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Test Report Date:

20 July 2026

Project Number:

1696

EMC Test Report - New Certification

Applicant:



ICOM Incorporated
1-1-32, Kamiminami
Hirano-Ku, Osaka, 547-0003
Japan

FCC ID:

AFJ453700

Product Model Number / HVIN

453700-01

Product Marketing Name / PMN

ID-5200A

In Accordance With:

CFR Title 47, Part 15 Subpart C (§15.247), Part 15 Subpart B

Digital Transmission System (DTS)

Approved By:

Ben Hewson, President

Celltech Labs Inc.
21-364 Lougheed Rd.
Kelowna, BC, V1X 7R8
Canada



Test Lab Certificate: 2470.01



**Industry
Canada**



IC Registration 3874A

ISED CAB ID: CA3874

FCC Registration: 608310

MRA Designation: CA3874

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1.0 REVISION HISTORY

Revision History					
Samples Tested By:		Art Voss, P.Eng.	Date(s) of Evaluation:		8 June - 22 June, 2026
Report Prepared By:		Art Voss, P.Eng.	Report Reviewed By:		Ben Hewson
Report Revision	Description of Revision		Revised Section	Revised By	Revision Date
0.1	Draft		n/a	Art Voss	16 June 2026
1.0	Initial Release		n/a	Art Voss	30 June 2026
2.0	Corrected Cab ID		Cover	Art Voss	9 July 2026
	Revised Scope to Clarify Use of WiFi Module		3		
3.0	Corrected Reference to RSS-247		Cover	Art Voss	20 July 2026
	Corrected Reference to ANSI C63.10		4, 5		

2.0 CLIENT AND DUT INFORMATION

Client Information	
Applicant Name	Icom Inc.
Applicant Address	1-1-32Kamiminami Hirano-KU
	Osaka-Shi, Osaka, 547-003
	Japan
DUT Information	
Device Identifier(s):	FCC ID: AFJ453700
Device Model(s) / HVIN:	453700-01
Device Marketing Name / PMN:	ID-5200A
Test Sample Serial No.:	00407
Device Type:	Mobile Transceiver
Equipment Class:	Digital Transmission Systems (DTS)
	Spread Spectrum Transmitter (DSS)
	Global Navigation Satellite System (GNSS) Receivers
Transmit Frequency Range:	Amateur Radio: 144-148MHz, 430-450MHz
	BT/BLE/ANT: 2402-2480MHz
Manuf. Max. Rated Output Power:	Amateur Radio: 50W
	BT/BLE - Low Power Communication Device Transmitter (DSS): 7dBm
Antenna Type and Gain:	BT: 2dBi
Modulation:	BT BR: GFSK
	BT EDR: Pi/4-DQPSK, 8DPSK
	BLE: GMSK
DUT Power Source:	13.8VDC
DUT Dimensions [LxWxH]	H x W x D:42mm dia x 4.5mm
Deviation(s) from standard/procedure:	None
Modification of DUT:	None

3.0 SCOPE

Preface:

This Certification Report was prepared on behalf of:

Icom Inc.

,(the '*Applicant*'), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (the '*Rules*'). The scope of this investigation was limited to only the equipment, devices and accessories (the '*Equipment*') supplied by the *Applicant*. The tests and measurements performed on this *Equipment* were only those set forth in the applicable *Rules* and/or the Test and Measurement Standards they reference. The *Rules* applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable *Rules* were applied to the measurement results obtained during this evaluation and ,unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the *Equipment* tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

Device:

The Icom ID-5200A is a dual band, 50W, VHF/UHF transceiver operating in the Amateur Radio Service band as an Amateur Radio Service device. It incorporates a Bluetooth transceiver and an integrated pre-certified WiFi Module, FCC ID: Z64-CC33DBMOD. The module is integrated into the host as per the module manufacturer's specifications and used as a stand-alone module.

Requirement:

As per FCC 47 CFR 97 Amateur Radio Service, the Amateur Radio transceiver is not subject to FCC certification. Certification of the Bluetooth transceiver is required in accordance with FCC 47 CFR 15C. The Amateur Radio, WiFi and Bluetooth transmitters are capable of simultaneous transmission.

Application:

This is an application for a New Certification.

Scope:

The scope of this investigation is limited to the evaluation and reporting of the wanted and spurious emissions of the Bluetooth transceiver in accordance with the rule parts cited in Normative References section of this report. This investigation includes evaluation of the emissions resulting from simultaneous transmission of all transmitters.

4.0 TEST SUMMARY

TEST SUMMARY					
Section	Description of Test	Procedure Reference	Applicable Rule Part(s) FCC	Test Date	Result
7.0	Occupied Bandwidth	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§2.1049	8 Jun 2026	Pass
8.0	DTS Bandwidth	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§15.247(a)(2)	9 Jun 2026	Pass
9.0	Conducted Power (Fundamental)	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§2.1046 §15.247(b)(3)	9 Jun 2026	Pass
9.0	Conducted Power (Fundamental)	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§2.1046 §15.247(b)(1)	9 Jun 2026	Pass
10.0	Power Spectral Density	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§15.247(e)	9 Jun 2026	Pass
11.0	FHSS Hopping Characteristics	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§15.247(a)(1)(iii)	9 Jun 2026	Pass
12.0	FHSS Channel Separation	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§15.247(a)(1)	9 Jun 2026	Pass
13.0	FHSS Time of Occupancy	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§15.247(a)(1)(iii)	9 Jun 2026	Pass
14.0	Conducted Tx Spurious Emissions Band Edge	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§2.1051 §15.247(d)	16 Jun 2026	Pass
15.0	Conducted Tx Spurious Emissions	ANSI C63.10-2020/Cor 1-2023 KDB 558074 D01v05	§2.1051 §15.247(d)	17 Jun 2026	Pass
16.0	Radiated Tx Spurious Emissions And Restricted Band	ANSI C63.4-2014 KDB 558074 D01v05	§15.109 §15.247(d)	22 Jun 2026	Pass
17.0	Radiated Rx Spurious Emissions Scanning Receiver	ANSI C63.4-2014 KDB 558074 D01v05	§15.109	22 Jun 2026	Pass
18.0	Radiated Tx Spurious Emissions Simultaneous Transmission	ANSI C63.4-2014 KDB 558074 D01v05	§15.109 §15.247(d)	22 Jun 2026	Pass

Test Station Day Log					
Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
8 Jun 2026	23.0	34	101.6	EMC	7
9 Jun 2026	23.3	36	100.4	EMC	8, 9, 10, 11, 12, 13
16 Jun 2026	27.1	35	100.6	EMC	14
17 Jun 2026	26.5	36	101.5	EMC	15
22 Jun 2026	23.0	27	102.0	OATS	16, 17, 18

EMC - EMC Test Bench

OATS - Open Area Test Site

LISN - LISN Test Area

IMM - Immunity Test Area

SAC - Semi-Anechoic Chamber

TC - Temperature Chamber

ESD - ESD Test Bench

RI - Radiated Immunity Chamber

I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.



Art Voss, P.Eng.
Technical Manager
Celltech Labs Inc.

16 June 2026

Date



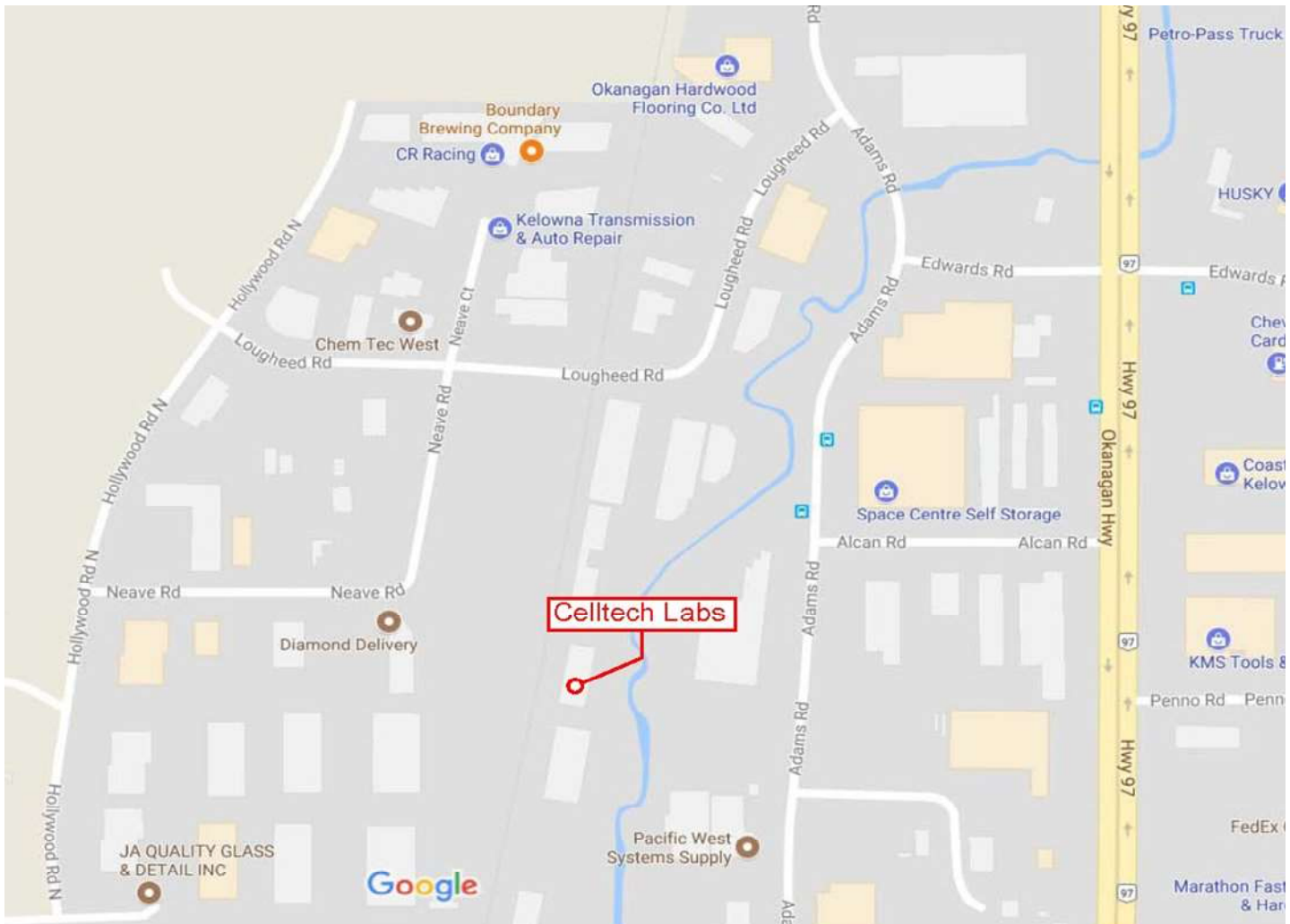
5.0 NORMATIVE REFERENCES

Normative References	
ISO/IEC 17025:2017	General requirements for the competence of testing and calibration laboratories
ANSI C63.4-2014	American National Standard of Procedures for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electric and Electronic Equipment in the Range of 9kHz to 40GHz
ANSI C63.10-2020 Cor 1-2023	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
CFR	Code of Federal Regulations Title 47: Telecommunication Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
CFR	Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Subpart B: Unintentional Radiators
CFR	Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Sub Part C (15.247) Intentional Radiators
FCC KDB 558074 D01v05r02	OET Major Guidance Publications, Knowledge Data Base Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

The facilities used to evaluate this device outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site (OATS) conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number CA3874 and Innovation, Science and Economic Development Canada under Test Site File Number ISED 3874A. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



7.0 OCCUPIED BANDWIDTH

Test Procedure

Normative Reference	FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d), KDB 558074 (8.3.2.1), ANSI C63.10 (6.9.3)
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General Procedure

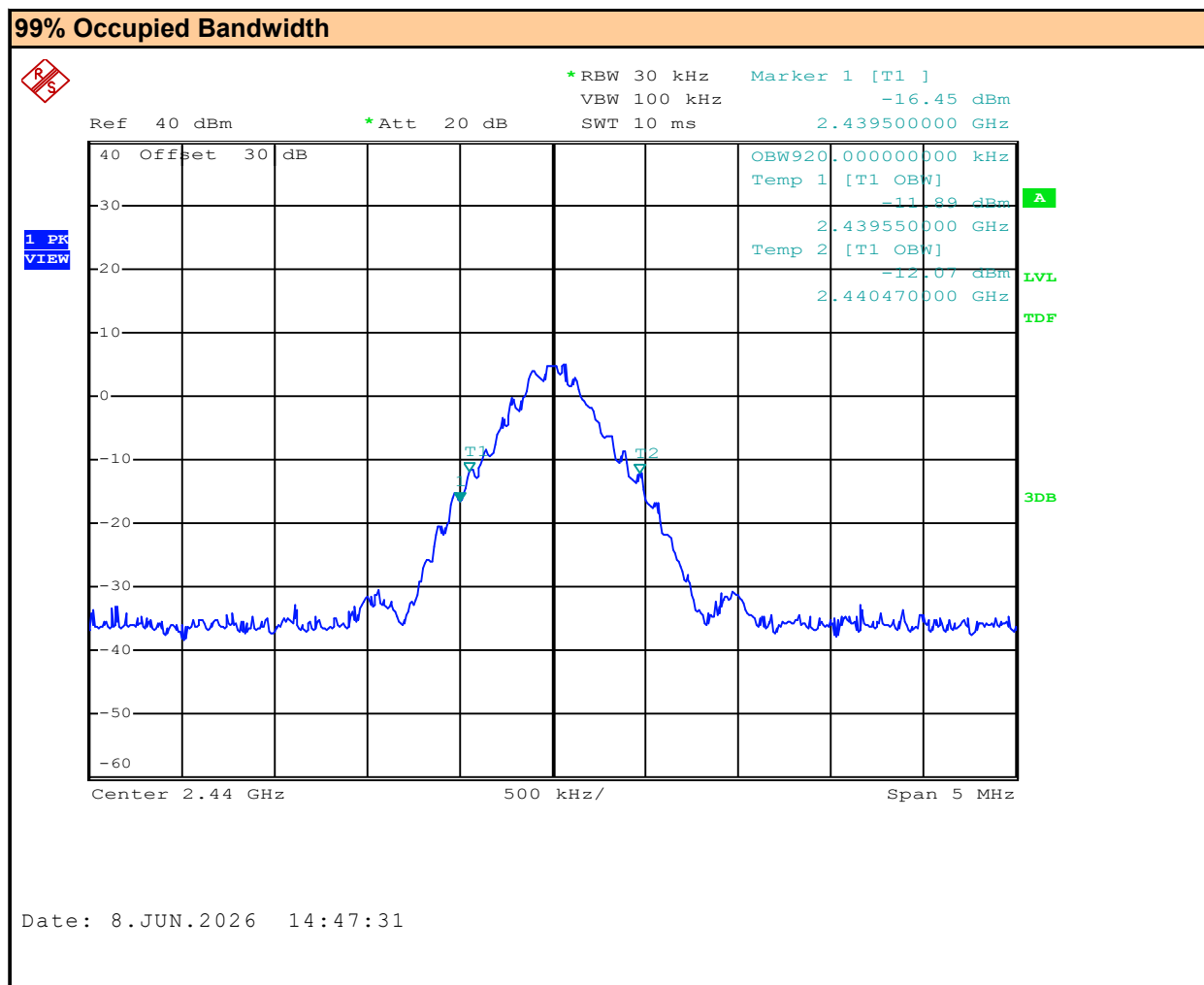
KDB 558074 (8.3.2.1)	8.3.2.1 General Section 15.247 permits the maximum conducted (average) output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth.
C63.10 (6.9.3)	6.9.3 Occupied bandwidth—power bandwidth (99%) measurement procedure The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power 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 $[10 \log (\text{OBW}/\text{RBW})]$ 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.

Test Setup	Appendix A - Figure A.1
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Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as described above using the 99% Occupied Bandwidth function. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at its maximum Duty Cycle. The 99% Occupied Bandwidth was measured and recorded and used for the basis for measuring the Conducted Output Power (See Section 10.0) and Power Spectral Density (See Section 11.0).

Plot 7.1 – Occupied Bandwidth, BT 1EDR

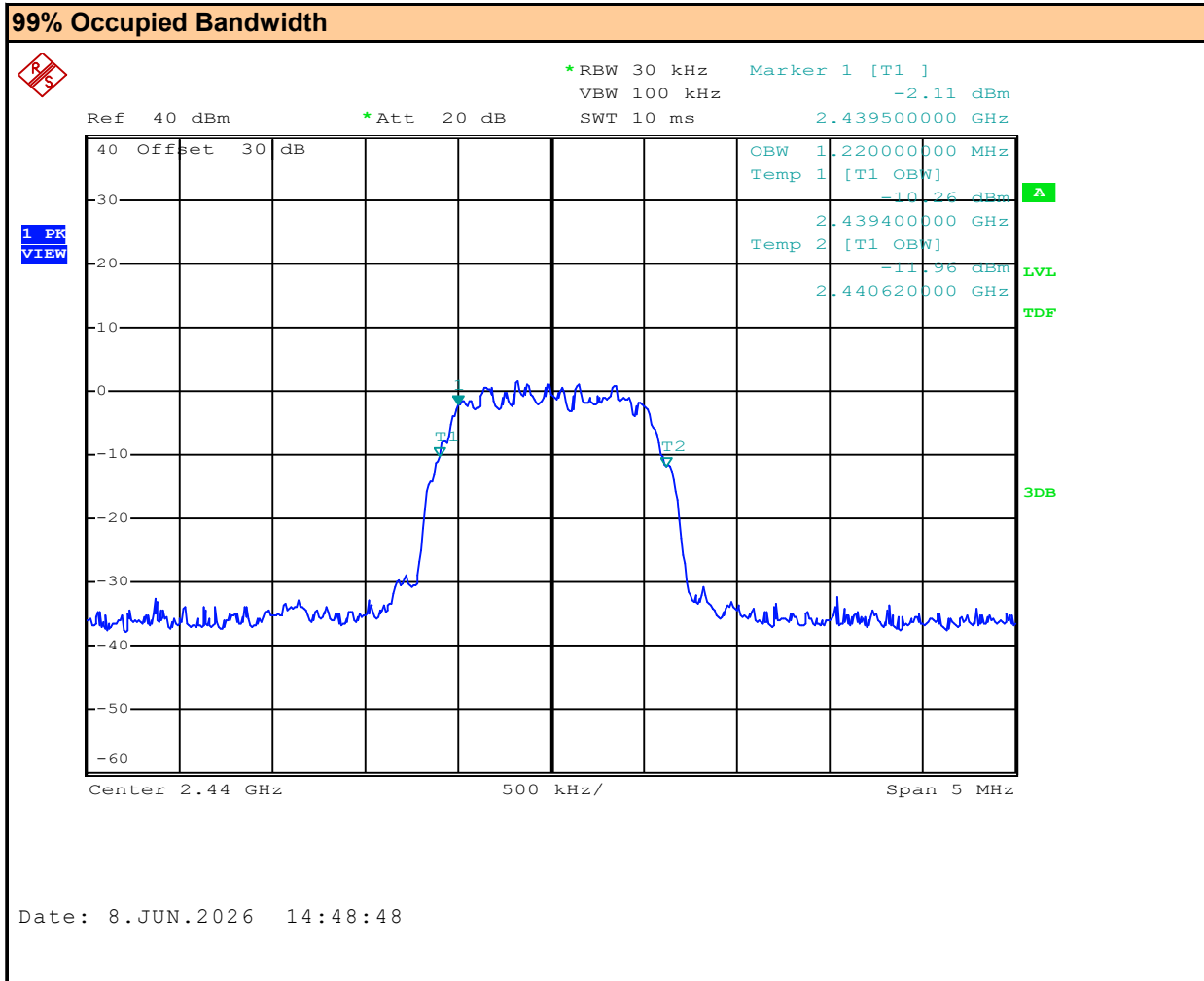


Channel: **38**
Mode: **BT EDR1**

Channel Frequency: **2440** MHz
Modulation: **GFSK**

Measured Occupied Bandwidth: **0.92** MHz

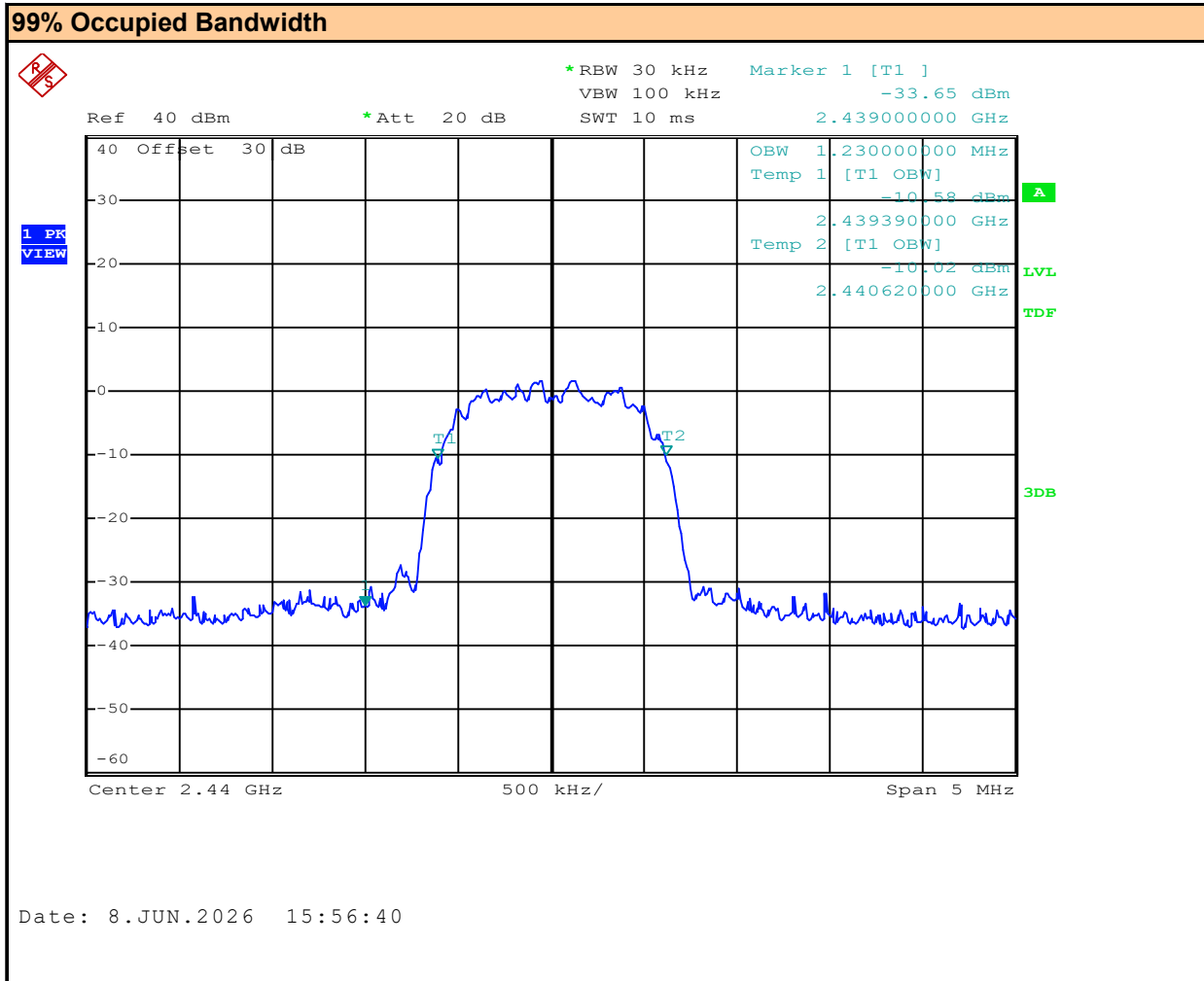
Plot 7.2 – Occupied Bandwidth, BT 2EDR



Channel: **38**
Mode: **BT 2EDR**

Channel Frequency: **2440** MHz
Modulation: **Pi/4-DQPSK**
Measured Occupied Bandwidth: **1.22** MHz

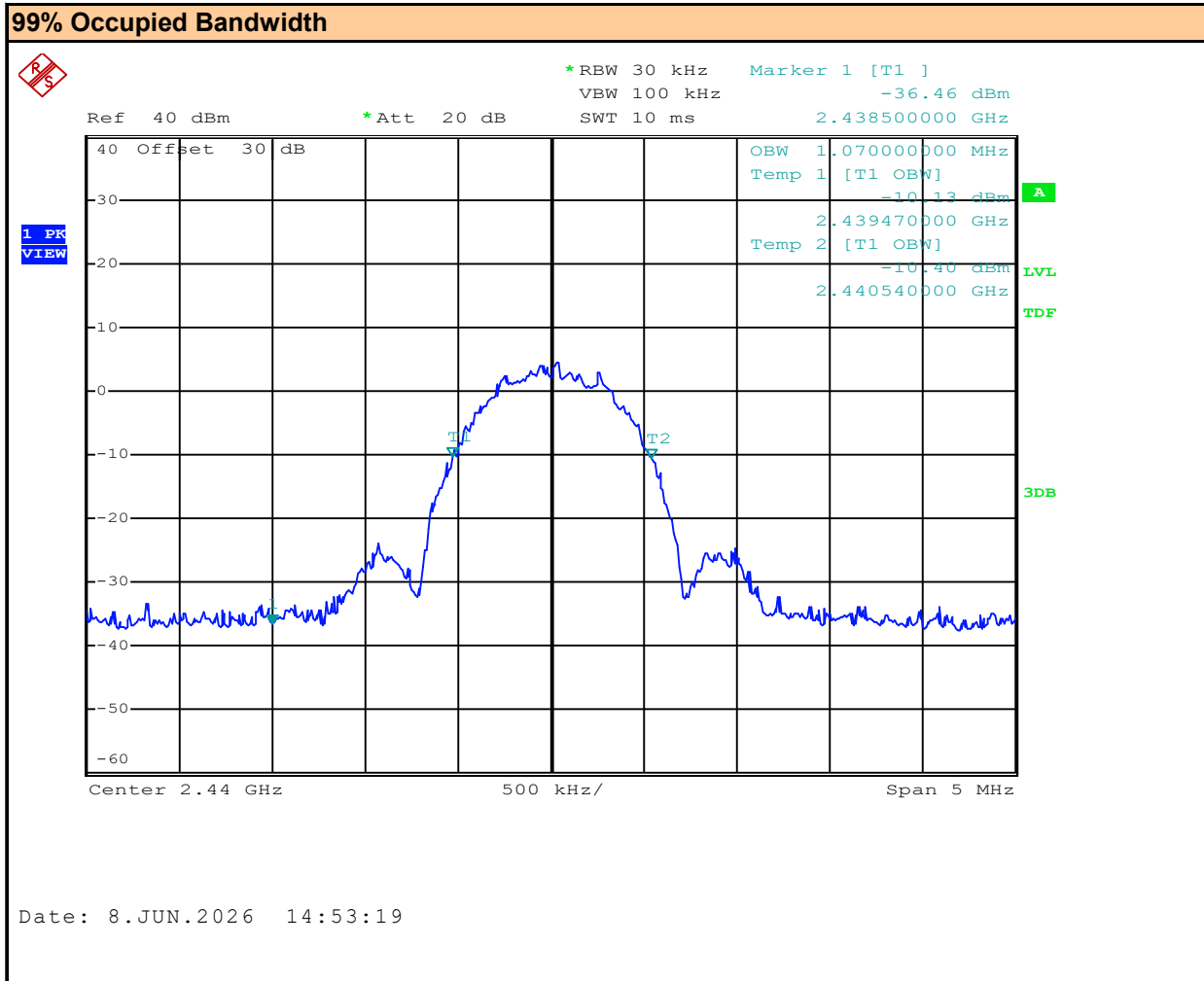
Plot 7.3 – Occupied Bandwidth, BT 3EDR



Channel: **38**
Mode: **BT 3EDR**

Channel Frequency: **2440** MHz
Modulation: **8-DSK**
Measured Occupied Bandwidth: **1.23** MHz

Plot 7.4 – Occupied Bandwidth, BT LE1

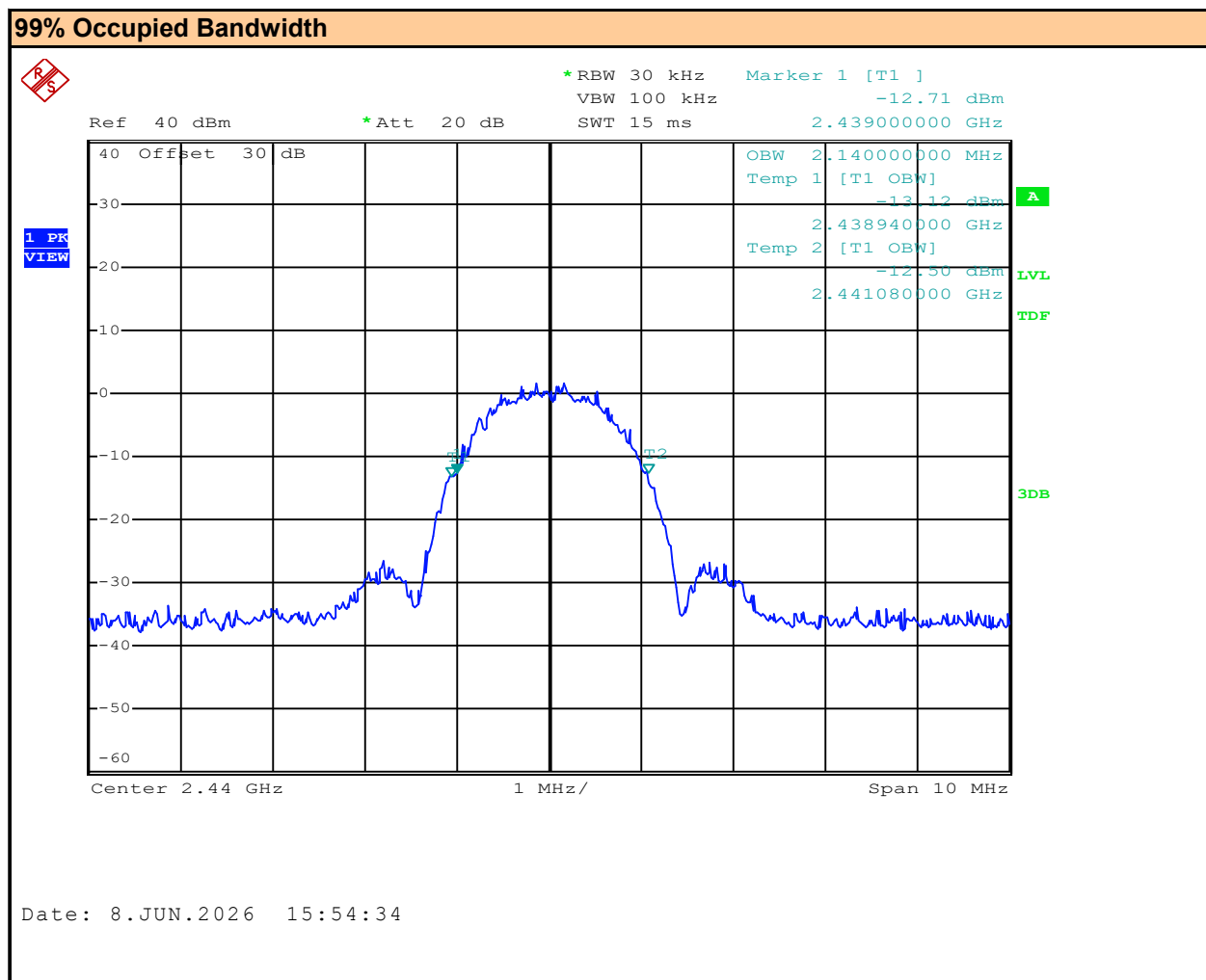


Channel: **19**
Mode: **LE 1MB**

Channel Frequency: **2440** MHz
Modulation: **GFSK**

Measured Occupied Bandwidth: **1.07** MHz

Plot 7.5 – Occupied Bandwidth, BT LE2



Channel: **19**
Mode: **LE 2MB**

Channel Frequency: **2440** MHz
Modulation: **GFSK**
Measured Occupied Bandwidth: **2.14** MHz

Table 7.1 – Summary of Occupied Bandwidth Measurements, (DSS)

99% Occupied Bandwidth Results:					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
38	2440.0	BT EDR1	GFSK	0.920	920KF1D
38	2440.0	BT 2EDR	Pi/4-DQPSK	1.220	1M22D1D
38	2440.0	BT 3EDR	8-DSPK	1.230	1M23D1D
19	2440.0	LE 1MB	GFSK	1.070	1M07F1D
19	2440.0	LE 2MB	GFSK	2.140	2M14F1D
Result:				Complies	

8.0 DTS BANDWIDTH

Test Procedure

Normative Reference	FCC 47 CFR §2.1049, §15.247(a)(2), RSS-Gen (6.7), RSS-247 (5.2)(a), KDB 558074 (8.2), ANSI C63.10 (11.8.2)
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Limits

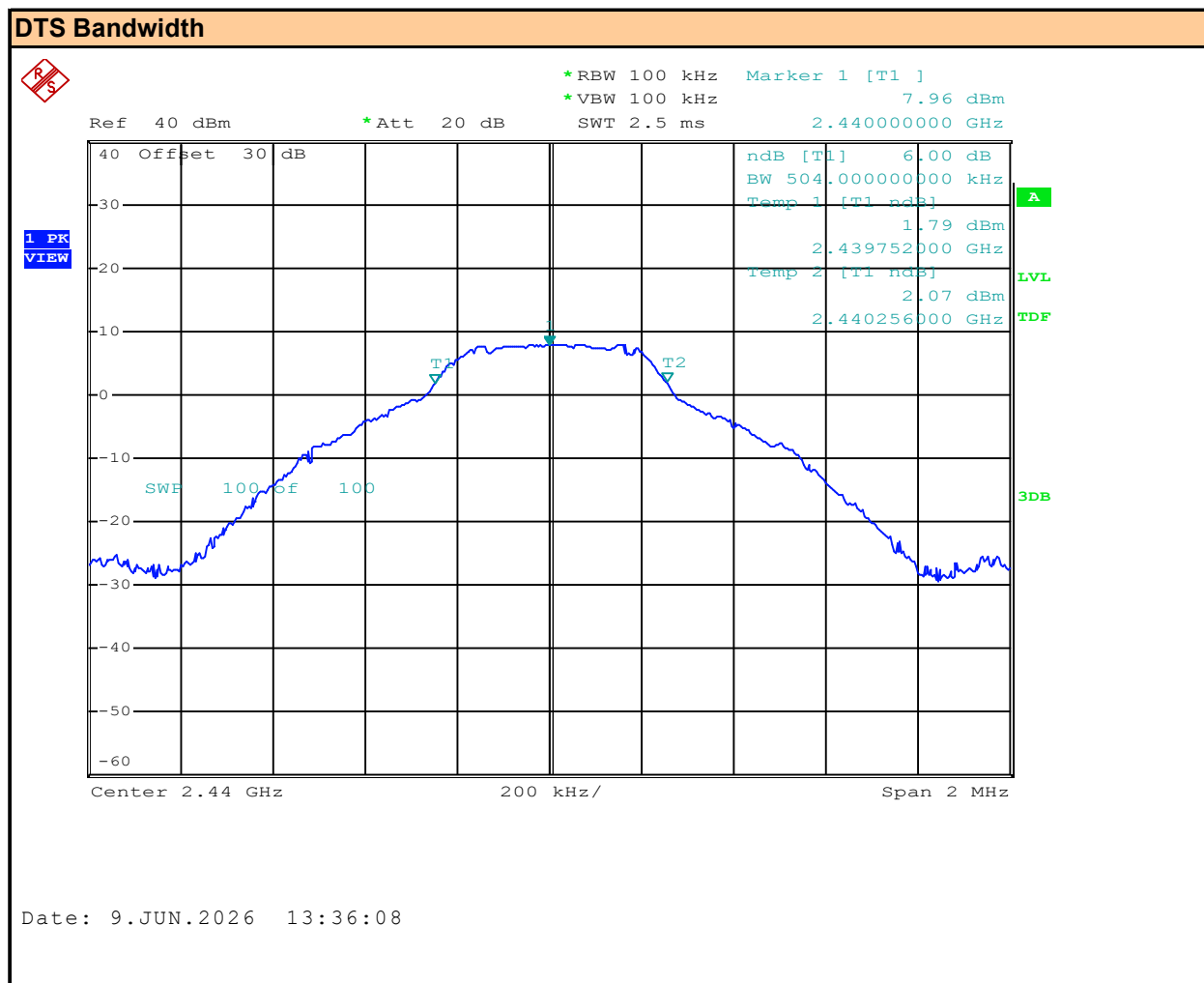
47 CFR §15.247(a)(2)	(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions: (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
RSS-247 (5.2)(a)	5.2 Digital transmission systems DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400 - 2483.5 MHz: a) The minimum 6 dB bandwidth shall be 500 kHz.
KDB 558074 (8.2) C63.10 (11.8.2)	8.2 Option 2 The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 X RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

Test Setup	Appendix A Figure A.1
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Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as above using the Automatic 6dB Cursor Bandwidth measurement. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at 100% Duty Cycle.

Plot 8.1 – 6dB DTS Bandwidth 1EDR



Channel: **39**

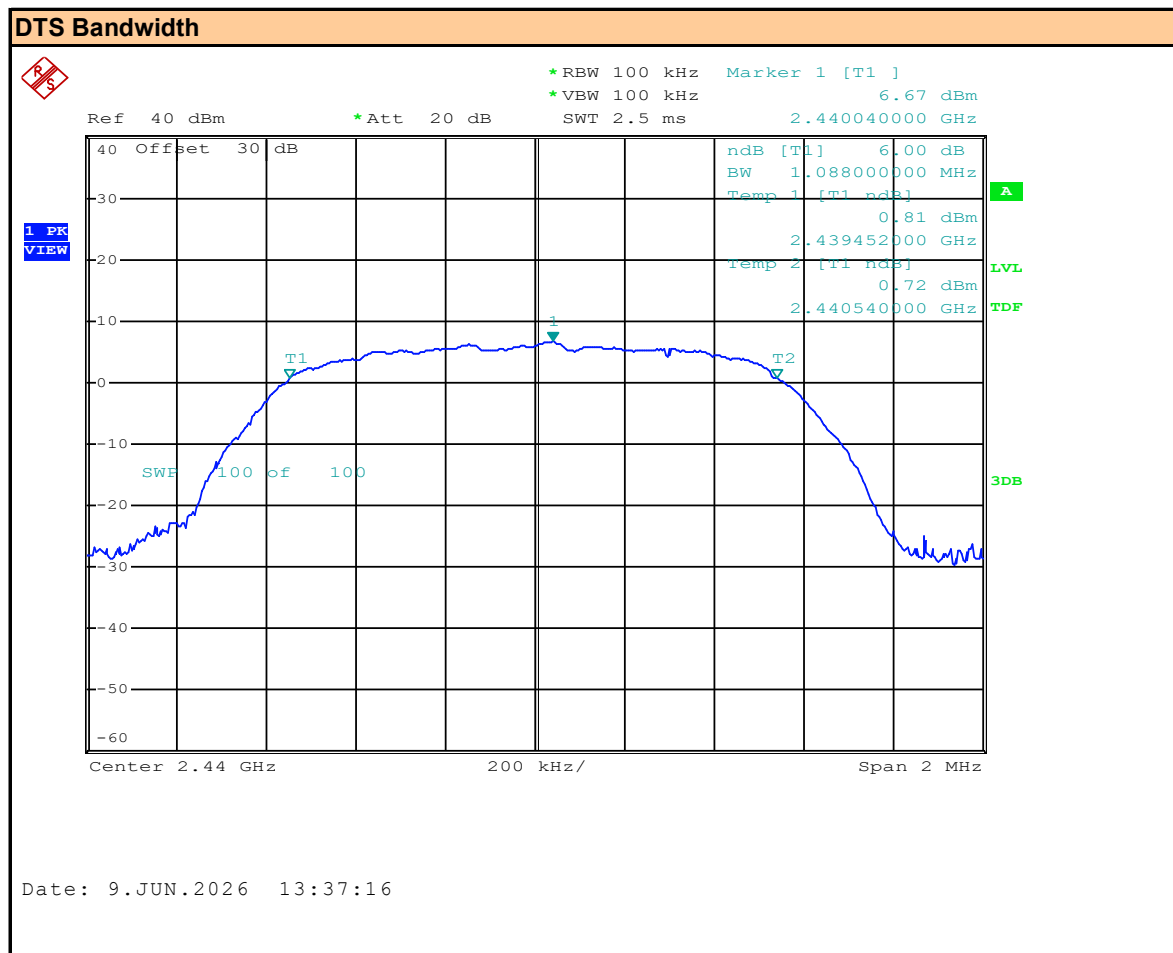
Mode: **BT 1EDR**

Channel Frequency: **2440** MHz

Modulation: **GFSK**

Measured DTS Bandwidth: **0.504** MHz

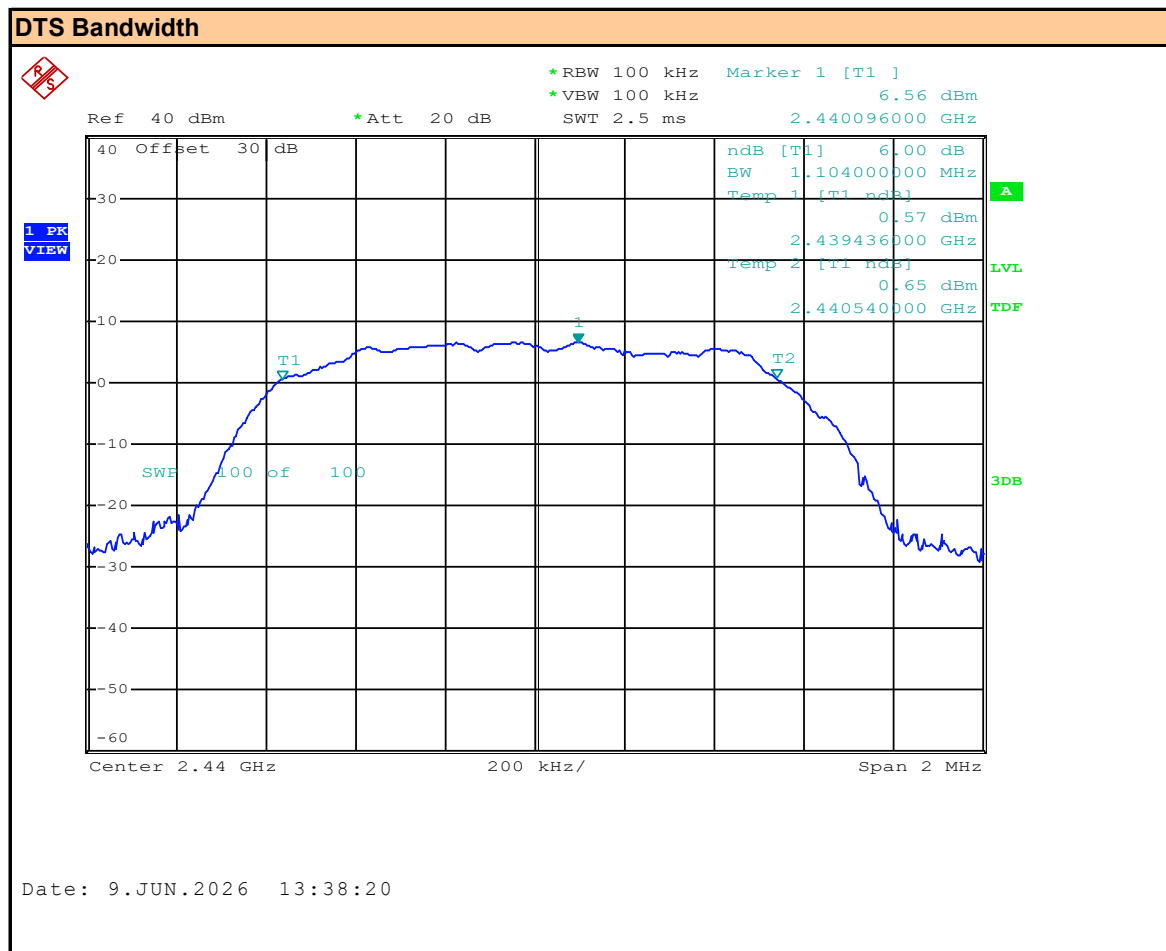
Plot 8.2 – 6dB DTS Bandwidth 2EDR



Channel: **39**
Mode: **BT 2EDR**

Channel Frequency: **2440** MHz
Modulation: **Pi/4-DQPSK**
Measured DTS Bandwidth: **1.088** MHz

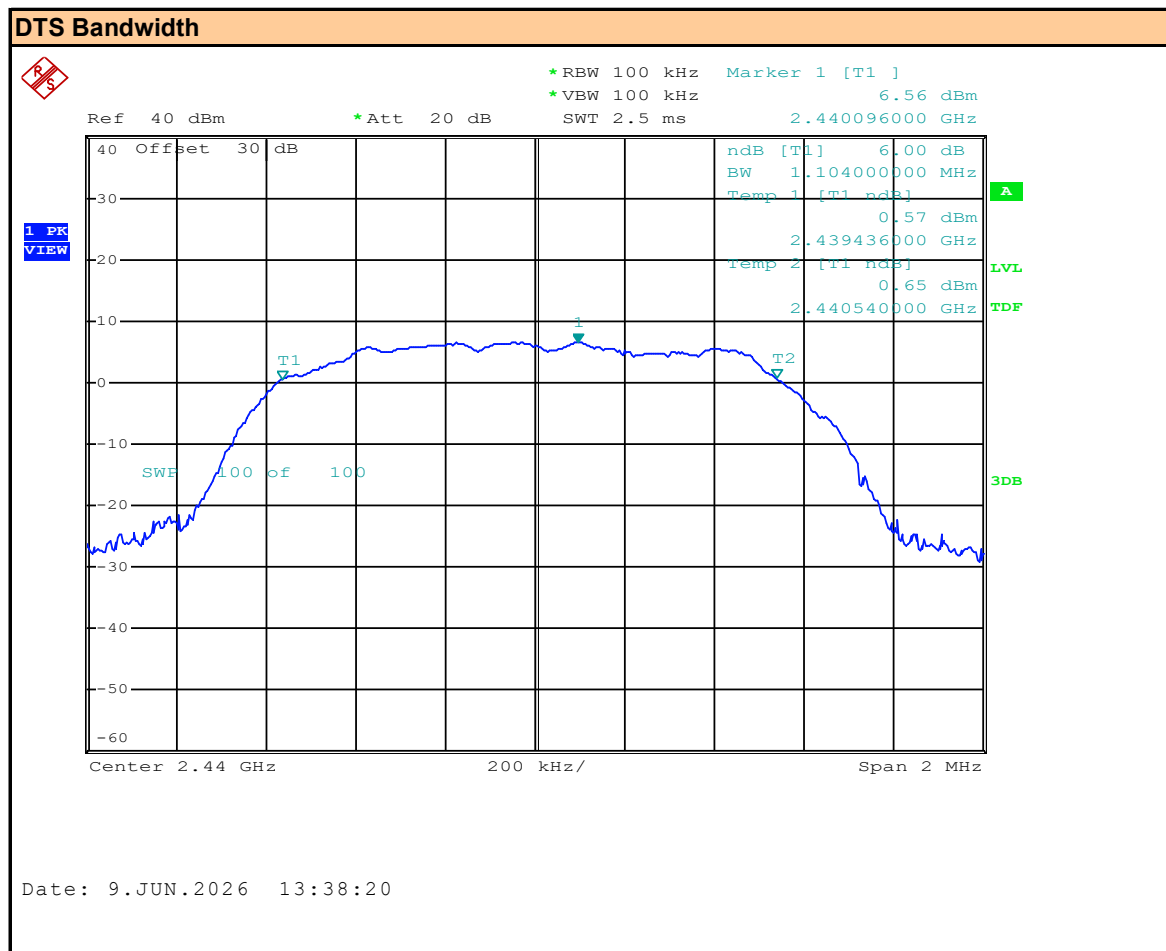
Plot 8.3 – 6dB DTS Bandwidth 3EDR



Channel: **39**
Mode: **BT 3EDR**

Channel Frequency: **2440** MHz
Modulation: **8-DPSK**
Measured DTS Bandwidth: **1.104** MHz

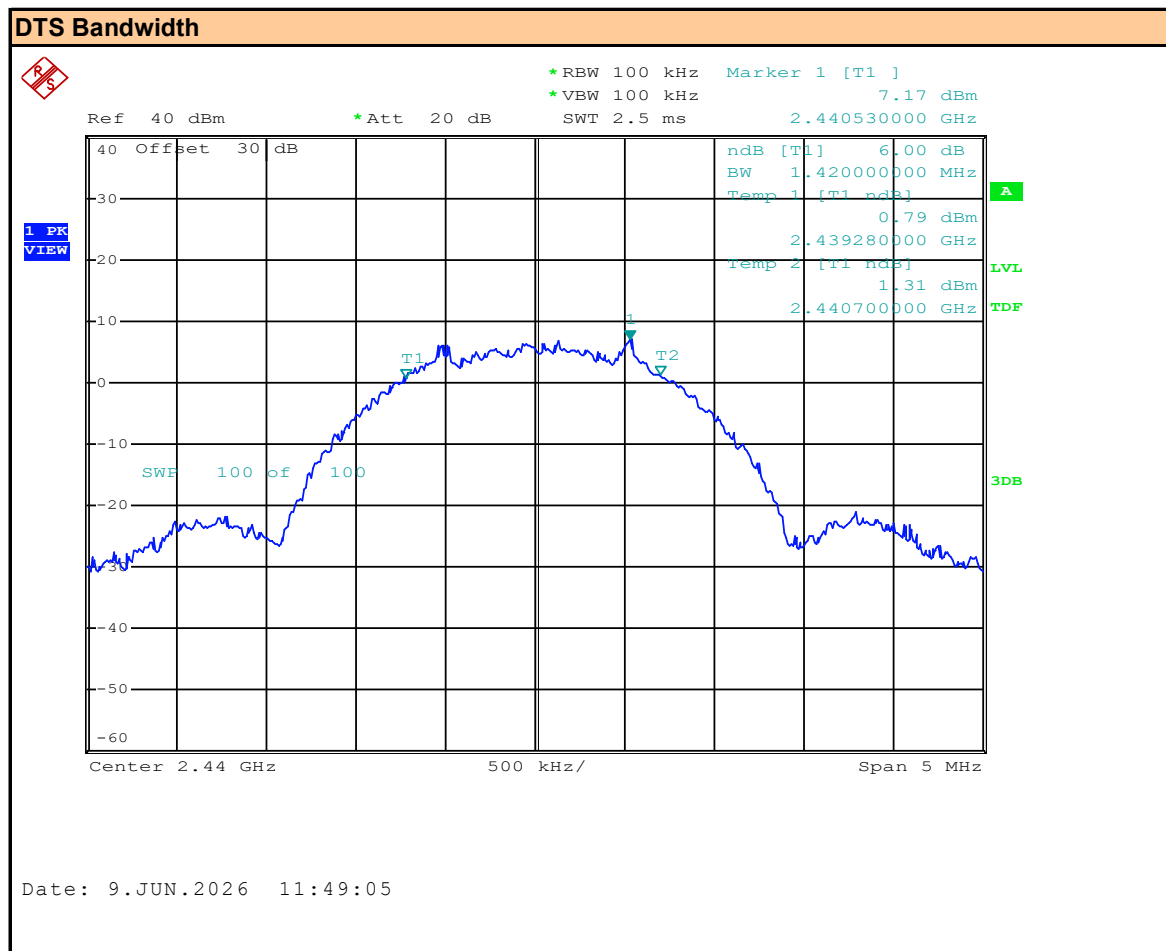
Plot 8.4 – 6dB DTS Bandwidth LE1



Channel: **18**
Mode: **LE1**

Channel Frequency: **2440** MHz
Modulation: **GFSK**
Measured DTS Bandwidth: **1.104** MHz

Plot 8.5 – 6dB DTS Bandwidth LE2



Channel: **18**
Mode: **LE2**

Channel Frequency: **2440** MHz
Modulation: **GFSK**
Measured DTS Bandwidth: **1.42** MHz

Table 8.1 – Summary of 6dB DTS Bandwidth Measurements, (DSS

DTS Bandwidth Results:						
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured DTS Bandwidth (MHz)	Minimum DTS Bandwidth (MHz)	Margin (MHz)
39	2440.0	BT 1EDR	GFSK	0.504	0.500	0.004
39	2440.0	BT 2EDR	Pi/4-DQPSK	1.088		0.588
39	2440.0	BT 3EDR	8-DPSK	1.104		0.604
18	2440.0	LE1	GFSK	1.104		0.604
18	2440.0	LE2	GFSK	1.420		0.920
Result:						Complies

9.0 ANTENNA PORT CONDUCTED POWER, (DSS)

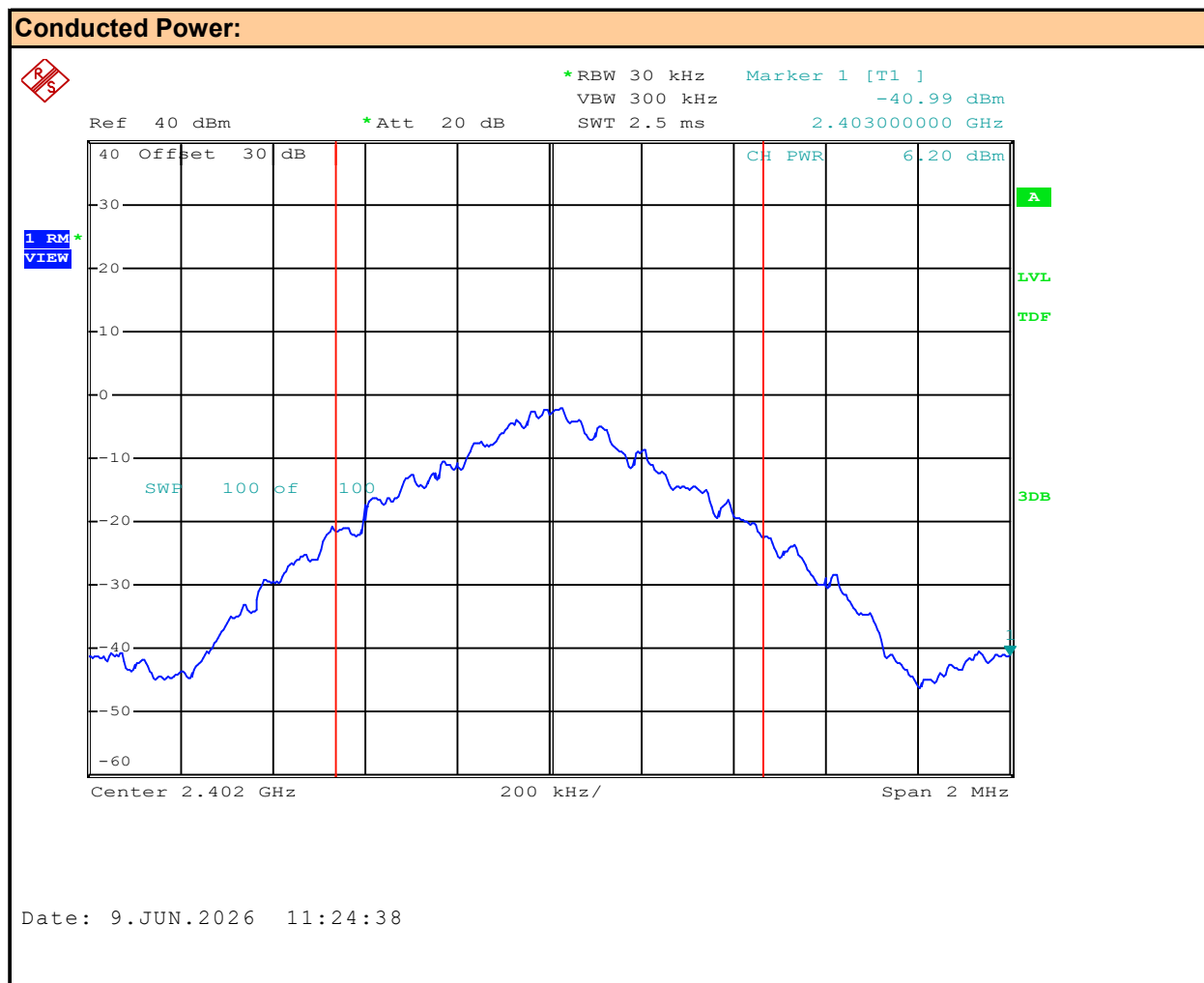
Test Procedure

Normative Reference	FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d), KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.2)
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Limits

47 CFR §15.247(b)(3)	(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.
RSS-247 (5.4)(d)	5.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) Devices shall comply with the following requirements, where applicable: d) For DTSS employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.

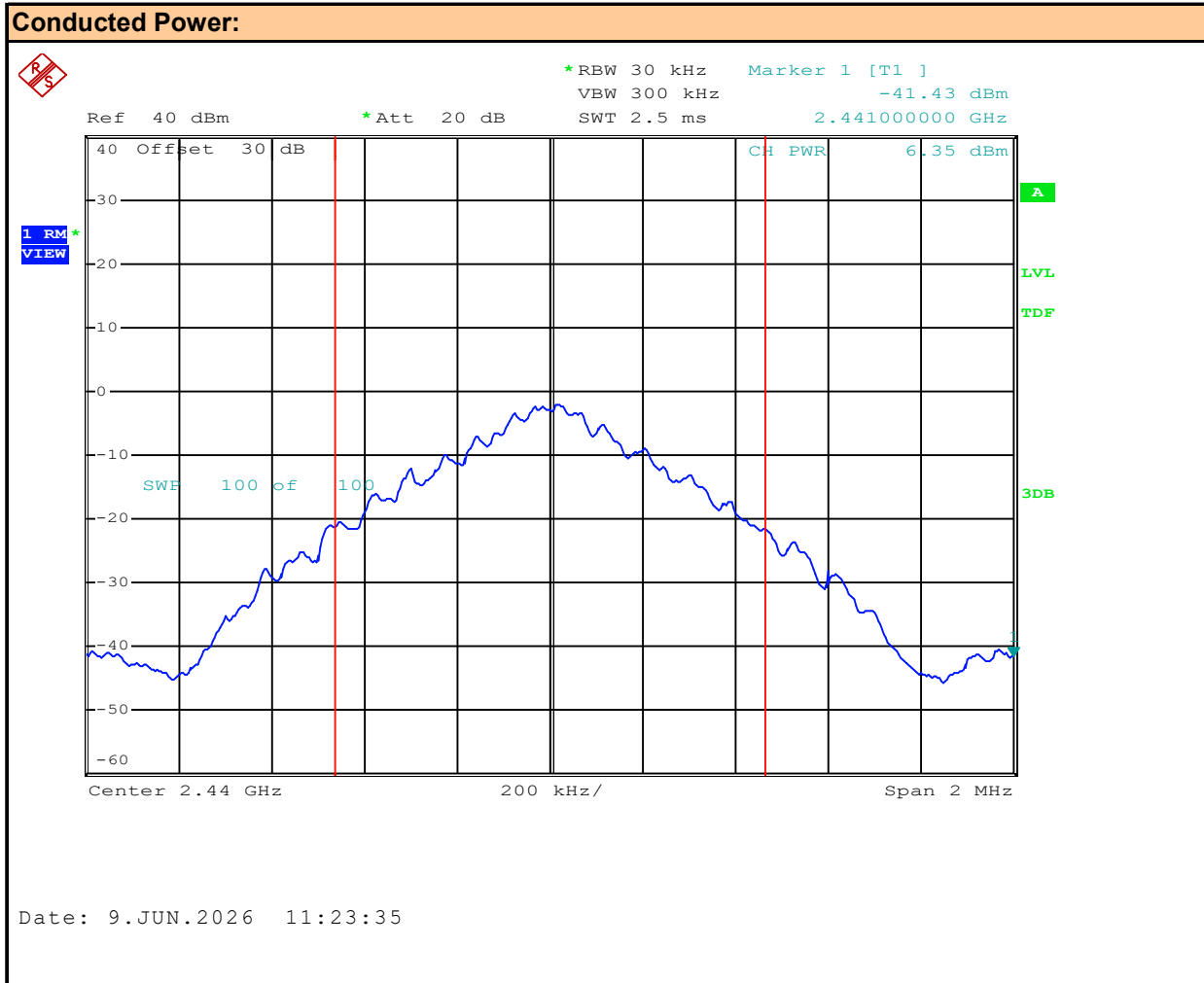
Plot 9.1 – 6dB DTS Bandwidth 1EDR, Ch 0



Channel:
Mode:

Channel Frequency: MHz
Measured Channel Power: dBm

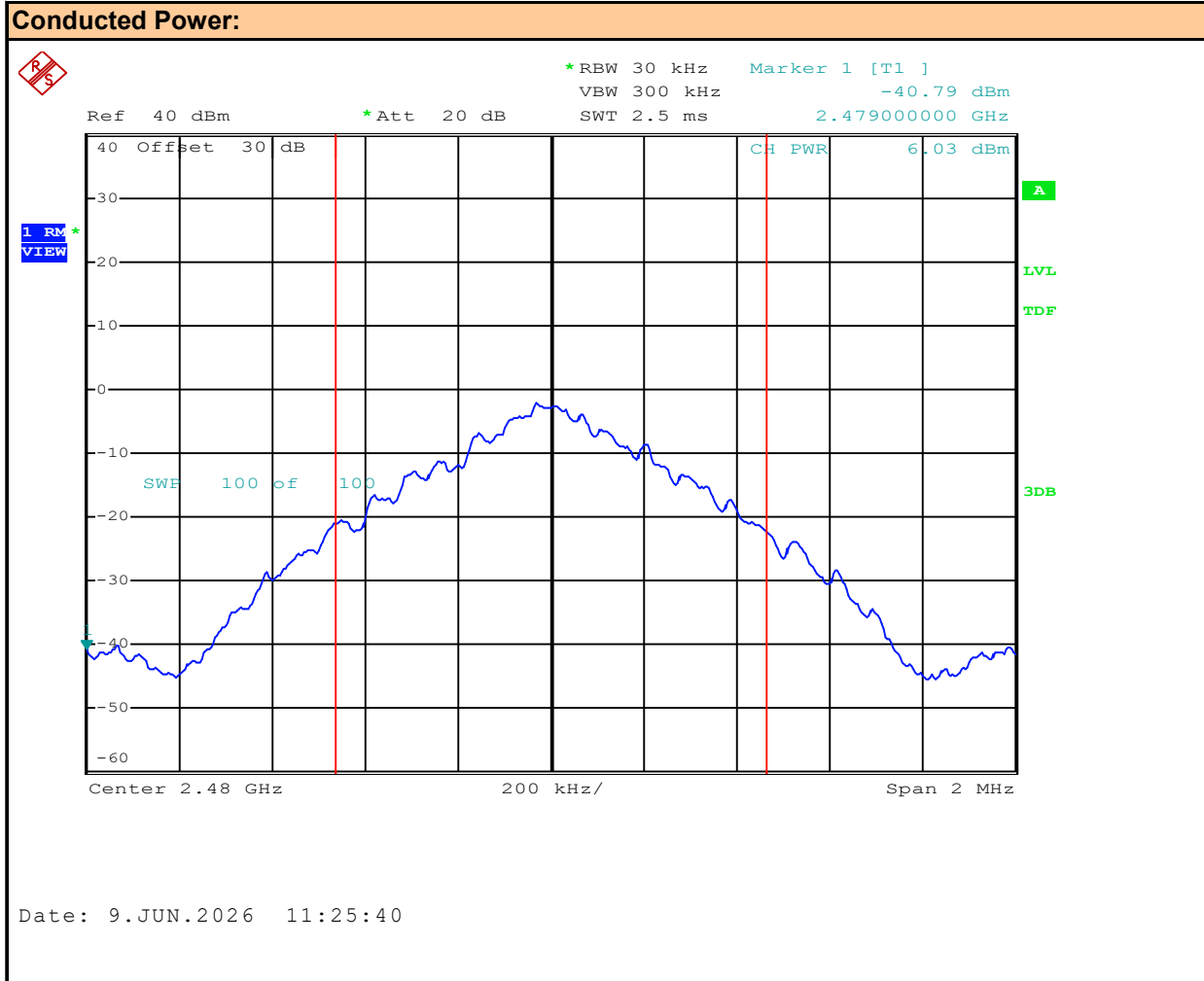
Plot 9.2 – 6dB DTS Bandwidth 1EDR, Ch 38



Channel: **38**
Mode: **1EDR**

Channel Frequency: **2440** MHz
Measured Channel Power: **6.35** dBm

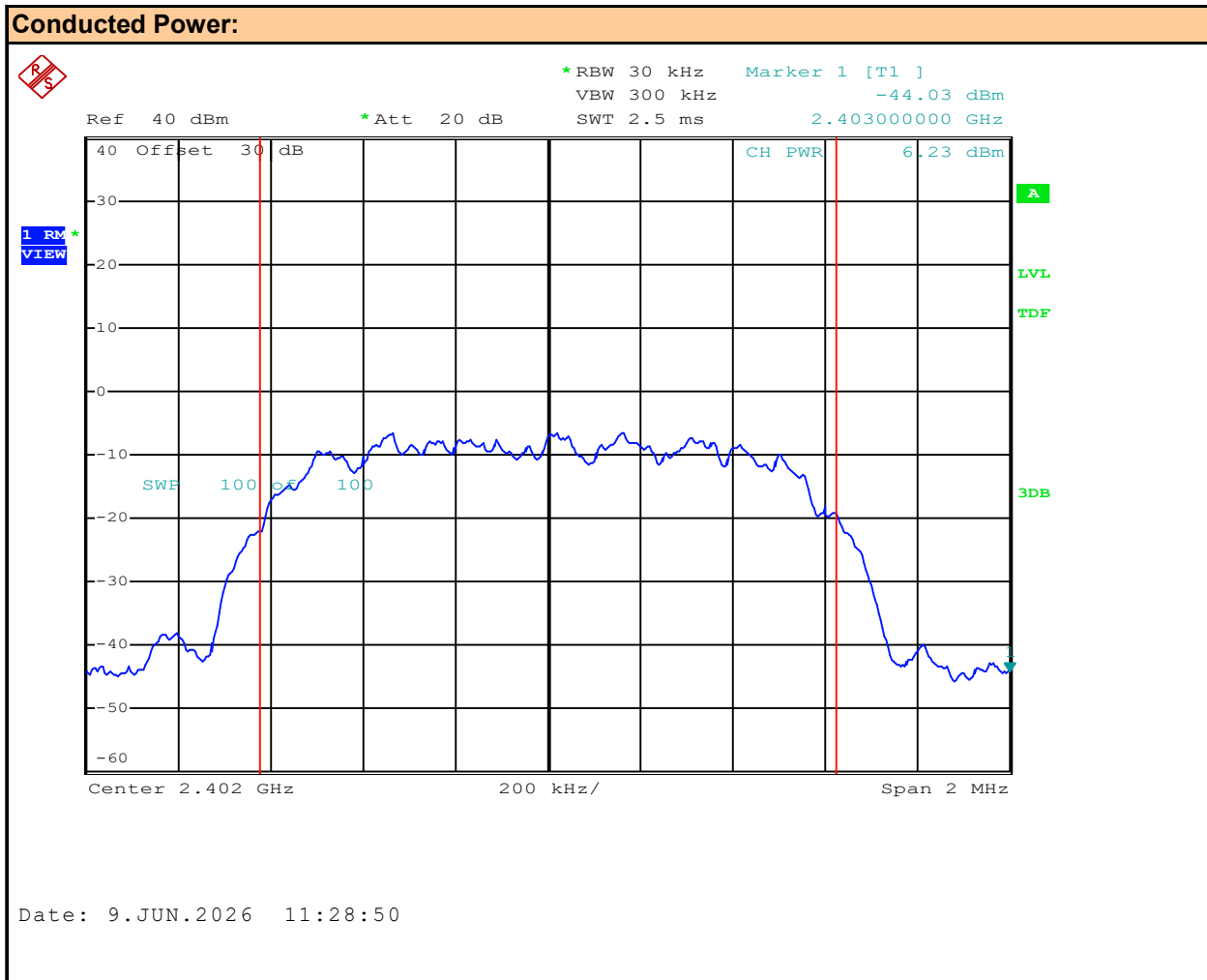
Plot 9.3 – 6dB DTS Bandwidth 1EDR, Ch 78



Channel: **78**
Mode: **1EDR**

Channel Frequency: **2480** MHz
Measured Channel Power: **6.03** dBm

Plot 9.4 – 6dB DTS Bandwidth 2EDR, Ch 0

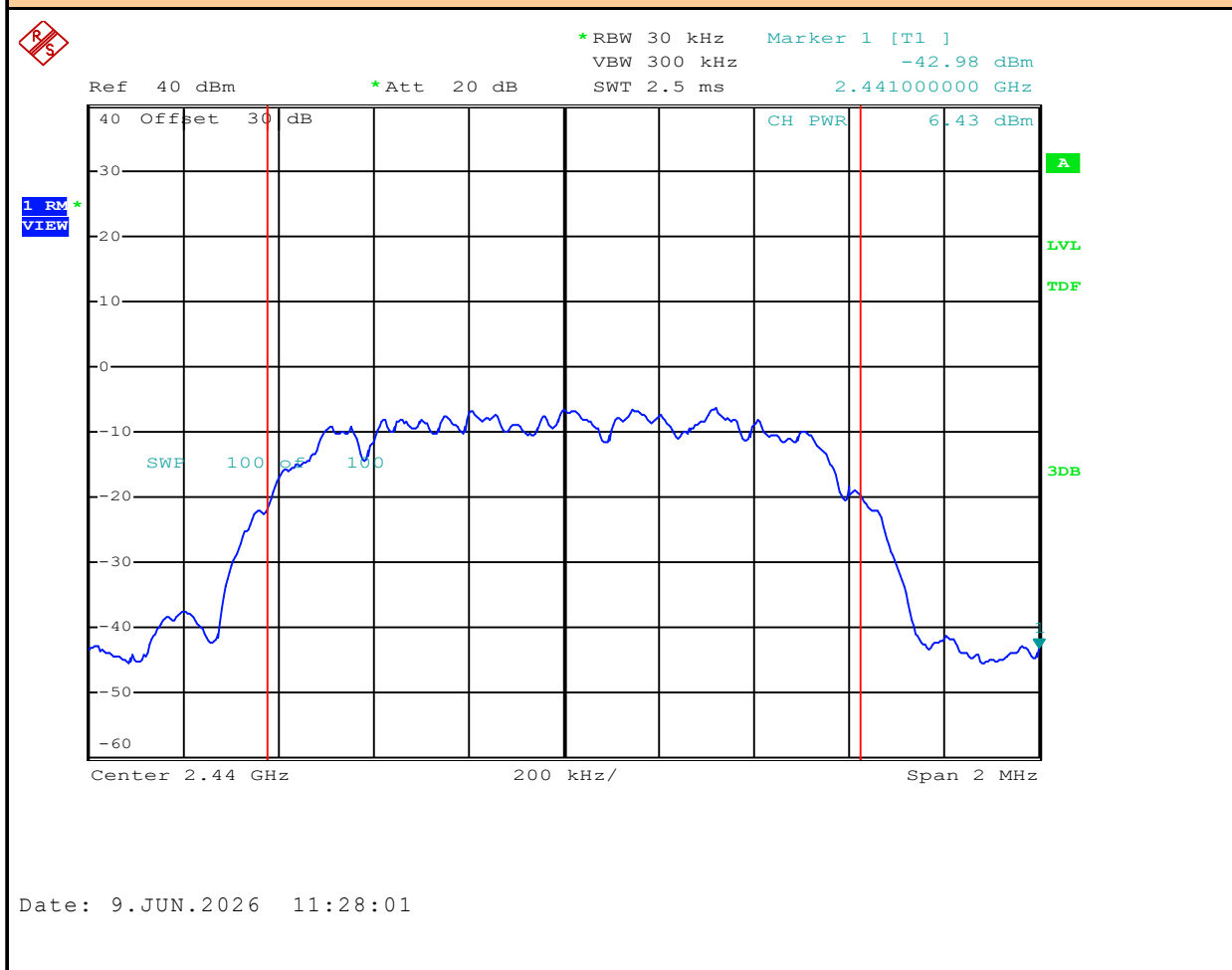


Channel: **0**
Mode: **2EDR**

Channel Frequency: **2402** MHz
Measured Channel Power: **6.23** dBm

Plot 9.5 – 6dB DTS Bandwidth 2EDR, Ch 38

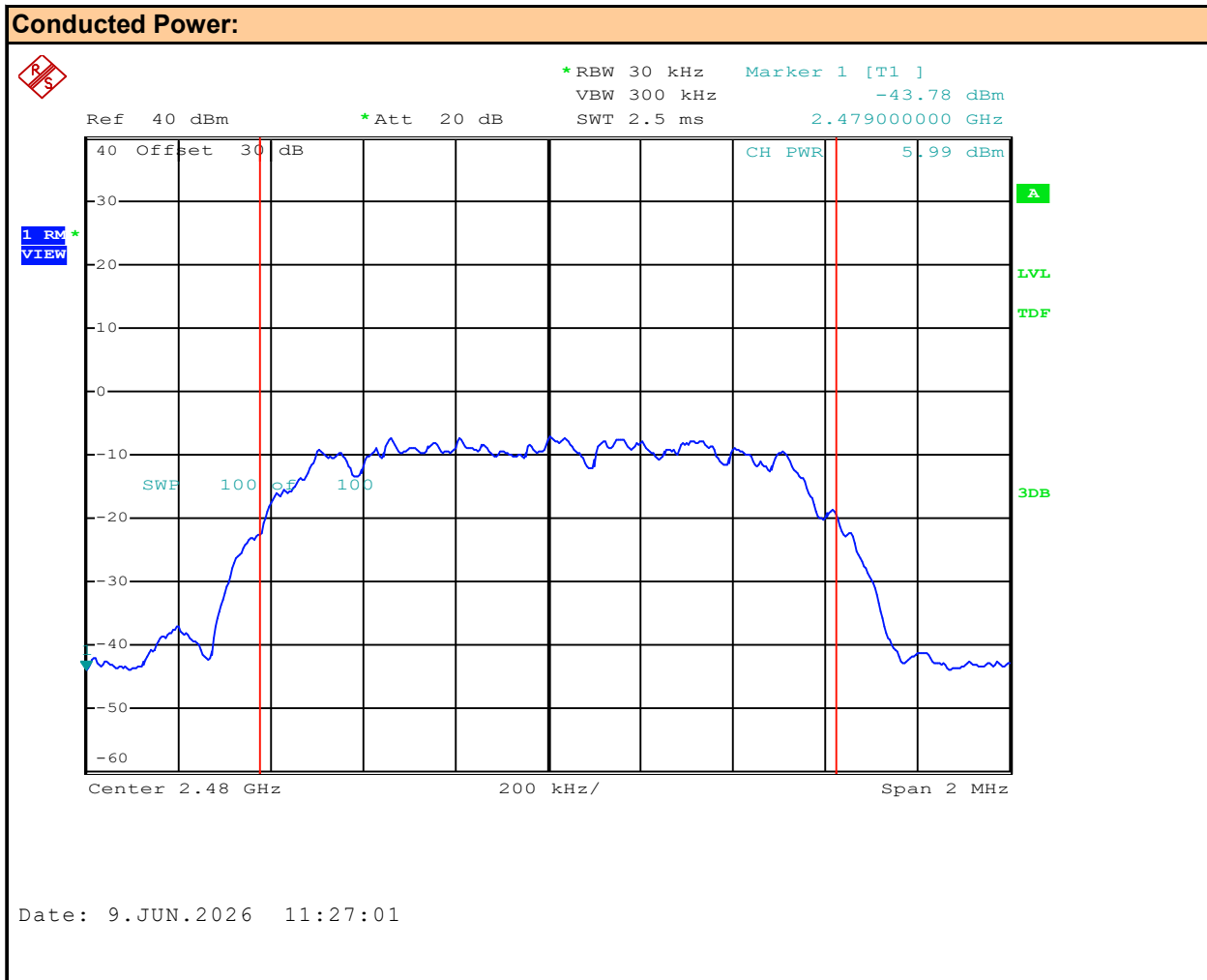
Conducted Power:



Channel: **38**
Mode: **2EDR**

Channel Frequency: **2440** MHz
Measured Channel Power: **6.43** dBm

Plot 9.6 – 6dB DTS Bandwidth 2EDR, Ch 78

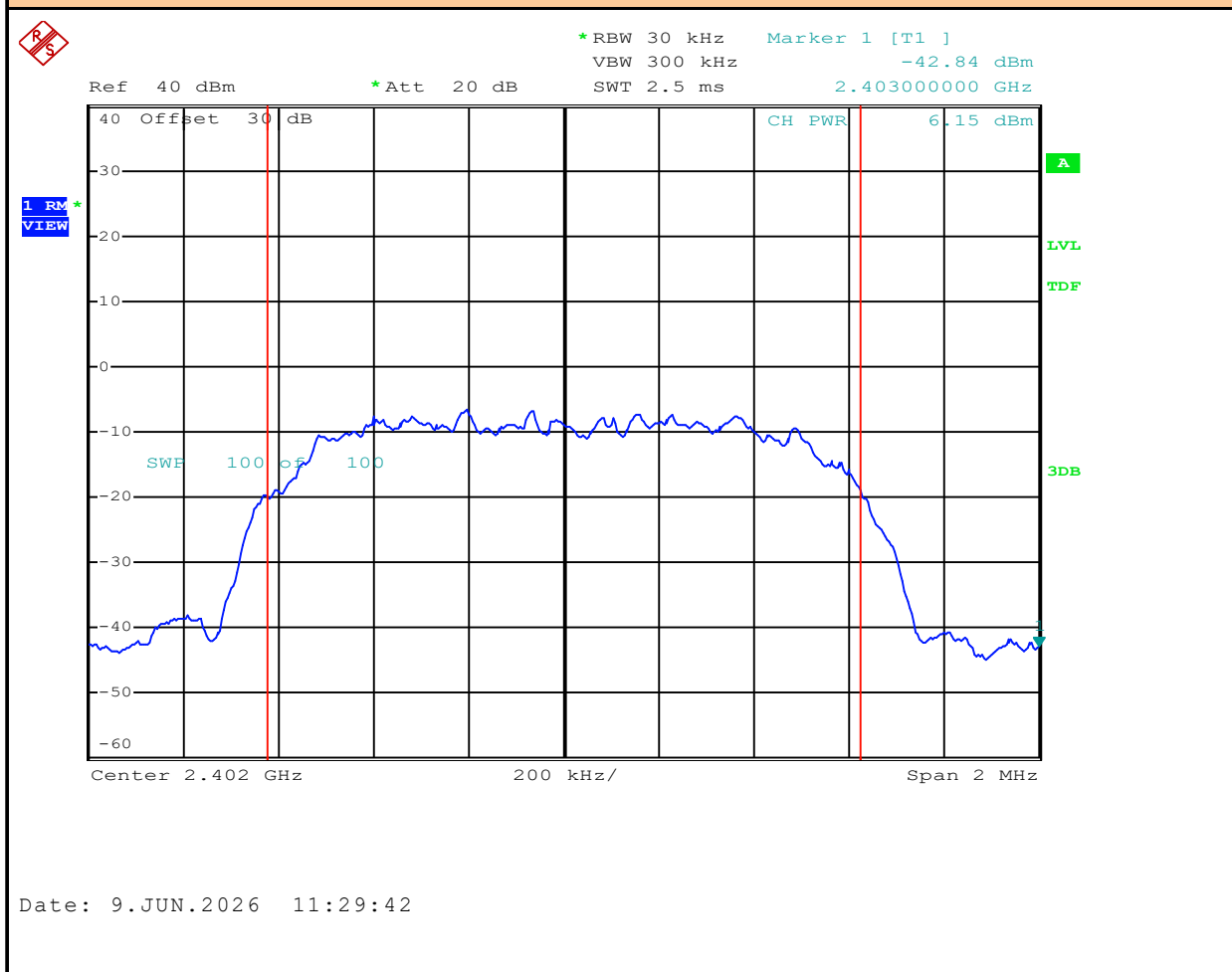


Channel: **78**
Mode: **2EDR**

Channel Frequency: **2480** MHz
Measured Channel Power: **5.99** dBm

Plot 9.7 – 6dB DTS Bandwidth 3EDR, Ch 0

Conducted Power:

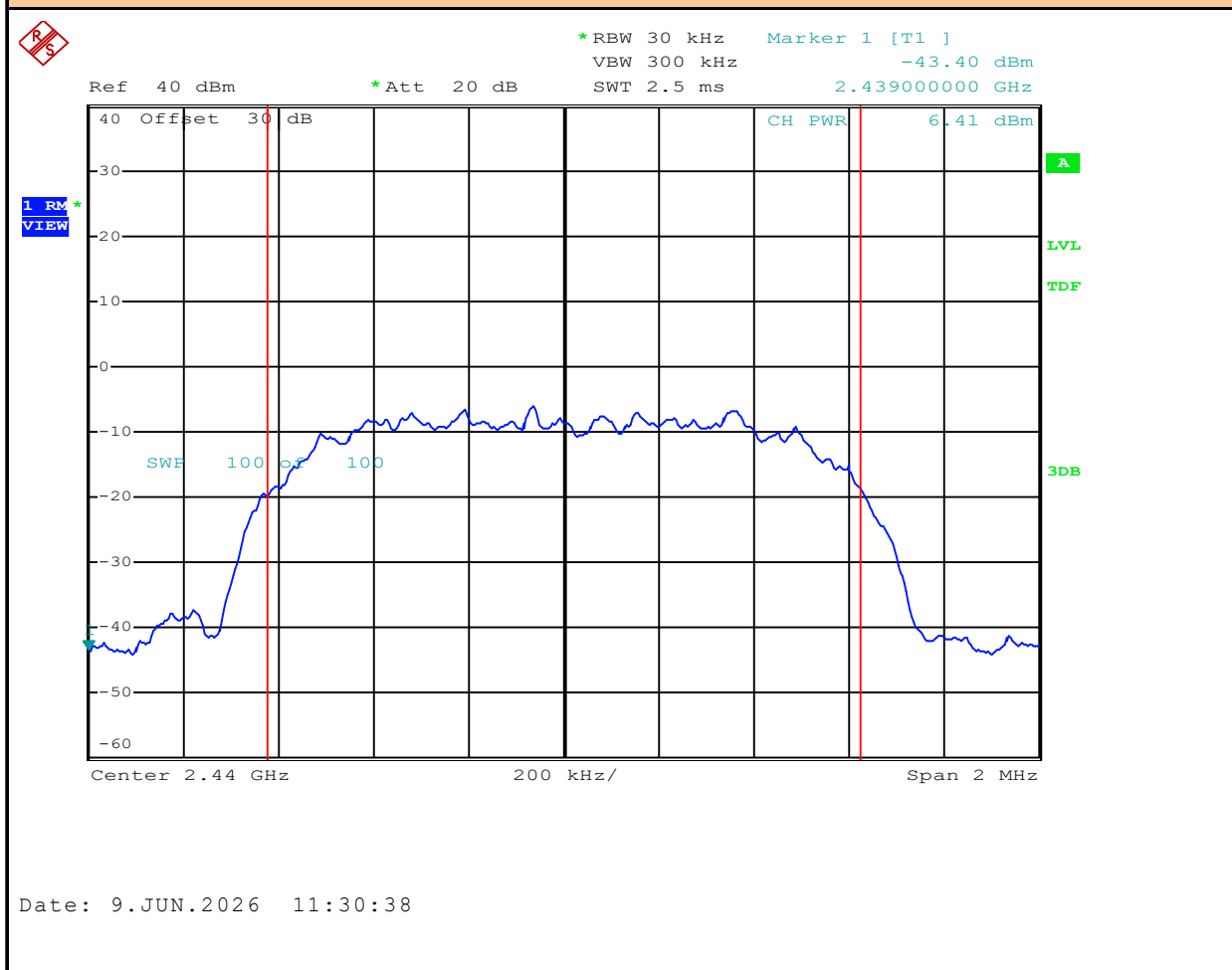


Channel: **0**
Mode: **3EDR**

Channel Frequency: **2402** MHz
Measured Channel Power: **6.15** dBm

Plot 9.8 – 6dB DTS Bandwidth 3EDR, Ch 38

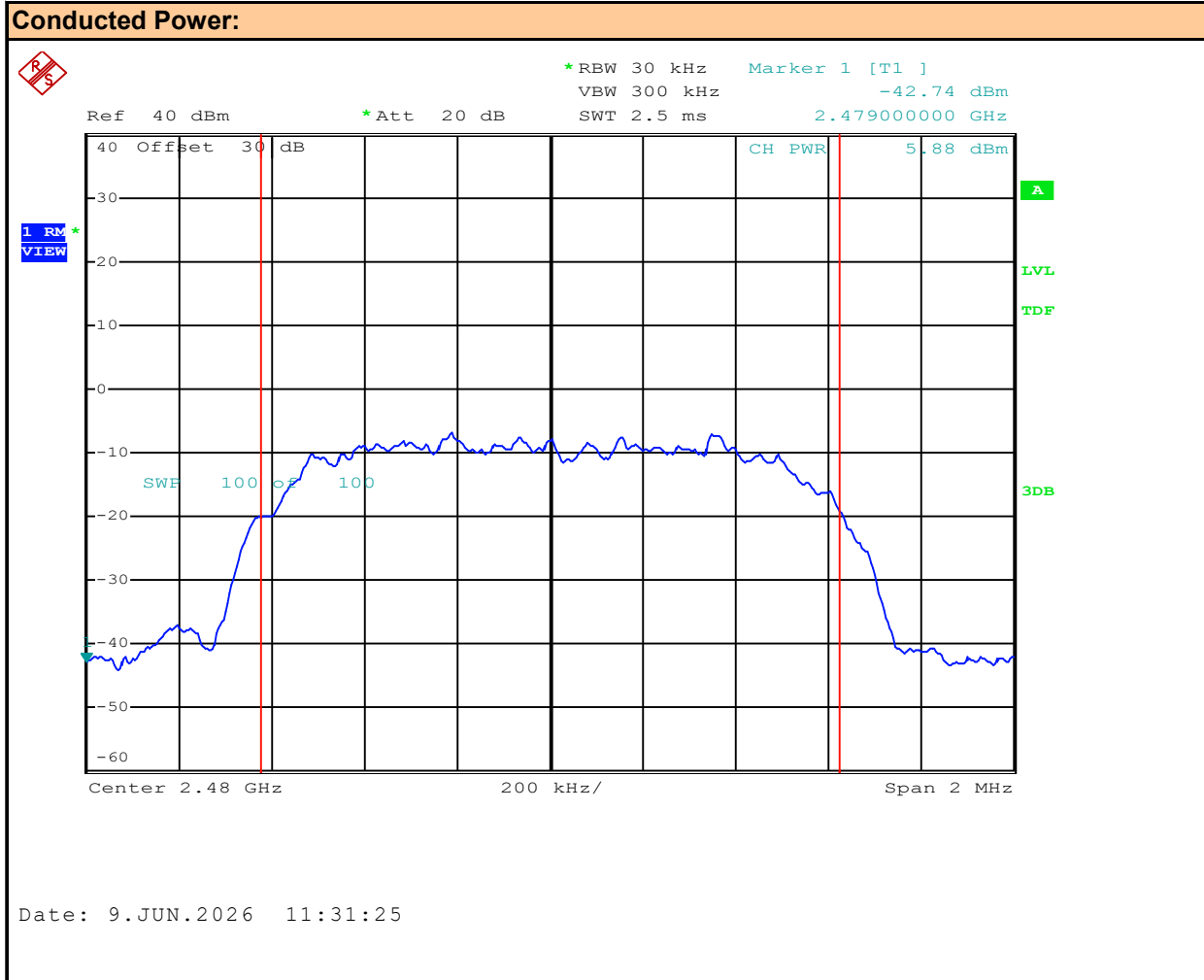
Conducted Power:



Channel: **38**
Mode: **3EDR**

Channel Frequency: **2440** MHz
Measured Channel Power: **6.41** dBm

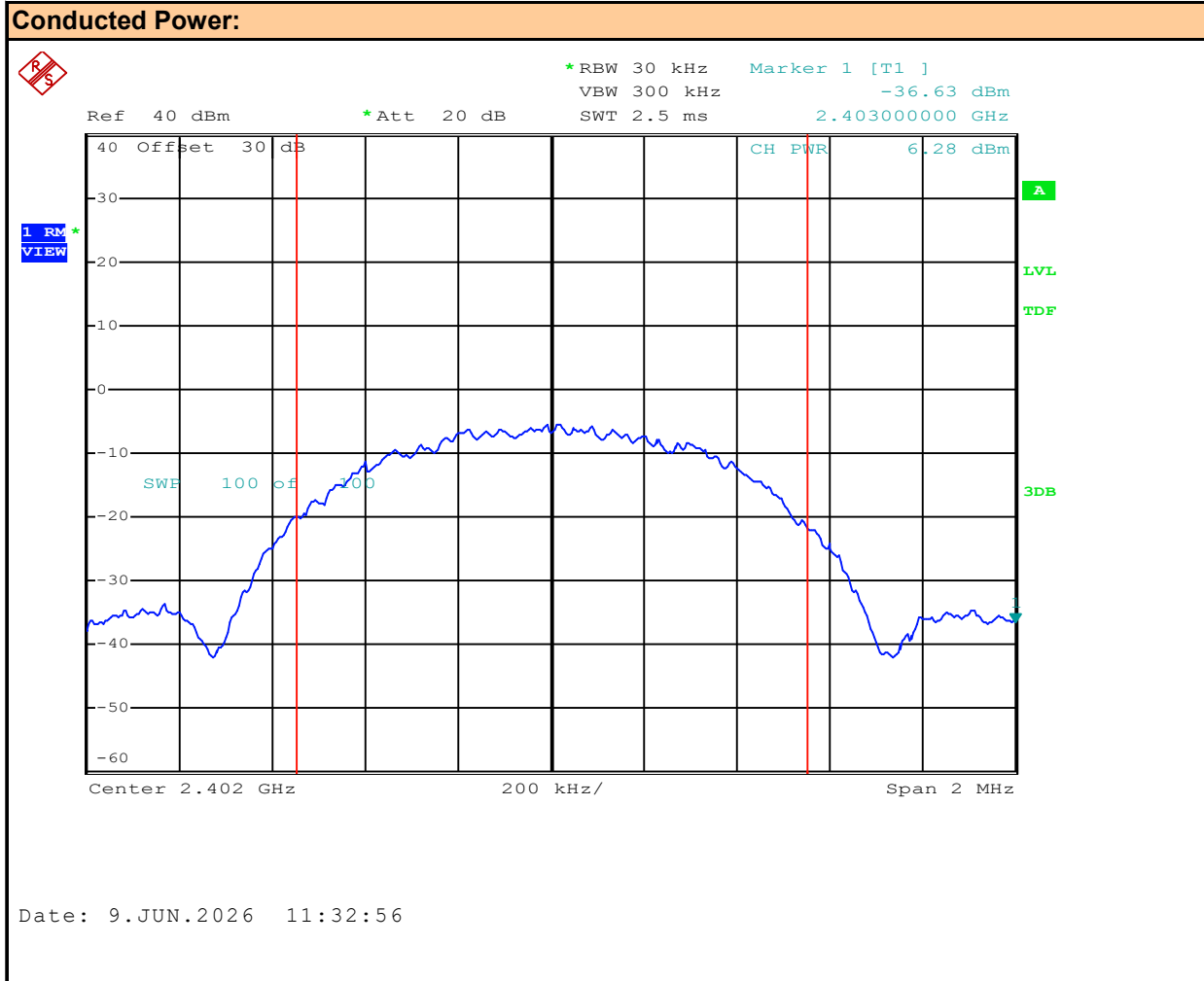
Plot 9.9 – 6dB DTS Bandwidth 3EDR, Ch 78



Channel: **78**
Mode: **3EDR**

Channel Frequency: **2480** MHz
Measured Channel Power: **5.88** dBm

Plot 9.10 – 6dB DTS Bandwidth LE1, Ch 0



Channel: **0**
Mode: **LE1**

Channel Frequency: **2402** MHz
Measured Channel Power: **6.28** dBm

Plot 9.11 – 6dB DTS Bandwidth LE1, Ch 19

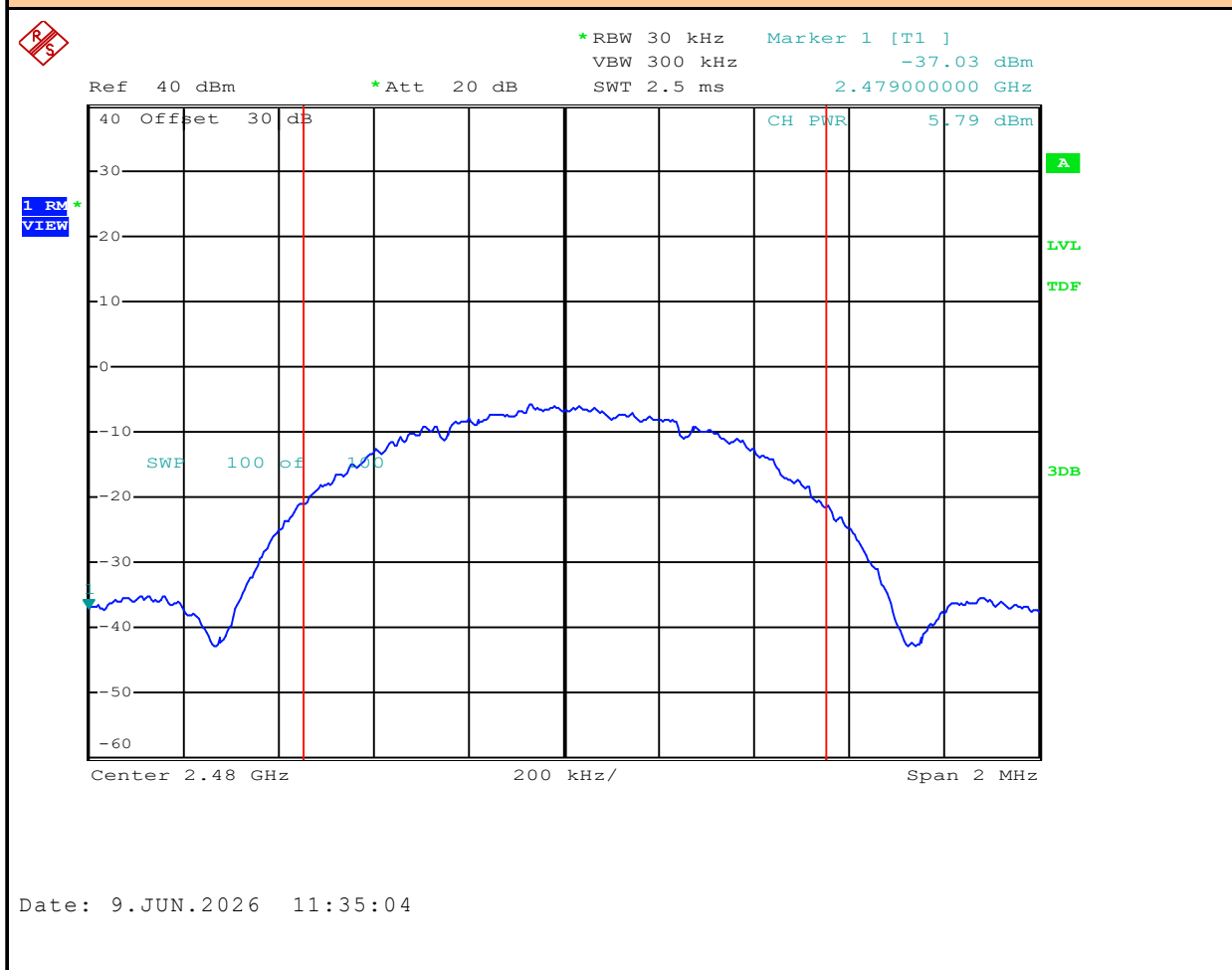


Channel: **19**
Mode: **LE1**

Channel Frequency: **2440** MHz
Measured Channel Power: **6.37** dBm

Plot 9.12 – 6dB DTS Bandwidth LE1, Ch 38

Conducted Power:



Channel: **38**
Mode: **LE1**

Channel Frequency: **2480** MHz
Measured Channel Power: **5.79** dBm

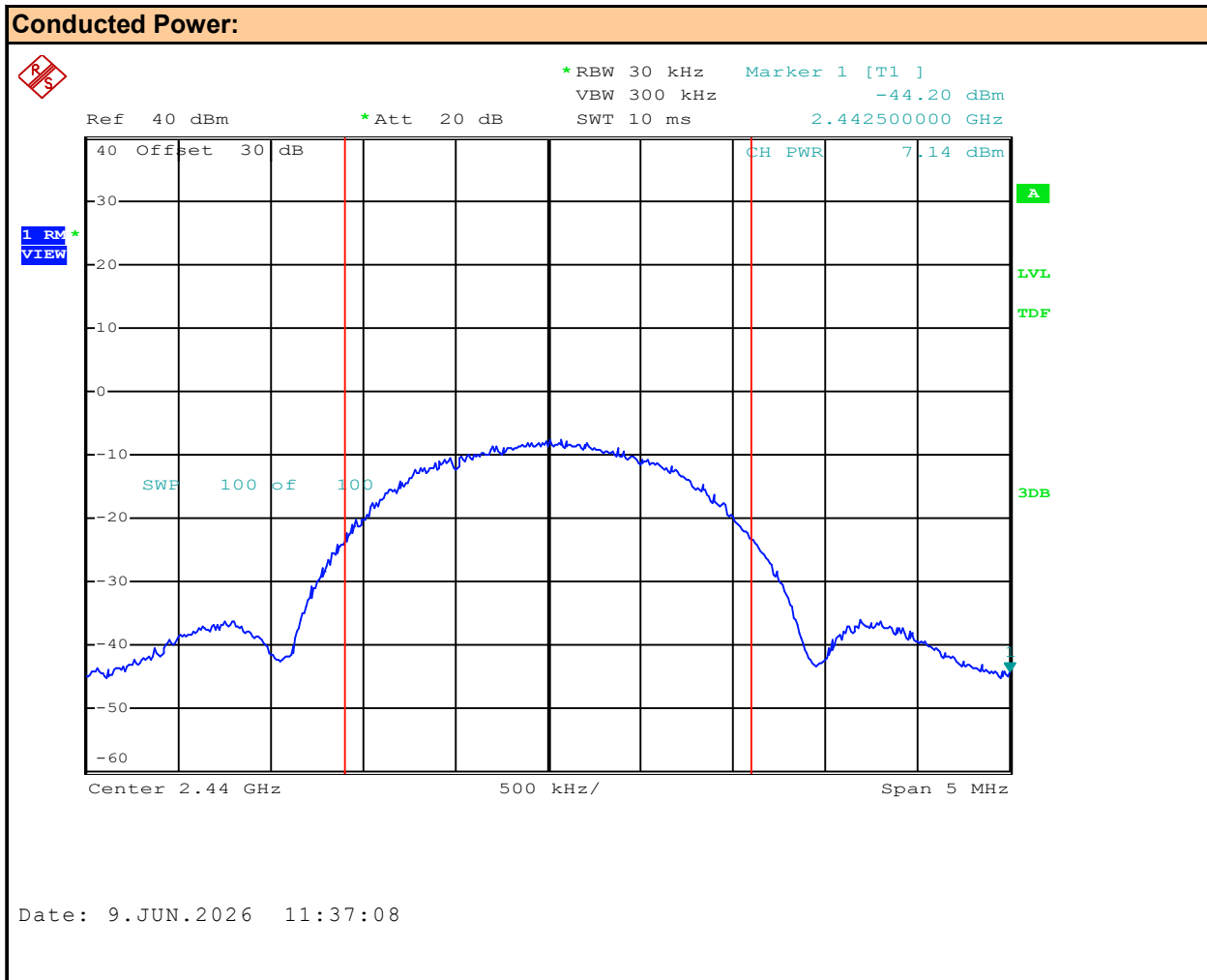
Plot 9.13 – 6dB DTS Bandwidth LE2, Ch 0



Channel: **0**
Mode: **LE2**

Channel Frequency: **2402** MHz
Measured Channel Power: **6.87** dBm

Plot 9.14 – 6dB DTS Bandwidth LE2, Ch 19

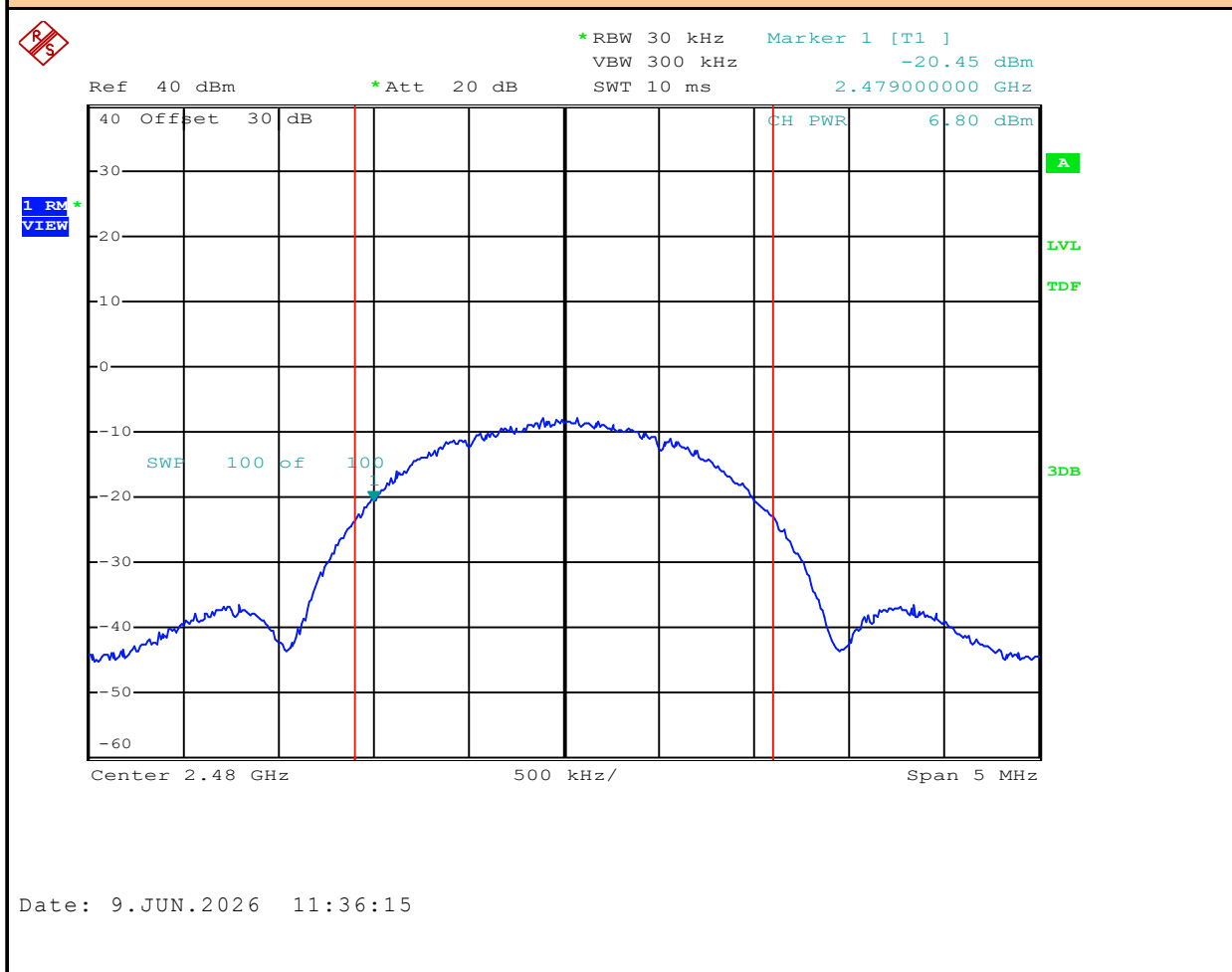


Channel: **19**
Mode: **LE2**

Channel Frequency: **2440** MHz
Measured Channel Power: **7.14** dBm

Plot 9.15 – 6dB DTS Bandwidth LE2, Ch 38

Conducted Power:



Channel: **38**
Mode: **LE2**

Channel Frequency: **2480** MHz
Measured Channel Power: **6.8** dBm

Table 9.1 – Summary of Conducted Power Measurements, (DSS)

Conducted Power Measurement Results:											
Channel Number	Channel Frequency (MHz)	Mode	Measured Power [P _{Meas}] (dBm)	Measured Power (W)	Conducted Limit [P _{Lim}] (dBm)	Conducted Margin (dB)	Antenna Gain (dBi)	EIRP [E _{Meas}] (dBm)	EIRP (W)	EIRP Limit [E _{Lim}] (dBm)	EIRP Margin (dB)
0	2402.00	1EDR	6.20	0.0042	30.00	23.8	2	8.20	0.0066	36	27.8
38	2440.00		6.35	0.0043		23.7		8.35	0.0068		27.7
78	2480.00		6.03	0.0040		24.0		8.03	0.0064		28.0
0	2402.00	2EDR	6.23	0.0042		23.8		8.23	0.0067		27.8
38	2440.00		6.43	0.0044		23.6		8.43	0.0070		27.6
78	2480.00		5.99	0.0040		24.0		7.99	0.0063		28.0
0	2402.00	3EDR	6.15	0.0041		23.9		8.15	0.0065		27.9
38	2440.00		6.41	0.0044		23.6		8.41	0.0069		27.6
78	2480.00		5.88	0.0039		24.1		7.88	0.0061		28.1
0	2402.00	LE1	6.28	0.0042		23.7		8.28	0.0067		27.7
19	2440.00		6.37	0.0043		23.6		8.37	0.0069		27.6
38	2480.00		5.79	0.0038		24.2		7.79	0.0060		28.2
0	2402.00	LE2	6.87	0.0049		23.1		8.87	0.0077		27.1
19	2440.00		7.14	0.0052		22.9		9.14	0.0082		26.9
38	2480.00		6.80	0.0048		23.2		8.80	0.0076		27.2
Result:									Complies		

Conducted Margin = $P_{Lim} - P_{Meas}$

Conducted Margin = $E_{Lim} - E_{Meas}$

10.0 POWER SPECTRAL DENSITY

Test Procedure

Normative Reference	FCC 47 CFR §15.247(e), RSS-247 (5.2)(b), KDB 558074 (10.3), ANSI C63.10 (11.10.3)
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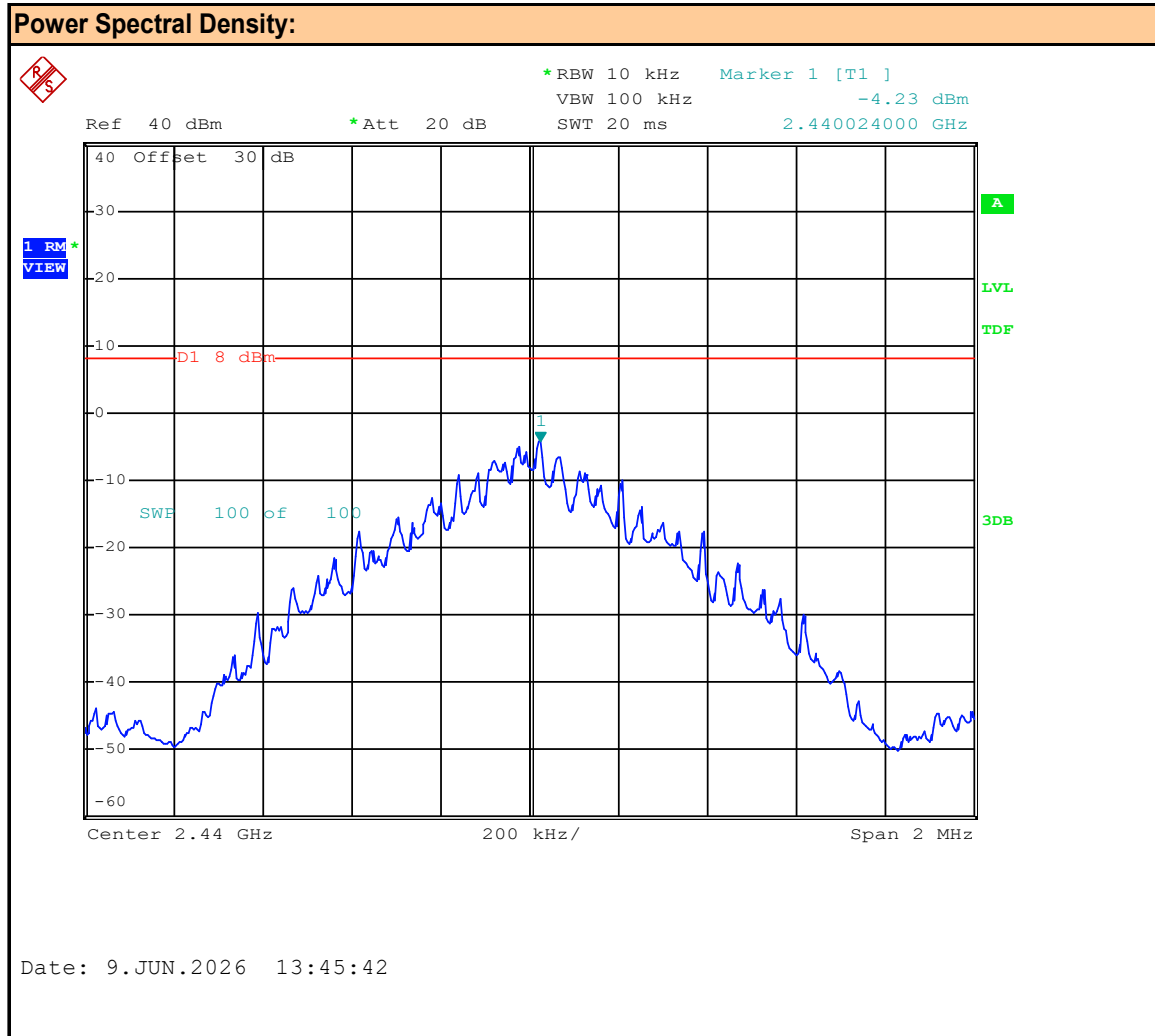
Limits

47 CFR §15.247(e)	(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
RSS-247 (5.2)(b)	b) The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).
KDB 558074 (10.3) C63.10 (11.10.3)	Method AVGPSD-1 (trace averaging with EUT transmitting at full power throughout each sweep) This procedure may be used when the maximum (average) conducted output power was used to demonstrate compliance to the output power limit. This is the baseline method for determining the maximum (average) conducted PSD level. If the instrument has an RMS power averaging detector, it must be used; otherwise, use the sample detector. The EUT must be configured to transmit continuously (duty cycle $\geq 98\%$); otherwise sweep triggering/signal gating must be implemented to ensure that measurements are made only when the EUT is transmitting at its maximum power control level (no transmitter off time is to be considered). a) Set instrument center frequency to DTS channel center frequency. b) Set span to at least $1.5 \times \text{OBW}$. c) Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$. d) Set VBW $\geq 3 \times \text{RBW}$. e) Detector = RMS f) Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span} / \text{RBW}$. g) Sweep time = auto couple. h) Employ trace averaging (RMS) mode over a minimum of 100 traces. i) Use the peak marker function to determine the maximum amplitude level. j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).
Test Setup	Appendix A Figure A.1

Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as described above. Number of Sweep Points $\geq 2 \times \text{Span} / \text{RBW} = 2 \times (1.5\text{MHz} / 3\text{kHz}) = 1000$, the SA was configured for 1001 Points. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at 100% Duty Cycle. The Power Spectral Density was measured and recorded.

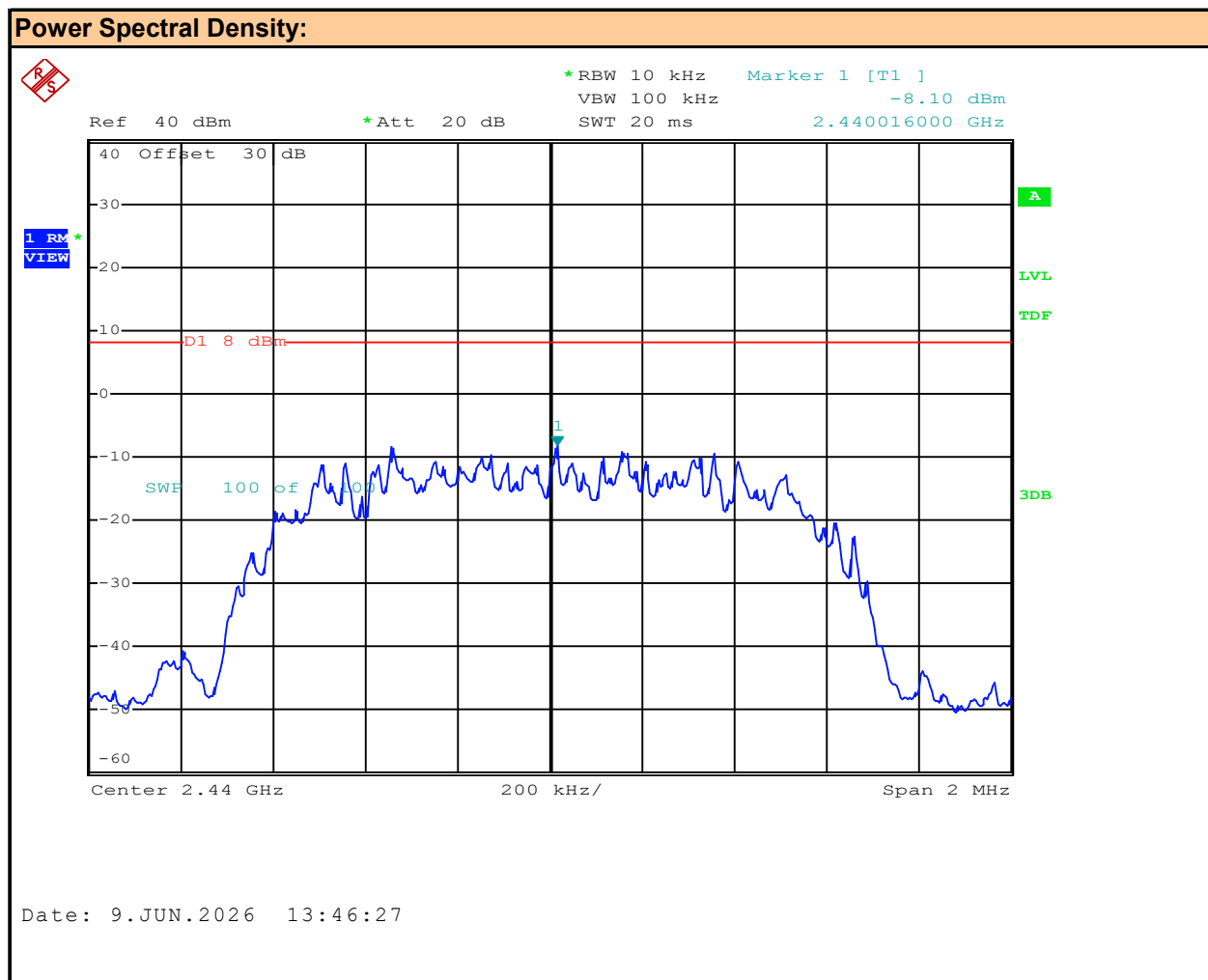
Plot 10.1 – Power Spectral Density, 1EDR



Channel: **39**
Mode: **1EDR**

Channel Frequency: **2440** MHz
Modulation: **GFSK**
Measured PSD: **-4.23** dBm

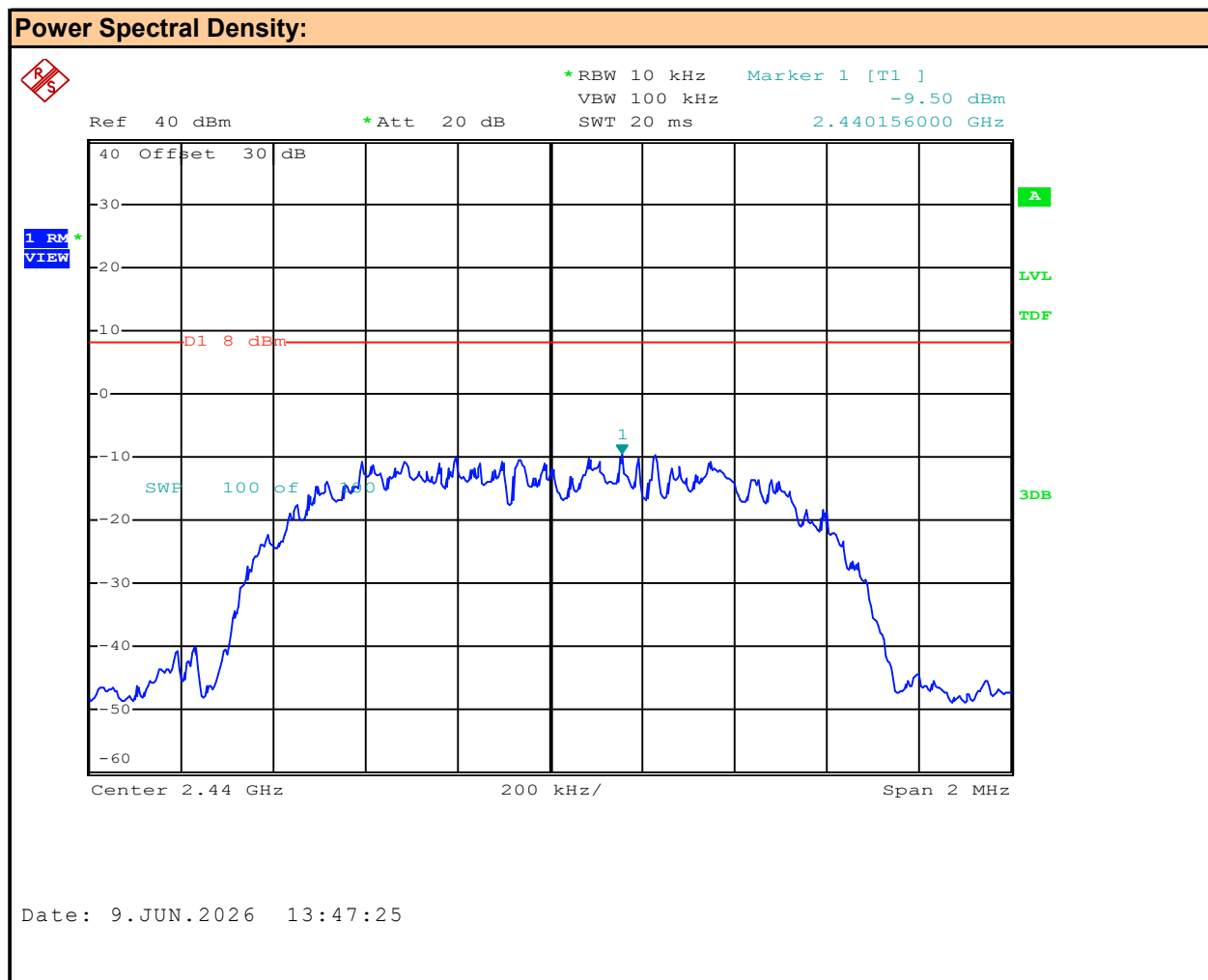
Plot 10.2 – Power Spectral Density, 2EDR



Channel: **39**
Mode: **2EDR**

Channel Frequency: **2440** MHz
Modulation: **PI/4-DQPSK**
Measured PSD: **-8.1** dBm

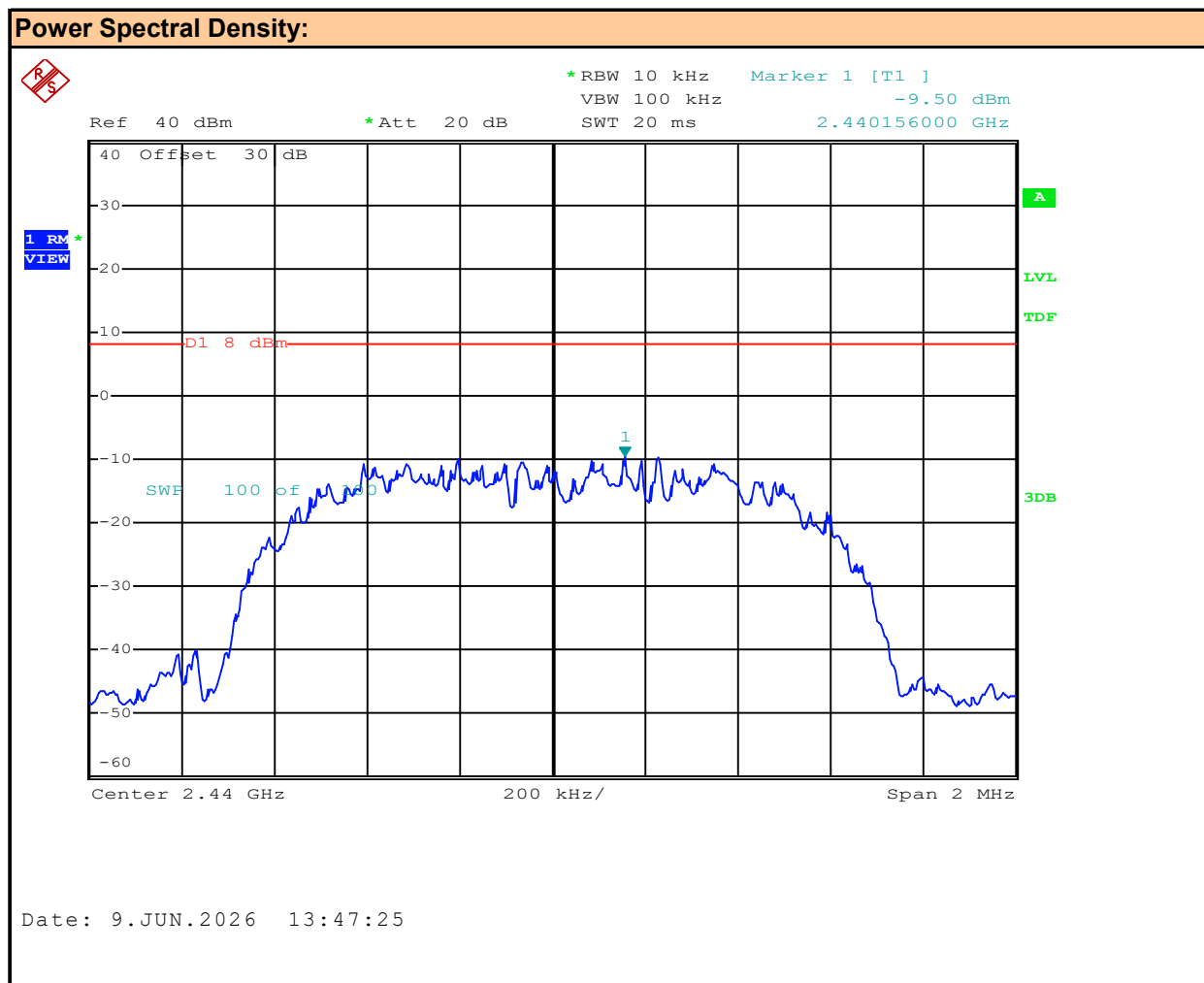
Plot 10.3 – Power Spectral Density, 3EDR



Channel: **39**
Mode: **3EDR**

Channel Frequency: **2440** MHz
Modulation: **8-DPSK**
Measured PSD: **-9.5** dBm

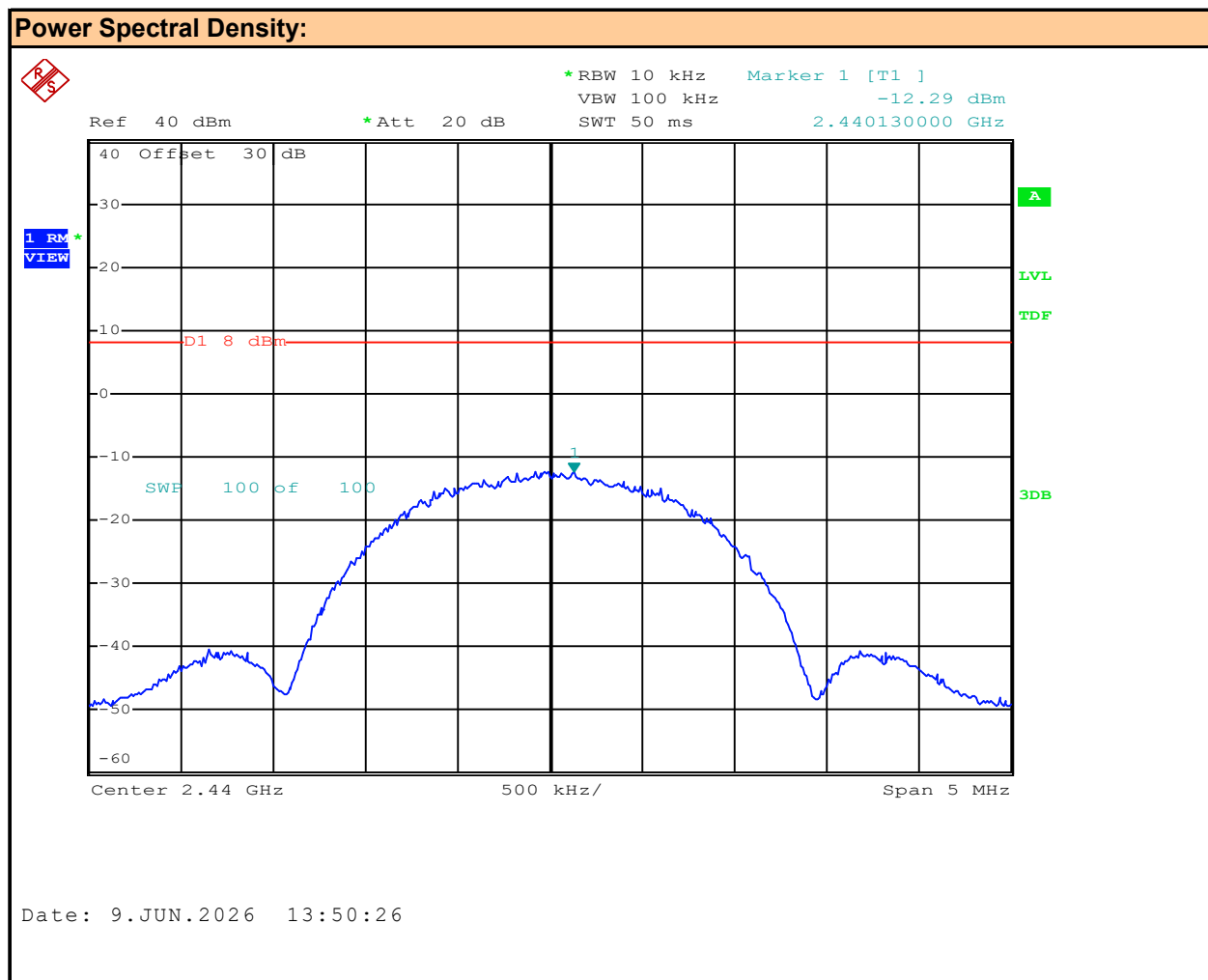
Plot 10.4 – Power Spectral Density, LE1



Channel: **19**
Mode: **LE1**

Channel Frequency: **2440** MHz
Modulation: **GFSK**
Measured PSD: **-9.5** dBm

Plot 10.5 – Power Spectral Density, LE2



Channel: **19**
Mode: **LE2**

Channel Frequency: **2440** MHz
Modulation: **GFSK**
Measured PSD: **-12.29** dBm

Table 10.1 – Summary of Power Spectral Density Measurements, (DSS)

Power Spectral Density Measurement Results:						
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured PSD [P _{Meas}] (dBm)	Conducted Limit [P _{Lim}] (dBm)	Margin (dB)
39	2440.00	1EDR	GFSK	-4.23	8.0	12.2
39		2EDR	Pi/4-DQPSK	-8.10		16.1
39		3EDR	8-DPSK	-9.50		17.5
19		LE1	GFSK	-9.50		17.5
19		LE2	GFSK	-12.29		20.3
Result:						Complies

Conducted Margin = $P_{\text{Limit}} - P_{\text{Meas}}$

11.0 FHSS NUMBER OF HOPPING CHANNELS

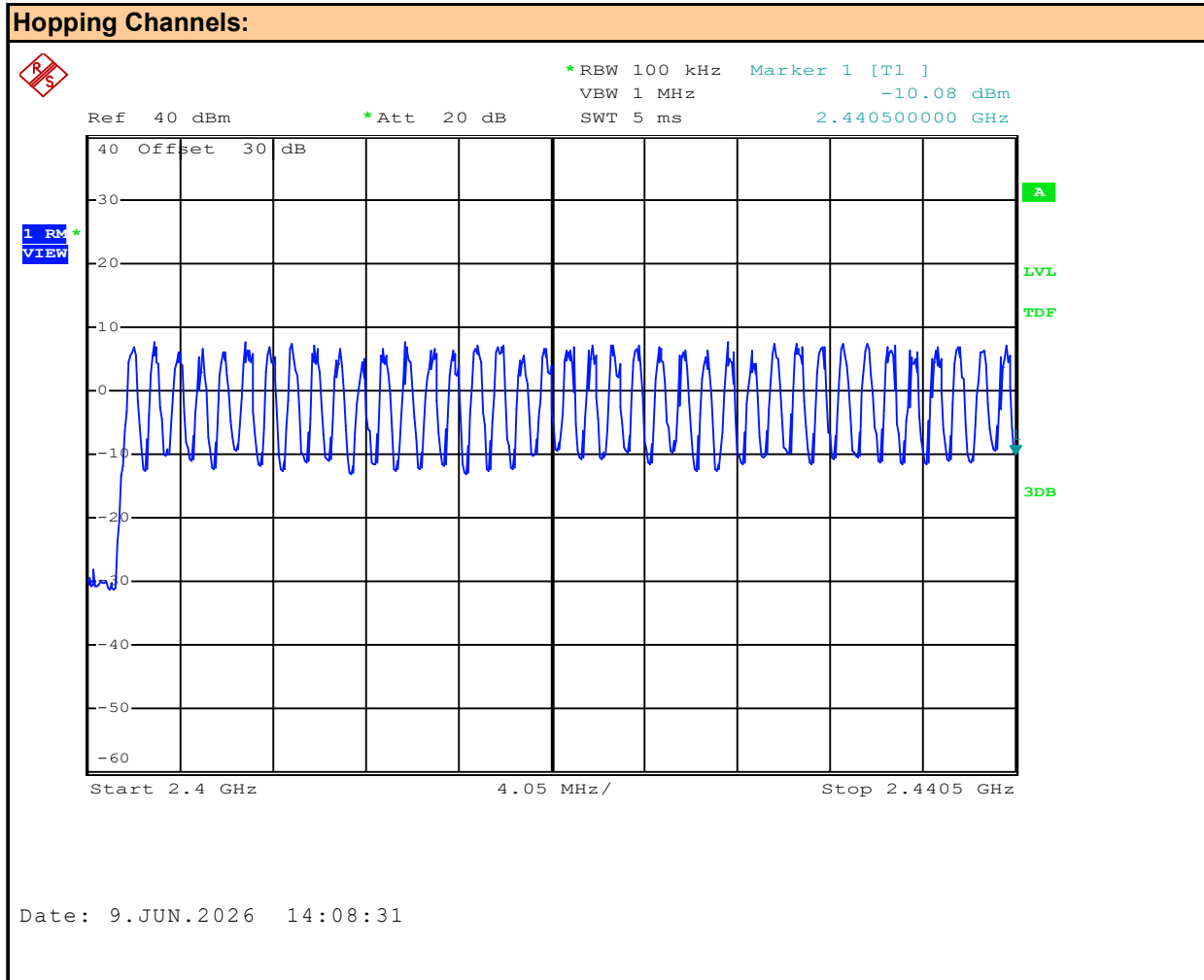
Test Procedure

Normative	FCC 47 CFR §15.247, RSS-247
Reference	KDB 558074, ANSI C63.10

Limits

47 CFR §15.247(a)(1)	(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
RSS-247 (5.1)(d)	5.1 Frequency hopping systems (FHS) The following applies to FHSs in each of the three bands: FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Plot 11.1a – Number of Hopping Channels, BT DH1

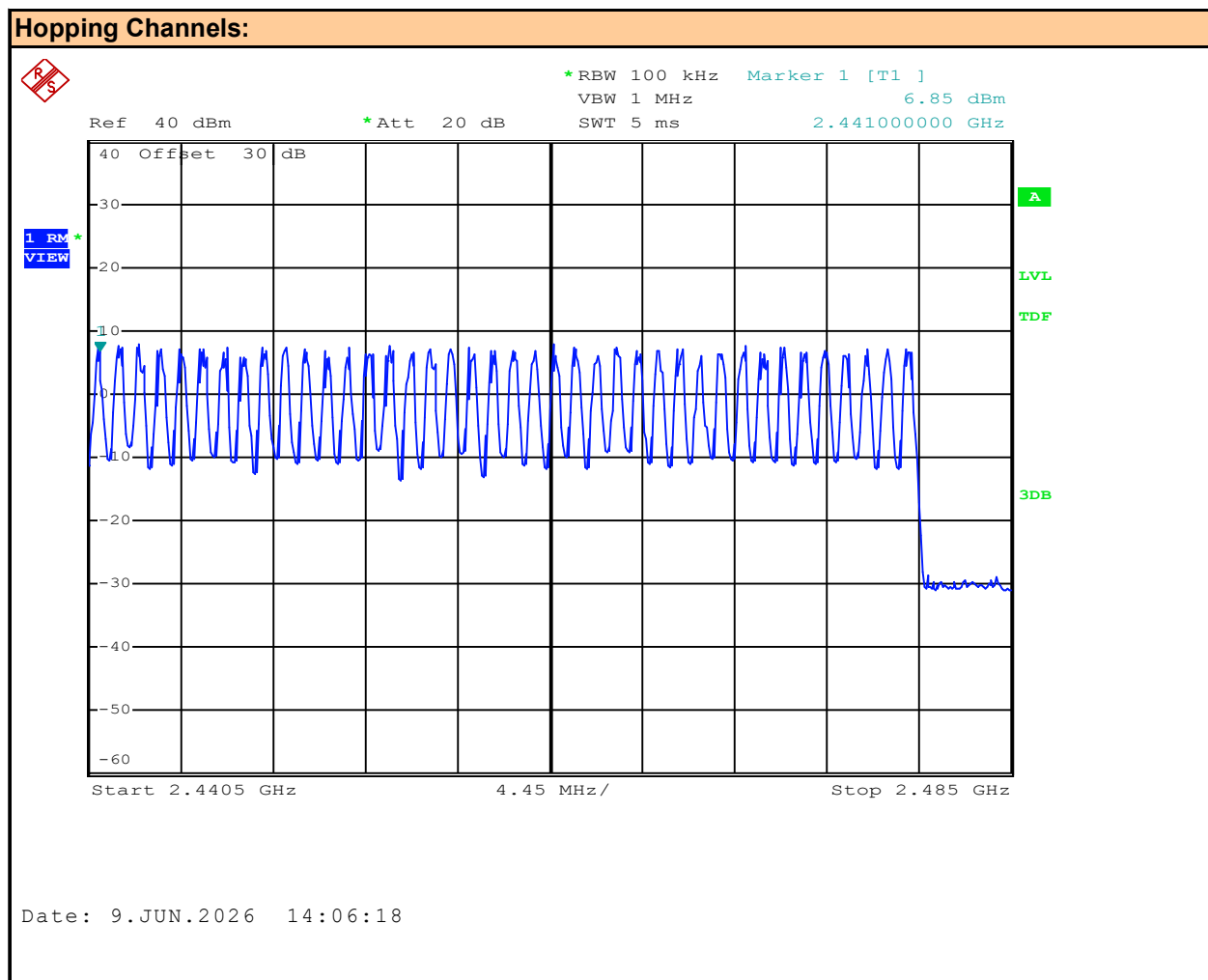


Channel:
Mode:

Channel Frequency: MHz
Modulation:

Number of Hopping Channels

Plot 11.1b – Number of Hopping Channels, BT DH1



Channel:

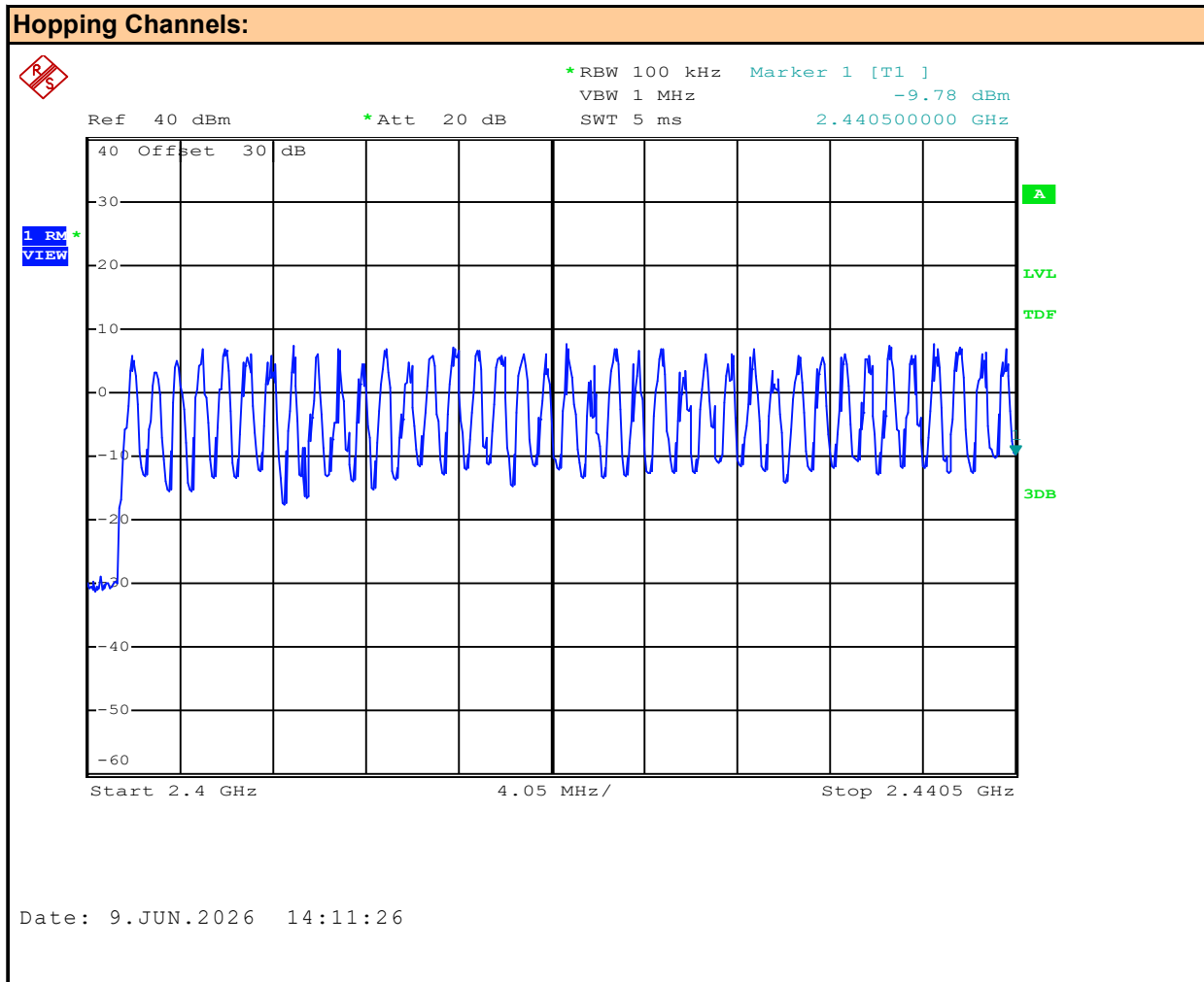
Mode:

Channel Frequency: MHz

Modulation:

Number of Hopping Channels

Plot 11.2a – Number of Hopping Channels, BT DH3

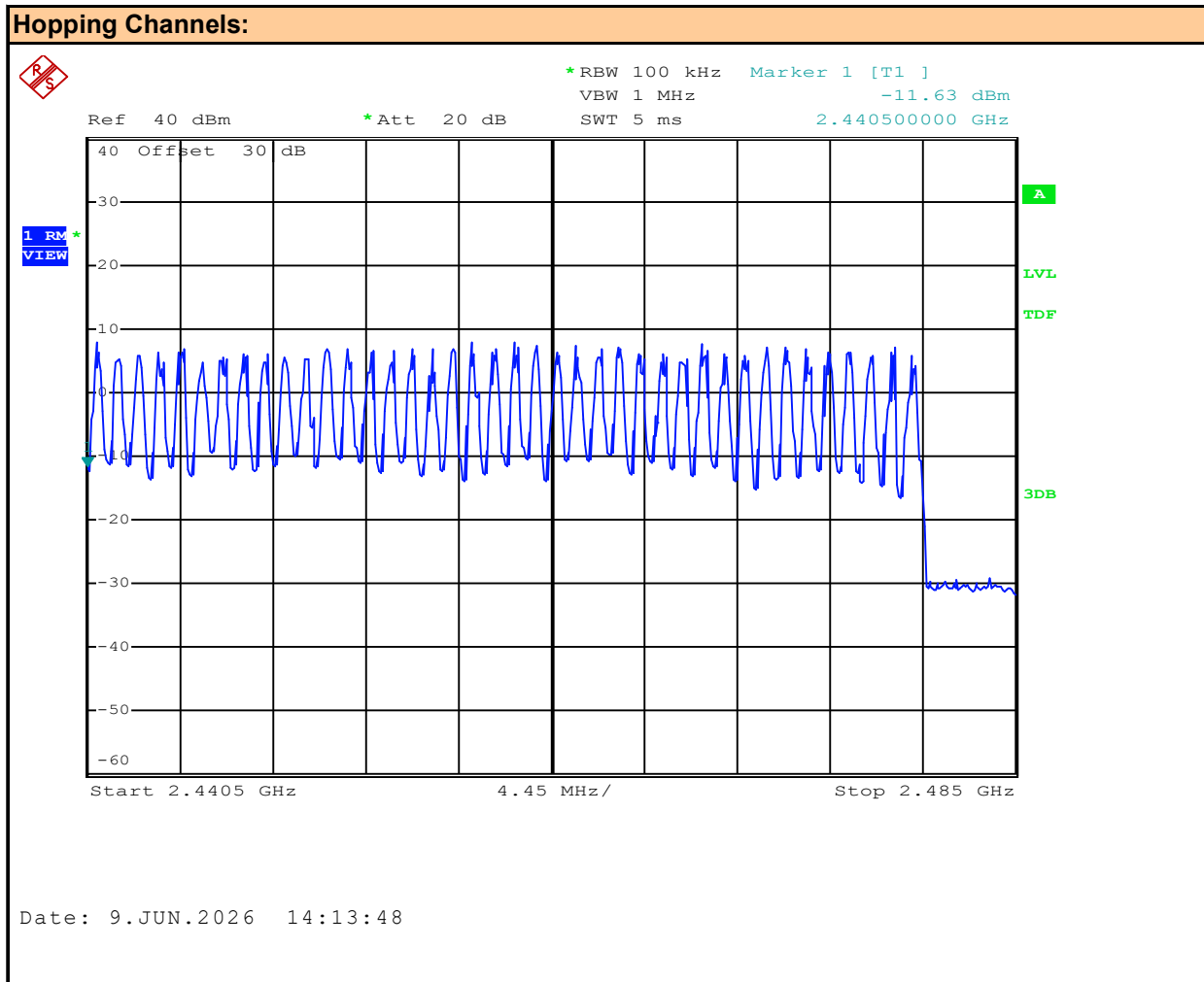


Channel:
Mode:

Channel Frequency: MHz
Modulation:

Number of Hopping Channels

Plot 11.2b – Number of Hopping Channels, BT DH3



Channel:

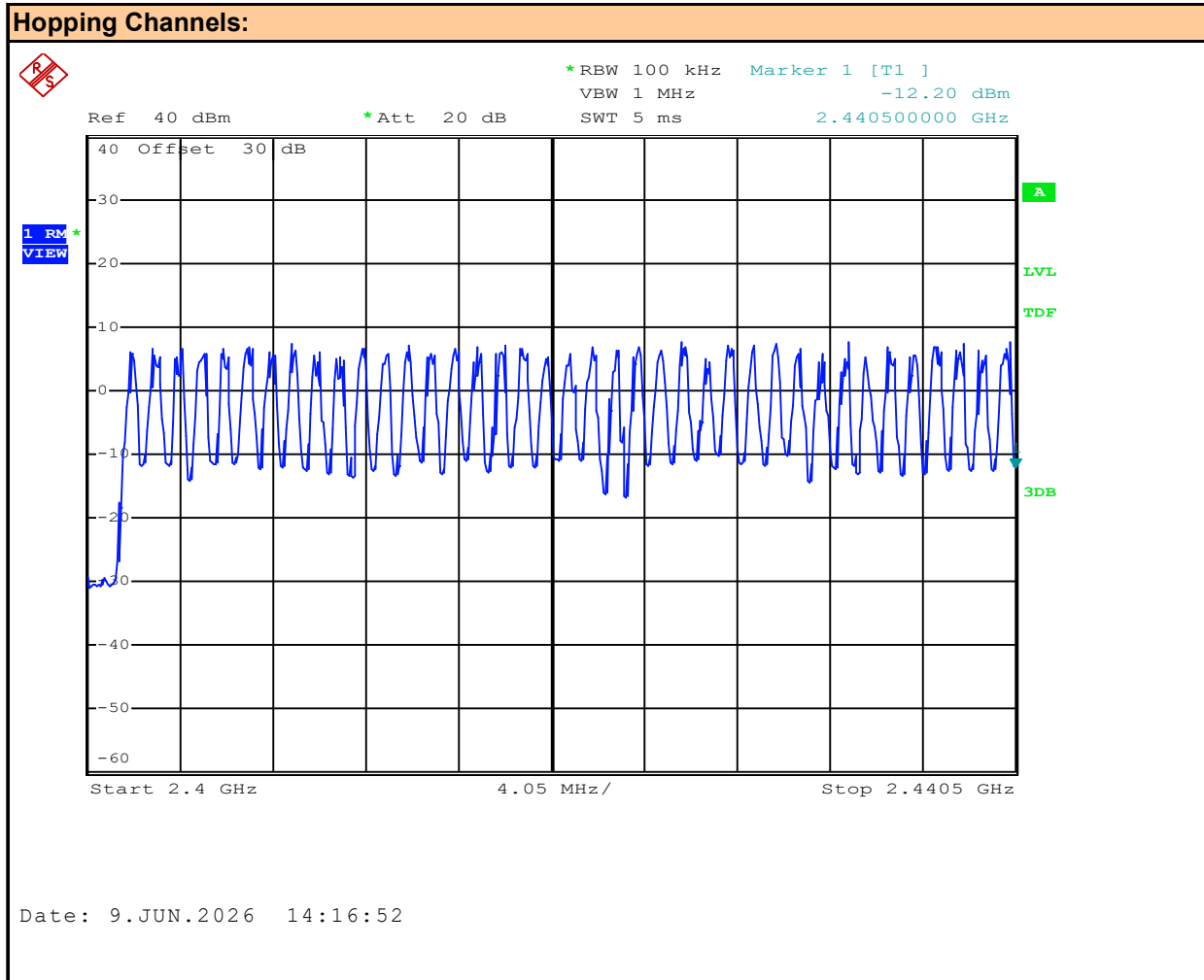
Mode:

Channel Frequency: MHz

Modulation:

Number of Hopping Channels

Plot 11.3a – Number of Hopping Channels, BT DH5



Channel:

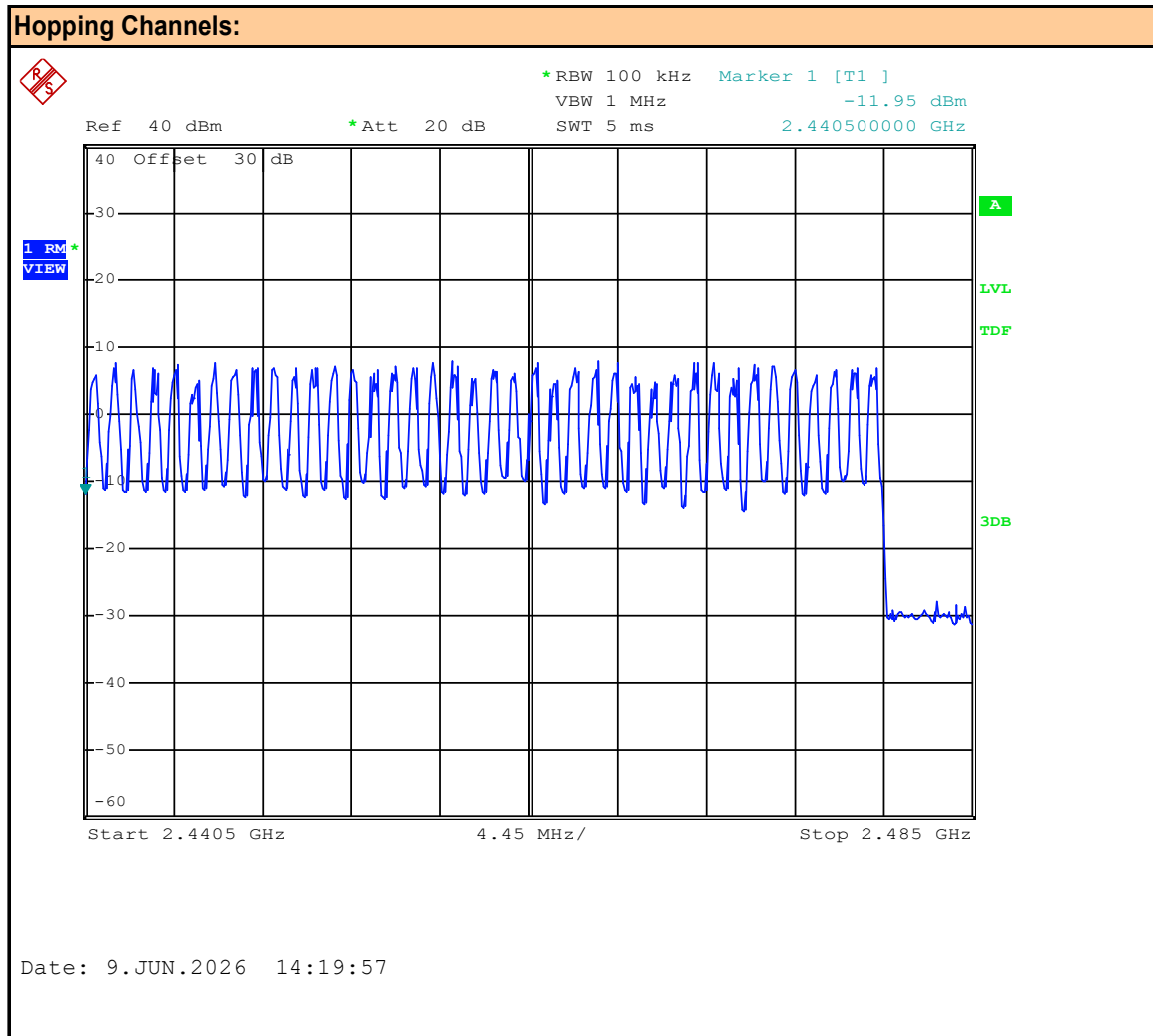
Mode:

Channel Frequency: MHz

Modulation:

Number of Hopping Channels

Plot 11.3b – Number of Hopping Channels, BT DH5



Channel:
Mode:

Channel Frequency: MHz
Modulation:
Number of Hopping Channels

Table 11.1 – Summary of FHSS Number of Hopping Channels

Hopping Channel Results DSS		
Frequency Range (MHz)	Mode	Number of Hopping Channels
2400-2441	DH1	39
2441-2485	DH1	40
Total:		79
2400-2441	DH2	39
2441-2485	DH2	40
Total:		79
2400-2441	DH3	39
2441-2485	DH3	40
Total:		79
Result:		Complies

12.0 FHSS CHANNEL SEPARATION

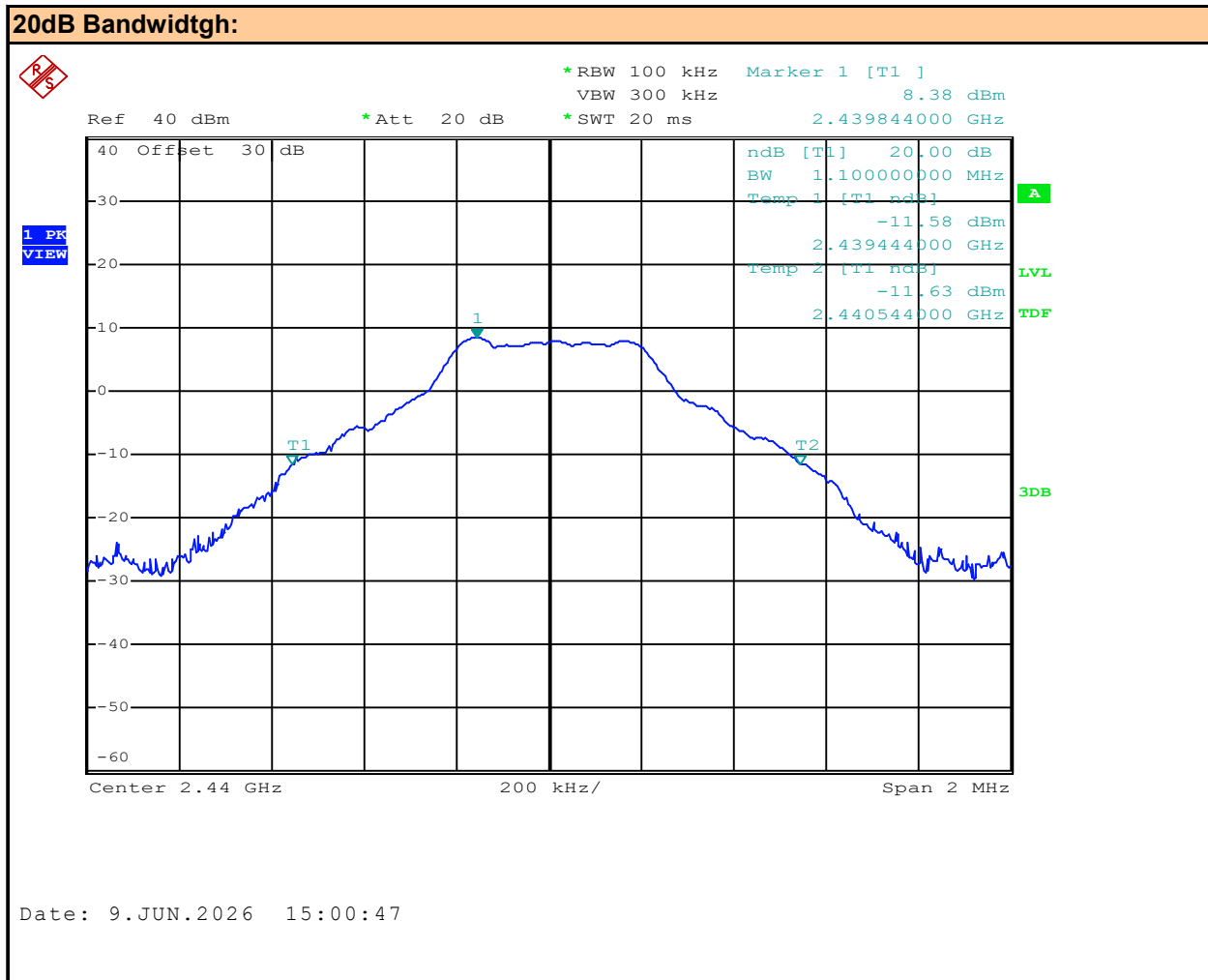
Test Procedure

Normative	FCC 47 CFR §15.247, RSS-247
Reference	KDB 558074, ANSI C63.10

Limits

47 CFR §15.247(a)(1)	(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400- 2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
RSS-247 (5.1)(db)	5.1 Frequency hopping systems (FHS) The following applies to FHSs in each of the three bands: FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

Plot 12.1 – 20dB BW, BT DH1

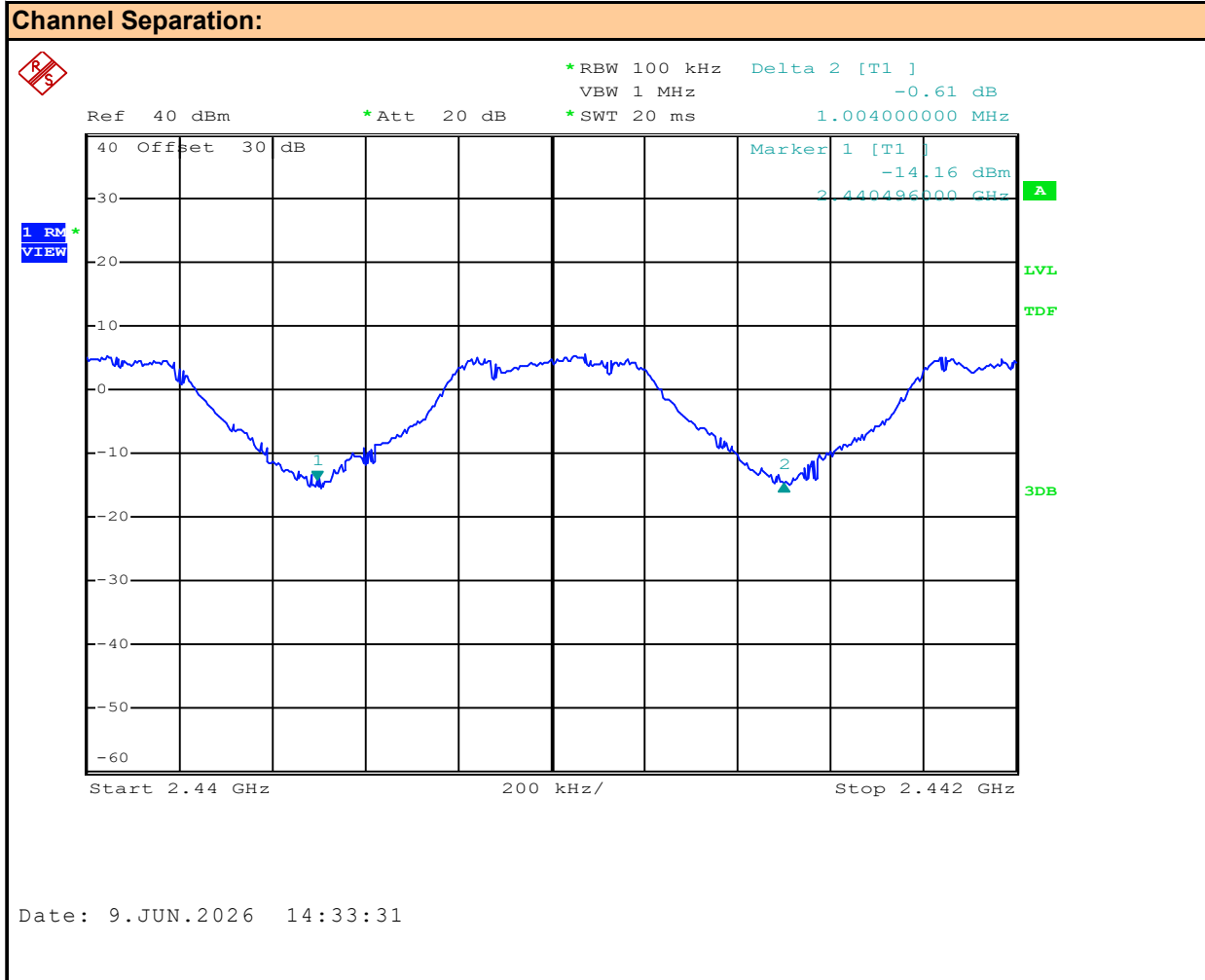


Channel: -
Mode: DH1

Channel Frequency: - MHz
Modulation: -

Measured 20dB Bandwidth: 1.10 MHz

Plot 12.2 – FHSS Channel Separation, BT DH1



Channel:

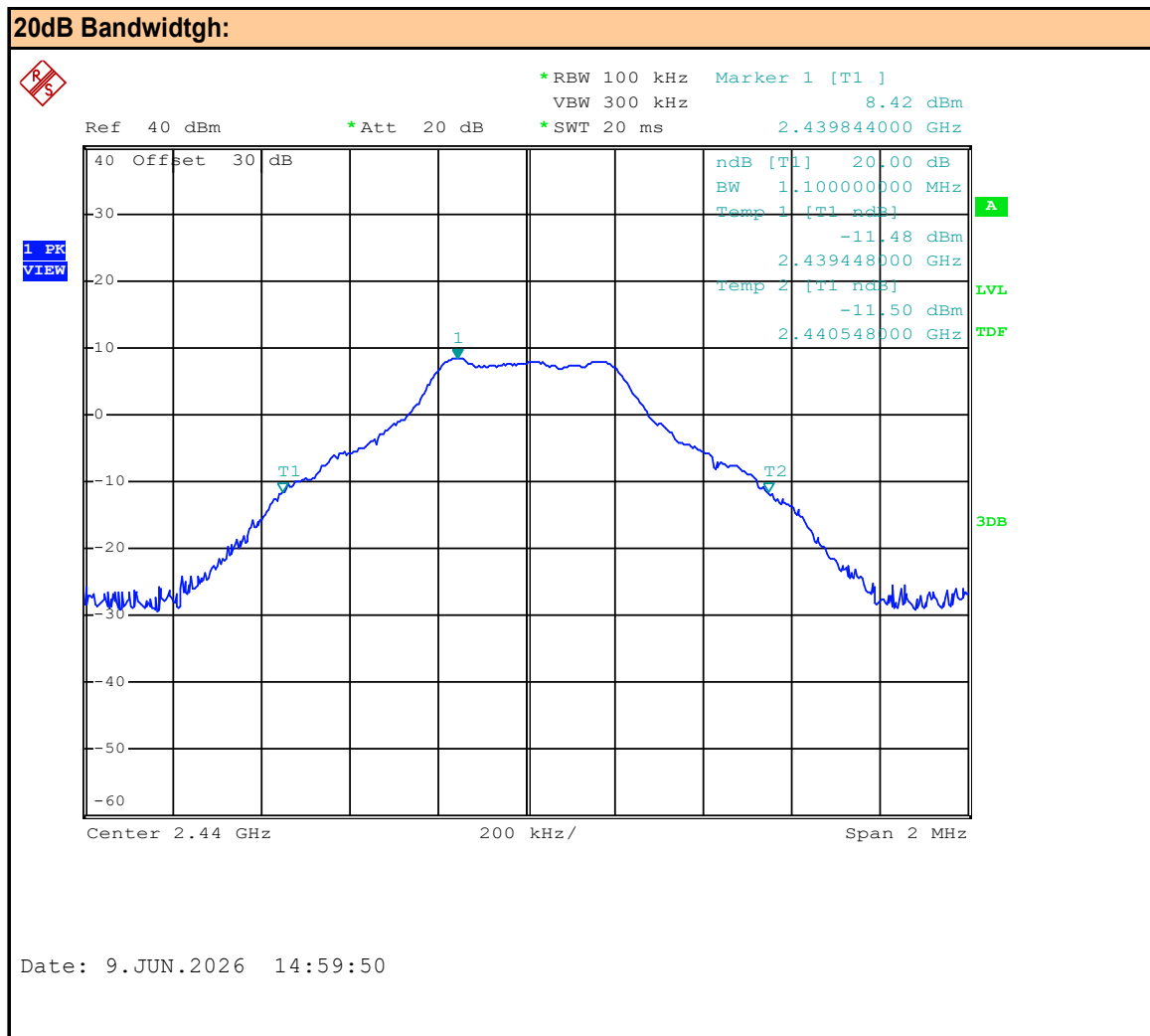
Mode:

Channel Frequency: MHz

Modulation:

Measured Separation: MHz

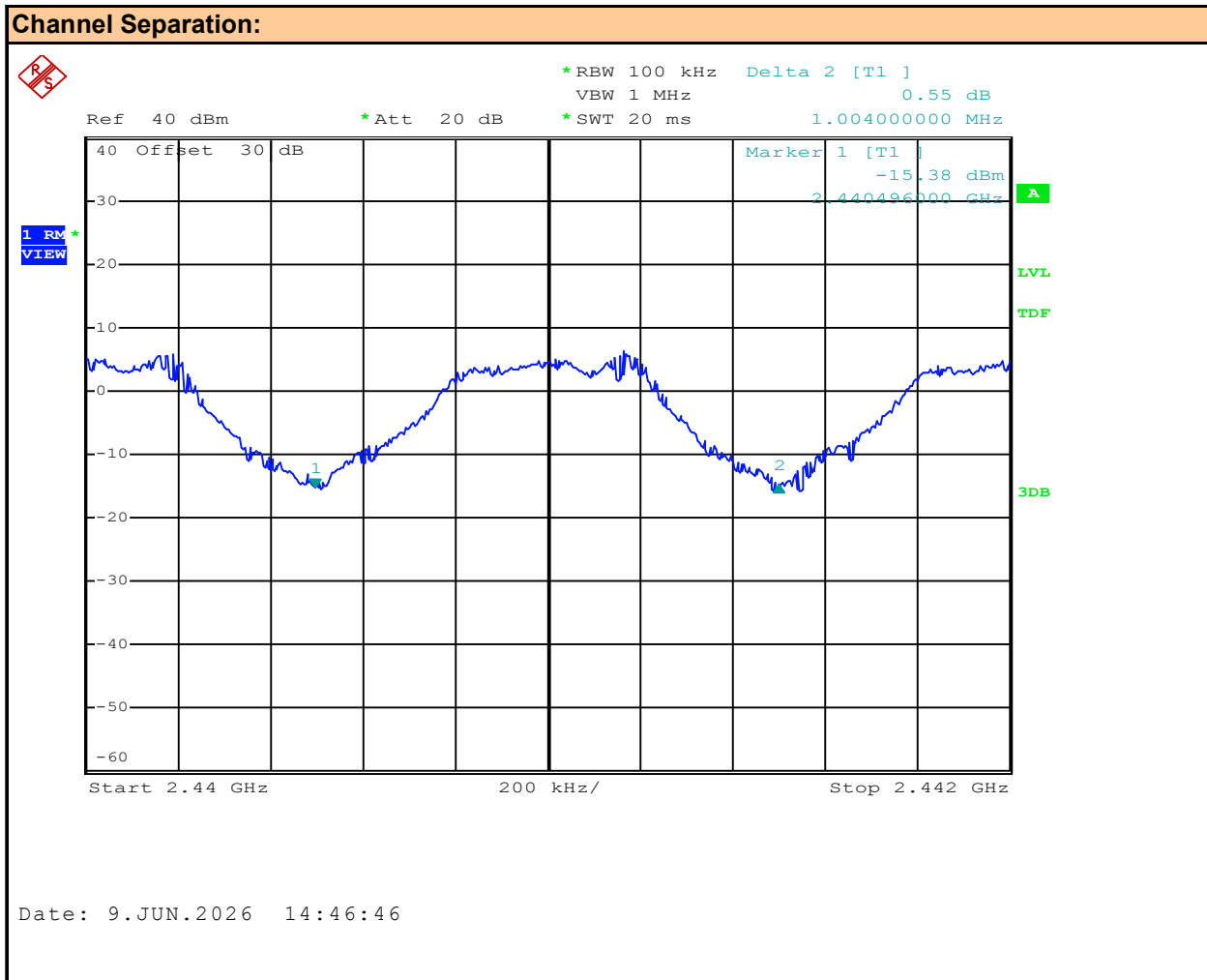
Plot 12.3 – 20dB BW, BT DH3



Channel:
Mode:

Channel Frequency: MHz
Modulation:
Measured 20dB Bandwidth: MHz

Plot 12.4 – FHSS Channel Separation, BT DH3



Channel:

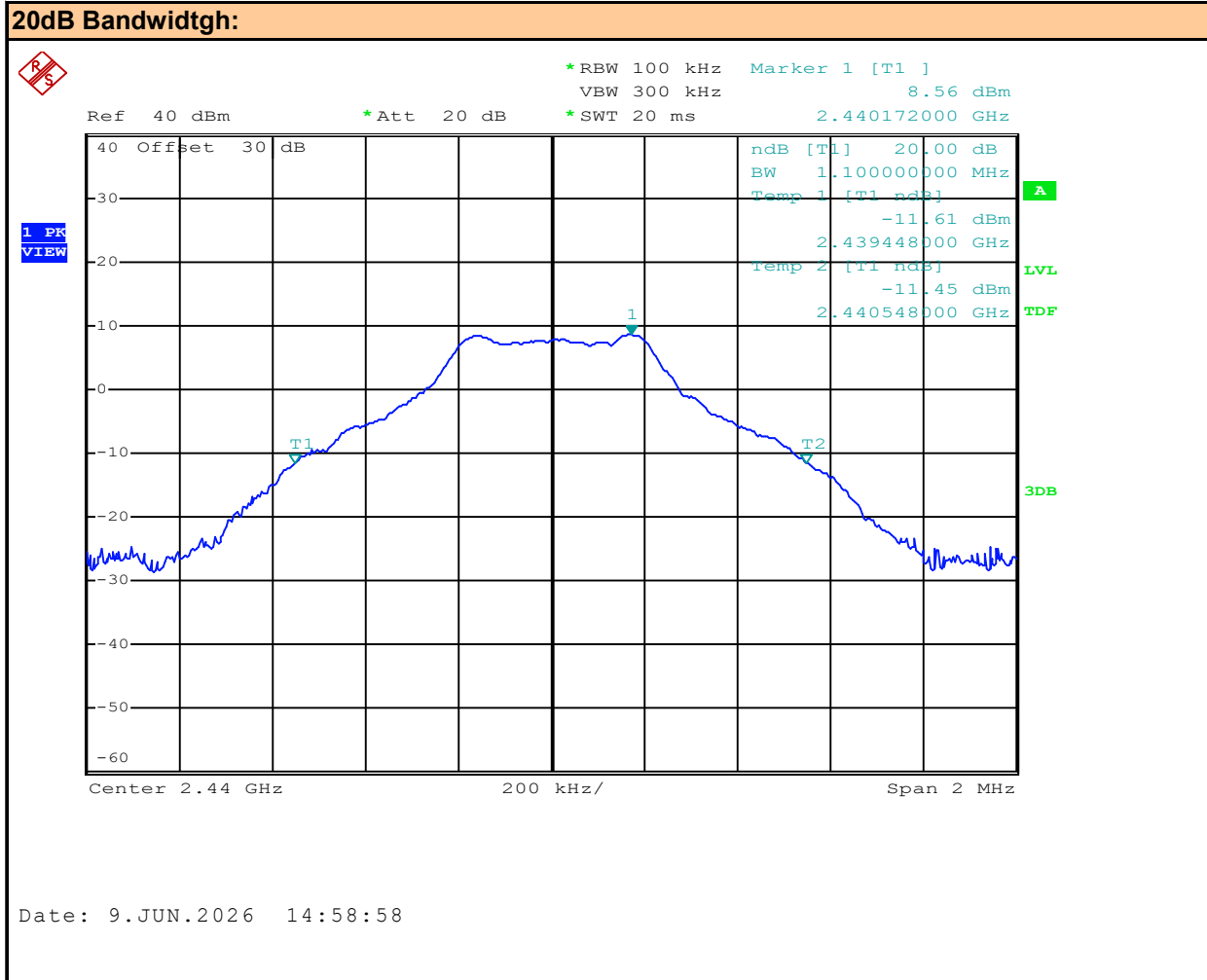
Mode:

Channel Frequency: MHz

Modulation:

Measured Separation: MHz

Plot 12.5 – 20dB BW, BT DH5

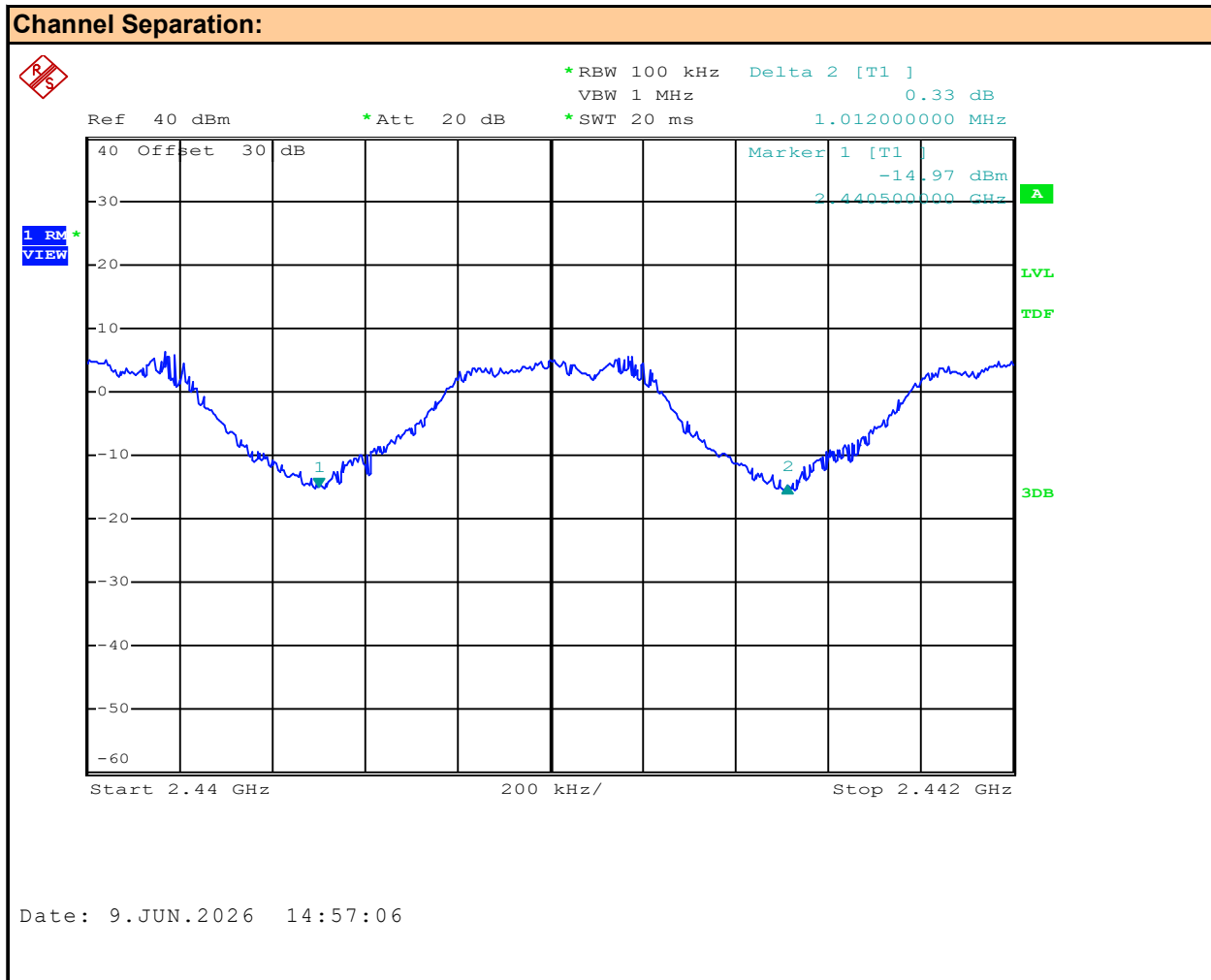


Channel: -
Mode: DH5

Channel Frequency: - MHz
Modulation: -

Measured 20dB Bandwidth: 1.10 MHz

Plot 12.6 – FHSS Channel Separation, BT DH5



Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Separation: MHz

Table 12.1 – Summary of FHSS Channel Separation

Hopping Channel Separation Results DSS				
Mode	20dB BW (MHz)	Channel Separation (MHz)	Minimum Bandwidth (MHz)	Margin (MHz)
DH1	1.1	1.004	0.733	0.271
DH2	1.1	1.004	0.733	0.271
DH3	1.1	1.012	0.733	0.279
Result:				Complies

Minimum Bandwidth = 20dB BW X 2/3

Margin = Channel Separation - Minimum Bandwidth

13.0 FHSS TIME OF OCCUPANCY

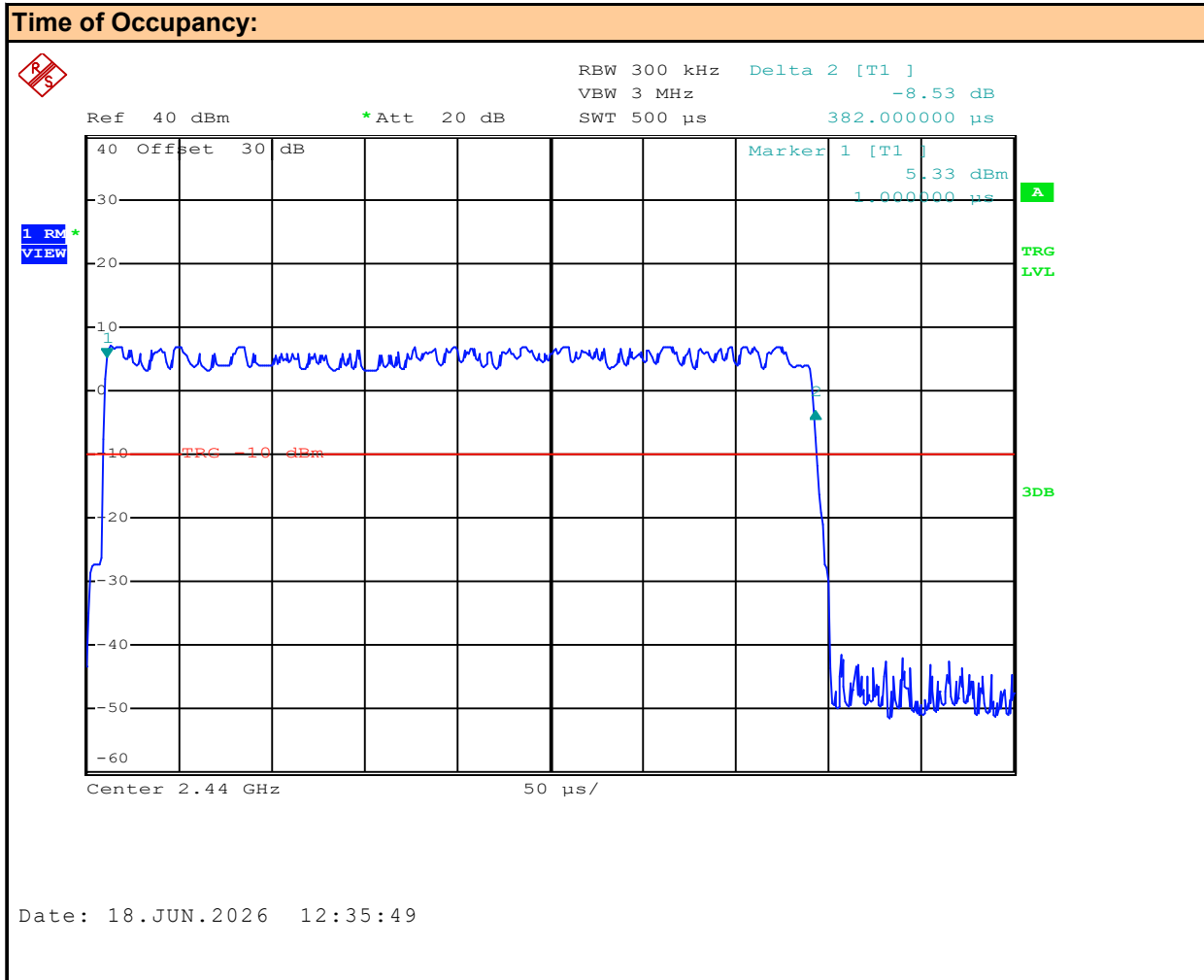
Test Procedure

Normative	FCC 47 CFR §15.247, RSS-247
Reference	KDB 558074, ANSI C63.10

Limits

47 CFR §15.247(a)(1)	(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
RSS-247 (5.1)(d)	5.1 Frequency hopping systems (FHS) FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

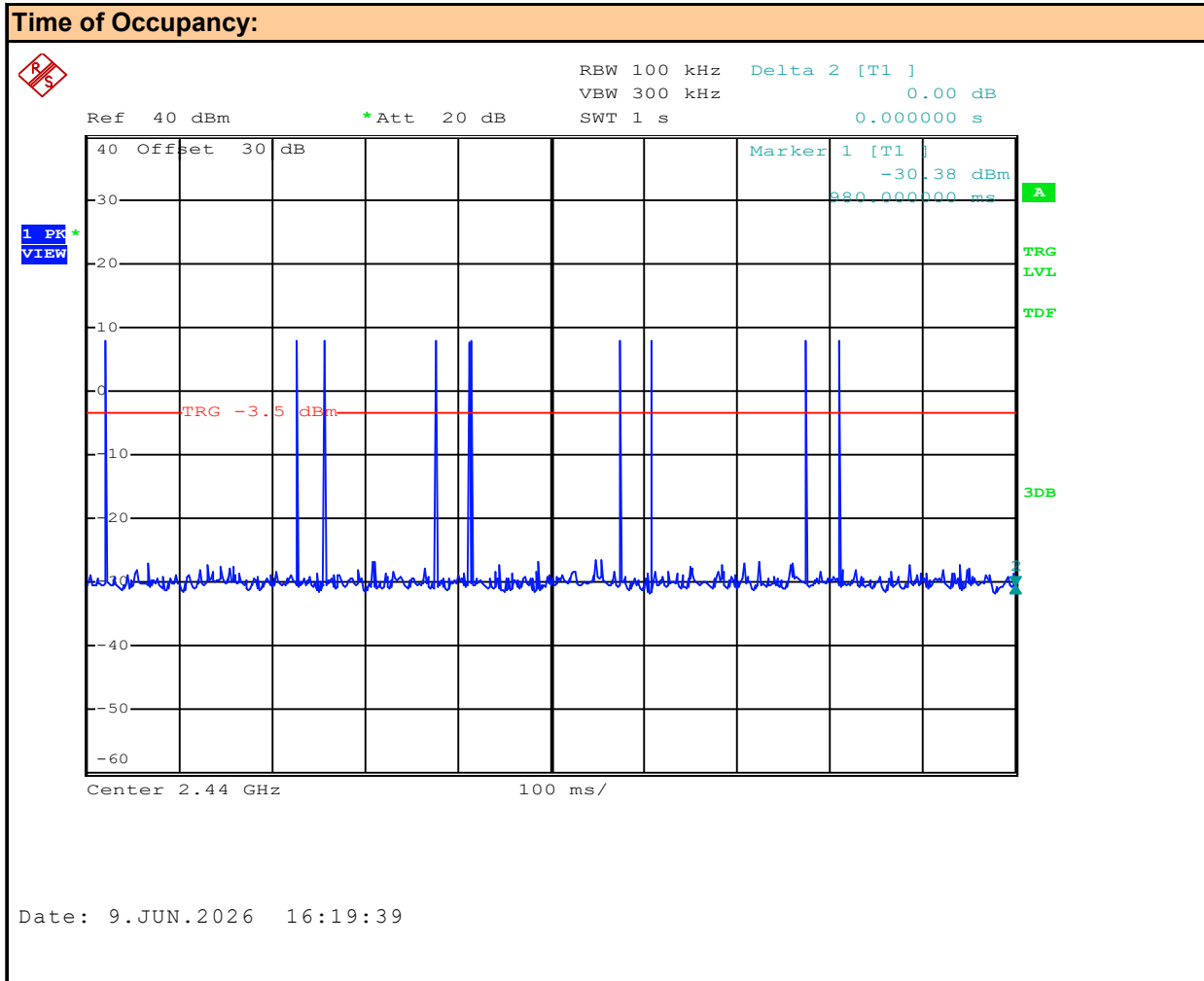
Plot 13.1 – Time of Occupancy, Dwell Time, DH1, 2-DH1, 3-DH1, DM1



Packet: **DH1, DM1, 2-DH1, 3-DH1**

Measured On-Time: **382** uSec

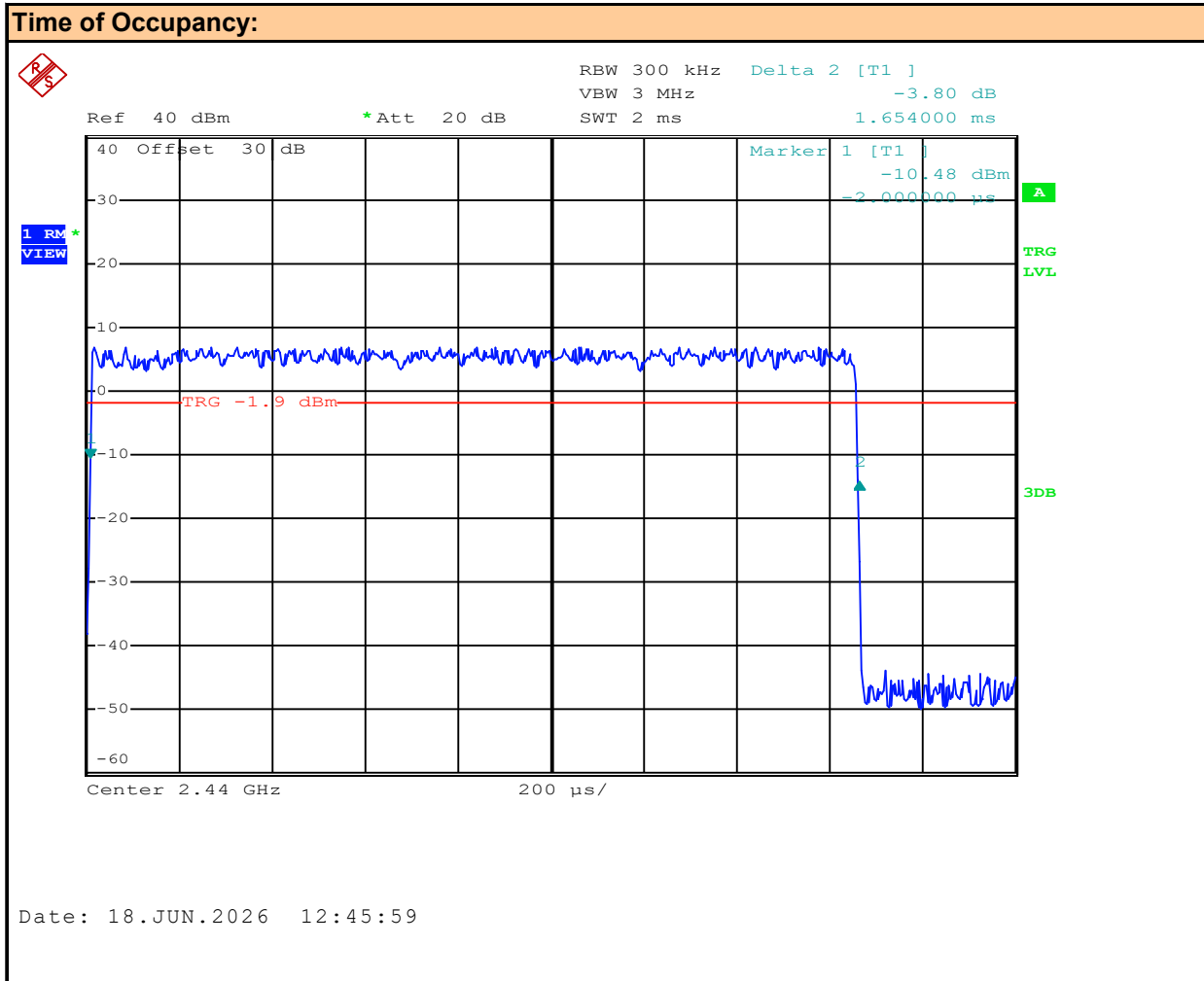
Plot 13.2 – Time of Occupancy, Transmit Count, DH1, 2-DH1, 3-DH1, DM1



Packet: **DH1, DM1, 2-DH1, 3-DH1**

Transmit Count **9** /1000mSec

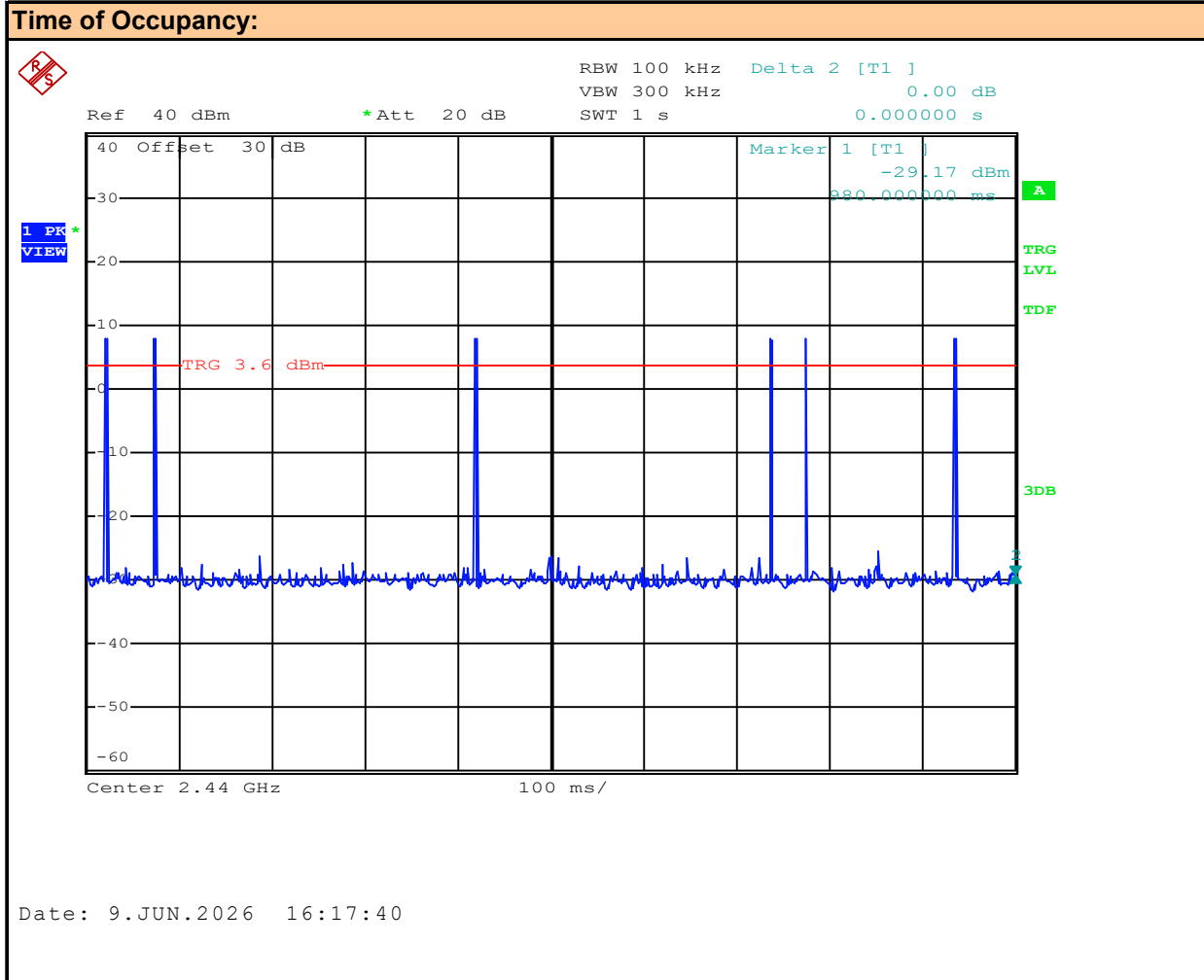
Plot 13.3 – Time of Occupancy, Dwell Time, DH3, 2-DH3, 3-DH3, DM3



Packet: **DH3, DM3, 2-DH3, 3-DH3**

Measured On-Time: **1.654** mSec

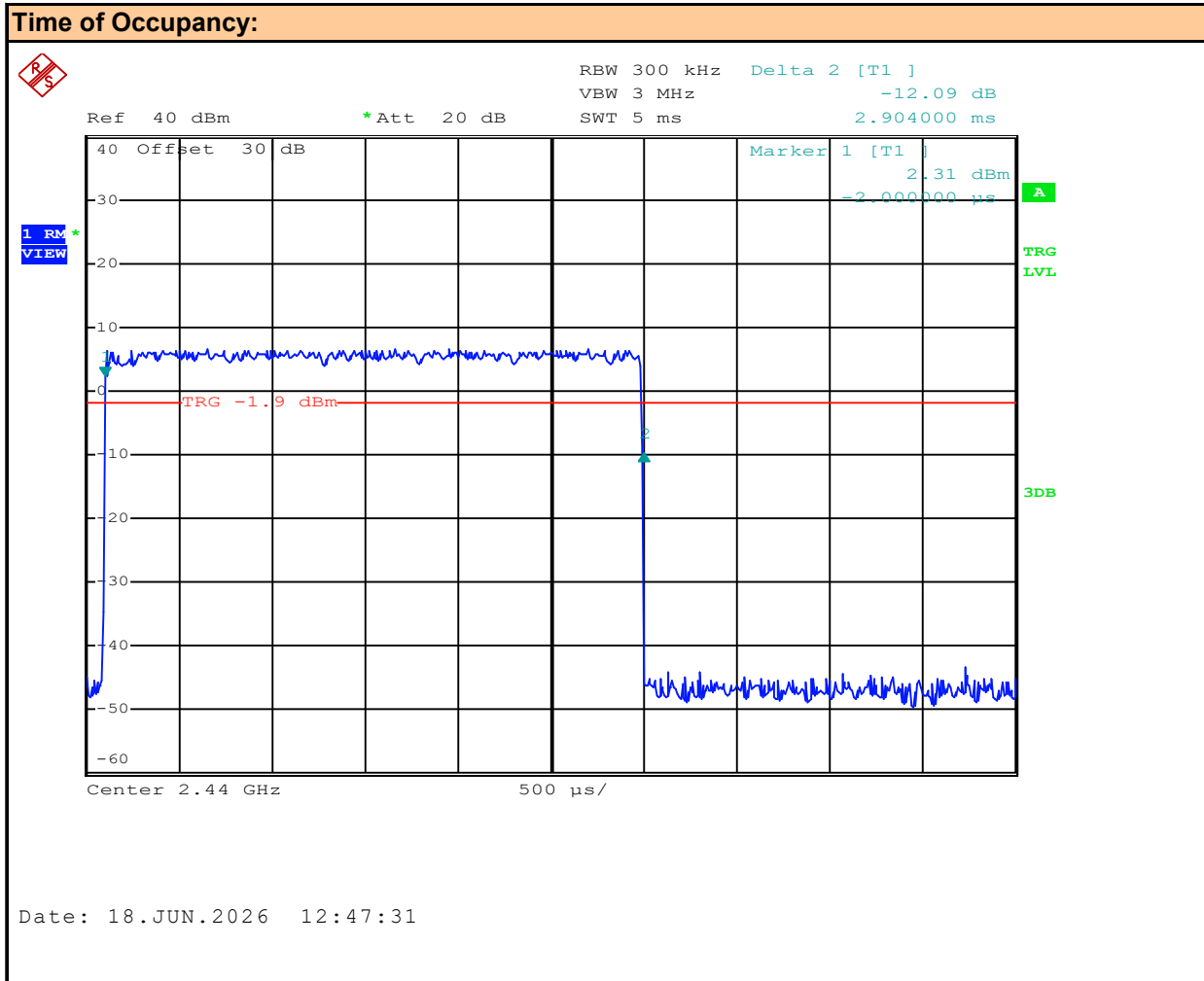
Plot 13.4 – Time of Occupancy, Transmit Count, DH3, 2-DH3, 3-DH3, DM3



Packet: **DH3, DM3, 2-DH3, 3-DH3**

Transmit Count **6** /1000mSec

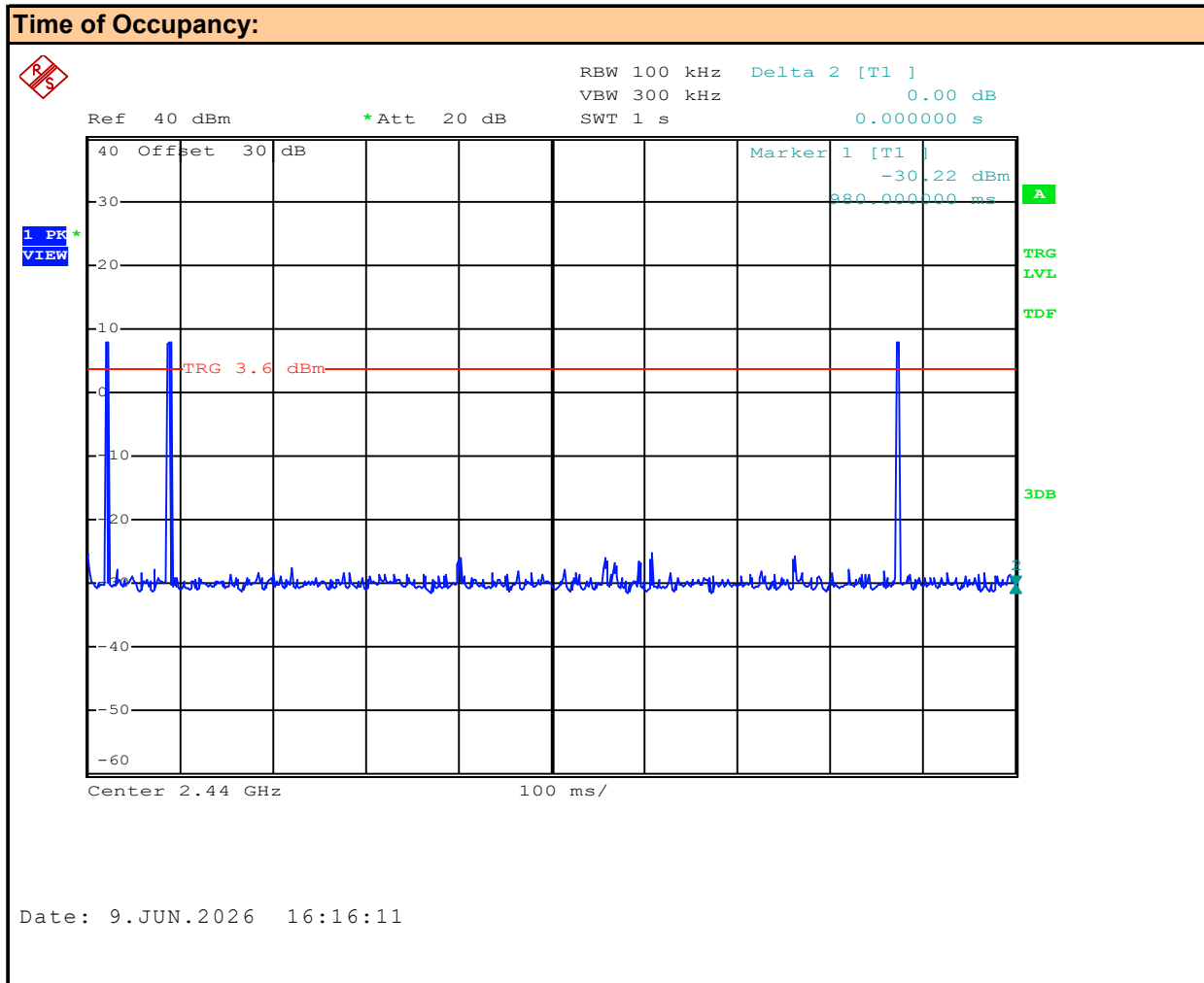
Plot 13.5 – Time of Occupancy, Dwell Time, DH5, 2-DH5, 3-DH5, DM5



Packet: **DH5, DM5, 2-DH5, 3-DH5**

Measured On-Time: **2.904** mSec

Plot 13.6 – Time of Occupancy, Transmit Count, DH5, 2-DH5, 3-DH5, DM5



Packet: **DH5, DM5, 2-DH5, 3-DH5**

Transmit Count **3** /1000mSec

Table 13.1 – Summary of FHSS Time of Occupancy

Accumulated Time of Occupancy										
Channel Frequency (MHz)	Packet	Channel On Time [t _{on}] (mSec)	Number of Transmits per Period [N _{Tx}]	Time of Period Occupancy [T _{Occ}] (mSec)	Observation Period [T _P] (mSec)	Number of Hopping Channels [N _{Hop}]	Required Observation Period [T _{Rqd}] (mSec)	Accumulated Time of Occupancy [T _{Acc}] (mSec)	Limit [Limit] (mSec)	Margin (mSec)
2441	DH1	0.382	10	3.820	1000	79	31600	120.71	400	279
	DH3	1.654	6	9.924				313.60		86
	DH5	2.904	3	8.712				275.30		125
Result:										Complies

Time of Period Occupancy [T_{POcc}] = Channel On Time [t_{on}] x Number of Transmits per Period [N_{Tx}]

Required Observation Period [T_{Rqd}] = Number of Hopping Channels [N_{Hop}] x 0.4Sec (400mSec)

Accumulated Time of Occupancy [T_{Acc}] = Time of Period Occupancy [T_{Occ}] x Required Observation Period [T_{Rqd}] / Observation Period [T_P]

Margin = Limit - [T_{Acc}]

14.0 CONDUCTED SPURIOUS EMISSIONS -BAND EDGE

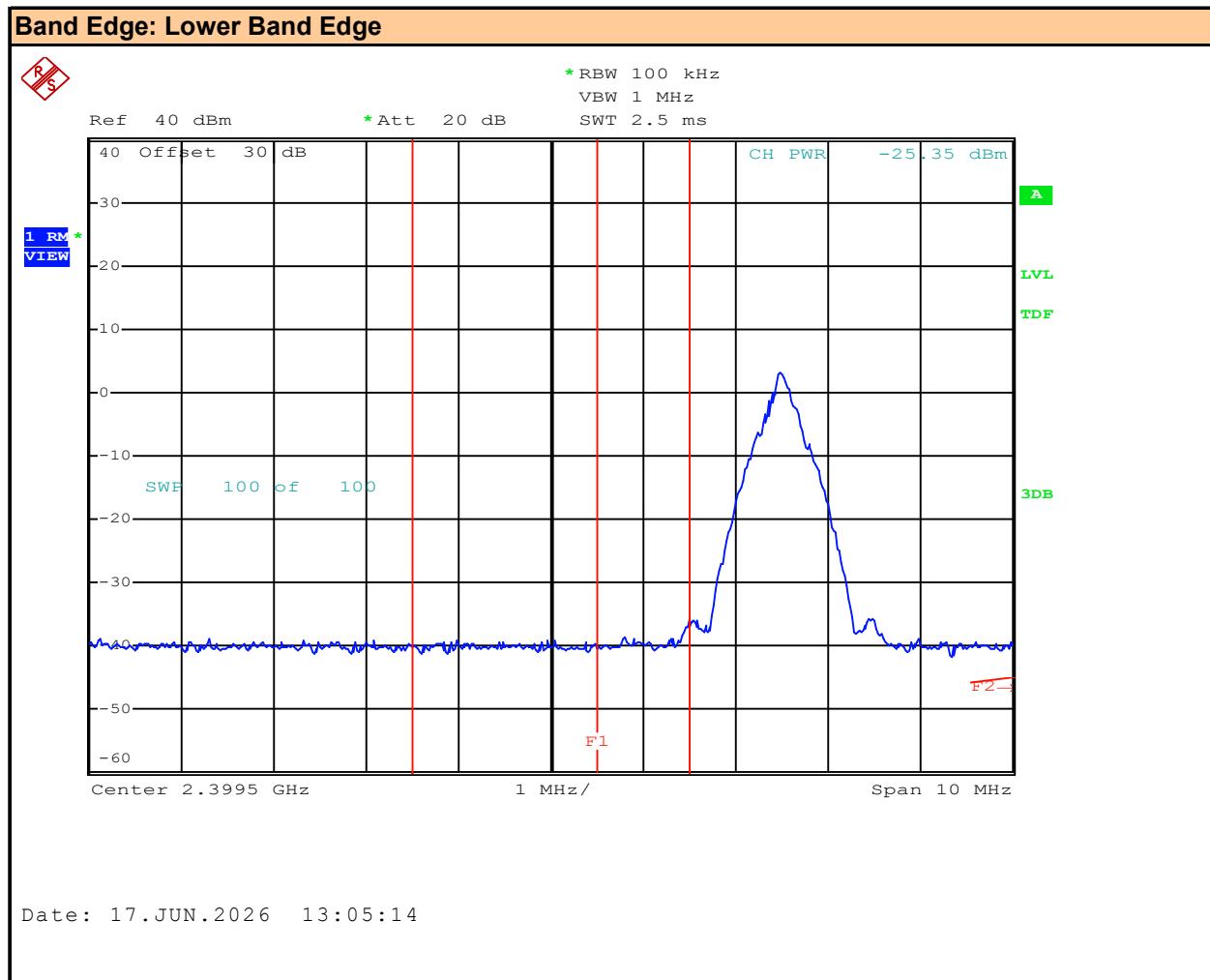
Test Procedure

Normative Reference	FCC 47 CFR §2.1051, §15.247(d), RSS-Gen (6.13), RSS-247 (5.5),
	KDB 558074 (11.3), ANSI C63.10 (11.11.3)

Limits

47 CFR §15.247(d)	(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.
KDB 558074 (11.3) C63.10 (11.11.3)	11.1 General The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions: b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc). 11.2 Reference level measurement a) Set instrument center frequency to DTS channel center frequency. b) Set the span to $\geq 1.5 \times DTS \text{ bandwidth}$. c) Set the RBW = 100 kHz. d) Set the VBW $\geq 3 \times RBW$. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. Note that the channel found to contain the maximum PSD level can be used to establish the reference

Plot 14.1 – Band Edge, BT 1EDR



Channel:

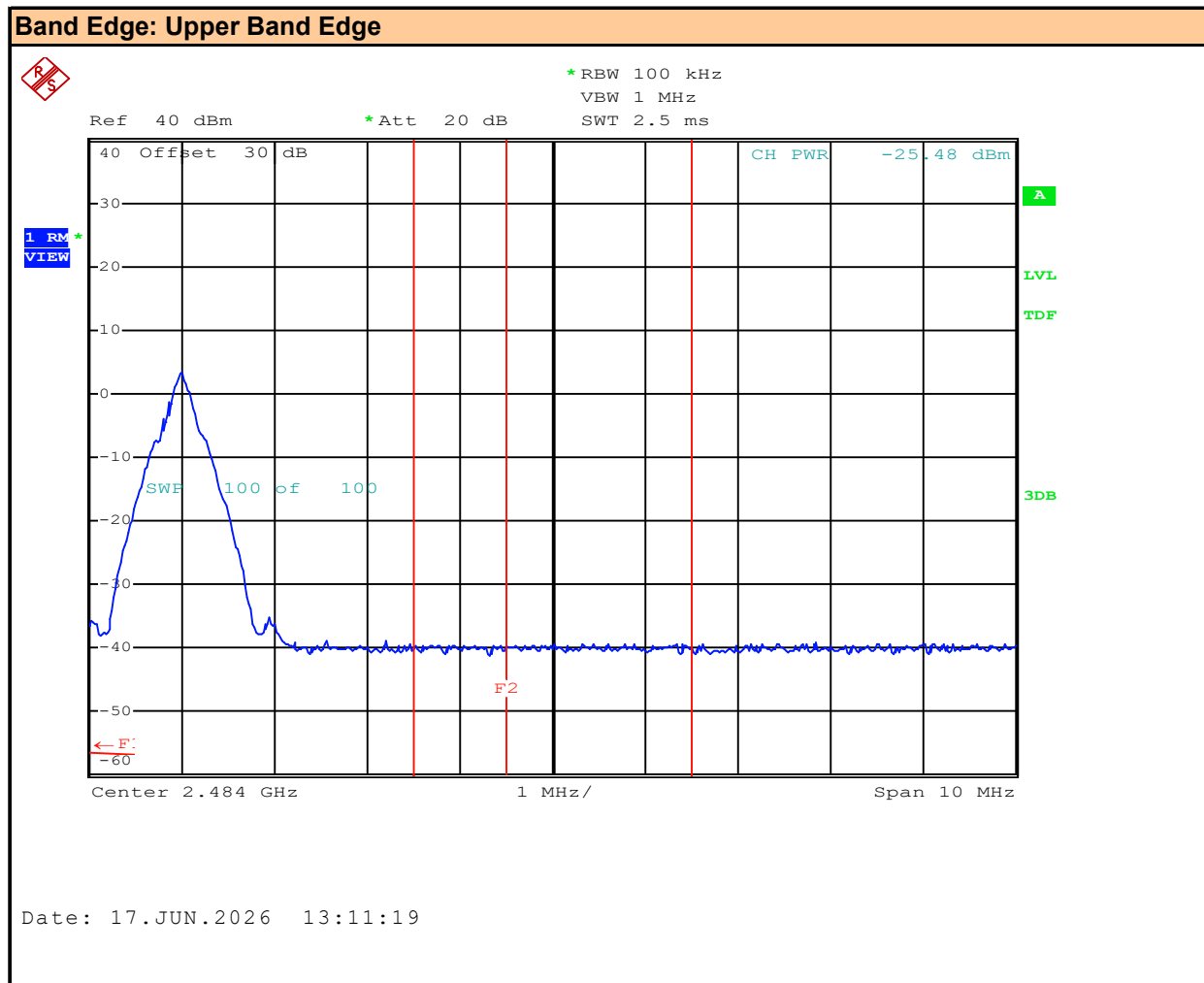
Channel Frequency: MHz

Mode:

Emission Power: dBm

Display Frequency Line F1 = 2400MHz

Plot 14.2 – Band Edge, BT 1EDR



Channel: **78**

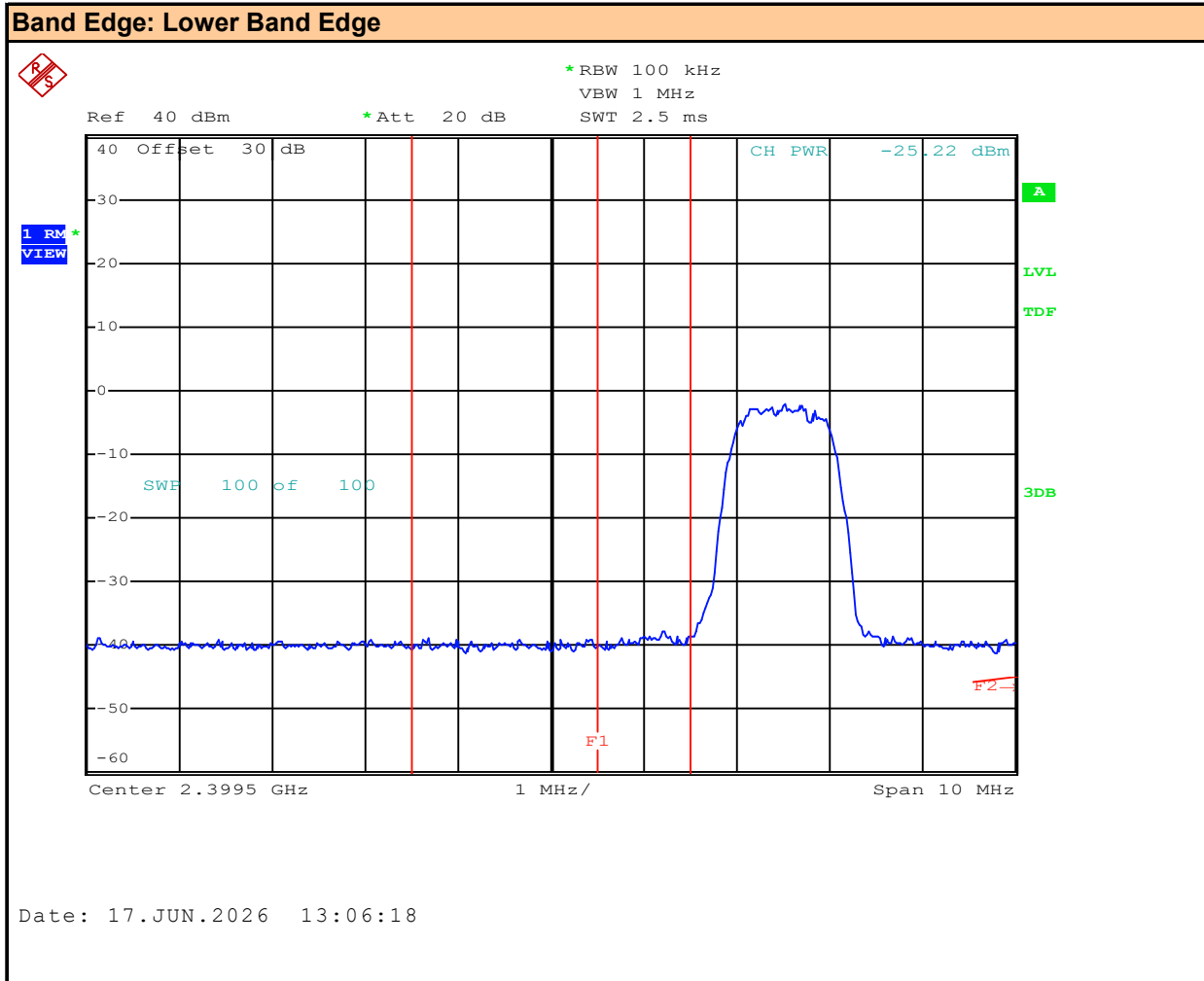
Channel Frequency: **2480** MHz

Mode: **1EDR**

Emission Power: **-25.48** dBm

Display Frequency Line F2 = 2483.5MHz

Plot 14.3 – Band Edge, BT 2EDR

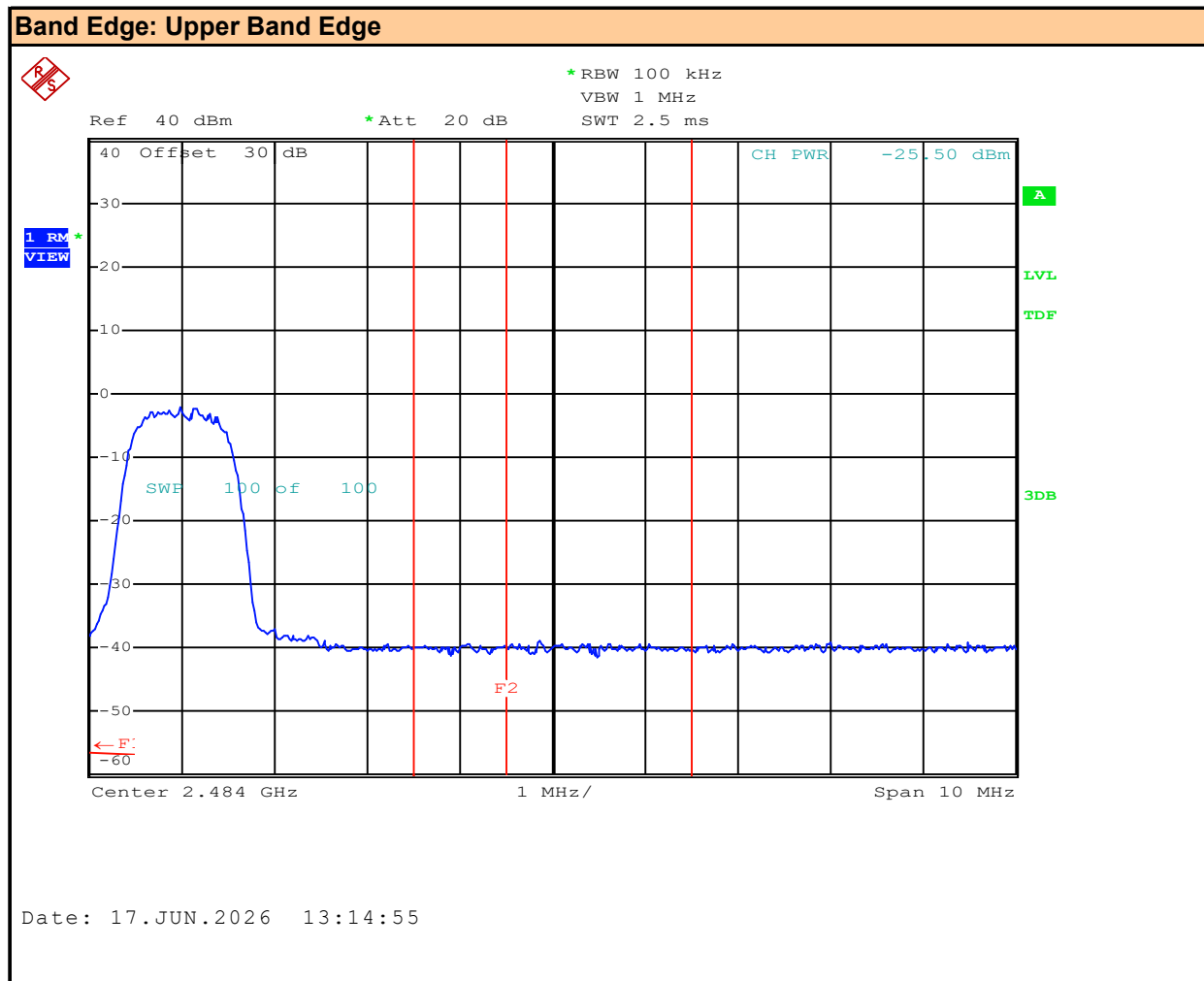


Channel: **0**
Mode: **2EDR**

Channel Frequency: **2402** MHz
Emission Power: **-25.22** dBm

Display Frequency Line F1 = 2400MHz

Plot 14.4 – Band Edge, BT 2EDR

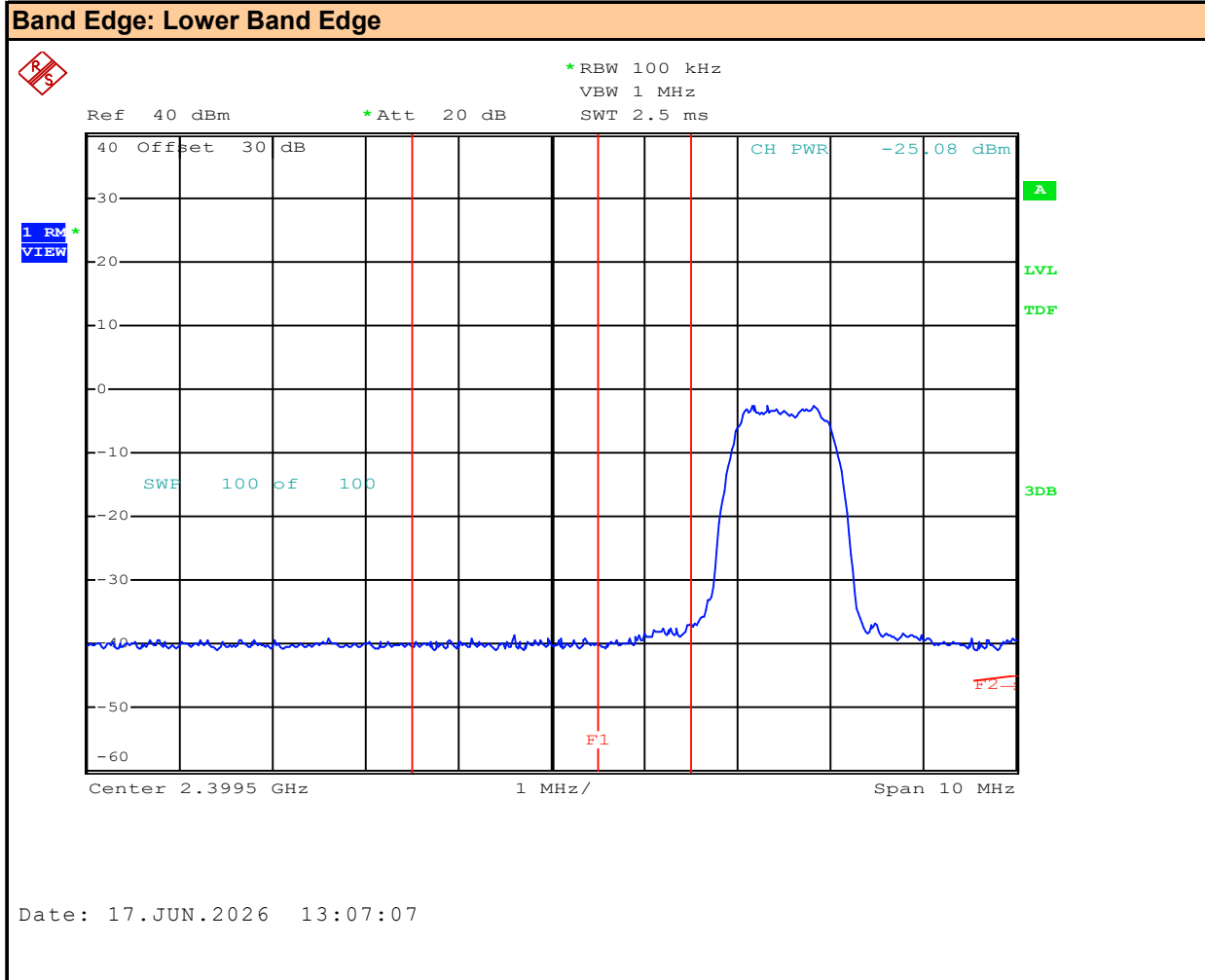


Channel:	78
Mode:	2EDR

Channel Frequency:	2480	MHz
Emission Power:	-25.5	dBm

Display Frequency Line F2 = 2483.5MHz

Plot 14.5 – Band Edge, BT 3EDR



Channel: **0**

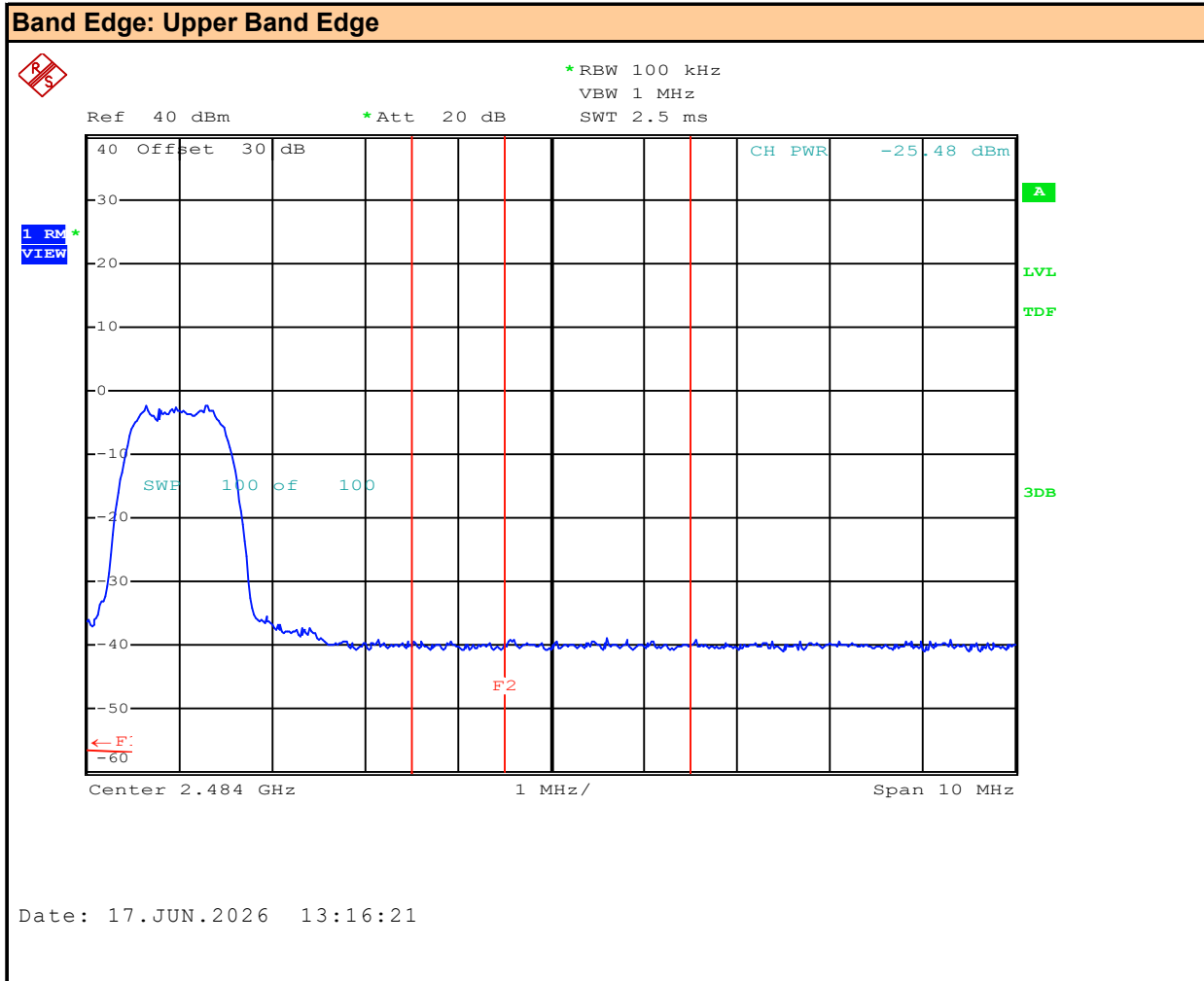
Mode: **3EDR**

Channel Frequency: **2402** MHz

Emission Power: **-25.08** dBm

Display Frequency Line F1 = 2400MHz

Plot 14.6 – Band Edge, BT 3EDR

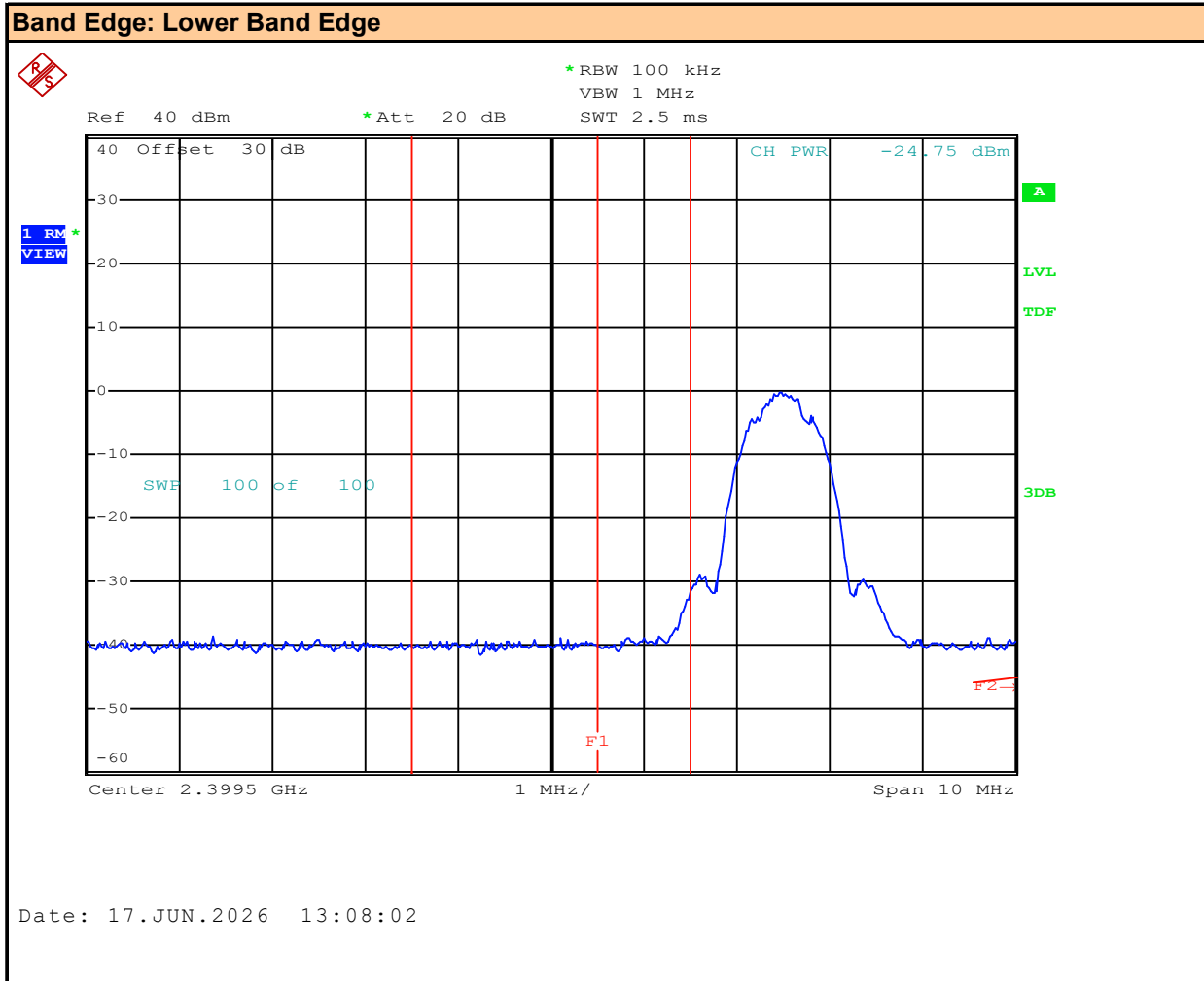


Channel: **78**
Mode: **3EDR**

Channel Frequency: **2480** MHz
Emission Power: **-25.48** dBm

Display Frequency Line F2 = 2483.5MHz

Plot 14.7 – Band Edge, BT LE1

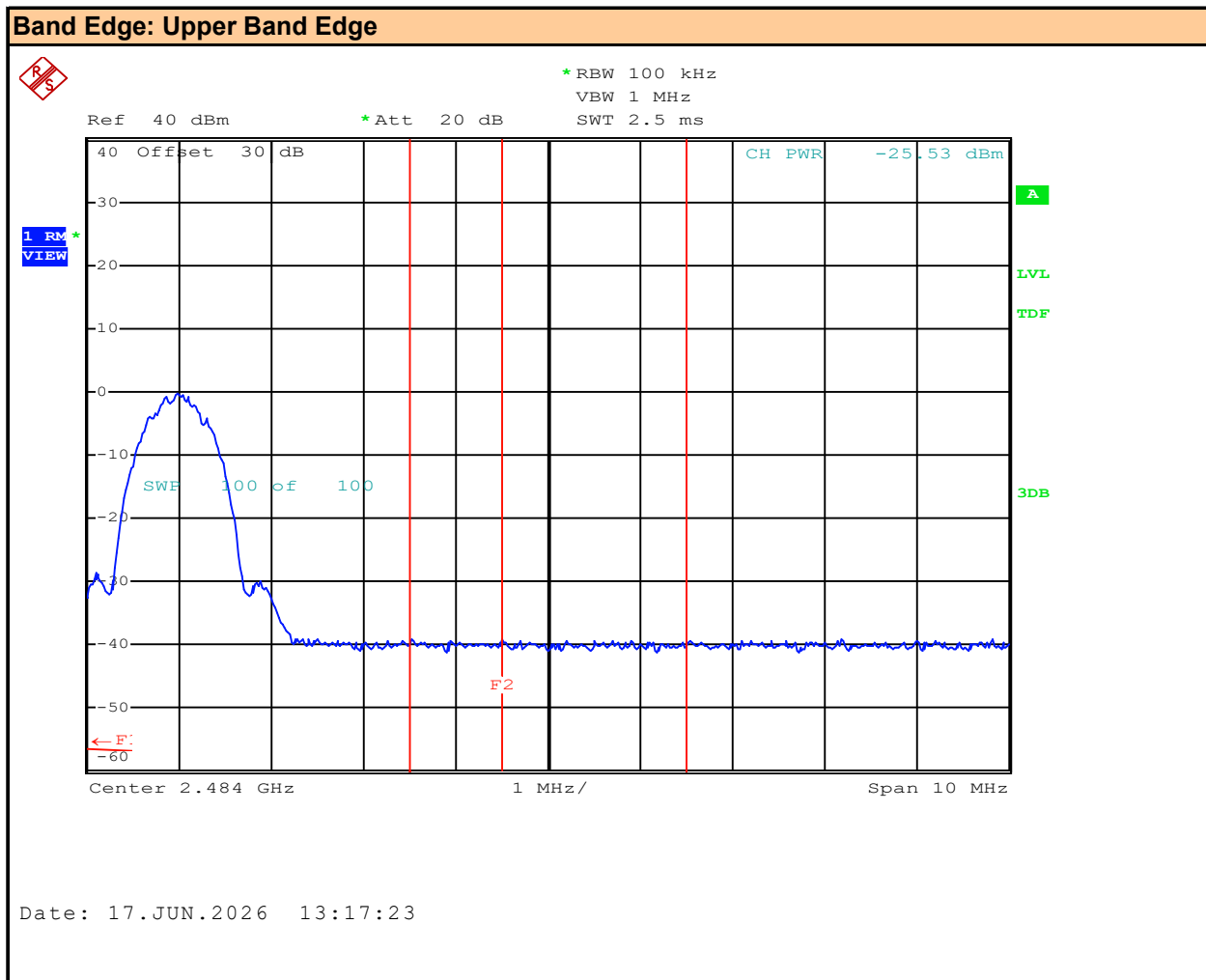


Channel: **0**
Mode: **LE1**

Channel Frequency: **2402** MHz
Emission Power: **-25.08** dBm

Display Frequency Line F1 = 2400MHz

Plot 14.8 – Band Edge, BT LE1

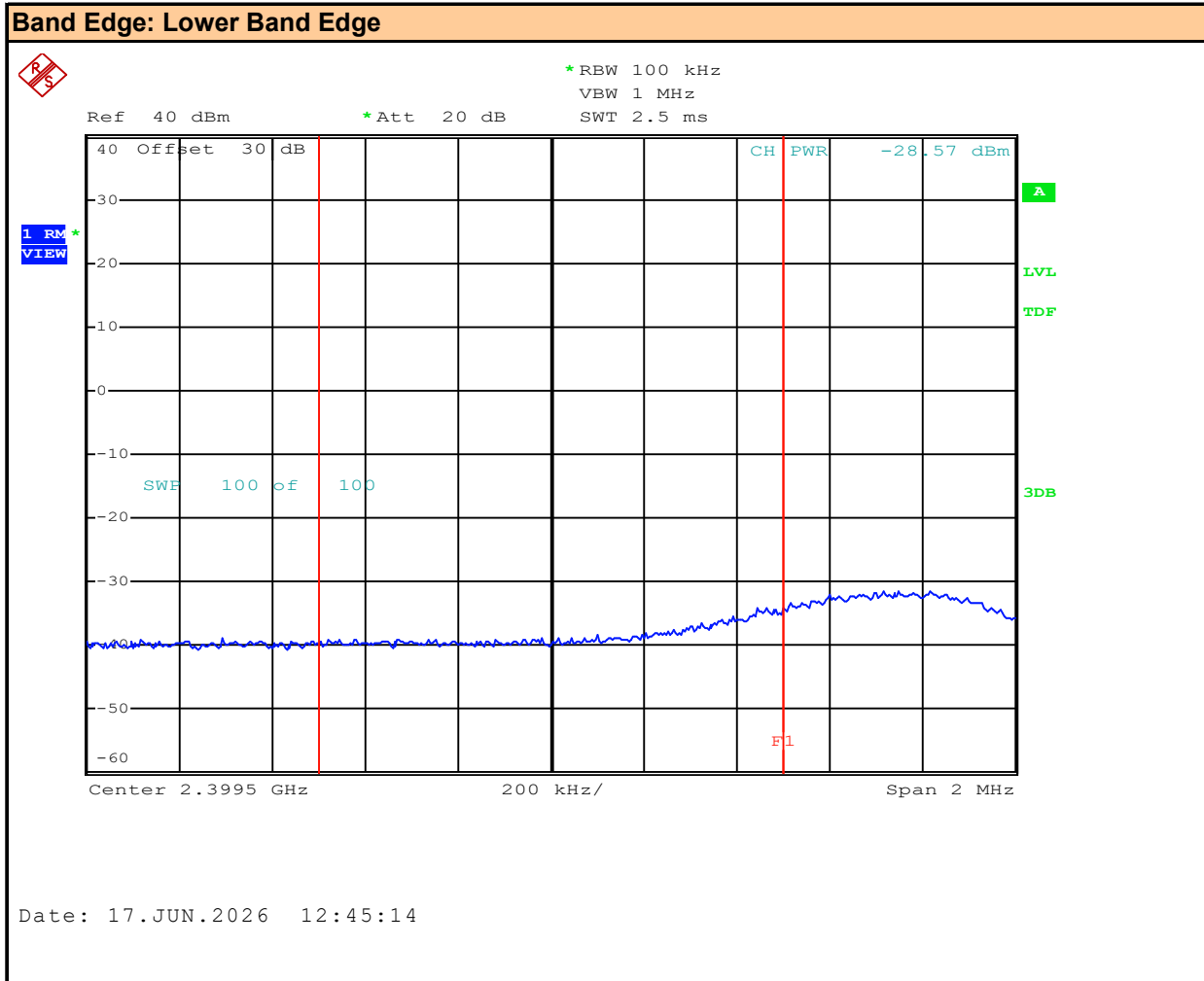


Channel: **39**
Mode: **LE1**

Channel Frequency: **2480** MHz
Emission Power: **-25.53** dBm

Display Frequency Line F2 = 2483.5MHz

Plot 14.9 – Band Edge, BT LE2

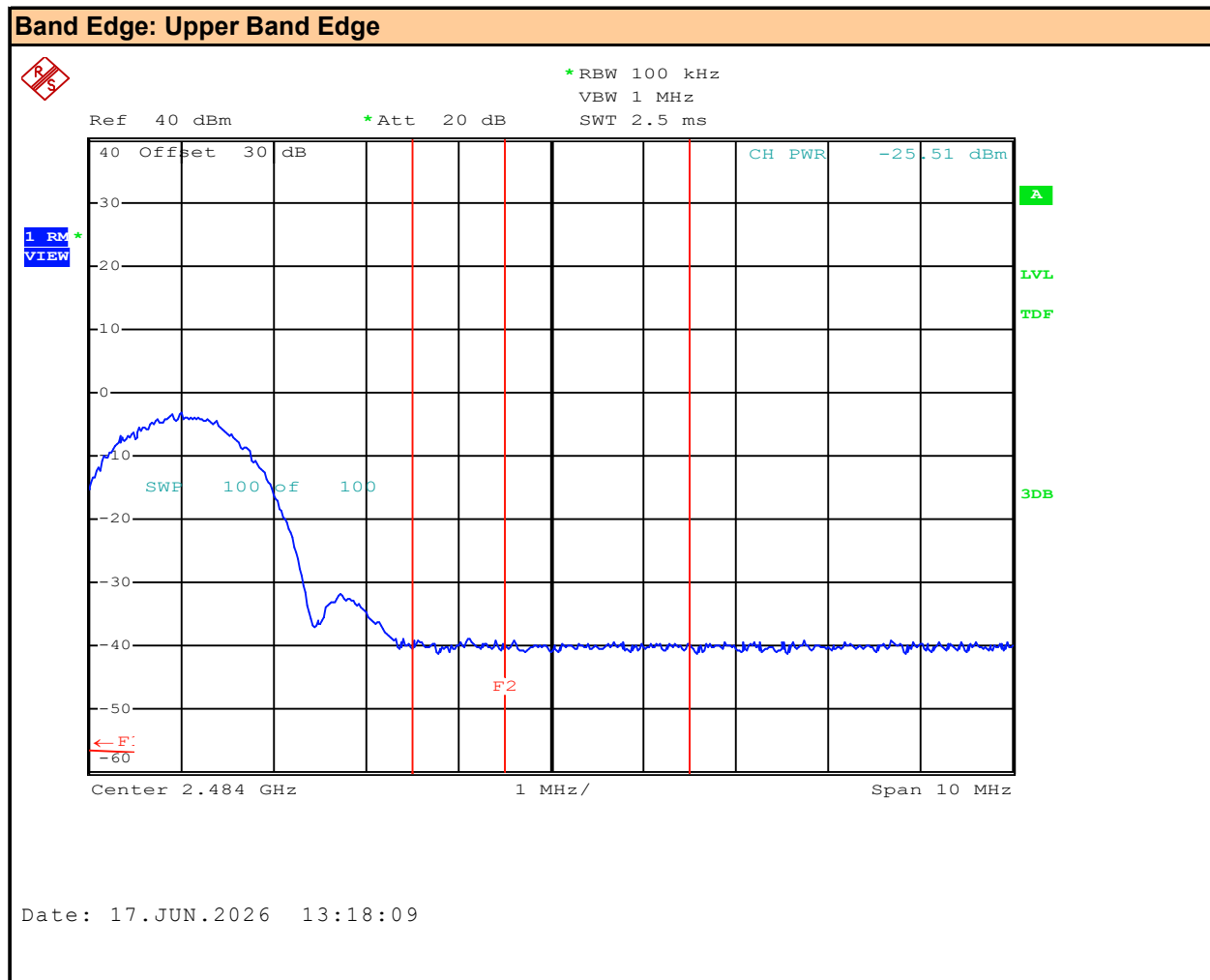


Channel:
Mode:

Channel Frequency: MHz
Emission Power: dBm

Display Frequency Line F1 = 2400MHz

Plot 14.10 – Band Edge, BT LE2



Channel: **39**
Mode: **LE1**

Channel Frequency: **2480** MHz
Emission Power: **-25.51** dBm

Display Frequency Line F2 = 2483.5MHz

Table 14.1 – Summary of Spurious Emission Measurements – Band Edge, (DSS)

Band Edge Measurement Results: BlueTooth										
Mode	Channel Number	Frequency (MHz)	Emission Power [P _{Em}] (dBm)	Antenna Gain [G _T] (dBi)	Emission EIRP [E _{Em}] (dBm)	Fundamental Power [P _{Fund}] (dBm)	Fundamental EIRP [E _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)
1EDR	0	2402.00	-25.35	2	-23.35	6.20	8.20	31.55	30	1.6
1EDR	78	2480.00	-25.48		-23.48	6.03	8.03	31.51		1.5
2EDR	0	2402.00	-25.22		-23.22	6.23	8.23	31.45		1.5
2EDR	78	2480.00	-25.50		-23.50	5.99	7.99	31.49		1.5
3EDR	0	2402.00	-25.08		-23.08	6.15	8.15	31.23		1.2
3EDR	78	2480.00	-25.48		-23.48	5.88	7.88	31.36		1.4
LE1	0	2402.00	-25.08		-23.08	6.28	8.28	31.36		1.4
LE1	39	2480.00	-25.53		-23.53	5.79	7.79	31.32		1.3
LE2	0	2402.00	-25.57		-23.57	6.87	8.87	32.44		2.4
LE1	39	2480.00	-25.51		-23.51	6.80	8.80	32.31		2.3
Result:									Complies	

$$\text{Emission } [E_{Em}] = [P_{Em}] + [G_T]$$

$$\text{Fundamental EIRP } [E_{Fund}] = [P_{Fund}] + [G_T]$$

$$\text{Attenuation } [Atten] = [E_{Fund}] - [E_{Em}]$$

$$\text{Margin} = \text{Attenuation} - \text{Limit}$$

15.0 CONDUCTED SPURIOUS EMISSIONS

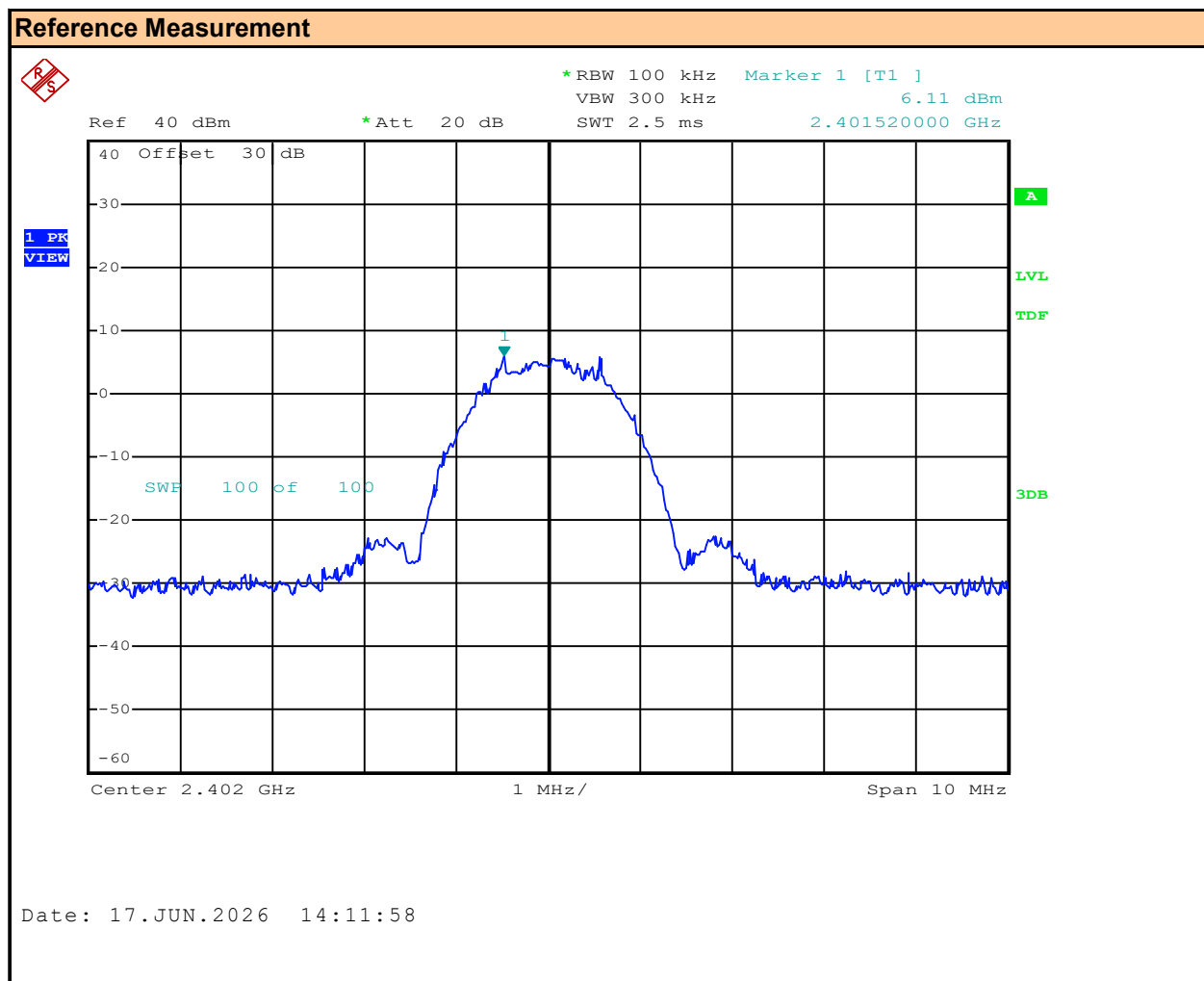
Test Procedure

Normative Reference	FCC 47 CFR §2.1051, §15.247(d), RSS-Gen (6.13), RSS-247 (5.5),
	KDB 558074 (11.3), ANSI C63.10 (11.11.3)

Limits

47 CFR §15.247(d)	(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.
KDB 558074 (11.3) C63.10 (11.11.3)	11.1 General The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions: b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc). 11.2 Reference level measurement a) Set instrument center frequency to DTS channel center frequency. b) Set the span to $\geq 1.5 \times DTS \text{ bandwidth}$. c) Set the RBW = 100 kHz. d) Set the VBW $\geq 3 \times RBW$. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. Note that the channel found to contain the maximum PSD level can be used to establish the reference

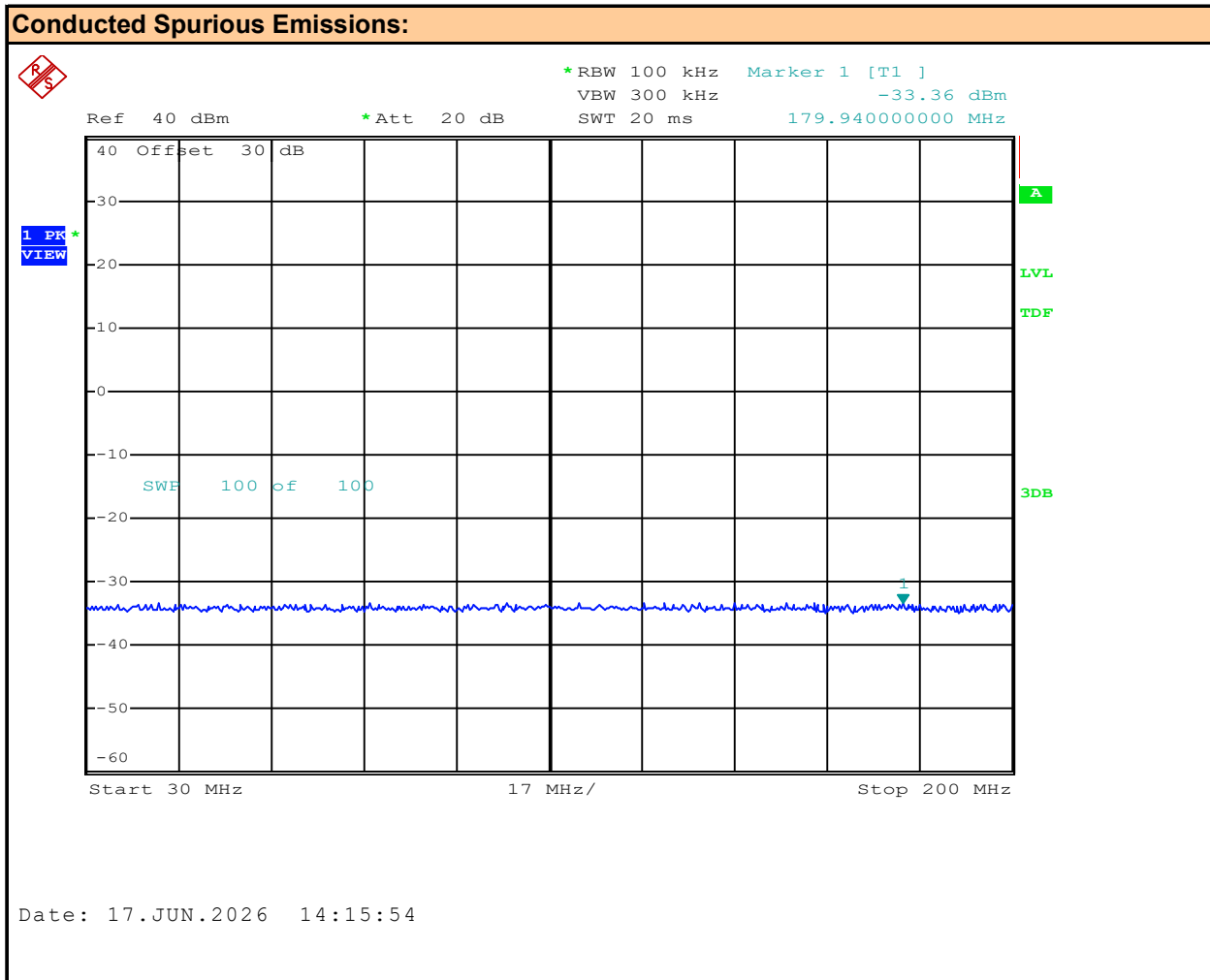
Plot 15.1 – Conducted Spurious Emissions, Reference Measurement



Channel: **0**
Mode: **LE2**

Channel Frequency: **2402** MHz
Reference Measurement: **6.11** dBm

Plot 15.2 – Conducted Spurious Emissions



Channel: **0**

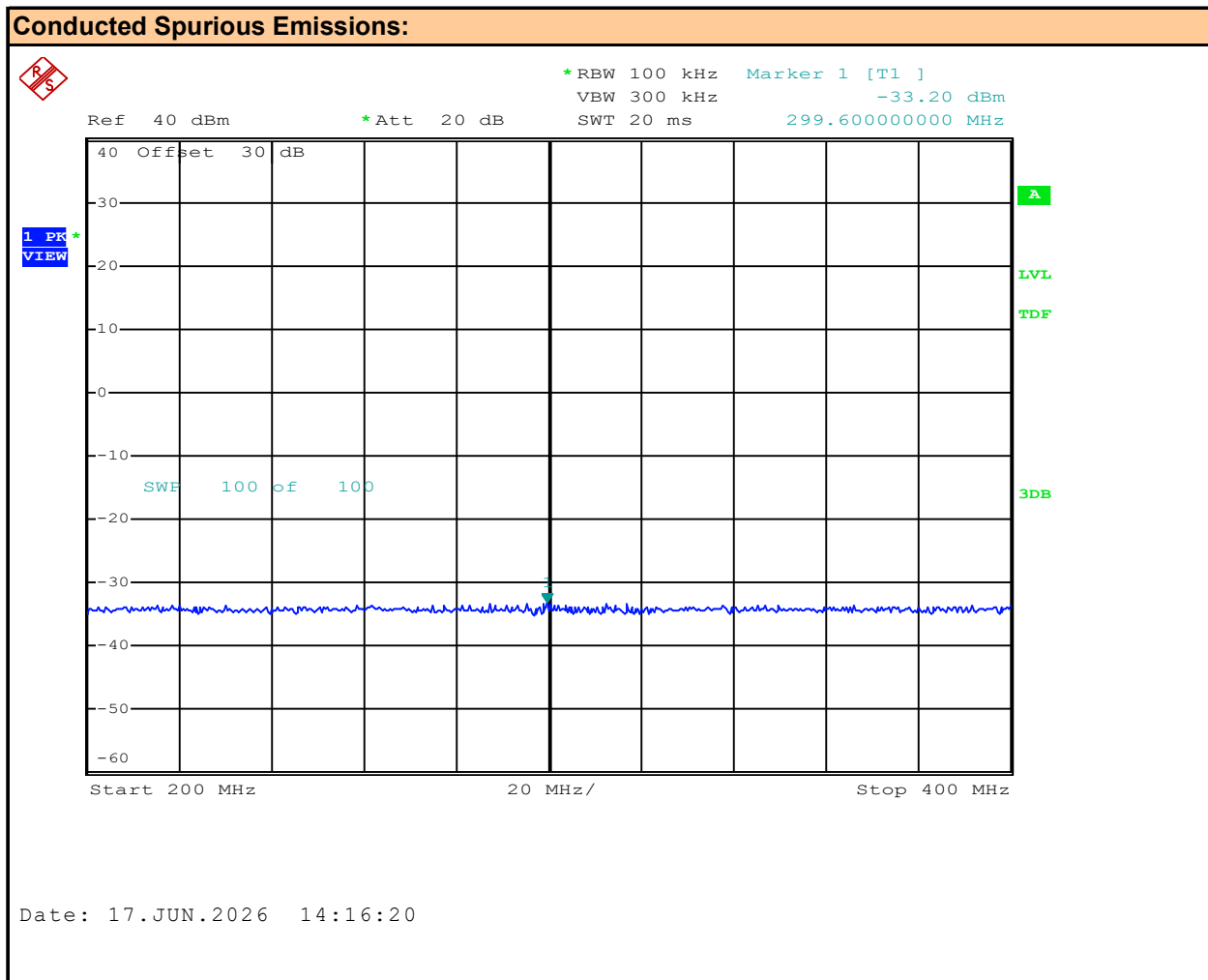
Channel Frequency: **2402** MHz

Mode: **LE2**

Measured Emission: **ND** dBm

Emission Frequency: **ND** MHz

Plot 15.3 – Conducted Spurious Emissions



Channel: **0**

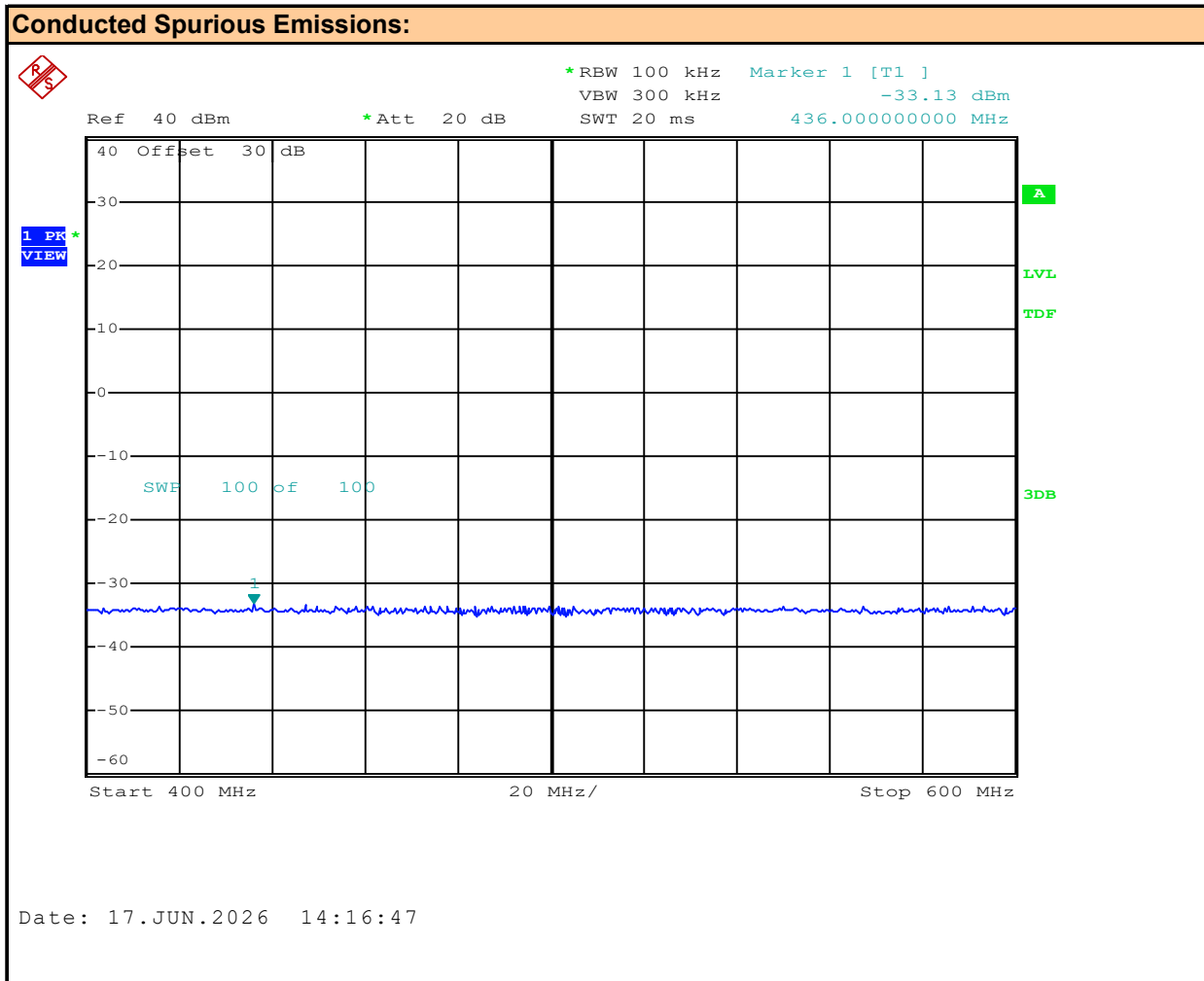
Channel Frequency: **2402** MHz

Mode: **LE2**

Measured Emission: **ND** dBm

Emission Frequency: **ND** MHz

Plot 15.4 – Conducted Spurious Emissions



Channel: **0**

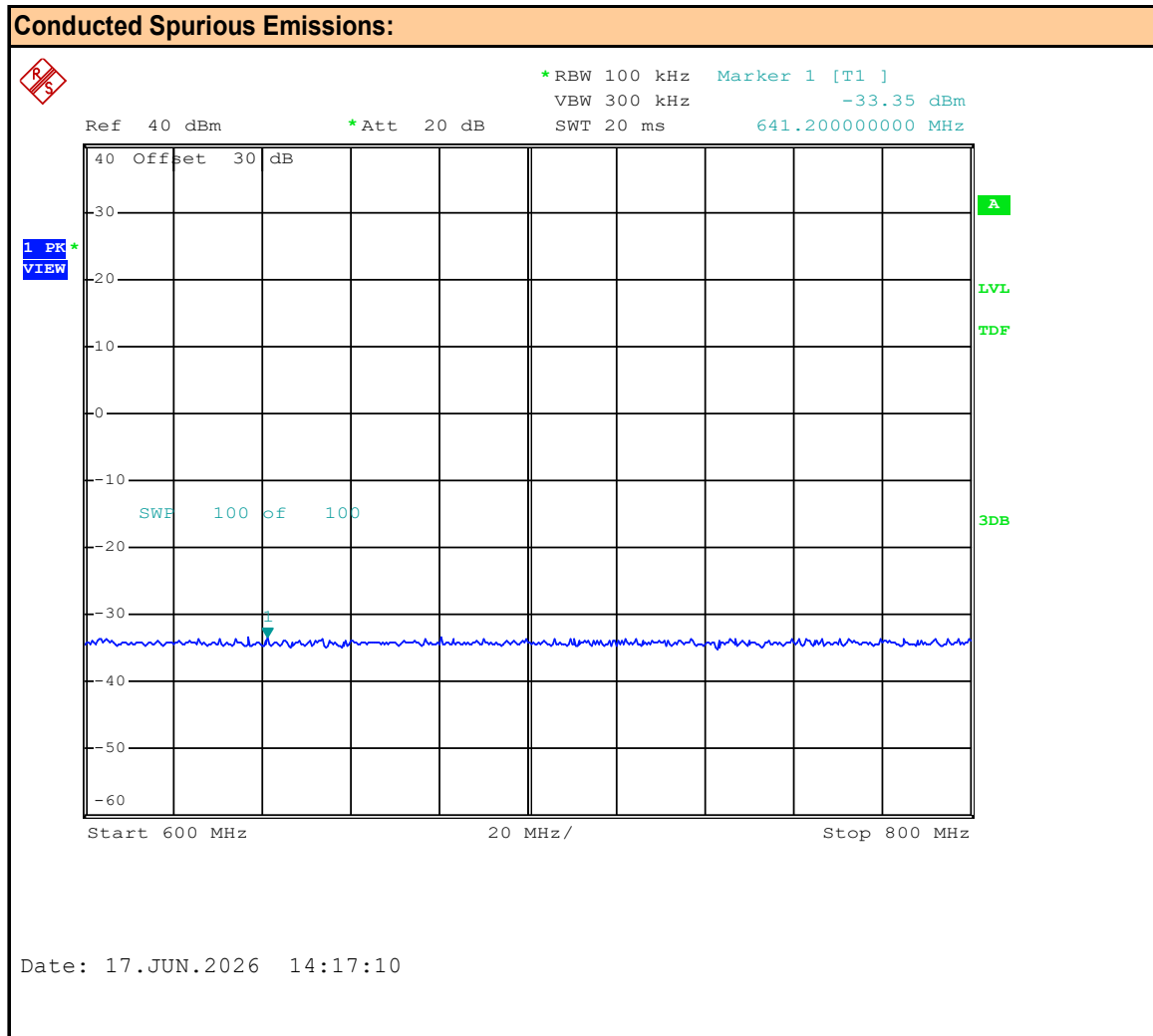
Channel Frequency: **2402** MHz

Mode: **LE2**

Measured Emission: **ND** dBm

Emission Frequency: **ND** MHz

Plot 15.5 – Conducted Spurious Emissions



Channel: **0**

Mode: **LE2**

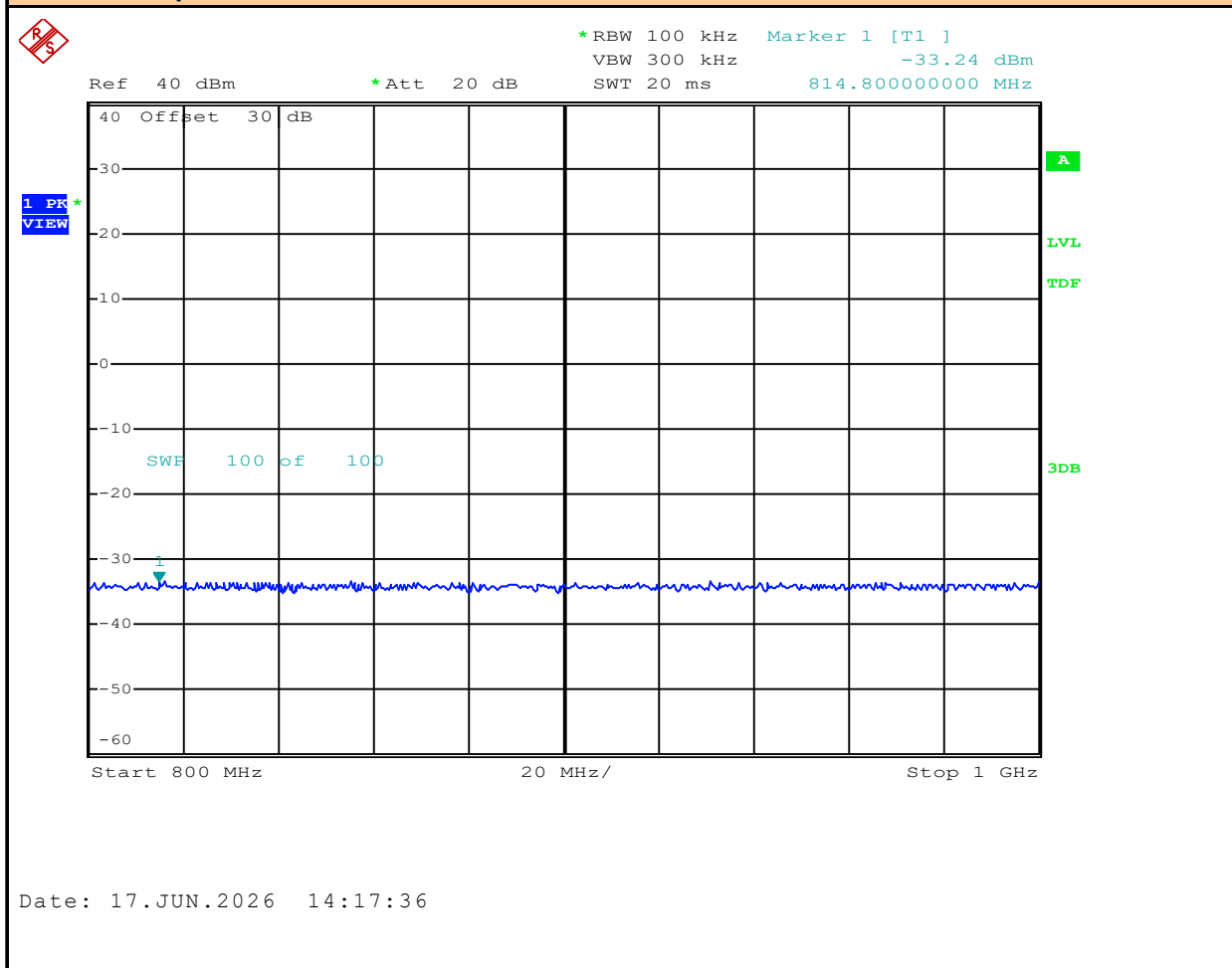
Emission Frequency: **ND** MHz

Channel Frequency: **2402** MHz

Measured Emission: **ND** dBm

Plot 15.6 – Conducted Spurious Emissions

Conducted Spurious Emissions:



Channel: **0**

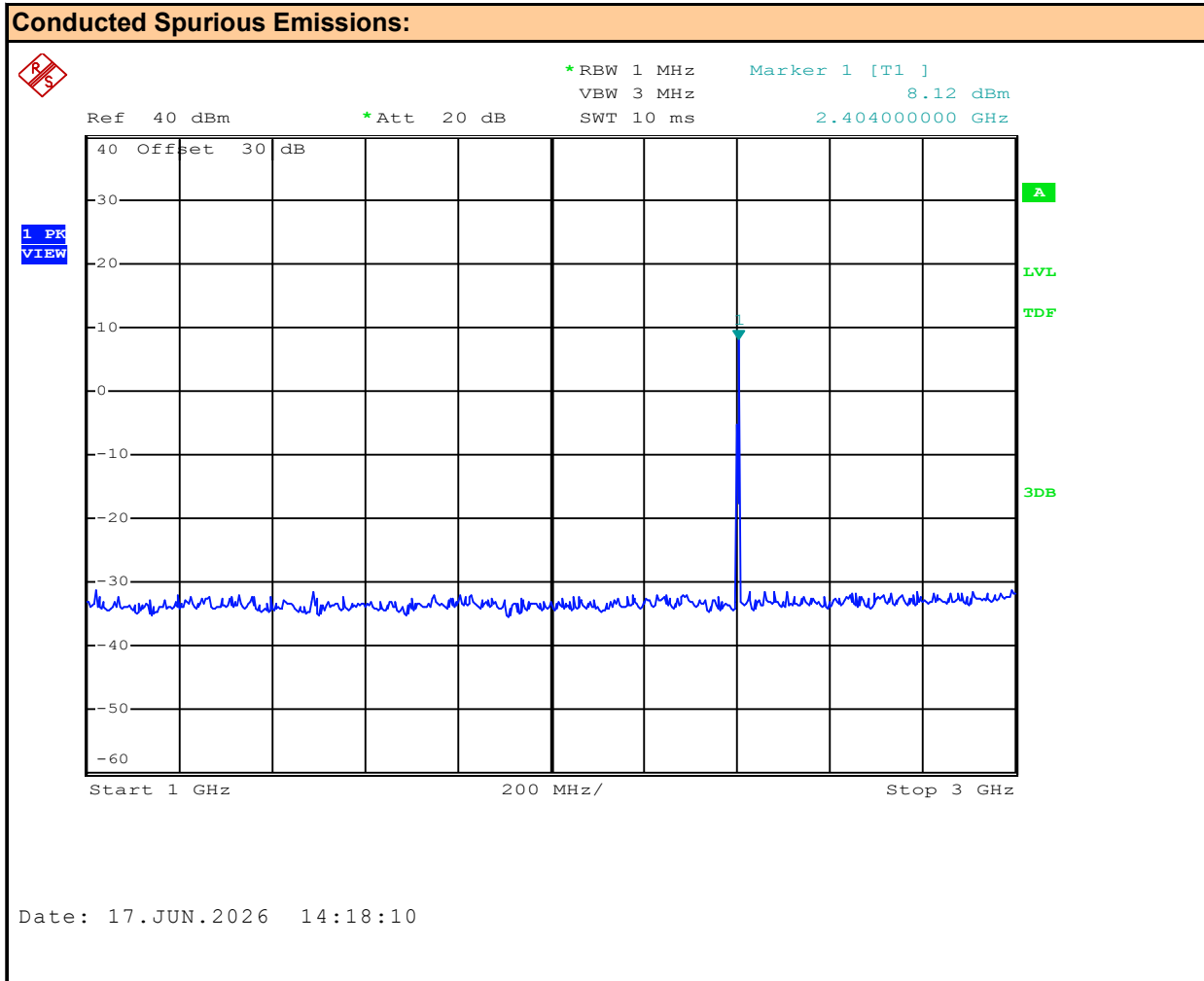
Mode: **LE2**

Emission Frequency: **ND** MHz

Channel Frequency: **2402** MHz

Measured Emission: **ND** dBm

Plot 15.7 – Conducted Spurious Emissions



Channel: 0

Channel Frequency: 2402 MHz

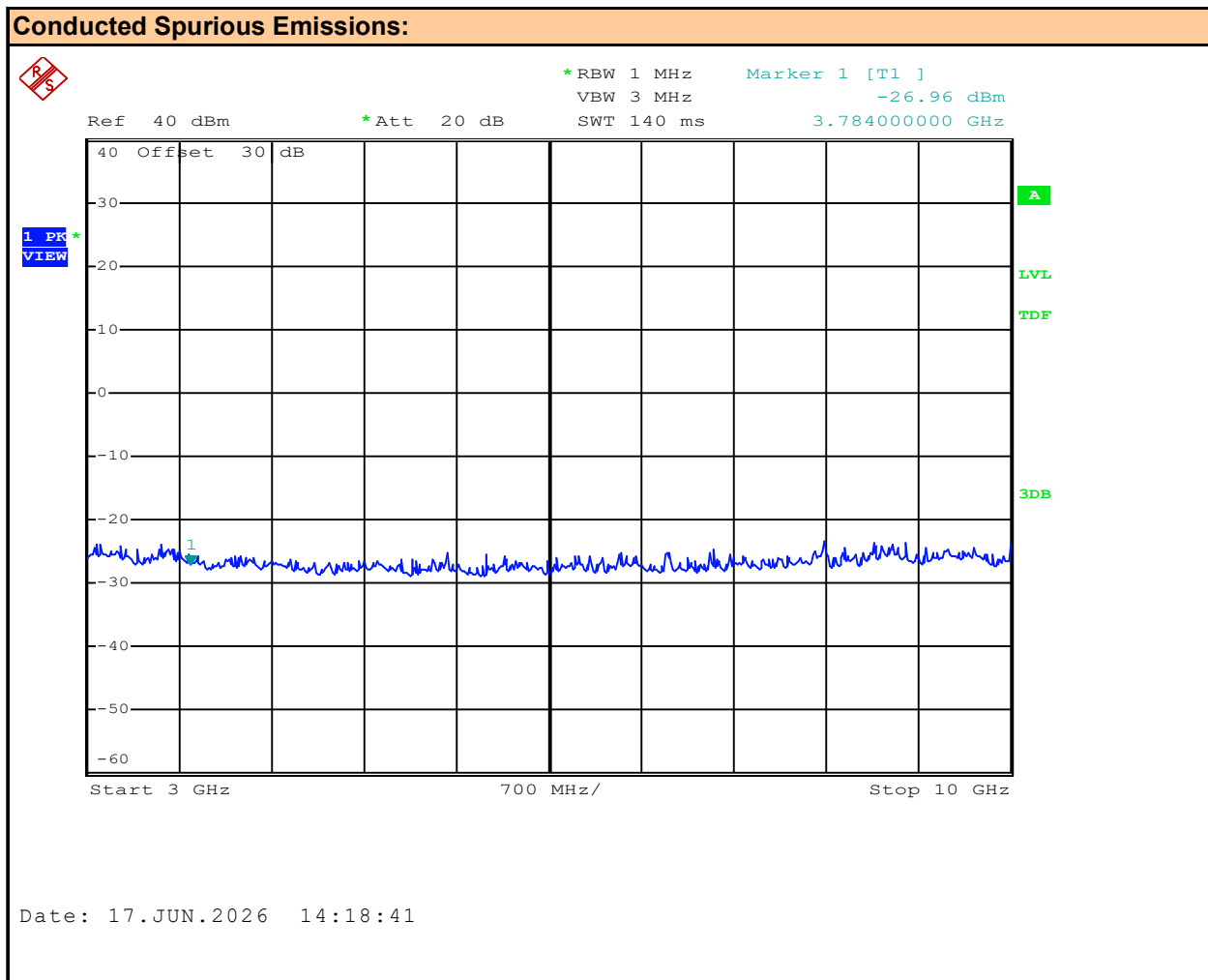
Mode: LE2

Measured Emission: ND dBm

Emission Frequency: ND MHz

Marker 1 = Fundamental

Plot 15.8 – Conducted Spurious Emissions



Channel: **0**

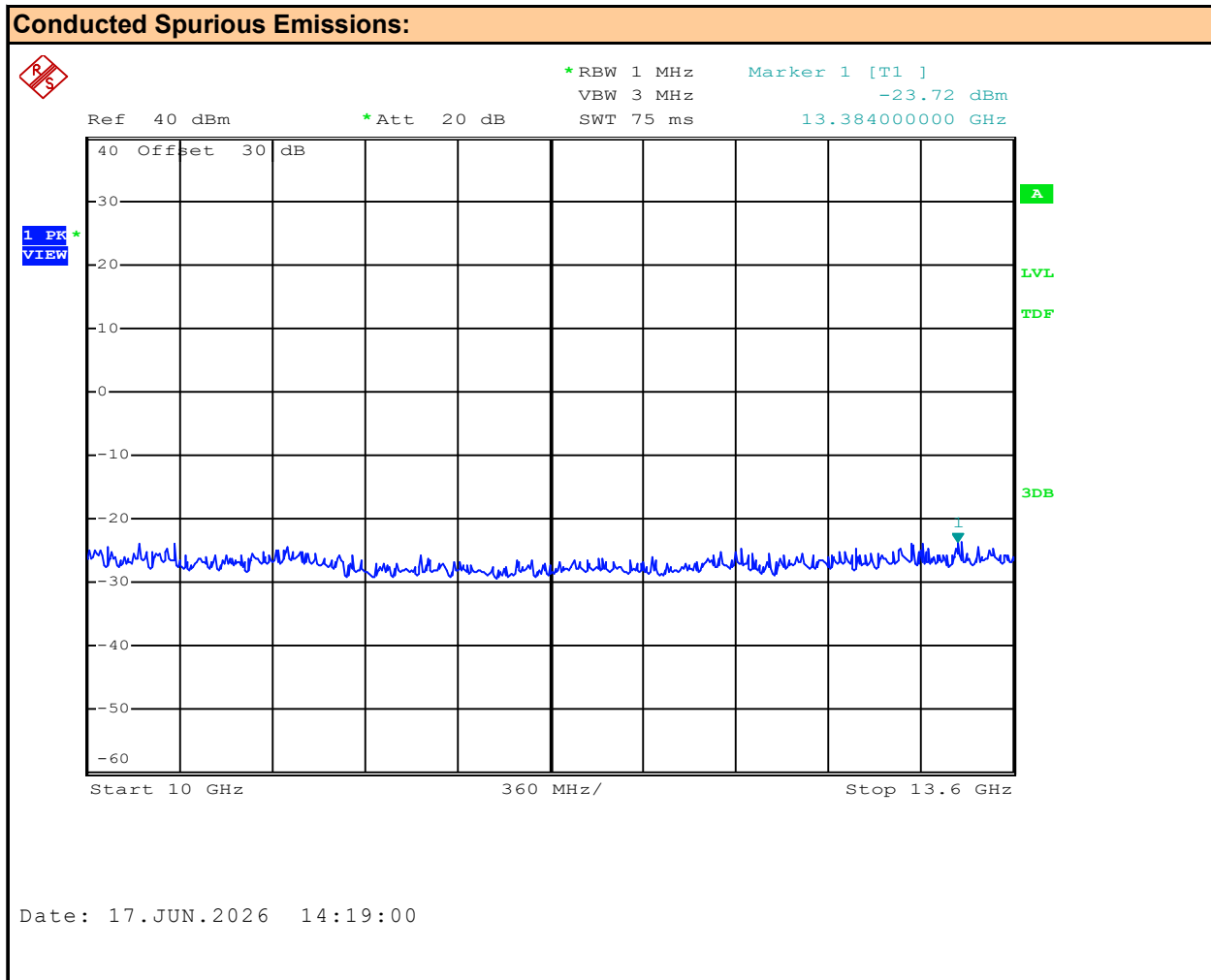
Channel Frequency: **2402** MHz

Mode: **LE2**

Measured Emission: **ND** dBm

Emission Frequency: **ND** MHz

Plot 15.9 – Conducted Spurious Emissions



Channel: 0

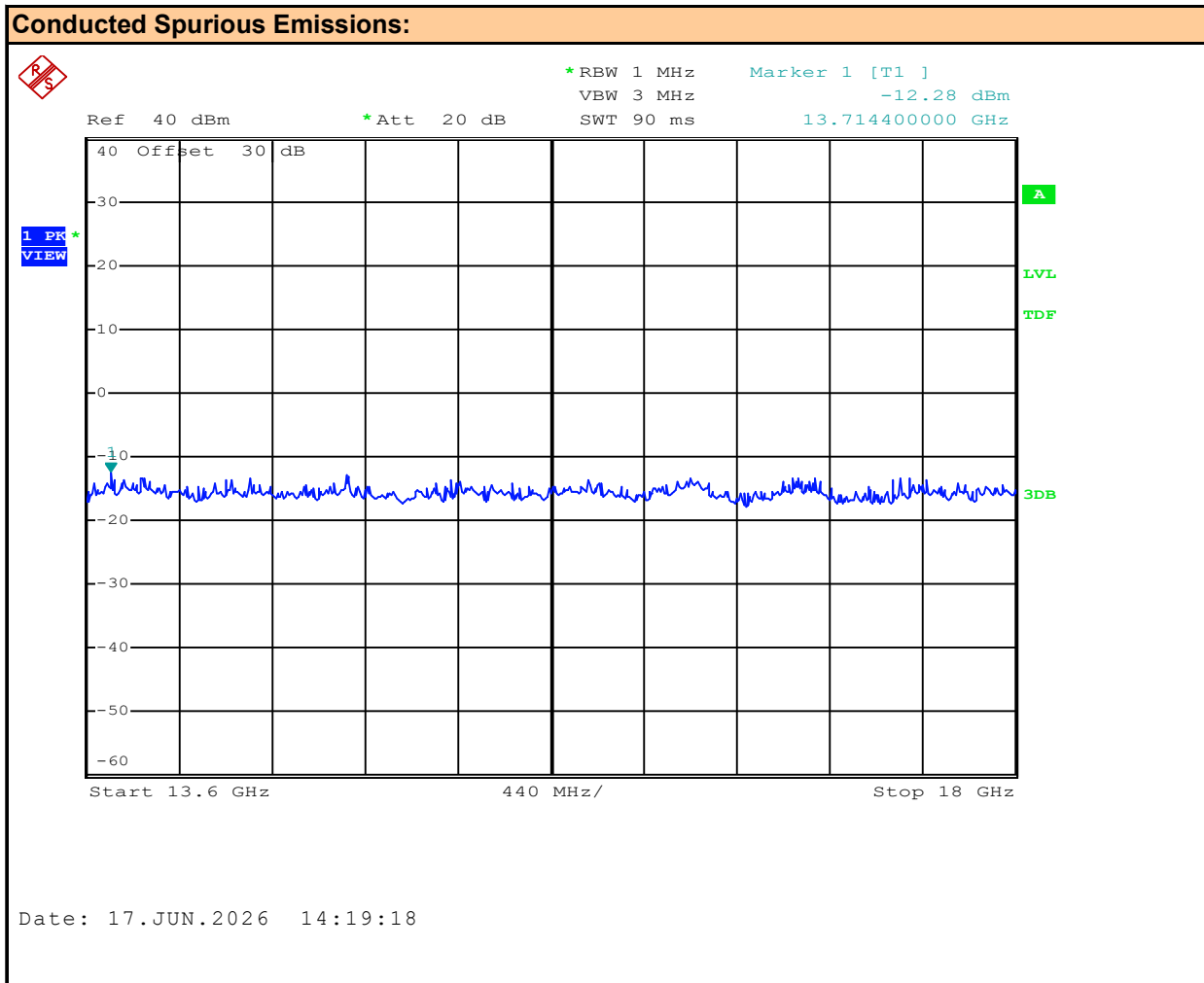
Channel Frequency: 2402 MHz

Mode: LE2

Measured Emission: ND dBm

Emission Frequency: ND MHz

Plot 15.10 – Conducted Spurious Emissions



Channel: **0**

Channel Frequency: **2402** MHz

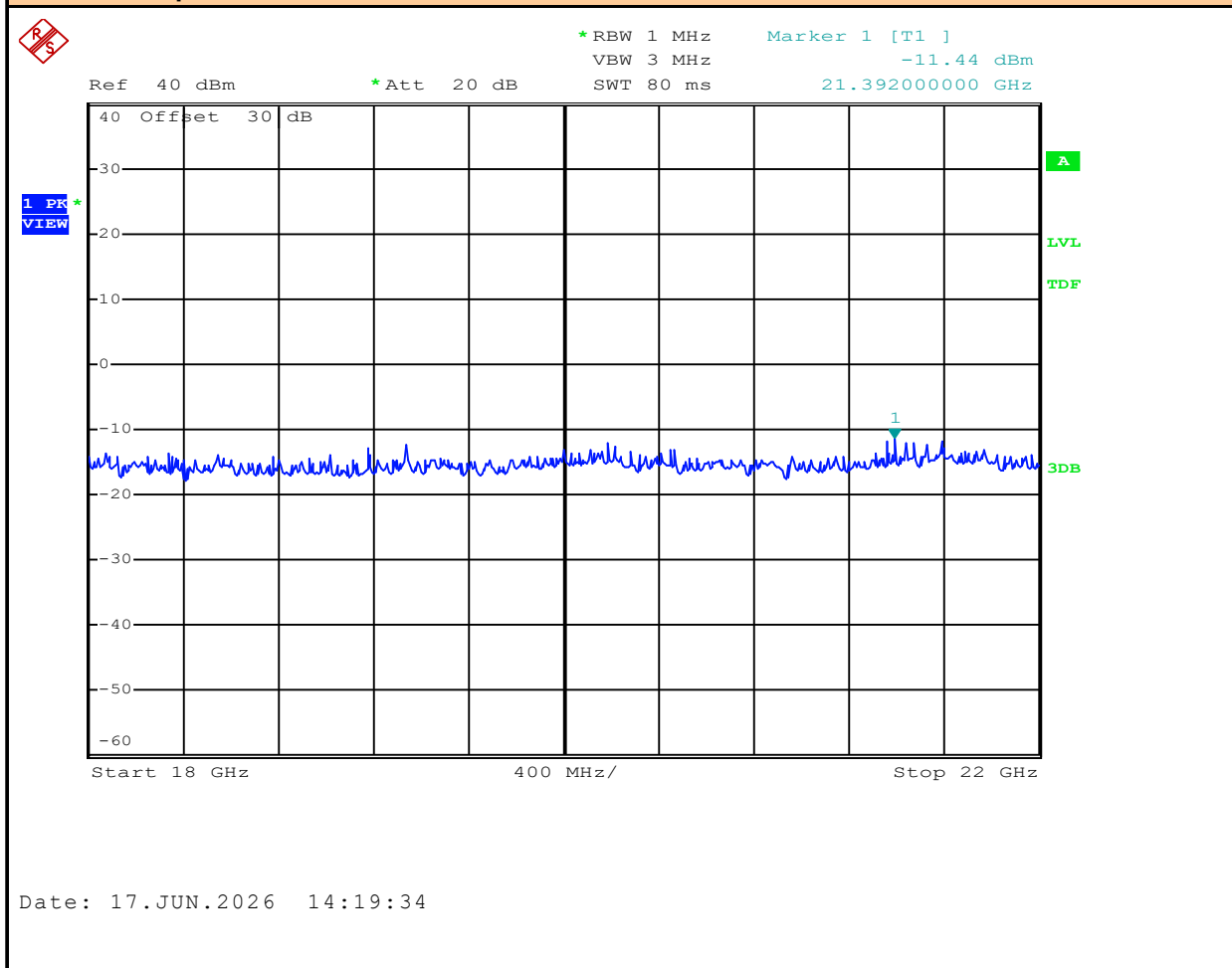
Mode: **LE2**

Measured Emission: **ND** dBm

Emission Frequency: **ND** MHz

Plot 15.11 – Conducted Spurious Emissions

Conducted Spurious Emissions:



Channel: **0**

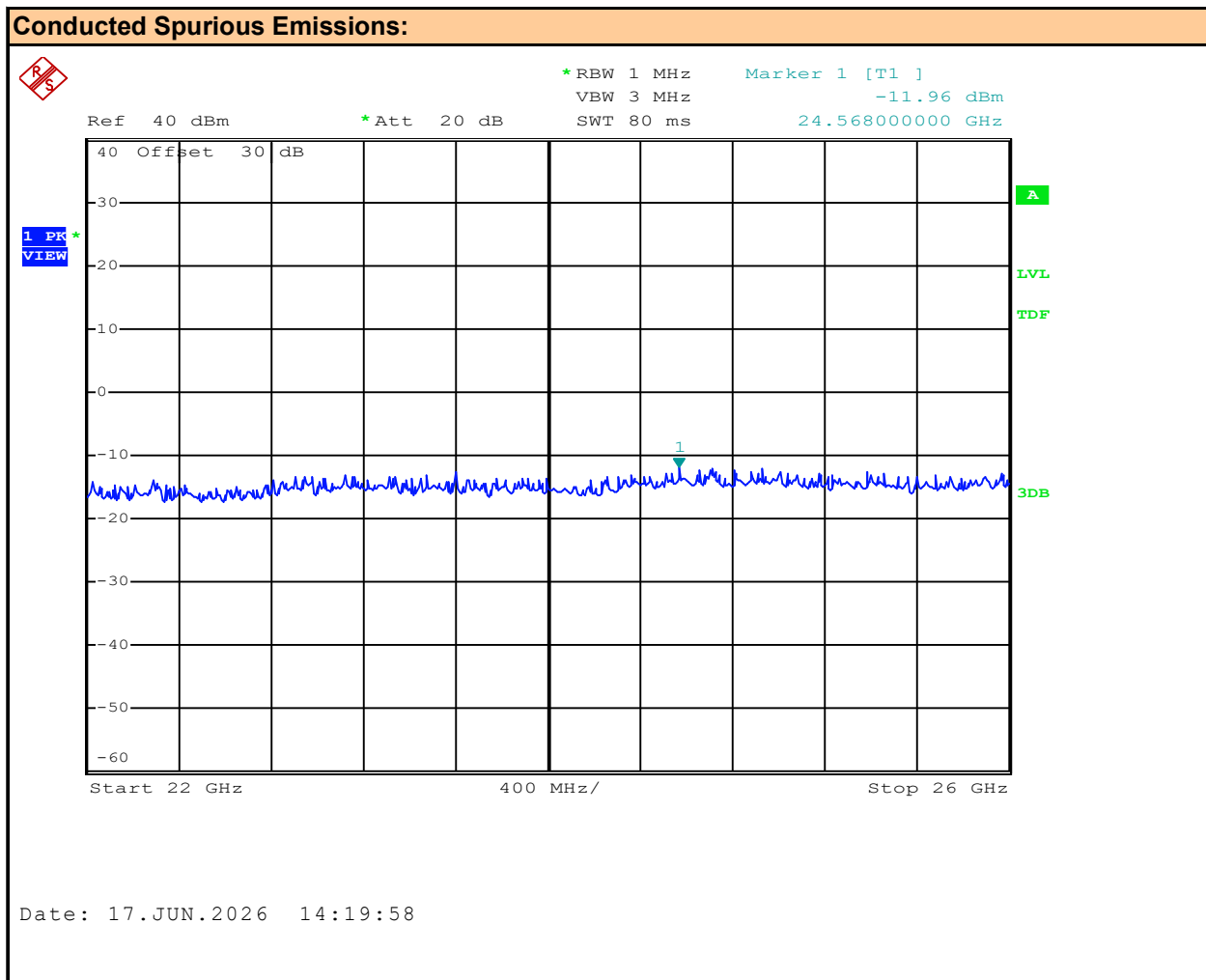
Mode: **LE2**

Emission Frequency: **ND** MHz

Channel Frequency: **2402** MHz

Measured Emission: **ND** dBm

Plot 15.12 – Conducted Spurious Emissions



Channel:

Channel Frequency: MHz

Mode:

Measured Emission: dBm

Emission Frequency: MHz

Table 15.1 – Summary of Conducted Spurious Emissions, (DSS)

Conducted Spurious Emissions Measurement Results:								
Mode	Channel Number	Frequency (MHz)	Emission Power [P _{Em}] (dBm)	Emission Frequency (MHz)	Reference Measurement [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)
LE2	0	2402.00	ND	ND	6.11	NA	30	NA
Result:							Complies	

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]

Margin = Attenuation - Limit

ND = None Detected

16.0 RADIATED TX SPURIOUS EMISSIONS, RESTRICTED BAND

Test Procedure

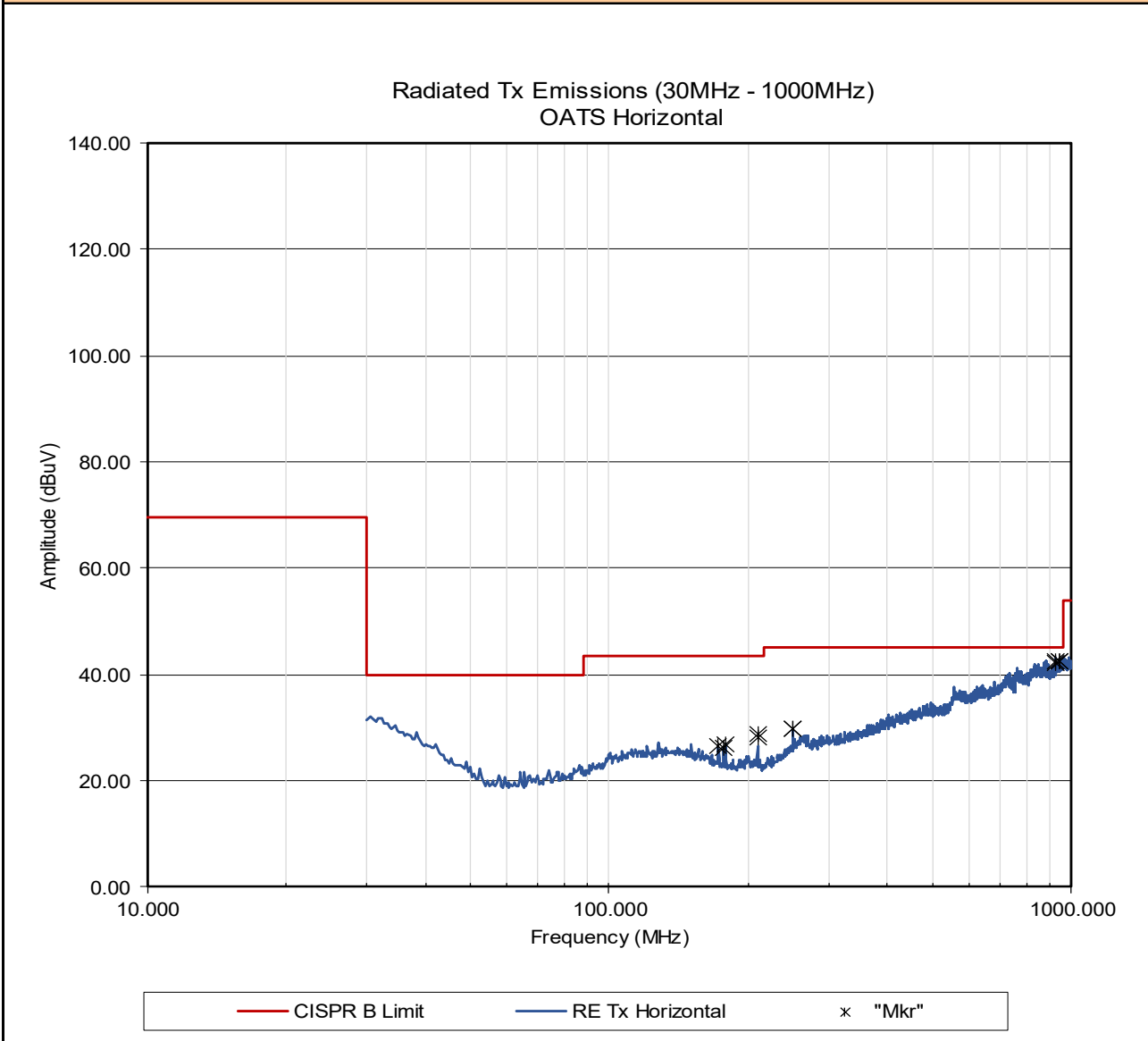
Normative Reference	FCC 47 CFR §2.1051, §15.247(d), §15.205(a), §15.205(c), §15.209(a)
	KDB 558074 (8.6), ANSI C63.10 (11.12)

Limits

47 CFR §15.247(d)	(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).																
47 CFR §15.209(a)	§15.209 Radiated emission limits; general requirements. (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table: <table> <tr> <th>Frequency (MHz)</th><th>Field Strength (microvolts/meter)</th></tr> <tr> <td>0.009 - 0.490</td><td>2400/F (kHz) @300m</td></tr> <tr> <td>0.490 - 1.705</td><td>24000/F (kHz) @30m</td></tr> <tr> <td>1.705 - 30</td><td>30 @ 30m</td></tr> <tr> <td>30 - 88</td><td>100 @3m</td></tr> <tr> <td>88 - 216</td><td>150 @3m</td></tr> <tr> <td>216 - 960</td><td>200 @3m</td></tr> <tr> <td>Above 960</td><td>500 @3m</td></tr> </table>	Frequency (MHz)	Field Strength (microvolts/meter)	0.009 - 0.490	2400/F (kHz) @300m	0.490 - 1.705	24000/F (kHz) @30m	1.705 - 30	30 @ 30m	30 - 88	100 @3m	88 - 216	150 @3m	216 - 960	200 @3m	Above 960	500 @3m
Frequency (MHz)	Field Strength (microvolts/meter)																
0.009 - 0.490	2400/F (kHz) @300m																
0.490 - 1.705	24000/F (kHz) @30m																
1.705 - 30	30 @ 30m																
30 - 88	100 @3m																
88 - 216	150 @3m																
216 - 960	200 @3m																
Above 960	500 @3m																

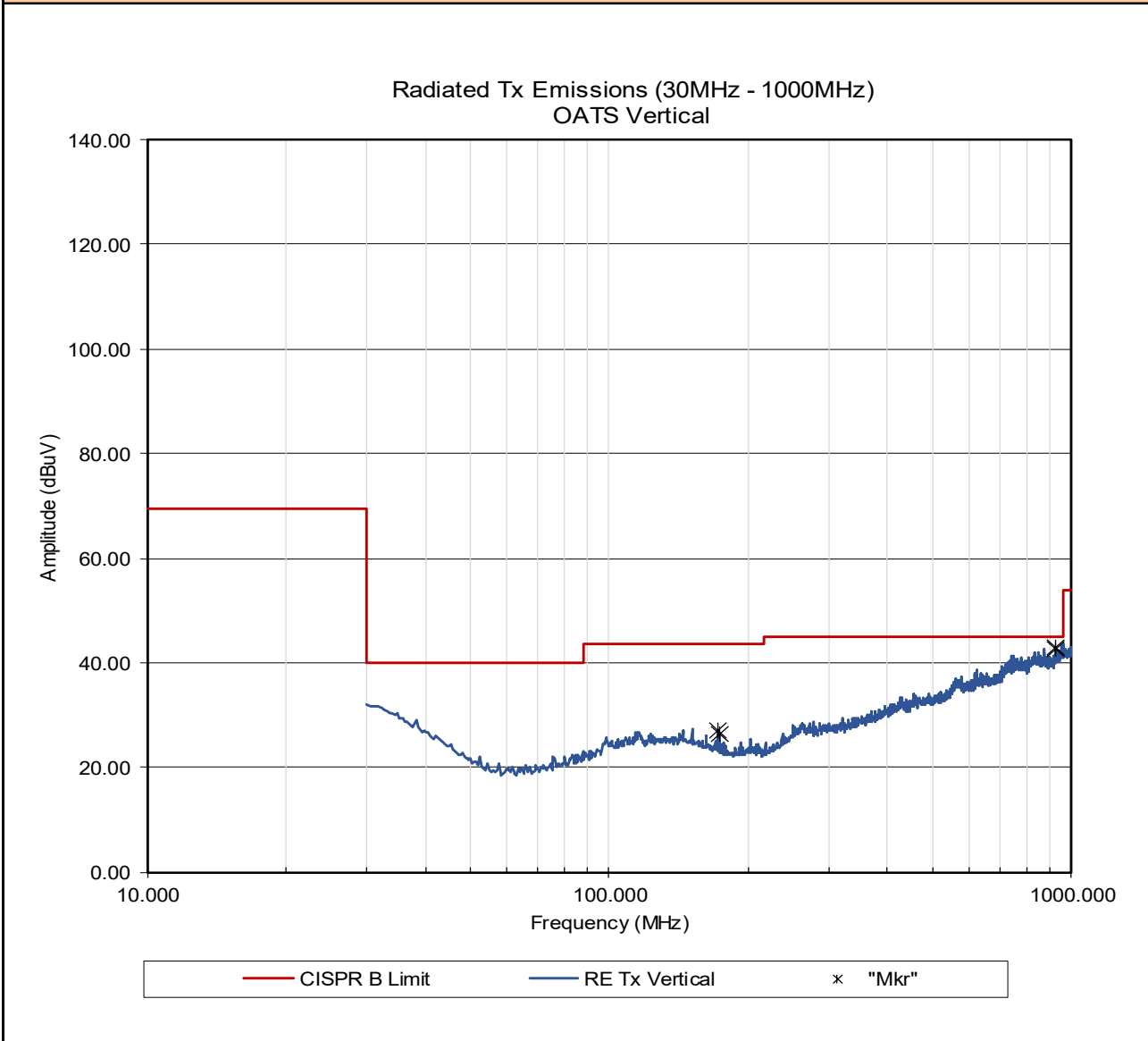
Plot 16.1 – Radiated Tx Spurious Emissions, 30 – 1000MHz, Horizontal

Radiated Tx Emissions:



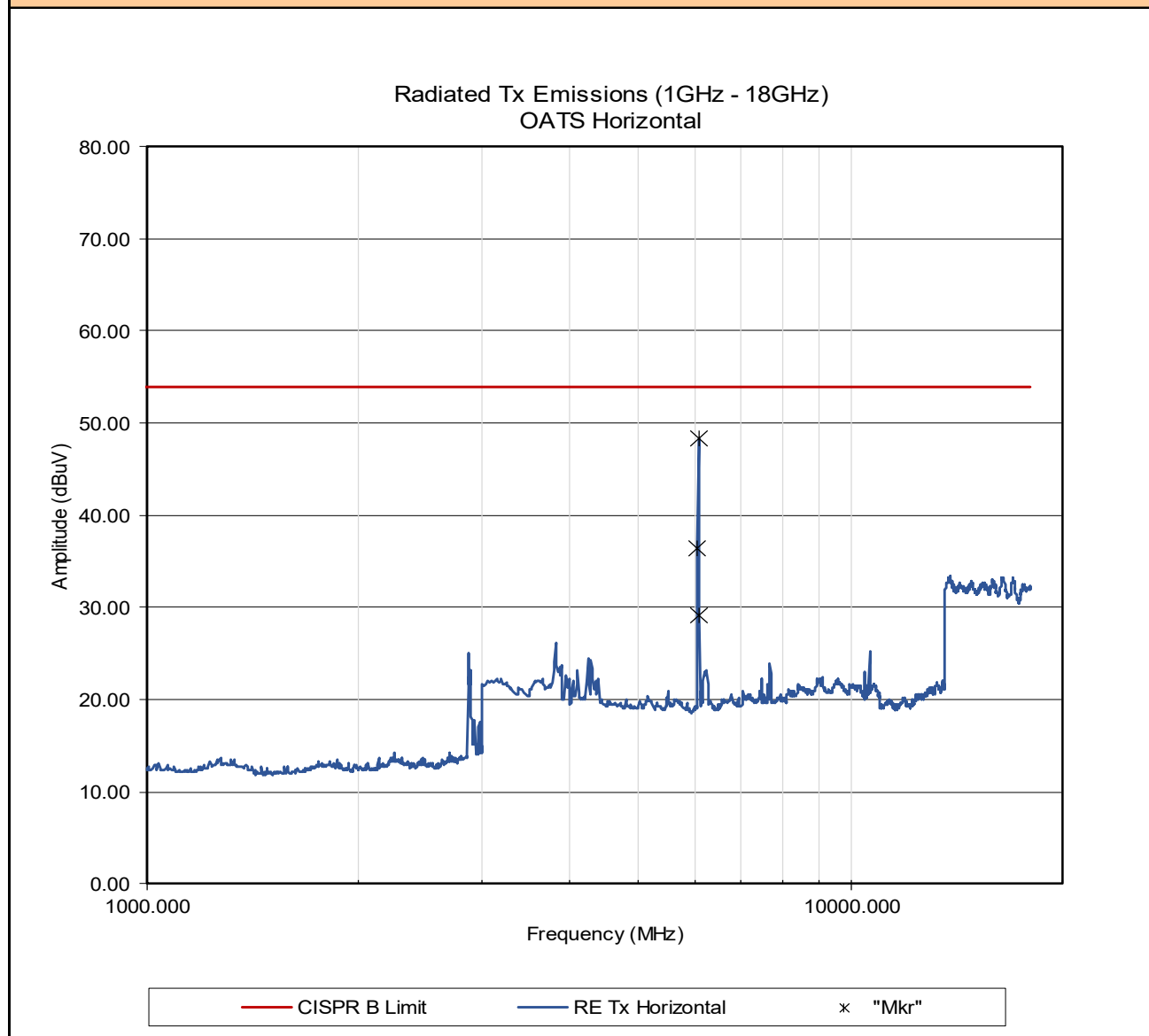
Plot 16.2 – Radiated Tx Spurious Emissions, 30 – 1000MHz, Vertical

Radiated Tx Emissions:



Plot 16.3 – Radiated Tx Spurious Emissions, 1 – 26GHz, Horizontal

Radiated Tx Emissions:



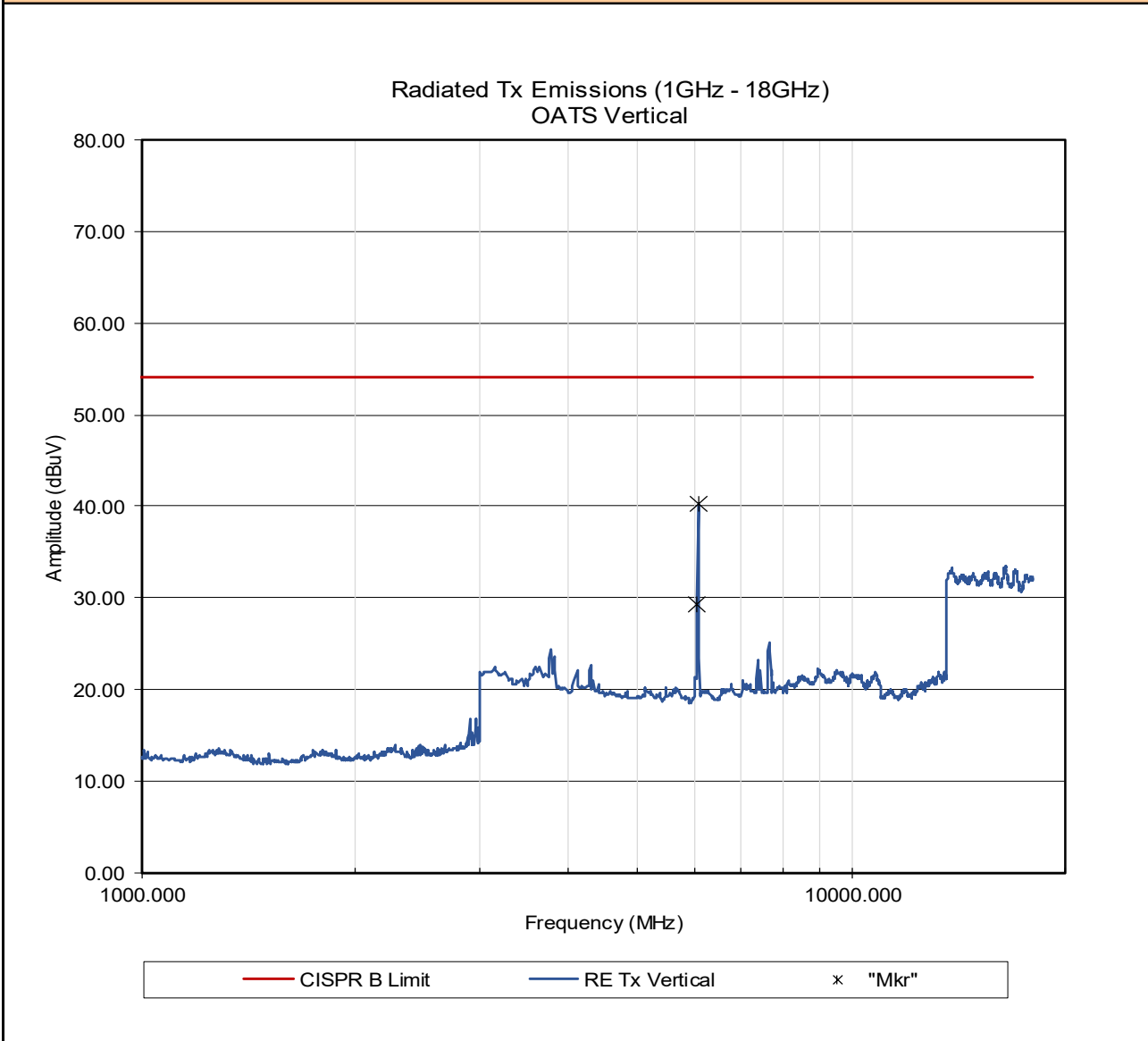
Channel:
Mode:
Modulation:

Channel Frequency: MHz
Emission Frequency: MHz
Emission Amplitude: dBuV

Marker = Fundamental

Plot 16.4 – Radiated Tx Spurious Emissions, 1 – 26GHz, Vertical

Radiated Tx Emissions:



Channel:
Mode:
Modulation:

Channel Frequency: MHz
Emission Frequency: MHz
Emission Amplitude: dBuV

Marker = Fundamental

Table 16.1 – Summary of Radiated Tx Spurious Emissions, Restricted Band, (DSS)

Summary of Radiated Tx Emissions											
Measured Frequency Range (MHz)	Channel Frequency	Antenna Polarization	Emission Frequency	Measured Emission [E _{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L _C] (dB)	Amplifier Gain [G _A] (dB)	Corrected Emission [E _{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)	
30-1000MHz	2440.0	Horizontal	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
30-1000MHz	2440.0	Vertical	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
1 - 26GHz	2440.0	Horizontal	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
1 - 26GHz	2440.0	Vertical	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
Results:									Complies		

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + \text{ACF} + L_C - G_A$$

17.0 RADIATED RX (SCANNING RECEIVER) SPURIOUS EMISSIONS

Test Procedure

Normative Reference	FCC 47 CFR §15.109, ICES-003(6.2) ANSI C63.4:2014
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Limits

47 CFR §15.109	(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values: 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m
ICES-003(6.2.1)	6.2.1 - Radiated Emissions Limits Below 1 GHz Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 5 determined at a distance of 3 metres. 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m

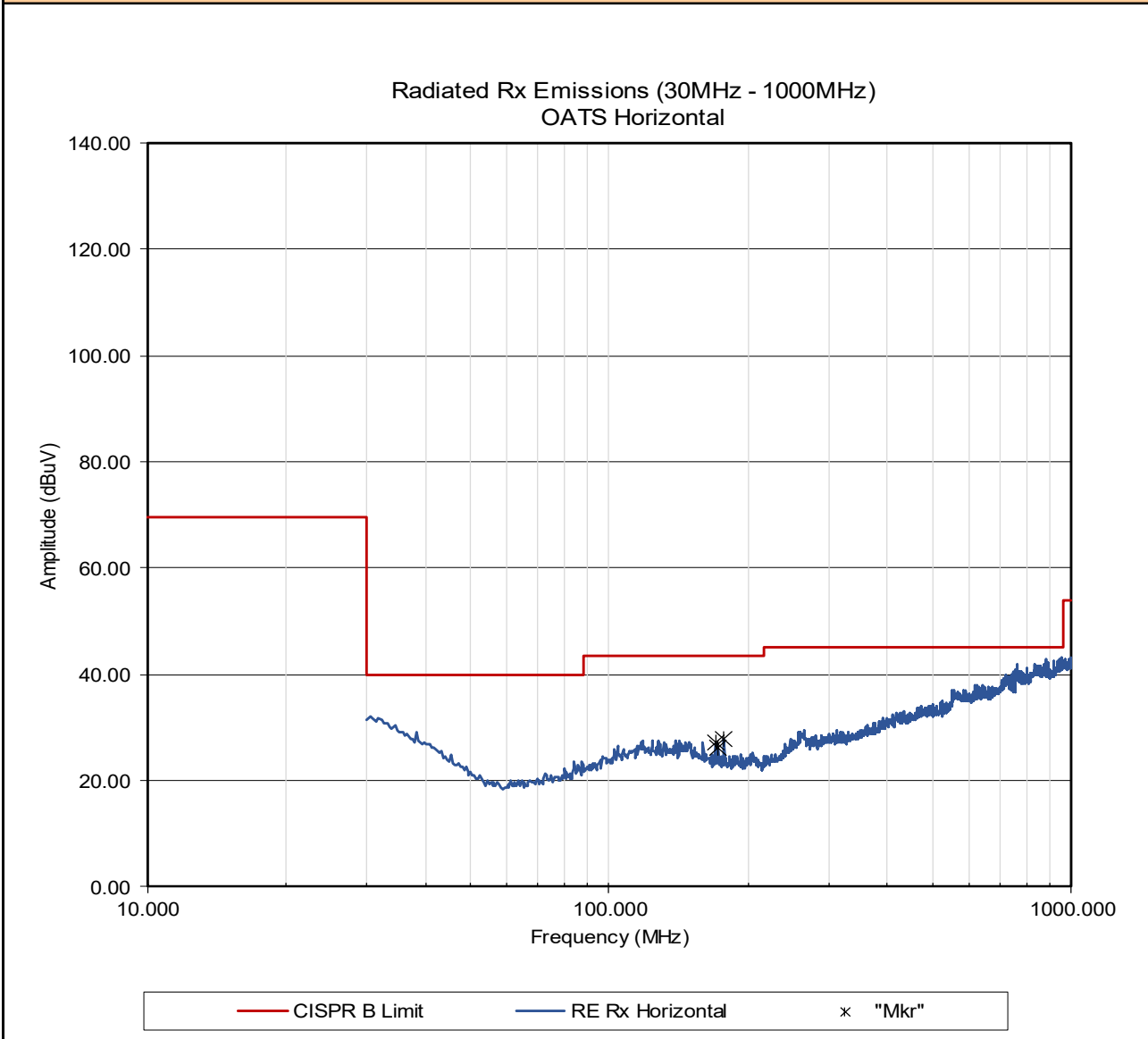
Test Setup	Appendix A Figure A.2
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Measurement Procedure

The DUT was set up as per ANSI C63.4:2014. Emissions were scanned between 30MHz and 1000MHz. The turntable was rotated 360 degrees and the antenna was elevated to 4m to optimize the measured emissions.

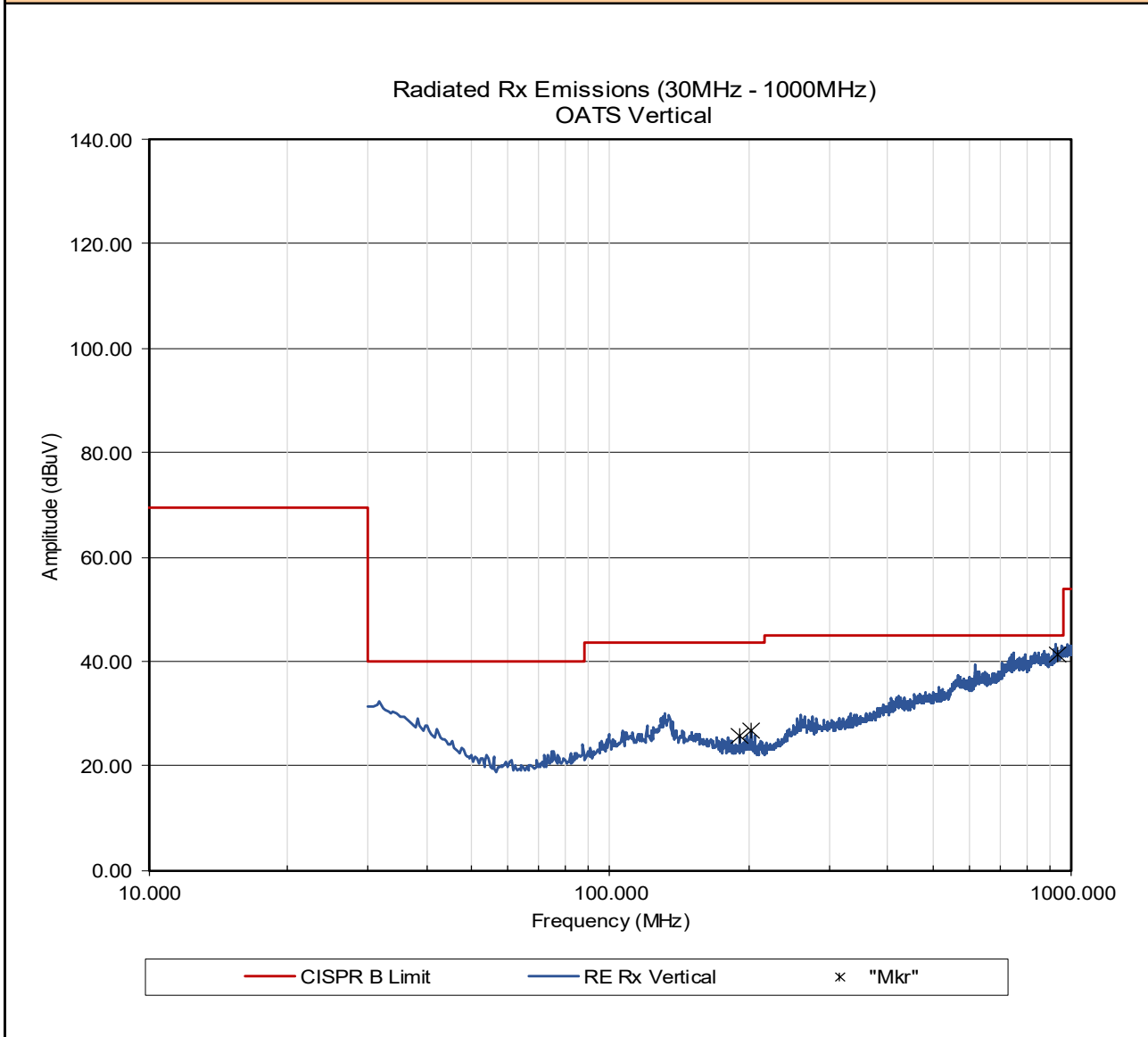
Plot 17.1– Radiated Rx Spurious Emissions, 30 – 1000MHz, Horizontal

Radiated Tx Emissions:



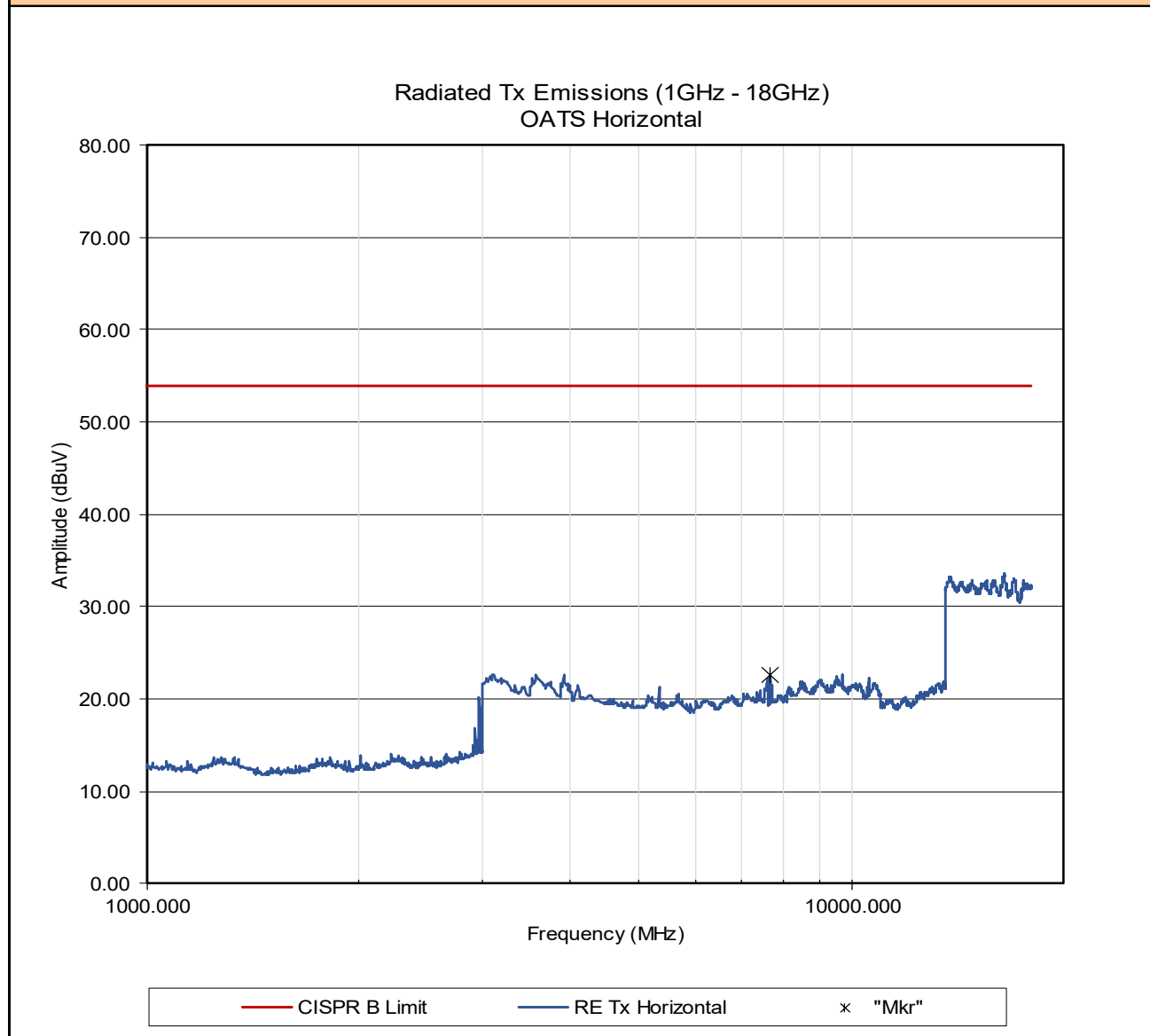
Plot 17.2– Radiated Rx Spurious Emissions, 30 – 1000MHz, Vertical

Radiated Tx Emissions:



Plot 17.3– Radiated Rx Spurious Emissions, 1-26GHz, Horizontal

Radiated Tx Emissions:

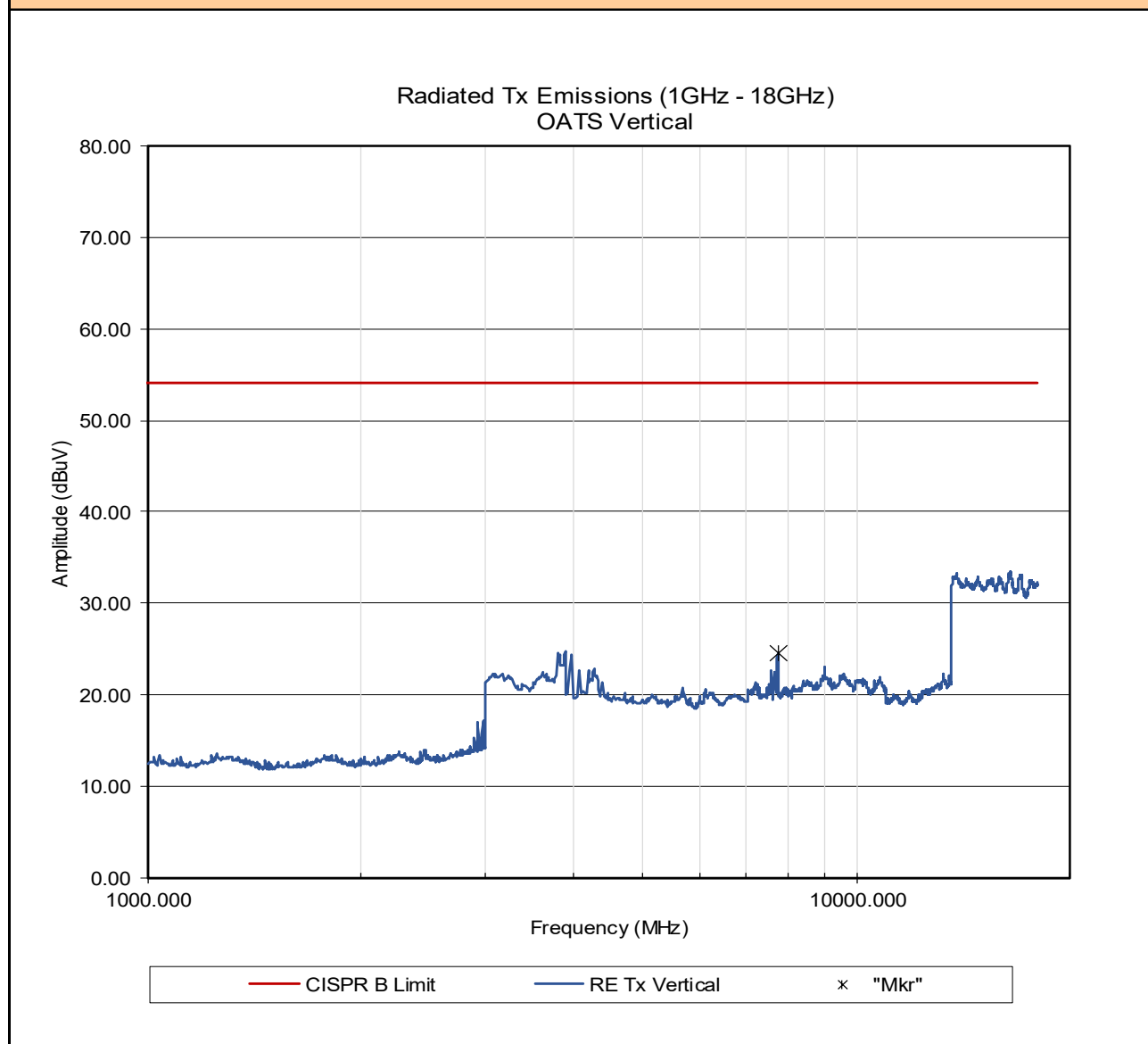


Channel:
Mode:
Modulation:

Channel Frequency: MHz
Emission Frequency: MHz
Emission Amplitude: dBuV

Plot 17.4– Radiated Rx Spurious Emissions, 1-26GHz, Vertical

Radiated Tx Emissions:



Channel:
Mode:
Modulation:

Channel Frequency: MHz
Emission Frequency: MHz
Emission Amplitude: dBuV

Table 17.1 – Summary of Radiated Rx Spurious Emissions, (DSS)

Summary of Radiated Rx (Scanning Receiver) Emissions											
Measured Frequency Range (MHz)	Channel Frequency	Antenna Polarization	Emission Frequency	Measured Emission [E _{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L _c] (dB)	Amplifier Gain [G _A] (dB)	Corrected Emission [E _{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)	
30-1000MHz	2440.0	Horizontal	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
30-1000MHz	2440.0	Vertical	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
1 - 26GHz	2440.0	Horizontal	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
1 - 26GHz	2440.0	Vertical	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
Results:										Complies	

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + \text{ACF} + L_{\text{C}} - G_{\text{A}}$$

18.0 SIMULTANEOUS TRANSMISSION

Test Procedure

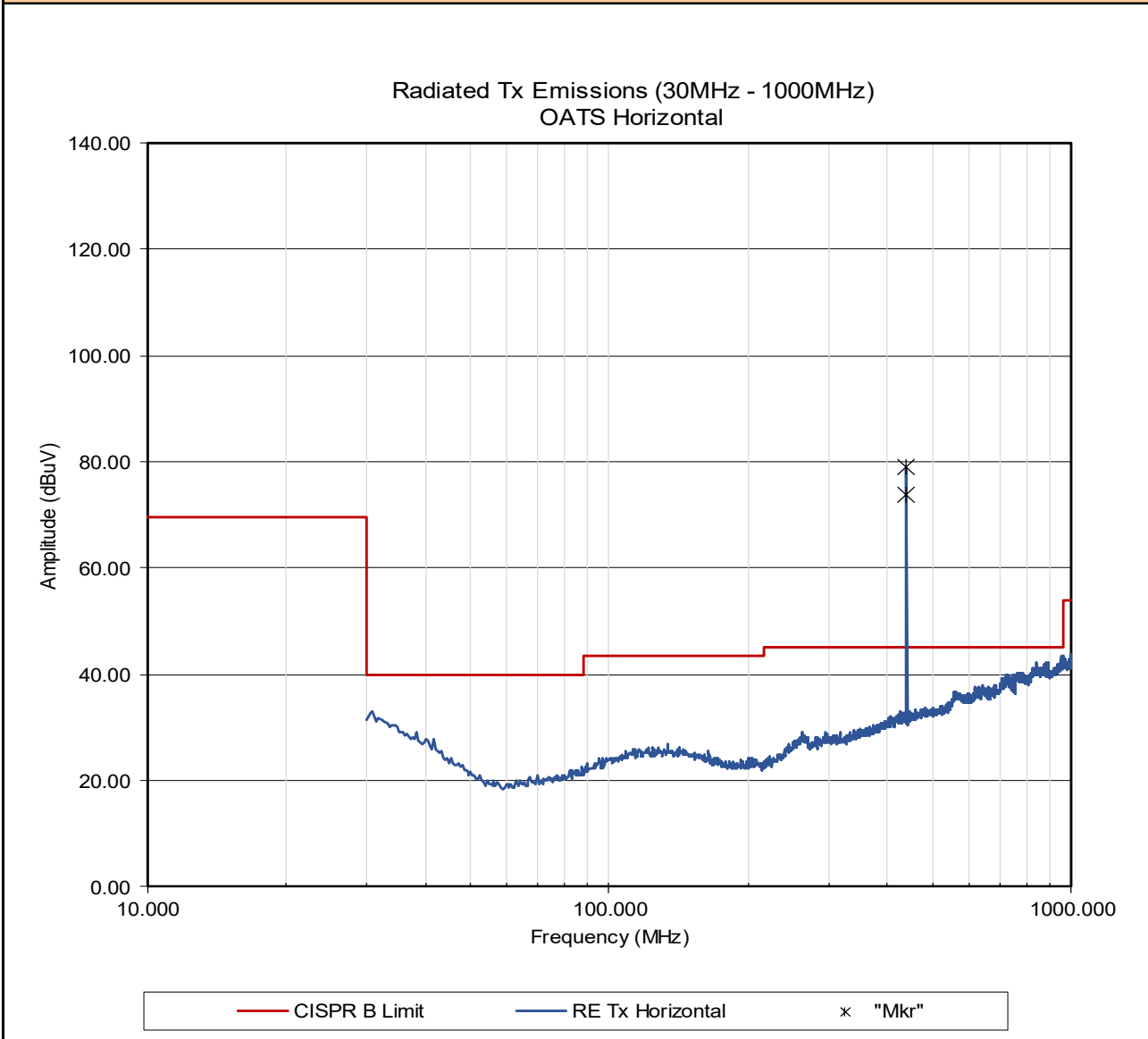
Normative Reference	FCC 47 CFR §2.1051, §15.247(d), §15.205(a), §15.205(c), §15.209(a)
	KDB 558074 (8.6), ANSI C63.10 (11.12)

Limits

47 CFR §15.247(d)	(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).																
47 CFR §15.209(a)	§15.209 Radiated emission limits; general requirements. (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table: <table> <tr> <th>Frequency (MHz)</th><th>Field Strength (microvolts/meter)</th></tr> <tr> <td>0.009 - 0.490</td><td>2400/F (kHz) @300m</td></tr> <tr> <td>0.490 - 1.705</td><td>24000/F (kHz) @30m</td></tr> <tr> <td>1.705 - 30</td><td>30 @ 30m</td></tr> <tr> <td>30 - 88</td><td>100 @3m</td></tr> <tr> <td>88 - 216</td><td>150 @3m</td></tr> <tr> <td>216 - 960</td><td>200 @3m</td></tr> <tr> <td>Above 960</td><td>500 @3m</td></tr> </table>	Frequency (MHz)	Field Strength (microvolts/meter)	0.009 - 0.490	2400/F (kHz) @300m	0.490 - 1.705	24000/F (kHz) @30m	1.705 - 30	30 @ 30m	30 - 88	100 @3m	88 - 216	150 @3m	216 - 960	200 @3m	Above 960	500 @3m
Frequency (MHz)	Field Strength (microvolts/meter)																
0.009 - 0.490	2400/F (kHz) @300m																
0.490 - 1.705	24000/F (kHz) @30m																
1.705 - 30	30 @ 30m																
30 - 88	100 @3m																
88 - 216	150 @3m																
216 - 960	200 @3m																
Above 960	500 @3m																

Plot 18.1 – Simultaneous Transmission, UHF + BlueTooth + 2.4GHz WiFi, Horizontal

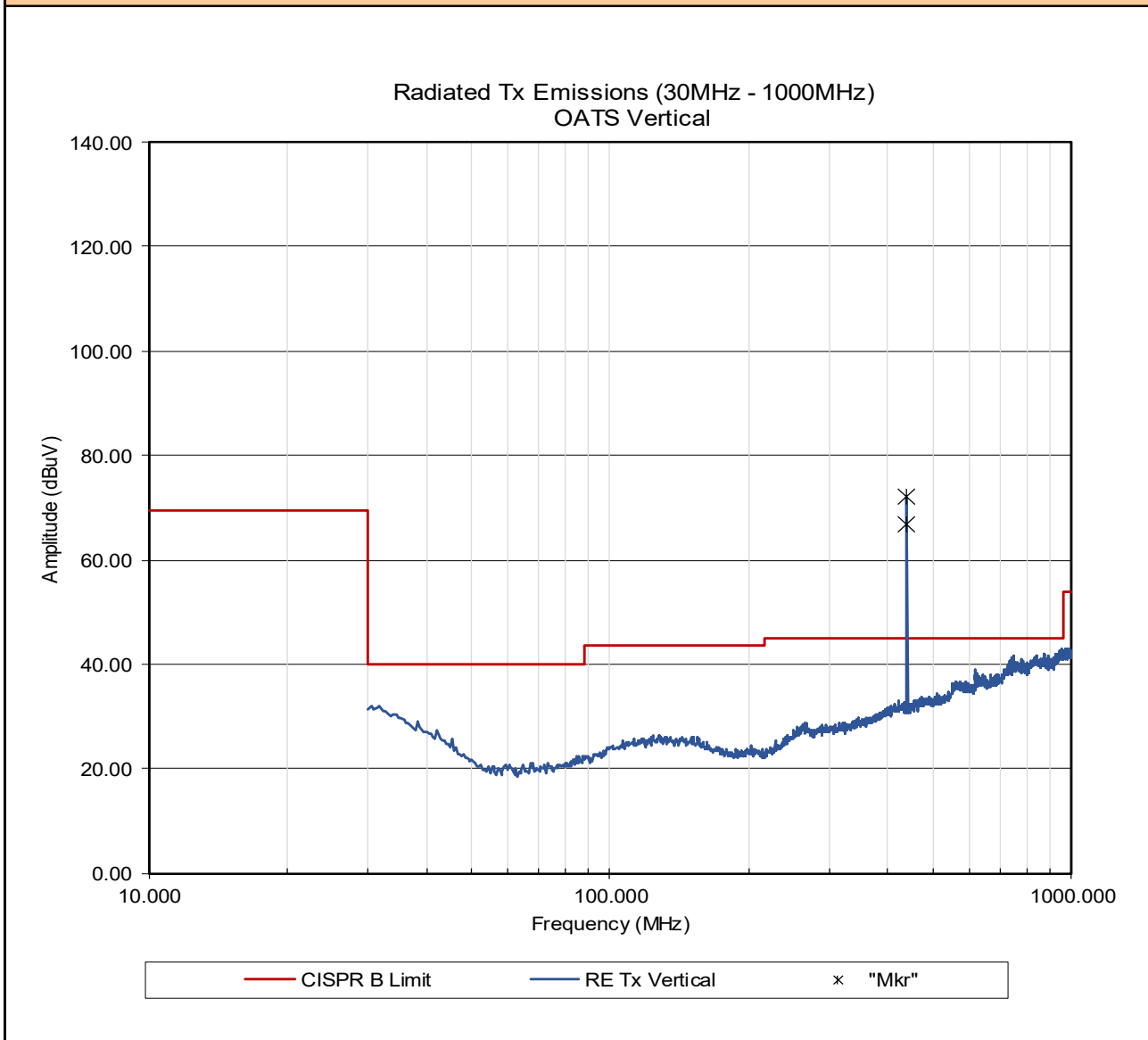
Radiated Tx Emissions:



Marker = UHF Fundamental

Plot 18.2 – Simultaneous Transmission, UHF + BlueTooth + 2.4GHz WiFi, Vertical

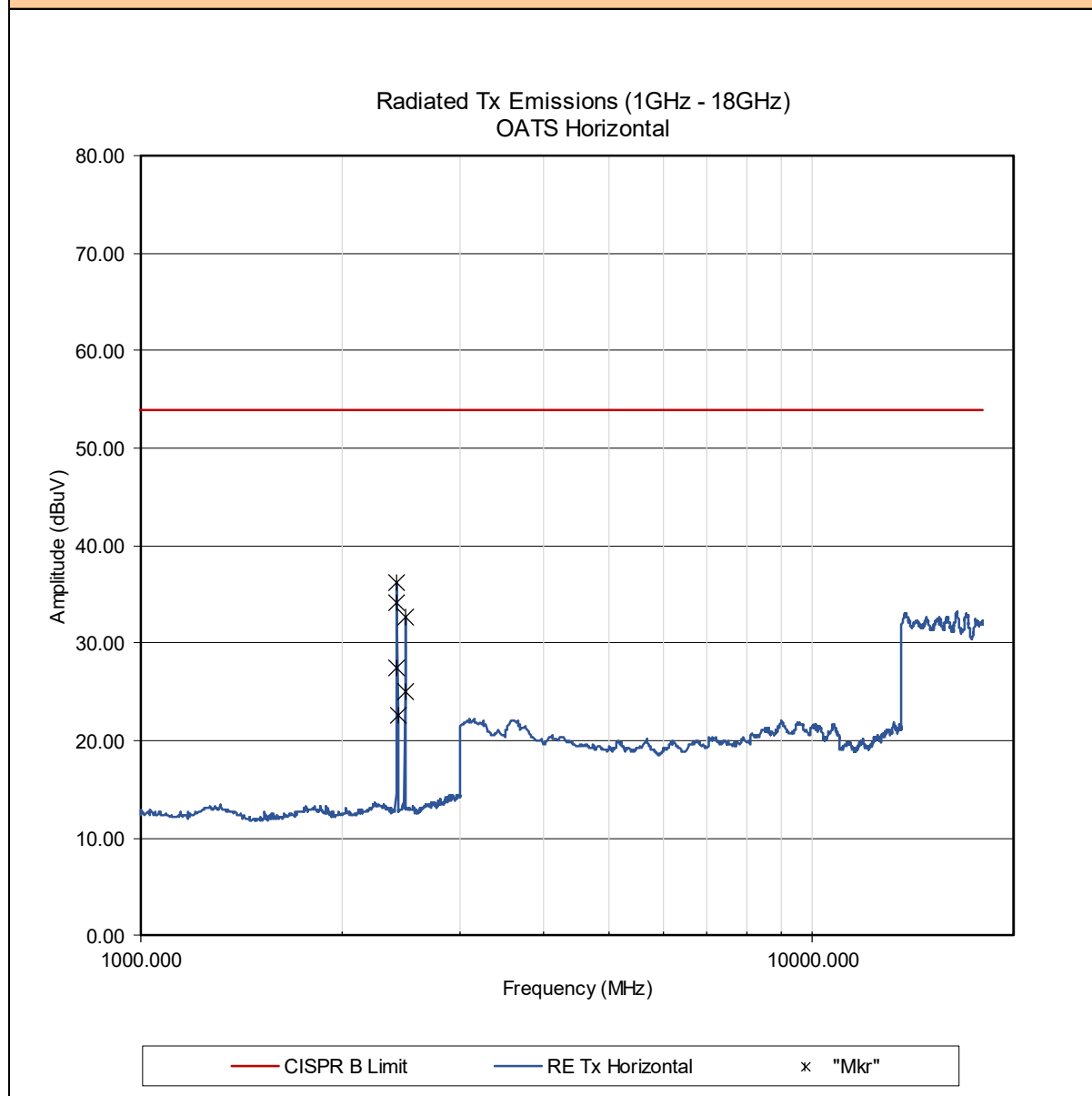
Radiated Tx Emissions:



Marker = UHF Fundamental

Plot 18.3 – Simultaneous Transmission, UHF + BlueTooth + 2.4GHz WiFi, Horizontal

Radiated Tx Emissions:



Channel:

Channel Frequency: MHz

Mode:

Emission Frequency: MHz

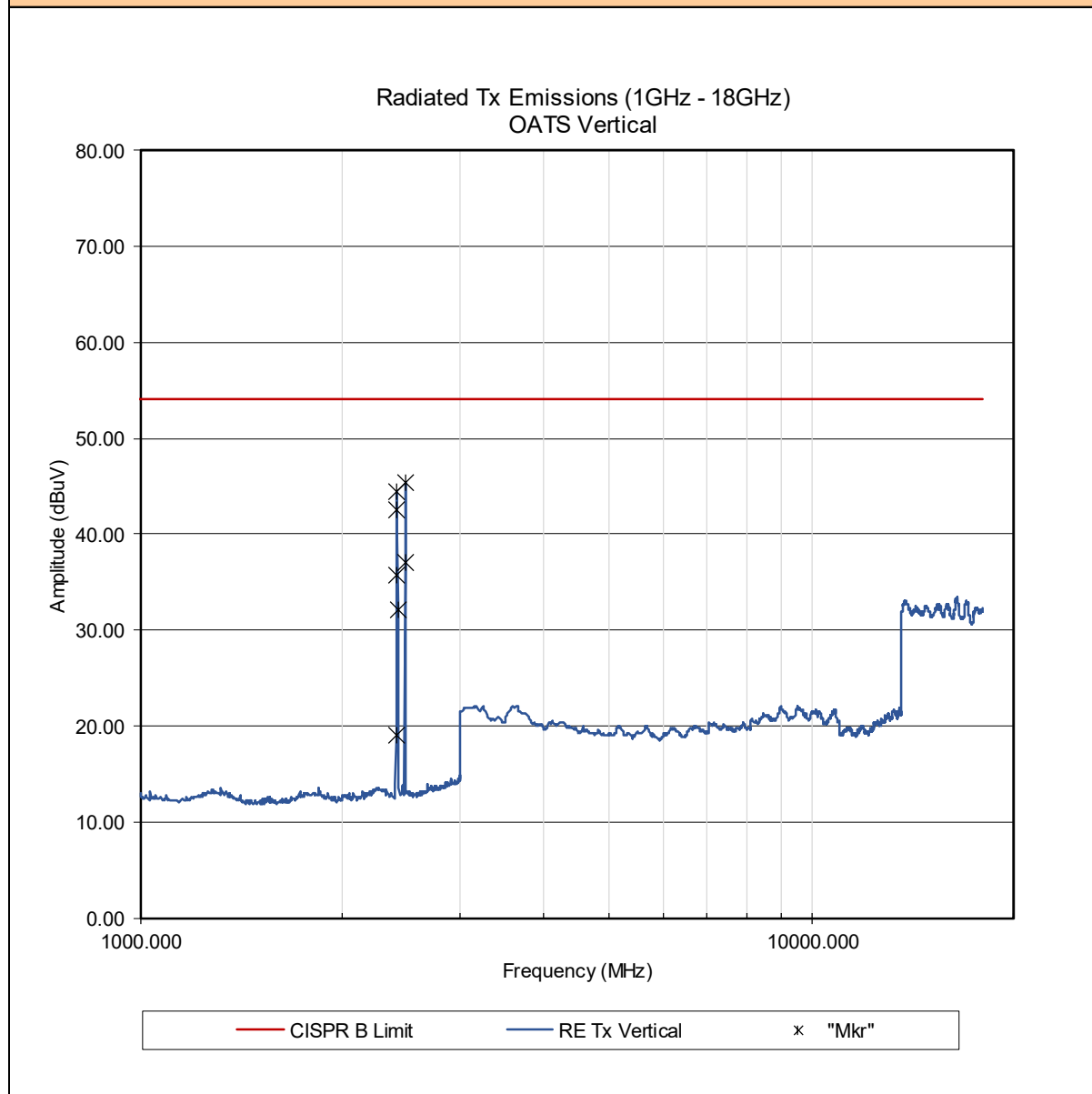
Modulation:

Emission Amplitude: dBuV

Markers = BlueTooth @ 2480MHz, WiFi @ 2412MHz

Plot 18.4 – Simultaneous Transmission, UHF + BlueTooth + 2.4GHz WiFi, Vertical

Radiated Tx Emissions:



Channel:

Channel Frequency: MHz

Mode:

Emission Frequency: MHz

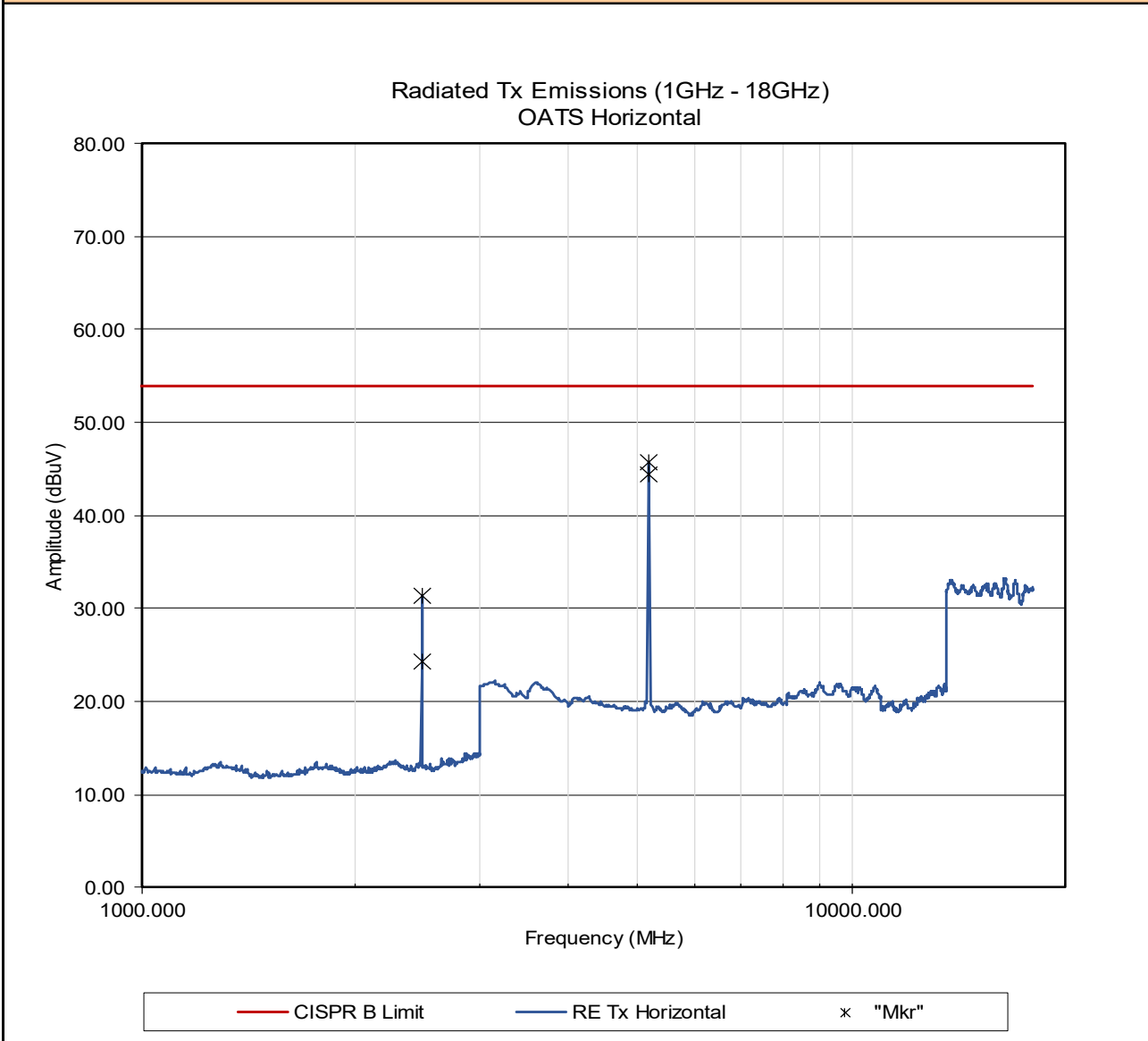
Modulation:

Emission Amplitude: dBuV

Markers = BlueTooth @ 2480MHz, WiFi @ 2412MHz

Plot 18.5 – Simultaneous Transmission, UHF + BlueTooth + 5GHz WiFi, Horizontal

Radiated Tx Emissions:



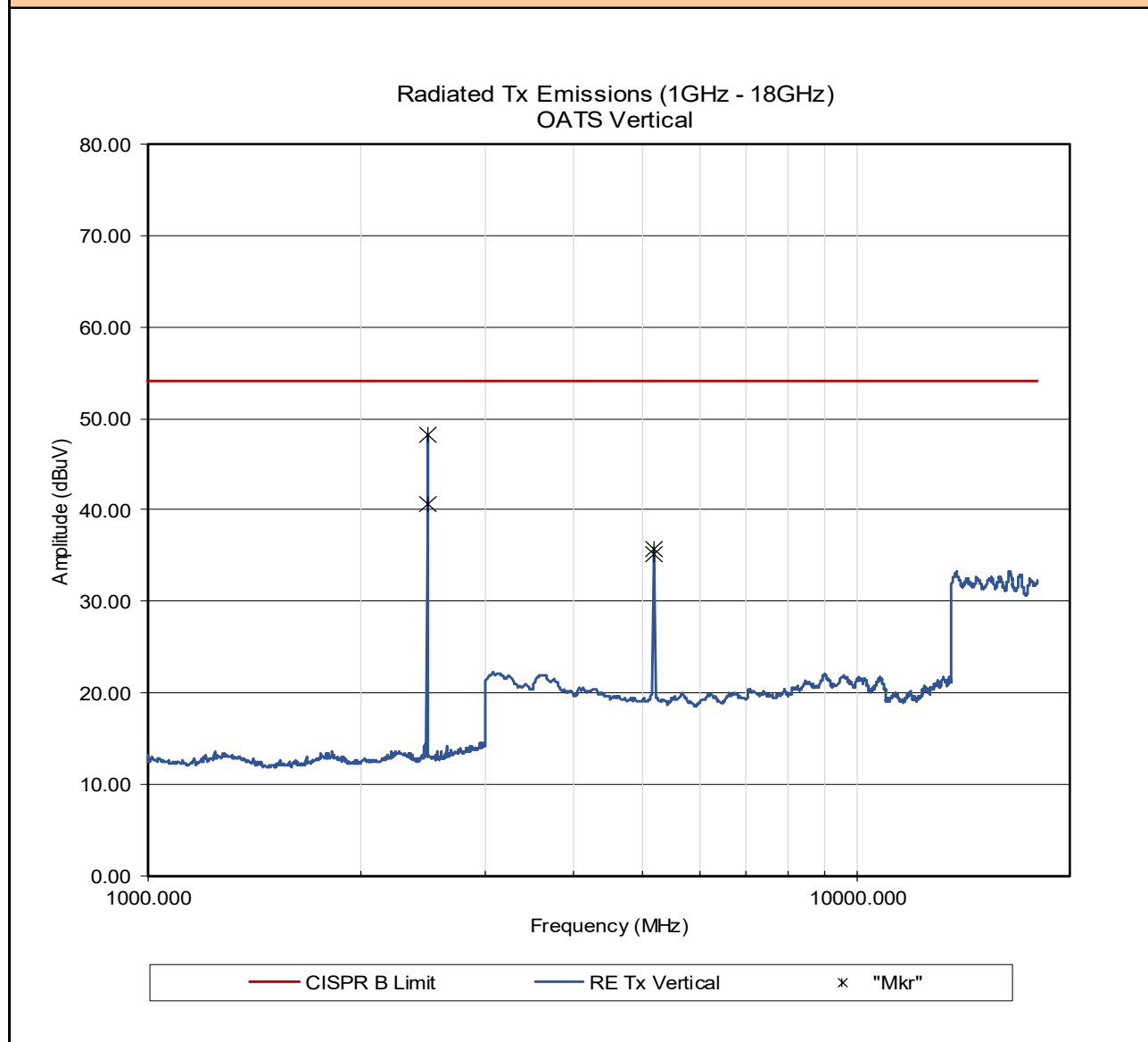
Channel:
Mode:
Modulation:

Channel Frequency: MHz
Emission Frequency: MHz
Emission Amplitude: dBuV

Markers = BlueTooth @ 2480MHz, WiFi @ 5180MHz

Plot 18.6 – Simultaneous Transmission, UHF + BlueTooth + 5GHz WiFi, Vertical

Radiated Tx Emissions:



Channel:

Mode:

Modulation:

Channel Frequency: MHz

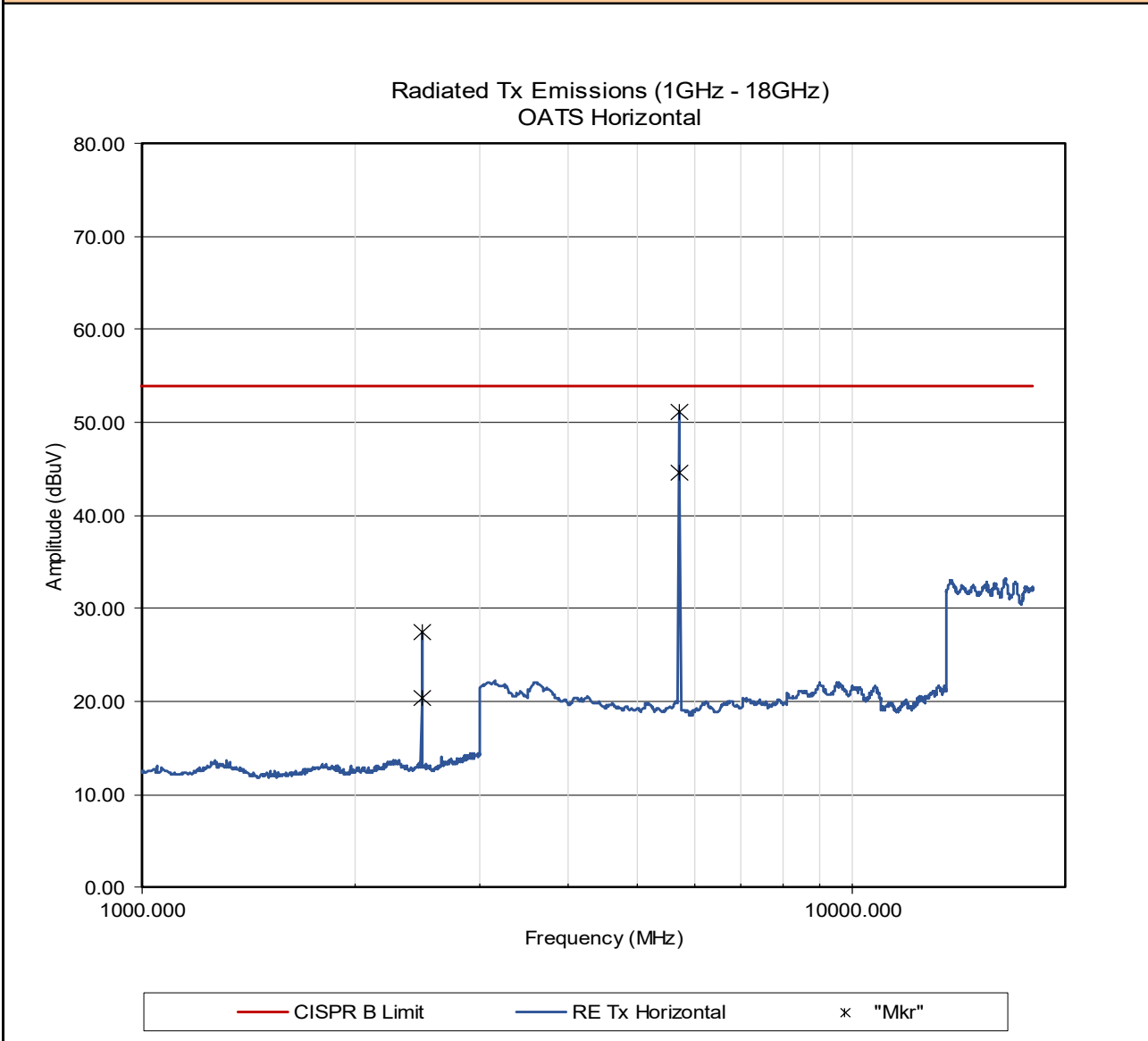
Emission Frequency: MHz

Emission Amplitude: dBuV

Markers = BlueTooth @ 2480MHz, WiFi @ 5180MHz

Plot 18.7 – Simultaneous Transmission, UHF + BlueTooth + 5GHz WiFi, Horizontal

Radiated Tx Emissions:



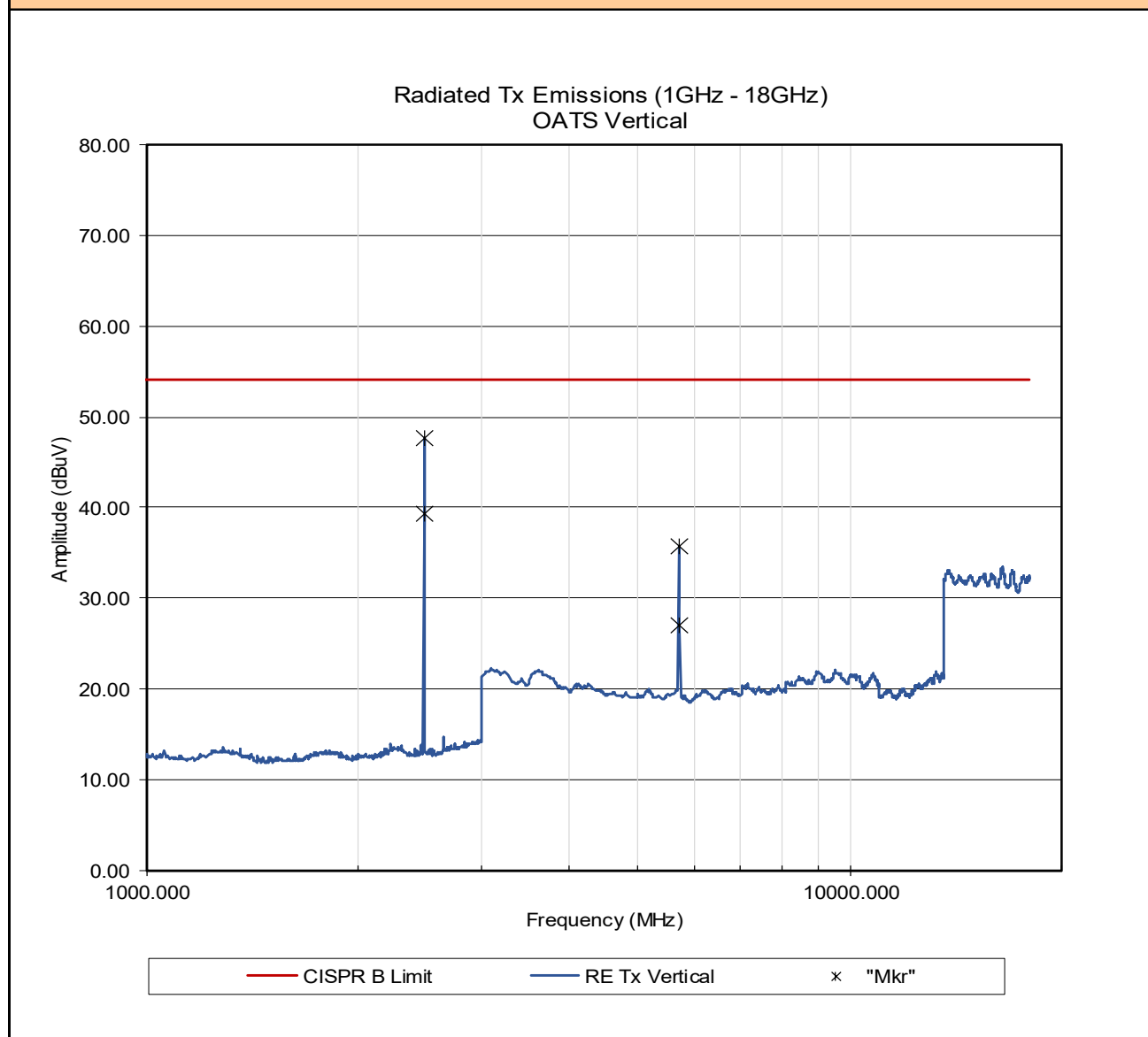
Channel:
Mode:
Modulation:

Channel Frequency: MHz
Emission Frequency: MHz
Emission Amplitude: dBuV

Markers = BlueTooth @ 2480MHz, WiFi @ 5720MHz

Plot 18.8 – Simultaneous Transmission, UHF + BlueTooth + 5GHz WiFi, Vertical

Radiated Tx Emissions:



Channel:
Mode:
Modulation:

Channel Frequency: MHz
Emission Frequency: MHz
Emission Amplitude: dBuV

Markers = BlueTooth @ 2480MHz, WiFi @ 5720MHz

Table 18.1 – Summary of Simultaneous Transmission Emissions

Summary of Radiated Tx Simultaneous Emissions											
Measured Frequency Range (MHz)	Channel Frequency	Antenna Polarization	Emission Frequency	Measured Emission [E _{Meas}] (dBuV)	Antenna ACF [ACF] (dB)	Cable Loss [L _c] (dB)	Amplifier Gain [G _A] (dB)	Corrected Emission [E _{Corr}] (dBuV/m)	Limit (dBuV)	Margin (dB)	
30-1000MHz	2440.0	Horizontal	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
30-1000MHz	2440.0	Vertical	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
1 - 26GHz	2440.0	Horizontal	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
1 - 26GHz	2440.0	Vertical	ND	ND (1)	n/a	n/a	0.00 (3)	ND	n/a	n/a	
Results:									Complies		

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + \text{ACF} + L_c - G_A$$

APPENDIX A – TEST SETUP DRAWINGS

Table A.1 – Conducted Measurement Setup

Equipment List				
Asset Number	Manufacturer	Model Number	Serial Number	Description
00241	R&S	FSU40	100500	Spectrum Analyzer
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable

Figure A.1 – Test Setup – Conducted Measurements

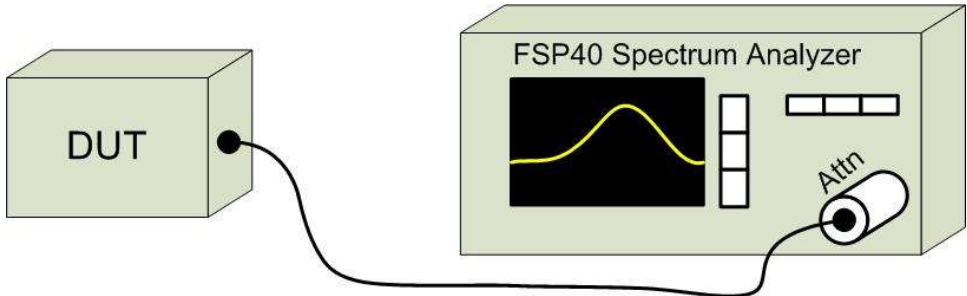


Table A.2 – Radiated Emissions Measurement Equipment

Equipment List				
Asset Number	Manufacturer	Model Number	Serial Number	Description
00050	Chase	CBL-6111A	1607	Bilog Antenna
00034	ETS	3115	6267	Double Ridged Guide Horn
00035	ETS	3115	6276	Double Ridged Guide Horn
00085	EMCO	6502	9203-2724	Loop Antenna
00161	Waveline Inc.	889		Standard Gain Horn 18-26GHz
00162	Waveline Inc.	889		Standard Gain Horn 18-26GHz
00165	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz
00166	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz
00333	HP	85685A	3010A01095	RF Preselector
00049	HP	85650A	2043A00162	Quasi-peak Adapter
00051	HP	8566B	2747A05510	Spectrum Analyzer
00241	R&S	FSU40	100500	Spectrum Analyzer
00265	Miteq	JS32-00104000-58-5P	1939850	Microwave L/N Amplifier
00071	EMCO	2090	9912-1484	Multi-Device Controller
00072	EMCO	2075	0001-2277	Mini-mast
00073	EMCO	2080	0002-1002	Turn Table
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable
00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable
00275	TMS	LMR400	n/a	25m Cable
00278	TILE	34G3	n/a	TILE Test Software

Figure A.2 – Test Setup Radiated Measurements 9kHzMHz – 30MHz

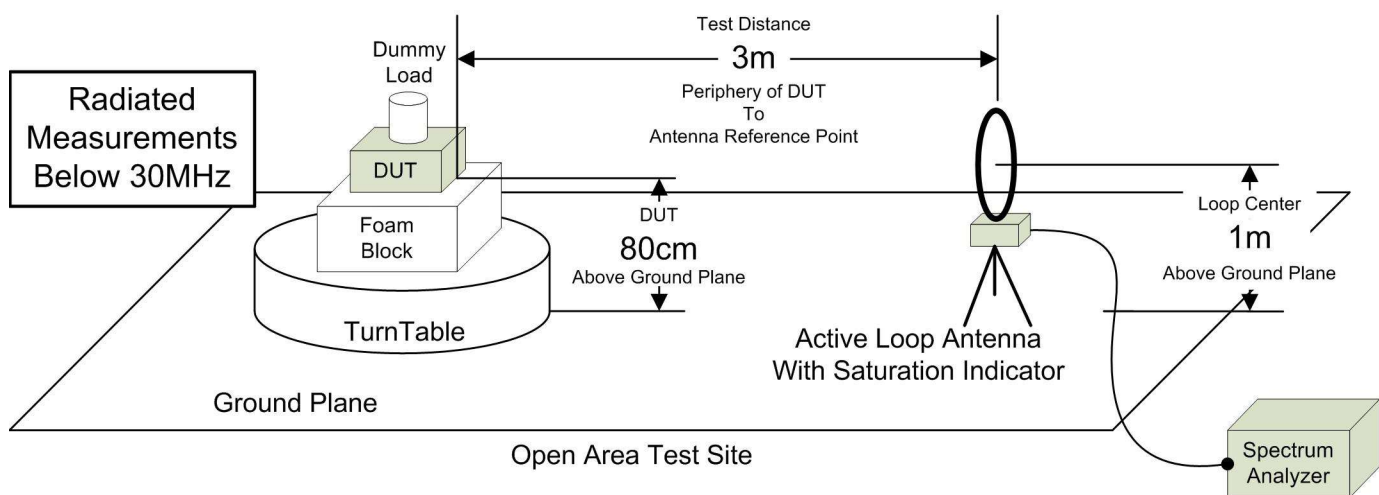


Figure A.3 – Test Setup Radiated Measurements 30MHz – 1GHz

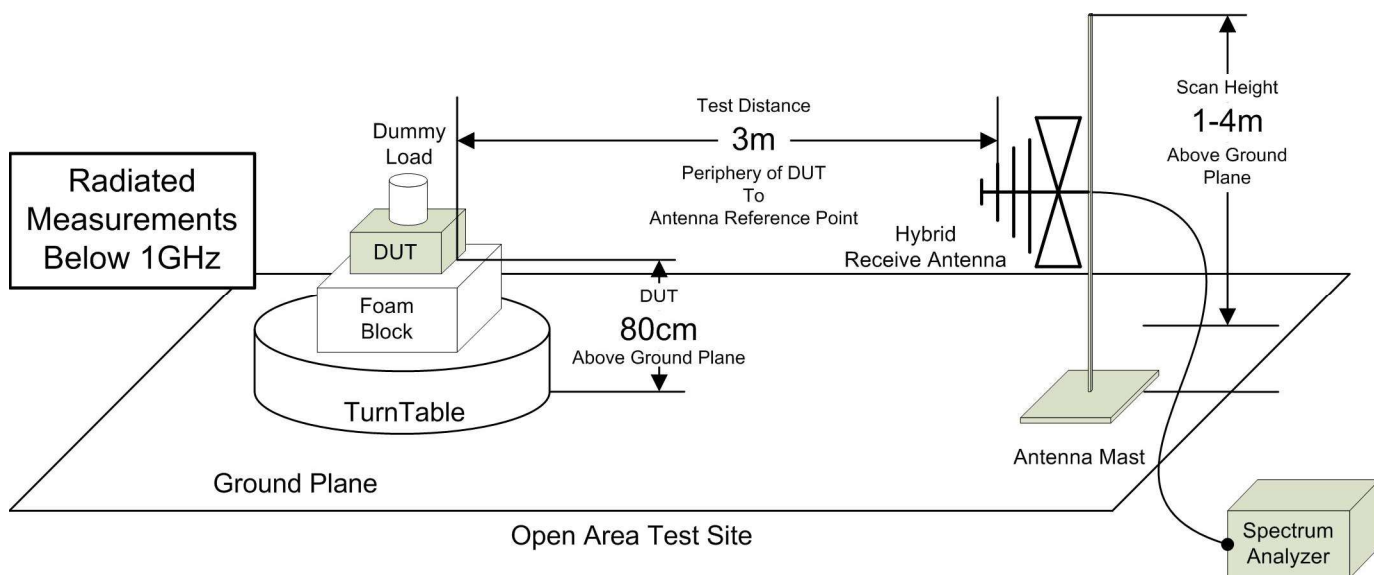


Figure A.4 – Test Setup Radiated Measurements 30MHz – 1GHz, Signal Substitution

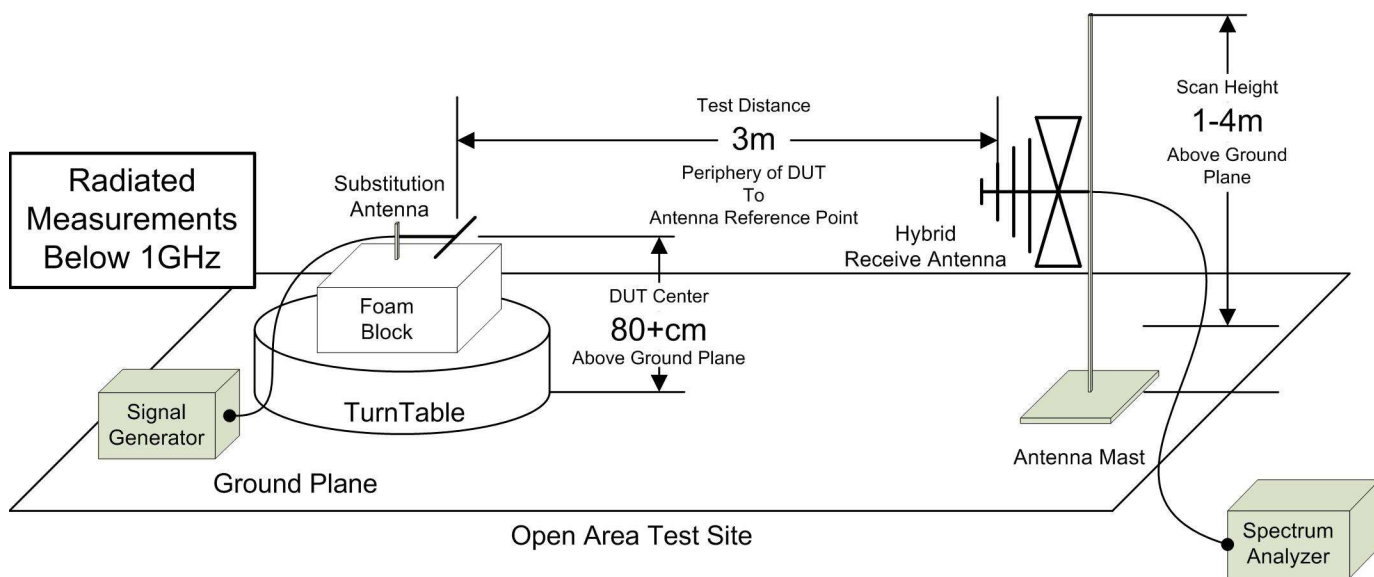


Figure A.5 – Test Setup Radiated Measurements 1 – 18GHz,

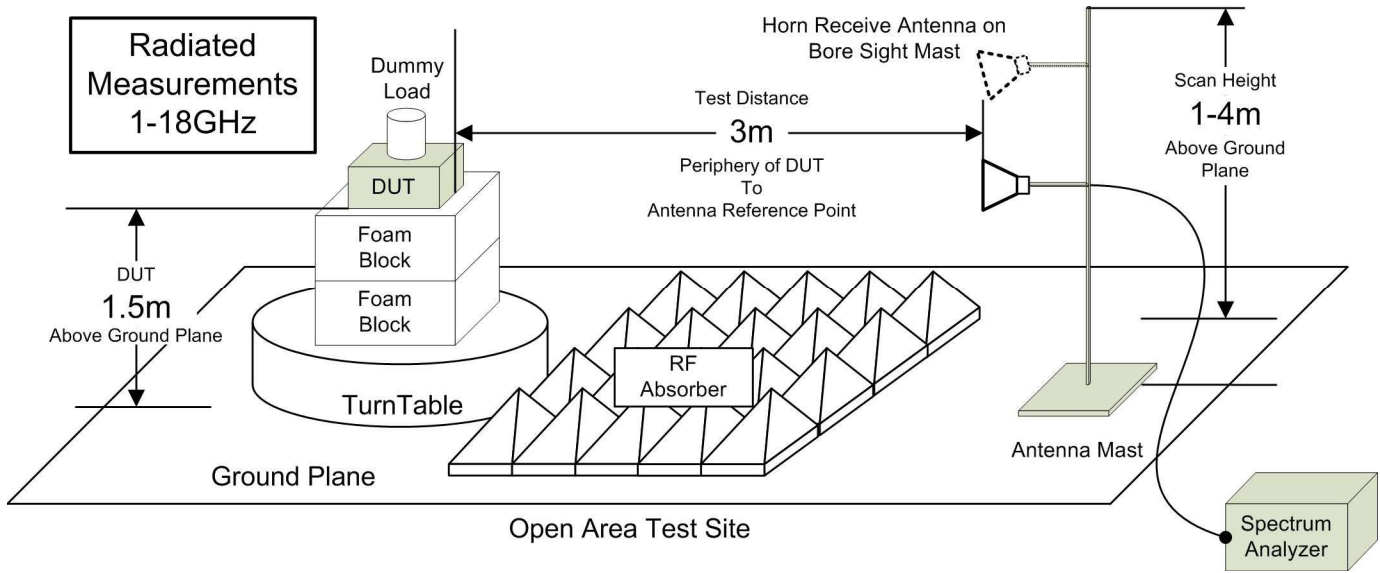
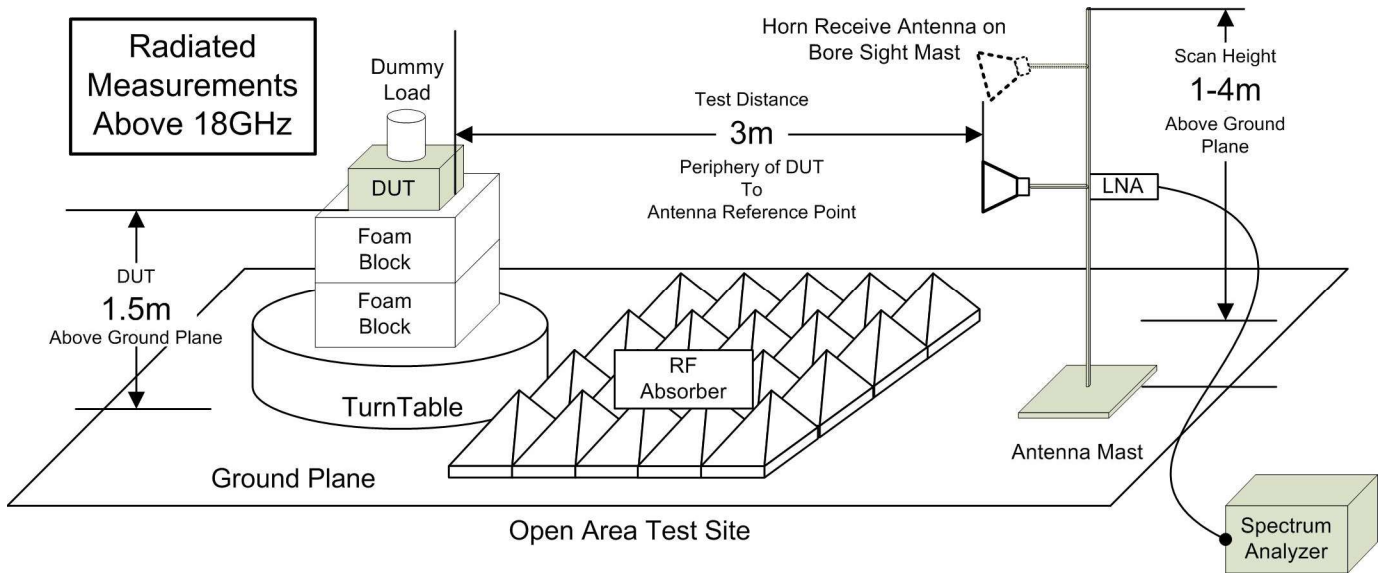


Figure A.6 – Test Setup Radiated Measurements 18 – 26.5GHz,



APPENDIX B – EQUIPMENT LIST AND CALIBRATION

Equipment List							
Asset Number	Manufacturer	Model Number	Serial Number	Description	Last Calibrated	Calibration Interval	Calibration Due
00050	Chase	CBL-6111A	1607	Bilog Antenna	16 Nov 2023	Triennial	16 Nov 2026
00035	ETS	3115	6276	Double Ridged Guide Horn	27 Mar 2025	Triennial	27 Mar 2028
00161	Waveline Inc.	889		Standard Gain Horn 18-26GHz	NCR	n/a	NCR
00165	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz	NCR	n/a	NCR
00241	R&S	FSU40	100500	Spectrum Analyzer	6 Sep 2024	Triennial	6 Sep 2027
00071	EMCO	2090	9912-1484	Multi-Device Controller	n/a	n/a	n/a
00072	EMCO	2075	0001-2277	Mini-mast	n/a	n/a	n/a
00073	EMCO	2080	0002-1002	Turn Table	n/a	n/a	n/a
00201	HP	E3611A	KR83015294	DC Power Supply	COU	n/a	COU
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a	COU
00065	Pasternack	PE7014-30	n/a	30dB, 5W Attenuator	COU	n/a	COU
00130	Pasternack	PE7019-30	n/a	30dB, 50W Attenuator	COU	n/a	COU
00275	TMS	LMR400	n/a	25m Cable	COU	n/a	COU
00278	TILE	34G3	n/a	TILE Test Software	NCR	n/a	NCR

NCR: No Calibration Required

COU: Calibrate On Use

APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY

CISPR 16-4 Measurement Uncertainty (U_{LAB})

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

Radiated Emissions 30MHz - 200MHz

$U_{LAB} = 5.14\text{dB}$ $U_{CISPR} = 6.3\text{dB}$

Radiated Emissions 200MHz - 1000MHz

$U_{LAB} = 5.90\text{dB}$ $U_{CISPR} = 6.3\text{dB}$

Radiated Emissions 1GHz - 6GHz

$U_{LAB} = 4.80\text{dB}$ $U_{CISPR} = 5.2\text{dB}$

Radiated Emissions 6GHz - 18GHz

$U_{LAB} = 5.1\text{dB}$ $U_{CISPR} = 5.5\text{dB}$

Power Line Conducted Emissions 9kHz to 150kHz

$U_{LAB} = 2.96\text{dB}$ $U_{CISPR} = 3.8\text{dB}$

Power Line Conducted Emissions 150kHz to 30MHz

$U_{LAB} = 3.12\text{dB}$ $U_{CISPR} = 3.4\text{dB}$

If the calculated uncertainty U_{lab} is **less** than U_{CISPR} then:

- | | |
|---|---|
| 1 | Compliance is deemed to occur if NO measured disturbance exceeds the disturbance limit |
| 2 | Non-Compliance is deemed to occur if ANY measured disturbance EXCEEDS the disturbance limit |

If the calculated uncertainty U_{lab} is **greater** than U_{CISPR} then:

- | | |
|---|--|
| 3 | Compliance is deemed to occur if NO measured disturbance, increased by ($U_{lab} - U_{CISPR}$), exceeds the disturbance limit |
| 4 | Non-Compliance is deemed to occur if ANY measured disturbance, increased by ($U_{lab} - U_{CISPR}$), EXCEEDS the disturbance limit |

Other Measurement Uncertainties (U_{LAB})

RF Conducted Emissions 9kHz - 40GHz

$U_{LAB} = 1.0\text{dB}$ $U_{CISPR} = \text{n/a}$

Frequency/Bandwidth 9kHz - 40GHz

$U_{LAB} = 0.1\text{ppm}$ $U_{CISPR} = \text{n/a}$

Temperature

$U_{LAB} = 1^{\circ}\text{C}$ $U_{CISPR} = \text{n/a}$

END OF REPORT