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04-Feb-26

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Subject: SUBTEL, Chile (Resolution 737) Certification Compliance 2026
Commercial Name: Fenix 8 47mm, Solar

	Información (Information)
Tipo de equipo (Equipment type)	Portable Digital Transceiver
Marca (Brand)	Garmin 
Modelo (Model)	A04861
Tecnología o modulación (Technology or modulation)	ASK for NFC / GFSK for ANT/ GFSK for BTBR / $\pi/4$ -DQPSK, 8DPSK for BTEDR / GFSK for BLE/ DSSS for 802.11b / OFDM for 802.11g/n
Frecuencias (Frequencies)	13.56 MHz / 2402-2480 MHz / 2402-2480 MHz / 2402-2480 MHz / 2402-2480 MHz / 2412-2462 MHz
Ganancia de antena (dBi) (Antenna gain (dBi))	ANT -5.80 dBi / 802.15.1 -5.80 dBi / 802.15.1 -5.80 dBi / BLE -5.80 dBi / 802.11b/g/n -5.80 dBi
P.i.r.e. (E.I R P.)	-37.75 dBm, 0.00 mW / -3.70 dBm, 0.42 mW / 4.80 dBm, 3.02 mW / 4.50 dBm, 2.81 mW / -3.80 dBm, 0.41 mW / 11.00 dBm, 12.58 mW
Módulos (Modules)	NFC, ANT, BTBR, BTEDR, BLE, WiFi

As all measurements for NFC are made in radiated mode to comply with the field strength limits, gain information is not required to be noted in the reports or any additional documentation.

Declaration of Conformity Statement: the equipment previously identified complies with the provisions established in the Technical Standard for Small Range Equipment, approved by Exempt Resolution No.1,985 of 2017, of the Undersecretary of Telecommunications.

Declaración de conformidad: El equipo anteriormente identificado cumple con las disposiciones establecidas en la Norma Técnica para Equipos de Corto Alcance, aprobada mediante la Resolución Exenta N° 1.985 de 2017, de la Subsecretaría de Telecomunicaciones.



Test Report Serial Number:	45461952 r1.0
Test Report Date:	26 July 2024
Project Number:	1659

EMC Test Report - New Certification

Applicant:



Garmin International Inc.
1200 East 151 St
Olathe, KS, 66062
USA

FCC ID:

IPH-04861

Product Model Number / HVIN

A04861

Product Marketing Name / PMN

A04861

In Accordance With:

CFR Title 47, Part 15 Subpart C, (§15.225), Part 15 Subpart B
 Part 15 Low Power Communication Device Transmitter (DXX)

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



FCC Registration: CA3874

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1.0 DOCUMENT CONTROL

Revision History					
Samples Tested By:		Art Voss, P.Eng.	Date(s) of Evaluation:		18 June - 19 July, 2024
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	15 July 2024	
1.0	Initial Release	n/a	Art Voss	26 July 2024	

2.0 CLIENT AND DUT INFORMATION

Client Information	
Applicant Name	Garmin International Inc.
Applicant Address	1200 East 151 St
	Olathe, KS, 66062
	USA
DUT Information	
Device Identifier(s):	FCC ID: IPH-04861
Device Model(s) / HVIN:	A04861
Device Marketing Name / PMN:	A04861
Test Sample Serial No.:	3469058597 - Conducted, 3469058595 - OTA
Device Type:	Portable Transceiver
Equipment Class:	Digital Transmission Systems (DTS)
	Spread Spectrum Transmitter (DSS)
	Low Power Communication Device (DTS)
	Global Navigation Satellite System (GNSS) Receivers
	NFC - Low Power Communication Device Transmitter (DXX)
Transmit Frequency Range:	WiFi (DTS): 2412-2472MHz
	BT/BLE/ANT: 2402-2480MHz
	NFC: 13.56MHz
Manuf. Max. Rated Output Power:	WiFi - Digital Transmission System (DTS): 11dBm EIRP
	BlueTooth - Spread Spectrum Transmitter (DSS): -4.8dBm EIRP
	BLE/ANT - Low Power Communication Device Transmitter (DTS): -3.7dBm EIRP
	NFC - Low Power Communication Device Transmitter (DXX): 46.5dBuV/m
Antenna Type and Gain:	-5.8dBi Max Slot Antenna
Modulation:	WiFi: DSSS, OFDM, CCK, MCS0-7
	BT BR: GFSK
	BT EDR: Pi/4-DQPSK, 8DPSK
	BLE: GMSK
	ANT: GFSK
	NFC: ASK
DUT Power Source:	4.5VDC Rechargeable Li-Ion
DUT Dimensions [LxWxH]	H x W x D: 47mm 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:

Garmin International 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 Garmin Model/HVIN: A04861 is a portable transceiver device consisting of a WiFi, BlueTooth (BT), BlueTooth Low Energy (BLE), Adaptive Network Topology (ANT) and Near Field Communication (NFC) transceivers. The WiFi and BT/BLE/ANT transceivers share the same antenna and cannot simultaneously transmit.

Requirement:

The transceivers of this equipment are subject to emissions evaluation in accordance with FCC: 47 CFR 2, 15C. As per FCC 47 CFR §2.1093, an RF Exposure (SAR) evaluation is required for this Equipment and the results of the RF Exposure (SAR) evaluation appear in a separate report.

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 in accordance with the rule parts cited in Normative References section of this report.

4.0 TEST RESULT SUMMARY

TEST SUMMARY					
Section	Description of Test	Procedure Reference	Applicable Rule Part(s) FCC	Test Date	Result
7.0	Occupied Bandwidth	ANSI C63.10-2013 KDB 558074 D01v05	§2.1049	17 July 2024	Pass
8.0	NFC Field Strength, Mask	ANSI C63.10-2013 KDB 558074 D01v05	§15.225(a)(c)	17 July 2024	Pass
9.0	Radiated Tx Emission	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(d)(e) §15.209	17 July 2024	Pass
10.0	Radiated Rx Emissions	ANSI C63.10-2013 KDB 558074 D01v05	§15.249(d)(e) §15.209	17 July 2024	Pass
11.0	Power Line Conducted Emissions	ANSI C63.4-2014	§15.107	18 July 2024	Pass
12.0	Frequency Stability	ANSI C63.10-2013 KDB 558074 D01v05	§15.225	19 July 2024	Pass

Test Station Day Log					
Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
17 July 2024	27.0	21	101.5	OATS	7, 8, 9, 10
18 July 2024	20.0	16	101.2	LISN	11
19 July 2024	22.6	18	100.8	TC	12

EMC - EMC Test Bench **SAC** - Semi-Anechoic Chamber
OATS - Open Area Test Site **TC** - Temperature Chamber
LISN - LISN Test Area **ESD** - ESD Test Bench
IMM - Immunity Test Area **RI** - Radiated Immunity Chamber

<p>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.</p>	 <hr/> Art Voss, P.Eng. Technical Manager Celltech Labs Inc. <hr/> 17 July 2024 Date
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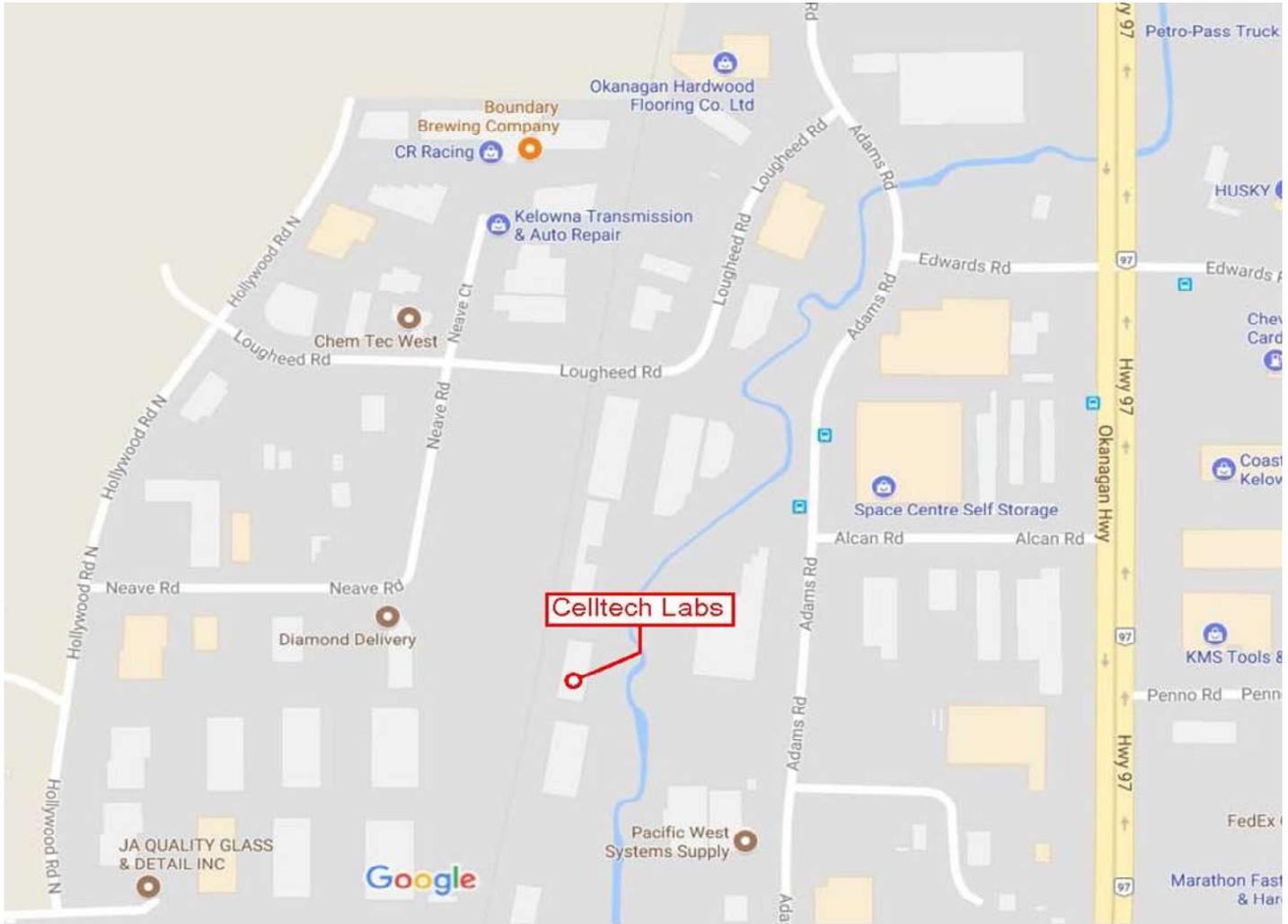
5.0 NORMATIVE REFERENCES

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 C63.10-2013	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 (15.225) Intentional Radiators

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

The facilities used to evaluate this device outlined in this report are located at 21-364 Loughheed 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 Industry Canada under Test Site File Number IC 3874A. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



7.0 OCCUPIED BANDWIDTH

Test Procedure

Normative	FCC 47 CFR §2.1046, §15.225
Reference	KDB 558074 (8.3.2.1), ANSI C63.10 (6.9.3)

General Procedure

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 $[10 \log (OBW/RBW)]$ 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.

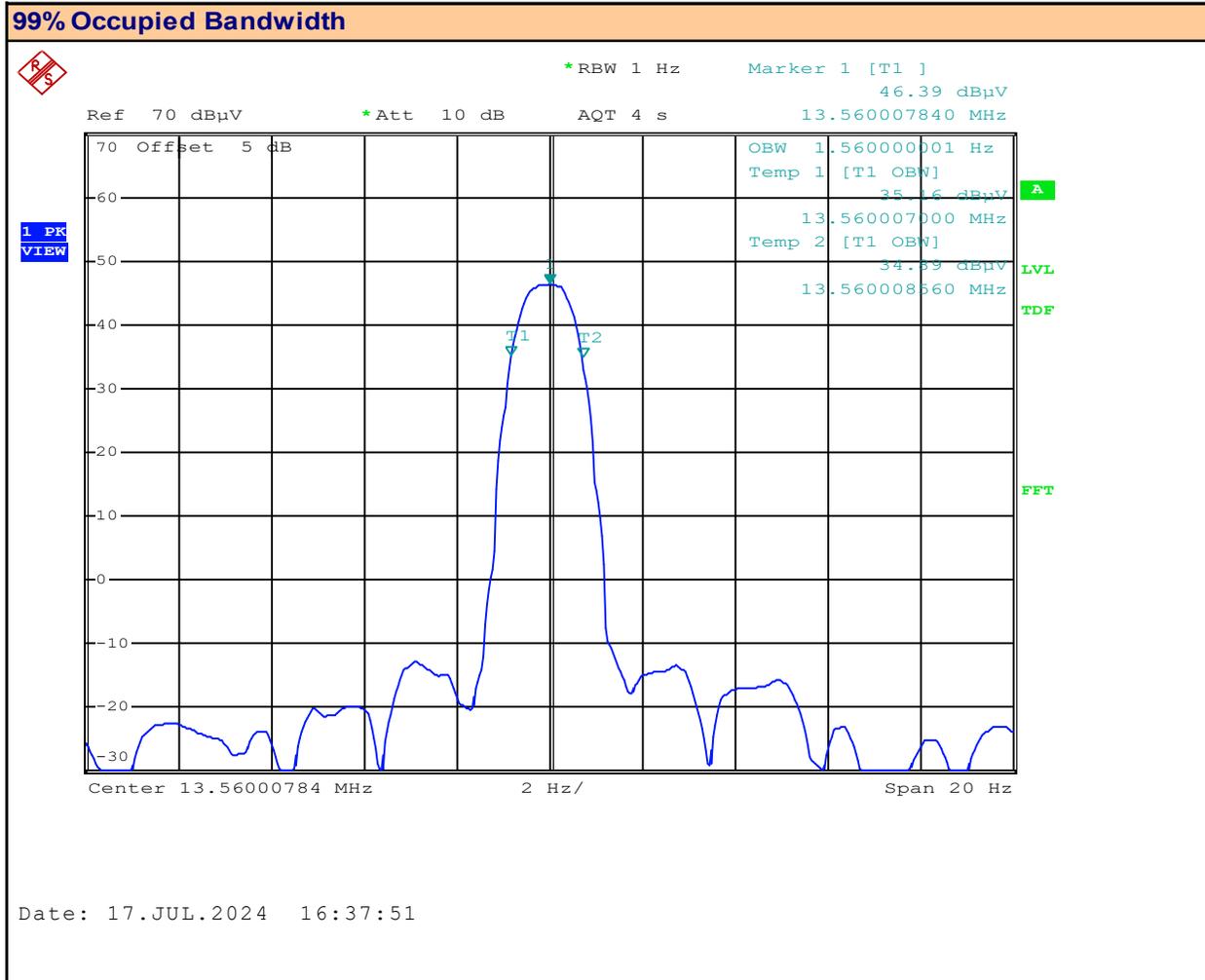
Test Setup

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 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.

Plot 7.1 – Occupied Bandwidth, NFC



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured Occupied Bandwidth: Hz

Table 7.1 - Summary of Occupied Bandwidth Measurements (NFC)

99% Occupied Bandwidth Results: NFC					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Occupied Bandwidth (Hz)	Emission Designator
-	13.56	NFC	ASK	1.56	1H56A1D
Result:					Complies

8.0 NFC FIELD STRENGTH / EMISSIONS MASK

Test Procedure

Normative Reference	FCC 47 CFR §2.1046, §15.225
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6)

Limits

§15.225	<p>Operation within the band 13.110-14.010 MHz.</p> <p>(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.</p> <p>(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.</p> <p>(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.</p> <p>(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.</p>
RSS-210 B.10(6)	<p>Band 13.110-14.010 MHz</p> <p>(a) the field strength of any emission shall not exceed the following limits:</p> <p>(i) 15.848 mV/m (84 dBμV/m) at 30 m, within the band 13.553-13.567 MHz</p> <p>(ii) 334 μV/m (50.5 dBμV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz</p> <p>(iii) 106 μV/m (40.5 dBμV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz</p> <p>(iv) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz</p>

General Procedure

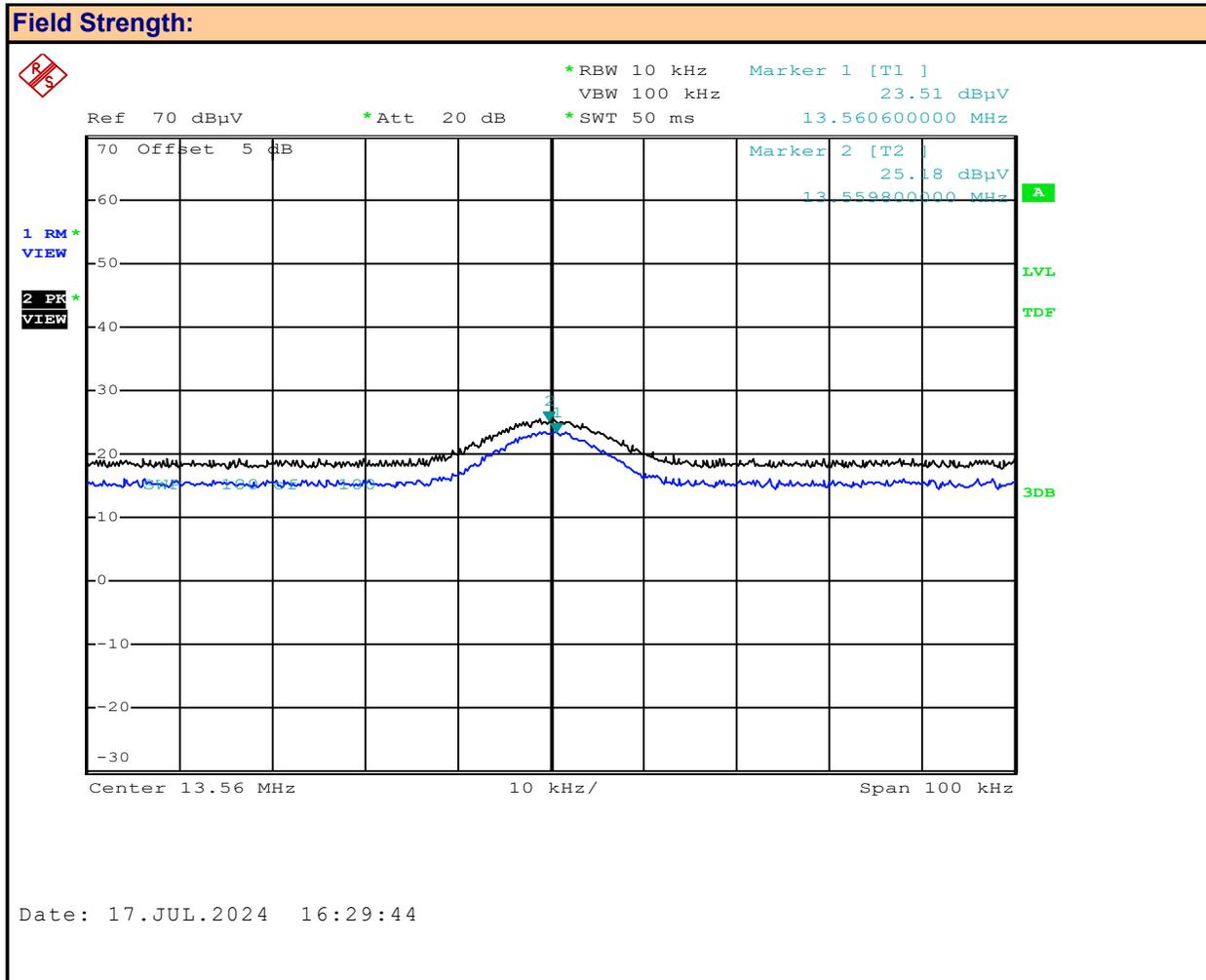
C63.10 (6.5.4)	<p>6.5.4 Final radiated emission tests</p> <p>Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported.</p> <p>Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.</p>
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Test Setup	Appendix A	Figure A.2
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Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

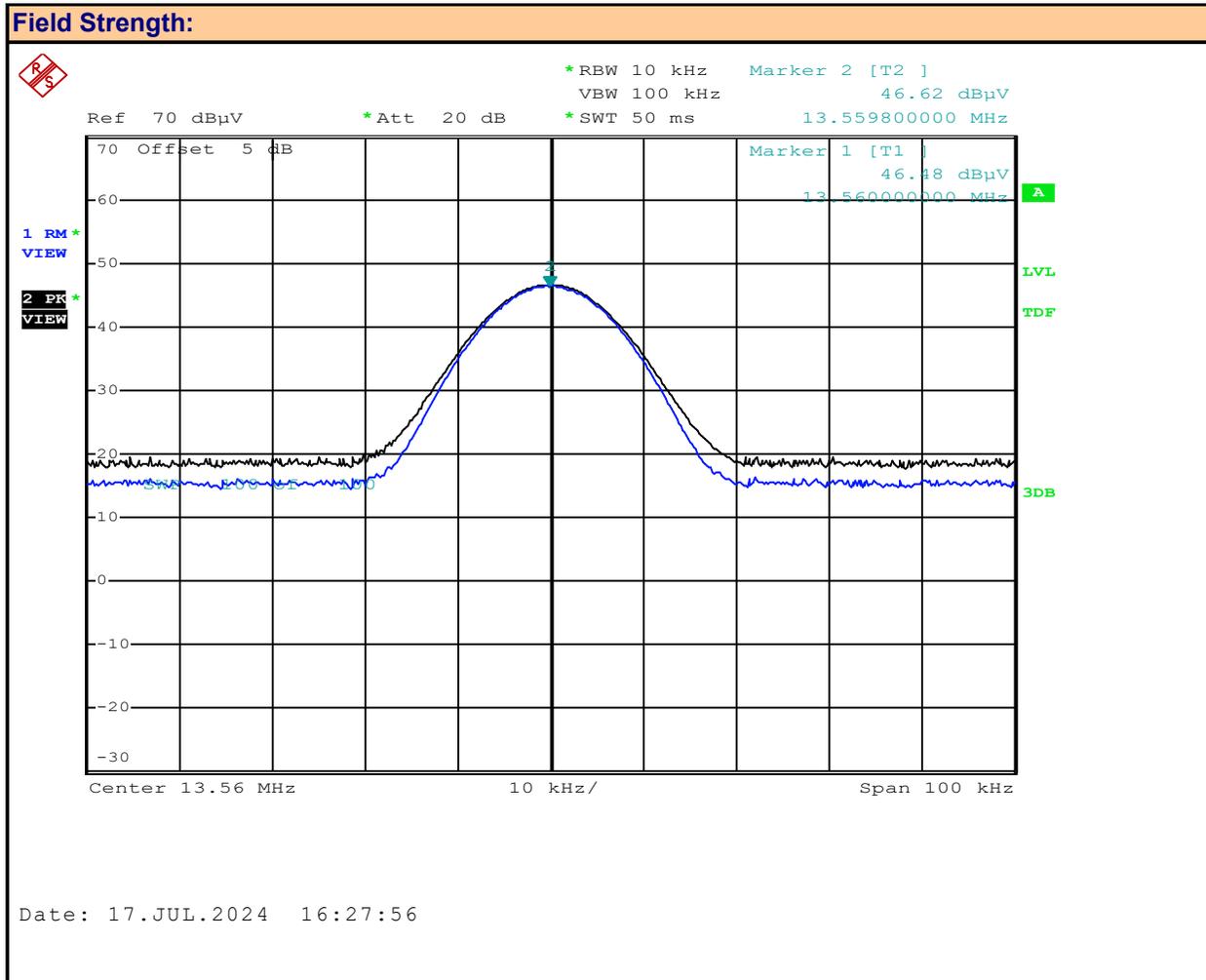
Plot 8.1 – Field Strength, NFC, Front



Polarization:
 Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured Field Strength (Pk): dBuV/m
 Measured Field Strength (Av): dBuV/m

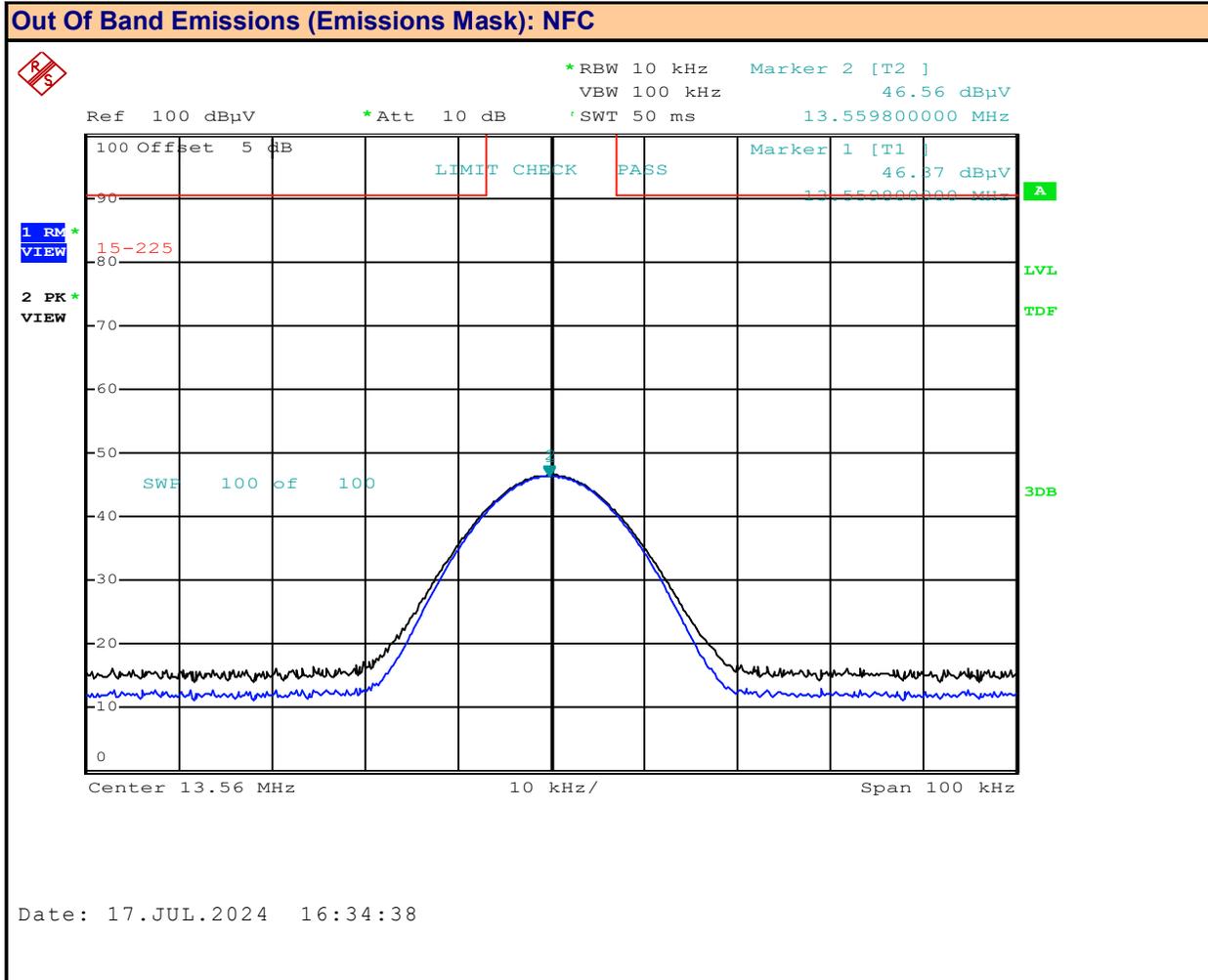
Plot 8.2 – Field Strength, NFC, Side



Polarization:
 Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured Field Strength (Pk): dBuV/m
 Measured Field Strength (Av): dBuV/m

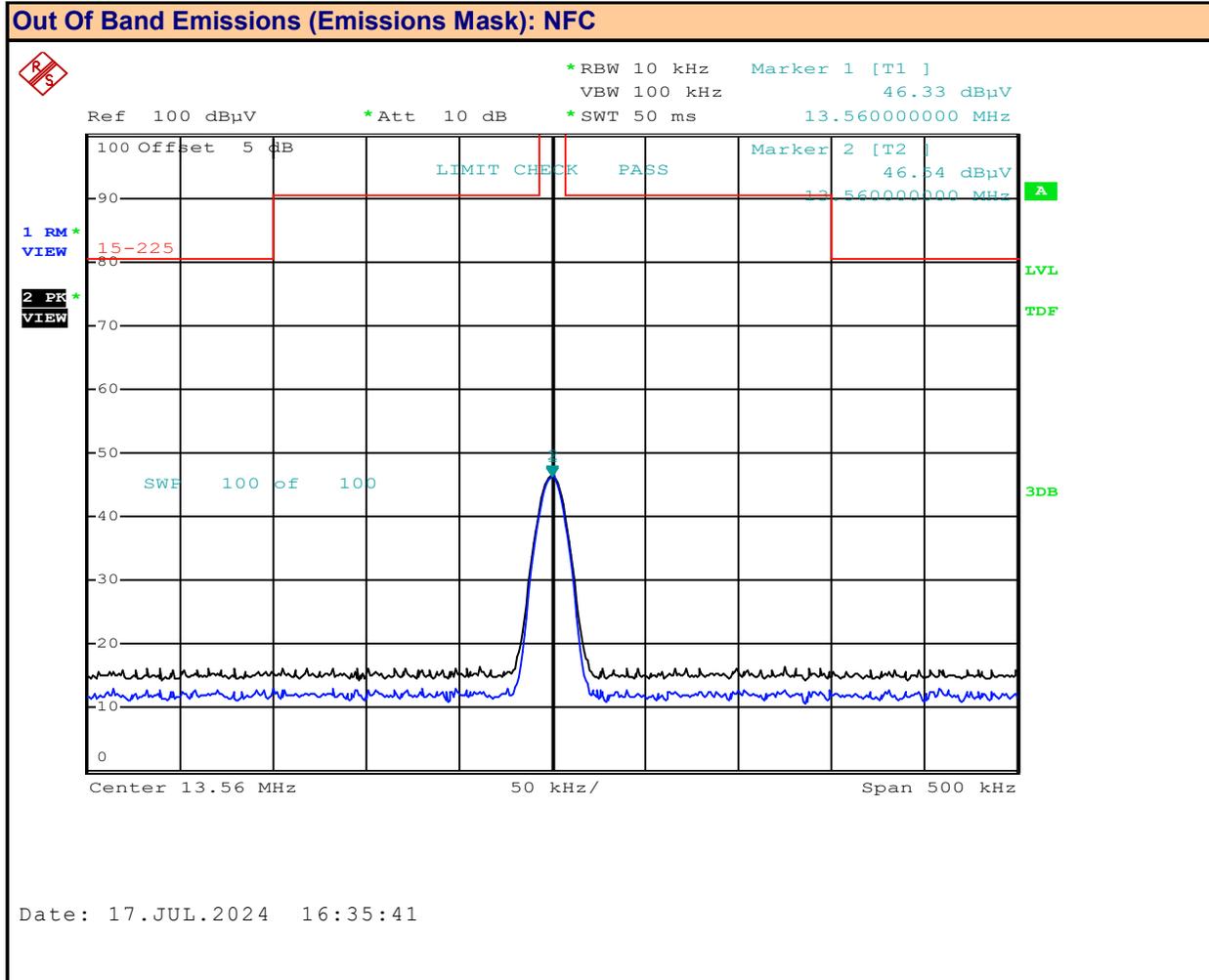
Plot 8.3 – Emissions Mask, NFC, Side



Polarization:
 Channel:
 Mode:

Channel Frequency: MHz
 Modulation:

Plot 8.4 – Emissions Mask, NFC, Side



Polarization:
 Channel:
 Mode:

Channel Frequency: MHz
 Modulation:

Table 8.1 – Summary of Field Strength Measurements (NFC)

Radiated Field Strength												
Frequency (MHz)	Mode	Modulation	Detector	Antenna Polarization	Measured Field Strength [FS _{Meas}] (dBuV @ 3m)	Cable Loss [L _c] (dBm)	Receive Antenna [ACF] (dB)	Corrected Field Strength [FS _{Corr}] (dBuV/m @3m)	Limit @30m [Lim _{30m}] (dBuV/m)	Limit* @3m [Lim _{3m}] (dBuV/m)	Margin (dB)	Emissions Mask
13.56	NFC	ASK	RMS	Front	23.51	0.5	10.5	34.51	84.00	124.0	89.5	Pass
				Side	46.48			57.48			66.5	Pass
			Peak	Front	25.18			36.18	104.00	144.0	107.8	Pass
				Side	46.62			57.62			86.4	Pass
Result:											Complies	

* Limit @ 3m = Limit @ 30m + 40dB/decade = 84dBuV/m + 40dB = 124dBuV/m (Average)

* Limit @ 3m = Limit @ 30m + 40dB/decade = 104dBuV/m + 40dB = 144dBuV/m (Peak)

$$FS_{Corr} = FS_{Meas} + ACF + L_c$$

$$Margin = Limit_{3m} - FS_{Corr}$$

Table 8.1 – Summary of Field Strength Measurements (NFC) – Cont.

Radiated Field Strength												
Frequency (MHz)	Mode	Modulation	Detector	Antenna Polarization	Measured Field Strength [FS _{Meas}] (dBuV @ 3m)	Cable Loss [L _c] (dBm)	Receive Antenna [ACF ^H] (dBuA/m)	Corrected Field Strength [H _{Corr}] (dBuA/m @3m)	Limit @30m [Lim _{30m}] (dBuV/m)	Limit** @3m [Lim _{3m}] (dBuA/m)	Margin (dB)	Emissions Mask
13.56	NFC	ASK	RMS	Front	23.51	0.5	-41	-16.99	84.00	72.5	89.5	Pass
				Side	46.48			5.98			66.5	Pass
			Peak	Front	25.18			-15.32	104.00	92.5	107.8	Pass
				Side	46.62			6.12			86.4	Pass
Result:											Complies	

** Limit @ 3m = Limit @ 30m + 40dB/decade = 84dBuV/m + 40dB = 124dBuV/m (Average)

** Limit @ 3m = Limit @ 30m + 40dB/decade = 104dBuV/m + 40dB = 144dBuV/m (Peak)

In accordance with ISED Notice 2020 - DRS0023:

"Guidance on Magnetic Field Strength Radiated Emissions Measurements 9kHz - 30MHz"

Limit Correction

$$\text{Limit}^H (\text{dBuA/m}) = \text{Limit}^E (\text{dBuV/m}) - Z_0 (\text{dB}\Omega)$$

Where $Z_0 = \text{Free-Space Impedance} = 120\pi\Omega = 377\Omega \Rightarrow 20\text{Log}377\Omega = 51.5\text{dB}\Omega$

$$\text{Limit}^H (\text{dBuA/m}) = \text{Limit}^E (\text{dBuV/m}) - Z_0 (\text{dB}\Omega) = 124\text{dBuV/m} - 51.5\text{dB}\Omega = 72.5\text{dBuA/m @ 3m (Average)}$$

$$\text{Limit}^H (\text{dBuA/m}) = \text{Limit}^E (\text{dBuV/m}) - Z_0 (\text{dB}\Omega) = 144\text{dBuV/m} - 51.5\text{dB}\Omega = 92.5\text{dBuA/m @ 3m (Peak)}$$

Measurement Correction

$$H_{\text{Corr}} (\text{dBuA/m}) = E_{\text{Meas}} (\text{dBuV}) + \text{ACF}^H (\text{dB}/\Omega\text{m}) + L_C - G_A$$

Where ACF^H is the Magnetic Antenna Correction Factor, L_C is Cable Loss, G_A is Pre-Amplifier Gain

External Pre-Amplifier (G_A) not used

$$\text{Margin} = \text{Limit}_{3\text{m}} - H_{\text{Corr}}$$

9.0 RADIATED SPURIOUS EMISSIONS – RESTRICTED BANDS

Test Procedure

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

Limits

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:	
	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	

Table 9.1 – Summary of Radiated Tx Emissions

See Appendix J for Measurement Plots

Summary of Radiated Tx Emissions											
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)	
30-1000 MHz	13.6	Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)	
		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)	
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

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

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

10.0 RADIATED RX SPURIOUS EMISSIONS

Test Procedure

Normative Reference	FCC 47 CFR §2.1046
	KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6)

General Procedure

C63.10 (6.5.4)	<p>6.5.4 Final radiated emission tests</p> <p>Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported.</p> <p>Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.</p>
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Test Setup	Appendix A	Figure A.2
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Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

Table 10.1 – Summary of Radiated Rx Emissions

See Appendix J for Measurement Plots

Summary of Radiated Rx Emissions										
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)
30-1000	-	Horizontal	(1)	(1) AV	-	-	0.00 (3)	(1)	-	(1)
30-1000	-	Vertical	(1)	(1) AV	-	-	0.00 (3)	(1)	-	(1)
Results:									Complies	

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

(3) External Amplifier not used

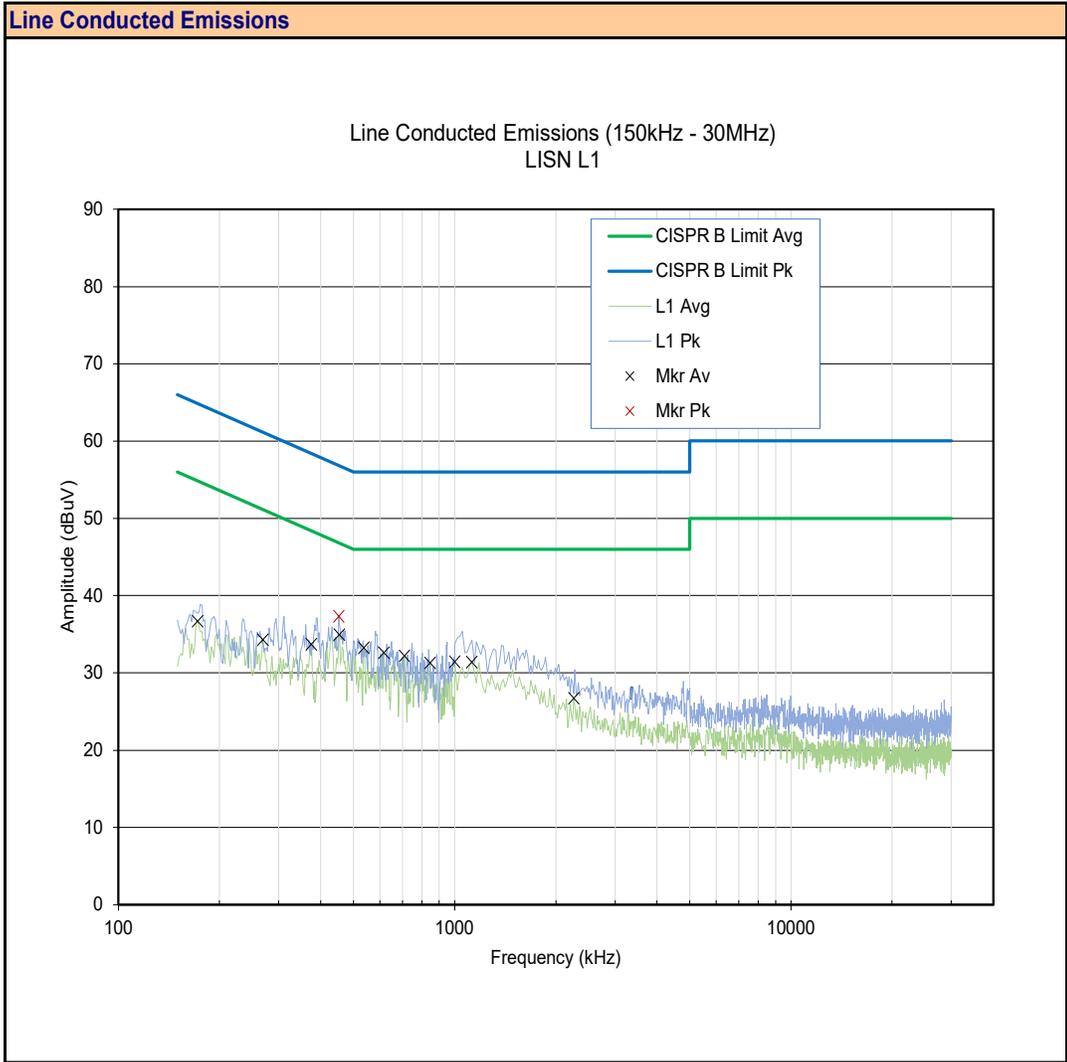
$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

11.0 POWER LINE CONDUCTED EMISSIONS

Test Procedure	
Normative Reference	FCC 47 CFR §15.107, ICES-003(6.1) ANSI C63.4-2014
Limits	
47 CFR §15.107	(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the frequency 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average
ICES-003(6.1)	6.1 - AC Power Line Conducted Emissions Limits 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 2. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average
Test Setup	Appendix A Figure A.7

Plot 11.1 – Power Line Conducted Emissions, Line 1



Plot 11.2 – Power Line Conducted Emissions, Line 2

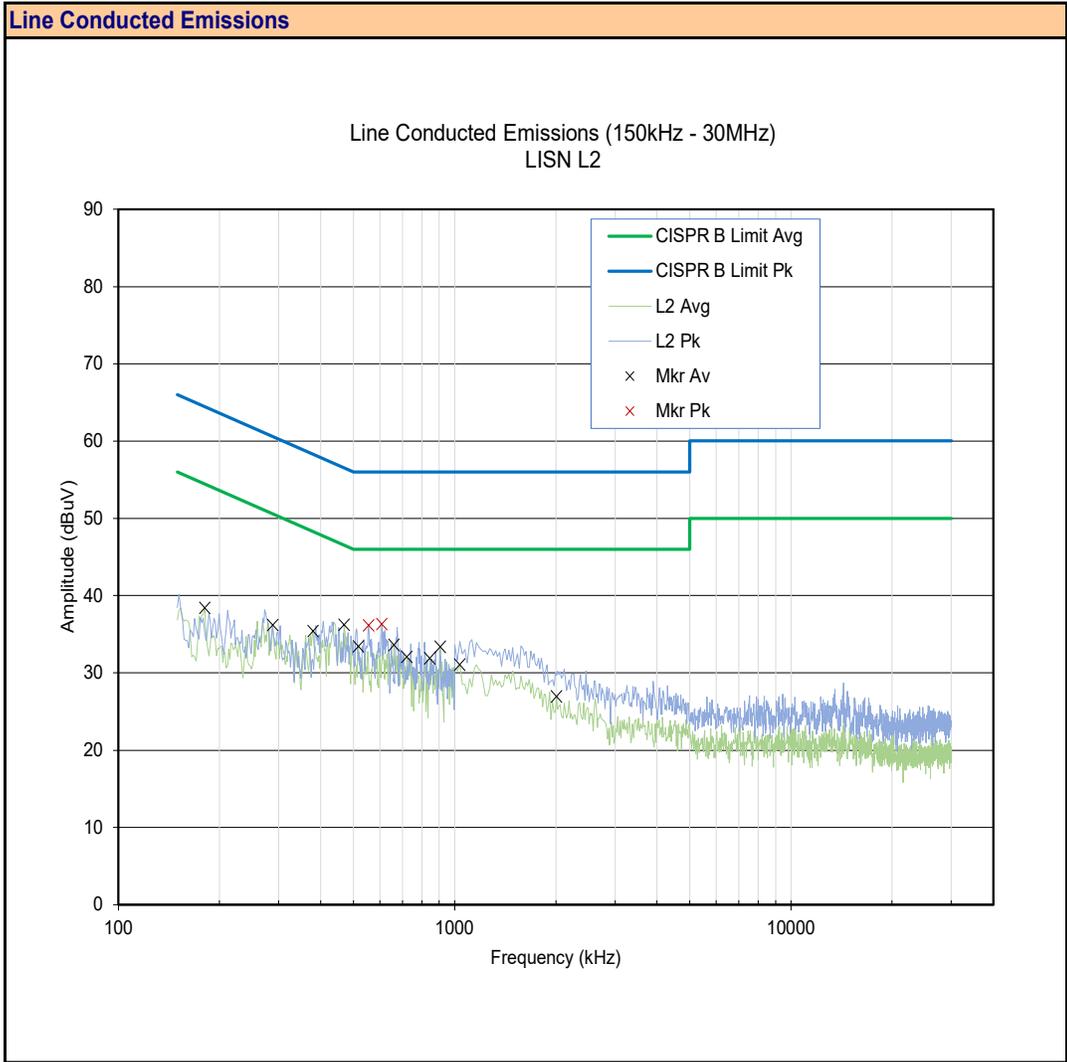


Table 11.1 – Summary of Power Line Conducted Emissions – L1

§15.107, ICES-003 (6.1)					
Emission	LISN	Detector	Corrected Emission	Limit	Margin
Frequency	Port		[E_{Corr}]*	[Limit]	[Margin]
			(W)	(dBuV/m)	(dB)
172.1 kHz	L1	Average	36.68	55.3	18.6
269.0 kHz	L1	Average	34.29	51.4	17.1
374.4 kHz	L1	Average	33.71	48.5	14.8
454.3 kHz	L1	Average	34.95	46.8	11.9
537.6 kHz	L1	Average	33.25	46.0	12.7
615.8 kHz	L1	Average	32.60	46.0	13.4
709.3 kHz	L1	Average	32.18	46.0	13.8
845.3 kHz	L1	Average	31.30	46.0	14.7
1000.0 kHz	L1	Average	31.44	46.0	14.6
1126.0 kHz	L1	Average	31.39	46.0	14.6
2260.0 kHz	L1	Average	26.71	46.0	19.3
452.6 kHz	L1	Peak	37.31	56.9	19.6
Results:				Complies	

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{Corr} = E_{Meas} + L_C + AFC$$

$$Margin = Limit - E_{Corr}$$

Table 11.2 – Summary of Power Line Conducted Emissions – L2

§15.107, ICES-003 (6.1)					
Emission	LISN	Detector	Corrected Emission	Limit	Margin
Frequency	Port		[E_{Corr}]*	[Limit]	[Margin]
			(W)	(dBuV/m)	(dB)
180.6 kHz	L2	Average	38.42	54.8	16.4
287.7 kHz	L2	Average	36.20	50.8	14.6
379.5 kHz	L2	Average	35.41	48.4	13.0
469.6 kHz	L2	Average	36.21	46.5	10.3
517.2 kHz	L2	Average	33.42	46.0	12.6
660.0 kHz	L2	Average	33.61	46.0	12.4
721.2 kHz	L2	Average	32.06	46.0	13.9
843.6 kHz	L2	Average	31.90	46.0	14.1
906.5 kHz	L2	Average	33.35	46.0	12.6
1036.0 kHz	L2	Average	31.07	46.0	14.9
2008.0 kHz	L2	Average	26.95	46.0	19.1
554.6 kHz	L2	Peak	36.17	56.0	19.8
607.3 kHz	L2	Peak	36.31	56.0	19.7
Results:				Complies	

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{\text{Corr}} = E_{\text{Meas}} + L_C + \text{AFC}$$

$$\text{Margin} = \text{Limit} - E_{\text{Corr}}$$

12.0 FREQUENCY STABILITY (NFC)

Test Conditions

Normative Reference	FCC 47 CFR §2.1055, §15.225
----------------------------	------------------------------------

Limits

47 CFR §15.225	(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+ 50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.
----------------	---

Measurement Procedure

47 CFR §2.1055 Frequency Stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

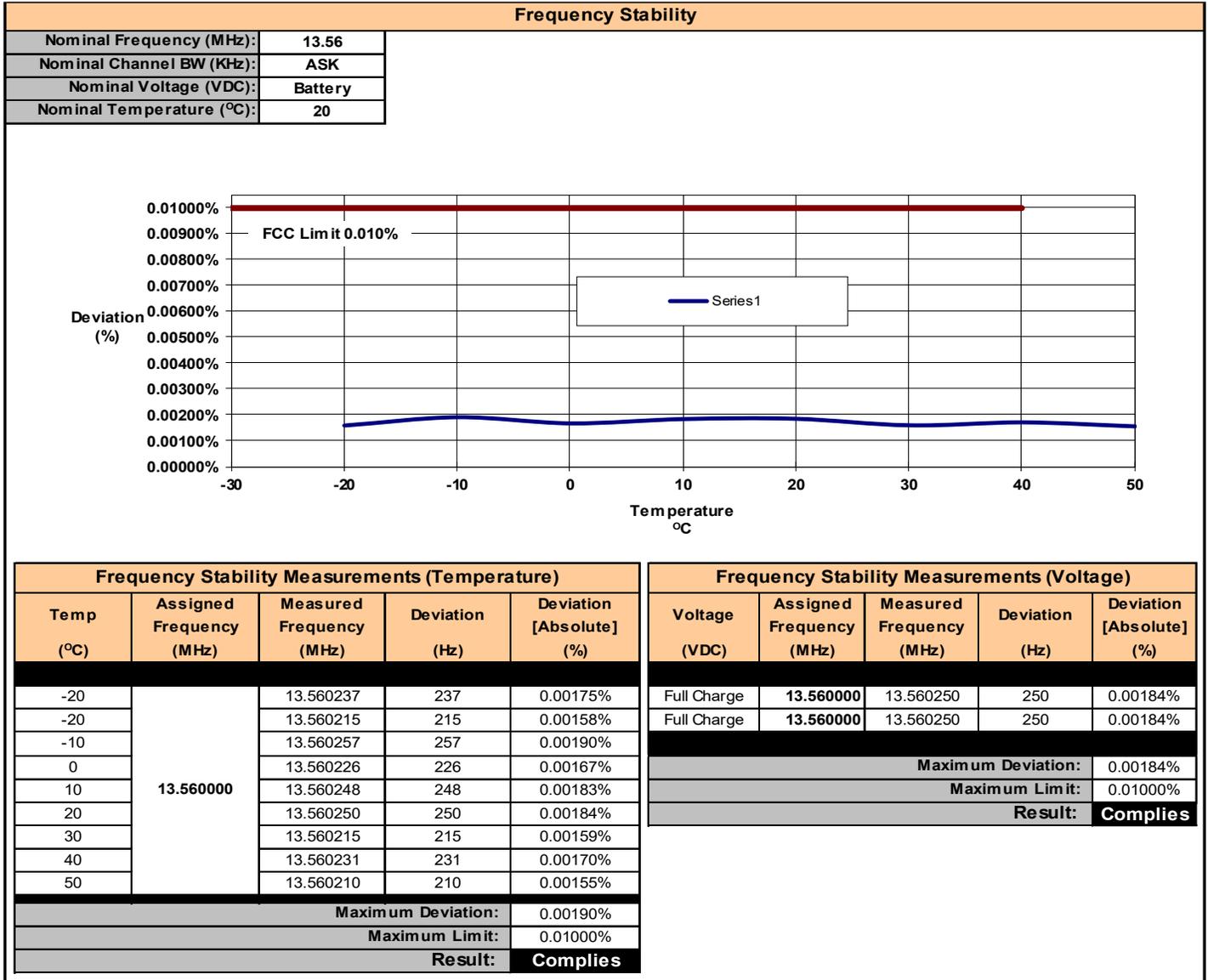
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

Test Setup

Appendix A

5

Table 12.1 – Summary of Frequency Stability Measurements – FCC



APPENDIX A – TEST SETUP DRAWINGS AND EQUIPMENT

Table A.1 – Setup - Conducted Measurements Equipment List

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

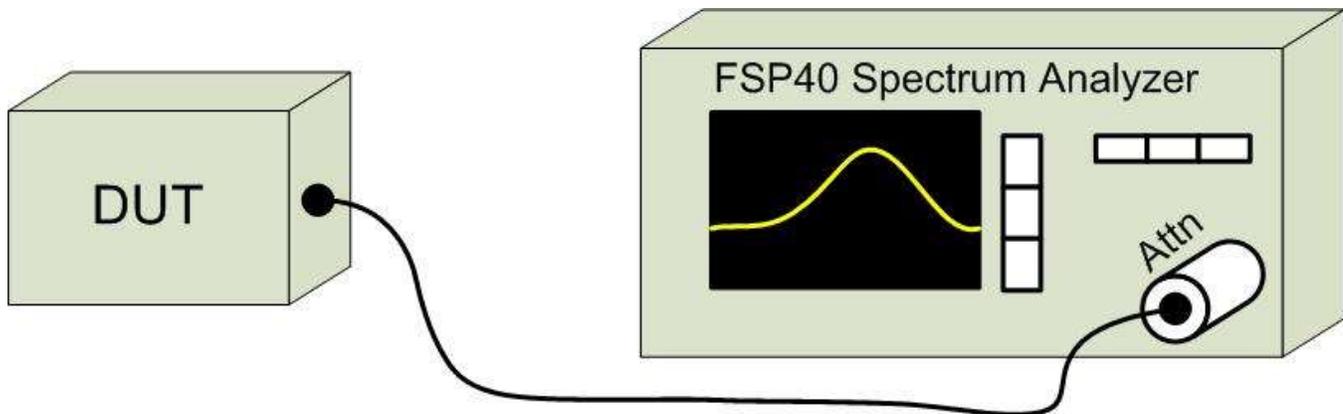


Figure A.1 – Test Setup Conducted Measurements

Table A.2 – Setup - Radiated Emissions Equipment List

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

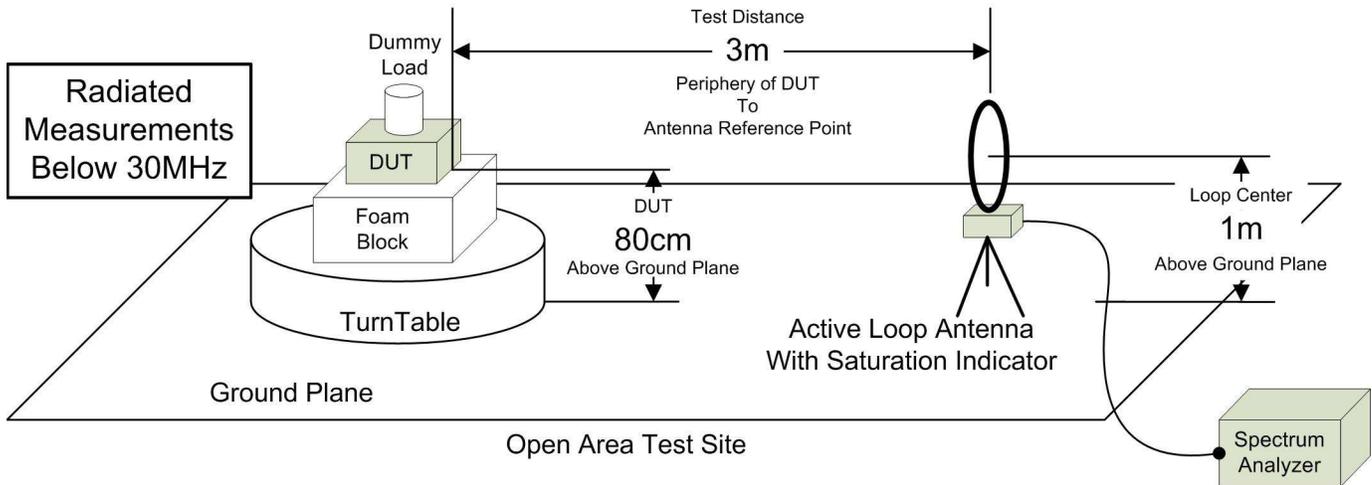


Figure A.2 – Test Setup Radiated Emissions Measurements Below 30MHz

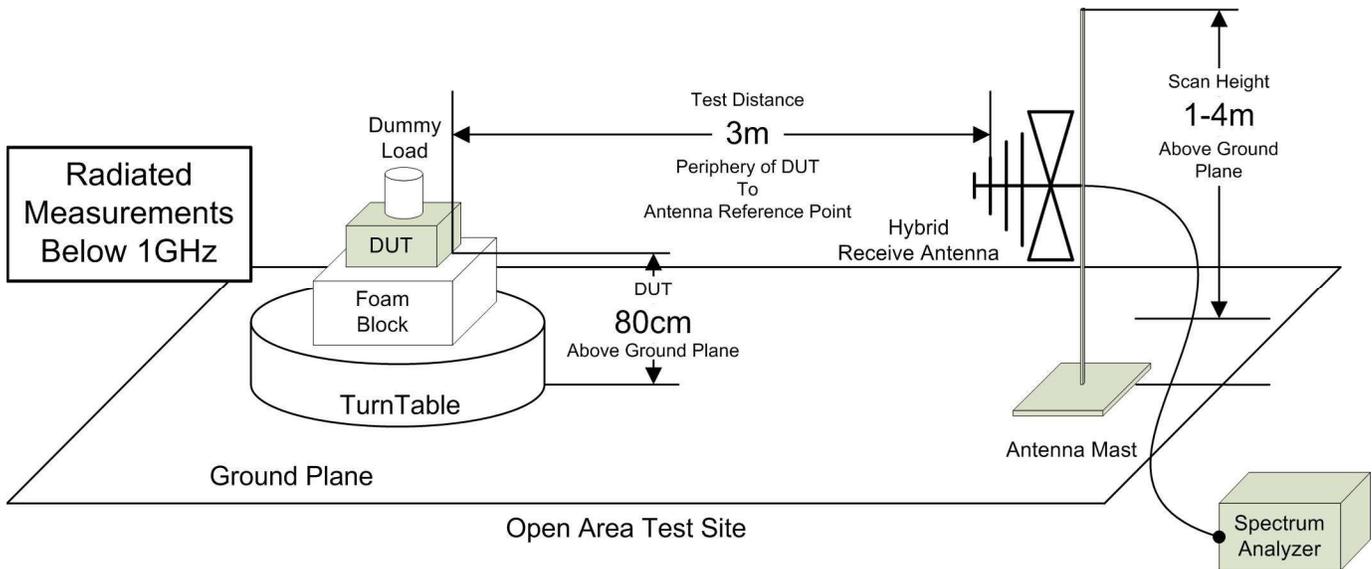


Figure A.3 – Test Setup Radiated Emissions Measurements 30 – 100MHz

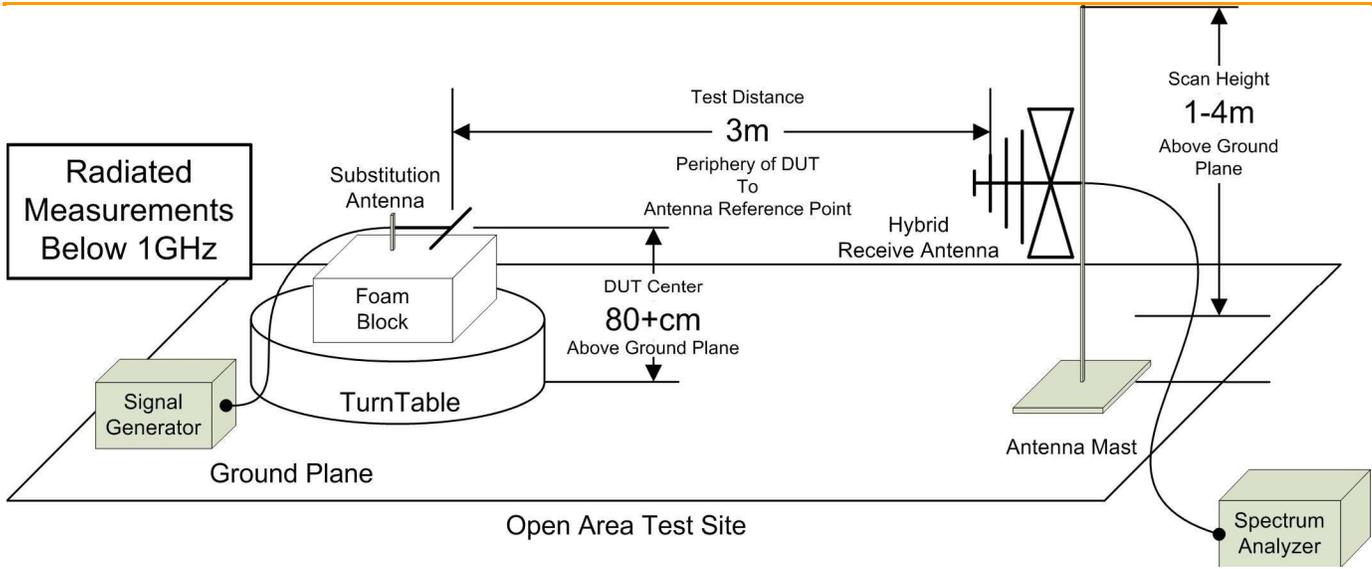


Figure A.4 – Test Setup Radiated Emissions Measurements 30 – 1000MHz Signal Substitution

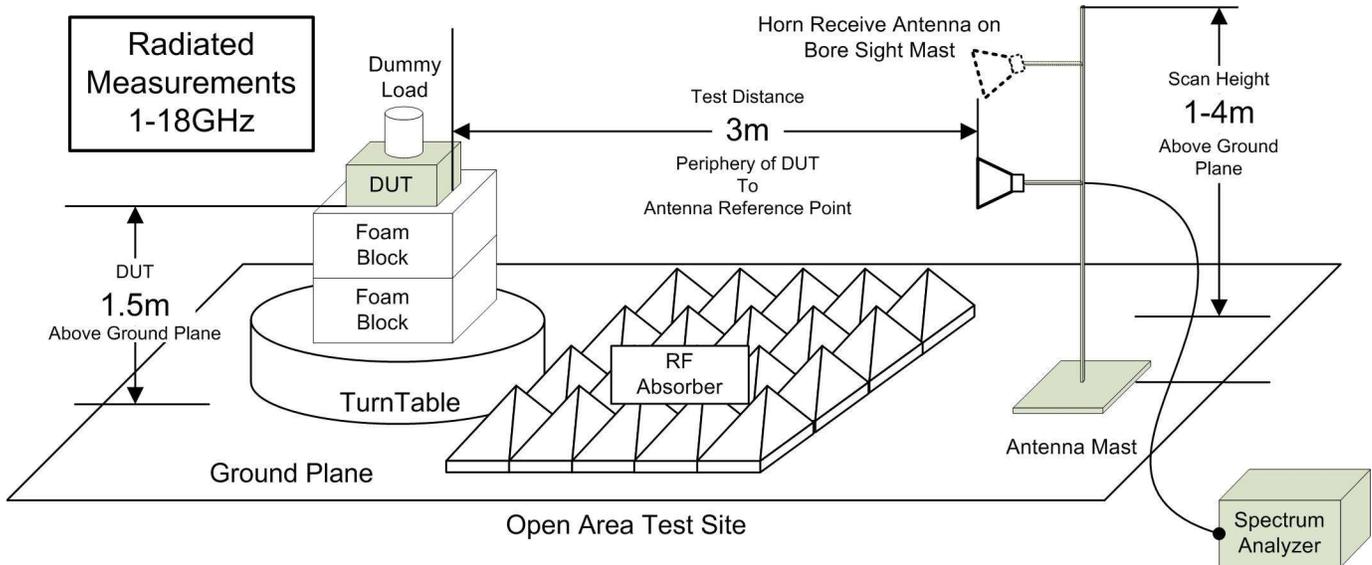


Figure A.5 – Test Setup Radiated Emissions Measurements 1 – 18GHz

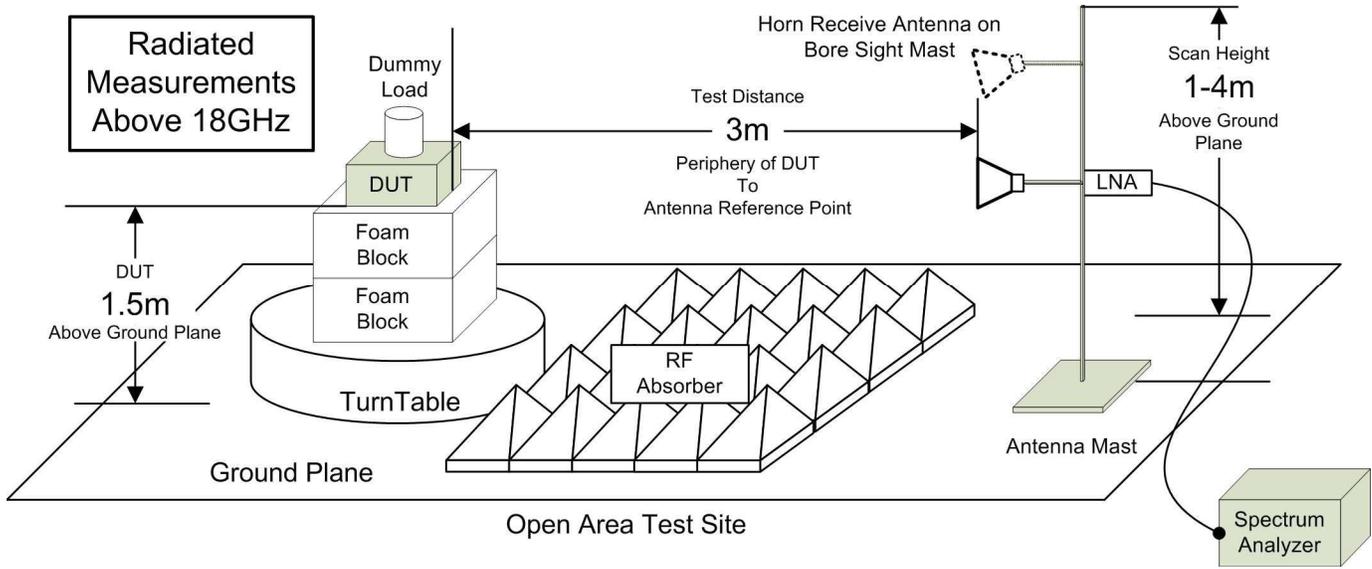


Figure A.6 – Test Setup Radiated Emissions Measurements Above 18 GHz

Table A.3 – Power Line Conducted Measurement Equipment

Equipment List			
Asset Number	Manufacturer	Model Number	Description
00241	R&S	FSU40	Spectrum Analyzer
00275	Coaxis	LMR400	25m Cable
00276	Coaxis	LMR400	4m Cable
00278	TILE	34G3	TILE Test Software
00257	Comm Power	LI-215A	LISN

Figure A.7 – Test Setup Power Line Conducted Measurements

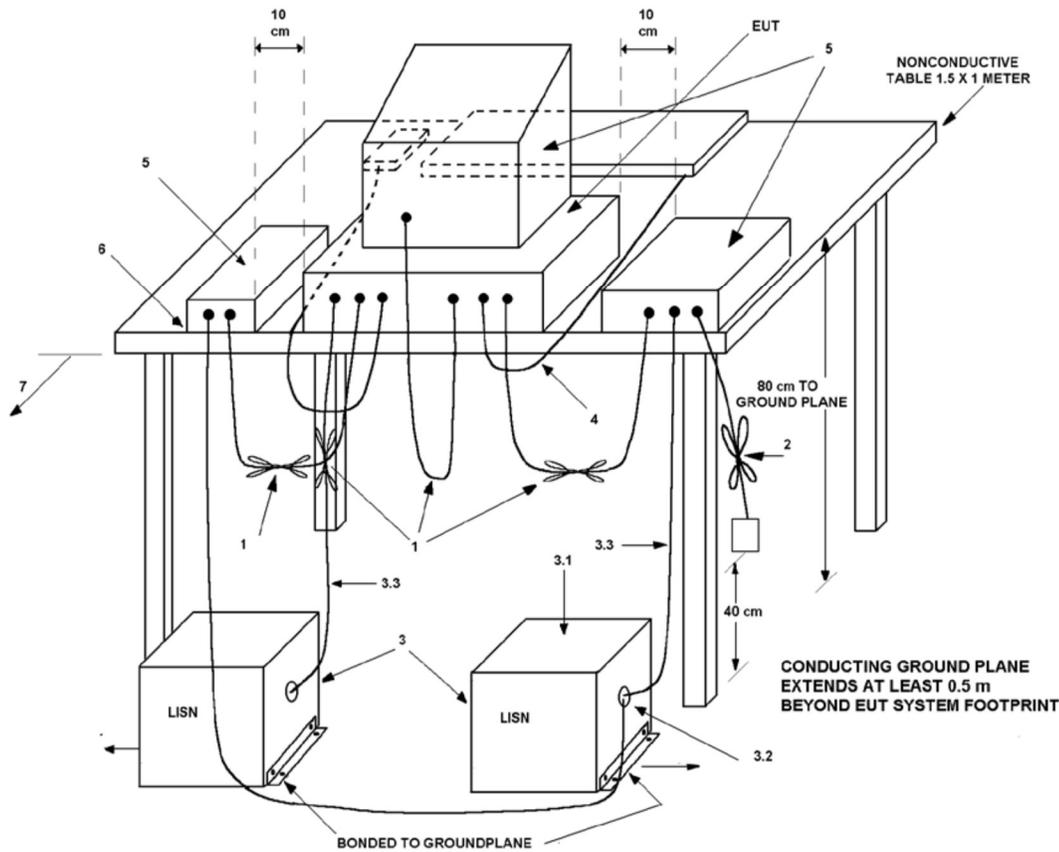


Table A.4 – Setup – Frequency Stability Equipment List

Equipment List				
Asset Number	Manufacturer	Model Number	Serial Number	Description
00241	R&S	FSU40	100500	Spectrum Analyzer
00081	ESPEC	ECT-2	0510154-B	Environmental Chamber
00234	VWR	61161-378	140320430	Temp/Humidity Meter

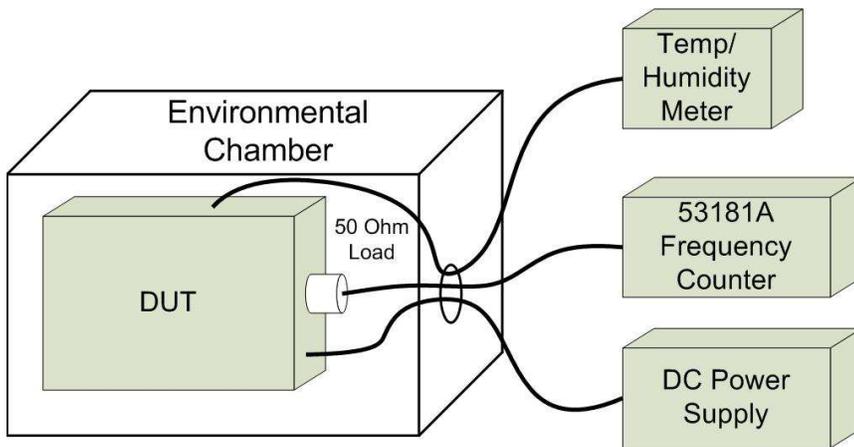


Figure A.8 – Frequency Stability

APPENDIX B – EQUIPMENT LIST AND CALIBRATION

Equipment List					Last	Calibration	Calibration
Asset Number	Manufacturer	Model Number	Serial Number	Description	Calibrated	Interval	Due
00050	Chase	CBL-6111A	1607	Bilog Antenna	16 Nov 2023	Triennial	16 Nov 2026
00035	ETS	3115	6276	Double Ridged Guide Horn	4 Mar 2022	Triennial	4 Mar 2025
00085	EMCO	6502	9203-2724	Loop Antenna	6 Sep 2022	Triennial	6 Sep 2025
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	10 Aug 2021	Triennial	10 Aug 2024
00005	HP	8648D	3847A00611	Signal Generator	28 Jun 2023	Triennial	28 Jun 2026
00003	HP	53181A	3736A05175	Frequency Counter	28 Jun 2023	Triennial	28 Jun 2026
00257	Com-Power	LI-215A	191934	LISN	27 Dec 2021	Triennial	27 Dec 2024
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
00081	ESPEC	ECT-2	0510154-B	Environmental Chamber	NCR	n/a	CNR
00234	VWR	61161-378	140320430	Temp/Humidity Meter	New	Triennial	New
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a	COU
00275	TMS	LMR400	n/a	25m Cable	COU	n/a	COU
00276	TMS	LMR400	n/a	4m 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} = 5.14dB U _{CISPR} = 6.3dB	
Radiated Emissions 200MHz - 1000MHz	
U _{LAB} = 5.90dB U _{CISPR} = 6.3dB	
Radiated Emissions 1GHz - 6GHz	
U _{LAB} = 4.80dB U _{CISPR} = 5.2dB	
Radiated Emissions 6GHz - 18GHz	
U _{LAB} = 5.1dB U _{CISPR} = 5.5dB	
Power Line Conducted Emissions 9kHz to 150kHz	
U _{LAB} = 2.96dB U _{CISPR} = 3.8dB	
Power Line Conducted Emissions 150kHz to 30MHz	
U _{LAB} = 3.12dB U _{CISPR} = 3.4dB	

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} = 1.0dB U _{CISPR} = n/a	
Frequency/Bandwidth 9kHz - 40GHz	
U _{LAB} = 0.1ppm U _{CISPR} = n/a	
Temperature	
U _{LAB} = 1°C U _{CISPR} = n/a	

END OF REPORT

APPENDIX I– RADIATED TX EMISSIONS MEASUREMENT PLOTS

APPENDIX J– RADIATED RX MEASUREMENT PLOTS



Test Report Serial Number:	45461951 r1.0
Test Report Date:	26 July 2024
Project Number:	1659

EMC Test Report - New Certification

Applicant:



Garmin International Inc.
1200 East 151 St
Olathe, KS, 66062
USA

FCC ID:

IPH-04861

Product Model Number / HVIN

A04861

Product Marketing Name / PMN

A04861

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



FCC Registration: CA3874

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1.0 REVISION HISTORY

Revision History					
Samples Tested By:		Art Voss, P.Eng.	Date(s) of Evaluation:		18 June - 19 July, 2024
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	15 July 2024	
1.0	Initial Release	n/a	Art Voss	26 July 2024	

2.0 CLIENT AND DUT INFORMATION

Client Information	
Applicant Name	Garmin International Inc.
Applicant Address	1200 East 151 St
	Olathe, KS, 66062
	USA
DUT Information	
Device Identifier(s):	FCC ID: IPH-04861
Device Model(s) / HVIN:	A04861
Device Marketing Name / PMN:	A04861
Test Sample Serial No.:	3469058597 - Conducted, 3469058595 - OTA
Device Type:	Portable Transceiver
Equipment Class:	Digital Transmission Systems (DTS)
	Spread Spectrum Transmitter (DSS)
	Low Power Communication Device (DTS)
	Global Navigation Satellite System (GNSS) Receivers
	NFC - Low Power Communication Device Transmitter (DXX)
Transmit Frequency Range:	WiFi (DTS): 2412-2472MHz
	BT/BLE/ANT: 2402-2480MHz
	NFC: 13.56MHz
Manuf. Max. Rated Output Power:	WiFi - Digital Transmission System (DTS): 11dBm EIRP
	BlueTooth - Spread Spectrum Transmitter (DSS): -4.8dBm EIRP
	BLE/ANT - Low Power Communication Device Transmitter (DTS): -3.7dBm EIRP
	NFC - Low Power Communication Device Transmitter (DXX): 46.5dBuV/m
Antenna Type and Gain:	-5.8dBi Max Slot Antenna
Modulation:	WiFi: DSSS, OFDM, CCK, MCS0-7
	BT BR: GFSK
	BT EDR: Pi/4-DQPSK, 8DPSK
	BLE: GMSK
	ANT: GFSK
DUT Power Source:	4.5VDC Rechargeable Li-Ion
DUT Dimensions [LxWxH]	H x W x D: 47mm 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:

Garmin International 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 Garmin Model/HVIN: A04861 is a portable transceiver device consisting of a WiFi, BlueTooth (BT), BlueTooth Low Energy (BLE), Adaptive Network Topology (ANT) and Near Field Communication (NFC) transceivers. The WiFi and BT/BLE/ANT transceivers share the same antenna and cannot simultaneously transmit.

Requirement:

The transceivers of this *equipment* are subject to emissions evaluation in accordance with FCC: 47 CFR 2, 15C. As per FCC 47 CFR §2.1093, an RF Exposure (SAR) evaluation is required for this *Equipment* and the results of the RF Exposure (SAR) evaluation appear in a separate report.

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 in accordance with the rule parts cited in Normative References section of this report.

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 C63.10-2013 KDB 558074 D01v05	§2.1049	11 July 2024	Pass
8.0	DTS Bandwidth	ANSI C63.10-2013 KDB 558074 D01v05	§15.247(a)(2)	12-16 July 2024	Pass
9.0	Conducted Power (Fundamental)	ANSI C63.10-2013 KDB 558074 D01v05	§2.1046 §15.247(b)(3)	16 June, 5 Jul Apr 2024	Pass
10.0	Conducted Power (Fundamental)	ANSI C63.10-2013 KDB 558074 D01v05	§2.1046 §15.247(b)(1)	16 June, 5 Jul 2024	Pass
11.0	Power Spectral Density	ANSI C63.10-2013 KDB 558074 D01v05	§15.247(e)	12-16 July 2024	Pass
12.0	FHSS Hopping Characteristics	ANSI C63.4-2014 KDB 558074 D01v05	§15.247(a)(1)(iii)	14 Jun 2024	Pass
13.0	FHSS Channel Separation	ANSI C63.4-2014 KDB 558074 D01v05	§15.247(a)(1)	14 Jun 2024	Pass
14.0	FHSS Time of Occupancy	ANSI C63.4-2014 KDB 558074 D01v05	§15.247(a)(1)(iii)	14 Jun 2024	Pass
15.0	Conducted Tx Spurious Emissions Band Edge	ANSI C63.10-2013 KDB 558074 D01v05	§2.1051 §15.247(d)	18 June, 16 Jul 2024	Pass
16.0	Conducted Tx Spurious Emissions	ANSI C63.10-2013 KDB 558074 D01v05	§2.1051 §15.247(d)	16 July 2024	Pass
17.0	Radiated Tx Spurious Emissions And Restricted Band	ANSI C63.4-2014 KDB 558074 D01v05	§15.109 §15.247(d)	17 July 2024	Pass
18.0	Radiated Rx Spurious Emissions	ANSI C63.4-2014 KDB 558074 D01v05	§15.109	17 July 2024	Pass
19.0	Power Line Conducted Emissions	ANSI C63.4-2014	§15.107	19 July 2024	Pass

Test Station Day Log					
Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
18 Jun 2024	20.6	18	101.6	EMC	9, 10, 15
5 July 2024	20.1	16	101.9	EMC	9, 10, 15
11 July 2024	22.1	15	101.6	EMC	7
12 July 2024	17.0	37	100.7	EMC	8, 9, 10
16 July 2024	20.7	16	101.1	EMC	8, 11, 15, 16
17 July 2024	27.0	21	101.5	OATS	17, 18
18 July 2024	20.0	16	101.2	LISN	19

EMC - EMC Test Bench	SAC - Semi-Anechoic Chamber
OATS - Open Area Test Site	TC - Temperature Chamber
LISN - LISN Test Area	ESD - ESD Test Bench
IMM - Immunity Test Area	RI - Radiated Immunity Chamber

<p>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.</p>	 <p>Art Voss, P.Eng. Technical Manager Celltech Labs Inc. 15 July 2024 Date</p> 
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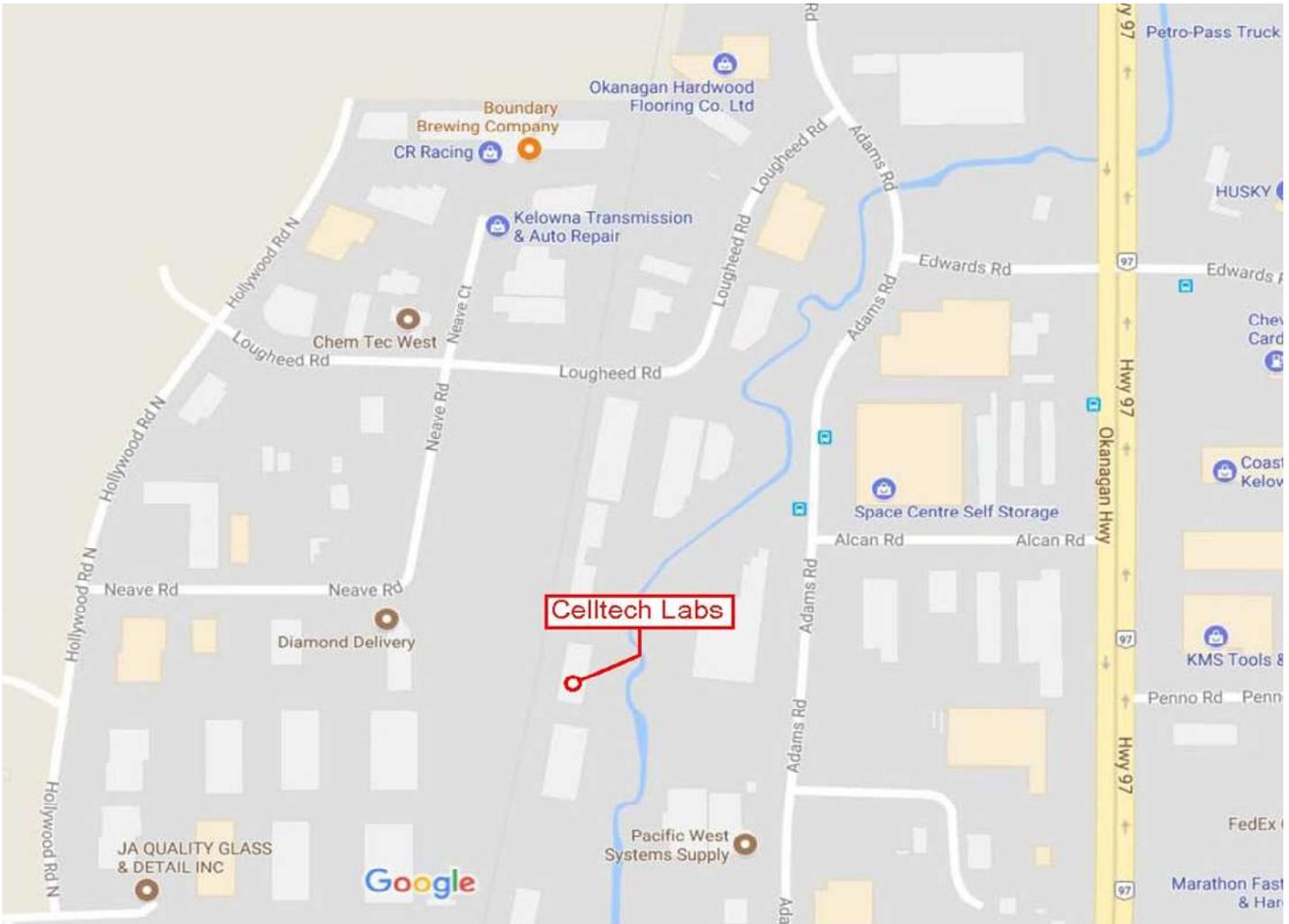
5.0 NORMATIVE REFERENCES

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 C63.10-2013	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)	<p>8.3.2.1 General</p> <p>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.</p>
C63.10 (6.9.3)	<p>6.9.3 Occupied bandwidth—power bandwidth (99%) measurement procedure</p> <p>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:</p> <ol style="list-style-type: none"> 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. 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. 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. Step a) through step c) might require iteration to adjust within the specified range. 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. 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).

Table 7.1 – Summary of Occupied Bandwidth Measurements, (DTS)
See Appendix D for measurement plots

99% Occupied Bandwidth Results: DTS					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
6	2437.0	802.11b	DSSS 5.5	14.3	14M3D1D
		802.11g	OFDM 6	16.4	16M4D1D
		802.11n	MCS0	17.5	17M5D1D
17	2440.0	BLE 1mb	GMSK	1.41	1M41G1D
17		BLE 2mb	GMSK	2.58	2M58g1D
38		ANT	GFSK	1.31	1M31F1D
Result:					Complies

Table 7.2 – Summary of Occupied Bandwidth Measurements, (DSS)
See Appendix D for measurement plots

99% Occupied Bandwidth Results: DSS					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Occupied Bandwidth (kHz)	Emission Designator
38	2440.0	BT BR	GFSK	912.0	912KF1D
38	2440.0	BT 2EDR	Pi/4-DQPSK	1100.0	1M10D1D
38	2440.0	BT 3EDR	8-DPSK	1100.0	1M10D1D
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

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.

Table 8.1 – Summary of 6dB DTS Bandwidth Measurements, (DTS)
See Appendix D for measurement plots

DTS Bandwidth Results: (DTS)						
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured 6dB BW [BW] (MHz)	Minimum 6dB BW [BW _{Min}] (MHz)	Margin (MHz)
6	2437.0	802.11b	DSSS 5.5	6.70	0.50	6.20
		802.11g	OFDM 6	16.60		16.10
		802.11n	MCS0	17.40		16.90
17	2440.0	BLE 1mb	GMSK	0.90		0.40
17		BLE 2mb	GMSK	1.66		1.16
38		ANT	GFSK	0.84		0.34
Result:					Complies	

Table 8.2 – Summary of 6dB DTS Bandwidth Measurements, (DSS)
See Appendix D for measurement plots

DTS Bandwidth Results: (DSS)					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured 6dB BW [BW] (kHz)	Margin
38	2440.0	BT BR	GFSK	500.00	n/a
		BT 2EDR	Pi/4-DQPSK	500.00	
		BT 3EDR	8-DPSK	500.00	
Result:					Complies

9.0 ANTENNA PORT CONDUCTED POWER, (DTS)

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.

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

See Appendix E for Measurement Plots

Conducted Power Measurement Results: DTS											
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Power [P _{Meas}] (dBm)	Limit [P _{Lim}] (dBm)	Conducted Margin (dB)	Antenna Gain [G] (dBi)	EIRP [E _{Meas}] (dBm)	EIRP Limit [E _{Lim}] (dBm)	EIRP Margin (dB)	
6	2437.00	802.11b	CCK 1	15.980	30	14.0	-5.8	10.2	36	25.8	
			CCK 2	16.460		13.5		10.7		25.3	
			DSSS 5.5	16.520		13.5		10.7		25.3	
			DSSS 11	16.350		13.7		10.6		25.5	
1	2412.00		DSSS 5.5			15.500		14.5		9.7	26.3
9	2452.00			16.830		13.2		11.0		25.0	
10	2452.00			13.880		16.1		8.1		27.9	
11	2462.00			13.070		16.9		7.3		28.7	
12	2467.00			9.100		20.9		3.3		32.7	
13	2472.00			4.830		25.2		-1.0		37.0	
6	2437.00		802.11g	OFDM6		15.760		14.2		10.0	26.0
				OFDM9		15.710		14.3		9.9	26.1
		OFDM12		15.680	14.3	9.9	26.1				
		OFDM6		15.110	14.9	9.3	26.7				
				15.210	14.8	9.4	26.6				
				12.890	17.1	7.1	28.9				
				11.640	18.4	5.8	30.2				
				8.830	21.2	3.0	33.0				
13	2472.00	7.960		22.0	2.2	33.8					
6	2437.00	802.11n		MCS0	16.090	13.9	10.3	25.7			
				MCS3	15.370	14.6	9.6	26.4			
				MCS7	11.450	18.6	5.7	30.4			
			MCS0	14.580	15.4	8.8	27.2				
				14.100	15.9	8.3	27.7				
				14.100	15.9	8.3	27.7				
				12.430	17.6	6.6	29.4				
				8.830	21.2	3.0	33.0				
				7.990	22.0	2.2	33.8				

Result: Complies

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Table 9.1 – Summary of Conducted Power Measurements, (DTS) – Cont.

See Appendix E for Measurement Plots

Conducted Power Measurement Results: DTS										
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Power [P _{Meas}] (dBm)	Limit [P _{Lim}] (dBm)	Conducted Margin (dB)	Antenna Gain [G] (dBi)	EIRP [E _{Meas}] (dBm)	EIRP Limit [E _{Lim}] (dBm)	EIRP Margin (dB)
37	2402.00	BLE 1mb	GMSK	-2.420	30	32.4	-5.8	-8.2	36	44.2
17	2440.00			1.830		28.2		-4.0		40.0
39	2480.00			-1.170		31.2		-7.0		43.0
1	2404.00	BLE 2mb	GMSK	1.100		28.9		-4.7		40.7
17	2440.00			2.010		28.0		-3.8		39.8
36	2478.00			-1.020		31.0		-6.8		42.8
2	2402.00	ANT	GFSK	-2.360		32.4		-8.2		44.2
38	2440.00			2.080		27.9		-3.7		39.7
80	2480.00			-1.080		31.1		-6.9		42.9
Result:										Complies

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

10.0 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.

Table 10.1 – Summary of Conducted Power Measurements, (DSS)

See Appendix E for Measurement Plots

Conducted Power Measurement Results: DSS													
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Power [P _{Meas}] (dBm)	Limit [P _{Lim}] (dBm)	Conducted Margin (dB)	Antenna Gain [G] (dBi)	EIRP [E _{Meas}] (dBm)	EIRP Limit [E _{Lim}] (dBm)	EIRP Margin (dB)			
0	2402.00	BT BR	GFSK	10.31	30	19.7	-5.8	4.5	36	31.5			
38	2440.00			10.10		19.9		4.3		31.7			
78	2480.00			10.59		19.4		4.8		31.2			
0	2402.00	BT 2EDR	Pi/4-DQPSK	9.03		21.0		3.2		32.8			
38	2440.00			9.97		20.0		4.2		31.8			
78	2480.00			10.34		19.7		4.5		31.5			
0	2402.00	BT 3EDR	8-DPSK	8.66		21.3		2.9		33.1			
38	2440.00			9.57		20.4		3.8		32.2			
78	2480.00			10.16		19.8		4.4		31.6			
Result:										Complies			

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

11.0 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)

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)	<p>Method AVGPSD-1 (trace averaging with EUT transmitting at full power throughout each sweep)</p> <p>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).</p> <p>a) Set instrument center frequency to DTS channel center frequency.</p> <p>b) Set span to at least 1.5 X OBW.</p> <p>c) Set RBW to: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$.</p> <p>d) Set VBW $\geq 3 \times \text{RBW}$.</p> <p>e) Detector = RMS</p> <p>f) Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.</p> <p>g) Sweep time = auto couple.</p> <p>h) Employ trace averaging (RMS) mode over a minimum of 100 traces.</p> <p>i) Use the peak marker function to determine the maximum amplitude level.</p> <p>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).</p>

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. 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.

Table 11.1 – Summary of Power Spectral Density Measurements, (DTS)
See Appendix F for Measurement Plots

PSD Results:						
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured PSD [P _{Meas}] (dBm)	PSD Limit [P _{Lim}] (dBm)	Margin (dB)
6	2437.0	802.11b	DSSS 5.5	-4.47	8.000	12.47
		802.11g	OFDM12	-7.90		15.90
		802.11n	MCS0	-8.66		16.66
17	2440.0	BLE 1mb	GMSK	-10.03		18.03
17		BLE 2mb	GMSK	-12.57		20.57
38		ANT	GFSK	-9.68		17.68
					Result:	Complies

$$\text{Margin} = [P_{\text{Lim}}] - [P_{\text{Meas}}]$$

Table 11.2 – Summary of Power Spectral Density Measurements, (DSS)
See Appendix F for Measurement Plots

PSD Results:						
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured PSD [P _{Meas}] (dBm)	PSD Limit [P _{Lim}] (dBm)	Margin (dB)
38	2440.0	BT BR	GFSK	2.79	8.0	5.21
		BT 2EDR	Pi/4-DQPSK	2.70		5.30
		BT 3EDR	8-DPSK	2.18		5.82
					Result:	Complies

$$\text{Margin} = [P_{\text{Lim}}] - [P_{\text{Meas}}]$$

12.0 FHSS NUMBER OF HOPPING CHANNELS

Test Procedure

Normative Reference	FCC 47 CFR §15.247, RSS-247
	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.

Table 12.2 – Summary of FHSS Number of Hopping Channels
See Appendix G for Measurement Plots

Number of Hopping Channels				
Start Frequency (MHz)	Channel Frequency (MHz)	Mode	Modulation	Number of Channels
2400	2441.0	BT BR	GFSK	40
2441	2485.0			39
Total [N_{Chan}]				79
2400	2441.0	BT 2EDR	Pi/4-DQPSK	40
2441	2485.0			39
Total [N_{Chan}]				79

13.0 FHSS CHANNEL SEPARATION

Test Procedure

Normative Reference	FCC 47 CFR §15.247, RSS-247
	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.

Table 13.1 – Summary of FHSS Channel Separation
See Appendix G for Measurement Plots

Hopping Channel Separation					
Mode	Modulation	20dB Bandwidth (MHz)	Channel Separation (MHz)	Minimum Separation (MHz)	Margin (MHz)
BT BR	GFSK	1.008	1.000	0.672	0.328
BT 2EDR	Pi/4-DQPSK	0.996	1.000	0.664	0.336
BT 3EDR	8-DPSK	1.380	1.000	0.920	0.080
Result:					Complies

Minimum Bandwidth = 20dB BW X 2/3

Margin = Channel Separation - 20dB Bandwidth

14.0 FHSS TIME OF OCCUPANCY

Test Procedure

Normative Reference	FCC 47 CFR §15.247, RSS-247
	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.

Table 14.1 – Summary of FHSS Time of Occupancy
 See Appendix G for Measurement Plots

Accumulated Time of Occupancy DSS										
Channel Frequency (MHz)	Packet	Channel On Time (Dwell) [t _{Dwell}] (mSec)	Meas Period [t _{Meas}] (mSec)	Number of Tx per Period [N _{Tx}]	Number of Channels Employed [N _{Chan}]	Maximum TOO Per Channel [t _{Max}] (mSec)	Maximum TOO Period [t _{Period}] (mSec)	Accumulated Time of Occupancy [t _{Occ}] (mSec)	Limit [Limit] (mSec)	Margin (mSec)
2440.00	DH1, ...	0.386	1000	11	79	400.0	31600	134.2	400	265.8
	DH3, ...	1.628		7				360.1		39.9
	DH5, ...	2.890		3				274.0		126.0
Result:									Complies	

TOO = Time of Occupancy

Number of Channels Employed [N_{Chan}]: See Table 11.1

Maximum TOO Period [t_{Period}] = Number of Channels [N_{Chan}] X 0.4Sec, as per §15.247, RSS-247

$$\text{Accumulated Time of Occupancy [t}_{\text{Occ}}] = \frac{(\text{Number of Tx per Period [N}_{\text{Tx}}] \times \text{Dwell Time [t}_{\text{Dwell}}] \times \text{Maximum TOO Period [t}_{\text{Period}}])}{\text{Measurement Period [t}_{\text{Meas}}]}$$

Margin = Limit [Limit] - Accumulated Time of Occupancy [t_{Occ}]

15.0 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)	<p>11.1 General</p> <p>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:</p> <p>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).</p> <p>11.2 Reference level measurement</p> <p>a) Set instrument center frequency to DTS channel center frequency.</p> <p>b) Set the span to $\geq 1.5 \times DTS \text{ bandwidth}$.</p> <p>c) Set the RBW = 100 kHz.</p> <p>d) Set the VBW $\geq 3 \times RBW$.</p> <p>e) Detector = peak.</p> <p>f) Sweep time = auto couple.</p> <p>g) Trace mode = max hold.</p> <p>h) Allow trace to fully stabilize.</p> <p>i) Use the peak marker function to determine the maximum PSD level.</p> <p>Note that the channel found to contain the maximum PSD level can be used to establish the reference</p>

Table 15.1 – Summary of Spurious Emission Measurements – Band Edge, Restricted Band (DTS)
See Appendix H for Measurement Plots

Band Edge Measurement Results (Restricted Band): DTS									
Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Antenna Gain [G] (dBi)	Emission EIRP [E _{Em}] (dBm)	Field Strength [FS] (dBuV)	Peak Limit (dBuV/m)	Margin (dB)
802.11b	9	2452.00	DSSS 5.5	-23.52	-5.8	-29.32	65.98	74	8.0
	10	2457.00		-28.21		-34.01	61.29		12.7
	11	2462.00		-28.50		-34.30	61.00		13.0
	12	2467.00		-29.15		-34.95	60.35		13.7
	13	2472.00		-24.45		-30.25	65.05		9.0
802.11g	9	2452.00	OFDM6	-19.26		-25.06	70.24		3.8
	10	2457.00		-18.83		-24.63	70.67		3.3
	11	2462.00		-18.20		-24.00	71.30		2.7
	12	2467.00		-17.03		-22.83	72.47		1.5
	13	2472.00		-21.84		-27.64	67.66		6.3
802.11n	9	2452.00	MCS0	-23.53		-29.33	65.97		8.0
	10	2457.00		-19.70		-25.50	69.80		4.2
	11	2462.00		-17.31		-23.11	72.19		1.8
	12	2467.00		-21.43		-27.23	68.07		5.9
	13	2472.00		-20.45		-26.25	69.05		5.0
BLE1	39	2480.00	GMSK	-27.46	-33.26	62.04	12.0		
BLE2	36	2478.00	GMSK	-26.81	-32.61	62.69	11.3		
ANT	78	2480.00	GFSK	-27.26	-33.06	62.24	11.8		
Results								Complies	

Margin = [FS] - Limit

FS = EIRP -20Log(d) +104.8

EIRP = Emission Power [P_{Em}] + Antenna Gain [G] + Ground Reflection Factor (0)

Table 15.2 – Summary of Spurious Emission Measurements – Band Edge, (DTS)
See Appendix H for Measurement Plots

Band Edge Measurement Results (Lower): DTS														
Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Fundamental Power [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)	Antenna Gain (dBi)	Emission EIRP [E _{Em}] (dBm)	Fundamental EIRP [E _{Fund}] (dBm)	EIRP Attenuation [Atten] (dB)	Limit (dB)	EIRP Margin (dB)
802.11b	1	2412.00	DSSS 5.5	-26.84	16.83	43.67	30	13.7	-5.8	-32.64	11.03	43.67	30	13.7
802.11g	1	2412.00	OFDM6	-28.28	15.76	44.04		14.0		-34.08	9.96	44.04		14.0
802.11n	1	2412.00	MCS0	-29.70	16.09	45.79		15.8		-35.50	10.29	45.79		15.8
BLE1	37	2402.00	GMSK	-38.33	1.83	40.16		10.2		-44.13	-3.97	40.16		10.2
BLE2	0	2404.00	GMSK	-38.41	2.01	40.42		10.4		-44.21	-3.79	40.42		10.4
ANT	0	2402.00	GFSK	-38.92	2.08	41.00		11.0		-44.72	-3.72	41.00		11.0
Result:													Complies	

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

Margin = [Atten] - Limit

Table 15.3 – Summary of Spurious Emission Measurements – Band Edge, Restricted Bands (DSS)
See Appendix H for Measurement Plots

Band Edge Measurement Results (Restricted Band): DTS									
Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Antenna Gain [G] (dBi)	Emission EIRP [E _{Em}] (dBm)	Field Strength [FS] (dBuV)	Peak Limit (dBuV/m)	Margin (dB)
BT BR	78	2480.00	GFSK	-25.60	-5.8	-31.40	63.90	74	10.1
BT 2EDR			Pi/4-DQPSK	-25.33		-31.13	64.17		9.8
BT 3EDR			8-DPSK	-25.67		-31.47	63.83		10.2
Results								Complies	

Margin = [FS] - Limit

FS = EIRP -20Log(d) +104.8

EIRP = Emission Power [P_{Em}] + Antenna Gain [G] + Ground Reflection Factor (0)

Table 15.4 – Summary of Spurious Emission Measurements – Band Edge, (DSS)
See Appendix H for Measurement Plots

Band Edge Measurement Results: DTS														
Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Fundamental Power [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)	Antenna Gain (dBi)	Emission EIRP [E _{Em}] (dBm)	Fundamental EIRP [E _{Fund}] (dBm)	EIRP Attenuation [Atten] (dB)	Limit (dB)	EIRP Margin (dB)
BT BR	0	2402.00	GFSK	-37.68	10.59	48.27	30	18.3	-5.8	-43.48	4.79	48.27	30	18.3
BT 2EDR			Pi/4-DQPSK	-37.58	10.34	47.92		17.9		-43.38	4.54	47.92		17.9
BT 3EDR			8-DPSK	-37.45	10.16	47.61		17.6		-43.25	4.36	47.61		17.6
													Result:	Complies

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

Margin = [Atten] - Limit

16.0 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)
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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)	<p>11.1 General</p> <p>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:</p> <p>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).</p> <p>11.2 Reference level measurement</p> <p>a) Set instrument center frequency to DTS channel center frequency.</p> <p>b) Set the span to $\geq 1.5 \times DTS \text{ bandwidth}$.</p> <p>c) Set the RBW = 100 kHz.</p> <p>d) Set the VBW $\geq 3 \times RBW$.</p> <p>e) Detector = peak.</p> <p>f) Sweep time = auto couple.</p> <p>g) Trace mode = max hold.</p> <p>h) Allow trace to fully stabilize.</p> <p>i) Use the peak marker function to determine the maximum PSD level.</p> <p>Note that the channel found to contain the maximum PSD level can be used to establish the reference</p>

Table 16.1 – Summary of Conducted Spurious Emissions, (DTS)
See Appendix I for Measurement Plots

Conducted Spurious Emissions Measurement Results:								
Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Emission Frequency (MHz)	Fundamental Measurement [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)
6	2437.00	DSSS 5.5	ND	ND				
								Complies

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

Margin = Attenuation - Limit

ND = None Detected

Table 16.2 – Summary of Conducted Spurious Emissions, (DSS)
See Appendix I for Measurement Plots

Conducted Spurious Emissions Measurement Results:								
Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Emission Frequency (MHz)	Fundamental Measurement [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)
38	2440.00	GFSK	ND	ND				
								Complies

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

Margin = Attenuation - Limit

ND = None Detected

17.0 RADIATED TX SPURIOUS EMISSIONS

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)	<p>§15.209 Radiated emission limits; general requirements.</p> <p>(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:</p> <table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Field Strength (microvolts/meter)</th> </tr> </thead> <tbody> <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> </tbody> </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																

Table 17.1 – Summary of Radiated Tx Spurious Emissions, (DTS)
See Appendix J for Measurement Plots

Summary of Radiated Tx Emissions										
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)
30-1000 MHz	2437.0	Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
30-1000 MHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18-25 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18 -25 GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
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

$$E_{Corr} = E_{Meas} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

Table 17.2 – Summary of Radiated Tx Spurious Emissions, (DSS)
See Appendix J for Measurement Plots

Summary of Radiated Tx Emissions										
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)
30-1000 MHz	2440.0	Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
30-1000 MHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18-25 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18 -25 GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
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

$$E_{Corr} = E_{Meas} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

18.0 RADIATED RX 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.

Table 18.1 – Summary of Radiated Rx Spurious Emissions
See Appendix J Measurement Plots

Summary of Radiated Rx Emissions										
Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)
30-1000	-	Horizontal	(1)	(1) AV	-	-	0.00 (3)	(1)	-	(1)
30-1000	-	Vertical	(1)	(1) AV	-	-	0.00 (3)	(1)	-	(1)
1000-25000	-	Horizontal	(1)	(1) AV	-	-	0.00 (3)	(1)	54.0	(1)
1000-25000	-	Vertical	(1)	(1) AV	-	-	0.00 (3)	(1)	54.0	(1)
Results:									Complies	

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

(3) External Amplifier not used

$$E_{Corr} = E_{Meas} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

19.0 LINE CONDUCTED EMISSIONS

Test Procedure

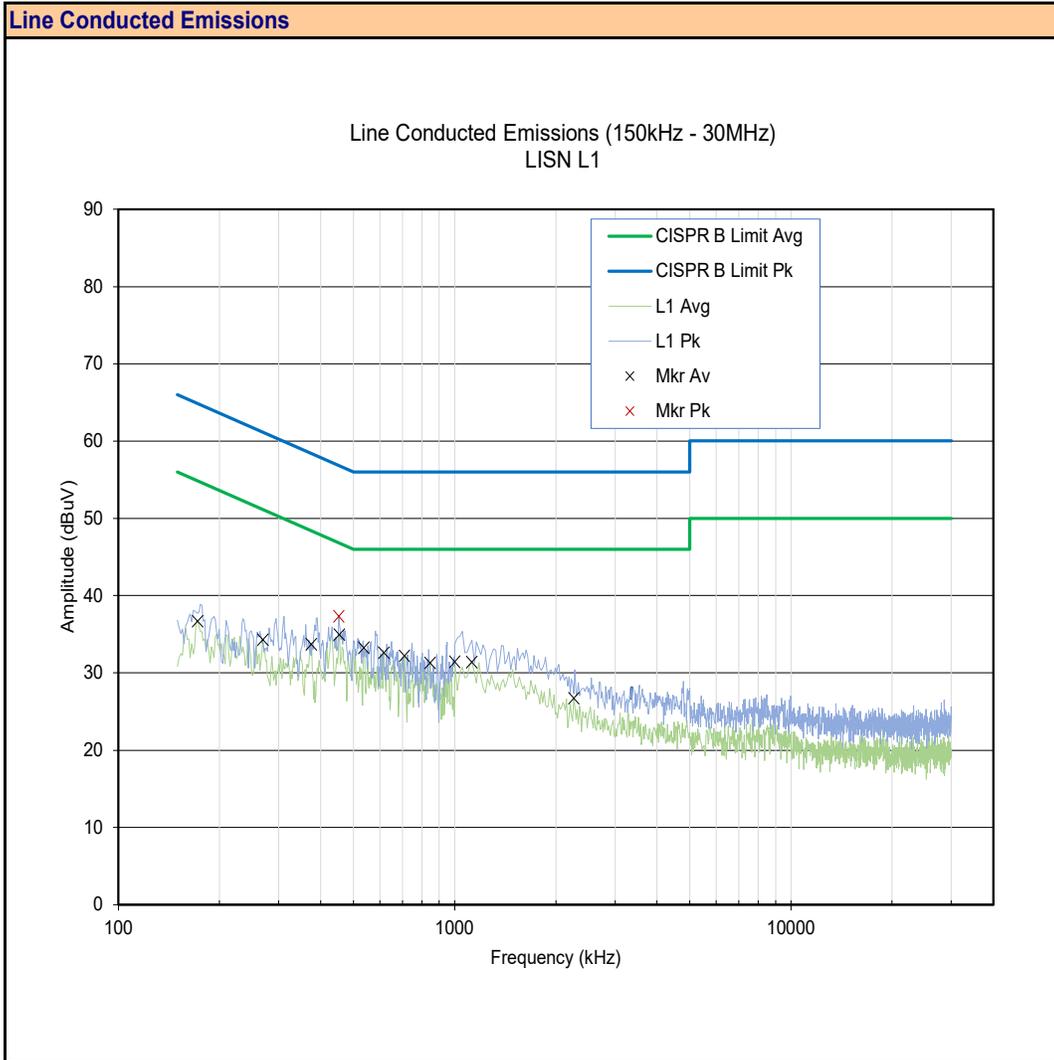
Normative Reference	FCC 47 CFR §15.107, ICES-003(6.1) ANSI C63.4-2014
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Limits

47 CFR §15.107	(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the frequency 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average
ICES-003(6.1)	6.1 - AC Power Line Conducted Emissions Limits 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 2. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average

Test Setup	Appendix A	Figure A.7
-------------------	-------------------	-------------------

Plot 19.1 – Power Line Conducted Emissions, Line 1



Plot 19.2 – Power Line Conducted Emissions, Line 2

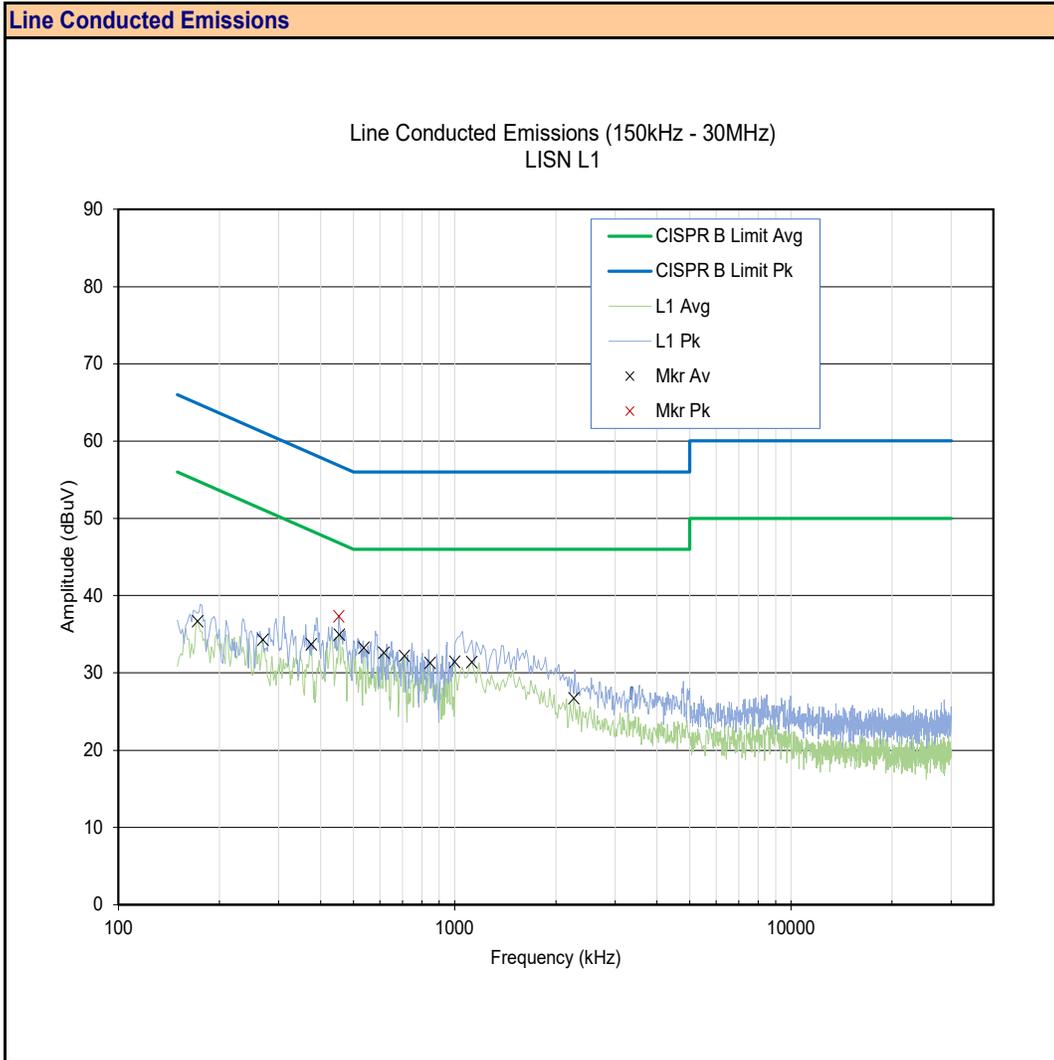


Table 19.1 – Summary of Power Line Conducted Emissions – L1

§15.107, ICES-003 (6.1)					
Emission	LISN	Detector	Corrected Emission	Limit	Margin
Frequency	Port		[E_{Corr}]*	[Limit]	[Margin]
			(W)	(dBuV/m)	(dB)
172.1 kHz	L1	Average	36.68	55.3	18.6
269.0 kHz	L1	Average	34.29	51.4	17.1
374.4 kHz	L1	Average	33.71	48.5	14.8
454.3 kHz	L1	Average	34.95	46.8	11.9
537.6 kHz	L1	Average	33.25	46.0	12.7
615.8 kHz	L1	Average	32.60	46.0	13.4
709.3 kHz	L1	Average	32.18	46.0	13.8
845.3 kHz	L1	Average	31.30	46.0	14.7
1000.0 kHz	L1	Average	31.44	46.0	14.6
1126.0 kHz	L1	Average	31.39	46.0	14.6
2260.0 kHz	L1	Average	26.71	46.0	19.3
452.6 kHz	L1	Peak	37.31	56.9	19.6
Results:				Complies	

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{Corr} = E_{Meas} + L_C + AFC$$

$$Margin = Limit - E_{Corr}$$

Table 19.1 – Summary of Power Line Conducted Emissions – L2

§15.107, ICES-003 (6.1)					
Emission	LISN	Detector	Corrected Emission	Limit	Margin
Frequency	Port		[E_{Corr}]*	[Limit]	[Margin]
			(W)	(dBuV/m)	(dB)
180.6 kHz	L2	Average	38.42	54.8	16.4
287.7 kHz	L2	Average	36.20	50.8	14.6
379.5 kHz	L2	Average	35.41	48.4	13.0
469.6 kHz	L2	Average	36.21	46.5	10.3
517.2 kHz	L2	Average	33.42	46.0	12.6
660.0 kHz	L2	Average	33.61	46.0	12.4
721.2 kHz	L2	Average	32.06	46.0	13.9
843.6 kHz	L2	Average	31.90	46.0	14.1
906.5 kHz	L2	Average	33.35	46.0	12.6
1036.0 kHz	L2	Average	31.07	46.0	14.9
2008.0 kHz	L2	Average	26.95	46.0	19.1
554.6 kHz	L2	Peak	36.17	56.0	19.8
607.3 kHz	L2	Peak	36.31	56.0	19.7
Results:				Complies	

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{\text{Corr}} = E_{\text{Meas}} + L_C + \text{AFC}$$

$$\text{Margin} = \text{Limit} - E_{\text{Corr}}$$

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

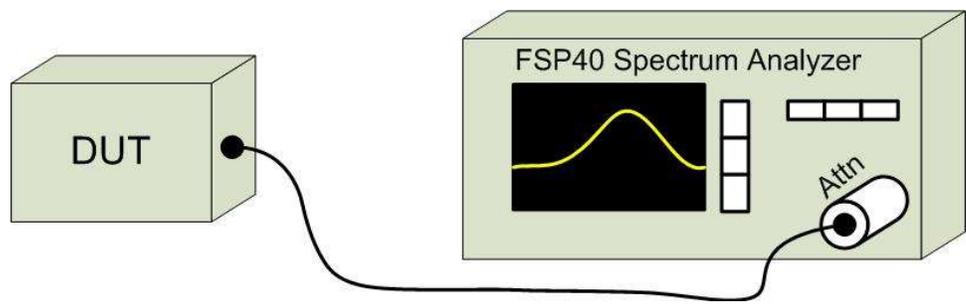


Table A.2 – Radiated Emissions Measurement Equipment

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

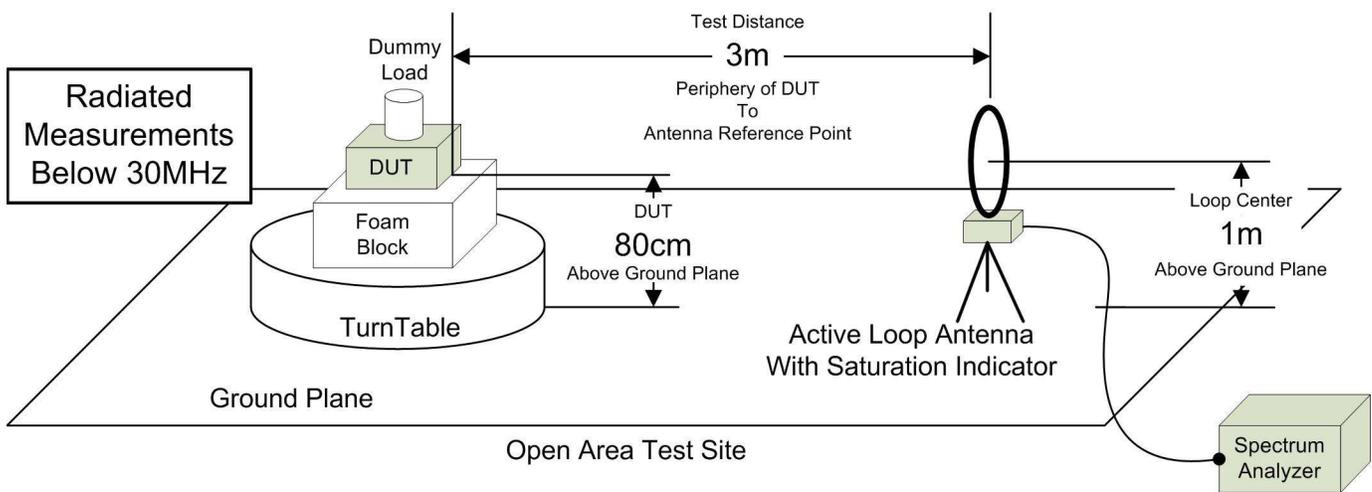


Figure A.3 – Test Setup Radiated Measurements 30MHz – 1GHz

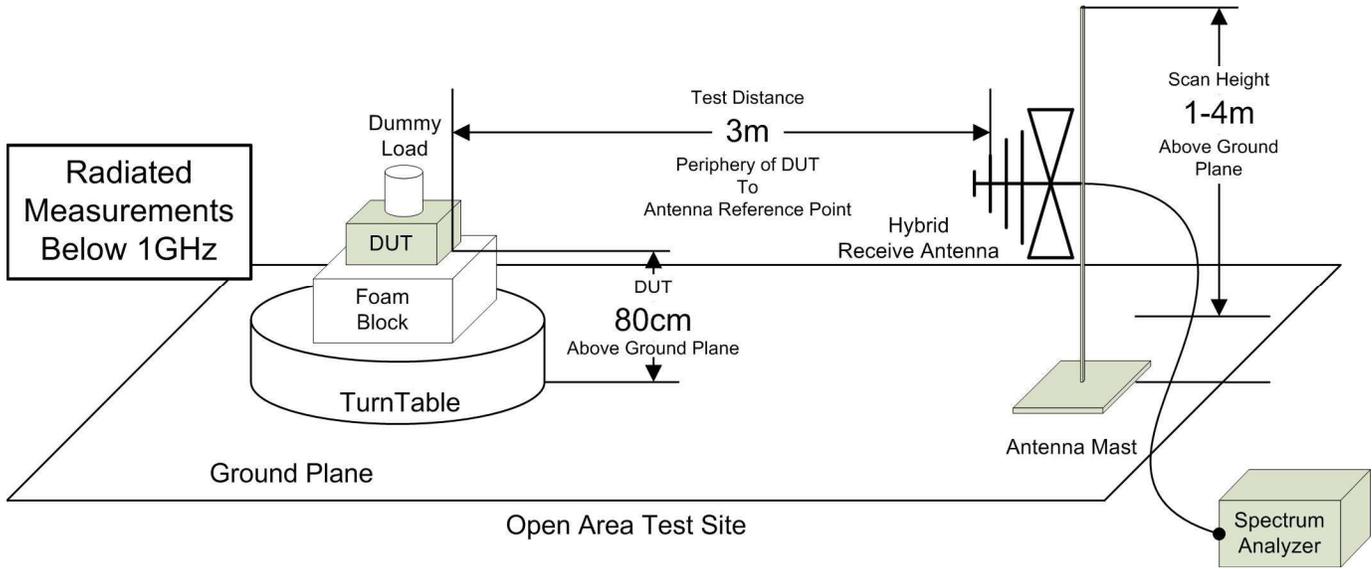


Figure A.4 – Test Setup Radiated Measurements 30MHz – 1GHz, Signal Substitution

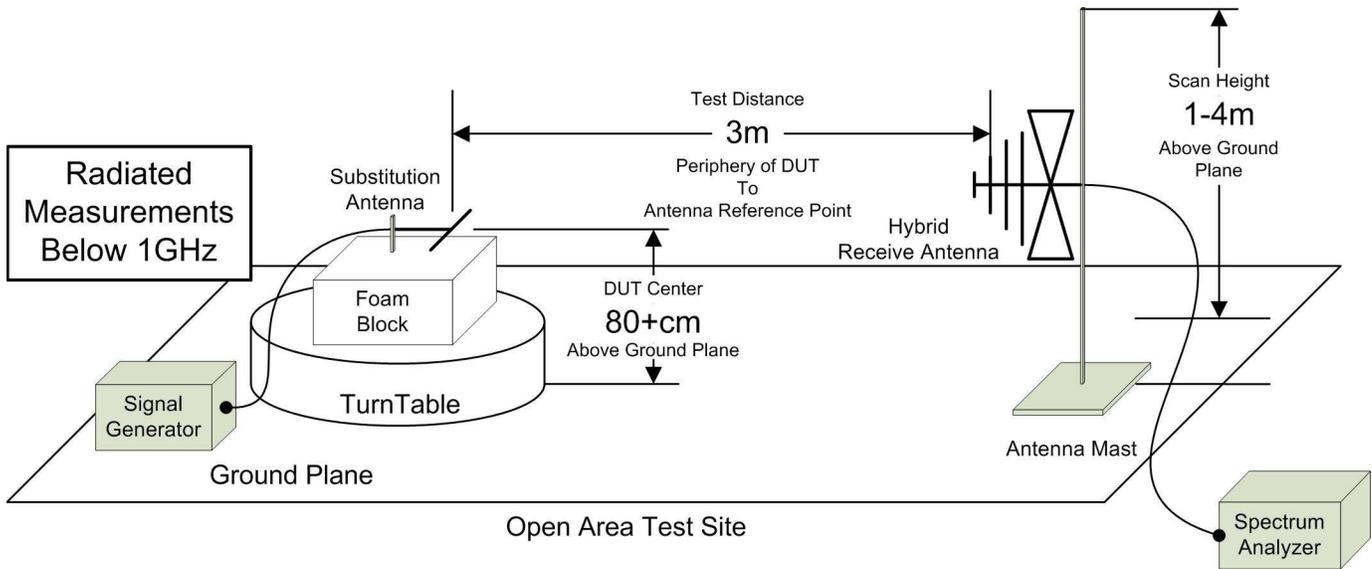


Figure A.5 – Test Setup Radiated Measurements 1 – 18GHz,

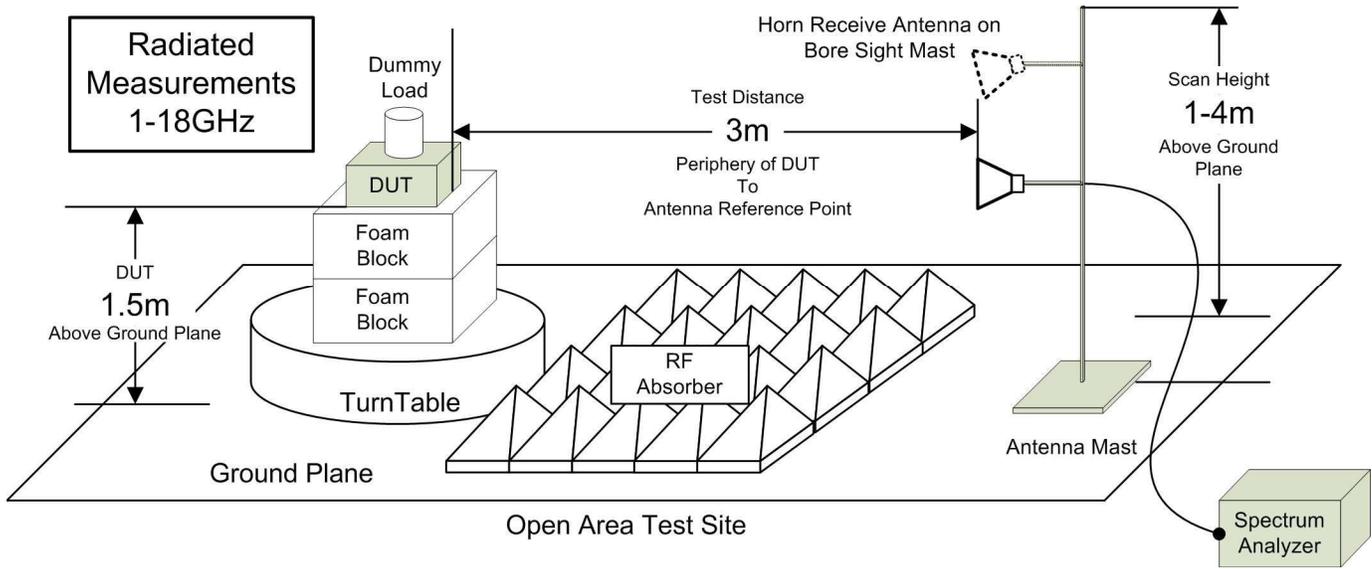


Figure A.6 – Test Setup Radiated Measurements 18 – 26.5GHz,

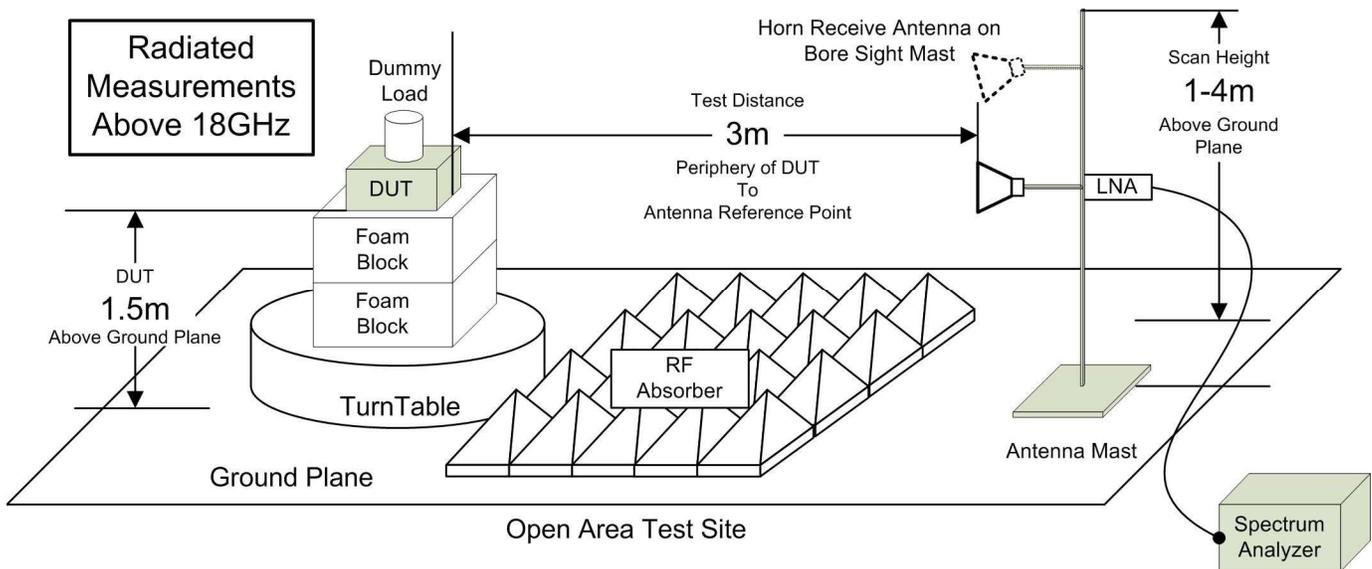


Table A.3 – Setup – Line Conducted Emissions Equipment List

Equipment List				
Asset Number	Manufacturer	Model Number	Serial Number	Description
00333	HP	85685A	3010A01095	RF Preselector
00049	HP	85650A	2043A00162	Quasi-peak Adapter
00051	HP	8566B	2747A05510	Spectrum Analyzer
00223	HP	8901A	3749A07154	Modulation Analyzer
00257	Com-Power	LI-215A	191934	LISN
00276	TMS	LMR400	n/a	4m Cable

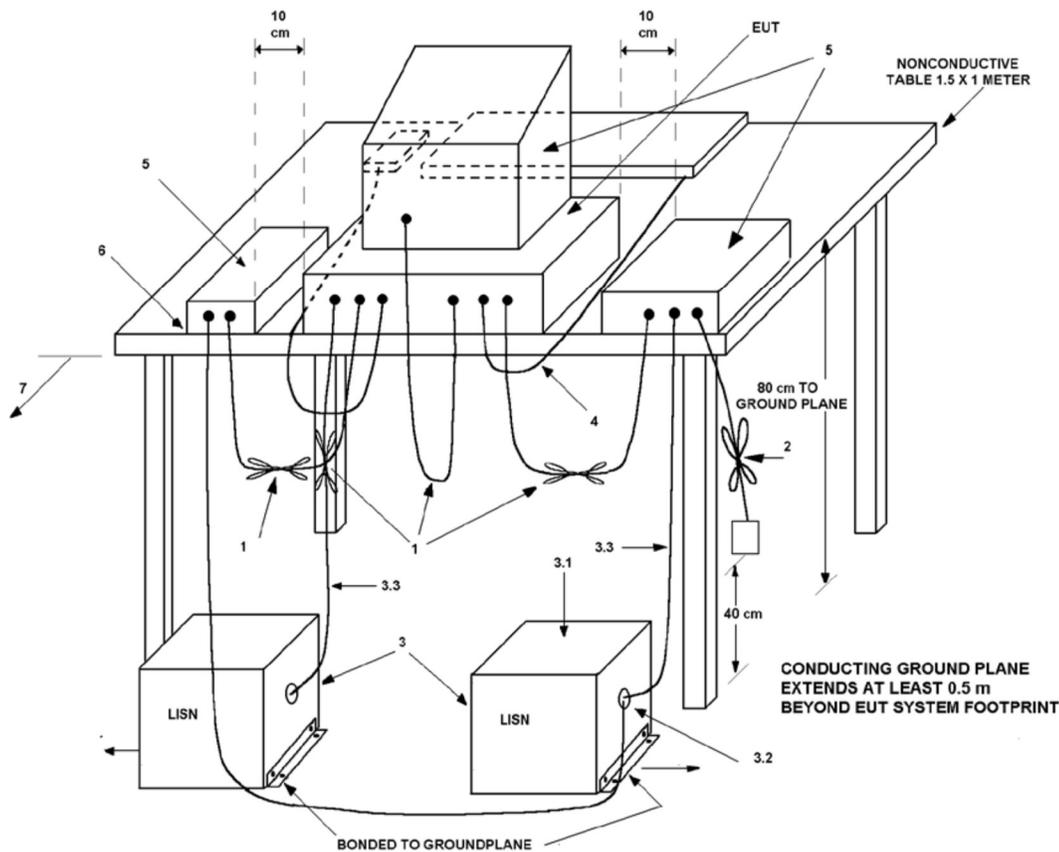


Figure A.7 – Test Setup Conducted Emissions Measurements

APPENDIX B – EQUIPMENT LIST AND CALIBRATION

Equipment List					Last Calibrated	Calibration Interval	Calibration Due
Asset Number	Manufacturer	Model Number	Serial Number	Description			
00050	Chase	CBL-6111A	1607	Bilog Antenna	16 Nov 2023	Triennial	16 Nov 2026
00035	ETS	3115	6276	Double Ridged Guide Horn	4 Mar 2022	Triennial	4 Mar 2025
00085	EMCO	6502	9203-2724	Loop Antenna	6 Sep 2022	Triennial	6 Sep 2025
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	10 Aug 2021	Triennial	10 Aug 2024
00005	HP	8648D	3847A00611	Signal Generator	28 Jun 2023	Triennial	28 Jun 2026
00003	HP	53181A	3736A05175	Frequency Counter	28 Jun 2023	Triennial	28 Jun 2026
00257	Com-Power	LI-215A	191934	LISN	27 Dec 2021	Triennial	27 Dec 2024
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
00081	ESPEC	ECT-2	0510154-B	Environmental Chamber	NCR	n/a	CNR
00234	VWR	61161-378	140320430	Temp/Humidity Meter	New	Triennial	New
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a	COU
00275	TMS	LMR400	n/a	25m Cable	COU	n/a	COU
00276	TMS	LMR400	n/a	4m 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

APPENDIX D – BANDWIDTH MEASUREMENT PLOTS

APPENDIX E – CONDUCTED POWER MEASUREMENT PLOTS

APPENDIX F – PSD MEASUREMENT PLOTS

APPENDIX G – FHSS MEASUREMENT PLOTS

APPENDIX H – CONDUCTED BAND EDGE PLOTS

APPENDIX I – CONDUCTED SPURIOUS EMISSIONS MEASUREMENT PLOTS

APPENDIX J – RADIATED TX/RX EMISSIONS MEASUREMENT PLOTS

99% Occupied Bandwidth Results: DTS					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
6	2437.0	802.11b	DSSS 5.5	14.3	14M3D1D
		802.11g	OFDM 6	16.4	16M4D1D
		802.11n	MCS0	17.5	17M5D1D
17	2440.0	BLE 1mb	GMSK	1.41	1M41G1D
17		BLE 2mb	GMSK	2.58	2M58g1D
38		ANT	GFSK	1.31	1M31F1D
Result:					Complies

99% Occupied Bandwidth

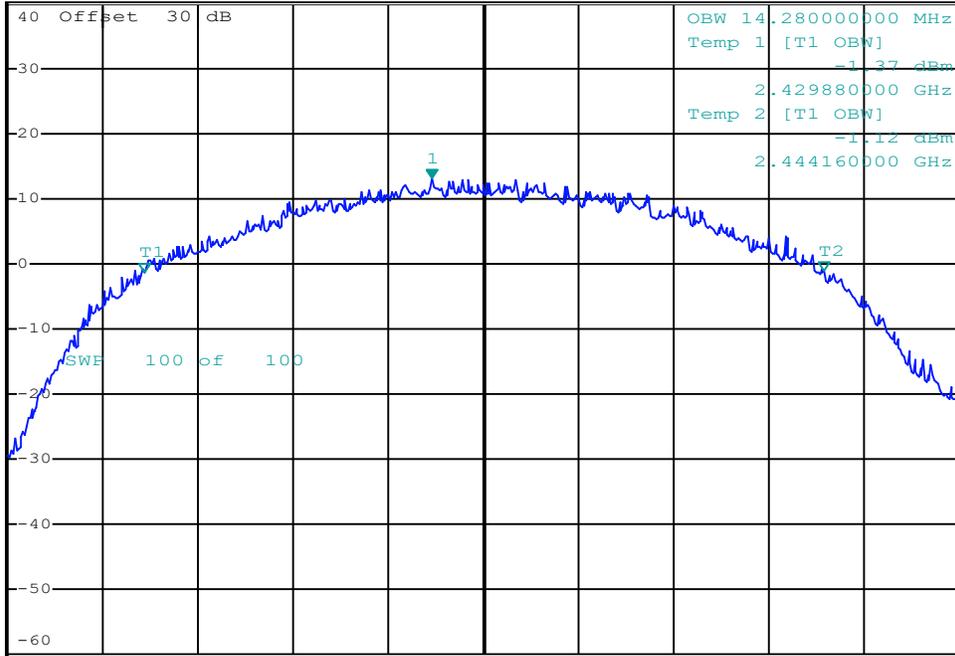


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz 13.05 dBm
 SWT 25 ms 2.435920000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Date: 16.JUL.2024 11:29:42

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: MHz

99% Occupied Bandwidth

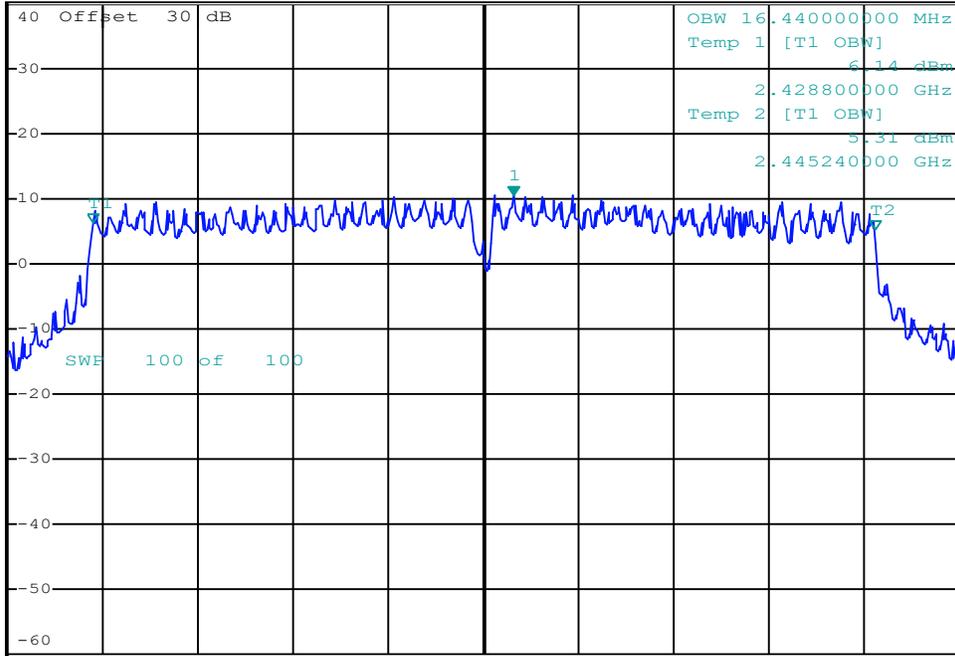


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz 10.58 dBm
 SWT 25 ms 2.437640000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Date: 16.JUL.2024 11:30:27

Channel:

Channel Frequency: MHz

Mode:

Modulation:

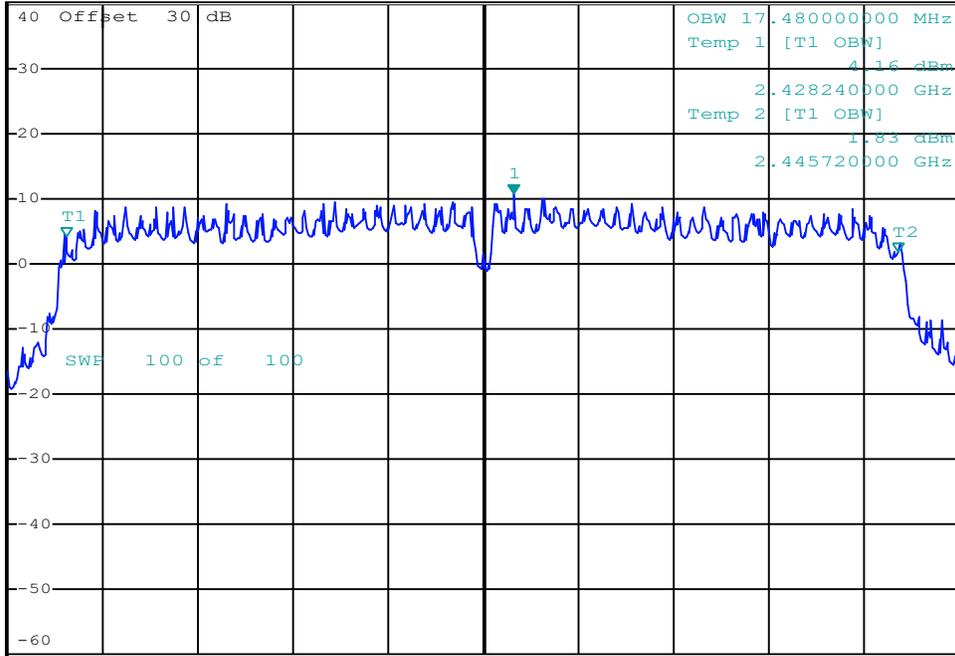
Measured Occupied Bandwidth: MHz

99% Occupied Bandwidth



*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz 10.61 dBm
 SWT 25 ms 2.437640000 GHz

Ref 40 dBm *Att 10 dB



Date: 16.JUL.2024 11:31:15

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: MHz

99% Occupied Bandwidth

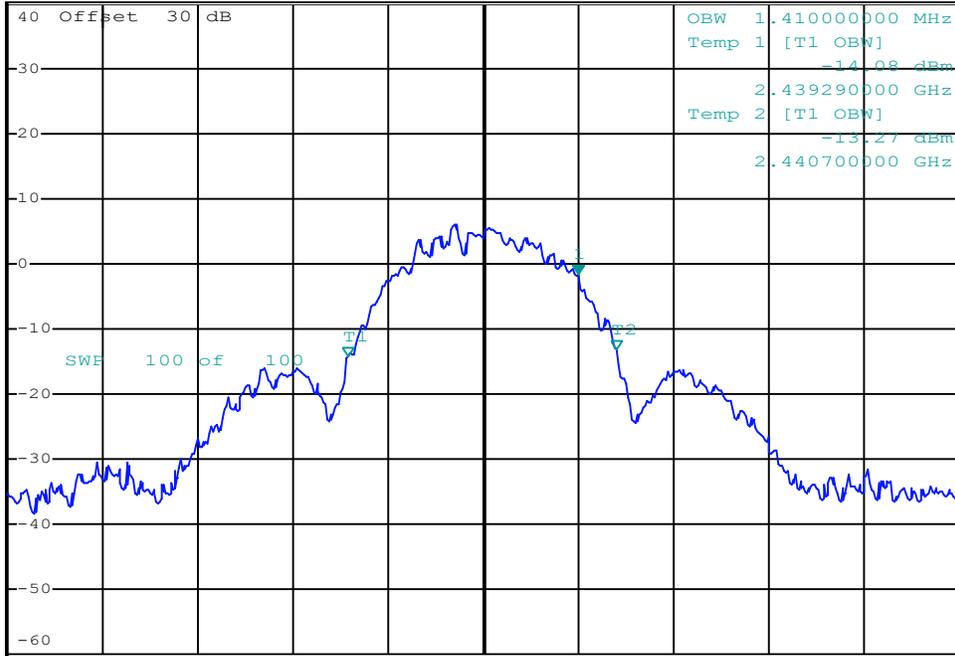


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz -1.54 dBm
 SWT 10 ms 2.440500000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Date: 11.JUL.2024 14:33:49

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: MHz

99% Occupied Bandwidth

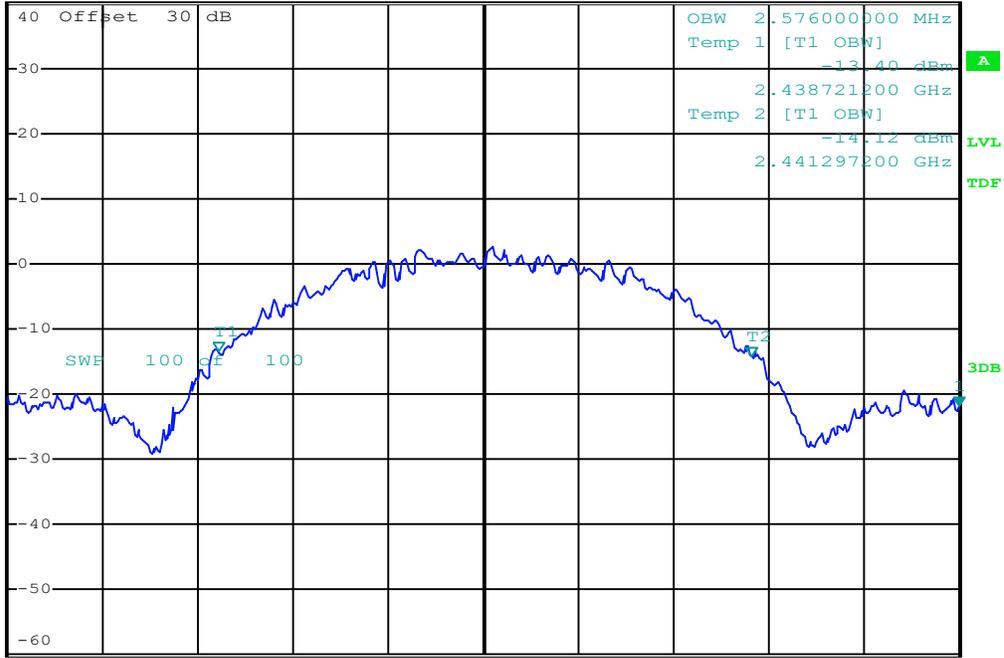


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz -21.93 dBm
 SWT 10 ms 2.442300000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Center 2.44 GHz

460 kHz/

Span 4.6 MHz

Date: 11.JUL.2024 14:28:06

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: MHz

99% Occupied Bandwidth

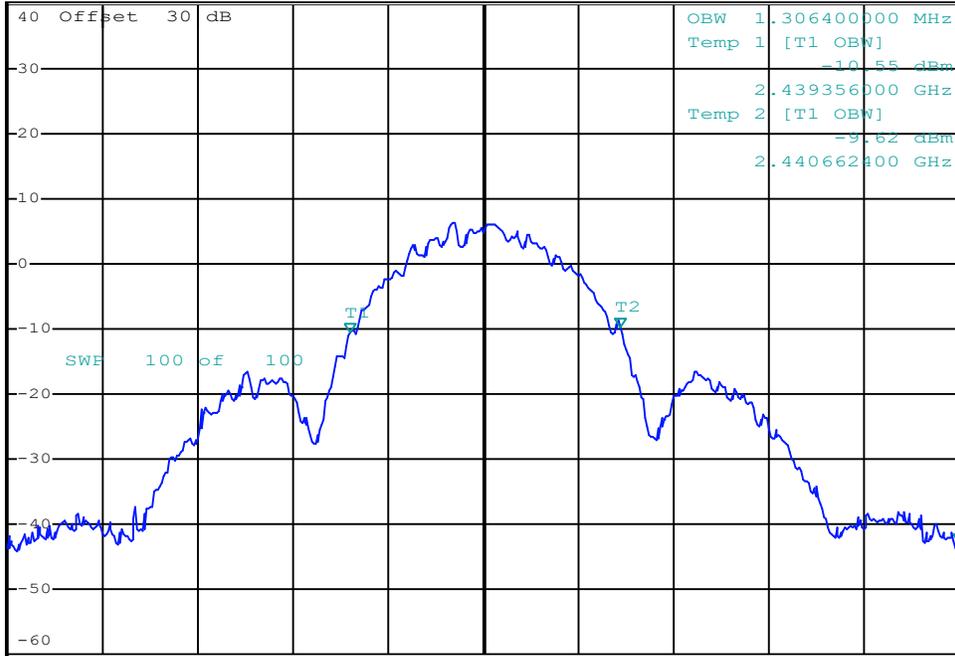


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz -42.74 dBm
 SWT 10 ms 2.442300000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Center 2.44 GHz

460 kHz/

Span 4.6 MHz

Date: 11.JUL.2024 14:29:25

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: kHz

99% Occupied Bandwidth Results: DSS					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Occupied Bandwidth (kHz)	Emission Designator
38	2440.0	BT BR	GFSK	912.0	912KF1D
38	2440.0	BT 2EDR	Pi/4-DQPSK	1100.0	1M10D1D
38	2440.0	BT 3EDR	8-DPSK	1100.0	1M10D1D
Result:					Complies

99% Occupied Bandwidth

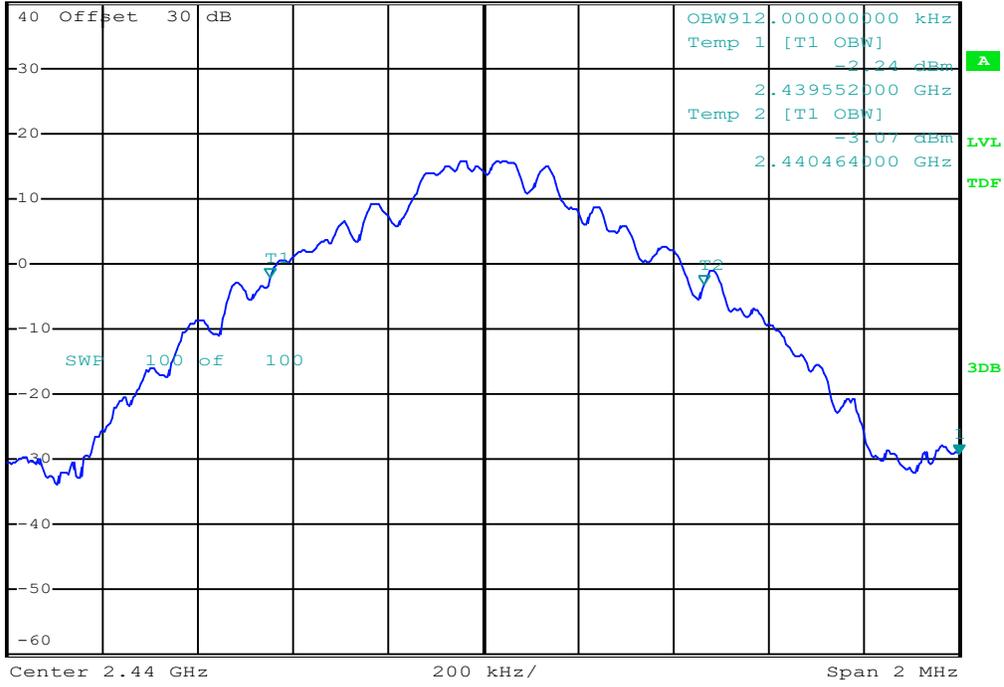


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz -29.05 dBm
 SWT 2.5 ms 2.441000000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Date: 11.JUL.2024 14:31:04

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: kHz

99% Occupied Bandwidth

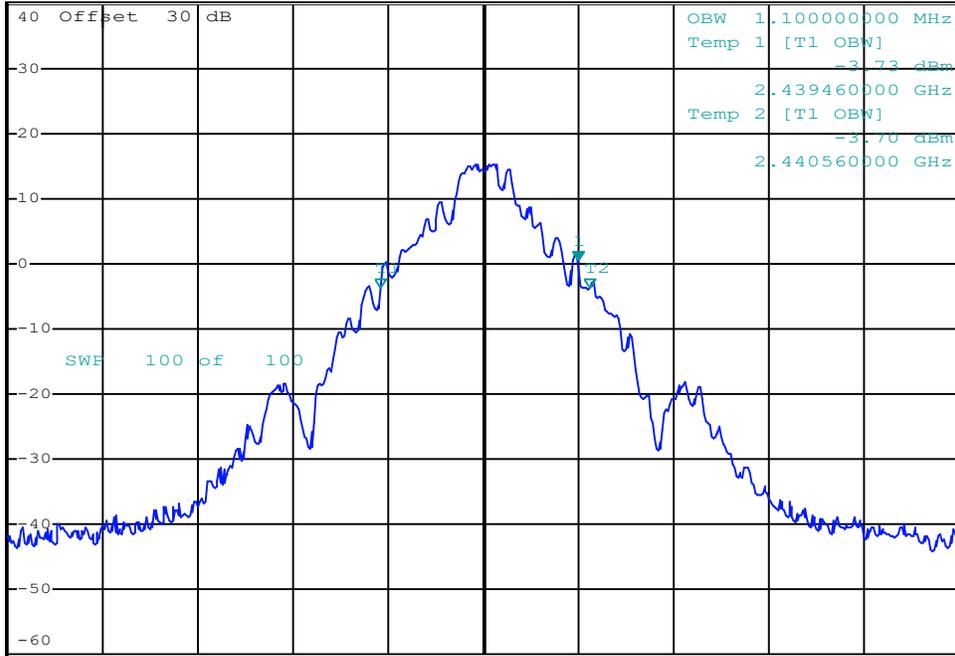


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz 0.47 dBm
 SWT 10 ms 2.440500000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Date: 11.JUL.2024 14:32:04

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: kHz

99% Occupied Bandwidth

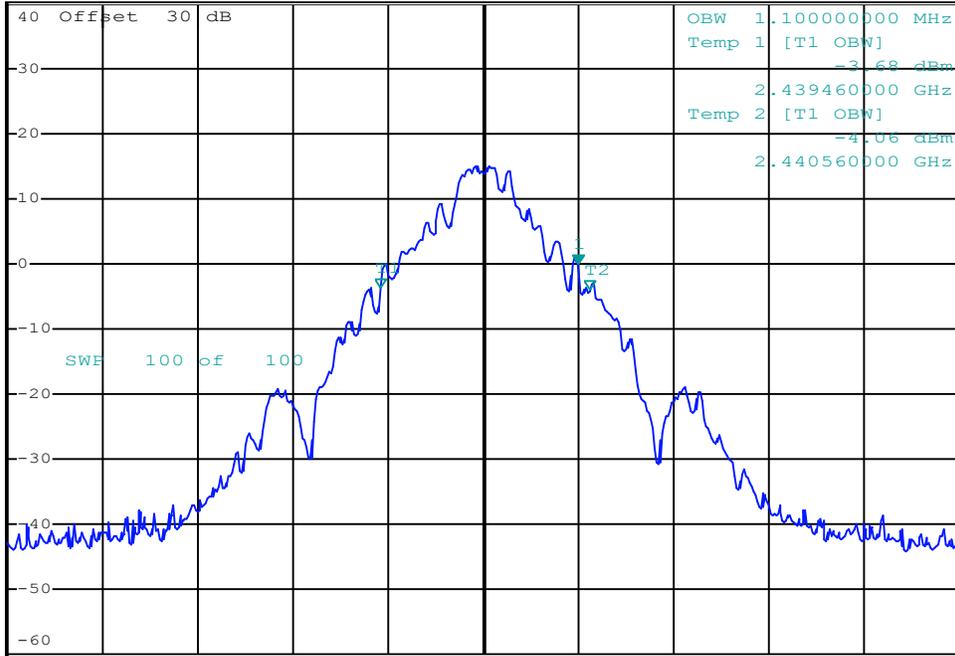


*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz 0.09 dBm
 SWT 10 ms 2.440500000 GHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Center 2.44 GHz

500 kHz/

Span 5 MHz

Date: 11.JUL.2024 14:32:50

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: kHz

DTS Bandwidth Results: (DTS)						
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured 6dB BW [BW] (MHz)	Minimum 6dB BW [BW_{Min}] (MHz)	Margin (MHz)
6	2437.0	802.11b	DSSS 5.5	6.70	0.50	6.20
		802.11g	OFDM 6	16.60		16.10
		802.11n	MCS0	17.40		16.90
17	2440.0	BLE 1mb	GMSK	0.90		0.40
17		BLE 2mb	GMSK	1.66		1.16
38		ANT	GFSK	0.84		0.34
					Result:	Complies

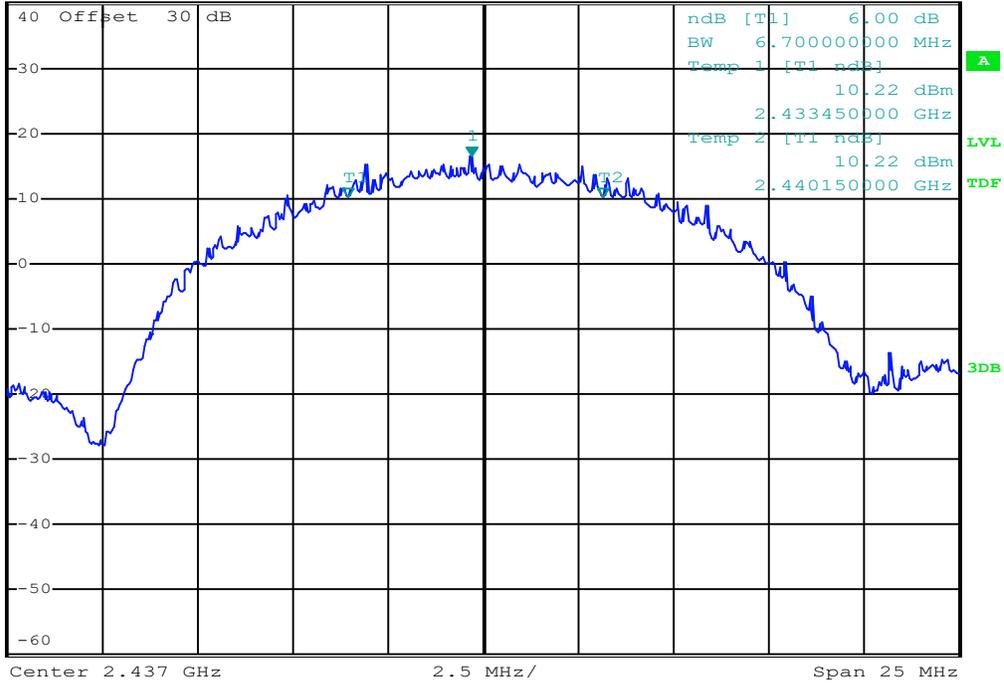
DTS (6dB) Bandwidth



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 16.47 dBm
 SWT 2.5 ms 2.436700000 GHz

Ref 40 dBm *Att 10 dB

1 PK
VIEW



Date: 16.JUL.2024 11:38:13

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Occupied Bandwidth: MHz

DTS (6dB) Bandwidth

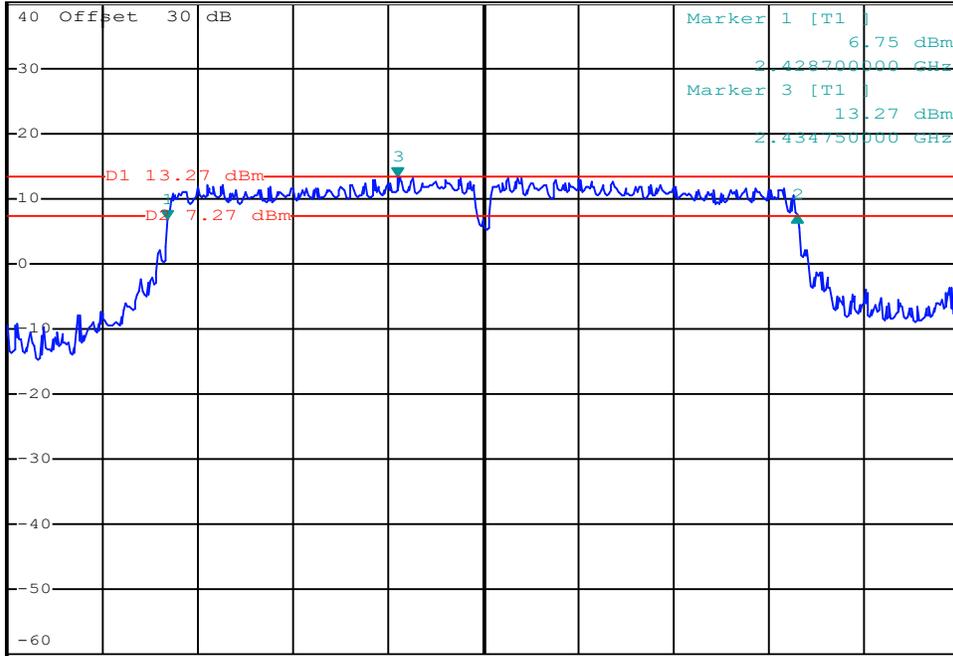


*RBW 100 kHz Delta 2 [T1]
 VBW 300 kHz 0.71 dB
 SWT 2.5 ms 16.55000000 MHz

Ref 40 dBm

*Att 10 dB

1 PK
VIEW



Date: 16.JUL.2024 11:37:13

Channel:

Mode:

Channel Frequency: MHz

Modulation:

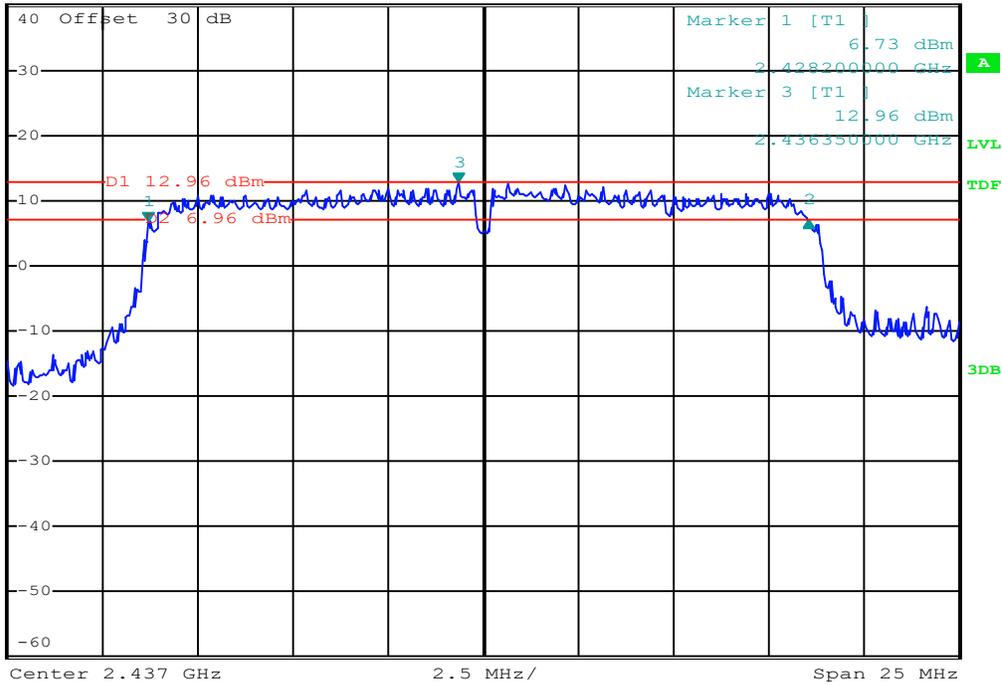
Measured Occupied Bandwidth: MHz

DTS (6dB) Bandwidth



*RBW 100 kHz Delta 2 [T1]
 VBW 300 kHz 0.43 dB
 Ref 40 dBm *Att 10 dB SWT 2.5 ms 17.350000000 MHz

1 PK
 VIEW



Date: 16.JUL.2024 11:35:36

Channel:

Channel Frequency: MHz

Mode:

Modulation:

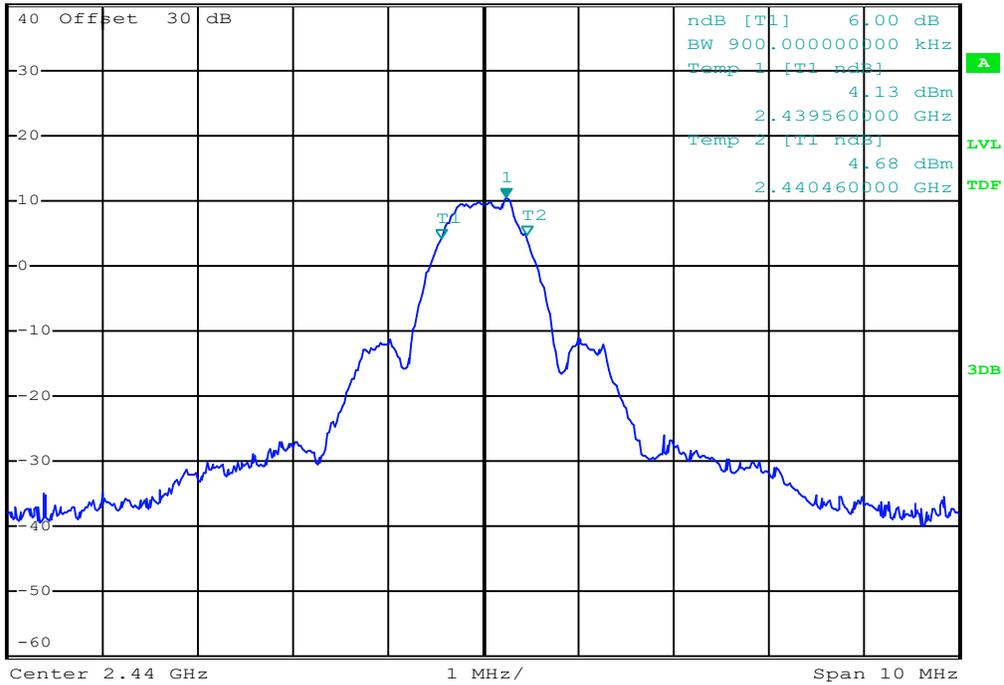
Measured Occupied Bandwidth: MHz

DTS (6dB) Bandwidth



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 10.35 dBm
 Ref 40 dBm *Att 10 dB SWT 2.5 ms 2.440240000 GHz

1 PK
VIEW



Date: 12.JUL.2024 10:34:45

Channel:

Channel Frequency: MHz

Mode:

Modulation:

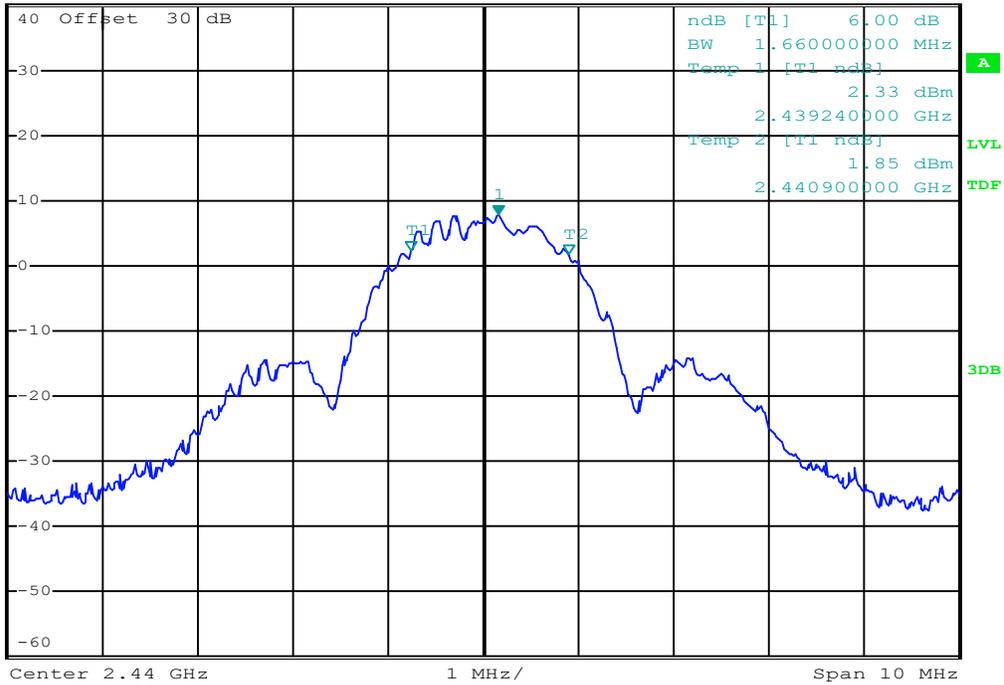
Measured Occupied Bandwidth: MHz

DTS (6dB) Bandwidth



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 7.76 dBm
 Ref 40 dBm *Att 10 dB SWT 2.5 ms 2.440160000 GHz

1 PK
VIEW



Date: 12.JUL.2024 10:35:25

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Occupied Bandwidth: MHz

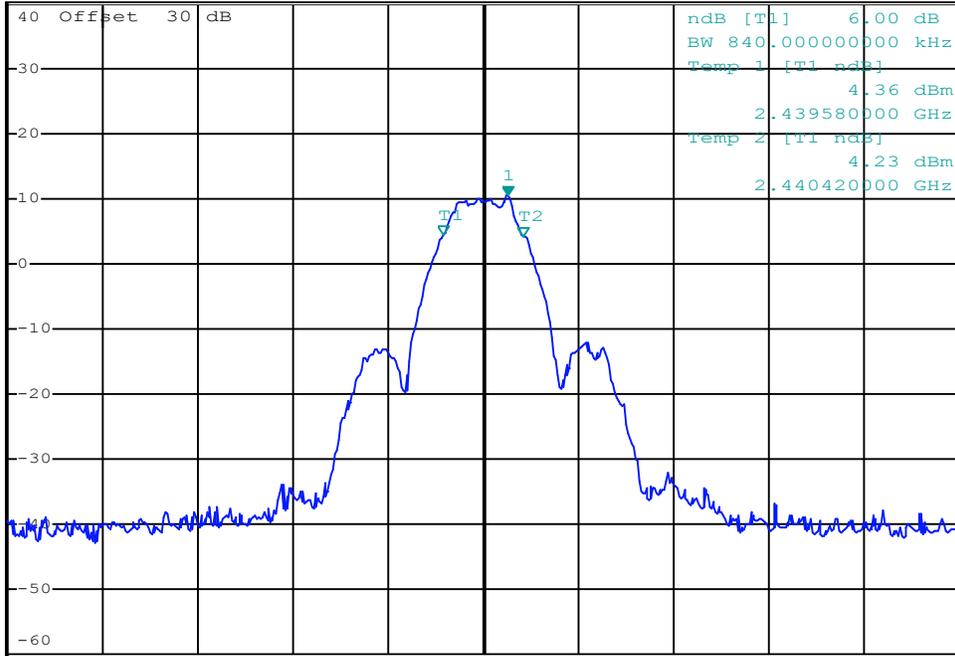
DTS (6dB) Bandwidth



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 10.39 dBm
 SWT 2.5 ms 2.440260000 GHz

Ref 40 dBm *Att 10 dB

1 PK
VIEW



Center 2.44 GHz 1 MHz/ Span 10 MHz

Date: 12.JUL.2024 11:27:47

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: MHz

DTS Bandwidth Results: (DSS)					
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured 6dB BW [BW] (kHz)	Margin
38	2440.0	BT BR	GFSK	500.00	n/a
		BT 2EDR	Pi/4-DQPSK	500.00	
		BT 3EDR	8-DPSK	500.00	
Result:					Complies

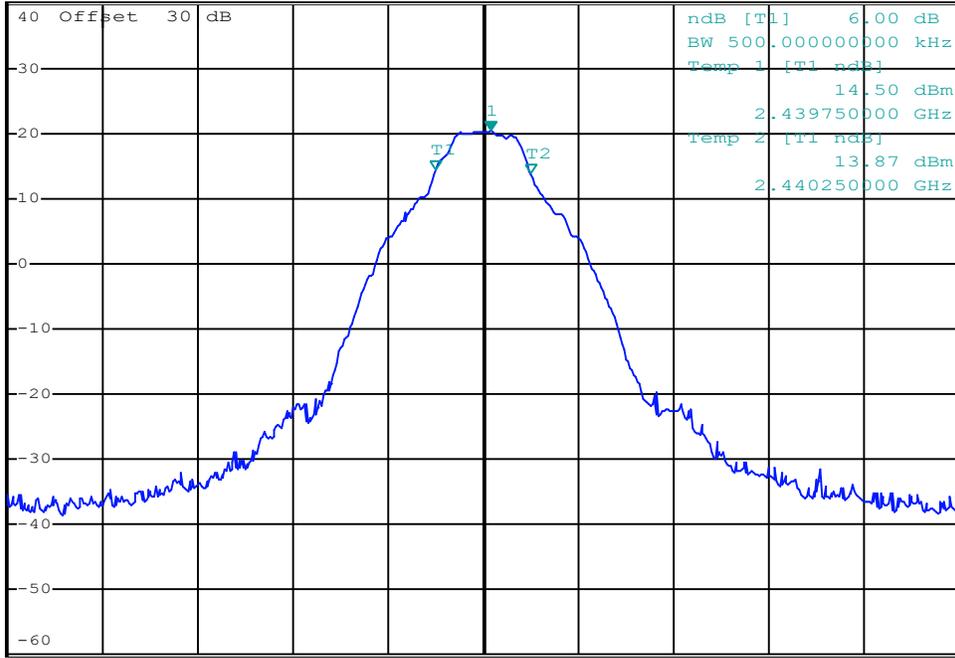
DTS (6dB) Bandwidth



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 20.37 dBm
 SWT 2.5 ms 2.440040000 GHz

Ref 40 dBm *Att 10 dB

1 PK
VIEW



Center 2.44 GHz

500 kHz/

Span 5 MHz

Date: 12.JUL.2024 11:28:33

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: kHz

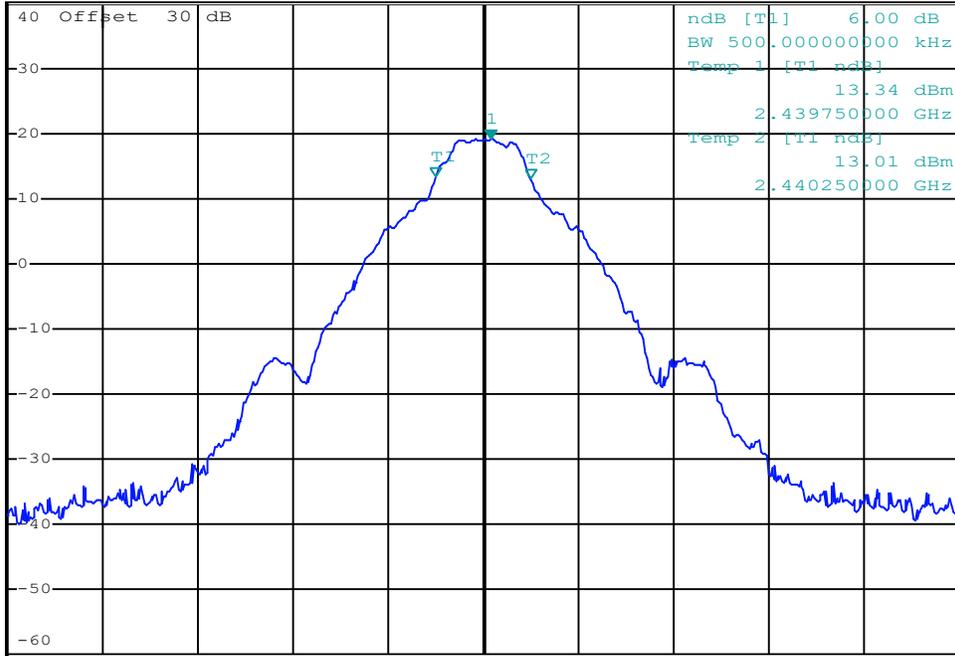
DTS (6dB) Bandwidth



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 19.12 dBm
 SWT 2.5 ms 2.440040000 GHz

Ref 40 dBm *Att 10 dB

1 PK
VIEW



Center 2.44 GHz

500 kHz/

Span 5 MHz

Date: 12.JUL.2024 11:29:03

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: kHz

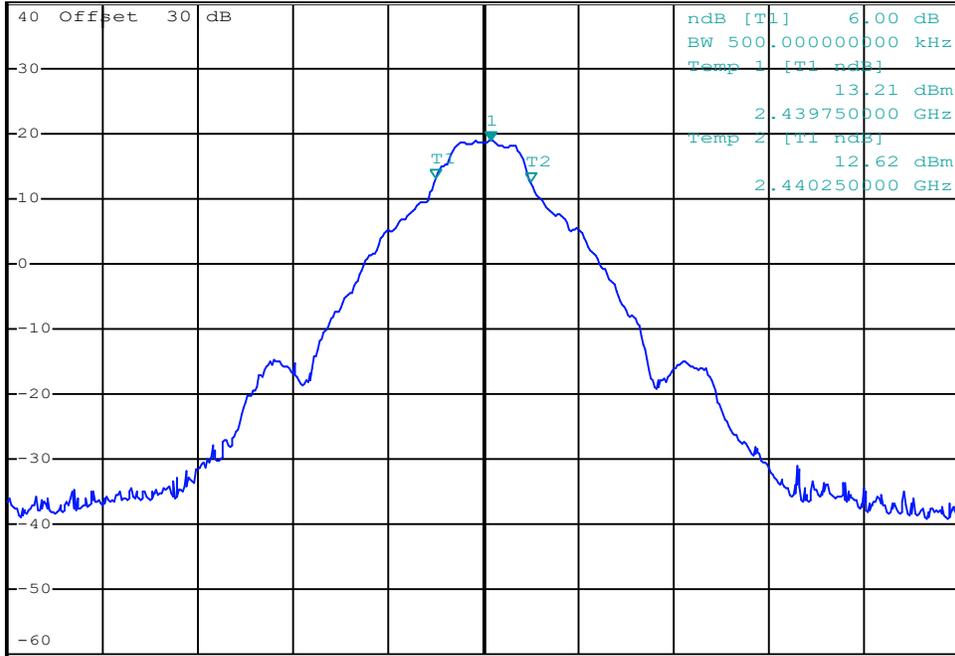
DTS (6dB) Bandwidth



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 18.82 dBm
 SWT 2.5 ms 2.440040000 GHz

Ref 40 dBm *Att 10 dB

1 PK
VIEW



Center 2.44 GHz

500 kHz/

Span 5 MHz

Date: 12.JUL.2024 11:29:35

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Occupied Bandwidth: kHz

Conducted Power Measurement Results: DTS

Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Power [P _{Meas}] (dBm)	Limit [P _{Lim}] (dBm)	Conducted Margin (dB)	Antenna Gain [G] (dBi)	EIRP [E _{Meas}] (dBm)	EIRP Limit [E _{Lim}] (dBm)	EIRP Margin (dB)				
6	2437.00	802.11b	CCK 1	15.980	30	14.0	-5.8	10.2	36	25.8				
			CCK 2	16.460		13.5		10.7		25.3				
			DSSS 5.5	16.520		13.5		10.7		25.3				
			DSSS 11	16.350		13.7		10.6		25.5				
1	2412.00					15.500				14.5		9.7	26.3	
9	2452.00					16.830				13.2		11.0	25.0	
10	2452.00			DSSS 5.5		13.880				16.1		8.1	27.9	
11	2462.00					13.070				16.9		7.3	28.7	
12	2467.00					9.100				20.9		3.3	32.7	
13	2472.00					4.830				25.2		-1.0	37.0	
6	2437.00		802.11g	OFDM6		15.760		30		14.2	-5.8	10.0	36	26.0
				OFDM9		15.710				14.3		9.9		26.1
		OFDM12		15.680	14.3	9.9	26.1							
1	2412.00				15.110		14.9			9.3		26.7		
9	2452.00				15.210		14.8			9.4		26.6		
10	2457.00				12.890		17.1			7.1		28.9		
11	2462.00			OFDM6	11.640		18.4			5.8		30.2		
12	2467.00				8.830		21.2			3.0		33.0		
13	2472.00				7.960		22.0			2.2		33.8		
6	2437.00	802.11n		MCS0	16.090	30	13.9		-5.8	10.3		36		25.7
				MCS3	15.370		14.6			9.6				26.4
				MCS7	11.450		18.6			5.7				30.4
1	2412.00				14.580			15.4			8.8		27.2	
9	2452.00				14.100			15.9			8.3		27.7	
10	2457.00				14.100			15.9			8.3		27.7	
11	2462.00			MCS0	12.430			17.6			6.6		29.4	
12	2467.00				8.830			21.2			3.0		33.0	
13	2472.00				7.990			22.0			2.2		33.8	
Result:										Complies				

Conducted Margin = Conducted Limit [P_{Lim}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Conducted Power Measurement Results: DTS

Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Power [P _{Meas}] (dBm)	Limit [P _{Lim}] (dBm)	Conducted Margin (dB)	Antenna Gain [G] (dBi)	EIRP [E _{Meas}] (dBm)	EIRP Limit [E _{Lim}] (dBm)	EIRP Margin (dB)
37	2402.00	BLE 1mb	GMSK	-2.420	30	32.4	-5.8	-8.2	36	44.2
17	2440.00			1.830		28.2		-4.0		40.0
39	2480.00			-1.170		31.2		-7.0		43.0
1	2404.00	BLE 2mb	GMSK	1.100		28.9		-4.7		40.7
17	2440.00			2.010		28.0		-3.8		39.8
36	2478.00			-1.020		31.0		-6.8		42.8
2	2402.00	ANT	GFSK	-2.360		32.4		-8.2		44.2
38	2440.00			2.080		27.9		-3.7		39.7
80	2480.00			-1.080		31.1		-6.9		42.9
Result:										Complies

Conducted Margin = Conducted Limit [P_{Lim}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Conducted Power:

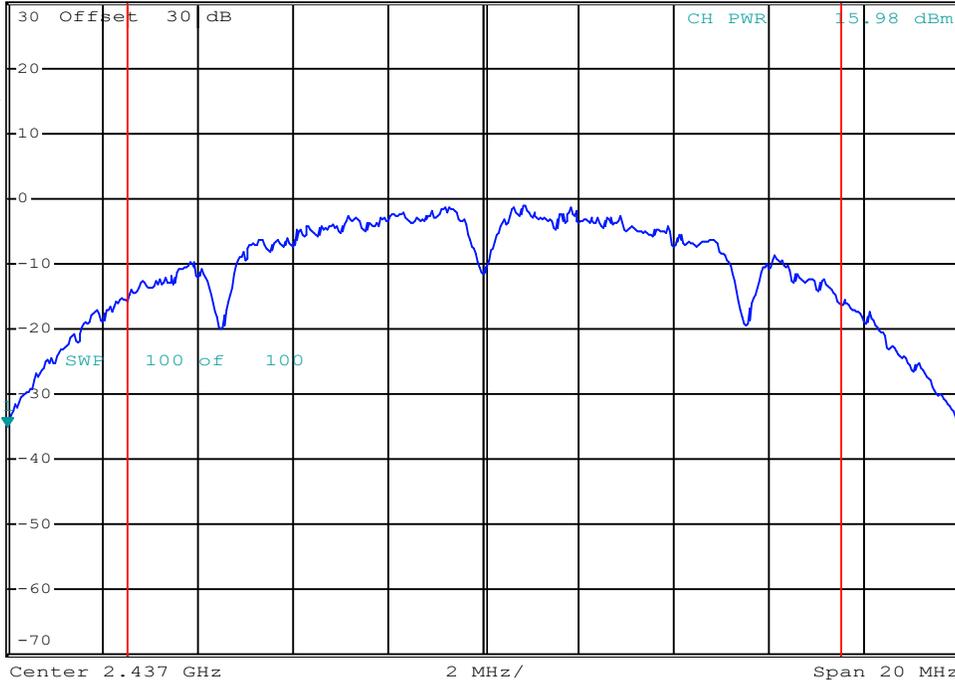


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.91 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 16:06:35

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

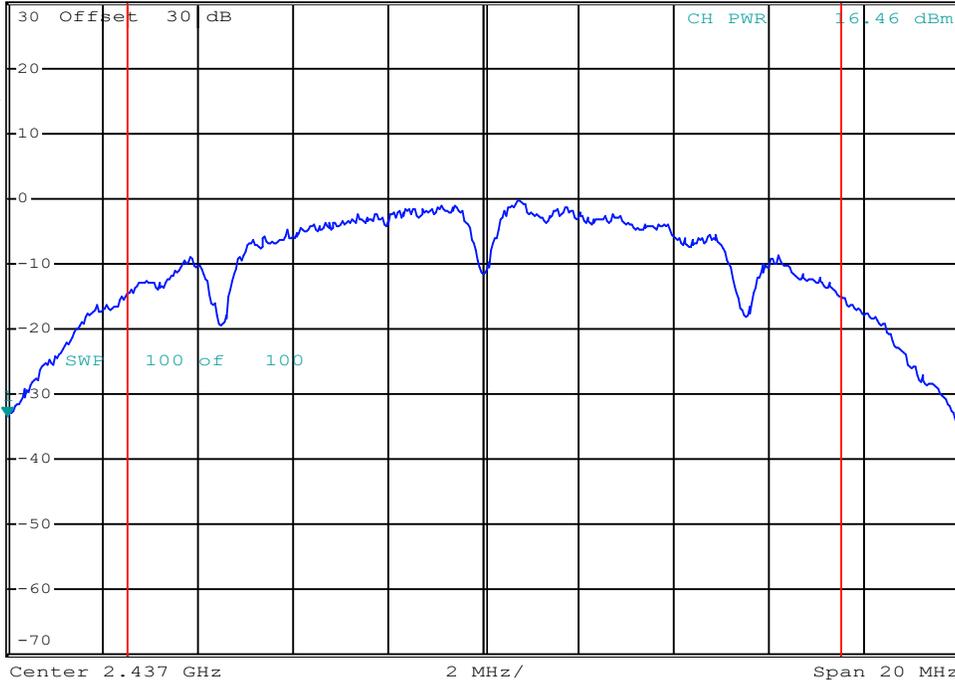


*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -33.44 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 16:02:20

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

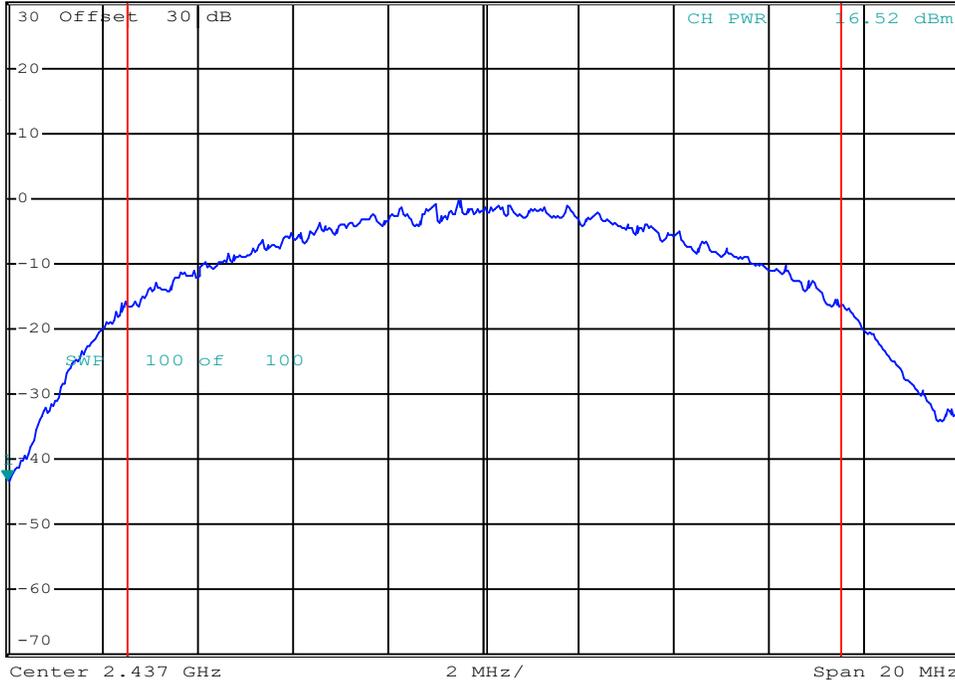


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -43.18 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 16:03:15

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

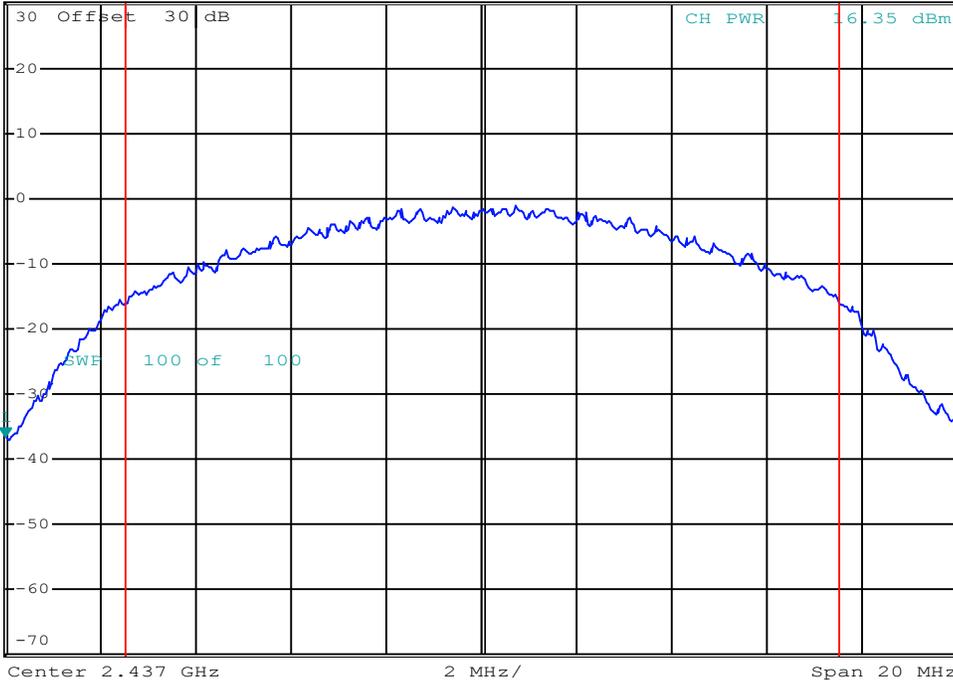


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -36.59 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 16:04:06

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

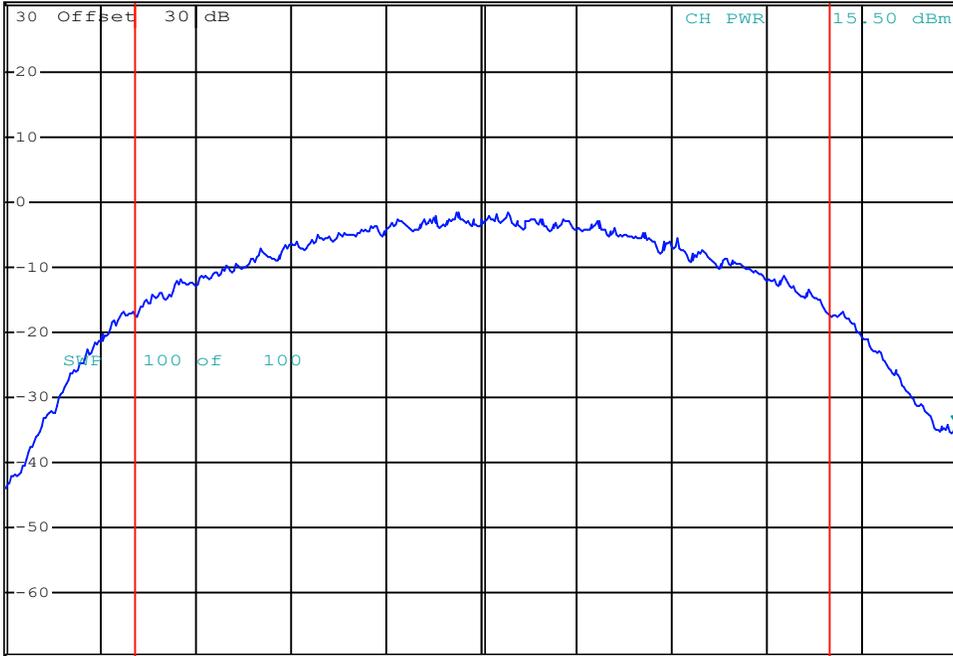
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -34.16 dBm
SWT 2.5 ms 2.422000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Center 2.412 GHz 2 MHz/ Span 20 MHz

Date: 18.JUN.2024 17:59:53

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

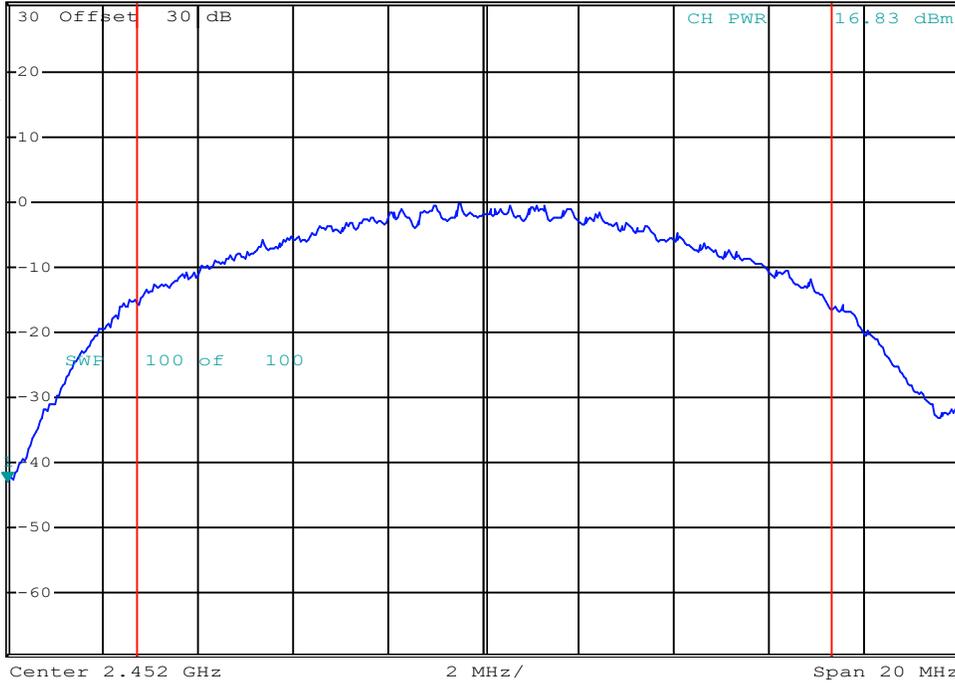
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -42.94 dBm
SWT 2.5 ms 2.442000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 18:01:53

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

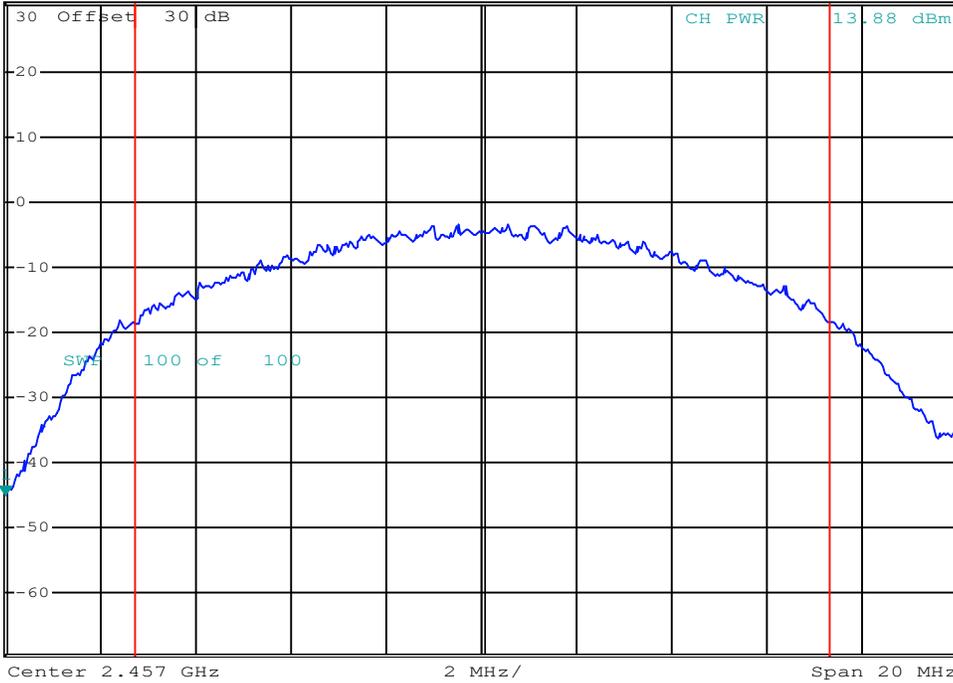
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -44.97 dBm
SWT 2.5 ms 2.447000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 18:02:36

Channel: 10

Mode: 802.11b

Channel Frequency: 2452 MHz

Modulation: DSSS 5.5

Measured Channel Power: 13.88 dBm

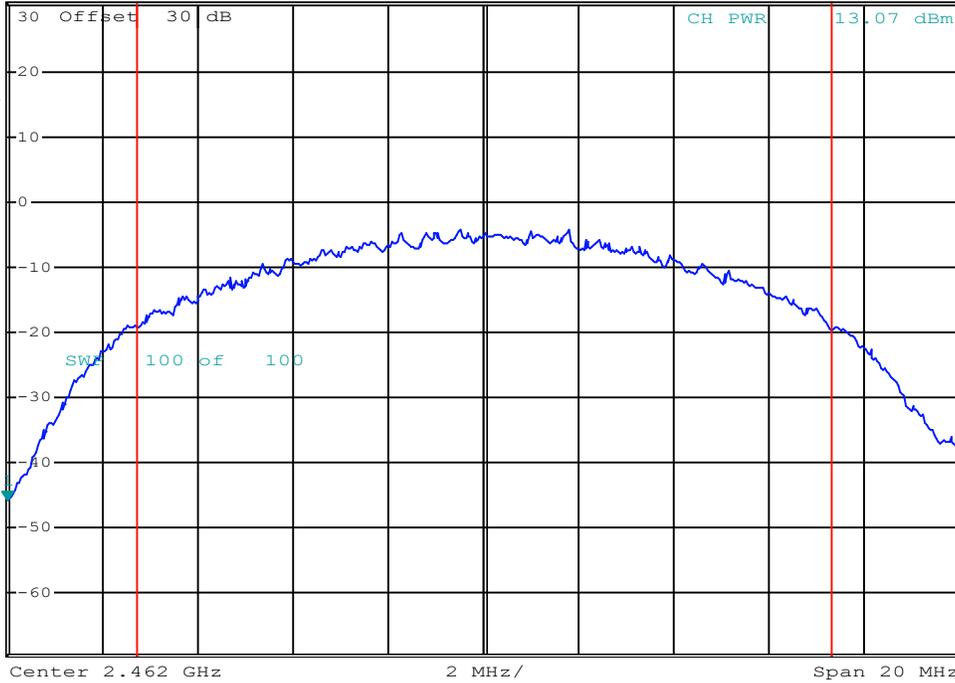
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -45.77 dBm
SWT 2.5 ms 2.452000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 18:03:14

Channel: 11

Mode: 802.11b

Channel Frequency: 2462 MHz

Modulation: DSSS 5.5

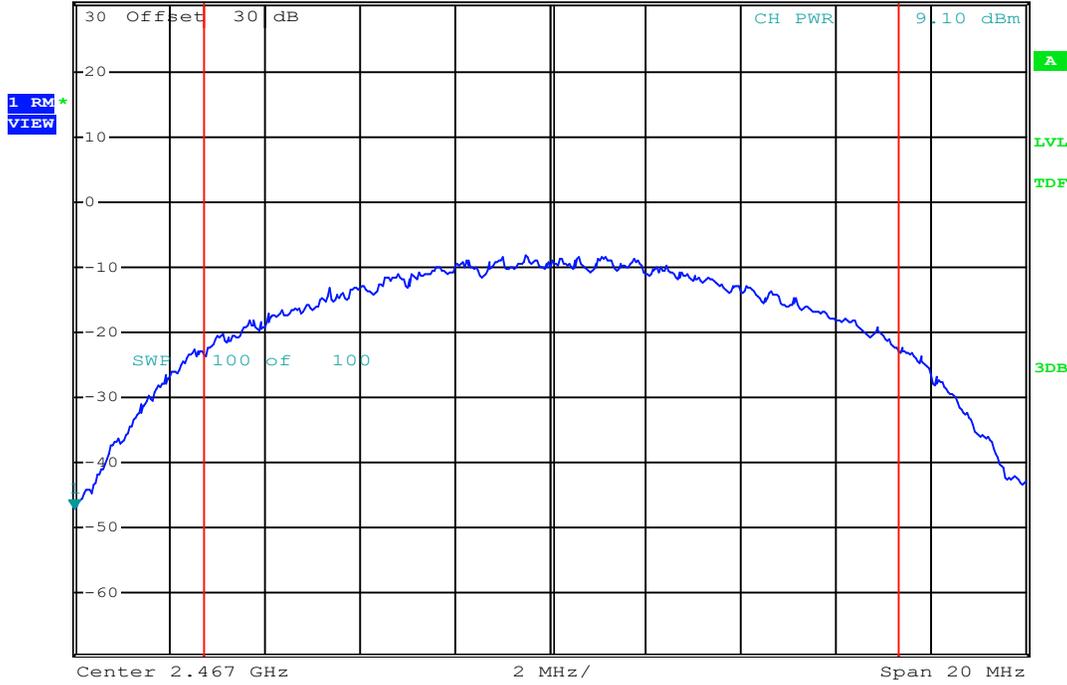
Measured Channel Power: 13.07 dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -47.00 dBm
SWT 2.5 ms 2.457000000 GHz

Ref 30.5 dBm *Att 10 dB



Date: 18.JUN.2024 18:03:54

Channel:

Mode:

Channel Frequency: MHz

Modulation:

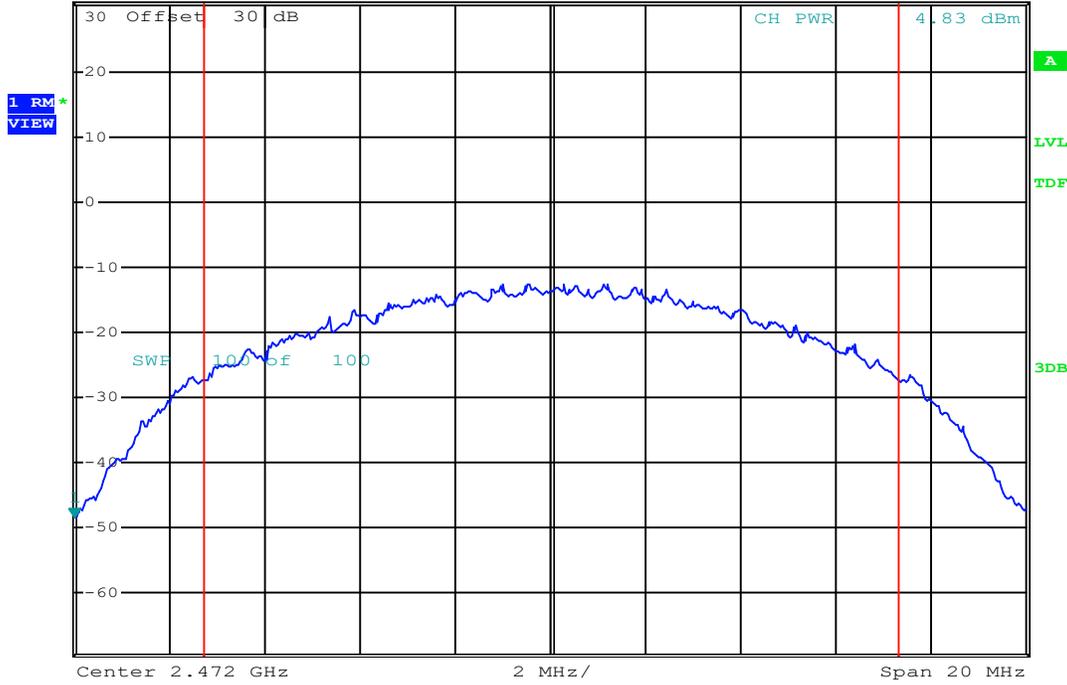
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -48.34 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 30.5 dBm *Att 10 dB



Date: 18.JUN.2024 18:04:30

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

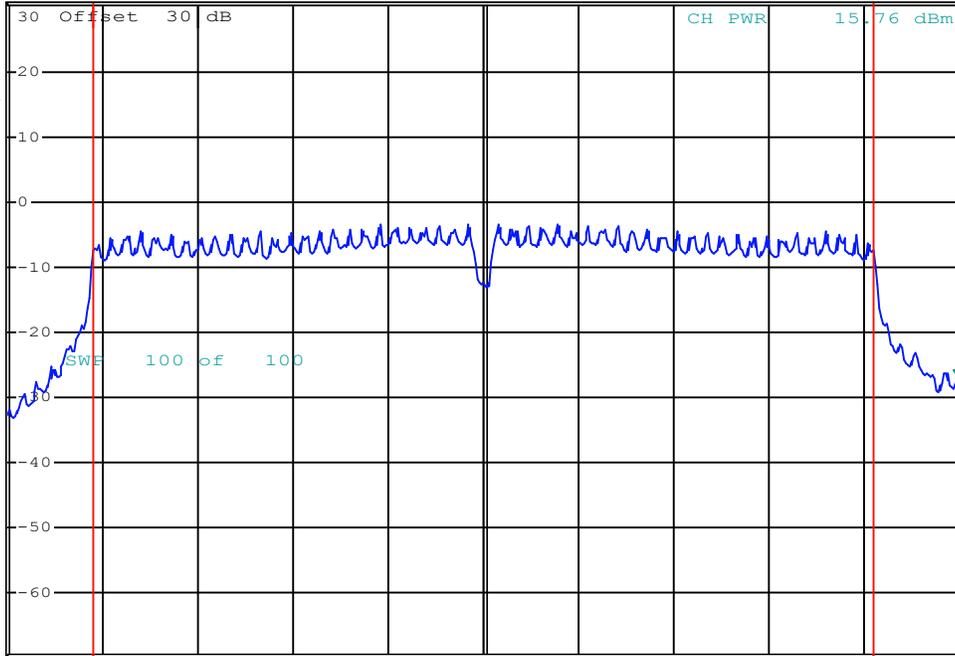
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -27.02 dBm
SWT 2.5 ms 2.447000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Center 2.437 GHz 2 MHz/ Span 20 MHz

Date: 18.JUN.2024 19:24:11

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

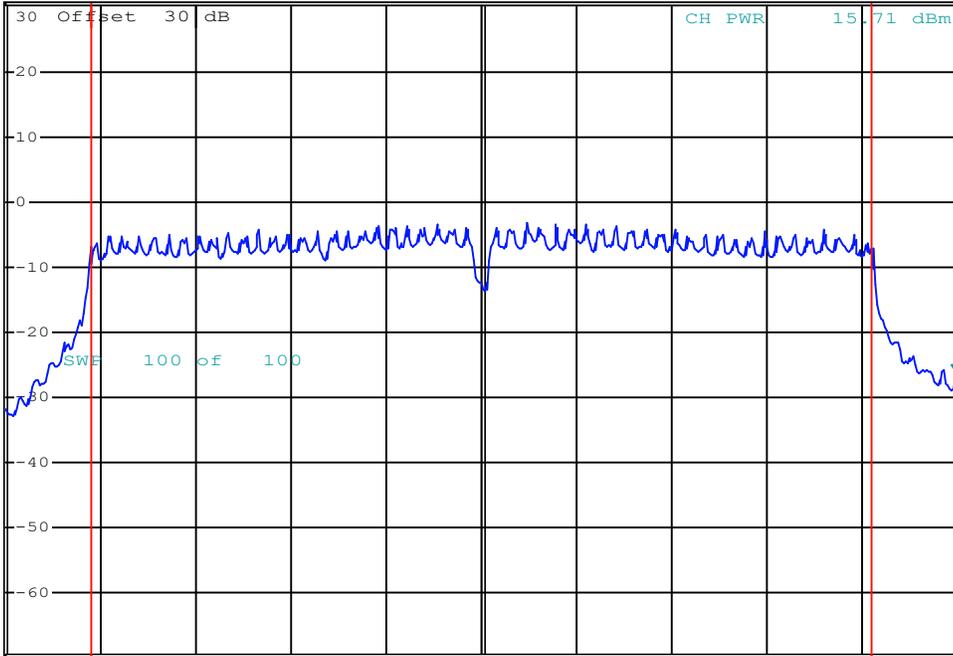
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -26.28 dBm
SWT 2.5 ms 2.447000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Center 2.437 GHz 2 MHz/ Span 20 MHz

Date: 18.JUN.2024 19:24:44

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

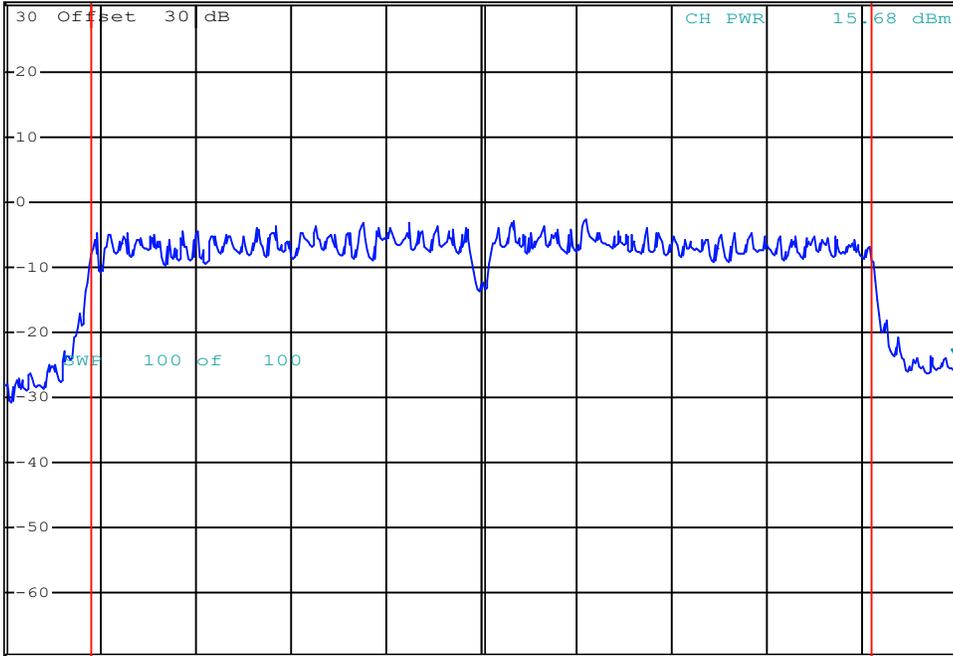
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -23.95 dBm
SWT 2.5 ms 2.447000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Center 2.437 GHz 2 MHz/ Span 20 MHz

Date: 18.JUN.2024 19:27:52

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

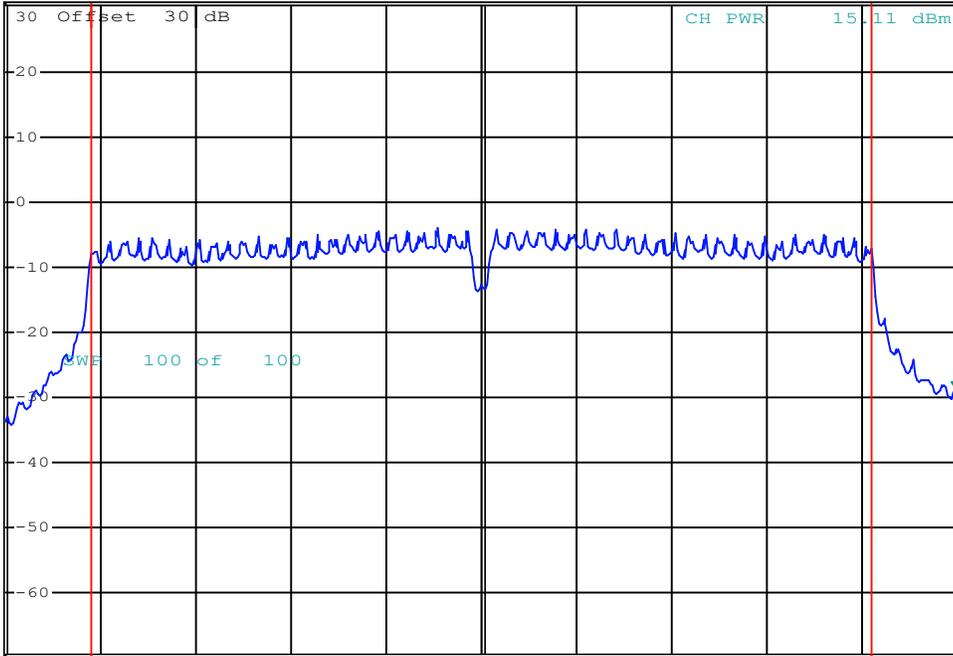
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -28.87 dBm
SWT 2.5 ms 2.422000000 GHz

Ref 30.5 dBm *Att 10 dB

1 RM*
VIEW



Center 2.412 GHz 2 MHz/ Span 20 MHz

Date: 18.JUN.2024 19:29:03

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:

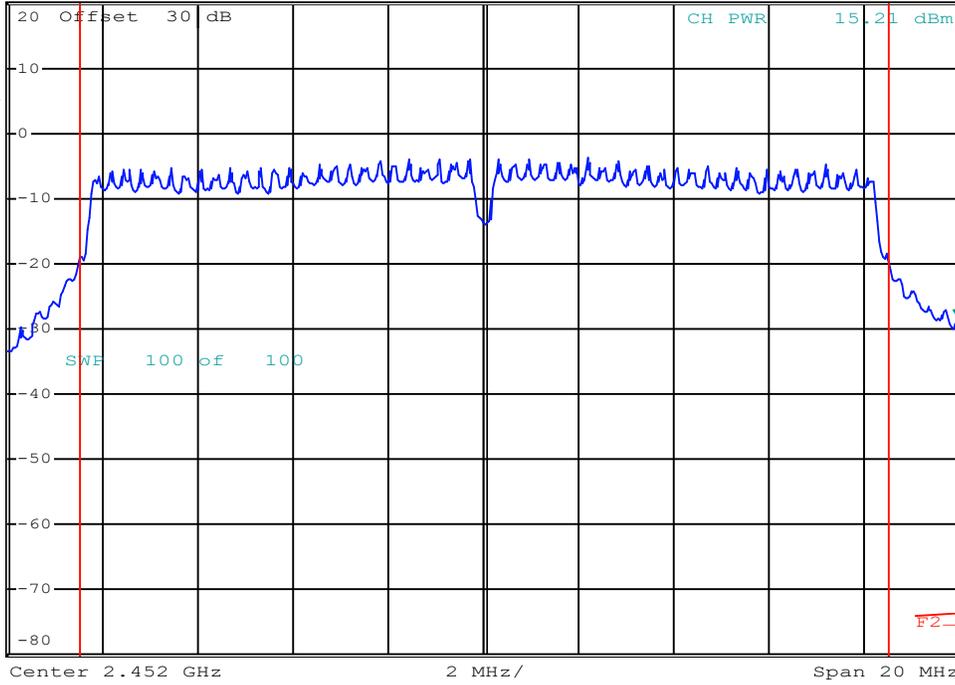


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -28.53 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 20 dBm

*Att 0 dB

1 RM*
VIEW



Date: 5.JUL.2024 10:45:49

Channel:

Channel Frequency: MHz

Mode:

Modulation:

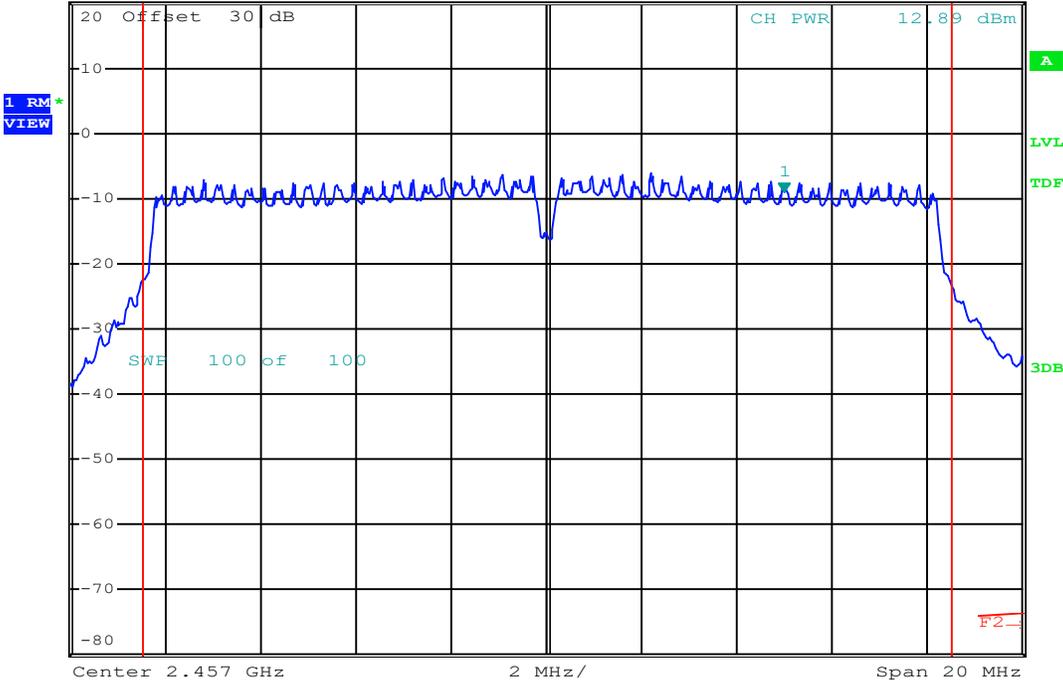
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -9.09 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:46:24

Channel: 10

Mode: 802.11g

Channel Frequency: 2457 MHz

Modulation: OFDM6

Measured Channel Power: 12.89 dBm

Conducted Power:

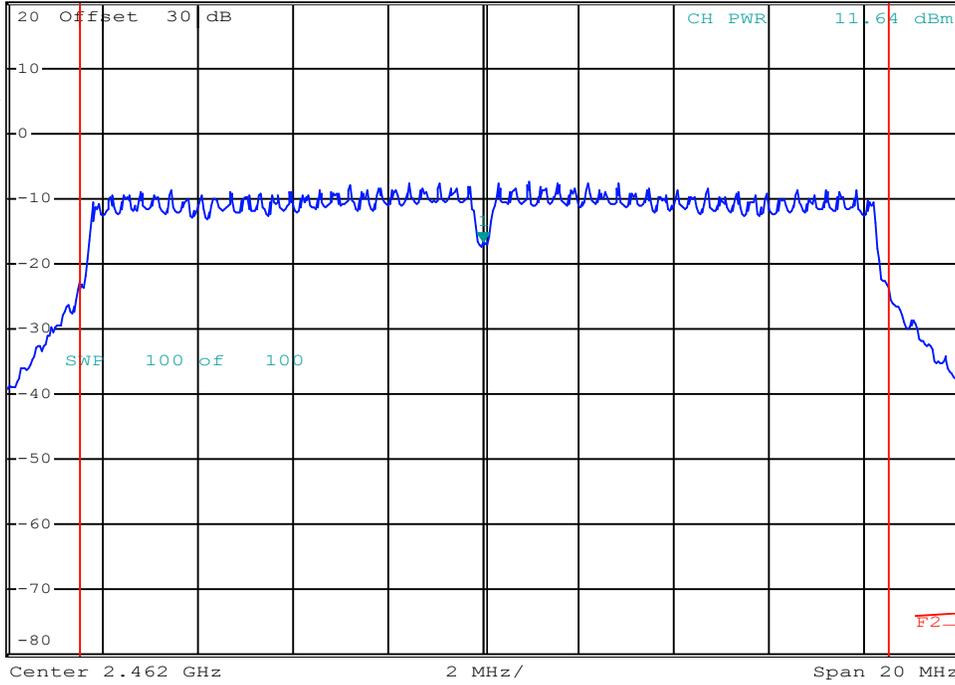


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -16.63 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 20 dBm

*Att 0 dB

1 RM*
VIEW



Date: 5.JUL.2024 10:47:04

Channel: 11

Mode: 802.11g

Channel Frequency: 2462 MHz

Modulation: OFDM6

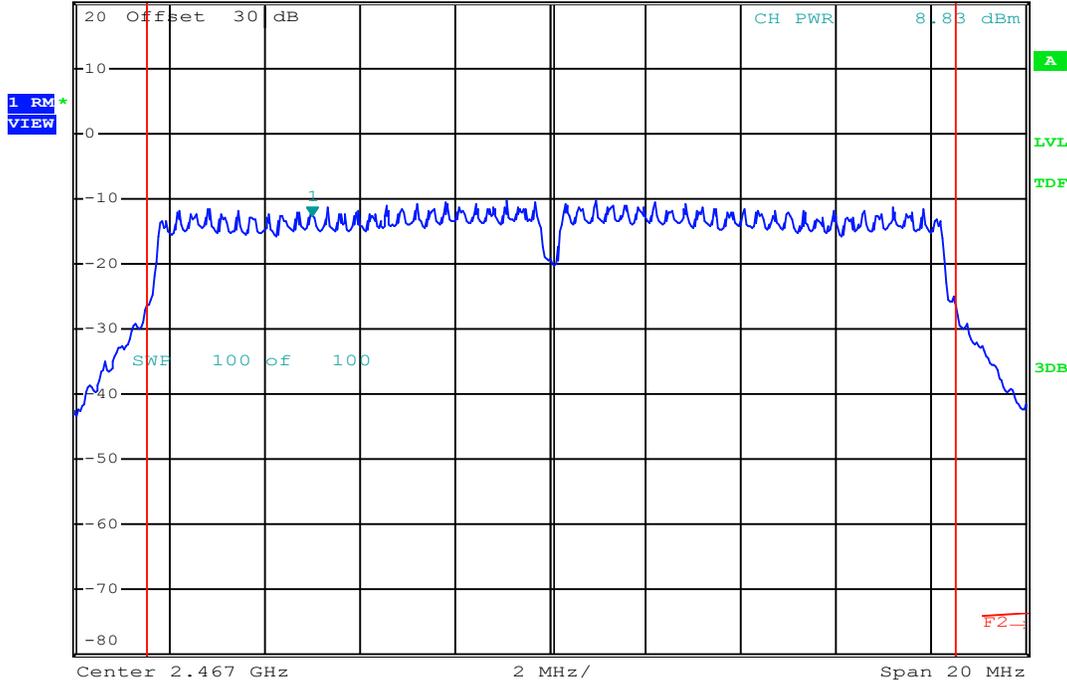
Measured Channel Power: 11.64 dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -12.67 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:47:40

Channel: 12

Mode: 802.11g

Channel Frequency: 2467 MHz

Modulation: OFDM6

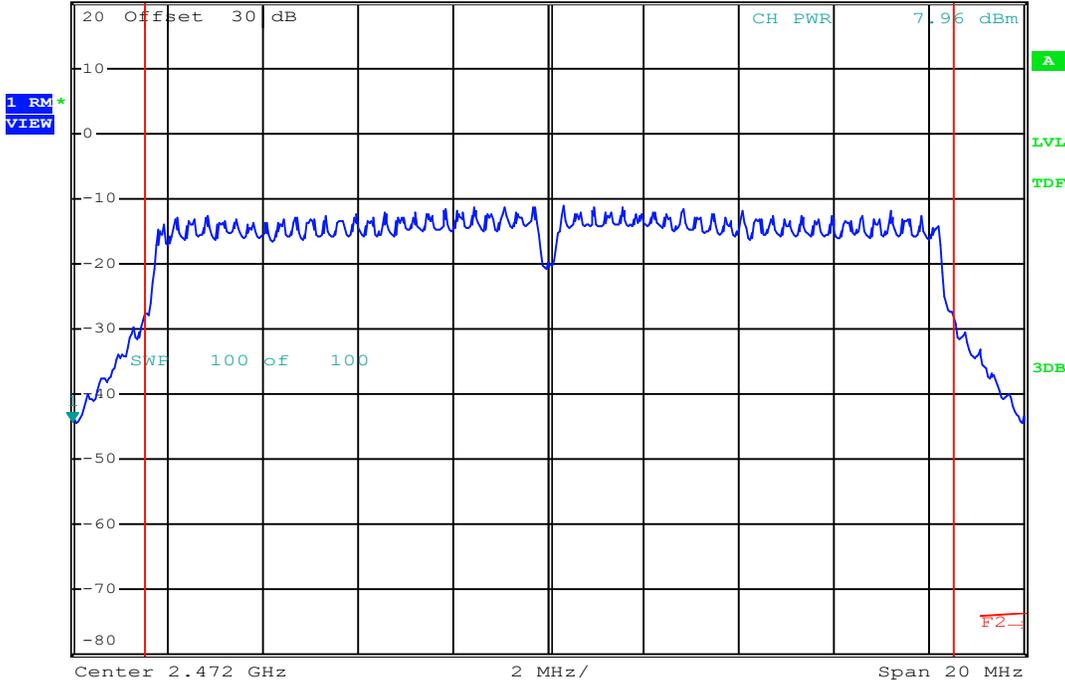
Measured Channel Power: 8.83 dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -44.30 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:48:22

Channel:

Channel Frequency: MHz

Mode:

Modulation:

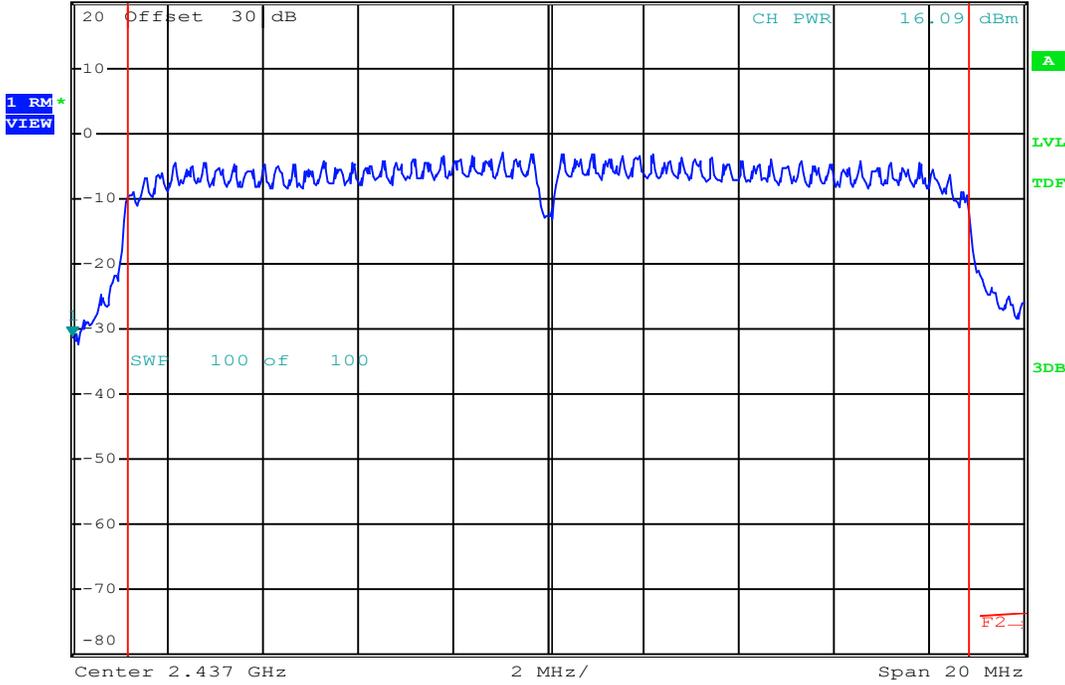
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -31.06 dBm
SWT 5 ms 2.427000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:50:09

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

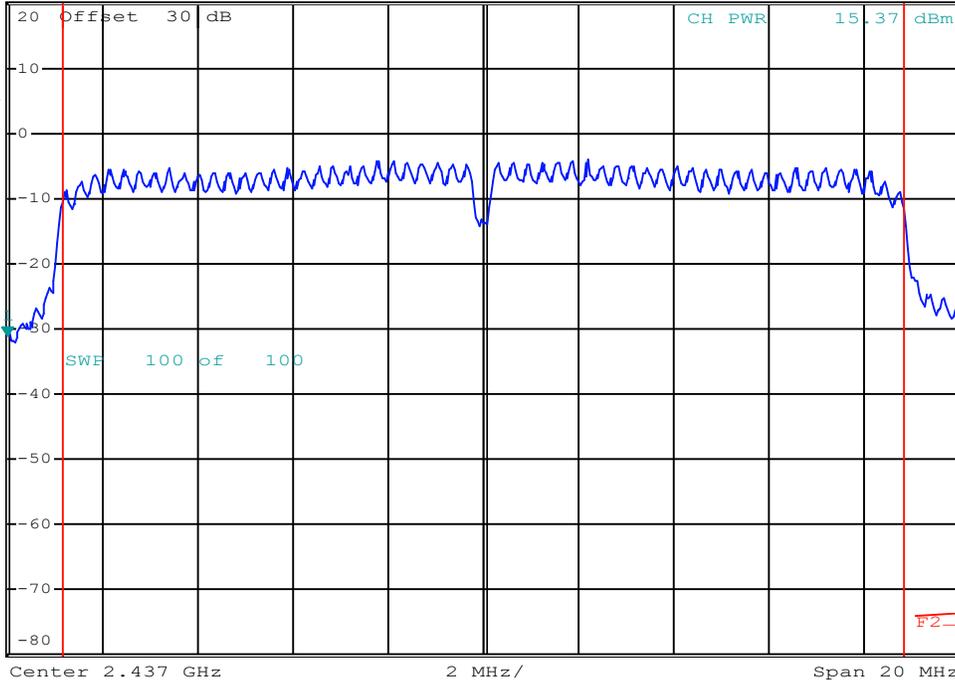


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -30.98 dBm
SWT 5 ms 2.427000000 GHz

Ref 20 dBm

*Att 0 dB

1 RM*
VIEW



Date: 5.JUL.2024 10:51:00

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

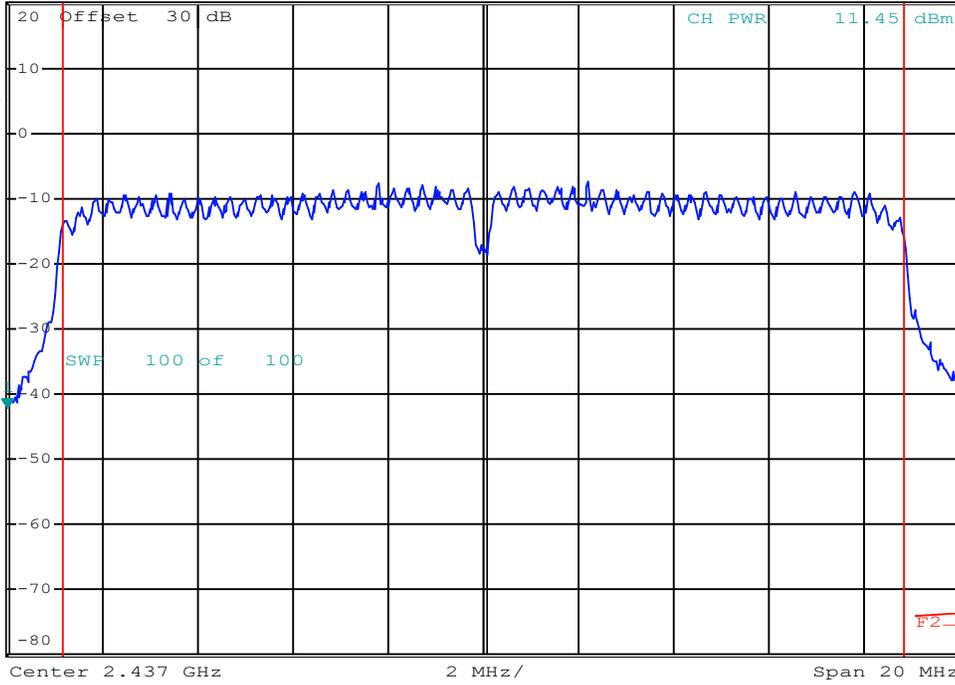


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -41.97 dBm
SWT 5 ms 2.427000000 GHz

Ref 20 dBm

*Att 0 dB

1 RM*
VIEW



Channel:

Channel Frequency: MHz

Mode:

Modulation:

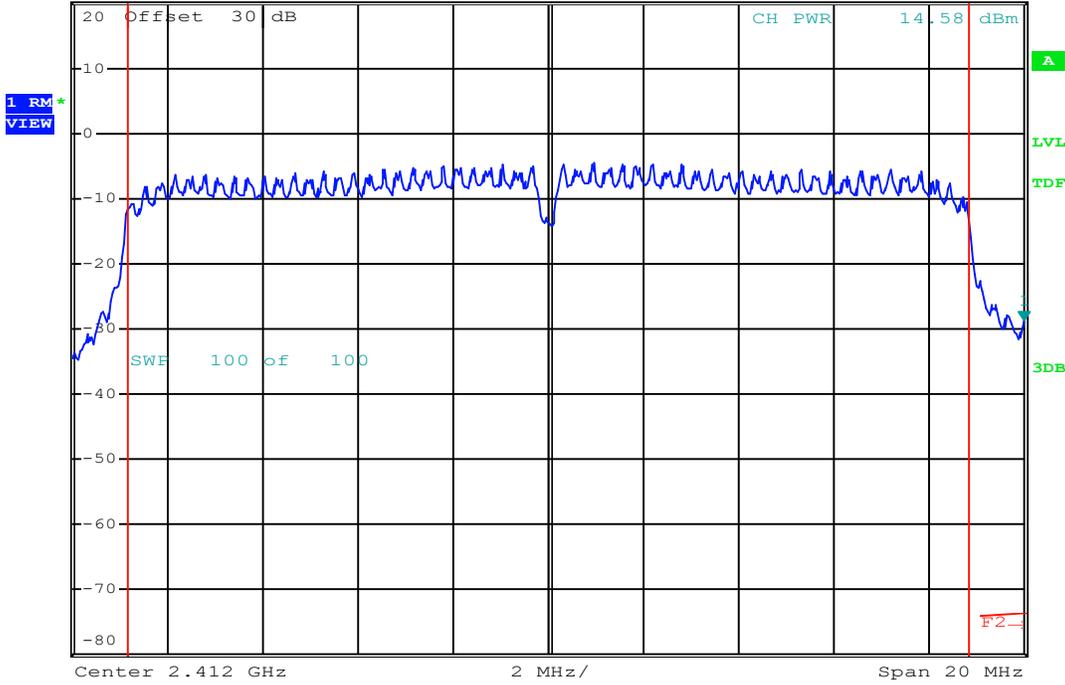
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -28.60 dBm
SWT 5 ms 2.422000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:52:52

Channel:

Mode:

Channel Frequency: MHz

Modulation:

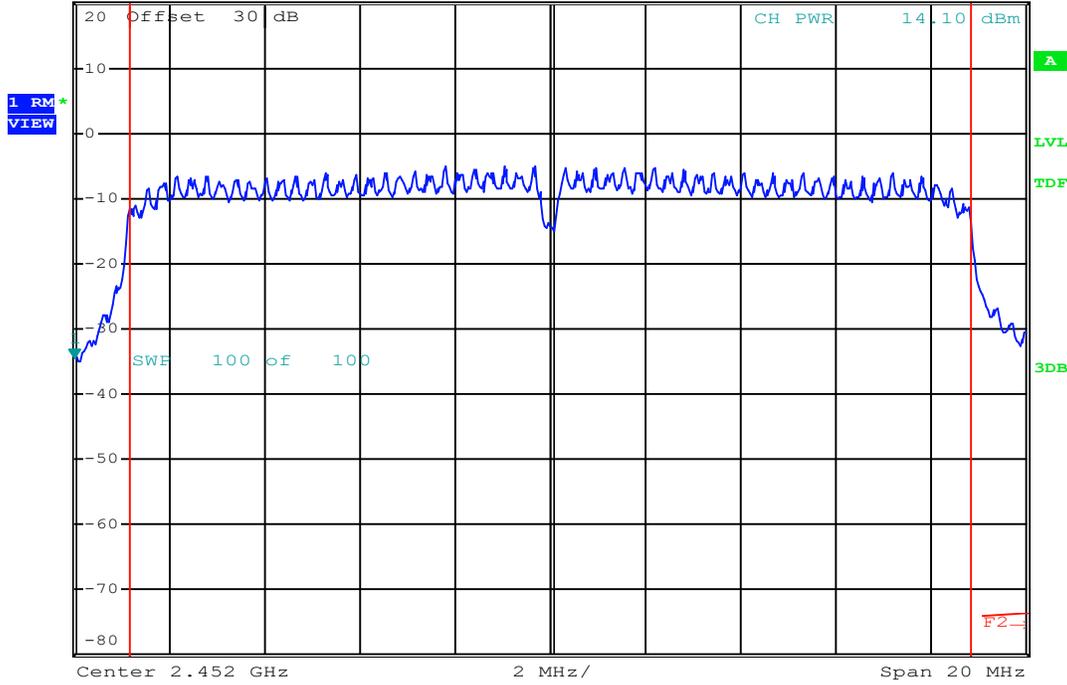
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.42 dBm
SWT 5 ms 2.442000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:54:35

Channel:

Channel Frequency: MHz

Mode:

Modulation:

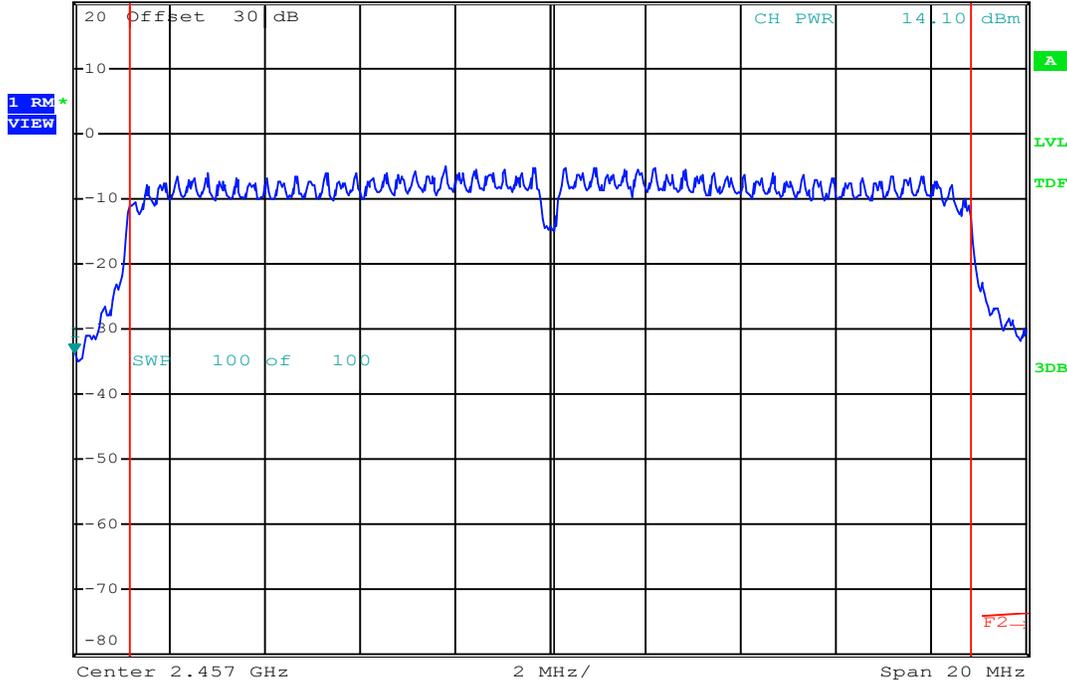
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -33.74 dBm
SWT 5 ms 2.447000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:55:19

Channel: 10

Mode: 802.11n

Channel Frequency: 2457 MHz

Modulation: MCS0

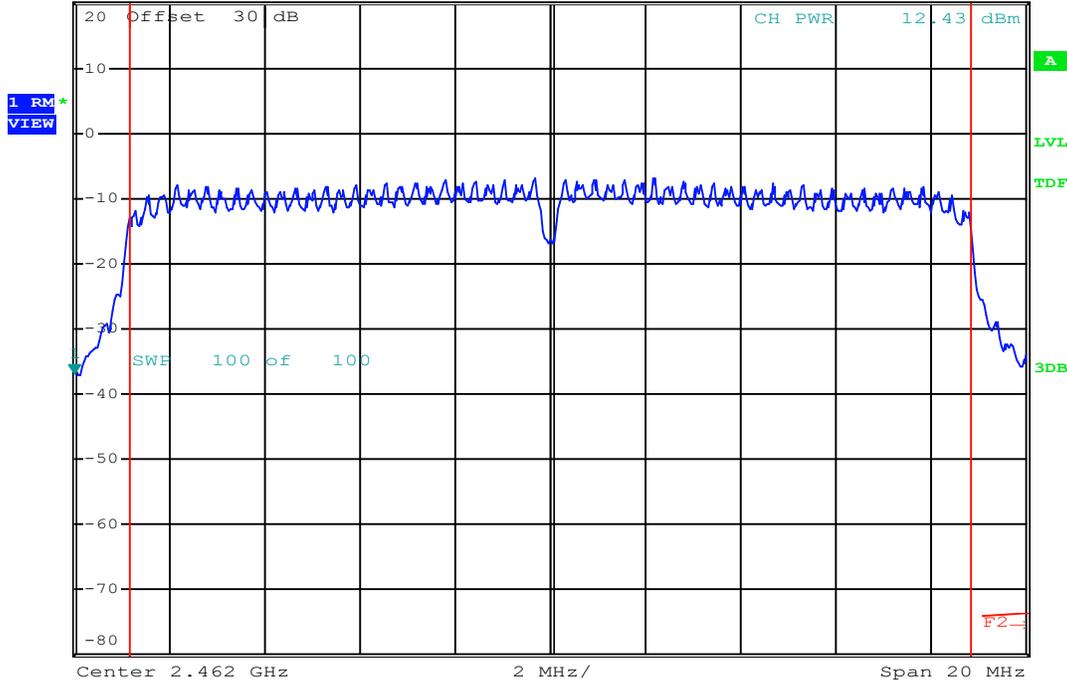
Measured Channel Power: 14.1 dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -36.89 dBm
SWT 5 ms 2.452000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:56:10

Channel: 11

Channel Frequency: 2462 MHz

Mode: 802.11n

Modulation: MCS0

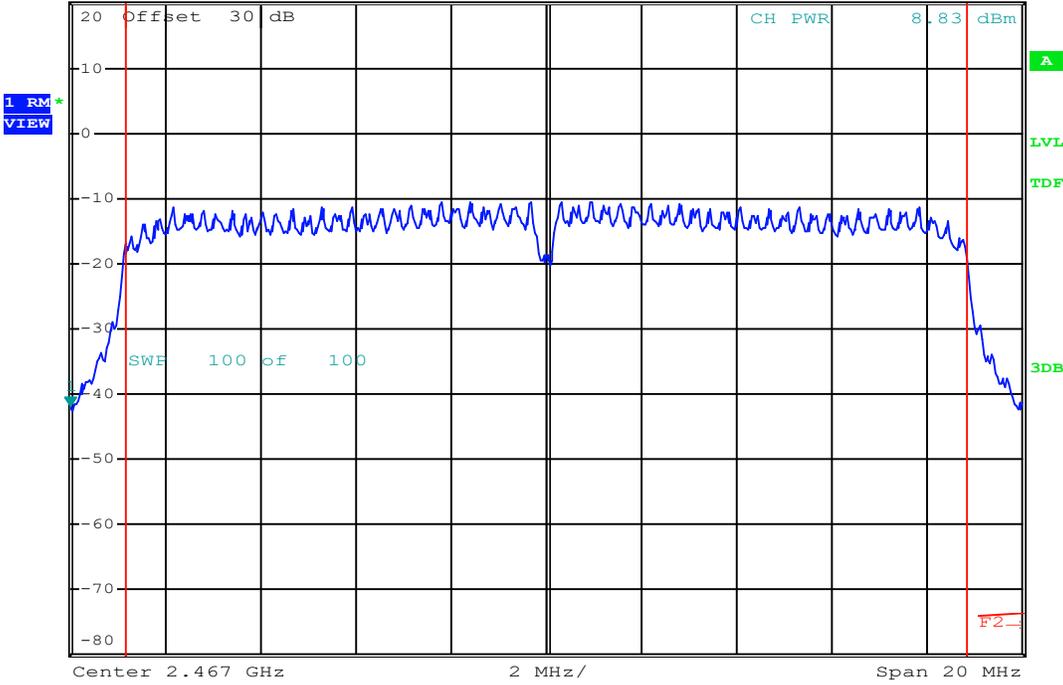
Measured Channel Power: 12.43 dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -41.84 dBm
SWT 5 ms 2.457000000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:56:50

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

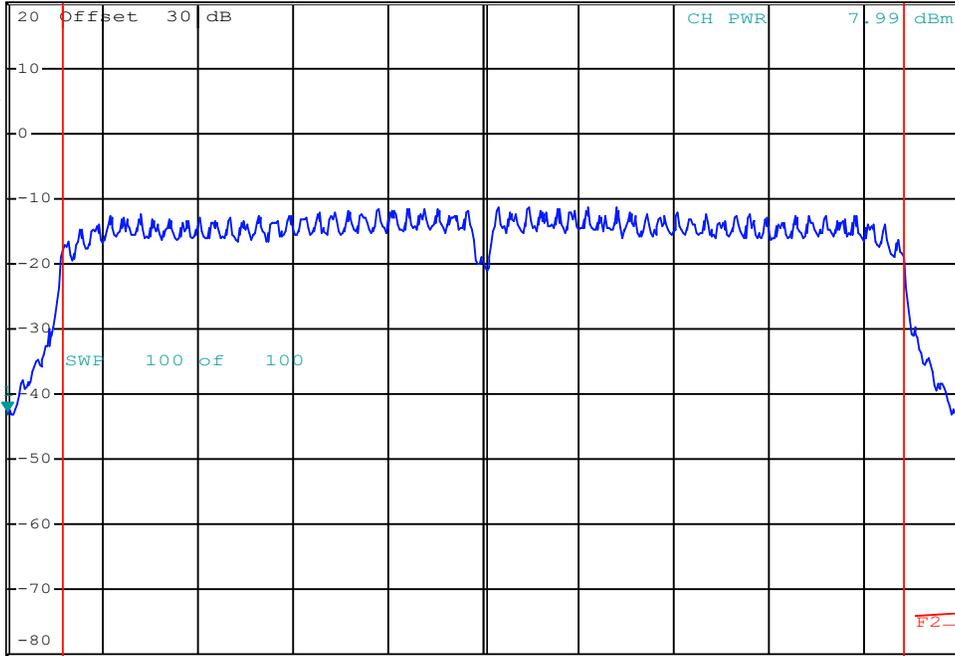


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -42.55 dBm
SWT 5 ms 2.462000000 GHz

Ref 20 dBm

*Att 0 dB

1 RM*
VIEW



Date: 5.JUL.2024 10:57:28

Channel: 13

Mode: 802.11n

Channel Frequency: 2472 MHz

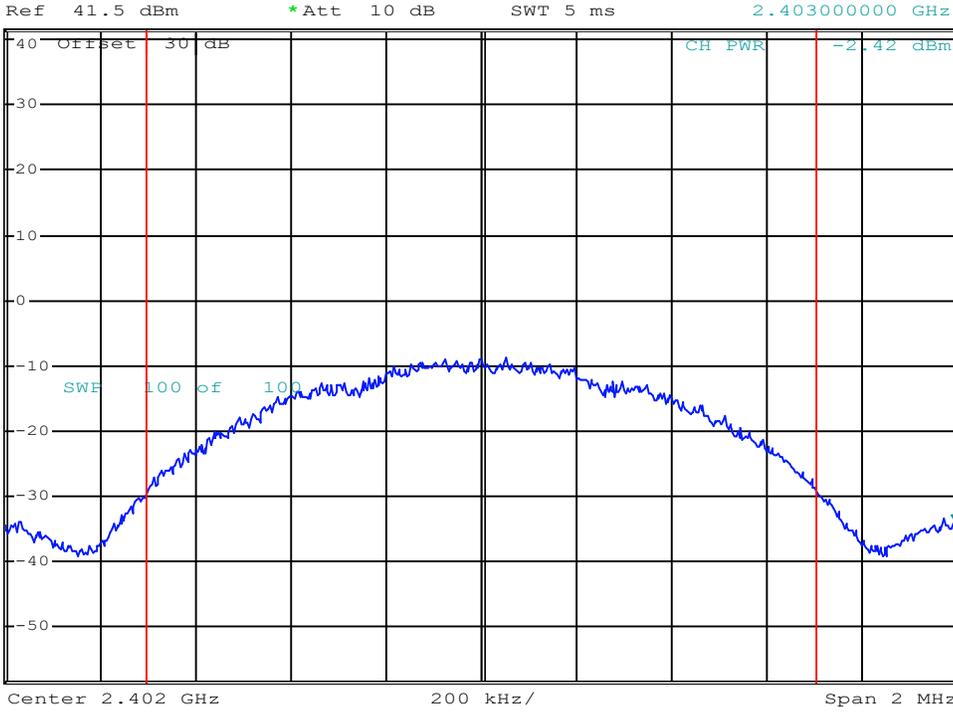
Modulation: MCS0

Measured Channel Power: 7.99 dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.18 dBm
SWT 5 ms 2.403000000 GHz



Date: 18.JUN.2024 21:04:08

Channel:

Mode:

Channel Frequency: MHz

Modulation:

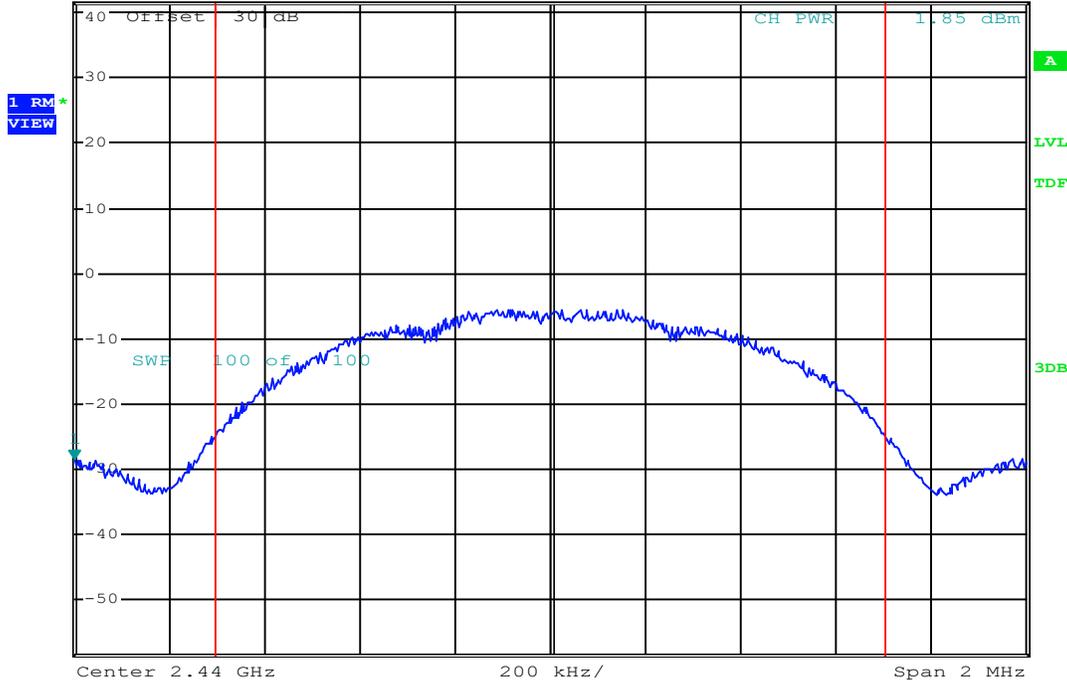
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -28.56 dBm
SWT 5 ms 2.439000000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 18.JUN.2024 21:04:40

Channel:

Mode:

Channel Frequency: MHz

Modulation:

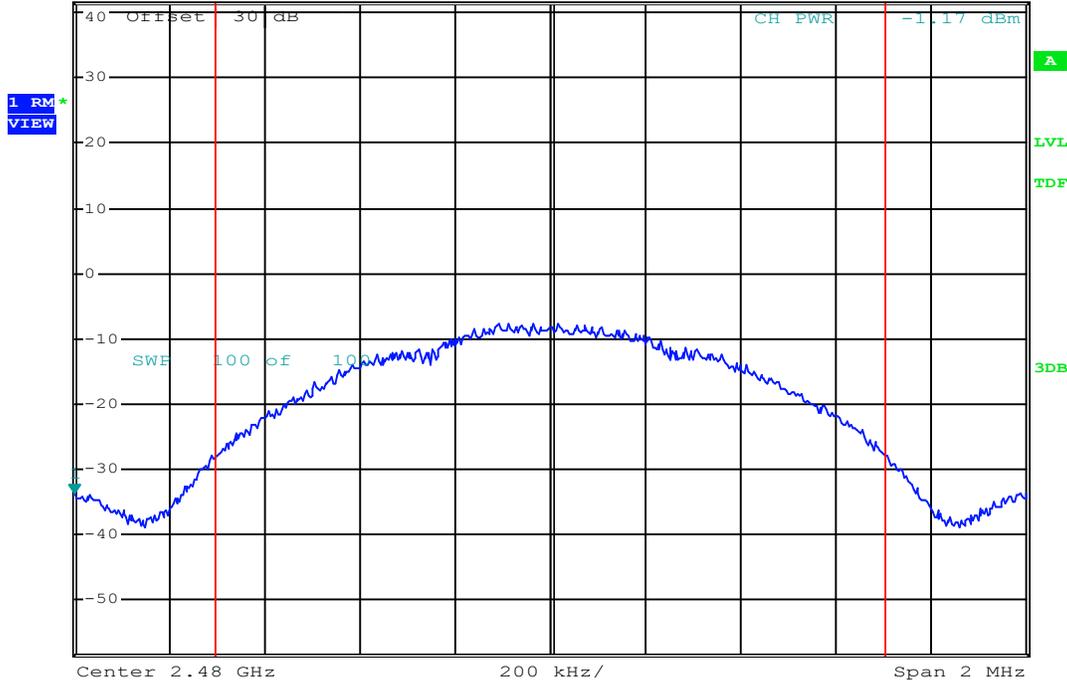
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -33.70 dBm
SWT 5 ms 2.479000000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 18.JUN.2024 21:05:09

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:

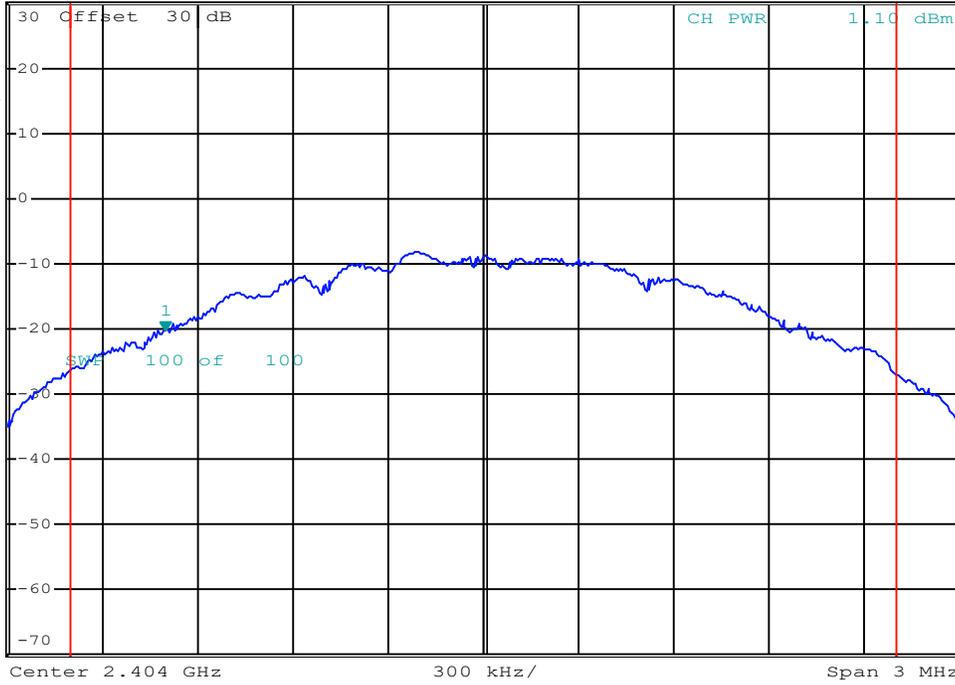


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -20.28 dBm
SWT 2.5 ms 2.403000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:49:42

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:

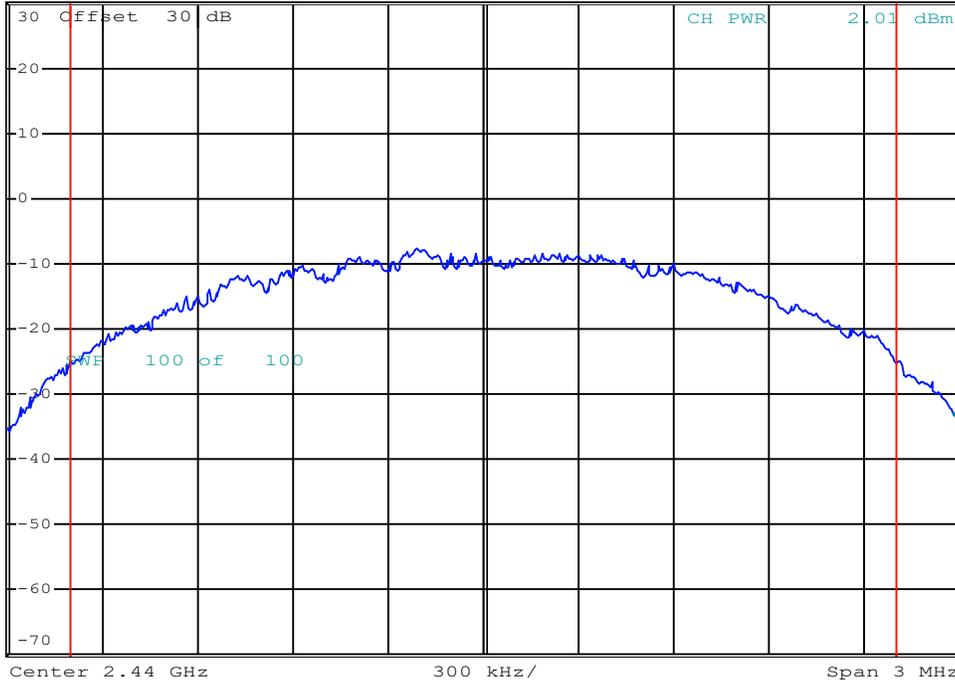


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.07 dBm
SWT 2.5 ms 2.441500000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:51:10

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

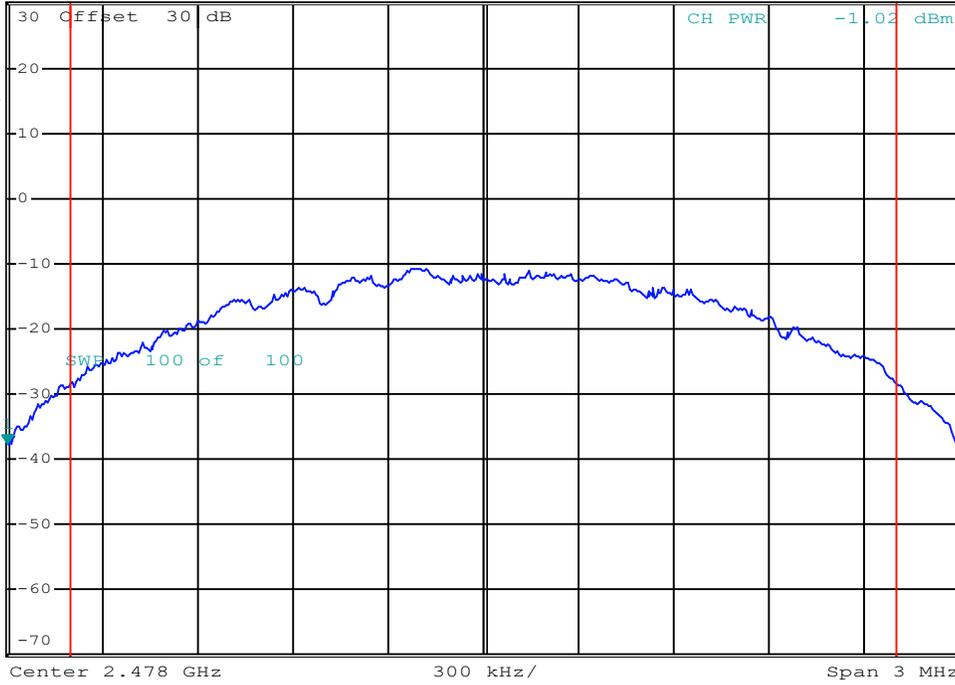


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -37.56 dBm
SWT 2.5 ms 2.476500000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:50:38

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

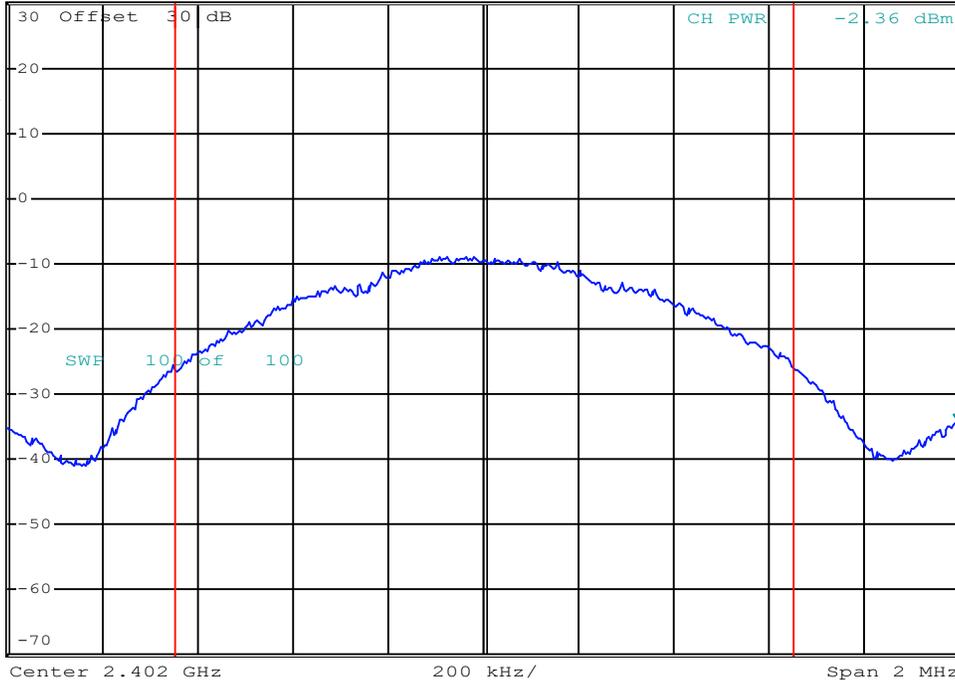


*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -34.54 dBm
SWT 2.5 ms 2.403000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:53:27

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

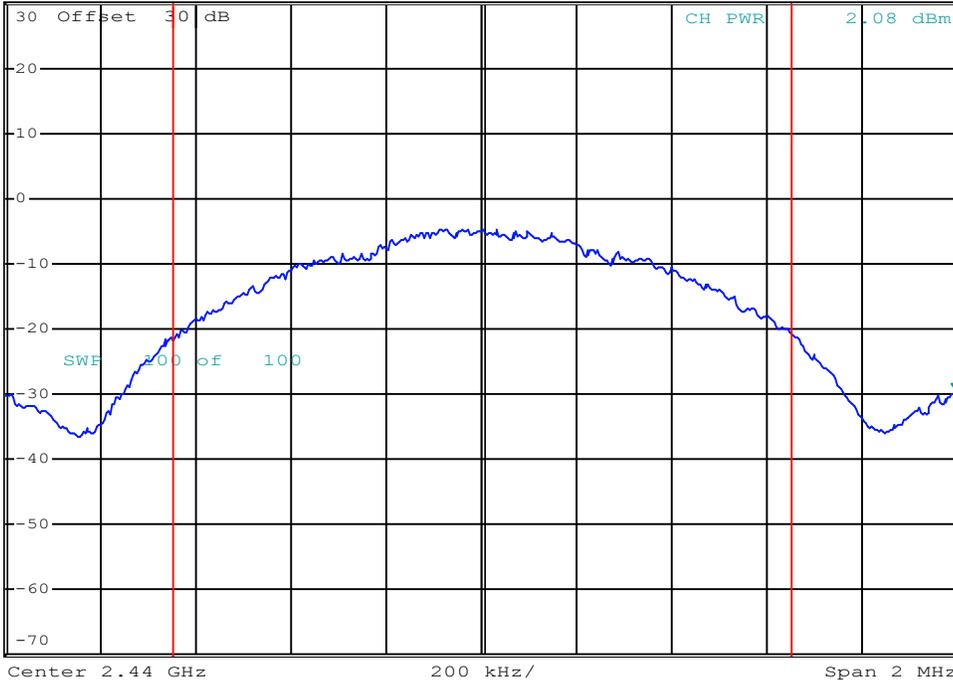


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -29.69 dBm
SWT 2.5 ms 2.441000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:52:19

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

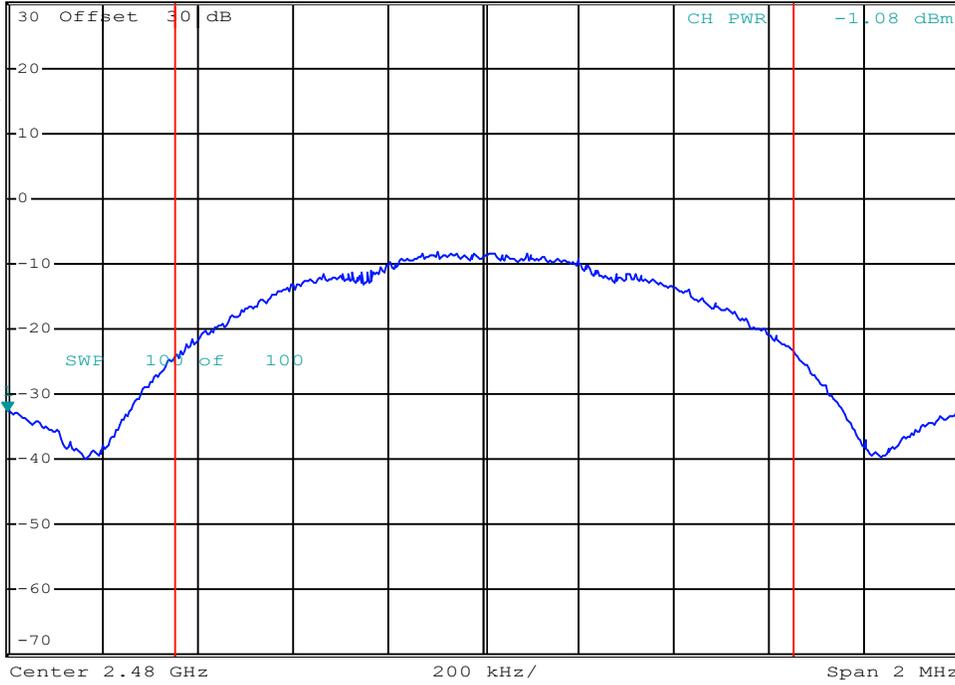


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -32.47 dBm
SWT 2.5 ms 2.479000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:53:01

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power Measurement Results: DSS

Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured Power [P _{Meas}] (dBm)	Limit [P _{Lim}] (dBm)	Conducted Margin (dB)	Antenna Gain [G] (dBi)	EIRP [E _{Meas}] (dBm)	EIRP Limit [E _{Lim}] (dBm)	EIRP Margin (dB)
0	2402.00	BT BR	GFSK	10.31	30	19.7	-5.8	4.5	36	31.5
38	2440.00			10.10		19.9		4.3		31.7
78	2480.00			10.59		19.4		4.8		31.2
0	2402.00	BT 2EDR	Pi/4-DQPSK	9.03		21.0		3.2		32.8
38	2440.00			9.97		20.0		4.2		31.8
78	2480.00			10.34		19.7		4.5		31.5
0	2402.00	BT 3EDR	8-DPSK	8.66		21.3		2.9		33.1
38	2440.00			9.57		20.4		3.8		32.2
78	2480.00			10.16		19.8		4.4		31.6
Result:										Complies

Conducted Margin = Conducted Limit [P_{Lim}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Conducted Power:

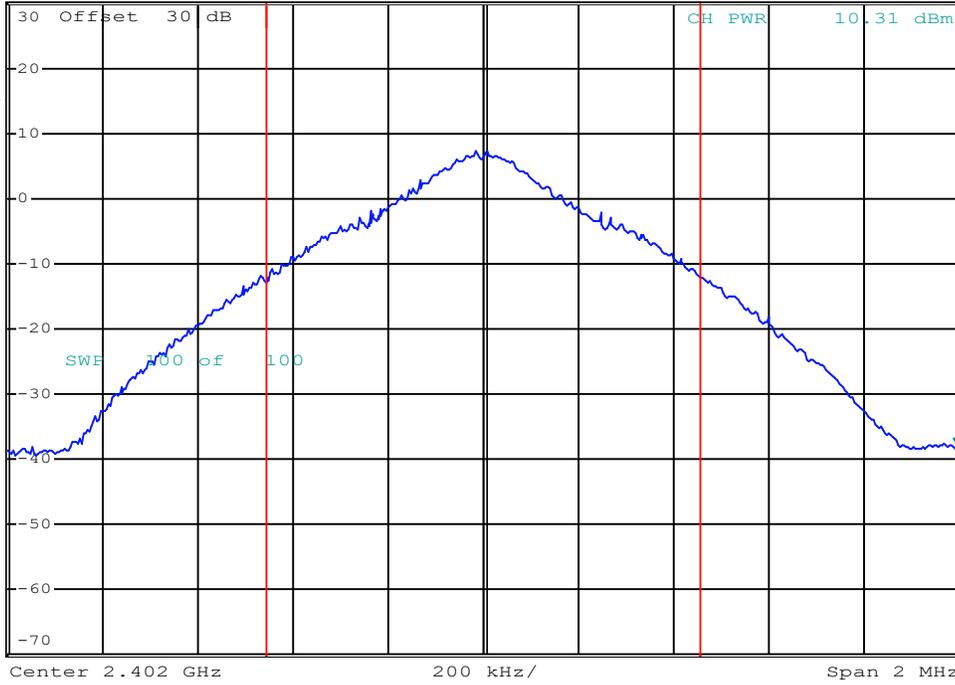


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -38.17 dBm
SWT 2.5 ms 2.403000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:56:01

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

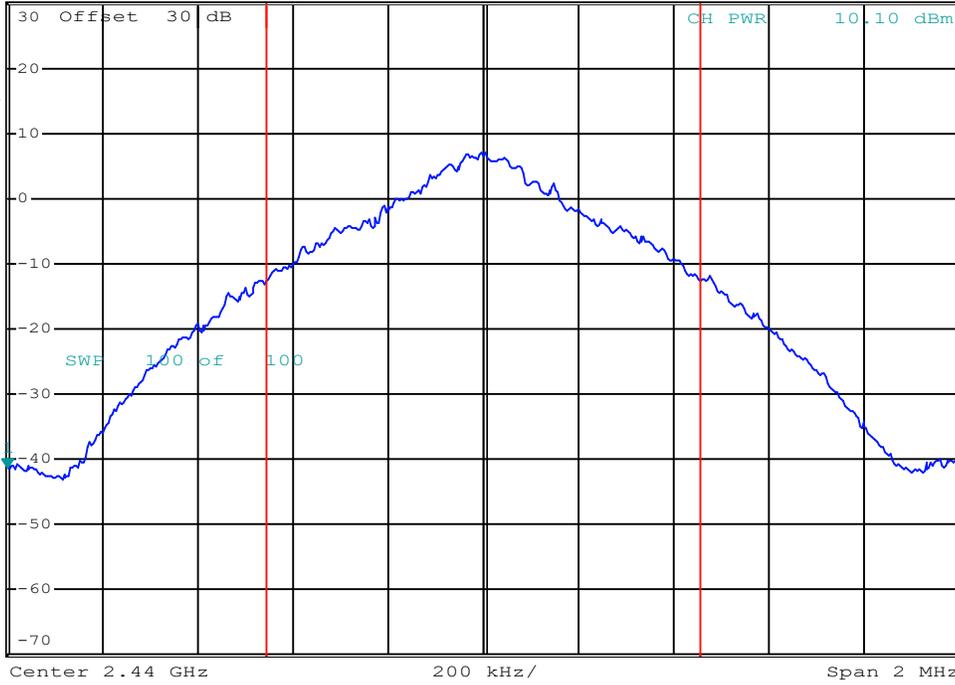


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -41.31 dBm
SWT 2.5 ms 2.439000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:56:39

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

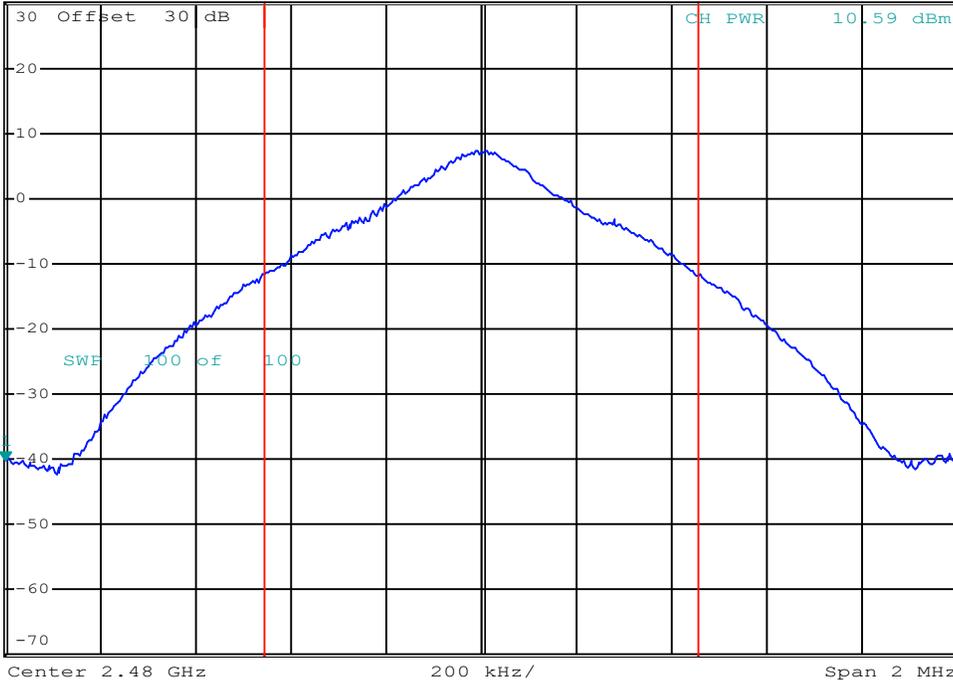


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -40.17 dBm
SWT 2.5 ms 2.479000000 GHz

Ref 30 dBm

*Att 10 dB

1 RM*
VIEW



Date: 18.JUN.2024 20:57:17

Channel:

Mode:

Channel Frequency: MHz

Modulation:

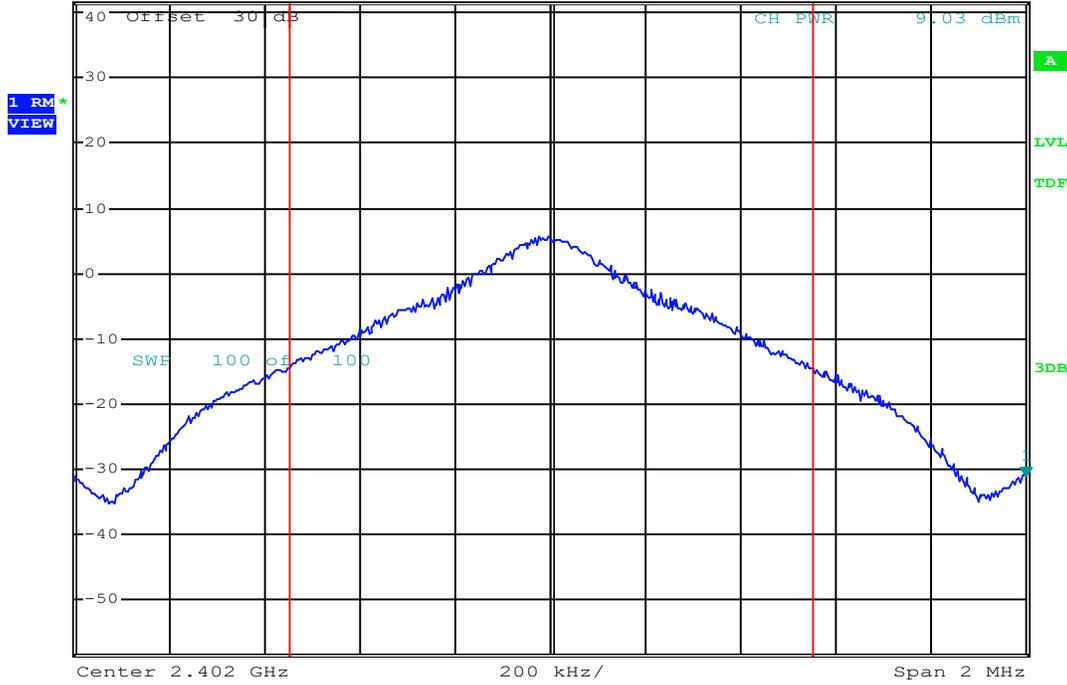
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -30.95 dBm
SWT 5 ms 2.403000000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 18.JUN.2024 21:01:04

Channel:

Channel Frequency: MHz

Mode:

Modulation:

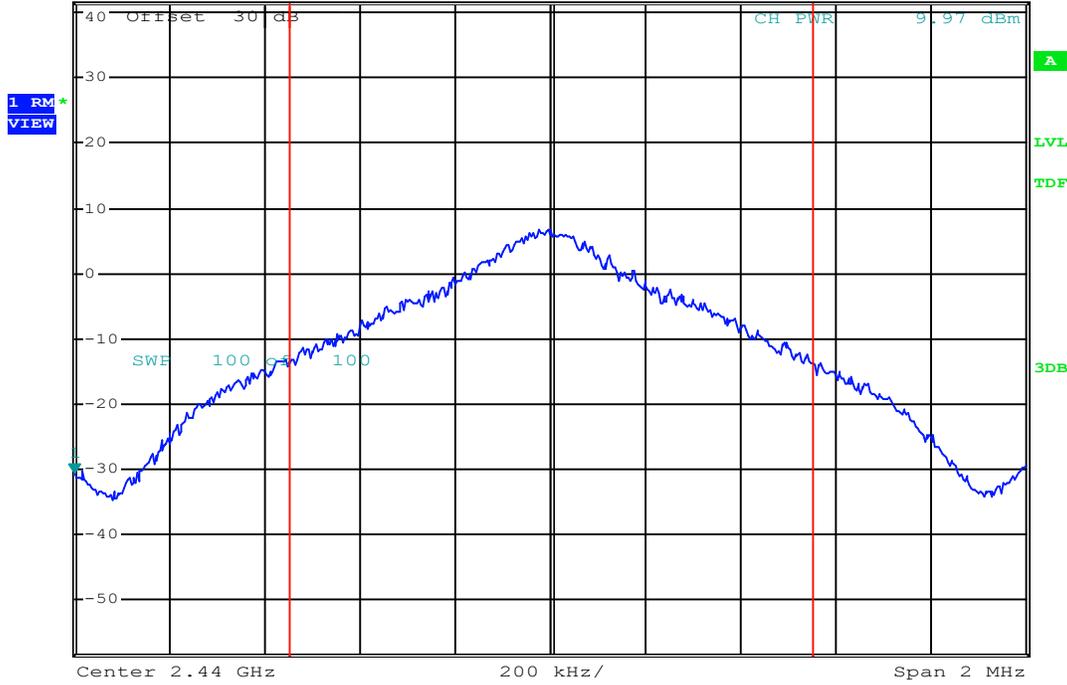
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -30.59 dBm
SWT 5 ms 2.439000000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 18.JUN.2024 21:01:39

Channel:

Channel Frequency: MHz

Mode:

Modulation:

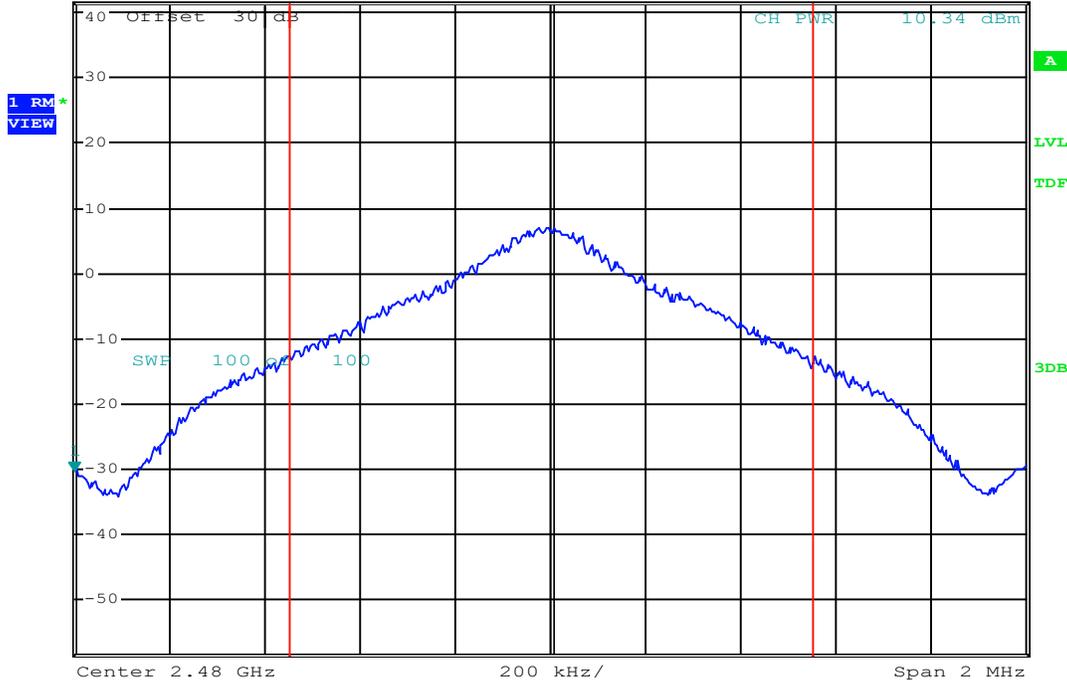
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -30.22 dBm
SWT 5 ms 2.479000000 GHz

Ref 41.5 dBm *Att 10 dB



Channel:

Channel Frequency: MHz

Mode:

Modulation:

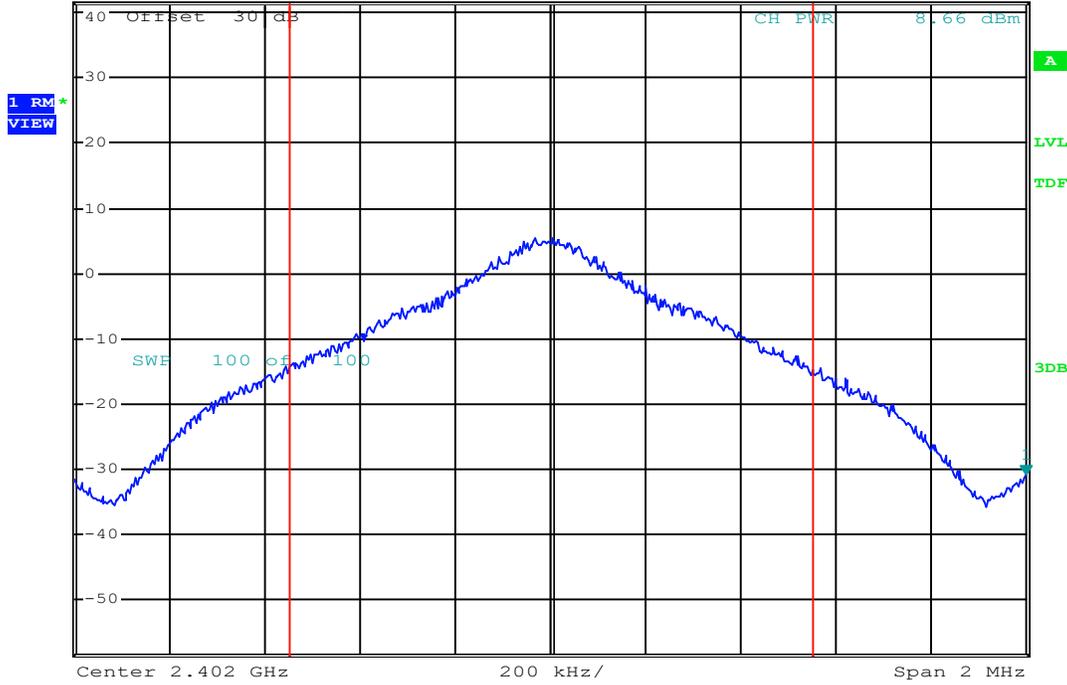
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -30.80 dBm
SWT 5 ms 2.403000000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 18.JUN.2024 21:03:01

Channel:

Channel Frequency: MHz

Mode:

Modulation:

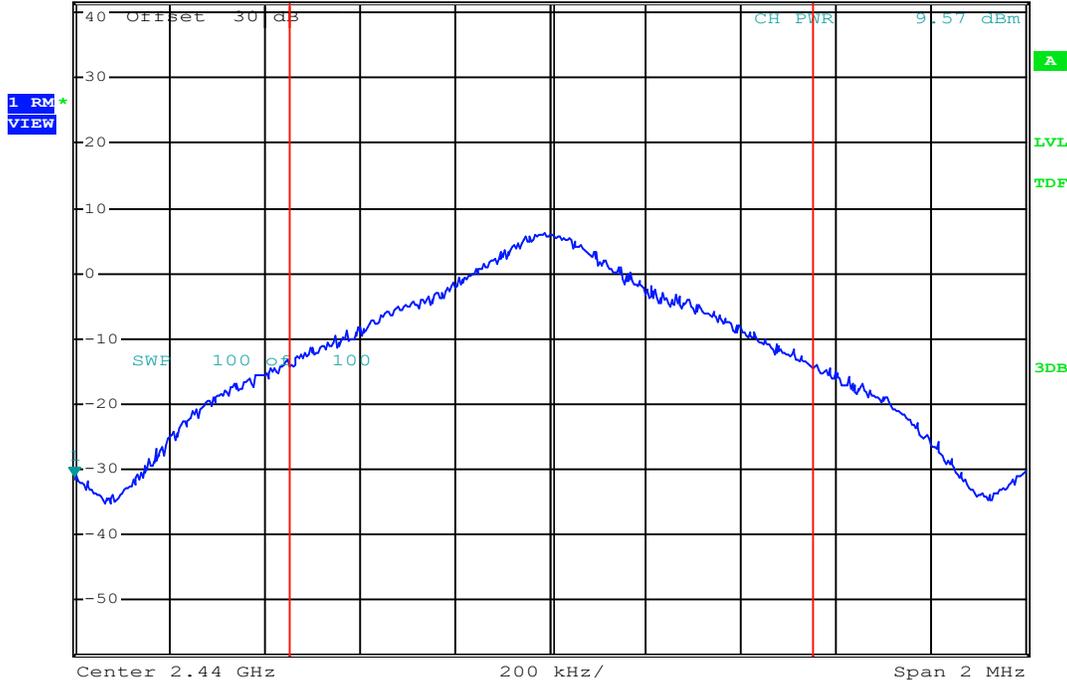
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -30.95 dBm
SWT 5 ms 2.439000000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 18.JUN.2024 21:02:01

Channel:

Channel Frequency: MHz

Mode:

Modulation:

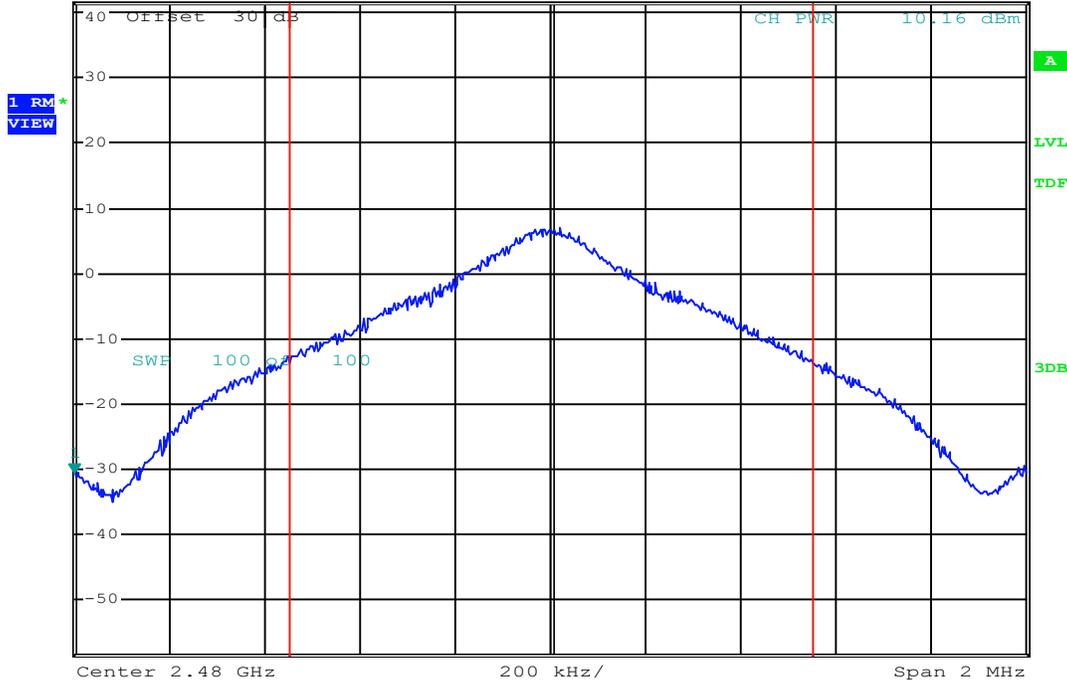
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -30.46 dBm
SWT 5 ms 2.479000000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 18.JUN.2024 21:02:39

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

PSD Results:						
Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured PSD [P_{Meas}] (dBm)	PSD Limit [P_{Lim}] (dBm)	Margin (dB)
6	2437.0	802.11b	DSSS 5.5	-4.47	8.000	12.47
		802.11g	OFDM12	-7.90		15.90
		802.11n	MCS0	-8.66		16.66
17	2440.0	BLE 1mb	GMSK	-10.03		18.03
17		BLE 2mb	GMSK	-12.57		20.57
38		ANT	GFSK	-9.68		17.68
					Result:	Complies

$$\text{Margin} = [P_{\text{Lim}}] - [P_{\text{Meas}}]$$

Power Spectral Density

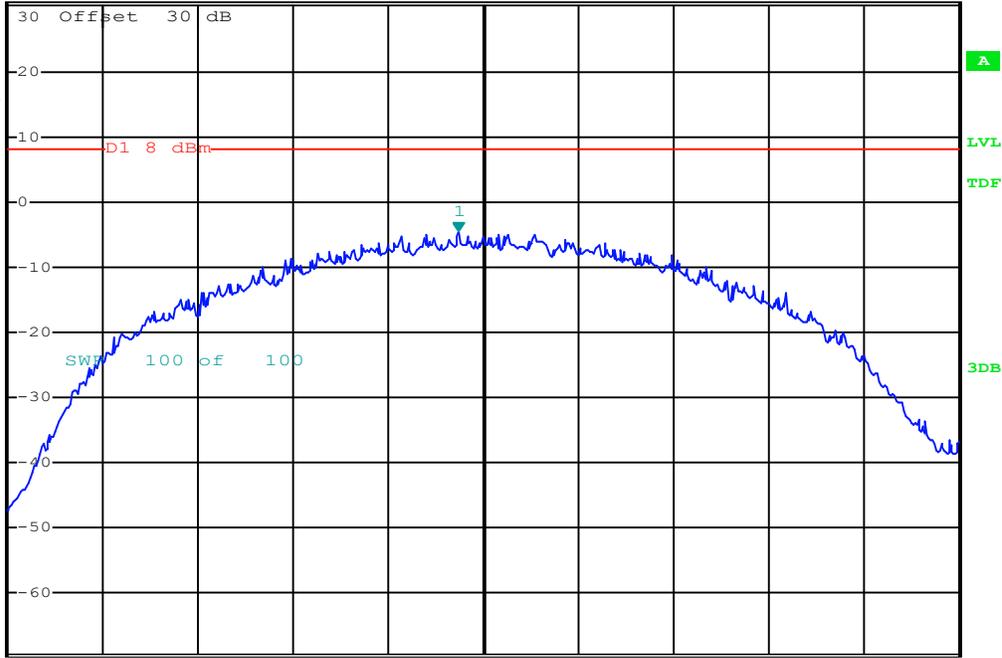


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz -4.47 dBm
SWT 25 ms 2.436480000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Date: 16.JUL.2024 11:40:21

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured PSD: dBm

Power Spectral Density

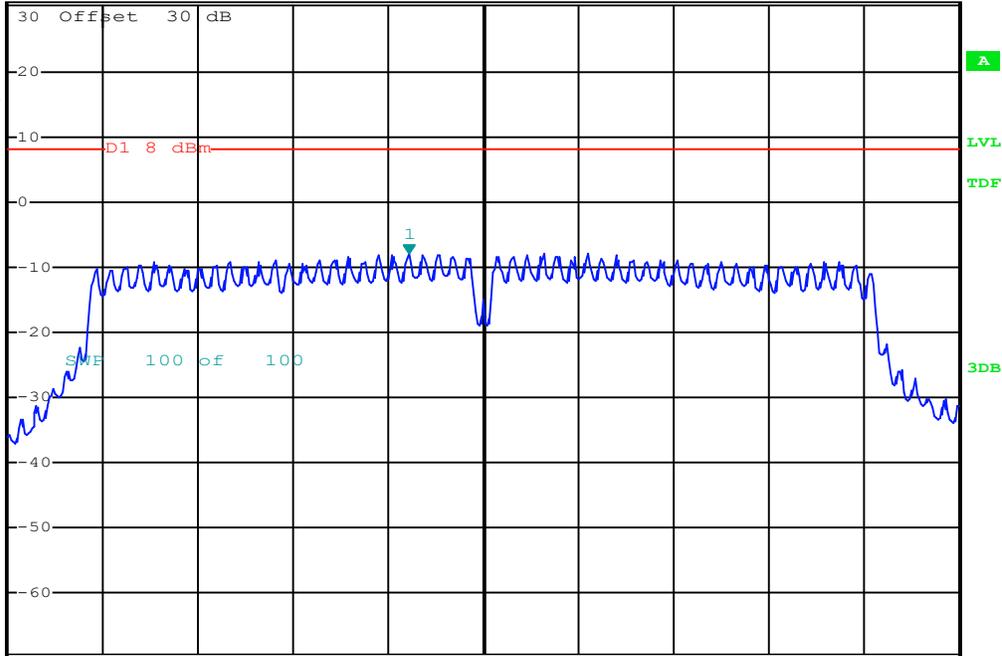


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz -7.90 dBm
SWT 25 ms 2.435440000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Date: 16.JUL.2024 11:41:08

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured PSD: dBm

Power Spectral Density

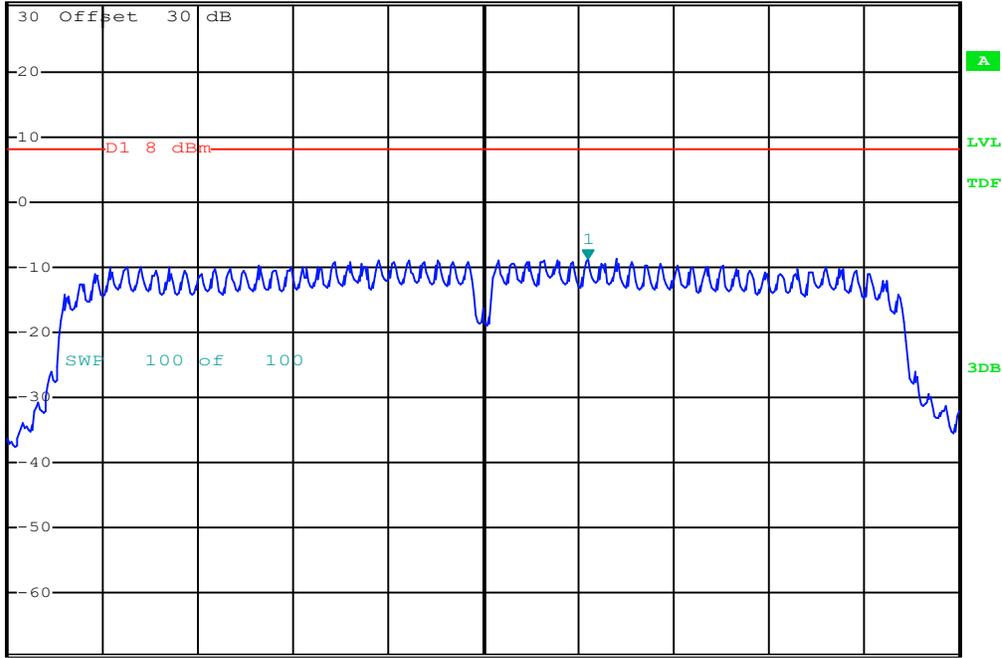


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz -8.66 dBm
SWT 25 ms 2.439200000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Date: 16.JUL.2024 11:42:12

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured PSD: dBm

Power Spectral Density

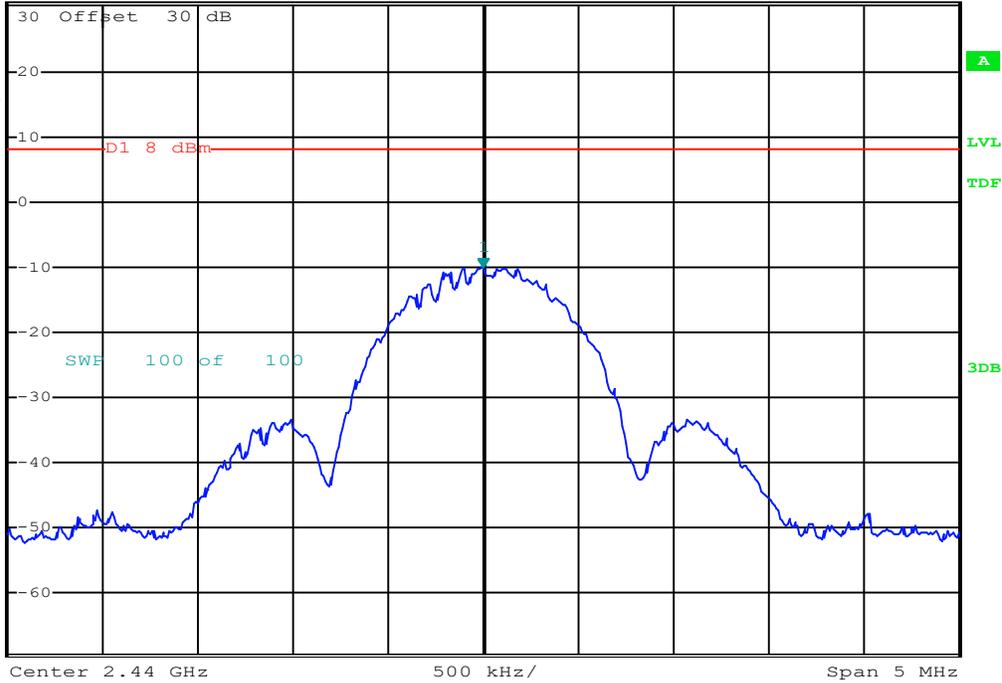


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz -10.03 dBm
SWT 10 ms 2.440000000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Date: 12.JUL.2024 13:54:16

Channel: 17

Mode: BLE 1mb

Channel Frequency: 2440 MHz

Modulation: GMSK

Measured PSD: -10.03 dBm

Power Spectral Density

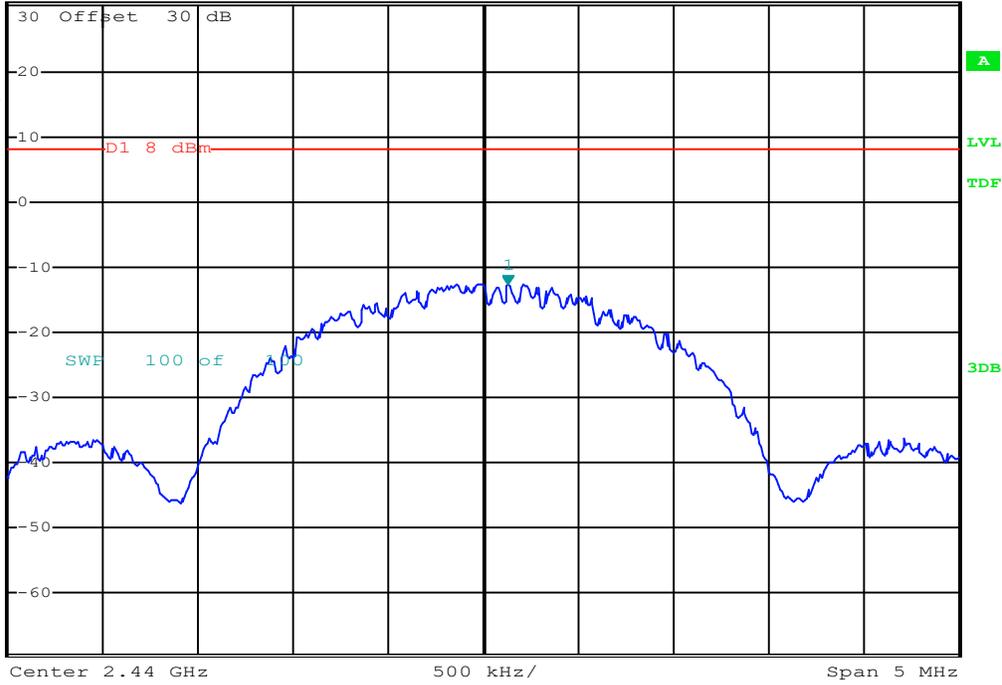


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz -12.57 dBm
SWT 10 ms 2.440130000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Date: 12.JUL.2024 13:54:51

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured PSD: dBm

Power Spectral Density

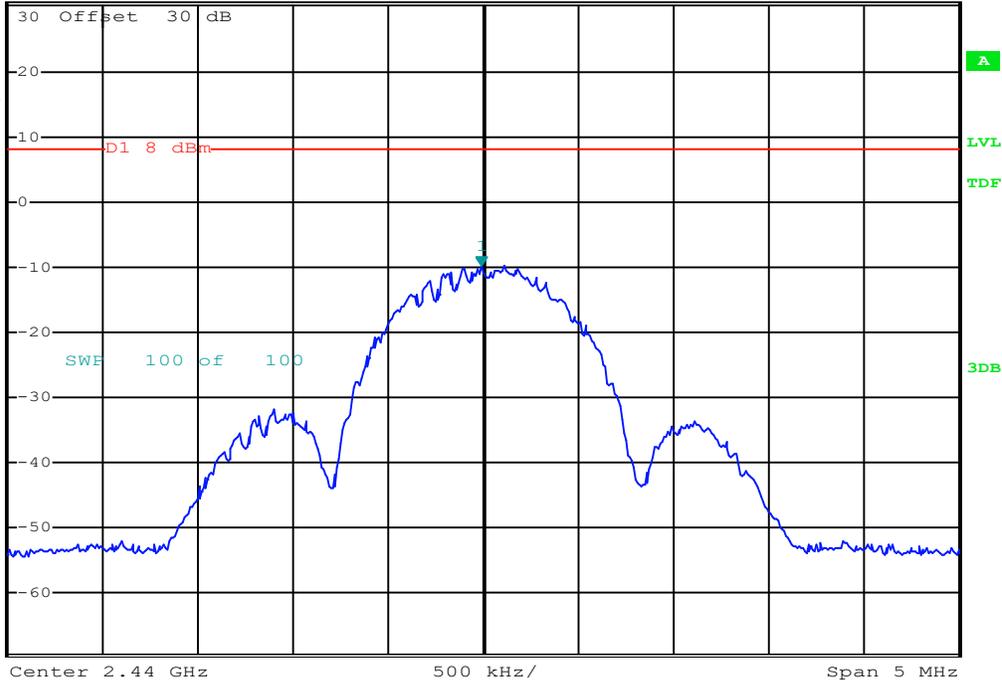


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz -9.86 dBm
SWT 10 ms 2.439990000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Date: 12.JUL.2024 13:55:30

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured PSD: dBm

PSD Results:

Channel Number	Channel Frequency (MHz)	Mode	Modulation	Measured PSD [P _{Meas}] (dBm)	PSD Limit [P _{Lim}] (dBm)	Margin (dB)
38	2440.0	BT BR	GFSK	2.79	8.0	5.21
		BT 2EDR	Pi/4-DQPSK	2.70		5.30
		BT 3EDR	8-DPSK	2.18		5.82
Result:					Complies	

$$\text{Margin} = [P_{\text{Lim}}] - [P_{\text{Meas}}]$$

Power Spectral Density

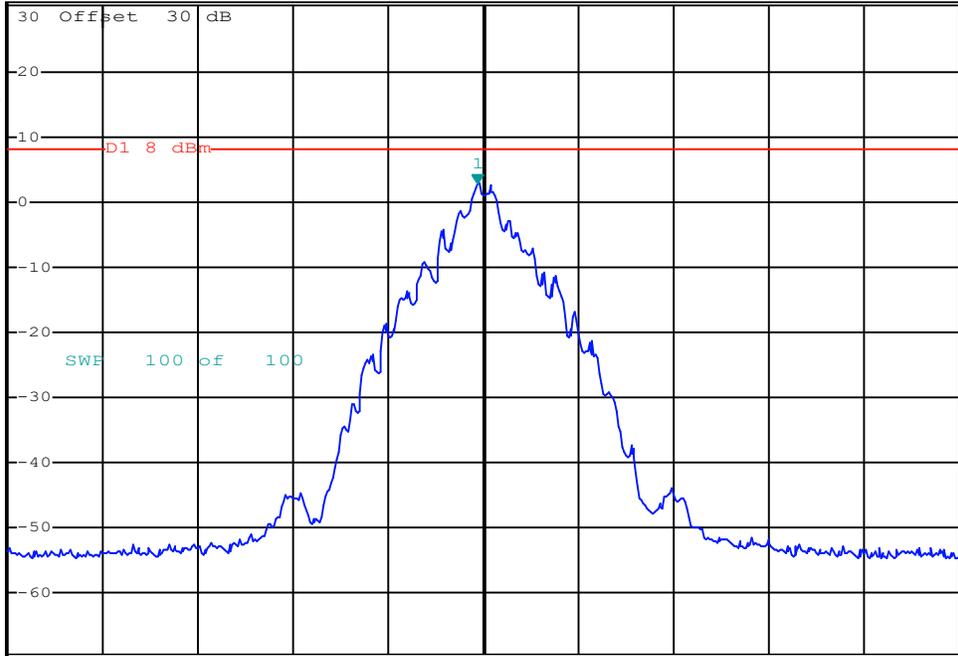


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz 2.79 dBm
SWT 10 ms 2.439970000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Center 2.44 GHz

500 kHz/

Span 5 MHz

Date: 12.JUL.2024 13:52:00

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured PSD: dBm

Power Spectral Density

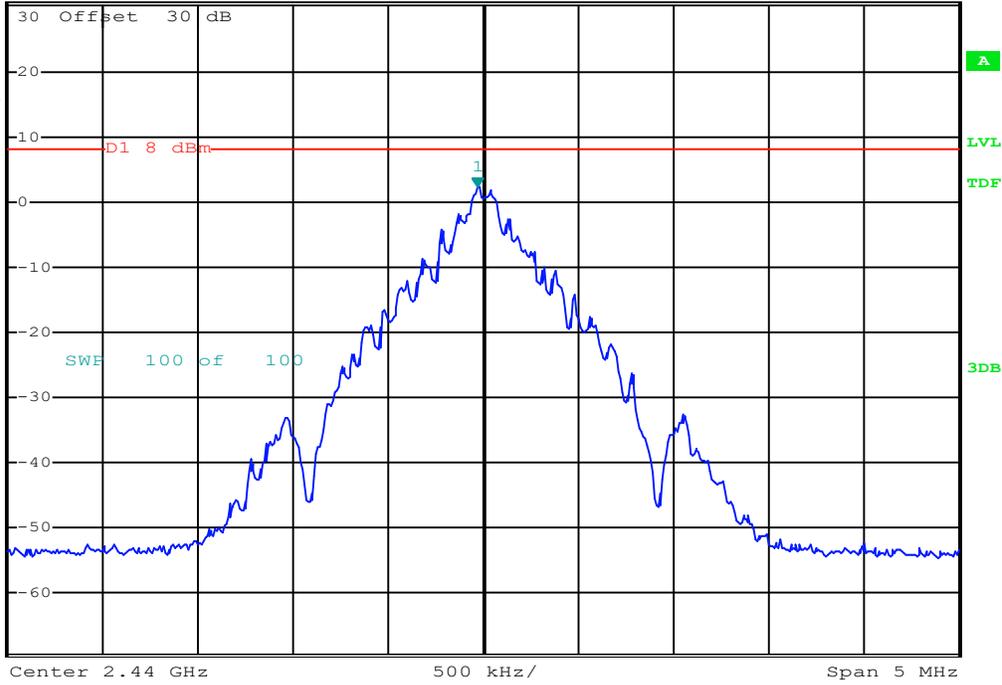


*RBW 30 kHz Marker 1 [T1]
VBW 300 kHz 2.18 dBm
SWT 10 ms 2.439970000 GHz

Ref 30.5 dBm

*Att 20 dB

1 RM *
VIEW



Date: 12.JUL.2024 13:53:31

Channel:

Mode:

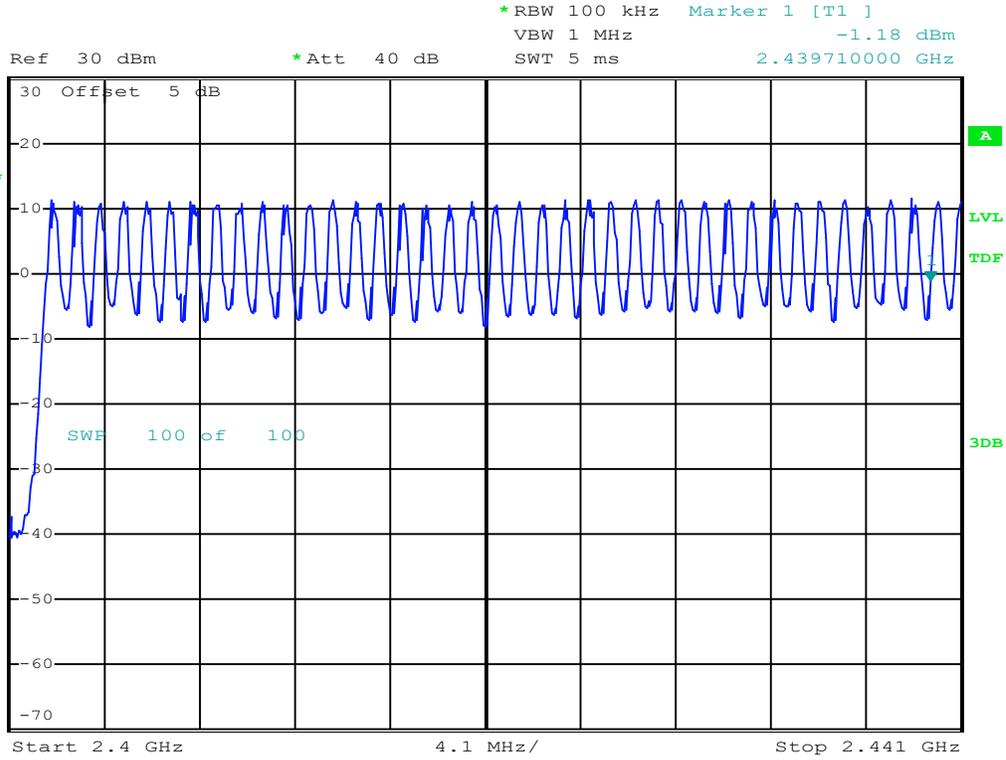
Channel Frequency: MHz

Modulation:

Measured PSD: dBm

Number of Hopping Channels				
Start Frequency (MHz)	Channel Frequency (MHz)	Mode	Modulation	Number of Channels
2400	2441.0	BT BR	GFSK	40
2441	2485.0			39
Total [N_{Chan}]				79
2400	2441.0	BT 2EDR	Pi/4-DQPSK	40
2441	2485.0			39
Total [N_{Chan}]				79

Number of Hopping Channels



Date: 28.MAR.2024 16:05:49

Start Freq: MHz

Stop Freq: MHz

Mode:

Modulation:

Number of Channels: kHz

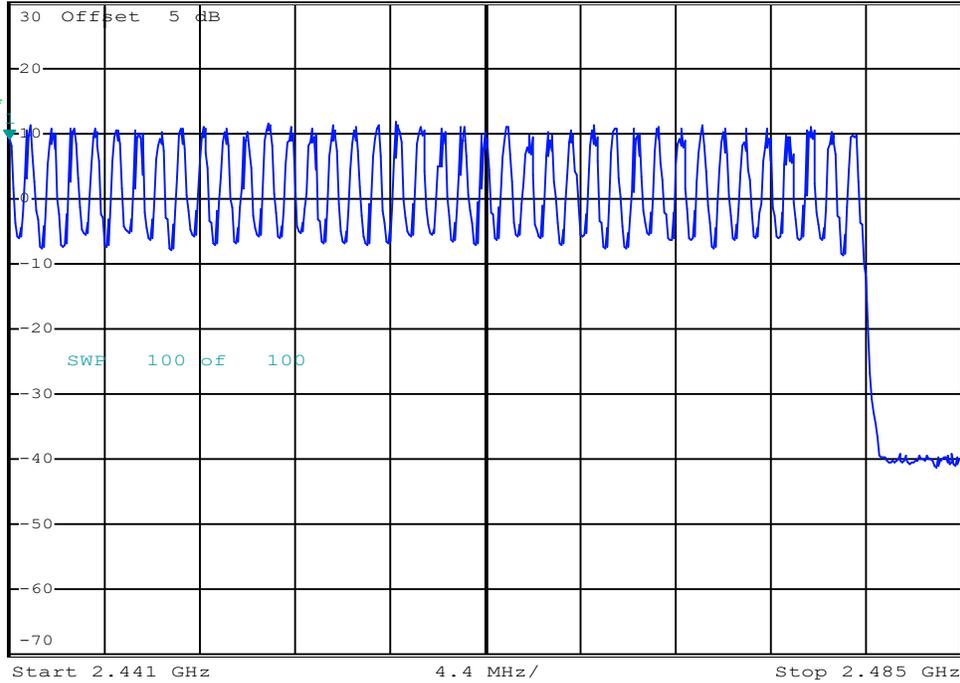
Number of Hopping Channels



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz 9.01 dBm
SWT 5 ms 2.441000000 GHz

Ref 30 dBm

*Att 40 dB



Date: 28.MAR.2024 16:08:13

Start Freq: MHz

Stop Freq: MHz

Mode:

Modulation:

Number of Channels: kHz

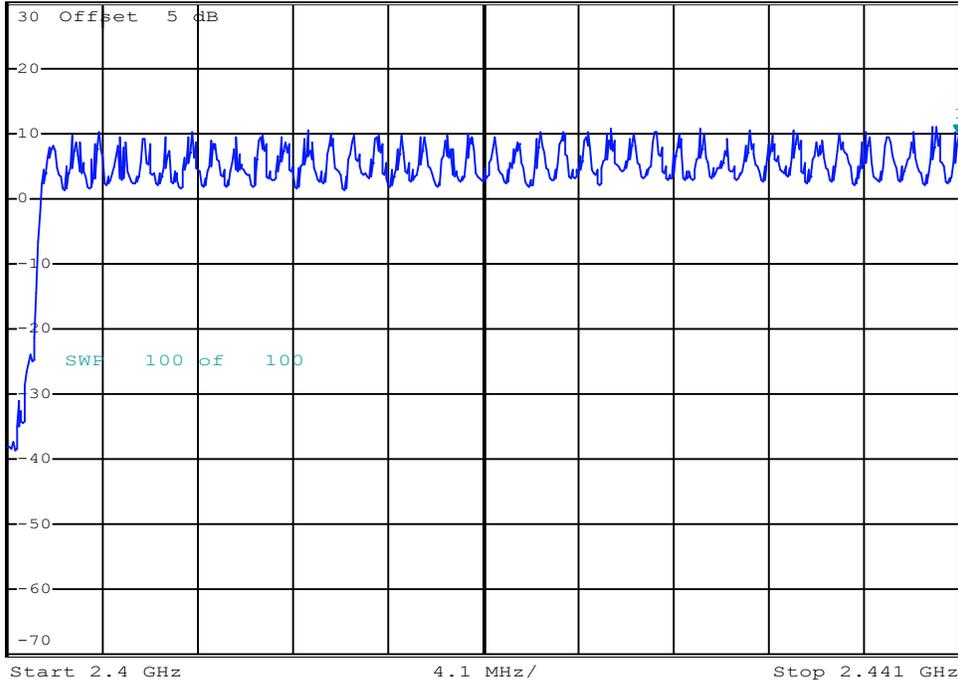
Number of Hopping Channels



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz 9.82 dBm
SWT 5 ms 2.441000000 GHz

Ref 30 dBm

*Att 40 dB



Date: 28.MAR.2024 16:15:03

Start Freq: MHz

Stop Freq: MHz

Mode:

Modulation:

Number of Channels: kHz

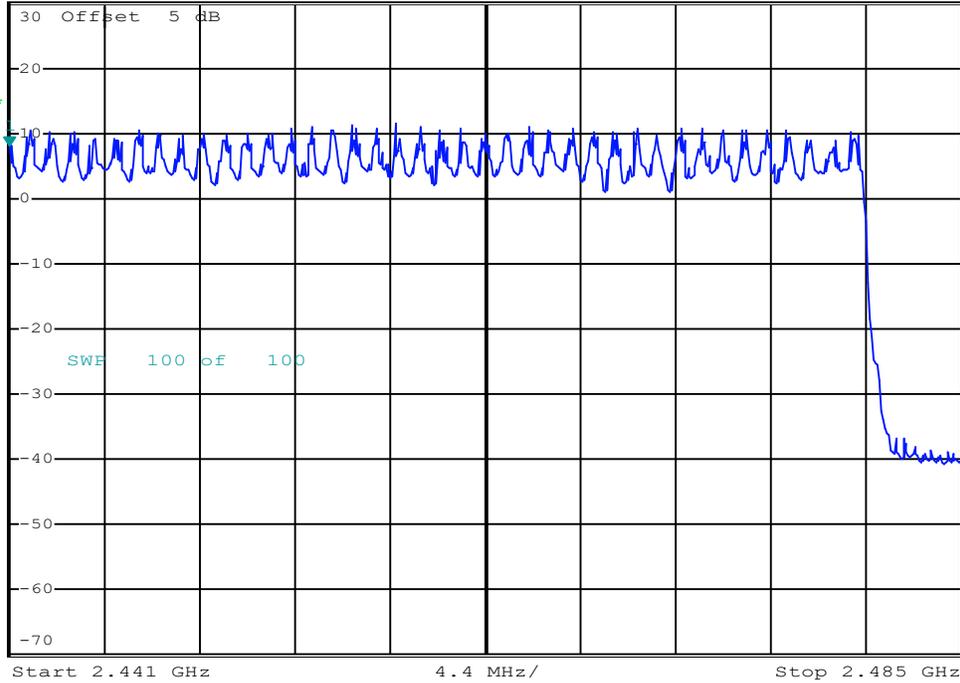
Number of Hopping Channels



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz 8.03 dBm
SWT 5 ms 2.441000000 GHz

Ref 30 dBm

*Att 40 dB



Date: 28.MAR.2024 16:12:04

Start Freq: MHz

Stop Freq: MHz

Mode:

Modulation:

Number of Channels: kHz

Hopping Channel Separation					
Mode	Modulation	20dB Bandwidth (MHz)	Channel Separation (MHz)	Minimum Separation (MHz)	Margin (MHz)
BT BR	GFSK	1.008	1.000	0.672	0.328
BT 2EDR	Pi/4-DQPSK	0.996	1.000	0.664	0.336
BT 3EDR	8-DPSK	1.380	1.000	0.920	0.080
Result:					Complies

Minimum Bandwidth = 20dB BW X 2/3

Margin = Channel Separation - 20dB Bandwidth

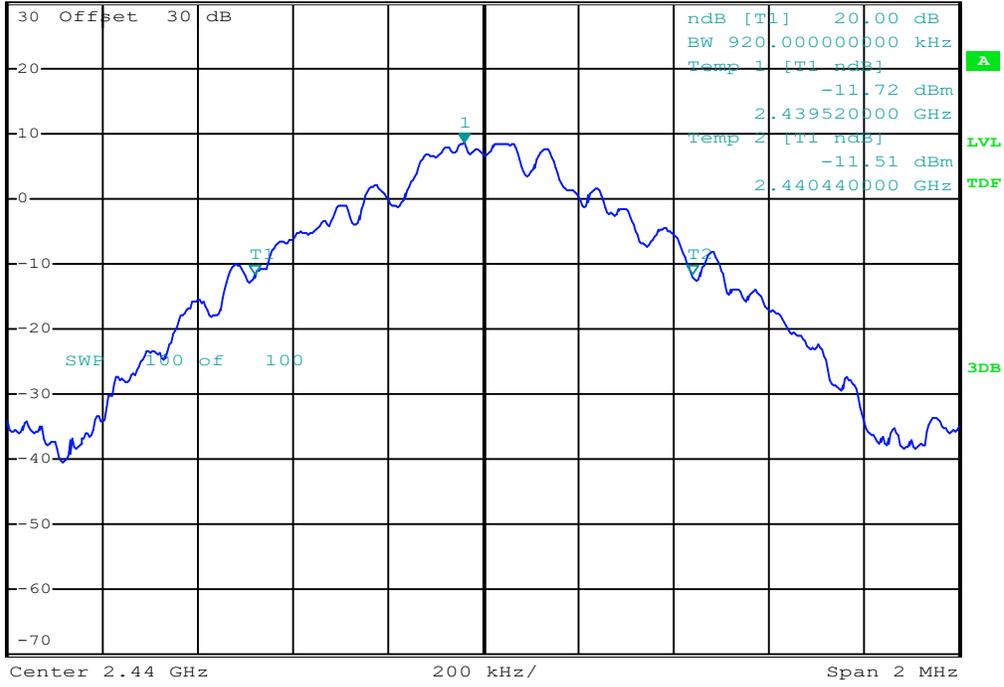
FHSS 20dB BW



*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz 8.48 dBm
 SWT 2.5 ms 2.439960000 GHz

Ref 30 dBm *Att 20 dB

1 PK
VIEW



Date: 16.APR.2024 17:49:12

Channel:

Mode:

Frequency: MHz

Modulation:

Measured 20dB BW: MHz

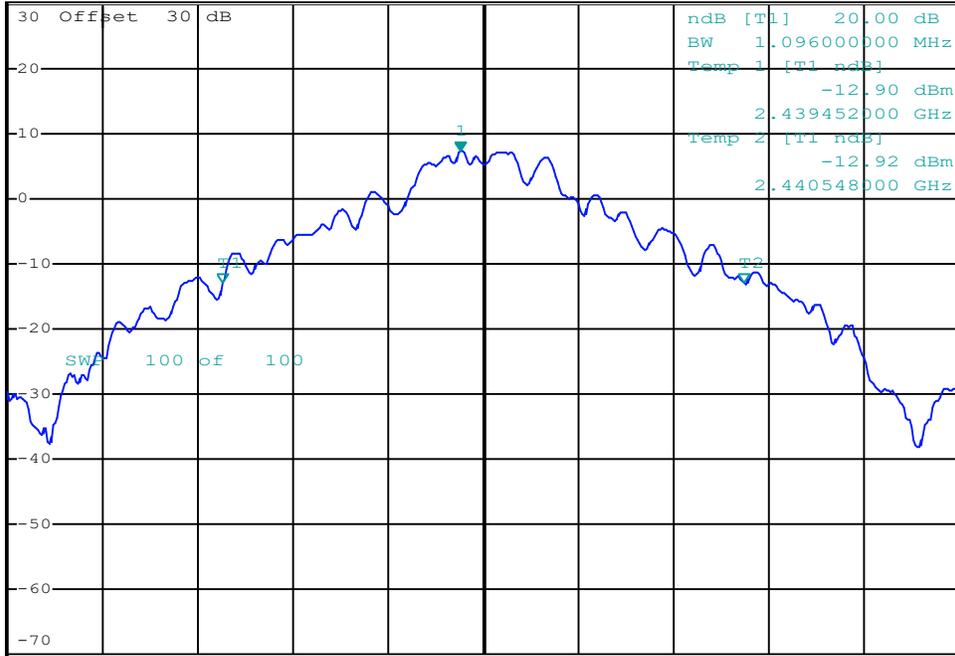
FHSS 20dB BW



*RBW 30 kHz Marker 1 [T1]
VBW 100 kHz 7.19 dBm
SWT 2.5 ms 2.439952000 GHz

Ref 30 dBm *Att 20 dB

1 PK
VIEW



Date: 16.APR.2024 17:45:10

Channel:

Frequency: MHz

Mode:

Modulation:

Measured 20dB BW: MHz

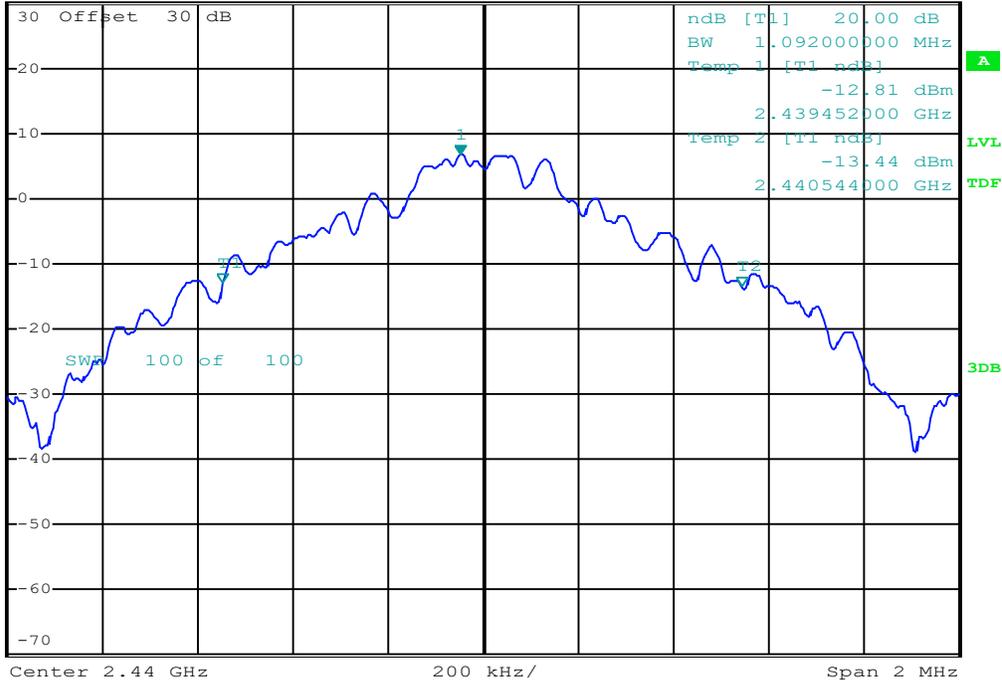
FHSS 20dB BW



*RBW 30 kHz Marker 1 [T1]
 VBW 100 kHz 6.68 dBm
 SWT 2.5 ms 2.439952000 GHz

Ref 30 dBm *Att 20 dB

1 PK
VIEW



Date: 16.APR.2024 17:45:43

Channel:

Frequency: MHz

Mode:

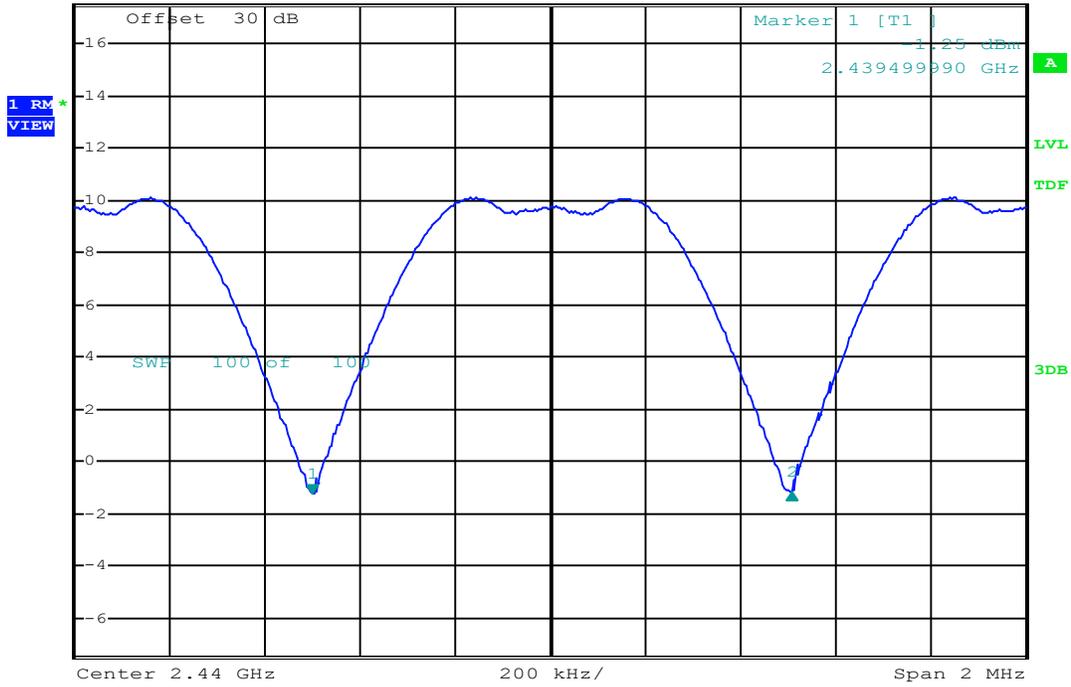
Modulation:

Measured 20dB BW: MHz

FHSS Channel Separation



*RBW 300 kHz Delta 2 [T1]
 VBW 3 MHz 0.10 dB
 Ref 17.5 dBm *Att 10 dB SWT 2.5 ms 1.008010000 MHz



Date: 14.JUN.2024 11:33:10

Channel:

Frequency: MHz

Mode:

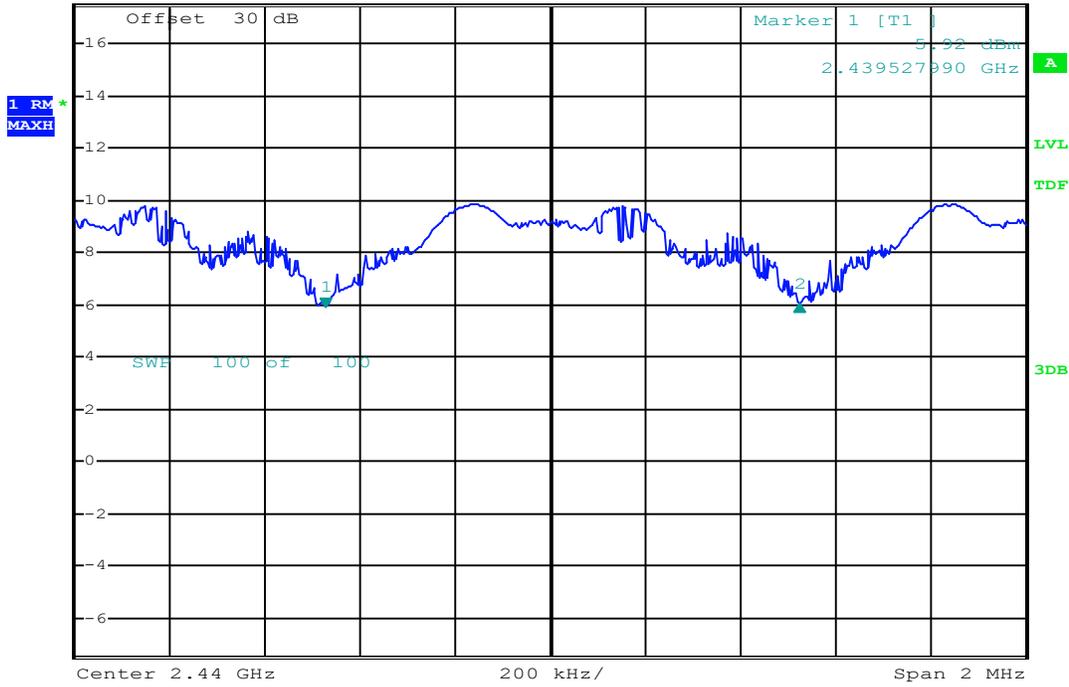
Modulation:

Measured Channel Separation: MHz

FHSS Channel Separation



*RBW 300 kHz Delta 2 [T1]
 VBW 3 MHz 0.10 dB
 Ref 17.5 dBm *Att 10 dB SWT 2.5 ms 996.010000000 kHz



Date: 14.JUN.2024 10:55:22

Channel:

Frequency: MHz

Mode:

Modulation:

Measured Channel Separation: MHz

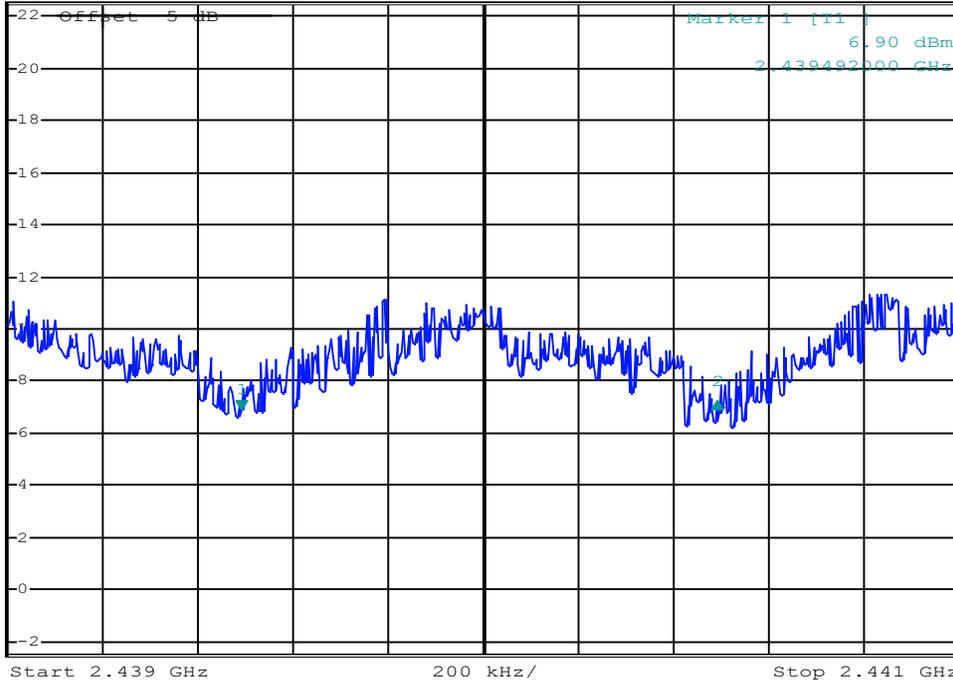
FHSS Channel Separation



*RBW 300 kHz Delta 2 [T1]
VBW 3 MHz 0.32 dB
SWT 2.5 ms 1.000000000 MHz

Ref 35 dBm

*Att 30 dB



Date: 4.APR.2024 21:46:40

Channel:

Frequency: MHz

Mode:

Modulation:

Measured Channel Separation: MHz

Accumulated Time of Occupancy DSS										
Channel Frequency (MHz)	Packet	Channel On Time (Dwell) [t _{Dwell}] (mSec)	Meas Period [t _{Meas}] (mSec)	Number of Tx per Period [N _{Tx}]	Number of Channels Employed [N _{Chan}]	Maximum TOO Per Channel [t _{Max}] (mSec)	Maximum TOO Period [t _{Period}] (mSec)	Accumulated Time of Occupancy [t _{Occ}] (mSec)	Limit [Limit] (mSec)	Margin (mSec)
2440.00	DH1, ...	0.386	1000	11	79	400.0	31600	134.2	400	265.8
	DH3, ...	1.628		7				360.1		39.9
	DH5, ...	2.890		3				274.0		126.0
Result:									Complies	

TOO = Time of Occupancy

Number of Channels Employed [N_{Chan}]: See Table 11.1

Maximum TOO Period [t_{Period}] = Number of Channels [N_{Chan}] X 0.4Sec, as per §15.247, RSS-247

Accumulated Time of Occupancy [t_{Occ}] =
$$\frac{(\text{Number of Tx per Period } [N_{Tx}] \times \text{Dwell Time } [t_{Dwell}] \times \text{Maximum TOO Period } [t_{Period}])}{\text{Measurement Period } [t_{Meas}]}$$

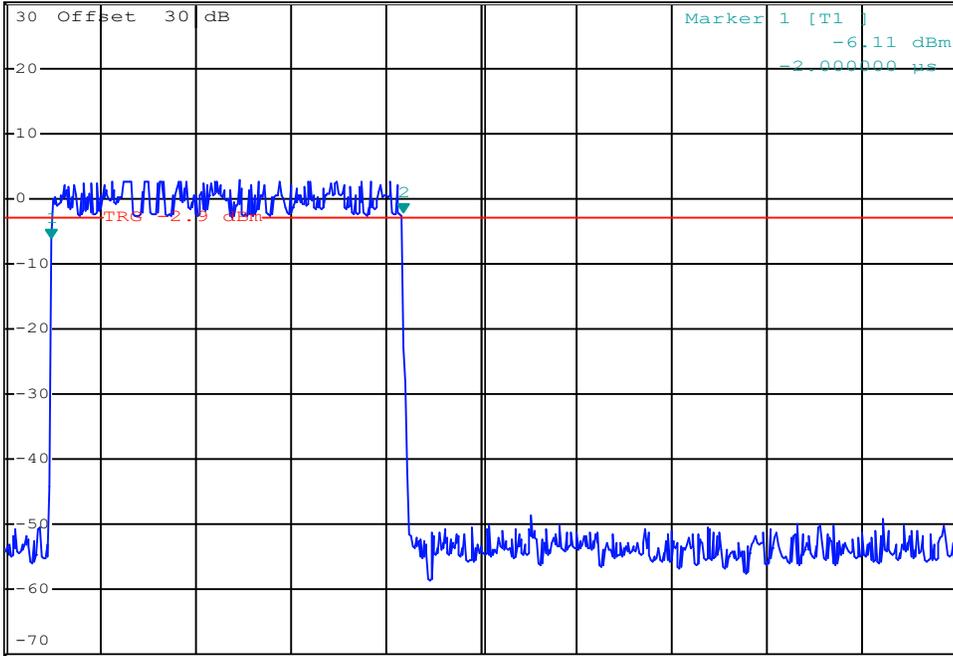
Margin = Limit [Limit] - Accumulated Time of Occupancy [t_{Occ}]

Dwell Time



Ref 30 dBm *Att 10 dB RBW 1 MHz Marker 2 [T1]
VEW 10 MHz -2.03 dBm
SWT 1 ms 368.000000 μ s

1 RM*
VIEW



Center 2.44 GHz 100 μ s/

Date: 14.JUN.2024 10:08:14

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

Measured Dwell Time: **0.386** mSec

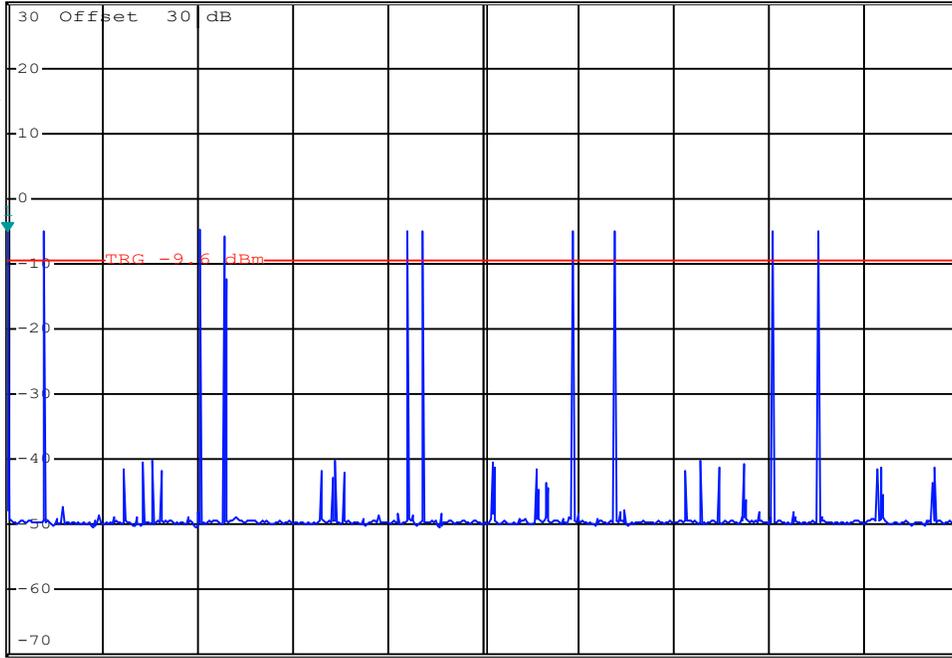
Number of Transmits



RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -4.95 dBm
SWT 1 s -2.000000 μ s

Ref 30 dBm *Att 10 dB

1 RM*
VIEW



Center 2.44 GHz 100 ms/

Date: 14.JUN.2024 10:14:43

Packet:

Transmit Count: /1000 mSec

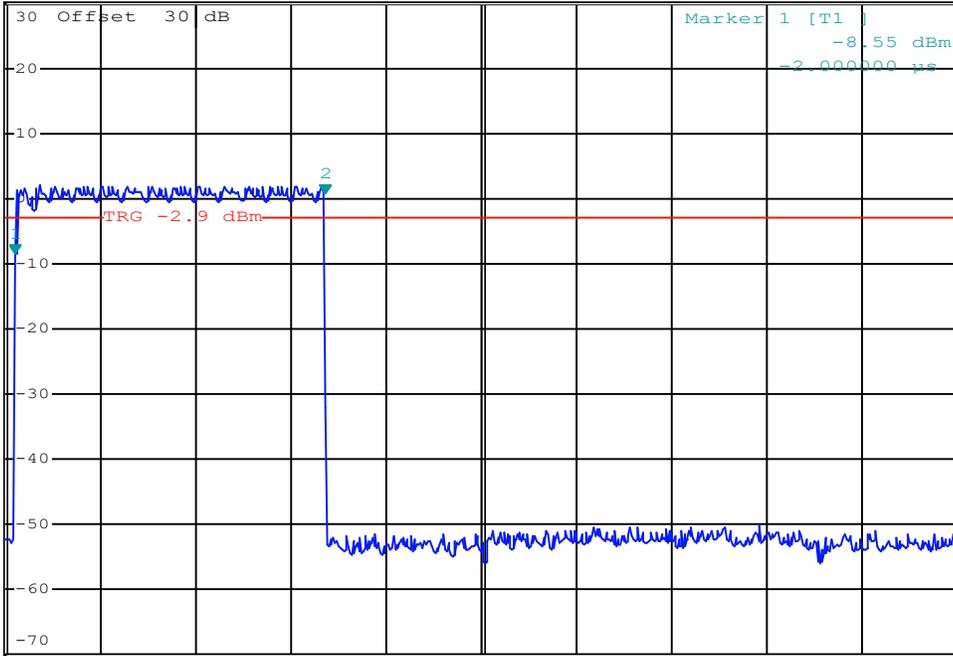
Measurement Period: mSec

Dwell Time



Ref 30 dBm *Att 10 dB RBW 1 MHz Marker 2 [T1]
VEW 10 MHz 0.72 dBm
SWT 5 ms 1.628000 ms

1 RM*
VIEW



Date: 14.JUN.2024 10:09:48

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

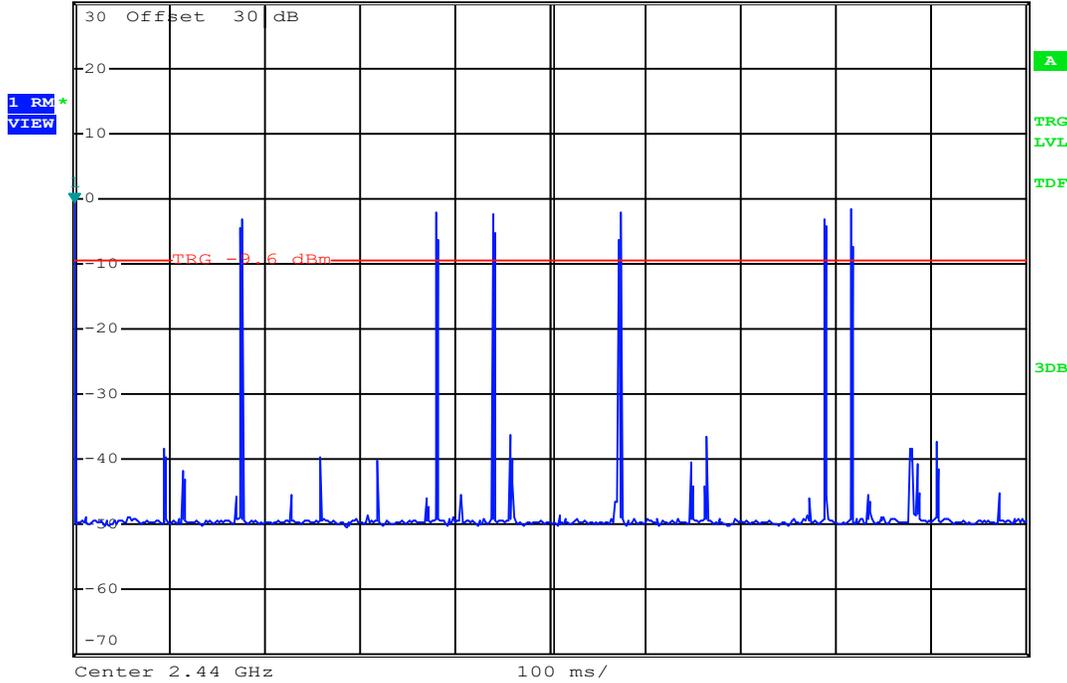
Measured Dwell Time: **1.628** mSec

Number of Transmits



RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -0.71 dBm
SWT 1 s -2.000000 μ s

Ref 30 dBm *Att 10 dB



Date: 14.JUN.2024 10:15:31

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

Transmit Count: **7** /1000 mSec

Measurement Period: **1000** mSec

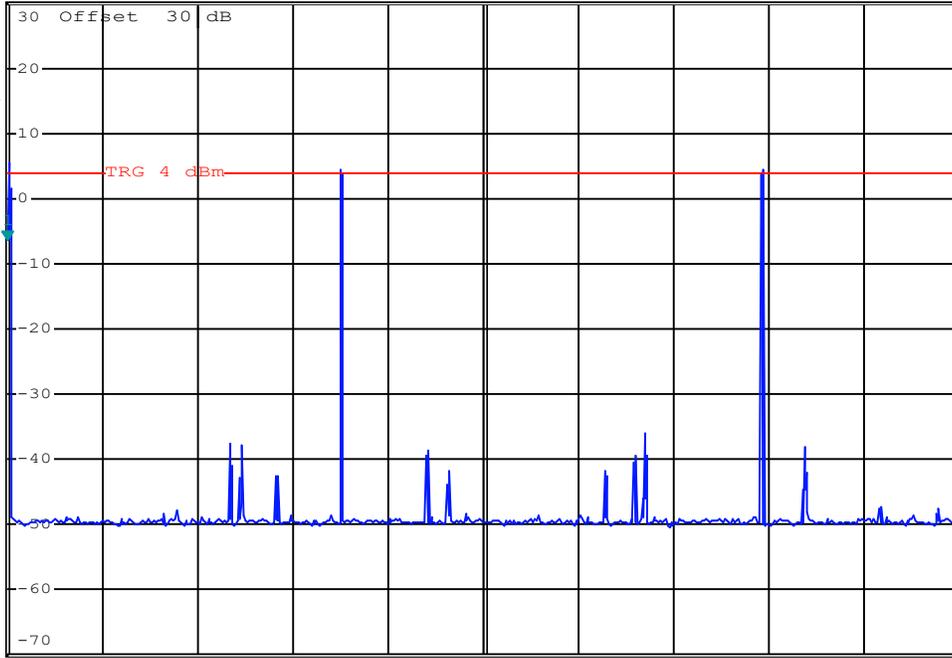
Number of Transmits



RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -6.46 dBm
SWT 1 s -2.000000 μ s

Ref 30 dBm *Att 10 dB

1 RM*
VIEW



Date: 14.JUN.2024 10:12:47

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

Transmit Count: **3** /1000 mSec

Measurement Period: **1000** mSec

Band Edge Measurement Results (Lower): DTS

Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Fundamental Power [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)	Antenna Gain (dBi)	Emission EIRP [E _{Em}] (dBm)	Fundamental EIRP [E _{Fund}] (dBm)	EIRP Attenuation [Atten] (dB)	Limit (dB)	EIRP Margin (dB)
802.11b	1	2412.00	DSSS 5.5	-26.84	16.83	43.67	30	13.7	-5.8	-32.64	11.03	43.67	30	13.7
802.11g	1	2412.00	OFDM6	-28.28	15.76	44.04		14.0		-34.08	9.96	44.04		14.0
802.11n	1	2412.00	MCS0	-29.70	16.09	45.79		15.8		-35.50	10.29	45.79		15.8
BLE1	37	2402.00	GMSK	-38.33	1.83	40.16		10.2		-44.13	-3.97	40.16		10.2
BLE2	0	2404.00	GMSK	-38.41	2.01	40.42		10.4		-44.21	-3.79	40.42		10.4
ANT	0	2402.00	GFSK	-38.92	2.08	41.00		11.0		-44.72	-3.72	41.00		11.0
Result:													Complies	

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

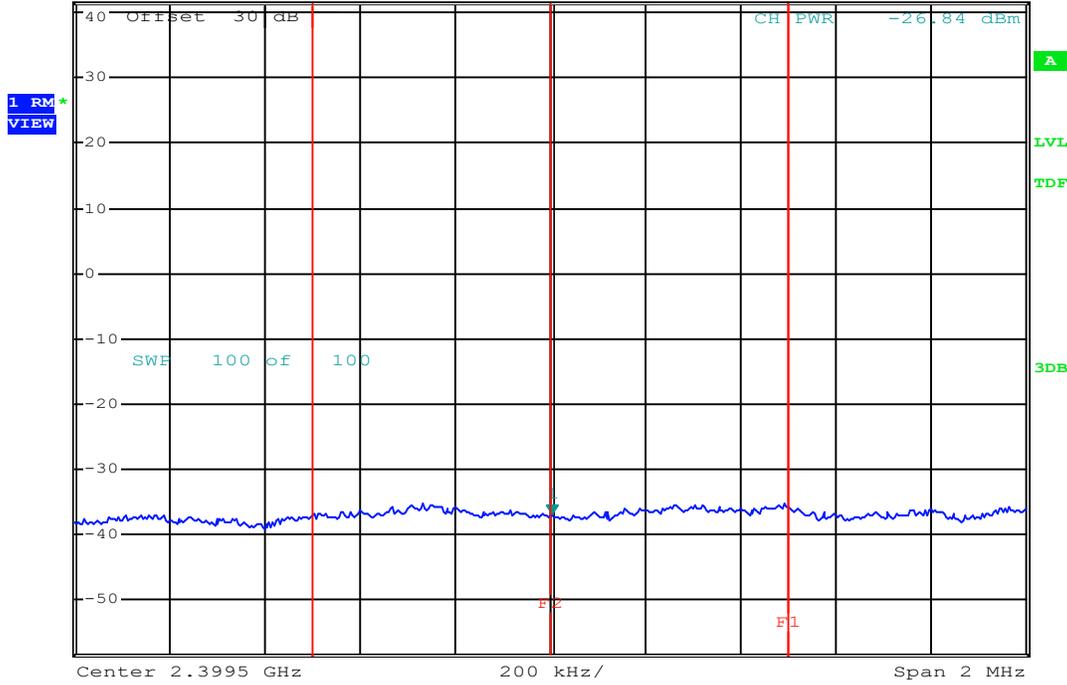
Margin = [Atten] - Limit

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -36.87 dBm
SWT 2.5 ms 2.399504000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 12:25:25

Channel:

Mode:

Channel Frequency: MHz

Modulation:

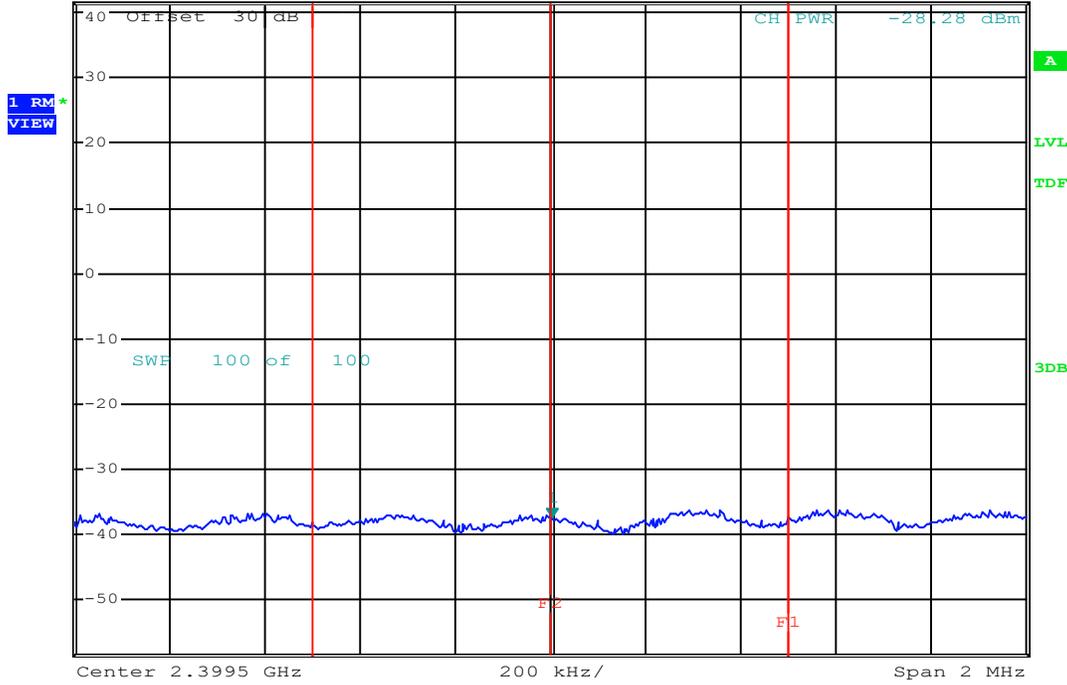
Emission Power: dBm

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -37.33 dBm
SWT 2.5 ms 2.399504000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 12:24:03

Channel:

Mode:

Channel Frequency: MHz

Modulation:

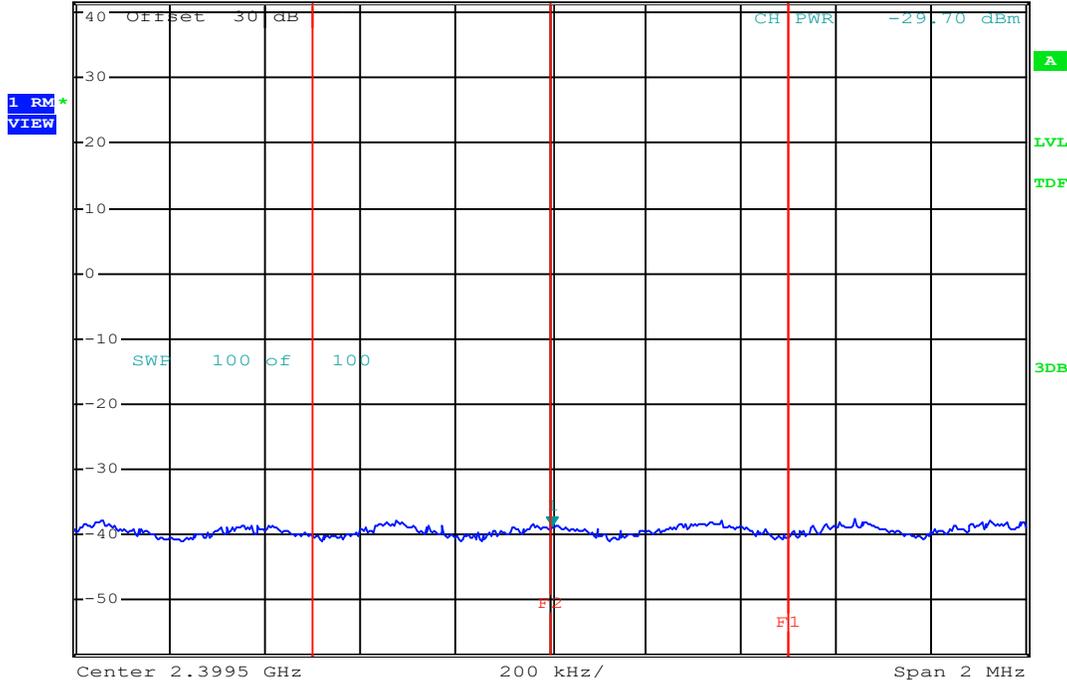
Emission Power: dBm

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
 VEW 1 MHz -38.73 dBm
 SWT 2.5 ms 2.399504000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 12:24:44

Channel:

Mode:

Channel Frequency: MHz

Modulation:

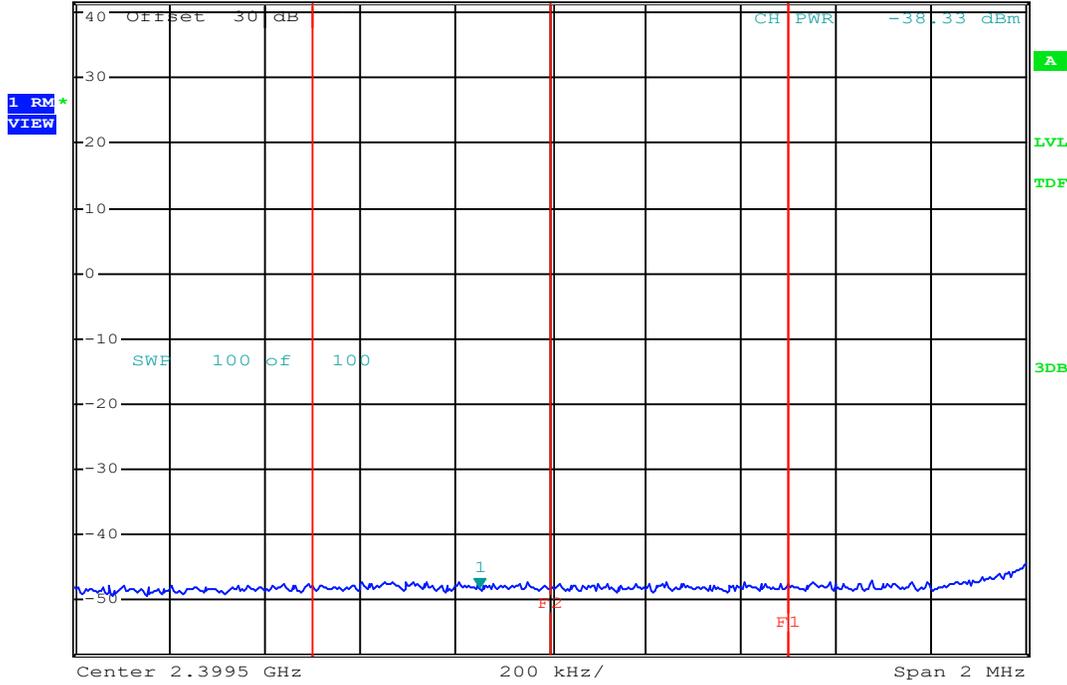
Emission Power: dBm

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -48.02 dBm
SWT 2.5 ms 2.399352000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 08:59:20

Channel:

Mode:

Channel Frequency: MHz

Modulation:

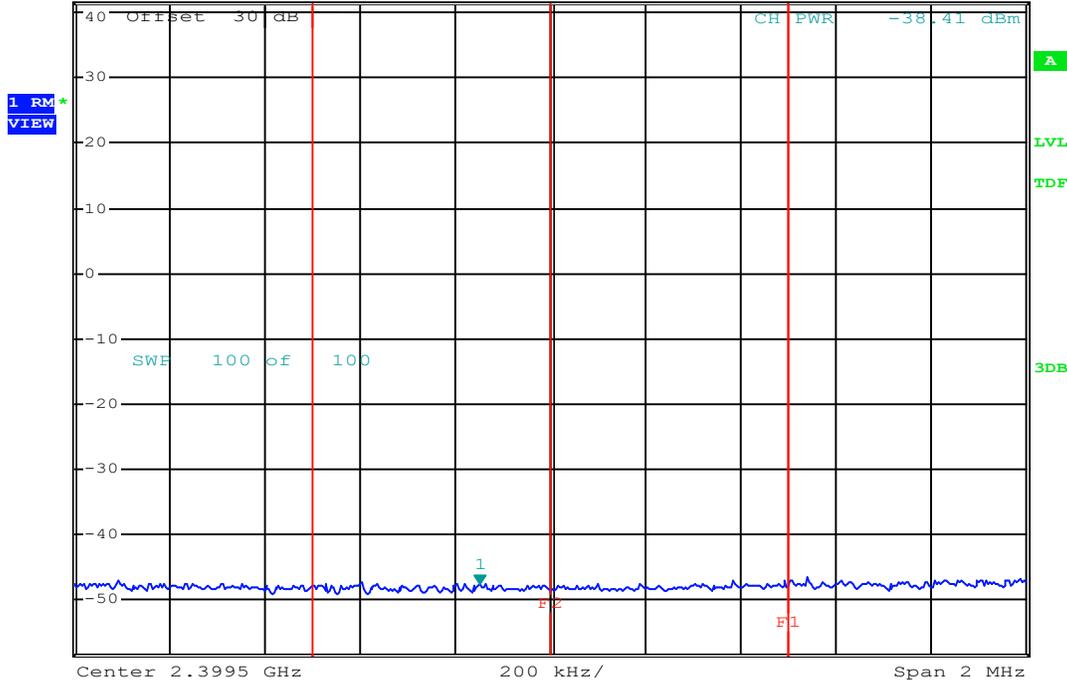
Emission Power: dBm

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -47.48 dBm
SWT 2.5 ms 2.399352000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 09:00:01

Channel:

Mode:

Channel Frequency: MHz

Modulation:

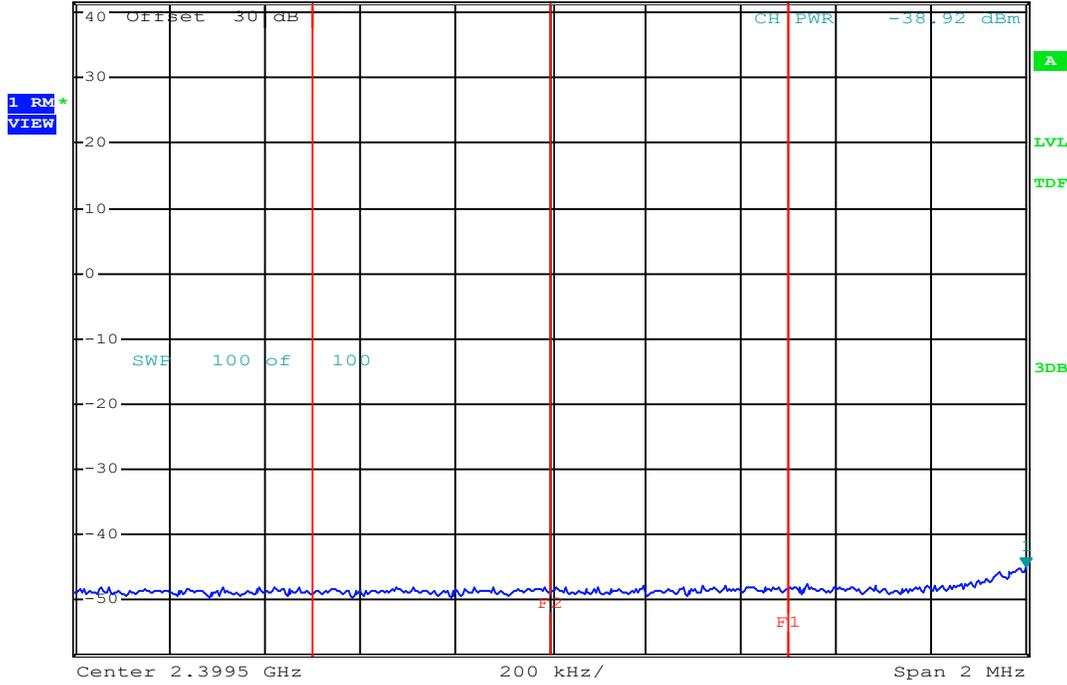
Emission Power: dBm

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -45.10 dBm
SWT 2.5 ms 2.400500000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 09:02:33

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge Measurement Results (Restricted Band): DTS									
Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Antenna Gain [G] (dBi)	Emission EIRP [E _{Em}] (dBm)	Field Strength [FS] (dBuV)	Peak Limit (dBuV/m)	Margin (dB)
802.11b	9	2452.00	DSSS 5.5	-23.52	-5.8	-29.32	65.98	74	8.0
	10	2457.00		-28.21		-34.01	61.29		12.7
	11	2462.00		-28.50		-34.30	61.00		13.0
	12	2467.00		-29.15		-34.95	60.35		13.7
	13	2472.00		-24.45		-30.25	65.05		9.0
802.11g	9	2452.00	OFDM6	-19.26		-25.06	70.24		3.8
	10	2457.00		-18.83		-24.63	70.67		3.3
	11	2462.00		-18.20		-24.00	71.30		2.7
	12	2467.00		-17.03		-22.83	72.47		1.5
	13	2472.00		-21.84		-27.64	67.66		6.3
802.11n	9	2452.00	MCS0	-23.53		-29.33	65.97		8.0
	10	2457.00		-19.70		-25.50	69.80		4.2
	11	2462.00		-17.31		-23.11	72.19		1.8
	12	2467.00		-21.43		-27.23	68.07		5.9
	13	2472.00		-20.45		-26.25	69.05		5.0
BLE1	39	2480.00	GMSK	-27.46	-33.26	62.04	12.0		
BLE2	36	2478.00	GMSK	-26.81	-32.61	62.69	11.3		
ANT	78	2480.00	GFSK	-27.26	-33.06	62.24	11.8		
Results								Complies	

Margin = [FS] - Limit

FS = EIRP -20Log(d) +104.8

EIRP = Emission Power [P_{Em}] + Antenna Gain [G] + Ground Reflection Factor (0)

Band Edge: Upper Band Edge

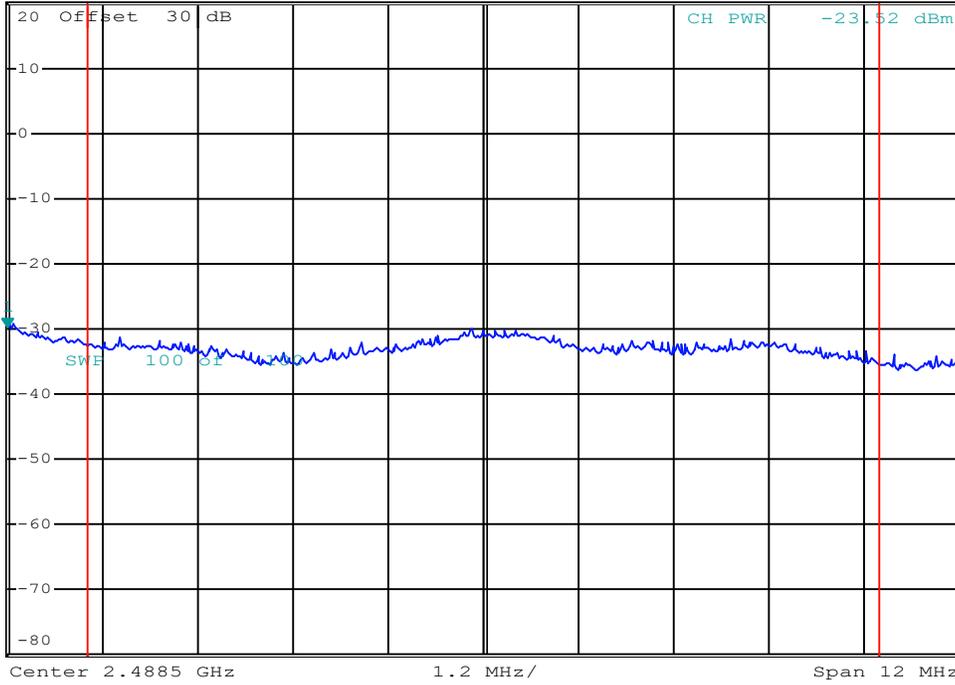


*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -29.68 dBm
SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm

*Att 10 dB

1 PK
VIEW



Date: 18.JUN.2024 15:44:33

Channel: 9

Mode: 802.11b

Band Edge: Upper

Channel Frequency: 2452 MHz

Modulation: DSSS 5.5

Emission Power: -23.52 dBm

Band Edge: Upper Band Edge

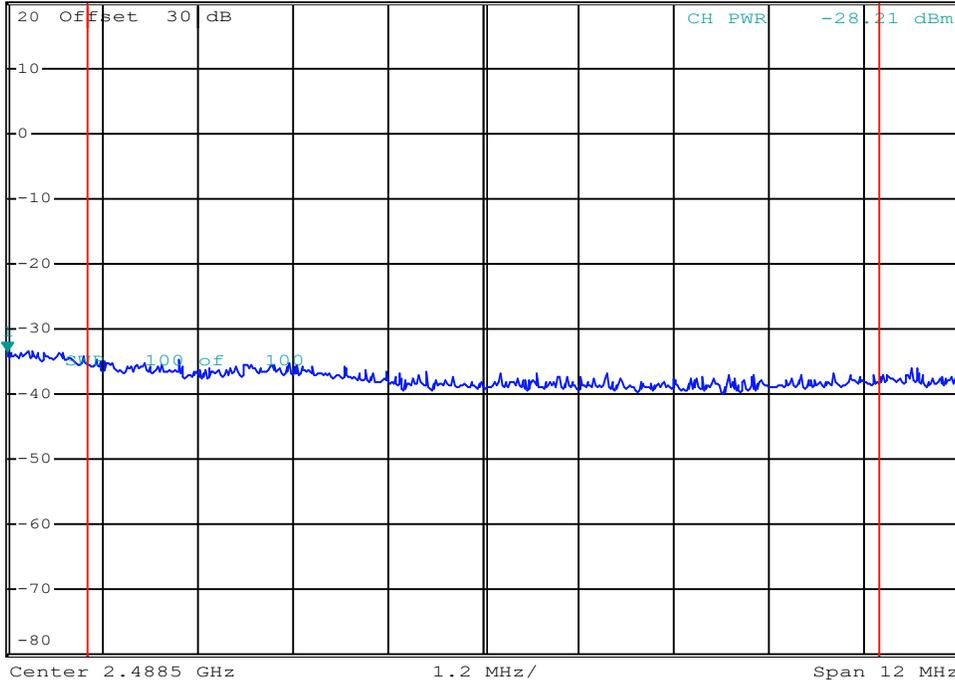


*RBW 1 MHz Marker 1 [T1]
 VEW 3 MHz -33.38 dBm
 SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm

*Att 10 dB

1 PK
VIEW



Date: 18.JUN.2024 15:56:23

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

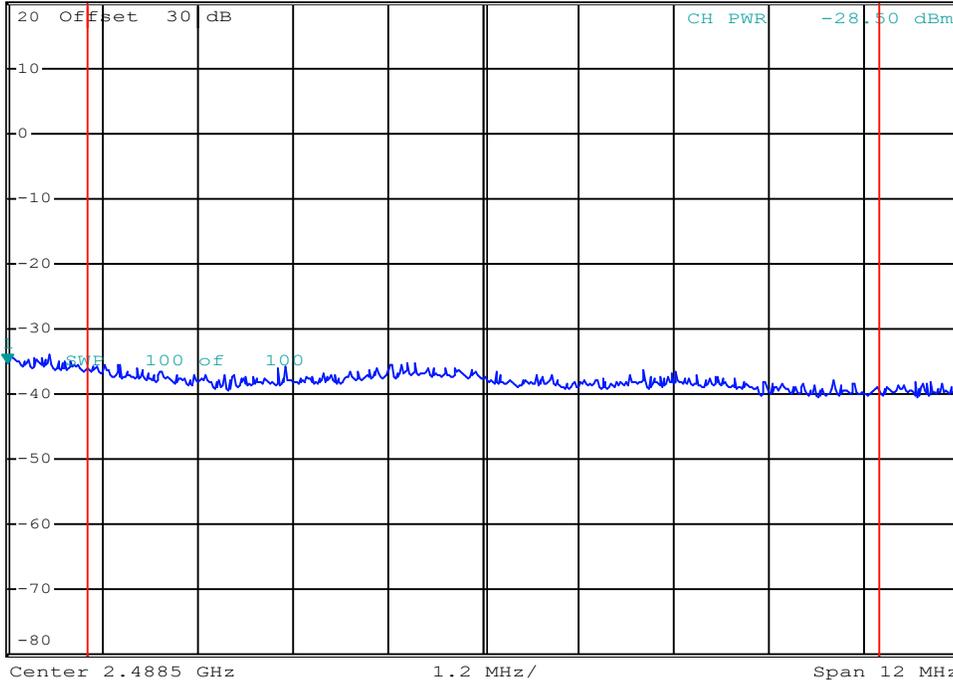


*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -35.25 dBm
SWT 2.5 ms 2.482500000 GHz

Ref 20 dBm

*Att 10 dB

1 PK
VIEW



Date: 18.JUN.2024 15:49:48

Channel: 11

Mode: 802.11b

Band Edge: Upper

Channel Frequency: 2462 MHz

Modulation: DSSS 5.5

Emission Power: -28.5 dBm

Band Edge: Upper Band Edge

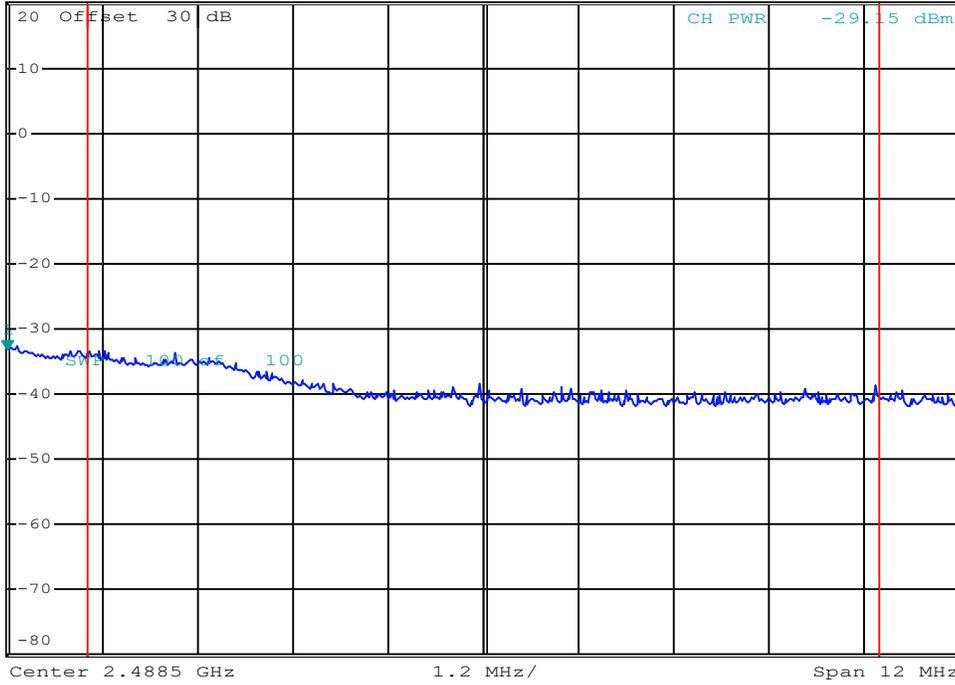


*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -33.04 dBm
SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm

*Att 10 dB

1 PK
VIEW



Date: 18.JUN.2024 15:52:14

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

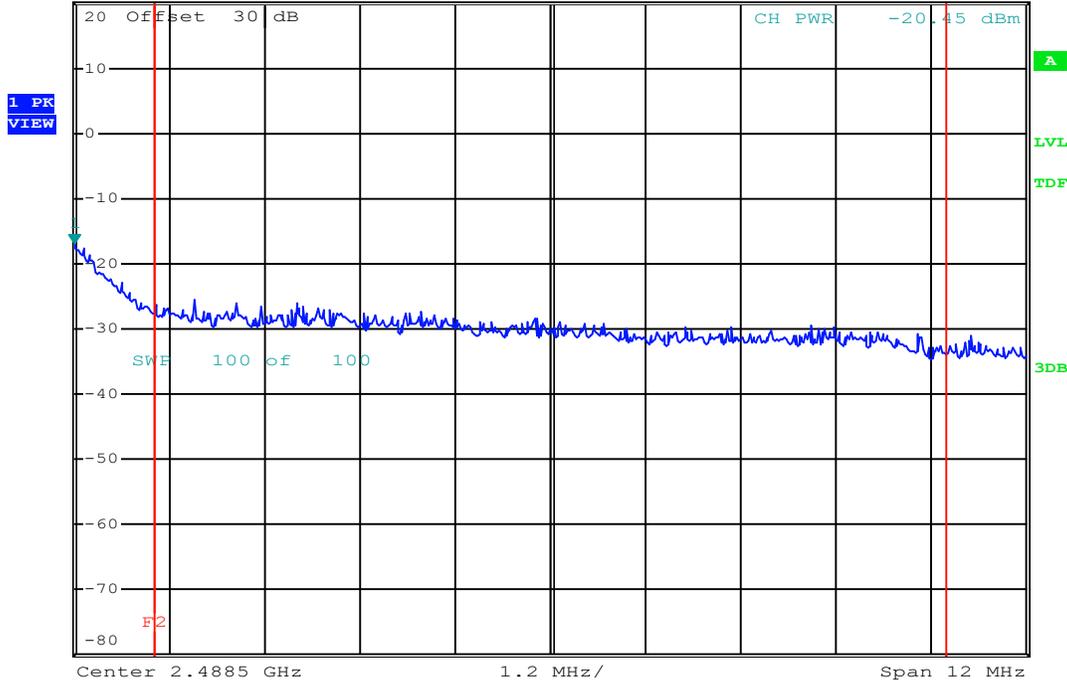
Emission Power: dBm

Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -16.76 dBm
SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:37:34

Channel:
Mode:
Band Edge:

Channel Frequency: MHz
Modulation:
Emission Power: dBm

Band Edge: Upper Band Edge

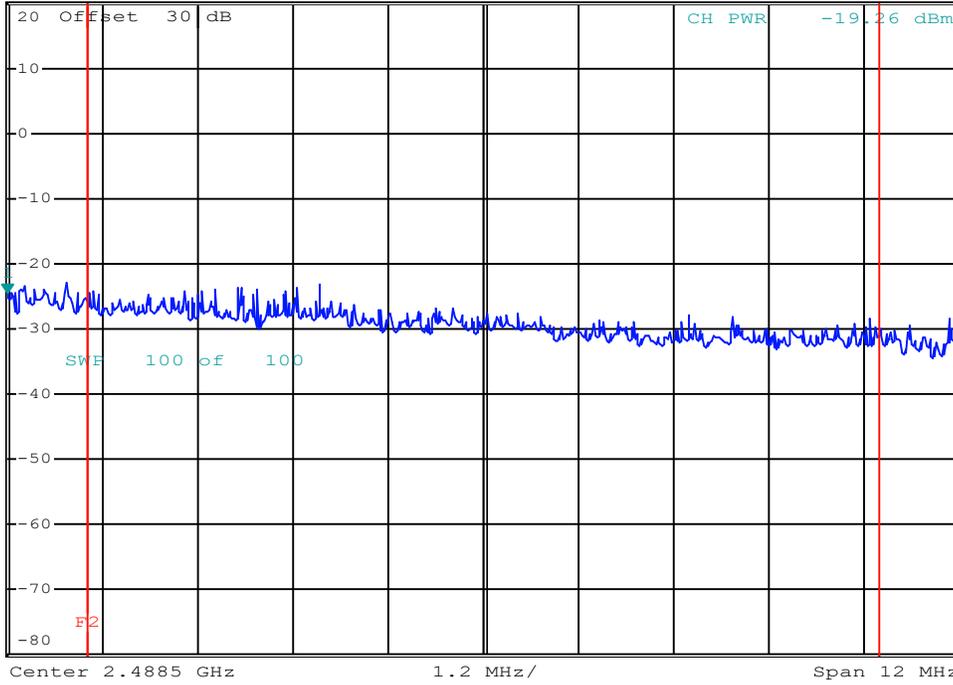


*RBW 1 MHz Marker 1 [T1]
 VEW 3 MHz -24.50 dBm
 SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm

*Att 0 dB

1 PK
VIEW



Date: 5.JUL.2024 10:40:51

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

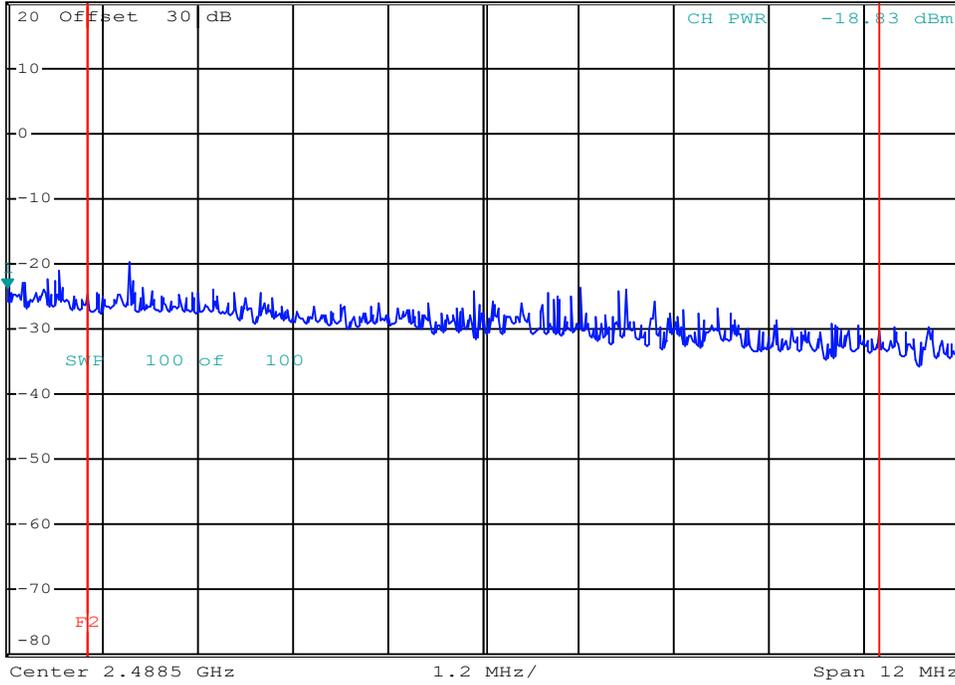
Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
 VEW 3 MHz -23.67 dBm
 SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm *Att 0 dB

1 PK
 VIEW



Date: 5.JUL.2024 10:41:41

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

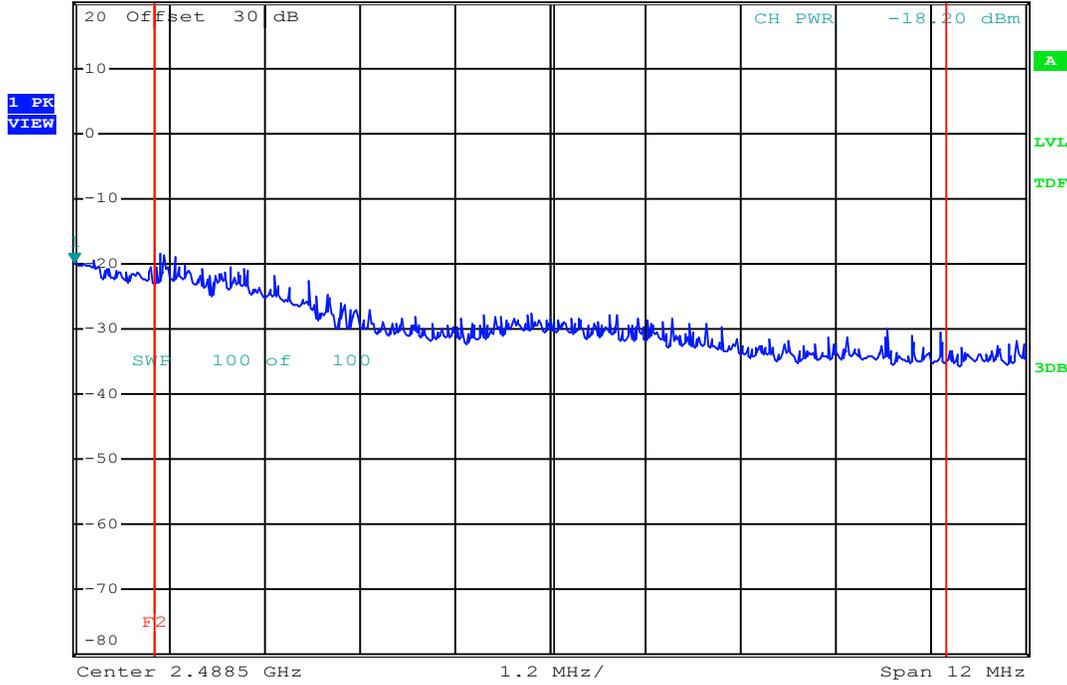
Emission Power: dBm

Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -19.69 dBm
SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:42:14

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

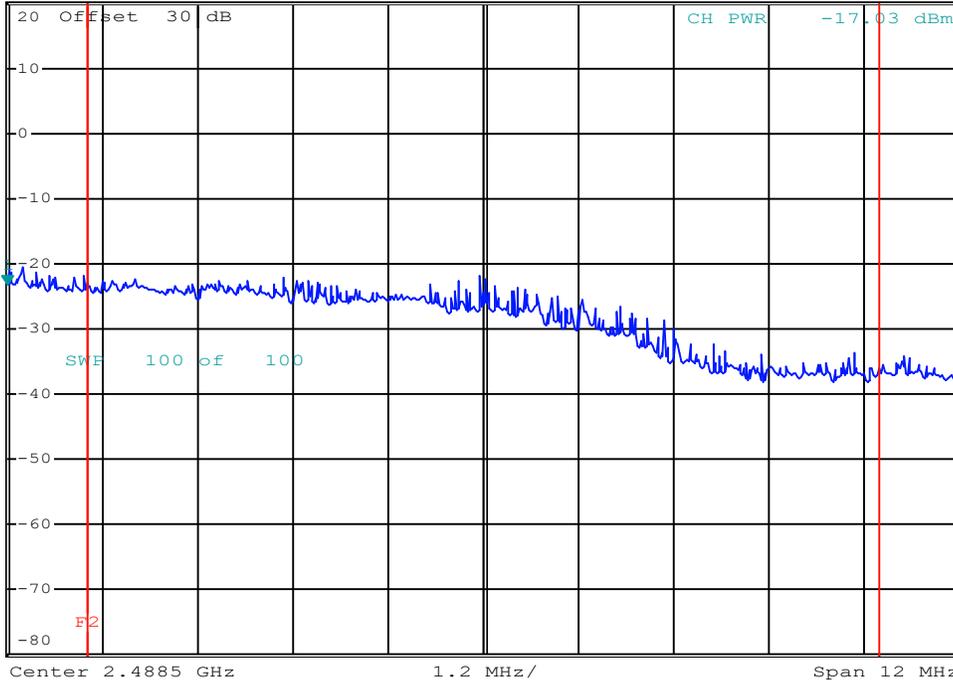
Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
 VEW 3 MHz -23.14 dBm
 SWT 2.5 ms 2.482500000 GHz

Ref 20 dBm *Att 0 dB

1 PK
 VIEW



Date: 5.JUL.2024 10:42:46

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

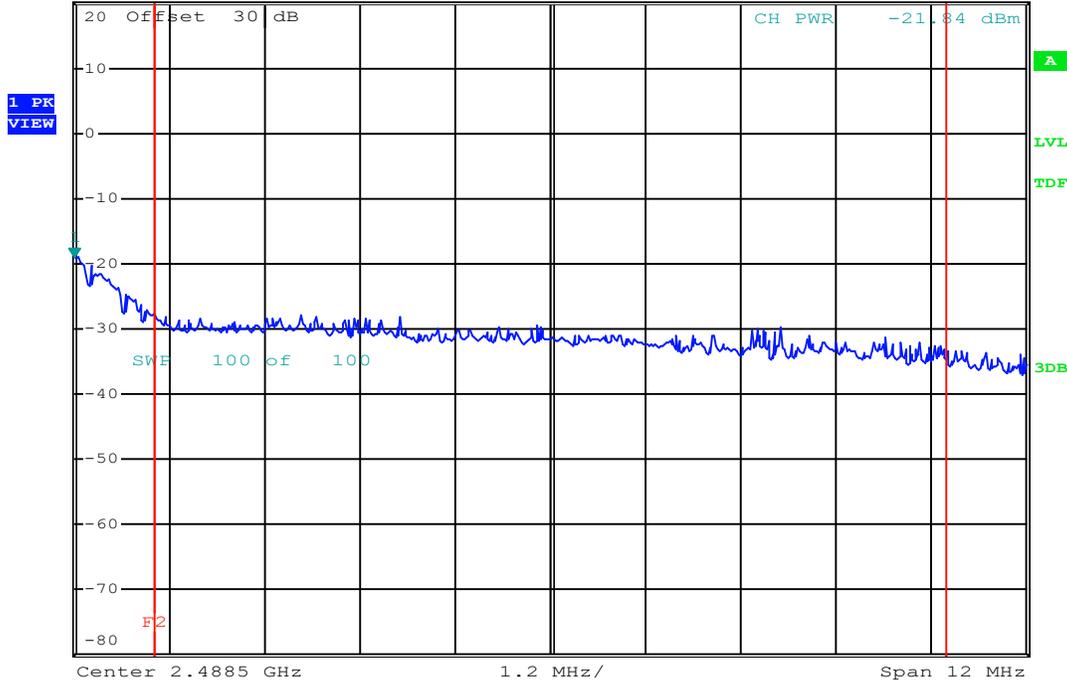
Emission Power: dBm

Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -18.98 dBm
SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm *Att 0 dB



Date: 5.JUL.2024 10:43:22

Channel:
Mode:
Band Edge:

Channel Frequency: MHz
Modulation:
Emission Power: dBm

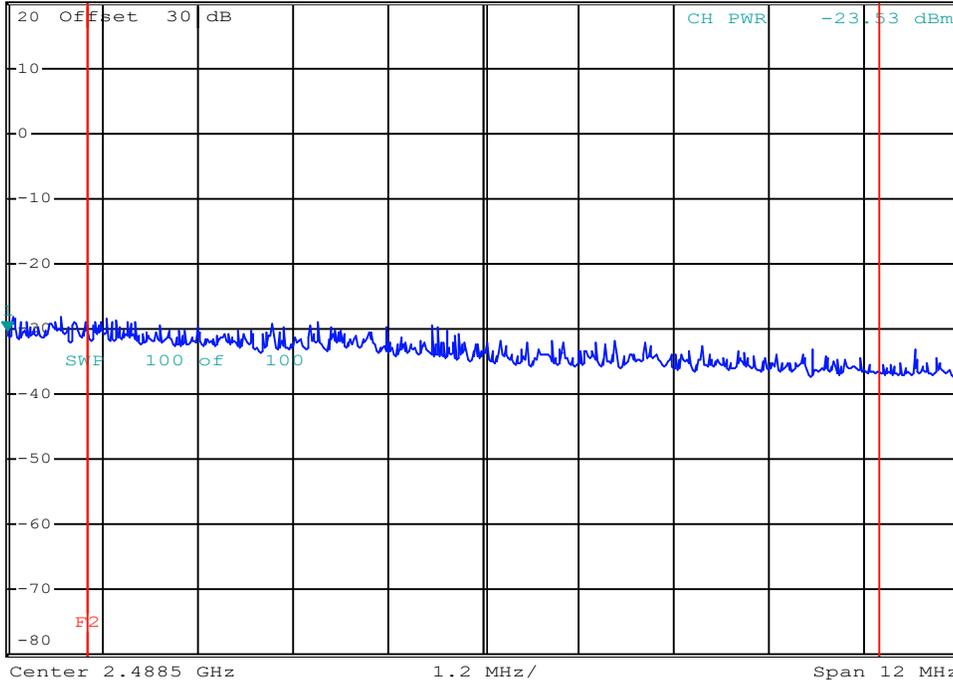
Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -30.14 dBm
SWT 2.5 ms 2.482500000 GHz

Ref 20 dBm *Att 0 dB

1 PK
VIEW



Date: 5.JUL.2024 10:34:48

Channel:
Mode:
Band Edge:

Channel Frequency: MHz
Modulation:
Emission Power: dBm

Band Edge: Upper Band Edge

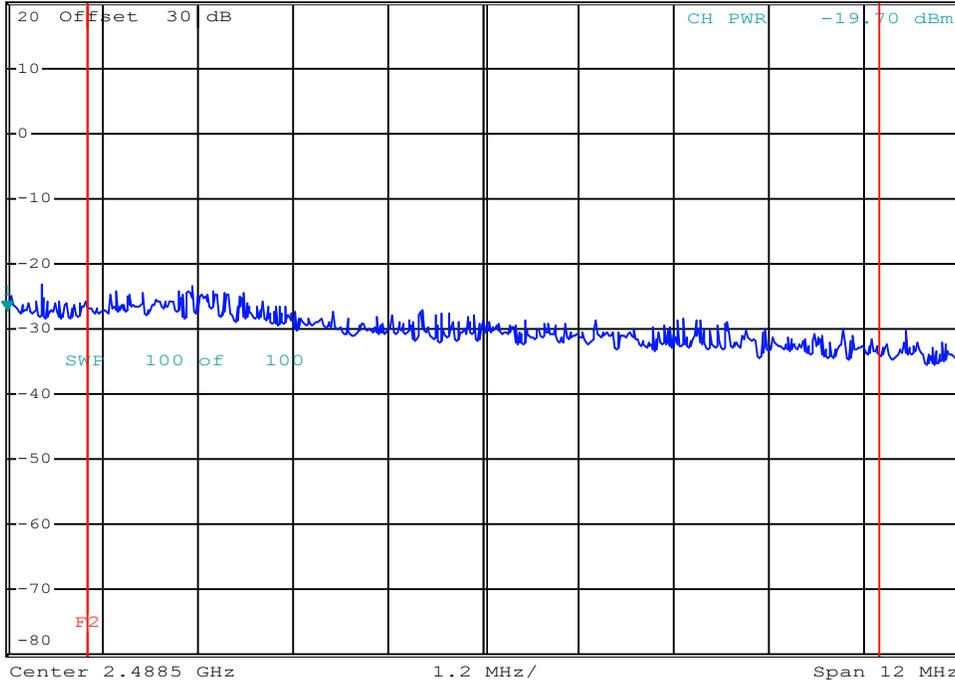


*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -27.13 dBm
SWT 2.5 ms 2.482500000 GHz

Ref 20 dBm

*Att 0 dB

1 PK
VIEW



Date: 5.JUL.2024 10:38:10

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

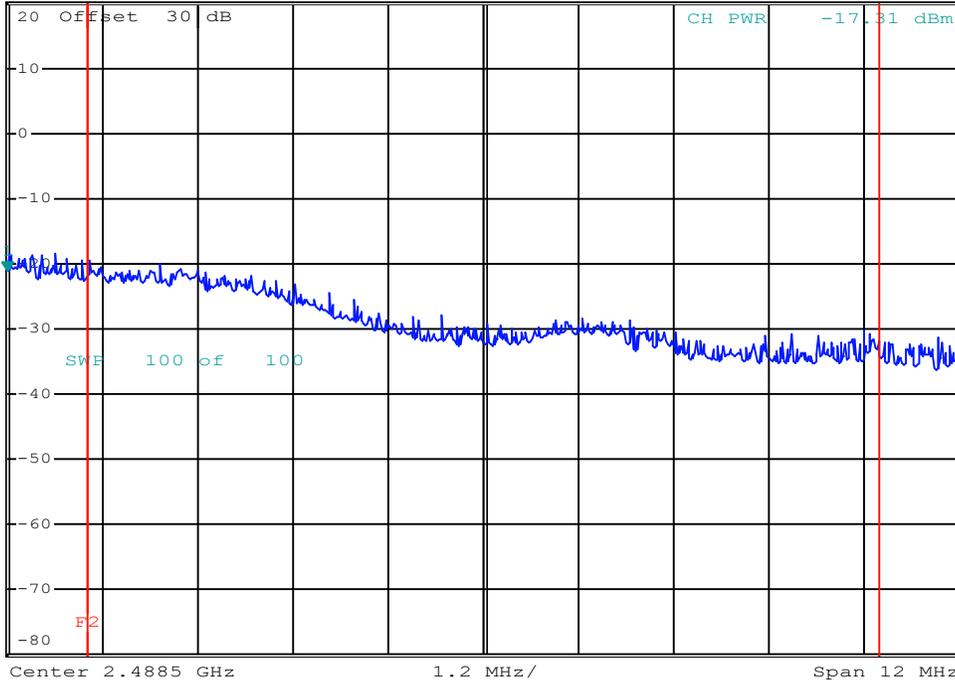


*RBW 1 MHz Marker 1 [T1]
 VEW 3 MHz -20.96 dBm
 SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm

*Att 0 dB

1 PK
VIEW



Date: 5.JUL.2024 10:38:36

Channel: 11

Mode: 802.11n

Band Edge: Upper

Channel Frequency: 2462 MHz

Modulation: MCS0

Emission Power: -17.31 dBm

Band Edge: Upper Band Edge

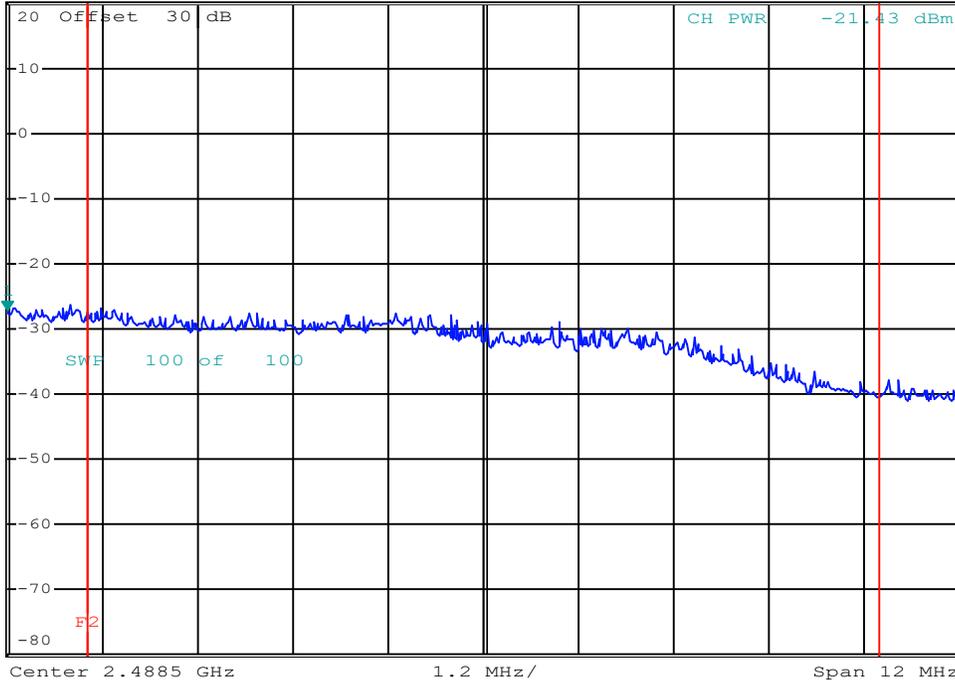


*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -27.20 dBm
SWT 2.5 ms 2.482500000 GHz

Ref 20 dBm

*Att 0 dB

1 PK
VIEW



Date: 5.JUL.2024 10:36:56

Channel: 12

Mode: 802.11n

Band Edge: Upper

Channel Frequency: 2467 MHz

Modulation: MCS0

Emission Power: -21.43 dBm

Band Edge: Upper Band Edge

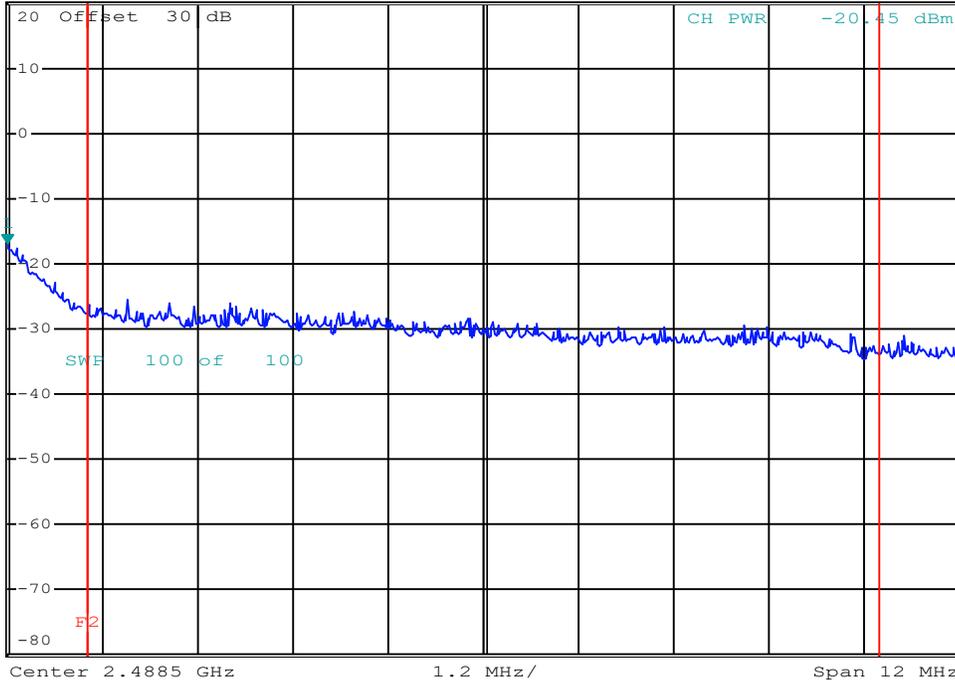


*RBW 1 MHz Marker 1 [T1]
 VEW 3 MHz -16.76 dBm
 SWT 2.5 ms 2.48250000 GHz

Ref 20 dBm

*Att 0 dB

1 PK
VIEW



Date: 5.JUL.2024 10:37:34

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

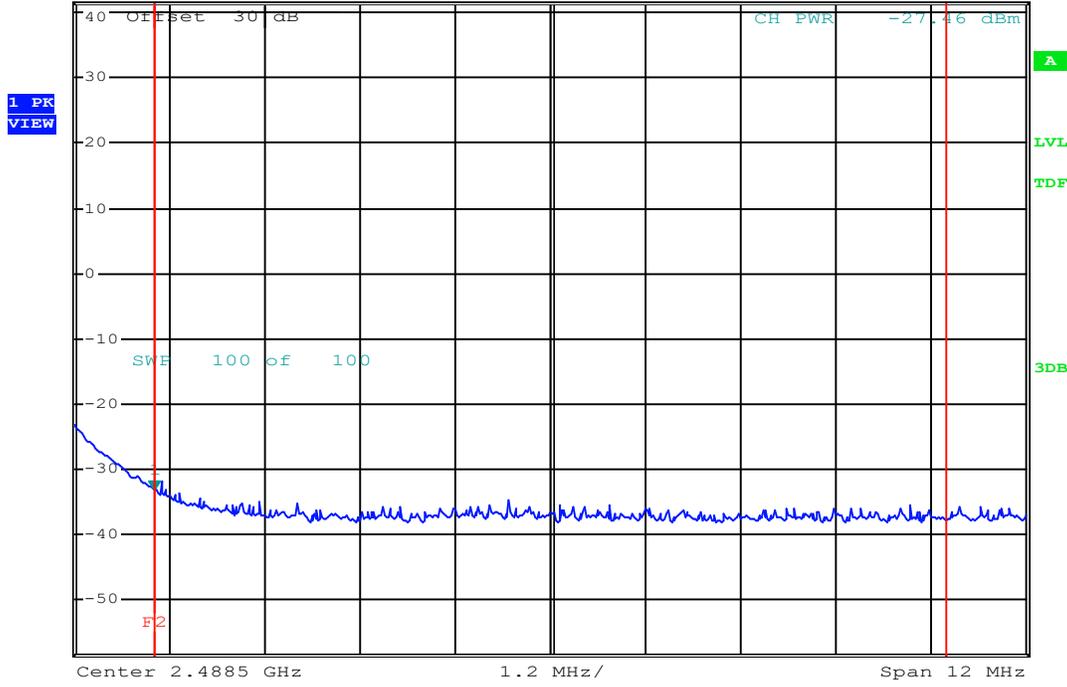
Emission Power: dBm

Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -33.27 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 09:10:37

Channel:
Mode:
Band Edge:

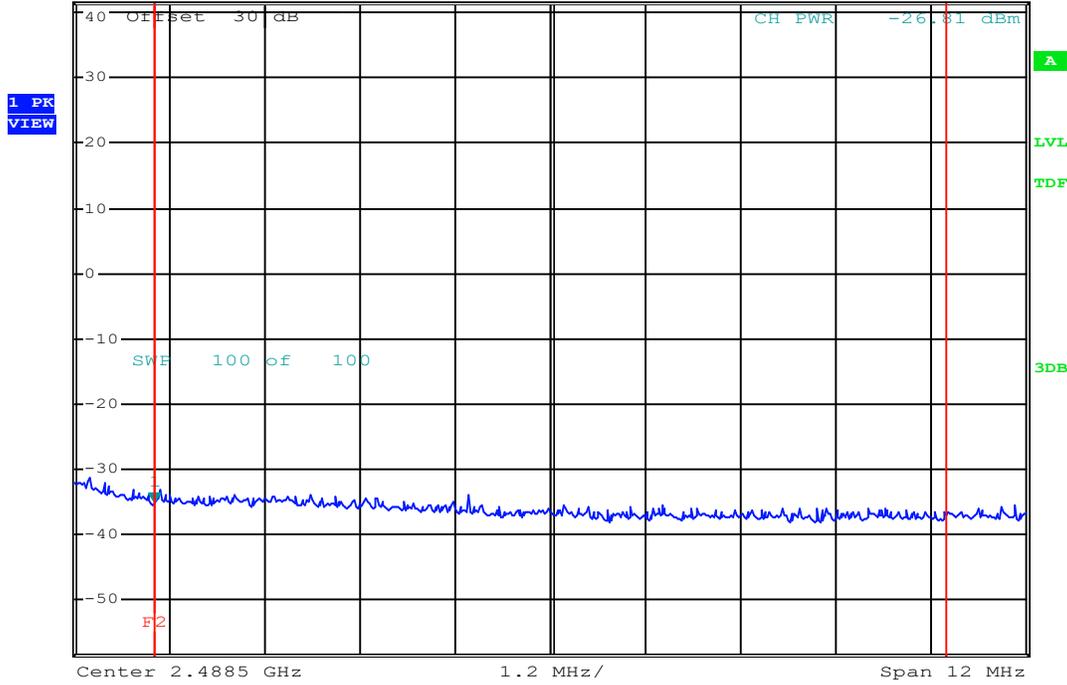
Channel Frequency: MHz
Modulation:
Emission Power: dBm

Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -35.12 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 09:53:41

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

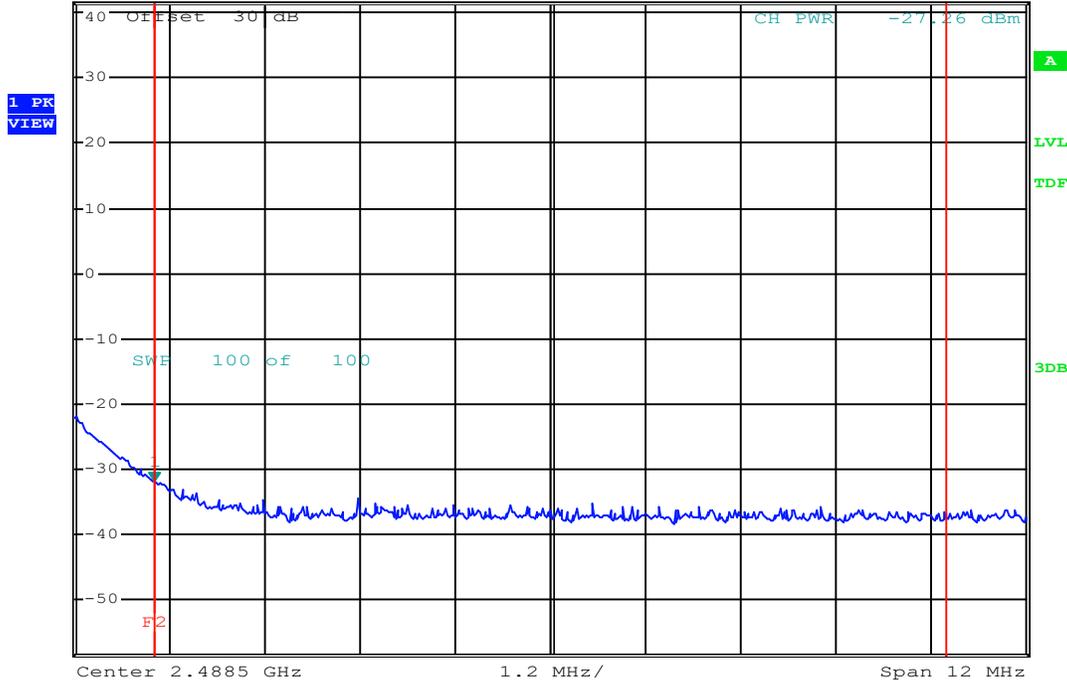
Emission Power: dBm

Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -31.80 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 09:54:25

Channel:

Mode:

Band Edge:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

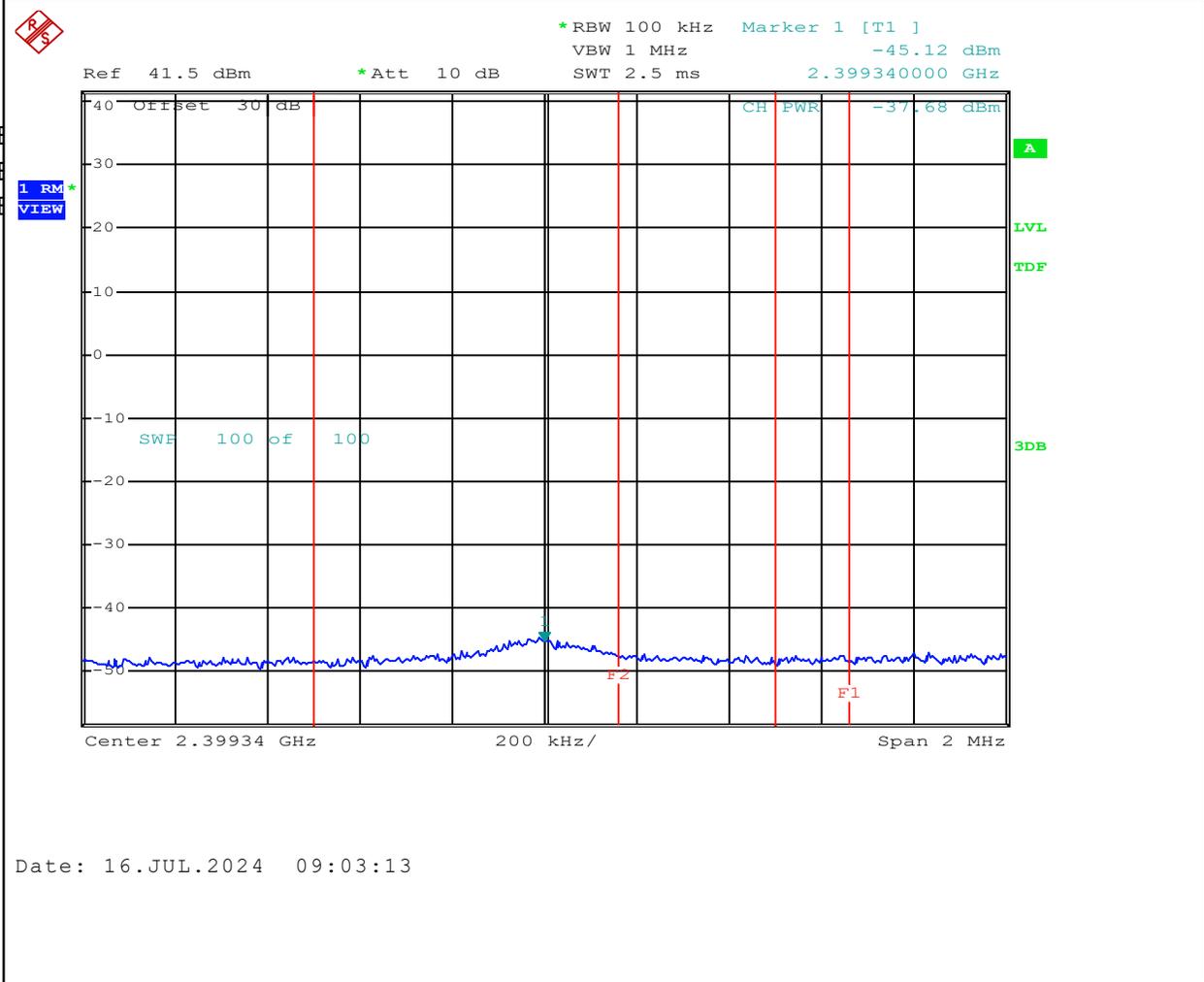
Band Edge Measurement Results: DTS

Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Fundamental Power [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)	Antenna Gain (dBi)	Emission EIRP [E _{Em}] (dBm)	Fundamental EIRP [E _{Fund}] (dBm)	EIRP Attenuation [Atten] (dB)	Limit (dB)	EIRP Margin (dB)
BT BR	0	2402.00	GFSK	-37.68	10.59	48.27	30	18.3	-5.8	-43.48	4.79	48.27	30	18.3
BT 2EDR			Pi/4-DQPSK	-37.58	10.34	47.92		17.9		-43.38	4.54	47.92		17.9
BT 3EDR			8-DPSK	-37.45	10.16	47.61		17.6		-43.25	4.36	47.61		17.6
Result:													Complies	

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

Margin = [Atten] - Limit

Band Edge: Lower Band Edge



Channel:
Mode:

Channel Frequency: MHz
Modulation:

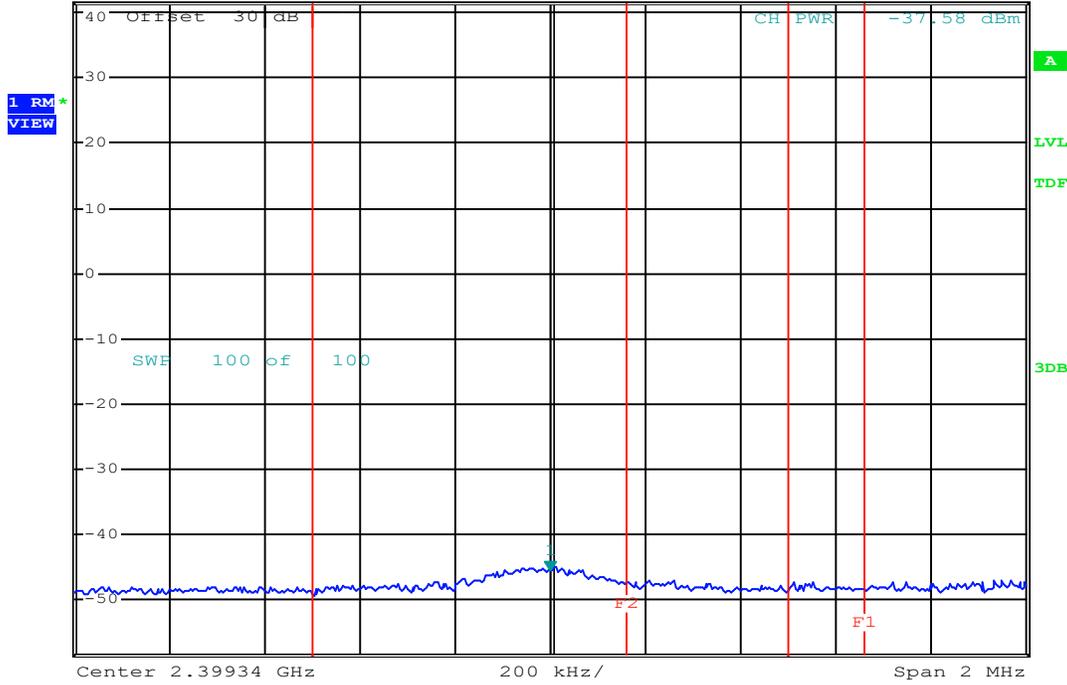
Emission Power: dBm

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -45.61 dBm
SWT 2.5 ms 2.399340000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 08:56:44

Channel:

Mode:

Channel Frequency: MHz

Modulation:

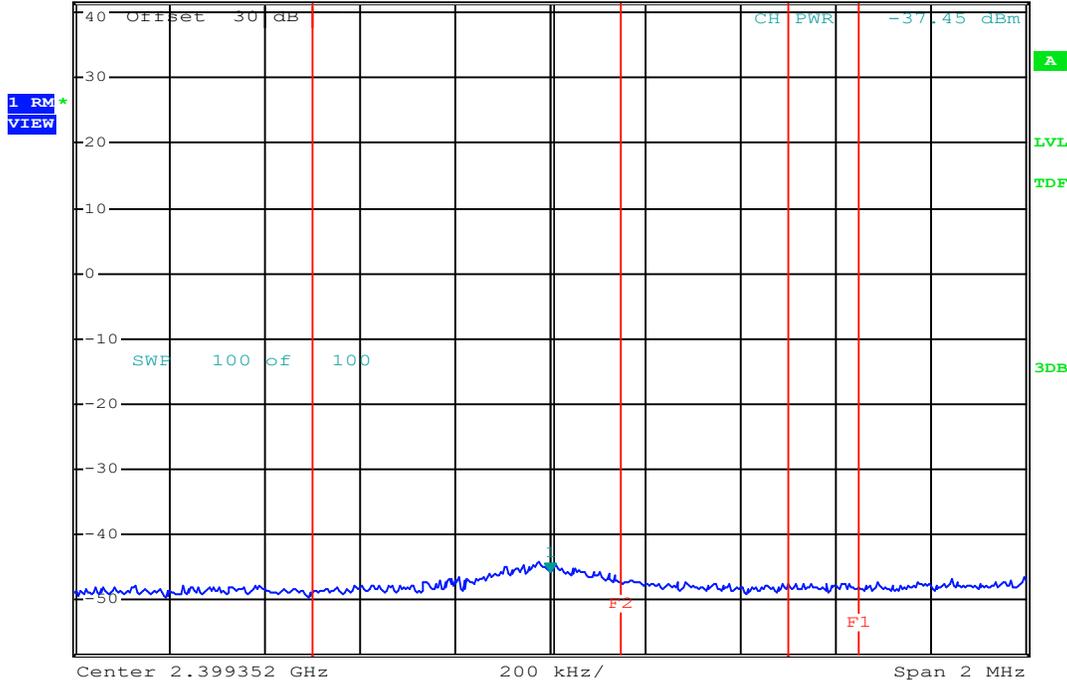
Emission Power: dBm

Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -45.76 dBm
SWT 2.5 ms 2.399352000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 08:58:04

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge Measurement Results (Restricted Band): DTS									
Mode	Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Antenna Gain [G] (dBi)	Emission EIRP [E _{Em}] (dBm)	Field Strength [FS] (dBuV)	Peak Limit (dBuV/m)	Margin (dB)
BT BR	78	2480.00	GFSK	-25.60	-5.8	-31.40	63.90	74	10.1
BT 2EDR			Pi/4-DQPSK	-25.33		-31.13	64.17		9.8
BT 3EDR			8-DPSK	-25.67		-31.47	63.83		10.2
Results								Complies	

Margin = [FS] - Limit

FS = EIRP -20Log(d) +104.8

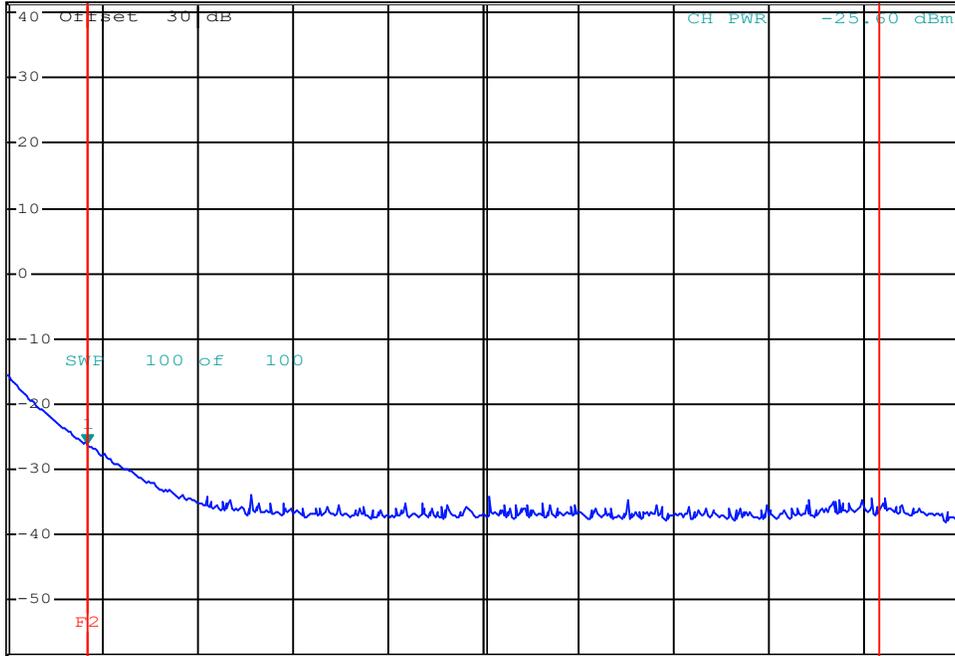
EIRP = Emission Power [P_{Em}] + Antenna Gain [G] + Ground Reflection Factor (0)

Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -26.13 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 41.5 dBm *Att 10 dB



Date: 16.JUL.2024 09:08:35

Channel:
Mode:

Channel Frequency: MHz
Modulation:

Emission Power: dBm

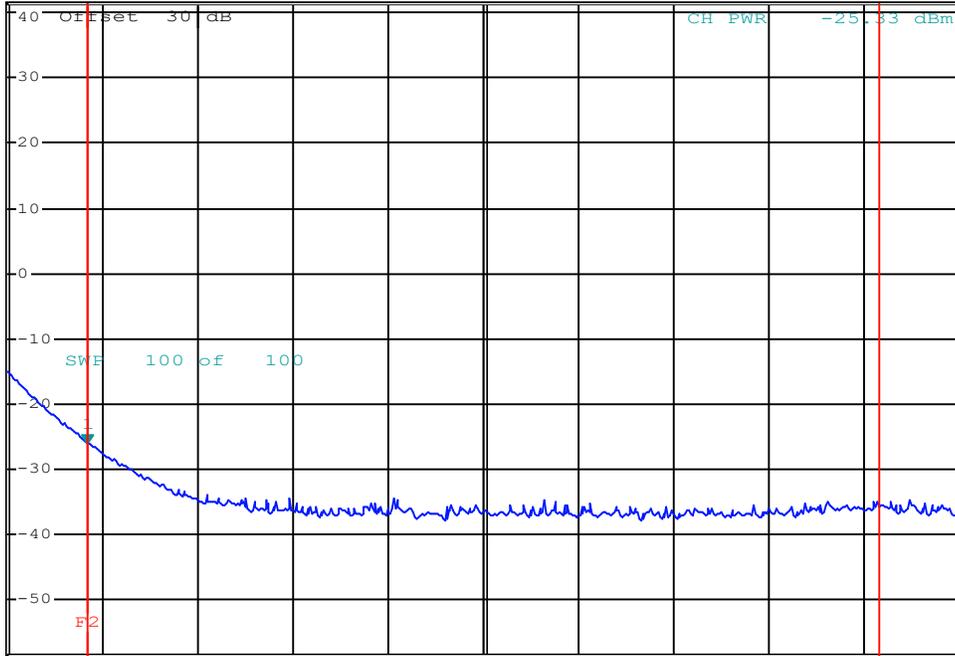
Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -25.98 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 41.5 dBm *Att 10 dB

1 PK
VIEW



Date: 16.JUL.2024 09:09:19

Channel:
Mode:

Channel Frequency: MHz
Modulation:
Emission Power: dBm

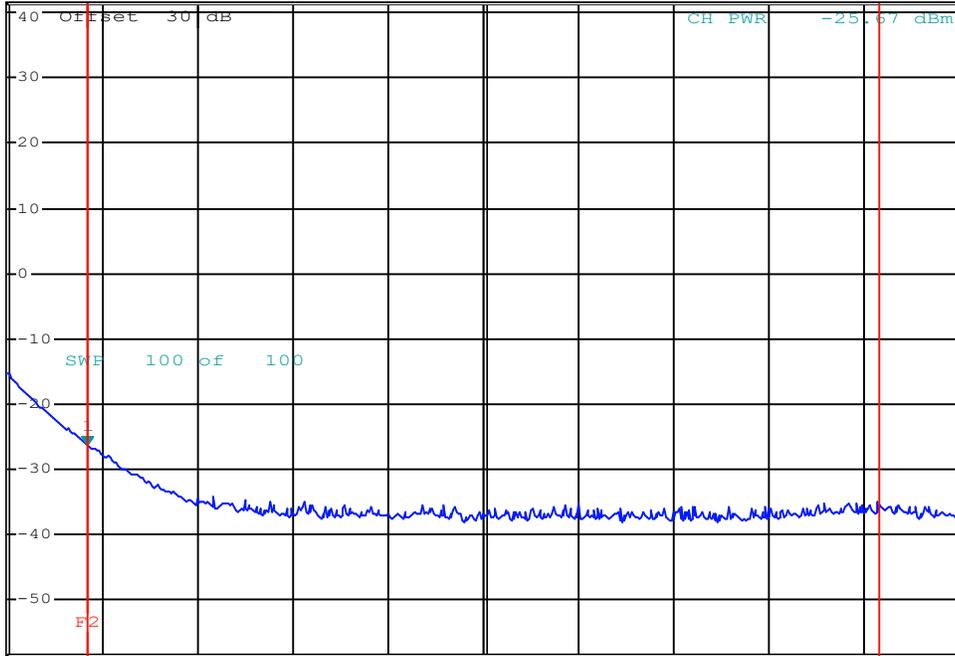
Band Edge: Upper Band Edge



*RBW 1 MHz Marker 1 [T1]
VEW 3 MHz -26.35 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 41.5 dBm *Att 10 dB

1 PK
VIEW



Center 2.4885 GHz 1.2 MHz/ Span 12 MHz

Date: 16.JUL.2024 09:09:48

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Conducted Spurious Emissions Measurement Results:								
Channel Number	Frequency (MHz)	Modulation	Emission Power [P _{Em}] (dBm)	Emission Frequency (MHz)	Fundamental Measurement [P _{Fund}] (dBm)	Attenuation [Atten] (dB)	Limit (dB)	Margin (dB)
6	2437.00	DSSS 5.5	ND	ND	16.52	-	30	-
							Complies	

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

Margin = Attenuation - Limit

ND = None Detected

Conducted Spurious Emissions:

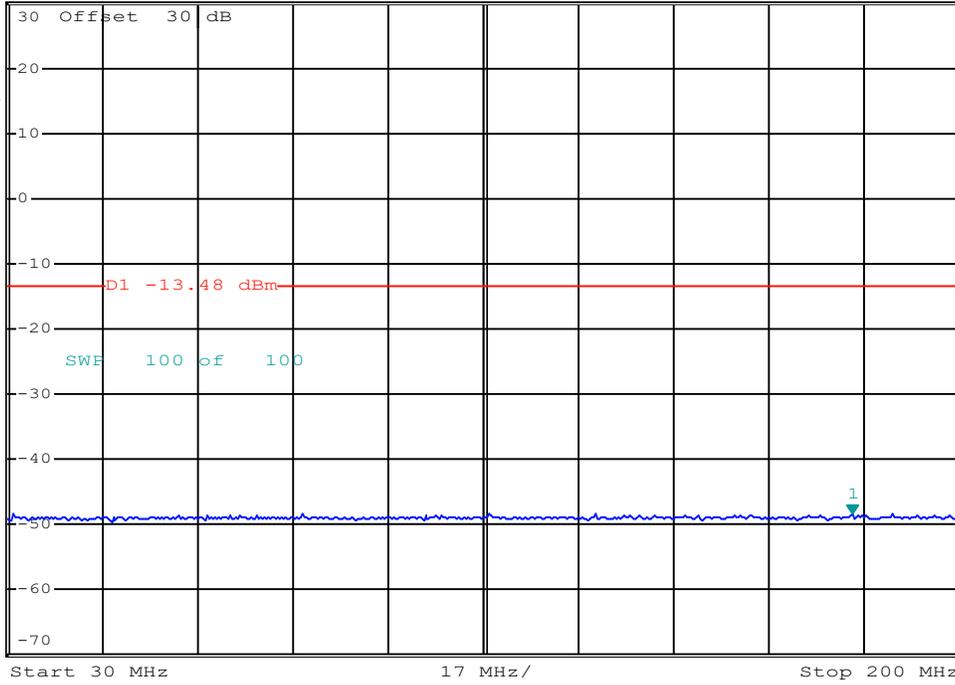


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -48.35 dBm
SWT 20 ms 180.960000000 MHz

Ref 30 dBm

*Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 13:59:07

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

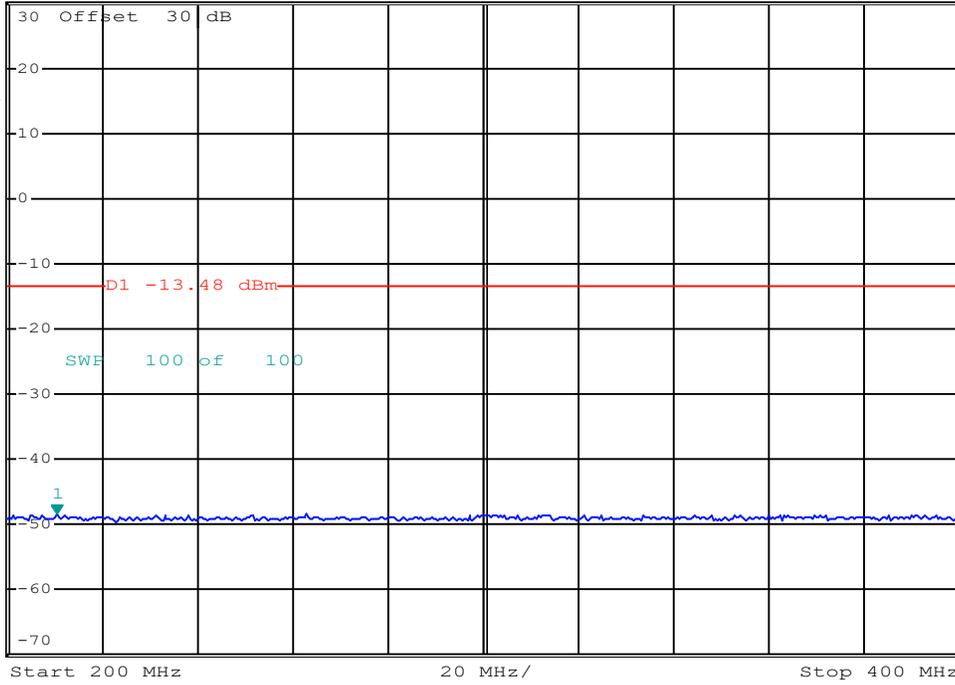


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -48.36 dBm
SWT 20 ms 210.40000000 MHz

Ref 30 dBm

*Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 13:57:08

Channel: 6

Channel Frequency: 2437 MHz

Mode: 802.11b

Modulation: DSSS 5.5

Emission Frequency: ND MHz

Measured Emission: ND dBm

Conducted Spurious Emissions:

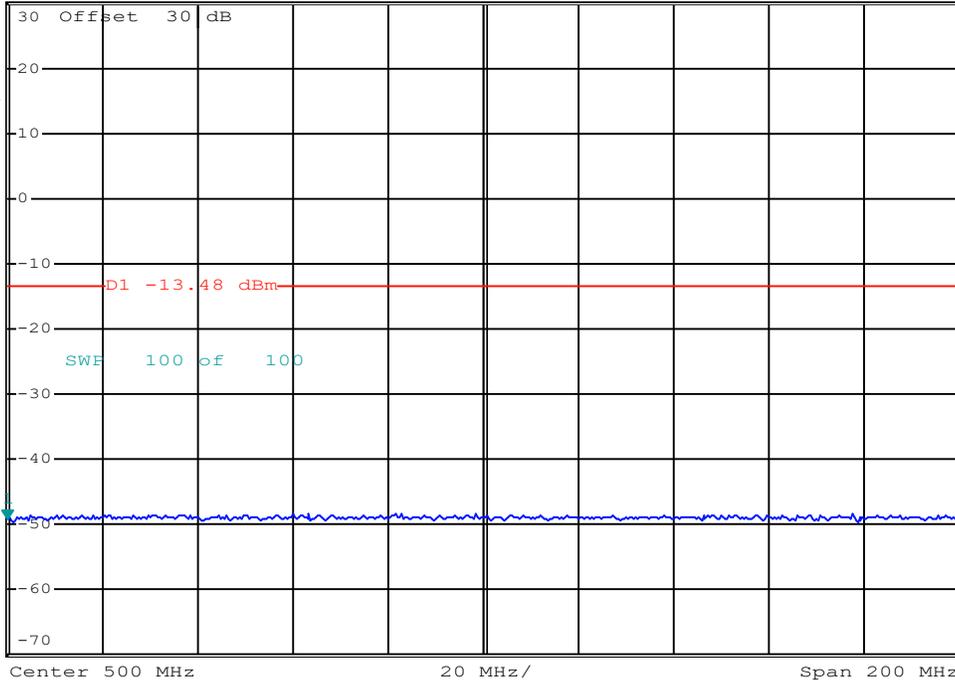


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -49.02 dBm
SWT 20 ms 400.00000000 MHz

Ref 30 dBm

*Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 13:57:25

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

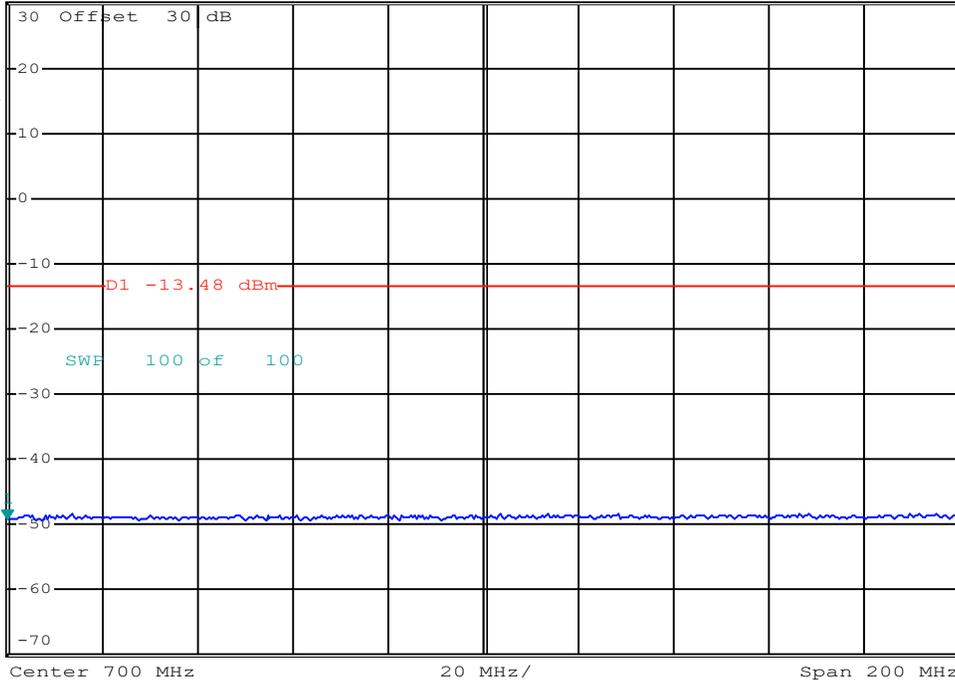


*RBW 100 kHz Marker 1 [T1]
 VEW 1 MHz -49.24 dBm
 SWT 20 ms 600.00000000 MHz

Ref 30 dBm

*Att 20 dB

1 RM*
 VIEW



Date: 16.JUL.2024 13:57:41

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

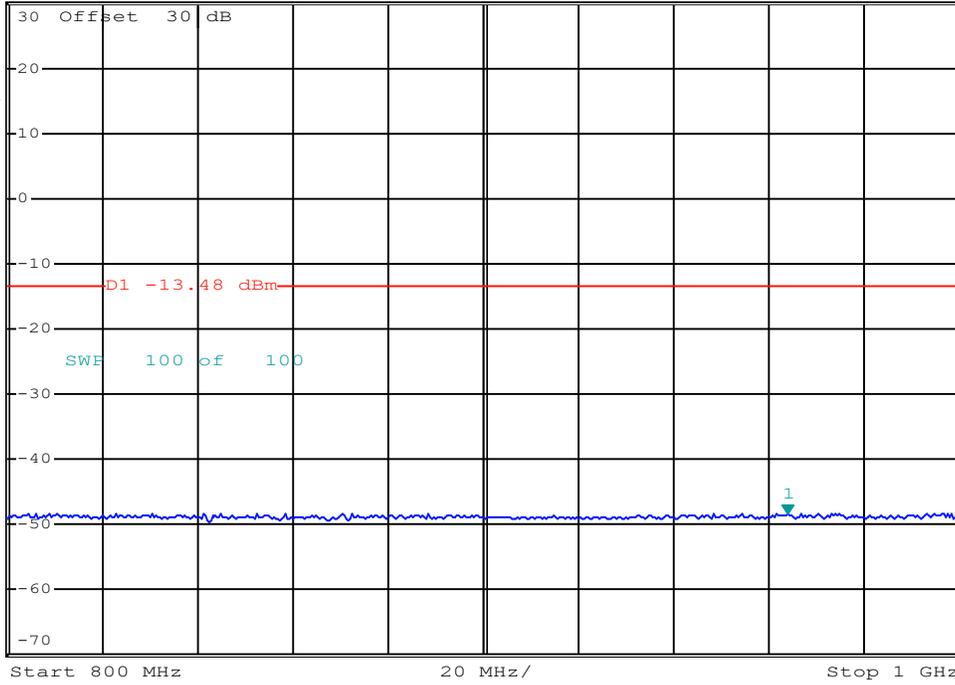


*RBW 100 kHz Marker 1 [T1]
 VEW 1 MHz -48.27 dBm
 SWT 20 ms 964.000000000 MHz

Ref 30 dBm

*Att 20 dB

1 RM*
 VIEW



Date: 16.JUL.2024 14:01:22

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

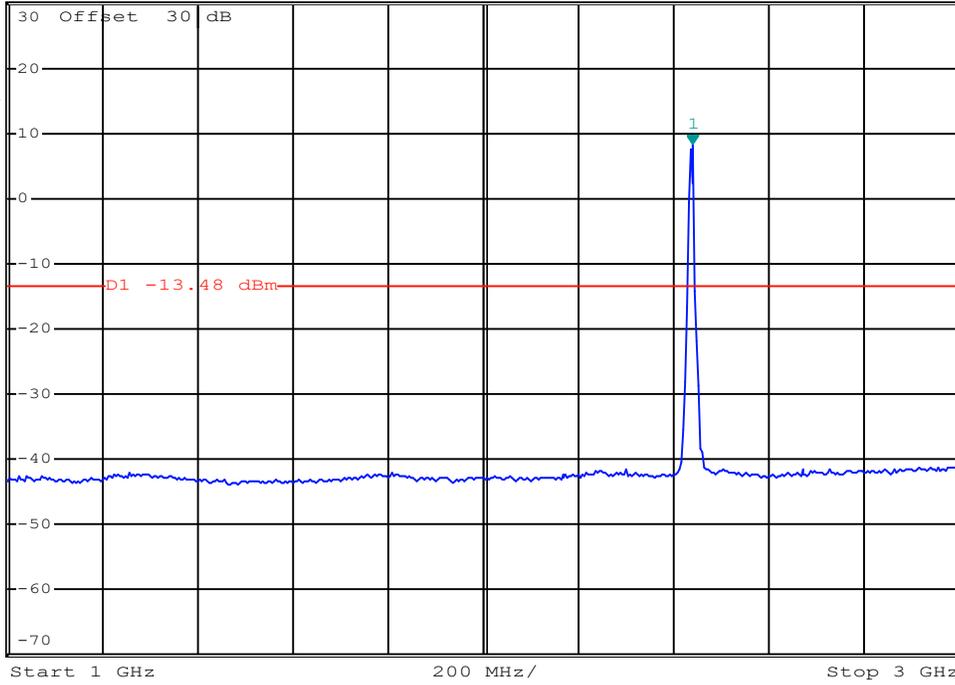
Conducted Spurious Emissions: Fundamental



*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz 8.34 dBm
SWT 10 ms 2.440000000 GHz

Ref 30 dBm *Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 14:01:49

Channel:

Mode:

Marker 1 = Fundamental

Channel Frequency: MHz

Modulation:

Measured Emission: dBm

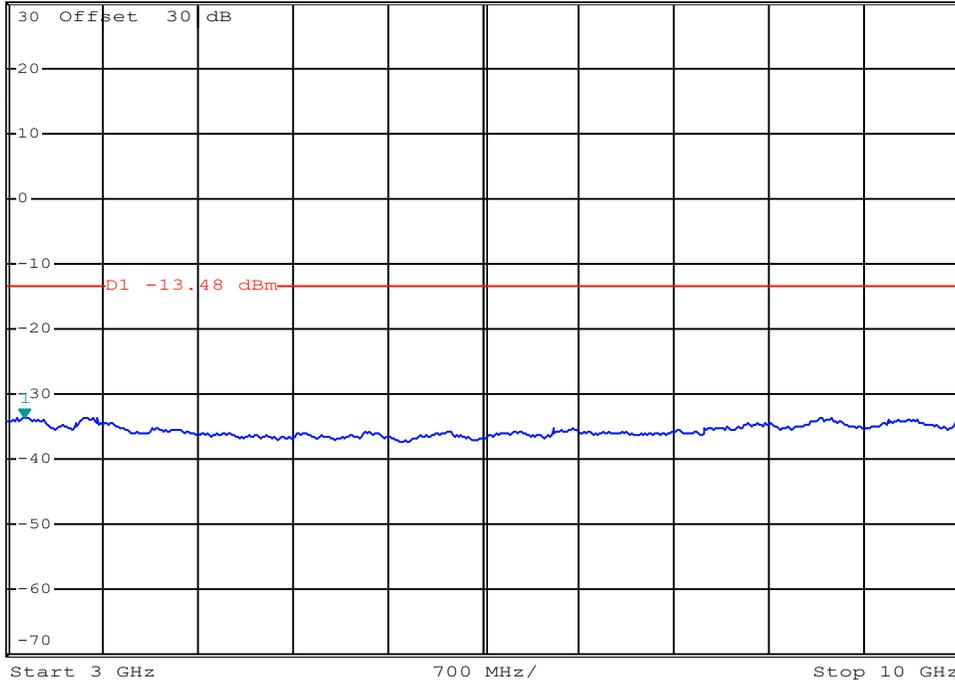
Conducted Spurious Emissions:



*RBW 1 MHz Marker 1 [T1]
 VEW 10 MHz -33.54 dBm
 SWT 140 ms 3.126000000 GHz

Ref 30 dBm *Att 20 dB

1 RM*
 VIEW



Date: 16.JUL.2024 14:02:12

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

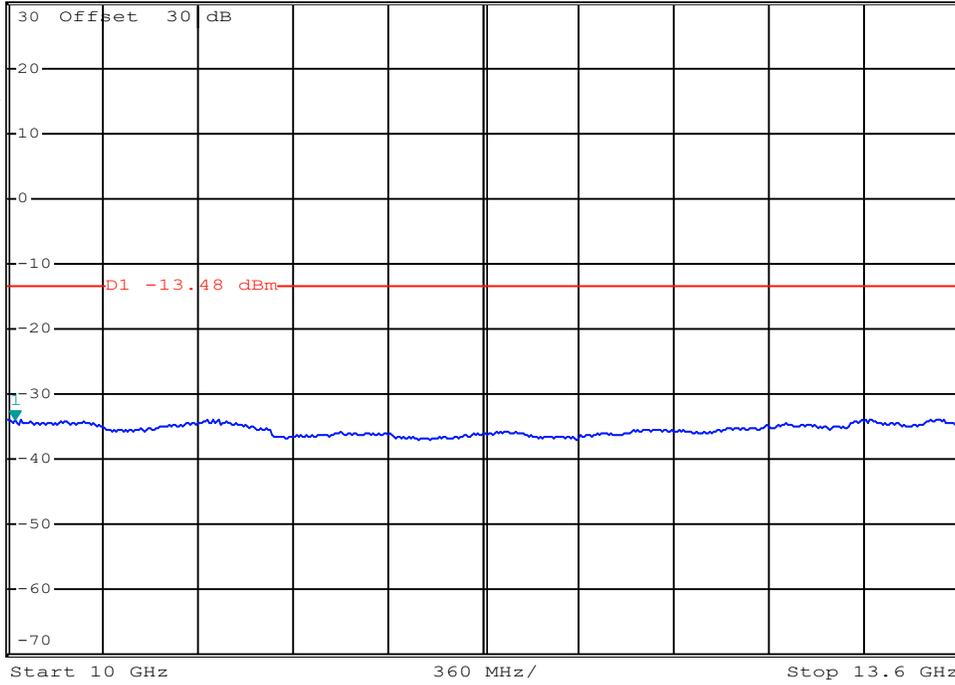


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -33.80 dBm
SWT 75 ms 10.028800000 GHz

Ref 30 dBm

*Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 14:02:29

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

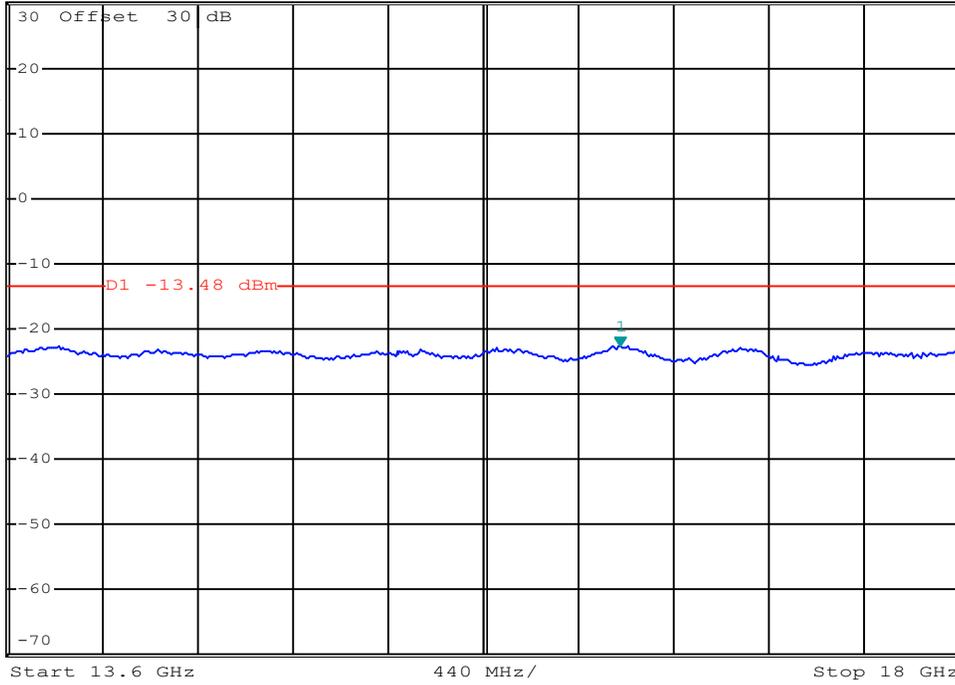


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -22.53 dBm
SWT 90 ms 16.433600000 GHz

Ref 30 dBm

*Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 14:03:23

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

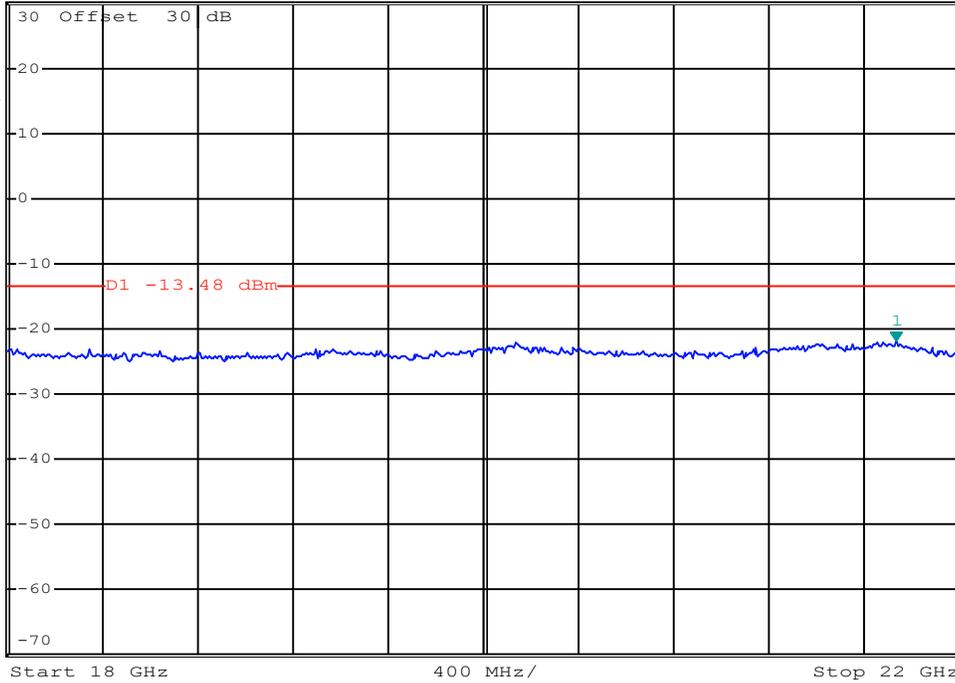


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -21.87 dBm
SWT 80 ms 21.736000000 GHz

Ref 30 dBm

*Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 14:03:38

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

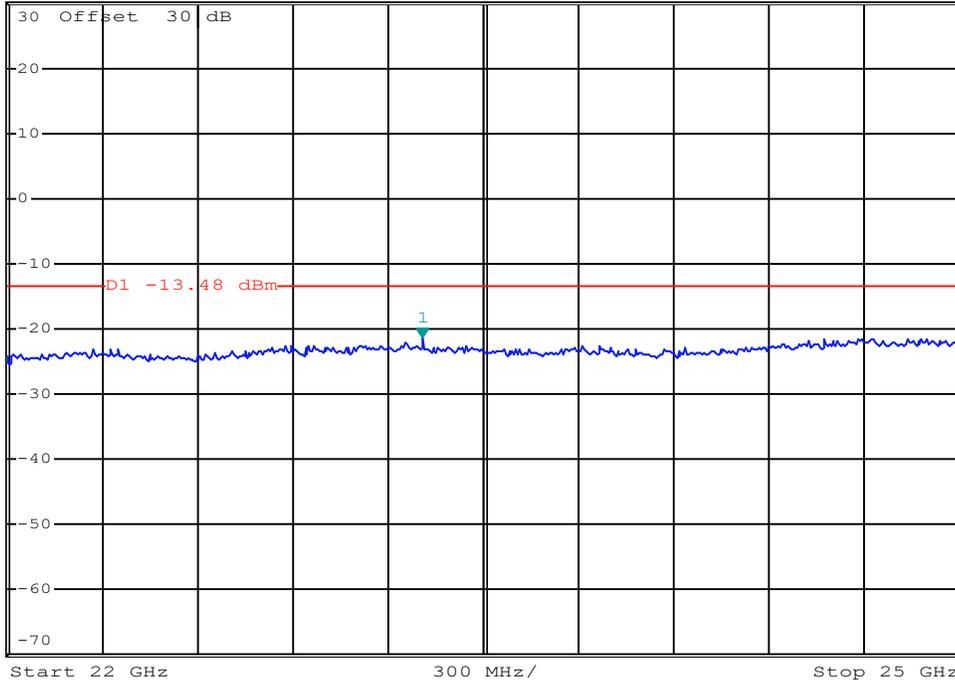


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -21.40 dBm
SWT 60 ms 23.308000000 GHz

Ref 30 dBm

*Att 20 dB

1 RM*
VIEW



Date: 16.JUL.2024 14:03:56

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Summary of Radiated Tx Emissions

Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)
30-1000 MHz	2437.0	Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
30-1000 MHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18-25 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18 -25 GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
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

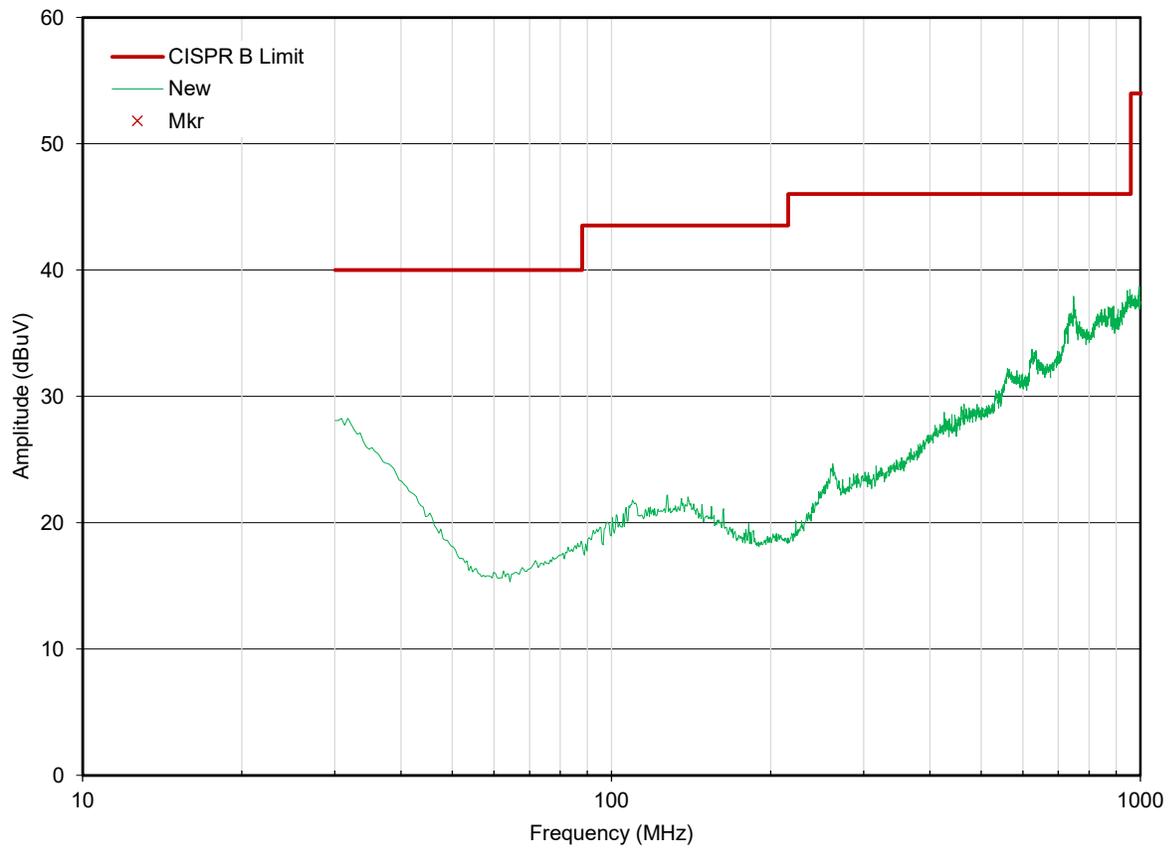
$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

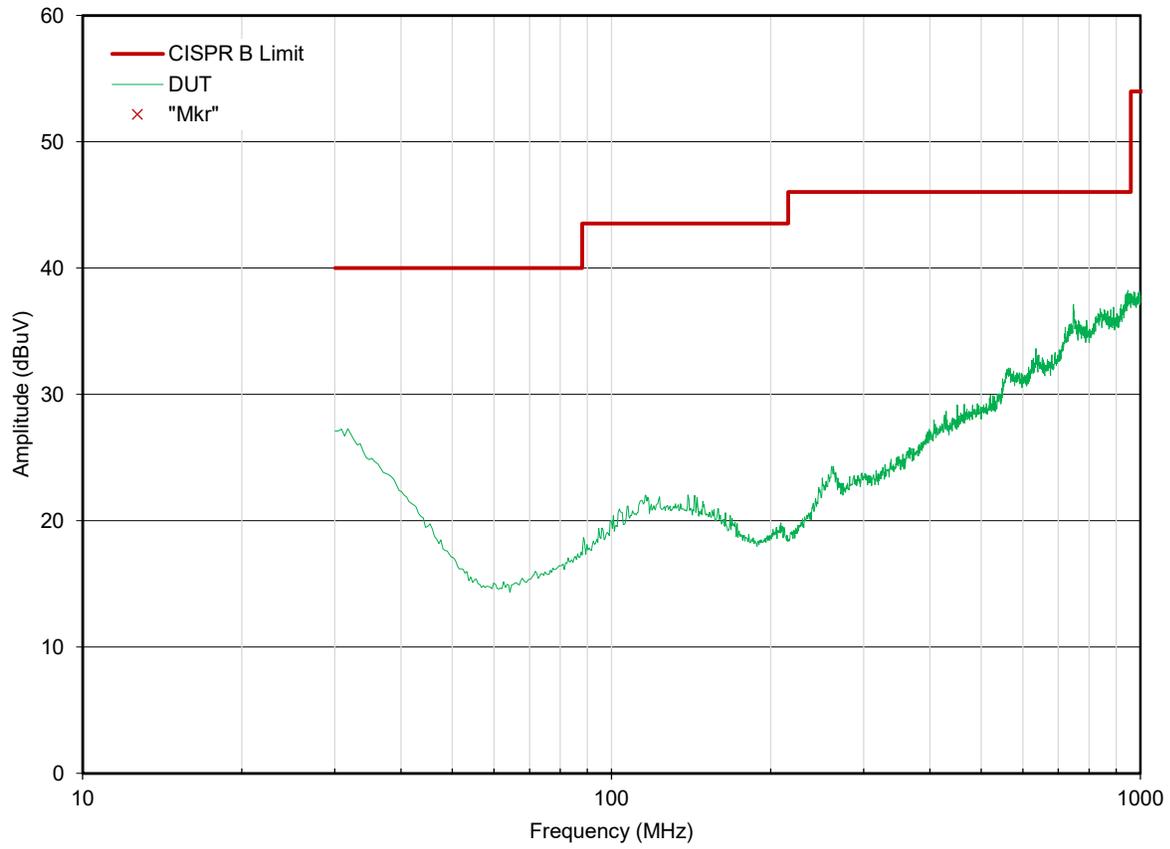
Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Horizontal



Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Vertical



Radiated Tx Emissions:



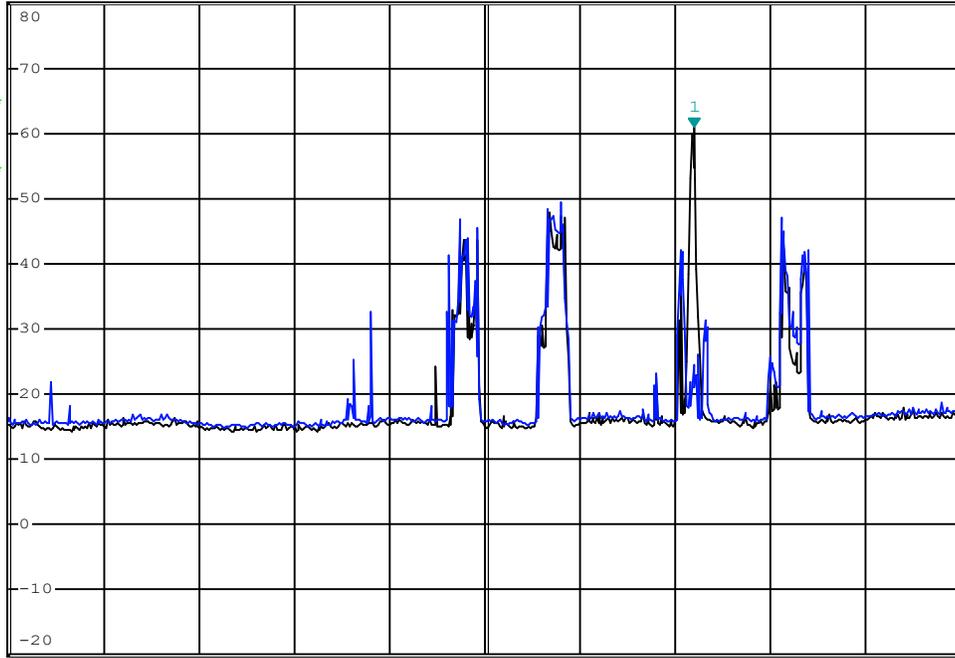
*RBW 1 MHz Marker 1 [T2]
VBW 10 MHz 60.90 dBuV
SWT 10 ms 2.44000000 GHz

Ref 80 dBuV

*Att 0 dB

1 RM*
VIEW

2 RM*
VIEW



Date: 17.JUL.2024 10:27:44

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

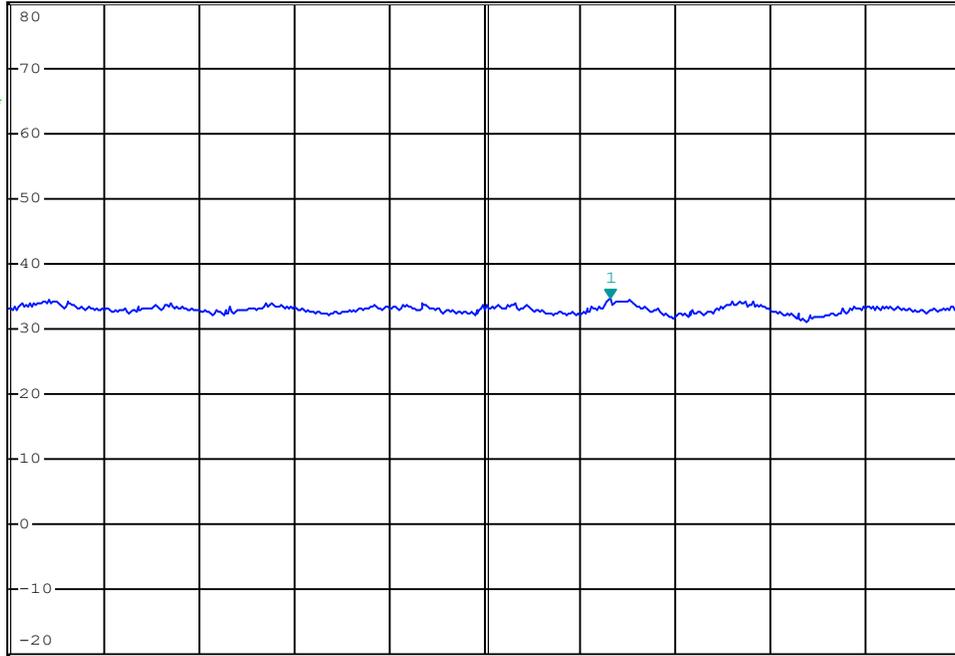


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 34.65 dBuV
SWT 90 ms 16.380800000 GHz

Ref 80 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 17.JUL.2024 10:28:47

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

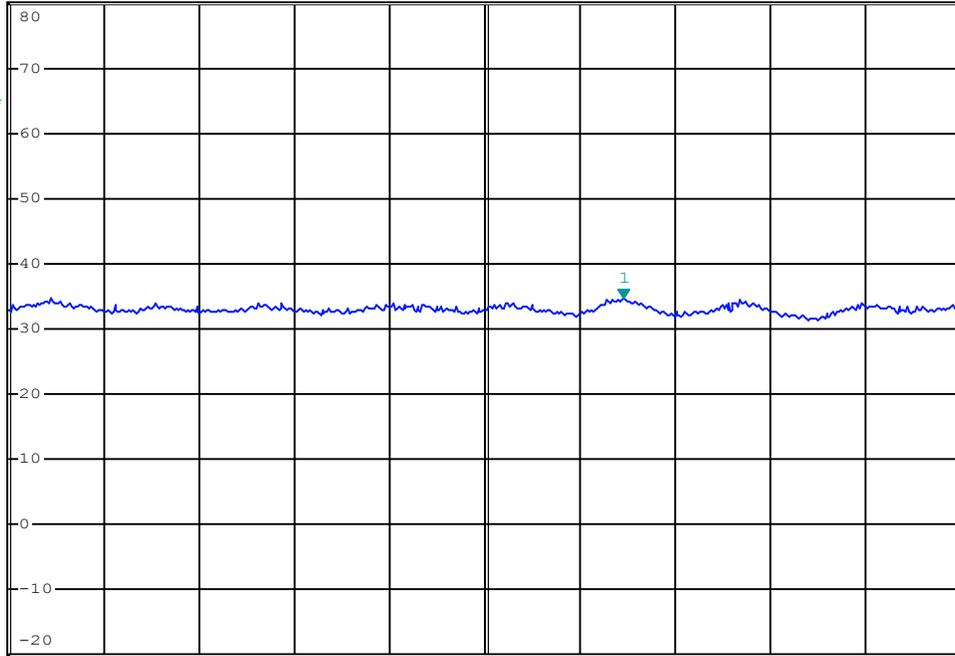


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 34.70 dBuV
SWT 90 ms 16.442400000 GHz

Ref 80 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 17.JUL.2024 10:20:48

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

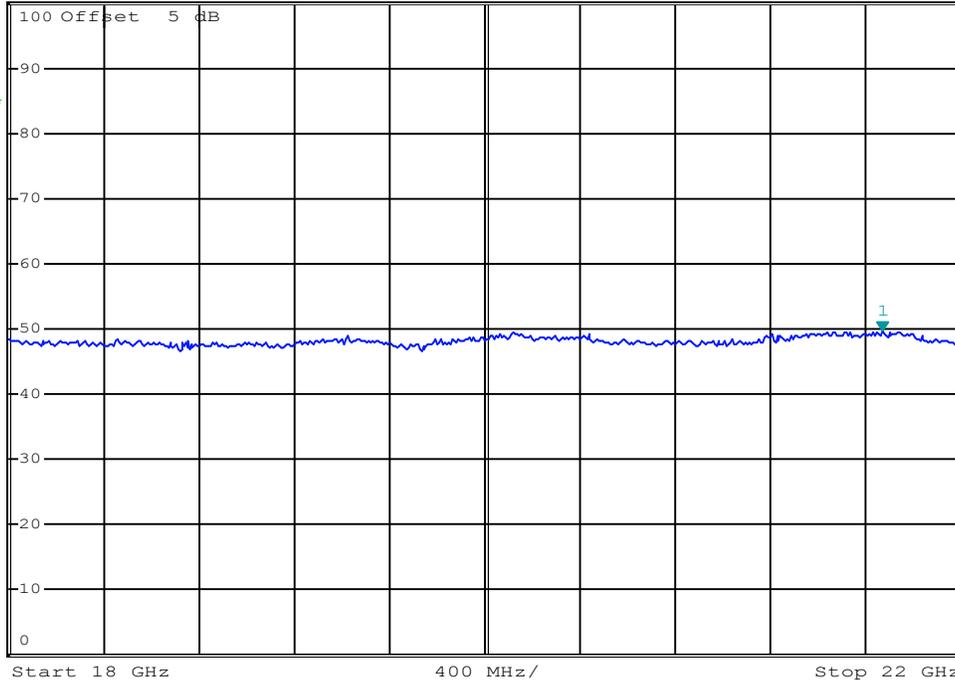


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 49.69 dBuV
SWT 80 ms 21.672000000 GHz

Ref 100 dBuV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 13:57:14

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

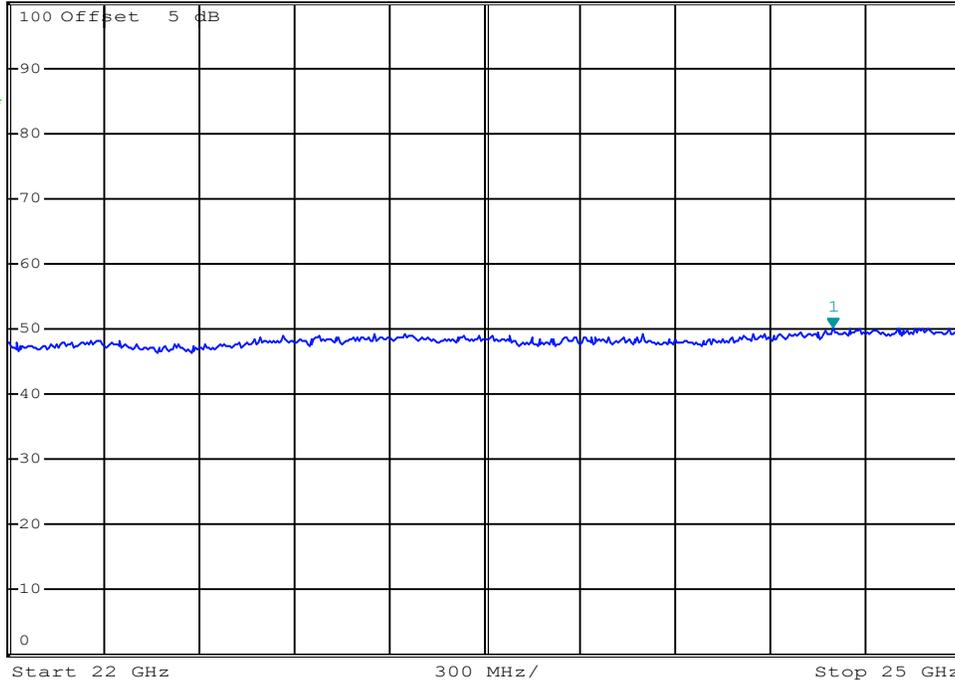


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 50.14 dBuV
SWT 60 ms 24.598000000 GHz

Ref 100 dBuV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 13:57:38

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

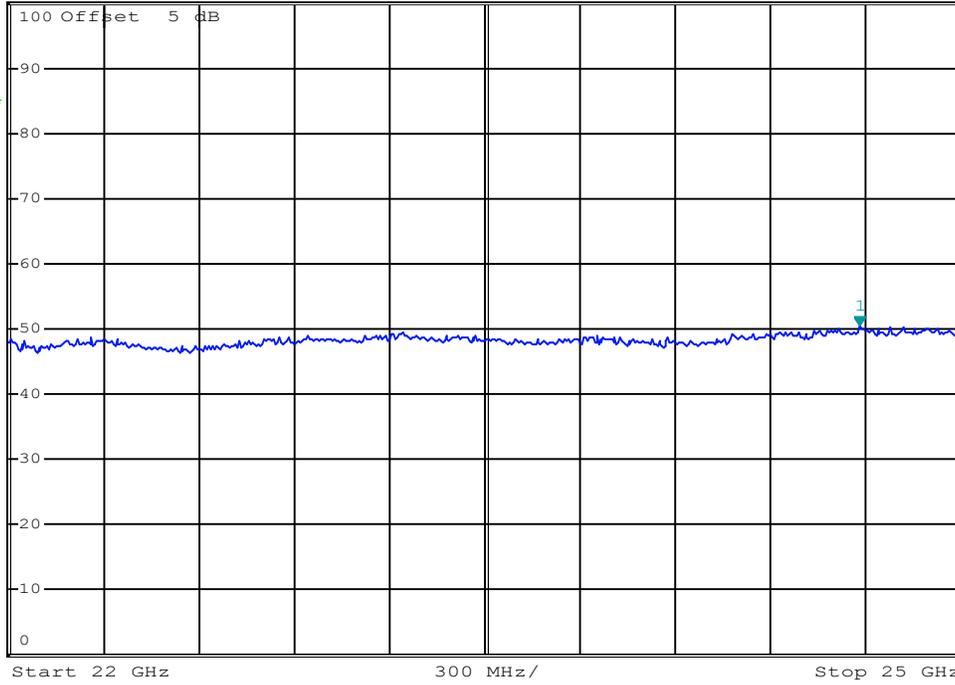


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 50.39 dBuV
SWT 60 ms 24.682000000 GHz

Ref 100 dBuV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 13:59:44

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Summary of Radiated Tx Emissions

Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)
30-1000 MHz	2440.0	Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
30-1000 MHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
1-18GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18-25 GHz		Horizontal	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
18 -25 GHz		Vertical	ND	(1) AV	n/a	n/a	0.00 (3)	ND	n/a	(1)
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

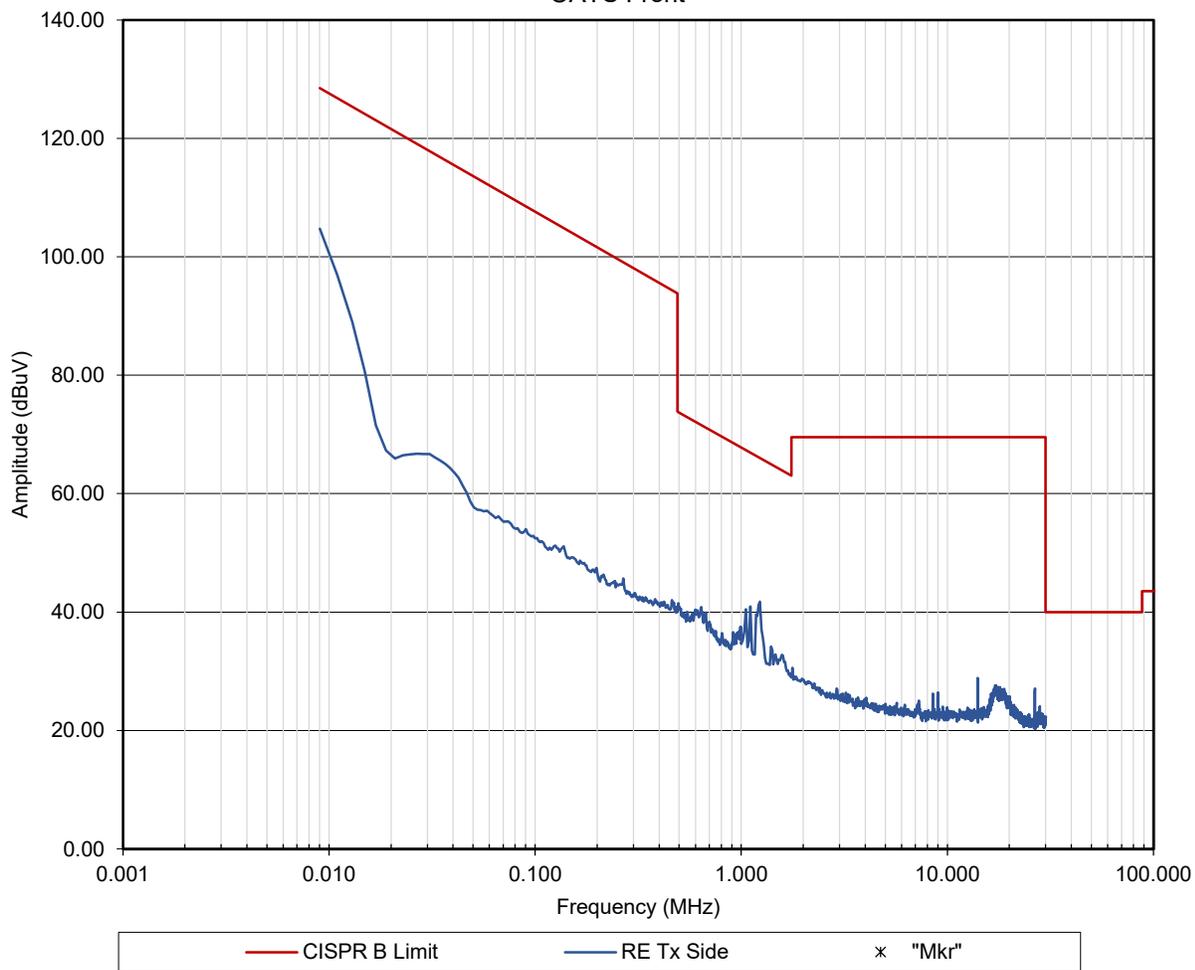
$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

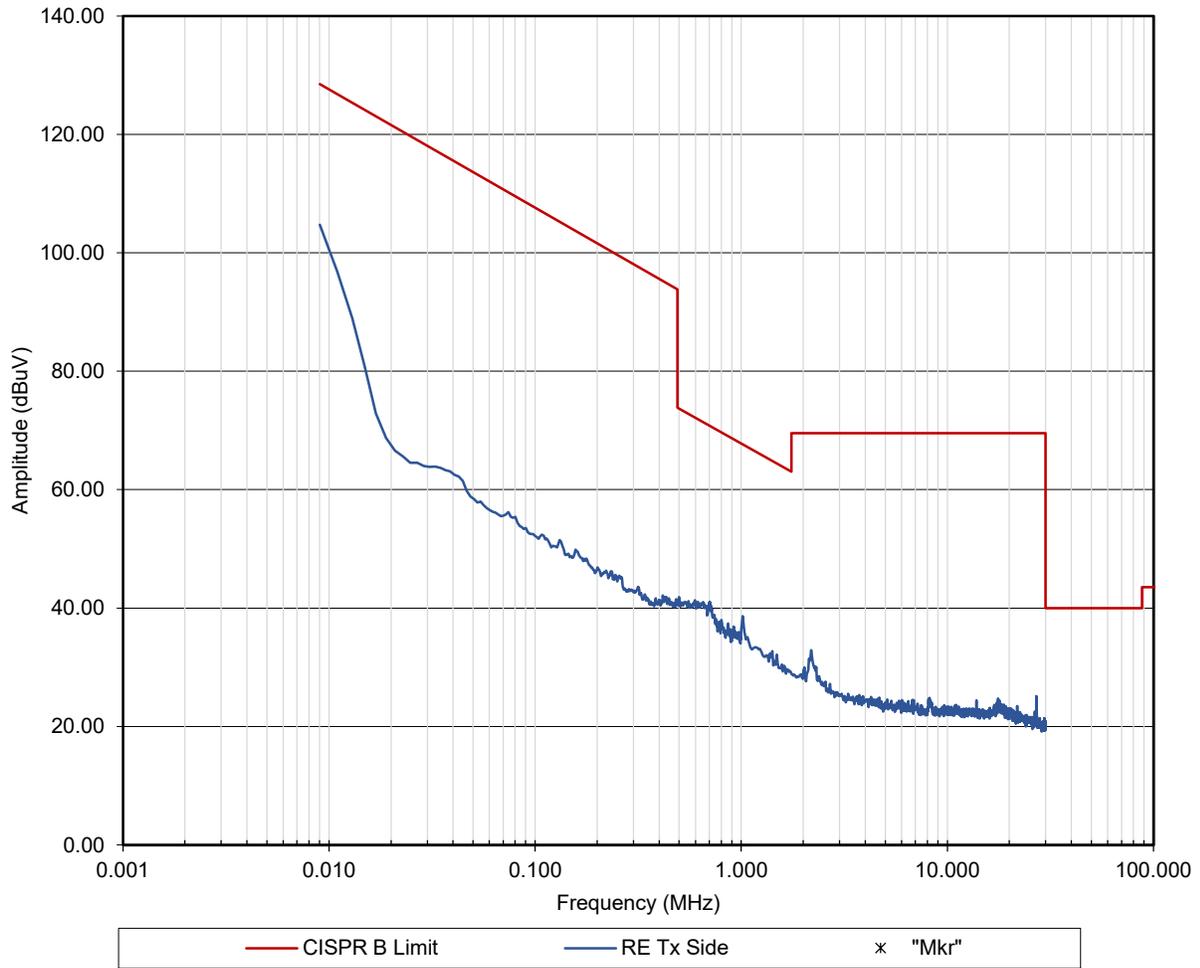
Radiated Tx Emissions:

Radiated Tx Emissions (9kHz - 30MHz)
OATS Front



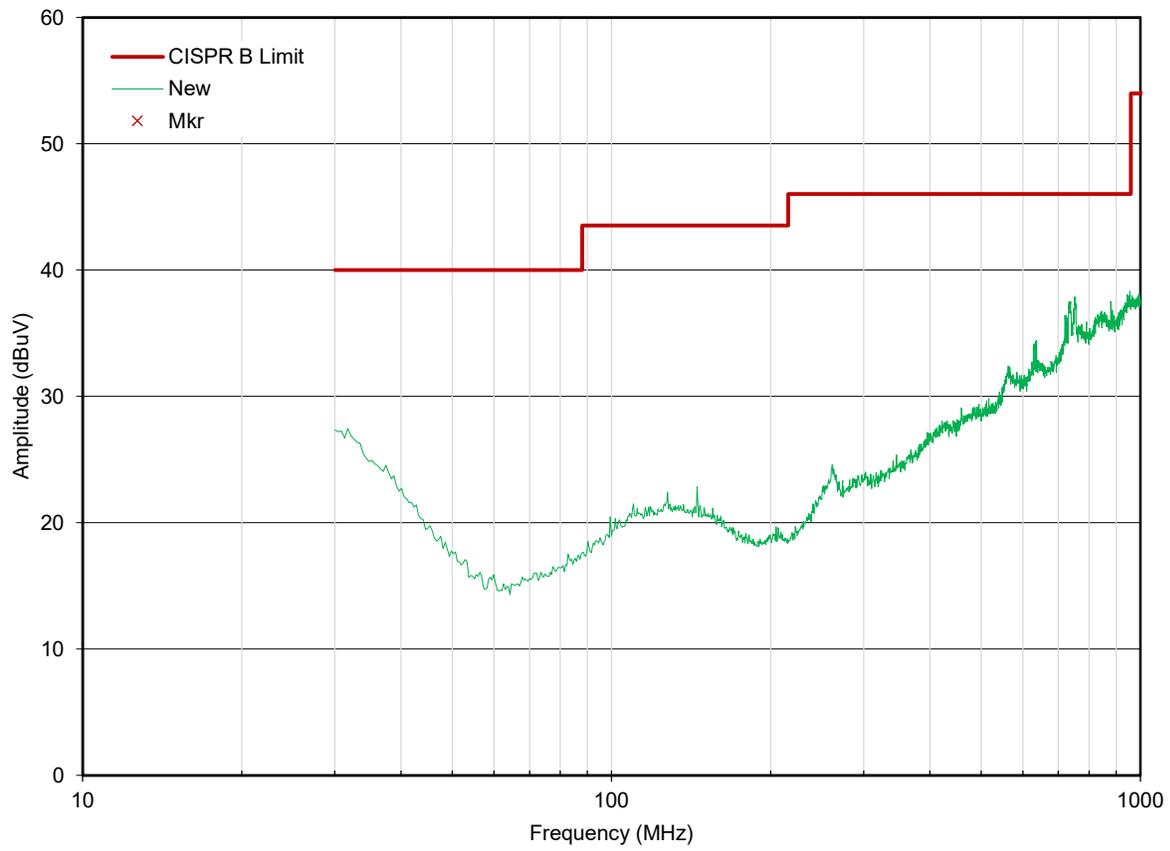
Radiated Tx Emissions:

Radiated Tx Emissions (9kHz - 30MHz)
OATS Side



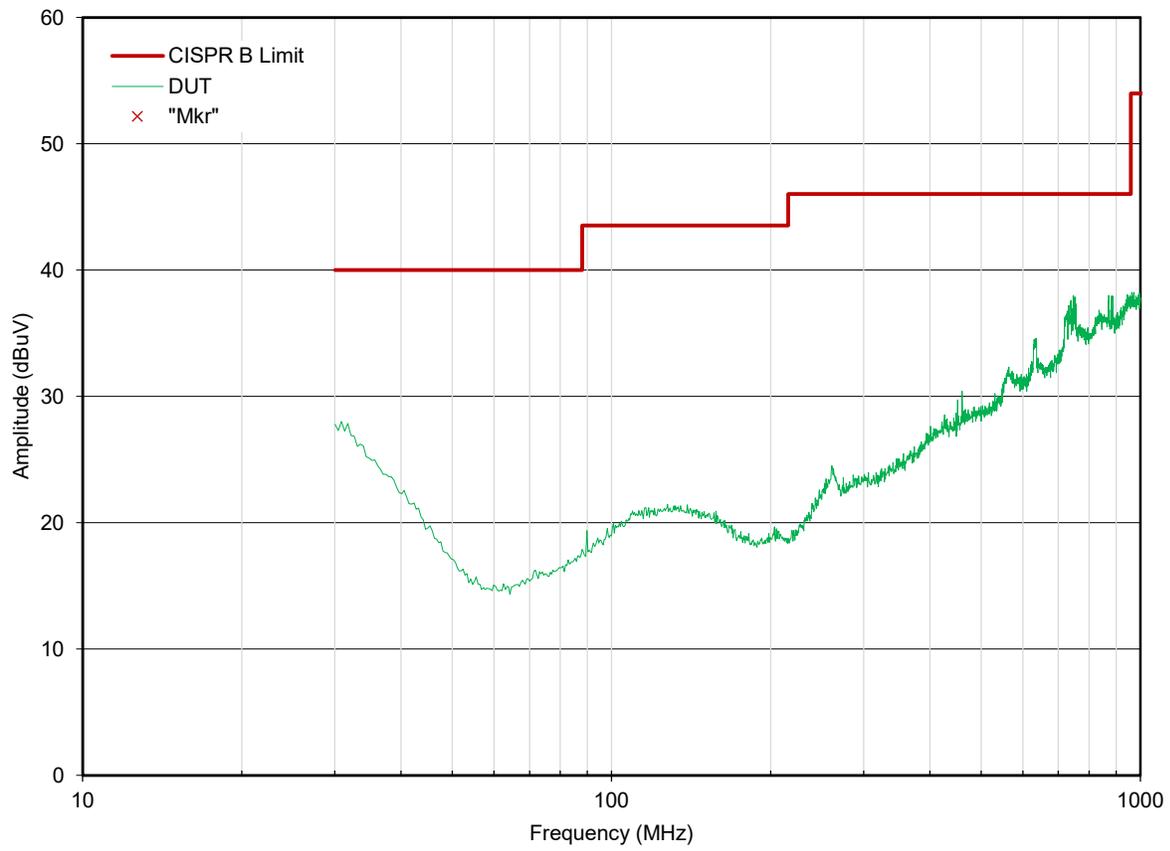
Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Horizontal



Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Vertical



Radiated Tx Emissions:



*RBW 1 MHz Marker 1 [T2]
VBW 10 MHz 48.19 dBuV
SWT 10 ms 2.44000000 GHz

Ref 80 dBuV

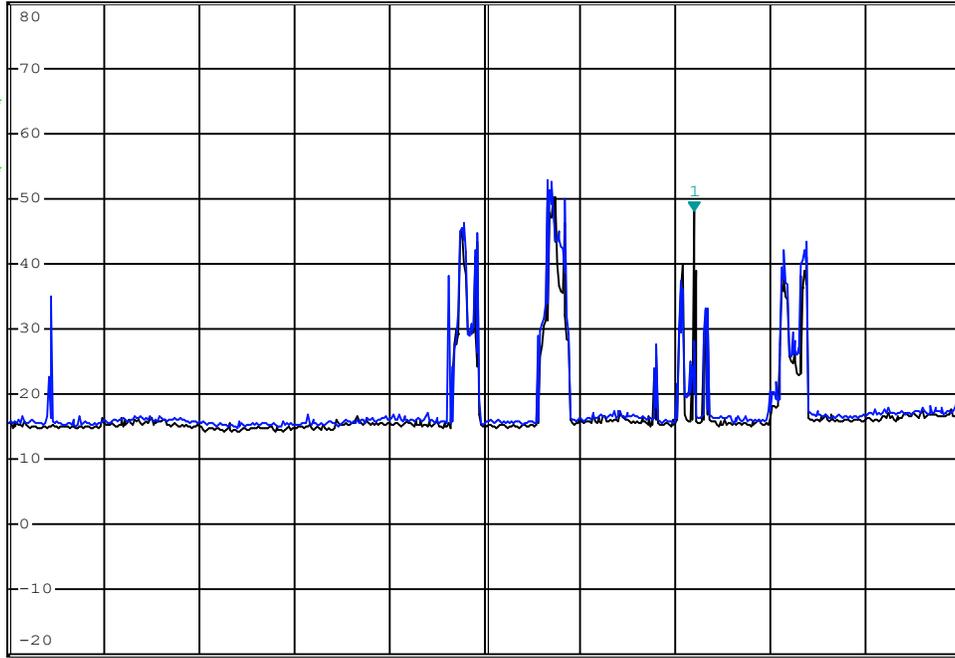
*Att 0 dB

1 RM*

VIEW

2 RM*

VIEW



Date: 17.JUL.2024 10:36:00

Channel: 38

Channel Frequency: 2440 MHz

Mode: BT BR

Modulation: GFSK

Polarization: Horizontal

Measured Channel Power: 48.19 dBuV

Emission Frequency: Fundamental MHz

Radiated Tx Emissions:



*RBW 1 MHz Marker 1 [T2]
VBW 10 MHz 59.32 dBuV
SWT 10 ms 2.440000000 GHz

Ref 80 dBuV

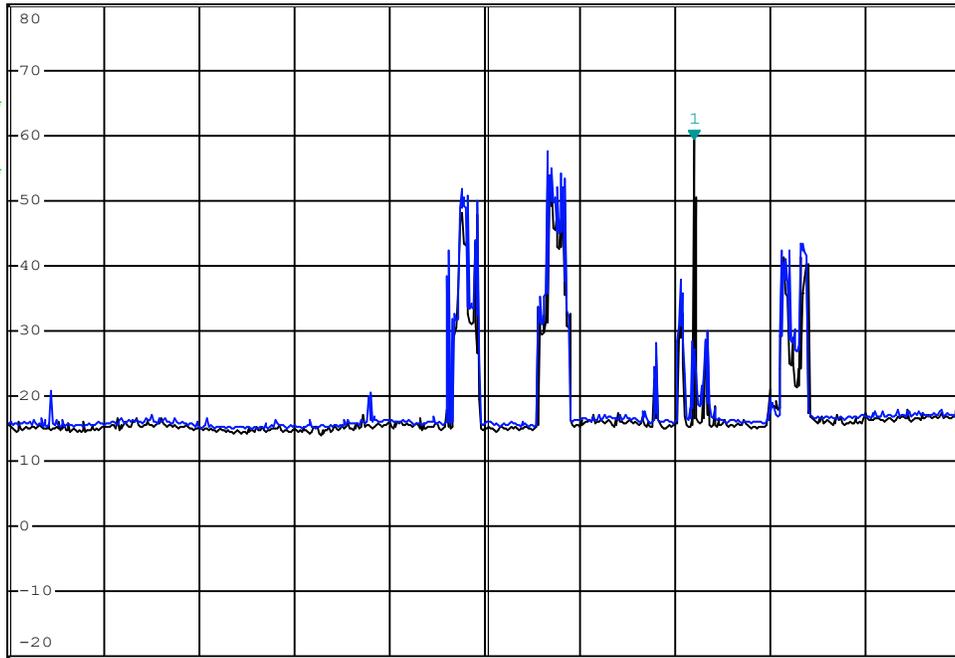
*Att 0 dB

1 RM*

VIEW

2 RM*

VIEW



Start 1 GHz

200 MHz/

Stop 3 GHz

Date: 17.JUL.2024 10:40:44

Channel: 38

Mode: BT BR

Polarization: Vertical

Emission Frequency: Fundamental MHz

Channel Frequency: 2440 MHz

Modulation: GFSK

Measured Channel Power: 59.32 dBuV

Radiated Tx Emissions:

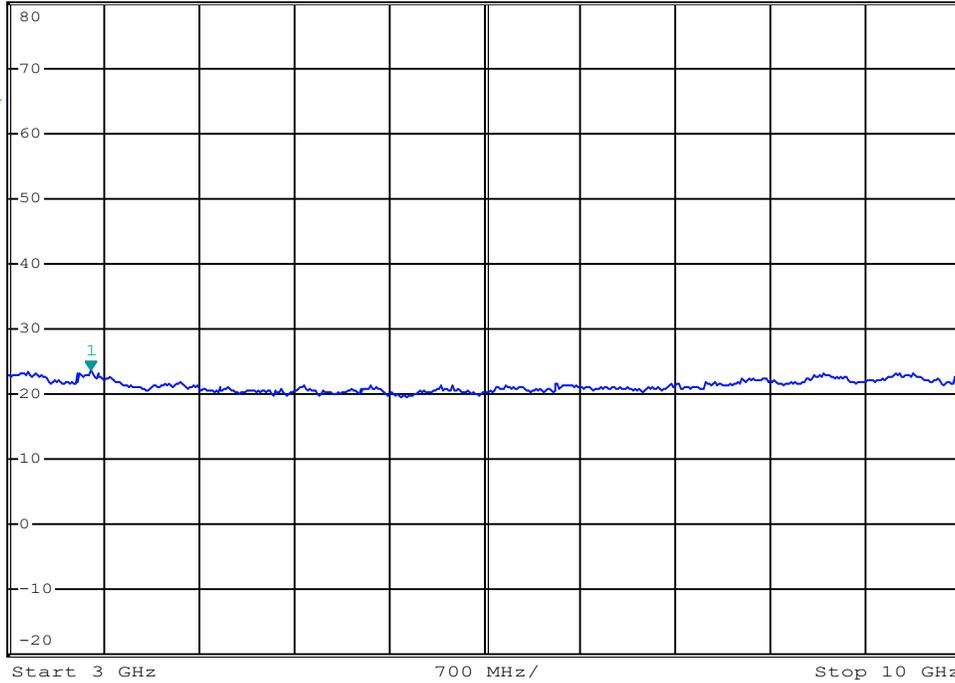


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 23.74 dBuV
SWT 140 ms 3.602000000 GHz

Ref 80 dBuV

*Att 0 dB

1 RM*
VIEW



Date: 17.JUL.2024 10:41:05

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

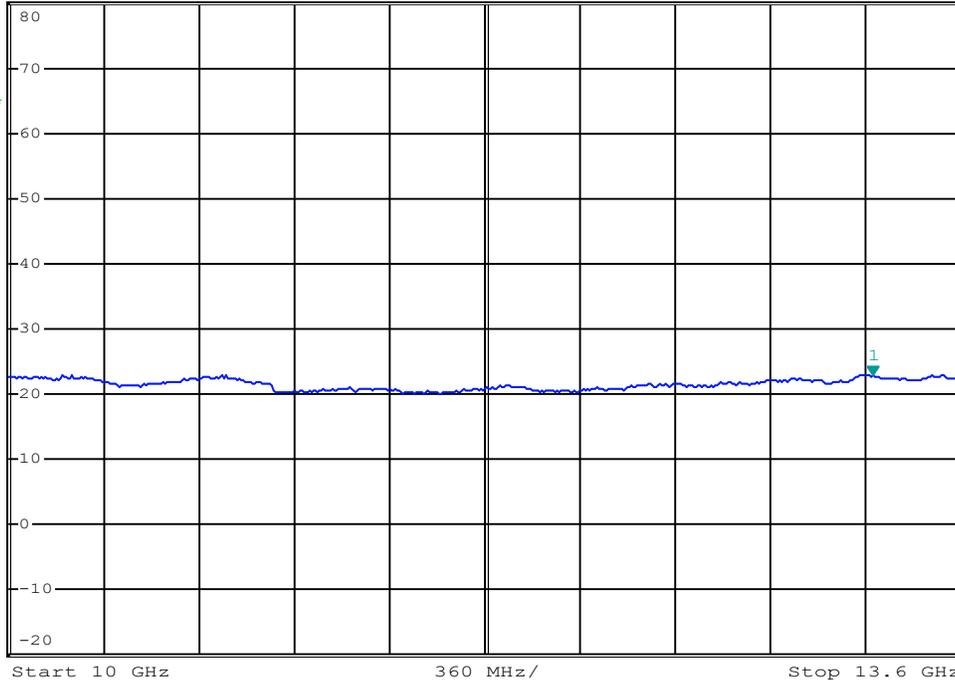


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 23.02 dBuV
SWT 75 ms 13.268800000 GHz

Ref 80 dBuV

*Att 0 dB

1 RM*
AVG



Date: 17.JUL.2024 10:41:27

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

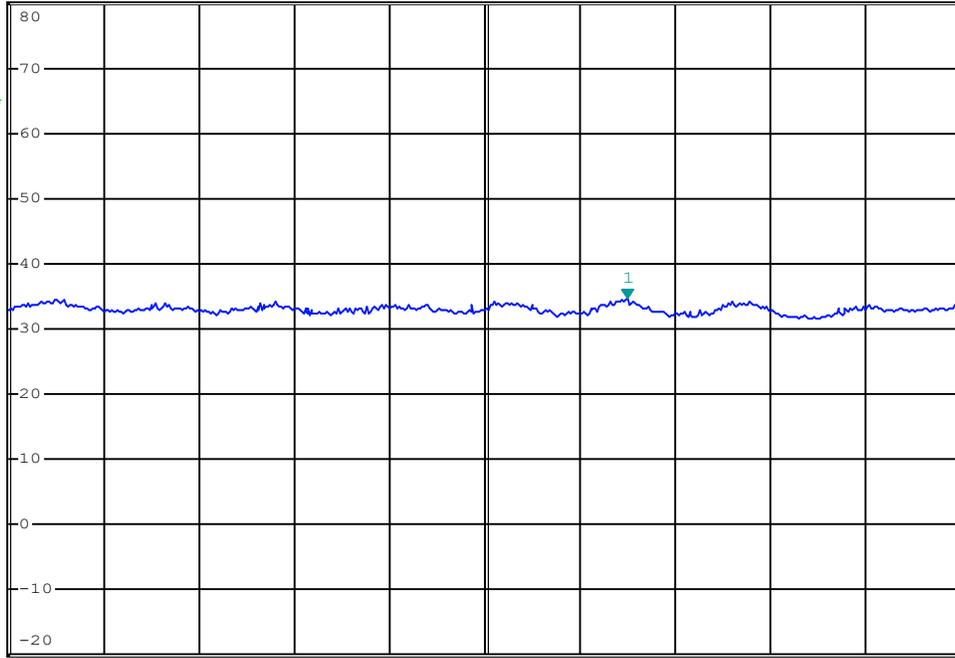


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 34.70 dBuV
SWT 90 ms 16.460000000 GHz

Ref 80 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 17.JUL.2024 10:36:47

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

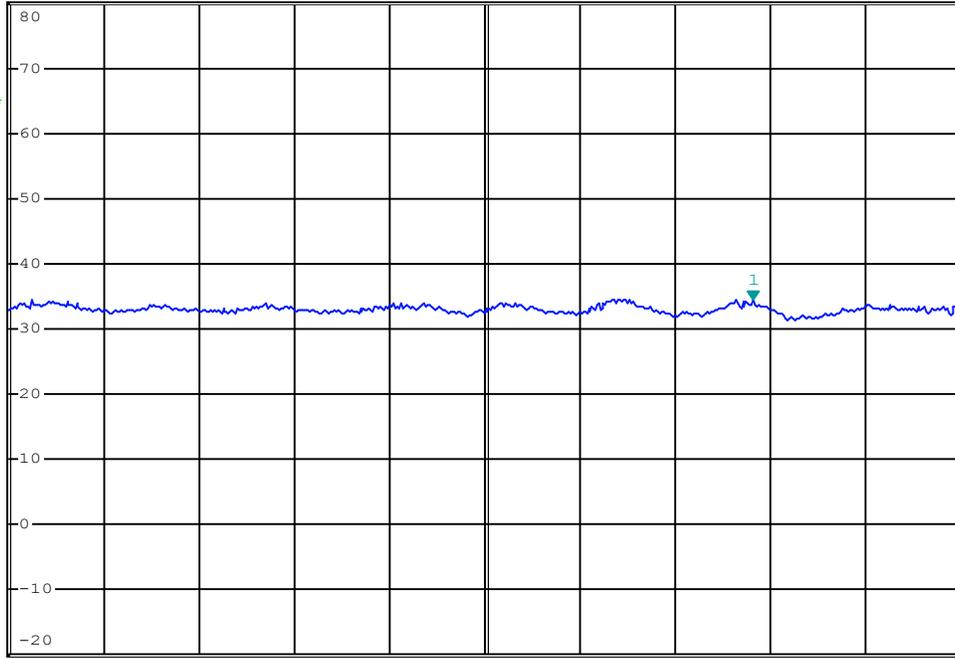


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 34.52 dBuV
SWT 90 ms 17.040800000 GHz

Ref 80 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 17.JUL.2024 10:41:43

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

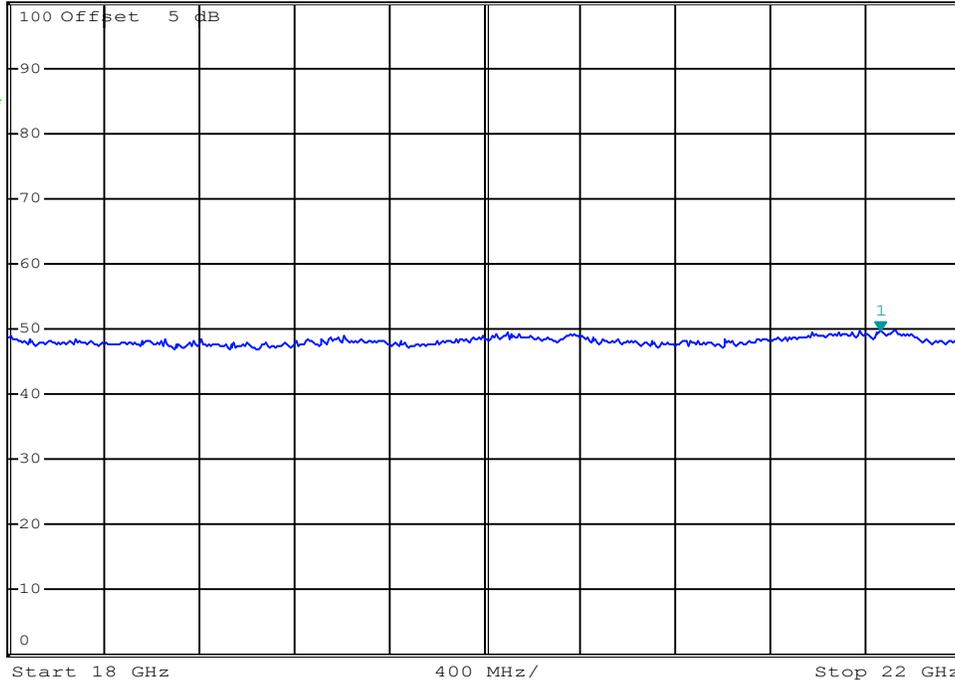


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 49.83 dBµV
SWT 80 ms 21.664000000 GHz

Ref 100 dBµV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 14:15:47

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

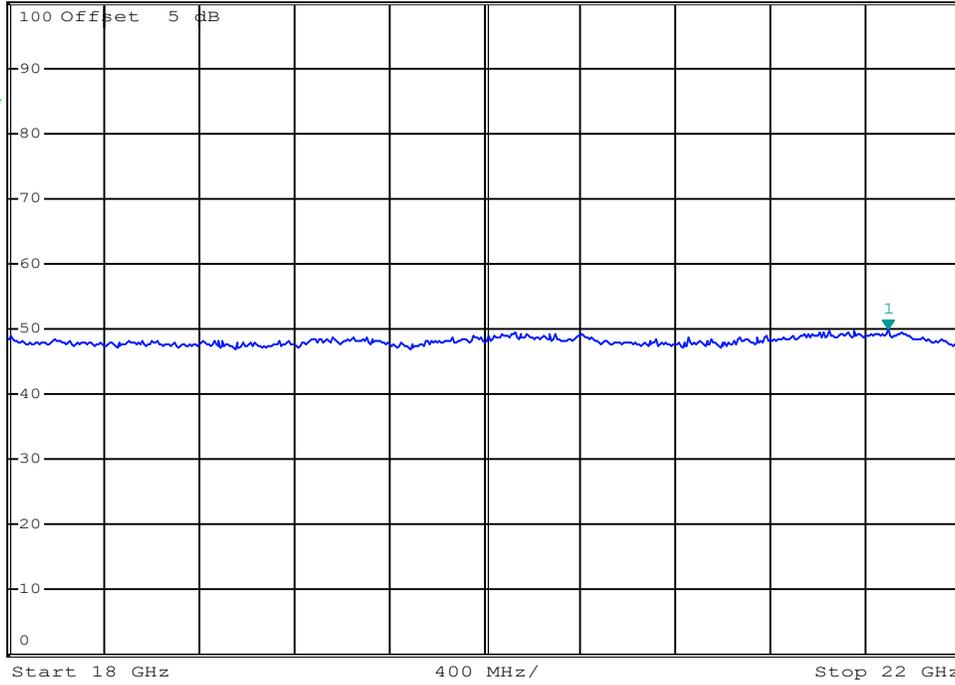


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 50.01 dBuV
SWT 80 ms 21.696000000 GHz

Ref 100 dBuV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 14:16:28

Channel: 38

Channel Frequency: 2440 MHz

Mode: BT BR

Modulation: GFSK

Polarization: Vertical

Measured Emission Power: ND dBuV

Emission Frequency: ND MHz

Radiated Tx Emissions:

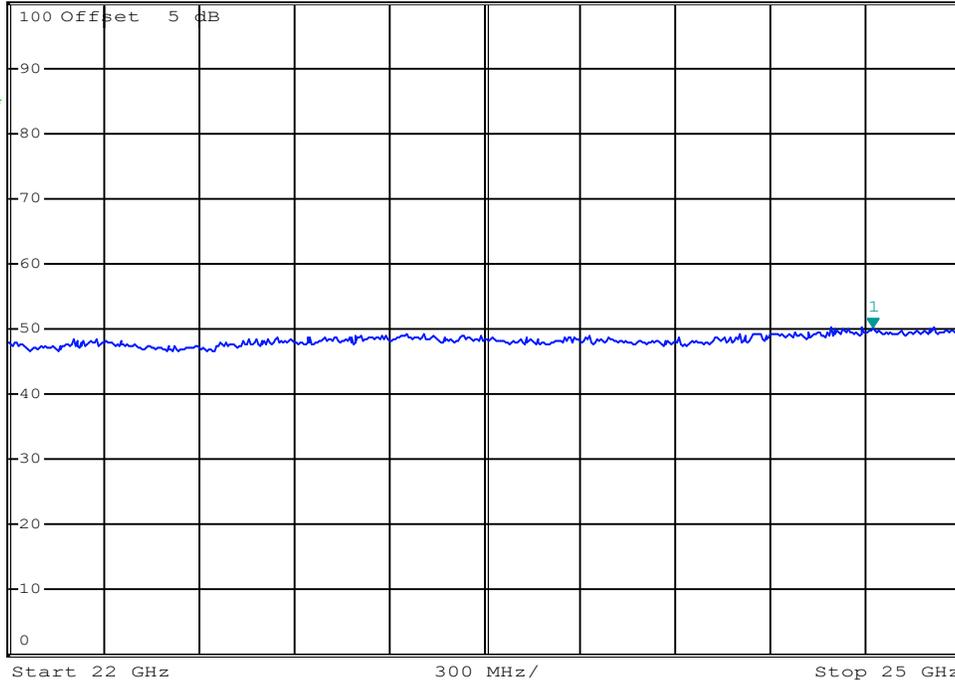


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 50.36 dBμV
SWT 60 ms 24.724000000 GHz

Ref 100 dBμV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 14:16:00

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

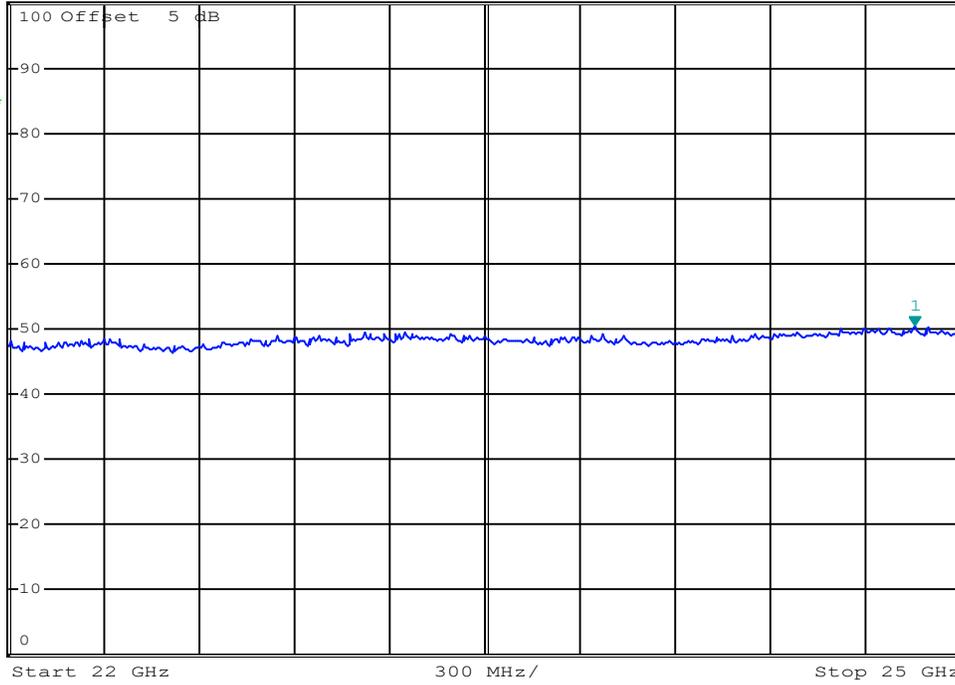


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 50.40 dBuV
SWT 60 ms 24.856000000 GHz

Ref 100 dBuV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 14:16:46

Channel: 38

Channel Frequency: 2440 MHz

Mode: BT BR

Modulation: GFSK

Polarization: Vertical

Measured Emission Power: ND dBuV

Emission Frequency: ND MHz

Summary of Radiated Rx Emissions

Measured Frequency Range (MHz)	Channel Frequency (MHz)	Antenna Polarization	Emission Frequency (MHz)	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)
30-1000	-	Horizontal	(1)	(1) AV	-	-	0.00 (3)	(1)	-	(1)
30-1000	-	Vertical	(1)	(1) AV	-	-	0.00 (3)	(1)	-	(1)
1000-25000	-	Horizontal	(1)	(1) AV	-	-	0.00 (3)	(1)	54.0	(1)
1000-25000	-	Vertical	(1)	(1) AV	-	-	0.00 (3)	(1)	54.0	(1)
Results:									Complies	

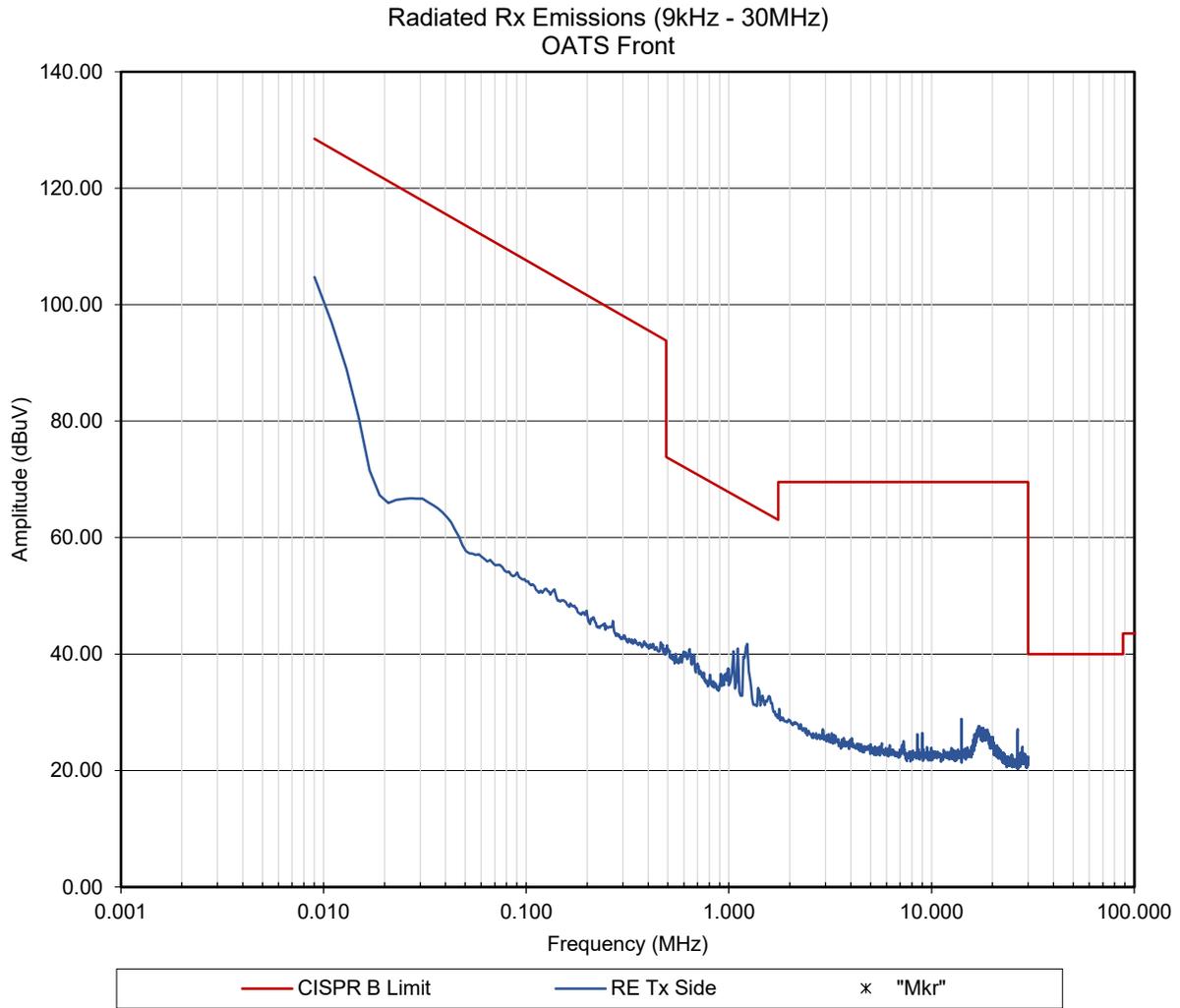
(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(3) External Amplifier not used

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

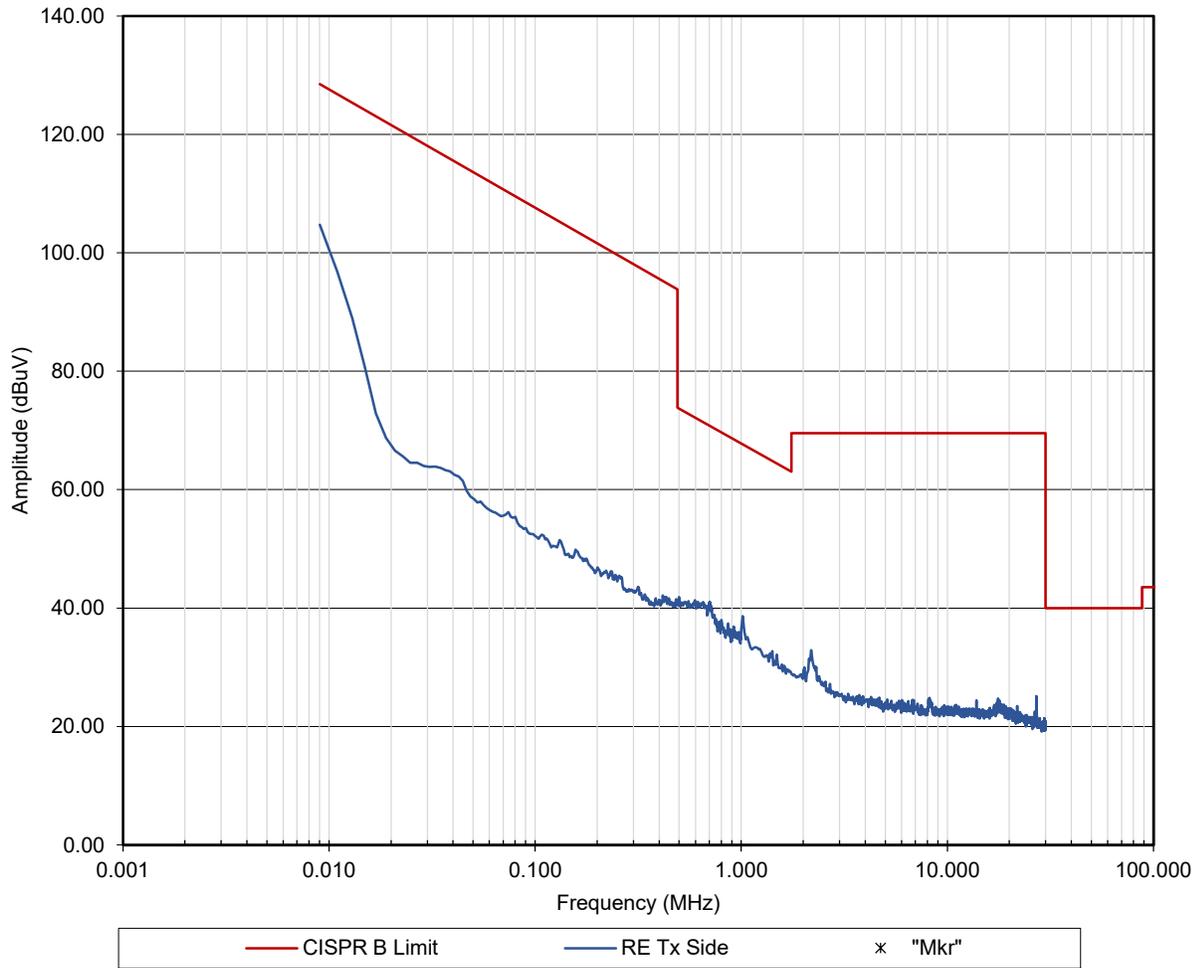
Where ACF^E is the Electric Antenna Correction Factor

Radiated Rx Emissions:



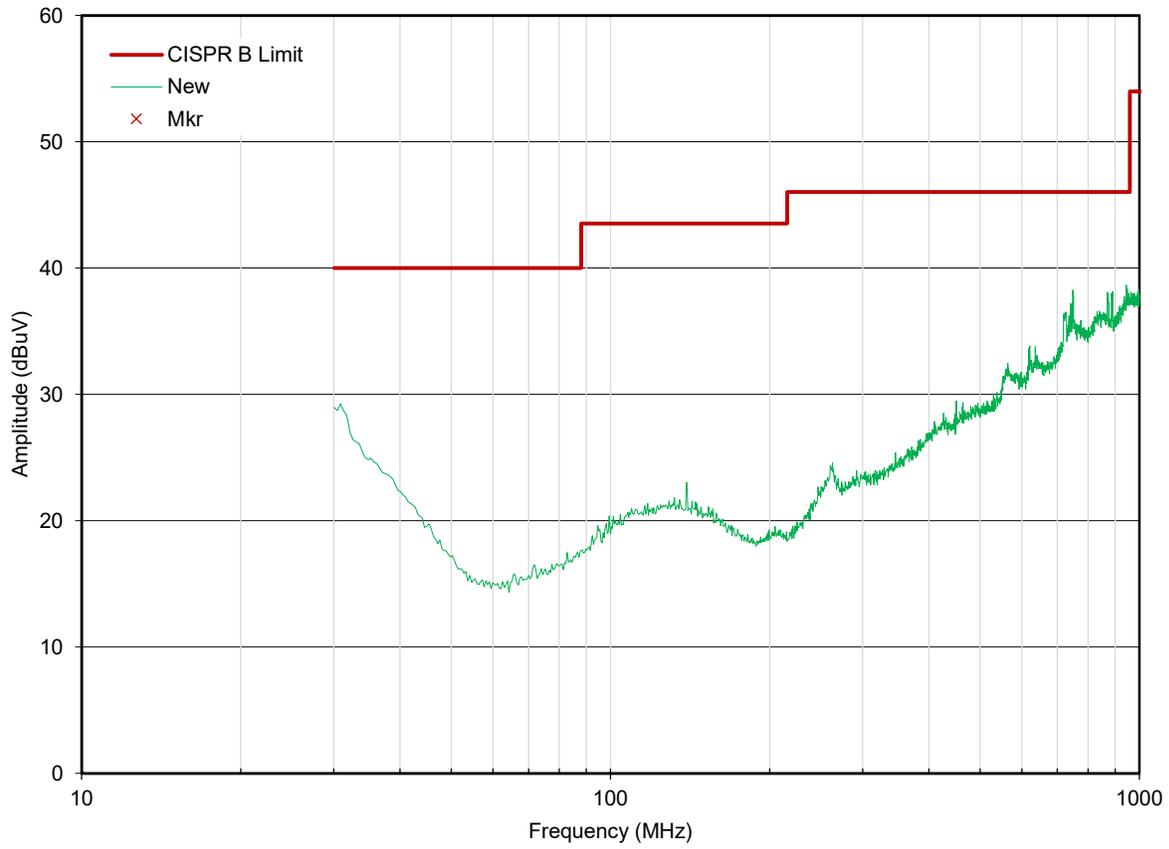
Radiated Rx Emissions:

Radiated Rx Emissions (9kHz - 30MHz)
OATS Side



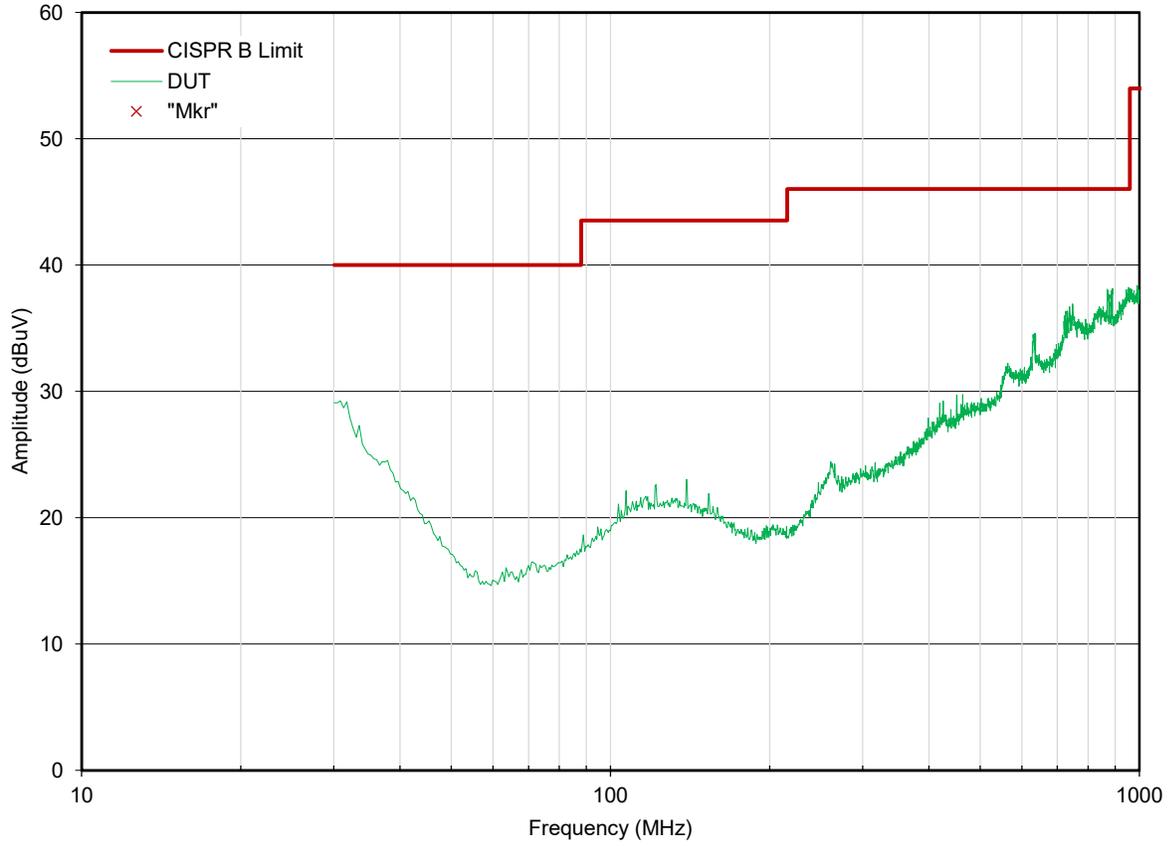
Radiated Tx Emissions:

Radiated Rx Emissions (30MHz - 1GHz)
OATS Horizontal



Radiated Tx Emissions:

Radiated Rx Emissions (30MHz - 1GHz)
OATS Vertical



Radiated Rx Emissions:



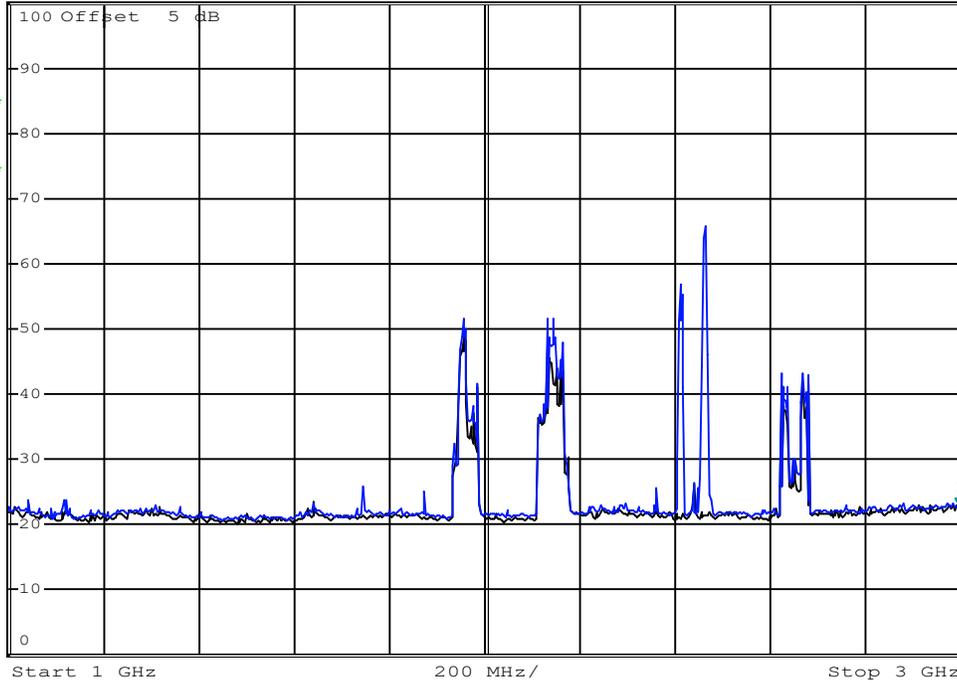
*RBW 1 MHz Marker 1 [T1]
 VBW 10 MHz 22.63 dBμV
 SWT 10 ms 3.000000000 GHz

Ref 100 dBμV

*Att 0 dB

1 RM*
VIEW

2 RM*
VIEW



Date: 17.JUL.2024 15:00:05

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

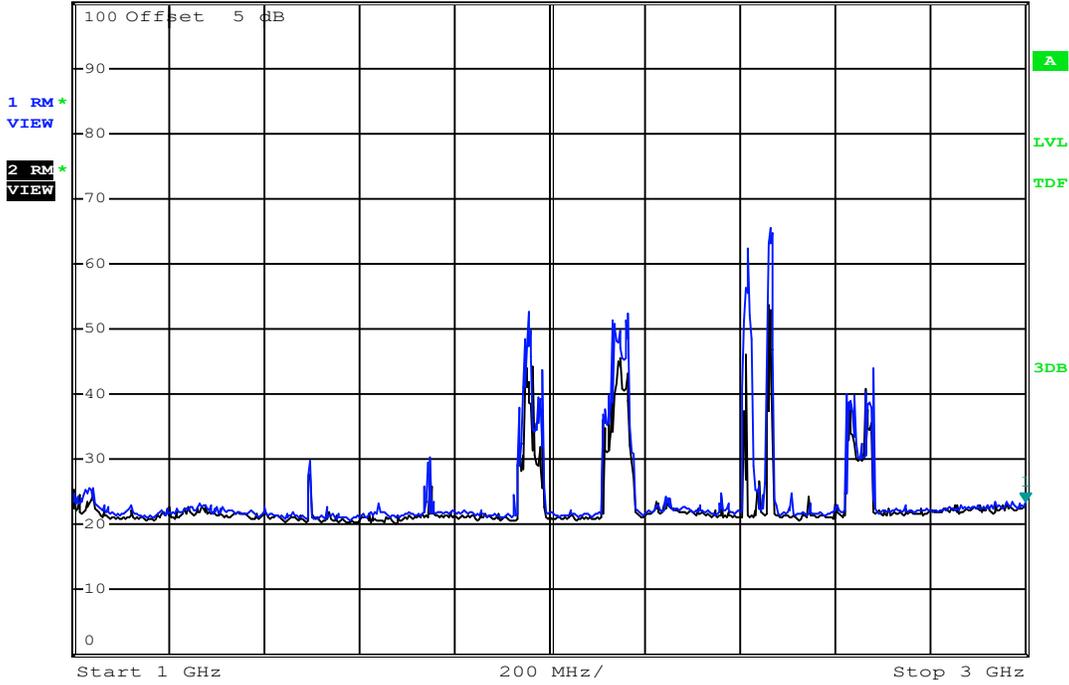
Measured Channel Power(AV): dBm

Radiated Rx Emissions:



*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 23.45 dBμV
SWT 10 ms 3.000000000 GHz

Ref 100 dBμV *Att 0 dB



Date: 17.JUL.2024 15:00:56

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

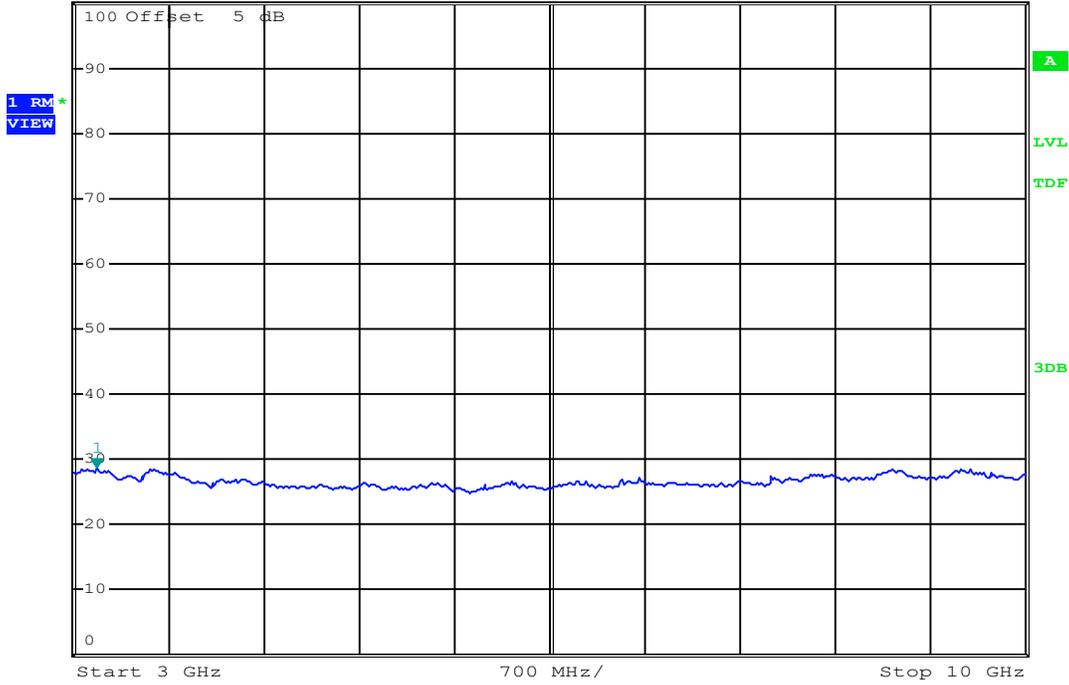
Measured Channel Power(AV): dBm

Radiated Rx Emissions:



*RBW 1 MHz Marker 1 [T1]
 VBW 10 MHz 28.67 dBμV
 SWT 140 ms 3.16800000 GHz

Ref 100 dBμV *Att 0 dB



Date: 17.JUL.2024 15:01:46

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

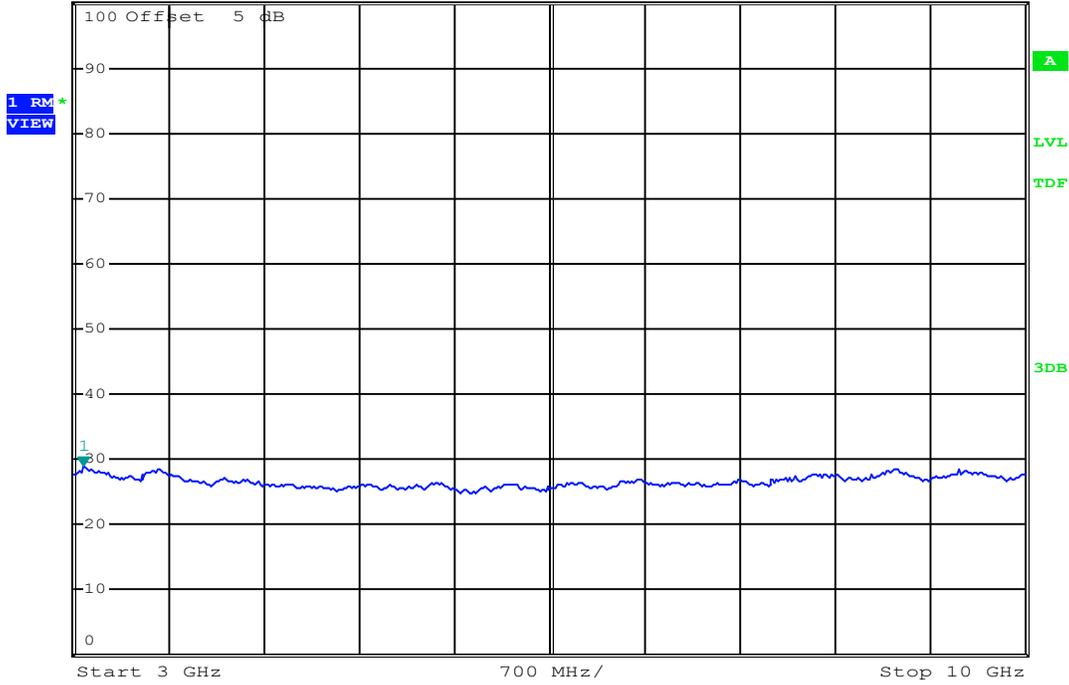
Measured Channel Power(AV): dBm

Radiated Rx Emissions:



*RBW 1 MHz Marker 1 [T1]
 VBW 10 MHz 28.96 dBµV
 SWT 140 ms 3.07000000 GHz

Ref 100 dBµV *Att 0 dB



Date: 17.JUL.2024 15:16:10

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

Measured Channel Power(AV): dBm

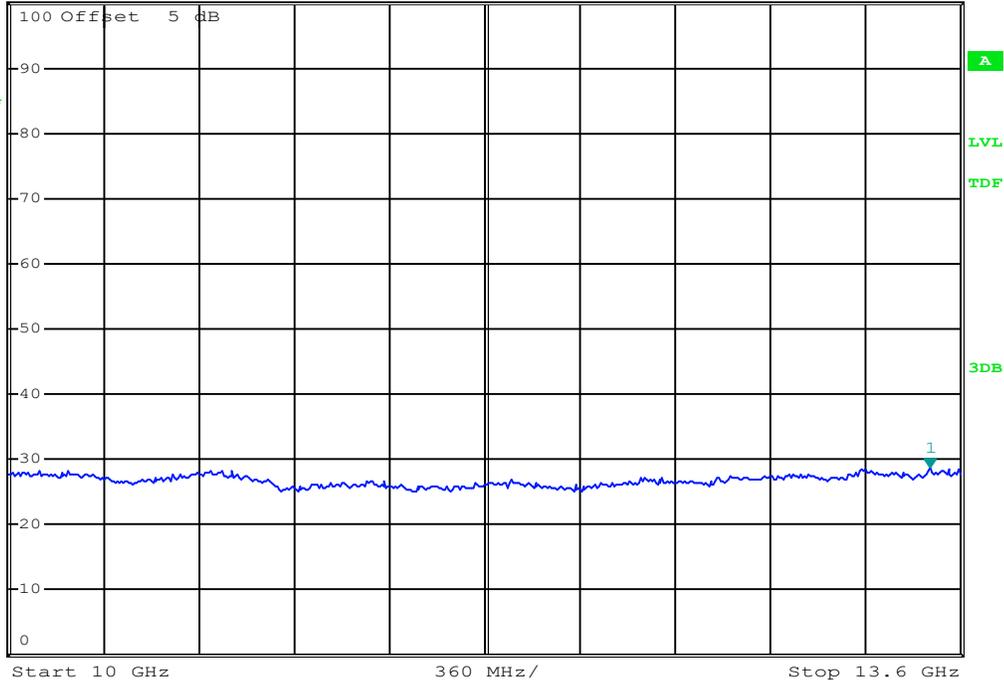
Radiated Rx Emissions:



*RBW 1 MHz Marker 1 [T1]
 VBW 10 MHz 28.62 dBμV
 SWT 75 ms 13.484800000 GHz

Ref 100 dBμV *Att 0 dB

1 RM*
 VIEW



Date: 17.JUL.2024 15:02:01

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

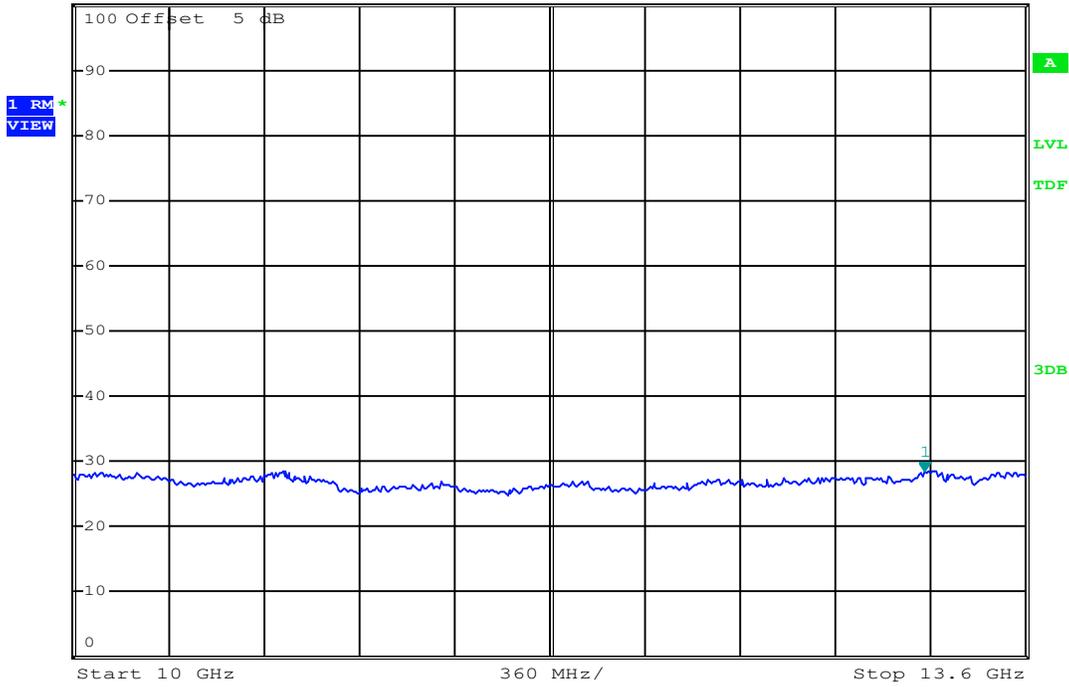
Measured Channel Power(AV): dBm

Radiated Rx Emissions:



*RBW 1 MHz Marker 1 [T1]
 VBW 10 MHz 28.61 dBµV
 SWT 75 ms 13.218400000 GHz

Ref 100 dBµV *Att 0 dB



Date: 17.JUL.2024 15:16:24

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

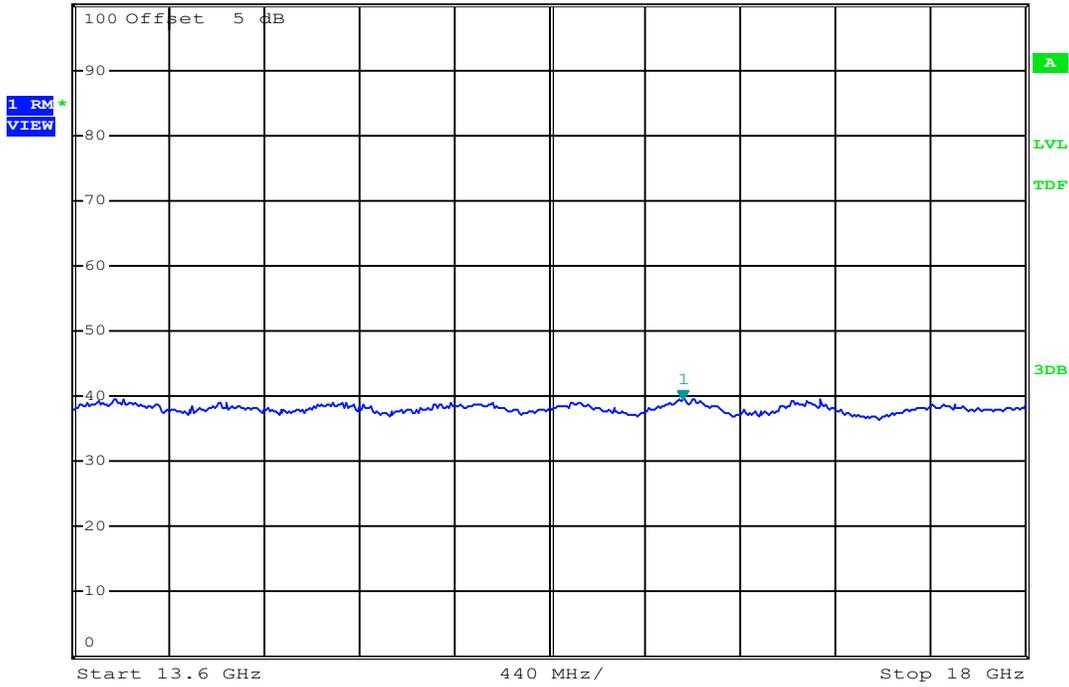
Measured Channel Power(AV): dBm

Radiated Rx Emissions:



*RBW 1 MHz Marker 1 [T1]
 VBW 10 MHz 39.58 dBμV
 SWT 90 ms 16.416000000 GHz

Ref 100 dBμV *Att 0 dB



Date: 17.JUL.2024 15:02:25

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

Measured Channel Power(AV): dBm

Radiated Rx Emissions:

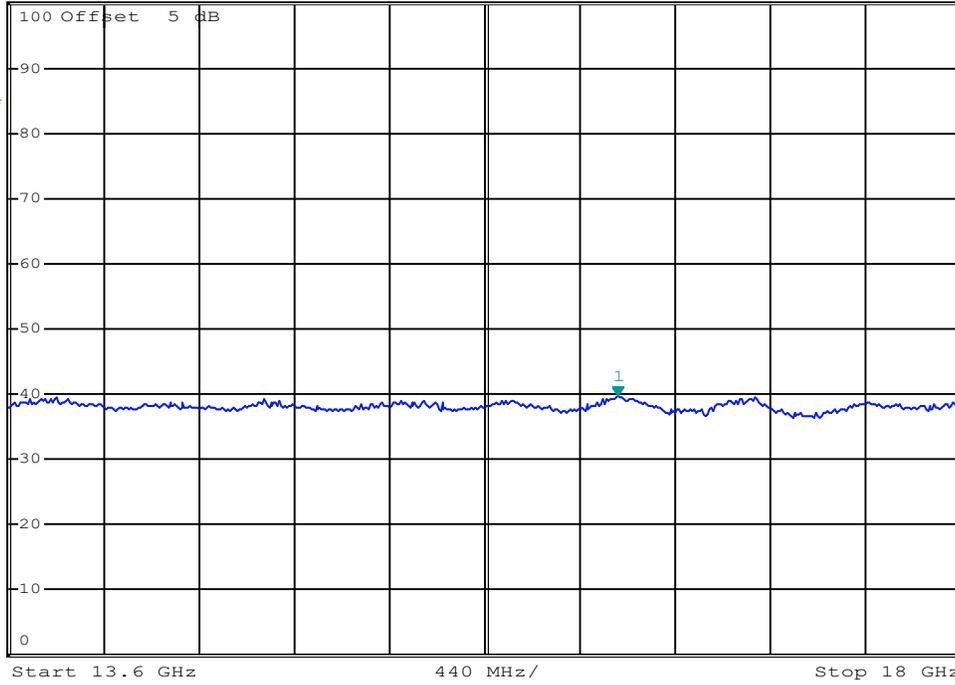


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 39.74 dBμV
SWT 90 ms 16.41600000 GHz

Ref 100 dBμV

*Att 0 dB

1 RM*
VIEW



Date: 17.JUL.2024 15:16:41

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

Measured Channel Power(AV): dBm

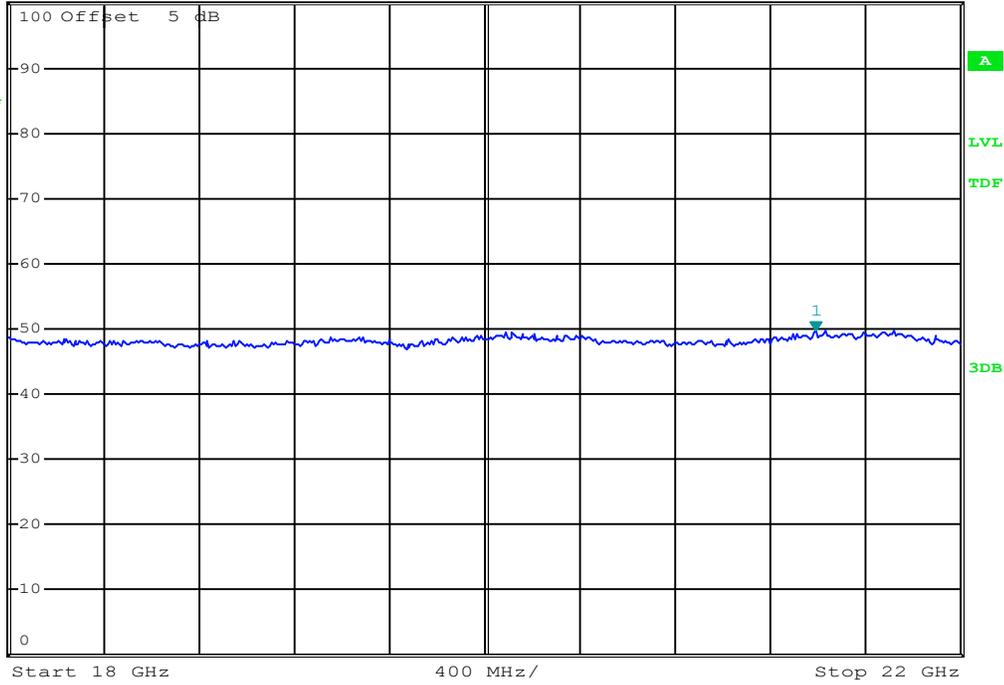
Radiated Rx Emissions:



*RBW 1 MHz Marker 1 [T1]
 VBW 10 MHz 49.68 dBμV
 SWT 80 ms 21.392000000 GHz

Ref 100 dBμV *Att 10 dB

1 RM*
 VIEW



Date: 17.JUL.2024 14:31:32

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

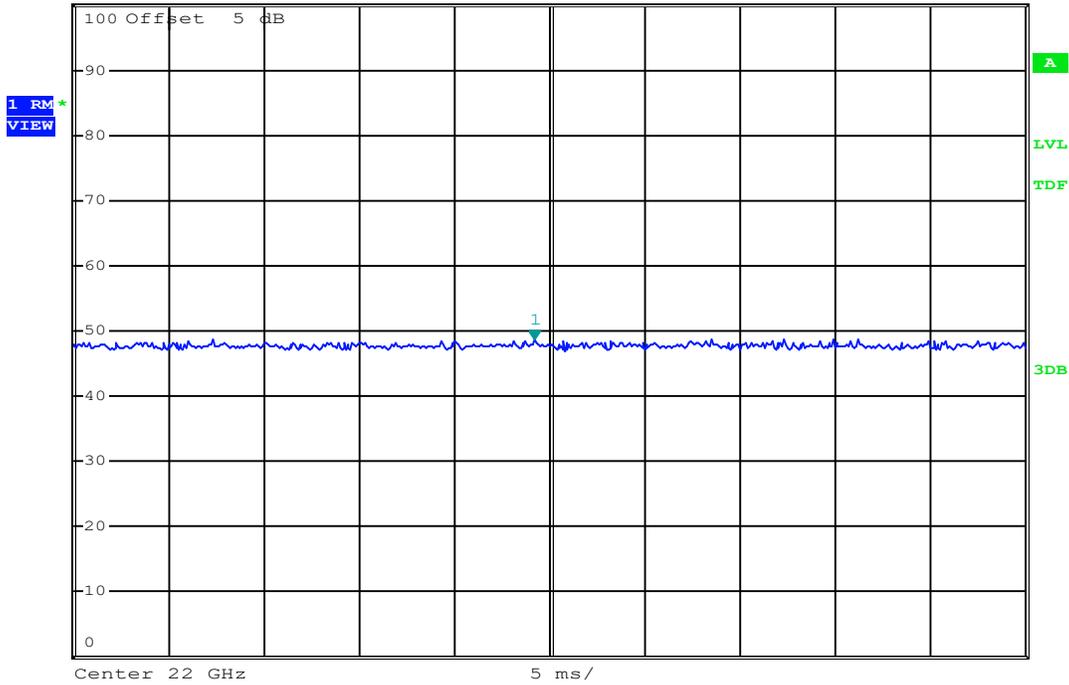
Emission Frequency: MHz

Measured Channel Power(AV): dBm

Radiated Rx Emissions:



Ref 100 dB μ V *Att 10 dB RBW 1 MHz Marker 1 [T1] 48.76 dB μ V
 VBW 10 MHz 24.200000 ms
 SWT 50 ms



Date: 17.JUL.2024 14:43:24

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

Measured Channel Power(AV): dBm

Radiated Rx Emissions:

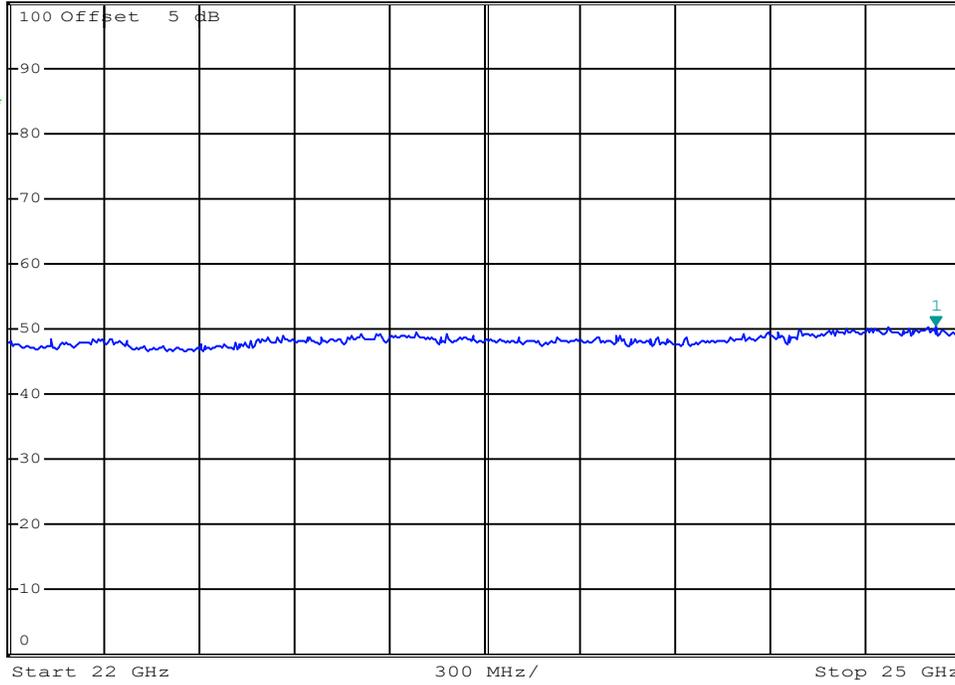


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 50.40 dBμV
SWT 60 ms 24.922000000 GHz

Ref 100 dBμV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 14:31:45

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

Measured Channel Power(AV): dBm

Radiated Rx Emissions:

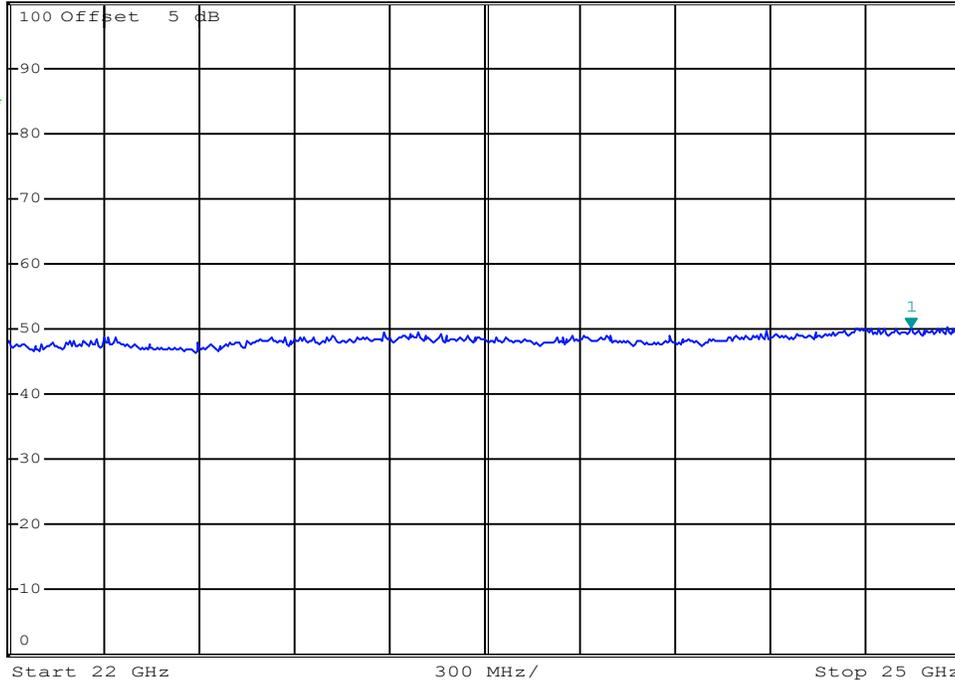


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 50.23 dBμV
SWT 60 ms 24.844000000 GHz

Ref 100 dBμV

*Att 10 dB

1 RM*
VIEW



Date: 17.JUL.2024 14:43:37

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power(PK): dBm

Emission Frequency: MHz

Measured Channel Power(AV): dBm

SAR Test Report - New Application

Applicant:



Garmin International Inc.
1200 East 151 St.
Olathe, KS, 66062
USA

FCC ID:

IPH-04861

Product Model Number / HVIN

A04861

Maximum *reported* SAR

DTS - 2.4GHz WLAN:	0.48	1g Head (W/kg)
DSS/DTS Bluetooth:	0.15	
General Pop. Limit:	1.60	

Maximum *reported* SAR

DTS - 2.4GHz WLAN:	0.18	10g Extremity (W/kg)
DSS/DTS Bluetooth:	<0.1	
General Pop. Limit:	4.00	

IC Registration Number

Product Name / PMN

A04861

In Accordance With:

FCC 47 CFR §2.1093

Radiofrequency Radiation Exposure Evaluation: Portable Devices

Approved By:



Ben Hewson, President
Celltech Labs Inc.
21-364 Loughheed Rd.
Kelowna, BC, V1X 7R8
Canada



Test Lab Certificate: 2470.01



**Industry
Canada**

IC Registration 3874A



FCC Registration: CA3874

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1.0 DOCUMENT CONTROL

Revision History					
Samples Tested By:		Ben Hewson/ Trevor Whillock	Date(s) of Evaluation:		20-21 June 2024
Report Prepared By:		Ben Hewson	Report Reviewed By:		Art Voss
Report Revision	Description of Revision	Revised Section	Revised By	Revision Date	
0.1	Draft	n/a	Ben Hewson	22 July 2024	
1.0	Initial Release	n/a	Art Voss	26 July 2024	

2.0 CLIENT AND DEVICE INFORMATION

Client Information	
Applicant Name	Garmin International Inc.
Applicant Address	1200 East 151 St
	Olathe, KS, 66062
	USA
DUT Information	
Device Identifier(s):	ISED ID: 1792A-04861
Device Model(s) / HVIN:	A04861
Device Marketing Name / PMN:	A04861
Test Sample Serial No.:	3472329152 - Conducted, 3472329454 - OTA
Software Ver /SVIN:	V9.11
Device Type:	Portable Transceiver
Equipment Class:	Wireless Local Area Network Device
	General Field Strength Device
Transmit Frequency Range:	WiFi (DTS): 2412-2462MHz
	BT/BLE/ANT: 2402-2480MHz
	NFC: 13.56MHz
Manuf. Max. Rated Output Power:	WiFi - Digital Transmission System (DTS): 16dBm
	BlueTooth - Spread Spectrum Transmitter (DSS):9.5dBm
	BLE/ANT - Low Power Communication Device Transmitter (DXX): 1.5dBm
	NFC - Low Power Communication Device Transmitter (DXX): 46.48dBuV/m
Antenna Type and Gain:	-5.8 dBi Max Slot Antenna
Modulation:	WiFi: DSSS, OFDM, CCK, MCS0-7
	BT BR: GFSK
	BT EDR: Pi/4-DQPSK, 8DPSK
	BLE: GMSK
	ANT: GFSK
NFC: ASK	
DUT Power Source:	4.5VDC Rechargeable Li-Ion
DUT Dimensions [LxWxH]	H x W x D: 47mm dia x 10.5mm
Deviation(s) from standard/procedure:	None
Modification of DUT:	None

3.0 SCOPE OF EVALUATION

This Certification Report was prepared on behalf of:
Garmin International 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.

The A04861, operates as a Portable transceiver near extremity, that is capable of operating in the 2.4GHz WiFi and Bluetooth, BLE & ANT frequency bands and has an additional NFC feature that operates at a fixed transmit frequency of 13.56MHz. The device is intended for General Population Use. The product operates from an internal proprietary Li-ion rechargeable battery which can be connected to a compliant USB interface port, AC or DC adapter for charging. Test samples provided by the manufacturer were capable of transmitting at select frequencies and modulations preset by the manufacturer. An additional antenna modification was prepared for one sample allowing the ability to connect test equipment for antenna port conducted power analysis.

Application:

This is an application for a new device certification.

Scope:

The scope of this evaluation limited to the evaluation of SAR for intended applications. It will include evaluation of the 2.4 GHz WiFi/BT transmitters for all required RF exposure configurations including Extremity and Head Configuration as the device may be operational while held to face.

The Test Plan developed for this evaluation is based on the required test channels and configurations which produced the highest worst case SAR and where applicable, SAR test reduction and/or SAR test exclusion may be utilized. The DUT was evaluated for SAR at the maximum tune up tolerance and conducted output power level, preset by the manufacturer and in accordance with the procedures described in RSS-102, IEC/IEEE 62209-1528, FCC KDB 447498 and FCC KDB 248227.

4.0 NORMATIVE REFERENCES

Normative References*	
ANSI / ISO 17025:2017	General Requirements for competence of testing and calibration laboratories
FCC CFR Title 47 Part 2 Title 47: Part 2.1093:	Code of Federal Regulations Telecommunication Radiofrequency Radiation Exposure Evaluation: Portable Devices
IEC International Standard /IEEE International Committee on Electromagnetic Safety IEC/IEEE 62209-1528	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528; Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)
FCC KDB KDB 865664 D01v01r04 KDB 865664 D02v01r02	SAR Measurement Requirements for 100MHz to 6GHz RF Exposure Compliance Reporting and Documentation Considerations
FCC KDB KDB 447498 D04v01	RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices Interim General RF Exposure Guidance
FCC KDB KDB 248227 D01v02r02	SAR Guidance for IEEE 802.11 (WiFi) Transmitters
* When the issue number or issue date is omitted, the latest version is assumed.	

5.0 STATEMENT OF COMPLIANCE

This measurement report demonstrates that samples of the product model(s) were evaluated for Specific Absorption Rate (SAR) on the date(s) shown, in accordance with the Measurement Procedures cited and were found to comply with the Standard(s) Applied based on the Exposure Limits of the Use Group indicated for which the product is intended to be used.

Applicant: Garmin International Inc.	Model / HVIN: A04861	
Standard(s) Applied: FCC 47 CFR §2.1093	Measurement Procedure(s): FCC KDB 865664, FCC KDB 447498, FCC KDB 248227 IEC/IEEE Standard 62209-1528	
Reason For Issue: <input checked="" type="checkbox"/> New Certification <input type="checkbox"/> Class I Permissive Change <input type="checkbox"/> Class II Permissive Change	Use Group: <input checked="" type="checkbox"/> General Population / Uncontrolled <input type="checkbox"/> Occupational / Controlled	Limits Applied: <input checked="" type="checkbox"/> 1.6W/kg - 1g Volume <input type="checkbox"/> 8.0W/kg - 1g Volume <input checked="" type="checkbox"/> 4.0W/kg - 10g Volume
Reason for Change:		Date(s) Evaluated: 20-21 June 2024

The results of this investigation are based solely on the test sample(s) provided by the applicant which was not adjusted, modified or altered in any manner whatsoever except as required to carry out specific tests or measurements. A description of the device, operating configuration, detailed summary of the test results, methodologies and procedures used during this evaluation, the equipment used and the various provisions of the rules are included in this test report.

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.	
	Ben Hewson Celltech Labs Inc.
	22 July 2024 Date

6.0 SAR MEASUREMENT SYSTEM

SAR Measurement System

Celltech Labs Inc. SAR measurement facility employs a Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY6 measurement system is comprised of the measurement server, a robot controller, a computer, a near-field probe, a probe alignment sensor, an Elliptical Planar Phantom (ELI) phantom and a specific anthropomorphic mannequin (SAM) phantom for Head and/or Body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller and a teach pendant (Joystick) to control the robot's servo motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical form the DAE to digital electronic signal and transfers data to the DASY6 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter, a command decoder and a control logic unit. Transmission to the DASY6 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot utilizes a controller with built in VME-bus computer.



DASY 6 SAR System with SAM Phantom



DASY 6 Measurement Controller

7.0 RF CONDUCTED POWER MEASUREMENT

Table 7.0 Conducted Power Measurements – 2.4GHz WiFi BT BLE ANT

Conducted Power Measurements														
Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dB)	SAR Test Channel (Y/-)	Duty Cycle (%)	Crest Factor (1/DC)	
WLAN 2.4G	802.11b	20	1	2412	CKK	1	15.25	16.00	0.040	-0.75	-	-	-	
			6	2437			15.98	16.00	0.040	-0.02	Y	100.0	1.000	
			11	2462			12.72	13.00	0.020	-0.28	-	-	-	
			13	2472			4.67	6.00	0.004	-1.33	-	-	-	
WLAN 2.4G	802.11g	20	1	2412	OFDM	6	15.58	16.00	0.040	-0.42	-	-	-	
			6	2437			15.87	16.00	0.040	-0.13	-	-	-	
			11	2462			15.52	16.00	0.040	-0.48	-	-	-	
WLAN 2.4G	802.11n	20	1	2412	MCS0	0	13.97	15.50	0.035	-1.53	-	-	-	
			6	2437			15.37	15.50	0.035	-0.13	-	-	-	
			11	2462			14.61	15.50	0.035	-0.89	-	-	-	
			13	2472			14.86	15.50	0.035	-0.64	-	-	-	
BT	BR	1	2	2402	GFSK	-	8.67	9.5	0.009	-0.83	-	-	-	
			38	2441			9.31	9.5	0.009	-0.19	Y	100.0	1.000	
			78	2480			9.12	9.5	0.009	-0.38	-	-	-	
	2EDR		2	2402	Pi/4-DQPSK	-	7.87	9.5	0.009	-1.63	-	-	-	-
			41	2441			8.54	9.5	0.009	-0.96	-	-	-	
			80	2480			9.25	9.5	0.009	-0.25	-	-	-	
	3EDR		2	2402	8DPSK	-	7.47	9.0	0.008	-1.53	-	-	-	-
			41	2441			8.17	9.0	0.008	-0.83	-	-	-	
80		2480	8.95	9.0			0.008	-0.05	-	-	-			
BT	LE	1	2	2404	GMSK	-	-2.84	1.50	0.001	-4.34	-	-	-	
			38	2440			1.20	1.50	0.001	-0.30	-	-	-	
			78	2480			-1.61	1.50	0.001	-3.11	-	-	-	
BT	LE	2	2	2404	GMSK	-	0.89	1.50	0.001	-0.61	-	-	-	
			40	2440			1.48	1.50	0.001	-0.02	-	-	-	
			80	2480			-1.97	1.50	0.001	-3.47	-	-	-	
ANT	ANT	1	2	2402	GFSK	-	-2.84	1.50	0.001	-4.34	-	-	-	
			40	2440			1.36	1.50	0.001	-0.14	-	-	-	
			80	2480			-1.63	1.50	0.001	-3.13	-	-	-	

The rated power and tolerance are stated for typical transmission modes and data rates. Some modes and data rates may produce lower than rated conducted power levels. Power measurements taken across the various channels, modes and data rates did not produce levels in excess of the Rated Power plus Tolerance. SAR was evaluated using the power level setting and duty cycle specified by the manufacturer to be the max output power and produce the most conservative SAR. SAR was evaluated at the maximum average tune up tolerance. See section 2.0 Client and Device Information for details. The reported SAR was not scaled down.

8.0 MEASUREMENT METHOD

Table 8.1 Number of Test Channels and SAR test reduction

The intended use of the device would have it transmit as a portable transceiver near extremity and/or held to face. As such the device was evaluated for both Extremity SAR (10g - 0mm) and Head SAR (1g - 10mm).

Wi-Fi SAR Evaluation:

SAR was evaluated in DSSS mode at the maximum duty cycle. The power level setting selected was specified by the manufacturer to be the max output power and produce the most conservative SAR.

The device supports channel 1 thru 13 for 2.5 GHz WLAN, though channel 11- 13 were reduced in power. Per FCC KDB 248227, provided higher maximum output power is not specified for other channels, channels 1, 6 and 11 are used to configure 22 MHz and 20MHz OFDM channels for SAR measurements; otherwise, the closest adjacent channel with the highest maximum output power specified for production units should be tested instead of channels 1, 6 or 11. When 40 MHz channels are supported, and provided higher maximum output power is not specified for other applicable 40 MHz channels, channel 6 is used to measure SAR. The highest conducted output power was found on Channel 6 and selected for initial evaluation.

SAR test reduction methodology was applied to reduce the total number of required test channels from the SAR test evaluation.

When applicable, SAR test reduction methods may be utilized.

802.11b DSSS SAR test reduction is determined according to the following:

- a) When the reported SAR of the highest measured maximum output power channel is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- b) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

- a) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

The initial test configuration for 2.4 GHz is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band.

When the same maximum output power was specified for multiple transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power are the same for multiple test channels, SAR is measured using the channel closest to the middle frequency band. When all the channels have the same maximum output power use the higher number channel.

When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until reported SAR is ≤ 1.2 W/kg or all required channels are tested.

1-g SAR Estimates Based on Area Scans per KDB 447498 - the SAR measurements in 2.4GHz met the conditions and were evaluated using the provisions of 447498, with SAR measurements below 1.0W/kg and no warning messages.

Table 8.2 Exemptions for Single RF Source

Per FCC KDB 447498 D04 Appendix B Exemptions for Single RF Sources

B.4 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the available maximum time averaged power may be used if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

The separation distance is the smallest distance from any part of the antenna or radiating structure to all persons, and for portable or mobile devices this is from the device outer housing to the closest antenna.

$$P_{th} \text{ (mW)} = ERP_{20cm} \text{ (mW)} = 2040f \quad \text{for } 0.3\text{GHz} \leq f < 1.5\text{GHz (B.1)}$$

$$P_{th} \text{ (mW)} = ERP_{20cm} \text{ (mW)} = 3060 \quad \text{for } 1.5\text{GHz} \leq f \leq 6\text{GHz (B.1)}$$

$$P_{th} \text{ (mW)} = (ERP_{20cm})/d \quad \text{for } d \leq 20\text{cm (B.2)}$$

$$P_{th} \text{ (mW)} = (ERP_{20cm}) \quad \text{for } 20\text{cm} < d \leq 40\text{cm (B.2)}$$

$$x = -\log_{10} (60/(ERP_{20cm}) \sqrt{f})$$

where f is in GHz, d is separation distance (cm), ERP_{20cm} is per Formula (B.1).

Transmitter	Frequency (f) (GHz)	Separation Distance (d) (cm)	Average Power (mW)	Antenna Gain (dBi)	ERP or Avg. Power (mW)*	P_{th} (mW)
ANT	2.48	0.5	1.5	-5.8	0.39	2.72
BLE	2.48	0.5	1.5	-5.8	0.39	2.72

*If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the available maximum time averaged power may be used if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

The BLE and ANT transmitters has a maximum frequency of 2480MHz. The BLE and ANT power was measured by the client and has a maximum average transmission power of 2.0mW and a minimum antenna separation distance of 5 mm.

Based on 447498 D04 Appendix B the BLE and ANT transmitters are exempt from further evaluation.

NFC Test Exclusion

The field strength of NFC Transmitter was measured and found to be 46.48dBuV/m @3m. The conversion of field strength to EIRP is given by:

$$EIRP = FS - 104.7 + 20 \cdot \log_{10}(d) \text{ where } FS = \text{field strength, } d = \text{measurement distance (3m)}$$

$$EIRP = 46.48 - 104.7 + 20 \cdot \log_{10}(3)$$

$$EIRP = -48.58\text{dBm} = 0.000014\text{mW}$$

device qualifies for SAR test exemption per KDB 447498 D04 Appendix B, B.2, 1 mW Blanket Exemption

The test exclusion threshold from the equations above, at 13.56MHz is 3W.

The NFC Transmitter qualifies for SAR Test Exclusion.

Simultaneous SAR Evaluation

Simultaneous transmission cannot occur between any of the 2.4GHz WiFi, Bluetooth or Ant transmitters.

Simultaneous transmission can occur between the NFC transmitter and any, and only, one of the 2.4GHz transmitters. The NFC transmitter qualifies for SAR test exclusion and the NFC estimated SAR is less than 0.000 W/kg. The NFC transmitter does not significantly contribute to the reported SAR.

9.0 ACCESSORIES EVALUATED

Table 9.0 Accessories Evaluated

Accessory List				
Test Report ID Number	Manufacturer's Part Number	Description	SAR Evaluated	SAR Tested
B1	010-13113-02	QuickFit 22 - Silicone Band	Y	Y
B2	010-12496-06	QuickFit 22 - Metal Band	Y	Y
B3	010-13306-10	Nylon Band	Y	Y

10.0 SAR MEASUREMENT SUMMARY

Table 10.0: Measured Results -Extremity 10g

Measured 10g SAR Results - EXTREMITY Configuration																	
Date	Plot ID	Test Frequency (MHz)	DUT Configuration					Accessories	Spacing		Measured SAR (W/kg)	SAR Drift (dB)	Delta Power (dB)	Crest Factor (n)	Fluid Sensitivity (n)	Duty Factor (%)	reported SAR (W/kg)
			Pos	Mode	BW	Mod	BR		DUT (mm)	Antenna (mm)							
Area Scan																	
6/21/2024	E50	2437	Back Touch	802.11b-NA	20	DSSS	1	- Nylon Band -	0	5	0.145	-0.210	-0.020	1.000	1.000	100.000	0.153
6/21/2024	E51	2437	Back Touch	802.11b-NA	20	DSSS	1	- Metal Band -	0	5	0.164	-0.100	-0.020	1.000	1.000	100.000	0.169
6/21/2024	E52	2437	Back Touch	802.11b-NA	20	DSSS	1	- Silicone Band -	0	5	0.201	-0.270	-0.020	1.000	1.000	100.000	0.215
6/21/2024	E53	2412	Back Touch	802.11b-NA	20	DSSS	1	- Silicone Band -	0	5	0.140	0.250	-0.750	1.000	1.000	100.000	0.166
6/21/2024	E54	2462	Back Touch	802.11b-NA	20	DSSS	1	- Silicone Band -	0	5	0.086	1.060	-0.280	1.000	1.000	100.000	0.092
6/21/2024	E55	2440	Back Touch	BT BR-NA	1	GFSK	1	- Silicone Band -	0	5	0.026	0.890	-0.190	1.000	1.000	100.000	0.028
Zoom Scan																	
6/21/2024	E52Z	2437	Back Touch	802.11b-NA	20	DSSS	1	- Silicone Band -	0	5	0.170	-0.130	-0.020	1.000	1.000	100.000	0.176
6/21/2024	E55Z	2440	Back Touch	BT BR-NA	1	GFSK	1	- Silicone Band -	0	5	0.022	1.010	-0.190	1.000	1.000	100.000	0.023
Applicable SAR Limit									Use Group				Limit				
FCC CFR 2.1093									Health Canada Safety Code 6				General Population/User Unaware				4 W/kg

Table 10.1: Measured Results -Head – Held-to Face 1g

Measured 1g SAR Results - FACE Configuration																	
Date	Plot ID	Test Frequency (MHz)	DUT Configuration					Accessories	Spacing		Measured SAR (W/kg)	SAR Drift (dB)	Delta Power (dB)	Crest Factor (n)	Fluid Sensitivity (n)	Duty Factor (%)	reported SAR (W/kg)
			Pos	Mode	BW	Mod	BR		DUT (mm)	Antenna (mm)							
Area Scan																	
6/21/2024	F50	2437	Front 10mm	802.11b-NA	20	DSSS	1	- Silicone Band -	10	15	0.541	-0.470	-0.020	1.000	1.000	100.000	0.606
6/21/2024	F51	2412	Front 10mm	802.11b-NA	20	DSSS	1	- Silicone Band -	10	15	0.352	-0.150	-0.750	1.000	1.000	100.000	0.433
6/21/2024	F52	2462	Front 10mm	802.11b-NA	20	DSSS	1	- Silicone Band -	10	15	0.142	0.200	-0.280	1.000	1.000	100.000	0.151
6/21/2024	F53	2440	Front 10mm	BT BR-NA	1	GFSK	1	- Silicone Band -	10	15	0.158	0.100	-0.190	1.000	1.000	100.000	0.165
Zoom Scan																	
6/21/2024	F50Z	2437	Front 10mm	802.11b-NA	20	DSSS	1	- Silicone Band -	10	15	0.439	-0.360	-0.020	1.000	1.000	100.000	0.479
6/21/2024	F53Z	2440	Front 10mm	BT BR-NA	1	GFSK	1	- Silicone Band -	10	15	0.143	-0.010	-0.190	1.000	1.000	100.000	0.150
Applicable SAR Limit									Use Group				Limit				
FCC CFR 2.1093									Health Canada Safety Code 6				General Population/User Unaware				1.6 W/kg

11.0 SCALING OF MAXIMUM MEASURE SAR

Table 11.0 SAR Scaling – Extremity 10g

Scaling of Maximum Measured SAR (10g)				
Measured Parameters	Configuration			
	Extremity	Extremity		
Plot ID	E52Z	E55Z		
Maximum Measured SAR _M	0.170	0.022		(W/kg)
Frequency	2437	2440		(MHz)
Drift				(dB)
Power Drift	-0.130	1.010 (5)		
Conducted Power	15.980	9.310		(dBm)
DC Transmitter Duty Cycle	(2)	(6)		(%)
DF Use Duty Factor	100.0 (3)	100.0 (7)		(%)
Fluid Deviation from Target				
Δε Permittivity	-3.80%	-3.80%		
Δσ Conductivity	5.82%	6.15%		
Fluid Sensitivity Calculation (1g) IEC/IEEE 62209-1528 7.8.2				
Delta SAR = Ce * Δε + Cσ * Δσ (8)				
Ce = (0.003456*f ³) - (0.03531*f ²) + (0.07675*f) - 0.186 (11)				
Cσ = (0.004479*f ³) - (0.01586*f ²) - (0.1972*f) + 0.7717 (12)				
f	Frequency (GHz)	2.437	2.44	
Ce		-0.159	-0.159	
Cσ		0.262	0.261	
Ce * Δε		0.006	0.006	
Cσ * Δσ		0.015	0.016	
ΔSAR		0.021 (1)	0.022 (4)	(%)
Manufacturer's Tuneup Tolerance				
Measured Conducted Power	15.980	9.310		(dBm)
Rated Conducted Power	16.000	9.500		(dBm)
ΔP	-0.020	-0.190		(dB)
Transmitter Duty Cycle [Crest Factor]				
Transmitter Duty Cycle (DC)	100.0	100.0		(%)
CF (1/DC)	1.00 (2)	1.00 (6)		
SAR Adjustment for Fluid Sensitivity				
SAR ₁ = SAR _M X [ΔSAR]	0.170 (1)	0.022 (4)		(W/kg)
SAR Adjustment for Tuneup Tolerance				
SAR ₂ = SAR ₁ + [ΔP]	0.171	0.023		(W/kg)
SAR Adjustment for Drift				
SAR ₃ = SAR ₂ + [Drift]	0.176	0.023 (5)		(W/kg)
SAR Adjustment for Transmitter Duty Cycle [Crest Factor]				
SAR ₄ = SAR ₃ x [CF]	0.176 (2)	0.023 (6)		(W/kg)
SAR Adjustment for Use Duty Factor				
SAR ₅ = SAR ₄ x [DF]	0.176 (3)	0.023 (7)		(W/kg)
reported 1g SAR				
reported SAR	0.18	0.02		(W/kg)

Table 11.1 SAR Scaling – Head – Held to Face 1g

Scaling of Maximum Measured SAR (1g)					
Measured Parameters		Configuration			
		Face	Face		
Plot ID		F50Z	F53Z		
Maximum Measured SAR _M		0.439	0.143		(W/kg)
Frequency		2437	2440		(MHz)
Drift	Power Drift	-0.360	-0.010		(dB)
Conducted Power		15.980	9.310		(dBm)
DC	Transmitter Duty Cycle	(9)	(12)		(%)
DF	Use Duty Factor	100.0 (10)	100.0 (13)		(%)
Fluid Deviation from Target					
Δe	Permittivity	-3.80%	-3.80%		
Δσ	Conductivity	5.82%	6.15%		
Fluid Sensitivity Calculation (1g) IEC/IEEE 62209-1528 7.8.2					
Delta SAR = Ce * Δe + Cσ * Δσ				(8)	
Ce = (-0.0007854*f ³) + (0.009402*f ²) - (0.02742*f) - 0.2026				(9)	
Cσ = (0.009804*f ³) - (0.08661*f ²) + (0.02981*f) + 0.7829				(10)	
f	Frequency (GHz)	2.437	2.44		
Ce		-0.225	-0.225		
Cσ		0.483	0.482		
Ce * Δe		0.009	0.009		
Cσ * Δσ		0.028	0.030		
ΔSAR		0.037 (8)	0.038 (11)		(%)
Manufacturer's Tuneup Tolerance					
Measured Conducted Power		15.980	9.310		(dBm)
Rated Conducted Power		16.000	9.500		(dBm)
ΔP		-0.020	-0.190		(dB)
Transmitter Duty Cycle [Crest Factor]					
Transmitter Duty Cycle (DC)		100.0	100.0		(%)
CF (1/DC)		1.00 (9)	1.00 (12)		
SAR Adjustment for Fluid Sensitivity					
SAR ₁ = SAR _M X [ΔSAR]		0.439 (8)	0.143 (11)		(W/kg)
SAR Adjustment for Tuneup Tolerance					
SAR ₂ = SAR ₁ + [ΔP]		0.441	0.149		(W/kg)
SAR Adjustment for Drift					
SAR ₃ = SAR ₂ + [Drift]		0.479	0.150		(W/kg)
SAR Adjustment for Transmitter Duty Cycle [Crest Factor]					
SAR ₄ = SAR ₃ x [CF]		0.479 (9)	0.150 (12)		(W/kg)
SAR Adjustment for Use Duty Factor					
SAR ₅ = SAR ₄ x [DF]		0.479 (10)	0.150 (13)		(W/kg)
reported 1g SAR					
reported SAR		0.48	0.15		(W/kg)

NOTES to Table

Scaling of the Maximum Measured SAR is based on the highest Face, Body, Extremity and/or Head SAR measured of ALL test channels, configurations and accessories used during THIS evaluation. The Measured Fluid Deviation parameters, Drift, Conducted Power, Duty Cycle [Crest] and Use Duty Factor apply only to those test frequencies and configurations producing the highest SAR. The reported SAR is the accumulation of all SAR Adjustments from the applicable steps above. The Plot ID is for identification of the SAR Measurement Plot(s) in the Annexes of this report.

NOTE: The above adjustments have been applied to ALL Measured SAR values. In some cases, the highest Measure SAR may not have produced the highest reported SAR after all adjustments have been made.

NOTE: Some of the above adjustments may not be applicable to each configuration. They are identified by grayed fields.

SAR₁

Per IEC/IEEE 62209-1528, FCC KDB 865664, ISED RSS-102 and ISED Notice 2012-DRS0529, SAR adjustment is applied when the calculated Δ SAR, resulting from the equations indicated, is negative (-).

Δ SAR is given as a percentage (%). The SAR is MULTIPLIED by this scaling factor only when the scaling factor is negative (-).

SAR₂

Per IEC/IEEE 62209-1528, FCC KDB 865664 and ISED RSS-102, adjustment is required only when the difference (Δ P) between the Measured Conducted Power and the Manufacturer's Rated Conducted Power is (-) Negative.

Δ P is given in dB. The absolute value of Δ P is ADDED (logarithmically) to the SAR when Δ P is negative (-).

SAR₃

Per IEC/IEEE 62209-1528, FCC KDB 865664 and ISED RSS-102, adjustment is required only when Measured Drift is negative (-). The absolute value of Measured Drift is ADDED (logarithmically) to the SAR.

Drift is given in dB. The absolute value of Drift is ADDED (logarithmically) to the SAR when Drift is negative (-).

SAR₄

Per IEC/IEEE 62209-1528, FCC KDB 865664 and ISED RSS-102, when the transmit Duty Cycle (DC) is less than 100%, the reported SAR must be scaled to 100% by the Crest Factor (CF). $CF = 1/DC$ where DC is in decimal.

CF is given as a decimal. The SAR is MULTIPLIED by this scaling factor only when the scaling factor is greater than 1.

SAR₅

Use Duty Factor applies to Push-To-Talk (PTT) transceivers or other devices whereby the user has some control of the transmitter on-off period. Per IEC/IEEE 62209-1528, FCC KDB 447498, FCC KDB 643646 and ISED RSS-102, a Duty Factor (DF) of 50% may be applied. In cases where Voice Activated transmit is employed, a DF of 75% may be applied.

DF is given as a percentage (%). The SAR is MULTIPLIED by this scaling factor only when the scaling factor is less than 100%.

reported SAR

The reported SAR is the Maximum SAR after all applicable adjustments have been made and is indicated on the cover page of this report.

Note (1): Delta SAR is Positive, SAR Adjustment for Fluid Sensitivity is not Required, in accordance with ISED Notice 2012-DRS0529

Note (2): Crest Factor = 1 (100% Duty Cycle), Crest Factor Adjustment not Required.

Note (3): Use Duty Factor is 100%. No Duty Factor Correction applied.

Note (4): Delta SAR is Positive, SAR Adjustment for Fluid Sensitivity is not Required, in accordance with ISED Notice 2012-DRS0529

Note (5): Power Drift is Positive, Drift Adjustment not Required.

Note (6): Crest Factor = 1 (100% Duty Cycle), Crest Factor Adjustment not Required.

Note (7): Use Duty Factor is 100%. No Duty Factor Correction applied.

12.0 SAR EXPOSURE LIMITS

Table 12.0 Exposure Limits

SAR RF EXPOSURE LIMITS			
FCC 47 CFR§2.1093	Health Canada Safety Code 6	General Population / Uncontrolled Exposure ⁽⁴⁾	Occupational / Controlled Exposure ⁽⁵⁾
Spatial Average ⁽¹⁾ (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak ⁽²⁾ (Head and Trunk averaged over any 1 g of tissue)		1.6 W/kg	8.0 W/kg
Spatial Peak ⁽³⁾ (Hands/Wrists/Feet/Ankles averaged over 10 g)		4.0 W/kg	20.0 W/kg
(1) The Spatial Average value of the SAR averaged over the whole body.			
(2) The Spatial Peak value of the SAR averaged over any 1 gram of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time.			
(3) The Spatial Peak value of the SAR averaged over any 10 grams of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time.			
(4) Uncontrolled environments are defined as locations where there is potential exposure to individuals who have no knowledge or control of their potential exposure.			
(5) Controlled environments are defined as locations where there is potential exposure to individuals who have knowledge of their potential exposure and can exercise control over their exposure.			

13.0 DETAILS OF SAR EVALUATION

13.0 Day Log

DAY LOG					Fluid Dielectric	SPC	Test	
Date	Ambient Temp (°C)	Fluid Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)				
20 Jun 2024	25.8	24.0	34%	101.8	x	x		2450 MHz
21 Jun 2024	24.0	24.2	33%	101.6			x	2450 MHz

*Per IEC/IEEE 62209-1528, test series was started within 24 hours of Fluid Parameter Measurement

13.1 DUT Setup and Configuration

DUT Setup and Configuration	
1	The device was evaluated for Extremity at a 0mm distance, for Head (held-to-face) at a 10mm distance, from a flat phantom filled with head tissue-equivalent medium. The DUT was evaluated for SAR in accordance with the procedures as described in FCC KDB 447498, 248227, 865664 and IEC/IEEE 62209-1528.
2	<p>2.4GHz 802.11g/n OFDM SAR Test Exclusion</p> <p>As Per KDB 248227 D01v02r02 - 5.2.2, b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is $\leq 1.2W/kg$</p> <p>When applying this formula to 10-g, the threshold should be multiplied by 2.5, i.e. when 10-g extremity SAR s considered the threshold adjusted SAR is $\leq 3.0W/kg$</p> <p>Maximum 802.11g/n OFDM specified power(POFDM)= 16.0dBm (39.8mW) Maximum 802.11b DSSS specified power (PDSSS)= 16.0dBm (39.8mW) Ratio OFDM/DSSS power = 100% Highest reported SAR (SARMAX)= 0.48W/kg</p> <p>POFDM/PDSSS X SARMAX = 0.48W/kg $\leq 3.0 W/kg$ (Extremity) and $\leq 1.5 W/kg$ (Body) and SAR test exclusion applies.</p>
3	The Device was capable of transmitting at various modulations, data rates and duty cycles. The Conducted Power was highest when measured in DSSS Mode-5.5 Mbps at 100% Duty cycle than any other configuration in the 2.4GHz Band. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer.
4	Bluetooth was evaluated for SAR in BT BR (GFSK) mode with a transmit duty cycle of 100% in the worst-case configuration from the WiFi test evaluation. The Duty cycle could not be altered in test mode or by the user. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer.
5	Each SAR evaluation was performed with a fully charged battery.

13.2 DUT Positioning

DUT Positioning	
Positioning	The DUT Positioner was securely fastened to the Phantom Platform. Registration marks were placed on the DUT and the Positioner to ensure consistent positioning of the DUT for each test evaluation.
FACE Configuration	Head SAR - (held- to-face). Devices that are designed to be near extremity and may operate with in a mode for voice communication, with the device positioned next to the mouth. When next-to-mouth SAR evaluation is required, the device is positioned at 10mm from a flat phantom filled with head tissue-equivalent medium.
BODY Configuration	Devices that are designed to be worn on the Body are positioned on the device holder with the surface of the DUT being 5mm from bottom of the phantom in the Body configuration.
HEAD Configuration	This device is not intended to be held to the ear and was not tested in the HEAD configuration.
LIMB Worn Configuration	Extremity SAR - (limb-worn) Devices that are designed to be near extremity are positioned with the back side directly against the phantom surface with the strap removed or opened to allow direct contact of the DUT to the phantom surface.

13.3 General Procedures and Report

a

General Procedures and Reporting	
General Procedures	<p>The fluid dielectric parameters of the Active Tissue Simulating Liquid (TSL) were measured as described in this Section, recorded and entered into the DASY Measurement Server. Active meaning the TSL used during the SAR evaluation of the DUT. The temperature of the Active TSL was measured and recorded prior to performing a System Performance Check (SPC). An SPC was performed with the Active TSL prior to the start of the test series. The temperature of the Active TSL was measured throughout the day and the Active TSL temperature was maintained to $\pm 0.5^{\circ}\text{C}$. The Active TSL temperature was maintained to within $\pm 1.0^{\circ}\text{C}$ throughout the test series. TSL analysis and SPC were repeated when the Active TSL use exceeded 84 hours.</p> <p>An Area Scan exceeding the length and width of the DUT projection was performed and the locations of all maximas within 2dB of the Peak SAR recorded. A Zoom Scan centered over the Peak SAR location(s) was performed and the 1g and 10g SAR values recorded. The resolutions of the Area Scan and Zoom Scan are described in the Scan Resolution table(s) in this Section. A Power Reference Measurement was taken at the phantom reference point immediately prior to the Area Scan. A Power Drift measurement was taken at the phantom reference point immediately following the Zoom Scan to determine the power drift. A Z-Scan from the <u>Maximum Distance to Phantom Surface</u> to the fluid surface was performed following the power drift measurement.</p>
Reporting	<p>Where appropriate the 1g SAR, 10g SAR and power drift measurements are recorded in the SAR Measurement Summary tables in the SAR Measurement Summary Section of this report. The SAR values shown in the 100% DC (Duty Cycle) column are the SAR values reported by the SAR Measurement Server with the DUT operating at or compensated for a 100% transmit duty cycle. A duty cycle compensation (crest factor) and fluid sensitivity scaling factor is shown, as well as other information such as transmit channel and frequency, modulation, accessories tested and DUT-phantom separation distance.</p> <p>In the Scaling of Maximum Measured SAR Section of this report, the highest measured SAR in the BODY and/or FACE and/or EXTREMITY (limb-worn) configurations, within the entire scope of this assessment, are, when applicable, scaled for Fluid Sensitivity, Manufacturer's Tune-Up Tolerance, Simultaneous Transmission and Drift. With the exception of Duty Cycle correction/compensation, SAR values are <u>ONLY</u> scaled up, not down. The final results of this scaling is the <u>reported SAR</u> which appears on the Cover Page of this report.</p>

13.4 Fluid Dielectric and Systems Performance Check

Fluid Dielectric and Systems Performance Check	
Fluid Dielectric Measurement Procedure	<p>The fluid dielectric parameters of the Tissue Simulating Liquid (TSL) are measured using the Open-Ended Coax Method connected to an Agilent 8753ET Network Analyzer connected to a measurement server running April Dielectric Property Measurement System. A frequency range of $\pm 100\text{MHz}$ for frequencies $> 300\text{MHz}$ and $\pm 50\text{MHz}$ for frequencies $\leq 300\text{MHz}$ with frequency step size of 10MHz is used. The center frequency is centered around the SAR measurement probe's calibration point for that TSL frequency range. A calibration of the setup is performed using a short-open-deionized water (at 23°C in a 300ml beaker) method. A sample of the TSL is placed in a 300ml beaker and the open-ended coax is submerged approximately 8mm below the fluid surface in the approximate center of the beaker. A check of the setup is made to ensure no air is trapped under the open-ended coax. The sample of TSL is measured and compared to the FCC KDB 865664 targets for HEAD or BODY for the entire fluid measurement range. Fluid adjustment are made if the dielectric parameters are $> 5\%$ in range that the DUT is to be tested. If the adjustments fail to bring the parameters to $\leq 5\%$ but are $< 10\%$, the SAR Fluid Sensitivity as per IEC/IEEE 62209-1528 and FCC KDB 865664 are applied to the highest measured SAR. A TSL with dielectric parameters $> 10\%$ in the DUT test frequency range are not used.</p>
Systems Performance Check	<p>The fluid dielectric parameters of the Active TSL are entered into the DASY Measurement Server at each of the 10MHz step size intervals. Active meaning the TSL used during the SAR evaluation of the DUT. The DASY Measurement System will automatically interpolate the dielectric parameters for DUT test frequencies that fall between the 10MHz step intervals.</p> <p>A Systems Performance Check (SPC) is performed in accordance with IEC/IEEE 62209-1528 "System Check" and FCC KDB 865664 "System Verification". A validation source, dipole or Confined Loop Antenna (CLA), is placed under the geometric center of the phantom and separated from the phantom in accordance to the validation source's Calibration Certificate data. A CW signal set to the frequency of the validate source's and SAR measurement probe's calibration frequency with a forward power set to the validation source's Calibration Certificate data power setting is applied to the validation source. An Area Scan is centered over the projection of the validation source's feed point and an Area Scan is taken. A Zoom Scan centered over the Peak SAR measurement of the Area Scan and the 1g and 10g SAR is measured. The measured 1g and 10g SAR is compared to the 1g and 10g SAR measurements from the validation source's Calibration Certificate. When required, the measured SAR is normalized to 1.0W and compared to the normalized SAR indicated on the validation source's Calibration Certificate. The SPC is considered valid when the measured and normalized SAR is $\leq 10\%$ of the measured and normalize SAR of the validation source's Calibration Certificate.</p> <p>The fluid dielectric parameters of the Active TSL and SPC are repeated when the Active TSL has been in use for greater than 84 hours or if the Active TSL temperature has exceed $\pm 1^\circ\text{C}$ of the initial fluid analysis.</p>

13.5 Scan Resolution 100MHz to 2GHz

Scan Resolution 100MHz to 2GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	$4 \pm 1 \text{ mm}$
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	$5^\circ \pm 1^\circ$
Area Scan Spatial Resolution $\Delta X, \Delta Y$	15 mm
Zoom Scan Spatial Resolution $\Delta X, \Delta Y$	7.5 mm
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	5 mm
Zoom Scan Volume X, Y, Z	30 mm
Fluid Depth	$150 \pm 5 \text{ mm}$
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

13.6 Scan Resolution 2GHz to 3GHz

Scan Resolution 2GHz to 3GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	4 ± 1 mm
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	5° ± 1°
Area Scan Spatial Resolution ΔX, ΔY	12 mm
Zoom Scan Spatial Resolution ΔX, ΔY	5 mm
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	5 mm
Zoom Scan Volume X, Y, Z	30 mm
Fluid Depth	150 ± 5 mm
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

13.7 Scan Resolution 5GHz to 6GHz

Scan Resolution 5GHz to 6GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	4 ± 1 mm
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	5° ± 1°
Area Scan Spatial Resolution ΔX, ΔY	10 mm
Zoom Scan Spatial Resolution ΔX, ΔY	4 mm
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	2 mm
Zoom Scan Volume X, Y, Z	22 mm
Fluid Depth	100 ± 5 mm
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

14.0 SAR MEASUREMENT VARIABILITY & UNCERTAINTY

Table 14.1 Measurement Variability

Per FCC KDB Publication 865664, SAR measurement variability is not required to be assessed for each frequency band where all measured SAR values are <0.8 W/kg for 1g and < 2.0 W/kg for 10g.

Table 14.2 Measurement Uncertainty

Per FCC KDB 865664 when the highest measured SAR is <1.5 W/kg for 1 g and < 3.75 W/kg for 10g all frequency bands, the extensive SAR measurement uncertainty analysis tables described in IEEE std 1528-2013 are not required.

15.0 FLUID DIELECTRIC PARAMETERS

Table 15.0 Fluid Dielectric Parameters 2450MHz HEAD TSL

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date:	22-Jun-2024	Fluid Temp:	23C	Frequency:	2450MHz	Tissue:	Head	ΔSAR 1g	ΔSAR 10g	SAR Correction Factor (1)	
Freq (MHz)	Test ε	Test σ (S/m)	Target ε	Target σ (S/m)	Deviation Permittivity	Deviation Conductivity	1g			10g	1g
2410.0000		36.7800	1.8400	39.2700	1.76	-6.34%	4.55%	0.036	0.022	1.000	1.000
2412.0000	*	36.7980	1.8440	39.2660	1.76	-6.29%	4.65%	0.037	0.022	1.000	1.000
2420.0000		36.8700	1.8600	39.2500	1.77	-6.06%	5.08%	0.038	0.023	1.000	1.000
2430.0000		36.8100	1.8800	39.2400	1.78	-6.19%	5.62%	0.041	0.025	1.000	1.000
2437.0000	*	36.8310	1.9150	39.2260	1.79	-6.11%	7.16%	0.048	0.028	1.000	1.000
2440.0000	*	36.8400	1.9300	39.2200	1.79	-6.07%	7.82%	0.051	0.030	1.000	1.000
2450.0000		36.8800	1.9100	39.2000	1.80	-5.92%	6.11%	0.043	0.025	1.000	1.000
2460.0000		36.8500	1.9100	39.1900	1.81	-5.97%	5.52%	0.040	0.024	1.000	1.000
2462.0000	*	36.8740	1.9080	39.1860	1.81	-5.90%	5.30%	0.039	0.023	1.000	1.000
2470.0000		36.9700	1.9000	39.1700	1.82	-5.62%	4.40%	0.034	0.020	1.000	1.000
2472.0000	*	36.9440	1.9020	39.1680	1.82	-5.68%	4.39%	0.034	0.020	1.000	1.000
2480.0000		36.8400	1.9100	39.1600	1.83	-5.92%	4.37%	0.034	0.021	1.000	1.000

*Channel Frequency Tested

16.0 SYSTEM VERIFICATION TEST RESULTS

Table 16.0 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
20 Jun 2024		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	24.0	26	34%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
36.24	39.20	-7.55%	1.93	1.80	7.22%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
14.70	13.50	8.89%	6.58	6.32	4.11%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
57.16	52.50	8.89%	25.92	24.90	4.11%
<p>Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEC/IEEE 62209-1528 and FCC KDB 865664,</p> <p>The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.</p> <p>The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value.</p> <p>The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.</p>					

17.0 SYSTEM VALIDATION SUMMARY

Table 17.0 System Validation Summary

SAR Validation Summary Chart							
Validation Date	Probe Model	Probe S/N	Validation Source	Frequency (MHz)	Validation Results		
					Linearity	Isotropy	Extrapolation
✓		= Complete			✓ = Not Required		
30-May-24	EX3DV4	7826	D2450V2	2450	Pass	Pass	Pass

18.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 18.0 Measurement System Specifications

Measurement System Specification	
Specifications	
Positioner	Stäubli Unimation Corp. Robot Model: TX90XL
Repeatability	+/- 0.035 mm
No. of axis	6.0
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor	Intel(R) Core(TM) i7-7700
Clock Speed	3.60 GHz
Operating System	Windows 10 Professional
Data Converter	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASY6, V 6.4.0.12171 / DASY52 V10.2(1504) Postprocessing Software: SEMCAD X, V14.6.12(7470)
Connecting Lines	Optical downlink for data and status info., Optical uplink for commands and clock
DASY Measurement Server	
Function	Real-time data evaluation for field measurements and surface detection
Hardware	Intel ULV Celeron CPU 400 MHz; 128 MB chip disk; 128 MB RAM
Connections	COM1, COM2, DAE, Robot, Ethernet, Service Interface
E-Field Probe	
Model	EX3DV4
Serial No.	7826
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Phantom	
Type	MFP V5.1C Planar Phantom
Shell Material	Fiberglass
Thickness	2mm +/- .2mm
Volume	> 8 Liter

Table 18.1

Measurement System Specification (Continued)		
Probe Specification		
Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents (e.g. DGBE))	 <p>EX3DV4 E-Field Probe</p>
Calibration:	ISO/IEC 17025	
Frequency:	4 MHz - 10 GHz; Linearity: ± 0.2 dB (30 MHz - 10 GHz)	
Directivity:	± 0.1 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis)	
Dynamic Range:	10 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically <1 mW/g)	
Dimensions:	Overall length: 337 mm; (tip: 20 mm) Tip diameter: 2.5 mm; Tip (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	
Application:	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better than 30%	
Phantom Specification		
<p>The ELI V5.0 phantom is an elliptical planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC/IEEE 62209-1528.</p>		 <p>ELI Phantom</p>
Phantom Specification		
<p>The SAM V4.0 phantom is a flat planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC/IEEE 62209-1528.</p>		 <p>SAM Phantom</p>
Phantom Specification		
<p>The MFP V5.1C phantom is a flat planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC/IEEE 62209-1528.</p>		 <p>MFP Phantom</p>
Device Positioner Specification		
<p>The DASY device positioner has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.</p>		 <p>Device Positioner</p>

19.0 TEST EQUIPMENT LIST

Table 19.0 Equipment List and Calibration

Test Equipment List				
DESCRIPTION	ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION DUE
Schmid & Partner DASY 6 System	-	-	-	-
-DASY Measurement Server	00158	1078	CNR	CNR
-Robot	00046	599396-01	CNR	CNR
-DAE4	00019	353	13-May-24	13-May-25
-EX3DV4 E-Field Probe	00357	7826	15-May-24	15-May-25
-D2450V2 Validation Dipole	00219	825	15-May-24	15-May-25
ELI Phantom	00247	1234	CNR	CNR
SAM Phantom	00154	1033	CNR	CNR
MFP Phantom	00355	1177/2	CNR	CNR
HP 85070C Dielectric Probe Kit	00033	none	CNR	CNR
Gigatronics 8652A Power Meter	00007	1835801	10-May-22	10-May-25
Gigatronics 80701A Power Sensor	00186	1837002	COU	COU
Gigatronics 80334A Power Sensor	00237	1837001	10-May-22	10-May-25
HP 8753ET Network Analyzer	00134	US39170292	6-Jan-24	6-Jan-27
Rohde & Schwarz SMR20 Signal Generator	00006	100104	COU	COU
Amplifier Research 10W1000C Power Amplifier	00041	27887	CNR	CNR
Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
Narda Directional Coupler 3020A	00064	-	CNR	CNR
Bipolar Power Supply 6299A	00086	1144A02155	CNR	CNR
DC-18G 10W 30db Attenuator	00102	-	COU	COU
R&S FSP40 Spectrum Analyzer	00241	100500	9-Aug-21	9-Aug-24
HP 8566B Spectrum Analyzer	00051	2747A055100	6-Jul-24	6-Jul-27
RF Cable-SMA	00311	-	CNR	CNR
HP Calibration Kit	00145	-	CNR	CNR

CNR = Calibration Not Required
 SB=Stand By
 COU = Calibrate on Use

Note: Per KDB 865664, Dipoles are evaluated annually for return loss and impedance. The dipole's SAR target can only be assessed by the SAR equipment manufacturer and remains the target until the dipole is recalibrated by the manufacturer. The dipole's SAR is evaluated and compared to this target during each and every System Verification which is performed prior to and/or during each DUT SAR evaluation. The results of these verifications are shown in Section 16.0

20.0 FLUID COMPOSITION

Table 20.0 Fluid Composition 2450MHz HEAD TSL

Tissue Simulating Liquid (TSL) Composition				2450MHz Head
Component by Percent Weight				
Water	Glycol	Salt ⁽¹⁾	HEC ⁽²⁾	Bacteriacide ⁽³⁾
52.0	48.0	0.0	0.0	0.0

(1) Non-Iodinized

(2) HydroxyEthyl-Cellulose: Sigma-Aldrich P/N 54290-500g

(3) Dow Chemical Dovicil 75 Antimicrobial Perservative

END OF REPORT

APPENDIX A – SYSTEM VERIFICATION PLOTS

DUT: D2450V2 - SN825; Type: D2450V2; Serial: SN825

Procedure Name: SPC 2450H_Input=250mw, 1gTarget=[12.15]13.5][14.85]W/kg 10g Target=[5.68][6.32][6.95] 2 2

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.93$ S/m; $\epsilon_r = 36.24$; $\rho = 1000$ kg/m³
Phantom section: Left Section

Date/Time: 6/20/2024 1:38:18 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN7826; ConvF(7.5, 7.2, 7.38) @ 2450 MHz; Calibrated: 5/15/2024
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 5/13/2024
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: xxxx
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 2450H_Input=250mw, 1gTarget=[12.15]13.5][14.85]W/kg 10g Target=[5.68][6.32][6.95] 2 2/Area Scan (9x4x1): Measurement grid:
dx=12mm, dy=12mm

Maximum value of SAR (measured) = 15.0 W/kg

SPC/SPC 2450H_Input=250mw, 1gTarget=[12.15]13.5][14.85]W/kg 10g Target=[5.68][6.32][6.95] 2 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.32 V/m; Power Drift = 0.23 dB

Peak SAR (extrapolated) = 32.8 W/kg

SAR(1 g) = 14.7 W/kg; SAR(10 g) = 6.58 W/kg

Smallest distance from peaks to all points 3 dB below = 10.2 mm

Ratio of SAR at M2 to SAR at M1 = 45.3%

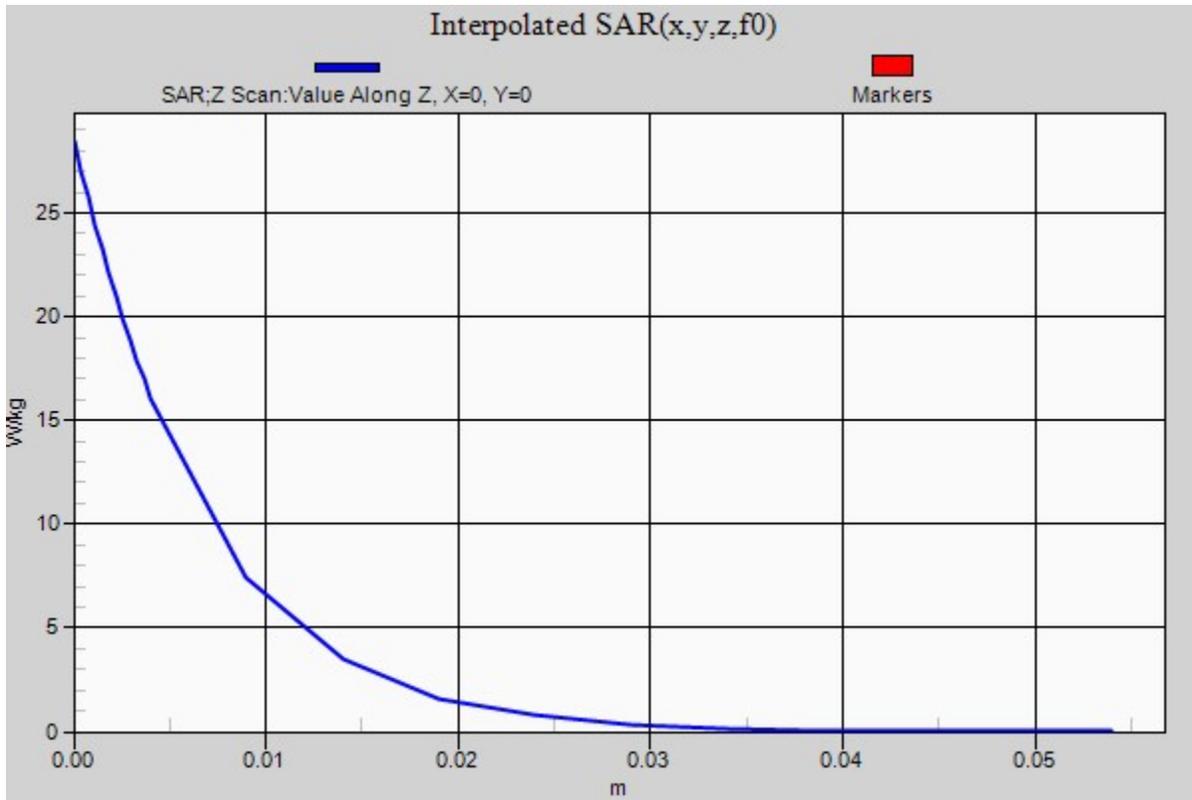
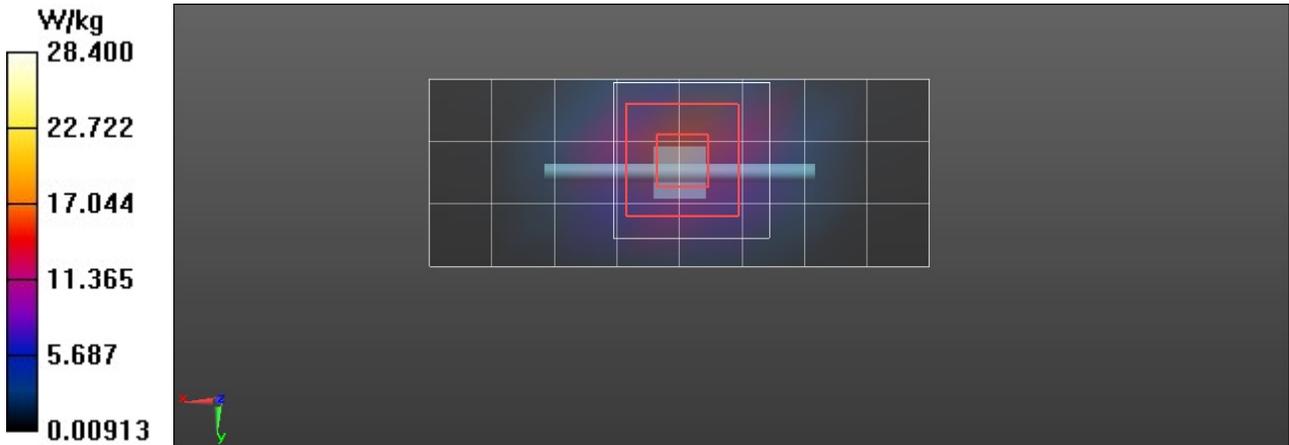
Maximum value of SAR (measured) = 16.6 W/kg

SPC/SPC 2450H_Input=250mw, 1gTarget=[12.15]13.5][14.85]W/kg 10g Target=[5.68][6.32][6.95] 2 2/Z Scan (1x1x22): Measurement grid:

dx=20mm, dy=20mm, dz=5mm

Penetration depth = 6.563 (6.434, 6.624) [mm]

Maximum value of SAR (interpolated) = 28.4 W/kg



APPENDIX B – MEASUREMENT PLOTS OF MAXIMUM MEASURED SAR

E52/E52Z

DUT: A04861; Type: Extremity Worn Transmitter; Serial: 3472329454
Procedure Name: E52-A04861,Extremity-Back Side, 2437 MHz, B1 Silicone Band, WIFI, CCK-1Mbps 2

Communication System: UID 0, CW (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.92$ S/m; $\epsilon_r = 36.05$; $\rho = 1000$ kg/m³
Phantom section: Left Section
Date/Time: 6/21/2024 12:24:39 PM
DASY5 Configuration:

- Probe: EX3DV4 - SN7826; ConvF(7.5, 7.2, 7.38) @ 2437 MHz; Calibrated: 5/15/2024
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 5/13/2024
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1177/2
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

2450H/E52-A04861,Extremity-Back Side, 2437 MHz, B1 Silicone Band, WIFI, CCK-1Mbps 2/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm

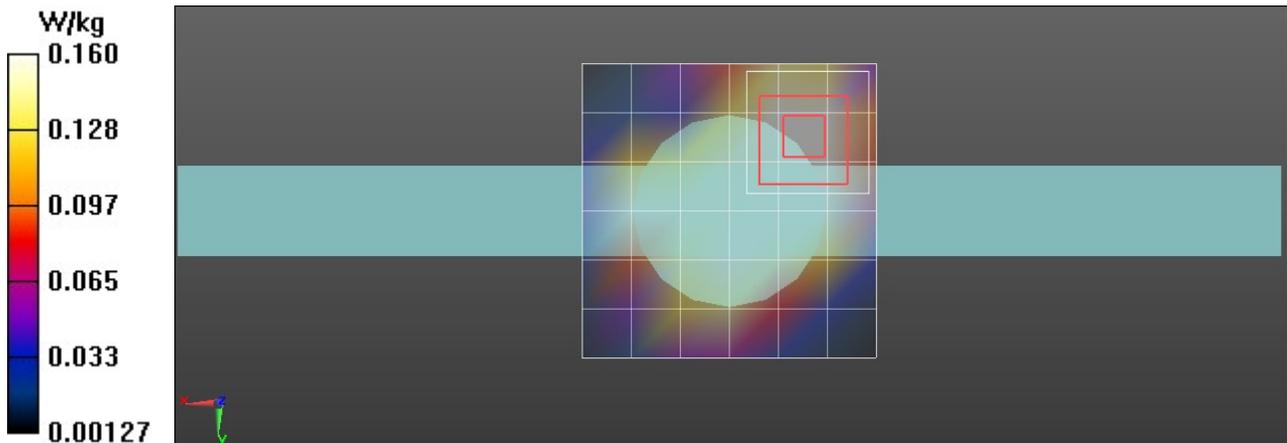
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.378 W/kg

2450H/E52-A04861,Extremity-Back Side, 2437 MHz, B1 Silicone Band, WIFI, CCK-1Mbps 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.342 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.910 W/kg
SAR(1 g) = 0.399 W/kg; SAR(10 g) = 0.170 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 46%

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.471 W/kg

2450H/E52-A04861,Extremity-Back Side, 2437 MHz, B1 Silicone Band, WIFI, CCK-1Mbps 2/Z Scan (1x1x17): Measurement grid: dx=20mm, dy=20mm, dz=20mm

Info: Interpolated medium parameters used for SAR evaluation.
Penetration depth = n/a (n/a, 9.486) [mm]
Maximum value of SAR (interpolated) = 0.160 W/kg



F50/F50Z

DUT: A04861; Type: Extremity Worn Transmitter; Serial: 3472329454
Procedure Name: F50- A04861, Face - Front Side, 10mm, 2437 MHz, B1, WIFI, CCK-1Mbps

Communication System: UID 0, CW (0); Frequency: 2437 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.92 \text{ S/m}$; $\epsilon_r = 36.05$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Left Section
 Date/Time: 6/21/2024 1:48:06 PM
 DASY5 Configuration:

- Probe: EX3DV4 - SN7826; ConvF(7.5, 7.2, 7.38) @ 2437 MHz; Calibrated: 5/15/2024
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 5/13/2024
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1177/2
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

2450/F50- A04861, Face - Front Side, 10mm, 2437 MHz, B1, WIFI, CCK-1Mbps/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
 Maximum value of SAR (measured) = 0.499 W/kg

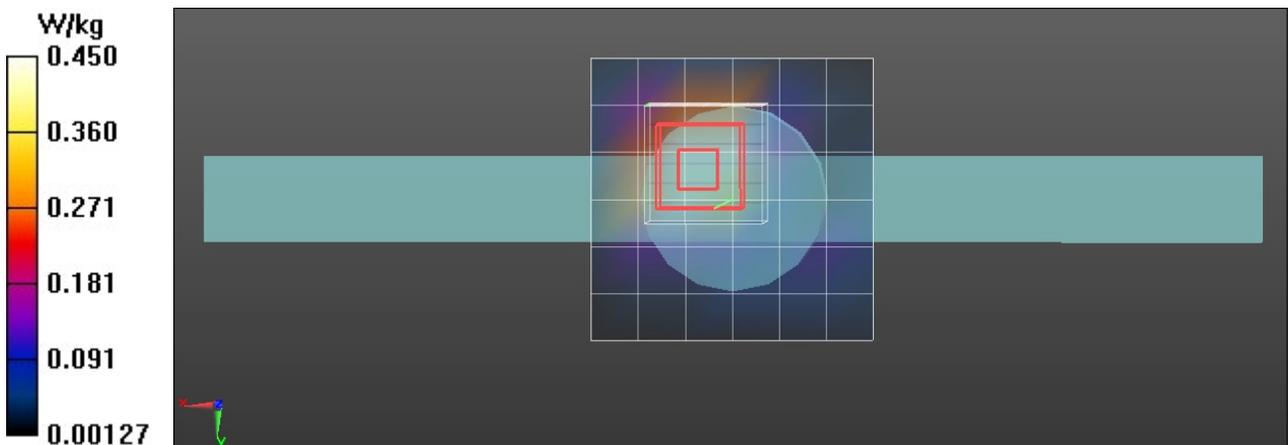
2450/F50- A04861, Face - Front Side, 10mm, 2437 MHz, B1, WIFI, CCK-1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.32 V/m; Power Drift = -0.36 dB
 Peak SAR (extrapolated) = 0.794 W/kg
SAR(1 g) = 0.439 W/kg; SAR(10 g) = 0.234 W/kg
 Smallest distance from peaks to all points 3 dB below = 12.6 mm
 Ratio of SAR at M2 to SAR at M1 = 65.5%

Info: Interpolated medium parameters used for SAR evaluation.
 Maximum value of SAR (measured) = 0.478 W/kg

2450/F50- A04861, Face - Front Side, 10mm, 2437 MHz, B1, WIFI, CCK-1Mbps/Z Scan (1x1x17): Measurement grid: dx=20mm, dy=20mm, dz=20mm

Info: Interpolated medium parameters used for SAR evaluation.
 Penetration depth = n/a (n/a, 9.088) [mm]
 Maximum value of SAR (interpolated) = 0.450 W/kg



APPENDIX D – PROBE CALIBRATION



Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Celltech**
 Kelowna, Canada

Certificate No. **EX-7826_May24**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7826**

Calibration procedure(s) **QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6,
 QA CAL-25.v8
 Calibration procedure for dosimetric E-field probes**

Calibration date **May 15, 2024**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.
 All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3) °C and humidity < 70%.
 Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
OCP DAK-3.5 (weighted)	SN: 1249	05-Oct-23 (OCP-DAK3.5-1249_Oct23)	Oct-24
OCP DAK-12	SN: 1016	05-Oct-23 (OCP-DAK12-1016_Oct23)	Oct-24
Reference 20 dB Attenuator	SN: CC2552 (20x)	26-Mar-24 (No. 217-04046)	Mar-25
DAE4	SN: 660	23-Feb-24 (No. DAE4-660_Feb24)	Feb-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by	Aidonia Georgiadou	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: May 15, 2024

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices – Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Parameters of Probe: EX3DV4 - SN:7826**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.71	0.63	0.62	$\pm 10.1\%$
DCP (mV) ^B	106.2	107.4	109.0	$\pm 4.7\%$

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max dev.	Max Unc ^E k = 2
0	CW	X	0.00	0.00	1.00	0.00	140.8	$\pm 2.1\%$	$\pm 4.7\%$
		Y	0.00	0.00	1.00		142.7		
		Z	0.00	0.00	1.00		137.8		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 5).

^B Linearization parameter uncertainty for maximum specified field strength.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Parameters of Probe: EX3DV4 - SN:7826**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle	-23.9°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3–4 mm for an *Area Scan* job.

Parameters of Probe: EX3DV4 - SN:7826

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity ^F (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k = 2)
30	55.0	0.75	15.06	15.06	15.06	0.00	1.25	±13.3%
150	52.3	0.76	12.01	12.01	12.01	0.00	1.25	±13.3%
450	43.5	0.87	10.73	10.73	10.73	0.16	1.30	±13.3%
750	41.9	0.89	9.59	9.16	9.52	0.40	1.27	±11.0%
835	41.5	0.90	9.27	8.89	9.16	0.39	1.27	±11.0%
900	41.5	0.97	9.14	8.62	8.90	0.39	1.27	±11.0%
1640	40.2	1.31	8.20	7.88	8.03	0.33	1.27	±11.0%
1810	40.0	1.40	8.06	7.73	7.92	0.28	1.27	±11.0%
1900	40.0	1.40	8.01	7.69	7.81	0.28	1.27	±11.0%
2300	39.5	1.67	7.62	7.30	7.48	0.30	1.27	±11.0%
2450	39.2	1.80	7.50	7.20	7.38	0.30	1.27	±11.0%
2600	39.0	1.96	7.36	7.06	7.23	0.29	1.27	±11.0%
5250	35.9	4.71	5.53	5.11	5.33	0.38	1.53	±13.1%
5600	35.5	5.07	4.68	4.54	4.65	0.37	1.75	±13.1%
5750	35.4	5.22	4.91	4.76	4.89	0.36	1.84	±13.1%

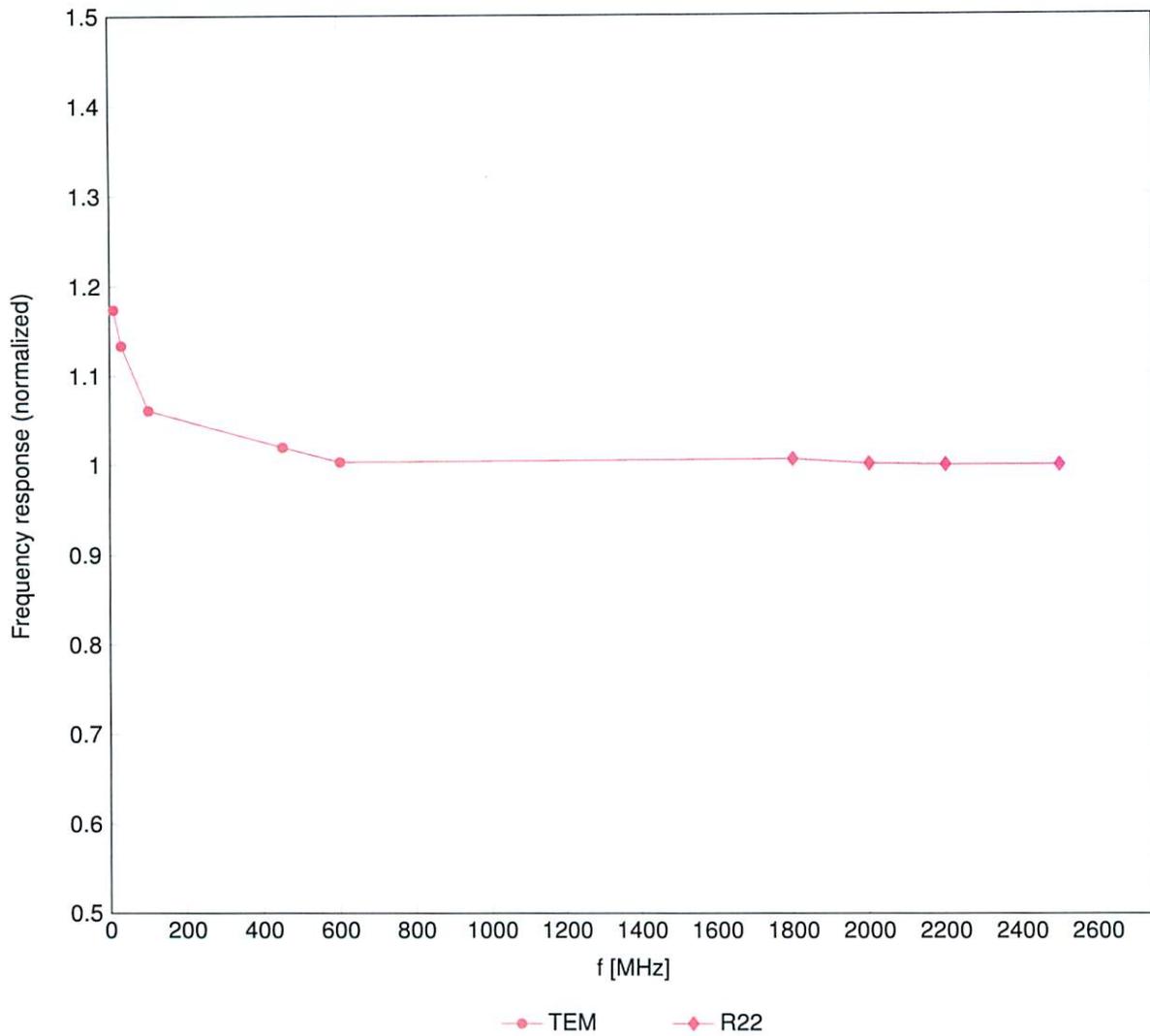
^C Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

^F The probes are calibrated using tissue simulating liquids (TSL) that deviate for ϵ and σ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10% if SAR correction is applied.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary.

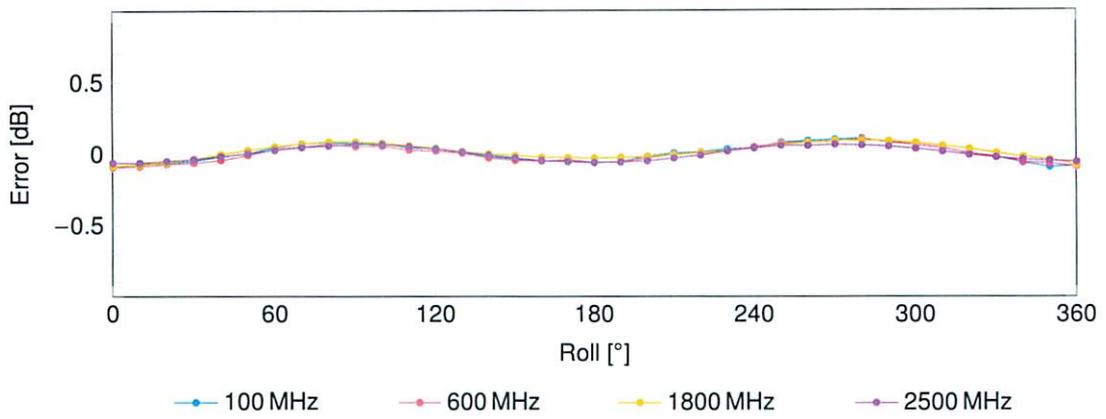
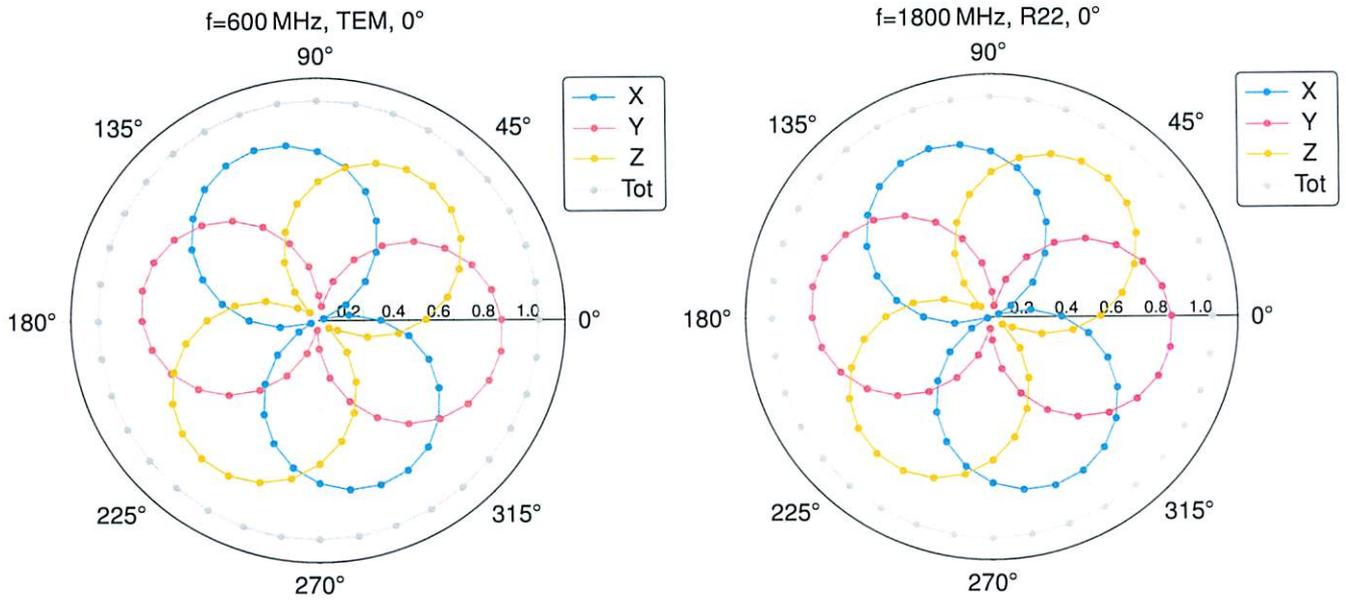
Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide:R22)



Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

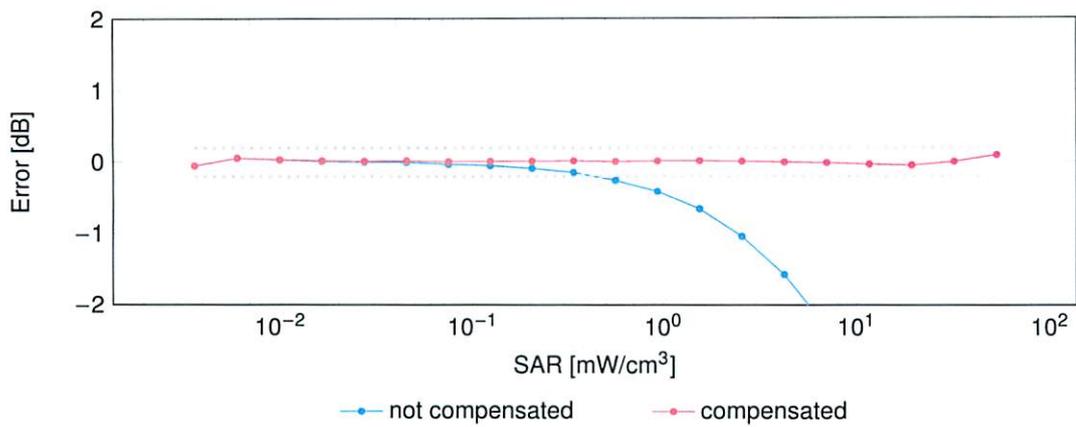
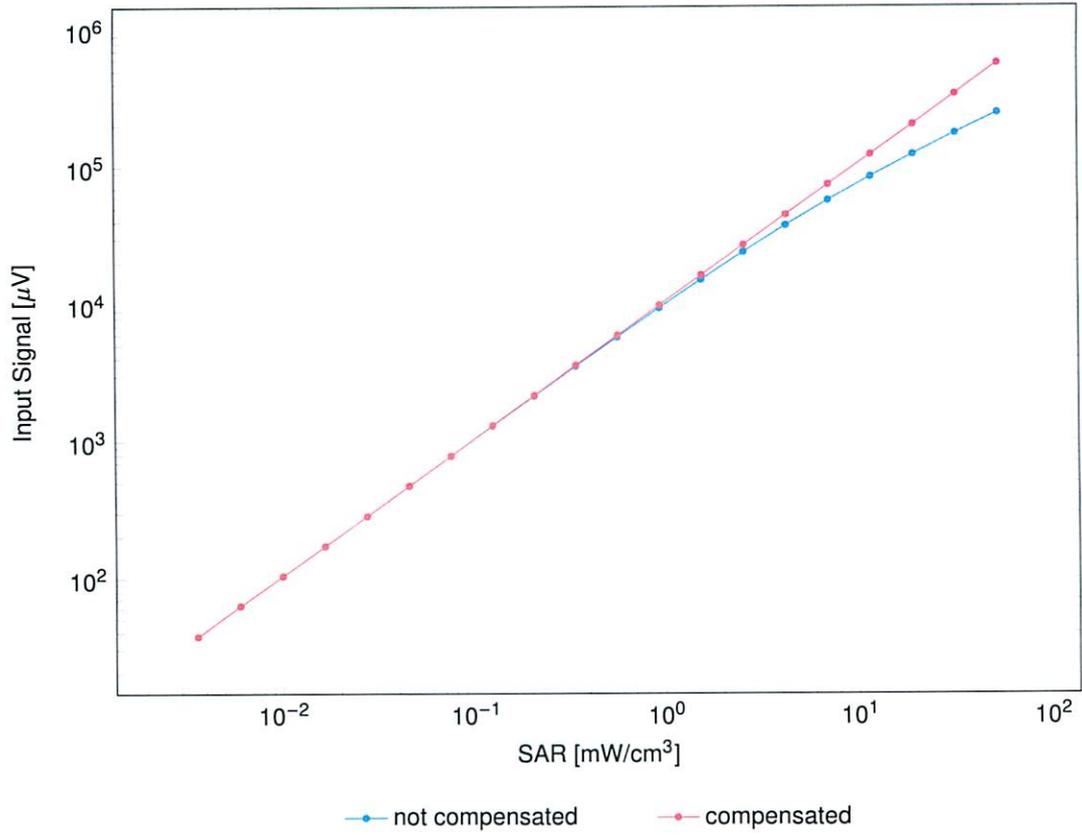
Receiving Pattern (ϕ), $\vartheta = 0^\circ$



Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

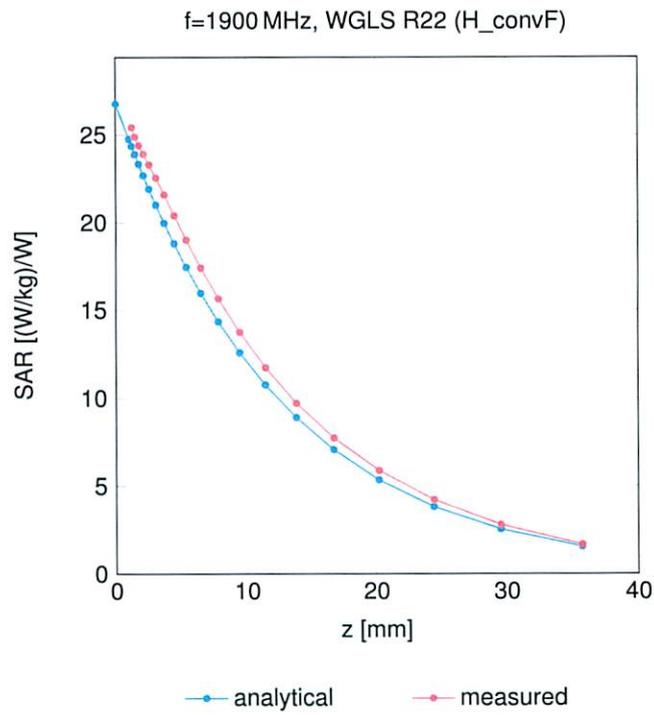
Dynamic Range f(SAR_{head})

(TEM cell, f_{eval} = 1900MHz)



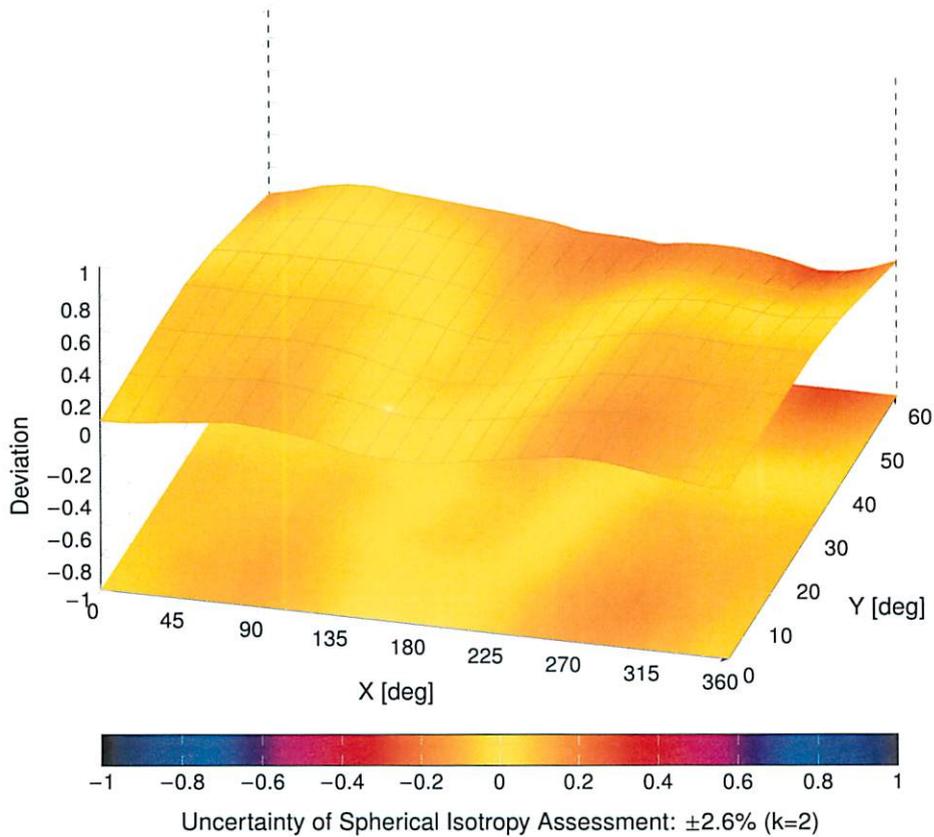
Uncertainty of Linearity Assessment: ±0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



APPENDIX E – DIPOLE CALIBRATION



Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Client **Celltech**
Kelowna, Canada

Certificate No. **D2450V2-825_May24**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:825**

Calibration procedure(s) **QA CAL-05.v12
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **May 15, 2024**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by: **Jeton Kastrati** Name: **Jeton Kastrati** Function: **Laboratory Technician**

Approved by: **Sven Kühn** Name: **Sven Kühn** Function: **Technical Manager**

Signature



Issued: May 16, 2024

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	1.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.9 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.2 Ω + 9.2 j Ω
Return Loss	- 20.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 15.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:825

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.88$ S/m; $\epsilon_r = 37.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 113.7 V/m; Power Drift = 0.01 dB

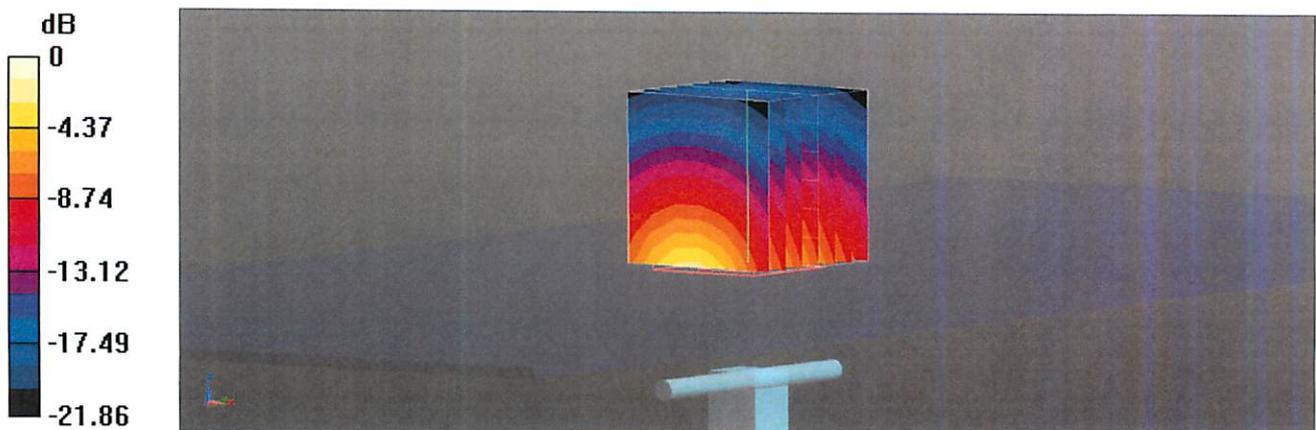
Peak SAR (extrapolated) = 26.8 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.32 W/kg

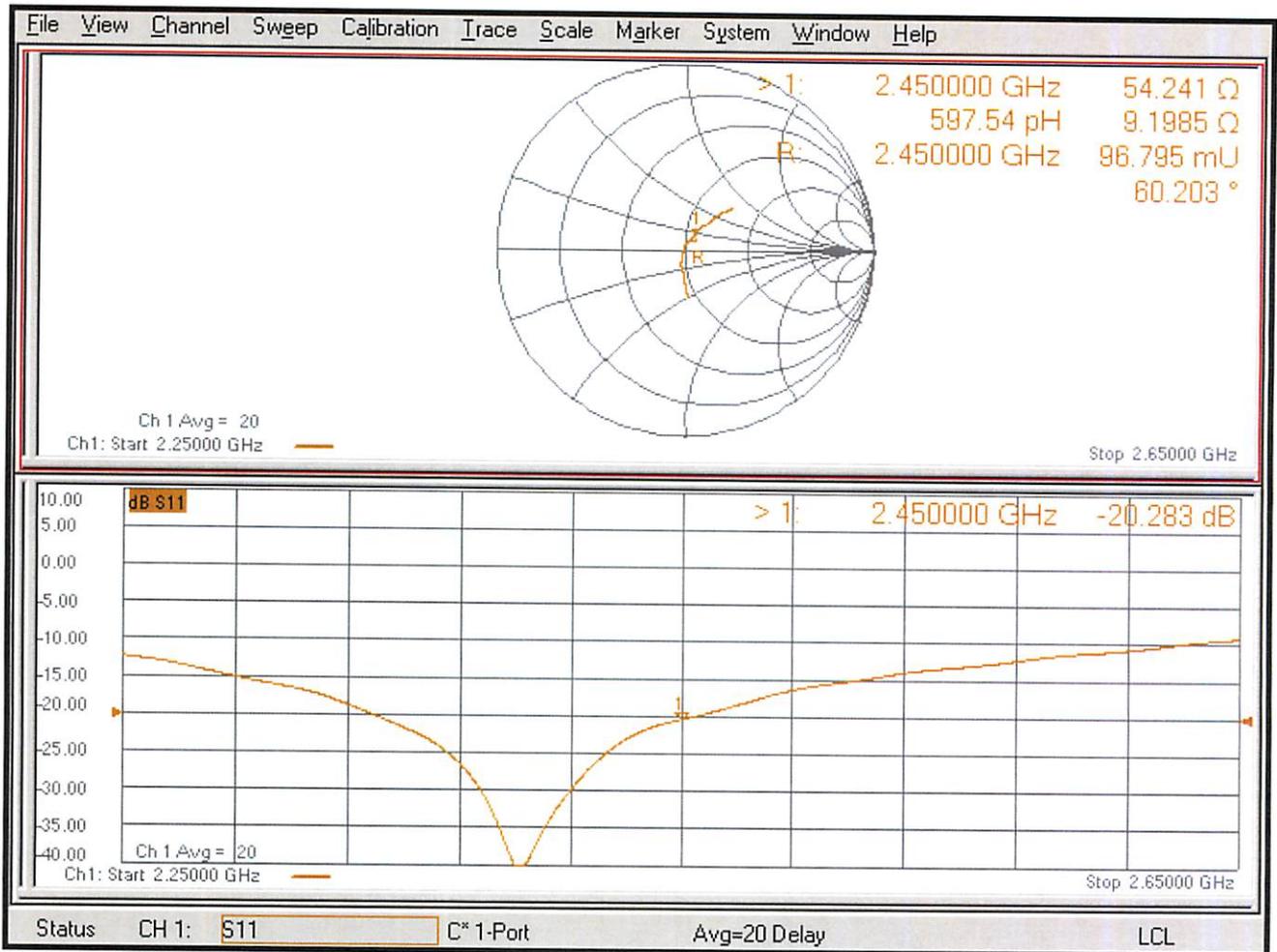
Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 51.4%

Maximum value of SAR (measured) = 21.2 W/kg



Impedance Measurement Plot for Head TSL



APPENDIX F - PHANTOM

Certificate of conformity / First Article Inspection

Item	Triple Modular Flat Phantom V5.1
Type No	QD 000 P51 C
Series No	1100 and higher
Manufacturer / Origin	Untersee Composites Knebelstrasse 8, CH-8268 Mannenbach, Switzerland

Tests

The sub-units of item 1100 are identified with the designation 1100/1, 1100/2 and 1100/3. Tests were conducted on all 3 sub-units of this phantom.

Test	Requirement	Details	Units tested
Material thickness	Compliant with the standard requirements.	2 mm +/- 0.2 mm 30 points over the bottom area	all
Material parameters	Dielectric parameters for required frequencies	200 MHz – 6 GHz - Relative permittivity 3 - 5 Loss tangent < 0.05.	Material sample
Material resistivity	The material is compatible with the liquids defined in the standards if handled and cleaned according to the instructions.	DGBE based simulating liquids. Observe Technical Note for material compatibility.	Material Samples
Shape	Internal dimensions	Internal height: > 175 mm Bottom internal length: 280 mm Bottom internal width: 175 mm Nominal filling height: 155 mm Nominal volume: 9.2 l	Pre-series, design
Sagging	Depending on standard	No initial sagging (negative preshaped, change < 0.5 mm)	1100/2

Standards

- [1] IEEE 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- [2] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005
- [3] IEC 62209 – 2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation and Procedures, Part 2: Procedure to determine the Specific Absorption Rate (SAR) for ... including accessories and multiple transmitters", March 2010
- [4] KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Conformity

Based on the dimensions and sample tests above, we certify that this item is in compliance with the standards [1] to [4] for frequencies > 700 MHz, if operated according to the specific requirements.

Date 16.07.2015

Signature / Stamp

s p e a g

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info@speag.com, http://www.speag.com