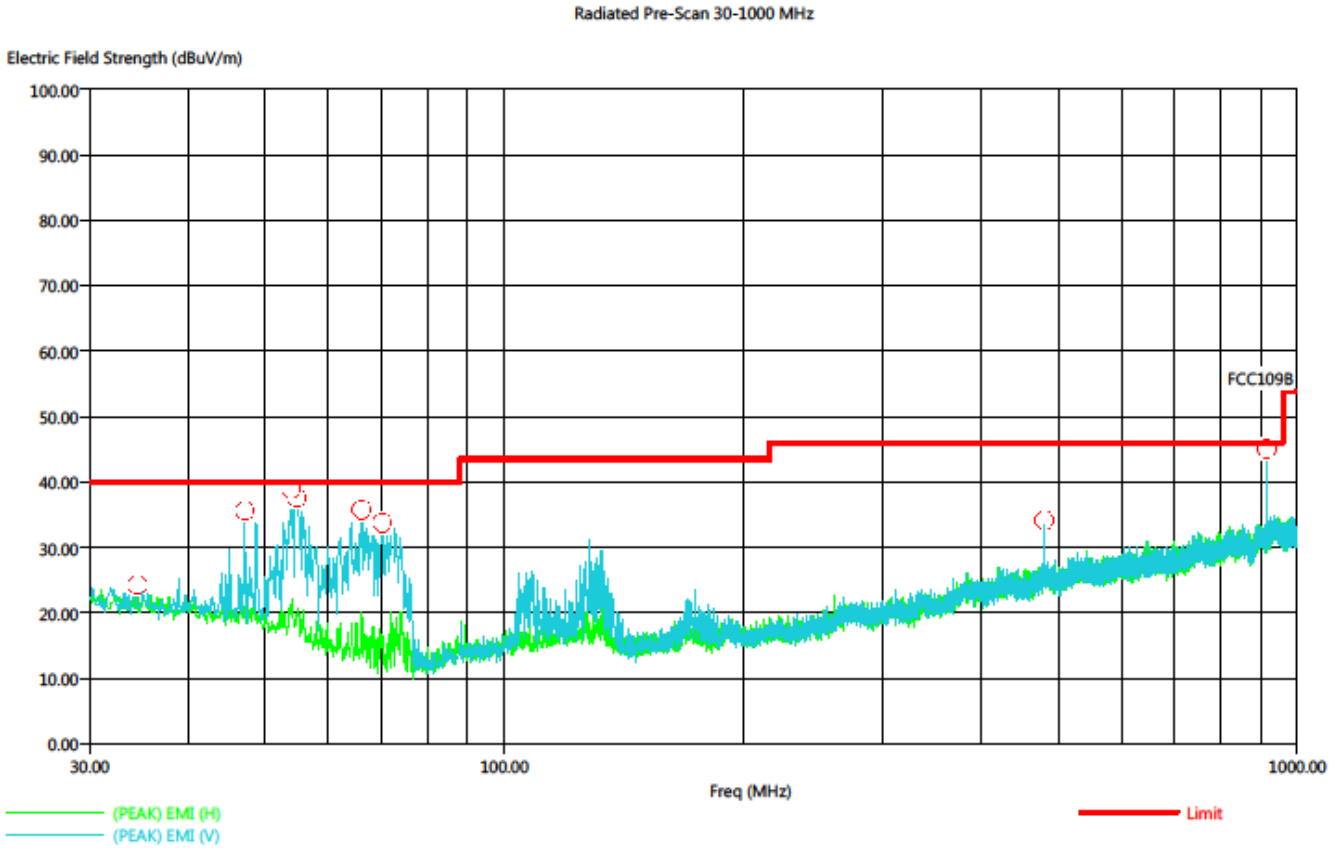
Freq (MHz)	Pol	(PEAK) Trace (dBuV)	Cable (dB)	Transducer (dB)	(PEAK) EMI (dBuV/m)	(QP) EMI (dBuV/m)	Limit (dBuV/m)	(QP) Margin (dB)	Ttbl Aql (deg)	Twr Ht (cm)
31.10	H	0.77	0.72	21.59	23.08	19.52	40.00	-20.48	66.00	288.50
50.90	V	16.50	0.79	17.91	35.20	29.21	40.00	-10.79	359.00	153.00
55.70	V	16.48	0.82	16.28	33.58	28.80	40.00	-11.20	3.30	209.00
56.40	V	22.18	0.83	15.87	38.88	35.15	40.00	-4.85	36.40	127.00
56.60	H	6.51	0.83	15.86	23.20	19.81	40.00	-20.19	322.10	276.10
57.60	V	18.74	0.84	15.52	35.09	31.42	40.00	-8.58	199.00	132.90
65.00	H	5.56	0.91	12.81	19.28	14.09	40.00	-25.91	228.80	125.10
65.90	H	4.14	0.92	12.46	17.53	14.40	40.00	-25.60	233.20	309.80
65.90	V	23.99	0.93	12.38	37.29	32.56	40.00	-7.44	185.40	131.40
67.70	V	23.40	0.95	11.80	36.14	32.22	40.00	-7.78	201.20	144.30
68.10	H	8.45	0.94	11.87	21.27	16.83	40.00	-23.17	265.50	343.70
74.10	H	10.71	0.99	10.62	22.32	17.11	40.00	-22.89	212.60	285.10

1

RADIATED EMISSIONS SINGLE CHANNEL (worst case findings)

Title: Radiated Pre-Scan 30-1000 MHz
File: Radiated Pre-Scan 30-1000 MHz Bridge 915
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge (915), WiFi enabled
Comments: Lab T
Clock Oscillators: 915 MHz & 2.4 GHz
Company: Flume Inc.
Model: F2700
Temperature: 62 F Humidity: 46 % Pressure: 29.3 inHg
Tested to: 24 GHz (no frequencies found above 1 GHz)

3/2/2023 8:30:28 AM
Sequence: Preliminary Scan



Title: Radiated Final 30-1000 MHz
File: Radiated Final 30-1000 MHz Bridge 915
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge (915), WiFi enabled
Comments: Lab T
Clock Oscillators: 915 MHz & 2.4 GHz
Company: Flume Inc.
Model: F2700
Temperature: 62 F Humidity: 46 % Pressure: 29.3 inHg
Tested to: 24 GHz (no frequencies found above 1 GHz)

3/2/2023 8:53:29 AM
Sequence: Final Measurements

Data

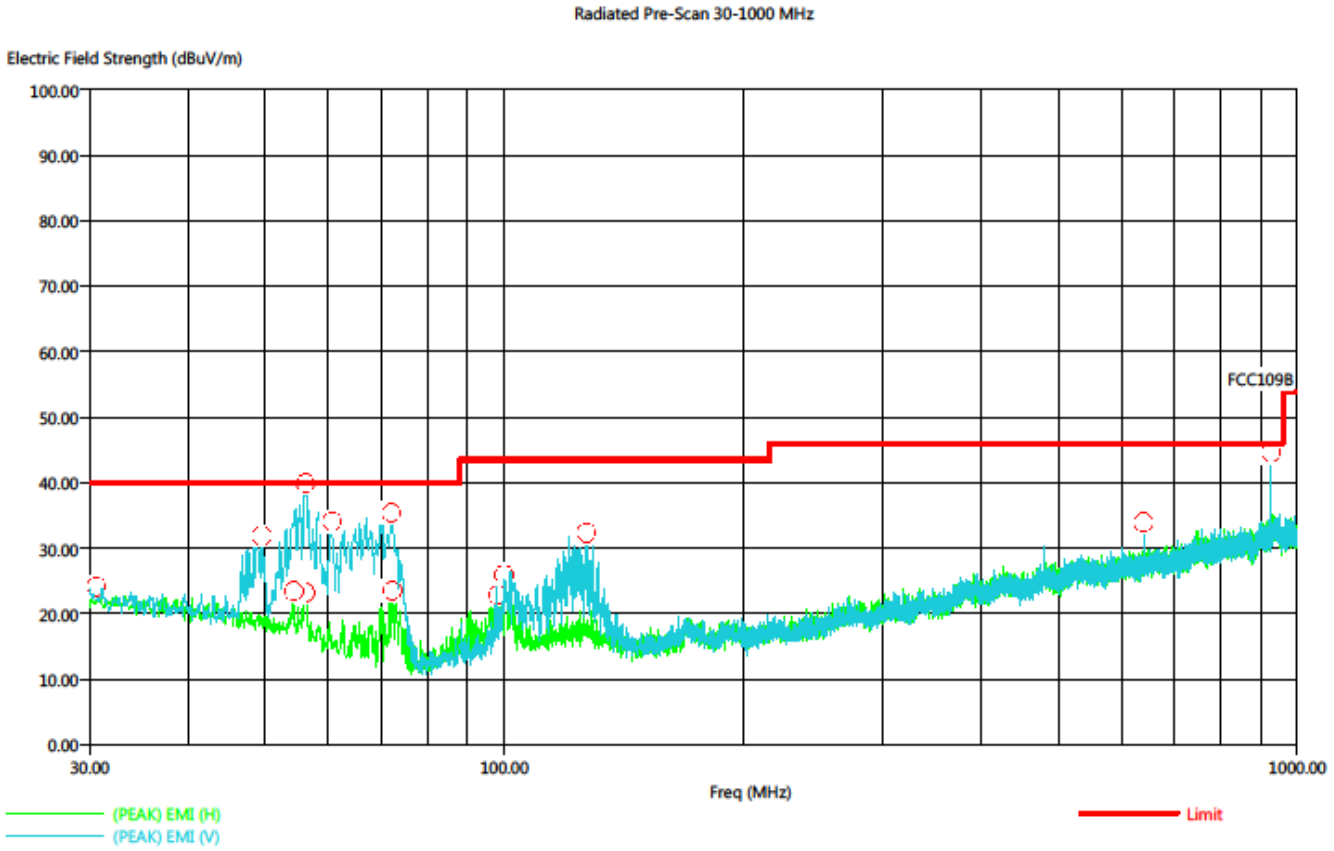
Freq (MHz)	Pol	(PEAK) Trace (dBuV)	Cable (dB)	Transducer (dB)	(PEAK) EMI (dBuV/m)	(QP) EMI (dBuV/m)	Limit (dBuV/m)	(QP) Margin (dB)	Ttbl Aql (deg)	Twr Ht (cm)
34.50	H	0.18	0.73	20.85	21.75	18.74	40.00	-21.26	5.20	340.40
47.10	V	11.16	0.78	18.62	30.55	23.79	40.00	-16.21	238.50	192.80
53.90	V	17.72	0.81	16.90	35.44	30.45	40.00	-9.55	177.70	191.50
54.80	V	19.77	0.82	16.60	37.19	33.91	40.00	-6.09	208.20	139.00
55.70	V	17.28	0.83	16.25	34.35	30.11	40.00	-9.89	38.30	142.60
66.10	H	5.34	0.92	12.39	18.65	15.24	40.00	-24.76	57.90	128.30
66.10	V	21.06	0.92	12.38	34.37	31.11	40.00	-8.89	358.70	147.50
72.10	H	9.17	0.98	10.89	21.04	17.30	40.00	-22.70	42.40	253.80
74.20	H	9.73	0.99	10.60	21.32	16.97	40.00	-23.03	17.90	279.50
133.10	H	1.80	1.29	14.89	17.98	14.76	43.52	-28.76	25.30	178.70
480.00	H	9.65	2.56	22.60	34.81	33.87	46.00	-12.13	220.70	123.50
480.00	V	9.95	2.56	22.60	35.11	33.18	46.00	-12.82	163.50	132.80

1

RADIATED EMISSIONS CO-LOCATION, HOPPING MODE AND RECEIVE MODE DATA SHEETS

Title: Radiated Pre-Scan 30-1000 MHz
File: Radiated Pre-Scan 30-1000 MHz co location
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Co-location, hopping, WiFi and receiving modes
Comments: Lab T
Clock Oscillators: 915 MHz & 2.4 GHz
Company: Flume Inc.
Model: F2700
Temperature: 52 F Humidity: 62 % Pressure: 29.2 inHg
Tested to: 24 GHz (no frequencies found above 1 GHz)

3/1/2023 12:06:12 PM
Sequence: Preliminary Scan



Title: Radiated Final 30-1000 MHz
File: Radiated Final 30-1000 MHz co location
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Co-location, hopping, WiFi and receiving modes
Comments: Lab T
Clock Oscillators:
Company: Flume Inc.
Model: F2700
Temperature: 52 F Humidity: 62 % Pressure: 29.2 inHg
Tested to: 24 GHz (no frequencies found above 1 GHz)

3/1/2023 12:17:38 PM
Sequence: Final Measurements

Data

Freq (MHz)	Pol	(PEAK) Trace (dBuV)	Cable (dB)	Transducer (dB)	(PEAK) EMI (dBuV/m)	(QP) EMI (dBuV/m)	Limit (dBuV/m)	(QP) Margin (dB)	Ttbl Aql (deg)	Twr Ht (cm)
30.60	H	0.75	0.72	21.60	23.07	19.73	40.00	-20.27	351.40	141.20
49.50	V	13.23	0.79	18.26	32.28	27.75	40.00	-12.25	0.00	144.30
54.30	H	6.03	0.82	16.68	23.53	17.91	40.00	-22.09	356.30	170.90
56.20	H	7.26	0.83	16.00	24.09	20.22	40.00	-19.78	295.30	125.10
56.20	V	22.10	0.83	16.00	38.93	35.59	40.00	-4.41	352.20	126.00
60.70	V	17.80	0.85	14.45	33.11	29.84	40.00	-10.16	167.10	123.50
72.10	V	24.07	0.98	10.90	35.95	33.03	40.00	-6.97	185.80	166.60
72.30	H	7.99	0.98	10.91	19.88	15.32	40.00	-24.68	87.20	123.50
98.30	H	7.63	1.09	13.96	22.68	17.11	43.52	-26.41	195.40	353.30
100.00	H	7.71	1.10	14.08	22.89	20.76	43.52	-22.76	164.60	237.50
127.00	V	14.62	1.27	15.50	31.39	28.53	43.52	-14.99	186.40	124.20
640.00	V	5.89	3.08	23.90	32.87	30.61	46.00	-15.39	74.00	122.10

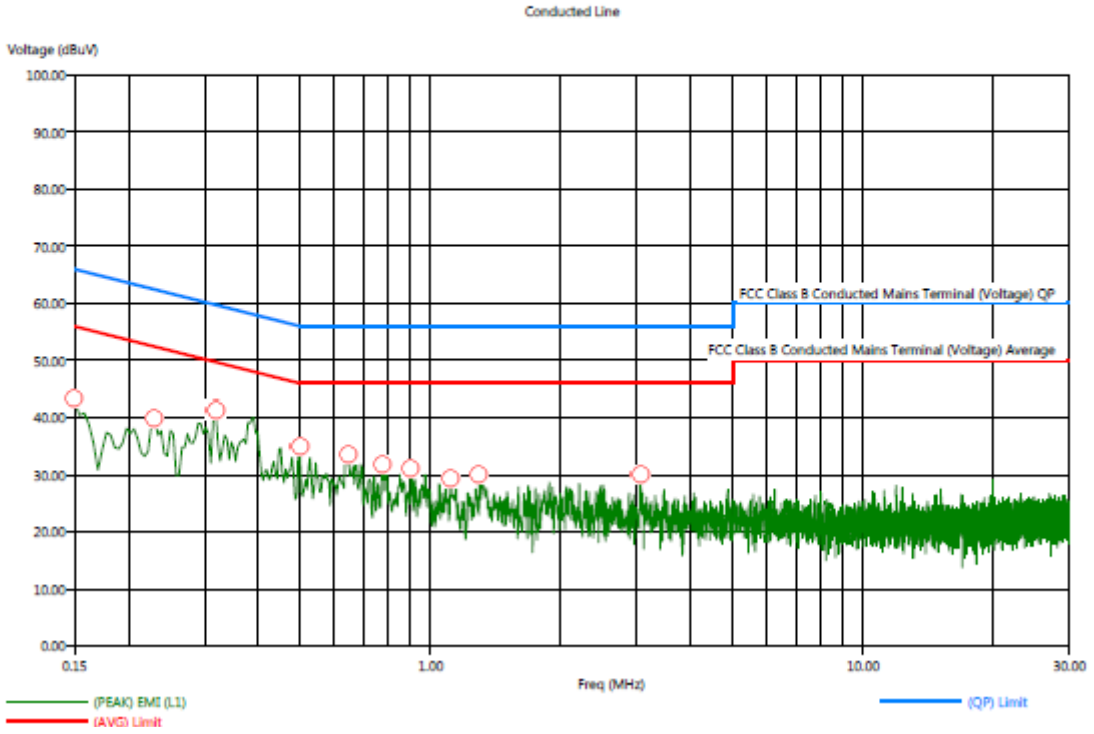
1

CONDUCTED EMISSIONS

DATA SHEETS

Title: Conducted Emissions - Line
File: Conducted - Pre-Test - Line 120
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge AC adapter, 915 MHz worst case
Comments: Lab T
Company: Flume Inc.
Model: F2700
Voltage: 120

3/3/2023 1:22:37 PM
Sequence: Preliminary Scan



Title: Conducted Emissions - Line
File: Conducted - Final Test - Line 120
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge AC adapter, 915 MHz worst case
Comments: Lab T
Company: Flume Inc.
Model: F2700
Voltage: 120

3/3/2023 1:24:11 PM
Sequence: Final Measurements

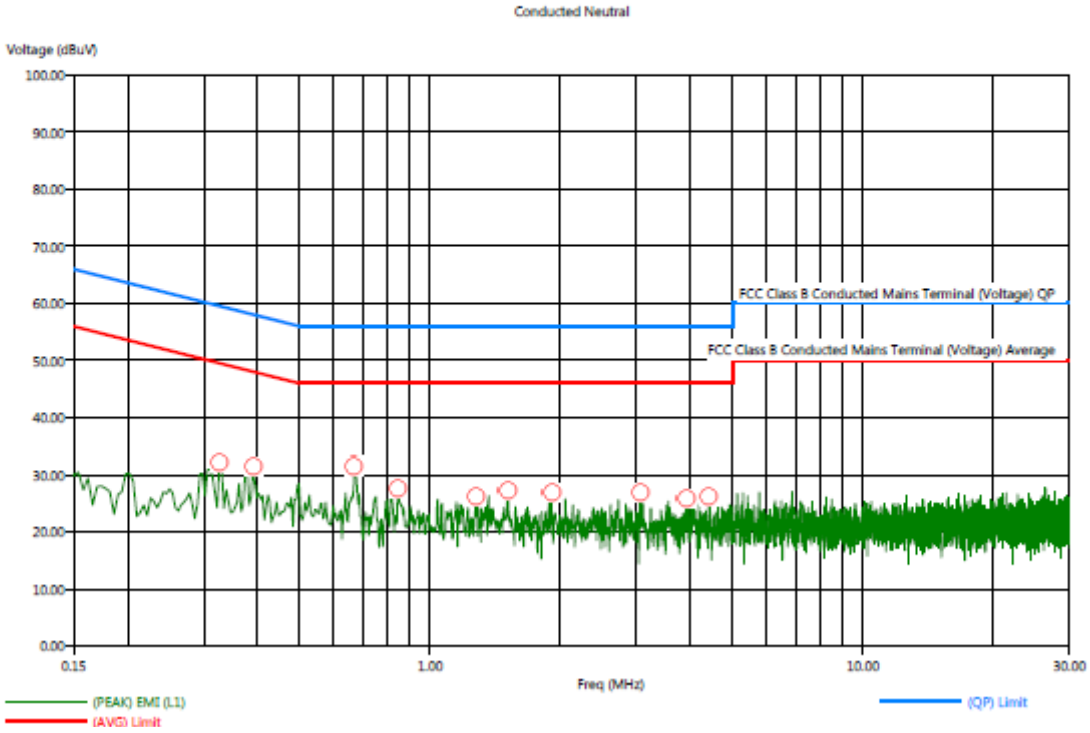
Data

Freq (MHz)	(PEAK) EMI (dBuV)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)
0.15	47.22	37.75	41.86	55.87	65.87	-18.12	-24.01
0.23	39.79	33.99	38.06	52.76	62.76	-18.77	-24.70
0.32	38.73	30.24	36.23	49.69	59.69	-19.45	-23.46
0.50	36.63	27.53	32.02	46.14	56.14	-18.61	-24.12
0.65	34.51	21.97	30.79	46.00	56.00	-24.03	-25.21
0.77	30.57	22.30	29.83	46.00	56.00	-23.70	-26.17
0.90	27.59	22.21	28.01	46.00	56.00	-23.79	-27.99
1.11	27.27	21.31	27.66	46.00	56.00	-24.69	-28.34
1.30	27.14	20.68	26.34	46.00	56.00	-25.32	-29.66
3.05	25.76	18.58	24.43	46.00	56.00	-27.42	-31.57

1

Title: Conducted Emissions - Neutral
File: Conducted - Pre-Test - Neutral 120
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge AC adapter, 915 MHz worst case
Comments: Lab T
Company: Flume Inc.
Model: F2700
Voltage: 120

3/3/2023 1:27:04 PM
Sequence: Preliminary Scan



Title: Conducted Emissions - Neutral
File: Conducted - Final Test - Neutral 120
Operator: R. Ramirez
EUT Type: Intelligent Water Monitoring Bridge
EUT Condition: Bridge AC adapter, 915 MHz worst case
Comments: Lab T
Company: Flume Inc.
Model: F2700
Voltage: 120

3/3/2023 1:28:23 PM
Sequence: Final Measurements

Data

Freq (MHz)	(PEAK) EMI (dBuV)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)
0.33	31.52	20.26	29.58	49.67	59.67	-29.42	-30.10
0.39	33.64	25.30	33.06	48.07	58.07	-22.77	-25.01
0.67	25.89	18.28	24.86	46.00	56.00	-27.72	-31.14
0.84	24.33	16.15	22.65	46.00	56.00	-29.85	-33.35
1.28	24.19	16.60	22.69	46.00	56.00	-29.40	-33.31
1.51	24.34	16.16	22.44	46.00	56.00	-29.84	-33.56
1.91	24.59	17.24	22.34	46.00	56.00	-28.76	-33.66
3.07	26.56	16.06	21.74	46.00	56.00	-29.94	-34.26
3.90	24.67	15.97	20.88	46.00	56.00	-30.03	-35.12
4.41	23.67	16.51	20.94	46.00	56.00	-29.49	-35.06

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FCC 15.247

Flume Inc.
Intelligent Water Monitoring Bridge
M/N: F2700

Date: 3/2/2023
Lab: T
Tested By: Rey Ramirez

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 24.8 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 24.8 GHz
								for the digital portion
								of the EUT
								No Emissions Detected
								from 1 GHz to 24.8 GHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								Receive mode on all channels of the 900 MHz FHSS were checked.
								No spurious emissions found
								Receive mode, 900 MHz FHSS and WiFi were tested during the
								Co-location test with the Bridge
								And Sensor communicating with
								Each other.
								Please see Appendix E for the
								Data sheets.

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247								
Company:	Flume Inc.						Date:	3/2/2023
EUT:	Intelligent Water Monitoring Bridge						Lab:	T
Model:	F2700						Test ENG:	R. Ramirez

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1805.00	56.57	H	73.98	-17.41	Peak	1.99	138	
1805.00	45.40	H	53.98	-8.58	Avg	1.99	138	
2707.50		H			Peak			**In Restricted Band**
2707.50		H			Avg			**No emissions found**
3610.00		H			Peak			**In Restricted Band**
3610.00		H			Avg			**No emissions found**
4512.50		H			Peak			**In Restricted Band**
4512.50		H			Avg			**No emissions found**
5415.00		H			Peak			**In Restricted Band**
5415.00		H			Avg			**No emissions found**
6317.50		H			Peak			**No emissions found**
6317.50		H			Avg			
7220.00		H			Peak			**No emissions found**
7220.00		H			Avg			
8122.50		H			Peak			**In Restricted Band**
8122.50		H			Avg			**No emissions found**
9025.00		H			Peak			**In Restricted Band**
9025.00		H			Avg			**No emissions found**

Test distance
3 meter

HARMONIC EMISSIONS LOW CHANNEL

FCC 15.247								
Company:	Flume Inc.						Date:	3/2/2023
EUT:	Intelligent Water Monitoring Bridge						Lab:	T
Model:	F2700						Test ENG:	R. Ramirez

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1805.00	57.33	V	73.98	-16.65	Peak	2	69.1	
1805.00	46.32	V	53.98	-7.66	Avg	2	69.1	
2707.50		V			Peak			**In Restricted Band**
2707.50		V			Avg			**No emissions found**
3610.00		V			Peak			**In Restricted Band**
3610.00		V			Avg			**No emissions found**
4512.50		V			Peak			**In Restricted Band**
4512.50		V			Avg			**No emissions found**
5415.00		V			Peak			**In Restricted Band**
5415.00		V			Avg			**No emissions found**
6317.50		V			Peak			**No emissions found**
6317.50		V			Avg			
7220.00		V			Peak			**No emissions found**
7220.00		V			Avg			
8122.50		V			Peak			**In Restricted Band**
8122.50		V			Avg			**No emissions found**
9025.00		V			Peak			**In Restricted Band**
9025.00		V			Avg			**No emissions found**

Test distance
3 meter

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247								
Company:	Flume Inc.						Date:	3/2/2023
EUT:	Intelligent Water Monitoring Bridge						Lab:	T
Model:	F2700						Test ENG:	R. Ramirez

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1830.00	56.77	H	73.98	-17.21	Peak	2.00	232.7	
1830.00	46.01	H	53.98	-7.97	Avg	2.00	232.7	
2745.00	62.09	H	73.98	-11.89	Peak	2.00	19.9	**In Restricted Band**
2745.00	51.14	H	53.98	-2.84	Avg	2.00	19.9	**In Restricted Band**
3660.00		H			Peak			**In Restricted Band**
3660.00		H			Avg			**No emissions found**
4575.00		H			Peak			**In Restricted Band**
4575.00		H			Avg			**No emissions found**
5490.00		H			Peak			**No emissions found**
5490.00		H			Avg			
6405.00		H			Peak			**No emissions found**
6405.00		H			Avg			
7320.00		H			Peak			**In Restricted Band**
7320.00		H			Avg			**No emissions found**
8235.00		H			Peak			**In Restricted Band**
8235.00		H			Avg			**No emissions found**
9150.00		H			Peak			**In Restricted Band**
9150.00		H			Avg			**No emissions found**

Test distance
3 meter

HARMONIC EMISSIONS MID CHANNEL

FCC 15.247			
Company:	Flume Inc.	Date:	3/2/2023
EUT:	Intelligent Water Monitoring Bridge	Lab:	T
Model:	F2700	Test ENG:	R. Ramirez

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1830.00	58.63	V	73.98	-15.35	Peak	1.5	346.8	
1830.00	46.56	V	53.98	-7.42	Avg	1.5	346.8	
2745.00	62.84	V	73.98	-11.14	Peak	1.89	105	**In Restricted Band**
2745.00	51.66	V	53.98	-2.32	Avg	1.89	105	**In Restricted Band**
3660.00		V			Peak			**In Restricted Band**
3660.00		V			Avg			**No emissions found**
4575.00		V			Peak			**In Restricted Band**
4575.00		V			Avg			**No emissions found**
5490.00		V			Peak			**No emissions found**
5490.00		V			Avg			
6405.00		V			Peak			**No emissions found**
6405.00		V			Avg			
7320.00		V			Peak			**In Restricted Band**
7320.00		V			Avg			**No emissions found**
8235.00		V			Peak			**In Restricted Band**
8235.00		V			Avg			**No emissions found**
9150.00		V			Peak			**In Restricted Band**
9150.00		V			Avg			**No emissions found**

Test distance
3 meter

HARMONIC EMISSIONS HIGH CHANNEL

FCC 15.247								
Company:	Flume Inc.						Date:	3/2/2023
EUT:	Intelligent Water Monitoring Bridge						Lab:	T
Model:	F2700						Test ENG:	R. Ramirez

Compatible Electronics, Inc. (Lab T)

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1854.00	59.24	H	73.98	-14.74	Peak	1.89	115.3	
1854.00	47.47	H	53.98	-6.51	Avg	1.89	115.3	
2781.00	62.49	H	73.98	-11.49	Peak	2	332.54	**In Restricted Band**
2781.00	51.44	H	53.98	-2.54	Avg	2	332.54	**In Restricted Band**
3708.00		H			Peak			**In Restricted Band**
3708.00		H			Avg			**No emissions found**
4635.00		H			Peak			**In Restricted Band**
4635.00		H			Avg			**No emissions found**
5562.00		H			Peak			**No emissions found**
5562.00		H			Avg			
6489.00		H			Peak			**No emissions found**
6489.00		H			Avg			
7416.00		H			Peak			**In Restricted Band**
7416.00		H			Avg			**No emissions found**
8343.00		H			Peak			**In Restricted Band**
8343.00		H			Avg			**No emissions found**
9270.00		H			Peak			**No emissions found**
9270.00		H			Avg			

Test distance
3 meter

HARMONIC EMISSIONS HIGH CHANNEL

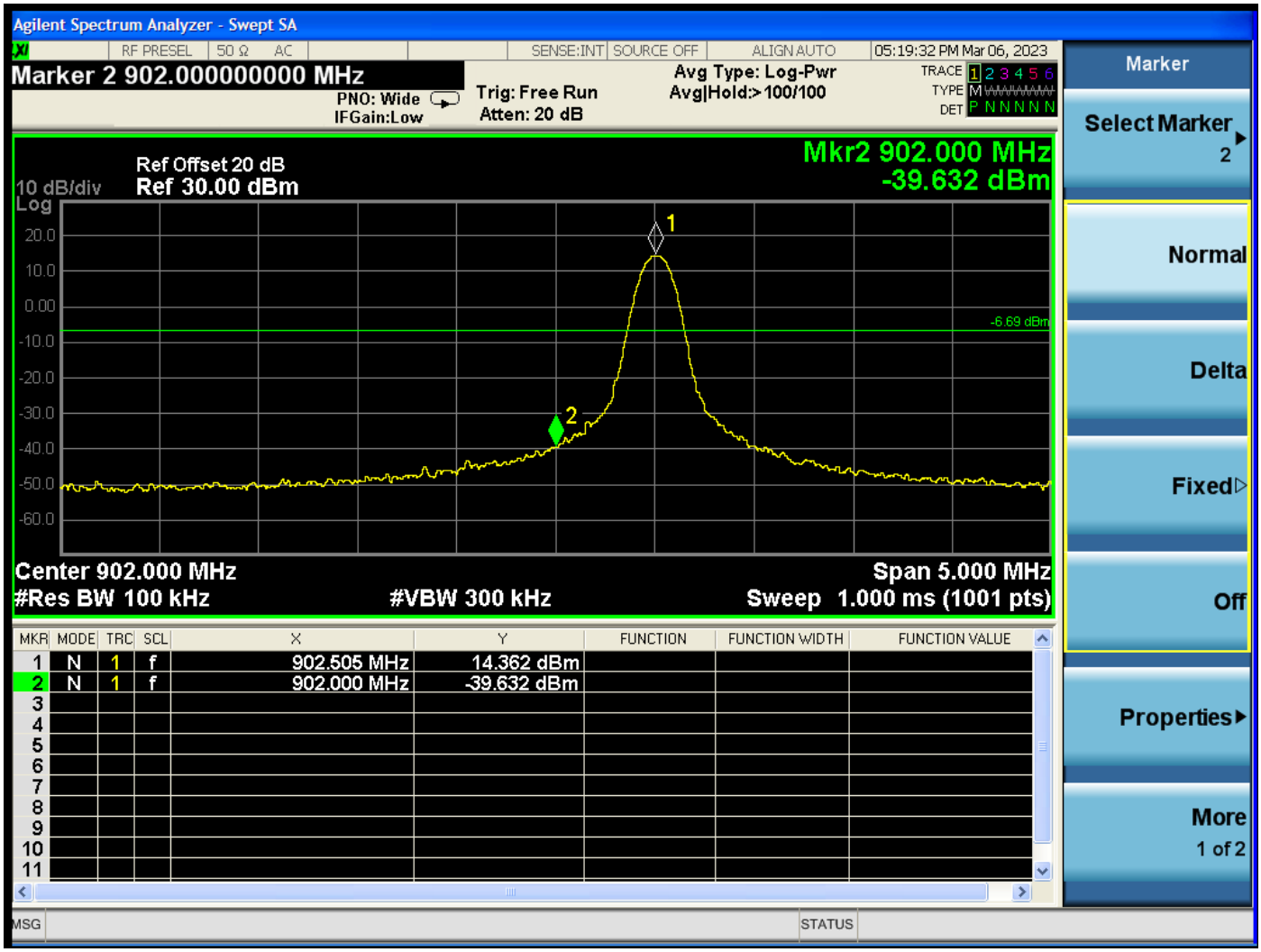
FCC 15.247			
Company:	Flume Inc.	Date:	3/2/2023
EUT:	Intelligent Water Monitoring Bridge	Lab:	T
Model:	F2700	Test ENG:	R. Ramirez

Compatible Electronics, Inc. (Lab T)

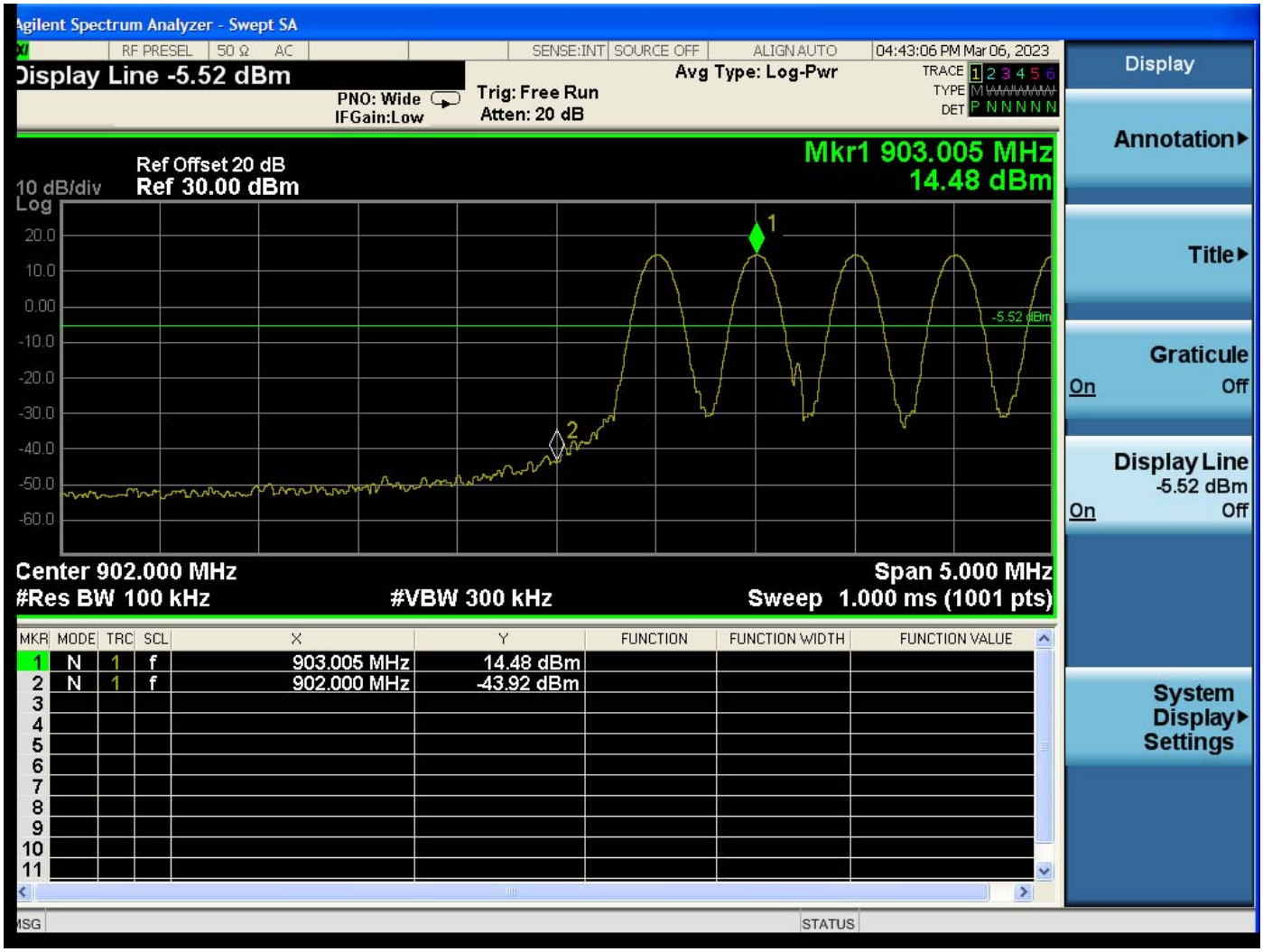
Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1854.00	56.81	V	73.98	-17.17	Peak	1.94	255.4	
1854.00	45.91	V	53.98	-8.07	Avg	1.94	255.4	
2781.00	62.64	V	73.98	-11.34	Peak	1.51	321.74	**In Restricted Band**
2781.00	51.23	V	53.98	-2.75	Avg	1.51	321.74	**In Restricted Band**
3708.00		V			Peak			**In Restricted Band**
3708.00		V			Avg			**No emissions found**
4635.00		V			Peak			**In Restricted Band**
4635.00		V			Avg			**No emissions found**
5562.00		V			Peak			**No emissions found**
5562.00		V			Avg			
6489.00		V			Peak			**No emissions found**
6489.00		V			Avg			
7416.00		V			Peak			**In Restricted Band**
7416.00		V			Avg			**No emissions found**
8343.00		V			Peak			**In Restricted Band**
8343.00		V			Avg			**No emissions found**
9270.00		V			Peak			**No emissions found**
9270.00		V			Avg			

Test distance
3 meter

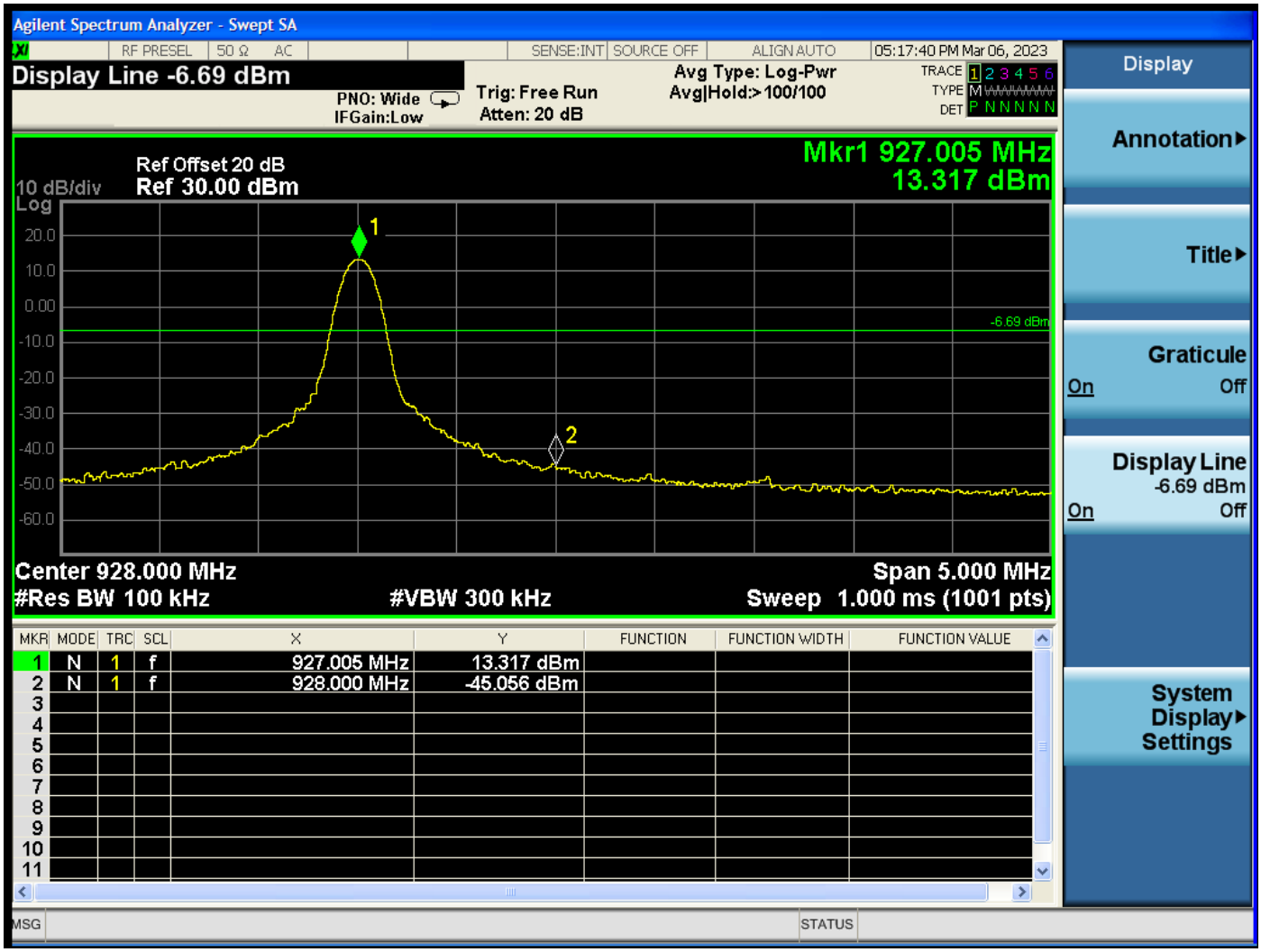
BAND EDGES DATA SHEETS



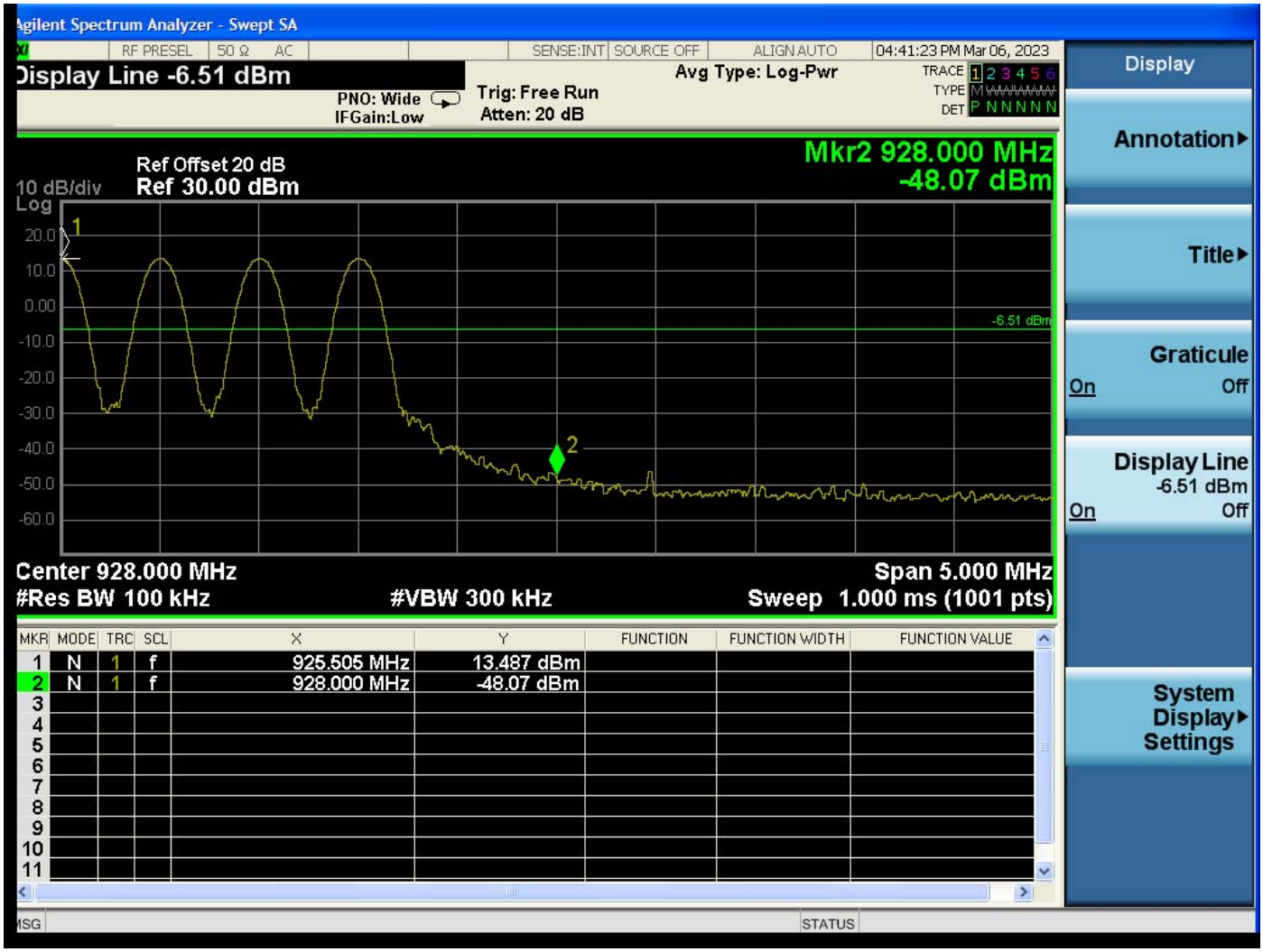
Band Edge – Low Channel – Fixed Frequency Mode



Band Edge – Low Channel - Frequency Hopping Mode

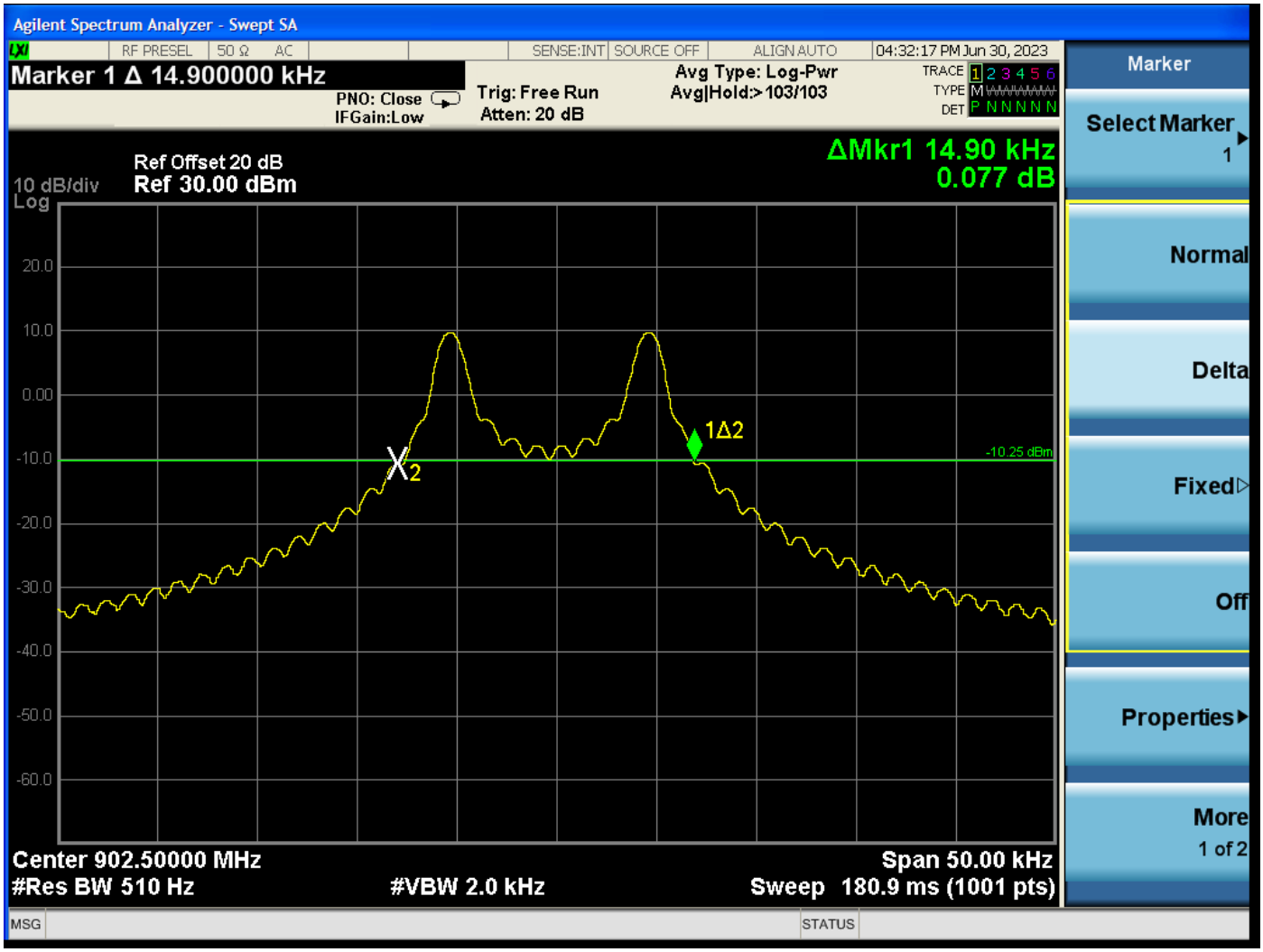


Band Edge – High Channel – Fixed Frequency Mode

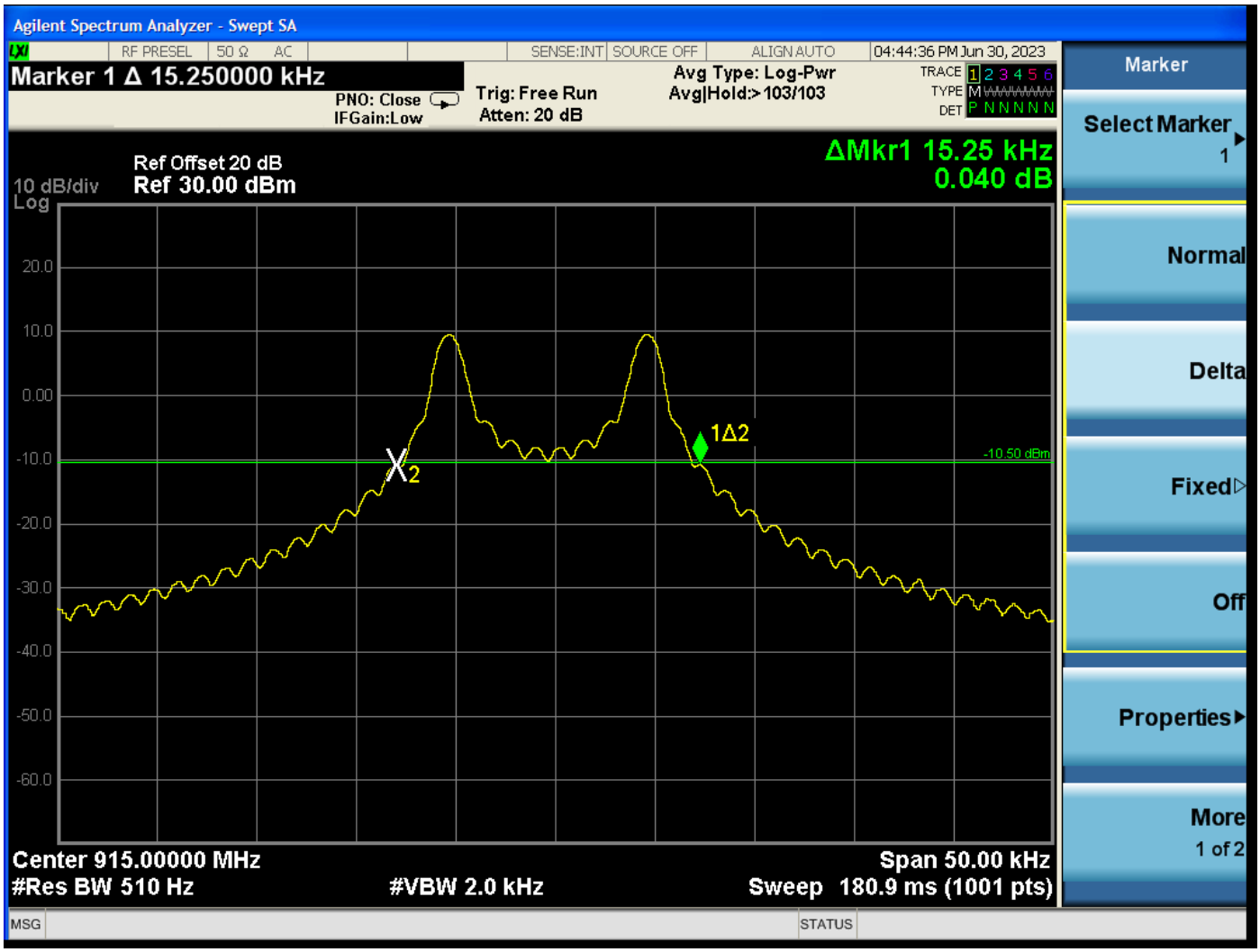


Band Edge – Frequency Hopping Mode

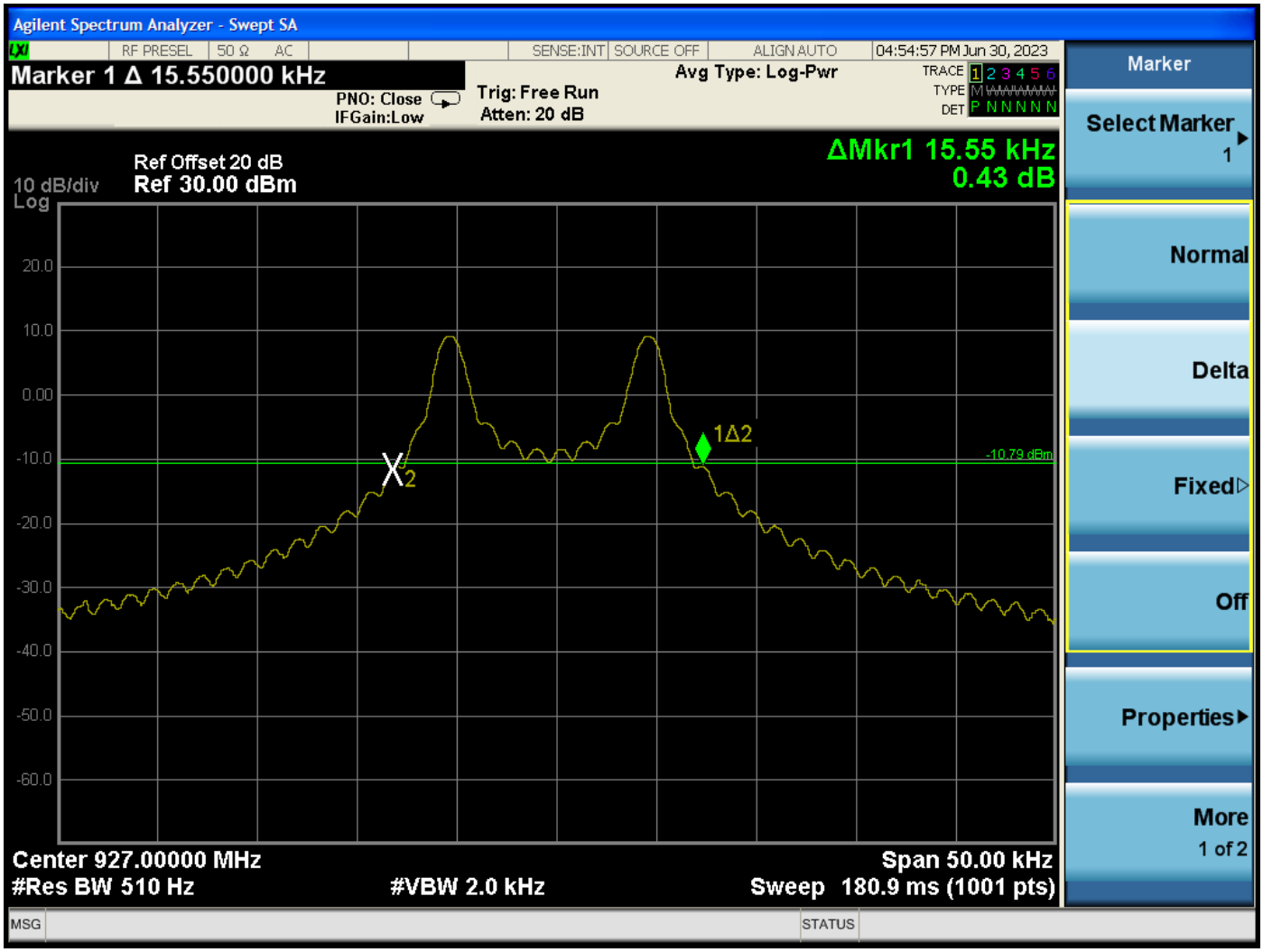
-20 DB BANDWIDTH DATA SHEETS



-20 dB Bandwidth – Low Channel

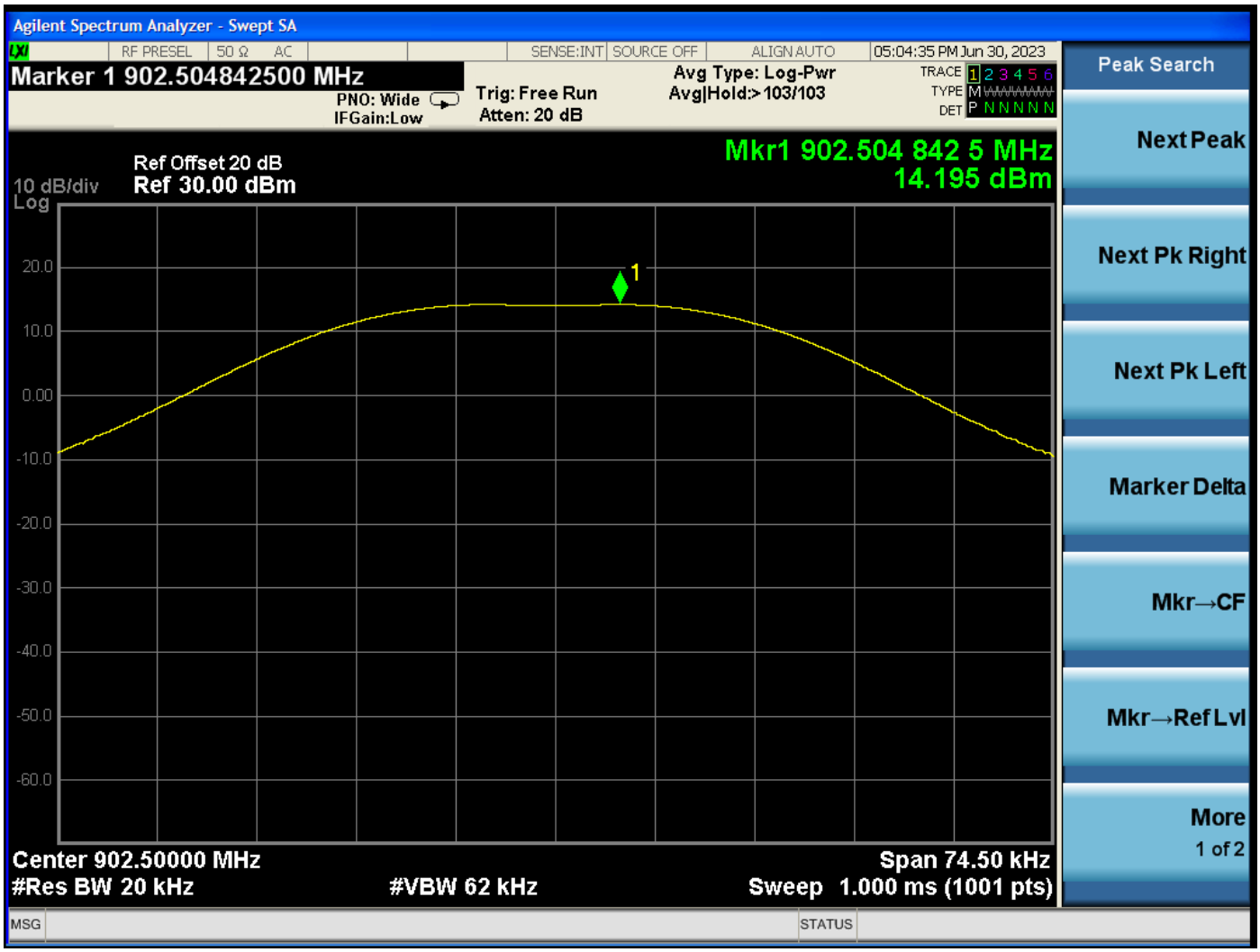


-20 dB Bandwidth – Middle Channel

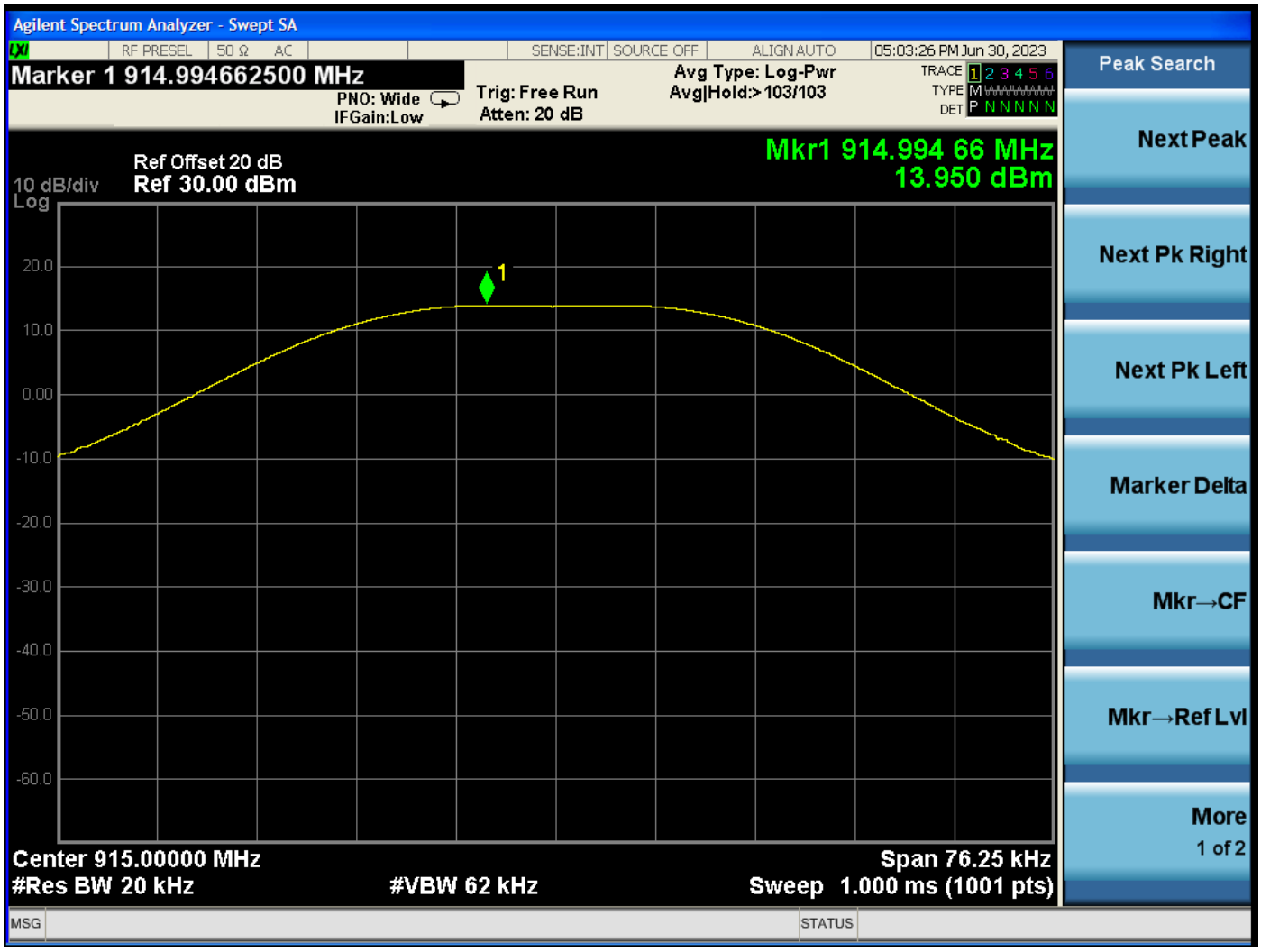


-20 dB Bandwidth – High Channel

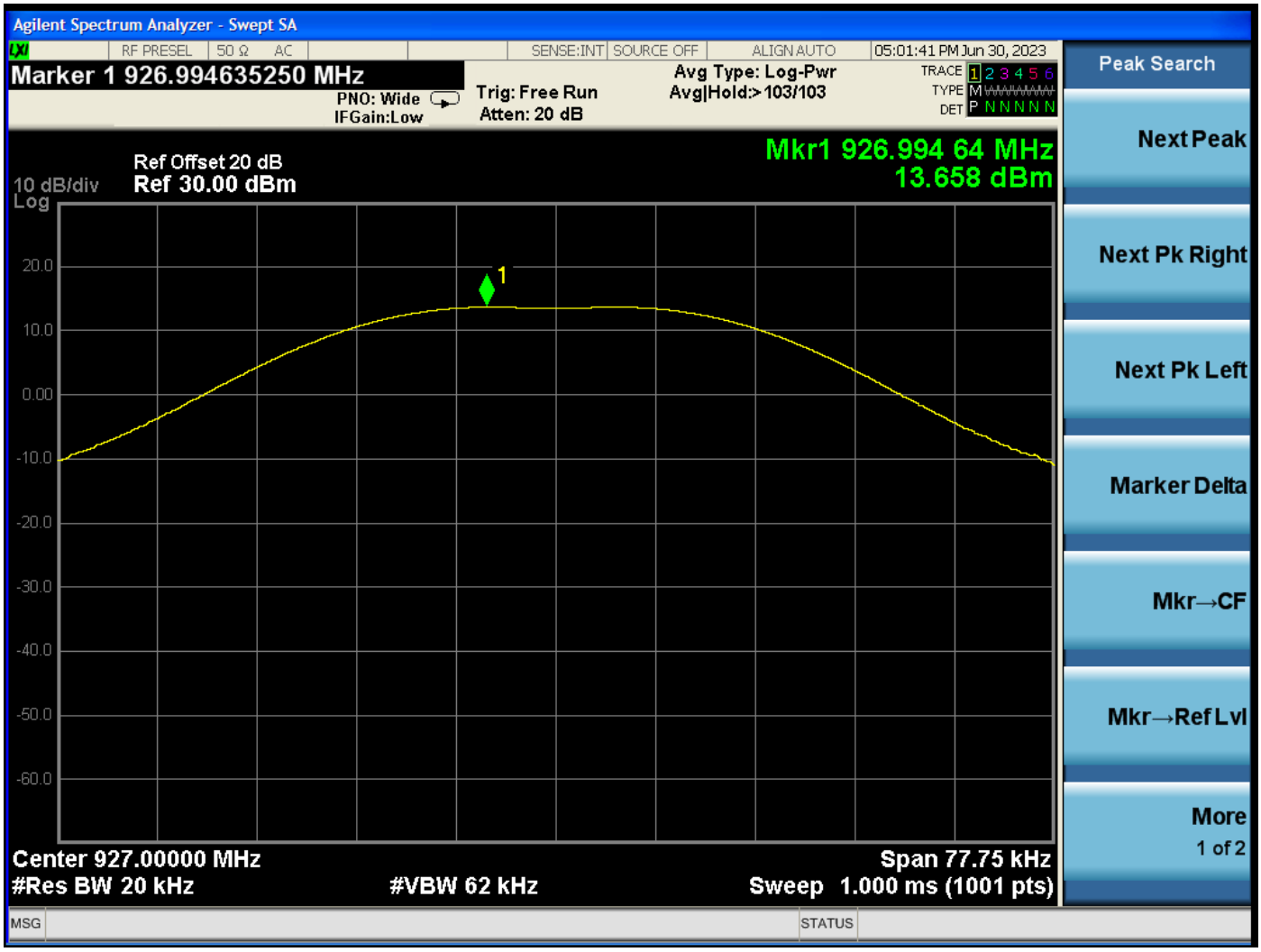
PEAK POWER OUTPUT DATA SHEETS



Peak Output Power – Low Channel



Peak Output Power – Middle Channel



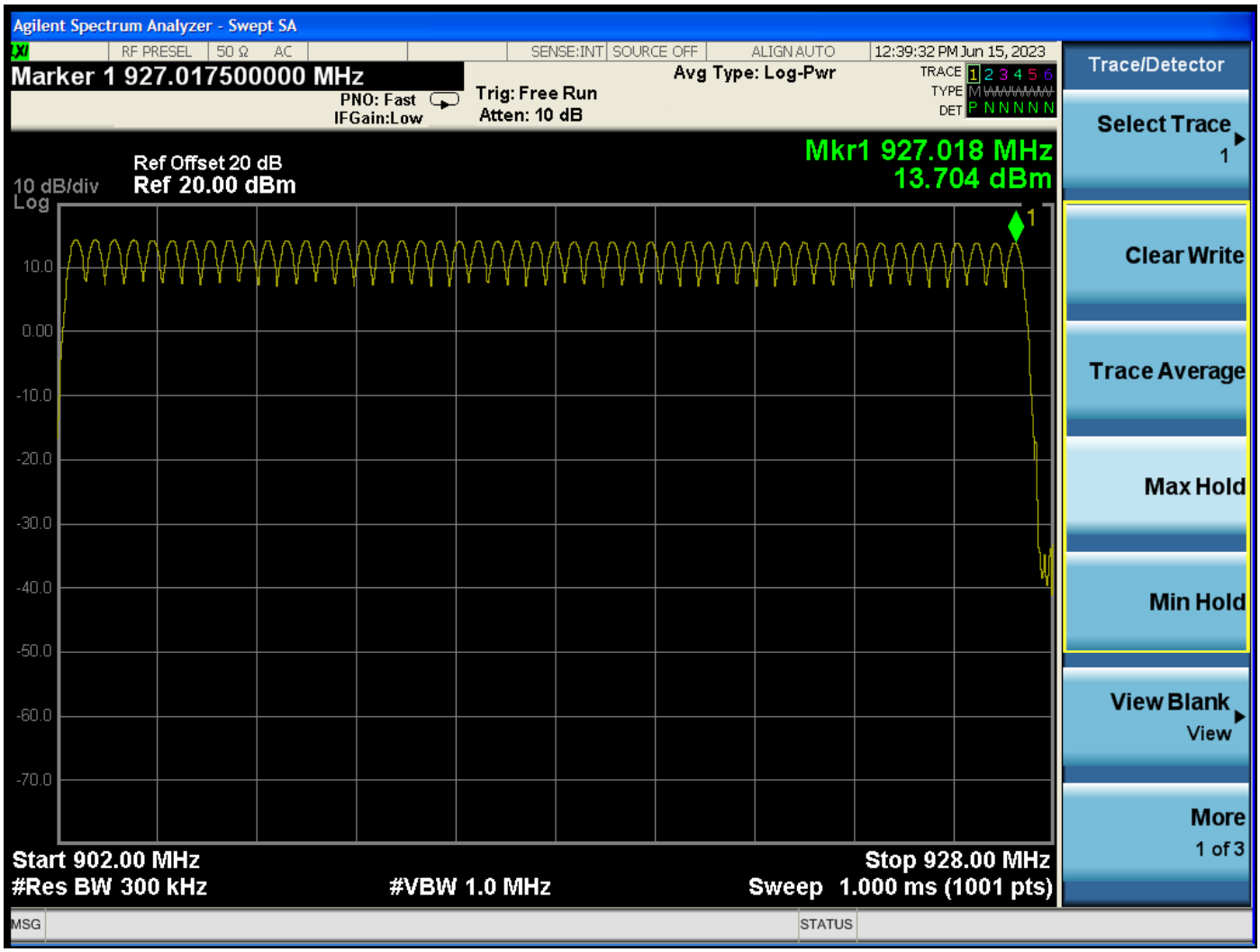
Peak Output Power – High Channel

CHANNEL FREQUENCY SEPARATION DATA SHEET

Channel Frequency Separation

NUMBER OF FREQUENCIES

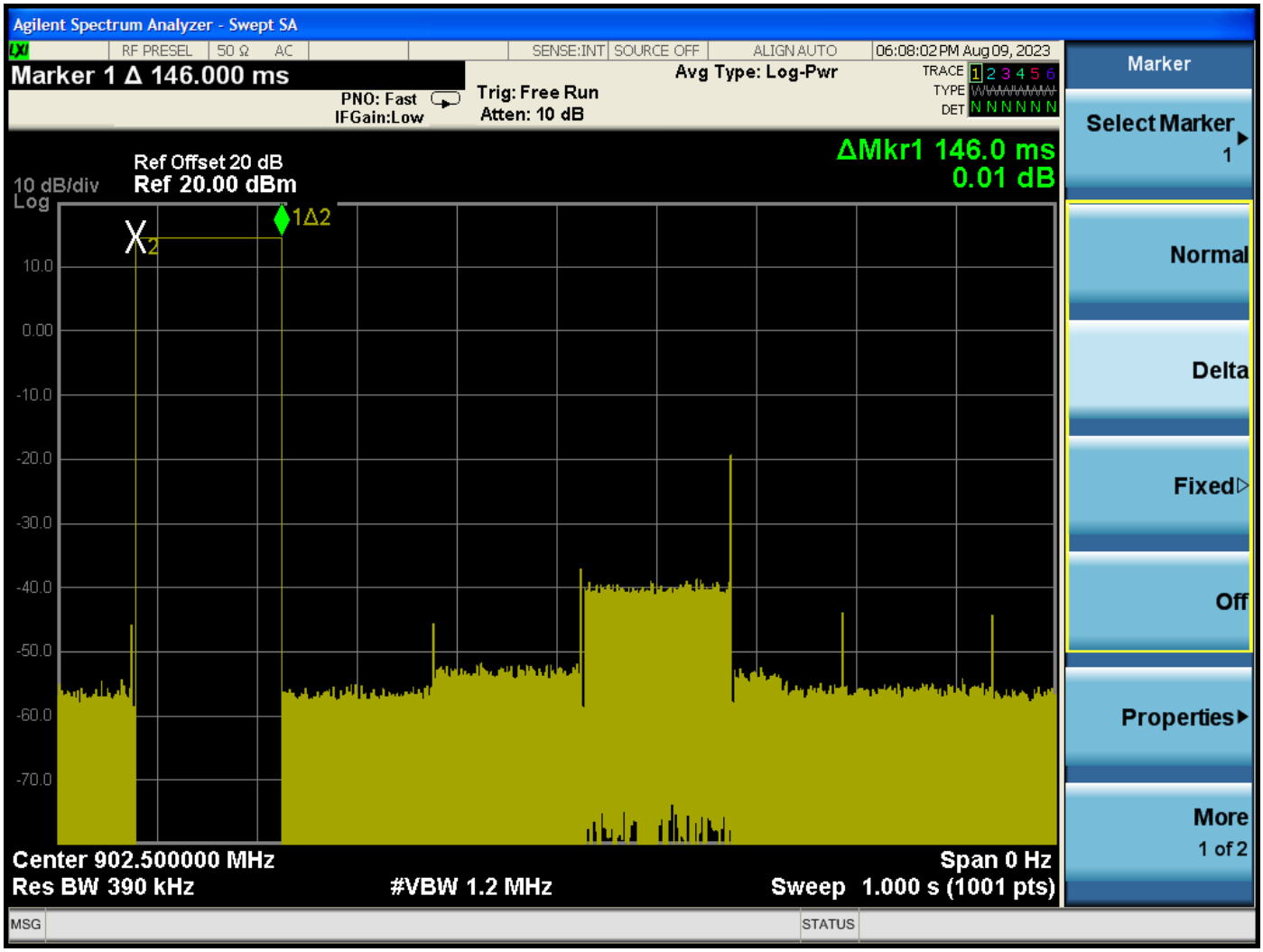
DATA SHEET



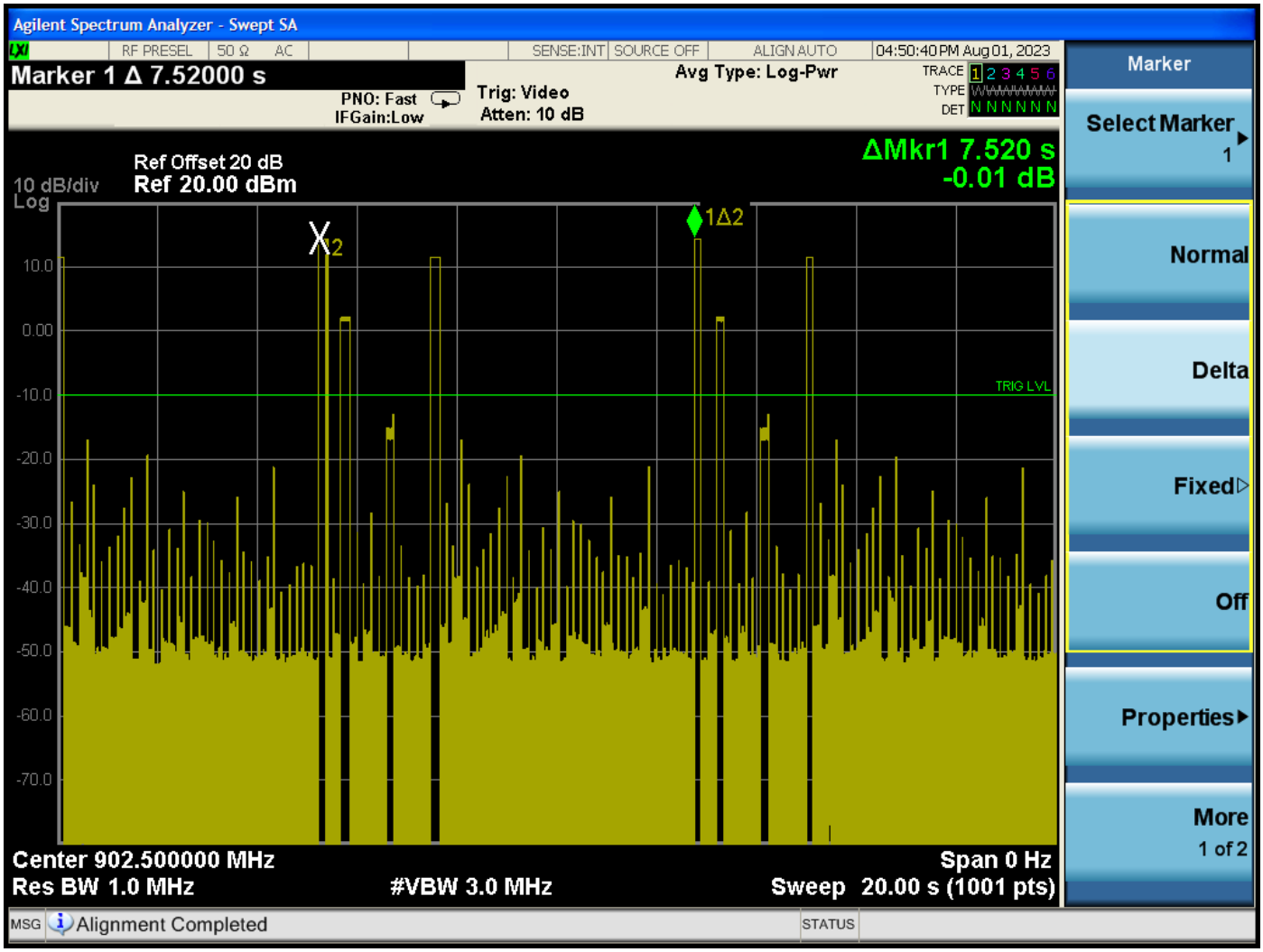
Number of Channels is 50

TIME OF OCCUPANCY

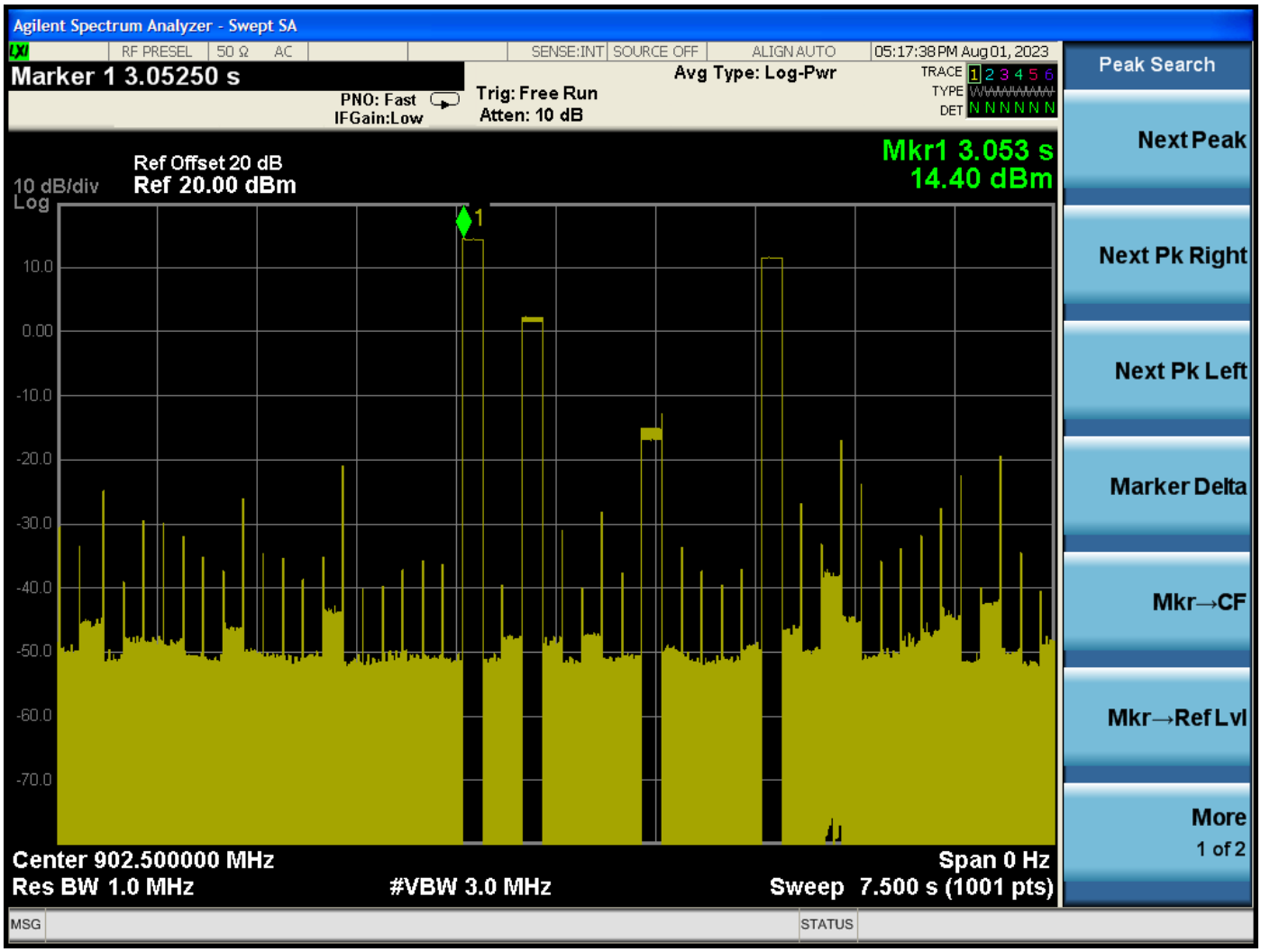
DATA SHEET



Time of One Pulse = 146 ms



Worst Case of 2 pulse in 20 seconds
Total Dwell Time = 146 * 2 = 292 ms
Limit = 400 ms in a 20 second period

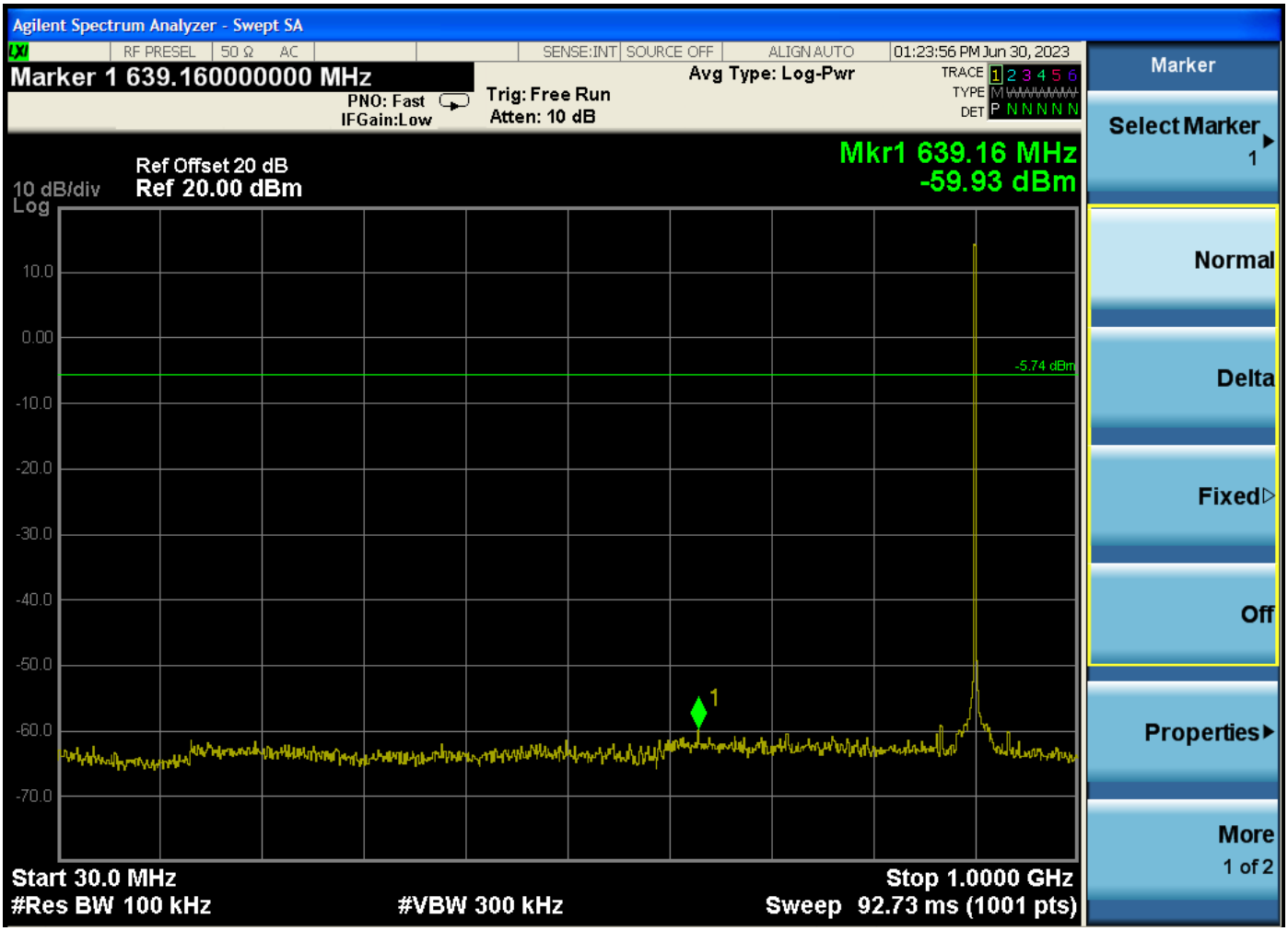


Single pulse in a 7.5 second period

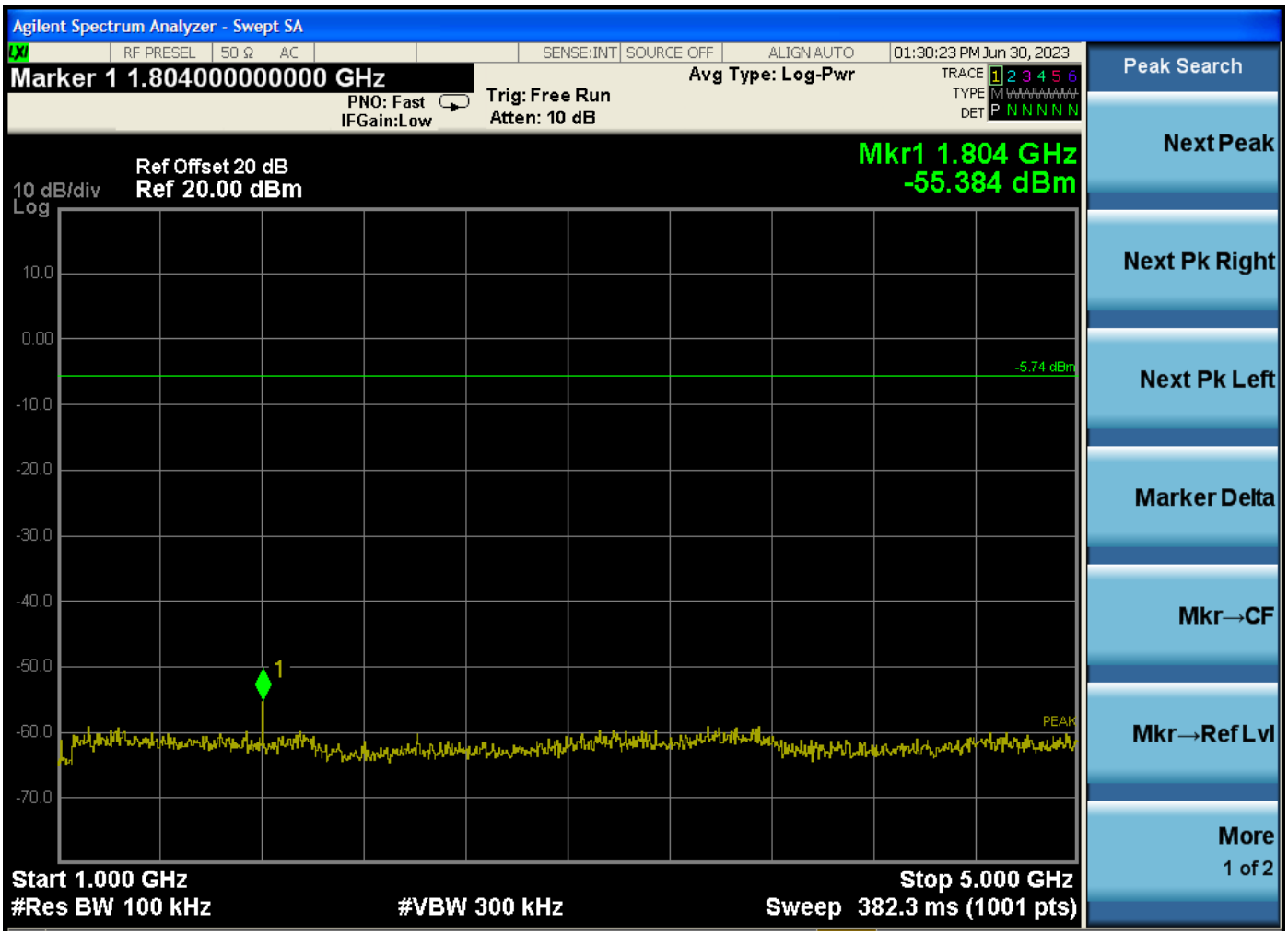
2.667 = (1) * (20/7.5)

Average Time of Occupancy
2.667 * 146 mS = 389.382 mS

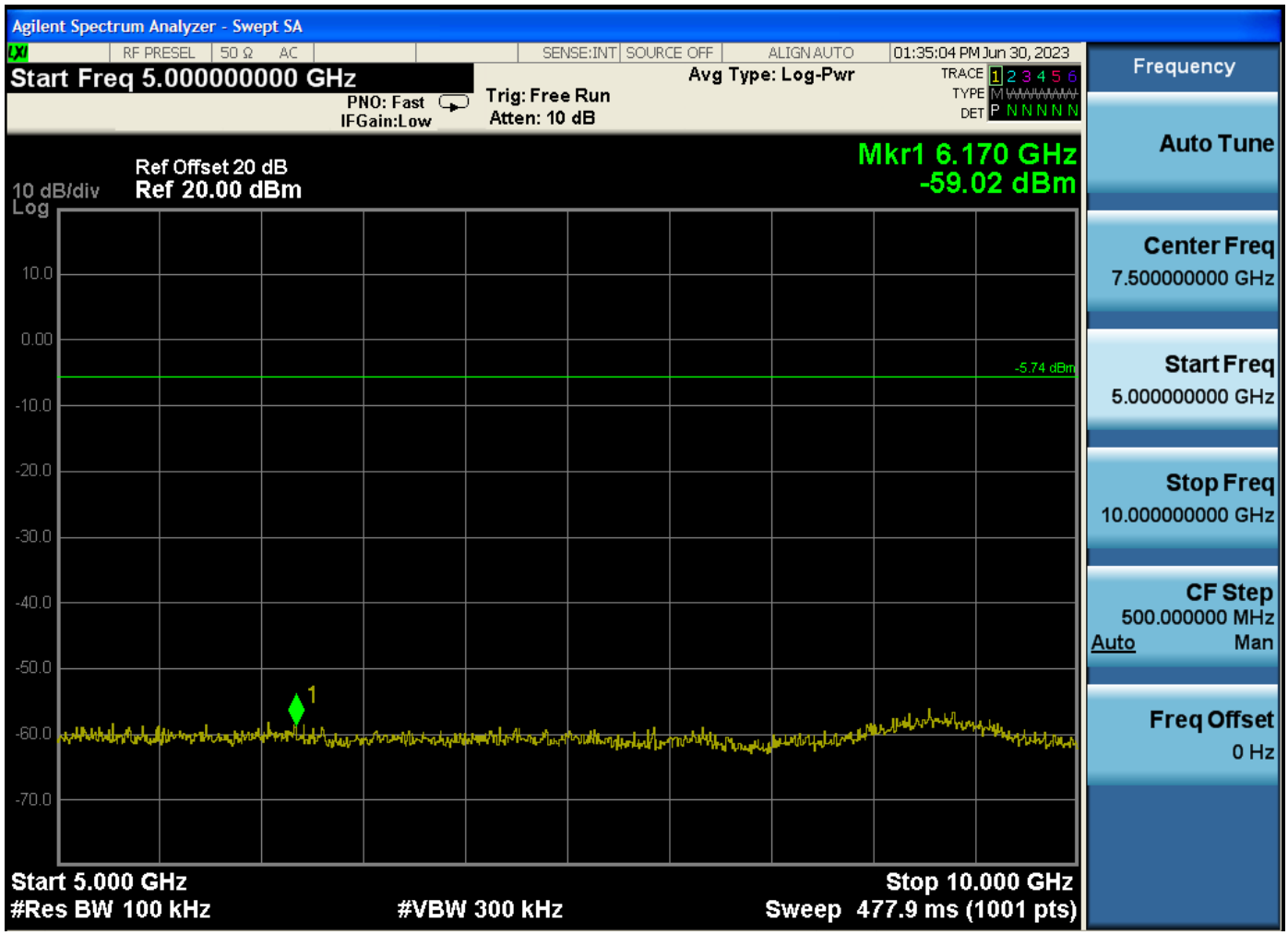
RF ANTENNA CONDUCTED TEST



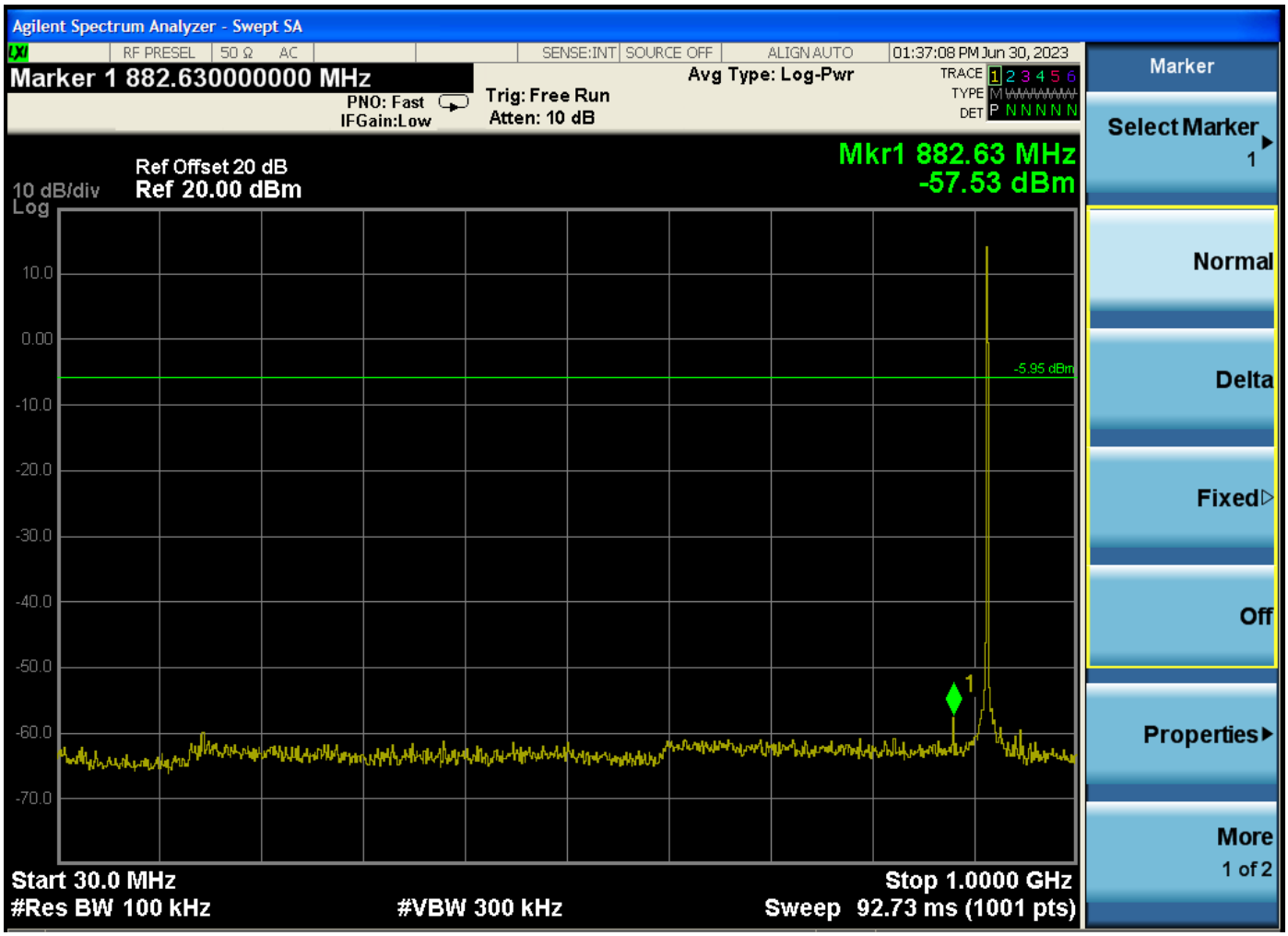
Low Channel 30-1000 MHz



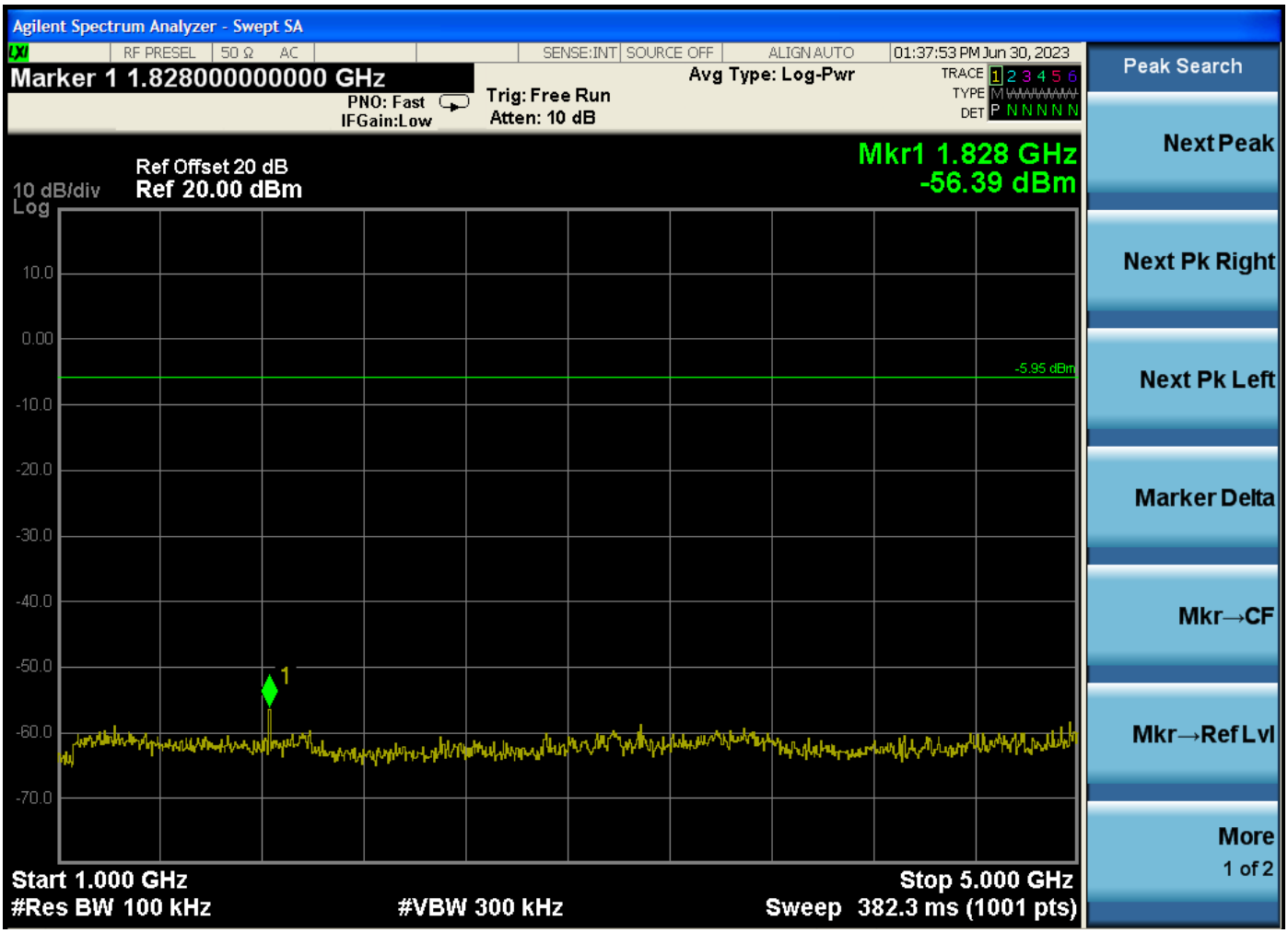
Low Channel 1-5 GHz



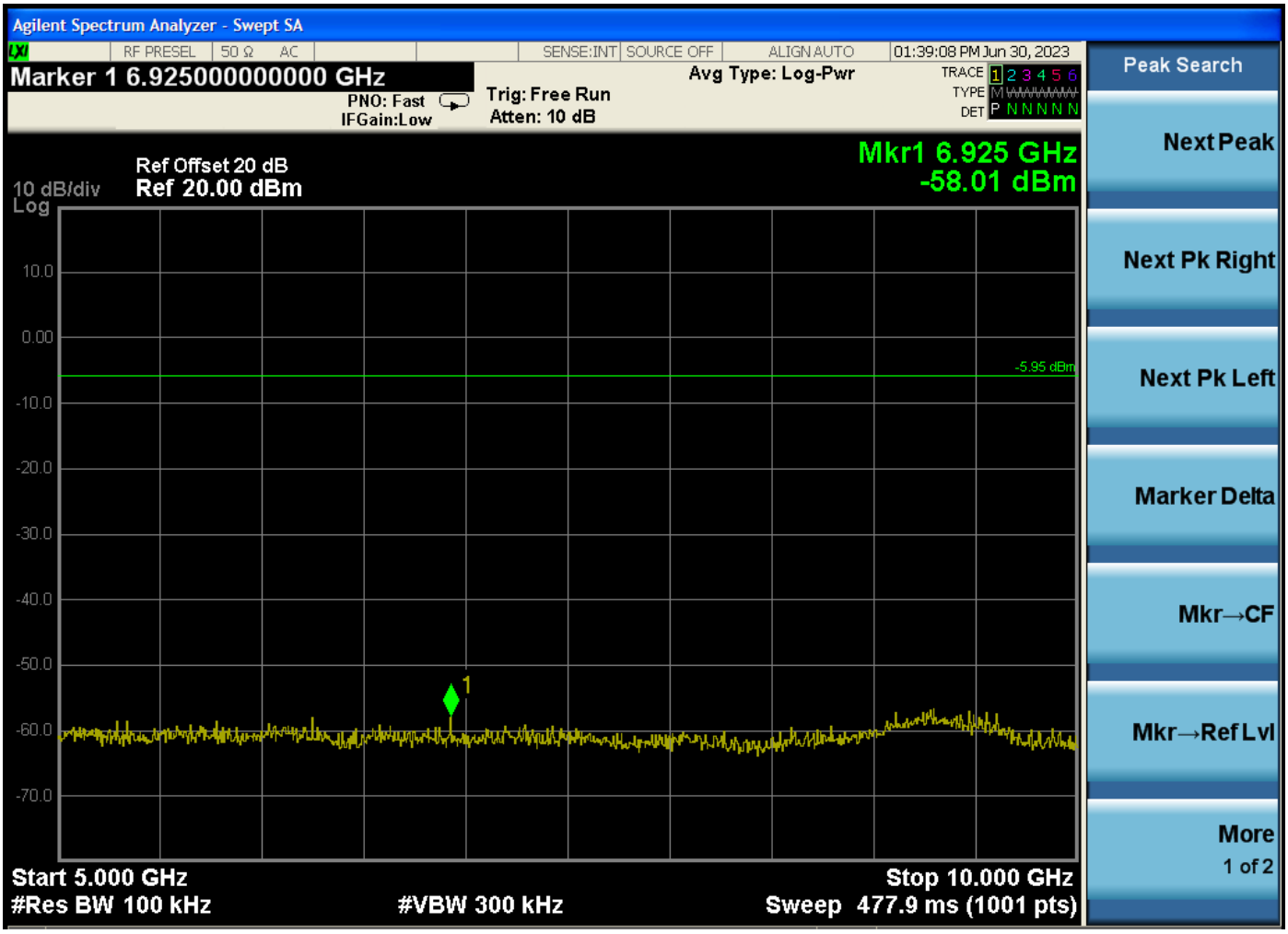
Low Channel 5-10 GHz



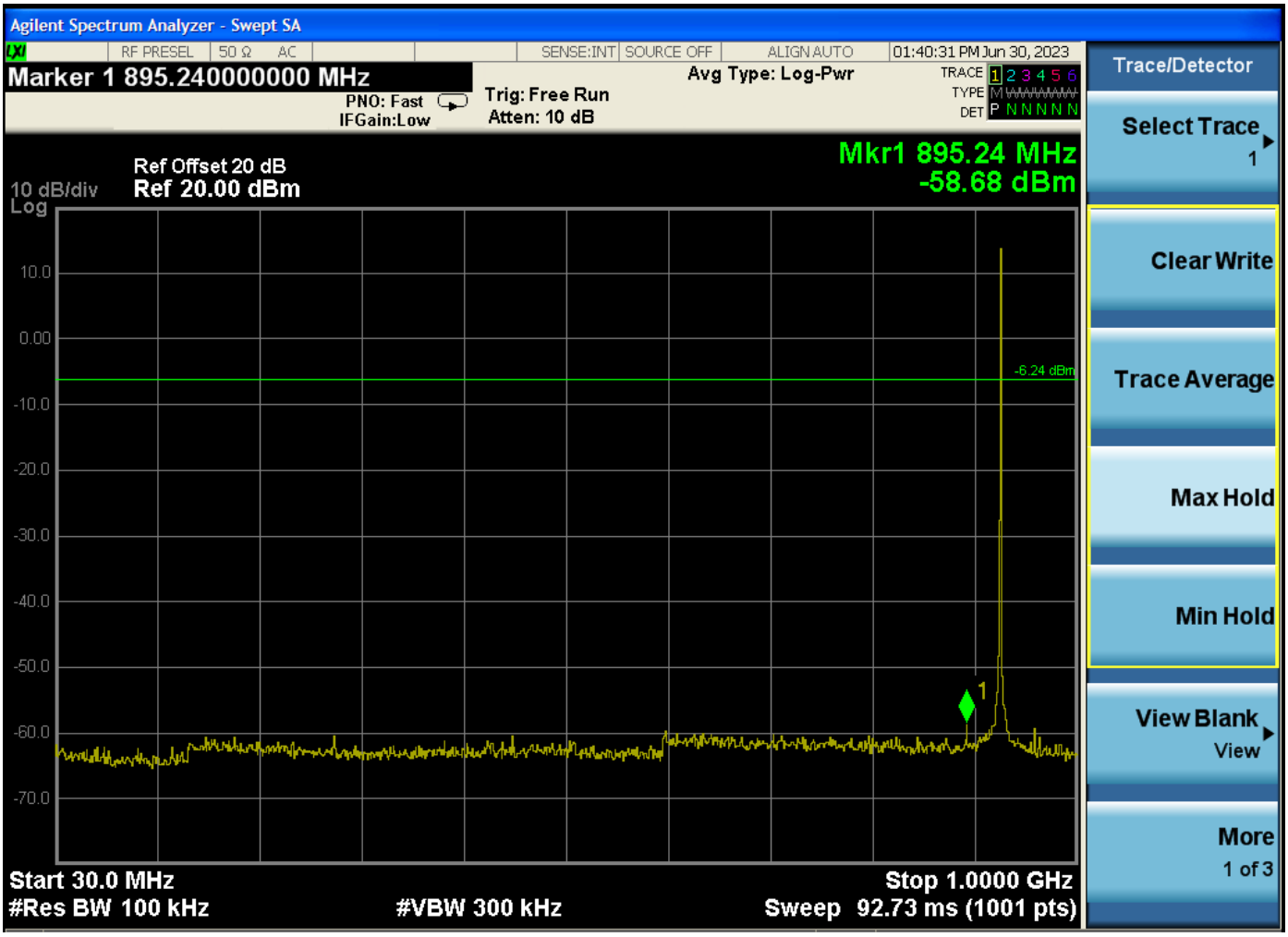
Middle Channel 30-1000 MHz



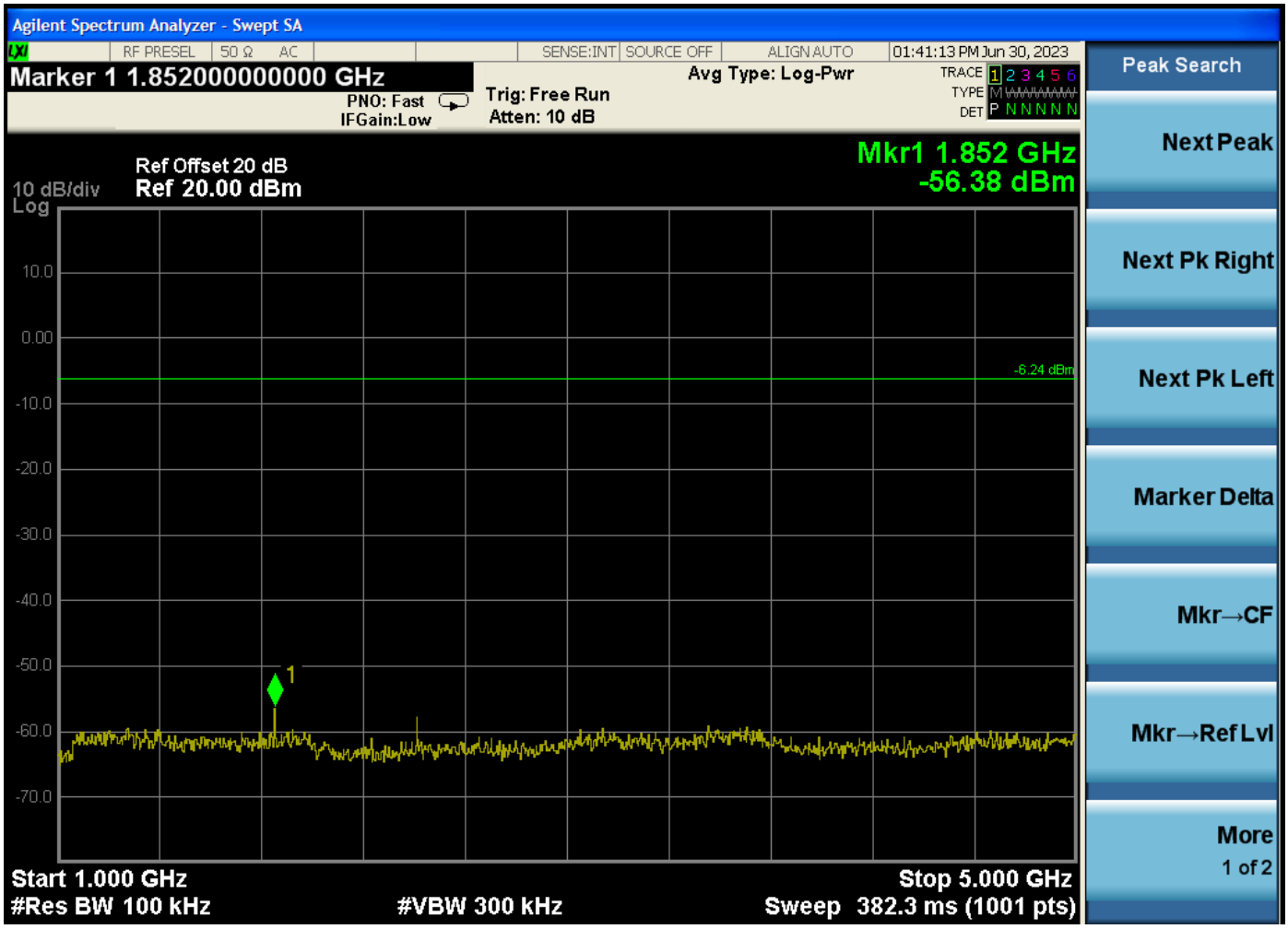
Middle Channel 1-5 GHz



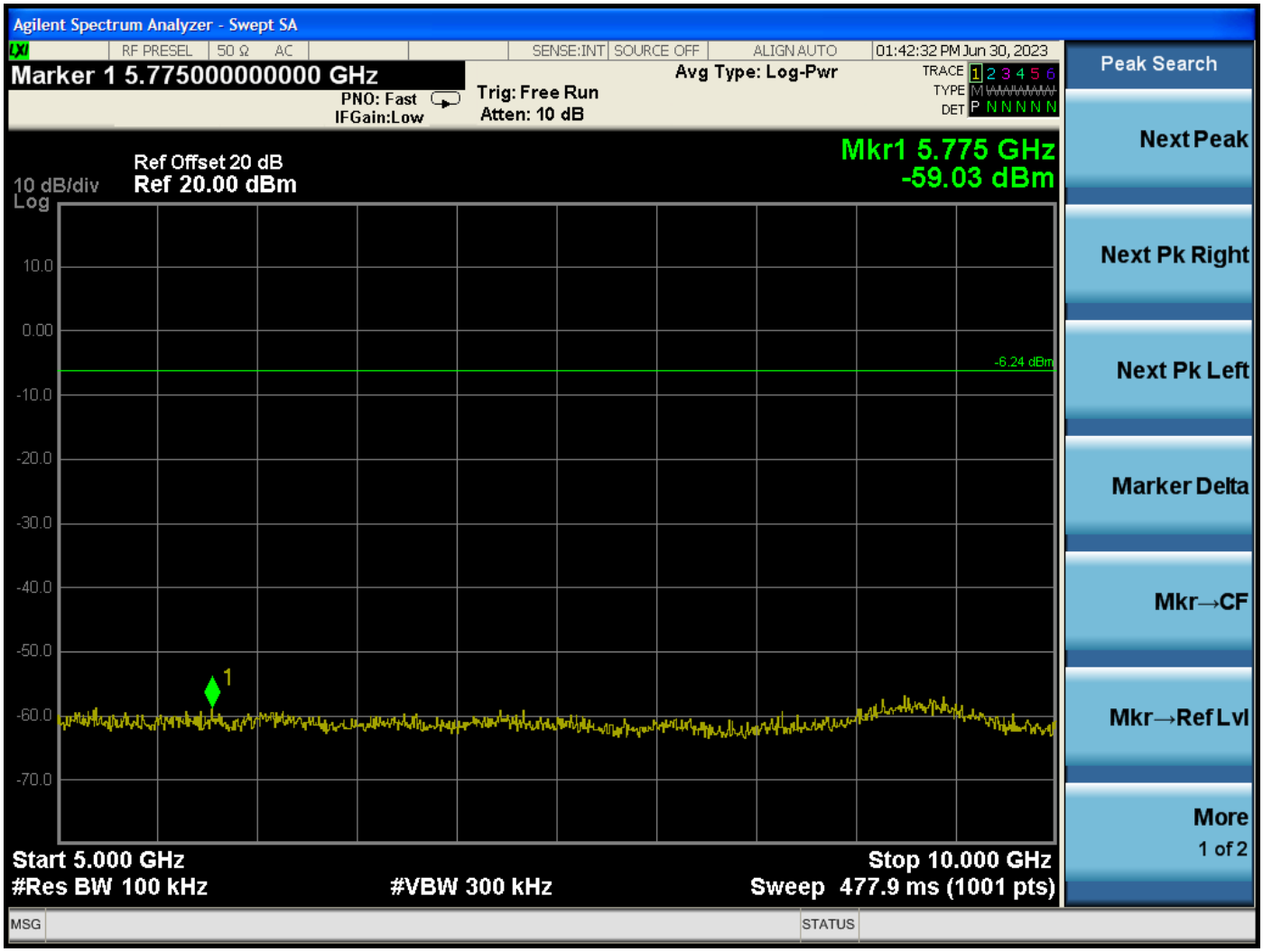
Middle Channel 5-10 GHz



High Channel 30-1000 MHz

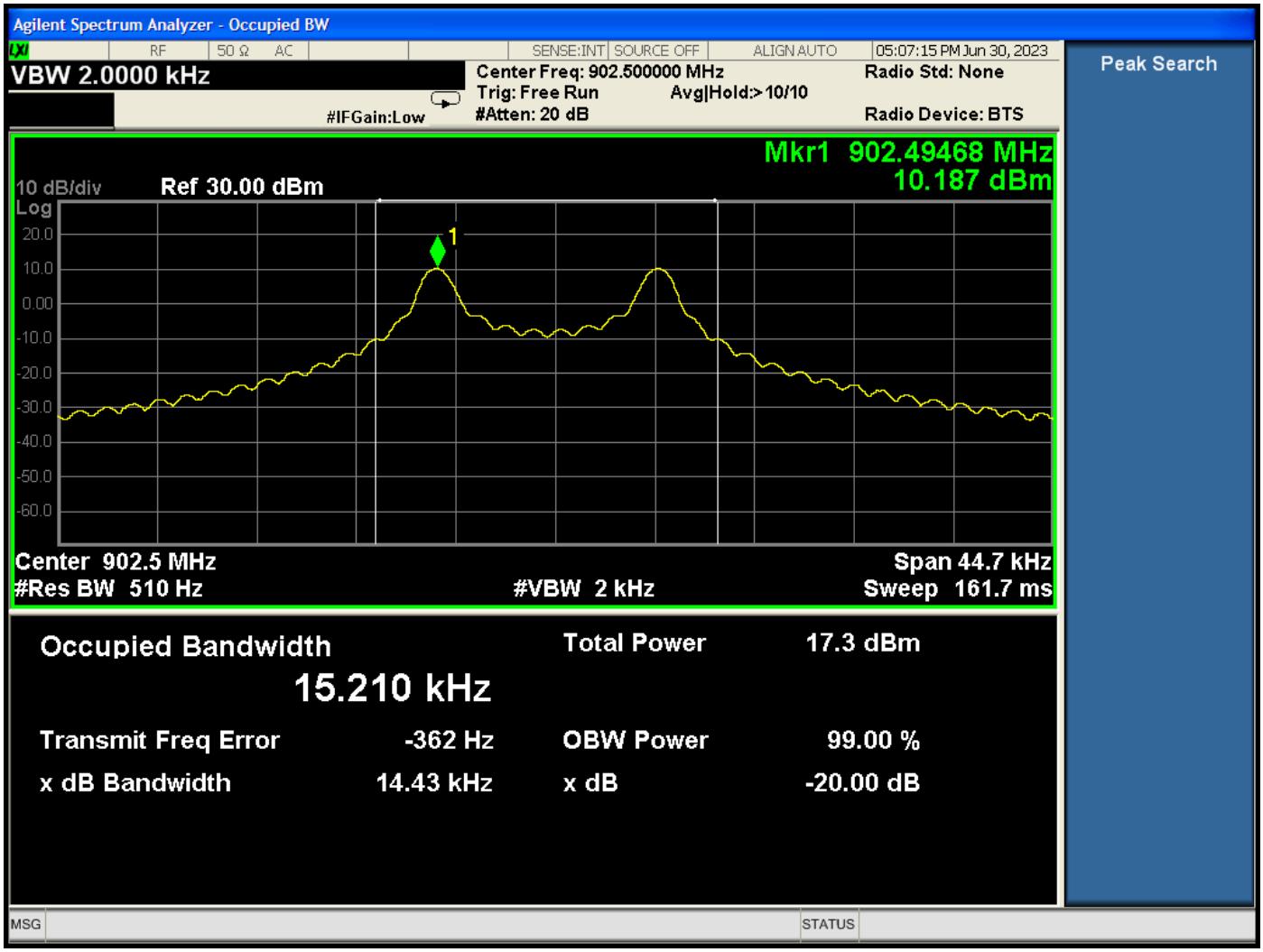


High Channel 1-5 GHz

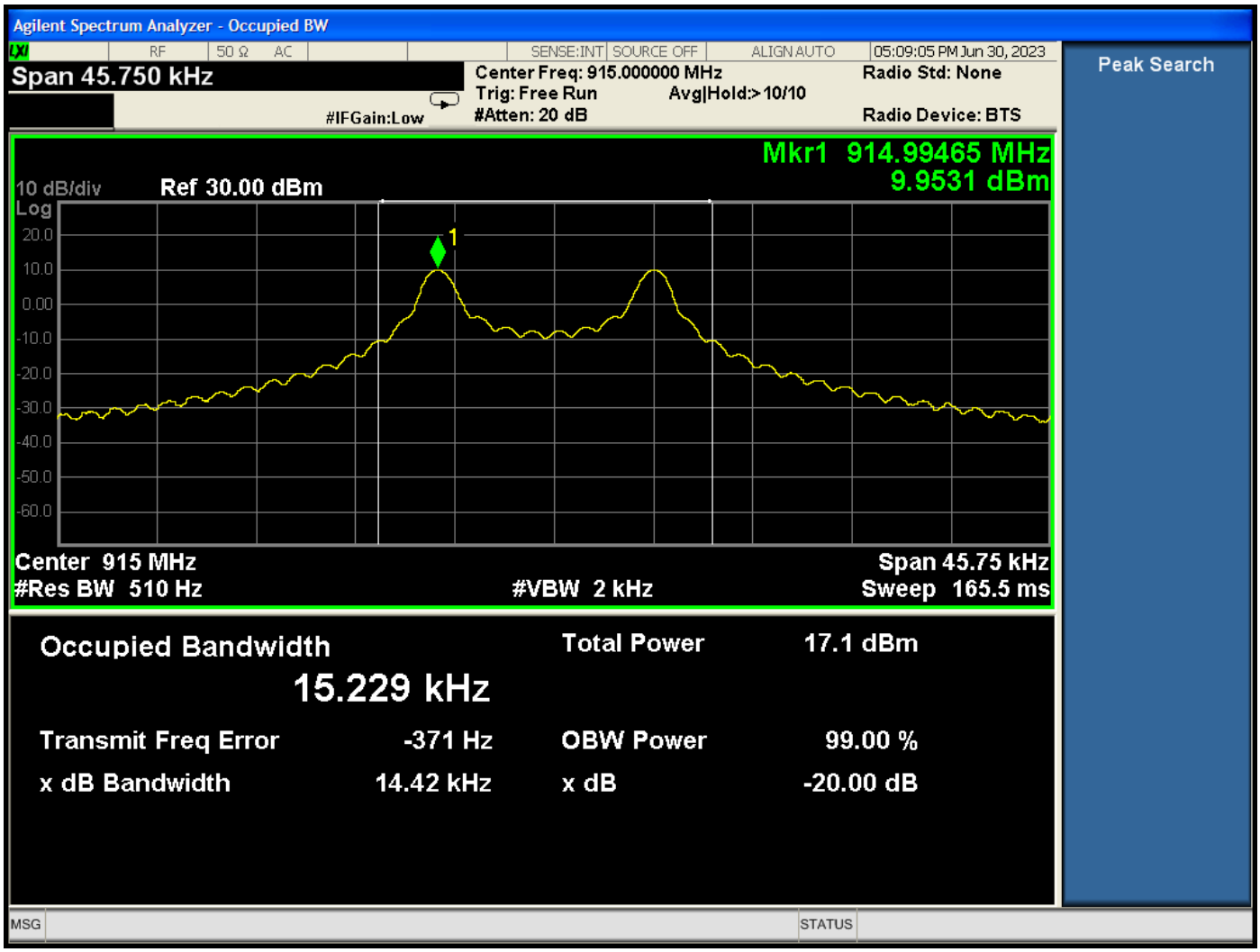


High Channel 5-10 GHz

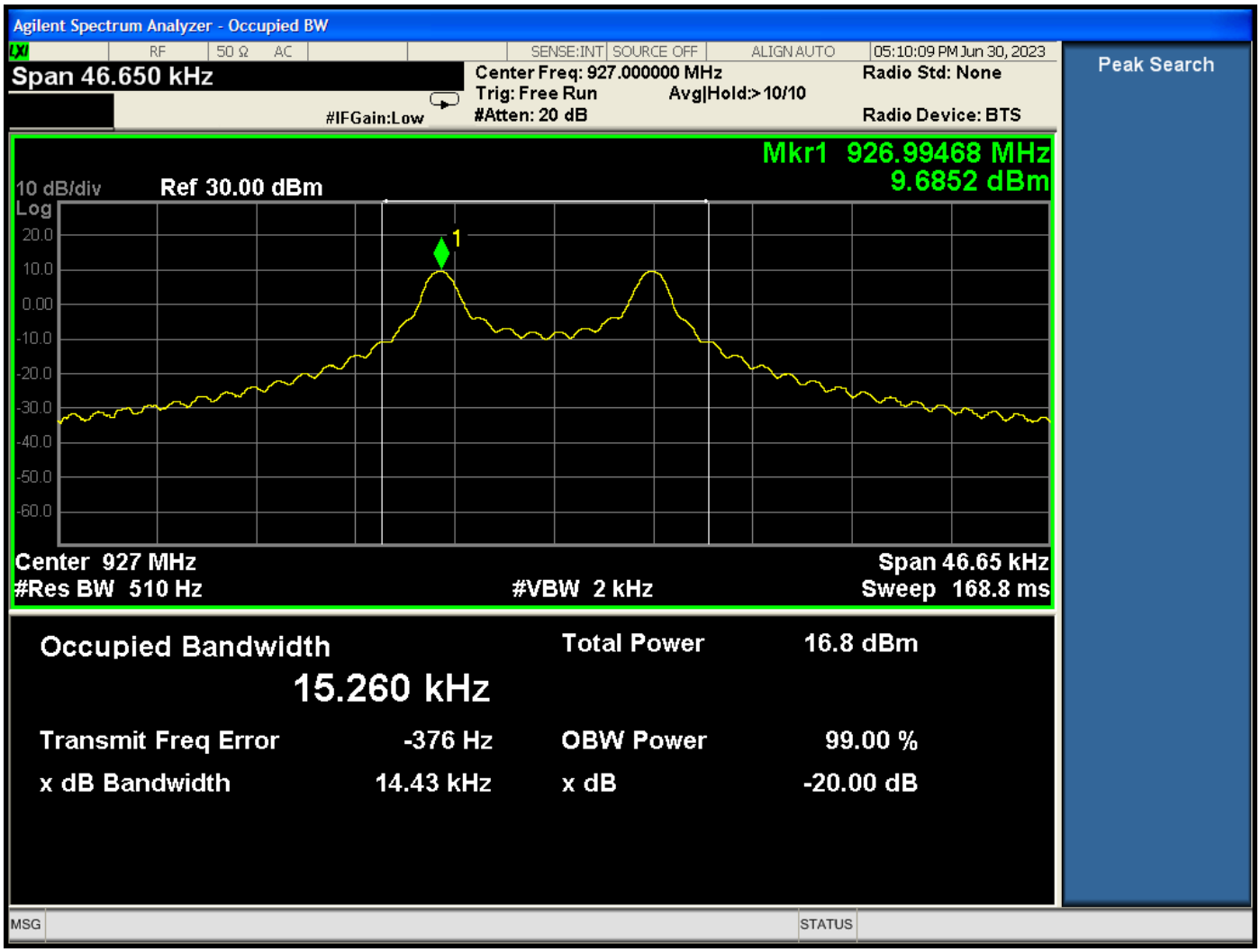
OCCUPIED BANDWIDTH


Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω AC
SENSE:INT SOURCE OFF ALIGN AUTO 05:07:15 PM Jun 30, 2023
VBW 2.0000 kHz
Center Freq: 902.500000 MHz
Trig: Free Run Avg|Hold:>10/10
#IFGain:Low #Atten: 20 dB
Radio Std: None
Radio Device: BTS
Peak Search
Mkr1 902.49468 MHz
10.187 dBm
10 dB/div Ref 30.00 dBm
Log
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Center 902.5 MHz
#Res BW 510 Hz
#VBW 2 kHz
Span 44.7 kHz
Sweep 161.7 ms
Occupied Bandwidth
15.210 kHz
Total Power 17.3 dBm
Transmit Freq Error -362 Hz
OBW Power 99.00 %
x dB Bandwidth 14.43 kHz
x dB -20.00 dB
MSG
STATUS

Low Channel


Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω AC
SENSE:INT SOURCE OFF ALIGN AUTO 05:09:05 PM Jun 30, 2023
Span 45.750 kHz
Center Freq: 915.000000 MHz
Trig: Free Run Avg|Hold:>10/10
#IFGain:Low #Atten: 20 dB
Radio Std: None
Radio Device: BTS
Peak Search
Mkr1 914.99465 MHz
9.9531 dBm
10 dB/div Ref 30.00 dBm
Log
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Center 915 MHz
#Res BW 510 Hz
#VBW 2 kHz
Span 45.75 kHz
Sweep 165.5 ms
Occupied Bandwidth
15.229 kHz
Total Power 17.1 dBm
Transmit Freq Error -371 Hz
OBW Power 99.00 %
x dB Bandwidth 14.42 kHz
x dB -20.00 dB
MSG
STATUS

Mid Channel



High Channel