Company: Silver Spring Networks

Test of: MicroAP 5
To: FCC CFR 47 Part 15.247 (DTS) &
IC RSS-247 (2400 – 2483.5 MHz)

Report No.: SSNT135-U3_Conducted Rev A

TEST REPORT ADDENDUM - CONDUCTED

Issue Date: 1st February 2017

Master Document Number	Addendum Reports
SSNT135-U3_Master	SSNT135-U3_Conducted
	SSNT135-U3_Radiated

This report is only valid in conjunction with the reports listed in the above table. Together these reports address the requirements for the type of device operating under the standard as listed.

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1. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by MiTest. MiTest is an automated test system developed by MiCOM Labs. MiTest is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.

The MiCOM Labs "MiTest" Automated Test System" (Patent Pending)

2. TEST RESULTS

2.1. 6 dB & 99% Bandwidth

Conducted Test Conditions for 6 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	6 dB and 99 % Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(2)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for 6 dB and 99% Bandwidth Measurement
The bandwidth at 6 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits for 6 dB and 99% Bandwidth

(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 and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Equipment Configuration for 6 dB & 99% Bandwidth			
Variant:	2.4 Mbps	**Duty Cycle (%):**	99
Data Rate:	2.40 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Measured 6 dB Bandwidth (MHz) Port(s)				6 dB Bandwidth (MHz)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	KHz	MHz
2401.2	1.098	--	--	--	1.098	1.098	≥500.0	-0.60
2440.8	1.089	--	--	--	1.089	1.089	≥500.0	-0.59
2476.8	1.107	--	--	--	1.107	1.107	≥500.0	-0.61

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				Maximum 99% Bandwidth (MHz)		
MHz	a	b	c	d			
2401.2	1.327	--	--	--	1.327		
2440.8	1.331	--	--	--	1.331		
2476.8	1.309	--	--	--	1.309		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 6 dB & 99% Bandwidth			
Variant:	250 kbps OQPSK	**Duty Cycle (%):**	99
Data Rate:	250.00 KBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OQPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Measured 6 dB Bandwidth (MHz) Port(s)				6 dB Bandwidth (MHz)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	KHz	MHz
2405.0	1.610	--	--	--	1.610	1.610	≥500.0	-1.11
2440.0	1.603	--	--	--	1.603	1.603	≥500.0	-1.10
2480.0	1.590	--	--	--	1.590	1.590	≥500.0	-1.09

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				Maximum 99% Bandwidth (MHz)		
MHz	a	b	c	d			
2405.0	2.212	--	--	--	2.212		
2440.0	2.212	--	--	--	2.212		
2480.0	2.212	--	--	--	2.212		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

2.2. Conducted Output Power

Conducted Test Conditions for Fundamental Emission Output Power			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Output Power	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (b) & (c)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Fundamental Emission Output Power Measurement
In the case of average power measurements an average power sensor was utilized.

For peak power measurements the spectrum analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Testing was performed under ambient conditions at nominal voltage only. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured, summed (Σ) and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.
Supporting Information
Calculated Power = A + G + Y+ 10 log (1/x) dBm

A = Total Power [10*Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)]
G = Antenna Gain
Y = Beamforming Gain
x = Duty Cycle (average power measurements only)

Limits for Fundamental Emission Output Power
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following for non-frequency hopping systems:

(3) For systems using digital modulation in the 902-928 MHz and 2400-2483.5 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. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.
(1) Fixed point-to-point operation:
(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point

operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

Equipment Configuration for Peak Output Power

Variant:	2.4 Mbps	**Duty Cycle (%):**	99.0
Data Rate:	2.40 MBit/s	**Antenna Gain (dBi):**	0.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dB	
2401.2	27.16	--	--	--	27.16	30.00	-2.84	18.00
2440.8	27.14	--	--	--	27.14	30.00	-2.86	18.00
2476.8	26.79	--	--	--	26.79	30.00	-3.21	18.00

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

The above measurements are true pulse readings and therefore a Duty Cycling correction factor is not required.

Equipment Configuration for Peak Output Power

Variant:	250 kbps OQPSK	**Duty Cycle (%):**	99.0
Data Rate:	250.00 KBit/s	**Antenna Gain (dBi):**	0.00
Modulation:	OQPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dB	
2405.0	24.58	--	--	--	24.58	30.00	-5.42	15.00
2440.0	24.16	--	--	--	24.16	30.00	-5.84	15.00
2480.0	4.21	--	--	--	4.21	30.00	-25.79	10.00

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

The above measurements are true pulse readings and therefore a Duty Cycling correction factor is not required.

2.3. Power Spectral Density

Conducted Test Conditions for Power Spectral Density			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Power Spectral Density	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (e)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Power Spectral Density
The transmitter output was connected to a spectrum analyzer and the measured made in a 3 kHz resolution bandwidth using the analyzer auto-coupled sweep-time. A peak value was found over the full emission bandwidth and the spectrum downloaded for post processing purposes.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. The Peak Power Spectral Density is the highest level found across the emission bandwidth. With multiple antenna port measurements the numerical analyzer data from each port is summed (å) and a link to this additional graphic is provided.

Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Measure and sum the spectra across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The individual spectra are then summed mathematically in linear power units. Unlike in-band power measurements, in which the sum involves a single measured value (output power) from each output, measurements for compliance with PSD limits involve summing entire spectra across corresponding frequency bins on the various outputs. Consistency is maintained for any device with multiple transmitter outputs to be certain the individual outputs are all aligned with the same span and same number of points. In this instance, the linear power spectrum value within the first spectral bin of output 0 is summed with that in the first spectral bin of output 1, and the first spectral bin of output 2, and so on up to the Nth output to obtain the true value for the first frequency bin of the summed spectrum. The summed spectrum value for each frequency bin is computed in this fashion. These summed spectral values were post processed and the resulting numerical and graphical data presented.

NOTE:
It may be observed that the spectrum in some antenna port plots break the limit line however this in itself does NOT constitute a failure. In all cases a spectrum summation plot is provided in order to prove compliance. A failure occurs only after the summation of all spectrum plots have been summed and are found to be greater than the limit line.

Supporting Information
Calculated Power = A + 10 log (1/x) dBm
A = Total Power Spectral Density [10 Log10 ($10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10}$)]
x = Duty Cycle

Limits Power Spectral Density
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.

Equipment Configuration for Power Spectral Density - Peak			
Variant:	2.4 Mbps	**Duty Cycle (%):**	99.0
Data Rate:	2.40 MBit/s	**Antenna Gain (dBi):**	0.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/3KHz)				Amplitude Summation	Limit	Margin
MHz	**a**	**b**	**c**	**d**	**dBm/3KHz**	**dBm/3KHz**	**dB**
2401.2	6.569	--	--	--	6.569	8.0	-1.4
2440.8	5.782	--	--	--	5.782	8.0	-2.2
2476.8	4.131	--	--	--	4.131	8.0	-3.9

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Power Spectral Density - Peak			
Variant:	250 kbps OQPSK	**Duty Cycle (%):**	99.0
Data Rate:	250.00 KBit/s	**Antenna Gain (dBi):**	0.00
Modulation:	OQPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/3KHz)				Amplitude Summation	Limit	Margin
MHz	a	b	c	d	dBm/3KHz	dBm/3KHz	dB
2405.0	6.799	--	--	--	6.799	8.0	-1.2
2440.0	6.856	--	--	--	6.856	8.0	-1.1
2480.0	-15.111	--	--	--	-15.111	8.0	-23.1

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

2.4. Emissions

2.4.1. Conducted Emissions

2.4.1.1. Conducted Spurious Emissions

Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Max Unwanted Emission Levels	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (d)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement
Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 30 dBc (average detector) or 20 dBc (peak detector) below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits Transmitter Conducted Spurious and Band-Edge Emissions
(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)).

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	2.4 Mbps	**Duty Cycle (%):**	99
Data Rate:	2.40 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Frequency Range	Transmitter Conducted Spurious Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
2401.2	30.0 - 26000.0	-40.453	-1.00	--	--	--	--	--	--
2440.8	30.0 - 26000.0	-39.717	-2.00	--	--	--	--	--	--
2476.8	30.0 - 26000.0	-40.028	-2.00	--	--	--	--	--	--

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	250 kbps OQPSK	**Duty Cycle (%):**	99
Data Rate:	250.00 KBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OQPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Frequency Range	Transmitter Conducted Spurious Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
2405.0	30.0 - 26000.0	-40.388	-1.00	--	--	--	--	--	--
2440.0	30.0 - 26000.0	-40.362	-2.00	--	--	--	--	--	--
2480.0	30.0 - 26000.0	-40.014	-22.00	--	--	--	--	--	--

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

2.4.1.2. Conducted Band-Edge Emissions

Conducted Low Band-Edge Emissions

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	2.4 Mbps	**Duty Cycle (%):**	99.0
Data Rate:	2.40 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	2401.2 MHz					
Band-Edge Frequency:	2400.0 MHz					
Test Frequency Range:	2350.0 - 2405.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-2.10	2.00	2400.40	--	--	-0.400

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	250 kbps OQPSK	**Duty Cycle (%):**	99.0
Data Rate:	250.00 KBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OQPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	2405.0 MHz					
Band-Edge Frequency:	2400.0 MHz					
Test Frequency Range:	2350.0 - 2405.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-33.53	-1.00	2403.70	--	--	-3.700

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Conducted High Band-Edge Emissions

Equipment Configuration for Conducted High Band-Edge Emissions - Peak			
Variant:	2.4 Mbps	**Duty Cycle (%):**	99.0
Data Rate:	2.40 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	2476.8 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2470.0 - 2533.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-39.50	0.00	2477.60	--	--	-5.900

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted High Band-Edge Emissions - Peak			
Variant:	250 kbps OQPSK	**Duty Cycle (%):**	99.0
Data Rate:	250.00 KBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OQPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	2480.0 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2470.0 - 2533.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-46.15	-21.00	2481.20	--	--	-2.300

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

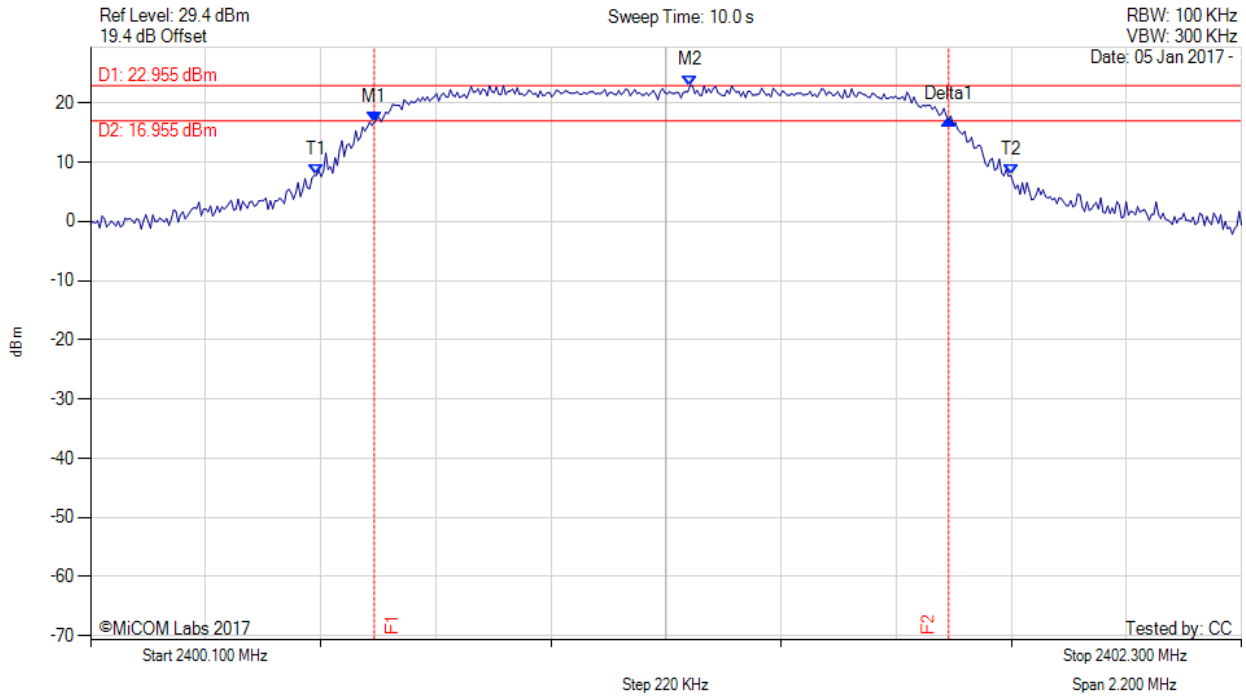
Note: click the links in the above matrix to view the graphical image (plot).

A. APPENDIX - GRAPHICAL IMAGES

A.1. 6 dB & 99% Bandwidth

6 dB & 99% BANDWIDTH

Variant: 2.4 Mbps, Channel: 2401.20 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

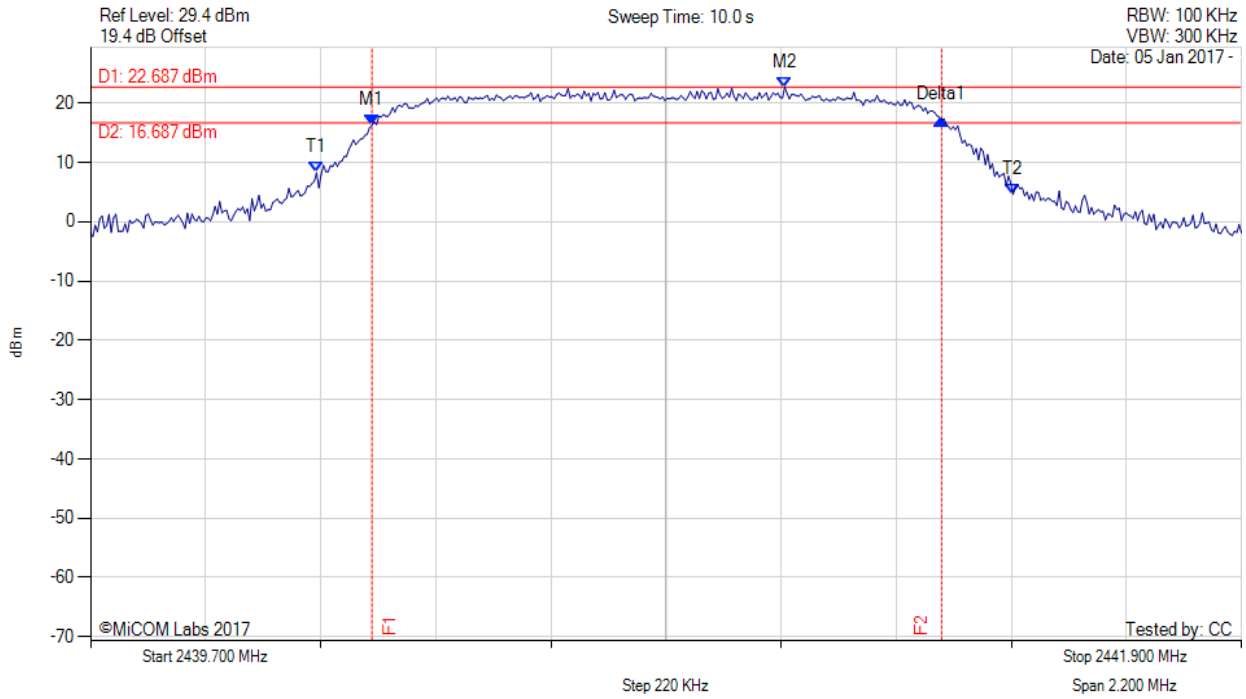


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2400.642 MHz : 16.709 dBm M2 : 2401.246 MHz : 22.955 dBm Delta1 : 1.098 MHz : 0.466 dB T1 : 2400.532 MHz : 7.814 dBm T2 : 2401.859 MHz : 7.777 dBm OBW : 1.327 MHz	Measured 6 dB Bandwidth: 1.098 MHz Limit: ≥500.0 kHz Margin: -0.60 MHz

back to matrix

6 dB & 99% BANDWIDTH

Variant: 2.4 Mbps, Channel: 2440.80 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

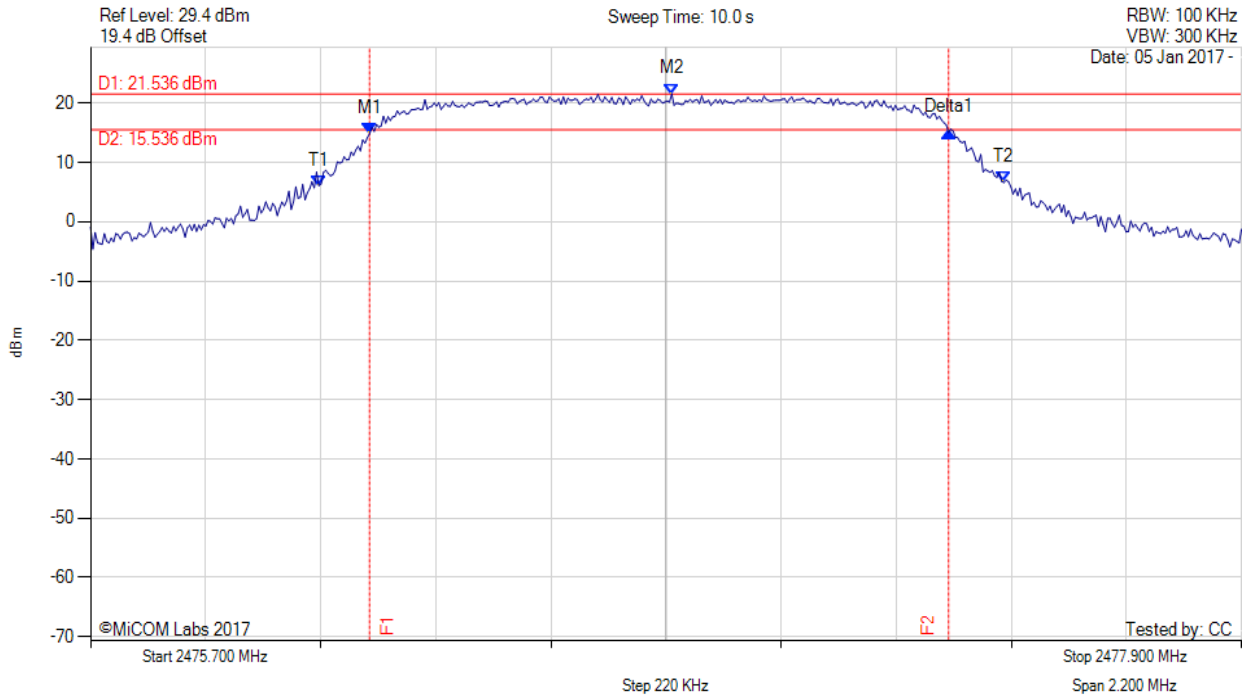


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2440.238 MHz : 16.268 dBm M2 : 2441.027 MHz : 22.687 dBm Delta1 : 1.089 MHz : 0.877 dB T1 : 2440.132 MHz : 8.243 dBm T2 : 2441.464 MHz : 4.607 dBm OBW : 1.331 MHz	Measured 6 dB Bandwidth: 1.089 MHz Limit: ≥500.0 kHz Margin: -0.59 MHz

back to matrix

6 dB & 99% BANDWIDTH

Variant: 2.4 Mbps, Channel: 2476.80 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

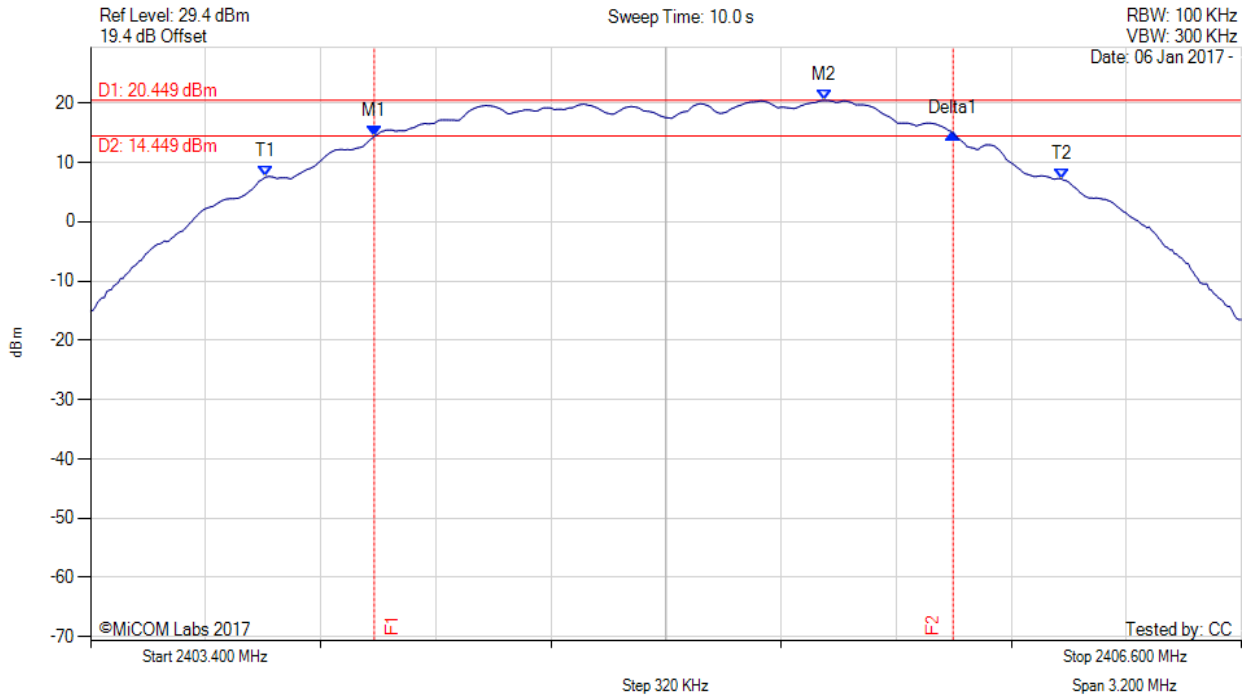


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2476.233 MHz : 14.859 dBm M2 : 2476.811 MHz : 21.536 dBm Delta1 : 1.107 MHz : 0.181 dB T1 : 2476.136 MHz : 6.093 dBm T2 : 2477.446 MHz : 6.606 dBm OBW : 1.309 MHz	Measured 6 dB Bandwidth: 1.107 MHz Limit: ≥500.0 kHz Margin: -0.61 MHz

back to matrix

6 dB & 99% BANDWIDTH

Variant: 250 kbps OQPSK, Channel: 2405.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

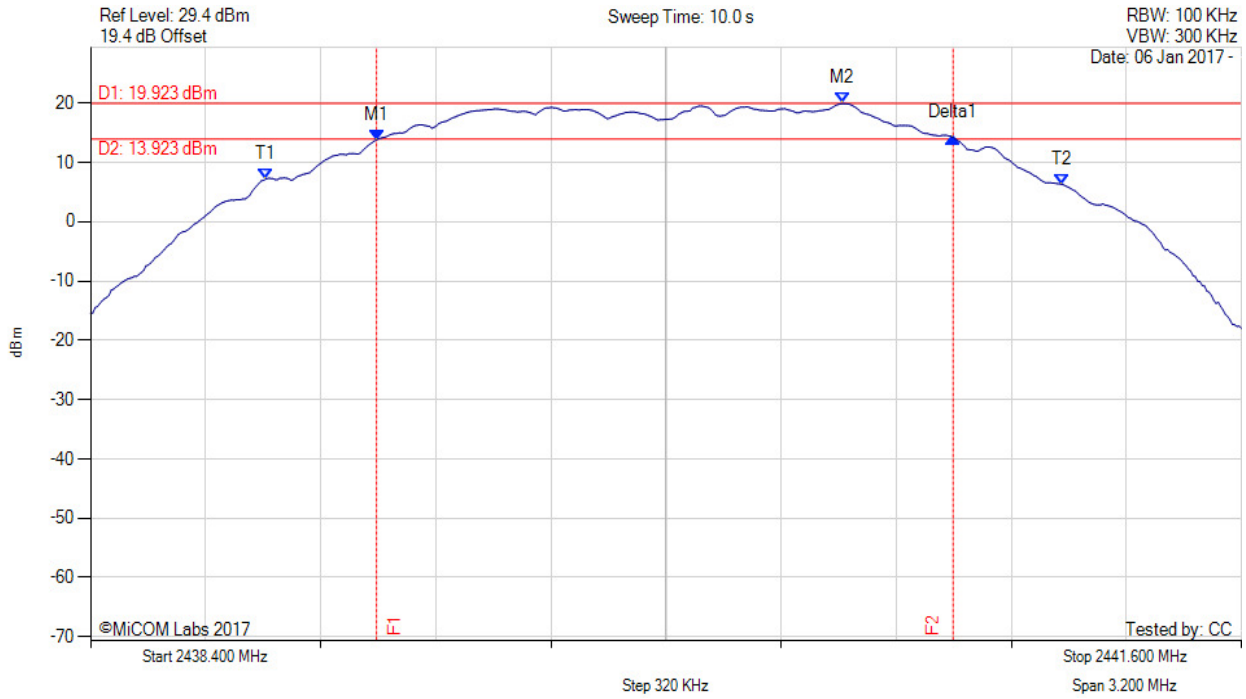


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2404.189 MHz : 14.360 dBm M2 : 2405.439 MHz : 20.449 dBm Delta1 : 1.610 MHz : 0.551 dB T1 : 2403.887 MHz : 7.541 dBm T2 : 2406.100 MHz : 7.212 dBm OBW : 2.212 MHz	Measured 6 dB Bandwidth: 1.610 MHz Limit: ≥500.0 kHz Margin: -1.11 MHz

back to matrix

6 dB & 99% BANDWIDTH

Variant: 250 kbps OQPSK, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

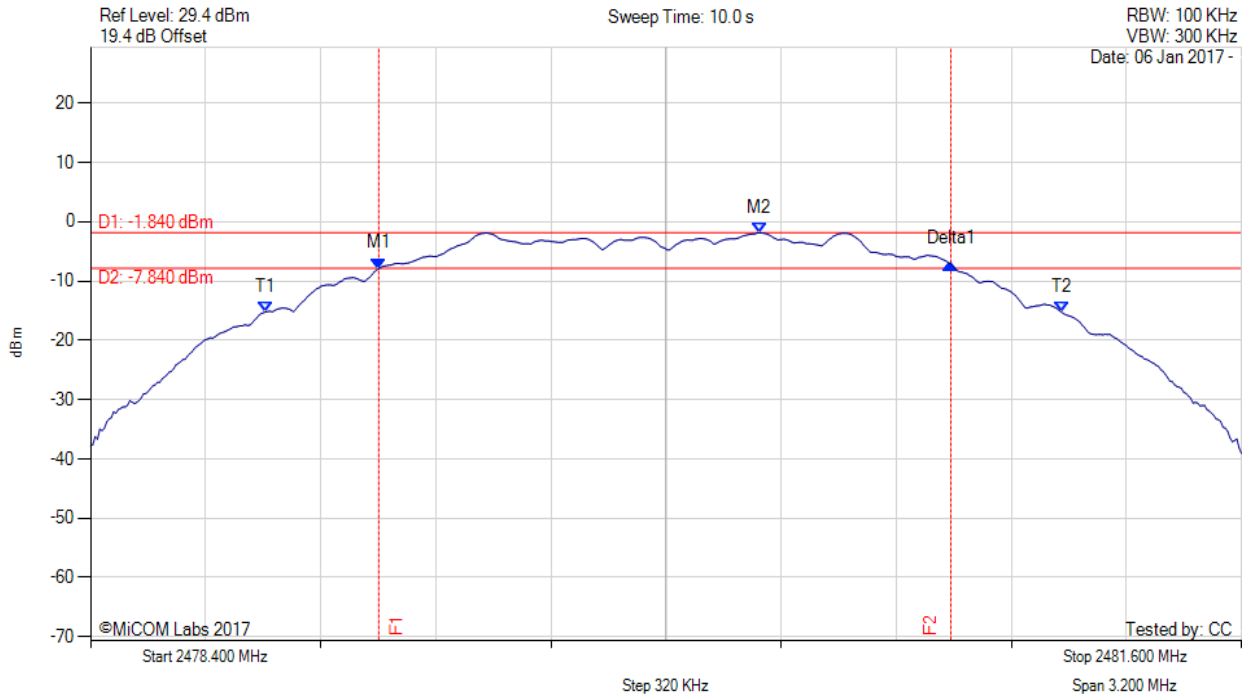


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2439.195 MHz : 13.801 dBm M2 : 2440.491 MHz : 19.923 dBm Delta1 : 1.603 MHz : 0.407 dB T1 : 2438.887 MHz : 7.185 dBm T2 : 2441.100 MHz : 6.305 dBm OBW : 2.212 MHz	Measured 6 dB Bandwidth: 1.603 MHz Limit: ≥500.0 kHz Margin: -1.10 MHz

back to matrix

6 dB & 99% BANDWIDTH

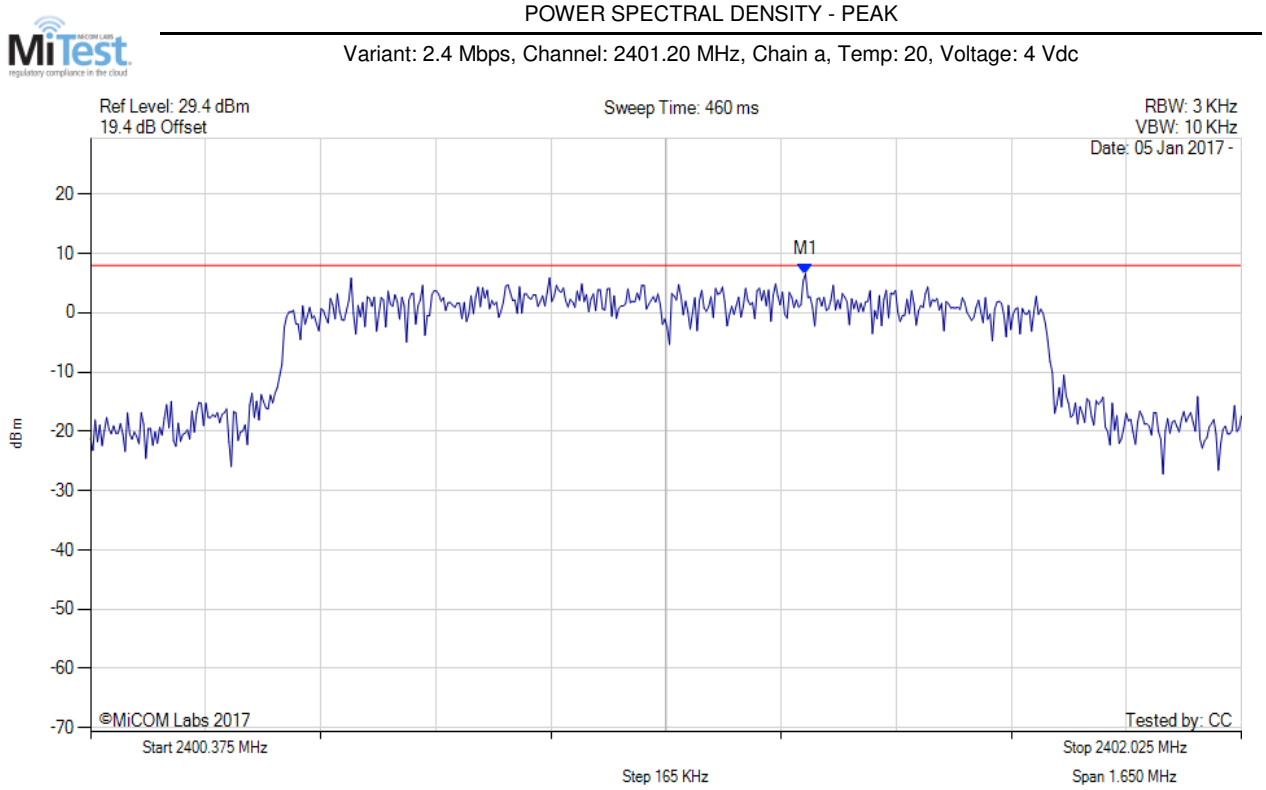
Variant: 250 kbps OQPSK, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2479.202 MHz : -7.915 dBm M2 : 2480.260 MHz : -1.844 dBm Delta1 : 1.590 MHz : 0.763 dB T1 : 2478.887 MHz : -15.222 dBm T2 : 2481.100 MHz : -15.259 dBm OBW : 2.212 MHz	Measured 6 dB Bandwidth: 1.590 MHz Limit: ≥500.0 kHz Margin: -1.09 MHz

back to matrix

A.2. Power Spectral Density

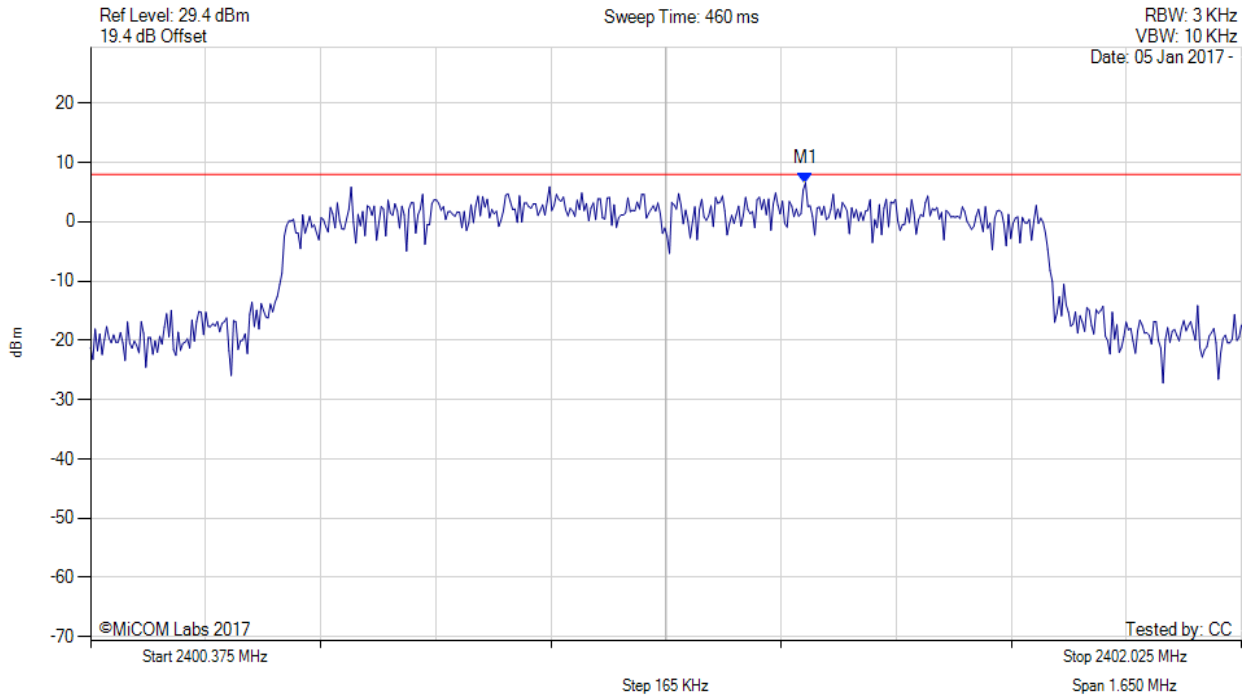


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.400 MHz : 6.569 dBm	Limit: ≤ 8.000 dBm Margin: -1.43 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 2.4 Mbps, Channel: 2401.20 MHz, SUM, Temp: 20, Voltage: 4 Vdc

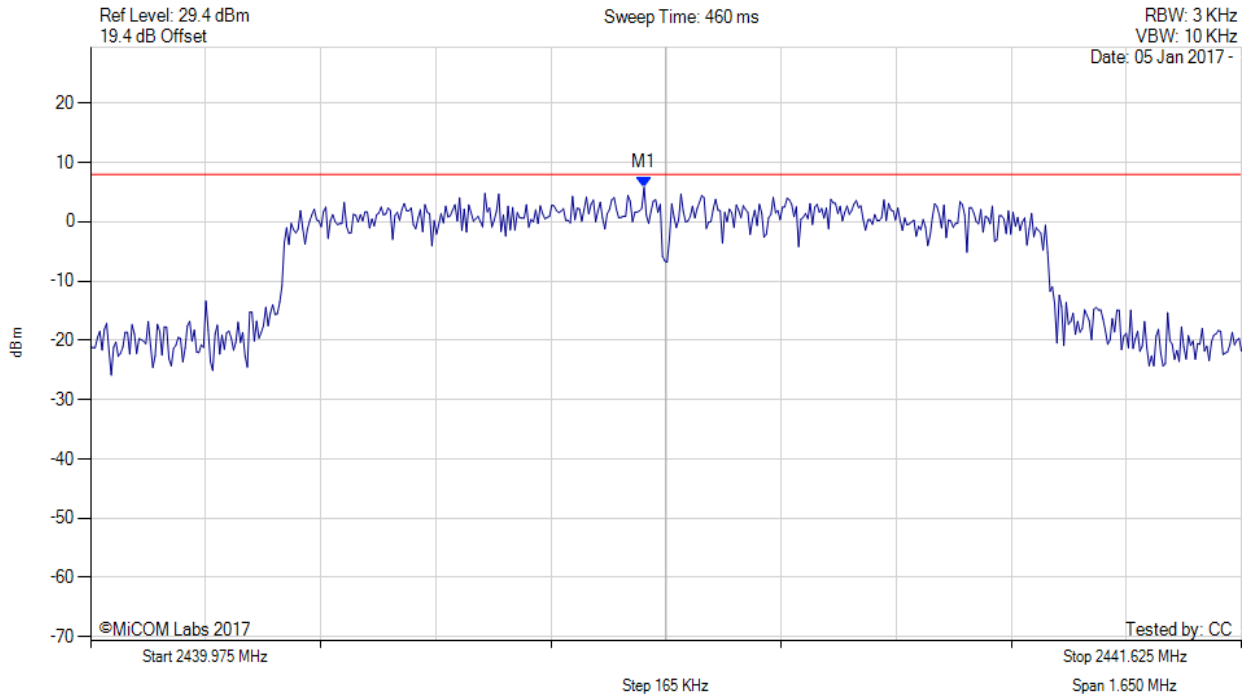


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.400 MHz : 6.569 dBm	Limit: ≤ 8.0 dBm Margin: -1.4 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 2.4 Mbps, Channel: 2440.80 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

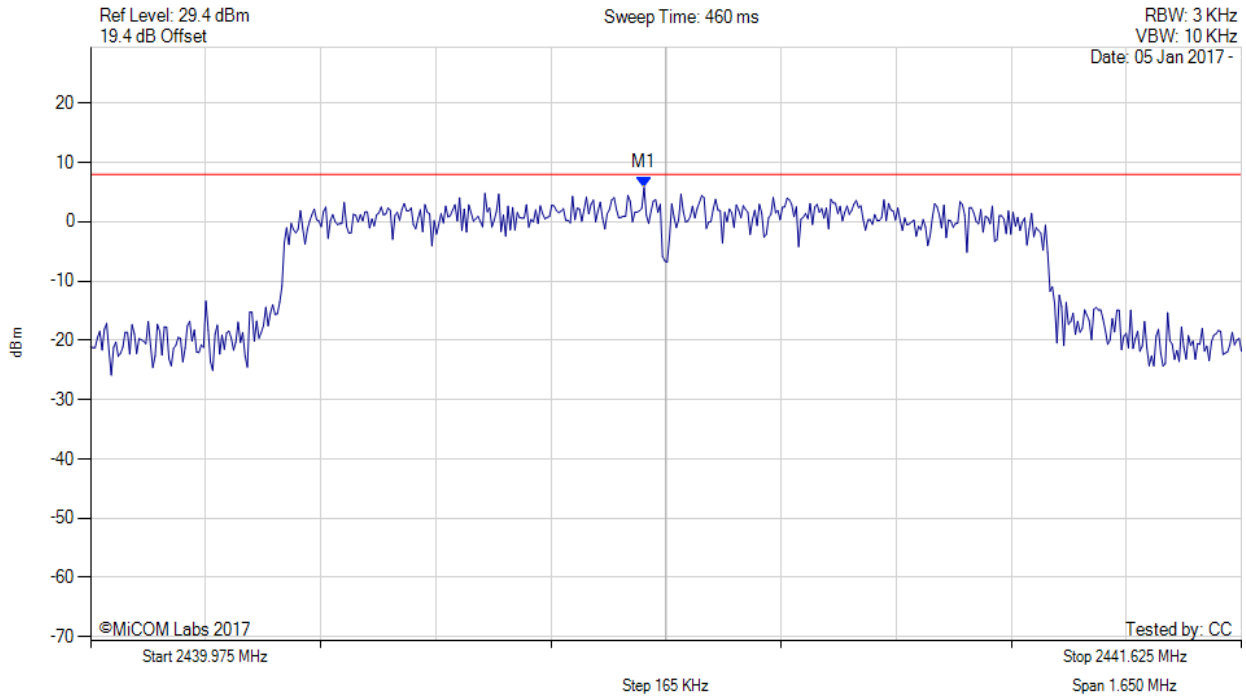


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.769 MHz : 5.782 dBm	Limit: ≤ 8.000 dBm Margin: -2.22 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 2.4 Mbps, Channel: 2440.80 MHz, SUM, Temp: 20, Voltage: 4 Vdc

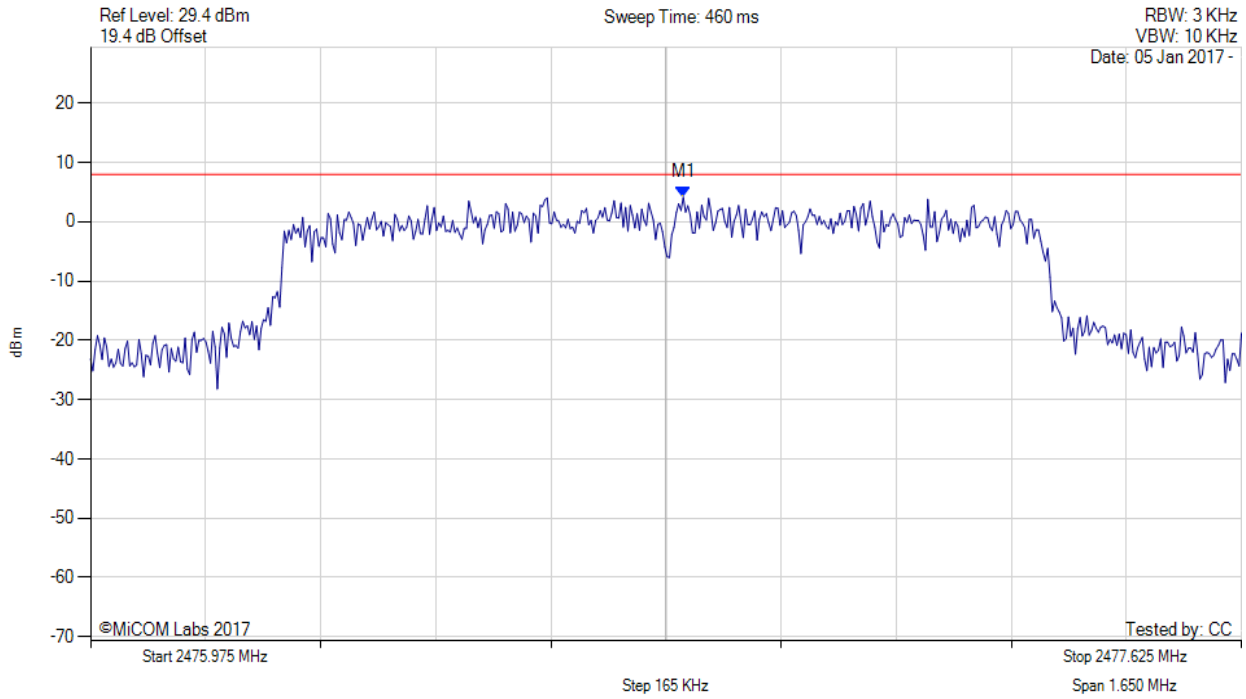


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.769 MHz : 5.782 dBm	Limit: ≤ 8.0 dBm Margin: -2.2 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 2.4 Mbps, Channel: 2476.80 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

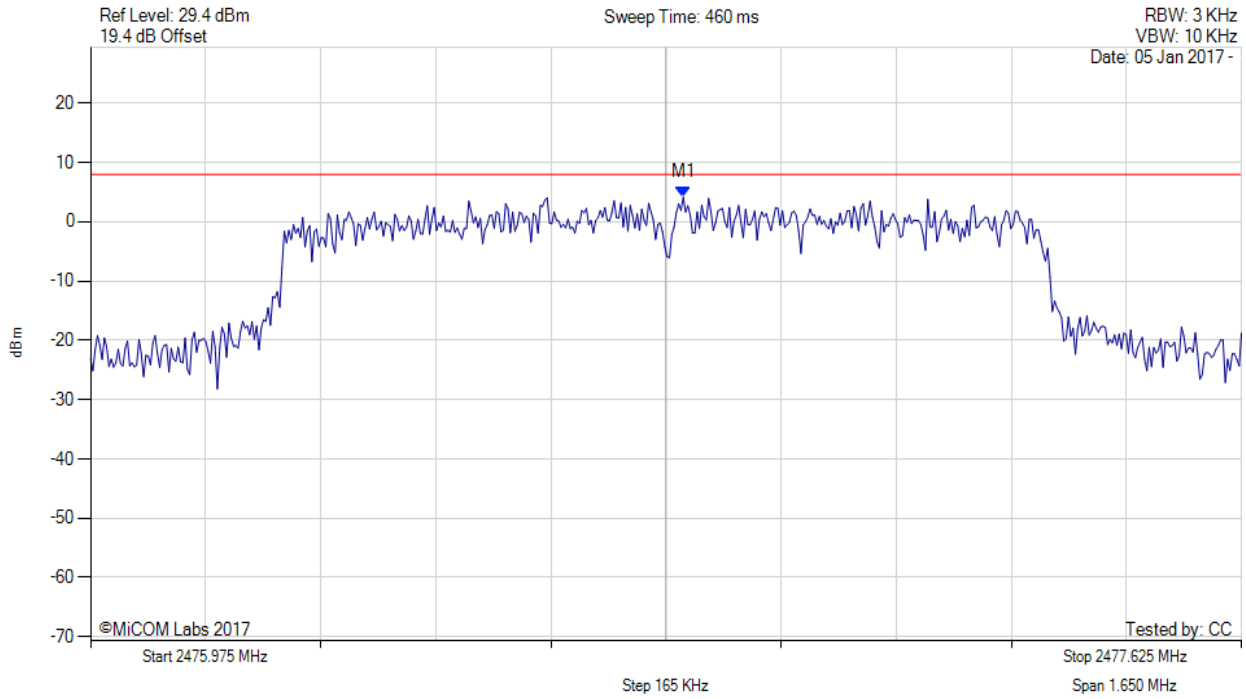


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2476.825 MHz : 4.131 dBm	Limit: ≤ 8.000 dBm Margin: -3.87 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 2.4 Mbps, Channel: 2476.80 MHz, SUM, Temp: 20, Voltage: 4 Vdc

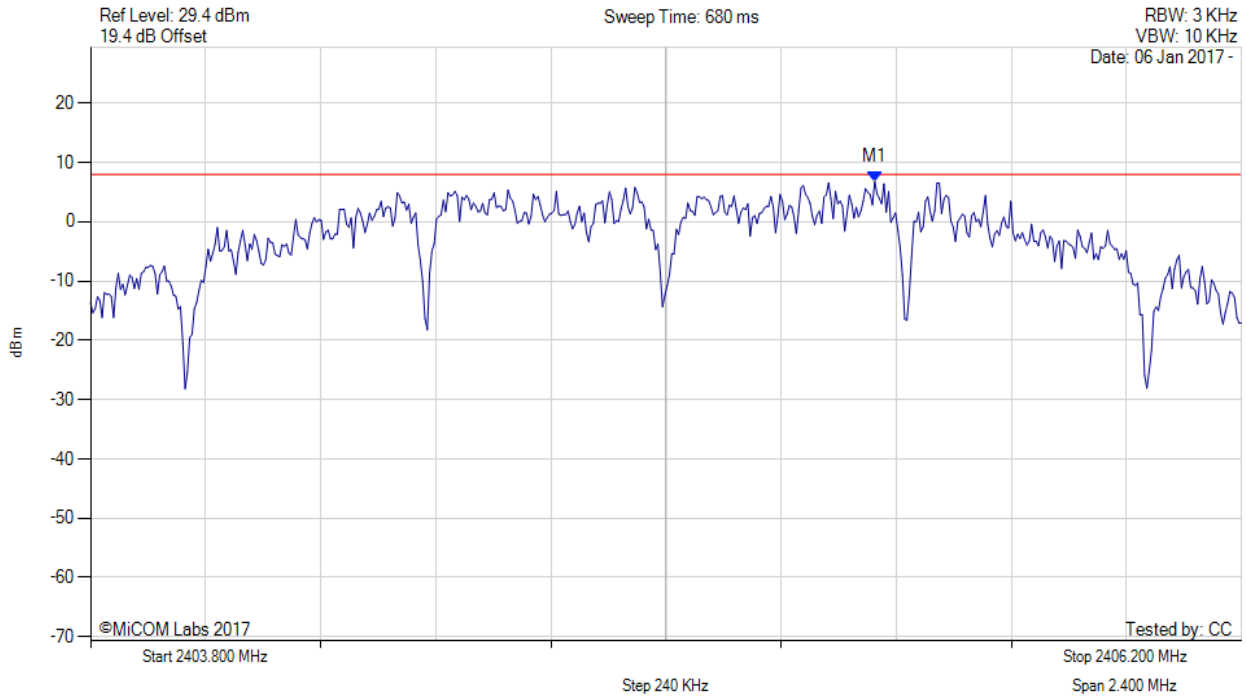


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2476.825 MHz : 4.131 dBm	Limit: ≤ 8.0 dBm Margin: -3.9 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 250 kbps OQPSK, Channel: 2405.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

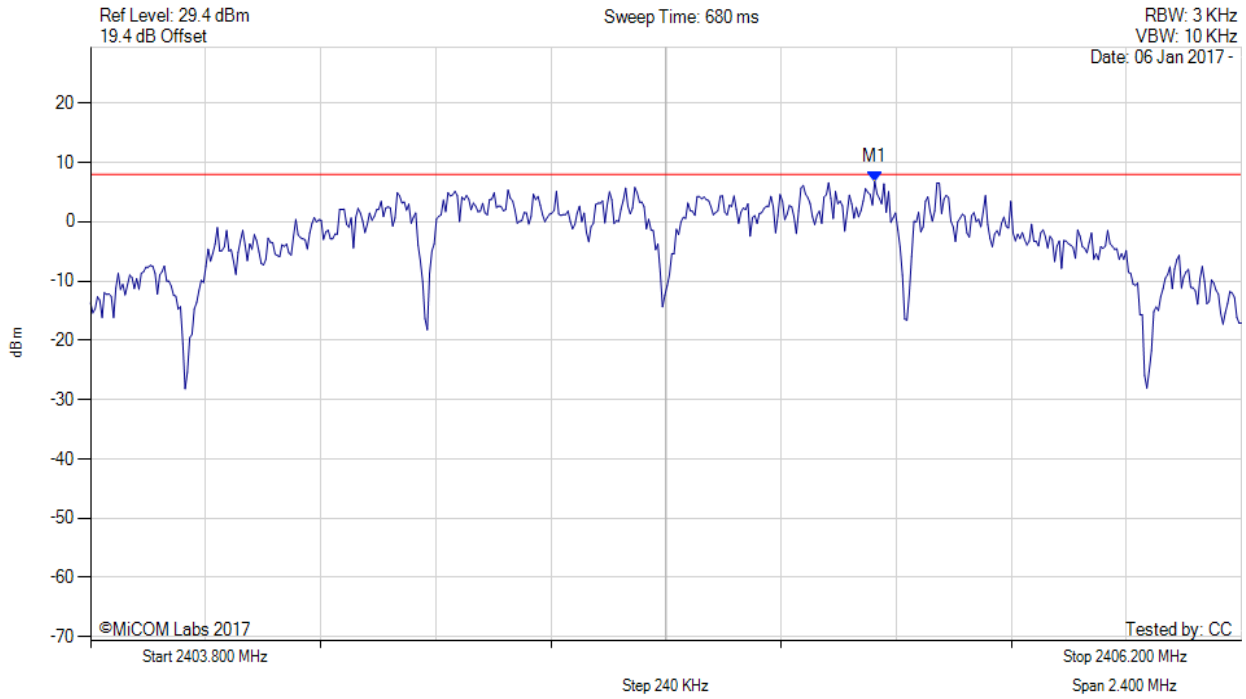


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2405.435 MHz : 6.799 dBm	Limit: ≤ 8.000 dBm Margin: -1.20 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 250 kbps OQPSK, Channel: 2405.00 MHz, SUM, Temp: 20, Voltage: 4 Vdc

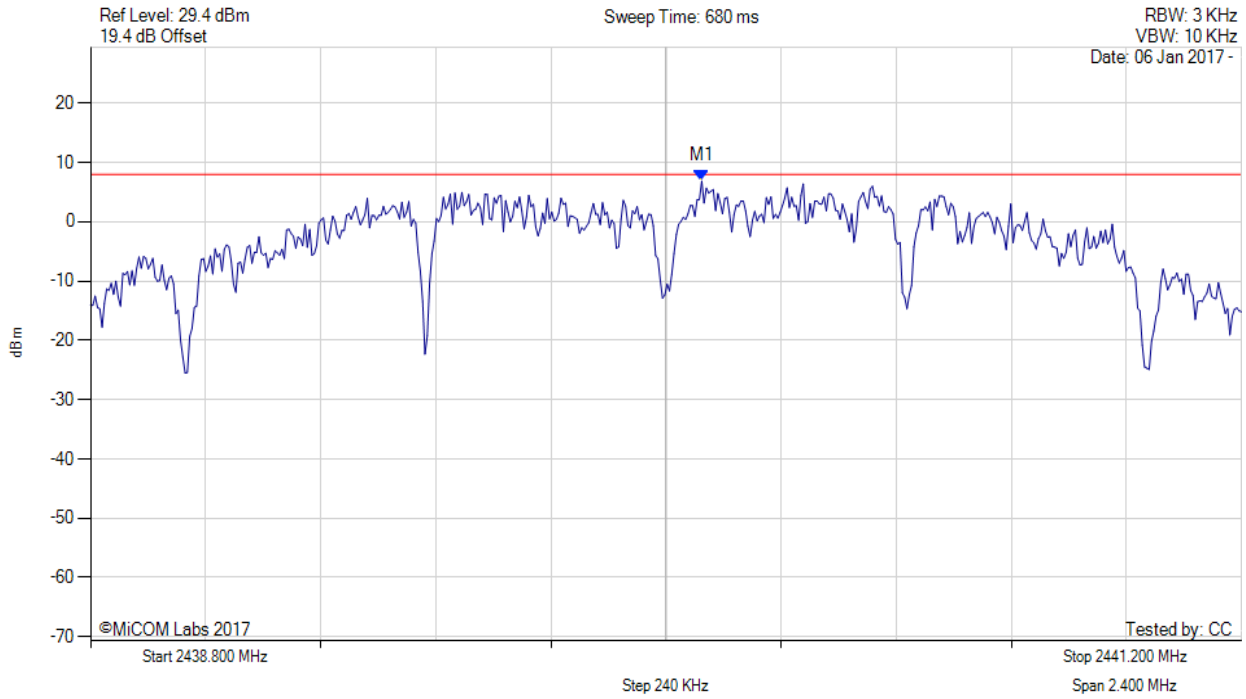


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2405.435 MHz : 6.799 dBm	Limit: ≤ 8.0 dBm Margin: -1.2 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 250 kbps OQPSK, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

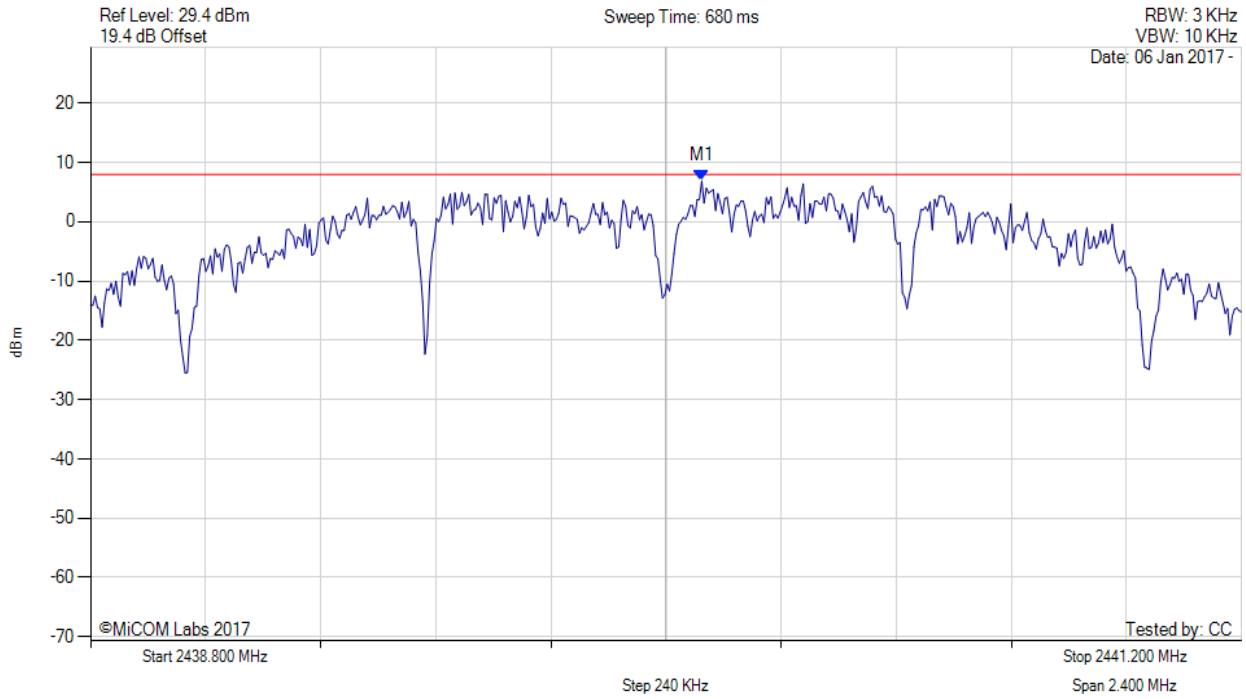


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.075 MHz : 6.856 dBm	Limit: ≤ 8.000 dBm Margin: -1.14 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 250 kbps OQPSK, Channel: 2440.00 MHz, SUM, Temp: 20, Voltage: 4 Vdc

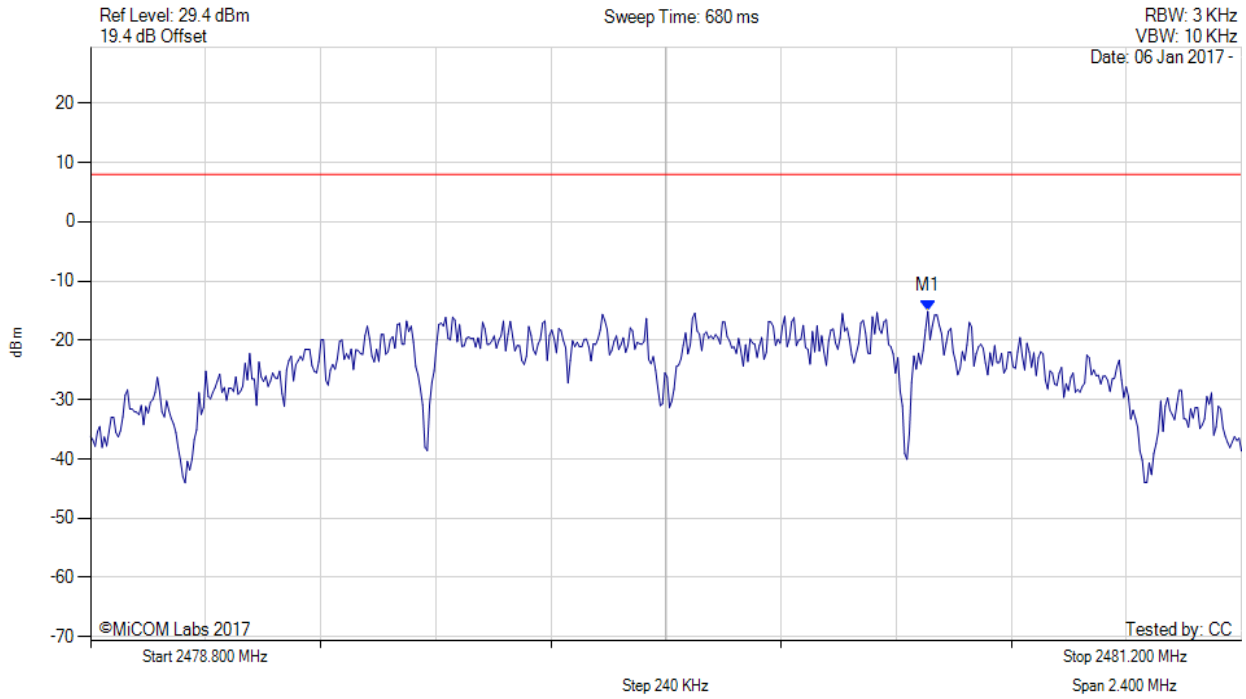


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.075 MHz : 6.856 dBm	Limit: ≤ 8.0 dBm Margin: -1.1 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 250 kbps OQPSK, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

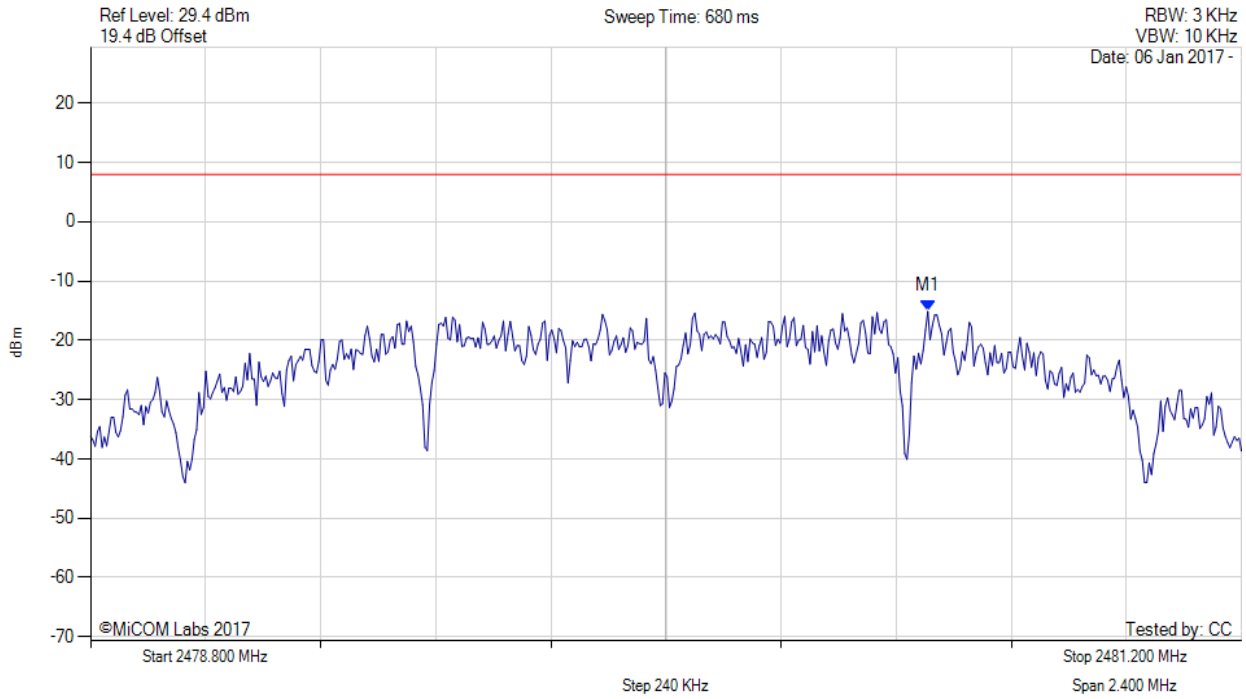


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2480.546 MHz : -15.111 dBm	Limit: ≤ 8.000 dBm Margin: 23.11 dB

back to matrix

POWER SPECTRAL DENSITY - PEAK

Variant: 250 kbps OQPSK, Channel: 2480.00 MHz, SUM, Temp: 20, Voltage: 4 Vdc



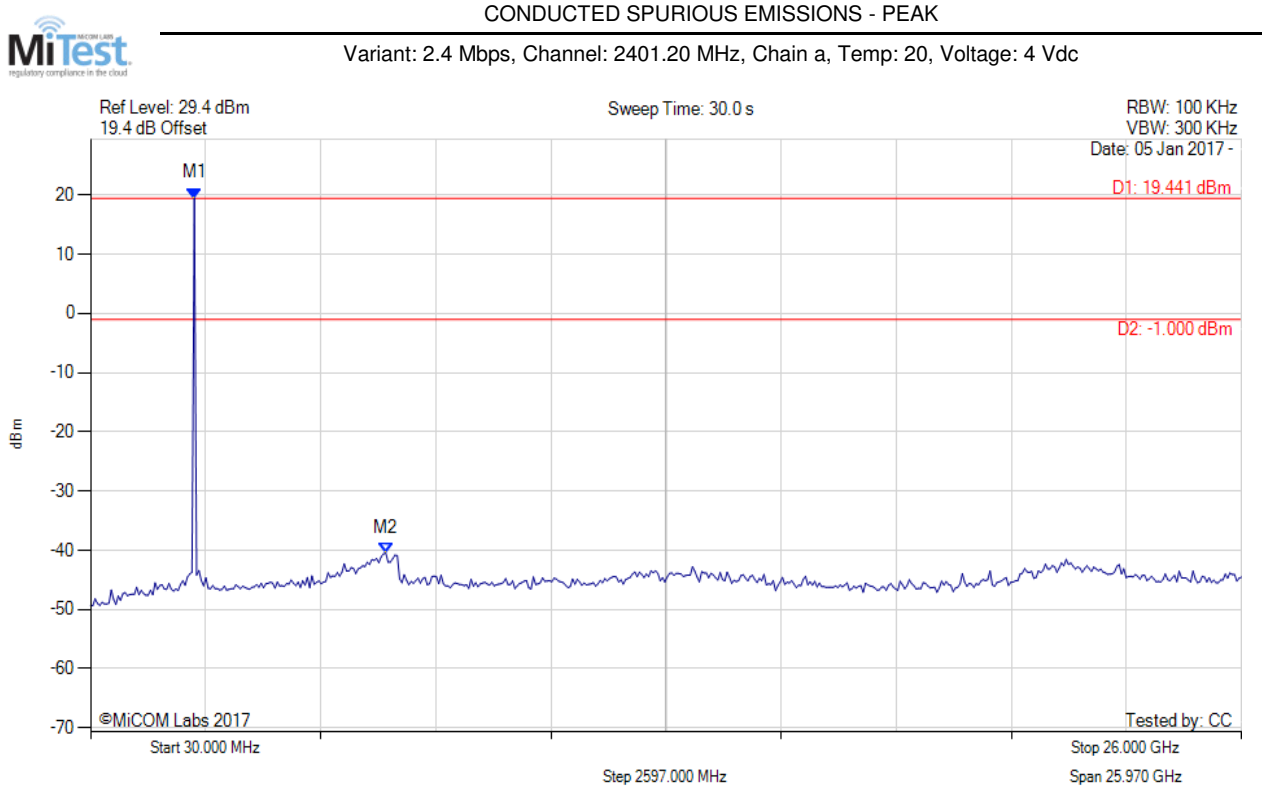
Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2480.546 MHz : -15.111 dBm	Limit: ≤ 8.0 dBm Margin: -23.1 dB

back to matrix

A.3. Emissions

A.3.1. Conducted Emissions

A.3.1.1. Conducted Spurious Emissions

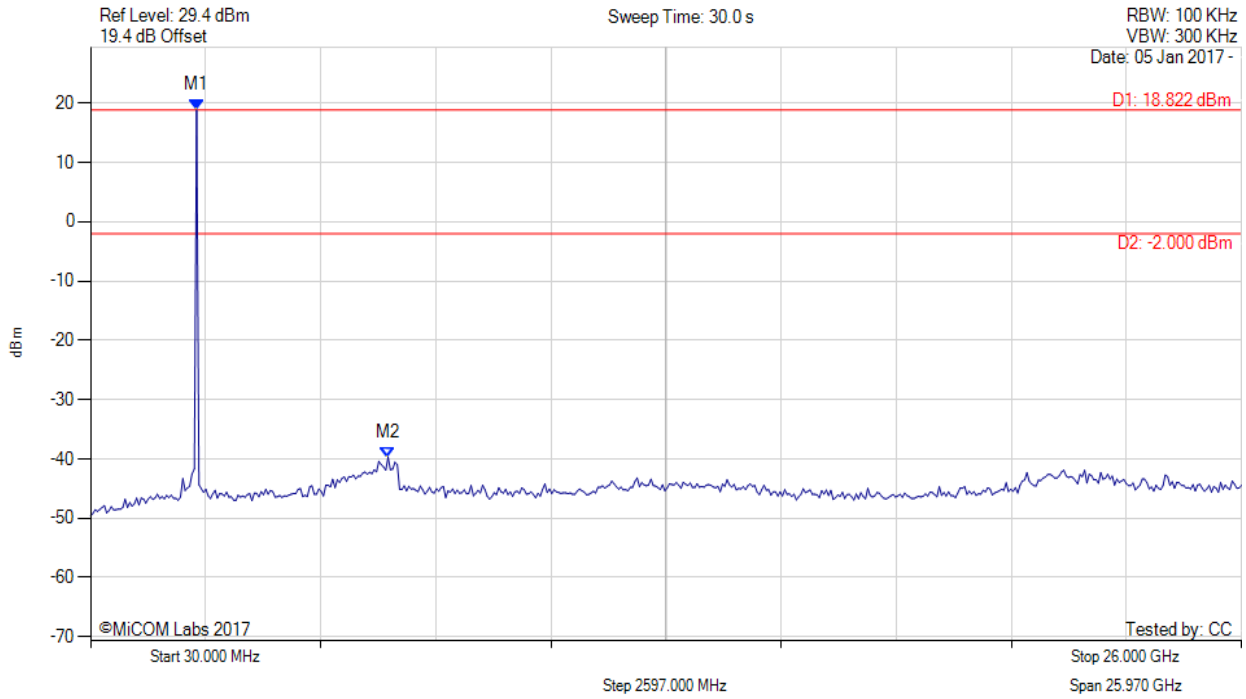


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2371.984 MHz : 19.441 dBm M2 : 6691.643 MHz : -40.453 dBm	Limit: -1.00 dBm Margin: -39.45 dB

back to matrix

CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 2.4 Mbps, Channel: 2440.80 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

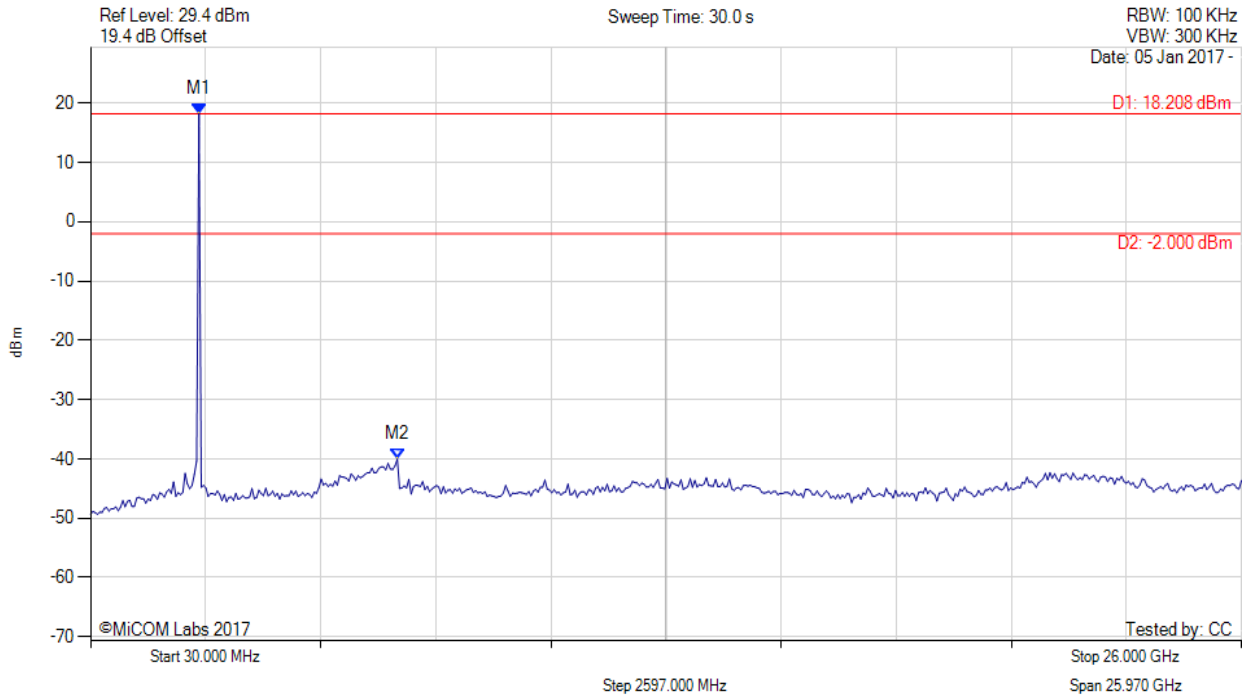


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2424.028 MHz : 18.822 dBm M2 : 6743.687 MHz : -39.717 dBm	Limit: -2.00 dBm Margin: -37.72 dB

back to matrix

CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 2.4 Mbps, Channel: 2476.80 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

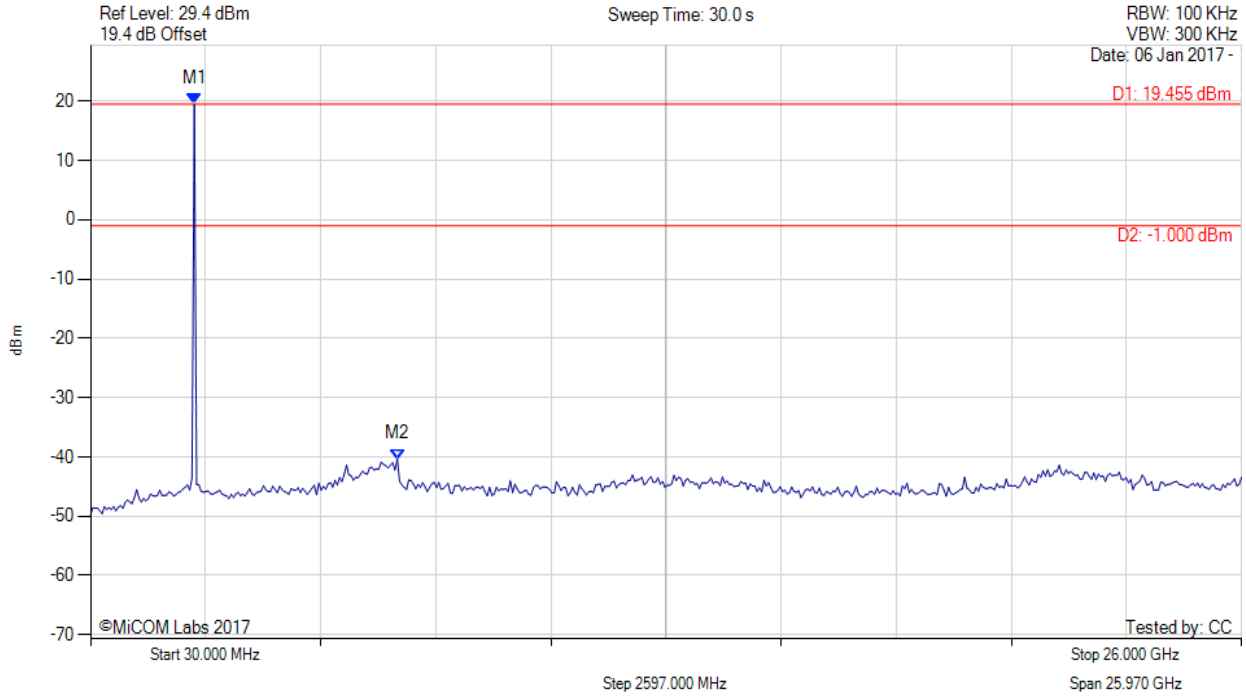


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2476.072 MHz : 18.208 dBm M2 : 6951.864 MHz : -40.028 dBm	Limit: -2.00 dBm Margin: -38.03 dB

back to matrix

CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 250 kbps OQPSK, Channel: 2405.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

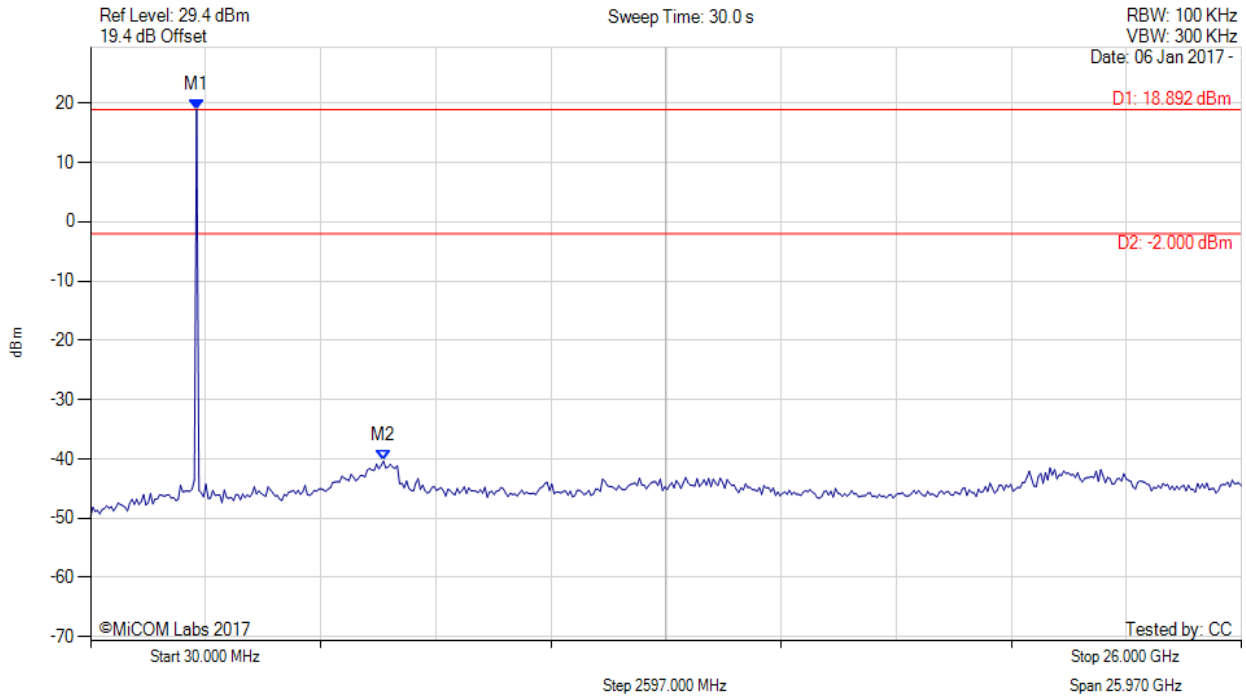


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2371.984 MHz : 19.455 dBm M2 : 6951.864 MHz : -40.388 dBm	Limit: -1.00 dBm Margin: -39.39 dB

back to matrix

CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 250 kbps OQPSK, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

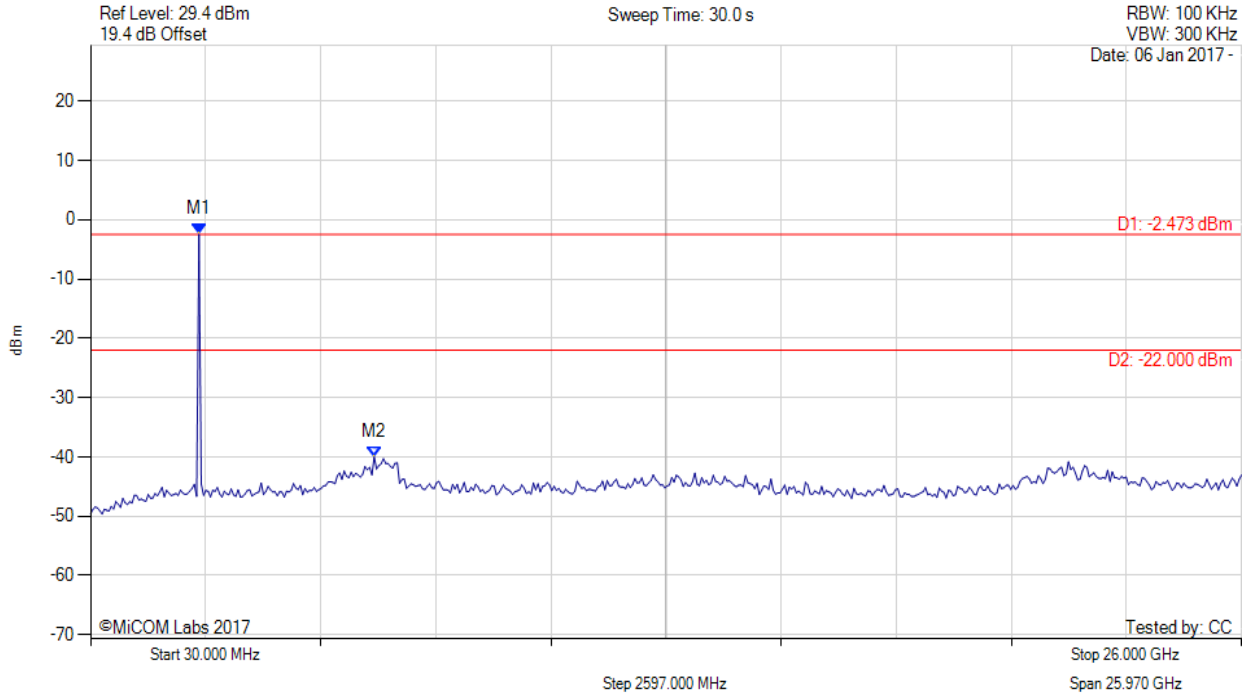


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2424.028 MHz : 18.892 dBm M2 : 6639.599 MHz : -40.362 dBm	Limit: -2.00 dBm Margin: -38.36 dB

back to matrix

CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 250 kbps OQPSK, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2476.072 MHz : -2.473 dBm M2 : 6431.423 MHz : -40.014 dBm	Limit: -22.00 dBm Margin: -18.01 dB

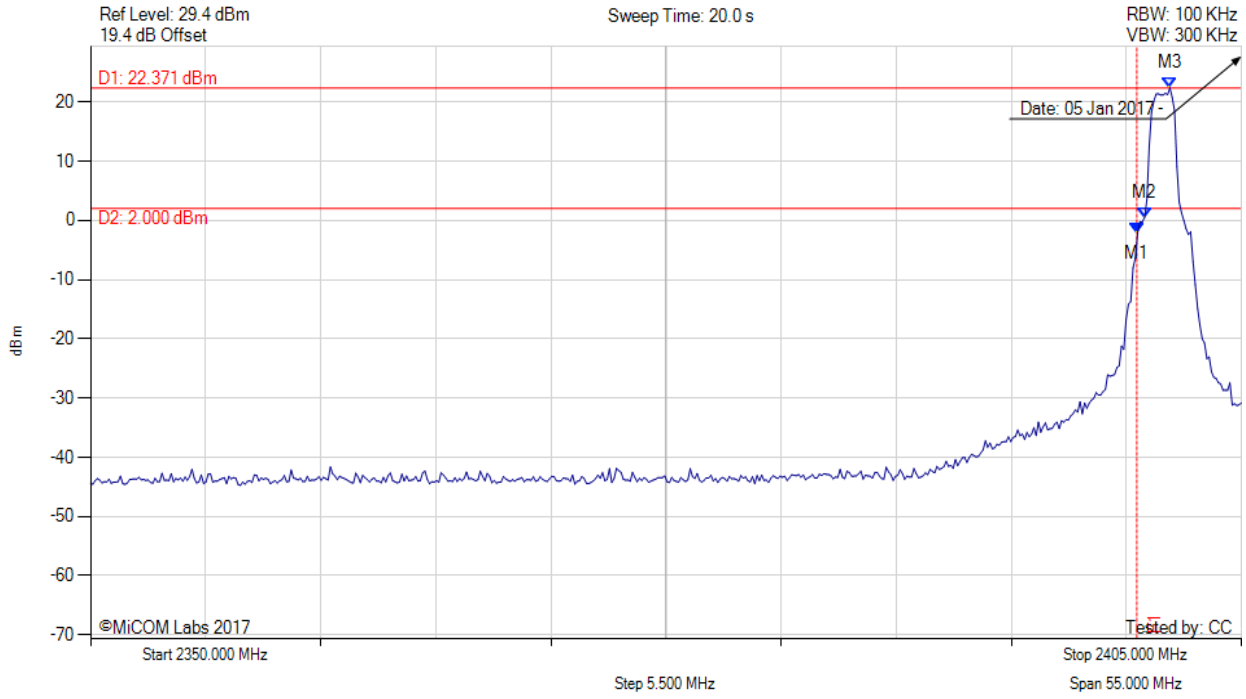
back to matrix

A.3.1.2. Conducted Band-Edge Emissions

Conducted Low Band-Edge Emissions

CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: 2.4 Mbps, Channel: 2401.20 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

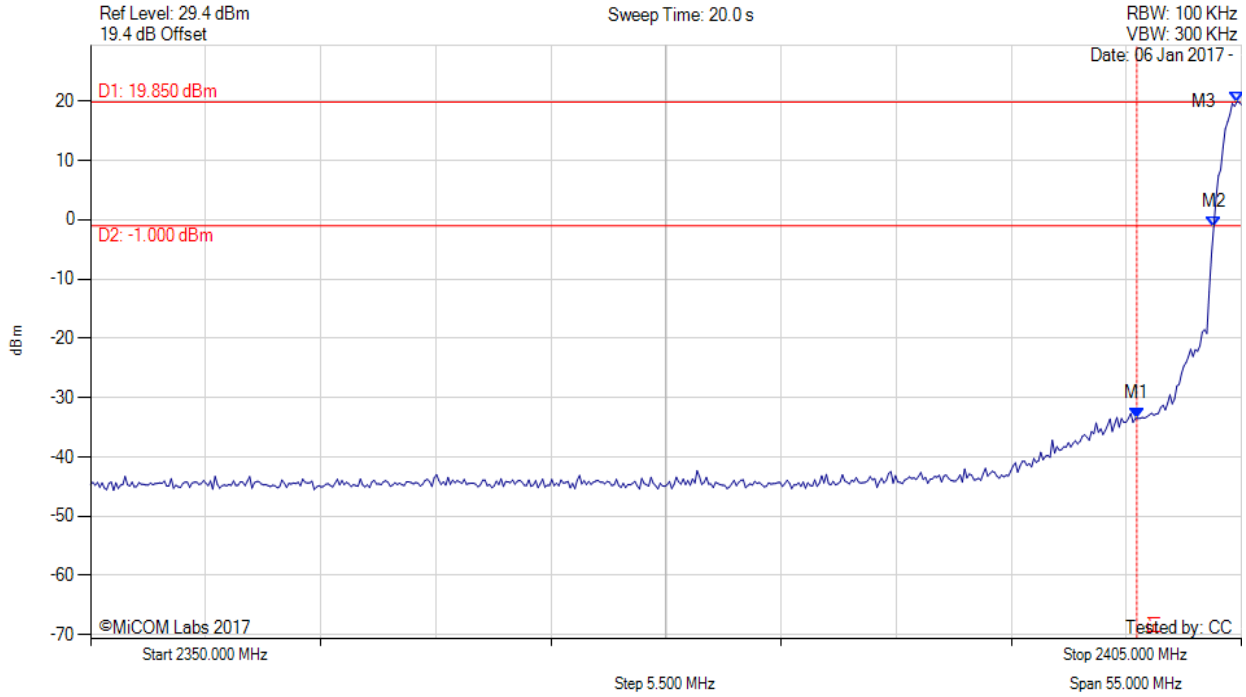


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2400.000 MHz : -2.103 dBm M2 : 2400.371 MHz : 0.482 dBm M3 : 2401.583 MHz : 22.371 dBm	Channel Frequency: 2401.20 MHz

back to matrix

CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: 250 kbps OQPSK, Channel: 2405.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc



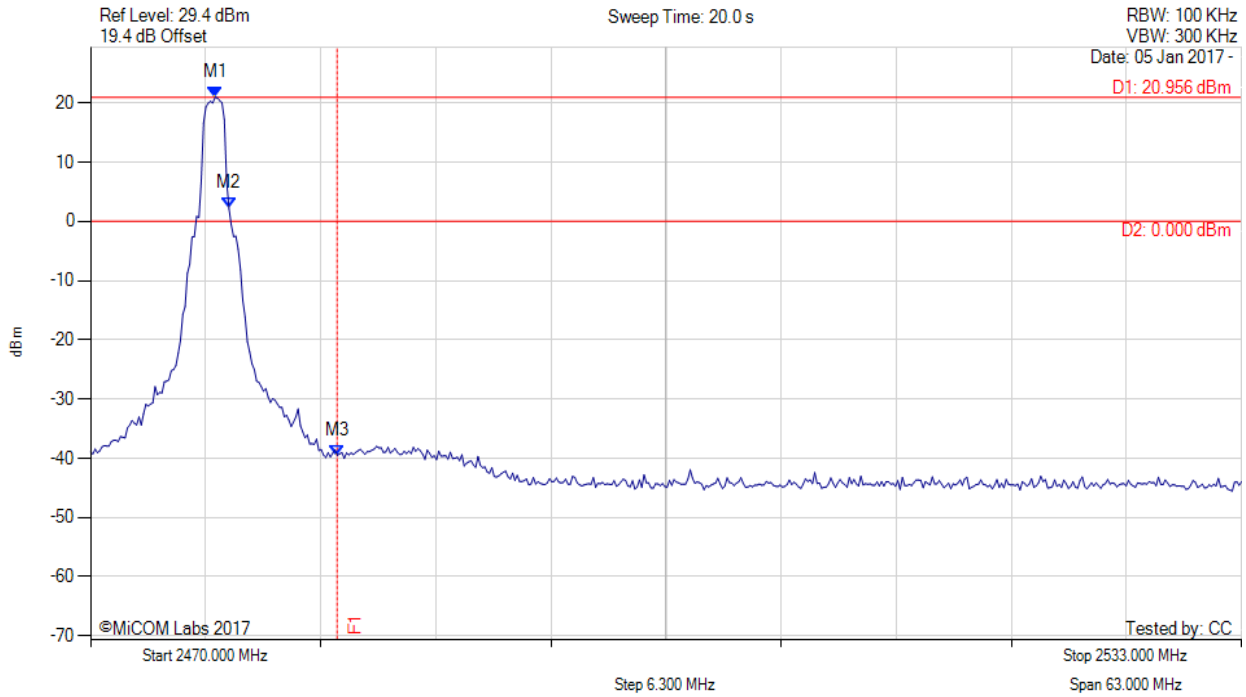
Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2400.000 MHz : -33.528 dBm M2 : 2403.677 MHz : -1.153 dBm M3 : 2404.780 MHz : 19.850 dBm	Channel Frequency: 2405.00 MHz

back to matrix

Conducted High Band-Edge Emissions

CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: 2.4 Mbps, Channel: 2476.80 MHz, Chain a, Temp: 20, Voltage: 4 Vdc

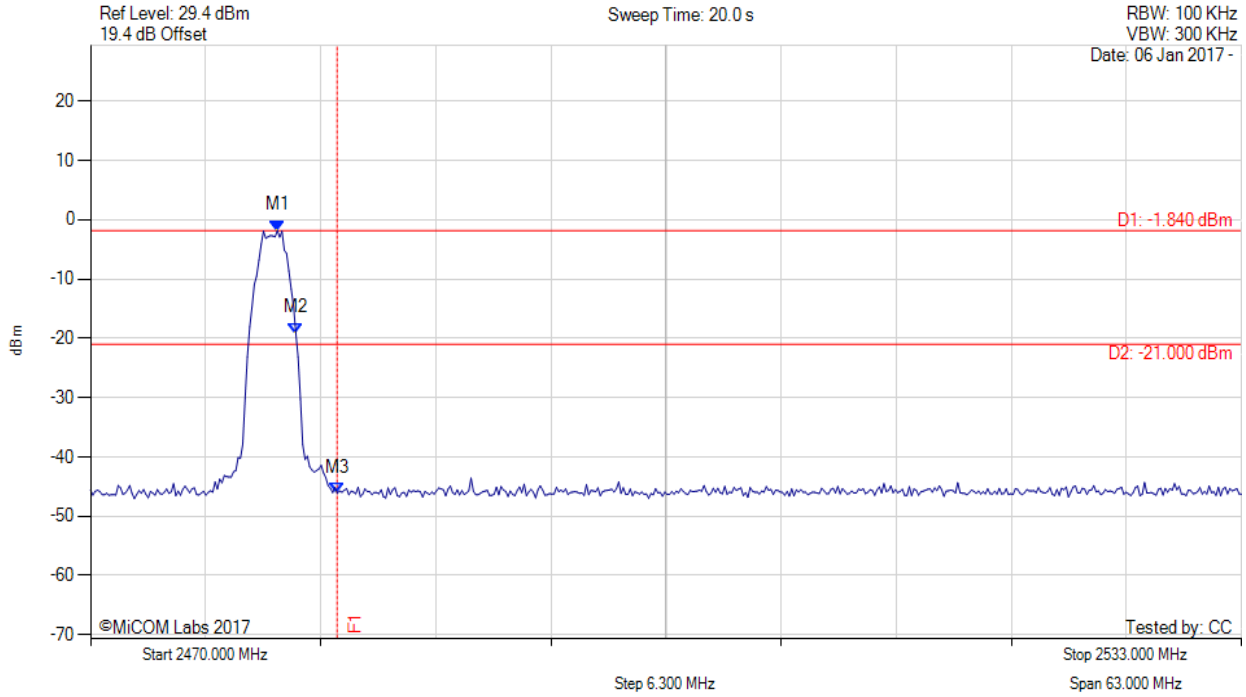


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2476.818 MHz : 20.956 dBm M2 : 2477.575 MHz : 2.199 dBm M3 : 2483.500 MHz : -39.501 dBm	Channel Frequency: 2476.80 MHz

back to matrix

CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: 250 kbps OQPSK, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 4 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2480.226 MHz : -1.840 dBm M2 : 2481.236 MHz : -19.111 dBm M3 : 2483.500 MHz : -46.146 dBm	Channel Frequency: 2480.00 MHz

back to matrix

575 Boulder Court
Pleasanton, California 94566, USA
Tel: +1 (925) 462 0304
Fax: +1 (925) 462 0306
www.micomlabs.com