Electromagnetic Compatibility
Test Report

Test Report No: MOT 061107
Issued on: November 06, 2007

Product Name
VoWLAN

Tested According to
FCC 47 CFR, Part 15, Subparts E
IC RSS-210

Tests Performed for
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Regis. No: 102724 1633.01

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Test personnel

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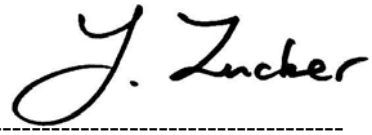

Report Reviewed By: ----------
Y. Zucker
QA and Lab. Manager
QualiTech EMC Laboratory

ACCREDITED
1633.01

Test Report details:

Test commencement date:	04.11.2007
Test completion date:	06.11.2007
Customer's Representative:	Teddy Neeman
Issued on:	06.11.2007

Assessment information:

This report contained an assessment of the EUT against Electromagnetic Compatibility based upon tests carried out on the samples submitted. The results contained in this report relate only to the items tested. Manufactured products will not necessarily give identical results due to production and measurement tolerances. QualiTech, EMC Lab does not assume responsibility for any conclusion and generalization drawn from the test results with regards to other specimens or samples of type of the equipment represented by test item.

The EUT was set up and exercised using the configuration, modes of operation and arrangements defined in this report only.

Modifications:

Modifications made to the EUT

None

Modifications made to the Test Standard

None

Summary of Compliance Status

WLAN 802.11a

Test Spec. Clause	Test Case	Remarks
47 CFR §15.247 (a) (2) RSS-210 section A8.2 (1)	6 dB Bandwidth	Comply
47 CFR §15.247 (b) (3) & RSS-210 section A8.4 (4)	Maximum Peak Output Power, 2400-2483.5 MHz	Comply
47 CFR §15.247 (e) & RSS-210 Section A8.2 (2)	Peak power spectral density	Comply
47 CFR §15.247 (d) & RSS-210 Section A8.5	Conducted Spurious Emissions	Comply
47 CFR §15.247 (d) & §15.205 & RSS-210 section A8.5	Spurious Radiated Emissions, Restricted Bands 2310-2390MHz & 2483.5-2500MHz	Comply
47 CFR §15.247 (d), & §15.205, & §15.209(a)	Spurious Radiated Emissions, Restricted Bands	Comply
47 CFR §15.109/209 & RSS-GEN section 7.2.3.2	Radiated Emission, Receive Mode	Comply
47 CFR §15.403(h)(i) & RSS-210 A9.2(1)	Emission Bandwidth (26dB BW)	Comply
47 CFR §15.407 (a) (1), (2), (3) & RSS-210A9.2(1)	Maximum Conducted Output Power, 5180-5250 MHz, 5.25–5.35 GHz and 5.47–5.725 GHz	Comply
47 CFR §15.407 (a) (1), (2), (3), (5) & RSS-210A9.2(1)	Peak Power Spectral Density	Comply
47 CFR §15.407 (a) (6)	Peak Excursion	Comply
47 CFR §15.407 (b) (1),(2),(3),(4) & §15.407 (b)(6) & RSS-210A3.3(1)	Conducted Spurious Emissions	Comply
47 CFR §15.407 (b) (7) & RSS-210A3.3(1)	Spurious Radiated Emissions, Restricted Bands	Comply
47 CFR §15.407(g)	Frequency Stability	Comply
47 CFR §15.203 & RSS - Gen. Section 7.1.4	Antenna Connector Requirements	Comply
47 CFR §15.407(h)(2)(i)(B) & §15.407(h)(2)(iii) and FCC 06-96 & RSS-210 Annex 9.	Dynamic Frequency Selection (DFS)	Comply

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1. General Description

Description of the EUT system/test Item:

Product name: VoWLAN
Model: F2977A
FCC ID: AZ489FT7031
IC: 109U-89FT7031

Description:

Single Mode VoWLAN 802.11a/b/g phone

Maximum Peak Output Power:

79.3mW (6Mbps) for WLAN 802.11a Middle and Upper Bands
39.8mW (6Mbps) for WLAN 802.11a Lower Band

Frequency range:

802.11a: 5.15-5.350, 5.470-5.825 GHz

Transmit Data rate:

Protocol	Rate [Mbps]							
802.11a	6	9	12	18	24	36	48	54

Type of Modulation:

Protocol	Modulation
802.11a	OFDM (64QAM, 16QAM, QPSK, BPSK)

Antenna Specification:

Type:
WLAN a/b/g: Integral (on board) PIFA Dual Band
Gain:
802.11a: 0 dBi peak free space.

2. Method of Measurements

2.1. Conducted RF Measurements:

The RF output of the transmitter under test was directly connected to the input of the Spectrum analyzer through a specialized antenna connector provided by the manufacturer, and an attenuator as specified. The external attenuator and cable loss were added to the reading. Worst-case results of the various modulation modes (where applicable) were reported.

For carrier frequency separation, number of hopping frequencies, time of occupancy, 20dB BW, peak output power, band edge emissions, and spurious emissions were measured according the guidelines in DA 00-705.

For PSD, emission peak was zoomed within the pass band with spectrum analyzer's settings as reported (Sweep time=Span/3kHz). Transmitter outputs transmitting simultaneously were aggregated through a combiner.

For Maximum Conducted Output Power, the spectrum analyzer was set for free ran, and 100 traces were averaged in power averaging mode. The transmitter was continuously transmitting, at a duty cycle of about 99%, and power was integrated across a bandwidth of the 26dB EBW of the signal, using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges. Alternatively, Peak Output Power was measured using a Peak Power Meter.

For spurious emissions measurement, the spectrum from 9 KHz to 40GHz was investigated with the transmitter set to the lowest, middle and highest channel frequencies.

For frequency stability, the 26dB Emission Bandwidth measurement was performed under extreme conditions with the DUT tuned to the band-edge channel. Worst case results were compared with the band-edge.

2.2. Radiated Emissions Measurements in the restricted bands:

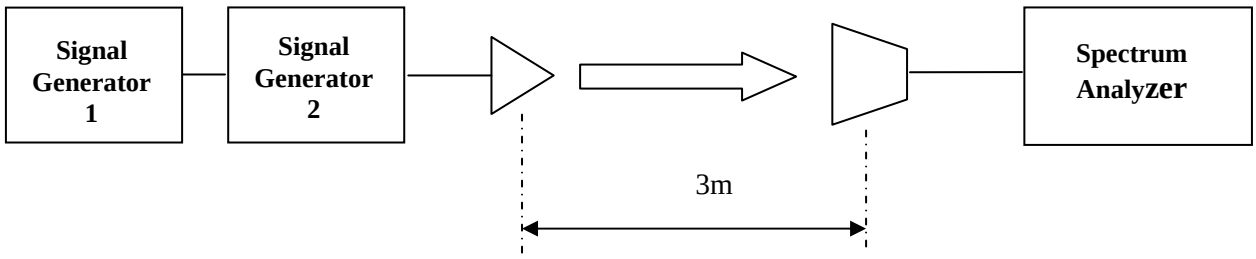
For radiated emissions, which fall in the restricted bands the spectrum from 1MHz to 25GHz was investigated following the guidelines in ANSI C63.4-2003, with the transmitter set to the lowest, middle and highest channel frequencies. Measurements were performed with peak detector and repeated averaged with VBW=10Hz.

2.3. Radiated Emission measurements:

Measurements were performed at a 3-meter measurement distance in the semi-anechoic chamber in order to evaluate the radiated electromagnetic interference characteristics of the EUT. The EUT was placed on a non-metallic table/support, 0.8m above the turntable, was configured, arranged and operated in a manner consistent with typical application and load conditions. The test program of exercising the equipment ensured that various parts of the EUT were exercised to permit detection of all EUT disturbances.
An appropriate antenna depending upon the frequency range, per ANSI C63.4-2003 clause 4.1.5 was used. While the turntable was being rotated, the height of the antenna was varied from 1 to 4m for the frequency range of 30MHz to 1GHz. The highest radiated emission was detected by manipulating the system cables to the worst-case position. This process was repeated for both antenna polarizations. The spectrum up to 40GHz was investigated for spurious emissions, using a band-reject filter where appropriate.
The amplitudes of worst-case emission were measured with the detector modes and resolution bandwidths over various frequency ranges according to the requirements of ANSI C63.4-2003 clause 4.2.

2.4. DFS Response Requirements measurements, Client Device:

Radar Waveform Calibration: the following equipment setup was used to generate and calibrate the radiated radar waveform. The Spectrum Analyzer was set to span zero at a selected radar frequency, 3kHz RBW and VBW, and Peak detection.

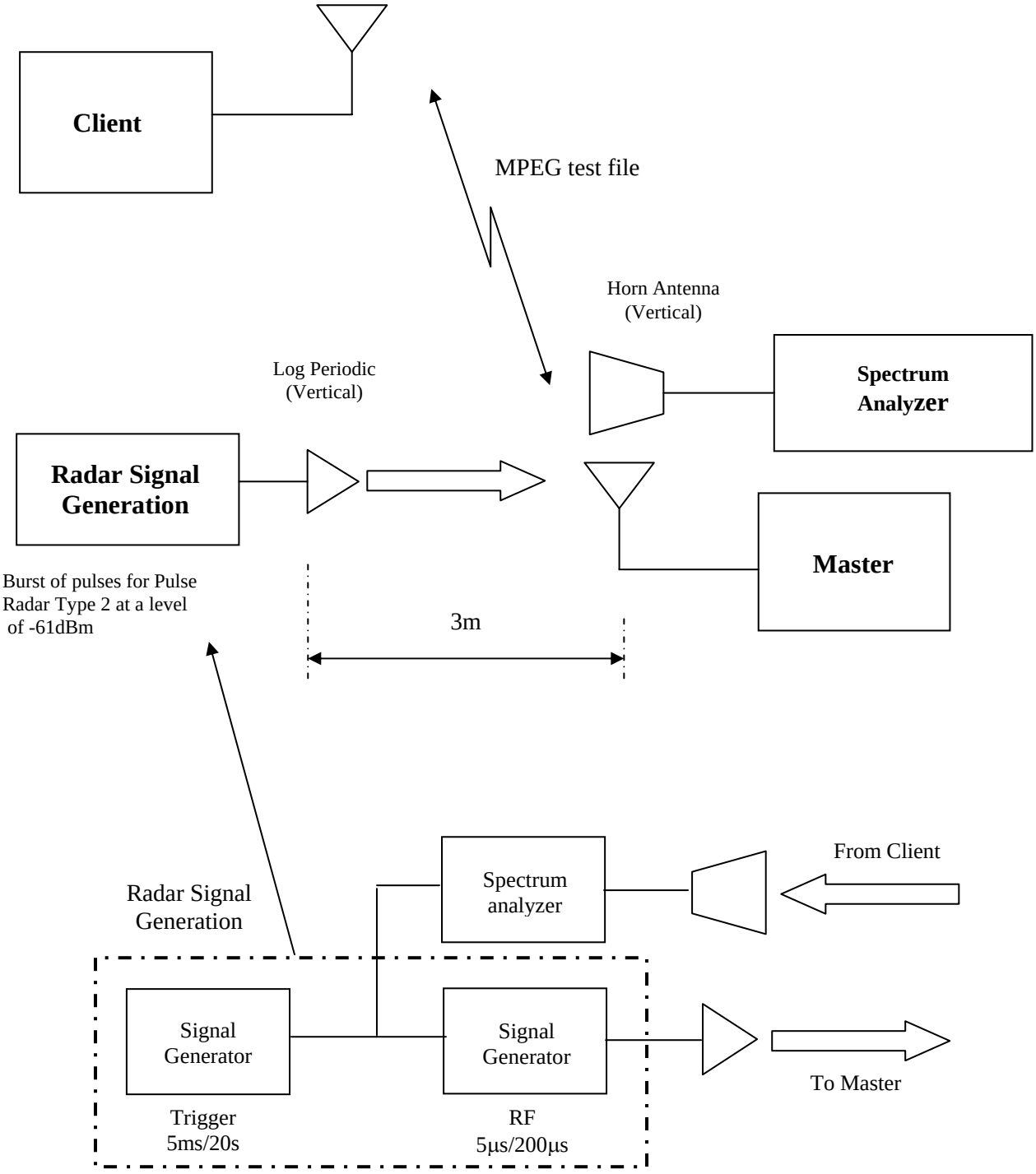


Test Procedure:

The IP master device was operated upon start-up and performed a Channel Availability Check and continued normal operation on the selected channel, transmitting MPEG Test File to the client.
The selected channel frequency was also set as the RF frequency of the Radar Signal Generation devices.
A burst of 25 pulses was generated for a minimum of 30 trials (Radar Type 2) pre-calibrated at appropriate levels above the threshold level to ensure "Radar detection" by the Master device.
The Spectrum Analyzer was used as a monitor to verify that the Client EUT has vacated the channel within the Channel Move Time and to verify the Channel Closing Transmission Time do not exceed 200ms starting at the beginning of the Channel Move Time plus any additional intermittent control signals up to an aggregate of 60ms, during the remaining of the 10seconds period.

For "30 Minute Non-Occupancy", Associated Test: The client was associated with the master and after master detection of radar pulse, the client moved with the master to the next chosen channel, and while streaming the MPEG test file, the vacated channel was monitored to verify that the DUT does not resume any transmission on this channel. The spectrum analyzer was running in max hold on the center of the vacated channel for more than 30 minutes. The 30 minute observation started immediately following the 10 second channel move time.
For "30 Minute Non-Occupancy", Non - Associated Test: The client device was powered on and the master device was powered off, and a scan was taken across all channels. The spectrum analyzer was running in max hold and sweep time of 20ms. Sweeping was left for a period of more than 30 minutes to verify that the client is not employing active scanning and not transmitting on any channel without being associated with the master device.

Radiated Setup: EUT is a client and Radar test Waveform is injected into the Master.



3. Test Facility & Uncertainty of Measurement

3.1. Accreditation/ Registration reference:

- *A2LA Certificate Number: 1633.01*

3.2. Test Facility description

The tests were performed at the EMC Laboratory, QualiTech Division, ECI Telecom Group

Address: 30, Hasivim St., Petah Tikva, Israel.
Tel: 972-3-926-8443

3m Anechoic Chamber:

The 3m-screened chamber is used in two configurations: the semi-anechoic configuration for Radiated Emission measurements and the full-anechoic configuration for Radiated Immunity tests.

Semi Anechoic Configuration:

Measurement distance	3m
Chamber dimensions	9.5m x 6.5m x 5.2m
Antenna height	1 - 4m
Shielding Effectiveness	Magnetic field ≥80dB at 15 kHz ≥90dB at 100 kHz Electric field >120dB from 1MHz to 1GHz >110dB from 1GHz to 10GHz
Absorbing material	Ferrite tiles on the walls and ceiling Frankonia hybrid absorbing material in selected positions on the walls
Normalized Site Attenuation measured at 5 positions	±3.49dB, 30MHz to 1GHz
Transmission Loss measured at 5 positions, at 1.5m height	±3dB, 1GHz to 18GHz

Full-Anechoic Configuration:

Measurement distance	3m
Chamber dimensions	7m x 4m x 3m
Antenna height	1.55m at Horizontal & Vertical polarizations
Shielding Effectiveness	Magnetic field ≥80dB at 15 kHz ≥90dB at 100 kHz Electric field >120dB from 1MHz to 1GHz >110dB from 1GHz to 10GHz
Absorbing material	Ferrite tiles on the walls and ceiling Frankonia hybrid absorbing material in selected positions on the walls and floor
Field Uniformity to EN61000-4-3	±3dB 80MHz to 18GHz

3.3. Uncertainty of Measurement:

Test Name	Test Method & Range	Uncertainty	
		Combined std. Uc(y) [dB]	**Expanded U** [dB]
Radiated Emission	30MHz÷230MHz, Horiz. polar. 30MHz÷230MHz, Ver. polar. 230MHz÷1000MHz, Horiz. polar. 230MHz÷1000MHz, Vert. polar.	1.8 2.0 1.5 1.5	3.6 3.9 3.0 3.0
Conducted Emission	9 kHz÷150 kHz 150 kHz÷30MHz	1.4 1.1	2.8 2.2

4. WLAN 802.11a: Report of Measurements and Examinations

4.1. Emission Bandwidth (26dB BW)

Reference document:	**47 CFR §15.403 (h) (i)**		
Test Requirements:	For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.		
Test setup:	See sec 2.1	**Pass**	
Method of testing:	Conducted		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 100kHz, VBW: 300kHz		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.1.1 - Plot 4.1.12	

Test results:

5150-5250 MHz

Frequency [MHz]	Data Rate [Mbps]	26 dB Bandwidth [kHz]	Ref Plots
802.11a Mode			
5180	54	18500	4.1.1
5200	54	20000	4.1.2
5240	54	18875	4.1.3

5250-5350 MHz

Frequency [MHz]	Data Rate [Mbps]	26 dB Bandwidth [kHz]	Ref Plot
802.11a Mode			
5260	54	19375	4.1.4
5300	54	20375	4.1.5
5320	54	19250	4.1.6

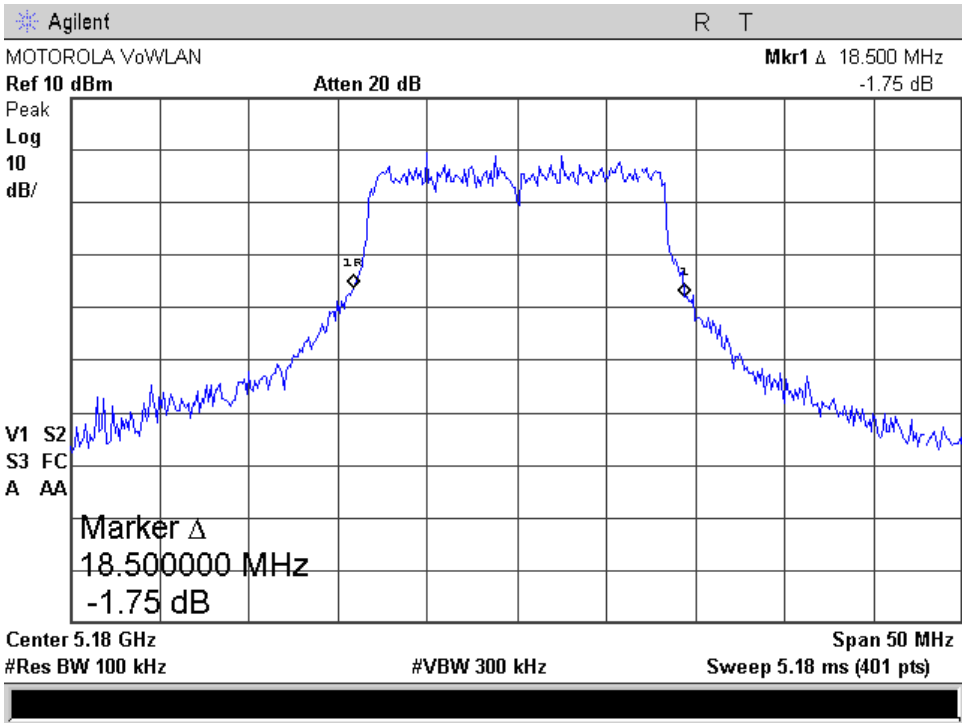
5470-5725 MHz

Frequency [MHz]	Data Rate [Mbps]	26 dB Bandwidth [kHz]	Ref Plot
802.11a Mode			
5500	54	19250	4.1.7
5600	54	19375	4.1.8
5700	54	19000	4.1.9

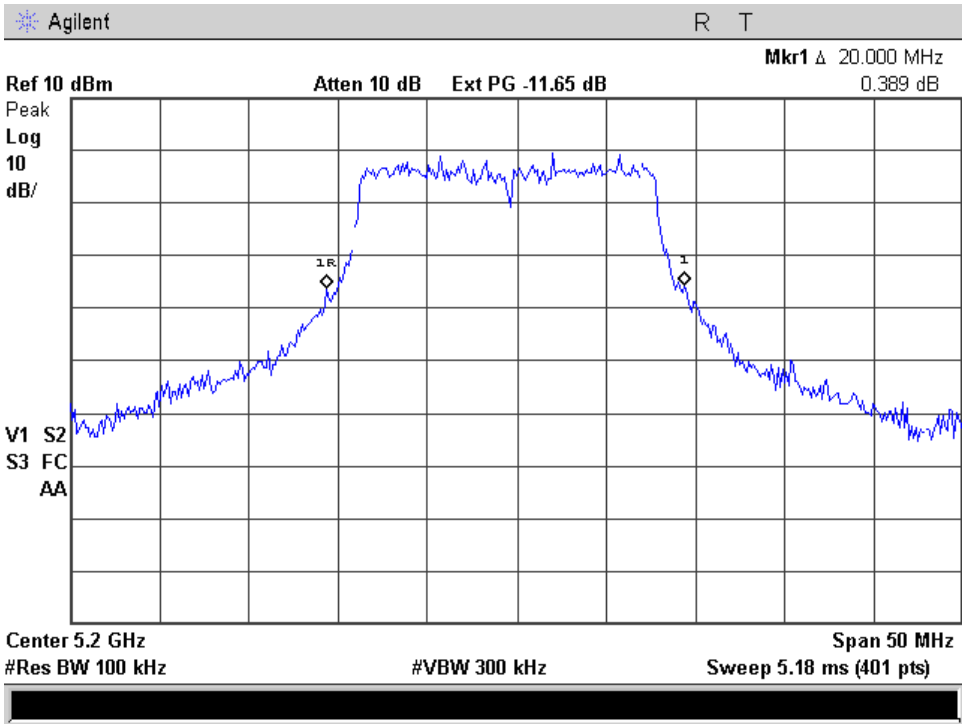
5725-5825 MHz

Frequency [MHz]	Data Rate [Mbps]	26 dB Bandwidth [kHz]	Ref Plot
802.11a Mode			
5745	54	18750	4.1.10
5785	54	19250	4.1.11
5805	54	19250	4.1.12

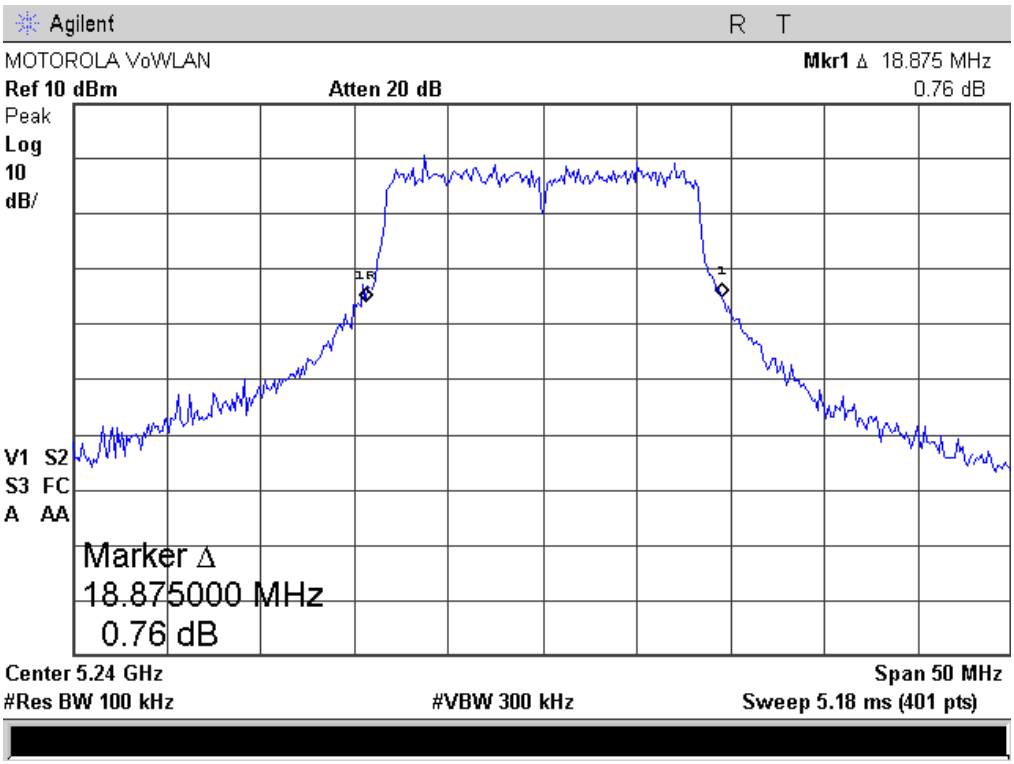
5150-5250 MHz
Plot 4.1.1



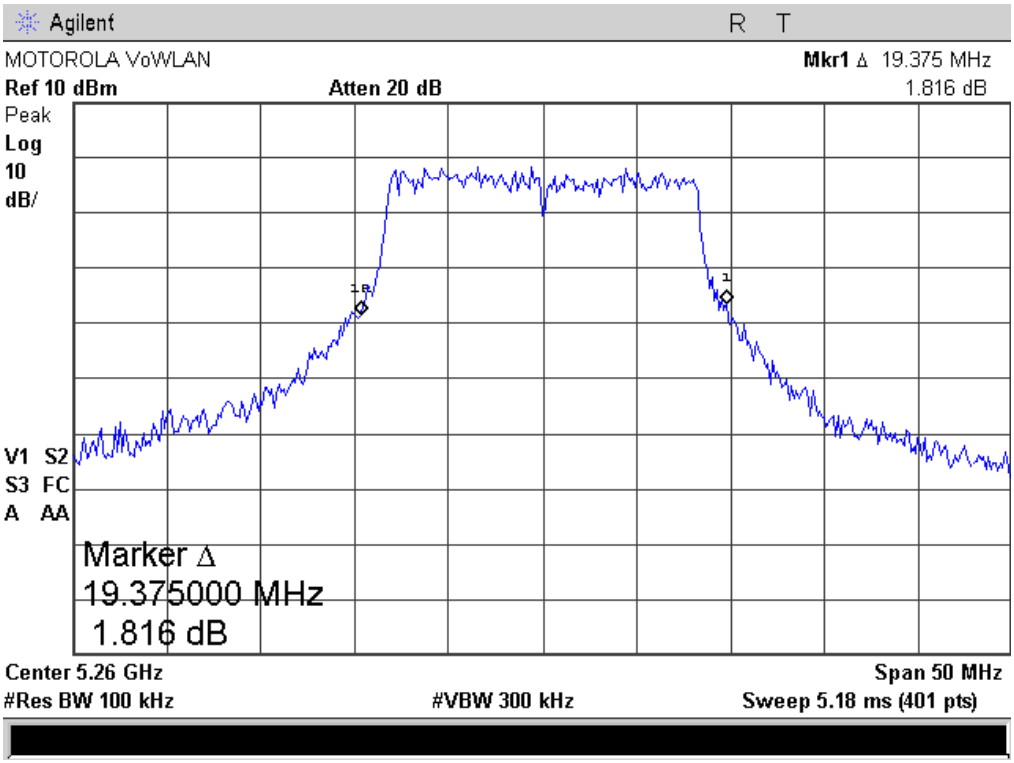
Plot 4.1.2



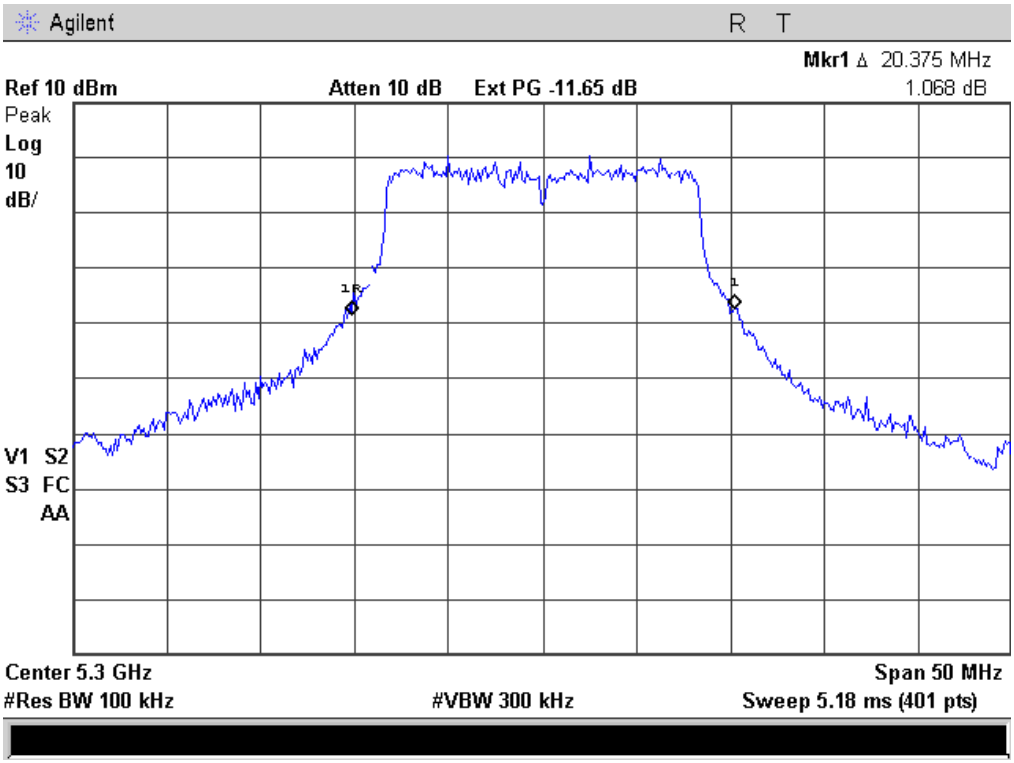
Plot 4.1.3


Agilent
R T
MOTOROLA VoWLAN
Mkr1 Δ 18.875 MHz
Ref 10 dBm
Atten 20 dB
0.76 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Marker Δ
18.875000 MHz
0.76 dB
Center 5.24 GHz
Span 50 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 5.18 ms (401 pts)

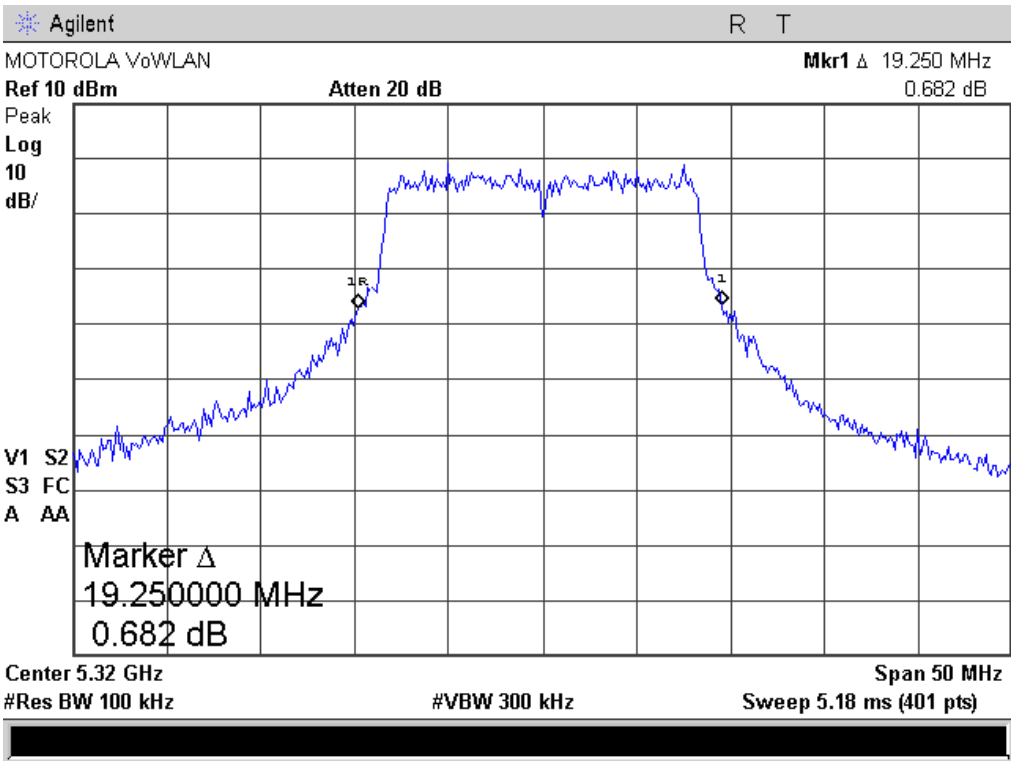
5250-5350 MHz
Plot 4.1.4



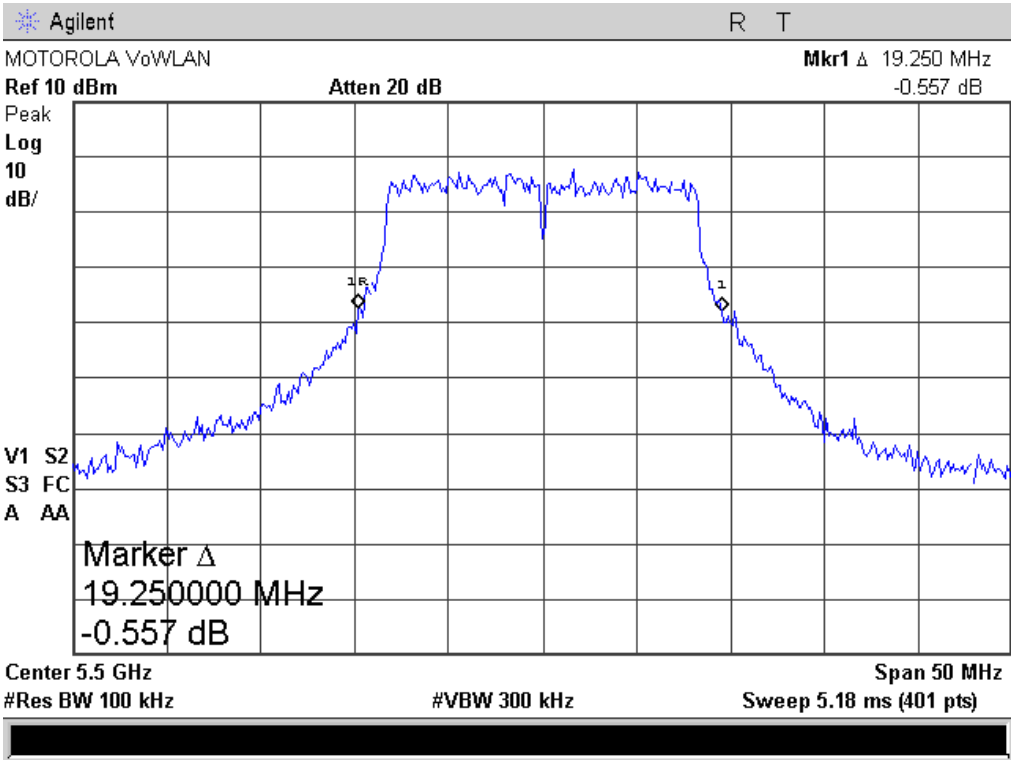
Plot 4.1.5



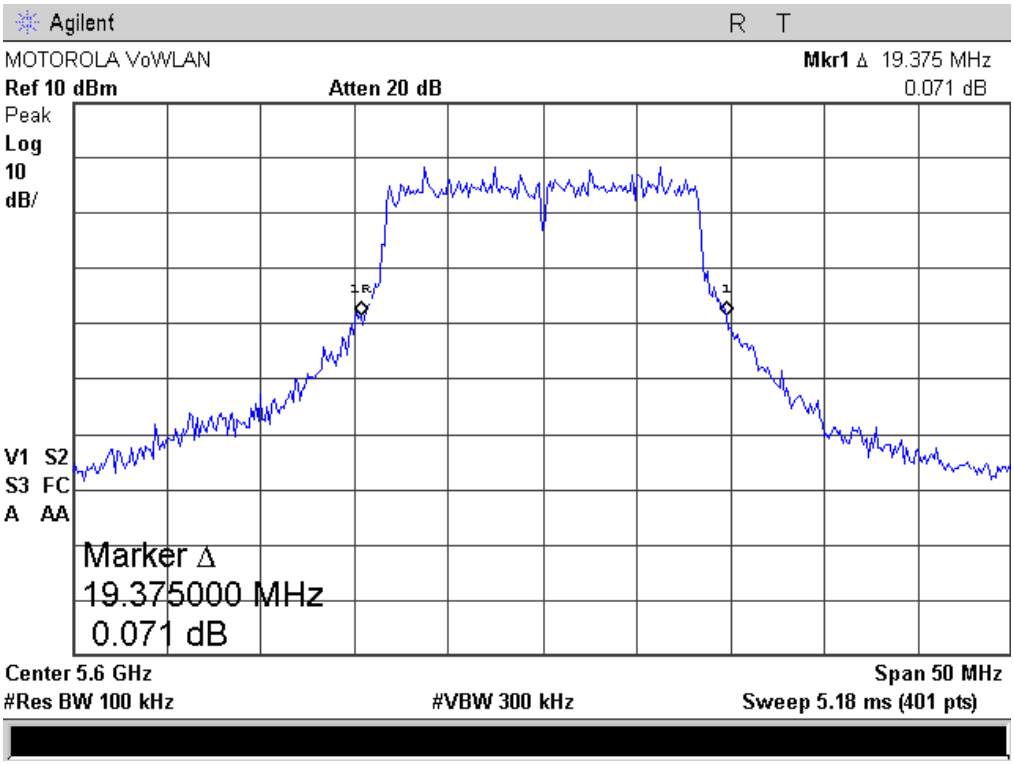
Plot 4.1.6


Agilent
R T
MOTOROLA VoWLAN
Mkr1 Δ 19.250 MHz
Ref 10 dBm
Atten 20 dB
0.682 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A AA
Marker Δ
19.250000 MHz
0.682 dB
Center 5.32 GHz
Span 50 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 5.18 ms (401 pts)

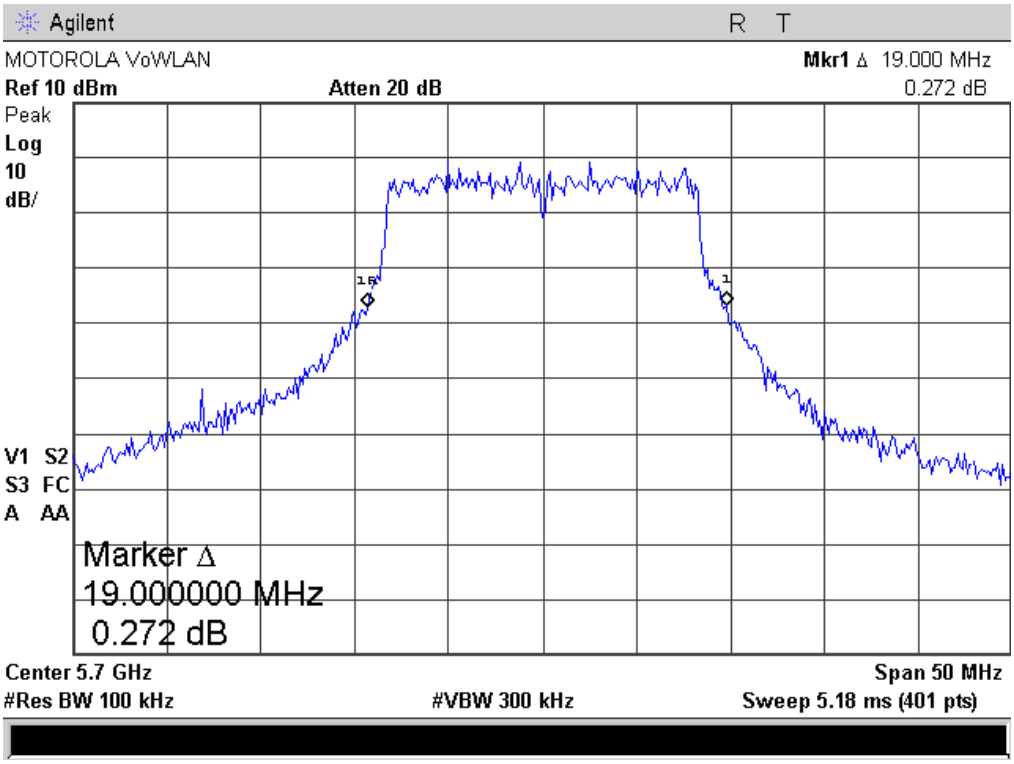
5470-5725 MHz
Plot 4.1.7



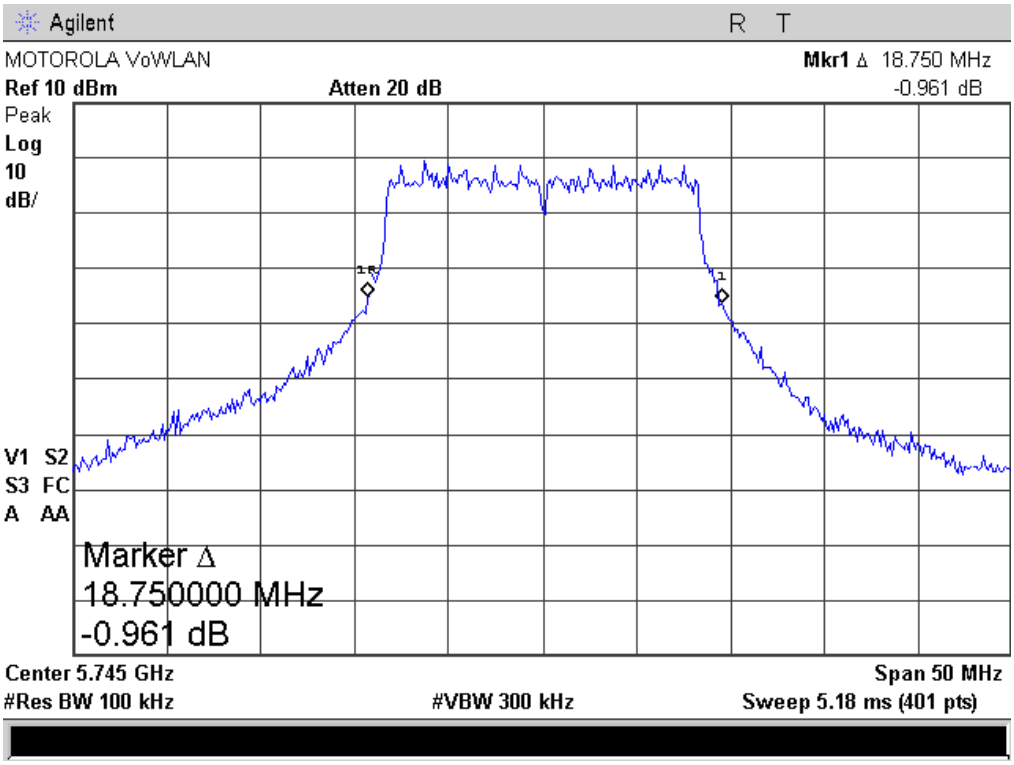
Plot 4.1.8



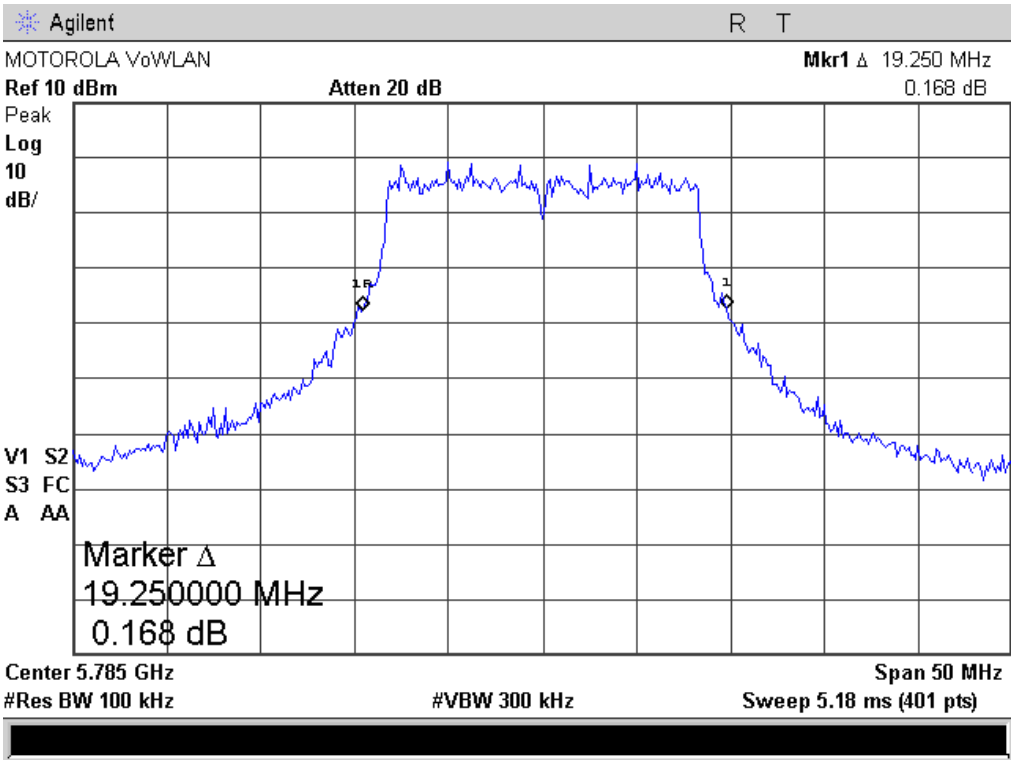
Plot 4.1.9



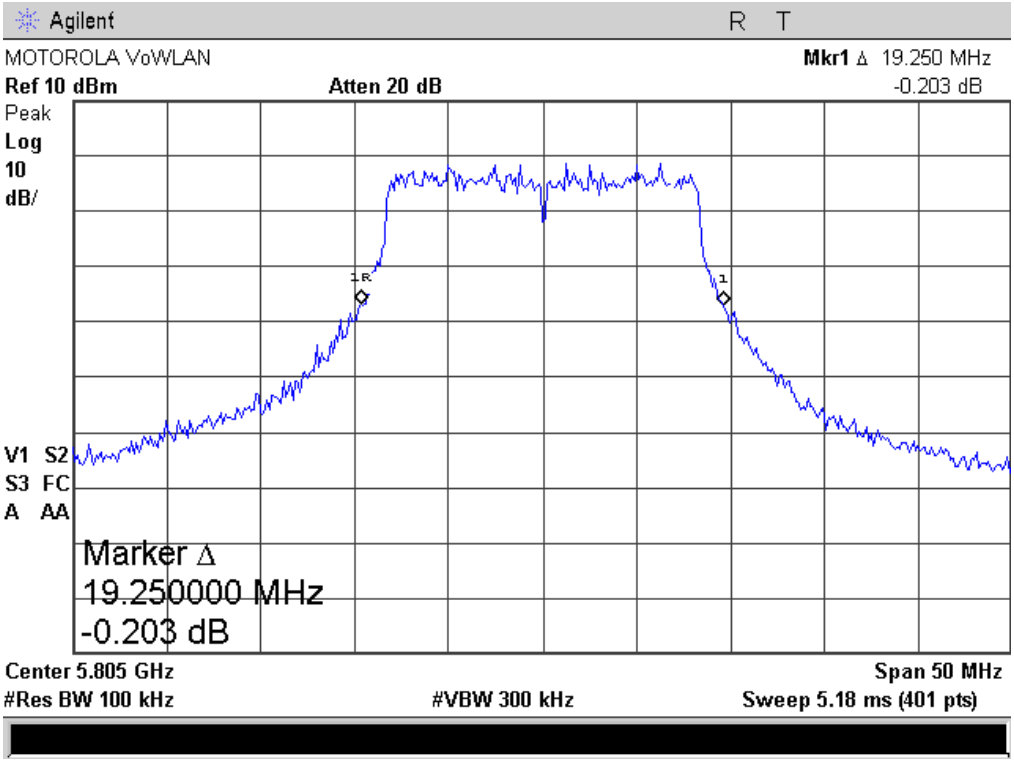
5725-5825 MHz
Plot 4.1.10



Plot 4.1.11



Plot 4.1.12



4.2. Maximum Conducted Output Power, 5180-5250 MHz, 5.25–5.35 GHz and 5.47–5.725 GHz

Reference document:	**47 CFR §15.407 (a) (1), (2), (3)**		
Test Requirements:	(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB,emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, (2) For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (3) For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1–MHz band both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.		
Test setup:	See sec 2.1	**Pass**	
Method of testing:	Conducted, Power meter		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 1MHz, VBW: 3MHz		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	-	

Test results:
5150-5250MHz Band:

Frequency [MHz]	26 dB Bandwidth (B) [MHz]	4 + 10Log B [dBm[	Measured Peak Power [dBm]	AVG Output power* [dBm]	Power Limit [dBm]	Margin [dB]
802.11a Mode						
5180	18500	16.67	15.54	12.54	16.67	-1.13
5200	20000	16.67	15.87	12.87	17.01	-1.14
5240	18875	16.76	15.36	12.36	16.76	-1.40

*Calculated (50% duty cycle), for reporting purposes only.

5250-5350MHz Band:

Frequency [MHz]	26 dB Bandwidth (B) [MHz]	11 + 10Log B [dBm[	Measured Peak Power [dBm]	AVG Output power* [dBm]	Power Limit [dBm]	Margin [dB]
802.11a Mode						
5260	19375	23.87	18.76	15.76	23.87	-5.11
5300	20375	24.09	18.82	15.82	24.09	-5.27
5320	19250	23.84	18.47	15.47	23.84	-5.37

*Calculated (50% duty cycle), for reporting purposes only.

5470-5725 MHz Band:

Frequency [MHz]	26 dB Bandwidth (B) [MHz]	11 + 10Log B [dBm[	Measured Peak Power [dBm]	AVG Output power* [dBm]	Power Limit [dBm]	Margin [dB]
802.11a Mode						
5500	19250	23.84	18.32	15.32	23.84	-5.52
5580	20375	24.09	18.93	15.93	24.09	-5.16
5600	19375	23.87	18.45	15.45	23.87	-5.42
5700	19000	23.79	18.65	15.65	23.79	-5.14

*Calculated (50% duty cycle), for reporting purposes only.

5725-5825 MHz Band:

Frequency [MHz]	26 dB Bandwidth (B) [MHz]	17 + 10Log B [dBm[	Measured Peak Power [dBm]	AVG Output power* [dBm]	Power Limit [dBm]	Margin [dB]
802.11a Mode						
5745	18750	29.73	18.78	15.78	29.73	-10.95
5765	19375	29.87	18.94	15.94	29.87	-10.93
5785	19250	29.84	18.67	15.67	29.84	-11.17
5805	19250	29.84	18.61	15.61	29.84	-11.23

*Calculated (50% duty cycle), for reporting purposes only.

4.3. Peak Power Spectral Density

Reference document:	**47 CFR §15.407 (a) (1), (2), (3), (5)**		
Test Requirements:	For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.		
Test setup:	See sec 2.1	**Pass**	
Method of testing:	Conducted		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 1MHz , VBW: 3MHz , Sweep Time: Auto		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.3.1 - Plot 4.3.12	

Test Results

5150-5250MHz Band:

Frequency [MHz]	Data Rate [Mbps]	PPSD [dBm/MHz]	PPSD Limit [dBm/MHz]	Margin [dB]	Ref Plot
802.11a Mode					
5180	6	1.0	4	-3.0	4.3.1
5200	6	1.0	4	-3.0	4.3.2
5240	6	1.1	4	-2.9	4.3.3

5250-5350MHz Band:

Frequency [MHz]	Data Rate [Mbps]	PPSD [dBm/MHz]	PPSD Limit [dBm/MHz]	Margin [dB]	Ref Plot
802.11a Mode					
5260	6	4.5	11	-6.5	4.3.4
5300	6	5.3	11	-5.7	4.3.5
5320	6	4.8	11	-6.2	4.3.6

5470-5725 MHz Band:

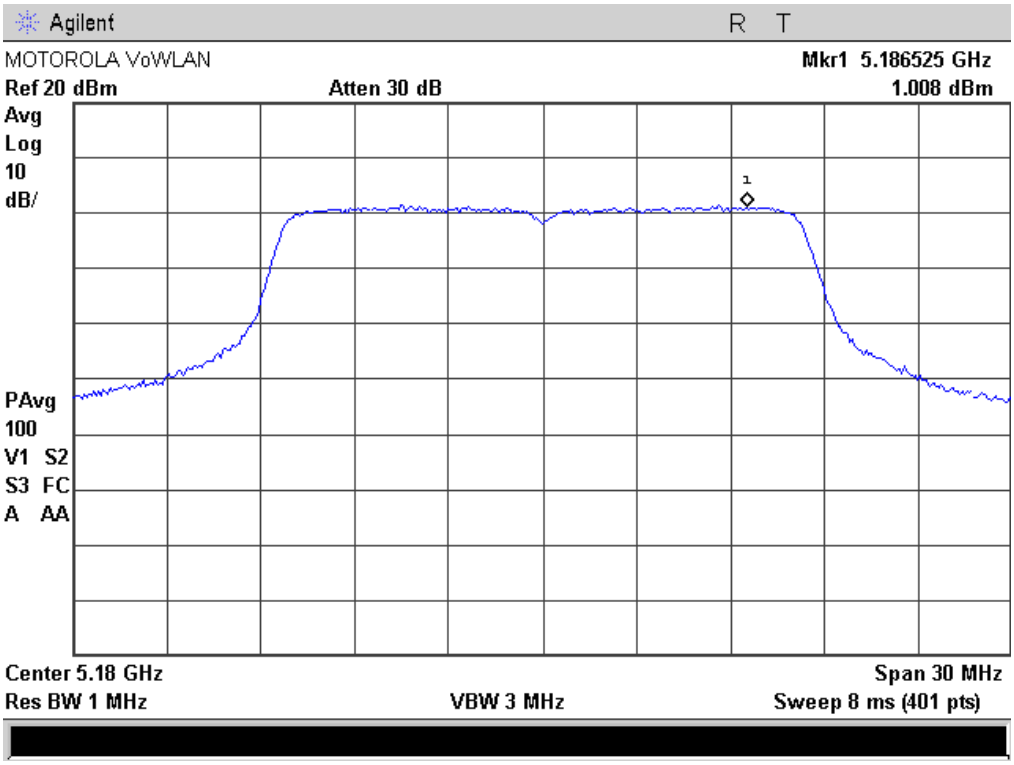
Frequency [MHz]	Data Rate [Mbps]	PPSD [dBm/MHz]	PPSD Limit [dBm/MHz]	Margin [dB]	Ref Plot
802.11a Mode					
5500	6	4.2	11	-6.8	4.3.7
5600	6	5.3	11	-5.7	4.3.8
5700	6	5.1	11	-5.9	4.3.9

5725-5825 MHz Band:

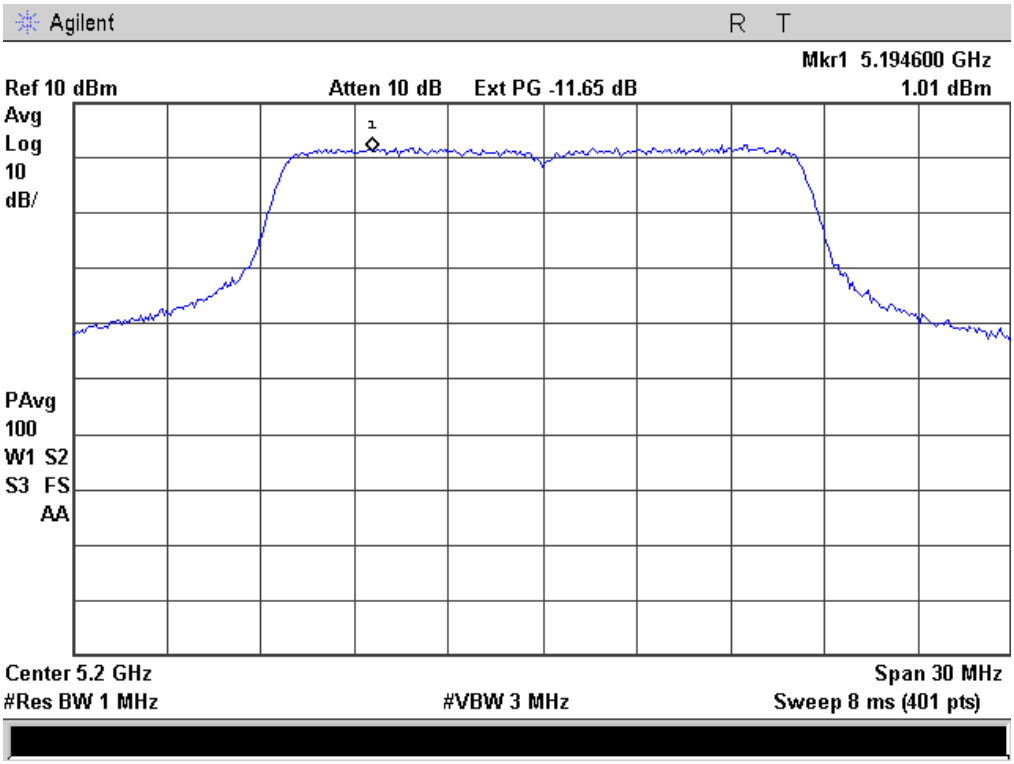
Frequency [MHz]	Data Rate [Mbps]	PPSD [dBm/MHz]	PPSD Limit [dBm/MHz]	Margin [dB]	Ref Plot
802.11a Mode					
5745	6	4.8	17	-12.2	4.3.10
5785	6	5.1	17	-11.9	4.3.11
5805	6	4.9	17	-12.1	4.3.12

802.11a Mode

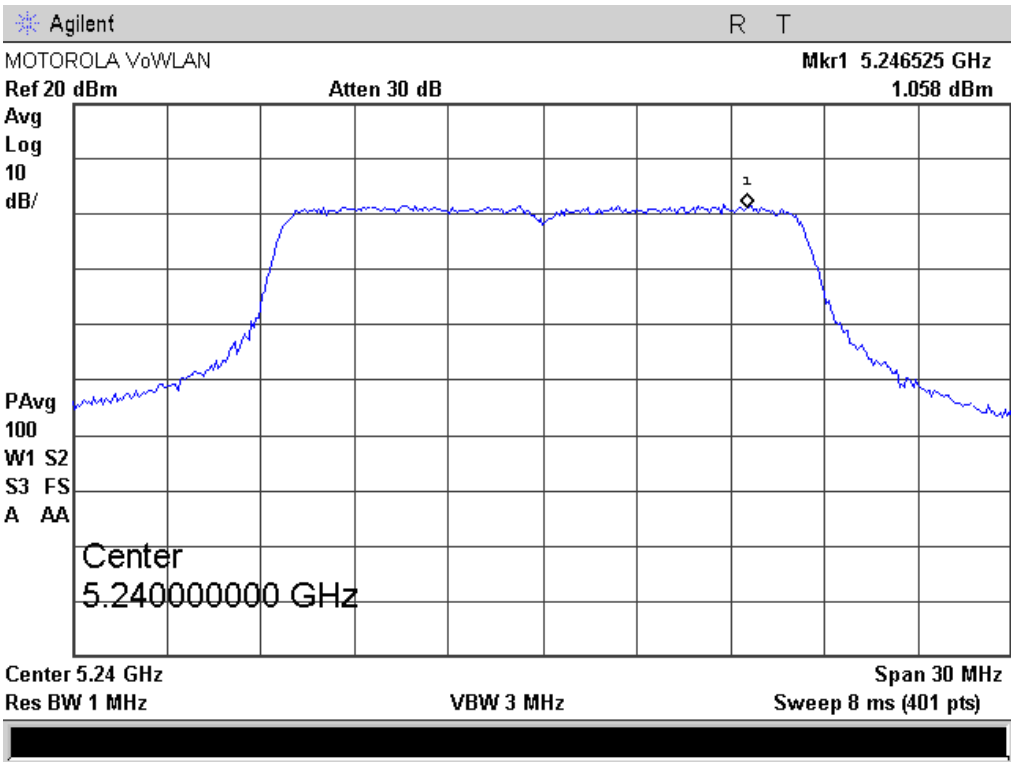
Plot 4.3.1



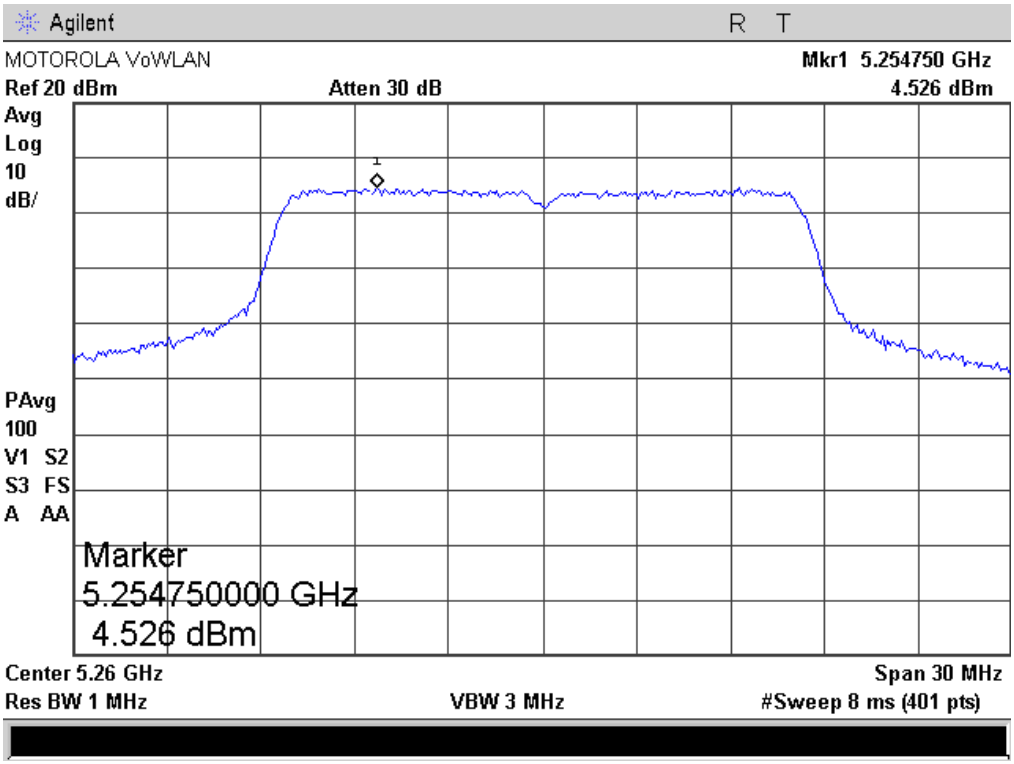
Plot 4.3.2



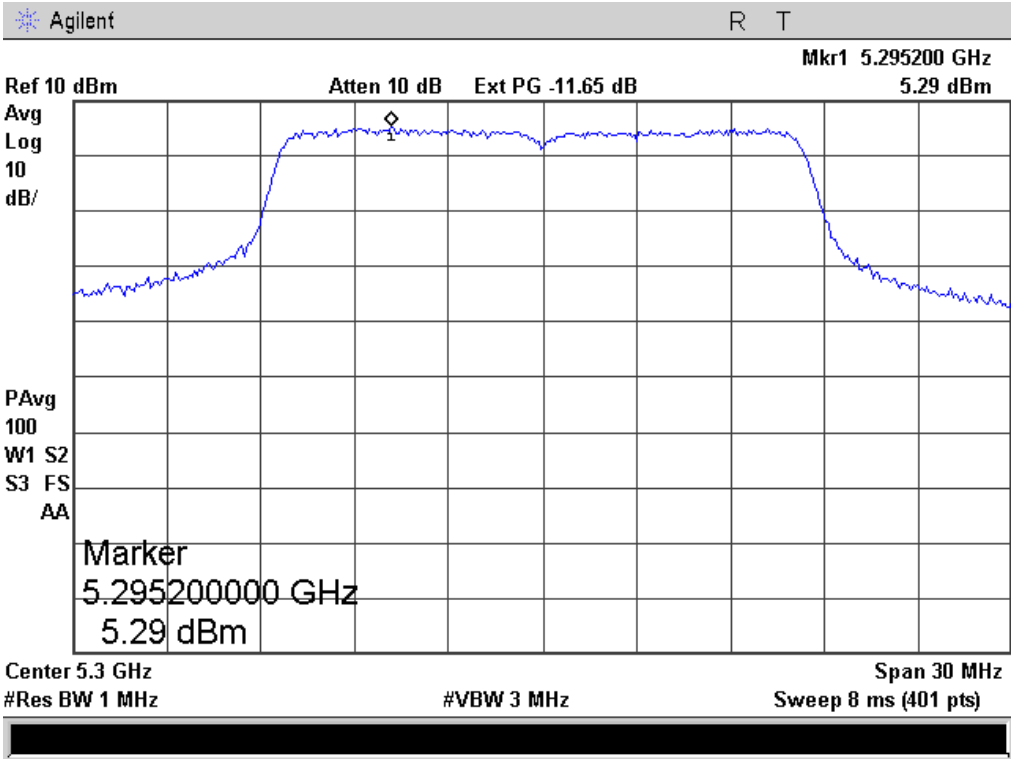
Plot 4.3.3


Agilent
R T
MOTOROLA VoWLAN
Mkr1 5.246525 GHz
Ref 20 dBm
Atten 30 dB
1.058 dBm
Avg
Log
10
dB/
PAvg
100
W1 S2
S3 FS
A AA
Center
5.240000000 GHz
Center 5.24 GHz
Span 30 MHz
Res BW 1 MHz
VBW 3 MHz
Sweep 8 ms (401 pts)

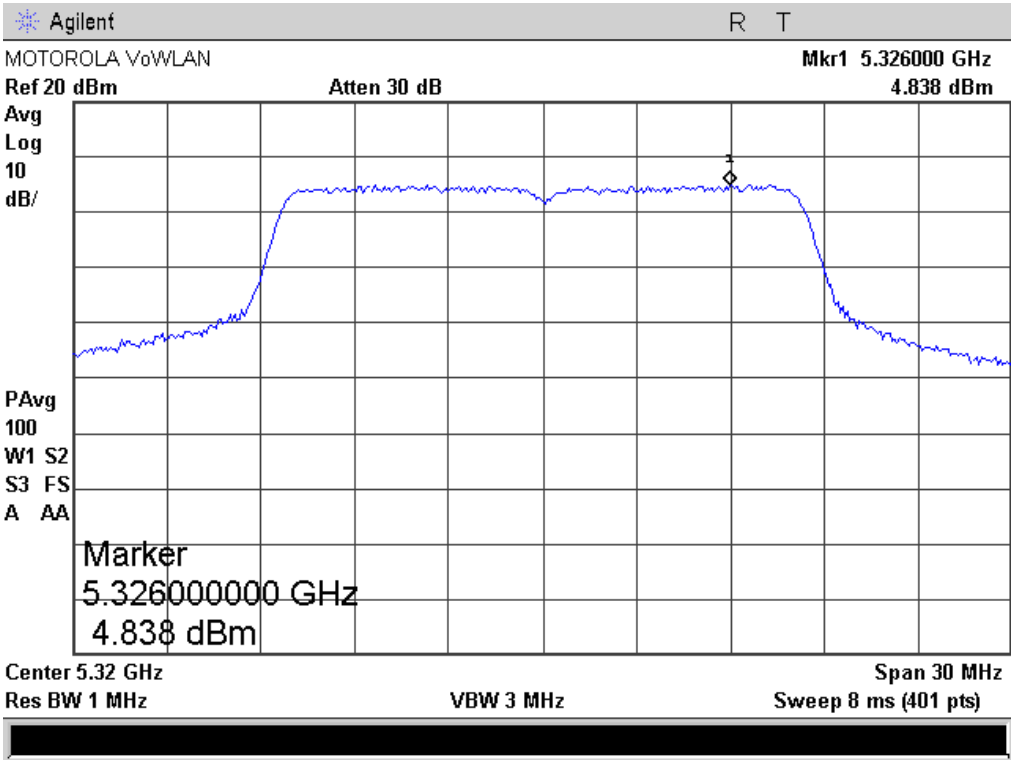
Plot 4.3.4



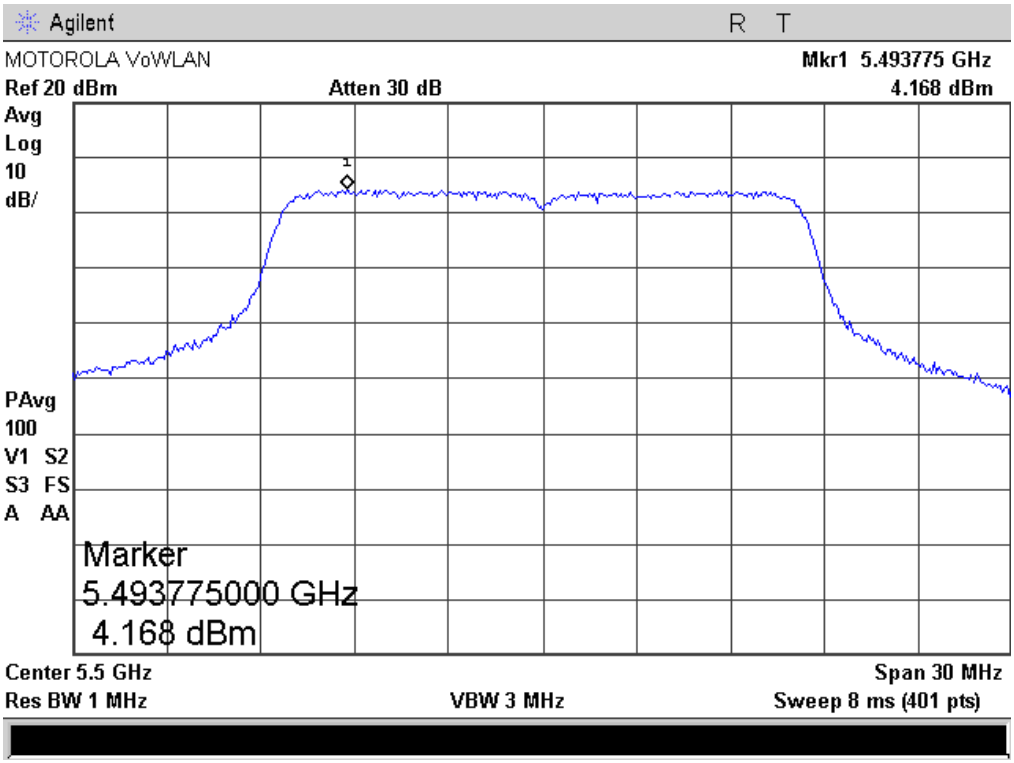
Plot 4.3.5



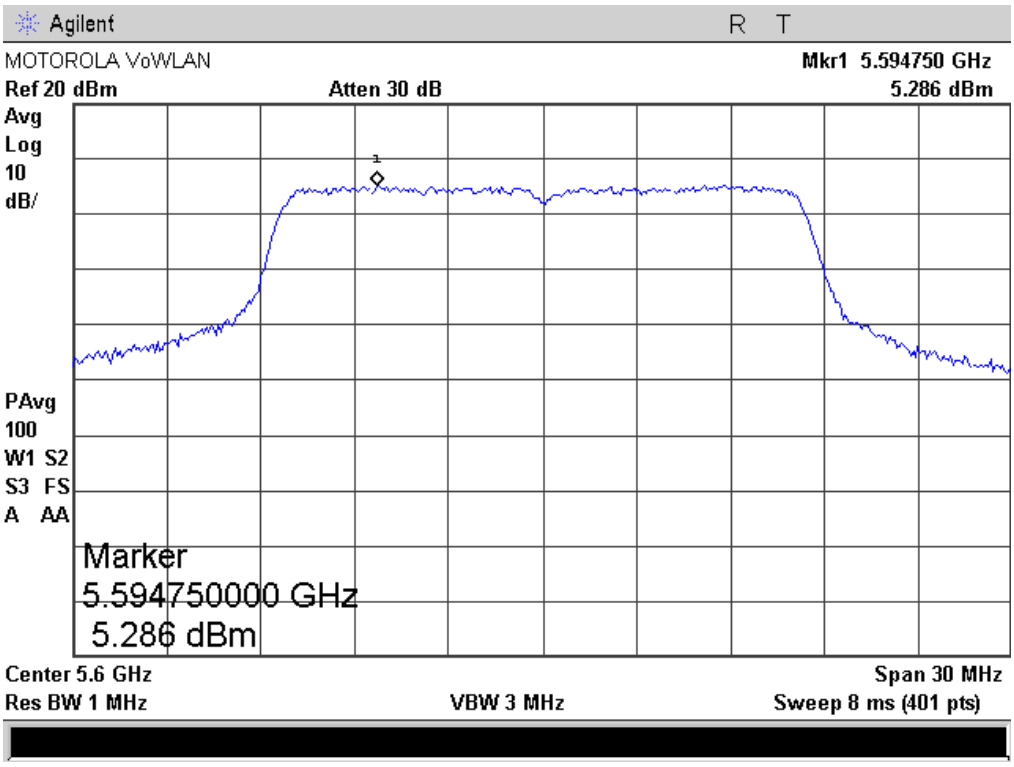
Plot 4.3.6



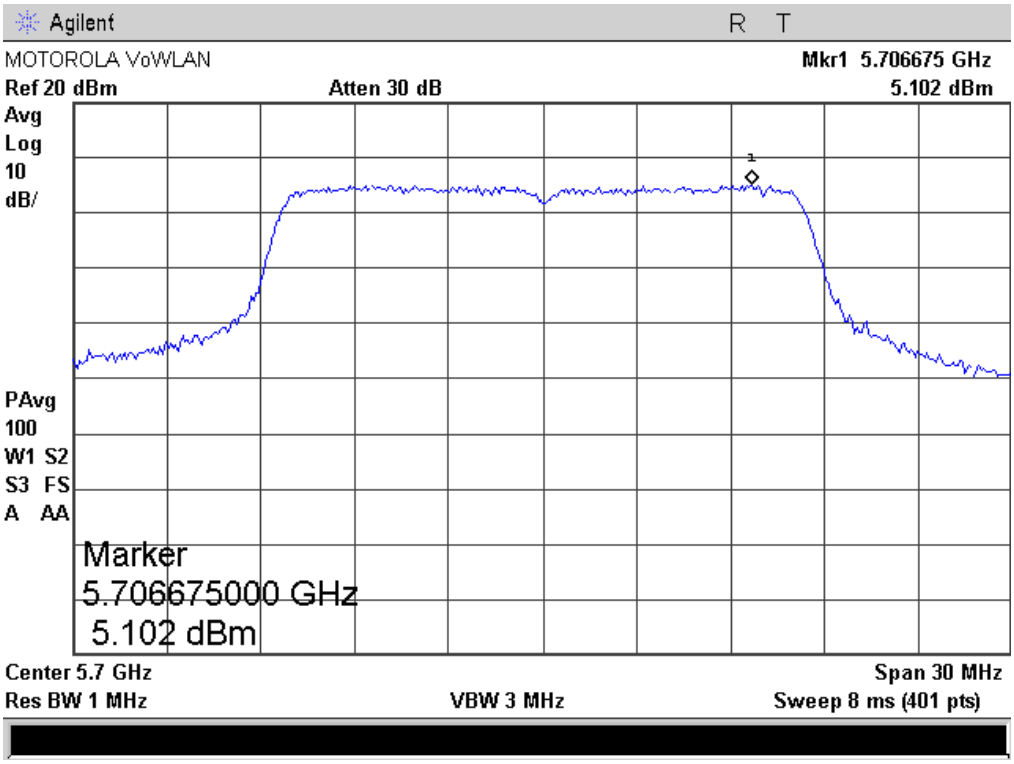
Plot 4.3.7



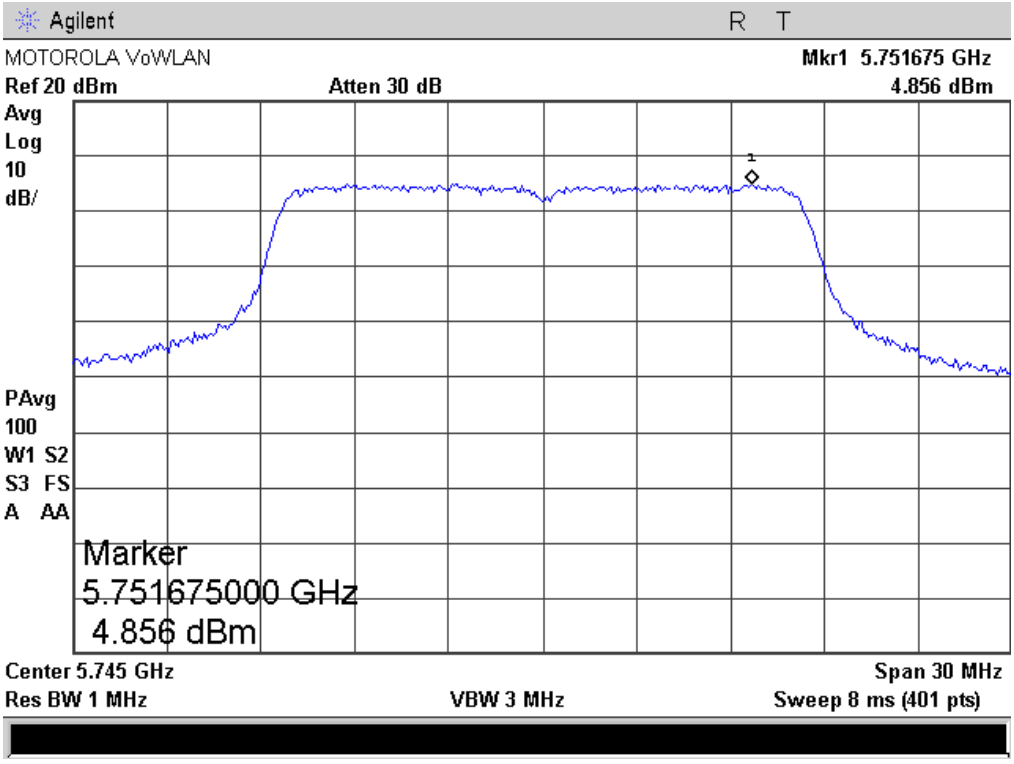
Plot 4.3.8


Agilent
R T
MOTOROLA VoWLAN
Mkr1 5.594750 GHz
Ref 20 dBm
Atten 30 dB
5.286 dBm
Avg
Log
10
dB/
PAvg
100
W1 S2
S3 FS
A AA
Marker
5.594750000 GHz
5.286 dBm
Center 5.6 GHz
Span 30 MHz
Res BW 1 MHz
VBW 3 MHz
Sweep 8 ms (401 pts)

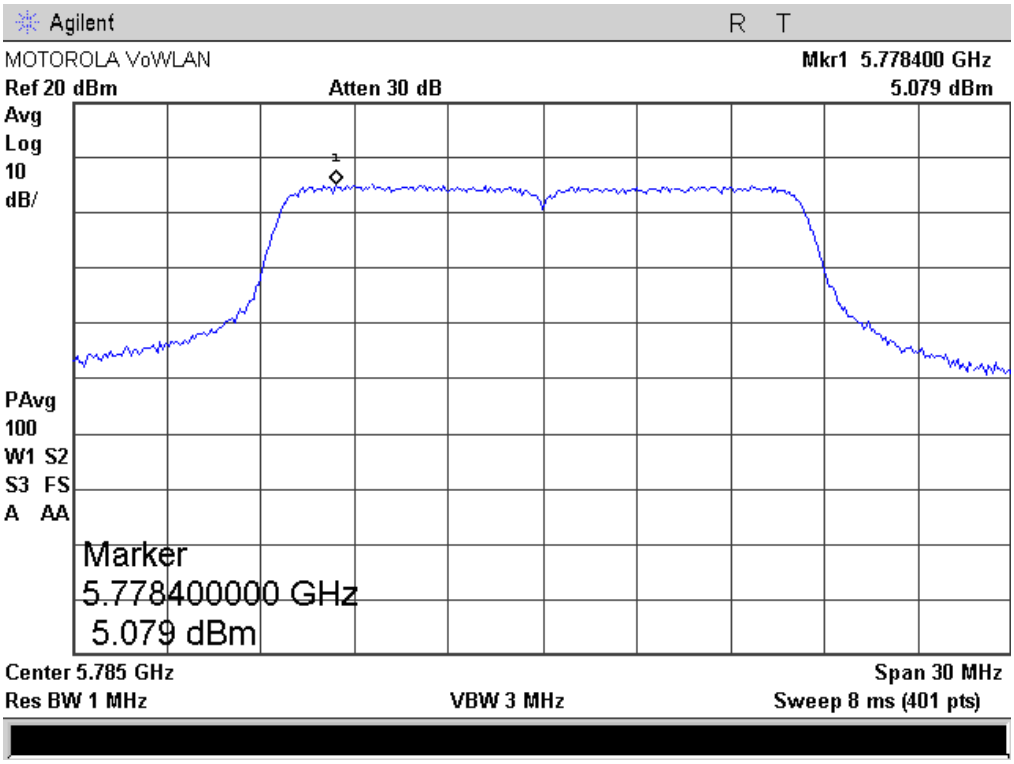
Plot 4.3.9



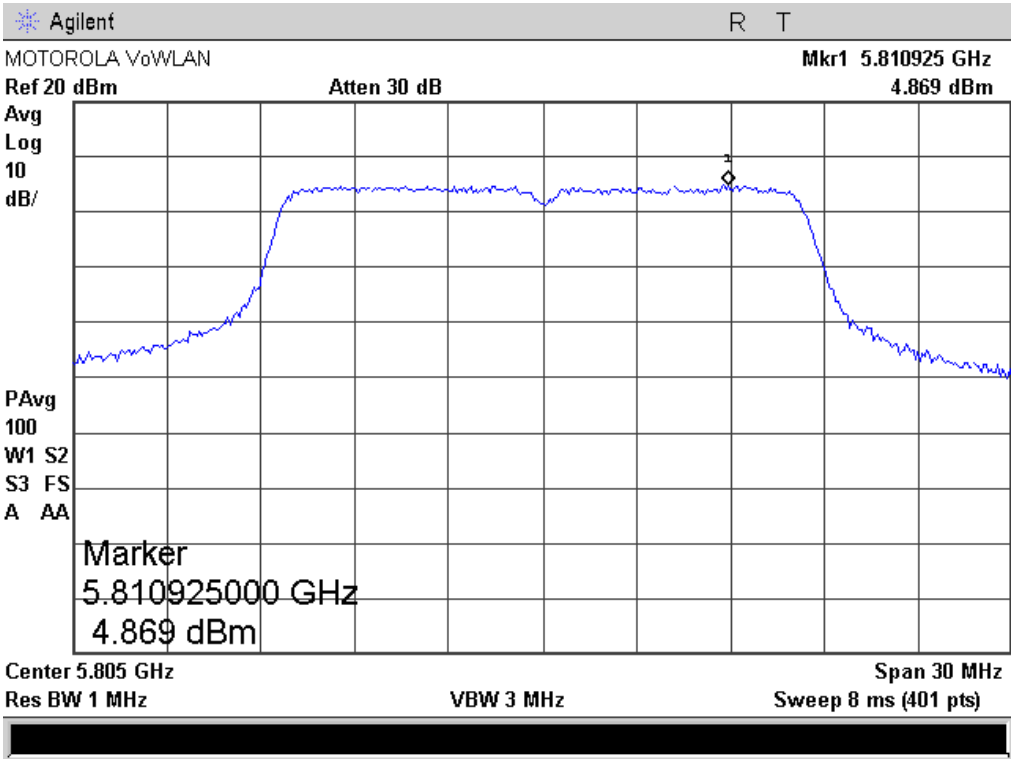
Plot 4.3.10



Plot 4.3.11



Plot 4.3.12



4.4. Peak Excursion

Reference document:	**47 CFR §15.407 (a) (6)**		
Test Requirements:	The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.		
Test setup:	See sec 2.1,	**Pass**	
Method of testing:	Conducted		
Operating conditions:	Under normal test conditions		
S.A. Settings:	Trace 1:RBW: 1MHz , VBW: 3MHz , Peak Max Hold, Sweep Time: Auto, Trace 2: RBW: 1MHz , VBW: 30kHz , Peak Max Hold, Sweep Time: Auto		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.4.1 - 4.4.12	

Test Results:

5150-5250 MHz:

Frequency [MHz]	Peak Excursion [dB]	Limit [dB]	Margin [dB]	Ref Plots
802.11a Mode				
5180	8.0	13	-5.0	4.4.1
5200	6.5	13	-6.5	4.4.2
5240	8.5	13	-4.5	4.4.3

5250-5350 MHz

Frequency [MHz]	Peak Excursion [dB]	Limit [dB]	Margin [dB]	Ref Plot
802.11a Mode				
5260	6.0	13	-7.0	4.4.4
5300	6.7	13	-6.3	4.4.5
5320	8.3	13	-4.7	4.4.6

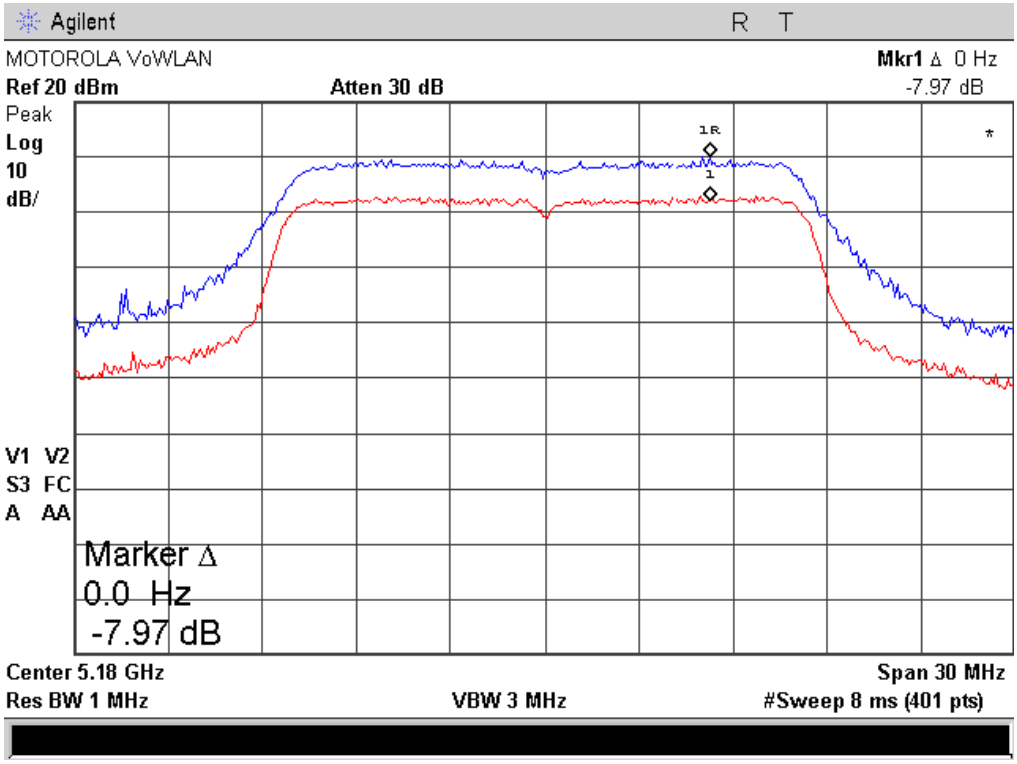
5470-5725 MHz

Frequency [MHz]	Peak Excursion [dB]	Limit [dB]	Margin [dB]	Ref Plot
802.11a Mode				
5500	6.2	13	-6.8	4.4.7
5600	8.0	13	-5.0	4.4.8
5700	6.8	13	-6.2	4.4.9

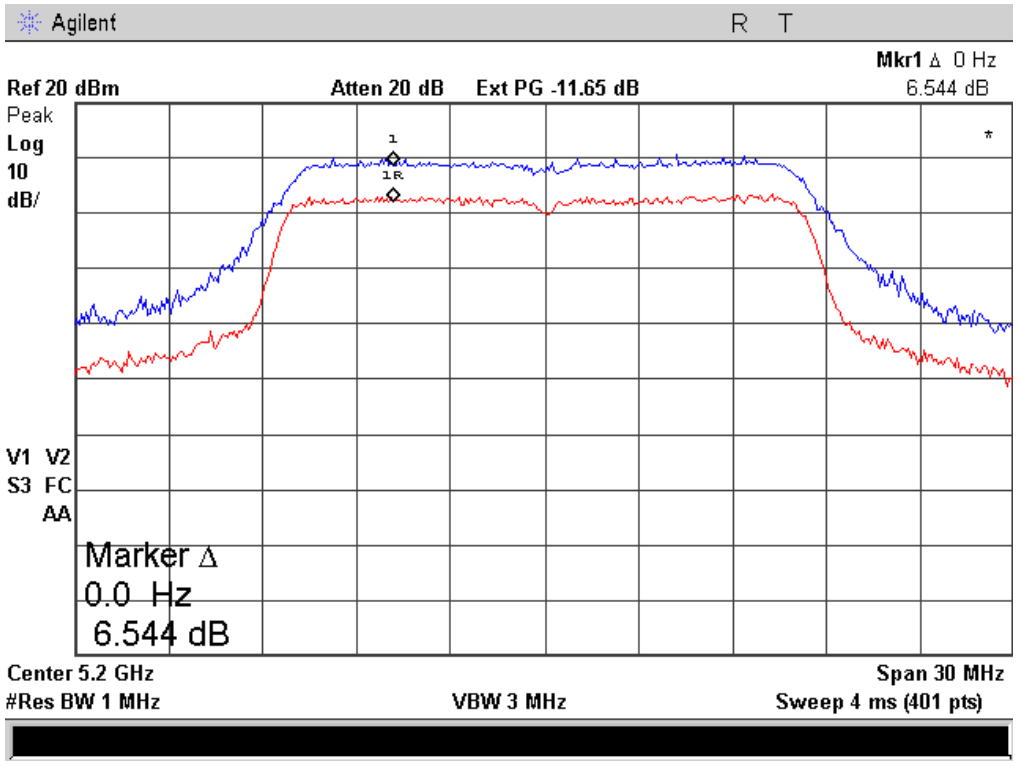
5725-5805 MHz

Frequency [MHz]	Peak Excursion [dB]	Limit [dB]	Margin [dB]	Ref Plot
802.11a Mode				
5745	5.4	13	-7.6	4.4.10
5785	7.8	13	-5.2	4.4.11
5805	8.0	13	-5.0	4.4.12

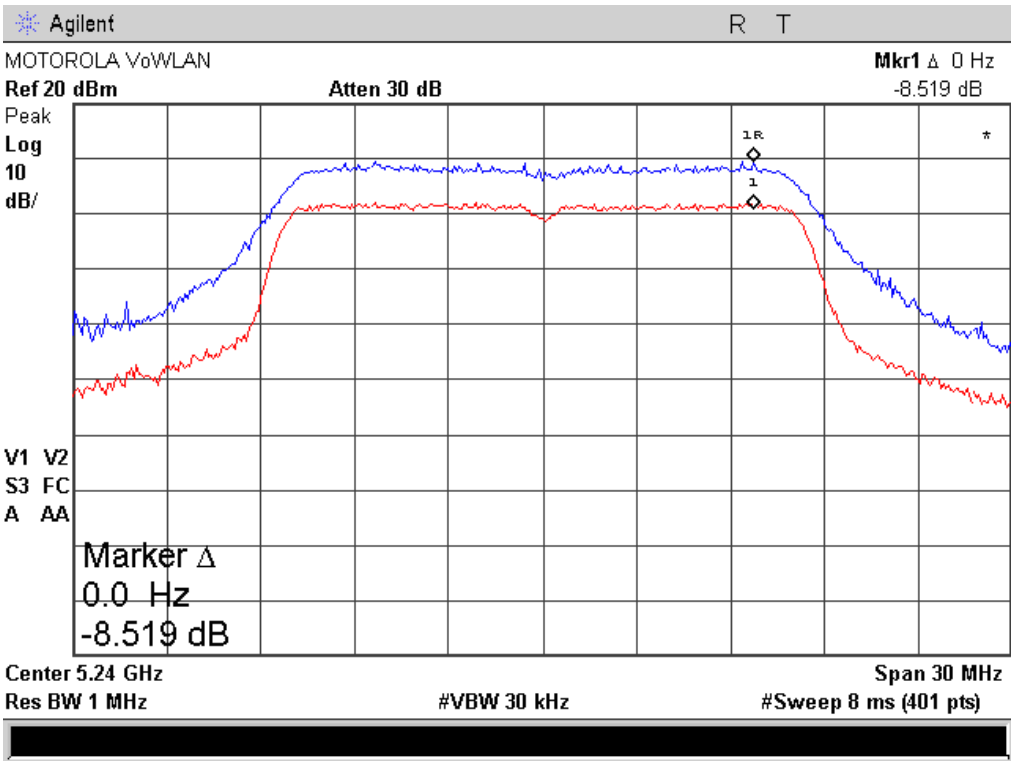
Plot 4.4.1



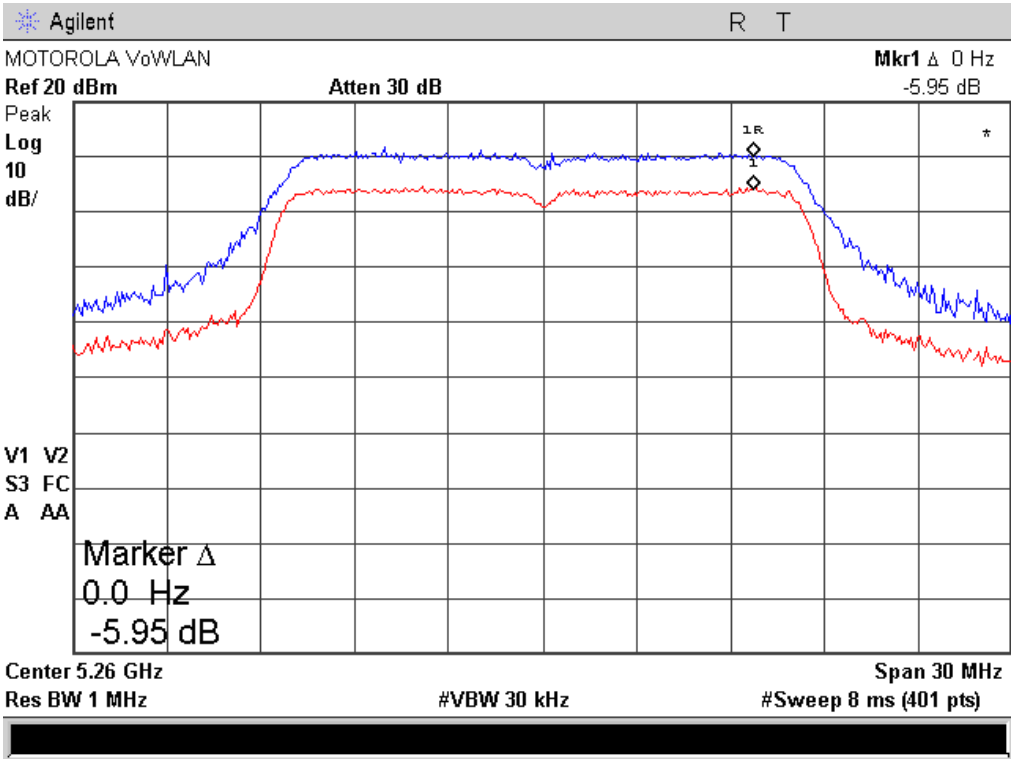
Plot 4.4.2



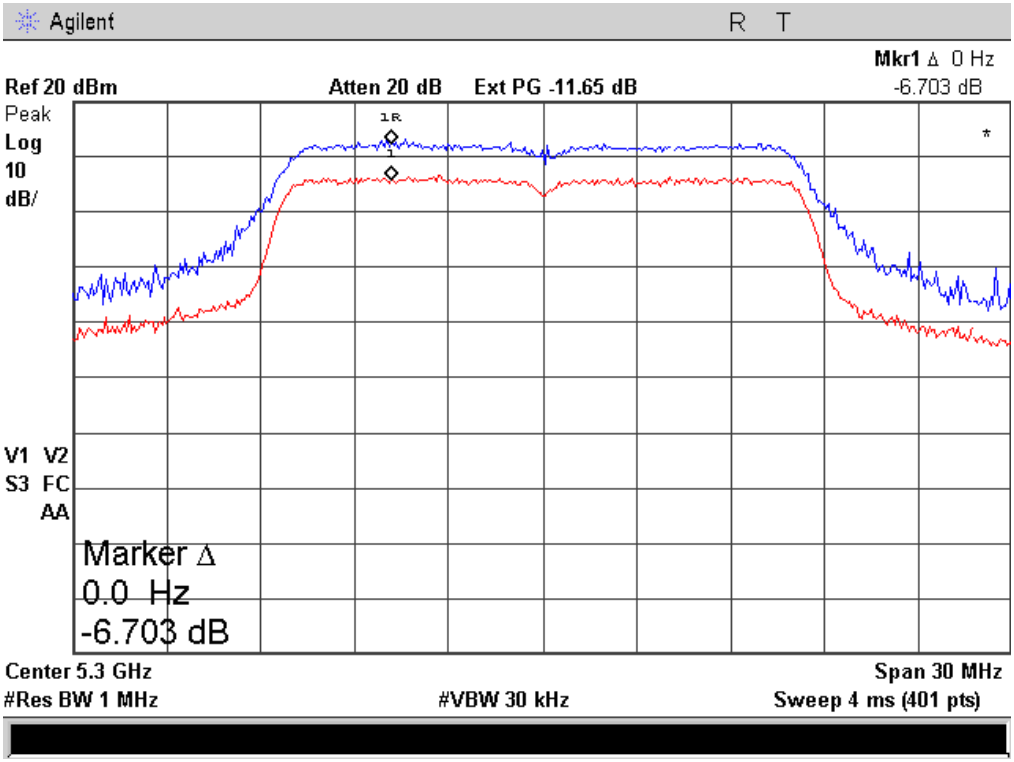
Plot 4.4.3


Agilent
R T
MOTOROLA VoWLAN
Mkr1 Δ 0 Hz
Ref 20 dBm
Atten 30 dB
-8.519 dB
Peak
Log
10
dB/
1R
1
*
V1 V2
S3 FC
A AA
Marker Δ
0.0 Hz
-8.519 dB
Center 5.24 GHz
Span 30 MHz
Res BW 1 MHz
#VBW 30 kHz
#Sweep 8 ms (401 pts)

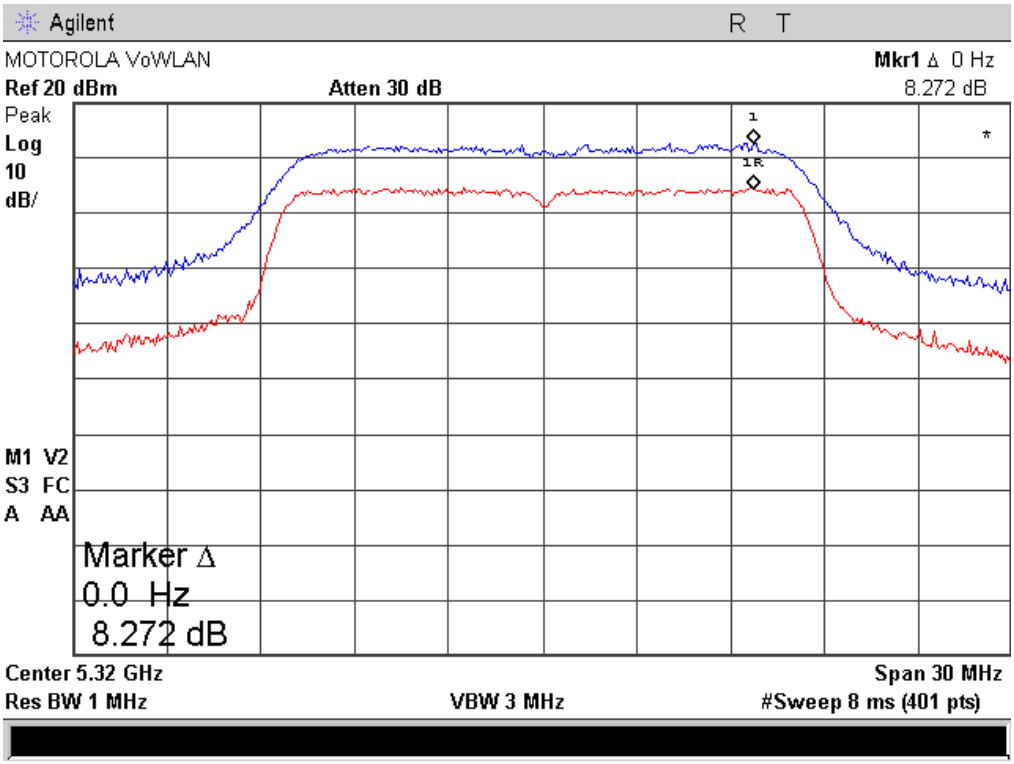
Plot 4.4.4



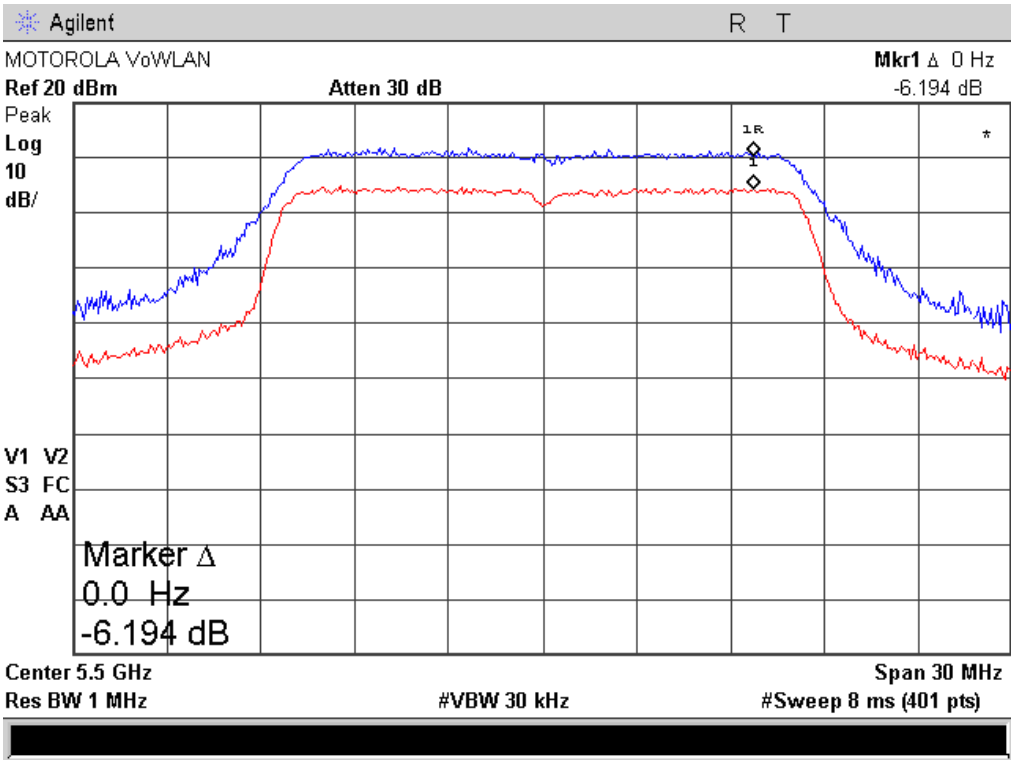
Plot 4.4.5



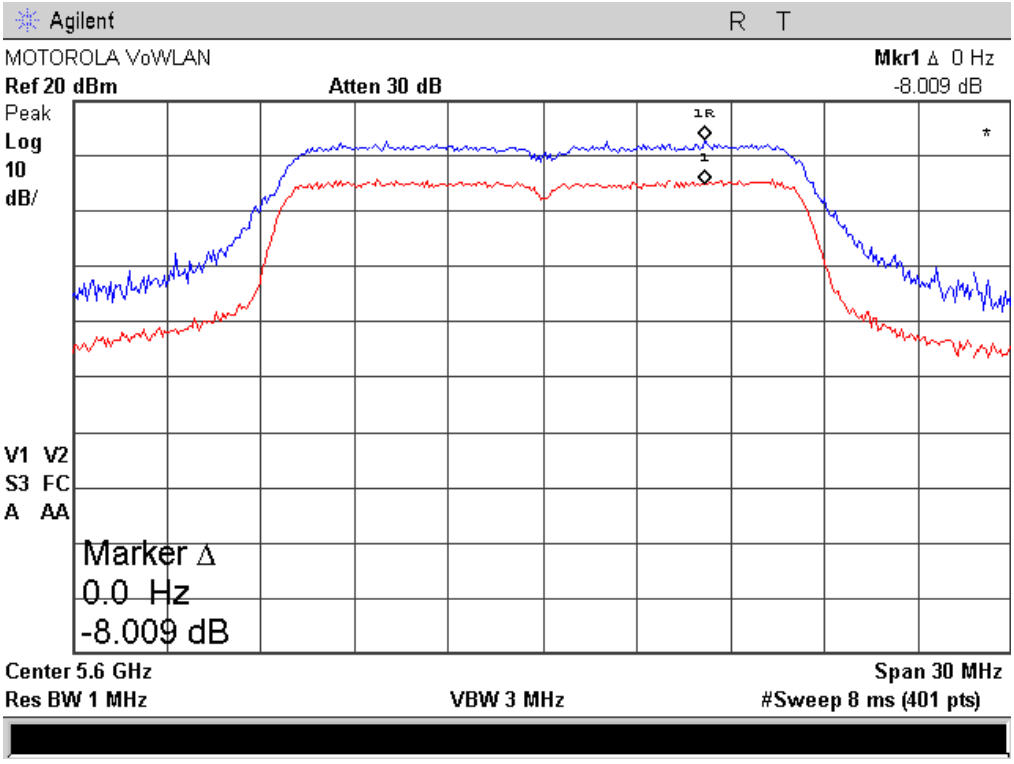
Plot 4.4.6


Agilent
R T
MOTOROLA VoWLAN
Mkr1 Δ 0 Hz
Ref 20 dBm
Atten 30 dB
8.272 dB
Peak
Log
10
dB/
M1 V2
S3 FC
A AA
Marker Δ
0.0 Hz
8.272 dB
Center 5.32 GHz
Span 30 MHz
Res BW 1 MHz
VBW 3 MHz
#Sweep 8 ms (401 pts)

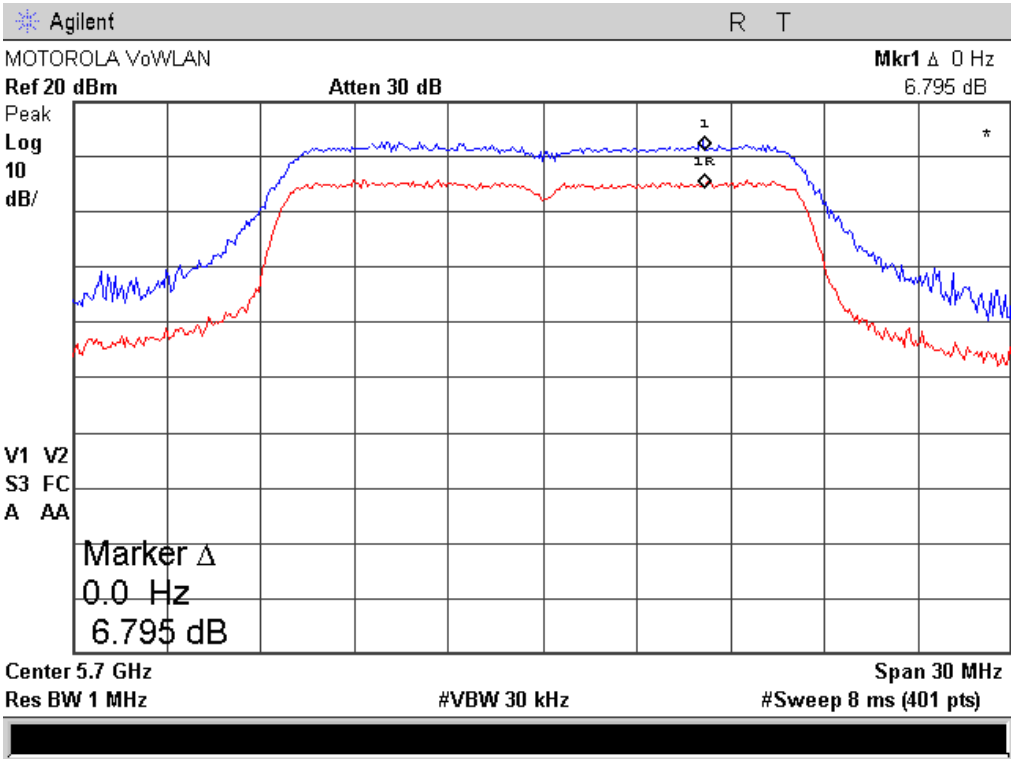
Plot 4.4.7



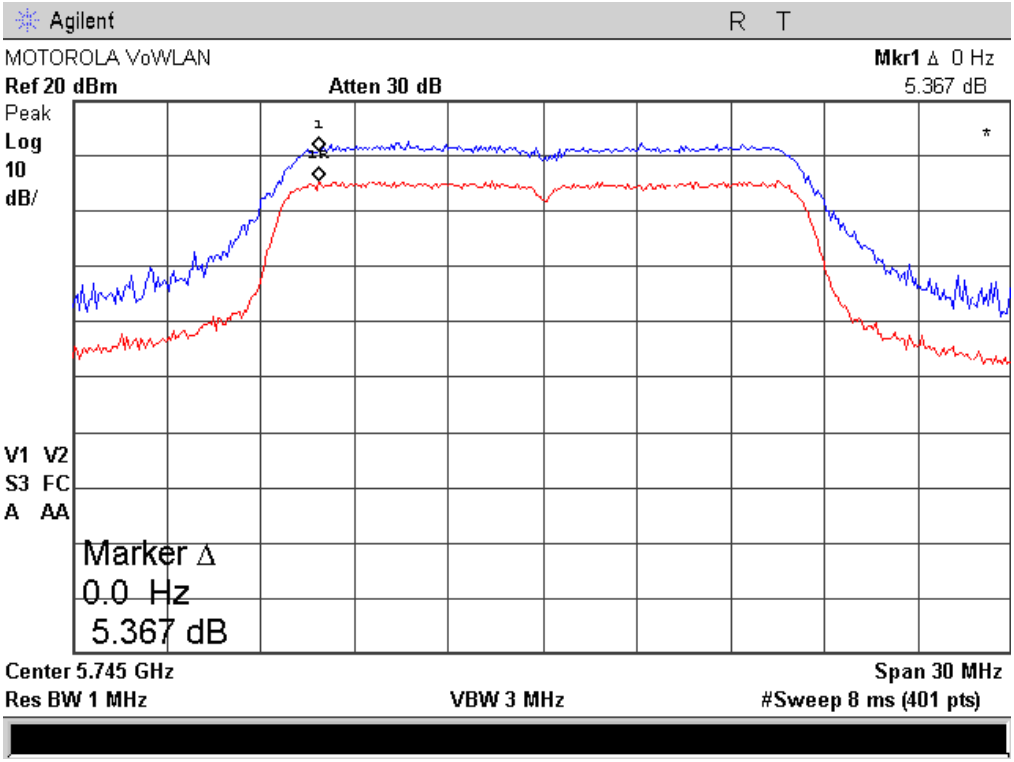
Plot 4.4.8



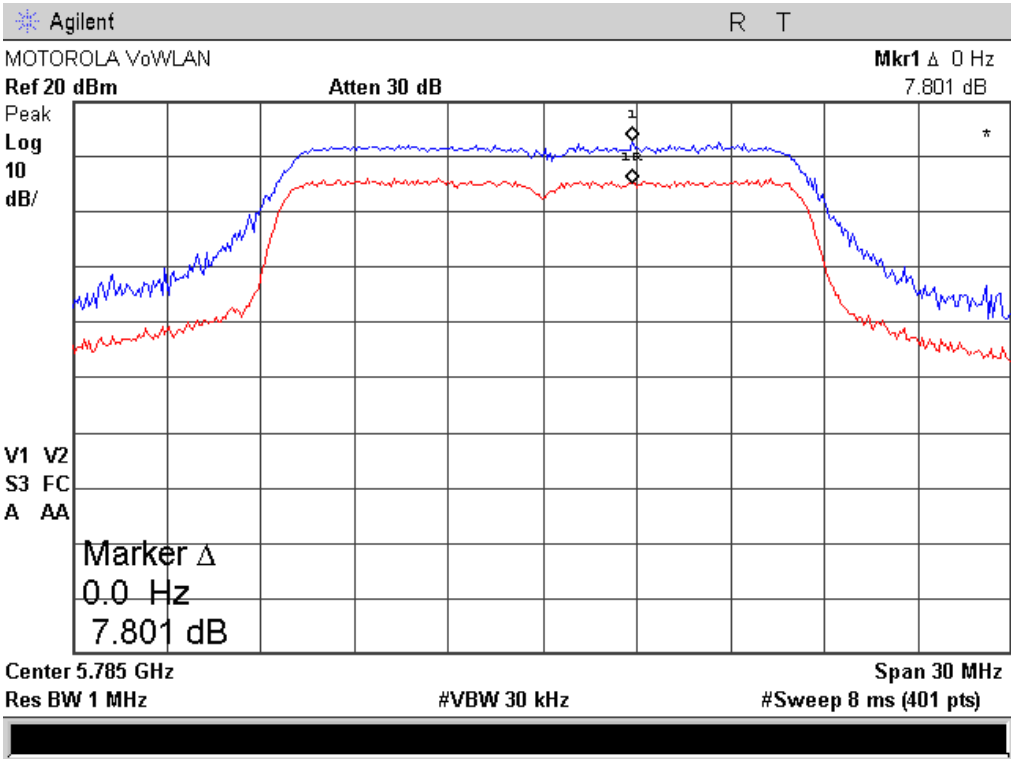
Plot 4.4.9



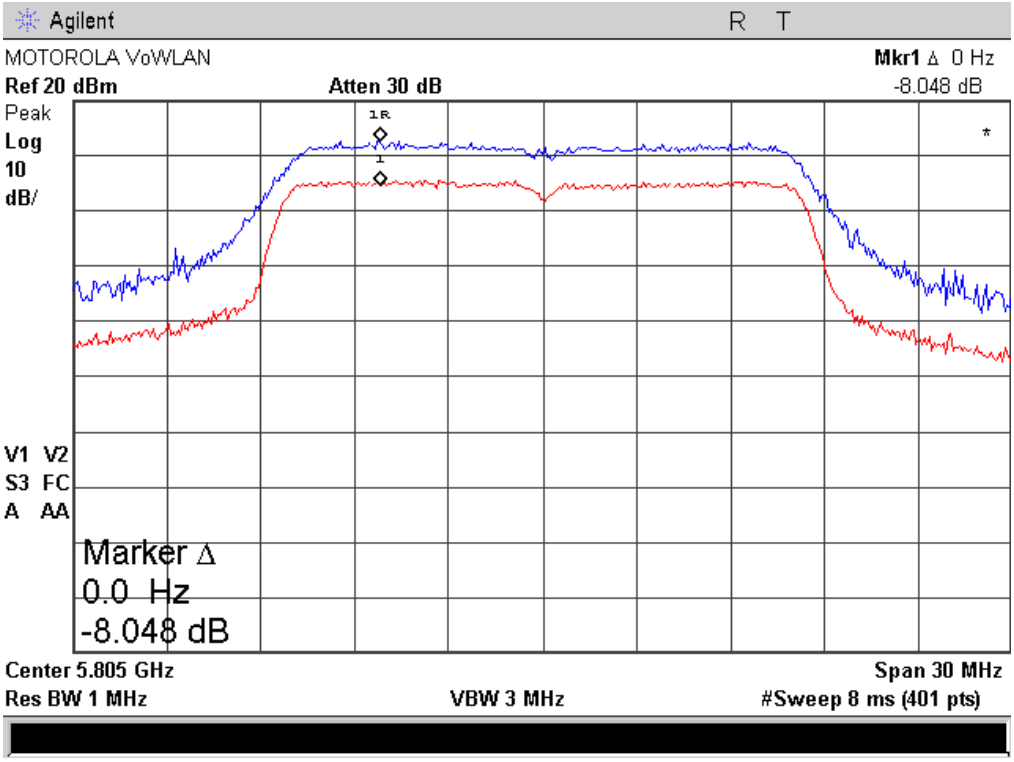
Plot 4.4.10



Plot 4.4.11



Plot 4.4.12



4.5. Conducted Spurious Emissions

Reference document:	**47 CFR §15.407 (b) (1),(2),(3),(4) & §15.407 (b)(6)**		
Test Requirements:	The peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits: For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz. For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz. Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Sec. 15.209.		
Test setup:	See sec 2.1	**Pass**	
Method of testing:	Conducted		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 1 MHz, VBW:1 MHz		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.5.1- Plot 4.5.34	

Test results:

5150-5250 MHz: Spurious

Frequency [MHz]	Data Rate [Mbps]	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode						
5180	54	-30.8	-27	4.5.1 - 4.5.2	-3.8	Comply
5220	54	-35.7	-27	4.5.3 - 4.5.4	-8.7	Comply
5240	54	-31.0	-27	4.5.5 - 4.5.6	-4.0	Comply

5250-5350 MHz: Spurious

Frequency [MHz]	Data Rate [Mbps]	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode						
5260	54	-32.35	-27	4.5.7 - 4.5.8	-5.4	Comply
5300	54	-29.86	-27	4.5.9 - 4.5.10	-2.9	Comply
5320	54	-32.06	-27	4.5.11 - 4.5.12	-5.1	Comply

5470-5725 MHz: Spurious

Frequency [MHz]	Data Rate [Mbps]	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode						
5500	54	-31.7	-27	4.5.13 - 4.5.14	-4.7	Comply
5600	54	-30.9	-27	4.5.15 - 4.5.16	-3.9	Comply
5700	54	-32.7	-27	4.5.17 - 4.5.18	-5.7	Comply

5725-5825 MHz: Spurious

Frequency [MHz]	Data Rate [Mbps]	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode						
5745	54	-32.1	-27	4.5.19 - 4.5.20	-5.1	Comply
5785	54	-31.3	-27	4.5.21 - 4.5.22	-4.3	Comply
5805	54	-30.8	-27	4.5.23 - 4.5.24	-3.8	Comply

5150-5250 MHz: Band edge

Frequency [MHz]	Data Rate [Mbps]	Antenna Gain	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode							
5150	54	0	-36.9	-27	4.5.25	-9.9	Comply
5350	54	0	-46.2	-27	4.5.26	-19.2	Comply

5250-5350 MHz: Band edge

Frequency [MHz]	Data Rate [Mbps]	Antenna Gain	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode							
5150	54	0	-42.3	-27	4.5.27	-15.3	Comply
5350	54	0	-35.1	-27	4.5.28	-8.1	Comply

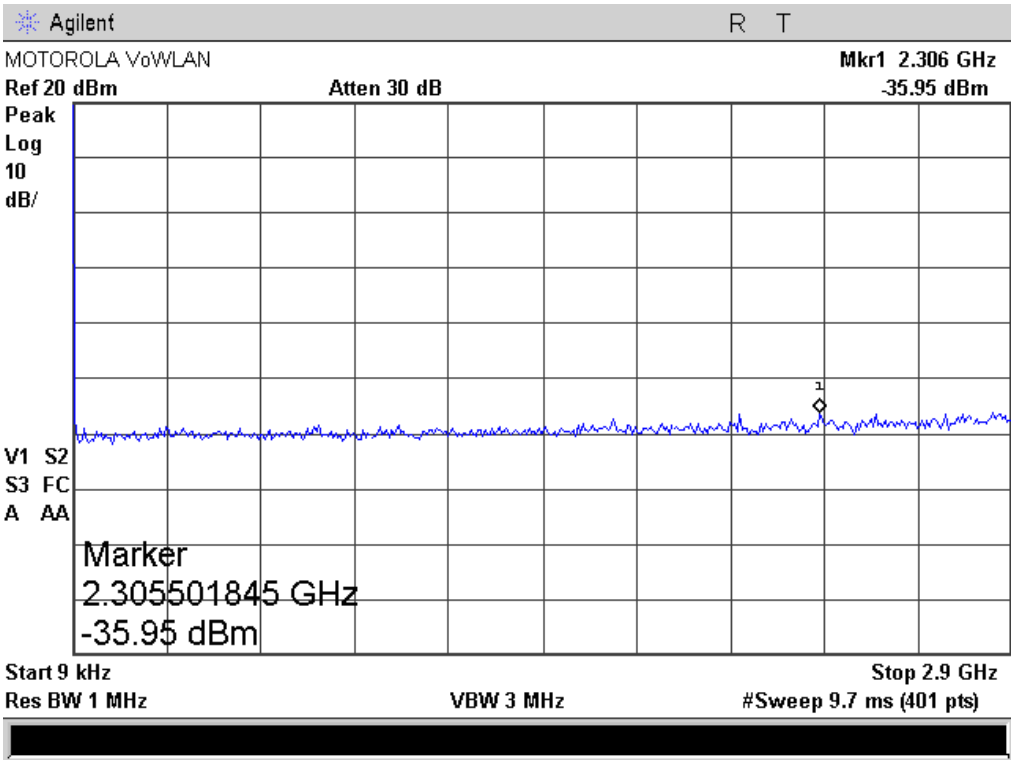
5470-5725 MHz: Band edge

Frequency [MHz]	Data Rate [Mbps]	Antenna Gain	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode							
5470	54	0	-36.0	-27	4.5.29	-9.0	Comply
5725	54	0	-37.5	-27	4.5.30	-10.5	Comply

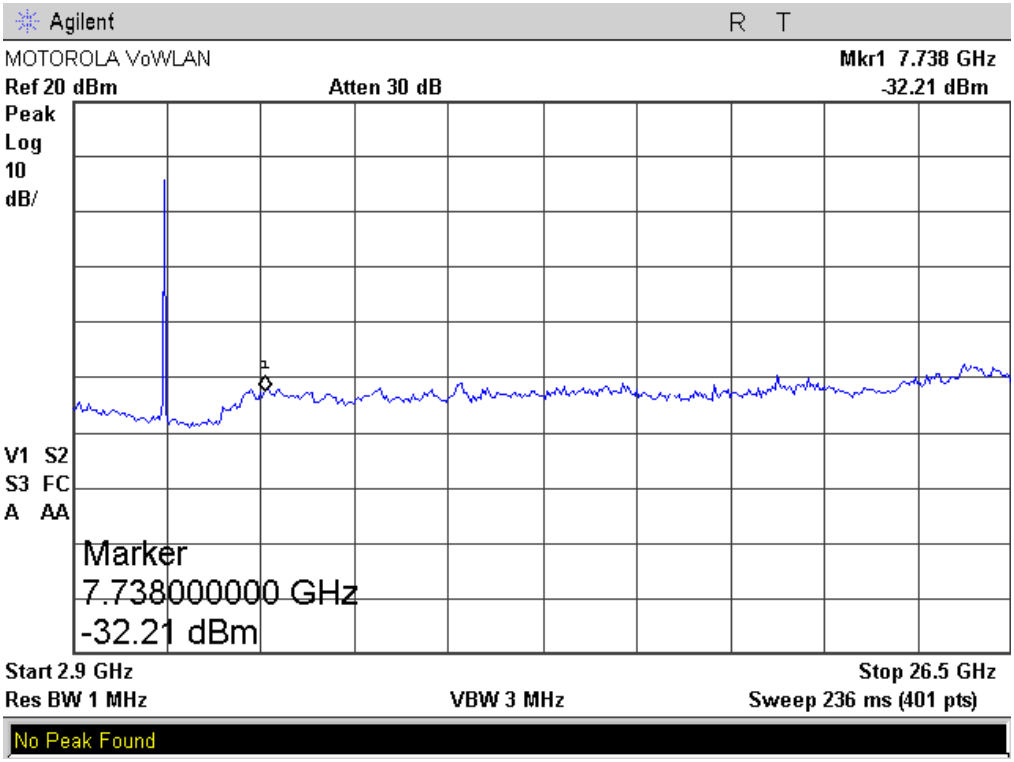
5725-5825 MHz: Band edge

Frequency [MHz]	Data Rate [Mbps]	Antenna Gain	Measured Value [dBm/MHz]	EIRP Value Limit [dBm/MHz]	Reference Plots	Margin	Result
802.11a Mode							
5725	54	0	-20.6	-17	4.5.31	-3.6	Comply
5715	54	0	-30.9	-27	4.5.32	-3.9	Comply
5825	54	0	-25.1	-17	4.5.33	-8.1	Comply
5835	54	0	-36.7	-27	4.5.34	-9.7	Comply

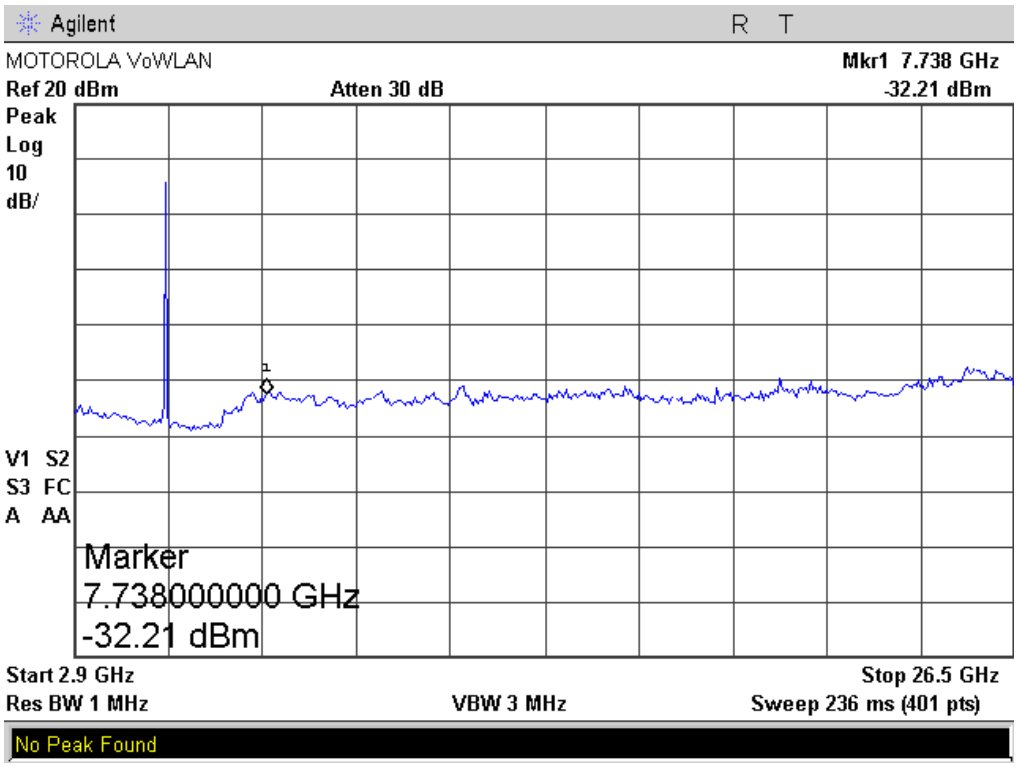
Spurious
Plot 4.5.1



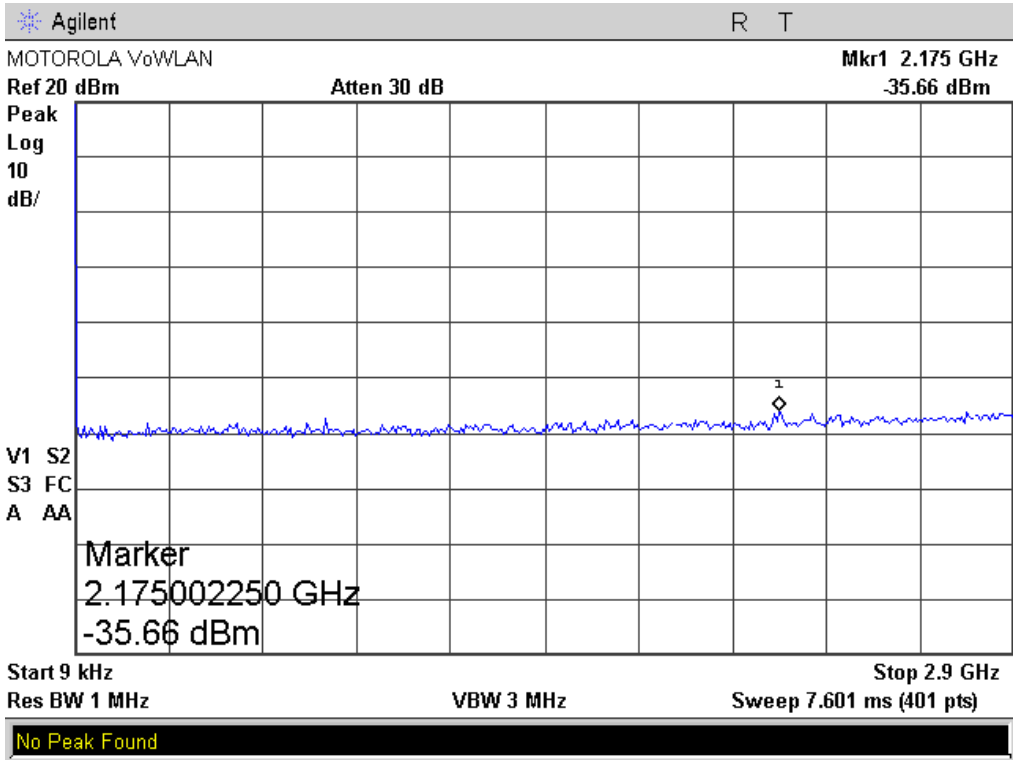
Plot 4.5.2



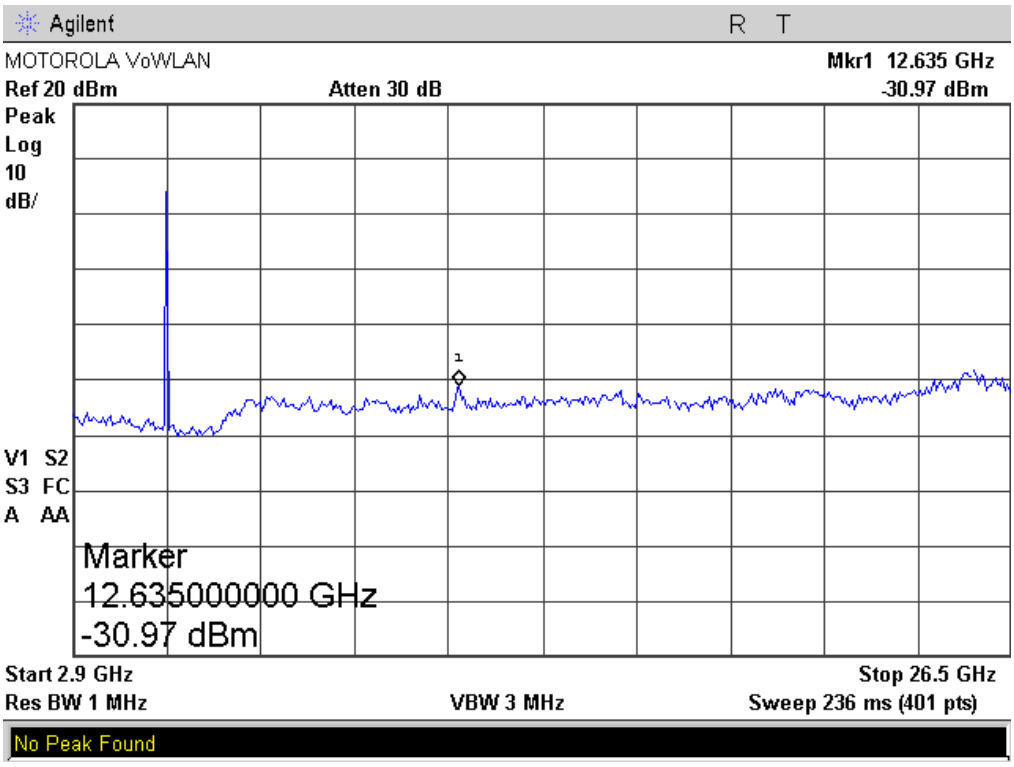
Plot 4.5.3



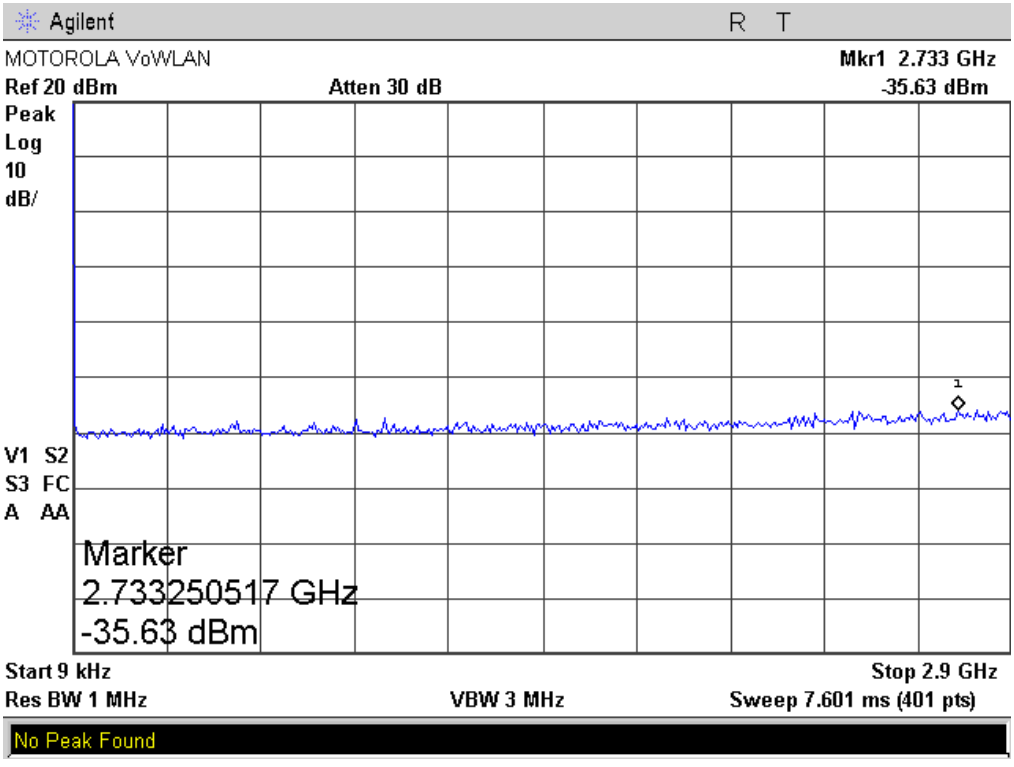
Plot 4.5.4



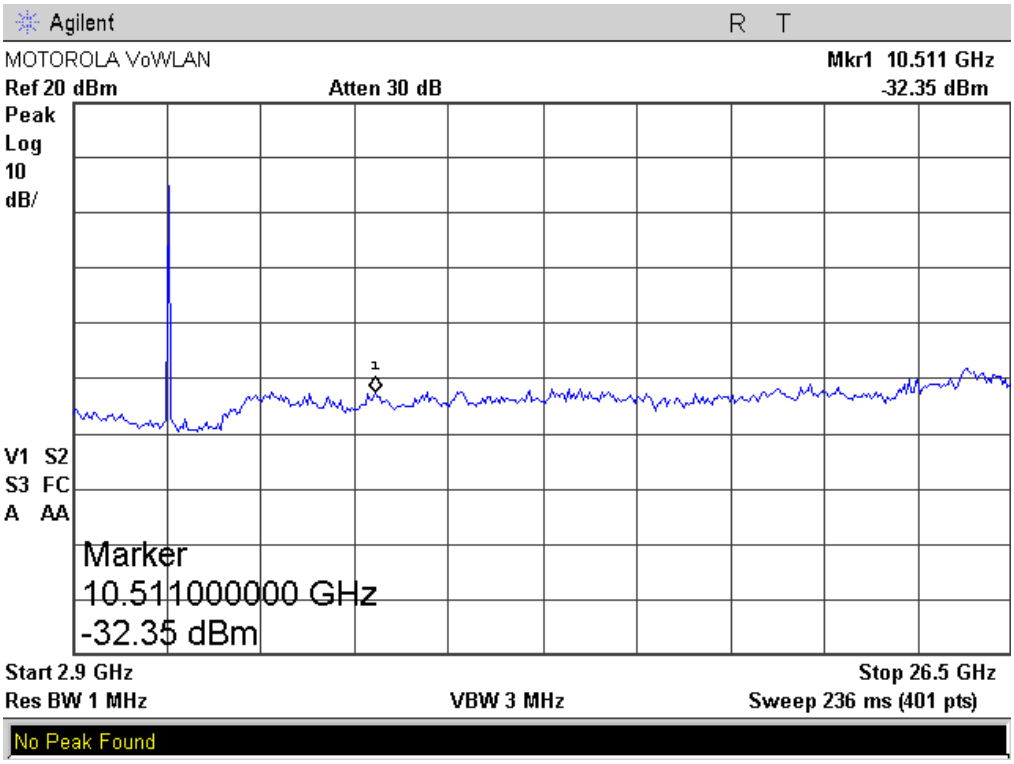
Plot 4.5.5



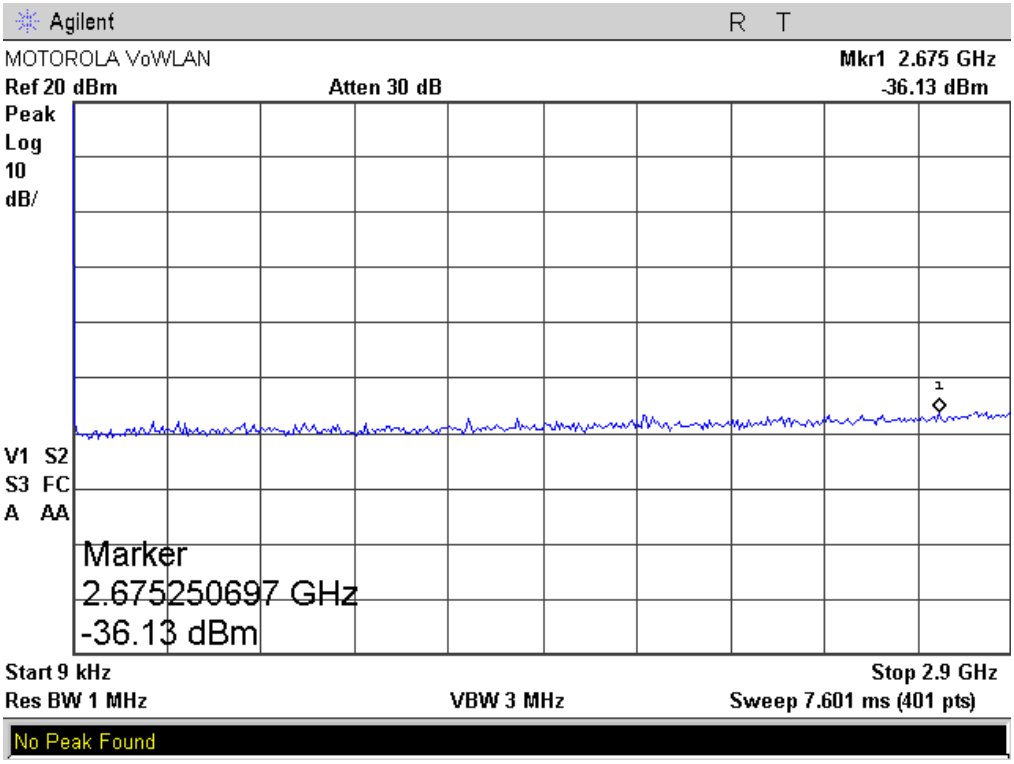
Plot 4.5.6



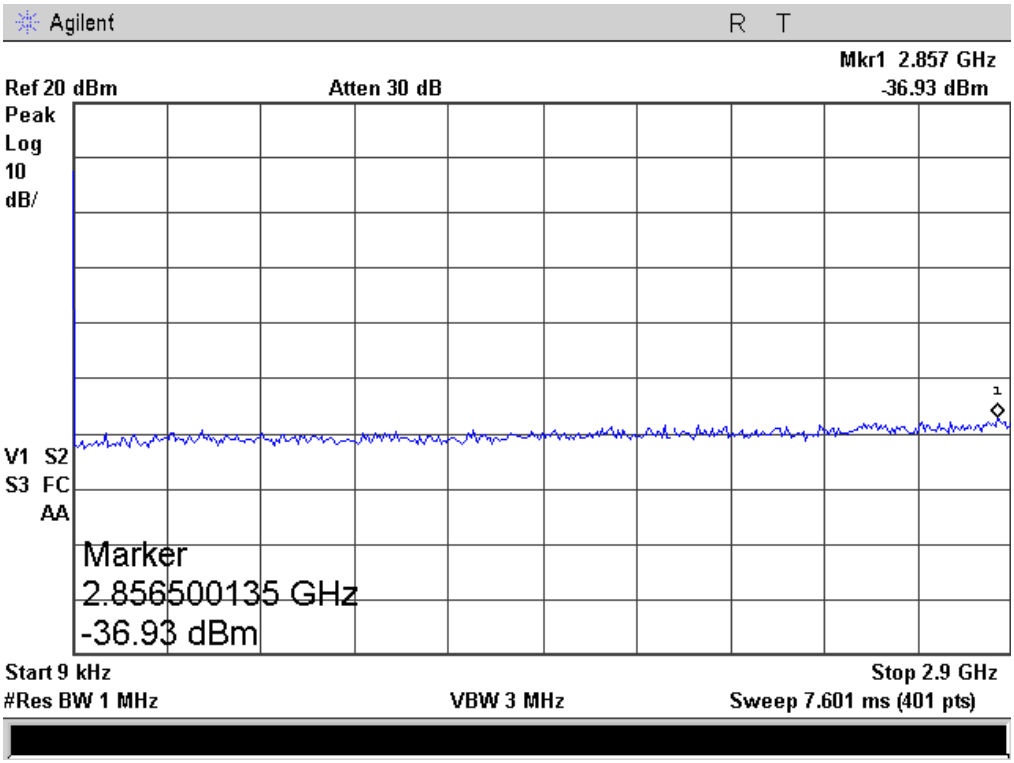
Plot 4.5.7



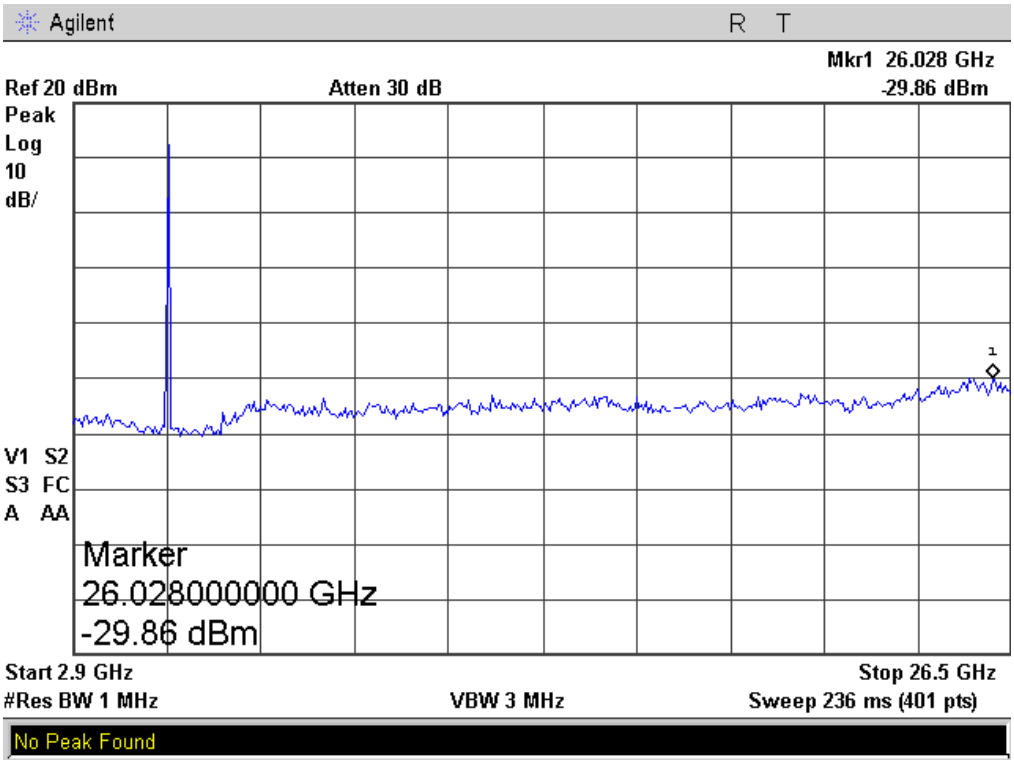
Plot 4.5.8



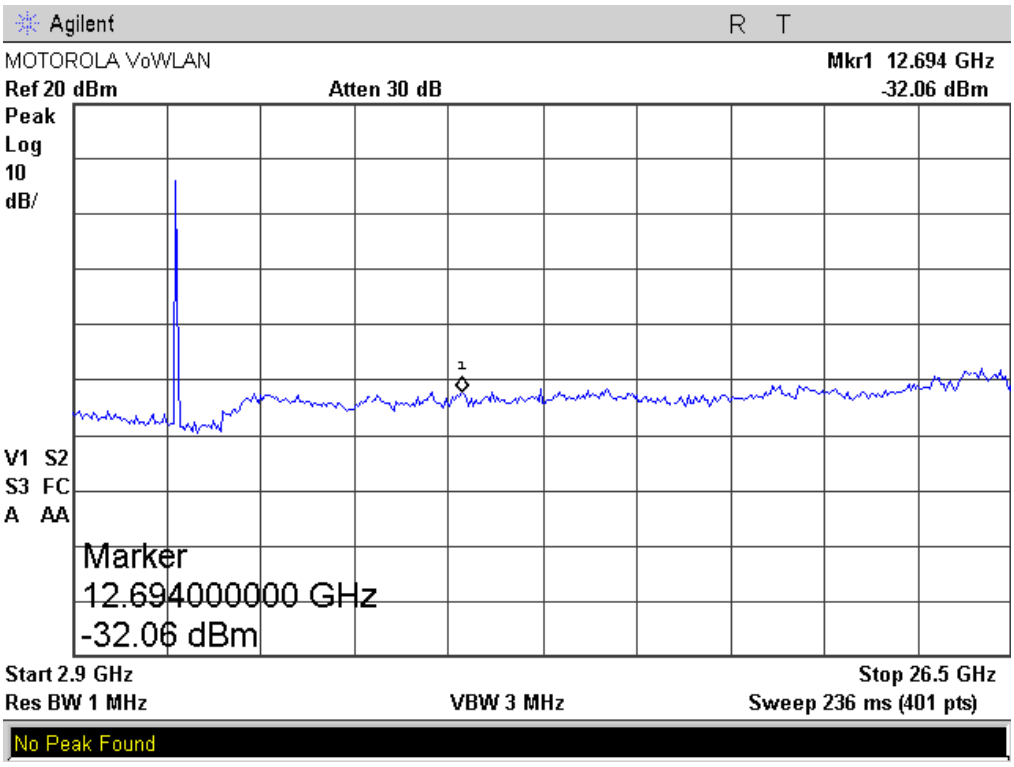
Plot 4.5.9



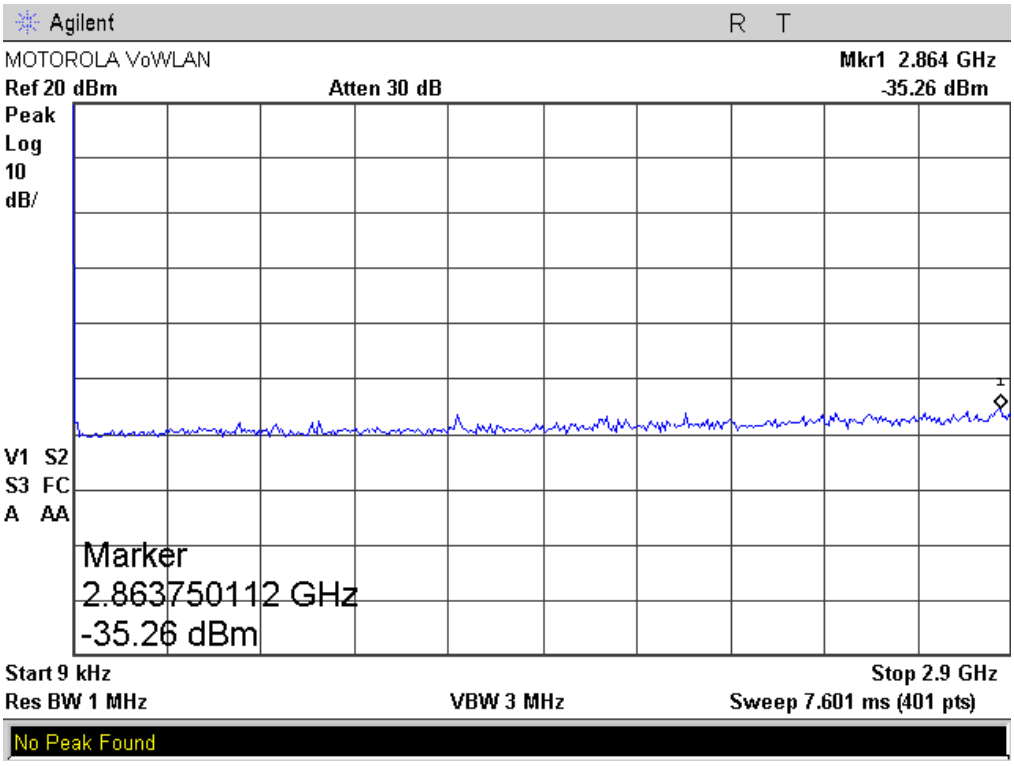
Plot 4.5.10



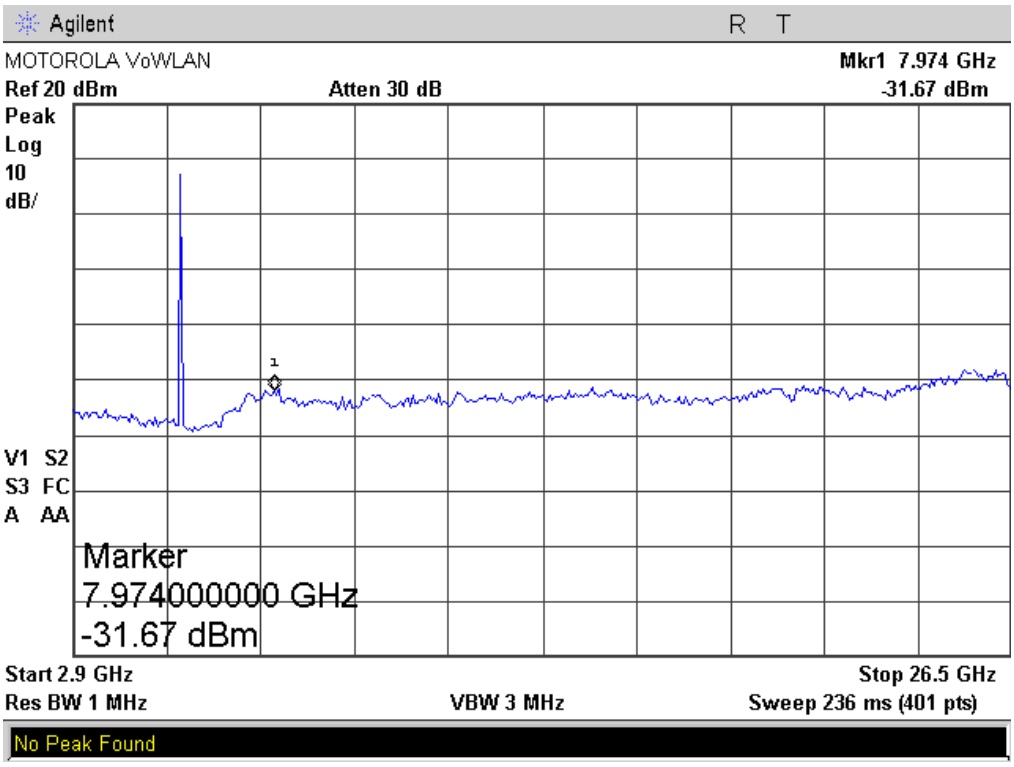
Plot 4.5.11



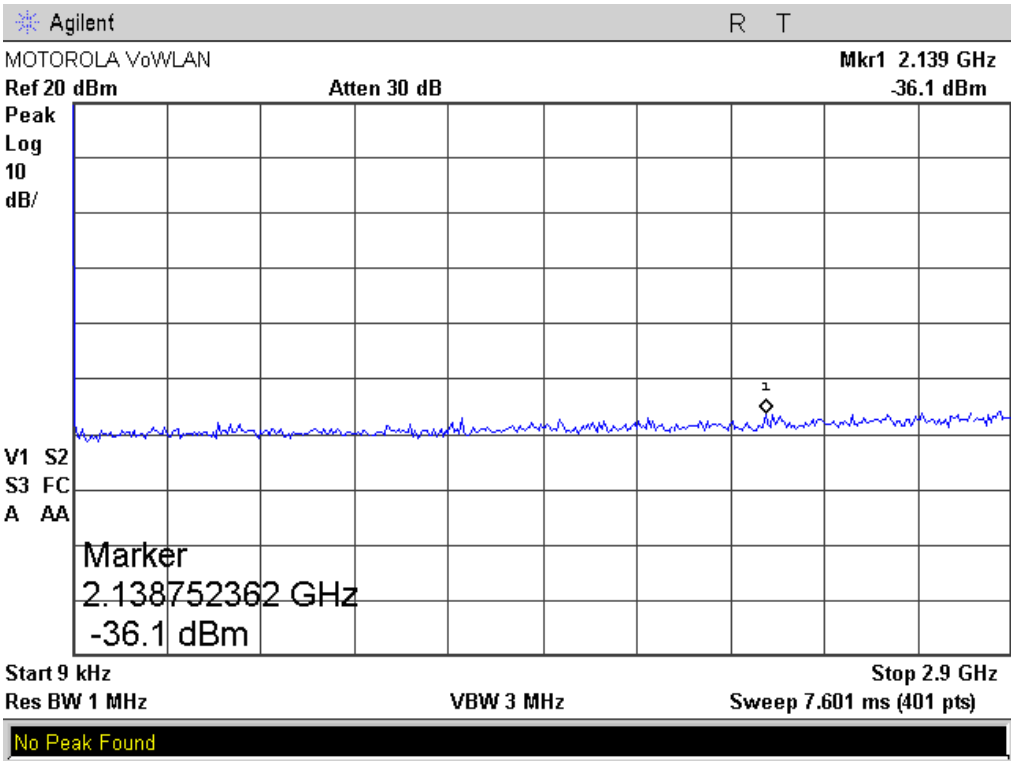
Plot 4.5.12



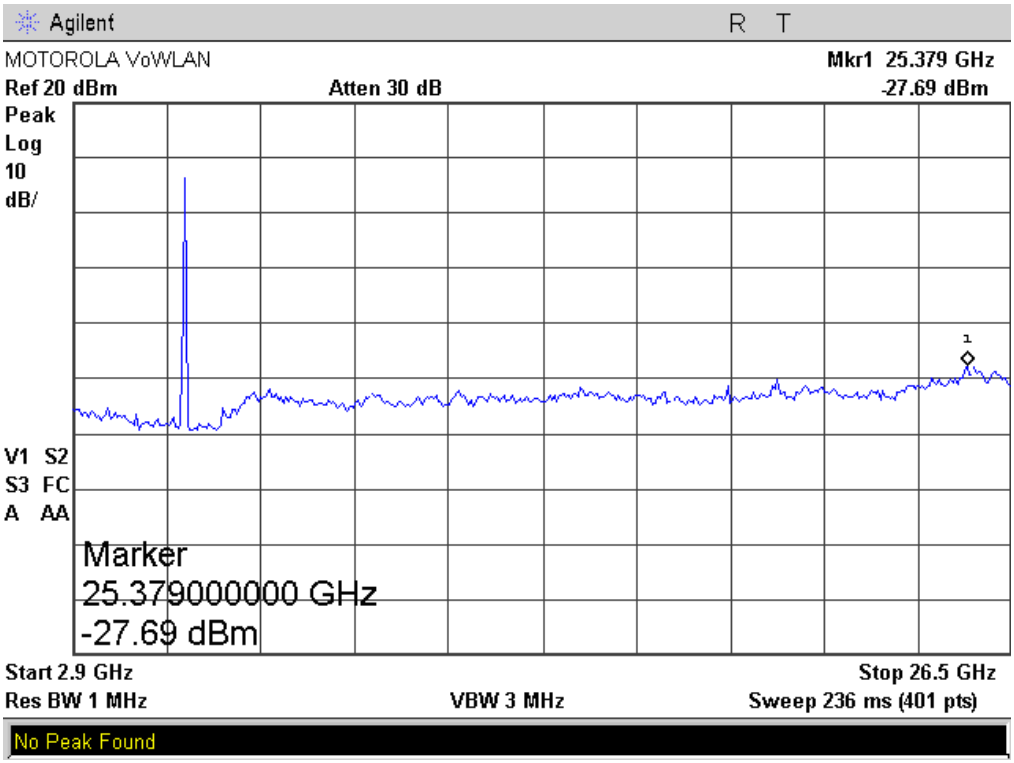
Plot 4.5.13



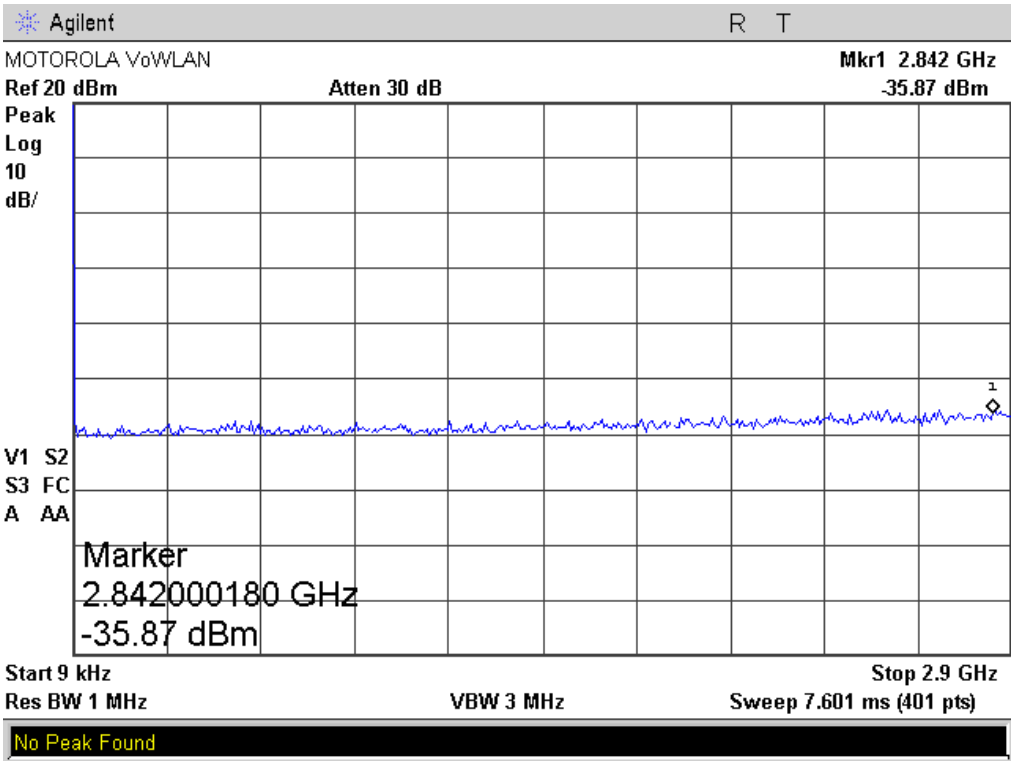
Plot 4.5.14



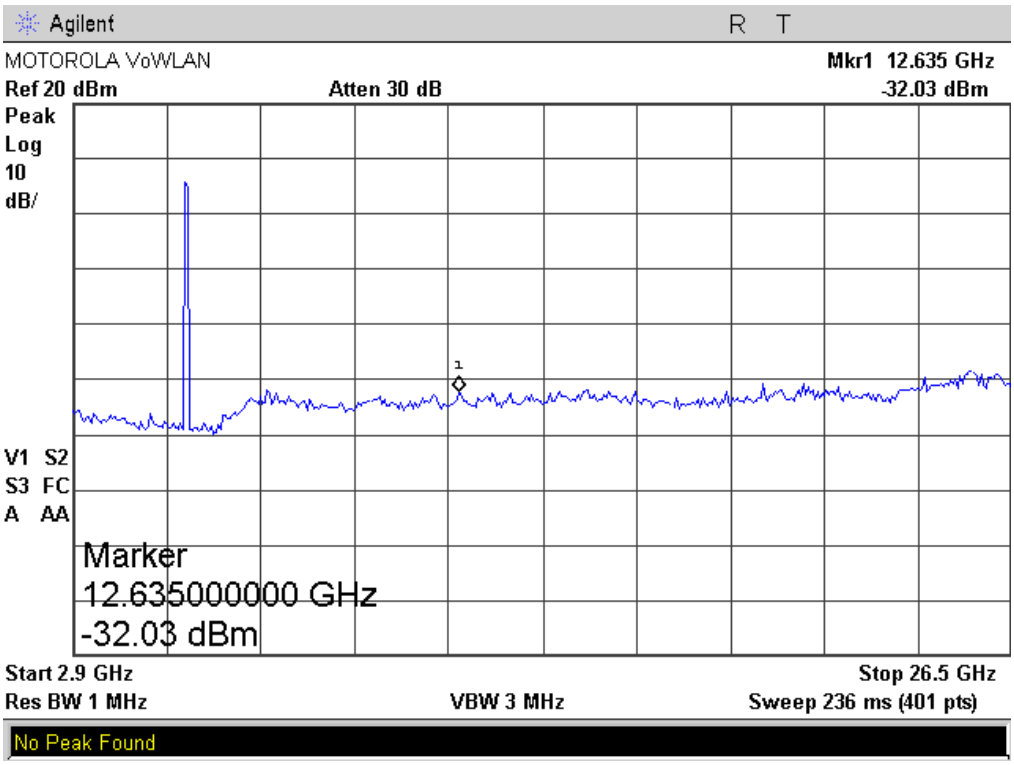
Plot 4.5.15



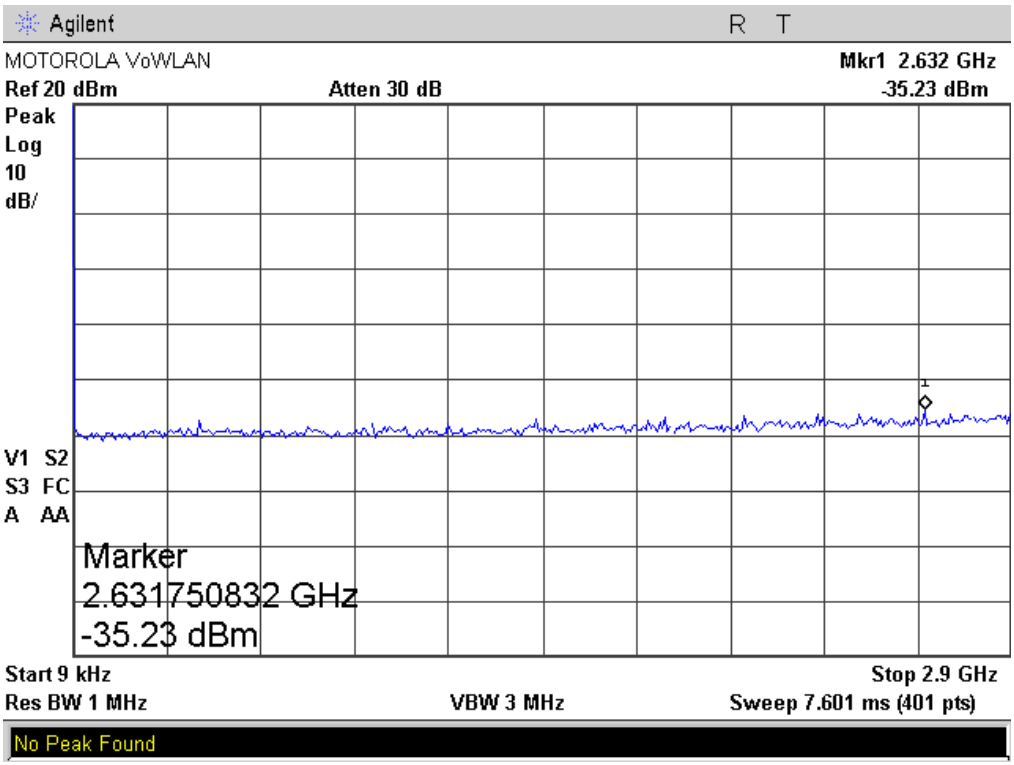
Plot 4.5.16



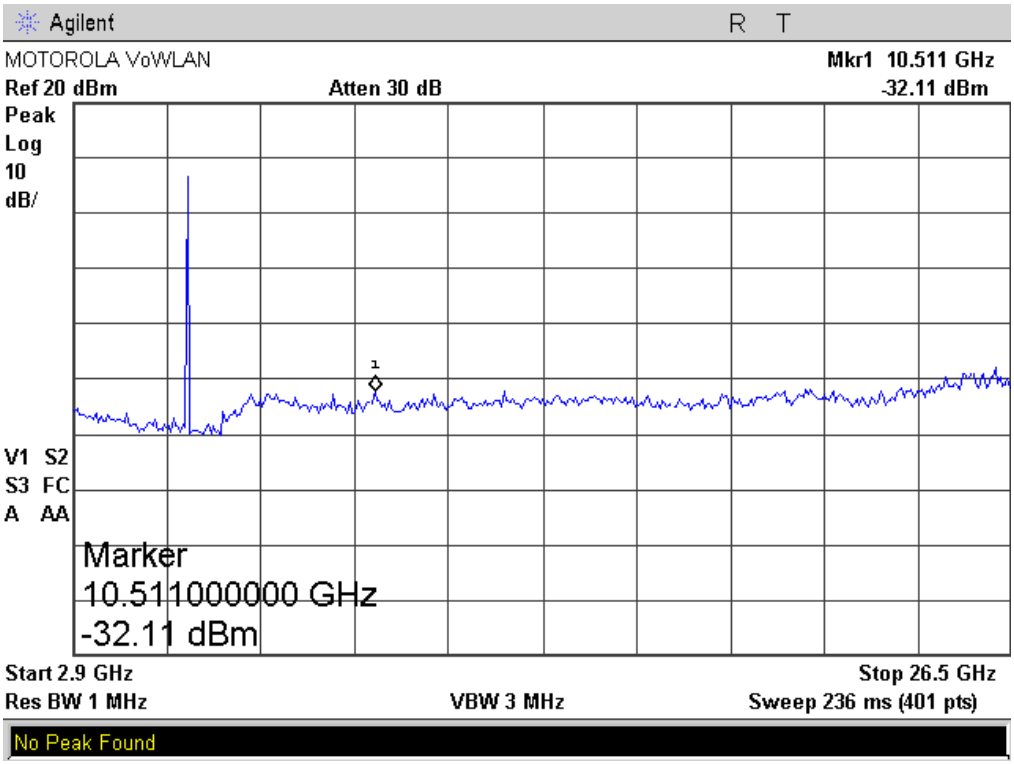
Plot 4.5.17



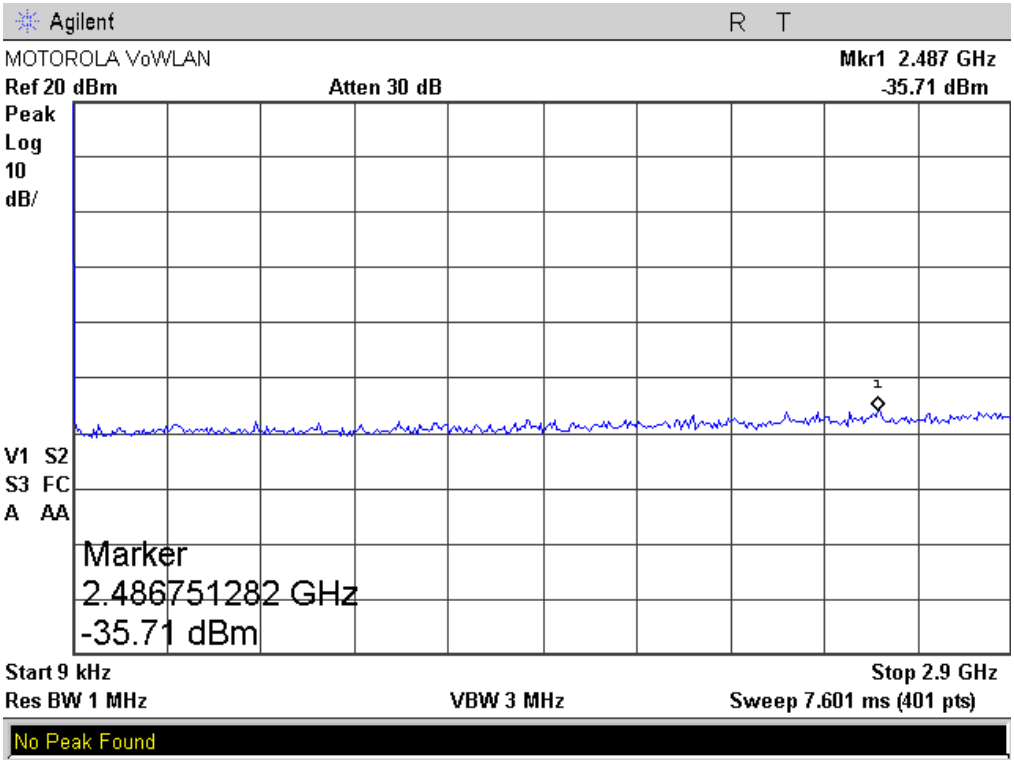
Plot 4.5.18



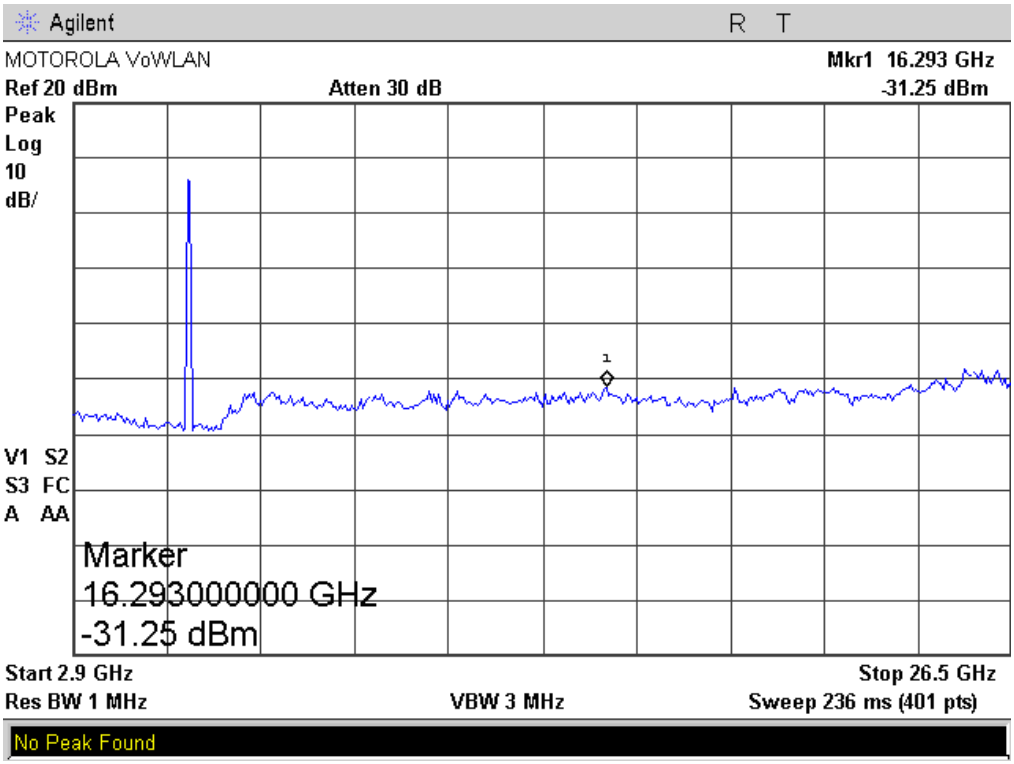
Plot 4.5.19



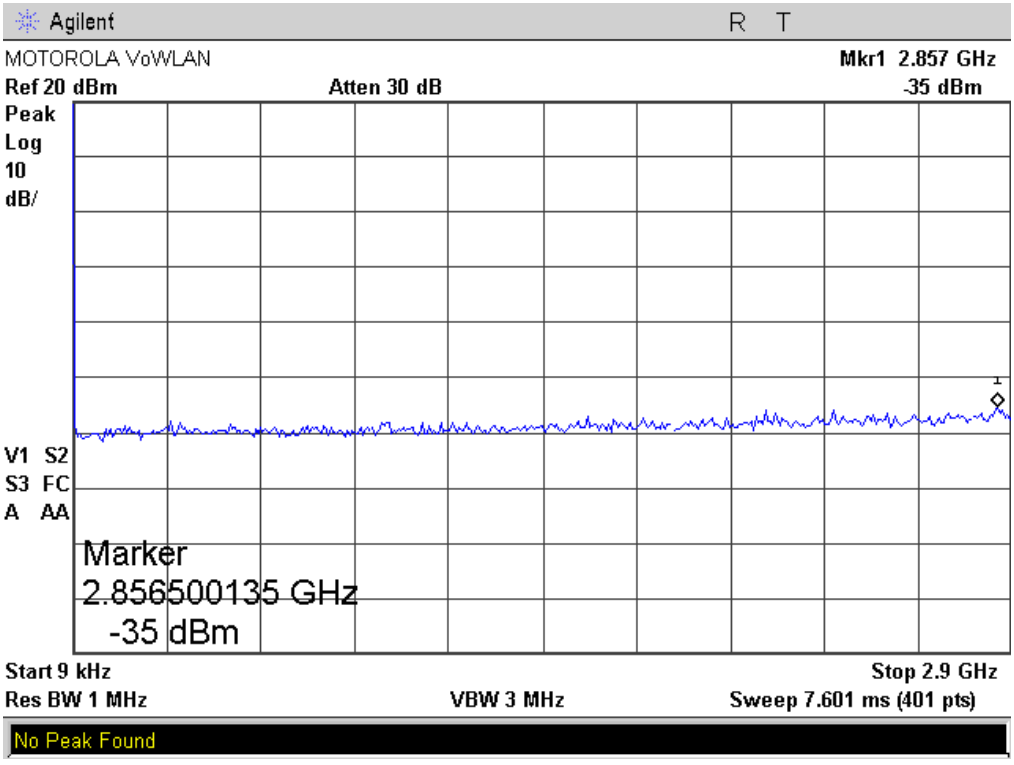
Plot 4.5.20



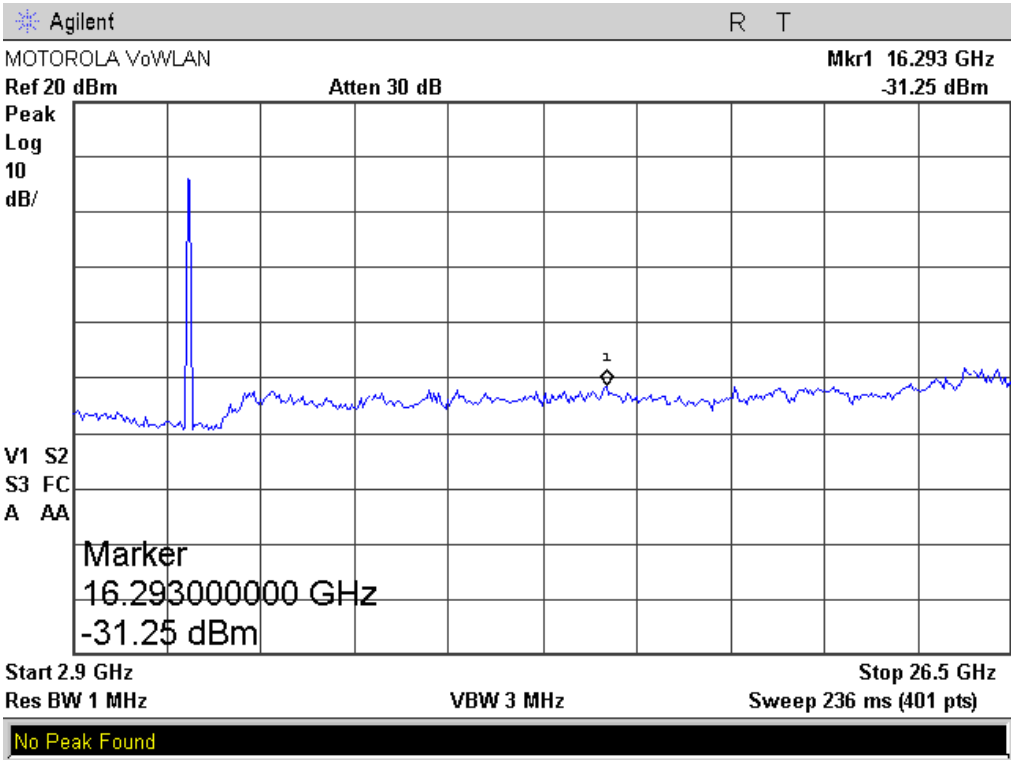
Plot 4.5.21



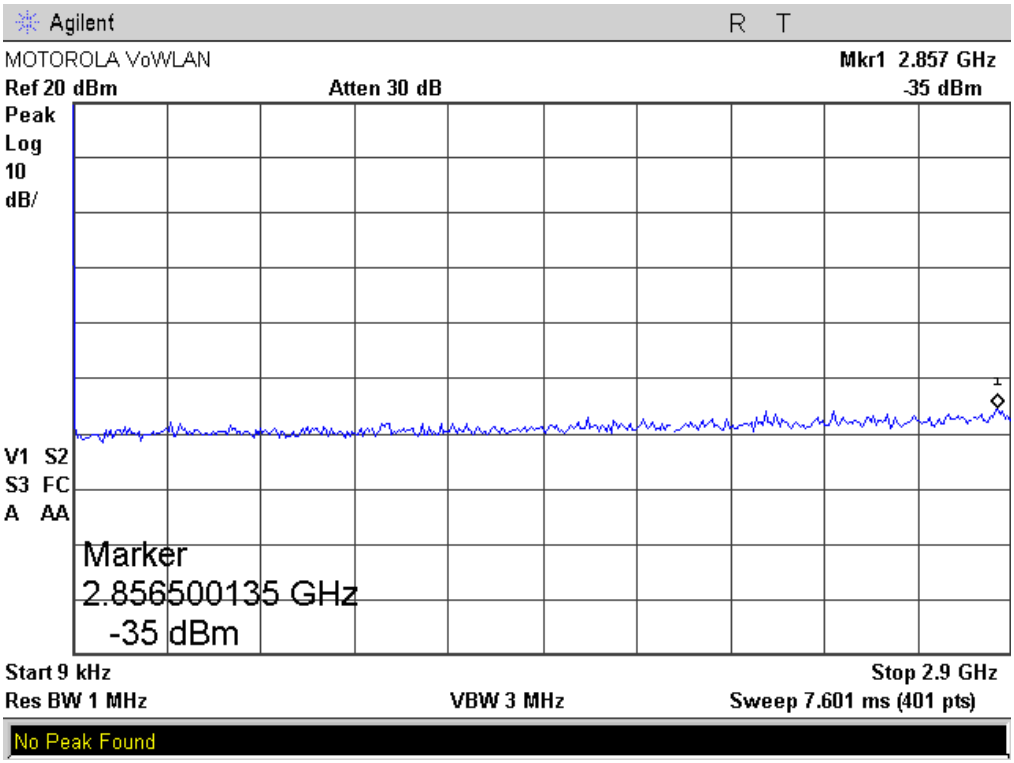
Plot 4.5.22



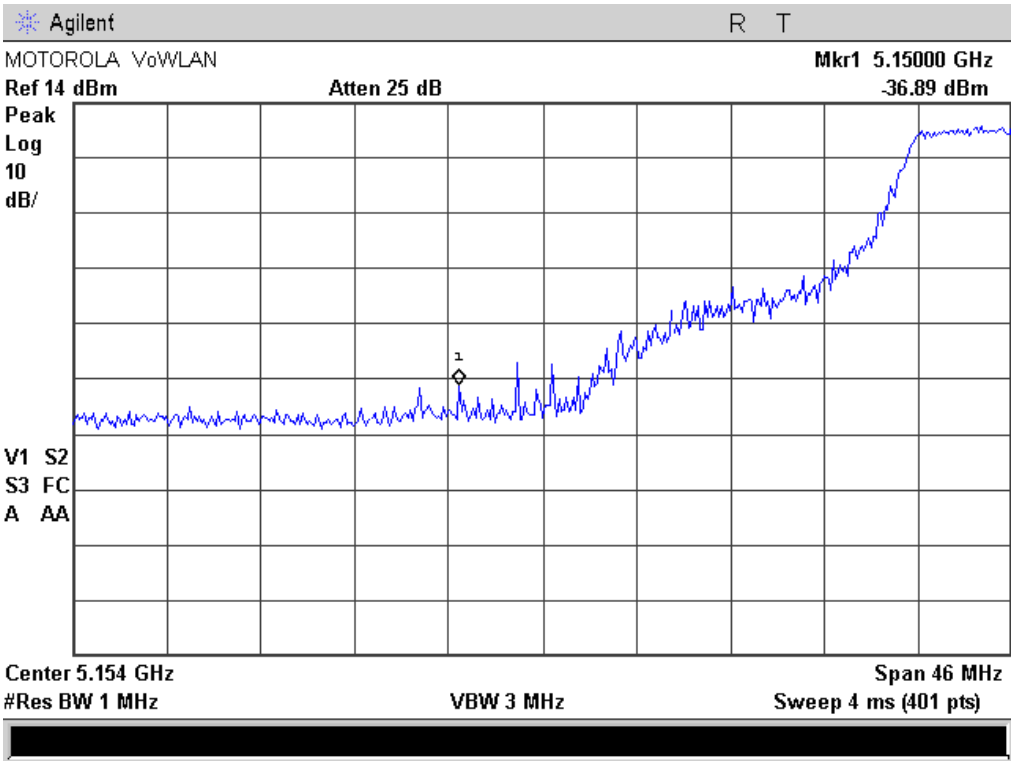
Plot 4.5.23



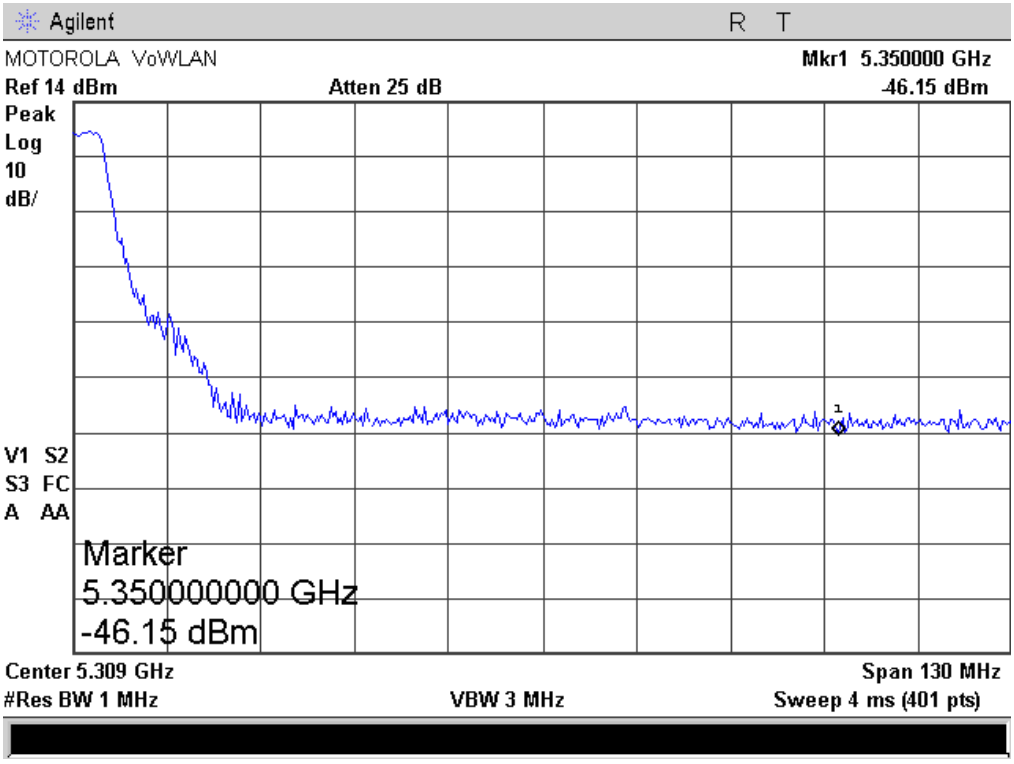
Plot 4.5.24



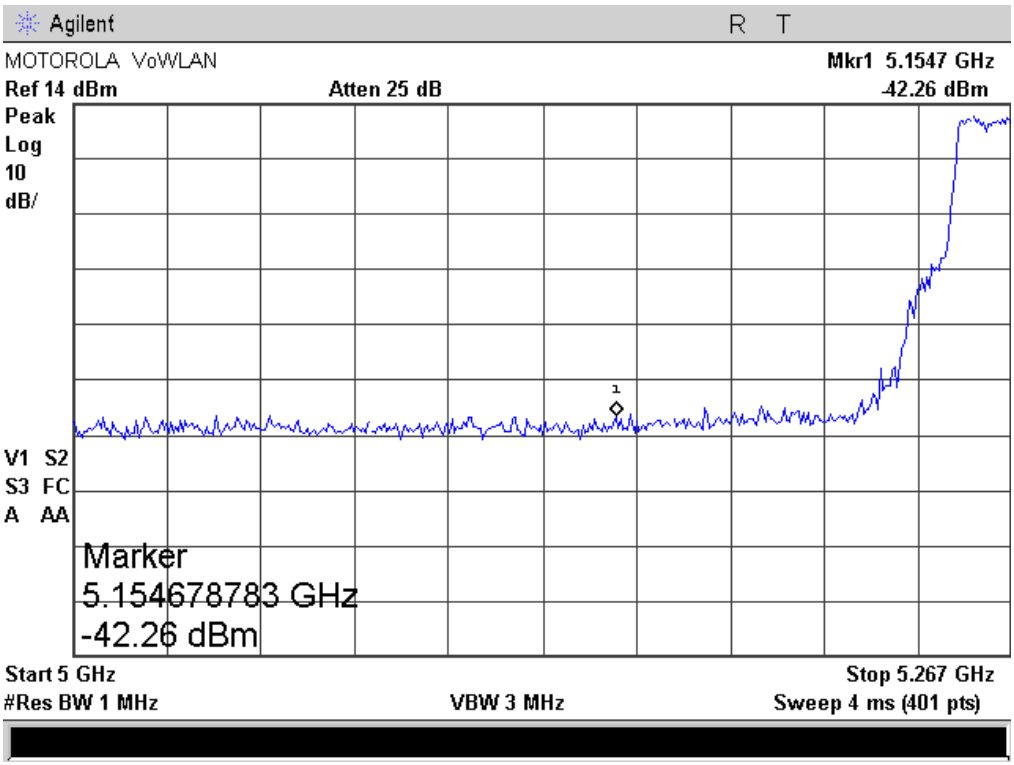
Band Edge
Plot 4.5.25



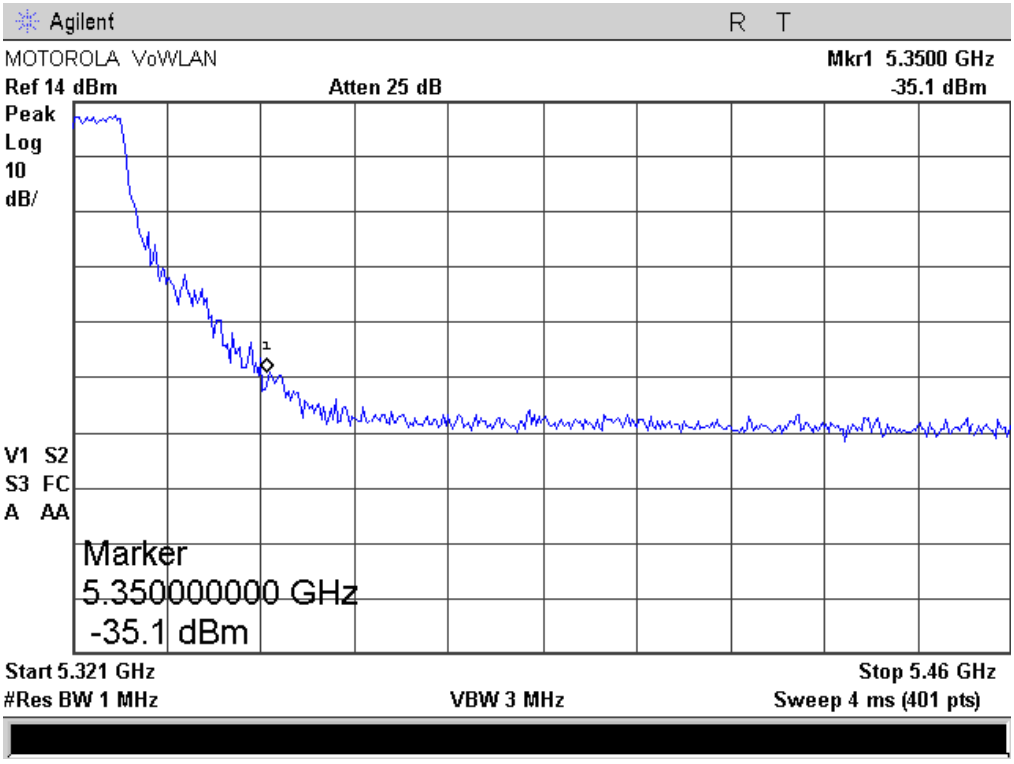
Plot 4.5.26



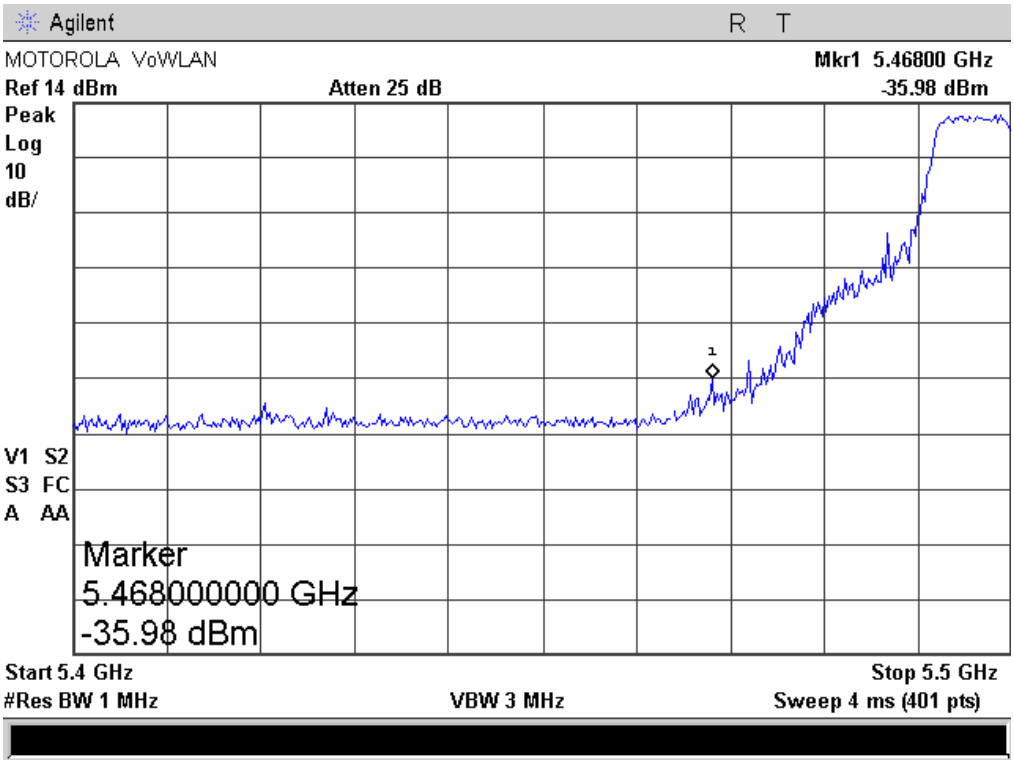
Plot 4.5.27



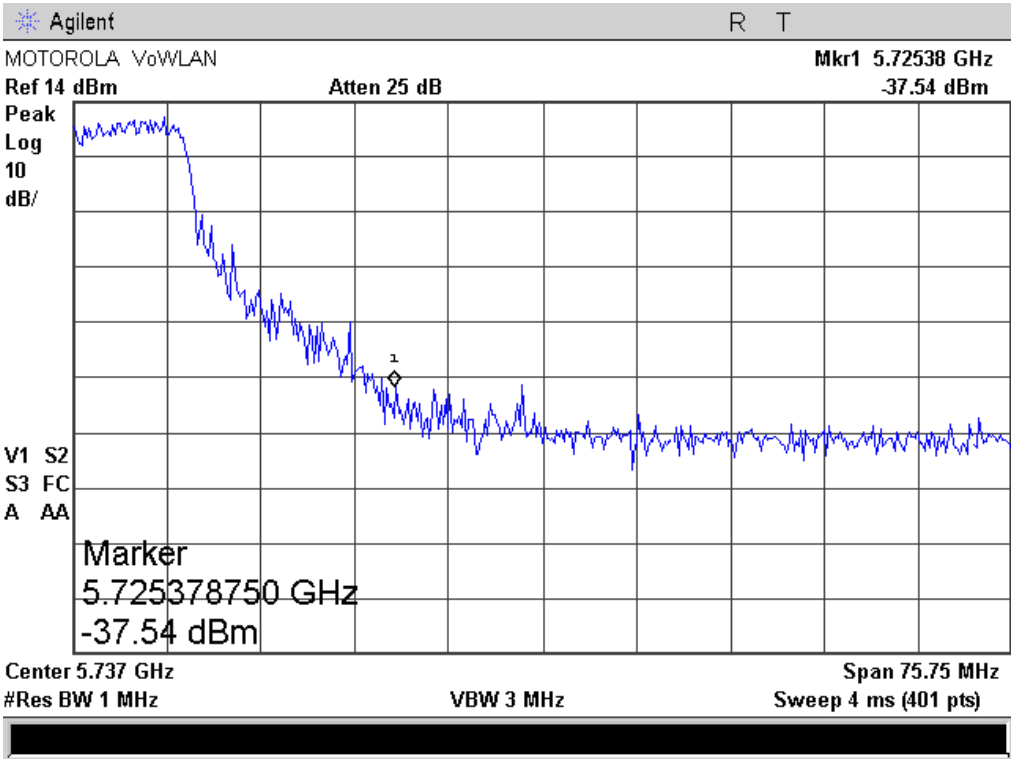
Plot 4.5.28



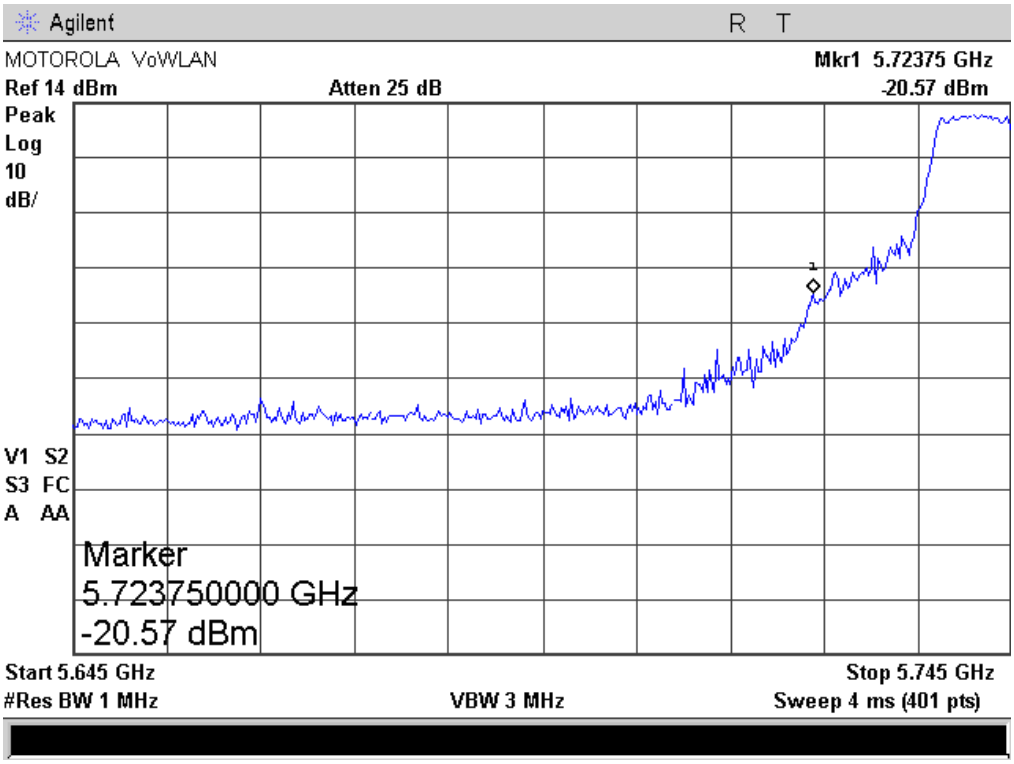
Plot 4.5.29



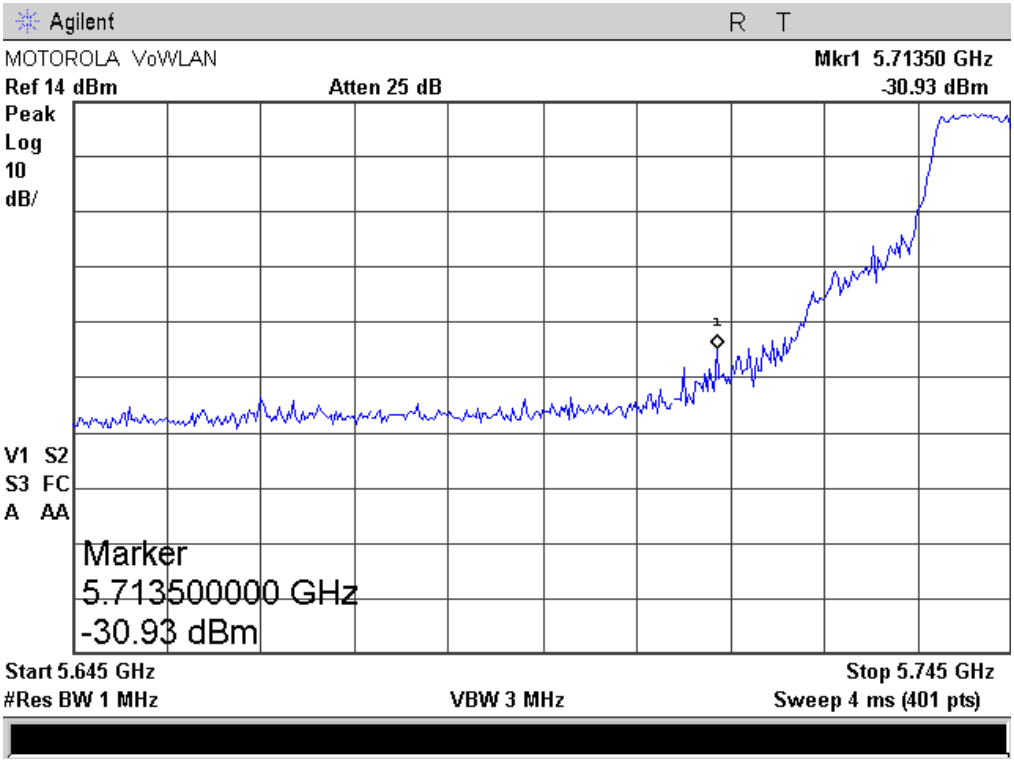
Plot 4.5.30



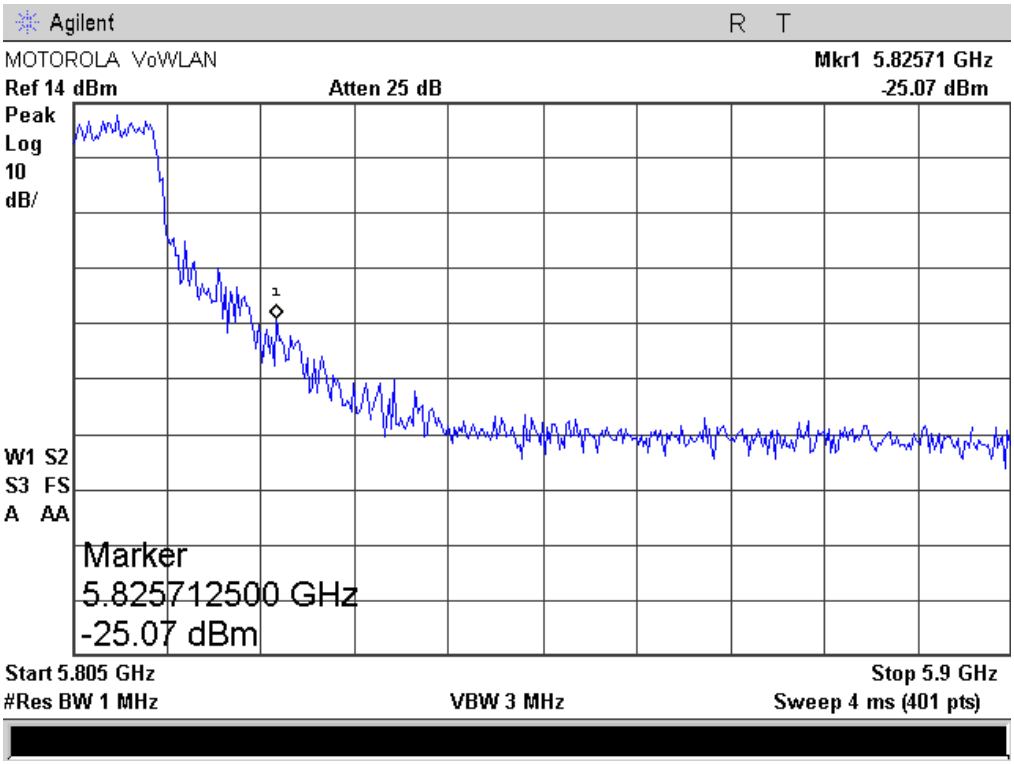
Plot 4.5.31



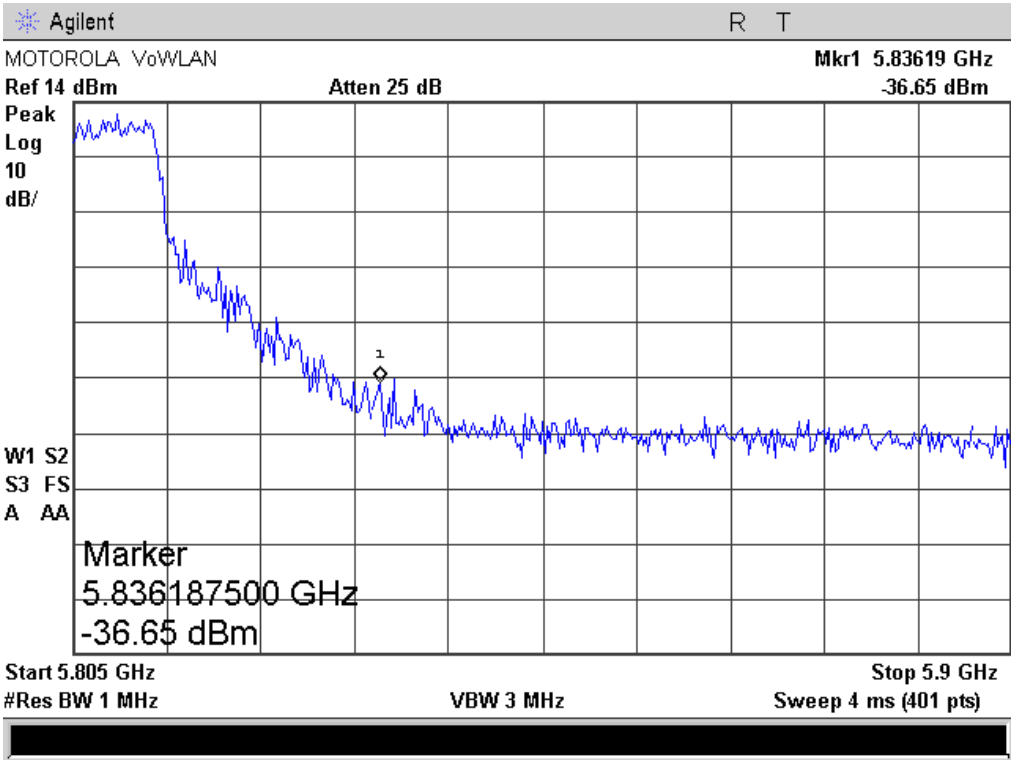
Plot 4.5.32



Plot 4.5.33



Plot 4.5.34



4.6. Spurious Radiated Emissions, Restricted Bands

Reference document:	**47 CFR §15.407 (b) (7)**		
Test Requirements:	The provisions of Sec. 15.205 apply to intentional radiators operating under this section.		
Test setup:	See sec 2.2, with High Pass Filter	**Pass**	
Method of testing:	Radiated		
Operating conditions:	Under normal test conditions		
S.A. Settings:	f >1GHz: Peak: RBW= 1MHz, VBW= 3MHz, Average: VBW= 10 Hz f<1GHz: RBW: 120kHz,VBW: 1MHz		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.6.1- Plot 4.6.58	

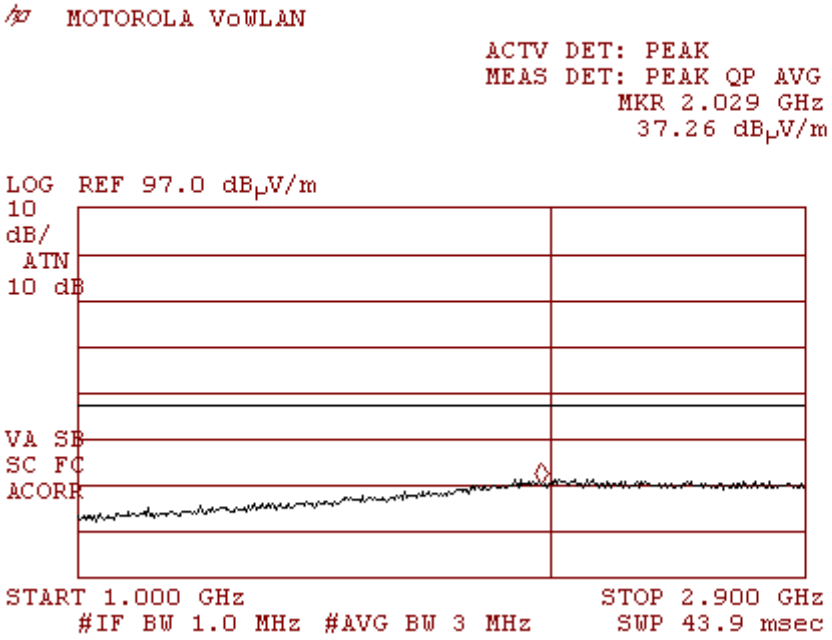
Test results:

Restricted bands:

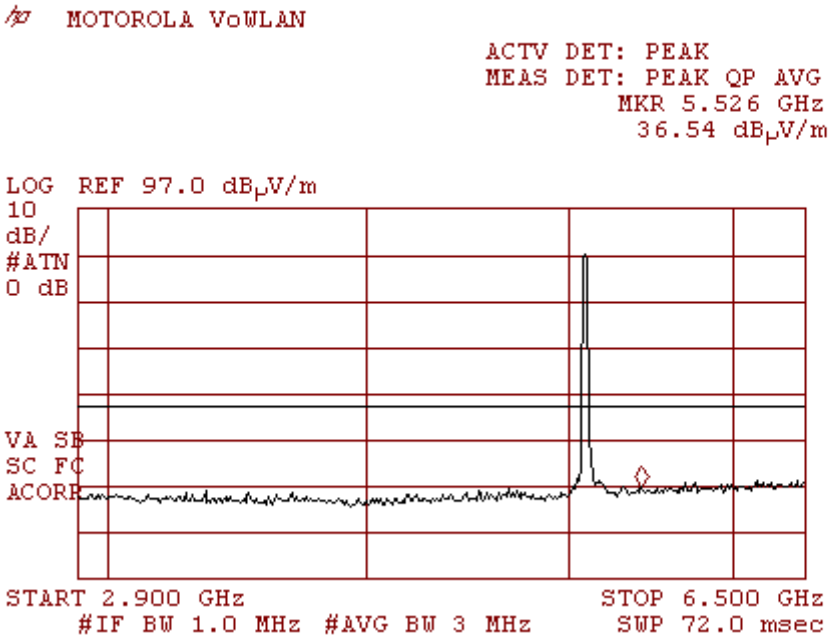
802.11a Mode							
Frequency [MHz]	Data Rate [Mbps]	Emission frequency [MHz]	Detector Type	Polar. V/H	Emission Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
5320	54	10640	peak	H	48.8	74	-25.2
5320	54	10640	Avg	H	42.0	54	-12.0
5500	54	11000	peak	H	45.2	74	-28.8
5500	54	11000	Avg	H	38.4	54	-15.6
5600	54	11200	peak	H	45.3	74	-28.7
5600	54	11200	Avg	H	38.5	54	-15.5
5805	54	11610	peak	H	46.1	74	-27.9
5805	54	11610	Avg	H	39.0	54	-15.0

Note: Spurious Emission [dBµV/m] = measured [dBµV] + Correction-factor [dB (1/m)]
Correction Factor = Antenna factor + Cable Loss +Filter I/L.

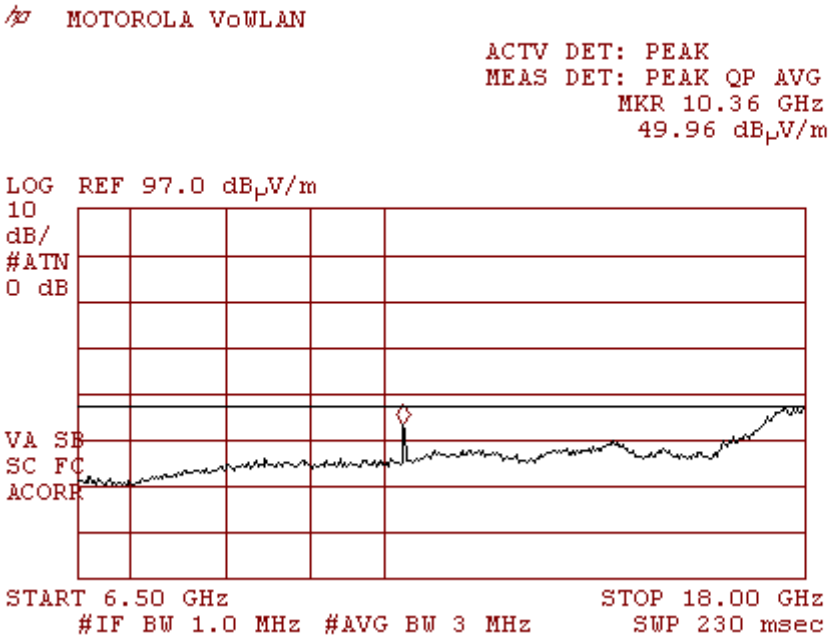
5180 MHz
Vertical & Horizontal Polarization
Plot 4.6.1



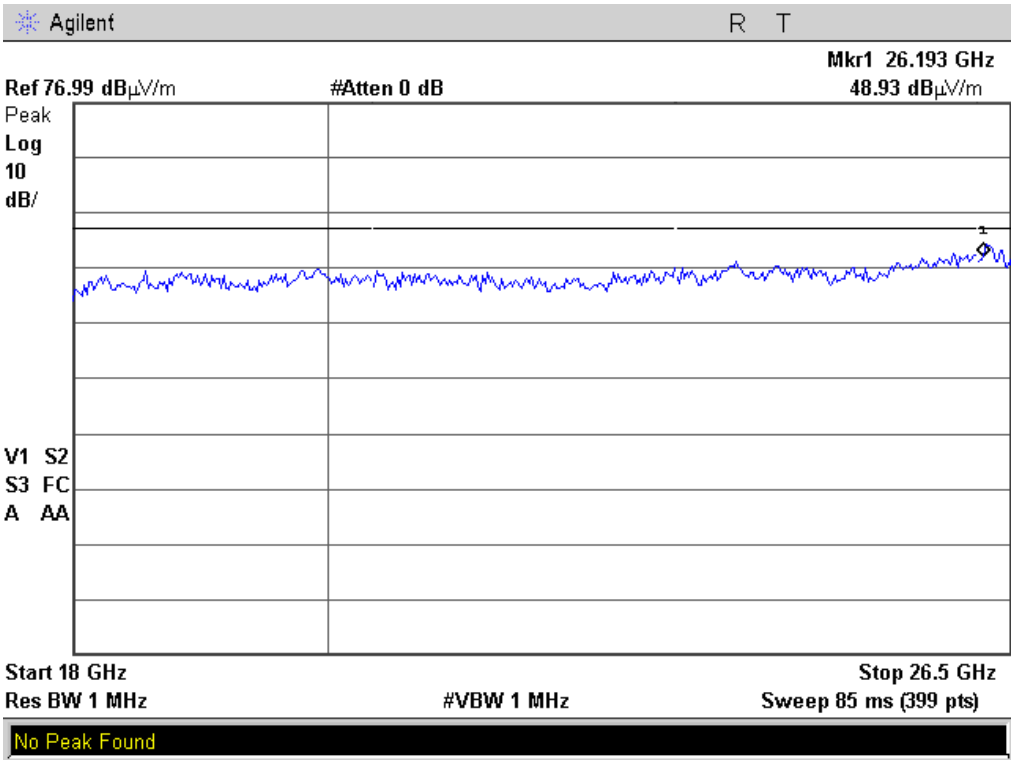
Vertical & Horizontal Polarization
Plot 4.6.2



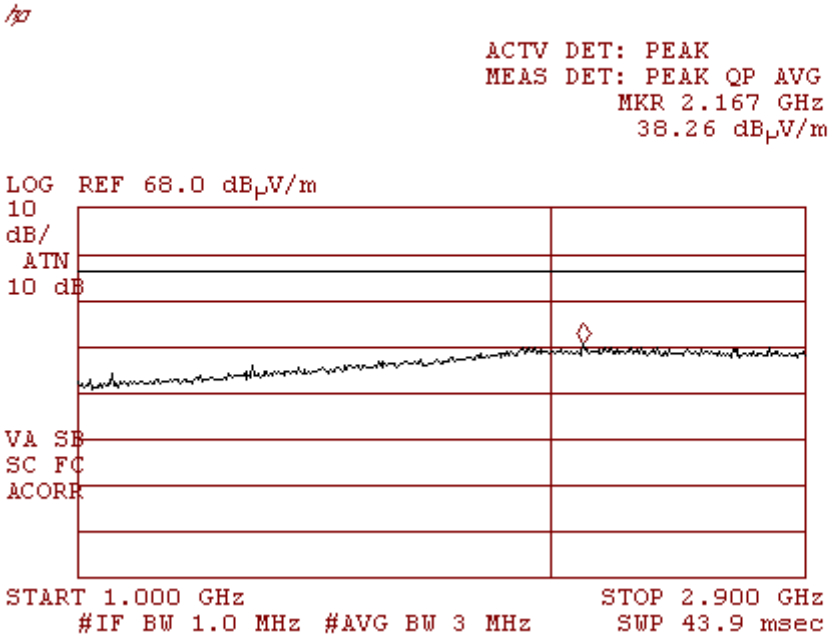
Vertical & Horizontal Polarization
Plot 4.6.3



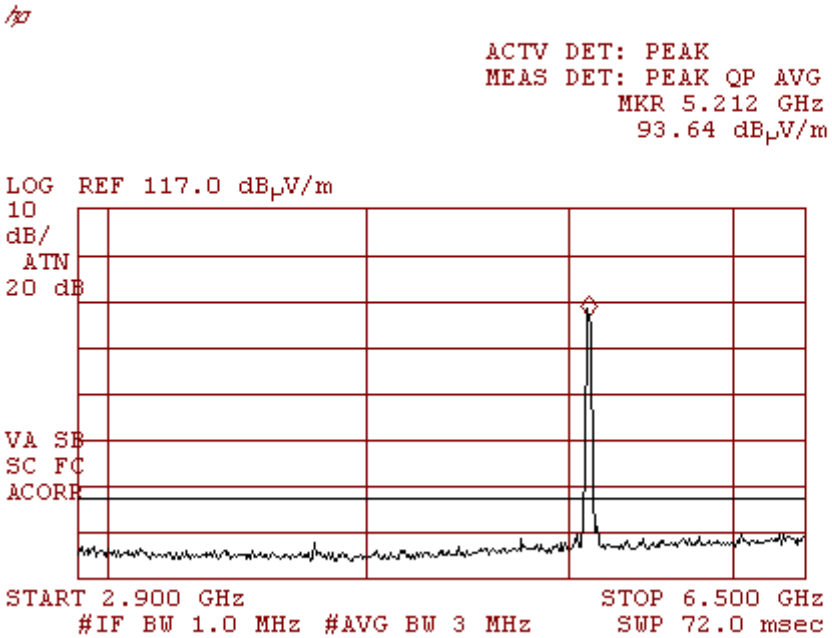
Vertical & Horizontal Polarization
Plot 4.6.4



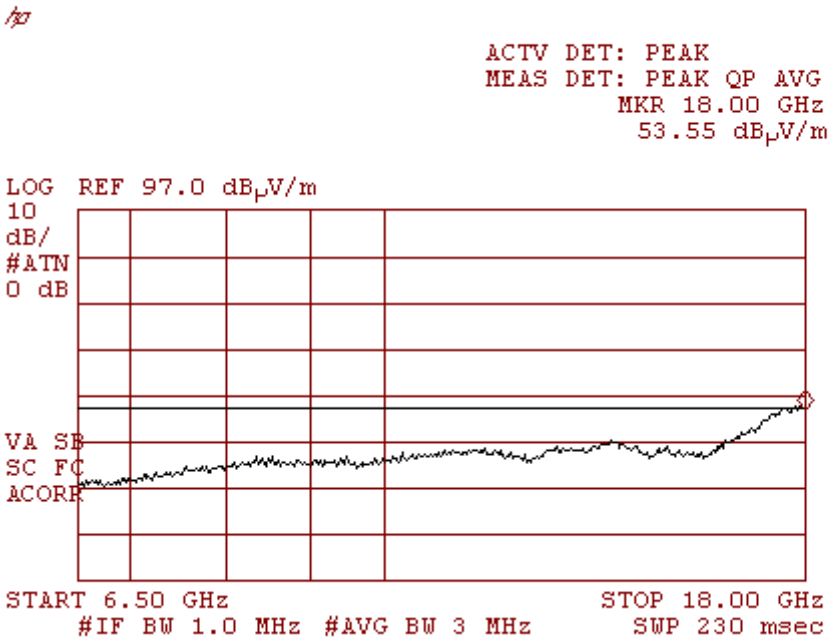
5200 MHz
Vertical & Horizontal Polarization
Plot 4.6.5



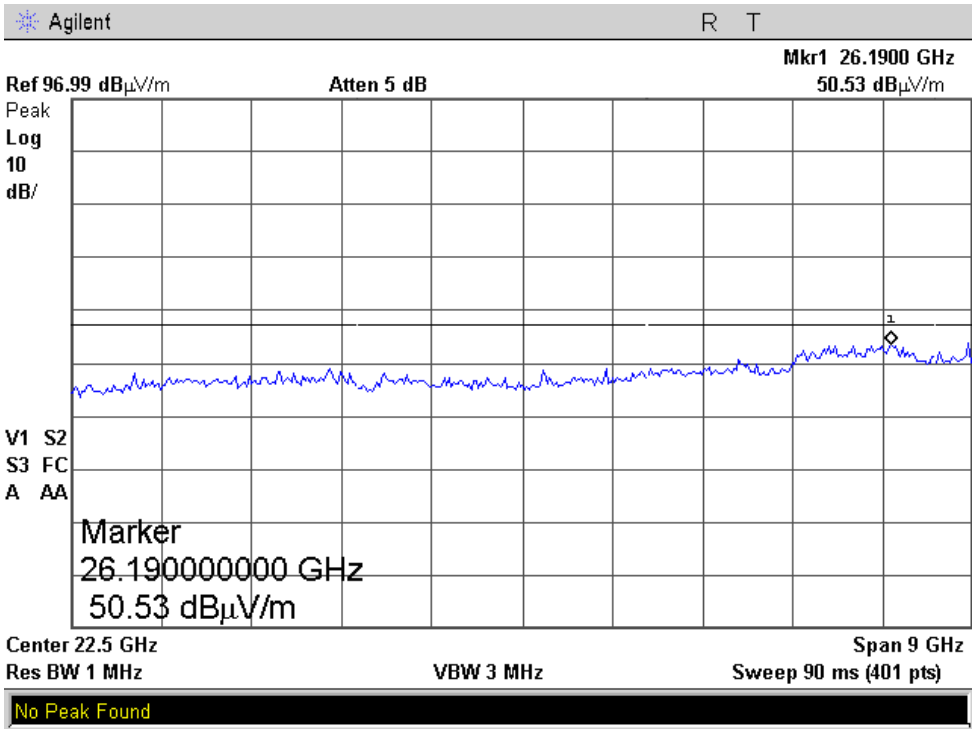
Plot 4.6.6



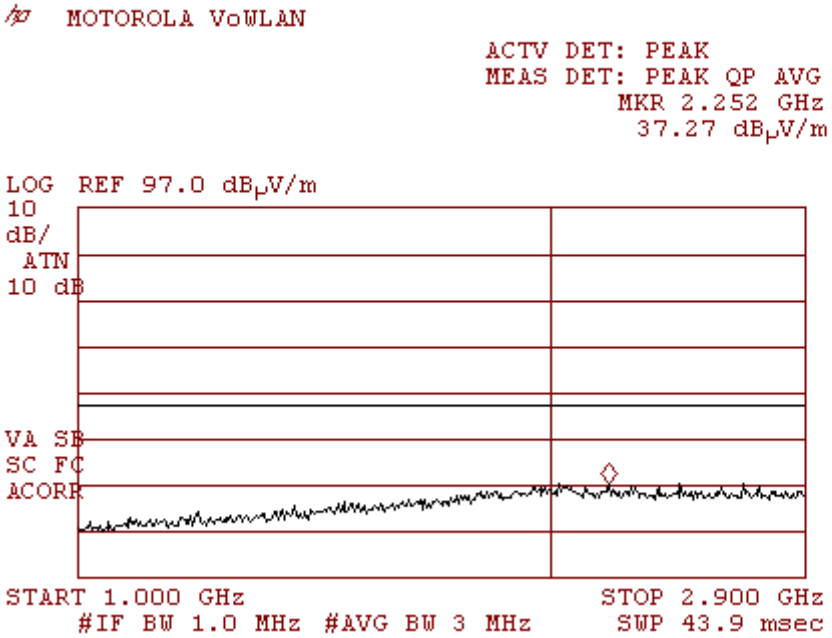
Plot 4.6.7



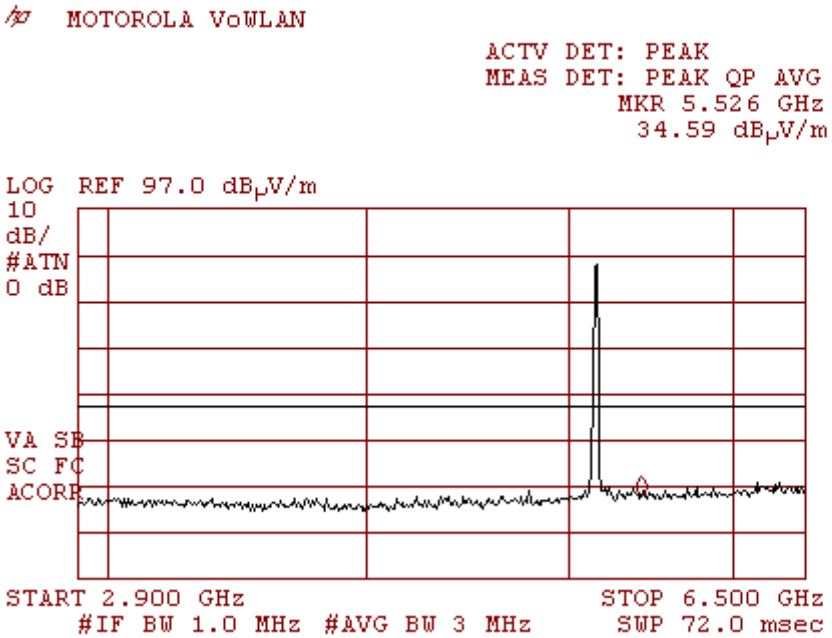
Plot 4.6.8



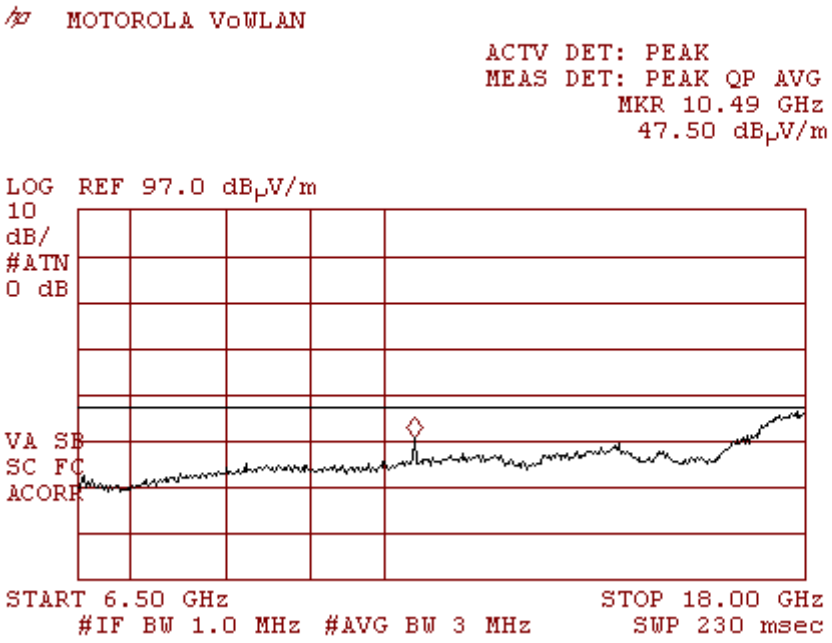
5240 MHz
Vertical & Horizontal Polarization
Plot 4.6.9



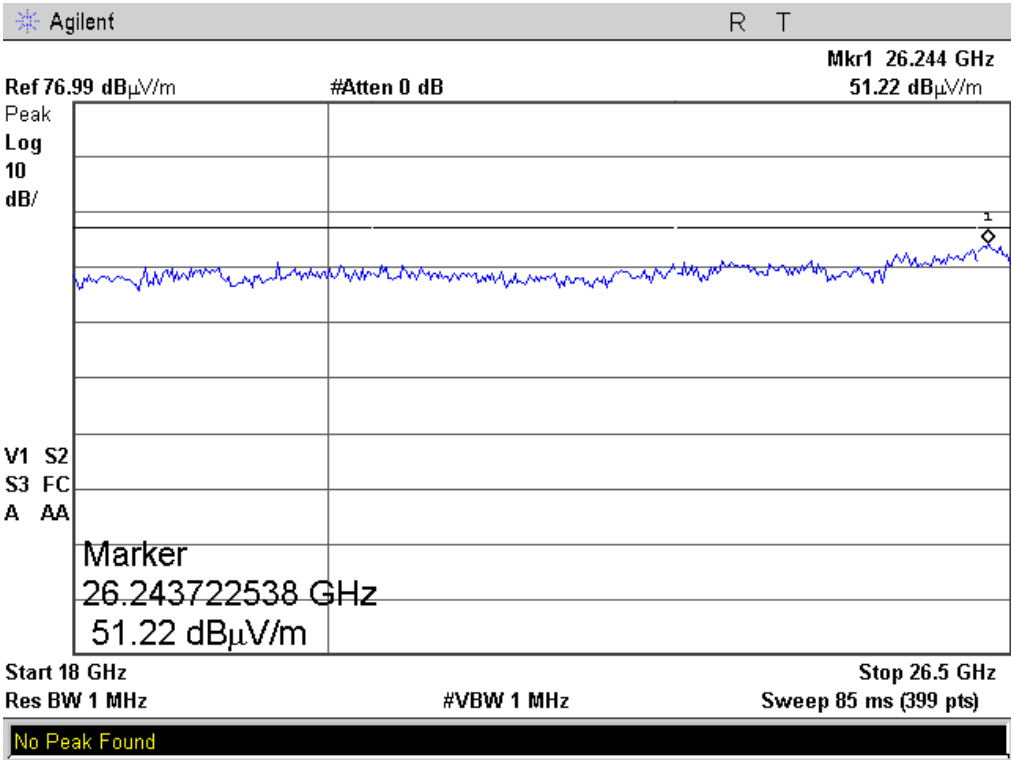
Vertical & Horizontal Polarization
Plot 4.6.10



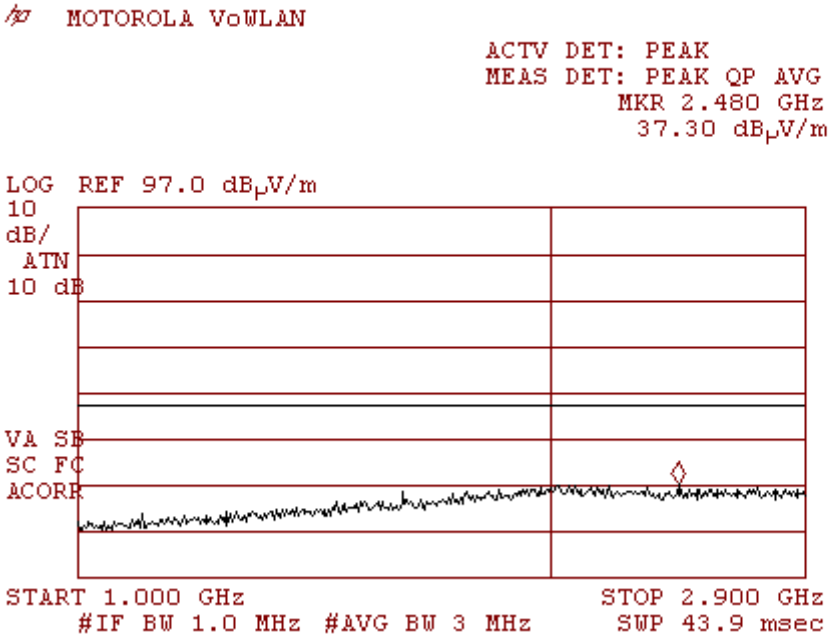
Vertical & Horizontal Polarization
Plot 4.6.11



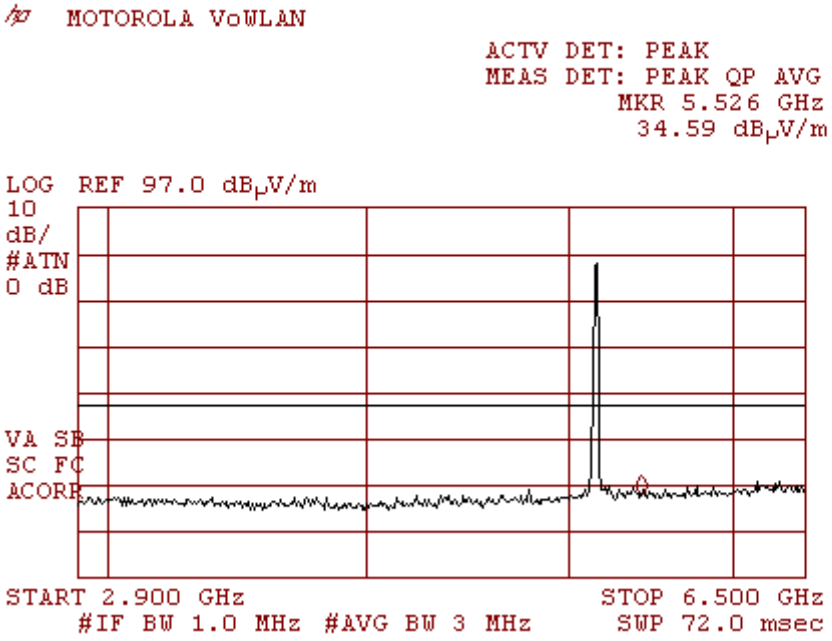
Vertical & Horizontal Polarization
Plot 4.6.12



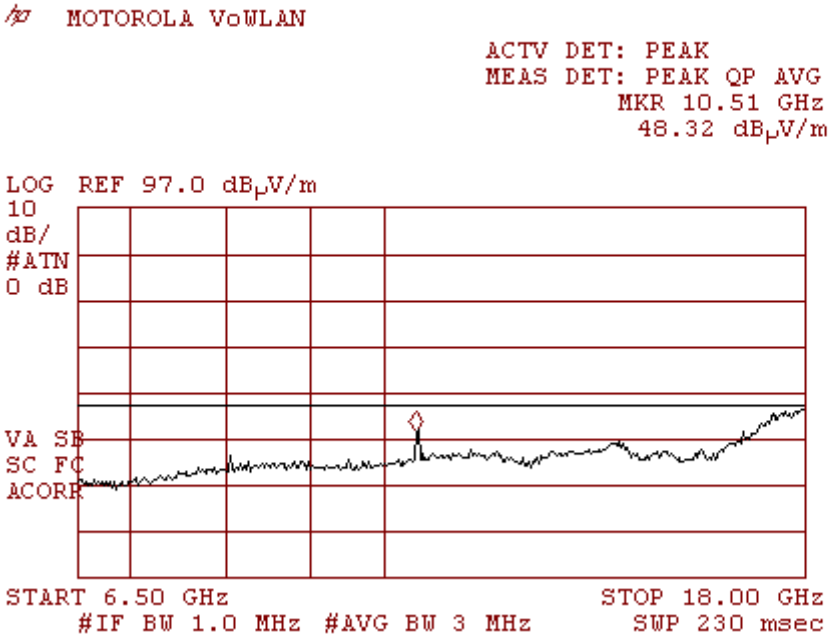
5260 MHz
Vertical & Horizontal Polarization
Plot 4.6.13



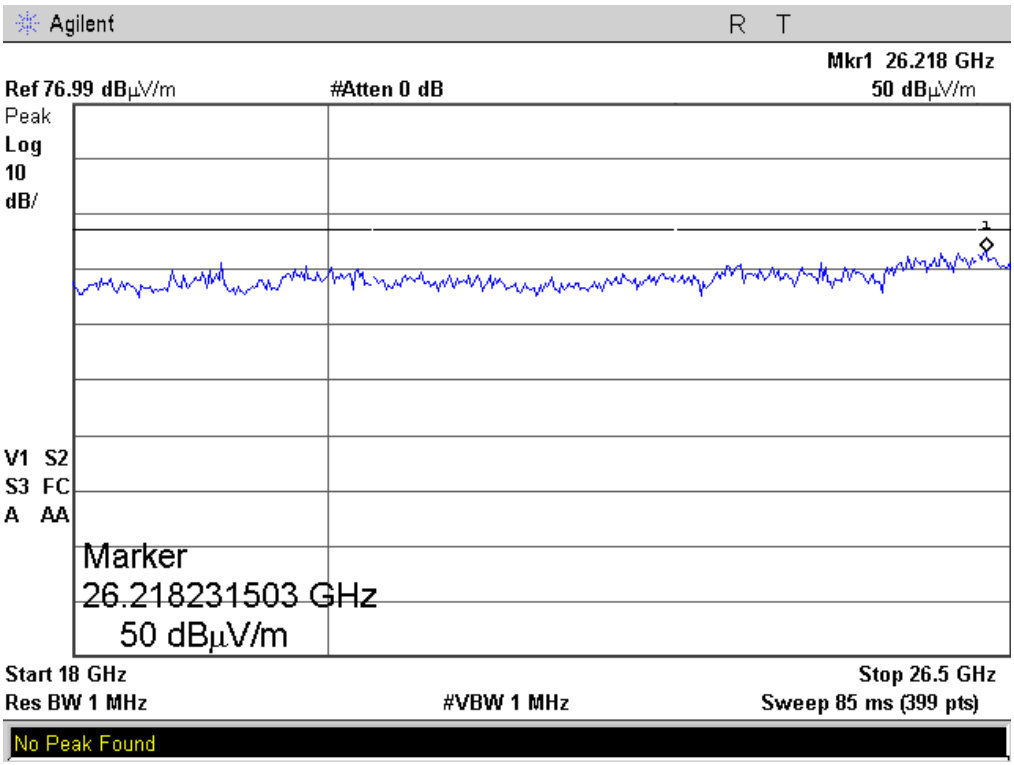
Vertical & Horizontal Polarization
Plot 4.6.14



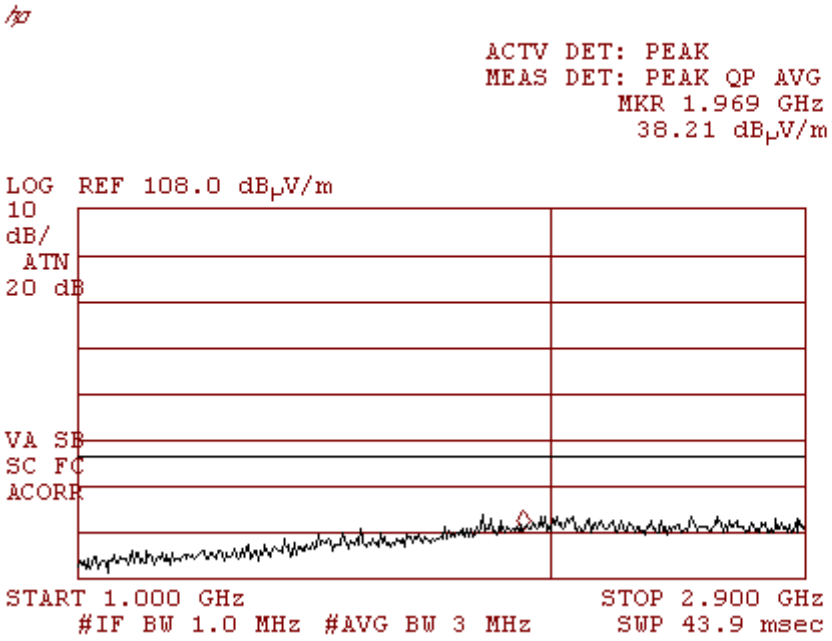
Vertical & Horizontal Polarization
Plot 4.6.15



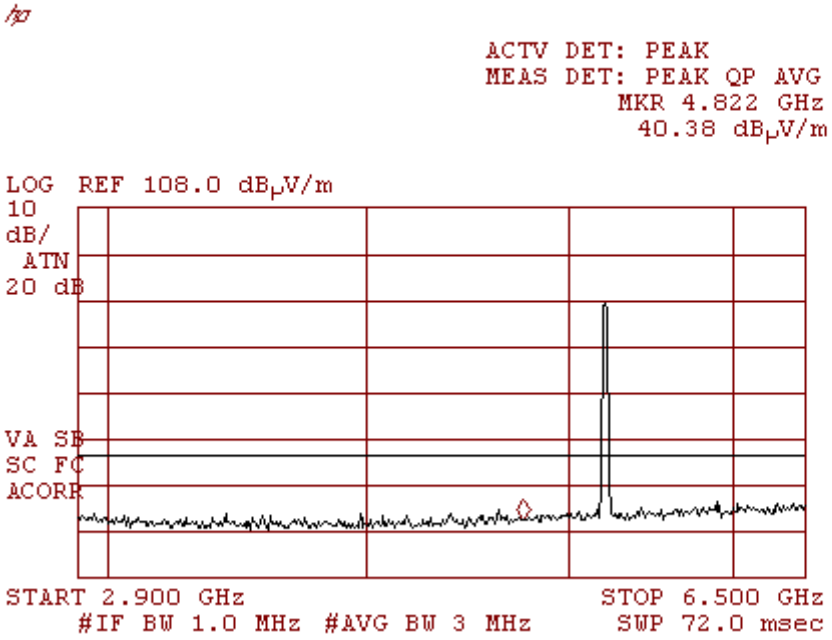
Vertical & Horizontal Polarization
Plot 4.6.16



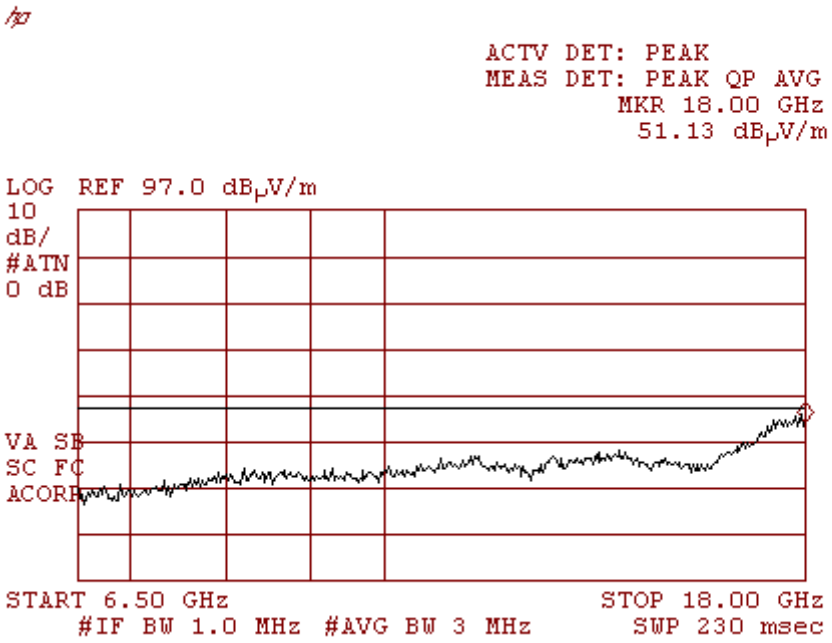
5300 MHz
Vertical & Horizontal Polarization
Plot 4.6.17



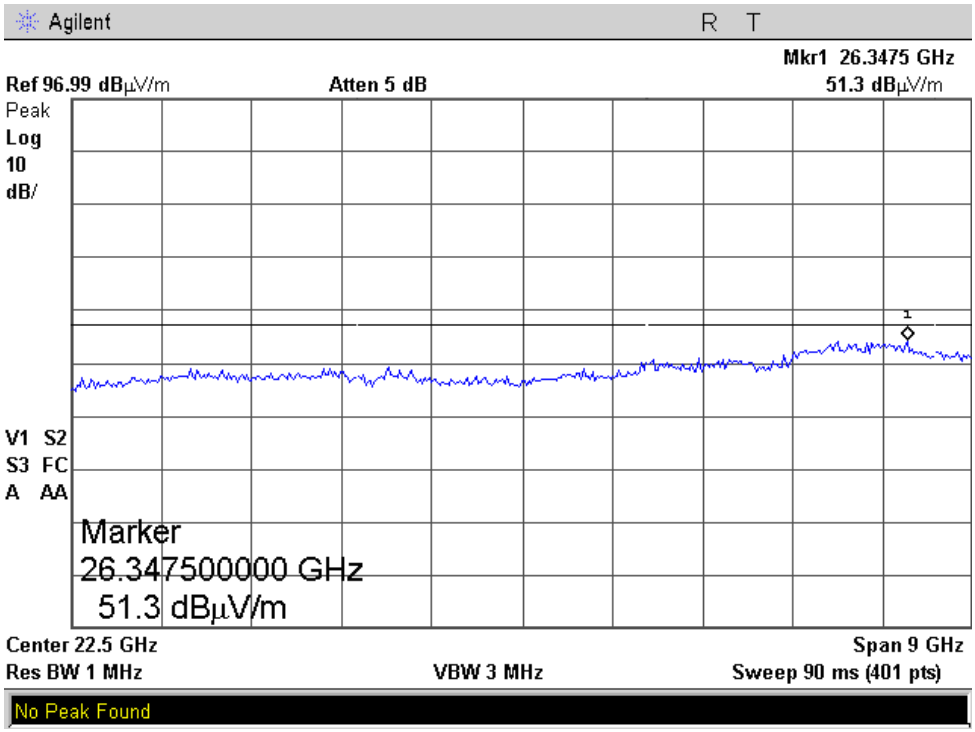
Plot 4.6.18



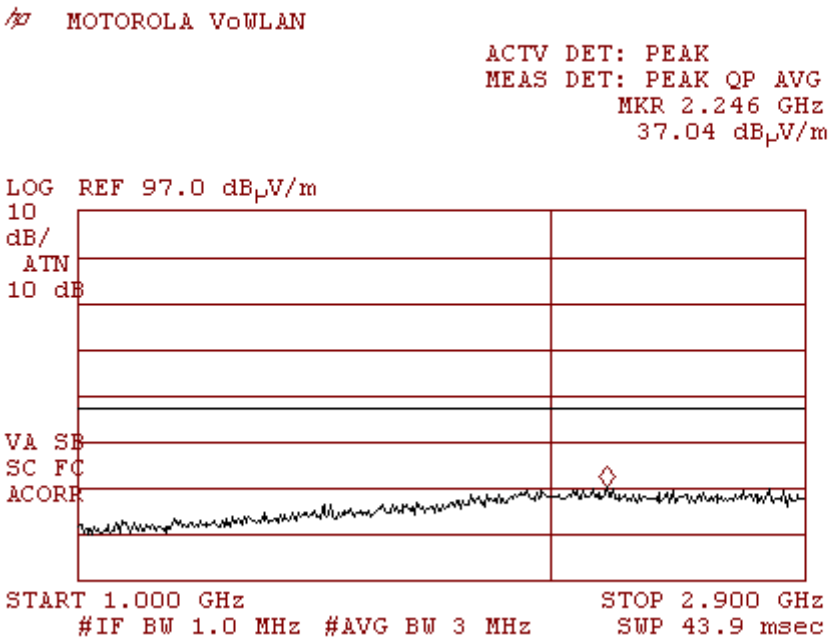
Plot 4.6.19



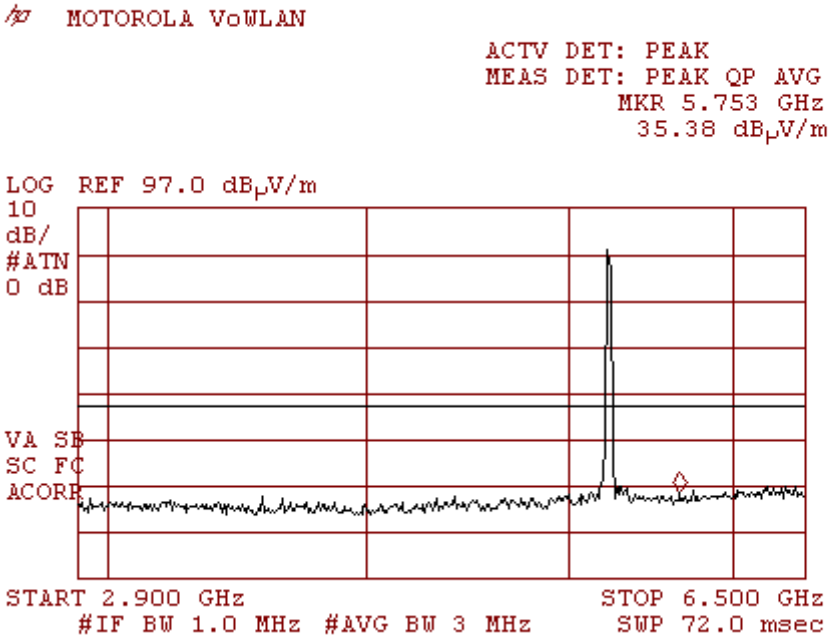
Plot 4.6.20



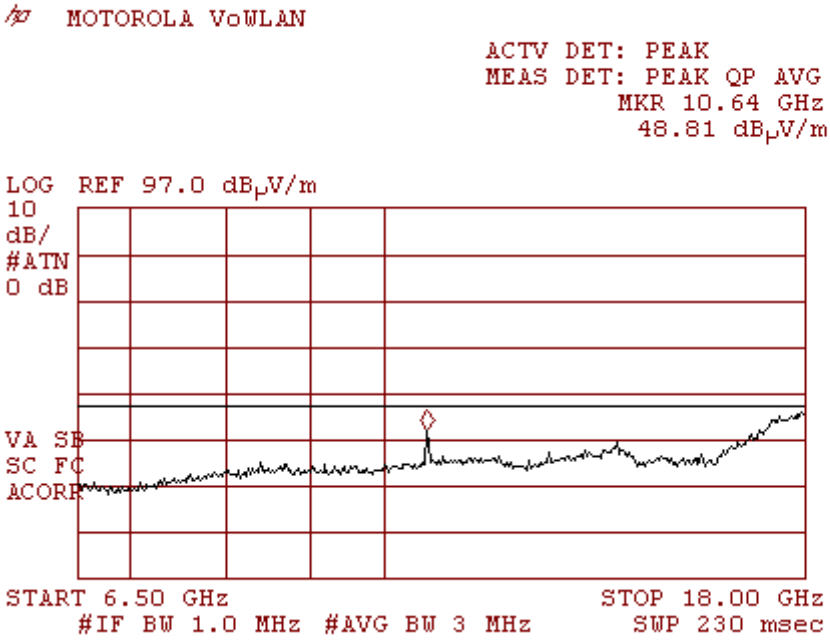
5320 MHz
Vertical & Horizontal Polarization
Plot 4.6.21



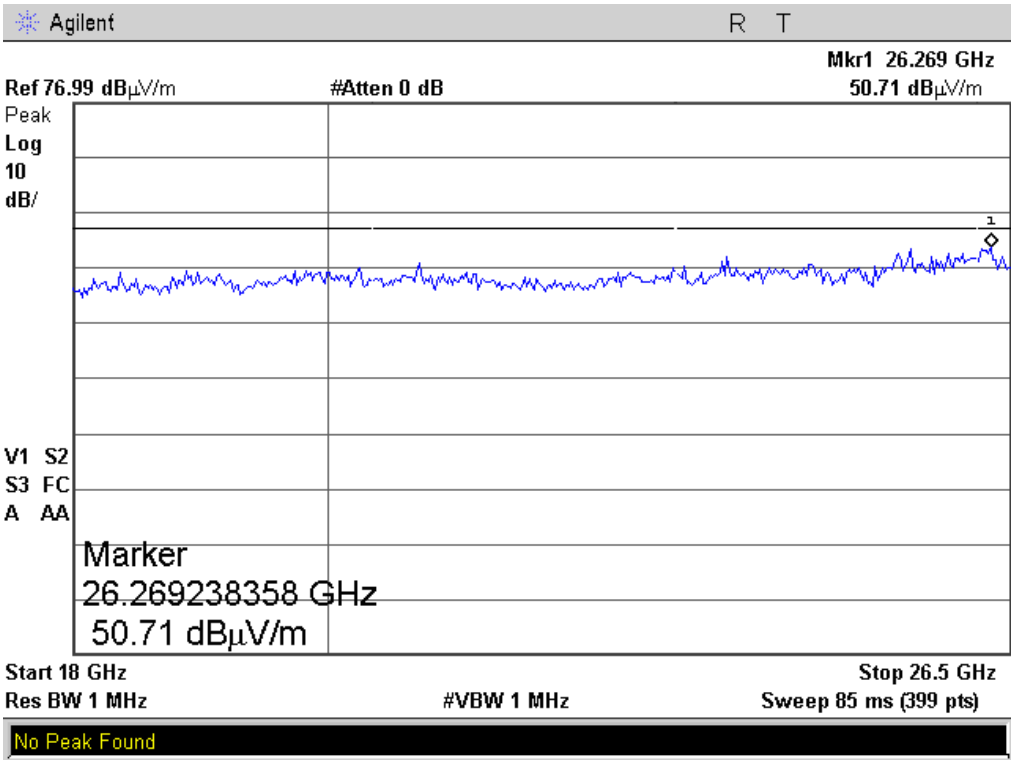
Vertical & Horizontal Polarization
Plot 4.6.22



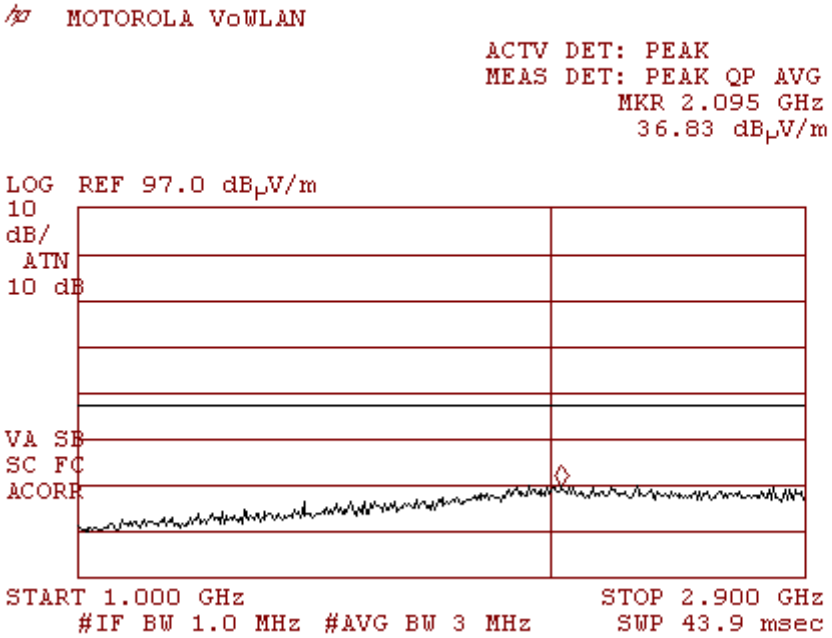
Vertical & Horizontal Polarization
Plot 4.6.23



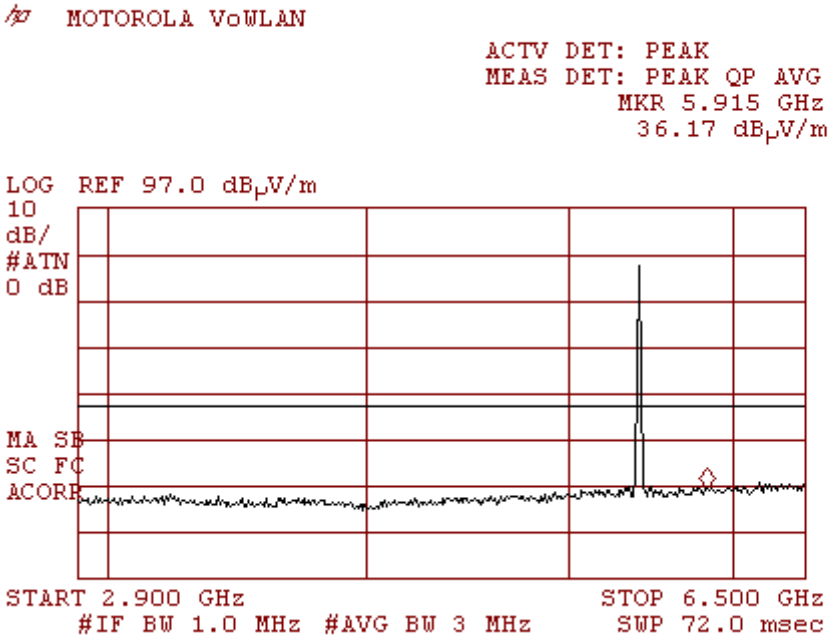
Vertical & Horizontal Polarization
Plot 4.6.24



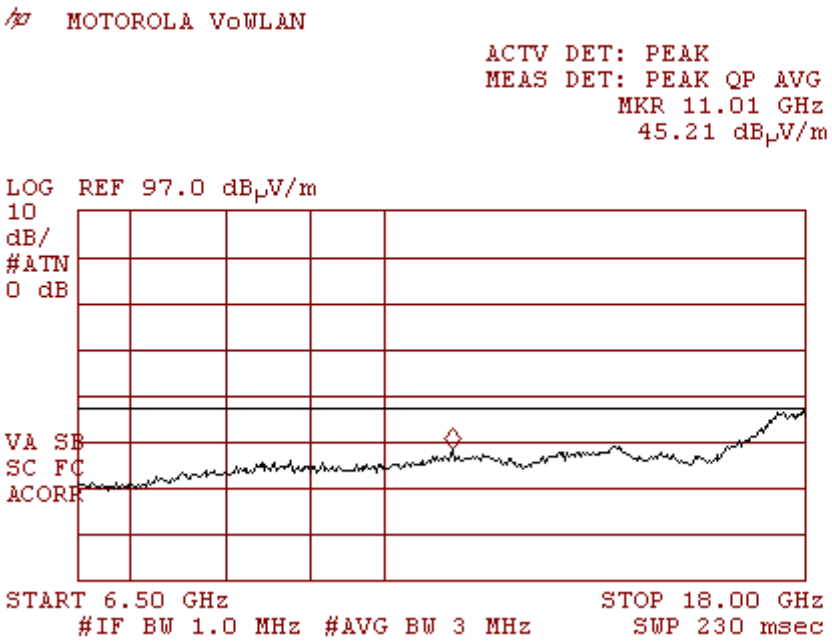
5500 MHz
Vertical & Horizontal Polarization
Plot 4.6.25



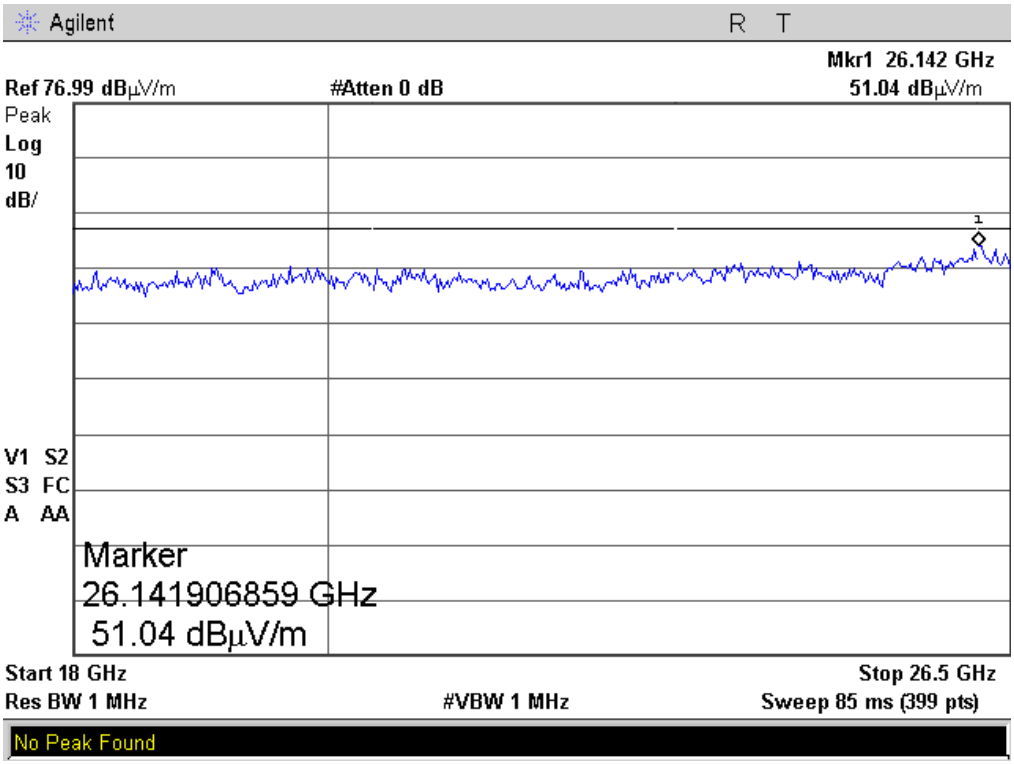
Vertical & Horizontal Polarization
Plot 4.6.26



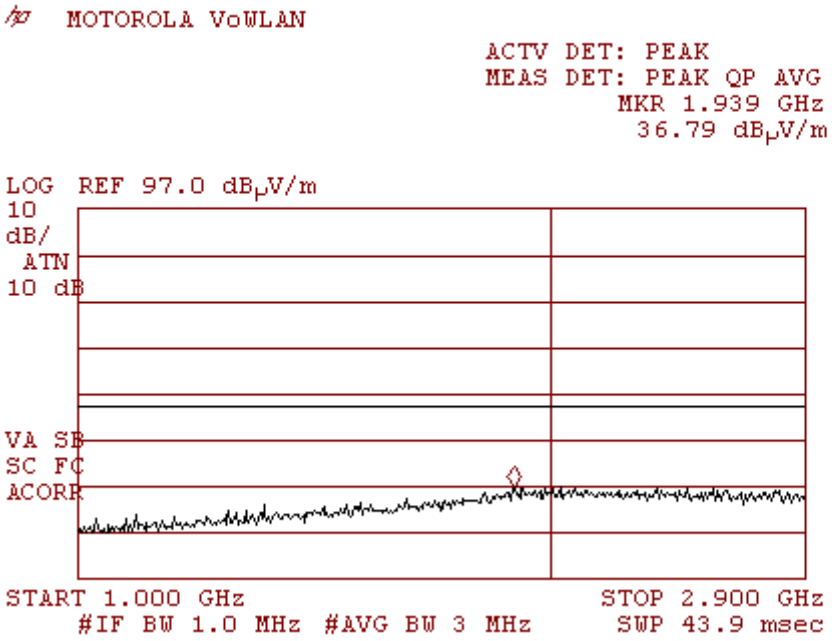
Vertical & Horizontal Polarization
Plot 4.6.27



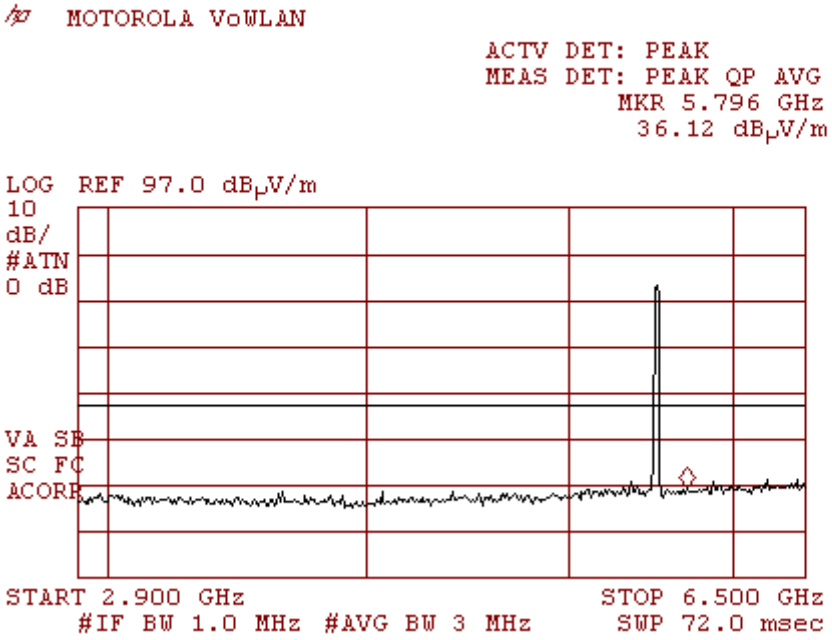
Vertical & Horizontal Polarization
Plot 4.6.28



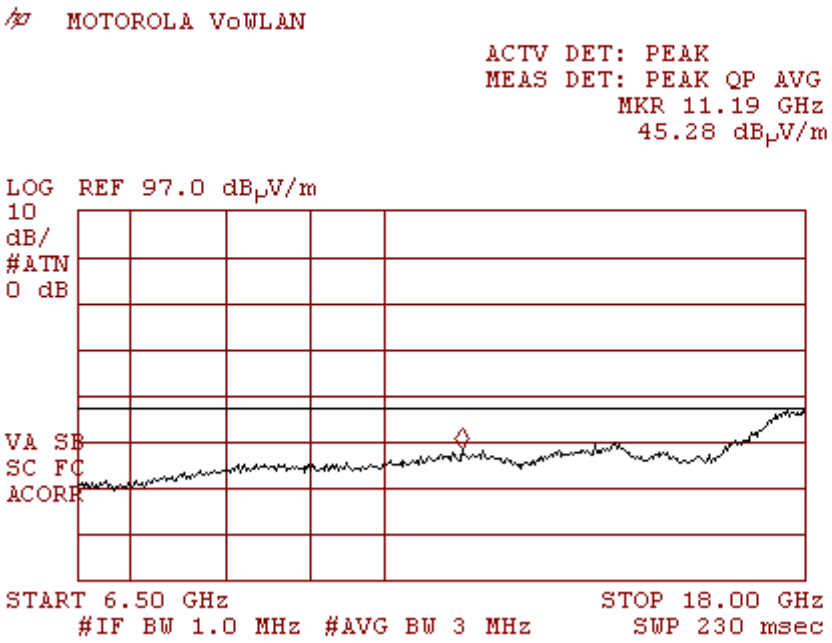
5600 MHz
Vertical & Horizontal Polarization
Plot 4.6.29



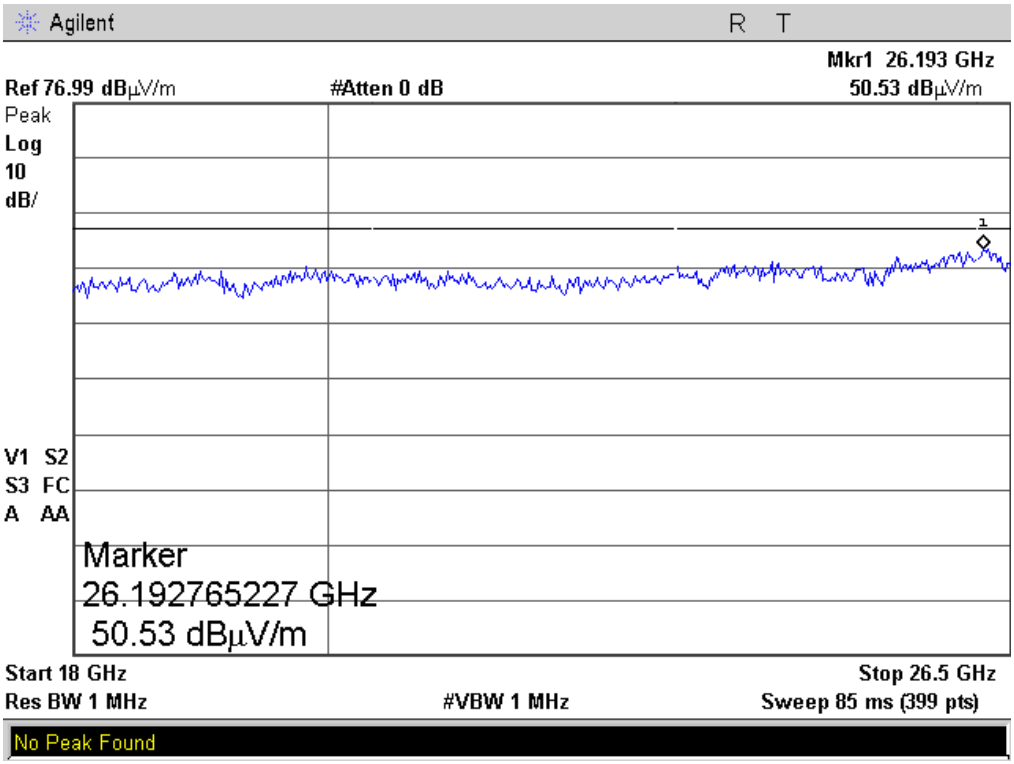
Vertical & Horizontal Polarization
Plot 4.6.30



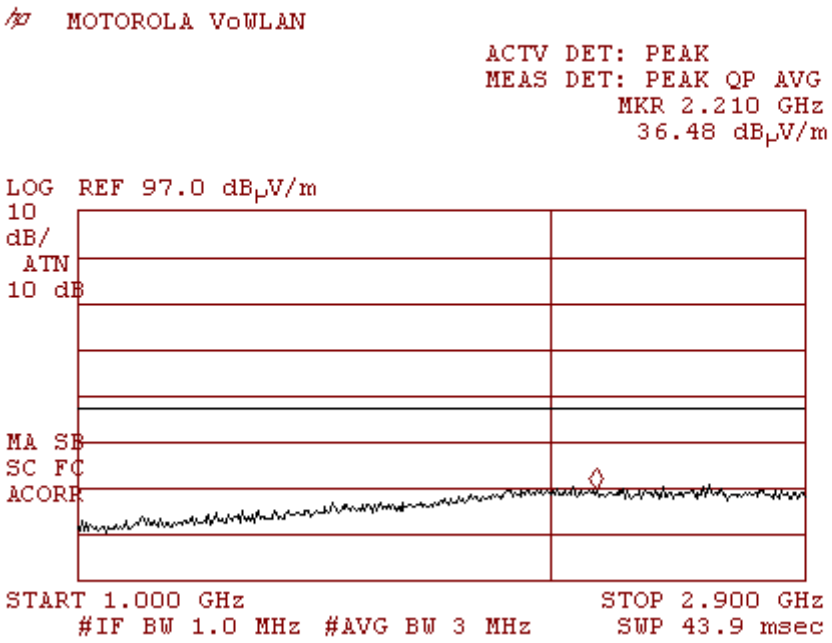
Vertical & Horizontal Polarization
Plot 4.6.31



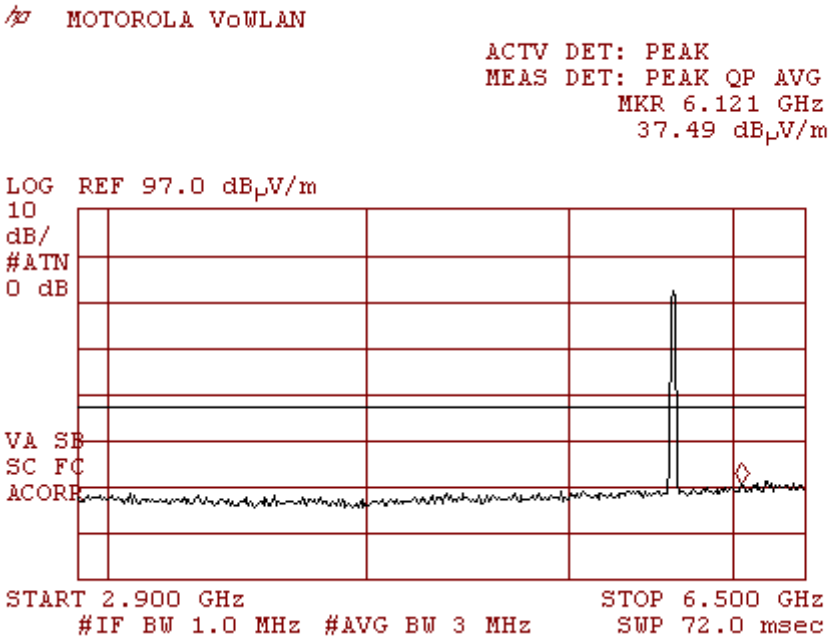
Vertical & Horizontal Polarization
Plot 4.6.32



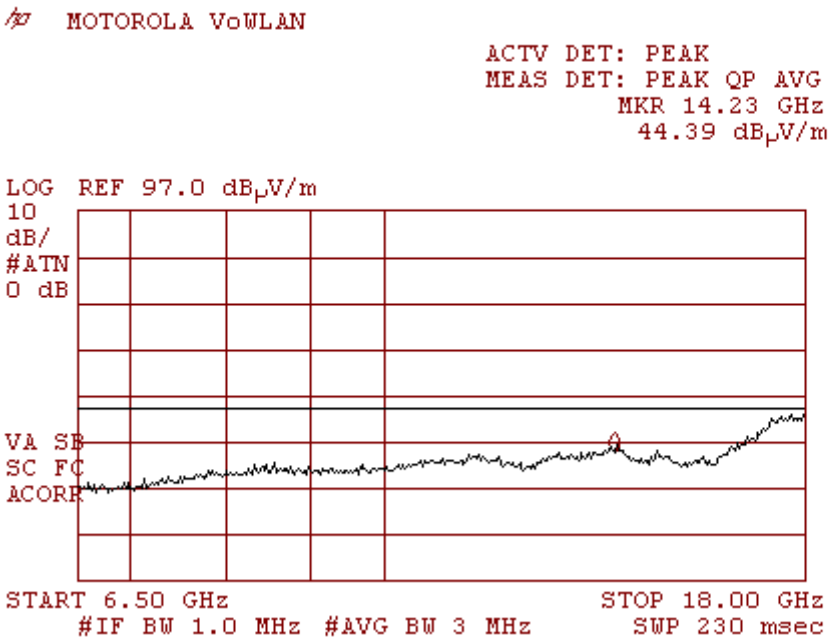
5700 MHz
Vertical & Horizontal Polarization
Plot 4.6.33



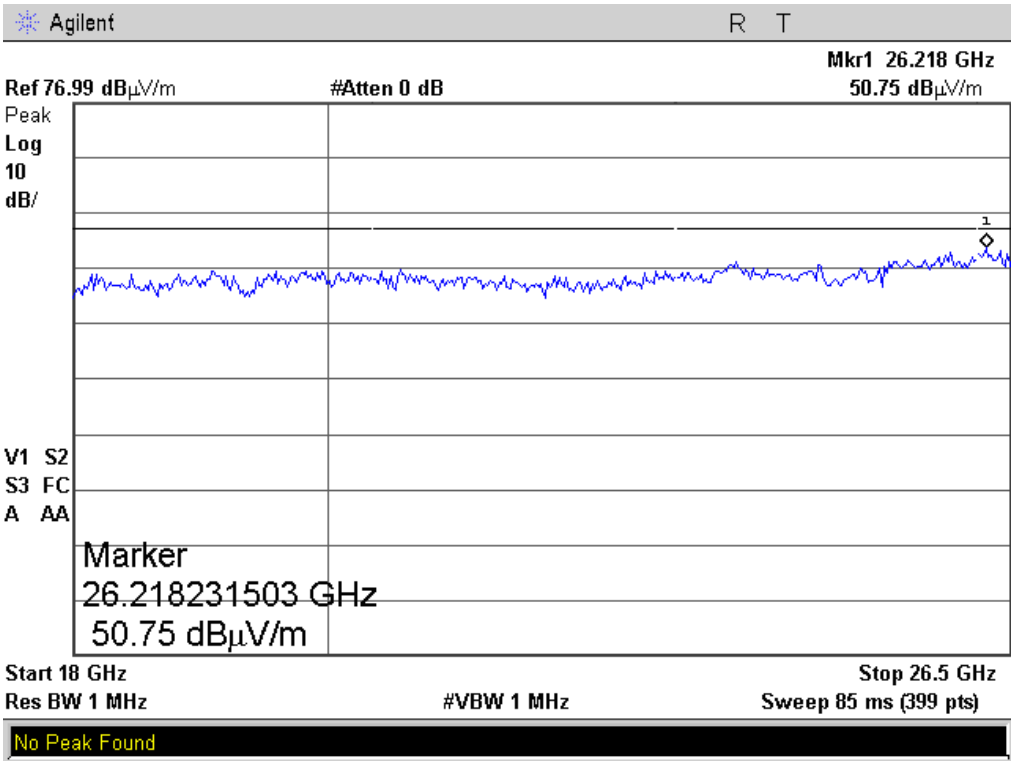
Vertical & Horizontal Polarization
Plot 4.6.34



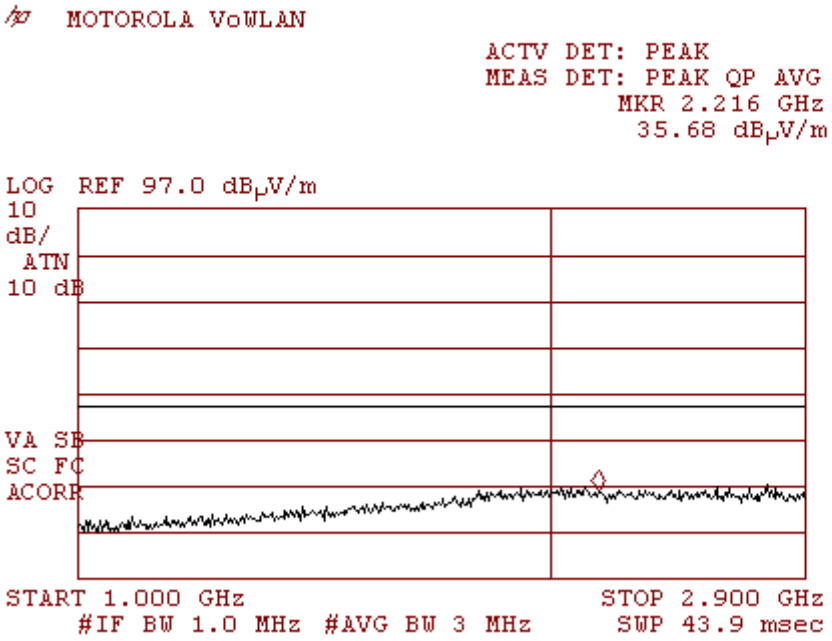
Vertical & Horizontal Polarization
Plot 4.6.35



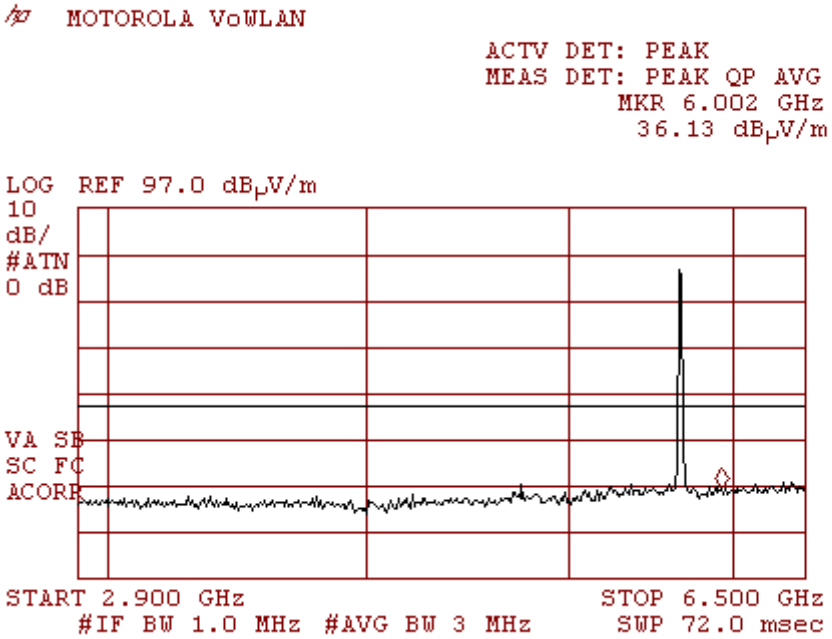
Vertical & Horizontal Polarization
Plot 4.6.36



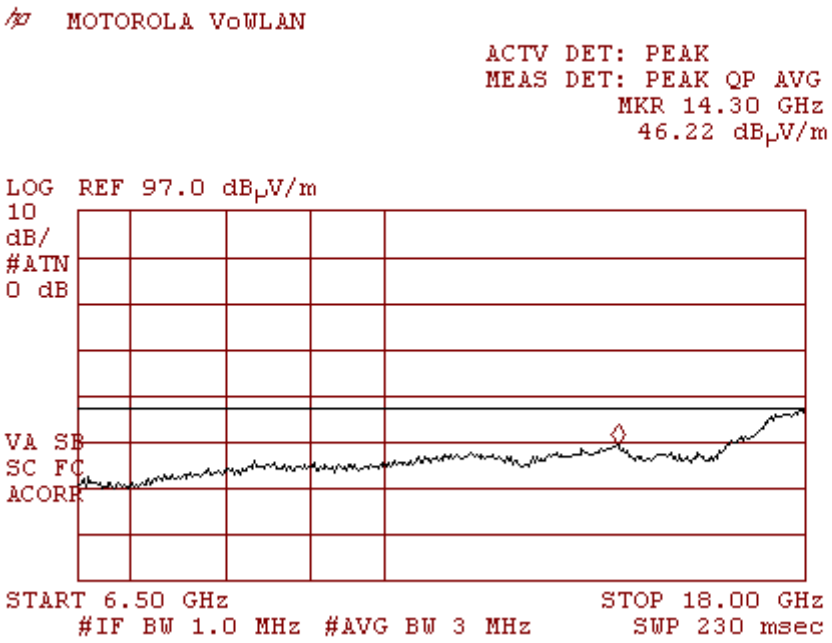
5745 MHz
Vertical & Horizontal Polarization
Plot 4.6.37



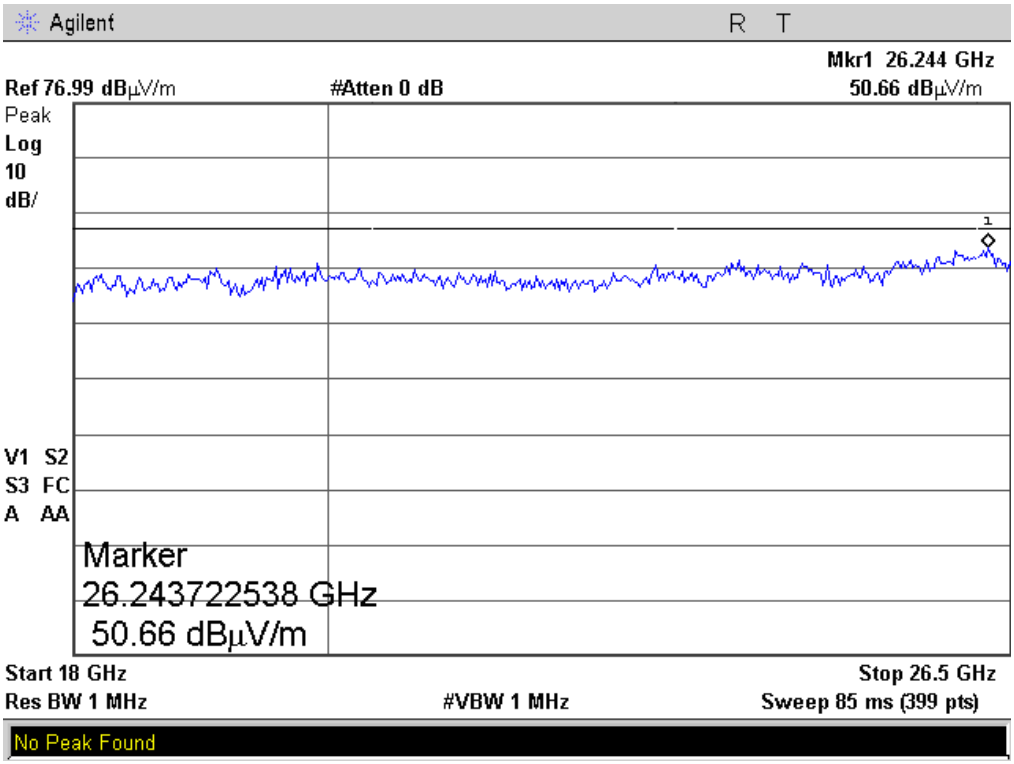
Vertical & Horizontal Polarization
Plot 4.6.38



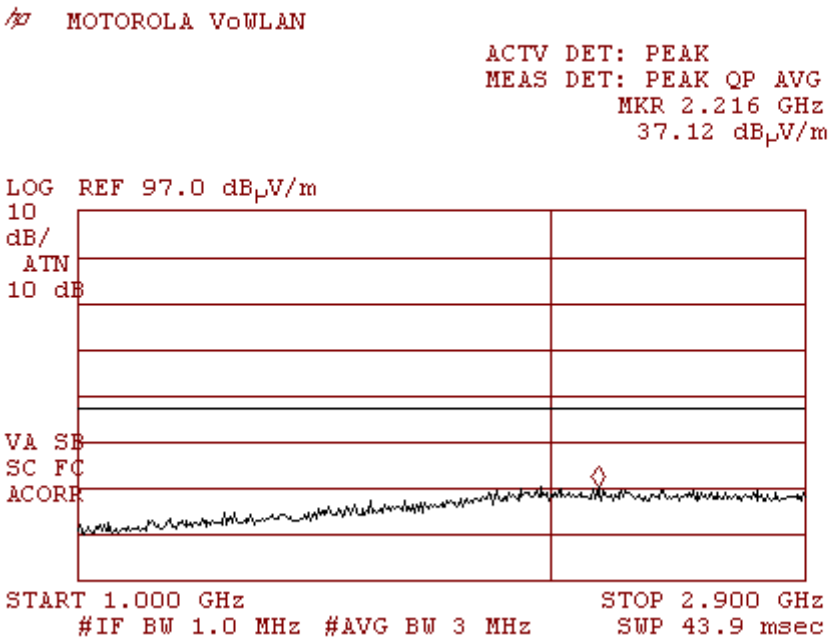
Vertical & Horizontal Polarization
Plot 4.6.39



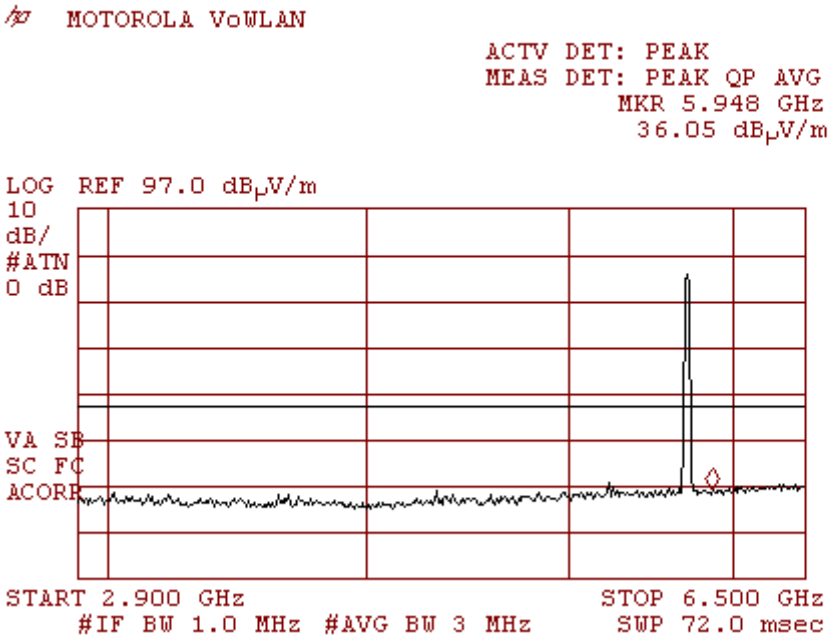
Vertical & Horizontal Polarization
Plot 4.6.40



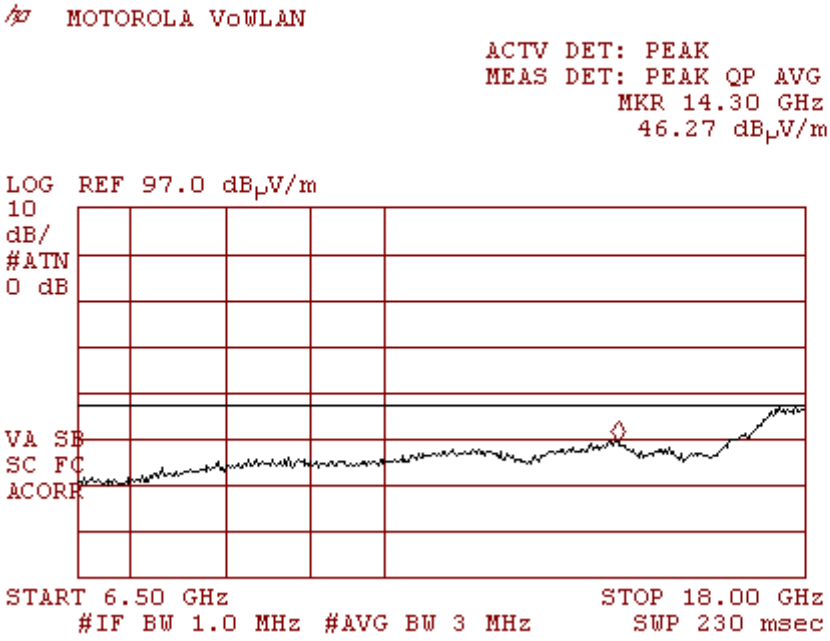
5785 MHz
Vertical & Horizontal Polarization
Plot 4.6.41



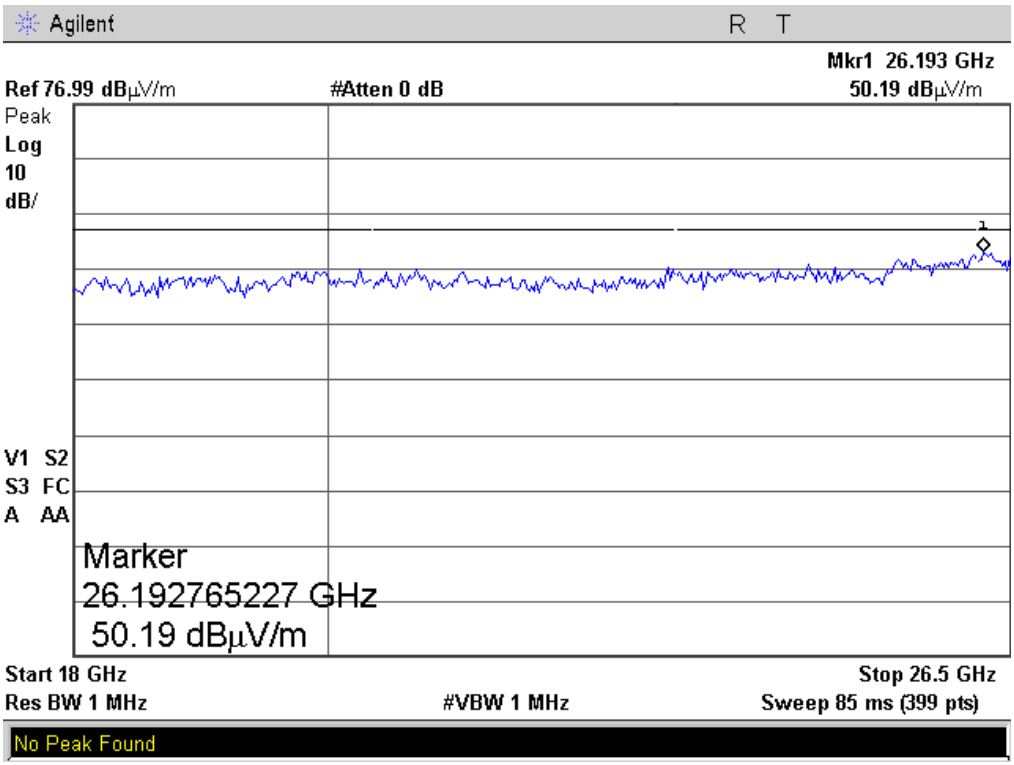
Vertical & Horizontal Polarization
Plot 4.6.42



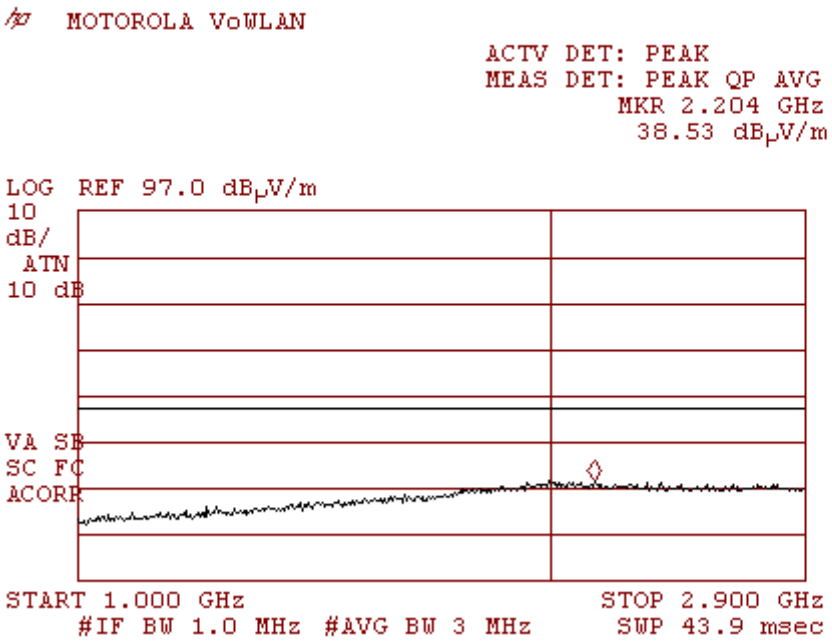
Vertical & Horizontal Polarization
Plot 4.6.43



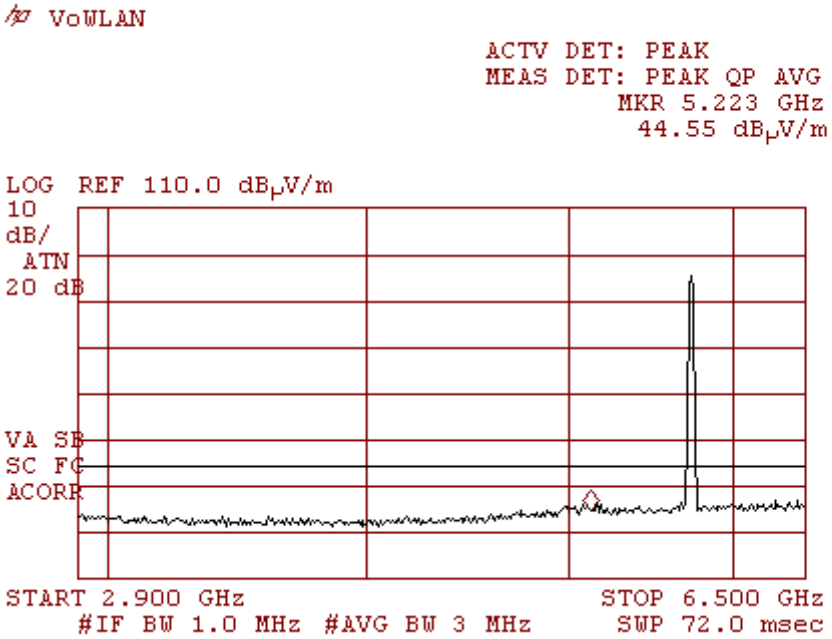
Vertical & Horizontal Polarization
Plot 4.6.44



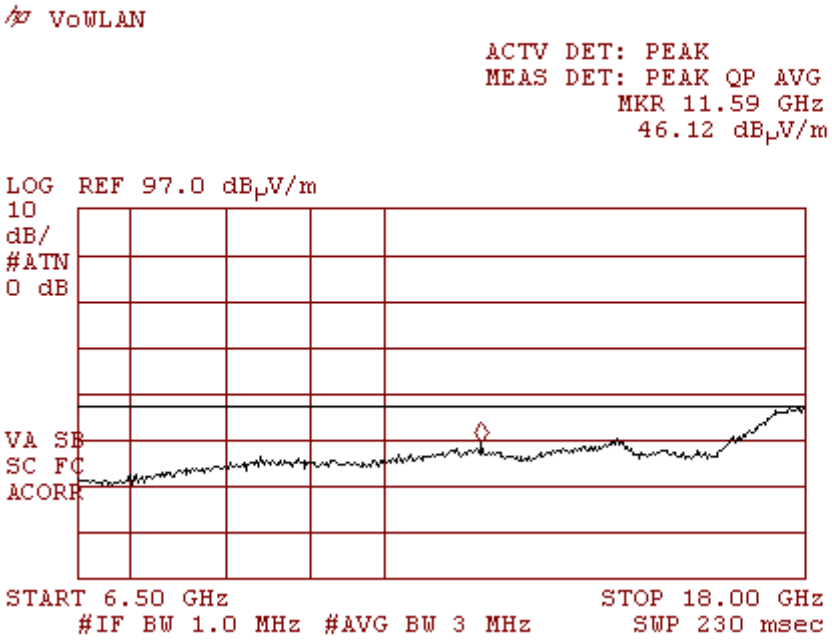
5805 MHz
Vertical & Horizontal Polarization
Plot 4.6.5



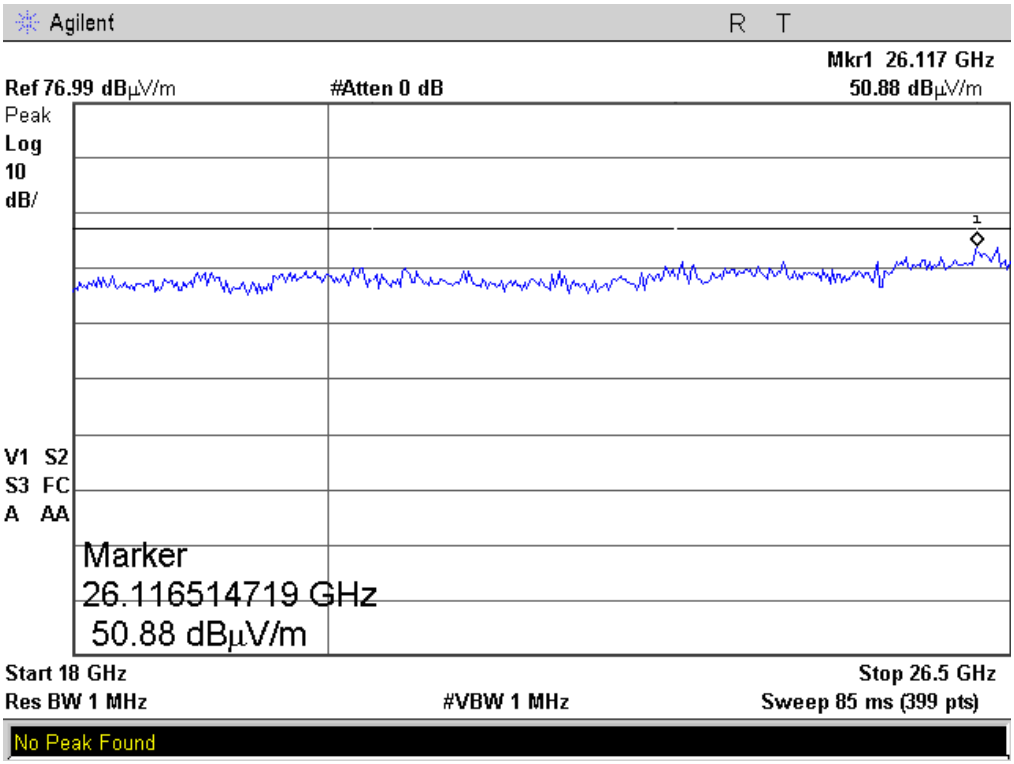
Vertical & Horizontal Polarization
Plot 4.6.46



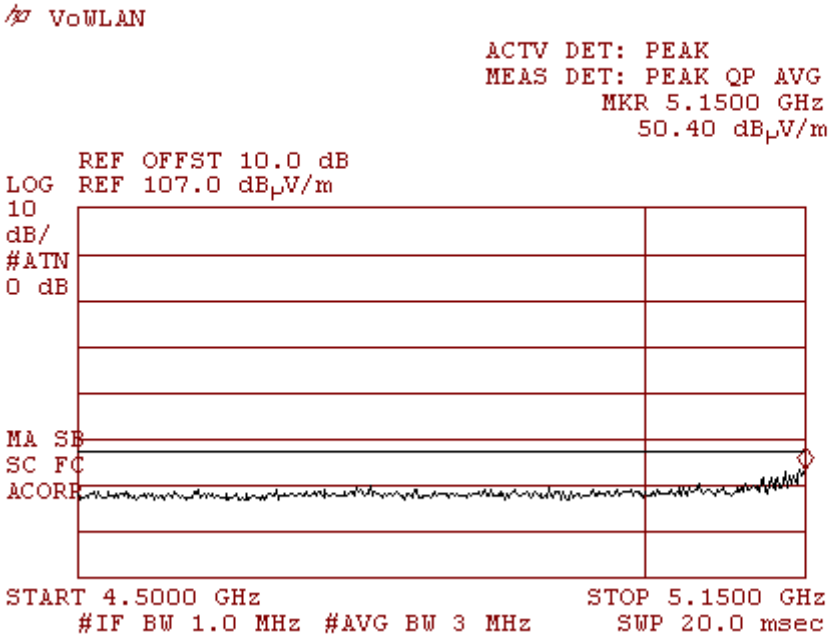
Vertical & Horizontal Polarization
Plot 4.6.47



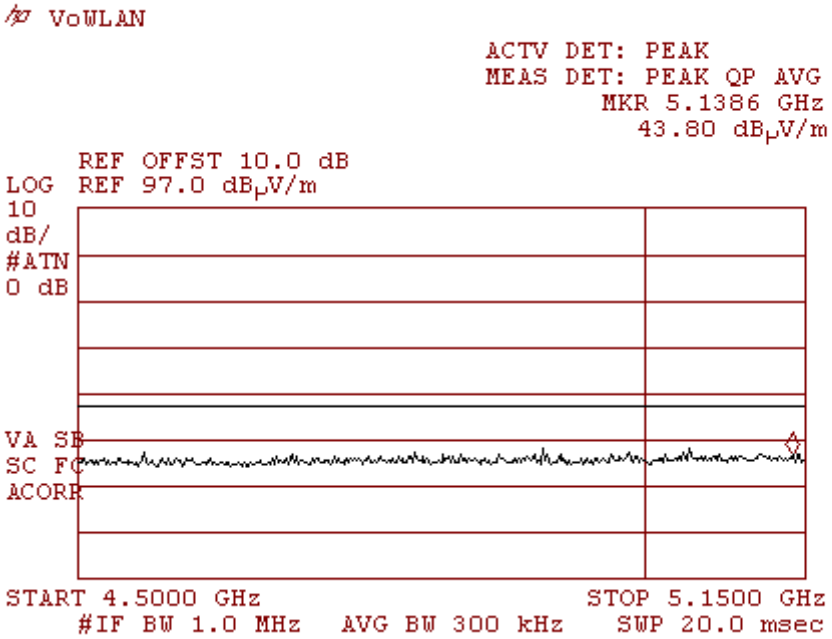
Vertical & Horizontal Polarization
Plot 4.6.48



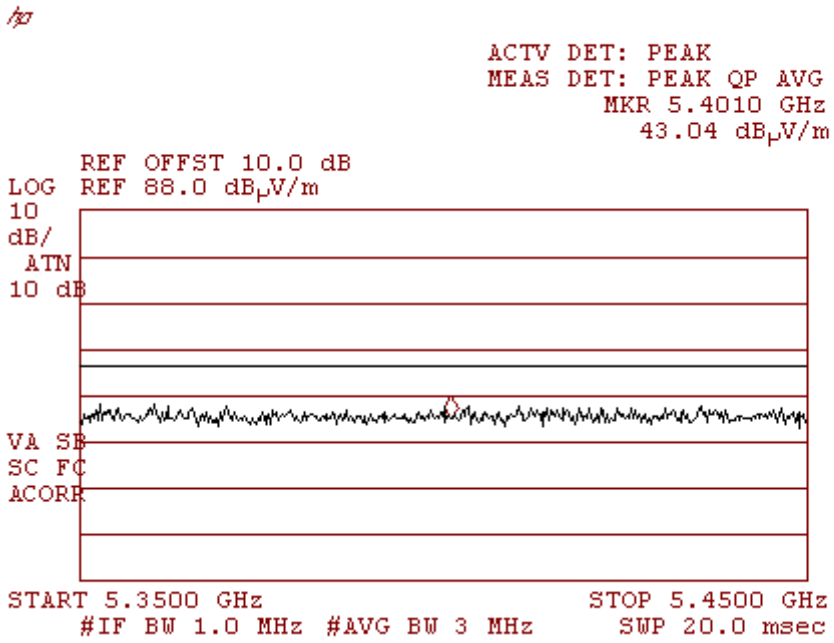
Restricted Band
5180 MHz
Vertical Polarization
Plot 4.6.49



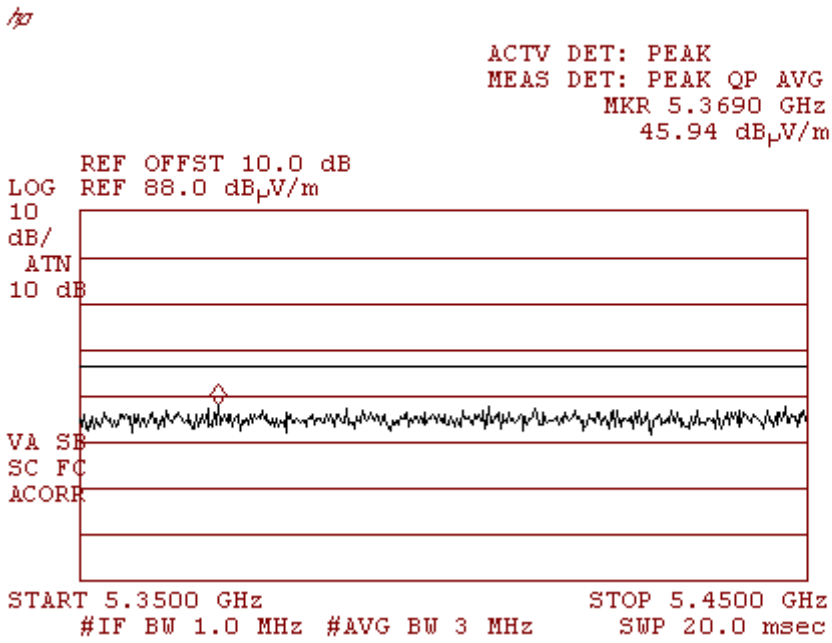
Horizontal Polarization
Plot 4.6.50



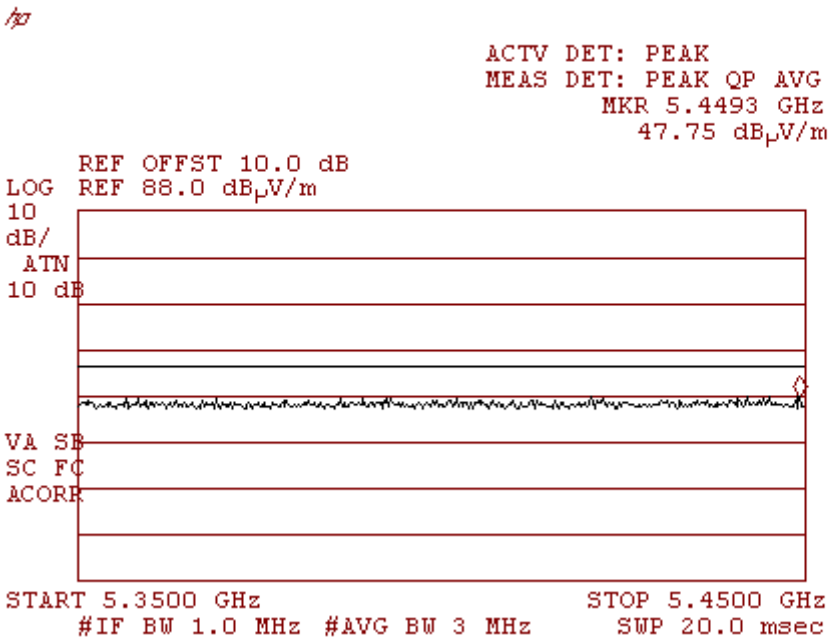
5320 MHz
Vertical Polarization
Plot 4.6.51



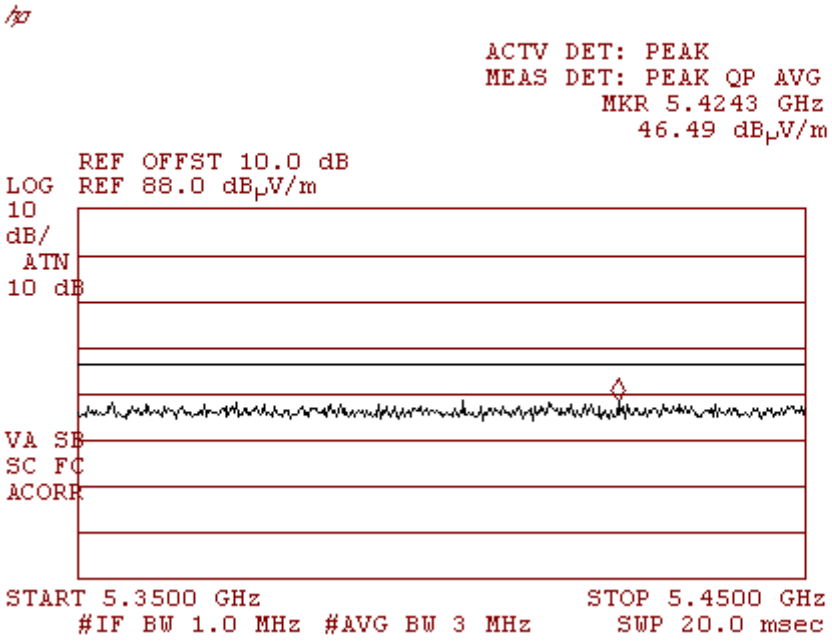
Horizontal Polarization
Plot 4.6.52



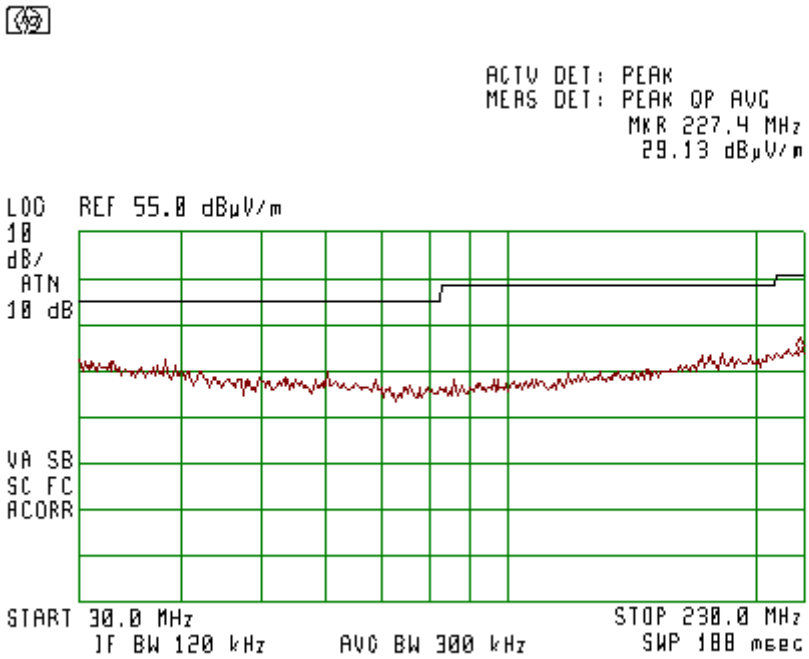
5500 MHz
Horizontal Polarization
Plot 4.6.53



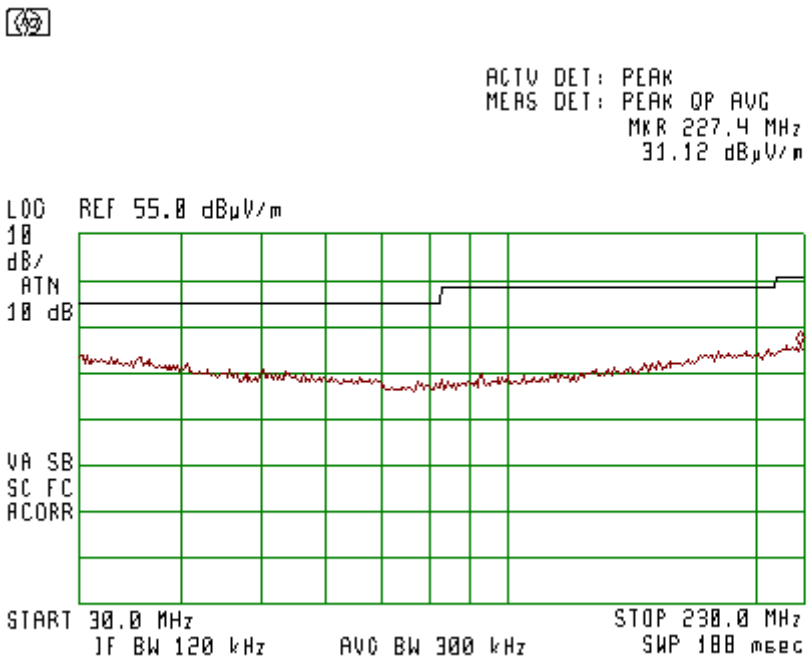
Vertical Polarization
Plot 4.6.54



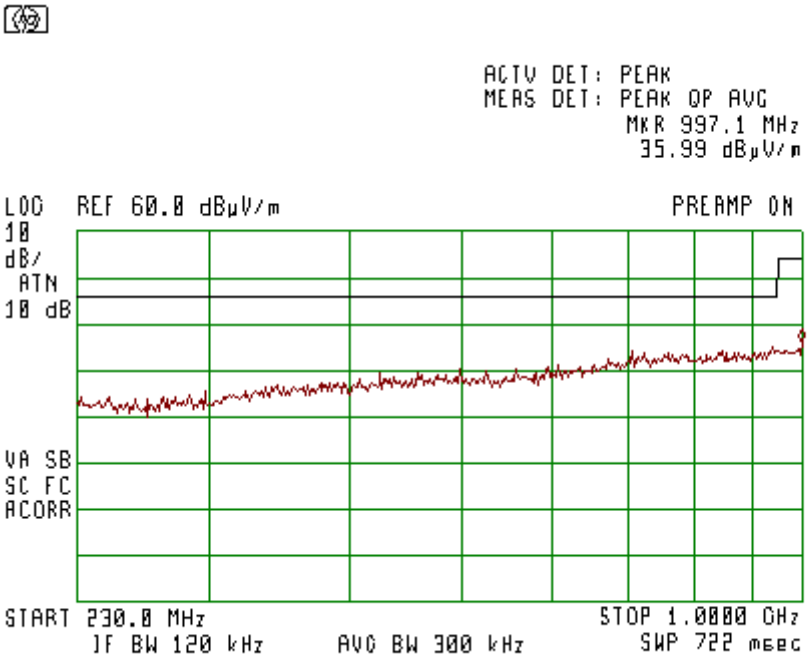
Below 1 GHz Worst case for all Mode and all channel Radiated Emission
Vertical Polarization
Plot 4.6.55



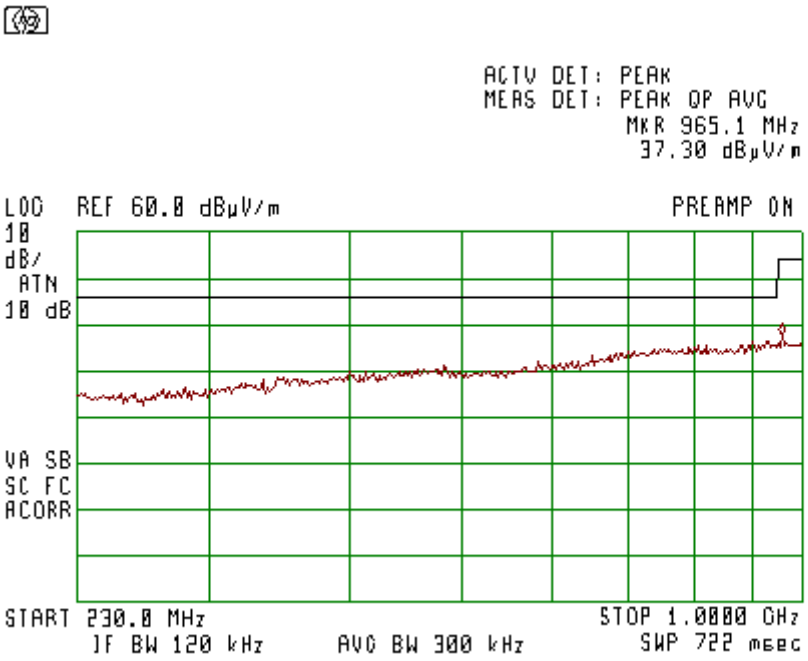
Horizontal Polarization
Plot 4.6.56



Horizontal Polarization
Plot 4.6.57



Vertical Polarization
Plot 4.6.58



4.7. Frequency Stability

Reference document:	**47 CFR §15.407(g)**		
Test Requirements:	Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.		
Test setup:	See sec 2.1	**Pass**	
Method of testing:	Conducted		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 100kHz, VBW: 300kHz		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	Data indicates that the fundamental emission is maintained within the band of operation under extreme conditions.	See Plot 4.7.1 to Plot 4.7.12	

Test results:

Voltage Variation

5150-5350 MHz

Frequency [MHz]	Data Rate [Mbps]	Extreme Conditions	Edge of 26 dB Bandwidth [MHz]	Margin [MHz]	Ref Plot
5180	54	Ambient temperature 22 °c, Input Voltage 3.145-4.255 Vdc	5170	20.22	4.7.1
5320	54	Ambient temperature 22 °c, Input Voltage 3.145-4.255 Vdc	5330	20.09	4.7.3

5470-5725 MHz

Frequency [MHz]	Data Rate [Mbps]	Extreme Conditions	Edge of 26 dB Bandwidth [MHz]	Margin [MHz]	Ref Plot
5500	54	Ambient temperature 22 °c, Input Voltage 3.145-4.255 Vdc	5485	14.61	4.7.5
5700	54		5710	14.79	4.7.8

5725-5825 MHz

Frequency [MHz]	Data Rate [Mbps]	Extreme Conditions	Edge of 26 dB Bandwidth [MHz]	Margin [MHz]	Ref Plot
5745	54	Ambient temperature 22 °c, Input Voltage 3.145-4.255 Vdc	5735	10.2	4.7.9
5805	54		5815	10.2	4.7.12

Temperature Variation

5150-5350 MHz

Frequency [MHz]	Data Rate [Mbps]	Extreme Conditions	Edge of 26 dB Bandwidth [MHz]	Margin [MHz]	Ref Plot
5180	54	Ambient temperature -30 to +50°c, Input Voltage 3.7Vdc	5170	20.45	4.7.14
5320	54	Ambient temperature -30 to +50 °c, Input Voltage 3.7Vdc	5330	19.94	4.7.15

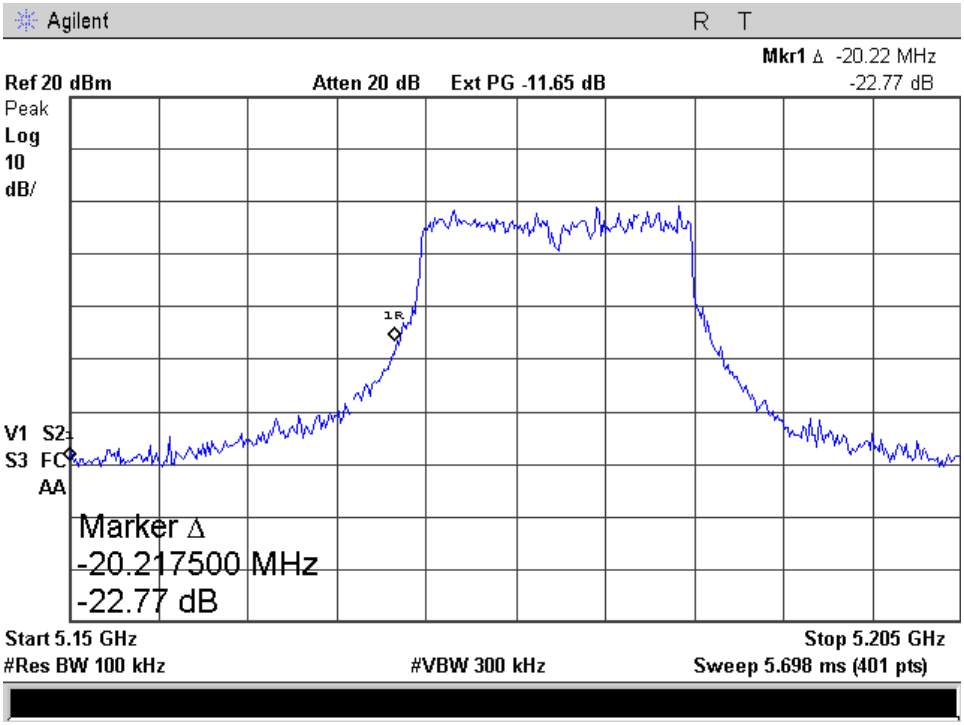
5470-5725 MHz

Frequency [MHz]	Data Rate [Mbps]	Extreme Conditions	Edge of 26 dB Bandwidth [MHz]	Margin [MHz]	Ref Plot
5500	54	Ambient temperature -30 to +50°c, Input Voltage 3.7Vdc	5485	15.05	4.7.18
5700	54		5701	15.18	4.7.20

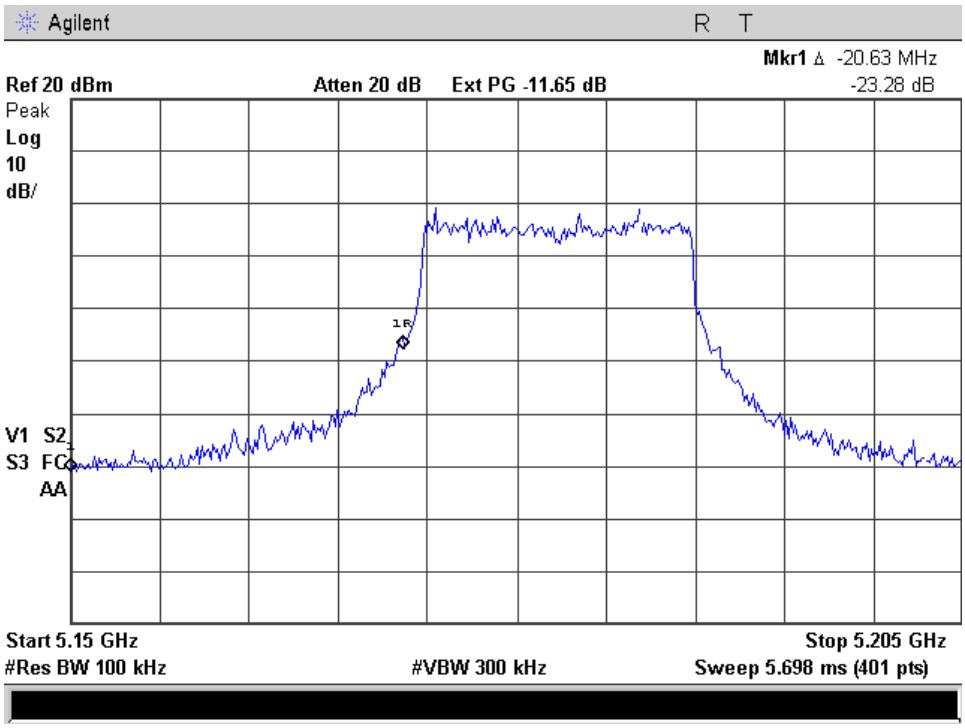
5725-5825 MHz

Frequency [MHz]	Data Rate [Mbps]	Extreme Conditions	Edge of 26 dB Bandwidth [MHz]	Margin [MHz]	Ref Plot
5745	54	Ambient temperature -30 to +50 °c, Input Voltage 3.7Vdc	5735	10.05	4.7.23
5805	54		5815	10.29	4.7.24

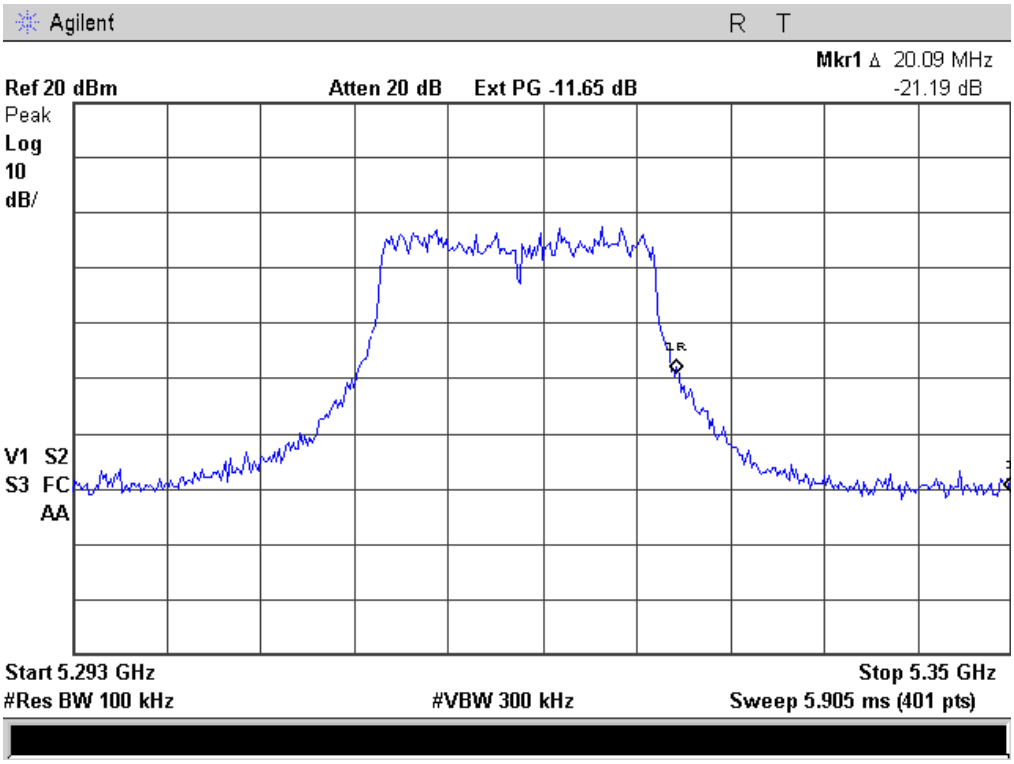
Voltage Variation
5150-5350 MHz, Carrier frequency 5180 MHz,
115% of Vnom
Plot 4.7.1



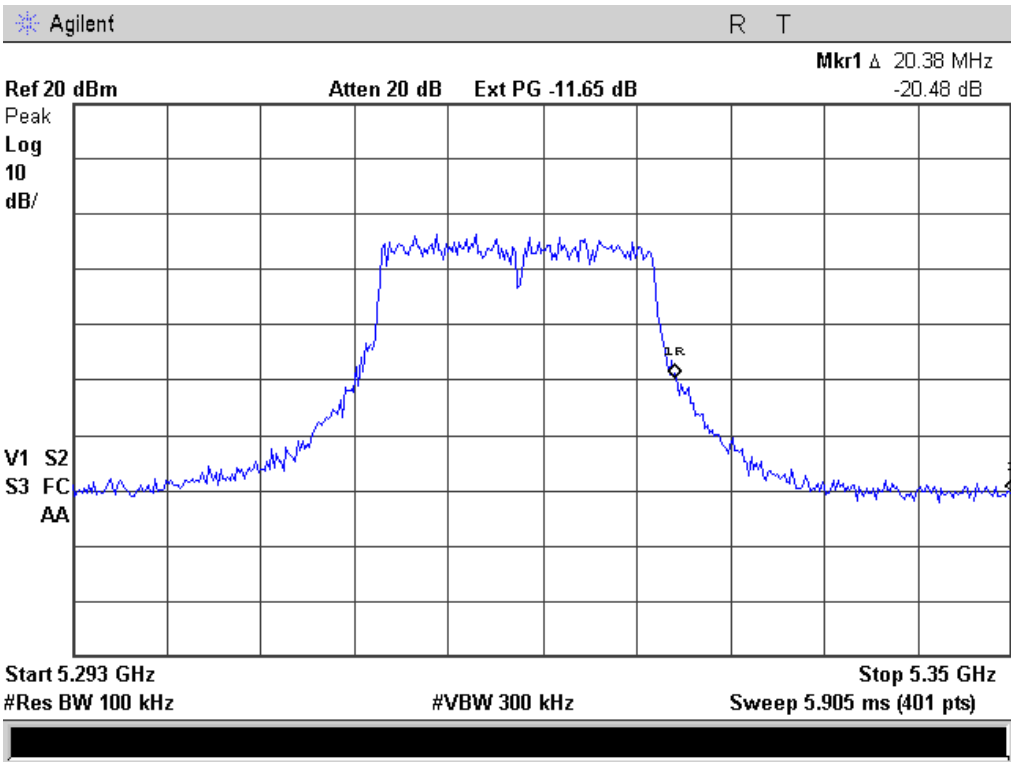
85% of Vnom
Plot 4.7.2



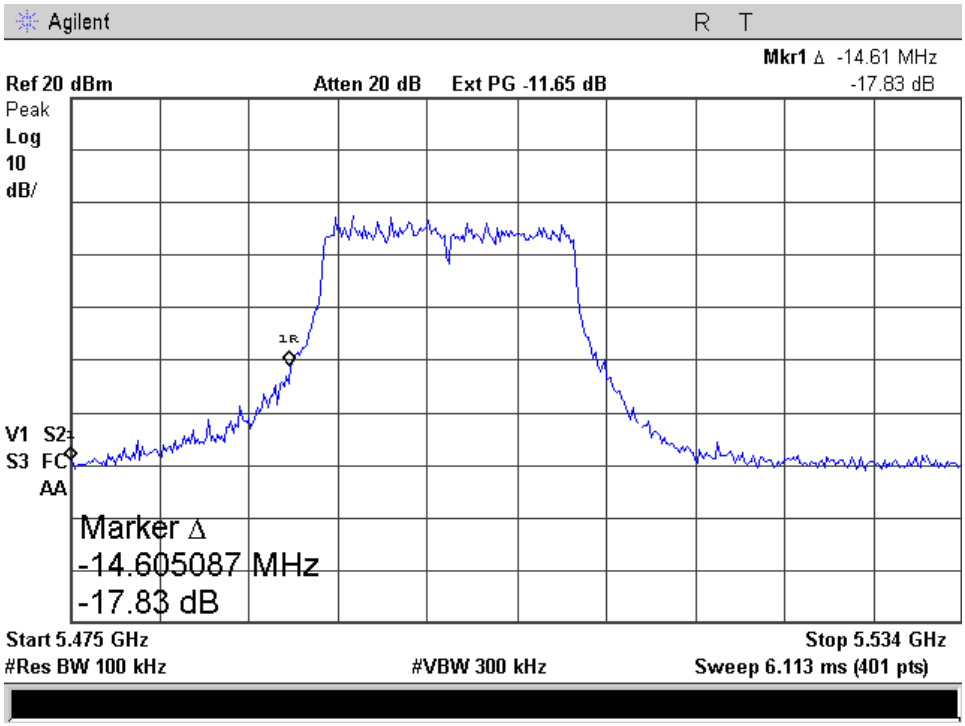
Carrier frequency 5320 MHz
115% of Vnom
Plot 4.7.3



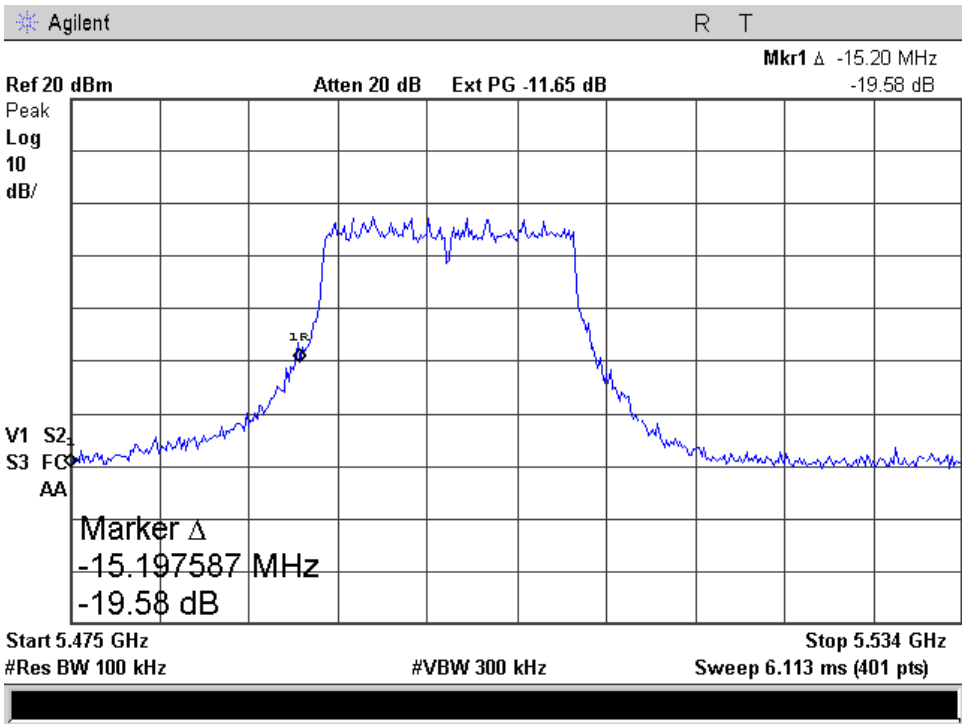
85% of Vnom
Plot 4.7.4



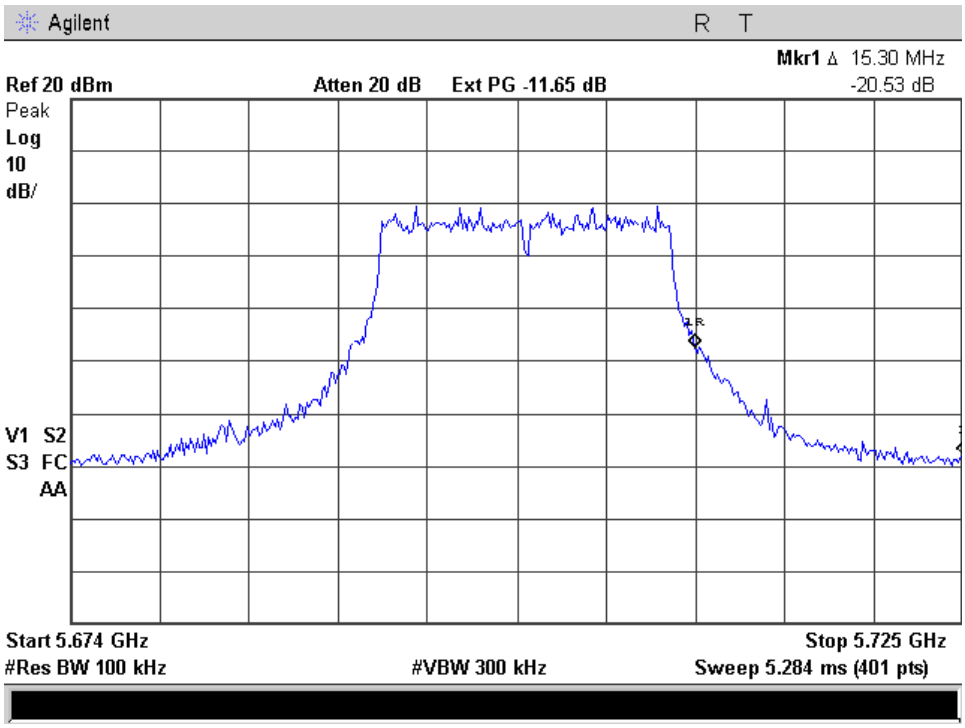
5470-5725 MHz
Carrier frequency 5500 MHz
115% of V mon
Plot 4.7.5



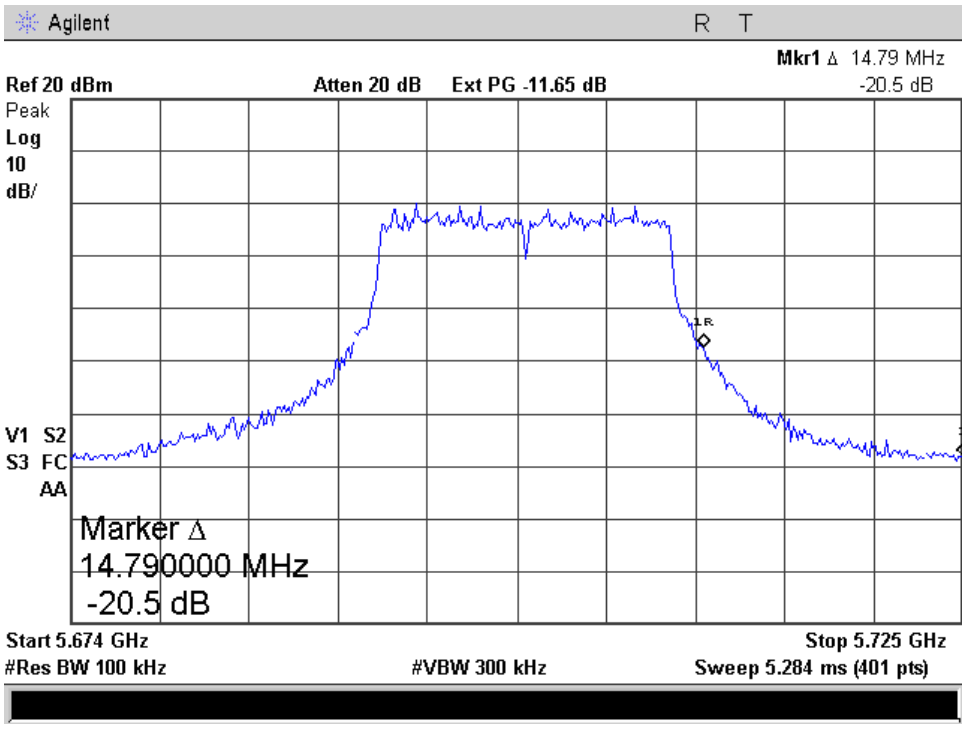
85% of V mon
Plot 4.7.6



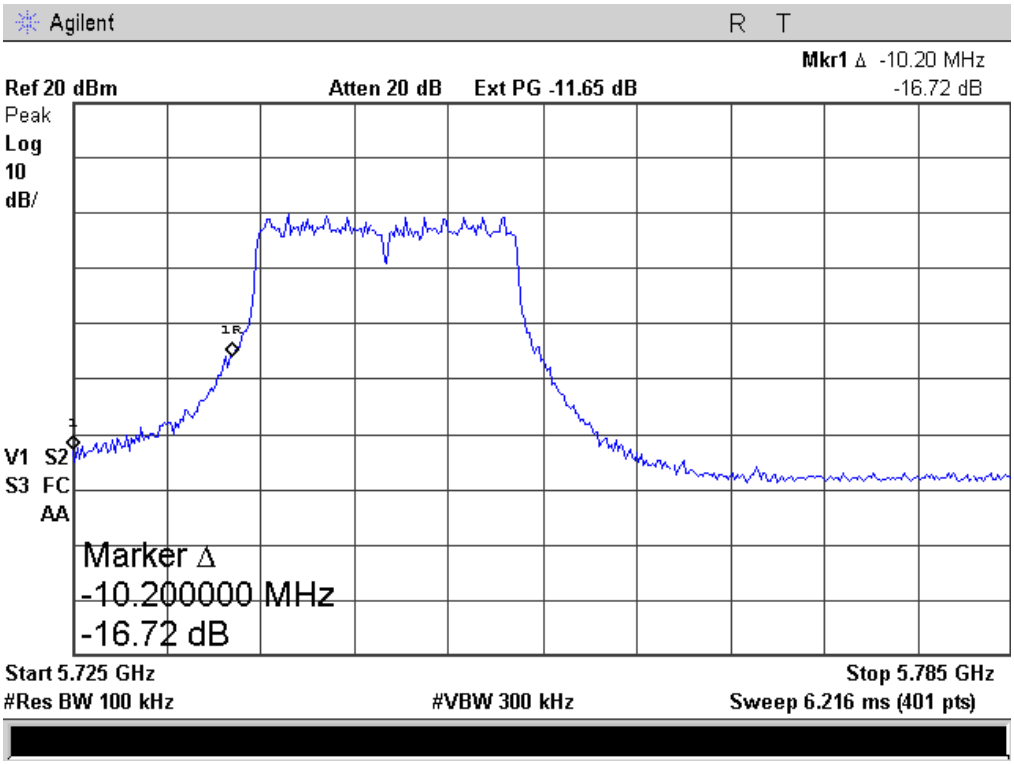
Carrier frequency 5700MHz
115 % of V nom
Plot 4.7.7



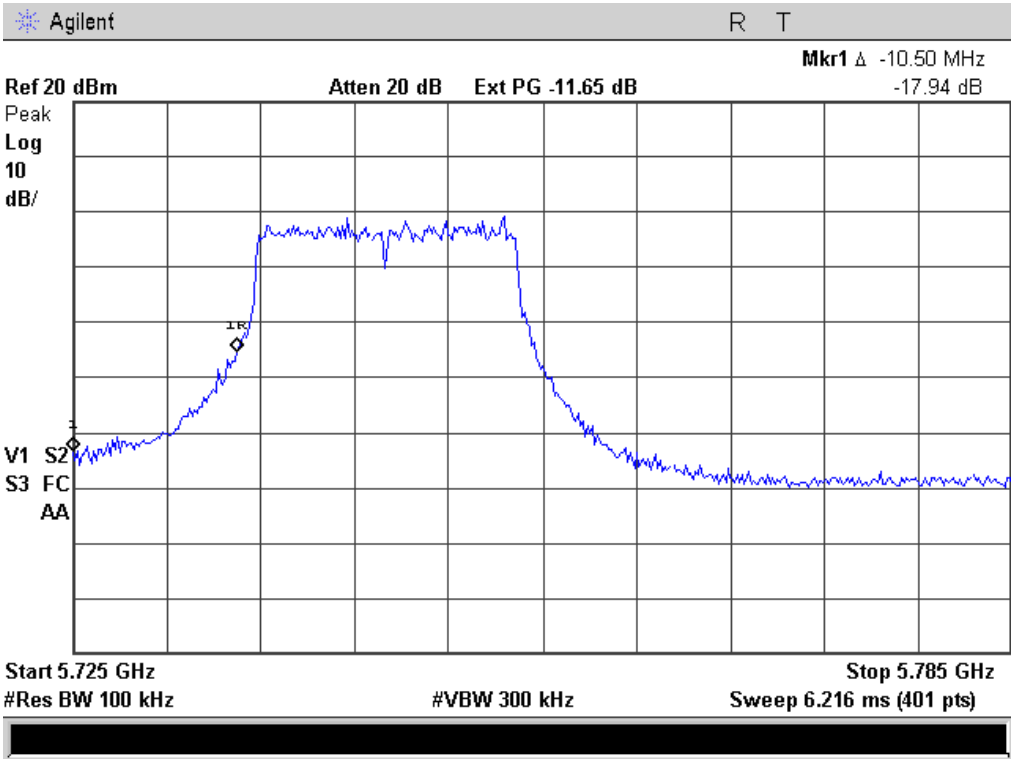
85 % of V nom
Plot 4.7.8



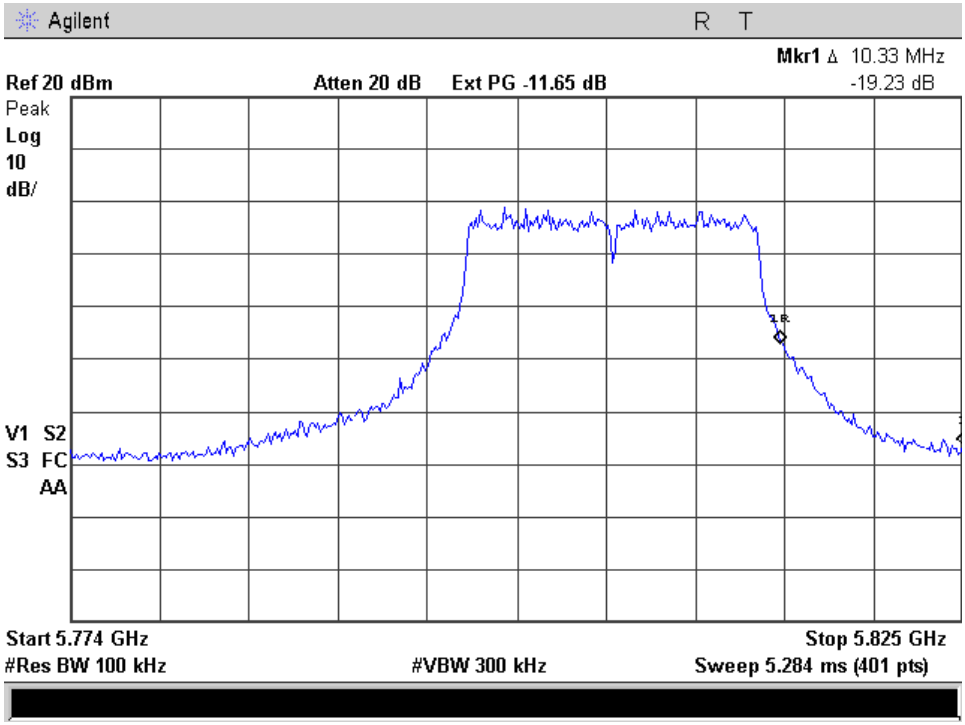
5725-5825 MHz
Carrier frequency 5745 MHz
115% of Vnom
Plot 4.7.9



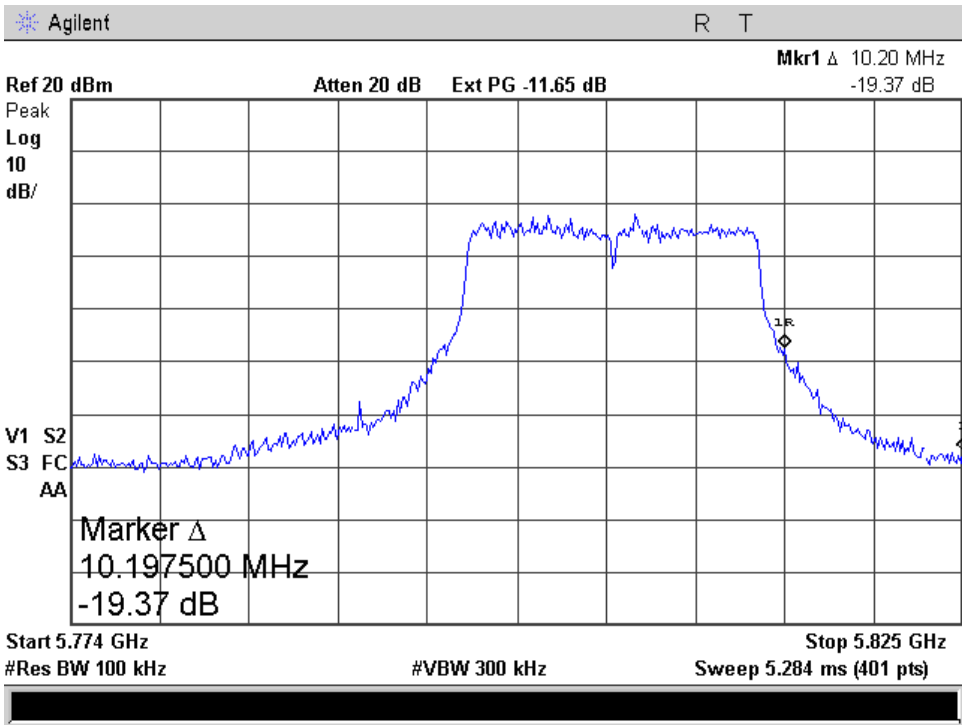
85% of Vnom
Plot 4.7.10



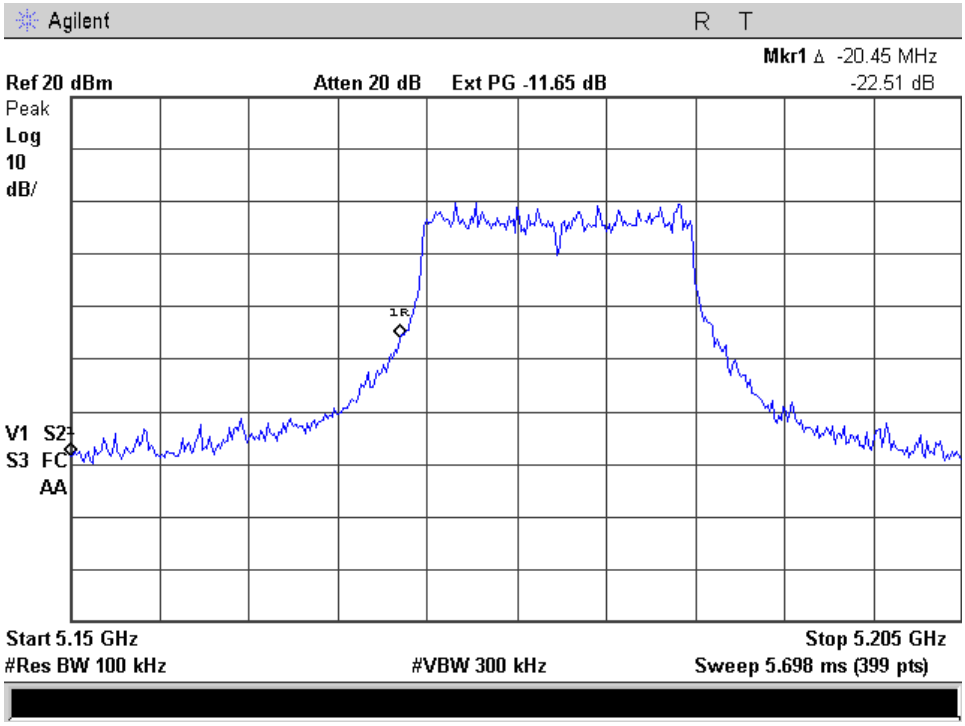
Carrier frequency 5805 MHz
115% of Vnom
Plot 4.7.11



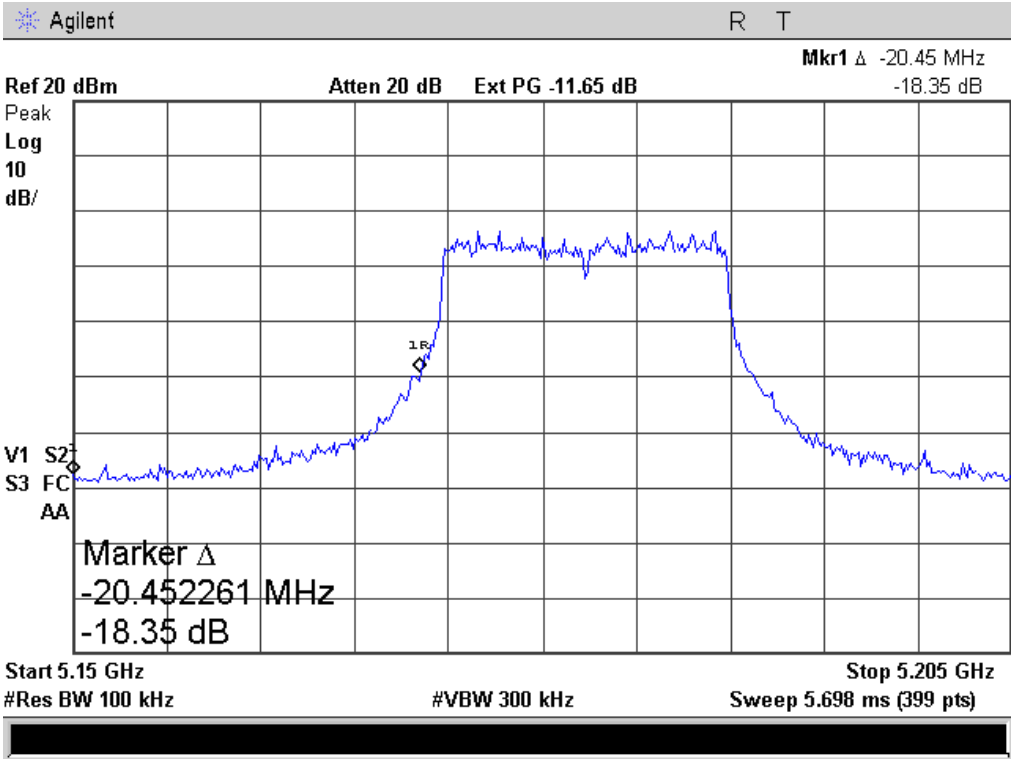
85% of Vnom
Plot 4.7.12



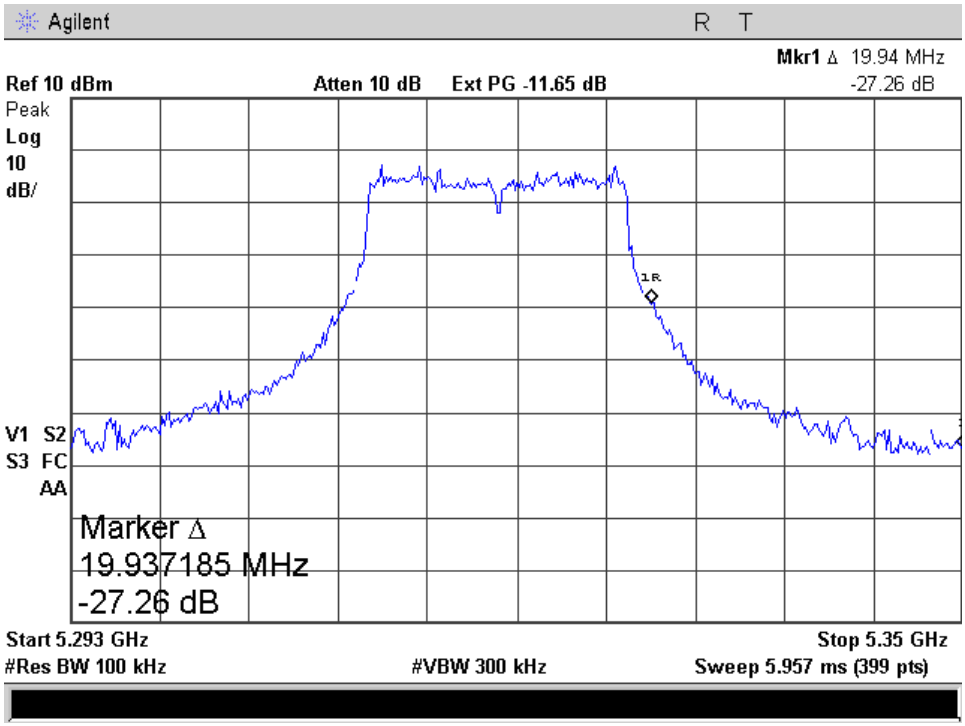
Temperature variation
5150-5350MHz Carrier frequency 5180 MHz
+ 50°c
Plot 4.7.13



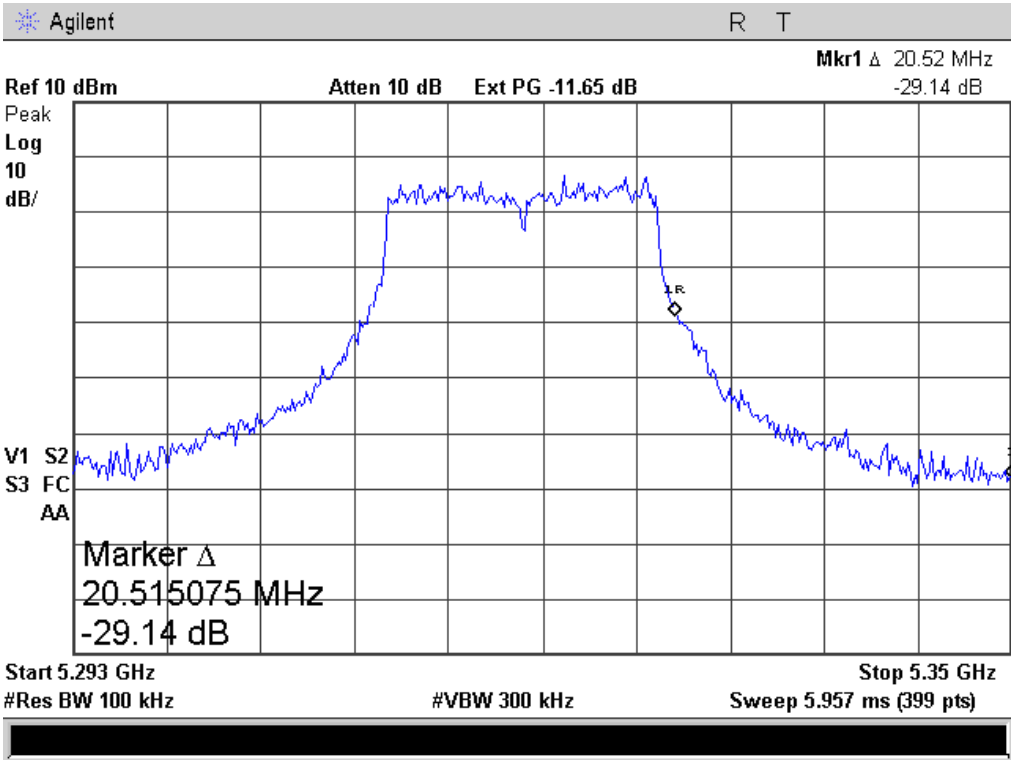
-30°c
Plot 4.7.14



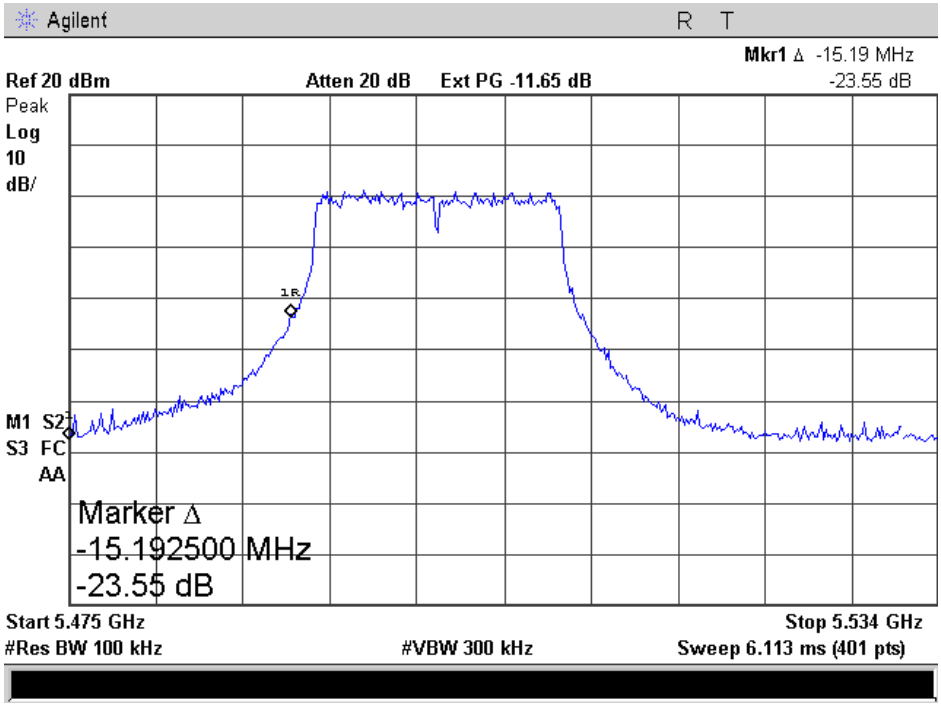
Carrier frequency 5320 MHz
+50°c
Plot 4.7.15



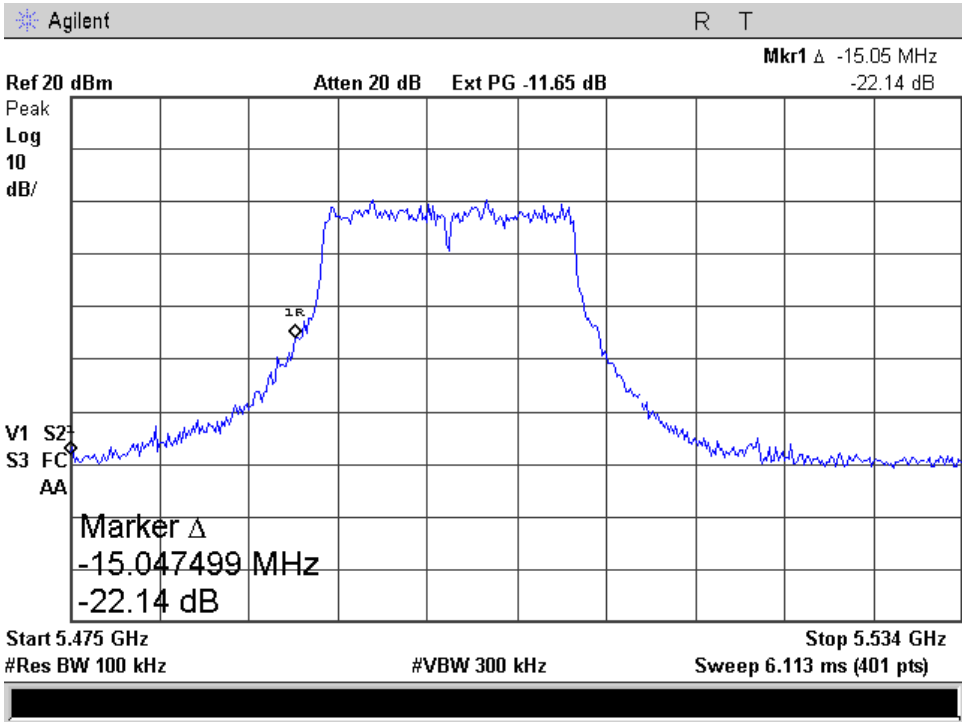
-30 °c
Plot 4.7.16



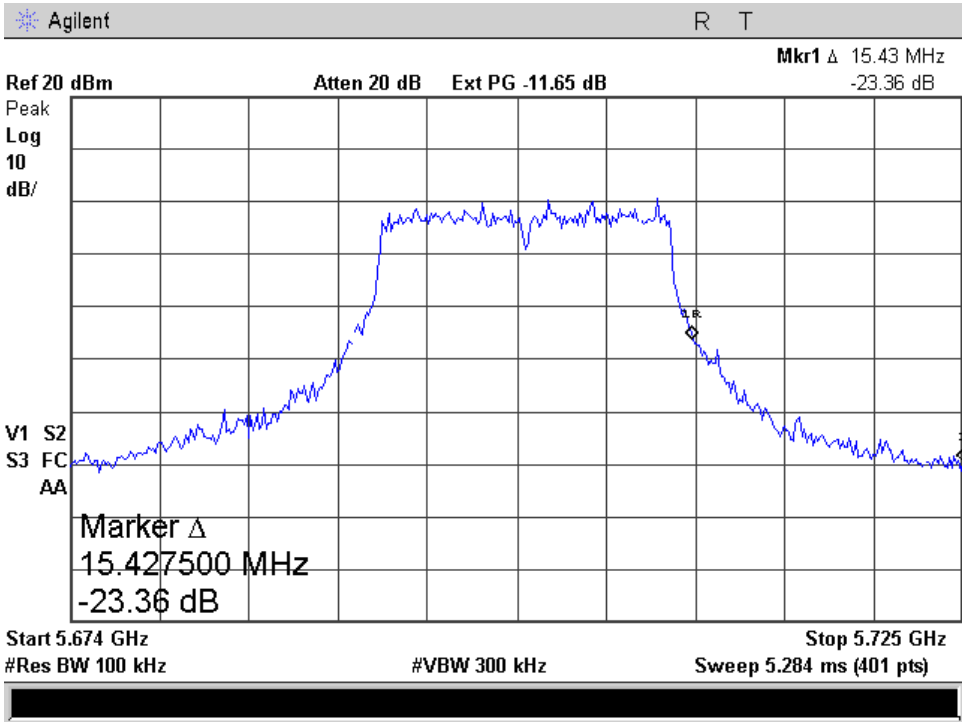
5470-5725 MHz,
Carrier frequency 5500 MHz
+50°c
Plot 4.7.17



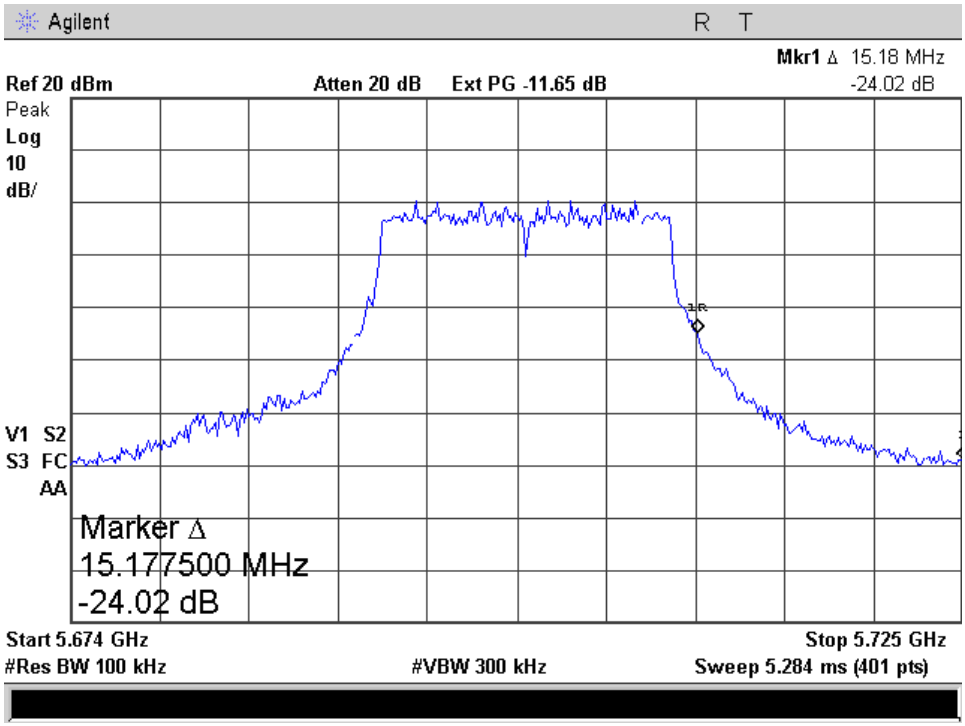
-30°c
Plot 4.7.18



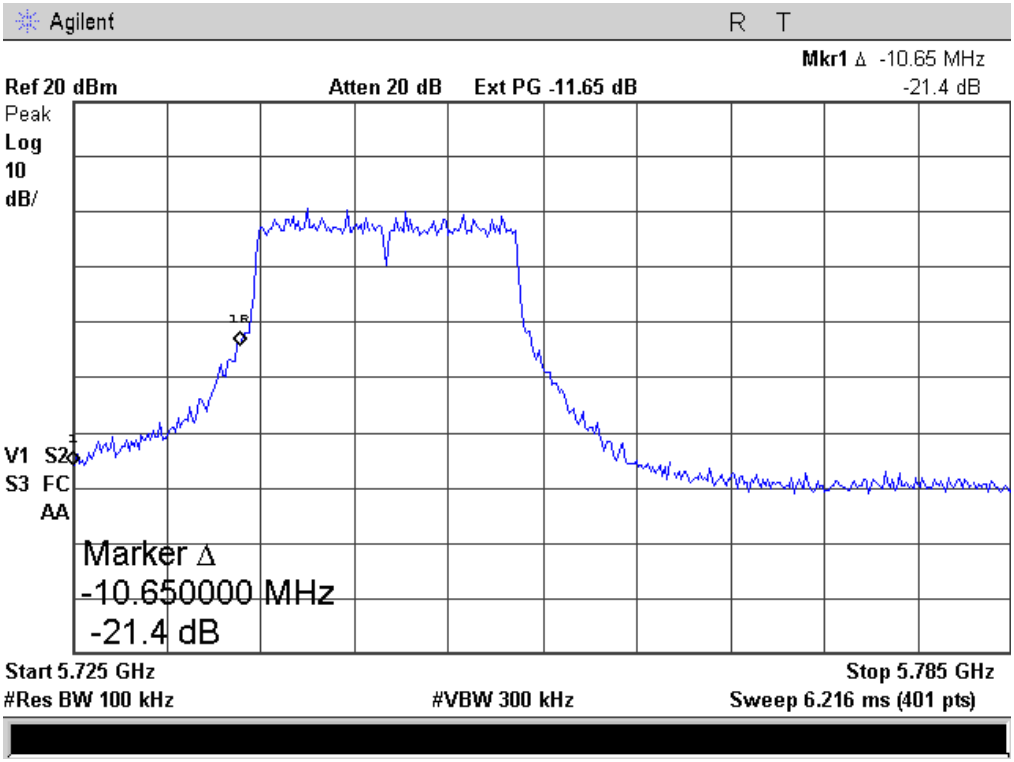
Carrier frequency 5700MHz
+50°c
Plot 4.7.19



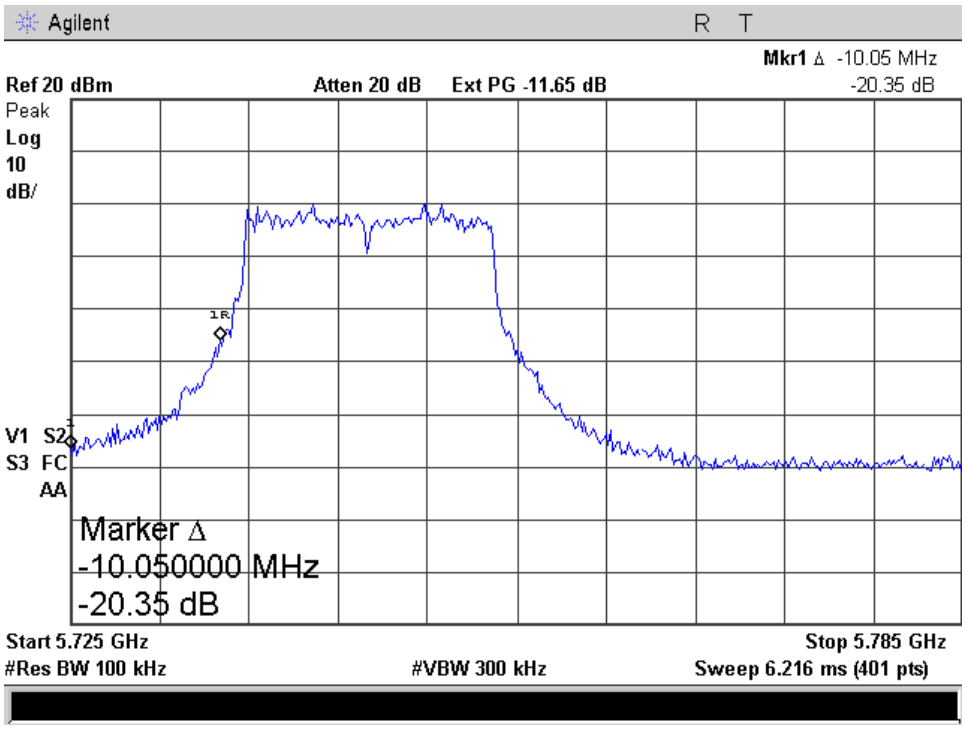
-30°c
Plot 4.7.20



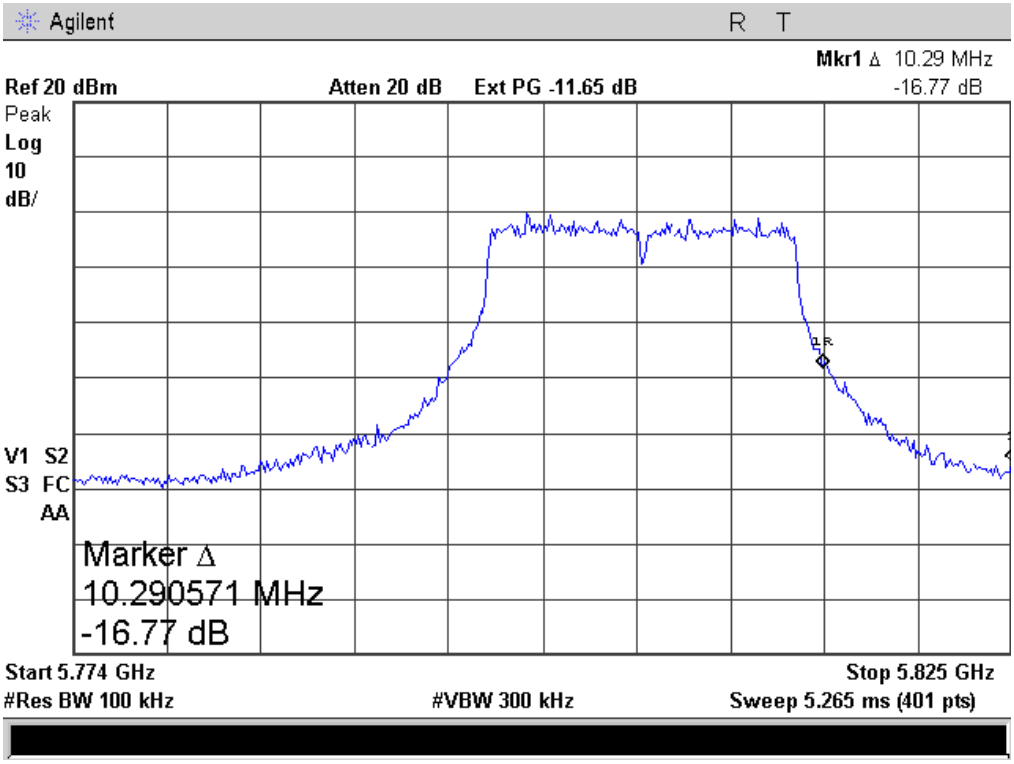
5725-5825 MHz
Carrier frequency 5745 MHz
+50°c
Plot 4.7.21



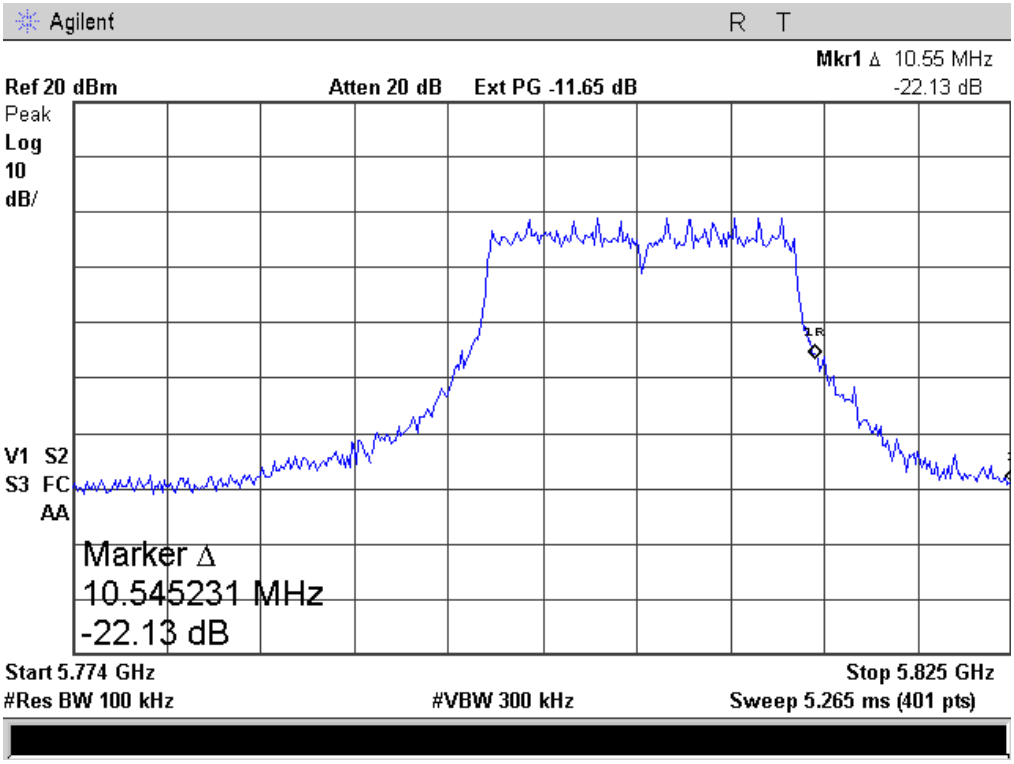
-30°c
Plot 4.7.22



Carrier frequency 5805 MHz
+50°c
Plot 4.7.23



-30°c
Plot 4.7.24



4.8. Antenna Connector Requirements

Reference document:	**47 CFR §15.203**	
Test Requirements:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with provisions of this section.	
Result:	The VoWlAN employs for WLAN a/b/g an Integral (on board) PIFA Dual Band.	**Comply**

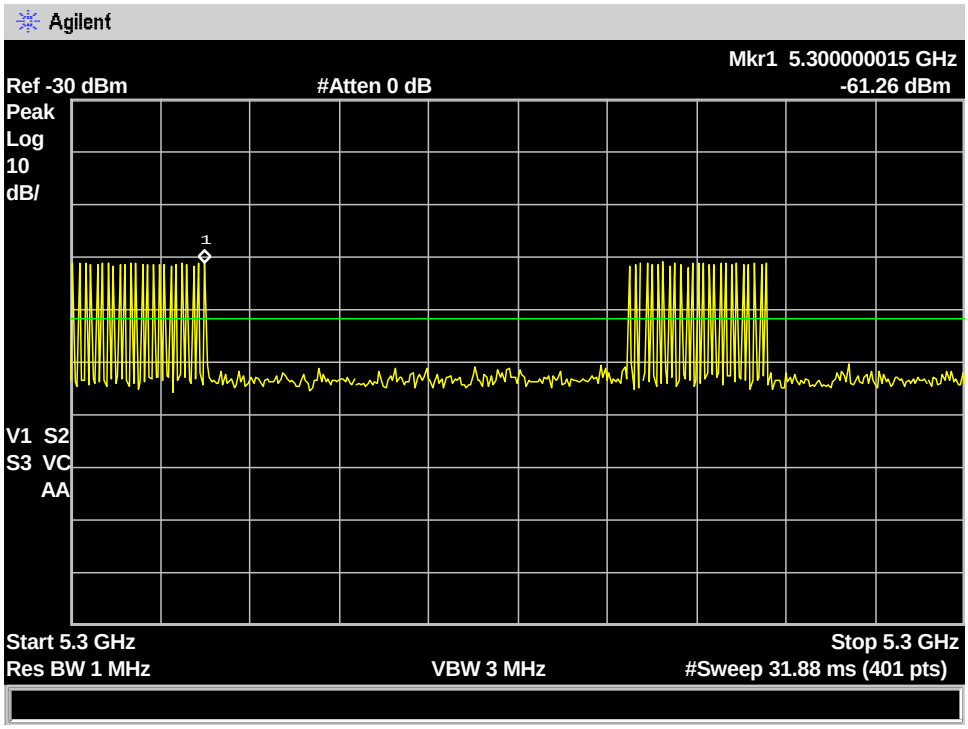
4.9. Dynamic Frequency Selection (DFS)

Reference document:	**47 CFR §15.407(h)(2)(i)(B) & §15.407(h)(2)(iii) and FCC 06-96**		
Test Requirements:	Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating in the 5.25-5.35GHz and 5.47-5.725 GHz bands. Operational Modes. The DFS requirement applies to the following: (B) The requirement for channel move time applies in both the master and slave operational modes. DFS Response Requirements: (iii) Channel Move Time. After the radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.		
Test setup:	See sec 2.4	**Pass**	
Method of testing:	Radiated		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 3 MHz, VBW:3 MHz, Span 0		
Environment conditions:	Ambient Temperature: 22°c	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 4.9.1 to Plot 4.9.4	

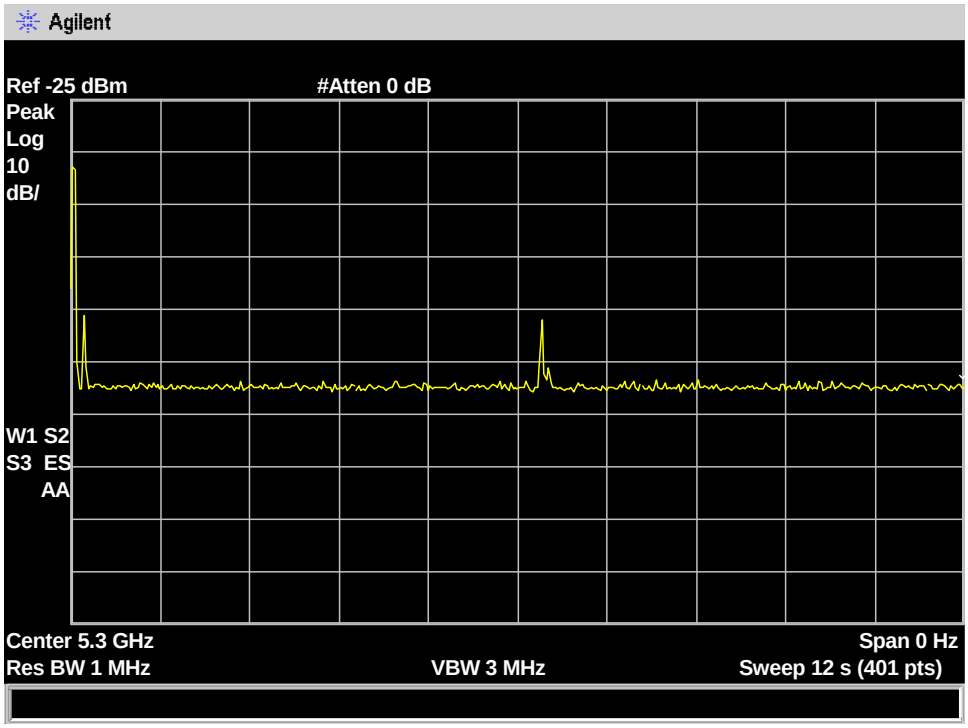
Test Results:

Channel Frequency [MHz]	Type of plot	Measured Channel Closing Transmission Time	Limit Channel Closing Transmission Time	Measured Move Time	Limit Move Time	Reference plots	Result
5280	Calibration of Radar Burst Level	-	-	-	-	4.9.1	Comply
5300	Transmission of the EUT on the operating channel at the end of the radar burst during the Channel Move Time	<40ms + aggregated <2ms	200ms + aggregated 60ms	< 6s	10s	4.9.2	
5260						4.9.3	
5320						4.9.4	
5280	30 Minute Non - Occupancy – Associated test	The client device did not transmit on this channel once the channel was cleared.				4.9.5	
5250 - 5725	30 Minute Non - Occupancy – Non - Associated test	The client device did not employ active scanning and did not transmit without being associated with the master device.				4.9.6	

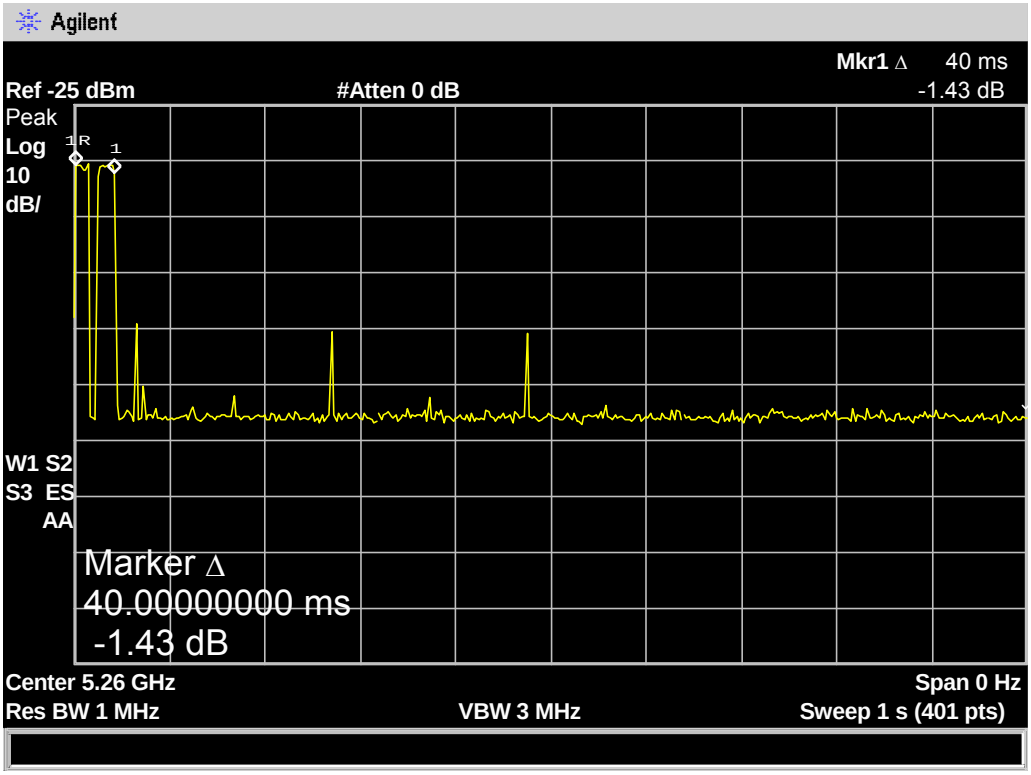
Radar Burst Level
Plot 4.9.1



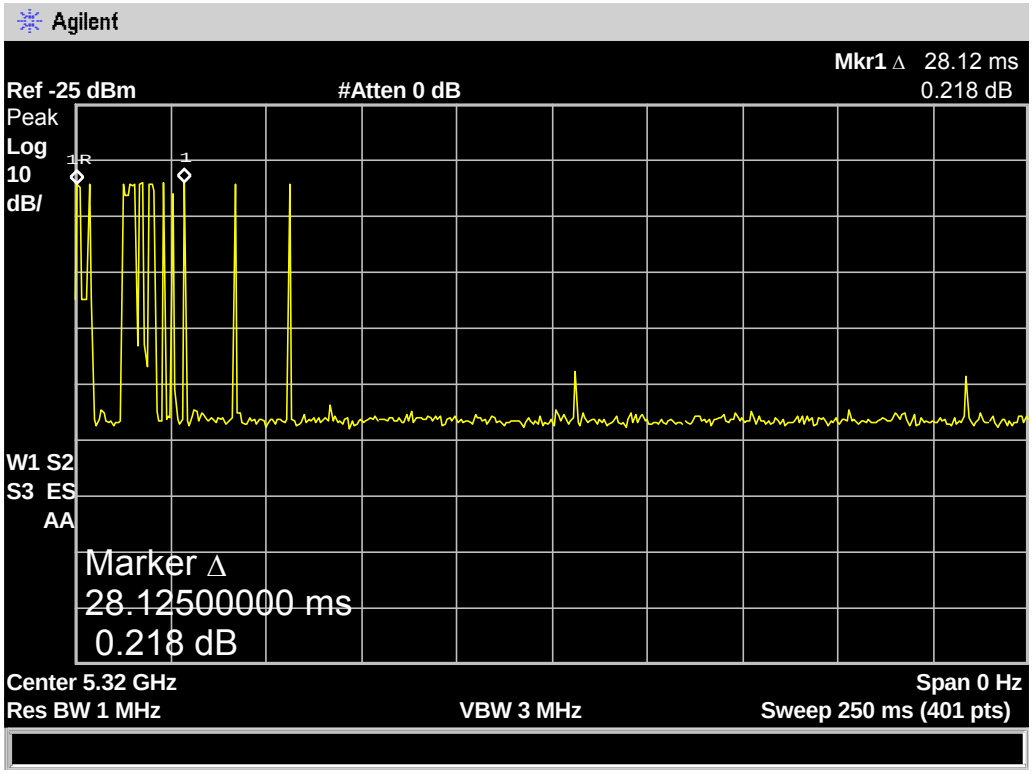
Channel Move Time
Plot 4.9.2



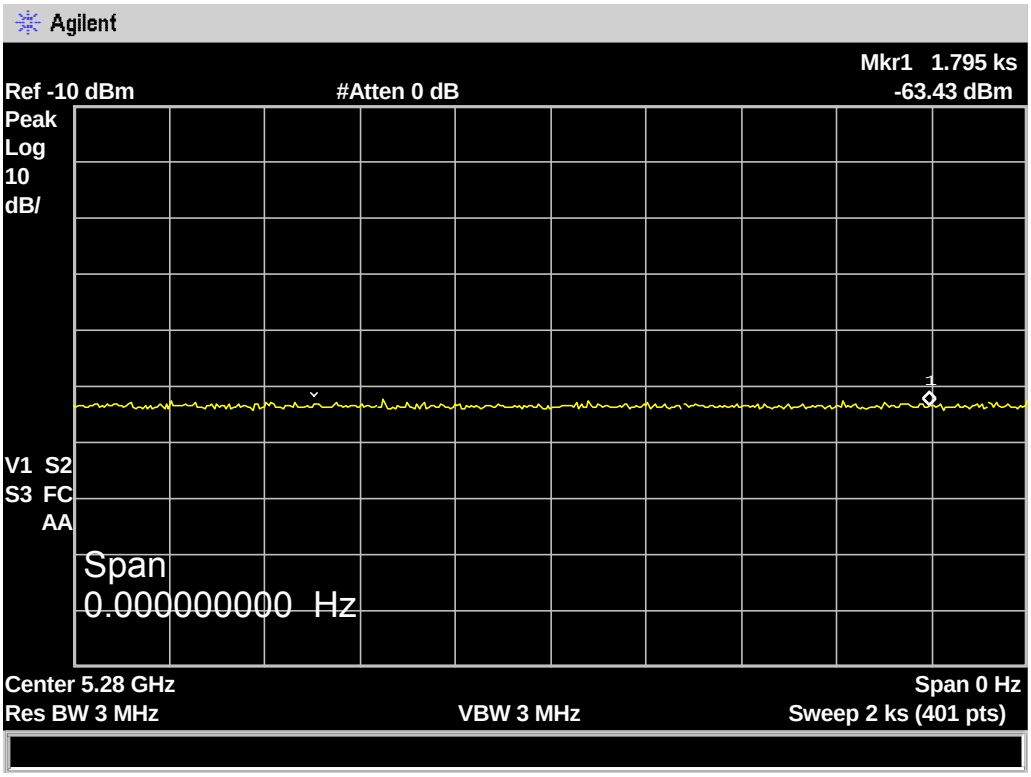
Channel Closing Transmission Time (Sweep 1s)
Plot 4.9.3



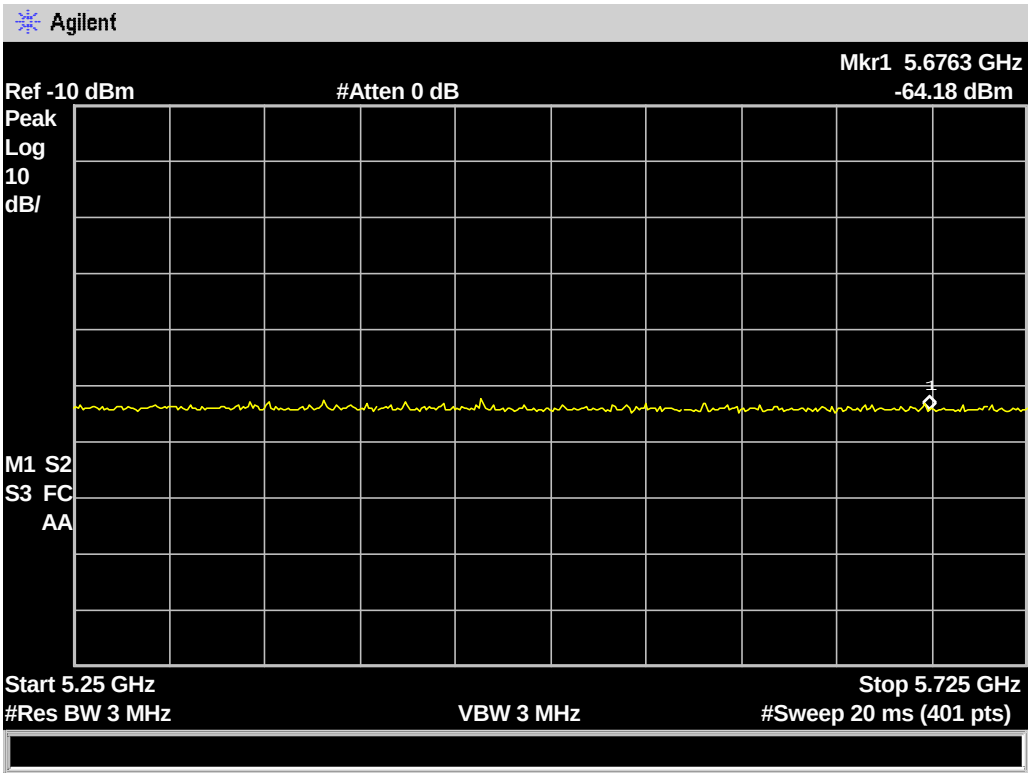
Channel Closing Transmission Time (Sweep 250ms)
Plot 4.9.4



30 Minutes Non-Occupancy, Associated test
Plot 4.9.5



30 Minutes Non-Occupancy, Non-Associated test
Plot 4.9.6



5. Appendix

Appendix A: List of Measuring Equipment used:

Equipment	Manufacturer/ Model	Serial Number	Due date
CISPR16 EMI Receiver	HP8546A	3710A00392	30-06-08
Spectrum Analyzer 9kHz ÷ 22 GHz	HP 8593EM	3536A00131	30-06-08
Spectrum Analyzer 100 Hz ÷ 26.5 GHz	Agilent E7405A	US41160436	30-06-08
LNA Amplifier 1 GHz ÷ 18 GHz	AMP – 5D-010180-30-10P-GW	618653	30-06-08
Power meter	Agilent N1911A	MY45100784	23-02-08
Dual Ridged Guide Ant.1-18 GHz	EMCO 3115	9602-4677	30-06-08
Antenna 18 GHz ÷ 26.5 GHz	Alpha Industry 861A/599	505	30-06-08
Turn table	HD100	100/693	-
Antenna Mast	HD 100	100/693	-
Biconical 20 –200 MHz	Schwarzbeck VHBB9124	9124/0255	16-05-08
Log-Periodic 200 – 1000 MHz	Schwarzbeck VUSLP9111	VUSLP9111184	16-05-08
Pre-Amplifier	MiTeq, AMF-5F-18002650-30-10P	945372	30-06-08
LISN	Fischer 50/250-25-2	-	30-06-08
Transient Limiter	HP11947A	-	30-06-08
Notch Filter	Micro-Tronics BRM50702-05	0001	30-06-08
Function Generator	HP-33250A	MY40000116	30-06-08
Signal Generator	HP 83732B	US37101834	30-06-08
Dual Ridged Guide Ant.1-18 GHz	EMCO 3115	6487	30-06-08
Access Point	Cisco AIR-AP1131AG-A-K9	FTX1129T22R	FCC ID: LDK102054E

Appendix B: Accreditation Certificate

ilac-MRA

THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

QUALITECH EXPERTS
Petach-Tikva ISRAEL

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005*).

Presented this 6th day of June 2007.

President
For the Accreditation Council
Certificate Number 1633.01
Valid to September 30, 2008

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

End of the Test Report