FCC/RF Test Report
as per

RSS-247 Issue 2
&
FCC Part 15 Subpart 15.247
on the

MY01

Prepared to:

MY01 Inc.

FCC ID: 2AUNM-G455M4N
IC: 25471-MU210

85 Rue Saint-Paul O, Suite 200,
Montreal, Qc, H2Y 3V4

Product Service

Choose certainty.
Add value.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Test Specialist	Jose Martinez-Ortega	24-11-2019	
Test Specialist	Abdoulaye Ndiaye	24-11-2019	
Authorised Signatory	Scott Drysdale	24-11-2019	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

EXECUTIVE SUMMARY
A sample of this product was tested and found to be in compliance with FCC Part 15 Subpart 15.247 and RSS-247 Issue 2.

A2LA Cert. No. 2955.02

ACCREDITATION
Our A2LA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our A2LA Accreditation.

TÜV SÜD Product Service
is a trading name of TUV SUD Ltd
2972 Joseph-A-Bombardier
Laval, QC H7P 6E3 Canada

TUV SUD Ltd is a
TÜV SÜD Group Company

Phone: +450-687-4976
www.tuv-sud.ca

Contents

TABLE OF APPENDICES

LIST OF TABLES

LIST OF PHOTOS

LIST OF FIGURES

LIST OF GRAPHS

1 Report Summary

1.1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	September 27, 2019
2	1. Added FCC ID & IC in front page 2. Replace "Band-Edge Compliance of RF Spurious Emissions" by Band-Edge Compliance of RF Spurious Emissions 3. Added HVIN number in page 10 4. Added Table A.6 to Appendix A.	January 10th, 2020

Table 1 – Modification Records

1.1.2 Acronyms & Definitions

The following definitions and acronyms are applicable in this report. See also ANSI C63.14.

Acronyms

AM	Amplitude Modulation
ASCE	Antenna Spurious Conducted Emissions
DTS	Digital Transmission System
EIRP	Equivalent Isotropical Radiated Power
ETSI	European Telecommunications Standards Institute
EUT	Equipment Under Test
OOB	Out of Band
PKPSD	Peak Power Spectrum Density
RBW	Resolution Bandwidth
RF	Radio Frequency of oscillation rate of electromagnetic fields (e.g. radio waves: 9kHz to 300GHz)
RMS	Root mean square, i.e., $V_p/\sqrt{2}$
Rx	Referred as antenna for receiving RF signals
SD	Spurious Domain
TR	Technical Report
Tx	Referred as antenna for transmitting RF signals
VBW	Video Bandwidth

Vp	Peak Voltage

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

2 Introduction

Applicant:	MY01 Inc.
Manufacturer:	MY01 Inc
Number of Samples Tested:	2
Test Specification/Issue/Date:	RSS-247 Issue 2: February 2017 FCC Part 15 Subpart C.247
Test Plan/Issue/Date:	N/A
Project Number: **Date:**	7169006625 2019-06-27
Model Number(s)	MY01 Several samples of the above model were tested.
Date of Receipt of EUT:	2019-08-19
Start of Test:	2019-08-26
Finish of Test:	2019-08-28
Name of Tester(s):	Abdoulaye Ndiaye Jose Martinez-Ortega
Related Documents:	ANSI C63.10:2013 FCC 15. Subpart 15 Subpart C/RSS-247

2.1.1 Brief Summary of Results

A brief summary of the tests carried out in accordance with RSS-247 Issue 2, FCC Part 15 Subpart 15.247 & FCC Part 15 Subpart 15.209 is summarized in Table 2.

Report Section	FCC Rule	IC Rule	Description	Class/Limit	Result
-	15.203 & 15.247(b)	RSS-210	Antenna Requirement	Note 1	Not Applicable
-	§15.207	RSS-GEN Clause 8.8	AC- Power Conducted Emissions	Note 2	Not Applicable
6	N/A	RSS-GEN.6.7	99% Bandwidth	Note 3	Pass
7	§15.247(a)(2)	RSS-247.5.2(a)	6dB Bandwidth	>500kHz	Pass
8	§15.247(b)(3)	RSS-247 5.4(d)	Peak Output Power	< 1W	Pass
9	15.247(e)	RSS-247 5.2(b)	Power Spectral Density	< 8 dBm (3 kHz BW)	Pass
10	§15.247(d)	RSS-247 5.5	Band-Edge Compliance of RF Spurious Emissions	≤ 20dBc	Pass
11	§15.209(a)	RSS-210 B.10(a)	Spurious Radiated Emission	Quasi-Peak Average	Pass

Note 1: Manufacture uses a SMA antenna connector for unique coupling to the intentional radiator
Note 2: EUT contains no means for connection directly or indirectly to AC mains and is powered by battery only
Note 3: RBW must be set between 1% & 5% of the 99% bandwidth

Table 2 – Test Summary Table

2.1.2 Declaration of Build Status

This report addresses the EMC verification testing and test results of the MY01 and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-247 Issue 2:2017
FCC Part 15 Subpart C 15.247:2016

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc, unless otherwise stated.

For a more detailed list of the standards and the revision used, see the "Applicable Standards, Specifications and Methods" section of this report.

2.1.3 Notes, Justification

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Restricted Bands of operation, the EUT is designed to operate only between: 2.402GHz–2.480GHz.

The EUT is a Bluetooth device, then the FCC 15.249 was used instead of FCC 15. 247.to check the level of emissions
In so far as the limits was not provided in the 15.249, the 15.247 must be used.

3 EUT: MY01

3.1 Specifications:

PRODUCT NAME:	MY01
MANUFACT URER:	MY01 Inc
Model	MY01 Continuous Compartmental Pressure Monitor
TUV NUMBER:	444686
PART NUMBER:	N/A
Frequency Range (MHz)	2402-2480
Channel Numbers	0-39 [40]
Data Rate	2Mbps
Modulation Type	GFSK
VOLTAGE RATING:	3Vdc Battery
Regular Output Power	0 dBm
Maximum Output Power	4 dBm
Hardware Version Identification Number (HVIN):	VER.0

Table 3. EUT – MY01 – Specifications

Channels	Frequency (MHz)	Channels	Frequency (MHz)
Channel #0	2.402GHz	Channel #20	2.442GHz
Channel #1	2.404GHz	Channel #21	2.444GHz
Channel #2	2.406GHz	Channel #22	2.446GHz
Channel #3	2.408GHz	Channel #23	2.448GHz
Channel #4	2.410GHz	Channel #24	2.450GHz
Channel #5	2.412GHz	Channel #25	2.452GHz
Channel #6	2.414GHz	Channel #26	2.454GHz
Channel #7	2.416GHz	Channel #27	2.456GHz
Channel #8	2.418GHz	Channel #28	2.458GHz
Channel #9	2.420GHz	Channel #29	2.460GHz
Channel #10	2.422GHz	Channel #30	2.462GHz
Channel #11	2.424GHz	Channel #31	2.464GHz
Channel #12	2.426GHz	Channel #32	2.466GHz
Channel #13	2.428GHz	Channel #33	2.468GHz
Channel #14	2.430GHz	Channel #34	2.470GHz
Channel #15	2.432GHz	Channel #35	2.472GHz
Channel #16	2.434GHz	Channel #36	2.474GHz
Channel #17	2.436GHz	Channel #37	2.476GHz
Channel #18	2.438GHz	Channel #38	2.478GHz
Channel #19	2.440GHz	Channel #39	2.480GHz

Table 4. MY01 – List of Channels

3.3 Mode of Operations

The MY01 operating in the 2.4GHz band with frequencies in the range of 2402 to 2480 GHz bands. For communication it uses BluetoothTM LE protocol.

The following modes were available on the EUT. The test personnel were able to switch among the modes using a button press:

1 Low Frequency modulated Tx carrier close to 100% Duty Cycle

2 Medium Frequency modulated Tx Carrier, close to 100% Duty Cycle

3 High Frequency modulated Tx Carrier, close to 100% Duty Cycle

4 Medium Frequency unmodulated continuous carrier

5 Rx Carrier

6 Low Tx at full power (4 dBm)

7 Mid Tx at full power (4 dBm)

8 High Tx at full Power (4 dBm)

3.3 Setup Diagram

During the EUT was exercised by powering to the rated voltage and connecting according to Figure 1.

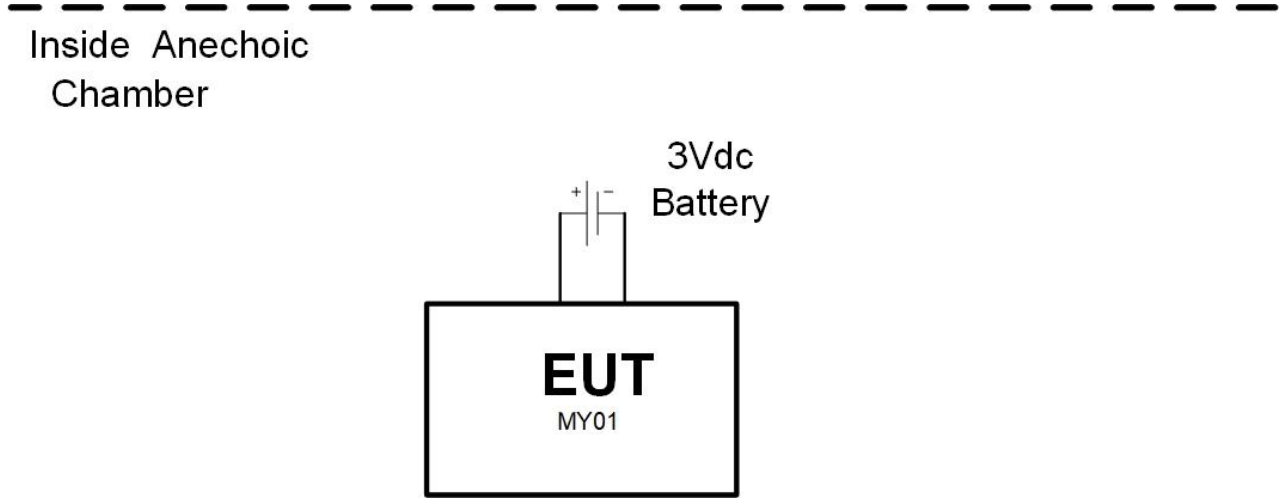


Figure 1: EUT Setup Diagram – MY01 – Spurious emissions

4 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

5 Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2. For instance, for the range of 0.15MHz-30MHz, 30MHz – 1GHz and 1GHz – 18GHz is ±3.3 dB, ±4.25dB and ±4.93dB, respectively with a 'k=2' coverage factor and a 95% confidence level.

Parameter	Uncertainty
Occupied channel Bandwidth	± 5%
RF output power, conducted	± 1.5dB
Power Spectral Density, conducted	± 3dB
Unwanted Emission, conducted	± 3dB
All emission, radiated	± 6dB
Temperature	± 3°C
Time	± 3%

Table 5 Acceptable Uncertainties

6 20 dB 99% Bandwidth

6.1.1 Purpose & Method

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, the maximum power does not exceed an amount which may create an excessive power level.
The method is given in Section 2.1 and 8.1 of FCC KDB 558074 and ANSI C63.10.

6.1.2 Test Specifications

REFERENCE STANDARD	ANSI C63.10-2013 Clause 6.9 RSS-GEN.6.7
SPECIFICATIONS	
Limit – % Bandwidth	99
Frequency range (MHz)	2402 2442 2480
Data rate	2Mbps
RBW (kHz):	Set to 1% to 3% of the 99% bandwidth
VBW (kHz)	3xRBW
EUT	
Identification	MY01
Voltage Input	3Vdc Battery
ENVIROMENTAL & TEST INFO	
Test Date (YYYY-MM-DD)	2019-08-28
Temperature (°C)	24 ± 2
Humidity (%)	50.4 ± 5
Atmospheric Pressure kPa (For Info Only)	105.4
Tester	Abdoulaye Ndiaye Jose Martinez-Ortega
Client Witness	Mohamad Nizar Kezzo, Chrouk Kasem

6.1.3 Test setup

The measurements for the 20dB Original Bandwidth was performed by conducted method (from the antenna SMA connector) in normal temperature condition. This test setup is depicted in Photo 1

Photo 1: OBW setup

6.1.4 Results

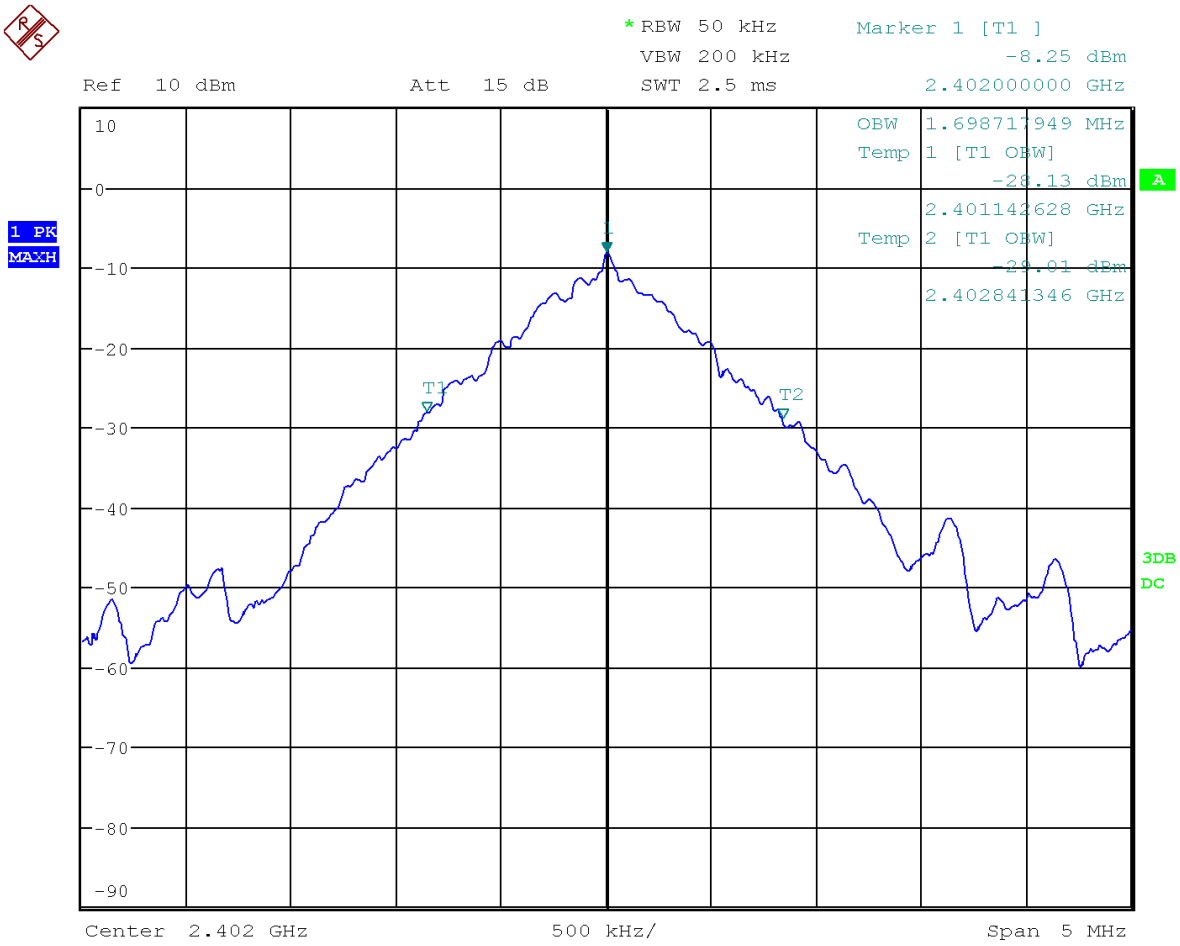
The Channel #20 gave a maximum of 1.79 MHz for 99% BW. Details are depicted in Table 6

Channel	Frequency (MHz)	99% Bandwidth (MHz)	Results
Low channel: #0	2402	1.698	Pass
Middle Channel: #20	2442	1.79	Pass
Highest Channel: #39	2480	1.74	Pass

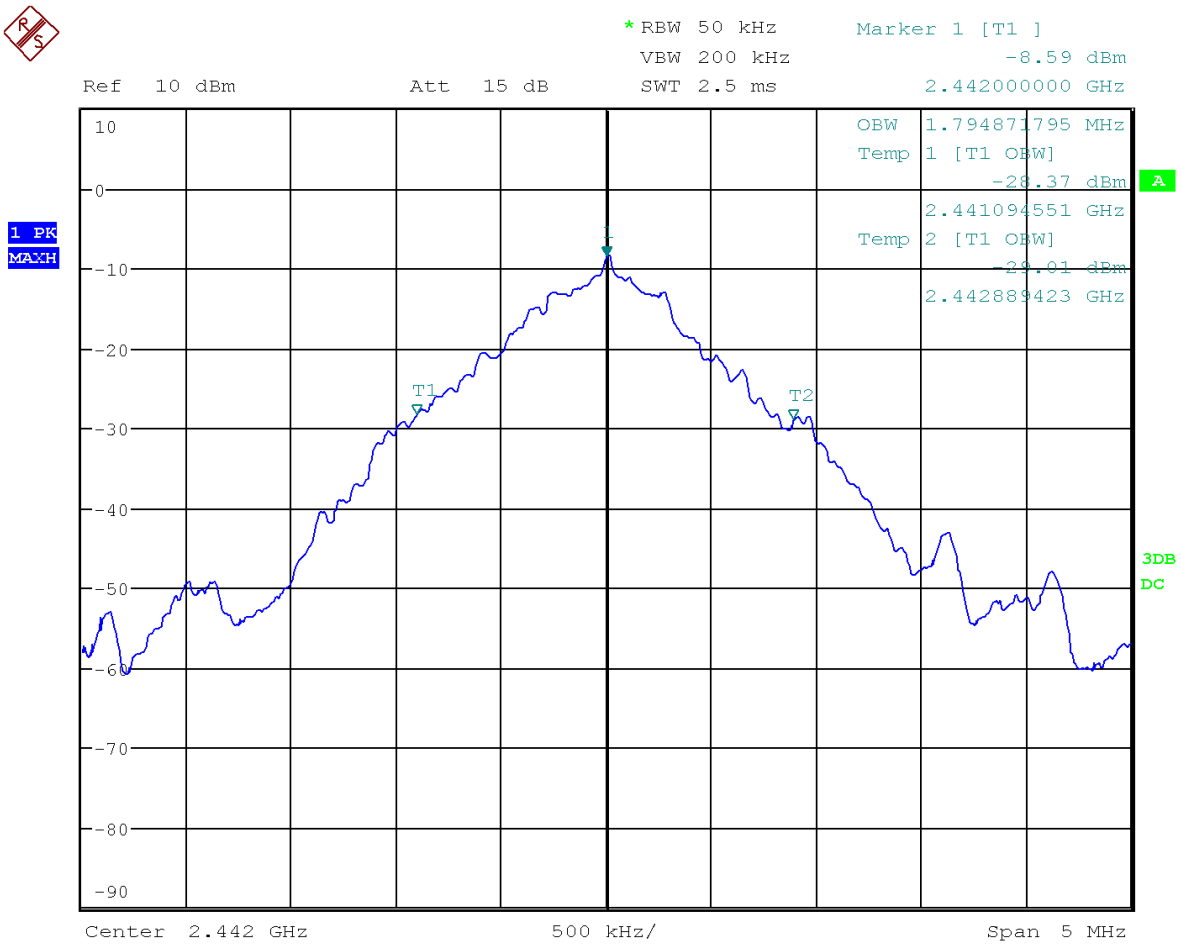
Table 6 – 99% Bandwidth Results

6.1.4.1 Graphs

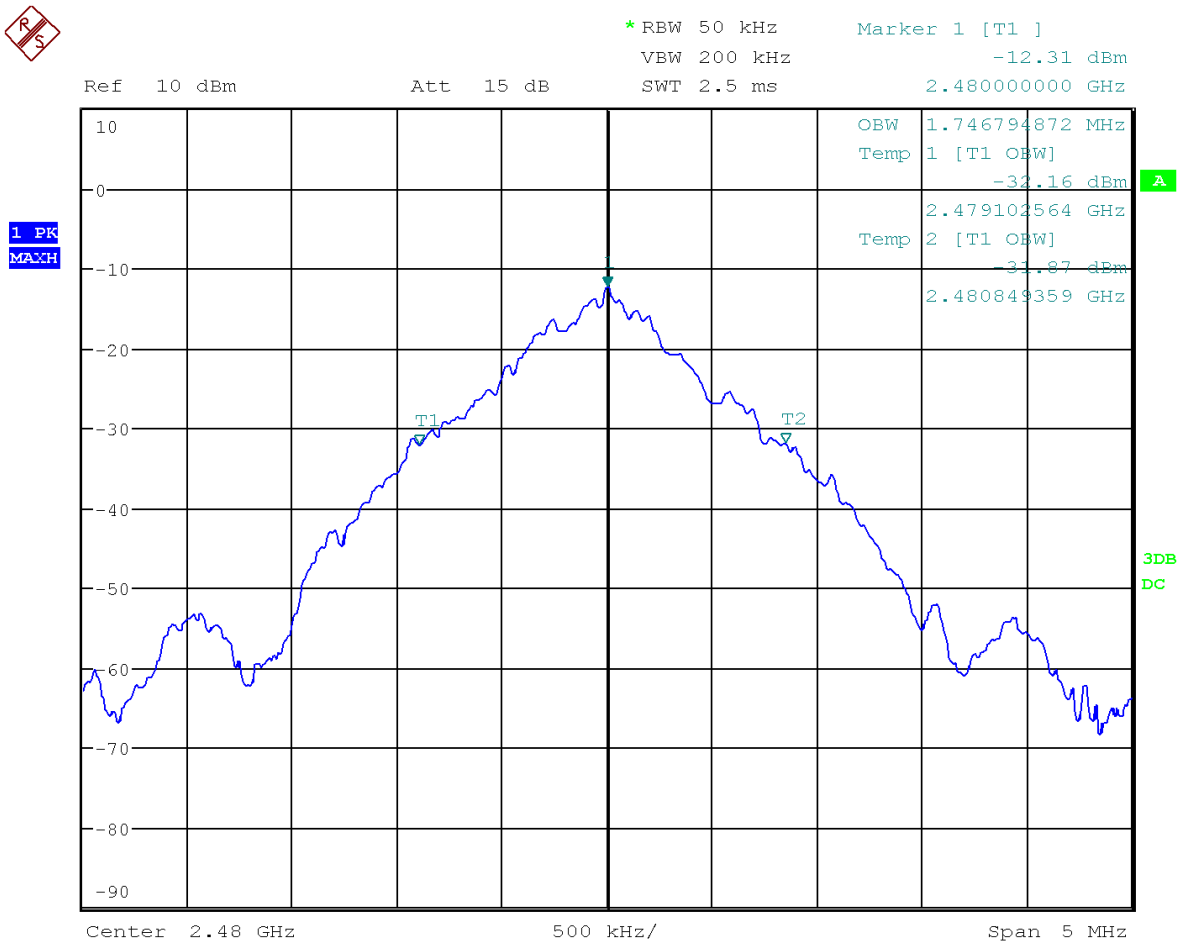
The graphs showed below show the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 99% bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute. No attenuator was used between the EUT and the Spectrum Analyzer.



Graph 1 Test Results – 99% Bandwidth Results – Lower Channel (#0))



Graph 2 Test Results – 99% Bandwidth Results – Middle Channel (#20)



Graph 3 Test Results – 99% Bandwidth Results – Highest Channel (#39)

6.1.5 Test Instruments

This test was carried out in Laval test location

Equipment	Model No.	Manufacturer	Calibration Period (months)	Calibration Due (YYY-MM-DD)	Asset No: LAVE
Spectrum Analyzer	ESU-40	Rohde & Schwarz	24	2021-04-20	4092
Cable 300mm SMA 90	SUCOFLEX-100	Huber+ Suhner	NCR	NCR	4310

Table 7 – Test Instrumentation – 99% OBW

7 6dB Bandwidth of Digitally Modulated Systems

7.1.1 Purpose & Method

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, the maximum power does not exceed an amount which may create an excessive power level.
The method is given in Section 8.1 of FCC KDB 558074 and ANSI C63.10.

7.1.2 Test Specifications

REFERENCE STANDARD	FCC Part 15.247(a)2 RSS-247 5.2(a)	
SPECIFICATIONS		
Limit – 6dB Bandwidth	≥500kHz	
Frequency range (MHz)	2402 2442 2480	
Data rate	2Mbps	
RBW (kHz):	100	
VBW (kHz)	300	
EUT		
Identification	MY01	
Voltage Input	3Vdc Battery	
ENVIROMENTAL & TEST INFO		
Test Date (YYYY-MM-DD)	2019-08-27	2019-08-28
Temperature (°C)	24 ± 2	24 ± 2
Humidity (%)	50.4 ± 5	50.4 ± 5
Atmospheric Pressure kPa (For Info Only)	100.5	105
Tester	Abdoulaye Ndiaye Jose Martinez-Ortega	
Client Witness	Mohamad Nizar Kezzo, Chrouk Kasem	

7.1.3 Test Setup

The measurements for the 6dB Original Bandwidth was performed by conducted method (from the antenna SMA connector) in normal temperature condition. This test setup is the same as the 20dB Bandwidth setup depicted in (Photo 1)

7.1.4 Results

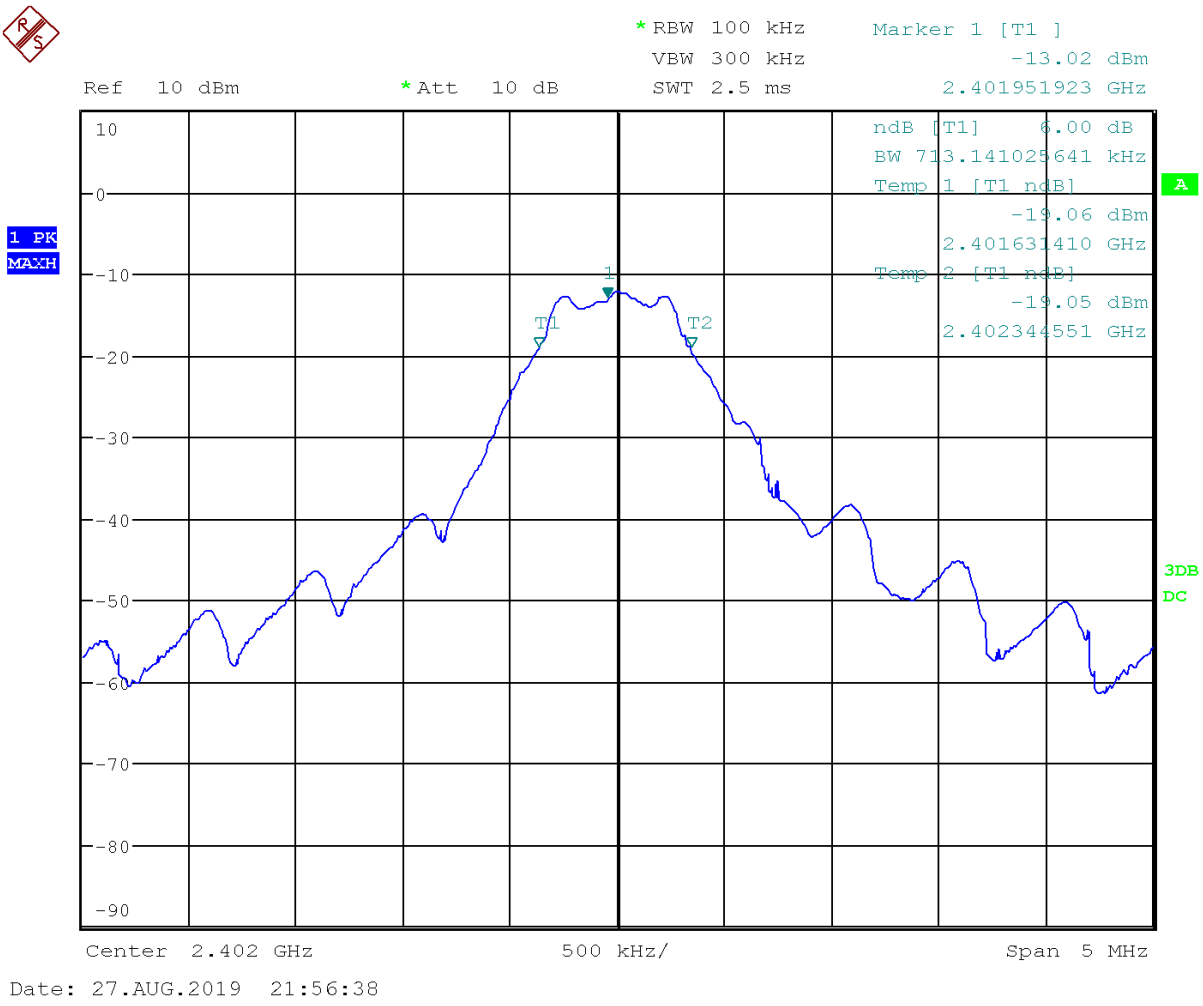
The minimum 6 dB BW measured was 0.665 MHz from channel #20 and Channel #39, respectively. Test results are depicted in Table 8.

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Results
Lower Channel: #0	2402	0.713	Pass
Middle Channel: #20	2442	0.665	Pass
Highest Channel: #39	2480	0.665	Pass

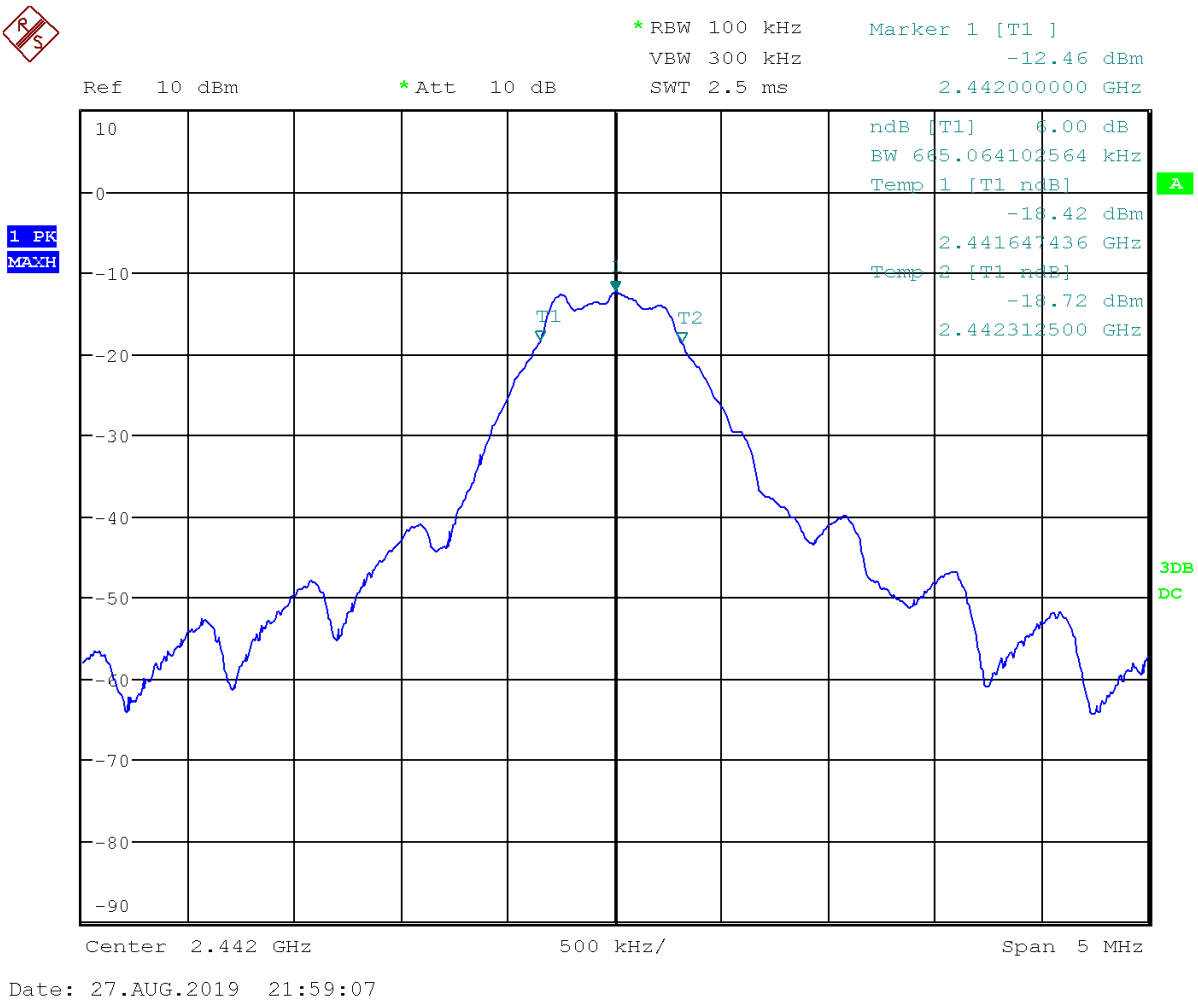
Table 8 – 6 dB Bandwidth Results

7.1.4.1 Graphs

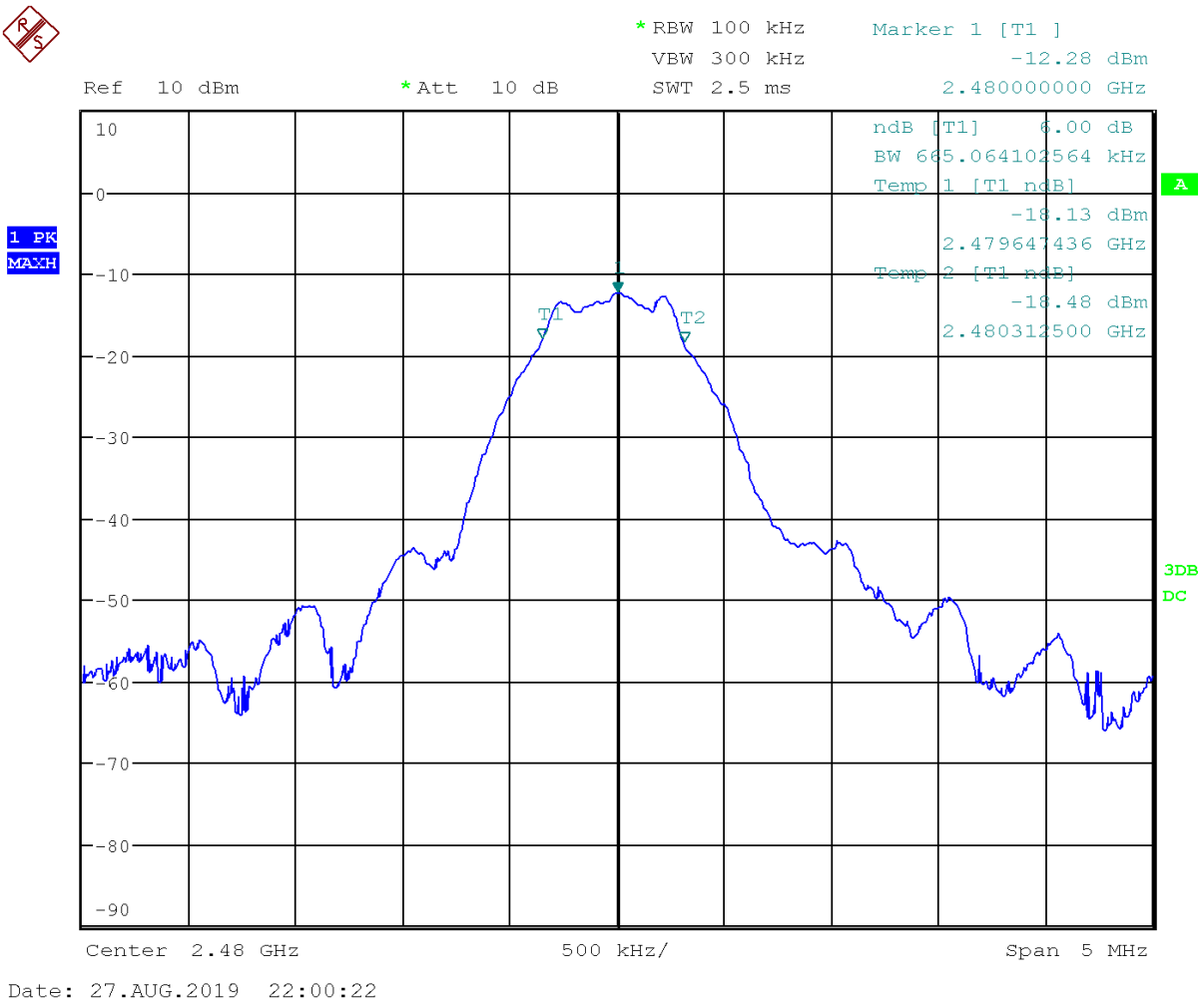
The graphs showed below show the BW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6-dB bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute. No attenuator was used between the EUT and the Spectrum Analyzer



Graph 4 Test Results – 6 dB Bandwidth Results – Lower Channel (#0)



Graph 5 Test Results – 6 dB Bandwidth Results – Middle Channel (#20)



Graph 6 Test Results – 6 dB Bandwidth Results – Highest Channel (#39)

7.1.5 Test Instruments

This test was carried out in Laval test location

Equipment	Model No.	Manufacturer	Calibration Period (months)	Calibration Due (YYY-MM-DD)	Asset No: LAVE
Spectrum Analyzer	ESU-40	Rohde & Schwarz	24	2021-04-20	4092
Cable 300mm SMA 90	SUCOFLEX-100	Huber+ Suhner	NCR	NCR	4310

Table 9 – Test Instrumentation – 6dB OBW

8 Maximum Peak Envelope Conducted Power – Digital Modulated

8.1.1 Purpose & Method

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.
The method is given in Section 8.3.1 of FCC KDB 558074 and ANSI C63.10.
This Test must be performed on normal temperature (23°C - 35°C) and extreme temperature (10°C - 50°C)

8.1.2 Test Specifications

REFERENCE STANDARD	FCC Part 15.247(b)3 RSS-247.5.4(d) ANSI C63.10. Clause 11.9.1	
SPECIFICATIONS		
Limit – Power (W)	<1	
Frequencies (MHz)	2402 2442 2480	
RBW (MHz):	3	
VBW (MHz)	10	
Span (MHz)	10	
EUT		
Identification	MY01	
Voltage Input	3Vdc Battery	
ENVIROMENTAL	**Normal Conditions**	**Extreme Conditions**
Test Date (YYYY-MM-DD)	2019-08-30	2019-08-30
Temperature (°C)	23 ± 2	50 ± 2 10 ± 2
Humidity (%)	45 ± 5	45 ± 5
Atmospheric Pressure kPa (For Info Only)	102.3	102.3
Tester	Abdoulaye Ndiaye Jose Martinez-Ortega	
Client Witness	Mohamad Nizar Kezzo, Chrouk Kasem	

8.1.3 Test Setup

The measurements for the RF output power was performed at both normal and at extremes operational temperatures as per Manufacturer Declaration. For normal Conditions the setup shown in Photo 1 was used, then for the (extreme conditions) the same setup was used but placed in the environmental chamber.

8.1.4 Results

The EUT was set to transmit at maximum power (4dBm) up to channel 39. The peak power measurements of channels tested are depicted in Table 10– 12.

Channel	Frequency (MHz)	EUT Power Setting (dBm)	Measured Peak Power (dBm)	External Attenuation +Cable (dB)	Corrected Peak Power (dBm)	Peak Power (mW)	Result
Low: #0	2402	4	-11.38	1.25	-10.13	0.097	Pass
Middle: #20	2442	4	-11.84	2.79	-9.05	0.124	Pass
High: #39	2480	4	-11.78	2.84	-8.94	0.127	Pass

Table 10 – Test Results Peak-Power Measurements at 23^{0}C

Channel	Frequency (MHz)	EUT Power Setting (dBm)	Measured Peak Power (dBm)	External Attenuation +Cable (dB)	Corrected Peak Power (dBm)	Peak Power (mW)	Result
Low: #0	2402	4	-10.62	1.25	-9.37	0.115	Pass
Middle: #20	2442	4	-9.73	2.79	-6.94	0.202	Pass
High: #39	2480	4	-8.36	2.84	-5.52	0.280	Pass

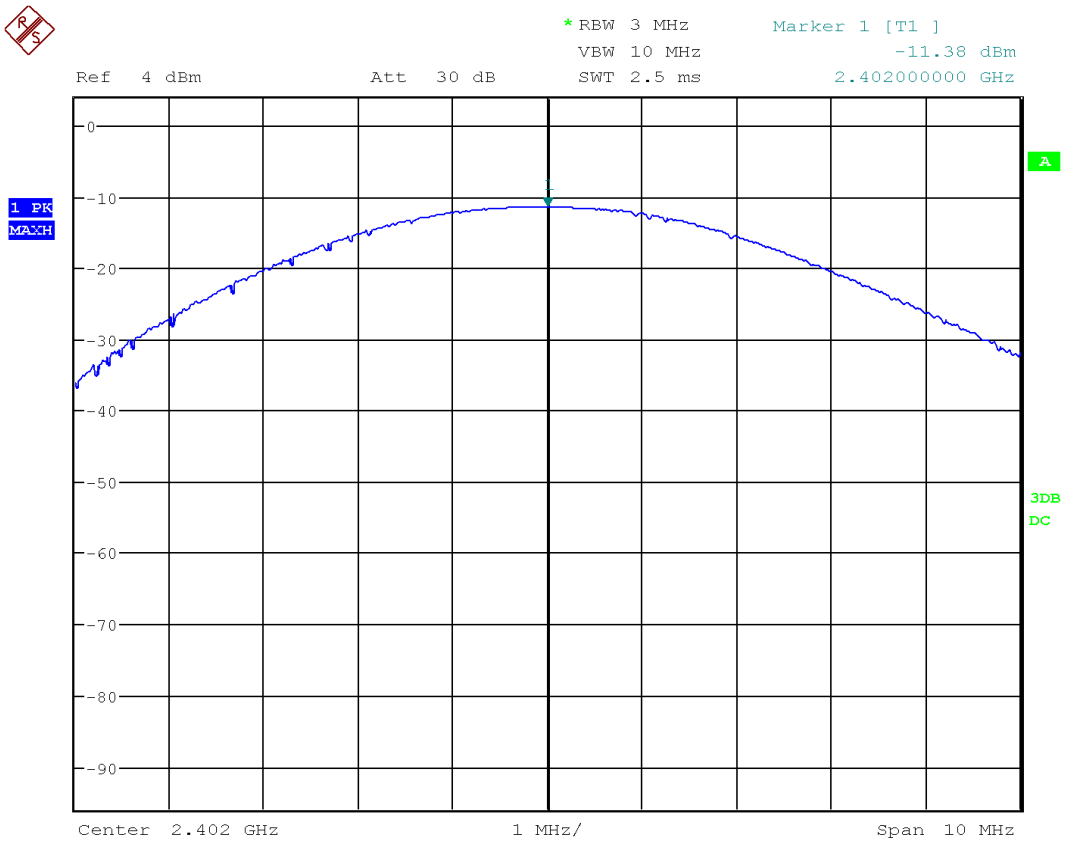
Table 11- Test Results Peak-Power Measurements – Extreme Temperature 10°C

Channel	Frequency (MHz)	EUT Power Setting (dBm)	Measured Peak Power (dBm)	External Attenuation +Cable (dB)	Corrected Peak Power (dBm)	Peak Power (mW)	Result
Low: #0	2402	4	-10.51	1.25	-9.26	0.118	Pass
Middle: #20	2442	4	-9.64	2.79	-6.85	0.206	Pass
High: #39	2480	4	-8.23	2.84	-5.39	0.289	Pass

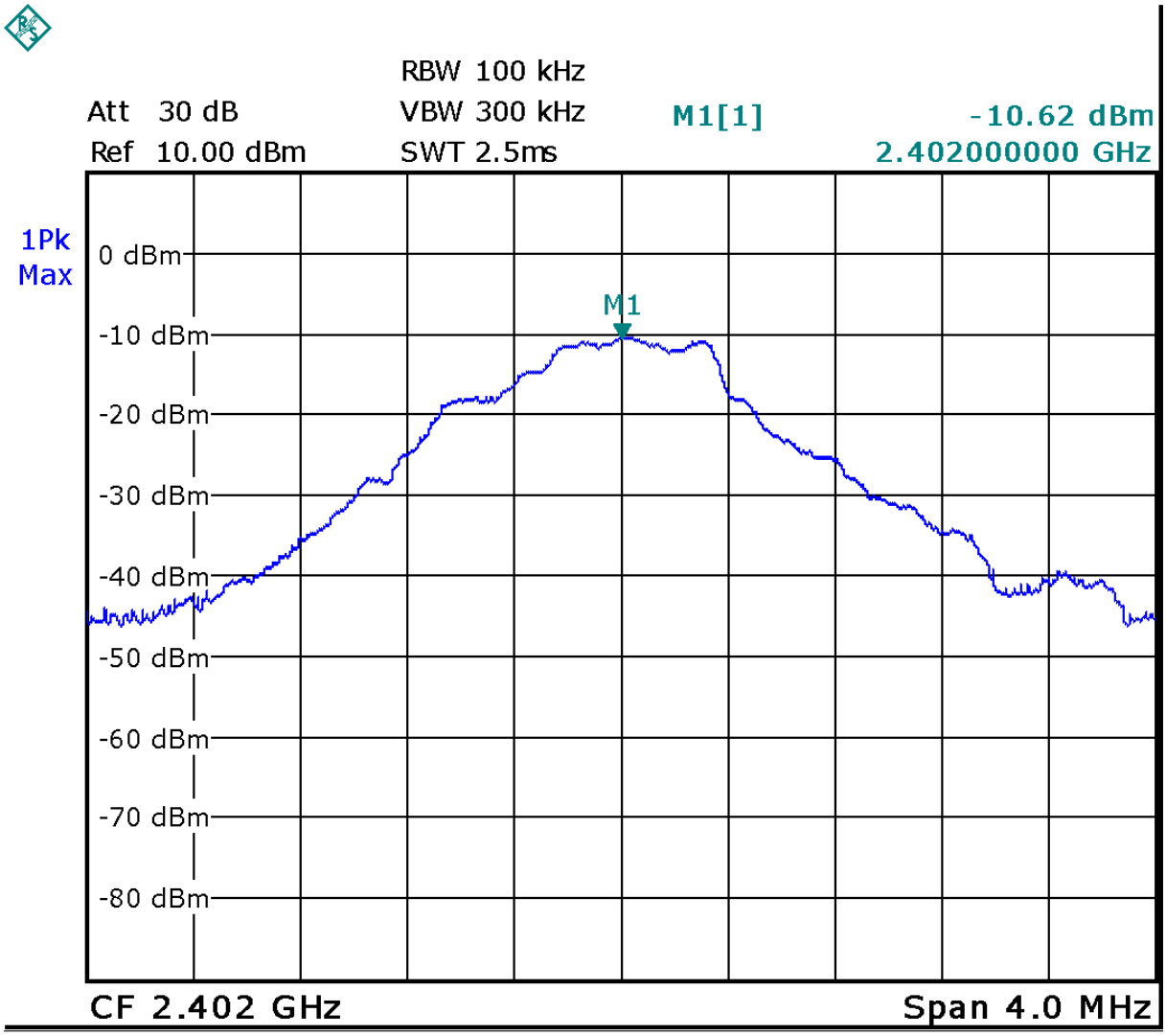
Table 12- Test Results – Peak-Power Measurements – Extreme Temperature 50°C

8.1.4.1 Graphs

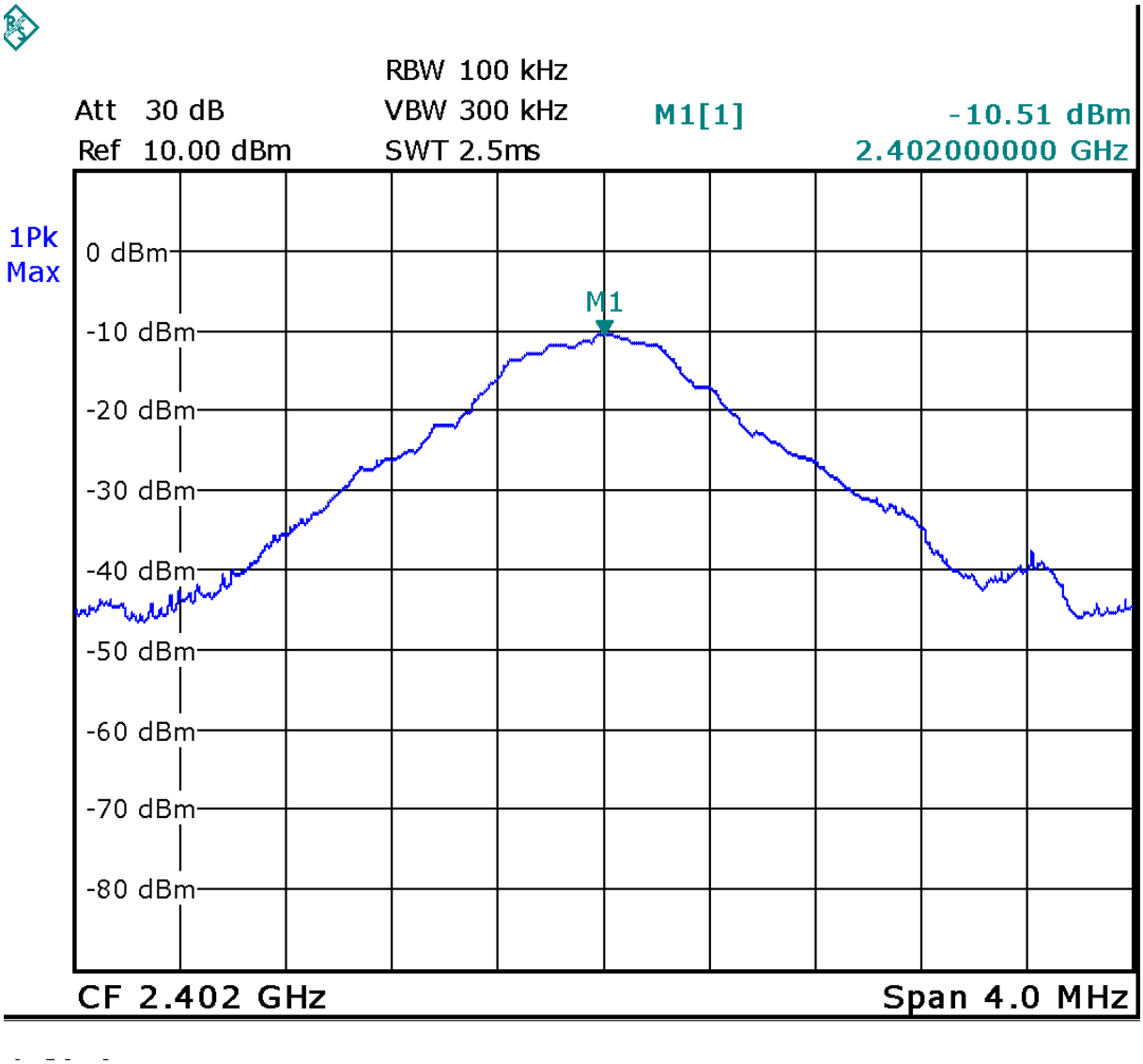
The plots shown below show the peak power output of the device during the antenna conducted measurements during transmit operation of the EUT. Note that no attenuator was used between the EUT and the Spectrum Analyzer.



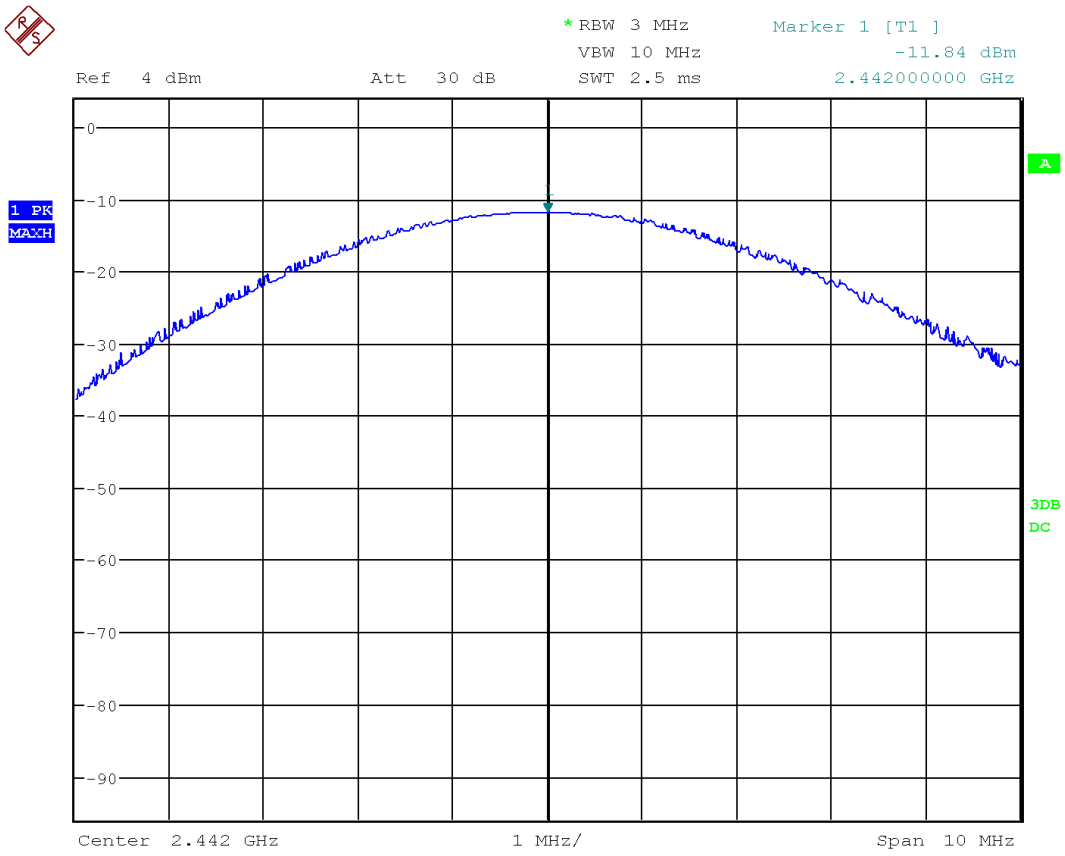
Graph 7 Test Results – Conducted Peak Power Measurements – Channel #0-at 23ºC



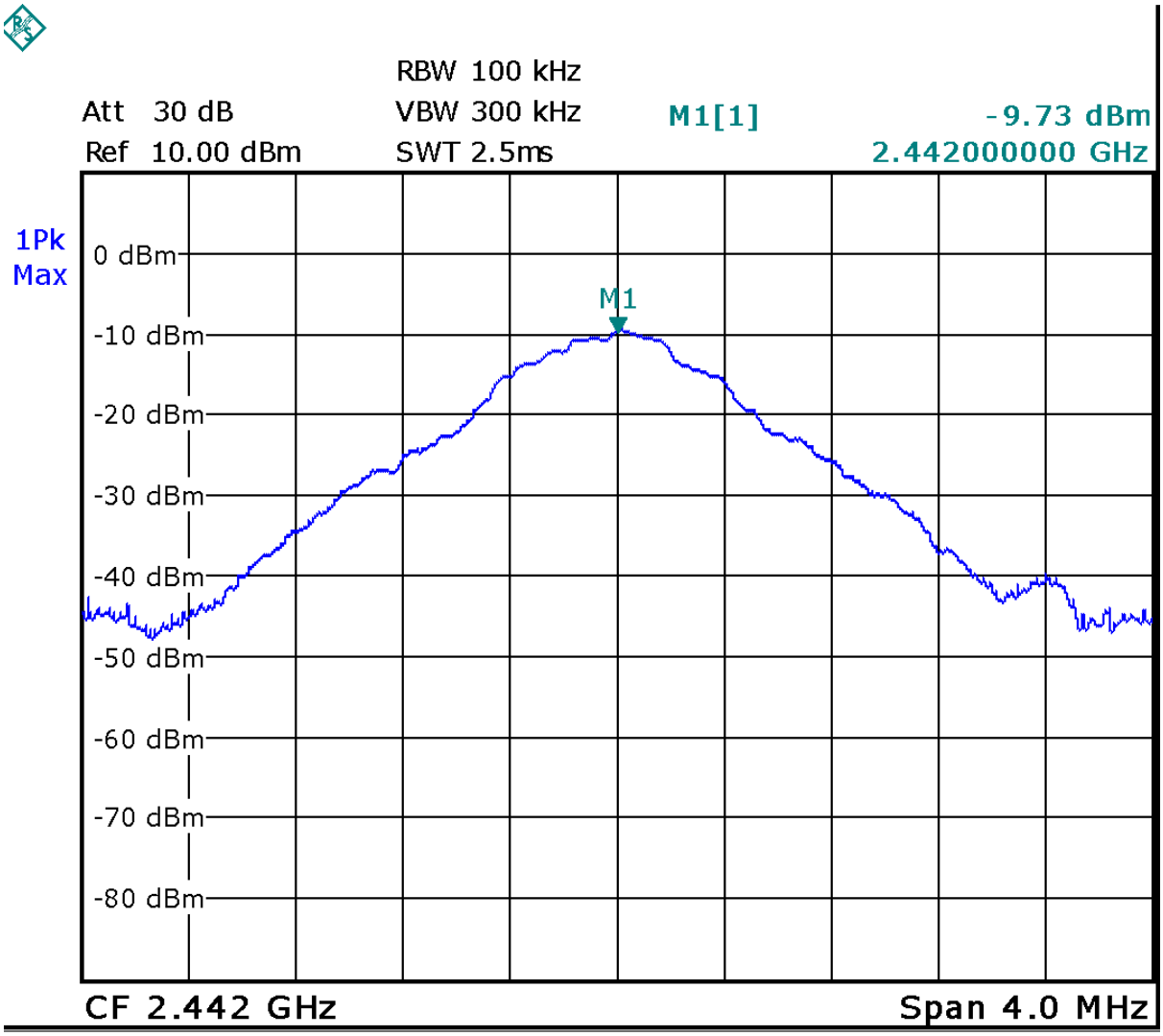
Graph 8 Test Results – Conducted Peak Power Measurements – Channel #0-at 10ºC



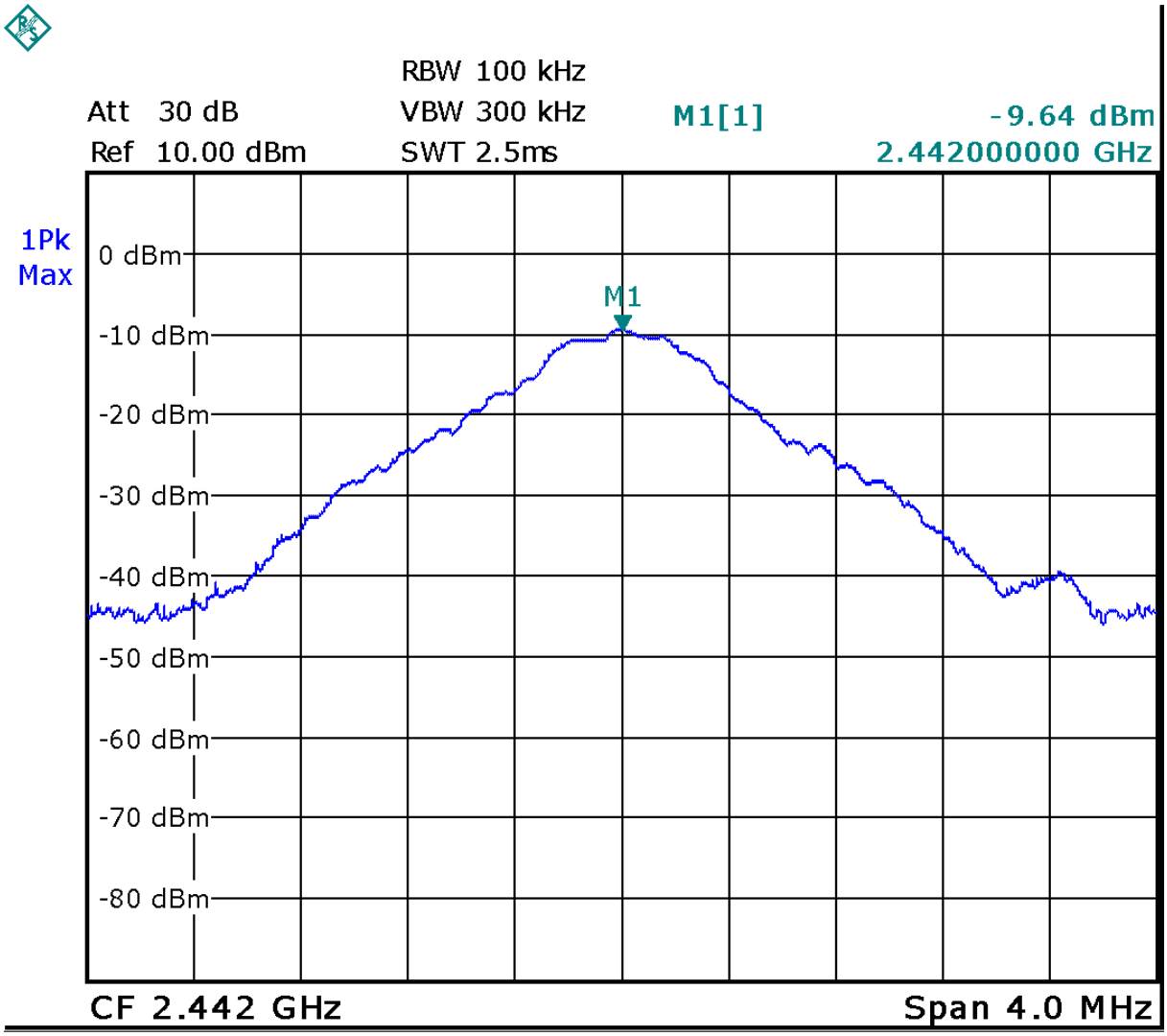
Graph 9 Test Results – Conducted Peak Power Measurements – Channel #0-at 50ºC



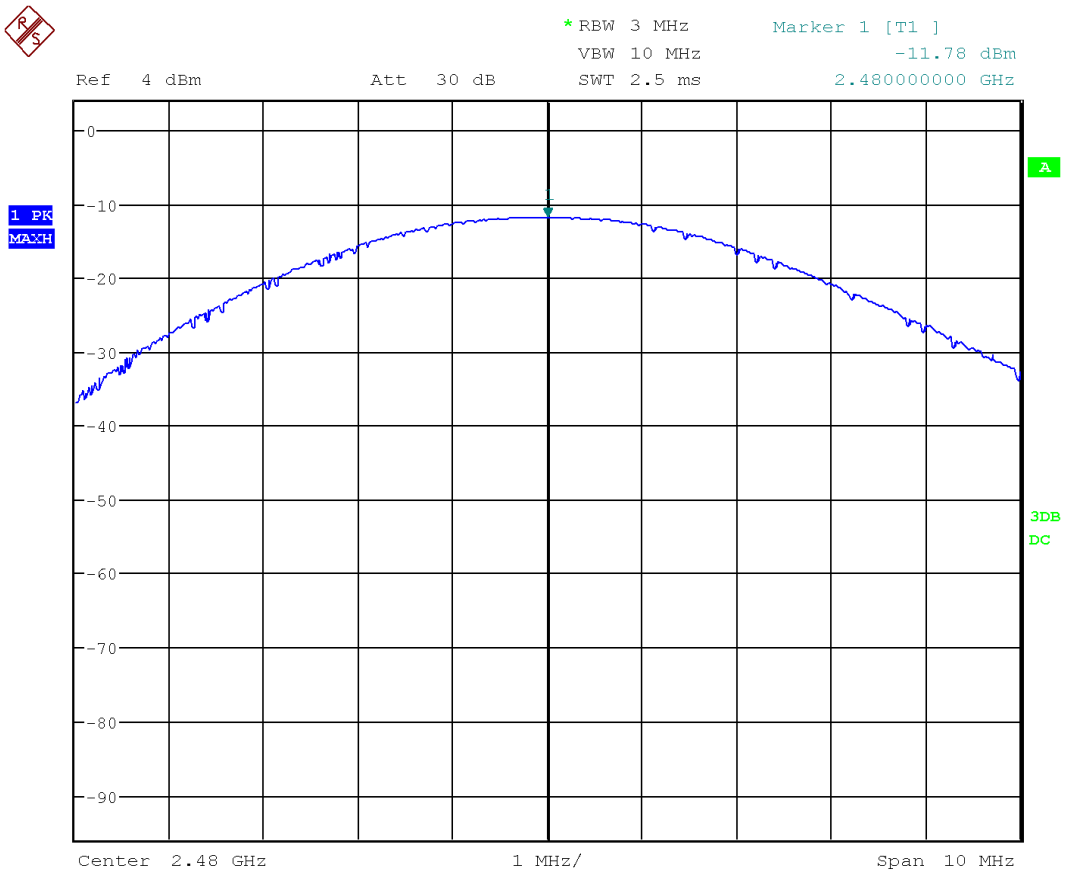
Graph 10 Test Results – Conducted Peak Power Measurements – Channel #20-at 23ºC



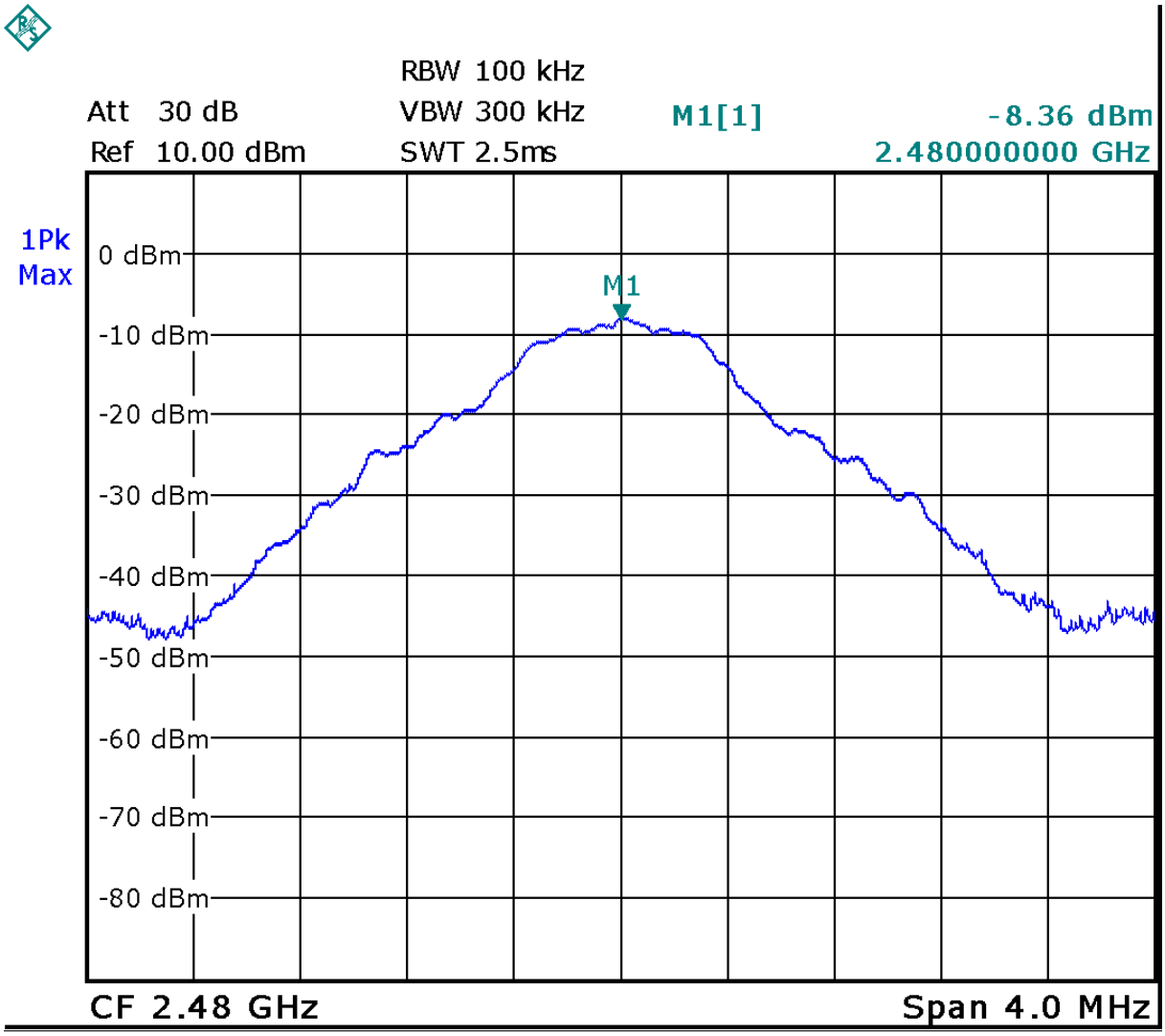
Graph 11 Test Results – Conducted Peak Power Measurements – Channel #20-at 10ºC



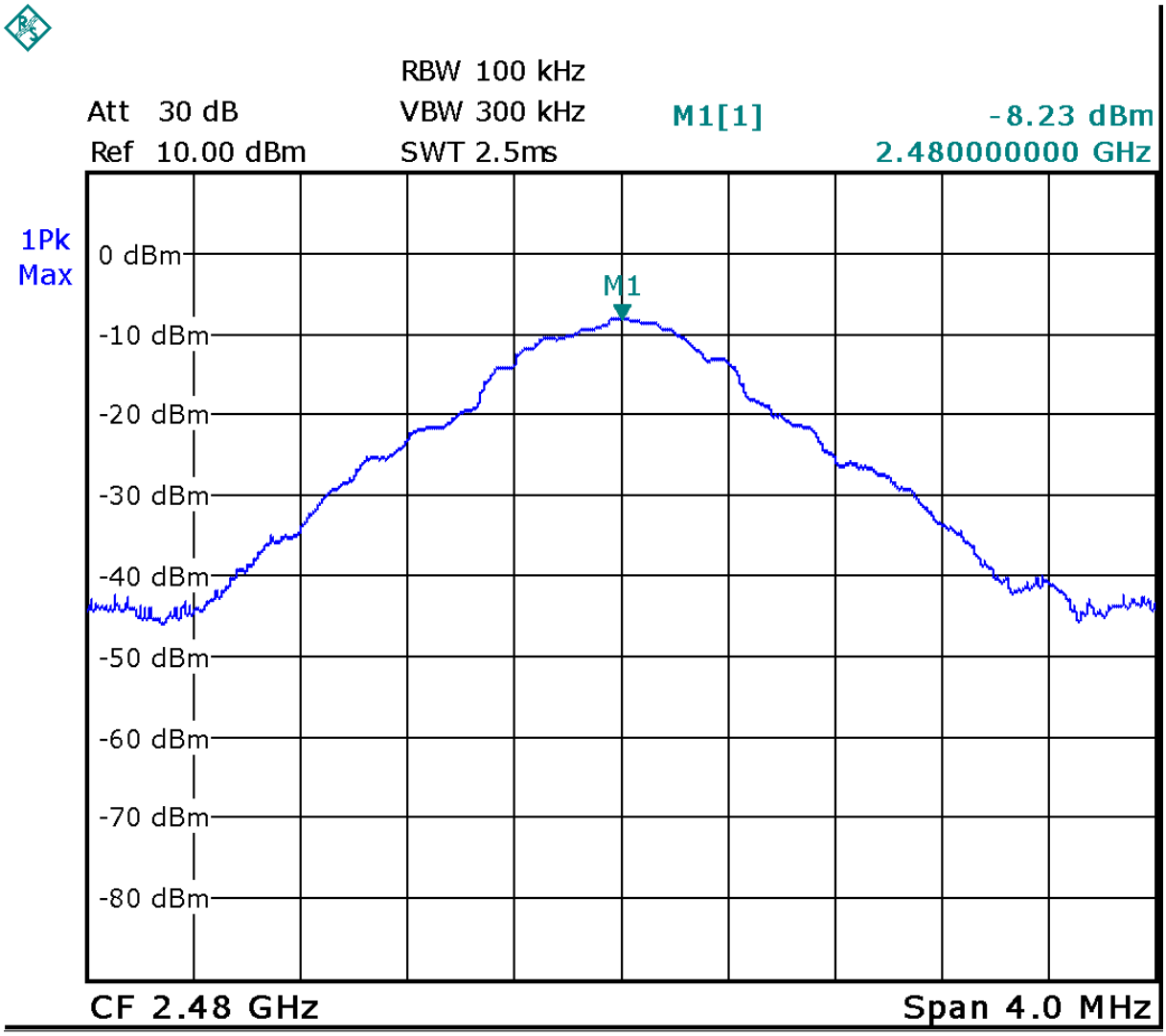
Graph 12 Test Results – Conducted Peak Power Measurements – Channel #20-at 50ºC



Graph 13 Test Results – Conducted Peak Power Measurements – Channel #39-at 23ºC



Graph 14 Test Results – Conducted Peak Power Measurements – Channel #39-at 10ºC



Graph 15 Test Results – Conducted Peak Power Measurements – Channel #39-at 50ºC

8.1.5 Test Instruments

This test was carried out in Laval test location

Equipment	Model No.	Manufacturer	Calibration Period (months)	Calibration Due (YYY-MM-DD)	Asset No: LAVE
Spectrum Analyzer	ESU-40	Rohde & Schwarz	24	2021-04-20	4092
Spectrum Analyzer	FSL	Rohde & Schwarz	24	2020-9-20	4095
Signal generator	SMU100A	Rohde & Schwarz	24	2020-08-23	4135
Cable 36in SMA	Lab-Flex 160	FLORIDA RF LABS	NCR	NCR	4079
Cable 254mm SMA	Minibend-10	Huber+ Suhner	NCR	NCR	4080
Environmental Chamber	GD-32-3-3	Russell	NCR	NCR	4099
Attenuator 10 dB	4779-10	Narda	NCR	NCR	4096

Table 13 – Test Instrumentation – Maximum Peak Envelope Conducted Power

9 Power Spectral Density

9.1.1 Purpose & Method

The purpose of this test is to ensure that the maximum power spectral density to the radiating element does not exceed the limits specified. This ensures that the modulation is significantly wide enough, or low enough in power that it will allow for co-operation of other wireless devices operating within this frequency allocation. The method applied is the PKPSD described in ANSI C63.10-2013 in Clause 11.10.

9.1.2 Test Specifications

REFERENCE STANDARD	FCC Part 15.247(e) RSS-247 5.2(b) ANSI C63.10. Clause 11.10
SPECIFICATIONS	
Limit (dBm)	<8
Frequencies (MHz)	2402 2442 2480
RBW (kHz):	100
VBW (kHz)	300
Span (MHz)	4
EUT	
Identification	MY01
Voltage Input	3Vdc Battery
ENVIROMENTAL & TEST INFO	
Test Date (YYYY-MM-DD)	2019-08-28
Temperature (°C)	24 ± 2
Humidity (%)	41 ± 5
Atmospheric Pressure kPa (For Info Only)	99.9
Tester	Abdoulaye Ndiaye Jose Martinez-Ortega
Client Witness	Mohamad Nizar Kezzo, Chrouk Kasem

9.1.3 Test Setup

The measurements for the Power Spectral Density was performed at normal operational temperature. This test setup is the same used in OBW testing (please refer to Photo 1).

9.1.4 Results

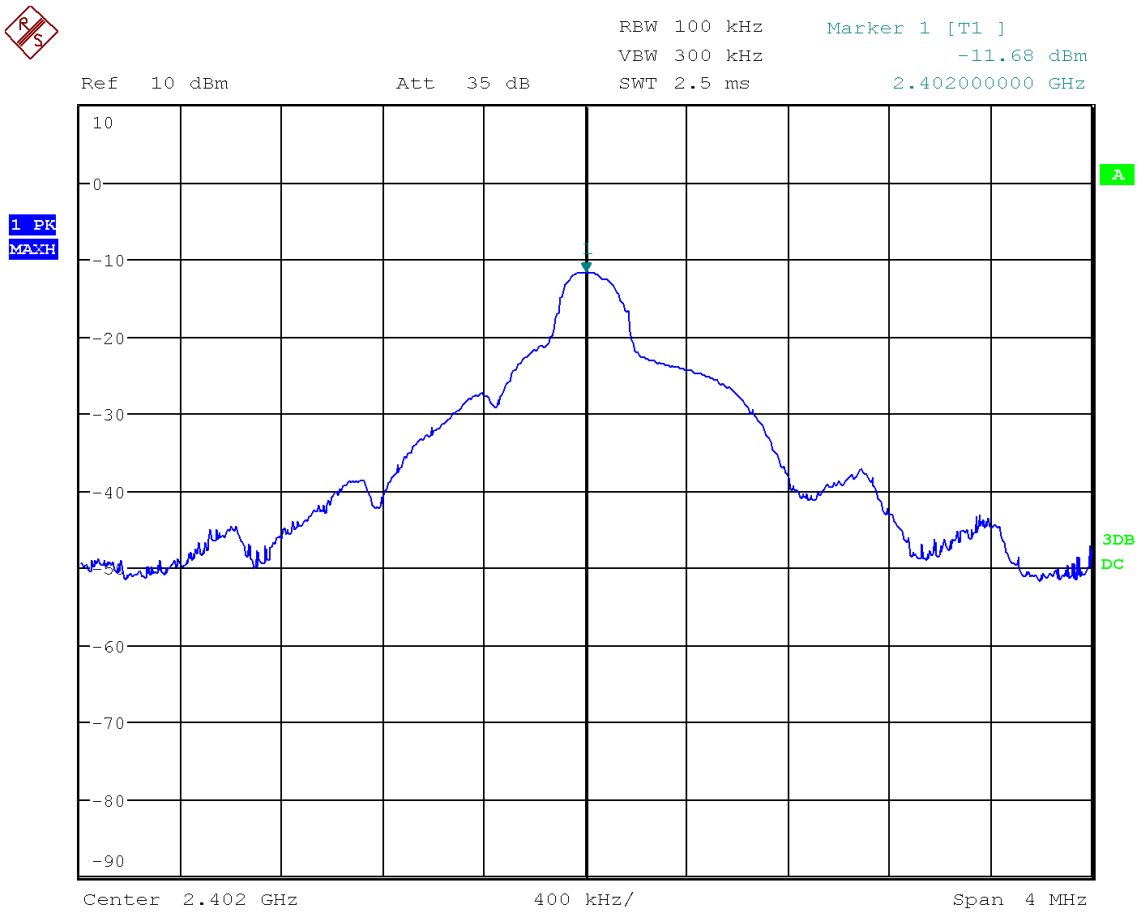
The EUT passed. Low, medium, and high bands were tested. The worst-case value is -11.18 dBm as measured with a 3 kHz resolution bandwidth (peak power) on the lower channel #0. The results of the peak power of channels tested are depicted in Table 14

Channel	Frequency (MHz)	EUT Power Setting (dBm)	Measured PSD (dBm)	External Attenuation +Cable (dB)	Corrected Peak Power (dBm)	Result
Low: #0	2402	4	-11.68	0.5	-11.18	Pass
Middle: #20	2442	4	-11.97	0.5	-11.47	Pass
High: #39	2480	4	-11.92	0.5	-11.42	Pass

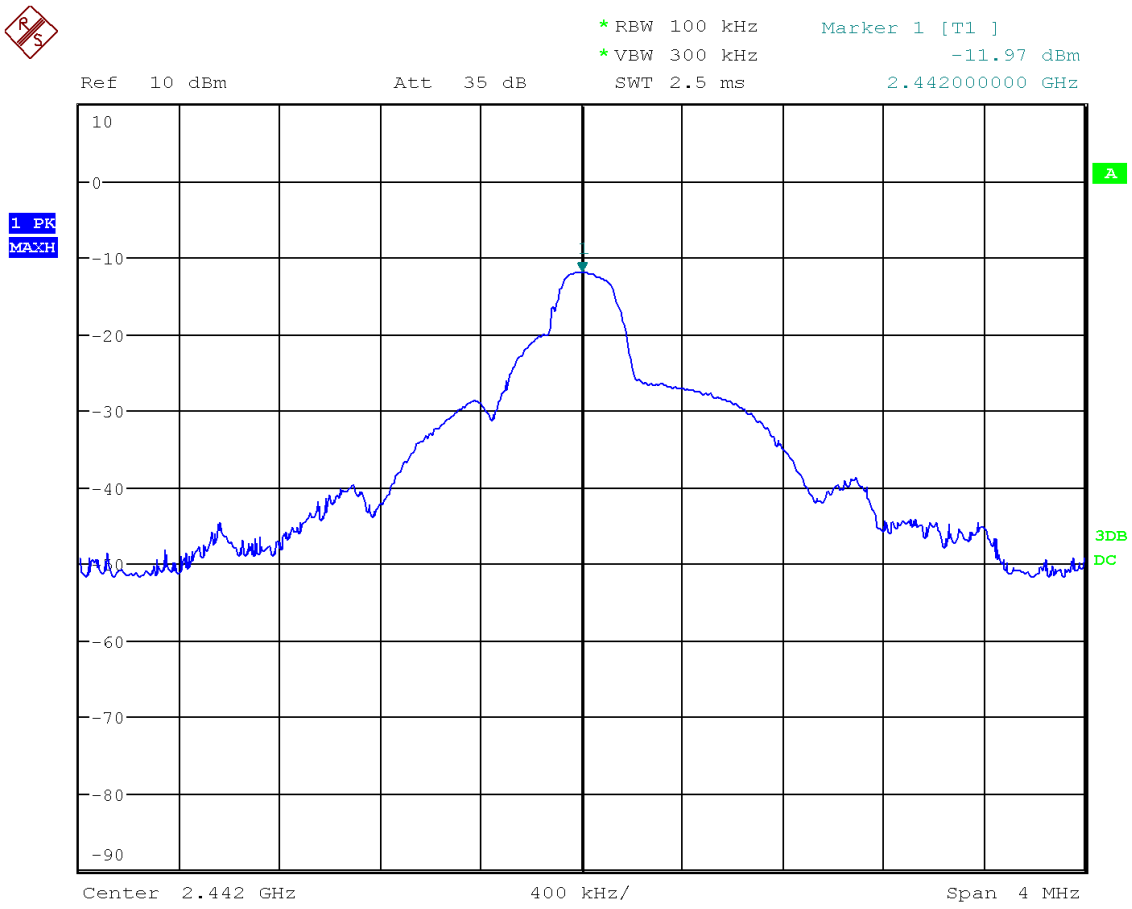
Table 14- Results – PKPSD

9.1.4.1 Graphs

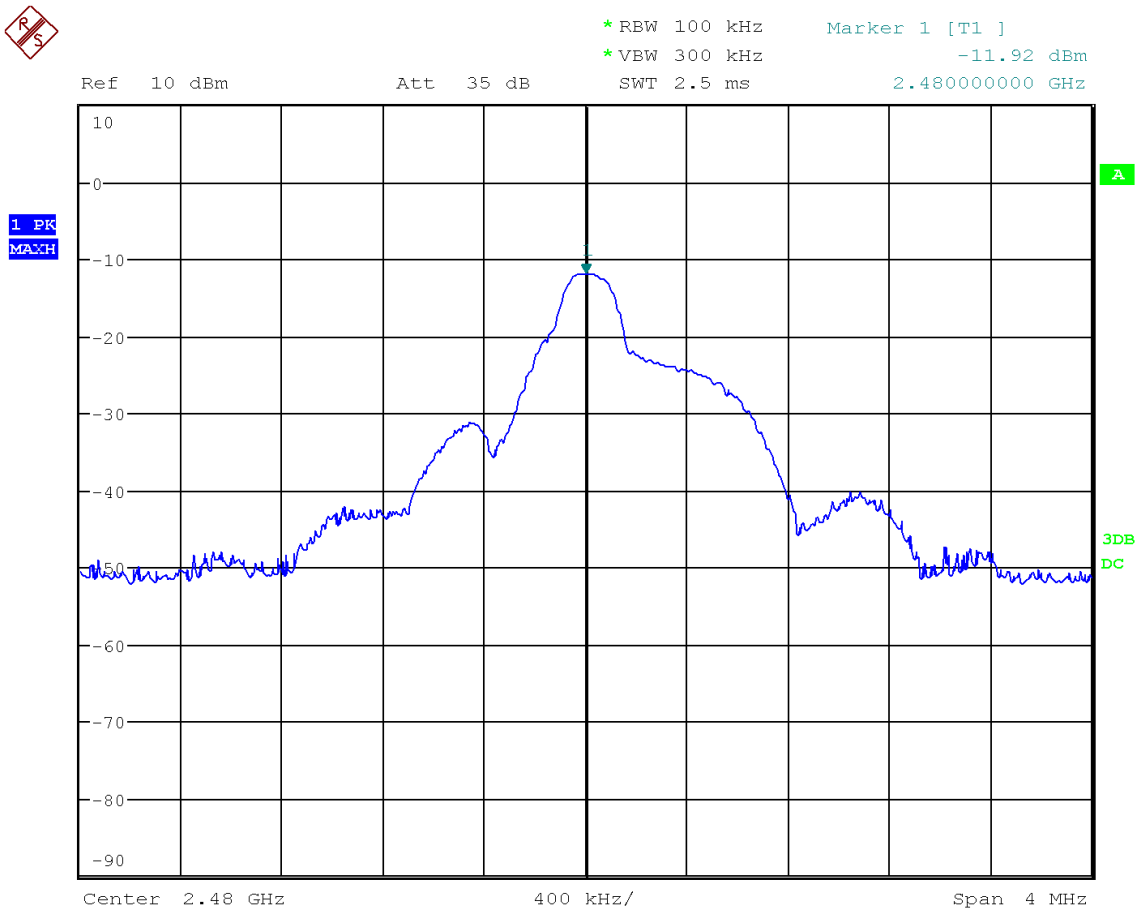
The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. Low, middle, and high channel was investigated. No attenuator was used between the EUT and the Spectrum Analyzer



Graph 16 Test Results – PKPSD – Channel #0



Graph 17 Test Results – PKPSD – Channel #20



Graph 18 Test Results – PKPSD – Channel #39

9.1.5 Test Instruments

This test was carried out in Laval test location

Equipment	Model No.	Manufacturer	Calibration Period (months)	Calibration Due (YYY-MM-DD)	Asset No: LAVE
Spectrum Analyzer	ESU-40	Rohde & Schwarz	24	2021-04-20	4092
Cable 300mm SMA 90	SUCOFLEX-100	Huber+ Suhner	NCR	NCR	4310

Table 15 – Test Instrumentation – Power Spectral Density

10 Band-Edge Compliance of RF Spurious Emissions

10.1.1 Purpose & Method

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that only the intended signal is delivered to the radiating element.

The limits are defined in 15.247(d). In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10th harmonic. This -20dBc requirement also applies at the ‘band edge’ or 2.4 GHz and 2.4840 GHz.

10.1.2 Test Specifications

REFERENCE STANDARD	FCC Part 15.247(d) RSS-247 5.5 ANSI C63.10 Clause 5.5, 5.6
SPECIFICATIONS	
Limit (dBc)	<20
Frequencies (MHz)	2402 2442 2483.5
RBW (kHz):	3
VBW (kHz)	10
EUT	
Identification	MY01
Voltage Input	3Vdc Battery
ENVIROMENTAL & TEST INFO	
Test Date (YYYY-MM-DD)	2019-08-28
Temperature (°C)	24 ± 2
Humidity (%)	50.4 ± 5
Atmospheric Pressure kPa (For Info Only)	105.4
Tester	Abdoulaye Ndiaye Jose Martinez-Ortega
Client Witness	Mohamad Nizar Kezzo, Chrouk Kasem

10.1.3 Test Setup

The measurements for the Antenna Spurious Conducted Emissions was performed at normal operational temperature. This test setup is the same used in OBW testing (please refer to Photo 1).

10.1.4 Results

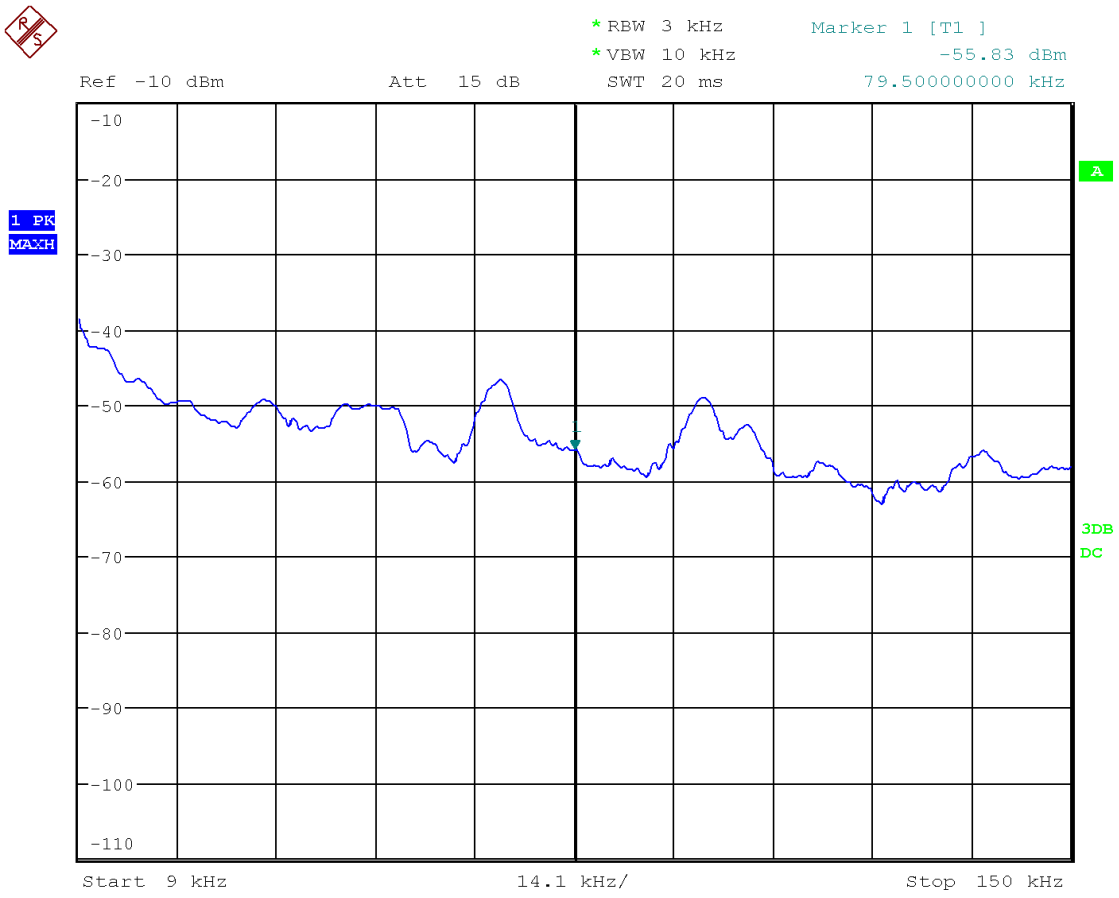
The EUT passed. Low, medium, and high bands were tested. The worst-case value is 39.66 dBm on channel 20. The peak power of channels tested are depicted in Table 16.

Channel	Frequency (MHz)	EUT Power Setting (dBm)	Measured Spurious Conducted (dBm)	External Attenuation +Cable (dB)	Margin from the fundamental (dBm)	Results <Note 1>
Low: #0	0.009-0.15	4	-55.83	0.5	43.49	Pass
Low: #0	0.15-30	4	-92.59	0.5	80.25	Pass
Low: #0	30-2400	4	-60.5	0.5	48.16	Pass
Low: #0	2400--2402	4	-68.65	0.5	56.31	Pass
Middle: #20	2402-2483.5	4	-52	0.5	39.66	Pass
High: #39	2483.5-25000	4	-52.99	0.5	40.65	Pass
Note 1. The highest level of the fundamental is -11.84 dBm based on RF output Power results (section 8)						

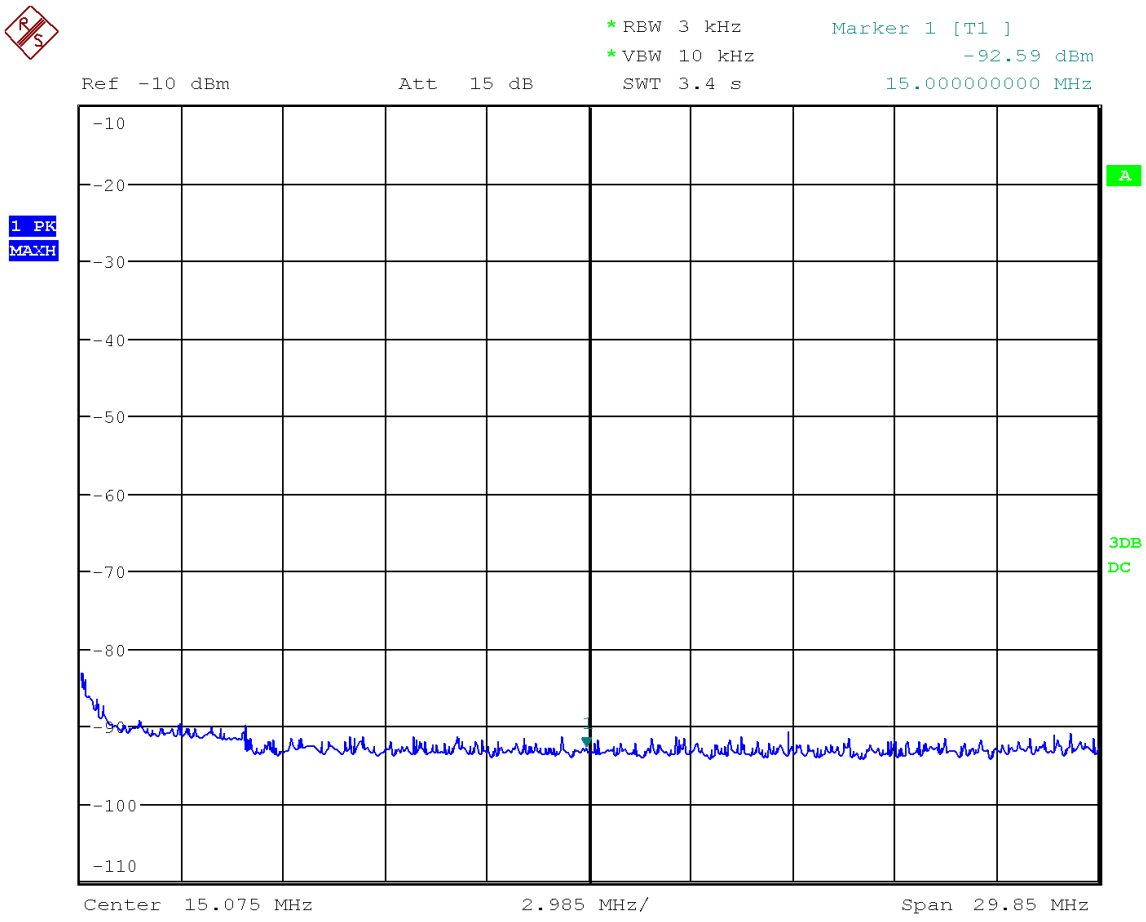
Table 16- Results – Antenna Spurious Conducted

10.1.4.1 Graphs

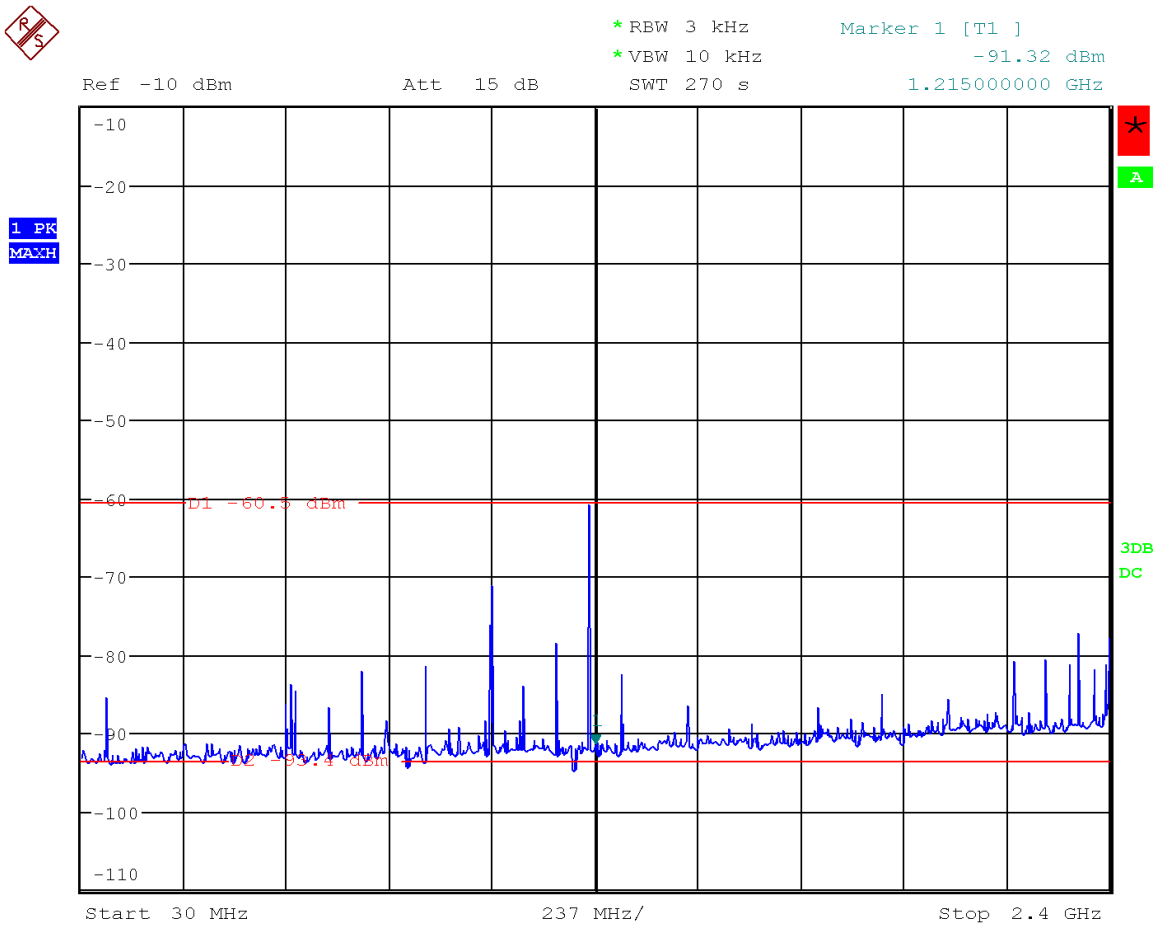
The graphs shown below show the worst-case peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. No attenuator was used between the EUT and the Spectrum Analyzer



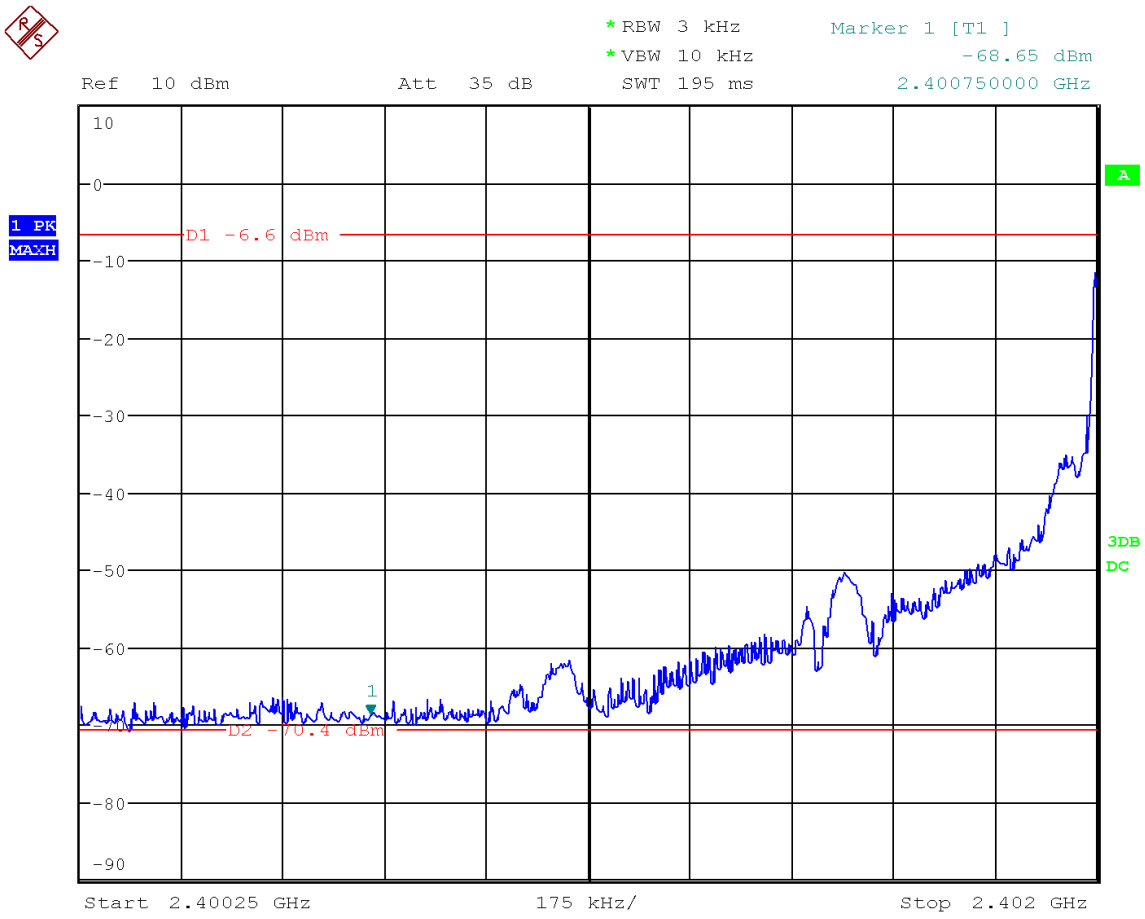
Graph 19 Test Results – ASCE – 9kHz to 150kHz –Channel #0



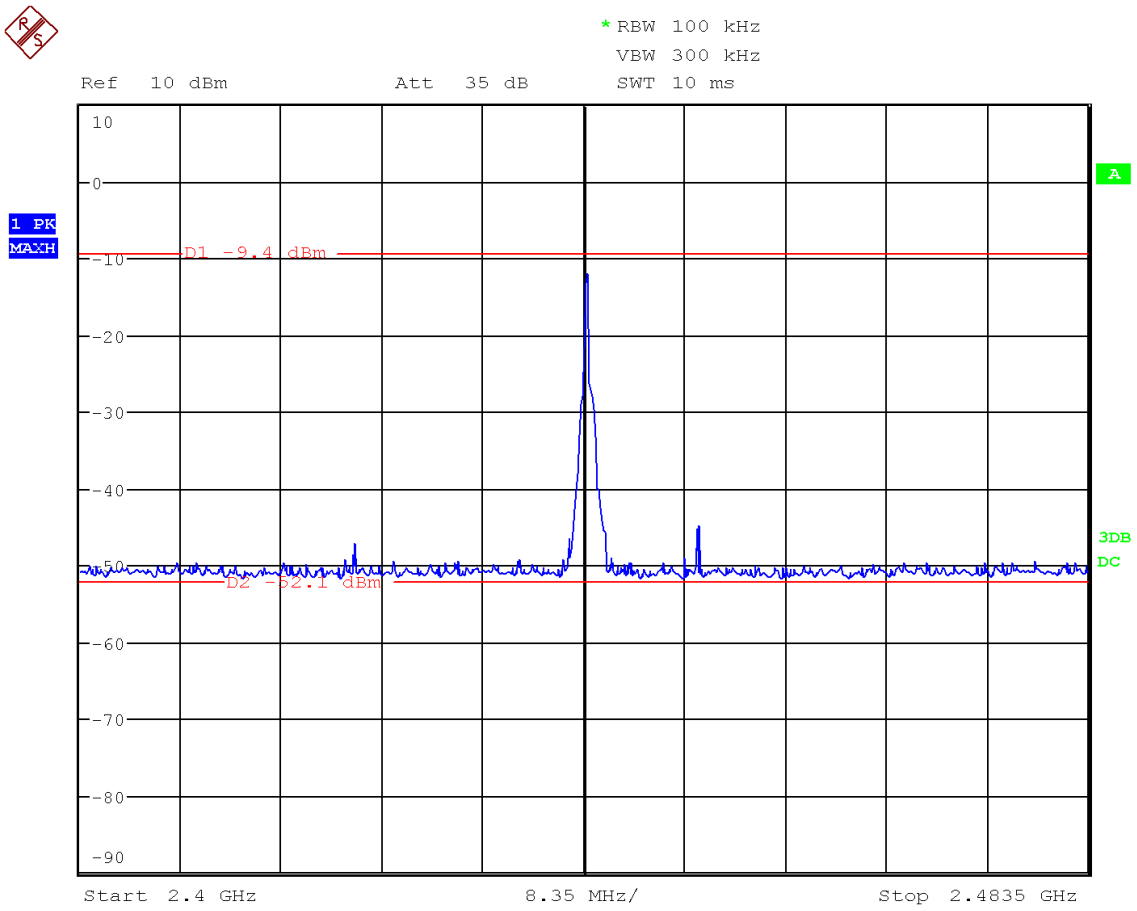
Graph 20 Test Results – ASCE –150kHz to 30MHz – Channel #0



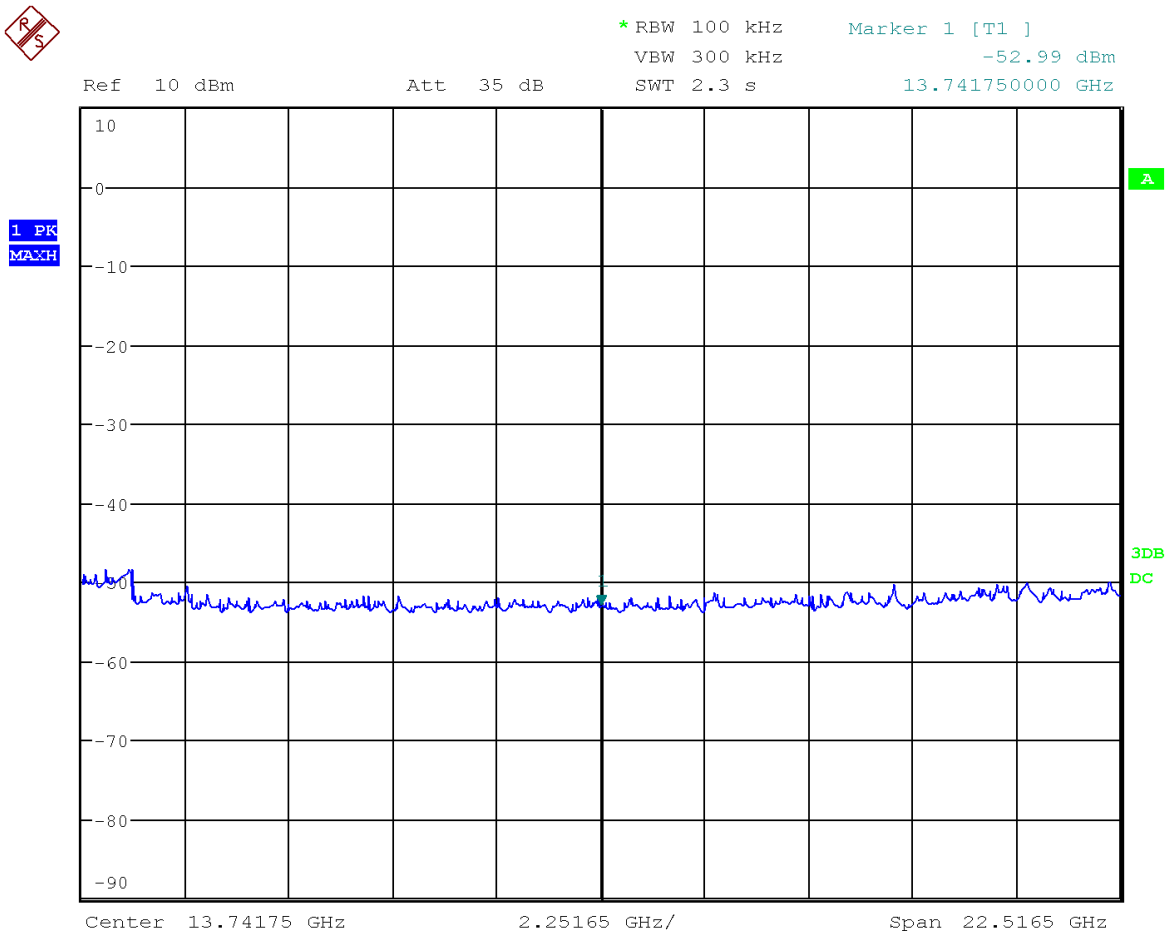
Graph 21 Test Results – ASCE –30MHz to 2.4GHz– Channel #0



Graph 22 Test Results – ASCE –2.4GHz to 2.402GHz– Channel #0



Graph 23 Test Results – ASCE –2.402GHz to 2.4835GHz– Channel #0



Graph 24 Test Results – ASCE –2.4835GHz to 25GHz– Channel #0

10.1.5 Test Instruments

This test was carried out in Laval test location

Equipment	Model No.	Manufacturer	Calibration Period (months)	Calibration Due (YYY-MM-DD)	Asset No: LAVE
Spectrum Analyzer	ESU-40	Rohde & Schwarz	24	2021-04-20	4092
Cable 300mm SMA 90	SUCOFLEX-100	Huber+ Suhner	NCR	NCR	4310

Table 17 – Test Instrumentation – Antenna Conducted Spurious Emission

11 Tx Spurious Radiated Emissions

11.1.1 Purpose & Method

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference. The method is as defined in Section 12.2 of FCC KDB 558074 and ANSI C63.10.

The limits, as defined in 15.247(d) for intentional radiated emissions, apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a) of the FCC standard. These emissions must comply with the radiated emission limits specified in Section 15.209(a) of the FCC standard.

All unintentional emissions must also meet the 'Spurious Conducted Emissions' requirements of -20 dBc or greater. See also 'Antenna Spurious Conducted Emissions' for further details.

Frequency	Limit
0.009 MHz – 0.490 MHz	2400/F(kHz) uV/m at 300m([1])
0.490 MHz – 1.705 MHz	24000/F(kHz) uV/m at 30m ([1])
1.705 MHz – 30 MHz	30 uV/m at 30m([1])
30 MHz – 88 MHz	100 uV/m (40.0 dBuV/m) at 3m ([1])
88 MHz – 216 MHz	150 uV/m (43.5 dBuV/m) at 3m ([1])
216 MHz – 960 MHz	200 uV/m (46.0 dBuV/m) at 3m ([1])
Above 960 MHz	500 uV/m (54.0 dBuV/m) at 3m ([1])
Above 1000 MHz	500 uV/m (54 dBuV/m) at 3m ([2])
Above 1000 MHz	500 uV/m (74 dBuV/m) at 3m ([3])
[1]Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1 [2]Limit is with 1 MHz measurement bandwidth and using an Average detector [3]Limit is with 1 MHz measurement bandwidth and using a Peak detector	

Table 18 Limits – Tx Spurious

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

11.1.2 Test Specifications

REFERENCE STANDARD	FCC Part 15.247(d) RSS-247 5.5 ANSI C63.10 Clause 5.5, 5.6 and 11.12
SPECIFICATIONS	
Limit (dB)	<20
Frequencies (MHz)	2402 2442 2480
RBW (kHz):	300
VBW (kHz)	1000
EUT	
Identification	MY01
Voltage Input	3Vdc
ENVIROMENTAL & TEST INFO	
Test Date (YYYY-MM-DD)	2019-08-19
Temperature (°C)	22 ± 2
Humidity (%)	61 ± 5
Atmospheric Pressure kPa (For Info Only)	99.9
Tester	Abdoulaye Ndiaye Jose Martinez-Ortega
Client Witness	Mohamad Nizar Kezzo, Chrouk Kasem

11.1.3 **Test Setup**

As per ANSI C63.10 Clause 6.3.1, below 1GHz, the height of the EUT was set to 80cm. And above 1GHz, the height was set to 1.5m.

Photo 2: – Test Setup – 15kHz to 30MHz

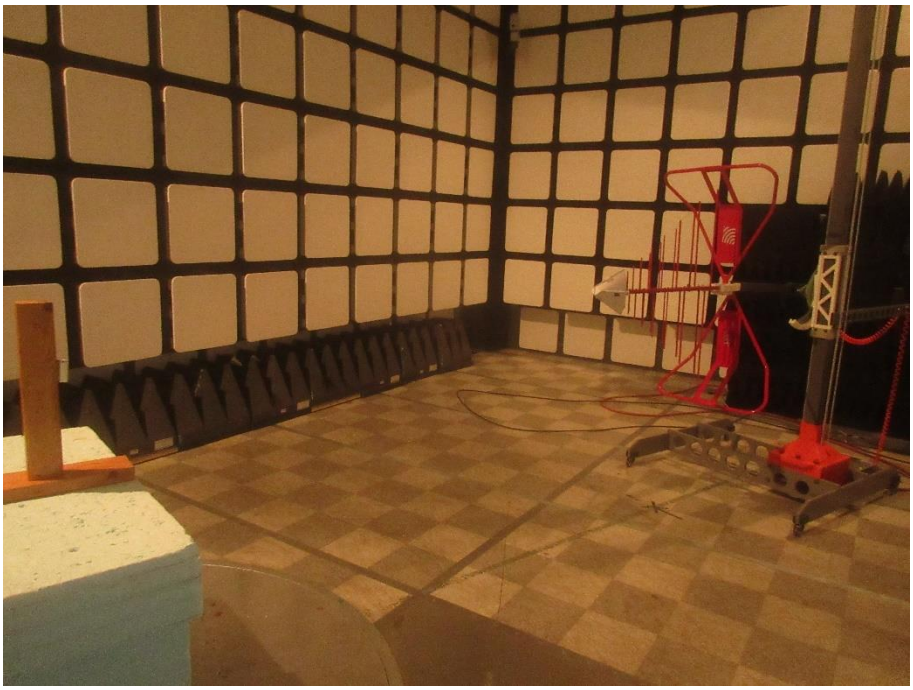


Photo 3: – Test Setup – 30MHz to 1GHz – Vertical Polarization

Photo 4: – Test Setup >1GHz – Horizontal Polarization

11.1.4 Results

The EUT passed. Low, medium, and high bands were tested. The worst-case are only presented and final measurements are given in Appendix A.

Channel	Frequency Range (MHz)	Frequency (MHz)	Polarization	Detector	Limit	Margin	Results
#0	0.009 – 0.015	-	-	-	See Table 18	Note 1	
	0.015 – 30					Note 1	
	30 – 1000	736.576	Vertical	Peak		2.7	Pass
	>1000	17996.9	Vertical	Average		2.5	Pass
#20	0.009 – 0.015	-	-	-		Note 1	Pass
	0.015 – 30					Note 1	Pass
	30 – 1000	736.478	Vertical	Peak		2.5	Pass
	>1000	17991.1	Horizontal	Average		2.5	Pass
#39	0.009 – 0.015	-	-	-		Note 1	Pass
	0.015 – 30					Note 1	
	30 – 1000	734.828	Vertical	Peak		8.9	Pass
	>1000	17998.8	Horizontal	Average		3.1	Pass
Note 1: No significant emission, i.e., 10dB below the limit was noted							

Table 19 – Test Results for Tx Spurious Emission – Worst Cases

11.1.4.1 Graphs

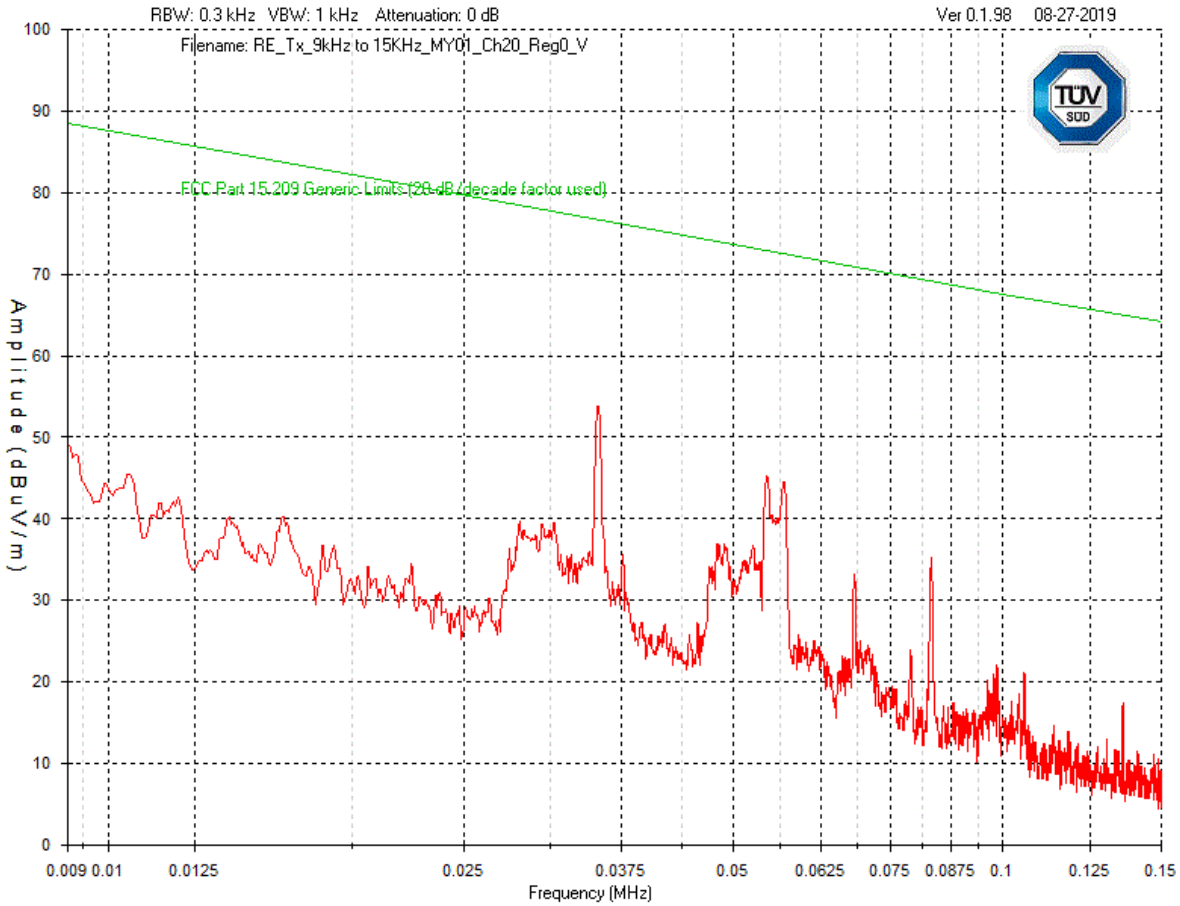
The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst-case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10th harmonic (a minimum of 24.835 GHz).

Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz for example, for 1-meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

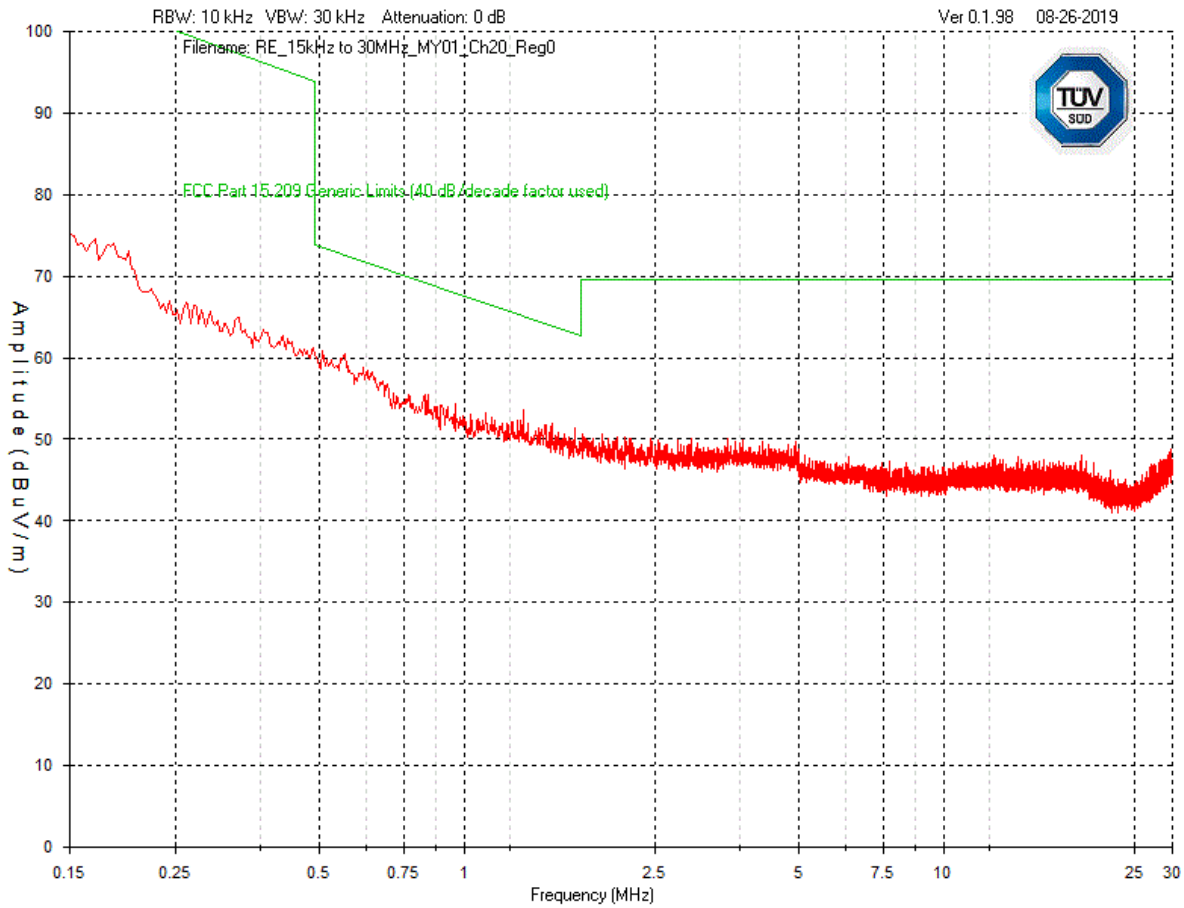
Low, middle and high channels. However, the worst-case graphs are presented.

11.1.4.2 Frequency range from 9kHz to 150kHz



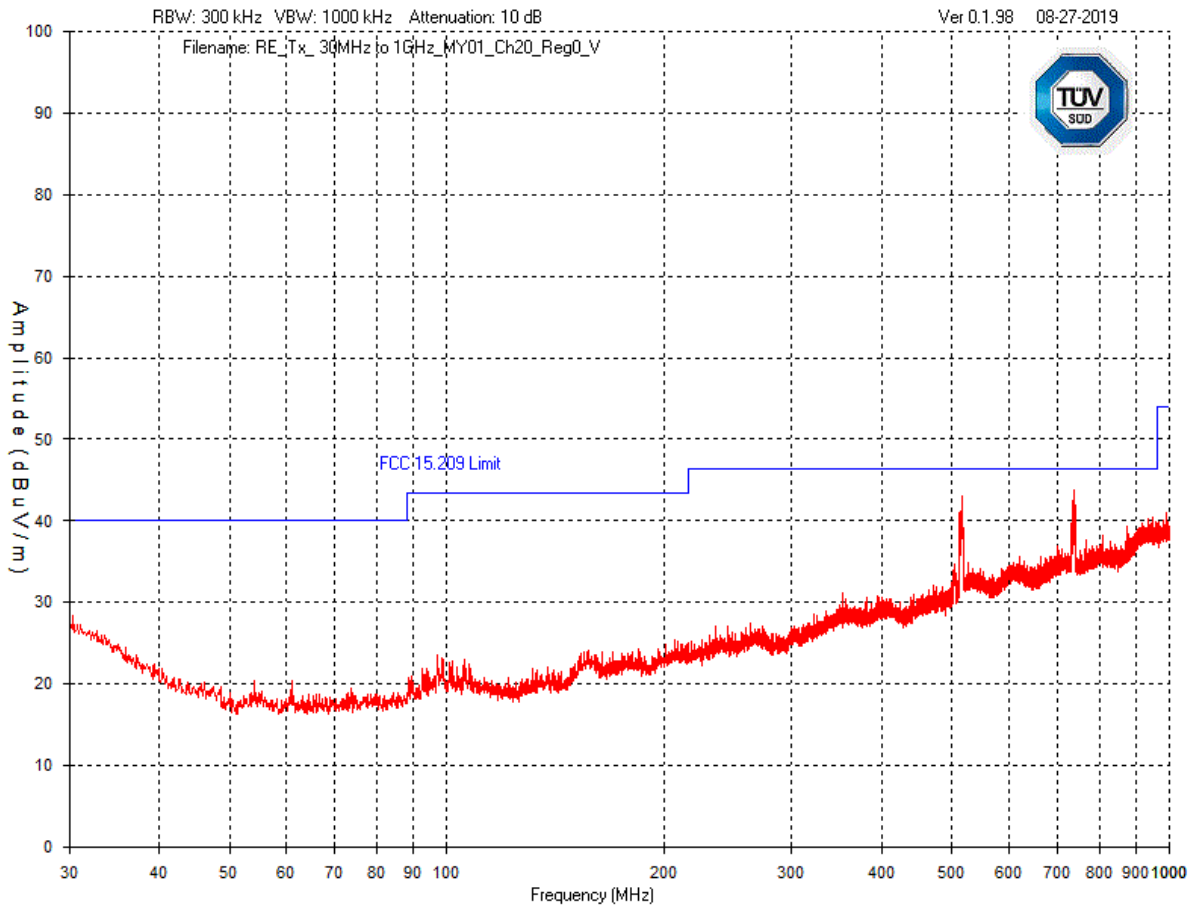
Graph 25 Test Results – Tx Spurious emission 9kHz – 150kHz-(Vertical polarisation): Channel #20

11.1.4.3 Frequency range from 150kHz to 30MHz



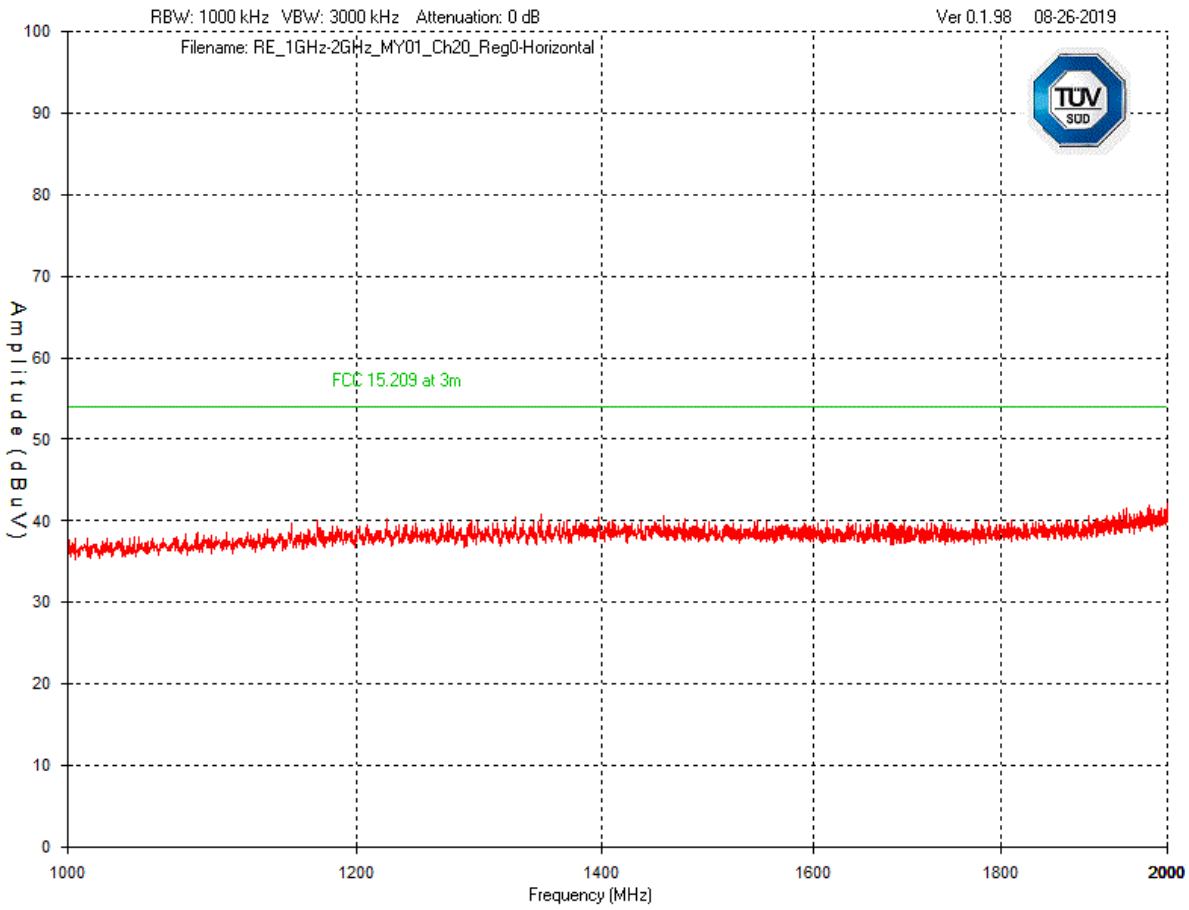
Graph 26 Test Results – Tx Spurious emission 150kHz – 30MHz-(Vertical polarisation): Channel #20

11.1.4.4 Frequency Range from 30MHz to 1GHz – Worst case – Channel #20



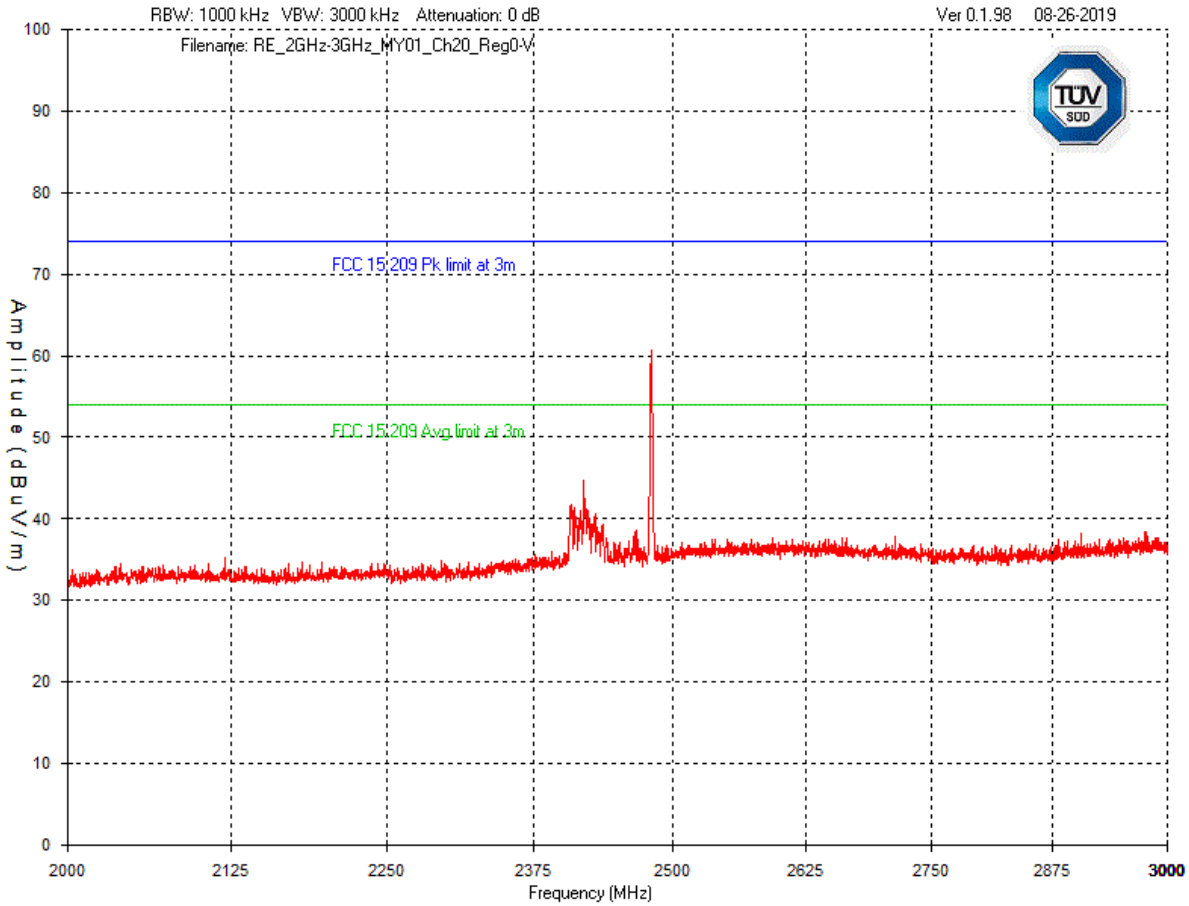
Graph 27 Test Results – Tx Spurious emission 30MHz – 1GHz-(Vertical polarisation): Channel #20

11.1.4.5 Frequency Range 1GHz –2GHz Worst case – Channel #20



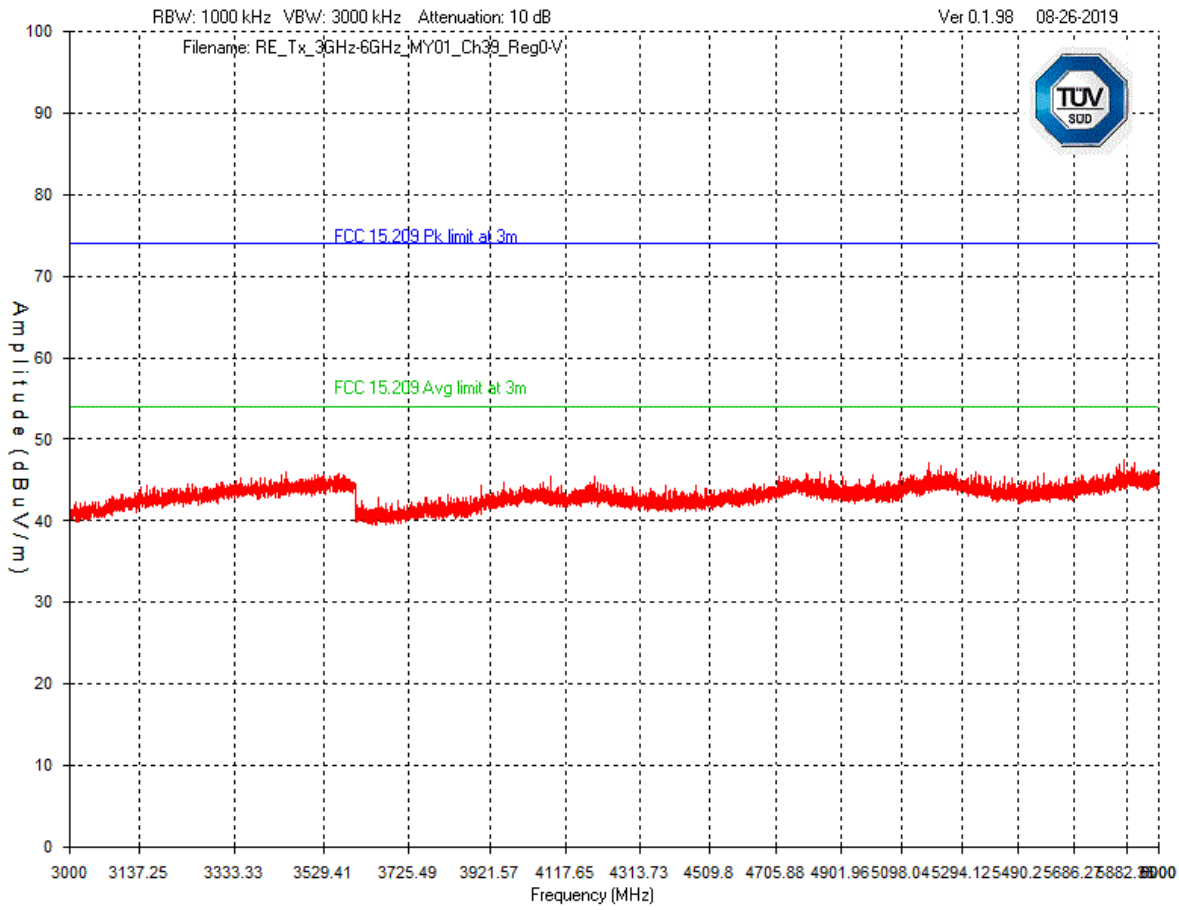
Graph 28 Test Results – Tx Spurious emission 1GHz – 2GHz-(Vertical polarisation): Channel #20

11.1.4.6 Frequency Range from 2GHz to 3GHz – Worst case – Channel #20



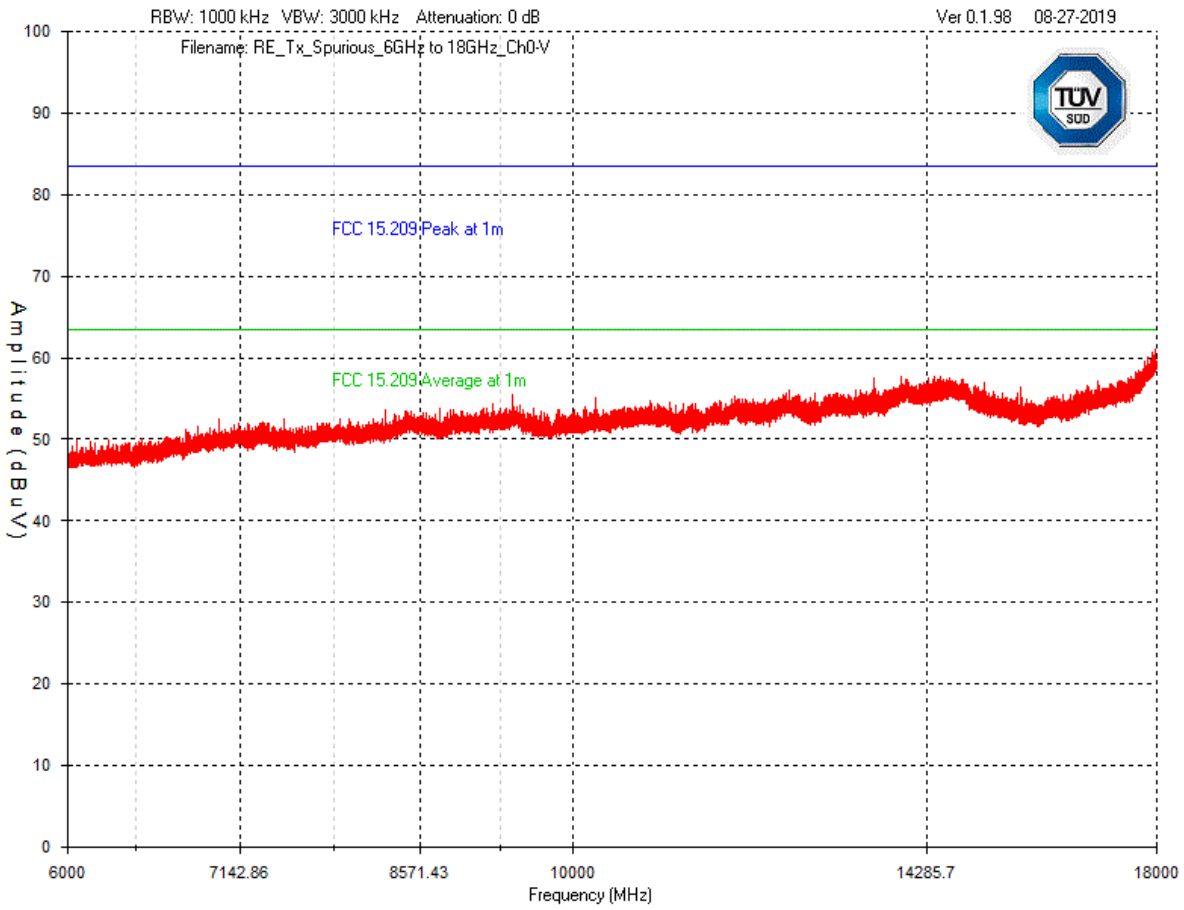
Graph 29 Test Results – Tx Spurious emission 2GHz – 3GHz-(Vertical polarisation): Channel #20

11.1.4.7 Frequency Range 3GHz – 6GHz – Worst case – Channel #39



Graph 30 Test Results – Tx Spurious emission 3GHz – 6GHz-(Vertical polarisation): Channel #39

11.1.4.8 Frequency Range 6GHz – 18GHz – Worst case – Channel 0



Graph 31 Test Results – Tx Spurious emission 6GHz – 18GHz-(Vertical polarisation): Channel #0

11.1.5 Test Instruments

This test was carried out in Laval test location.

Equipment	Model No.	Manufacturer	Calibration Period (months)	Calibration Due (YYY-MM-DD)	Asset No LAV0
Spectrum Analyzer	ESU-40	Rohde & Schwarz	24	2021-04-20	4092
BiLog Antenna	3142-E	ETS	24	2021-11-29	4002
Attenuator 4 dB	20181128A	KLP	24	2021-11-29	4300
Horn Antenna	ATH1G18G	AR	24	2021-04-25	4005
Attenuator 6 dB	FP-50-3	Trilithic	NCR	NCR	4125
LPA pre-amp	Keysight	LPA-10-20	24	2021-02-28	244
1-26.5GHz preamp	Agilent	8449B	NCR	NCR	4006
RF Cable 10m	LMR-400-10M-50OHM-MN-MN	LexTec	NCR	NCR	4025
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	4026
Emission software	0.1.94	Global EMC	NCR	NCR	4058

Table 20 – Test Instrumentation – Tx Spurious Emission

Tx Spurious Emissions – Worst Cases

Frequency	Detector	Raw Reading	Antenna - Bilog3142E_V Factor	Atten 10dB Factor	Cable 27 - 10m LMR400 Factor	Cable 28 - 7m LMR400 Factor	Preamp-LNA1450 Factor	Level	FCC 15.209 Limit	FCC 15.209 Limit Margin
736.576	PEAK	39.4	25.2	10	1.2	0.9	-33	43.7	46	2.3
734.828	PEAK	38.6	25.3	10	1.2	0.9	-33	43	46	3
516.359	PEAK	41.1	23.2	10	1	0.7	-33.2	42.8	46	3.2
512.573	PEAK	39.9	23	10	1	0.7	-33.2	41.4	46	4.6
844.645	PEAK	30.2	25.6	10	1.3	0.9	-32.7	35.3	46	10.7
30.3884	PEAK	30.6	19	10	0.3	0.2	-32.4	27.7	40	12.3

Table A.1 Tx Spurious Emission Channel #0 – 30MHz to 1GHz – Vertical Polarization

Frequency	Detector	Raw Reading	Antenna - Bilog3142E_V Factor	Atten 10dB Factor	Cable 27 - 10m LMR400 Factor	Cable 28 - 7m LMR400 Factor	Preamp-LNA1450 Factor	Level	FCC 15.209 Limit	FCC 15.209 Limit Margin
30.3884	PEAK	31.2	19	10	0.3	0.2	-32.4	28.3	40	11.7
96.997	PEAK	33.4	13	10	0.5	0.3	-33.5	23.7	43.5	19.8
516.165	PEAK	41.4	23.2	10	1	0.7	-33.2	43.1	46	2.9
734.634	PEAK	38.1	25.3	10	1.2	0.9	-33	42.5	46	3.5
736.478	PEAK	39.5	25.3	10	1.2	0.9	-33	43.9	46	2.1
989.319	PEAK	33.3	27.1	10	1.4	1	-31.9	40.9	54	13.1

Table A.2 Tx Spurious Emission Channel #20 –30MHz – 1GHz: Vertical Polarization

Frequency	Detector	Raw Reading	Antenna - Bilog3142E_V Factor	Atten 10dB Factor	Cable 27 - 10m LMR400 Factor	Cable 28 - 7m LMR400 Factor	Preamp-LNA1450 Factor	Level	FCC 15.209 Limit	FCC 15.209 Limit Margin
31.2623	PEAK	30.9	18.6	10	0.3	0.2	-32.4	27.6	40	12.4
96.7057	PEAK	31.5	12.9	10	0.5	0.3	-33.5	21.7	43.5	21.8
299.833	PEAK	32	17.7	10	0.8	0.6	-33.3	27.8	46	18.2
405.96	PEAK	31.6	20.8	10	0.9	0.6	-33.3	30.6	46	15.4
516.068	PEAK	35.3	23.2	10	1	0.7	-33.2	37	46	9
602.29	PEAK	32.5	24.2	10	1.1	0.8	-33.2	35.4	46	10.6
688.707	PEAK	32.5	25.5	10	1.2	0.8	-33.1	36.9	46	9.1
734.828	PEAK	33.1	25.3	10	1.2	0.9	-33	37.5	46	8.5
980.775	PEAK	32.8	27.1	10	1.4	1	-31.9	40.4	54	13.6

Table A.3 Tx Spurious Emission Channel #39 –30MHz – 1GHz: Vertical Polarization

Frequency	Detector	Raw Reading	Ant DRG 1GHz to 18GHz Factor	Cable RE Blue SMA Short1 Factor	Cable RE Blue SMA Short2 Factor	Preamp - HP 8449B 4006 Factor	Level	FCC 15.209 Average at 1m Limit	FCC 15.209 Peak at 1m Limit	FCC 15.209 Average at 1m Margin	FCC 15.209 Peak at 1m Margin
7471.28	PEAK	44.6	36.9	2	2	-33	52.5	63.5	83.5	11	31
9407.15	PEAK	46.3	38.7	2	2	-33.6	55.4	63.5	83.5	8.1	28.1
10229.4	PEAK	45.3	39.1	2	2	-33.4	55	63.5	83.5	8.5	28.5
12425.7	PEAK	44.3	40.2	2.1	2.1	-32.6	56.1	63.5	83.5	7.4	27.4
13531.5	PEAK	44.4	40.1	2.1	2.1	-31.2	57.5	63.5	83.5	6	26
14483.6	PEAK	43.7	41.9	2.1	2.1	-31.9	57.9	63.5	83.5	5.6	25.6
17996.9	PEAK	45	45.1	1.6	1.6	-32.3	61	63.5	83.5	2.5	22.5

Table A.4 Tx Spurious Emission Channel #0–> 1GHz: Vertical Polarization

Frequency	Detector	Raw Reading	Ant DRG 1GHz to 18GHz Factor	Cable RE Blue SMA Short1 Factor	Cable RE Blue SMA Short2 Factor	Preamp - HP 8449B 4006 Factor	Level	FCC 15.209 Average at 1m Limit	FCC 15.209 Peak at 1m Limit	FCC 15.209 Average at 1m Margin	FCC 15.209 Peak at 1m Margin
8178.05	PEAK	45.8	37.4	2	2	-33.2	54	63.5	83.5	9.5	29.5
8602.34	PEAK	45.3	37.9	2	2	-33.3	53.9	63.5	83.5	9.6	29.6
9315.7	PEAK	45.7	38.8	2	2	-33.5	55	63.5	83.5	8.5	28.5
10404.9	PEAK	45	39.4	2	2	-33.2	55.2	63.5	83.5	8.3	28.3
10521.2	PEAK	44.8	39.4	2	2	-33.2	55	63.5	83.5	8.5	28.5
11206.2	PEAK	44.6	39.3	2.1	2.1	-32.8	55.3	63.5	83.5	8.2	28.2
14646.7	PEAK	44.2	41.9	2	2	-32.1	58	63.5	83.5	5.5	25.5
17991.1	PEAK	45	45.1	1.6	1.6	-32.3	61	63.5	83.5	2.5	22.5

Table A.5 Tx Spurious Emission Channel #20–> 1GHz: Horizontal Polarization

Frequency (MHz)	Detector	Raw Reading	Ant DRG 1GHz to 18GHz Factor	Cable RE Blue SMA Short1 Factor	Cable RE Blue SMA Short2 Factor	Preamp - HP 8449B 4006 Factor	Level dB(uV/m)	FCC 15.209 Average at 3m Limit	FCC 15.209 Peak at 3m Limit	FCC 15.209 Average at 3m Margin	FCC 15.209 Peak at 3m Margin
2480.48	PEAK	61.2	28.5	2.3	1.8	-33.1	60.7	54	74	-6.7	13.3
2419.17	PEAK	45.5	28.2	2.3	1.8	-33.1	44.7	54	74	9.3	29.3
2408.66	PEAK	42.6	28.2	2.3	1.8	-33.1	41.8	54	74	12.2	32.2
2411.16	PEAK	42.3	28.2	2.3	1.8	-33.1	41.5	54	74	12.5	32.5
2115.37	PEAK	34.7	26.9	2.1	1.5	-33	32.2	54	74	21.8	41.8
2000	PEAK	35.1	26.6	2.1	1.4	-33.1	32.1	54	74	21.9	41.9
2480.48	PEAK	61.2	28.5	2.3	1.8	-33.1	60.7	54	74	-6.7	13.3
2419.17	PEAK	45.5	28.2	2.3	1.8	-33.1	44.7	54	74	9.3	29.3

Table A.6 Tx Spurious Emission Channel #20–> 1GHz: Vertical Polarization