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TEST REPORT

Report Number:	**102952641LEX-001**
Project Number:	**G102952641**
Report Issue Date:	**6/22/2017**
Product Name:	**IQPanel2**
FCC Standards:	**FCC Part 22 Subpart H, Part 24 Subpart E, and Part 27 Subpart C**
Industry Canada Standards:	**RSS-132 Issue 3, RSS-133 Issue 6, and RSS-139 Issue 3**

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Drive
Lexington, KY 40510

Client:
Qolsys
20111 Stevens Creek Blvd.
Cupertino, CA 95014

Report prepared by

Brian Daffin, Engineer

Report reviewed by

Bryan Taylor, Team Leader

TABLE OF CONTENTS

1 Introduction and Conclusion

The tests indicated in Section 2 were performed on the product constructed as described in Section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

The INTERTEK-Lexington laboratory is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1 and ANSI C63.4. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. The test site is listed with the FCC under Registration Number 485103.

2 Test Summary

Page	Test full name	FCC Reference	Industry Canada	Result
6	Conducted Output Power	§2.1046, § 22.913(a), §24.232(d), §27.50	RSS-132 (5.4), RSS-133 (4.1), RSS-133 (6.4), RSS-139 (6.5)	Pass
6	Radiated Output Power	§ 22.913(a), § 24.232(c), §27.50	RSS-132 (5.4), RSS-133 (6.4), RSS-139 (6.5)	Pass
8	Occupied Bandwidth	§2.1049, §22.917(b)(d), §24.238(a)	RSS-GEN (4.6.1), RSS-133 (2.3),	Pass
27	Conducted Spurious Emissions at Antenna Terminals	§2.1049, §2.1051, §22.917(a)(b), § 24.238(a)(b), §27.53	RSS-132 (5.5), RSS-133 (6.5.1), RSS-139 (6.6)	Pass
35	Radiated Spurious Emissions (Transmitter)	§2.1053, §22.917(a)(b), §24.238(a)(b), §27.53	RSS-132 (5.5), RSS-133 (6.5), RSS-139 (6.6)	Pass
40	Frequency Stability	§2.1055, §22.355, §24.235 §27.54	RSS-132 (5.3), RSS-133 (6.3), RSS-139 (6.4)	Pass

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	Qolsys
Model Number	IQPanel2
Serial Number	Test Sample 1
Receive Date	3/13/2017
Test Start Date	3/13/2017
Test End Date	3/23/2017
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	1852.4 – 1907.6MHz (UMTS Band II) 1712.4 – 1752.6 (UMTS Band IV) 826.4 – 846.6MHz (UMTS Band V)
Modulation Type	DQPSK
Transmission Control	Base Station Simulator
Maximum Output Power (Conducted, Average)	21.95dBm (UMTS Band II) 21.87dBm (UMTS Band IV) 24.71dBm (UMTS Band V)
Max Antenna Gain (declared by manufacturer)	3.7dBi
Test Channels	9262, 9400, 9538 (UMTS Band II) 1312, 1427, 1513 (UMTS Band IV) 4132, 4182, 4233 (UMTS Band V)
Antenna Type	Internal
Operating Voltage	115VAC/60Hz (Via AC / DC Power Adapter)

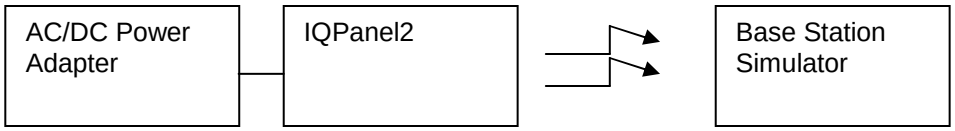
Description of Equipment Under Test
The IQPanel2 was a smart home security control panel.

Operating modes of the EUT:

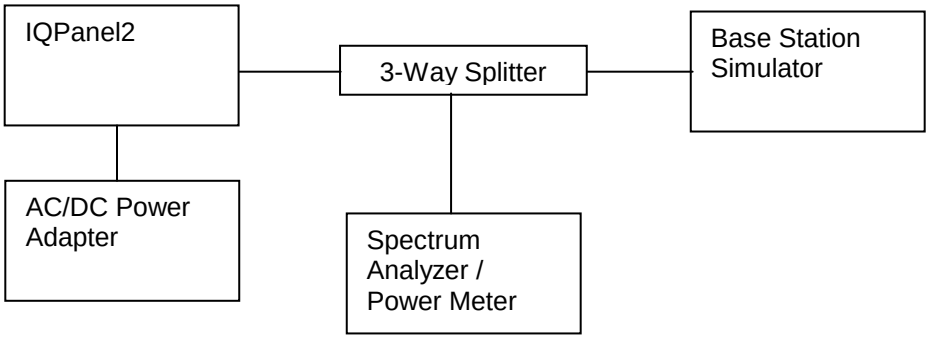
No.	Descriptions of EUT Exercising
1	Transmitting a UMTS signal in bands II, IV, or V
2	Receive / idle mode

3.1 System setup including cable interconnection details, support equipment and simplified block diagram

3.2 EUT Block Diagram:



Block Diagram for Radiated Tests



Block Diagram for Conducted Tests at the Antenna Port

3.3 Cables:

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
DC Power Cable	5 ft	None	None	Test Sample	AC/DC Power Converter

3.4 Support Equipment:

No support equipment was used during this evaluation.

4 Conducted Output Power, Peak to Average Ratio, Radiated Output Power

4.1 Test Limits

§ 2.1046

For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8).

§ 24.232 (d)

Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

§ 27.50

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

4.2 Test Procedure

The transmitter output was connected to a coaxial cable, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The EUT was placed into a call and the burst average power was measured with a power meter dBm. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. Tests were performed at three frequencies (low, middle, and high channels) and on the highest power levels, which can be setup on the transmitters.

The radiated output power was determined by adding the peak antenna gain to the measured conducted output power to determine the peak radiated power.

$$ERP = ConductedOutputPower(dBm) + AntennaGain(dBi) - 2.15$$

$$EIRP = ConductedOutputPower(dBm) + AntennaGain(dBi)$$

4.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Base Station Simulator	3956	Rohde&Schwarz	CMU 200	9/25/2016	9/15/2017

4.4 Results:

Conducted Output Power, Peak to Average Ratio, Radaiated Output Power

Band	Mode	UL Channel	Frequency (MHz)	Avg. Pwr (dBm)	Pk. Pwr (dBm)	Peak to Average Ratio (dB)	Antenna Gain (dBi)	EIRP (dBm)	ERP (dBm)
		4132	826.4	24.71	26.55	1.84	3.7	28.41	26.26
		4183	836.6	24.53	27.34	2.81	3.7	28.23	26.08
UMTS850 (Band V)	Rel 99 12.2kbps RMC	4233	846.6	24.52	26.51	1.99	3.7	28.22	26.07
		9262	1852.4	21.95	24.71	2.76	3.7	25.65	23.5
		9400	1880	21.38	24.72	3.34	3.7	25.08	22.93
UMTS1900 (Band II)	Rel 99 12.2kbps RMC	9538	1907.6	21.3	24.25	2.95	3.7	25	22.85
		1312	1712.4	21.77	24.51	2.74	3.7	25.47	23.32
		1427	1735.4	21.81	24.86	3.05	3.7	25.51	23.36
UMTS 1700 (Band IV)	Rel 99 12.2kbps RMC	1513	1752.6	21.87	24.63	2.76	3.7	25.57	23.42

5 Occupied Bandwidth

5.1 Test Limits

§2.1049:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

5.2 Test Procedure

The EUT was connected to a spectrum analyzer using a coaxial cable and power divider. The EUT was placed into a call using base station simulator. The base station simulator was set to force the EUT to its maximum power setting. The occupied bandwidth function of the analyzer was used to automatically generate the occupied bandwidth plots below. A peak detector was used for this measurement.

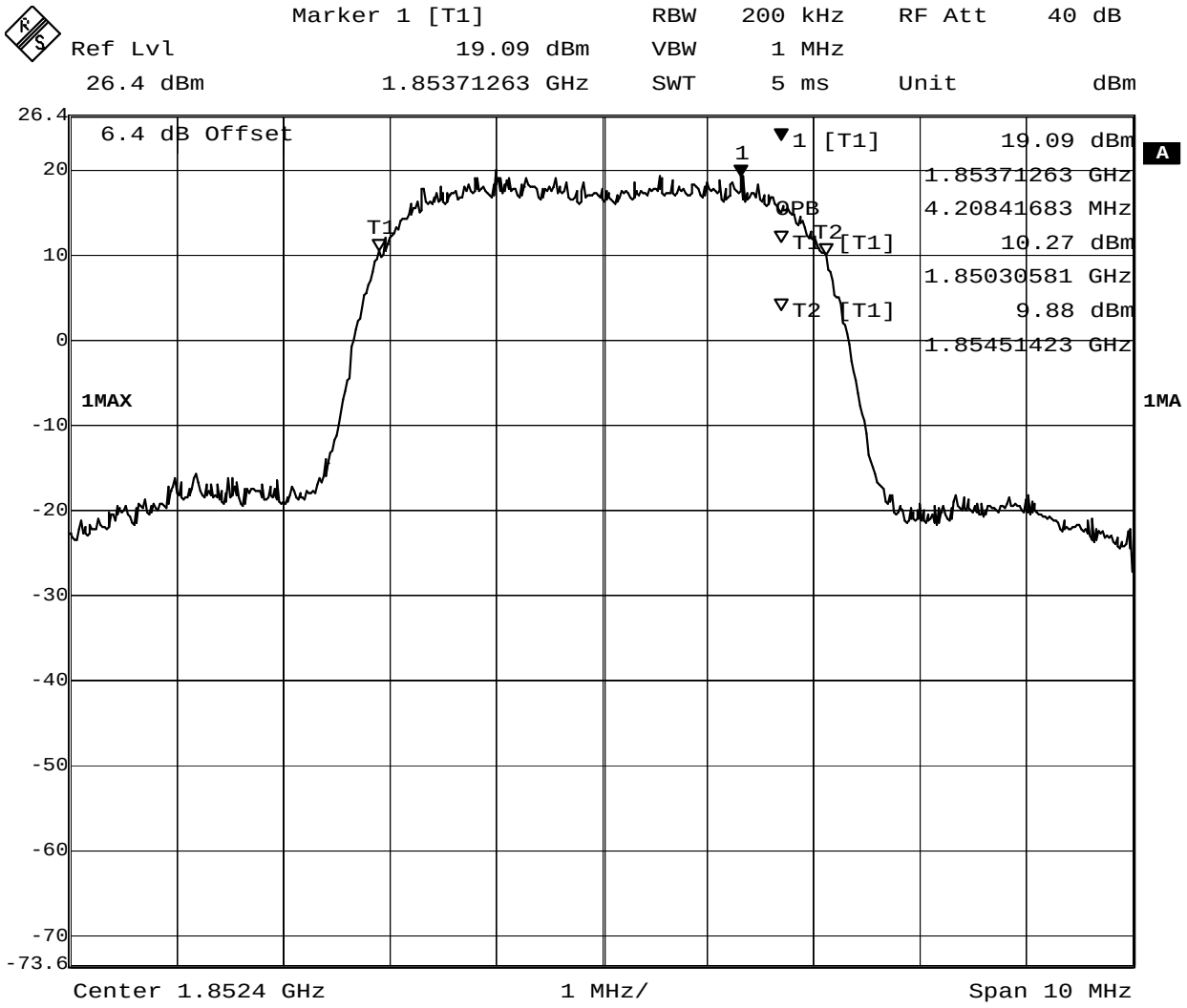
5.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Base Station Simulator	3956	Rohde&Schwarz	CMU 200	9/25/2016	9/15/2017
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK 30	9/20/2016	9/20/2017
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	9/20/2016	9/20/2017
RF Combiner	SX558	Weinschel	1506A	Time of Use	Time of Use

5.4 Results:

The worst case bandwidth measurements are shown below. Bandwidth plots are shown following the table.

TX Band	99% Bandwidth	26dB Bandwidth
Band II	4.21MHz	4.87MHz
Band IV	4.23MHz	4.89MHz
Band V	4.23MHz	5.37MHz



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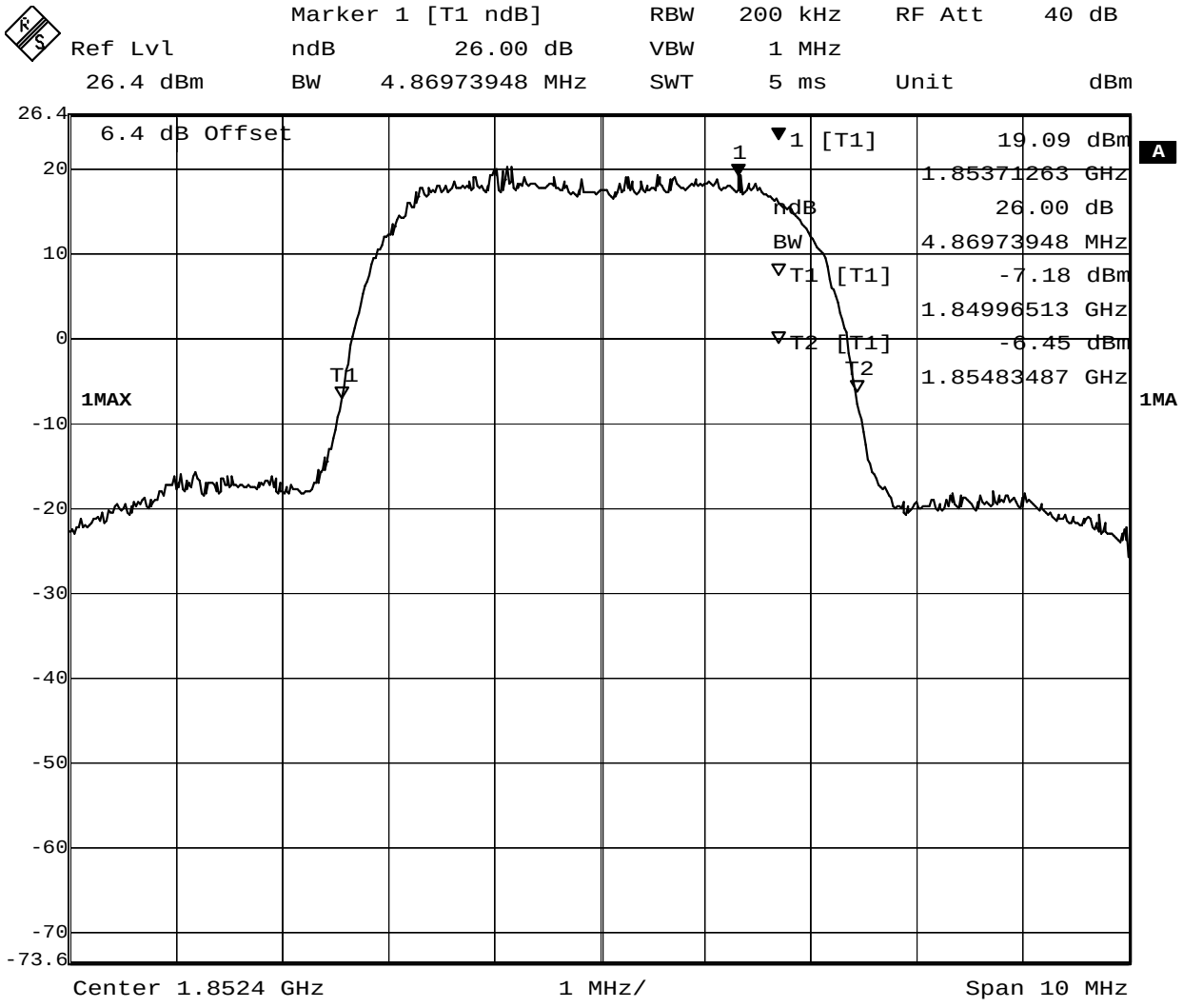
99% Bandwidth
Band II
Channel 9262



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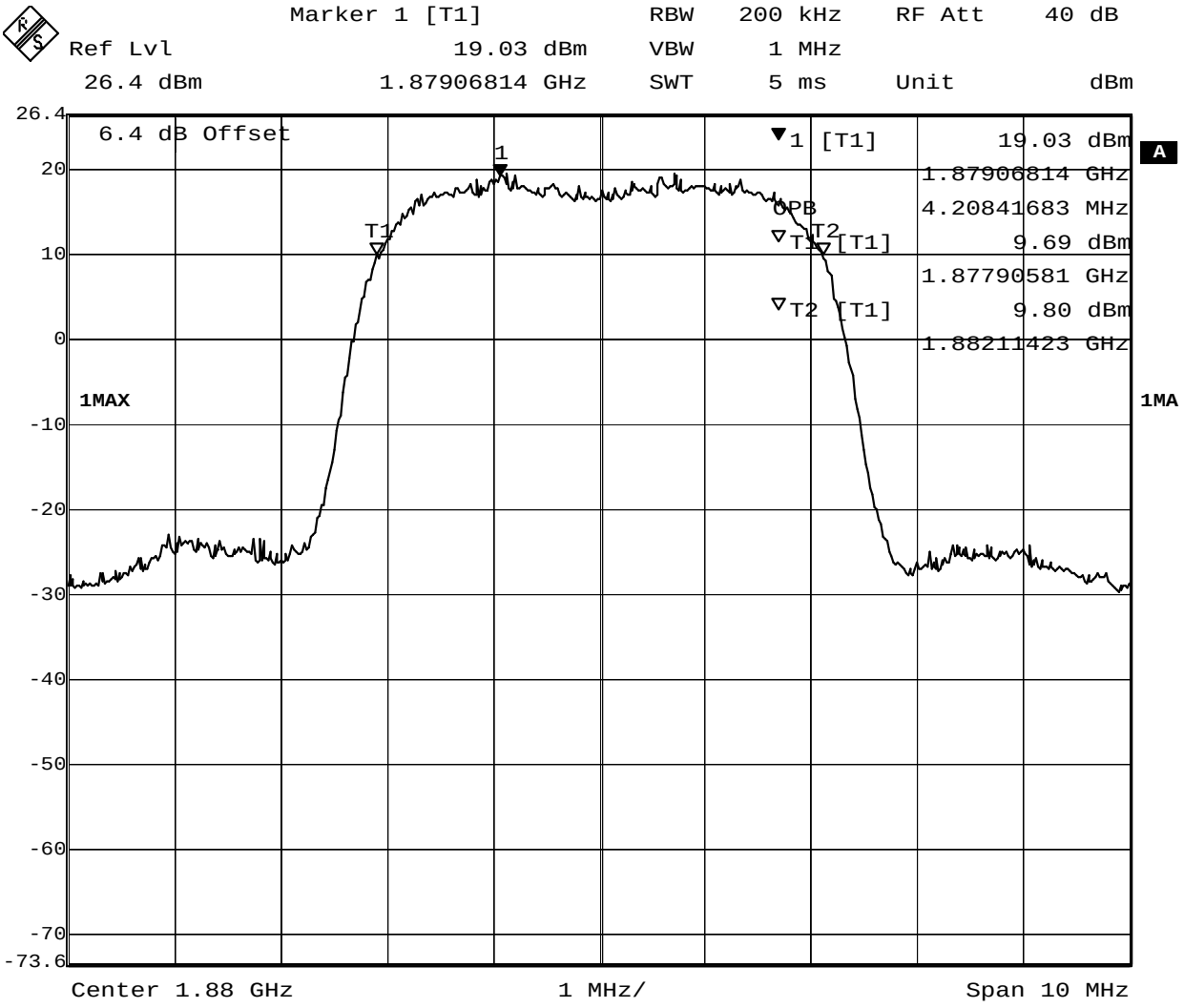
26dB Bandwidth
Band II
Channel 9262



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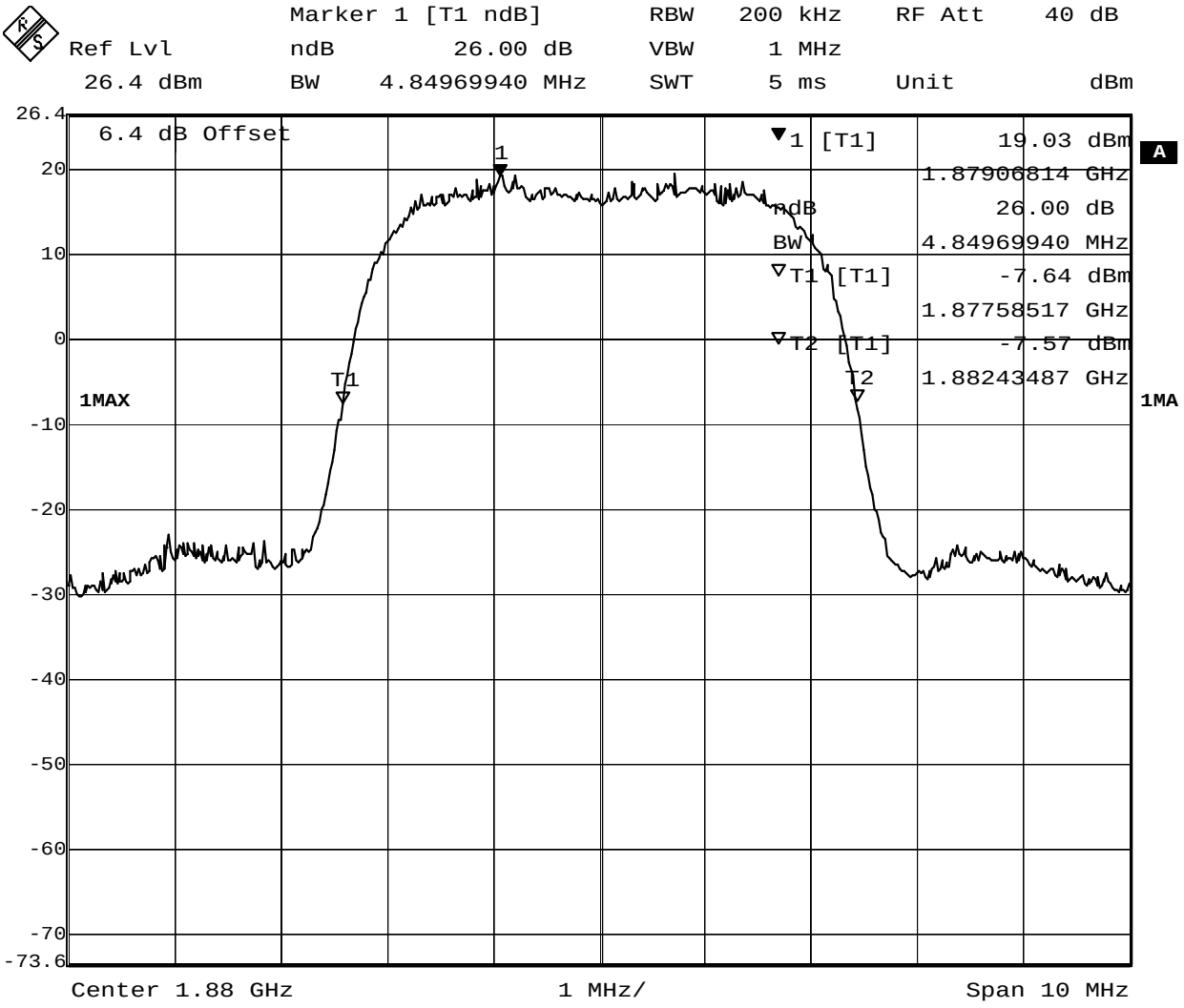
99% Bandwidth
Band II
Channel 9400



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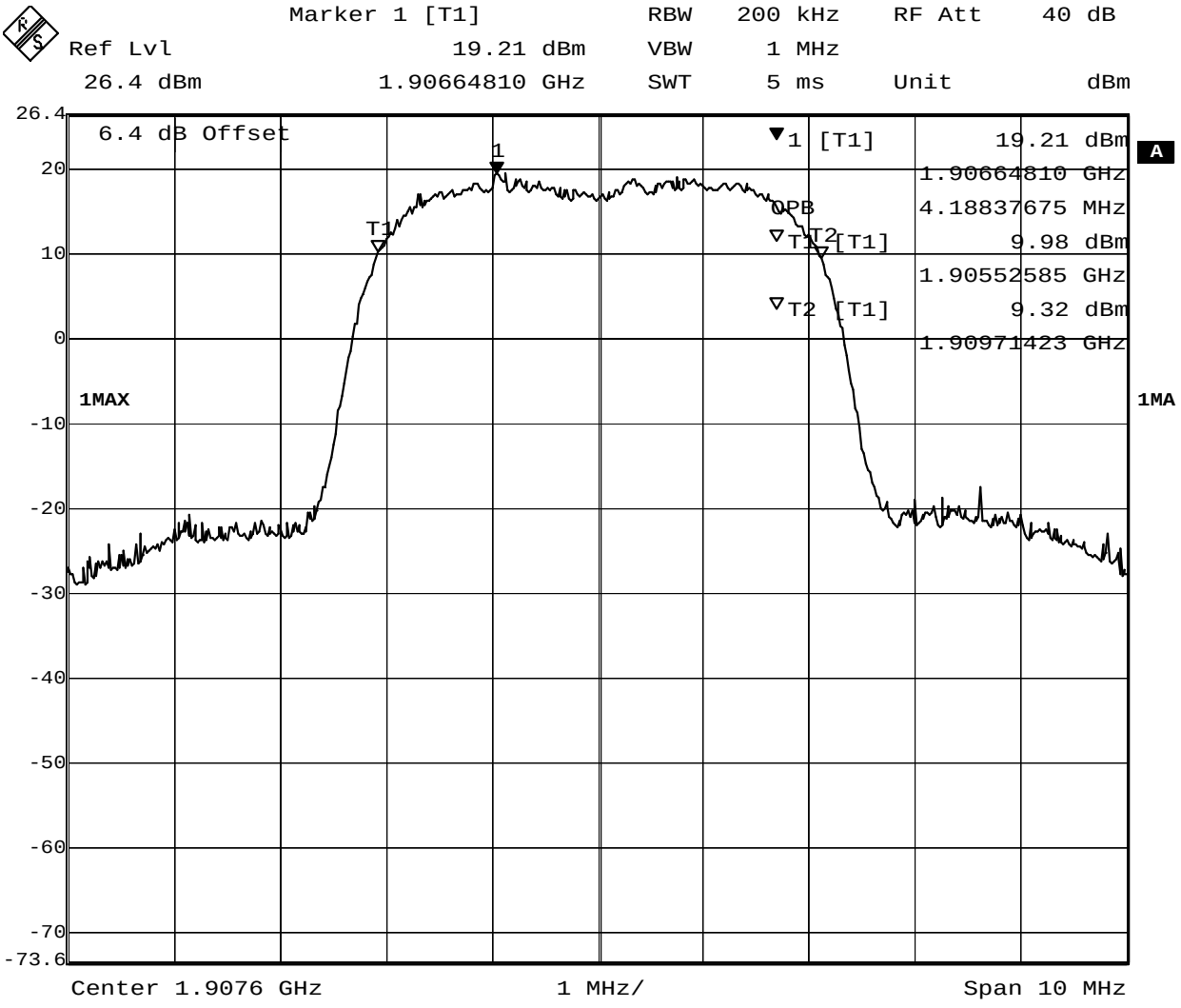
26dB Bandwidth
Band II
Channel 9400



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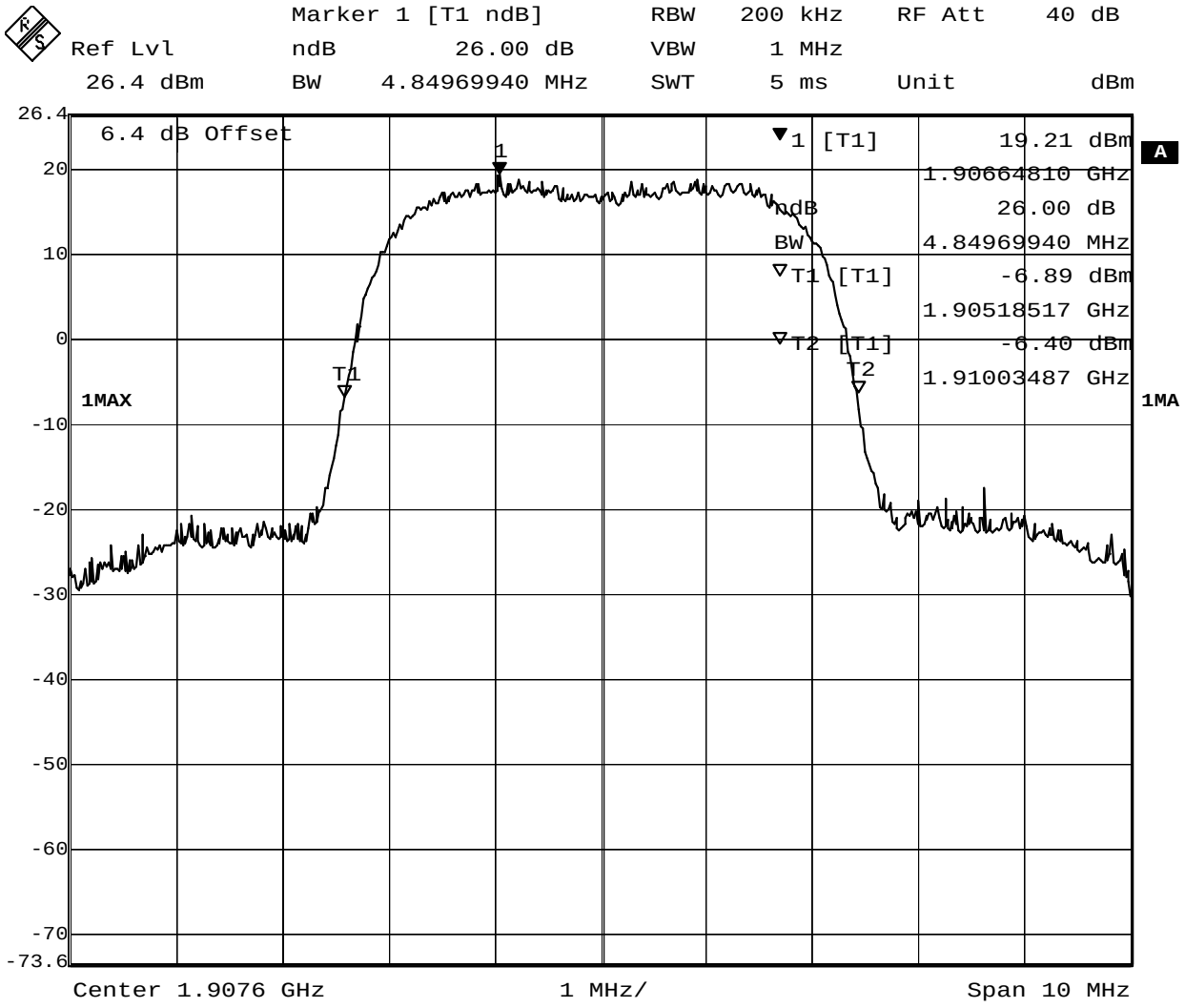
99% Bandwidth
Band II
Channel 9538



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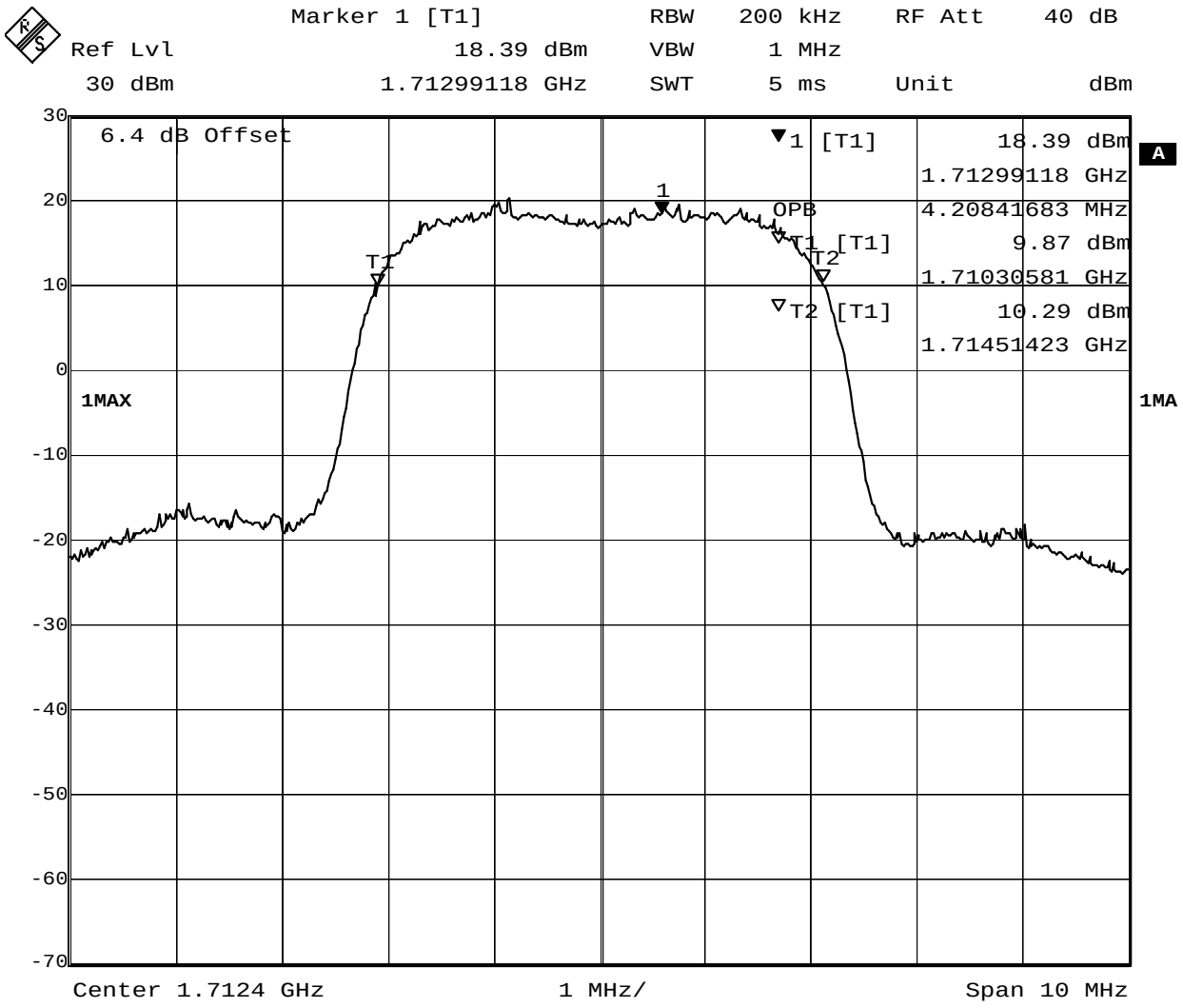
26dB Bandwidth
Band II
Channel 9538



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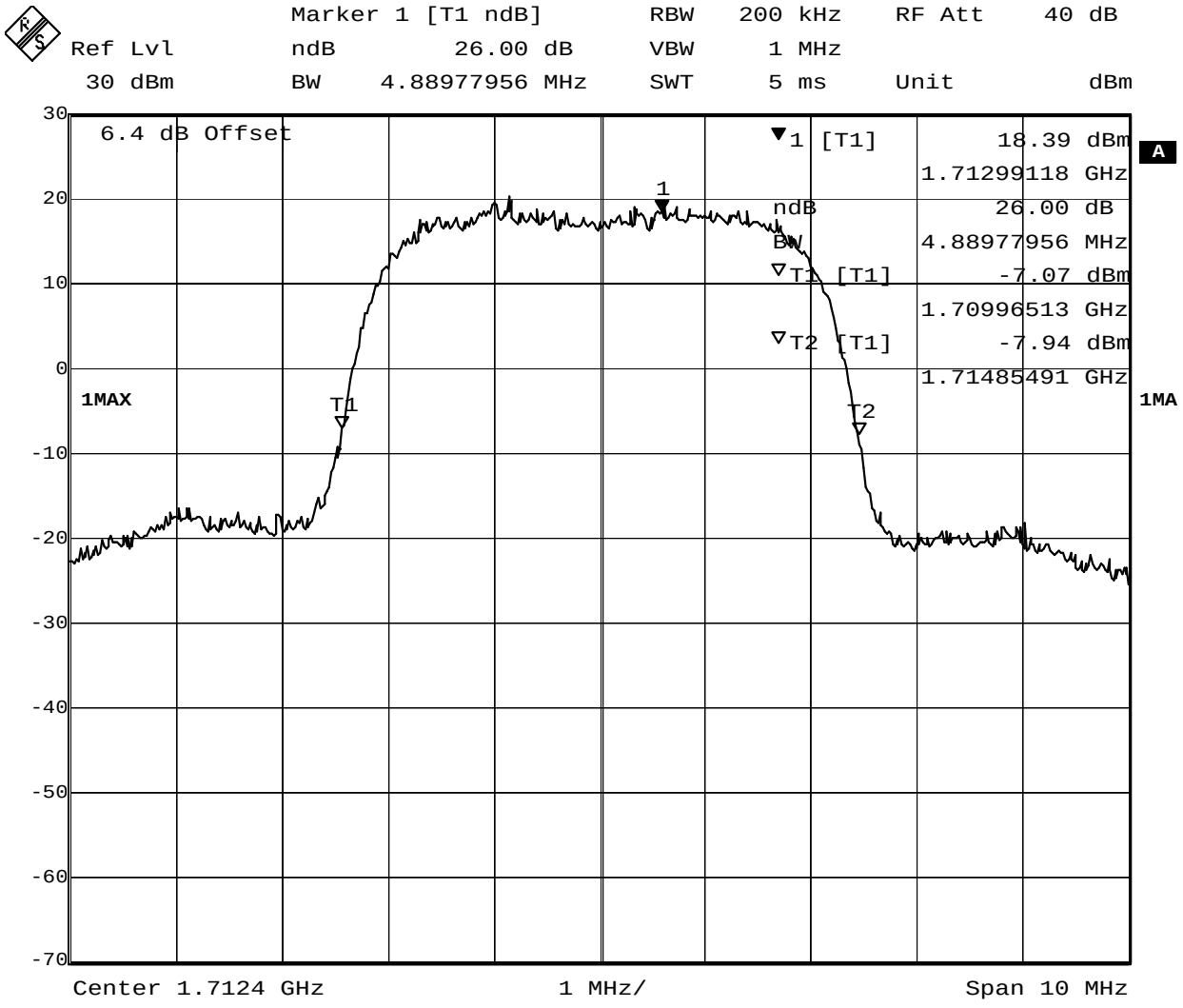
99% Bandwidth
Band IV
Channel 1312



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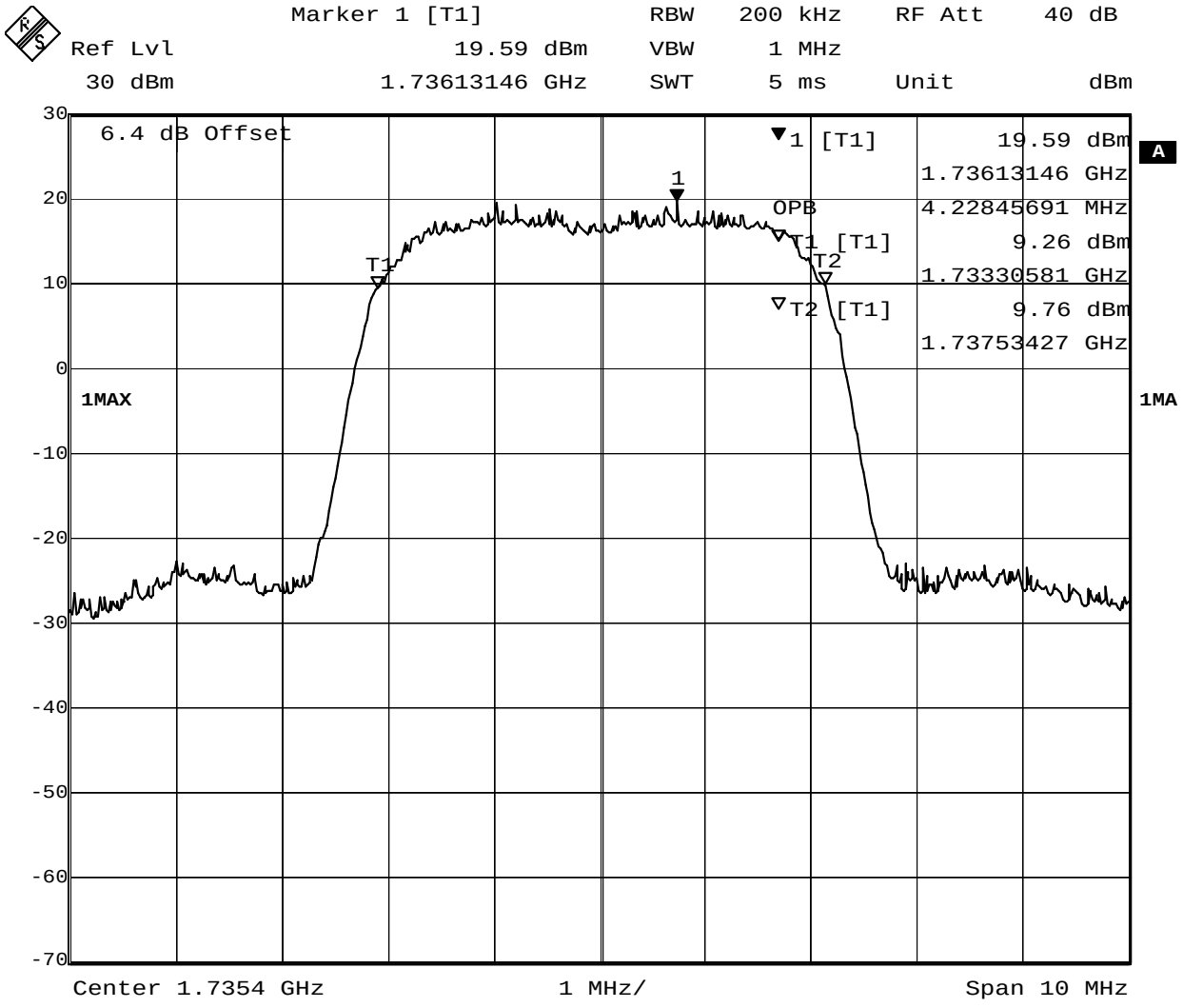
26dB Bandwidth
Band IV
Channel 1312



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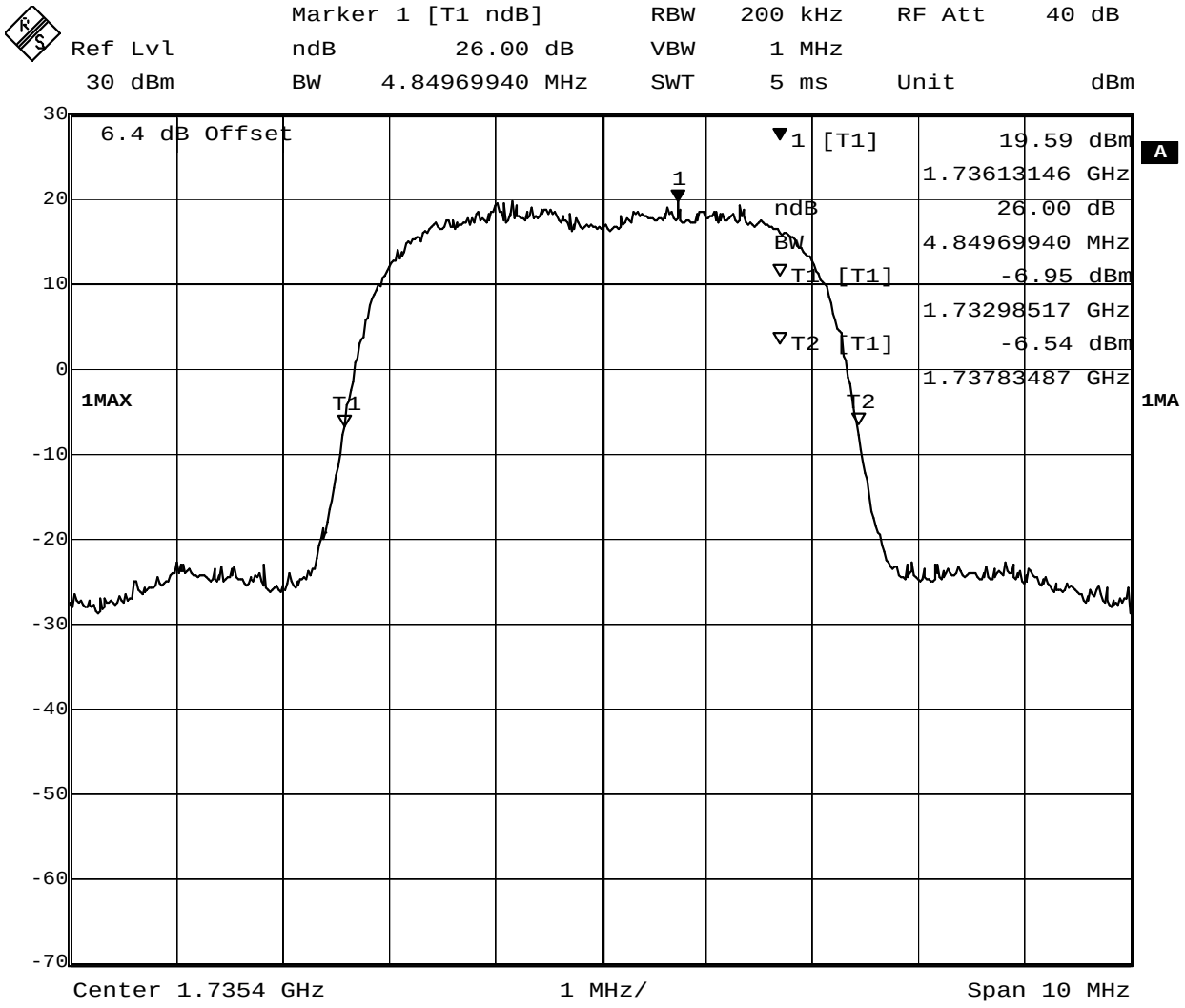
99% Bandwidth
Band IV
Channel 1427



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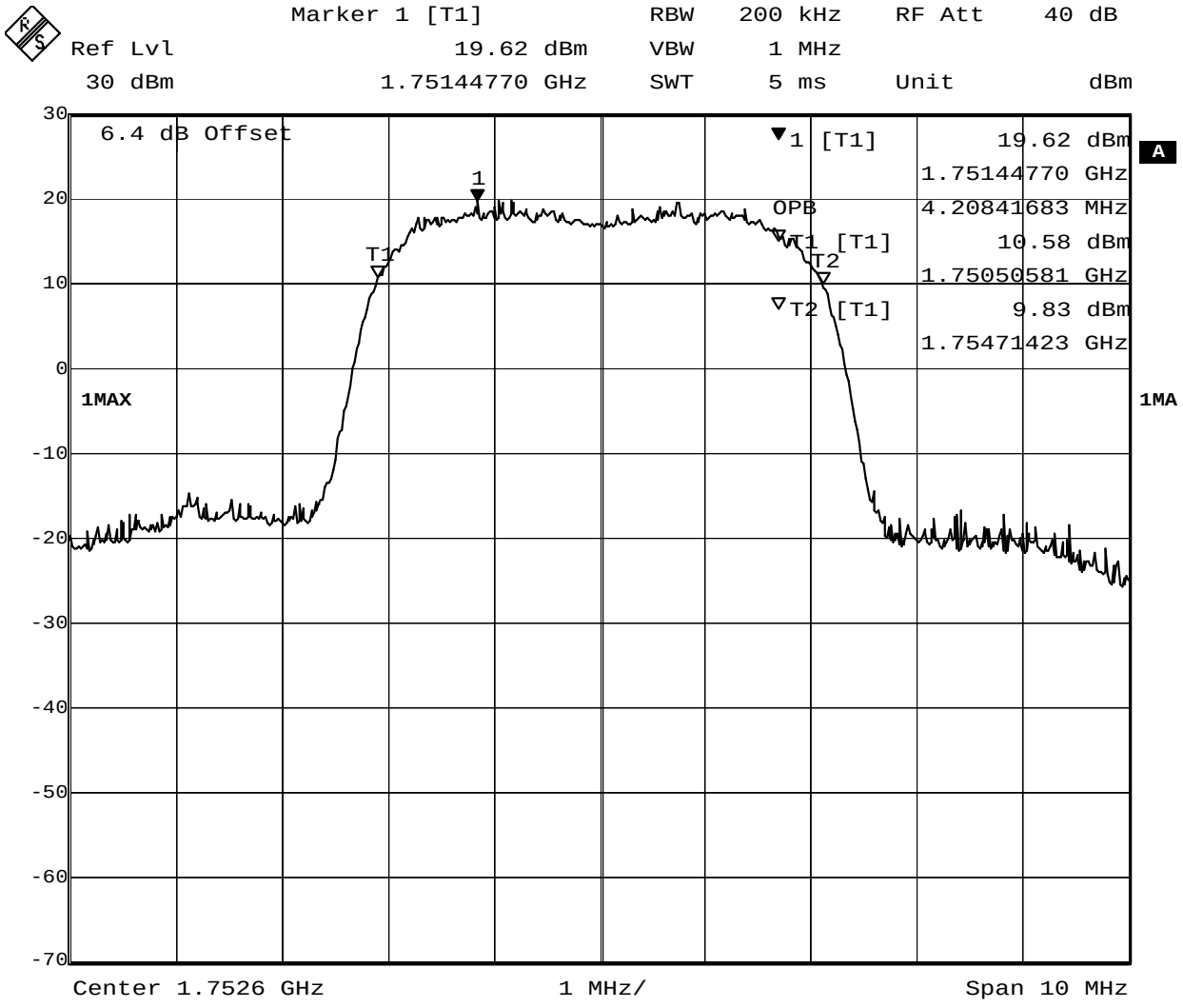
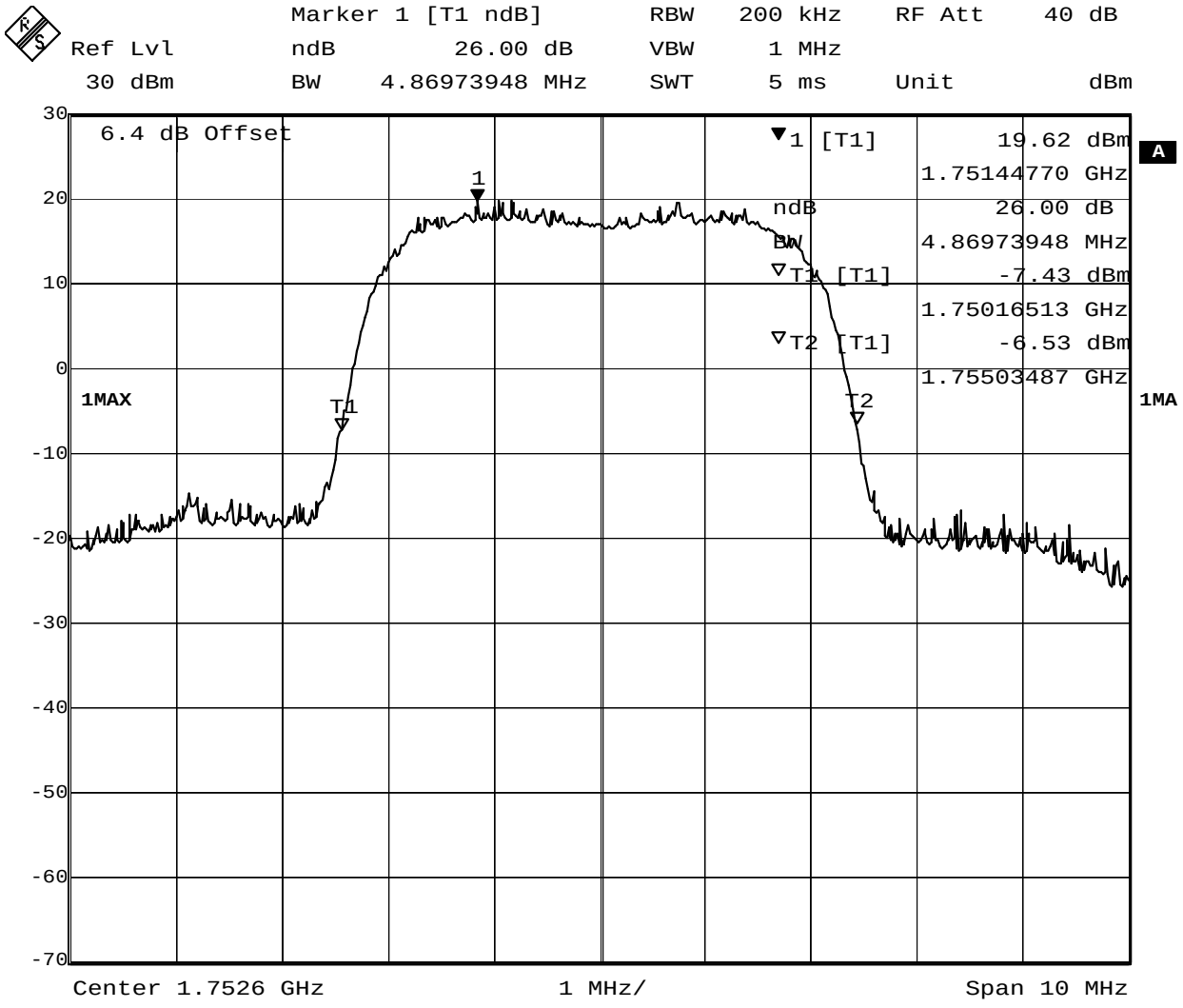
26dB Bandwidth
Band IV
Channel 1427



99% Bandwidth
Band IV
Channel 1523



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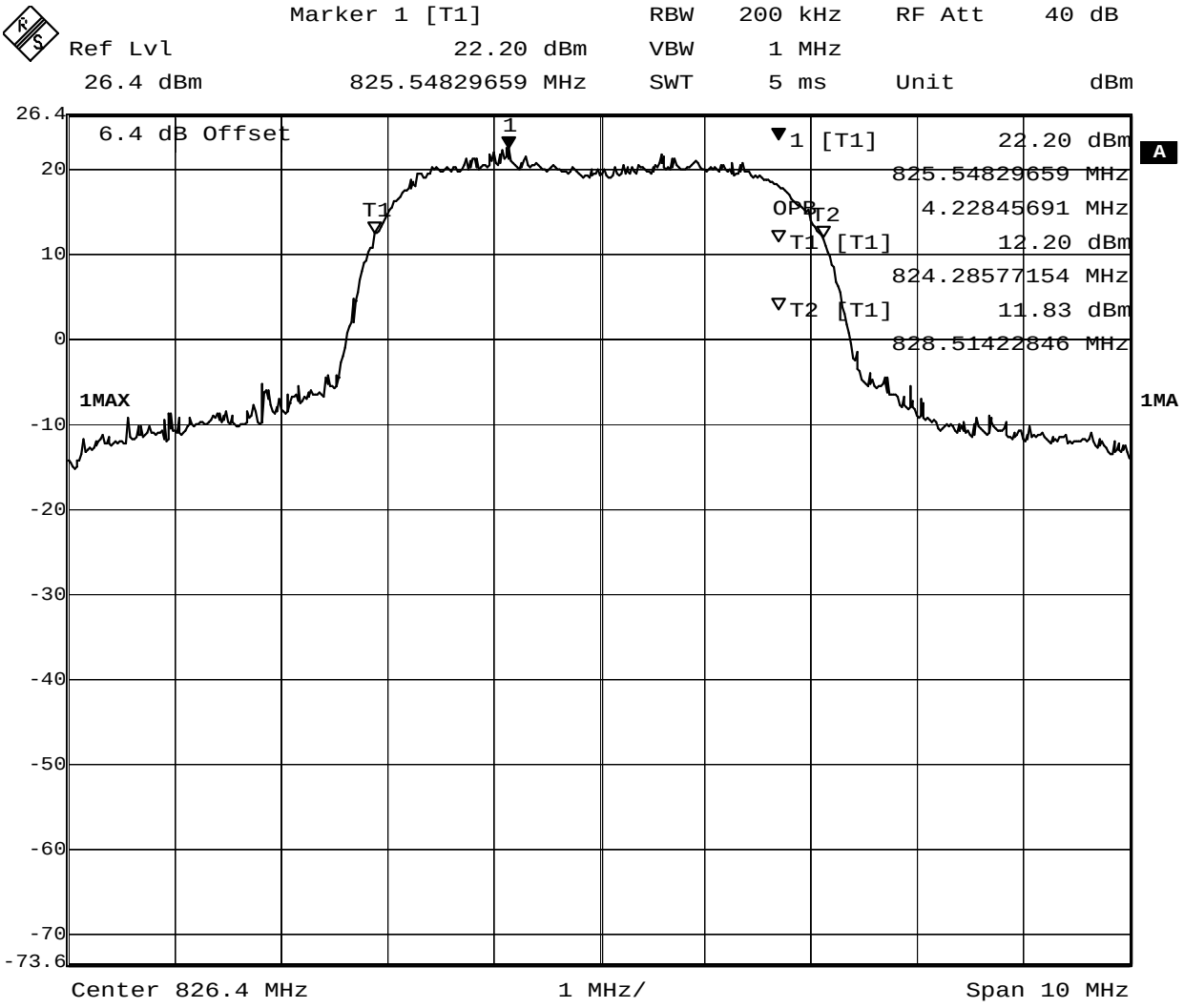
26dB Bandwidth
Band IV
Channel 1523



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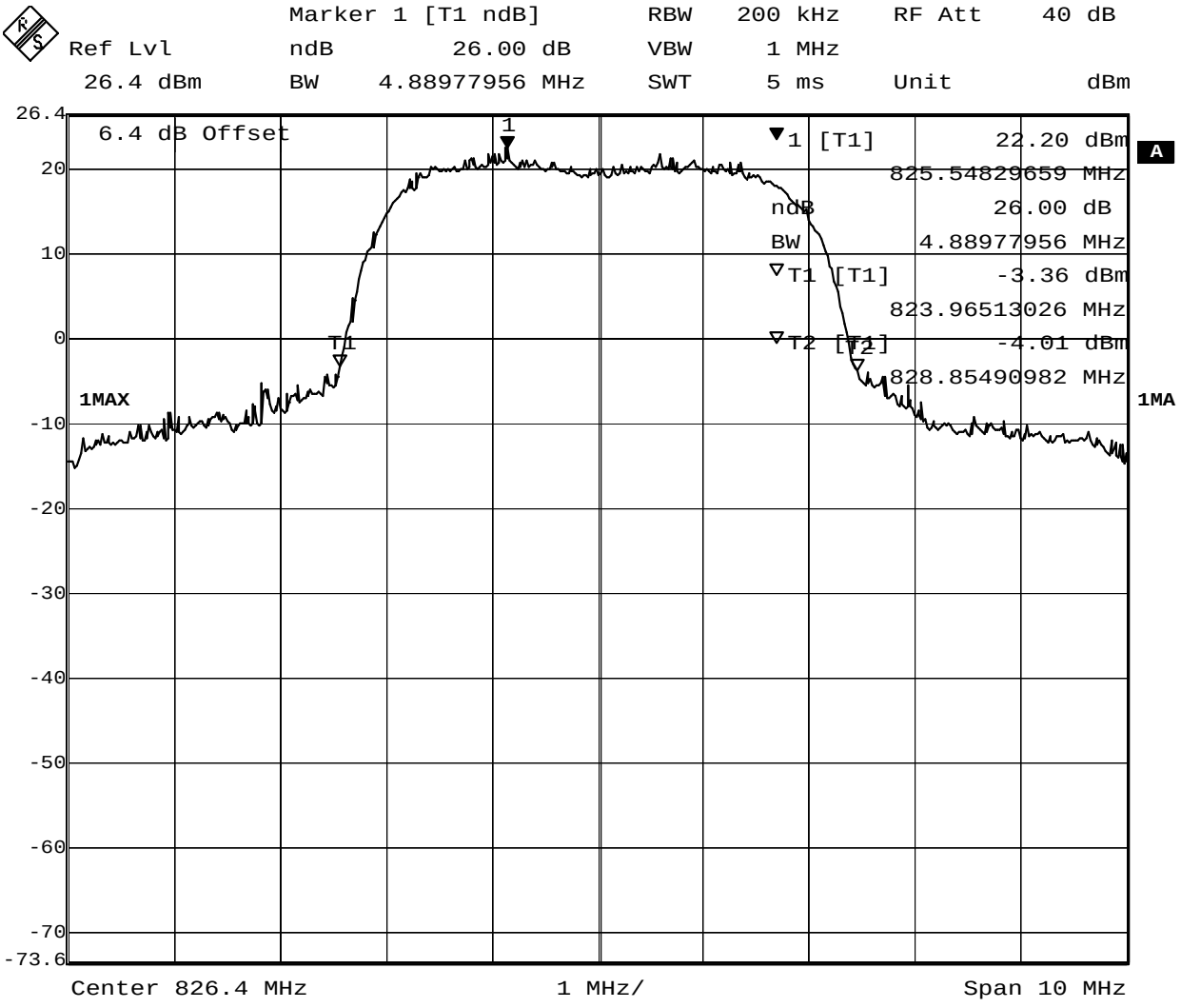
99% Bandwidth
Band V
Channel 4132



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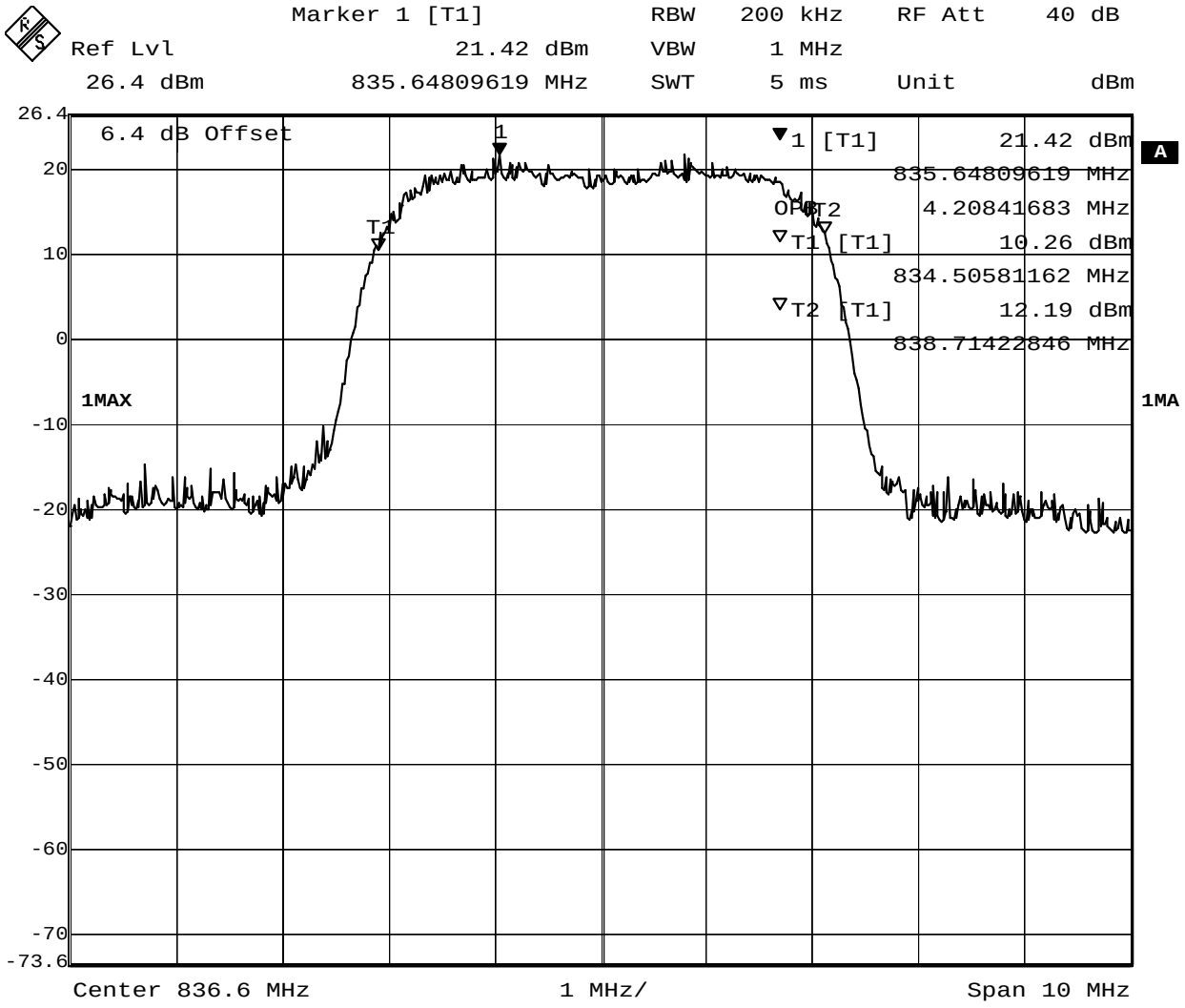
26dB Bandwidth
Band V
Channel 4123



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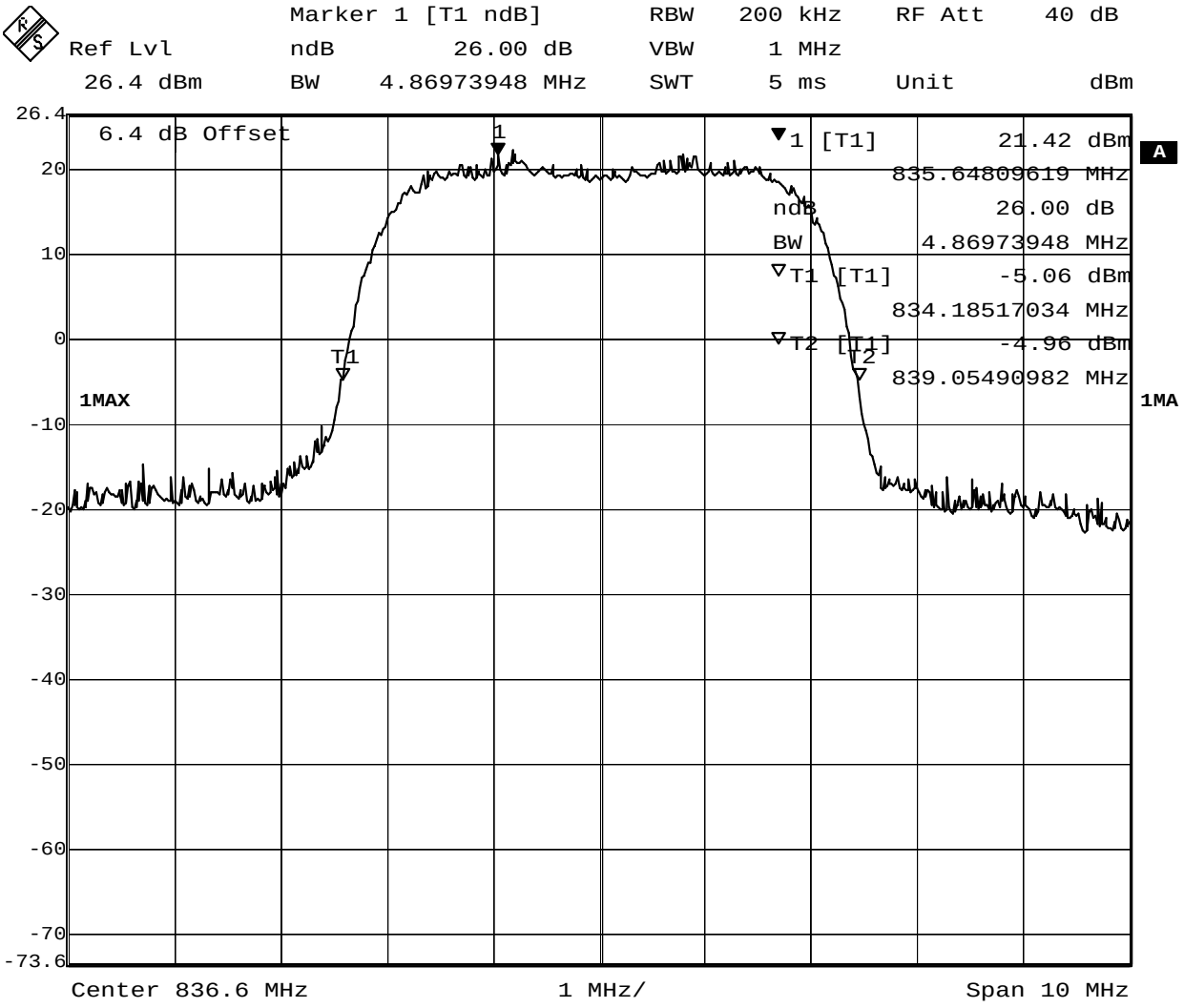
99% Bandwidth
Band V
Channel 4183



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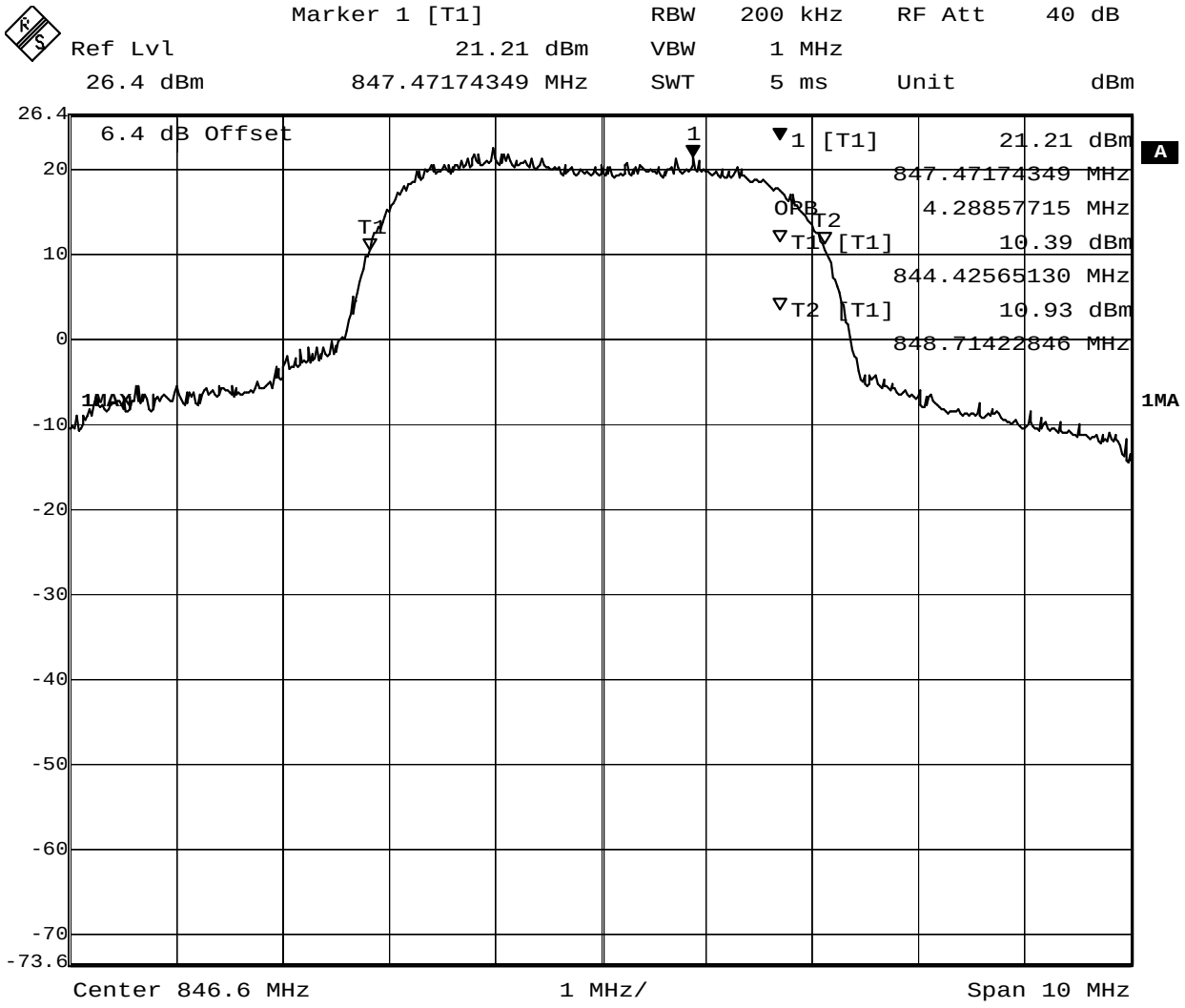
26dB Bandwidth
Band V
Channel 4183



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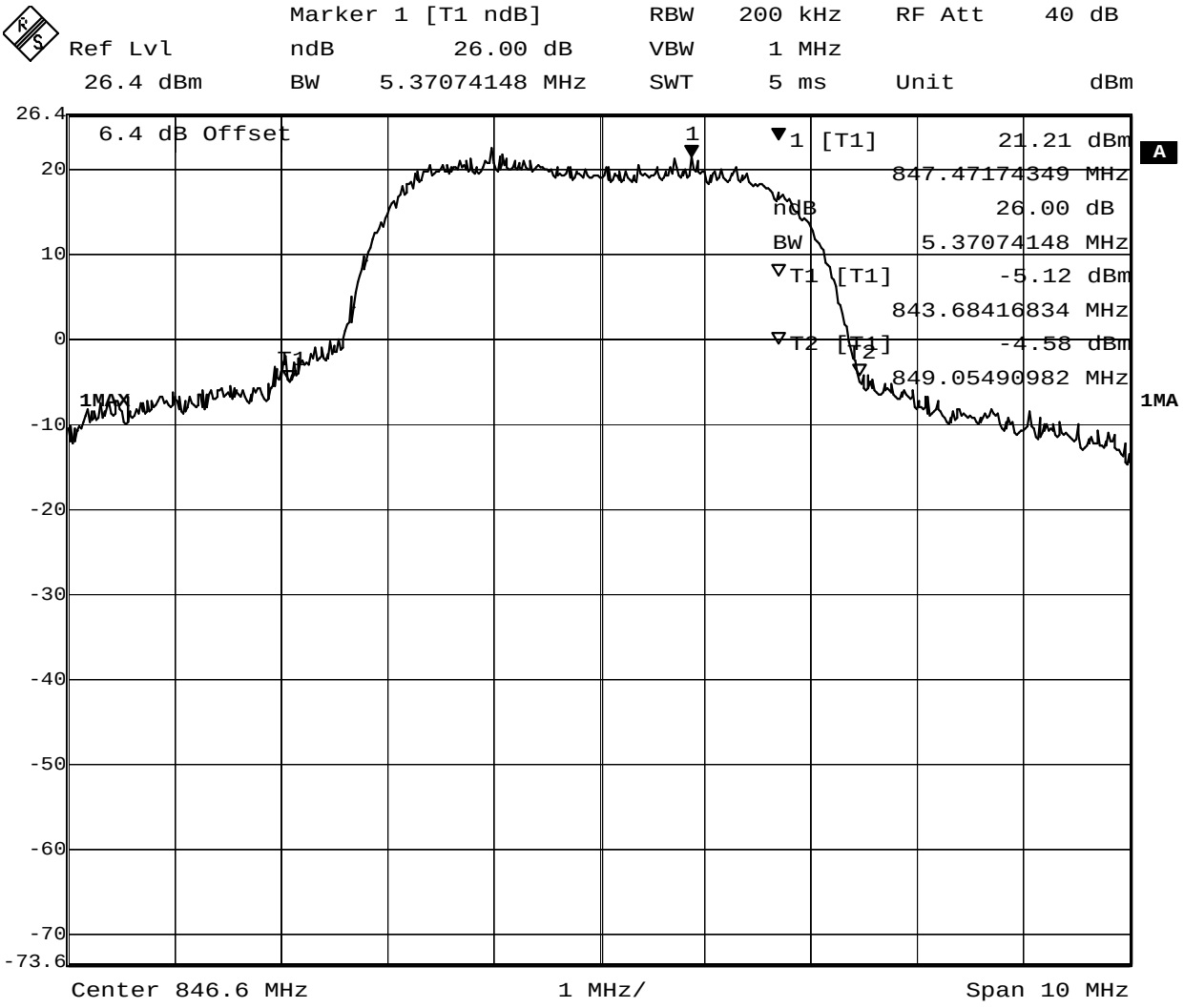
99% Bandwidth
Band V
Channel 4233



Date: 20.MAR.2017 10:28:56

26dB Bandwidth
Band V
Channel 4233

6 Conducted Spurious Emissions at Antenna Terminals

6.1 Test Limits

§ 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 22.917

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§ 24.238

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§ 27.53 (9)

(h) *AWS emission limits*—(1) *General protection levels.* Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB

6.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The base station simulator was set to force the EUT to its maximum power setting. The resolution bandwidth of the spectrum analyzer was set at 100kHz or 1MHz depending on the transmit band and the detector was set to peak detection for general scans up to the 10^{th} harmonic. Emissions scans near the fundamental were measured using an RMS detector. Sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

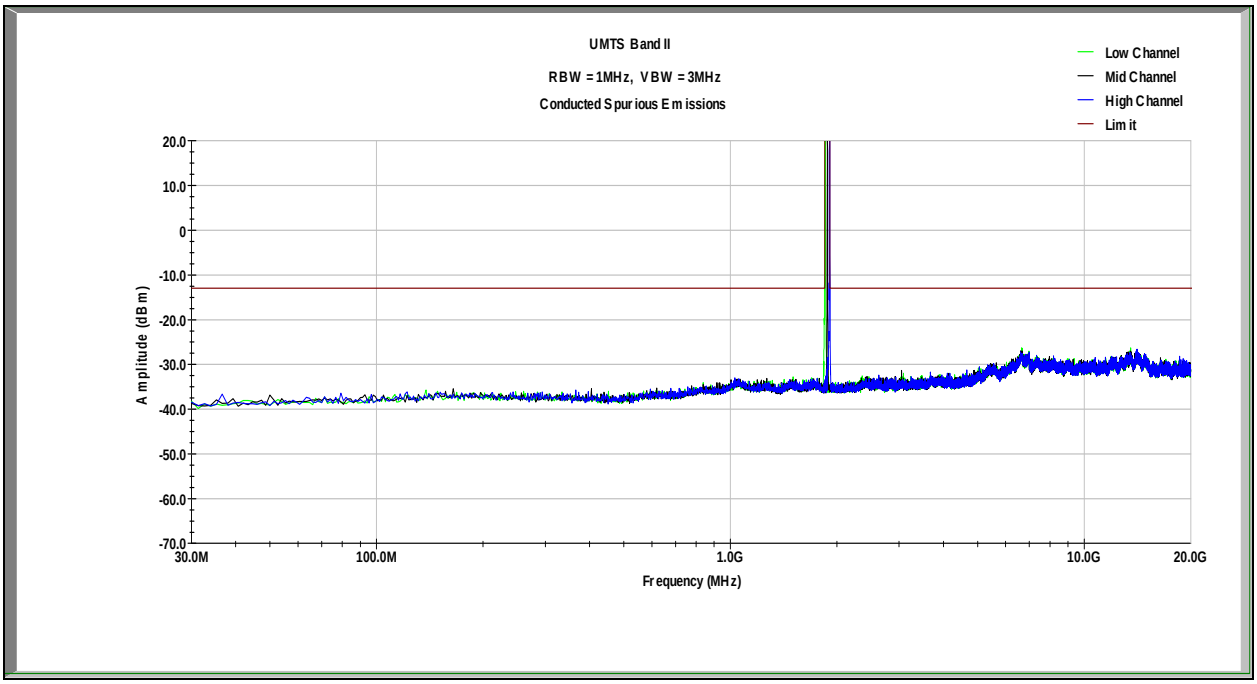
6.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Base Station Simulator	3956	Rohde&Schwarz	CMU 200	9/25/2016	9/15/2017
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK 30	9/20/2016	9/20/2017
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	9/20/2016	9/20/2017
RF Combiner	SX558	Weinschel	1506A	Time of Use	Time of Use

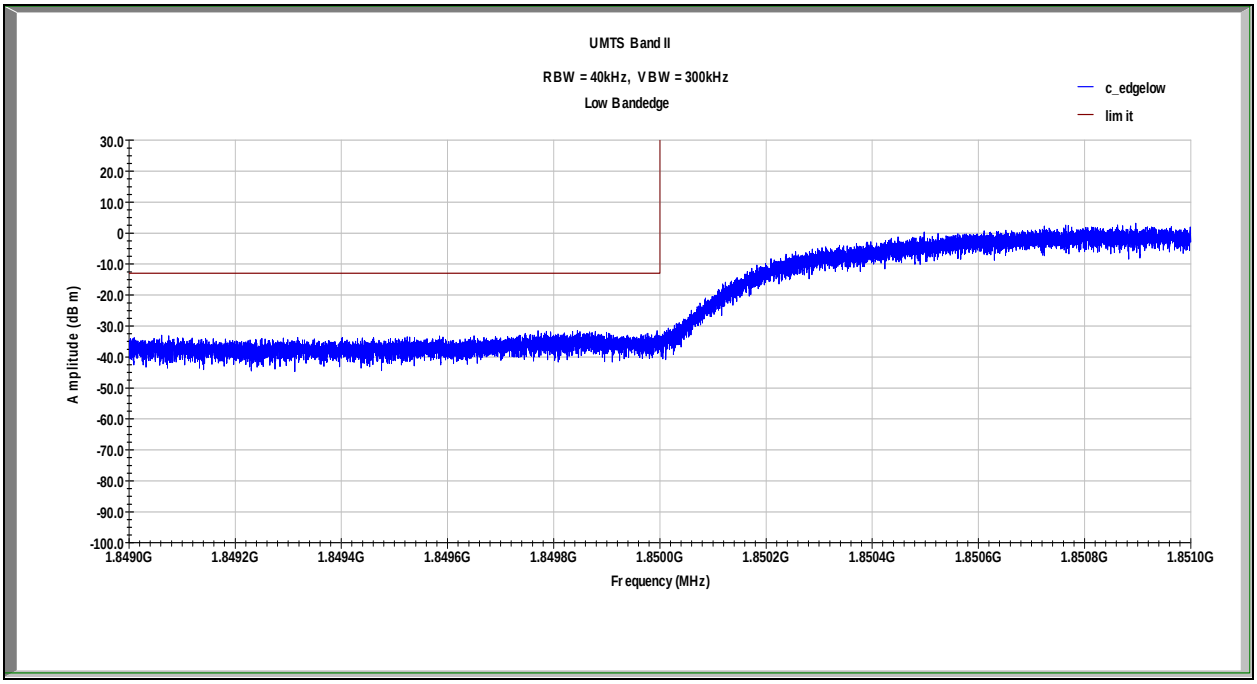
6.4 Results:

The following plots show that all spurious emissions are attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

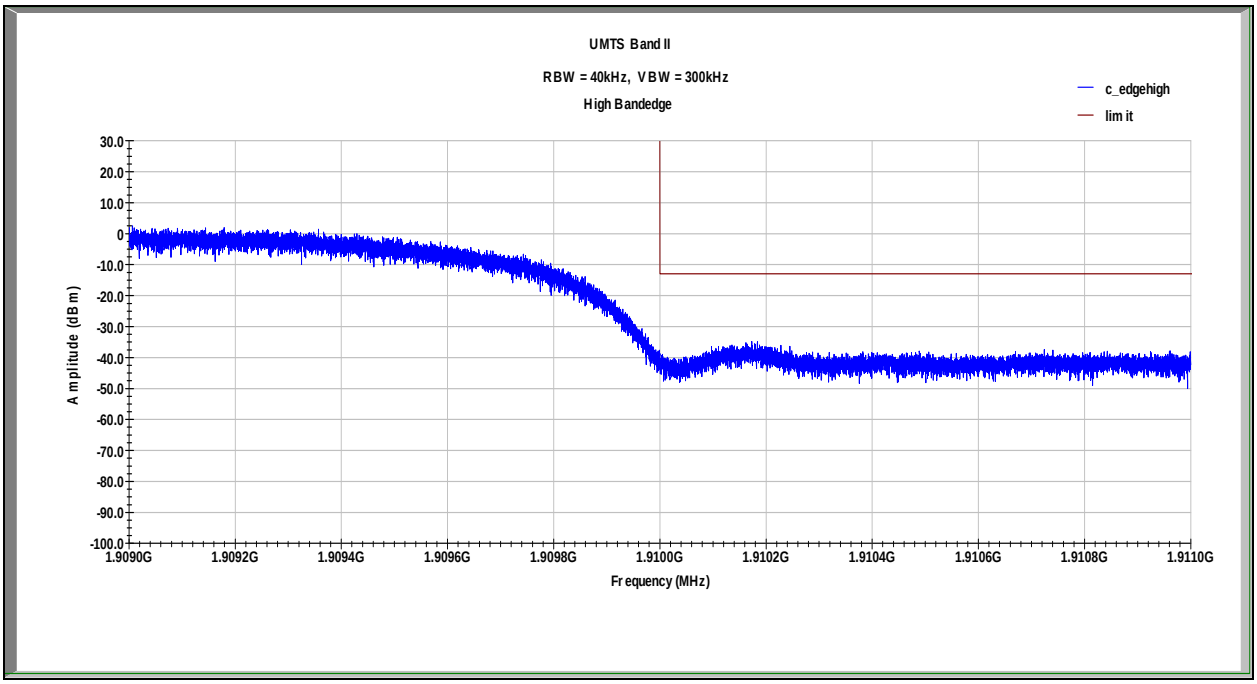
Conducted Spurious Emissions – Band II



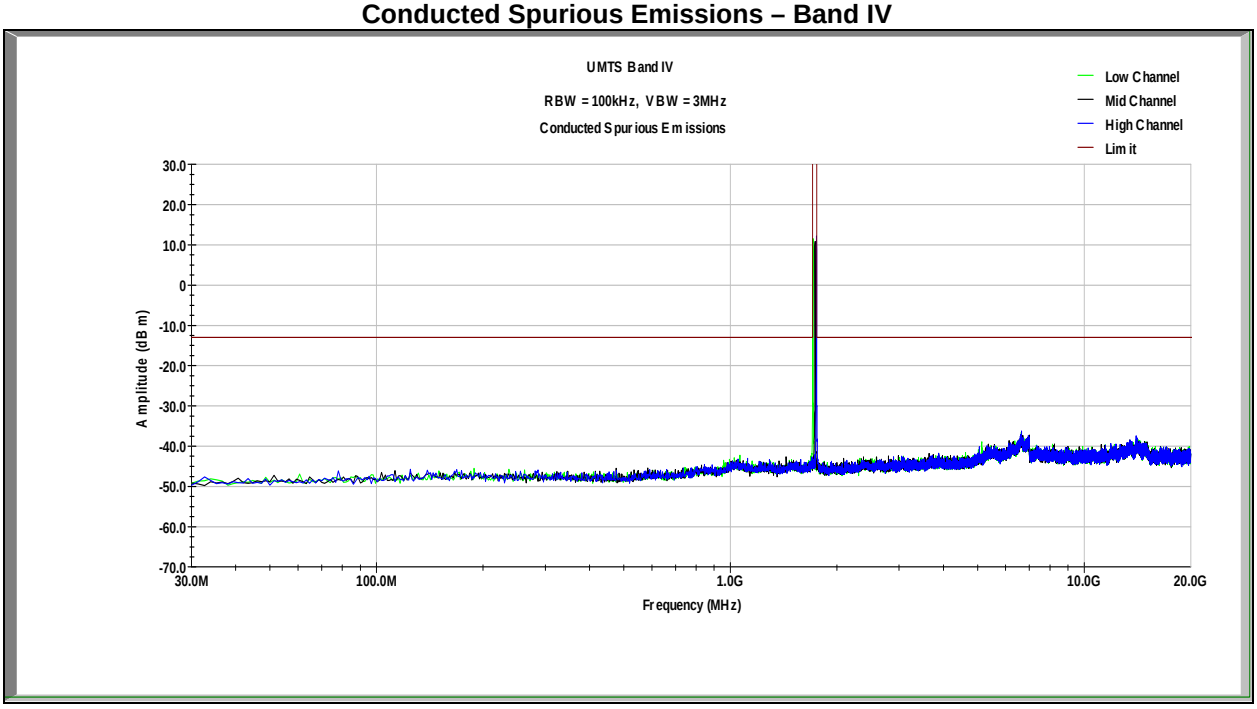
Low Band Edge Conducted Spurious Emissions – Band II



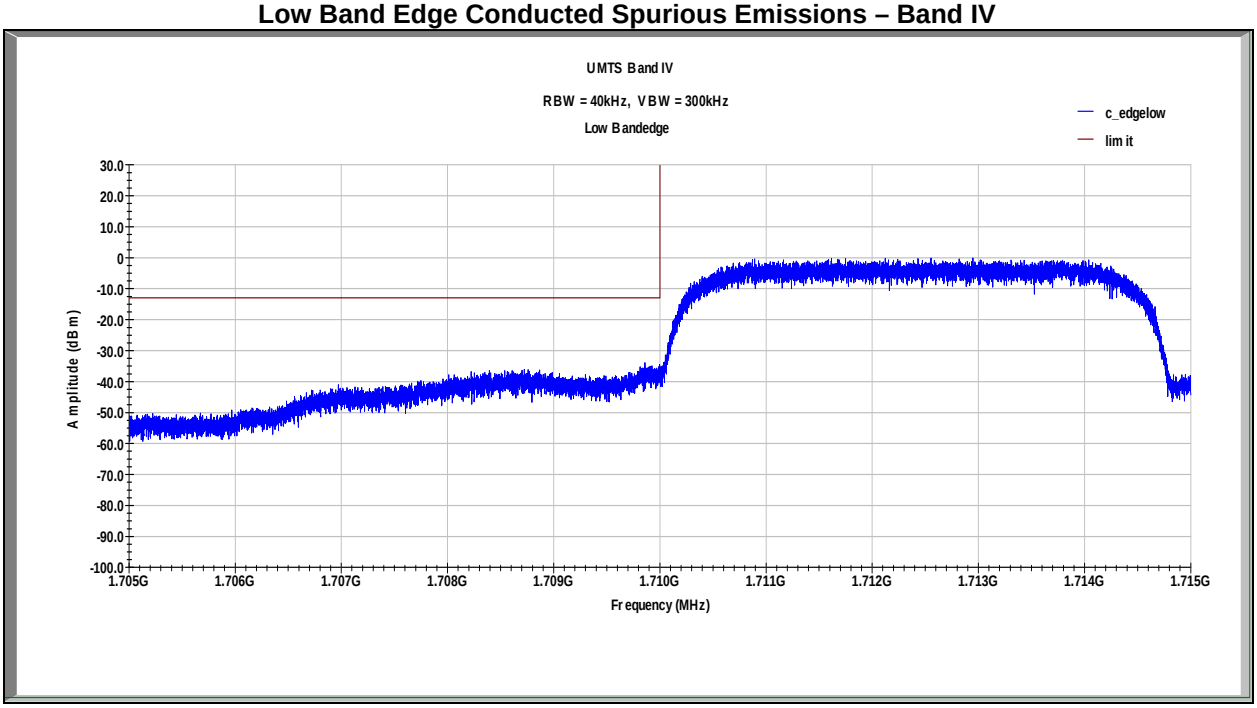
High Band Edge Conducted Spurious Emissions – Band II



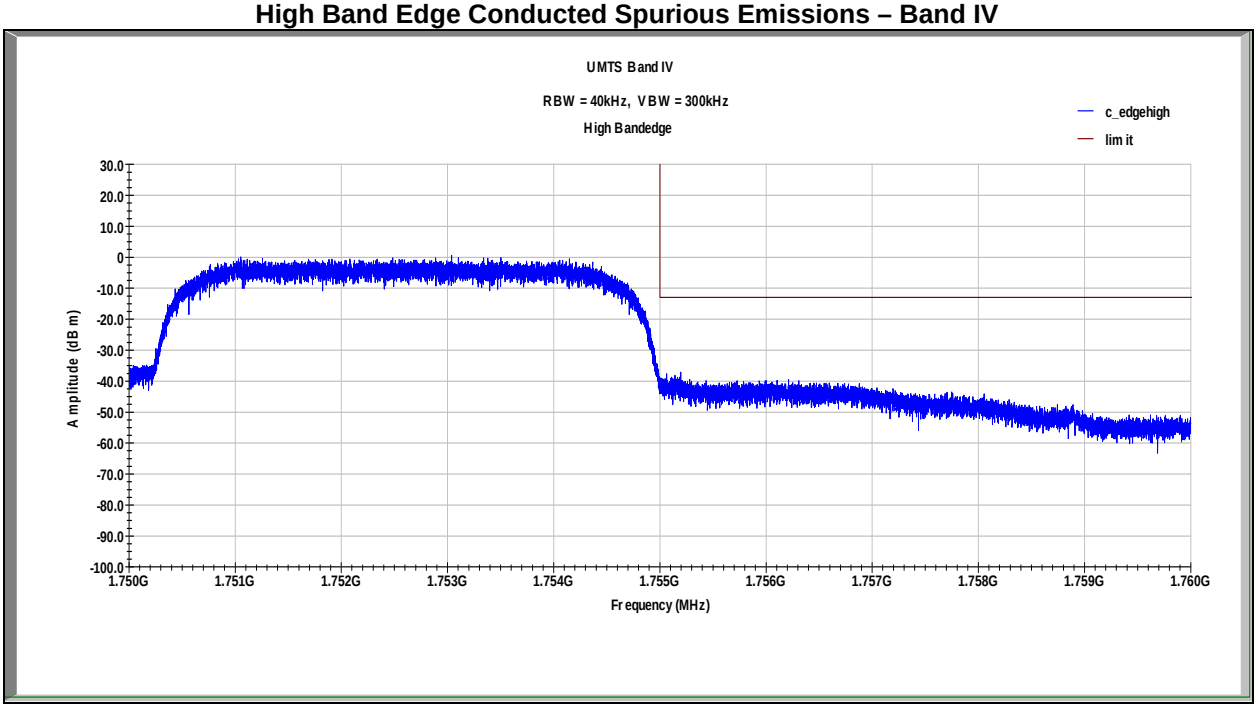
Conducted Spurious Emissions – Band IV



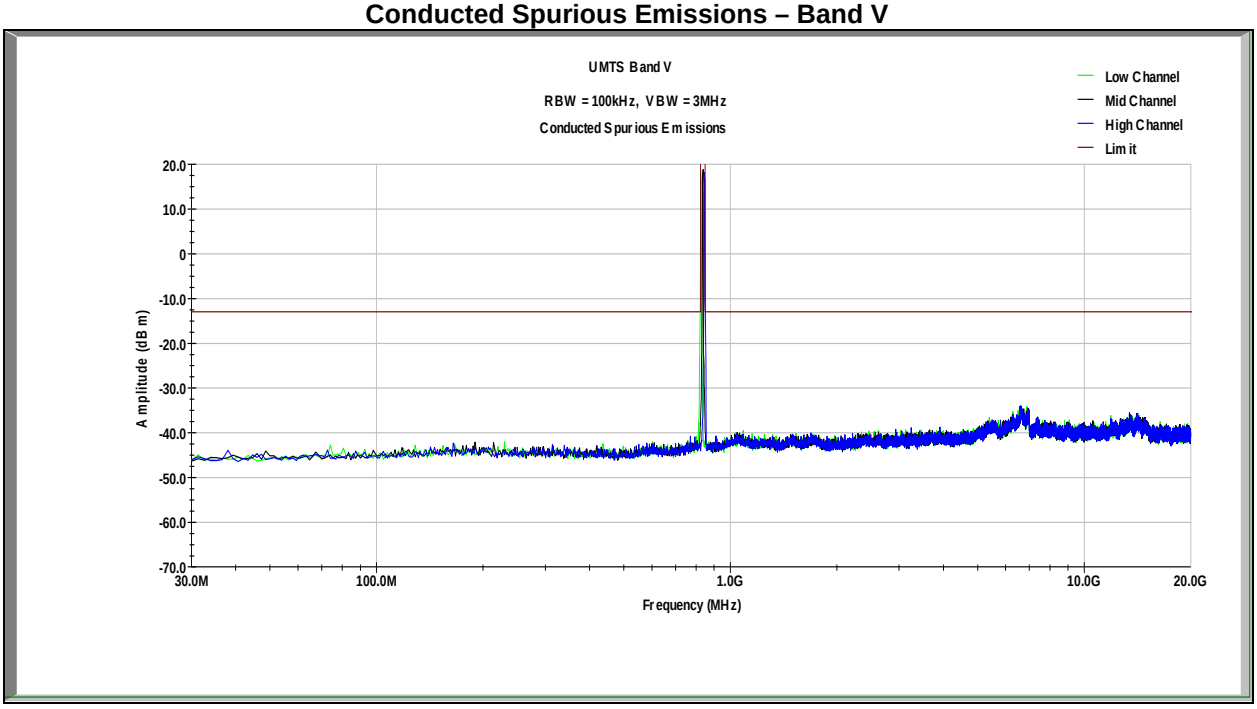
Low Band Edge Conducted Spurious Emissions – Band IV



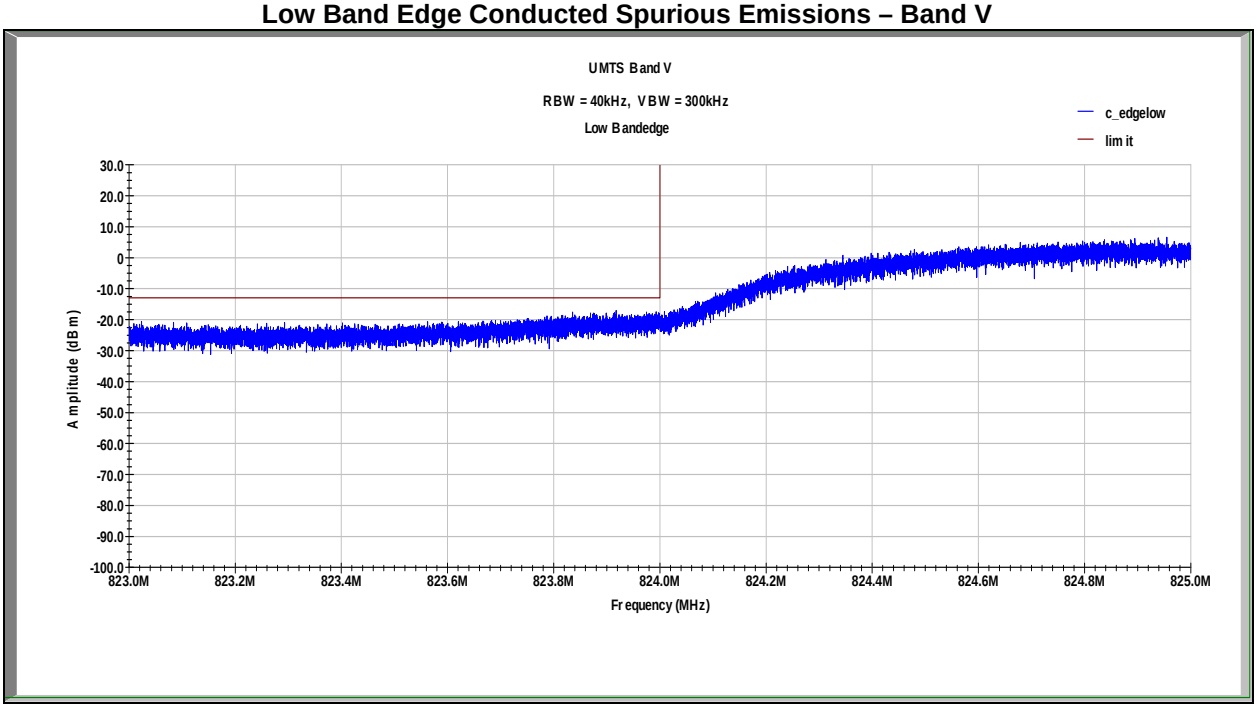
High Band Edge Conducted Spurious Emissions – Band IV



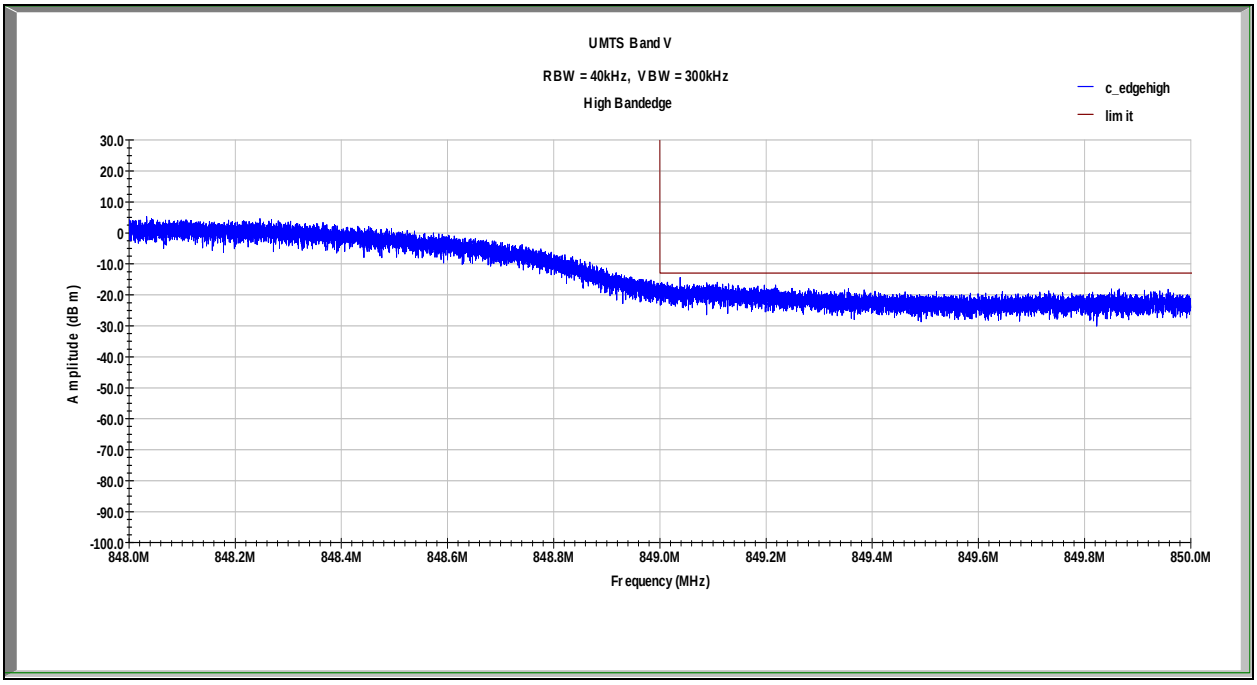
Conducted Spurious Emissions – Band V



Low Band Edge Conducted Spurious Emissions – Band V



High Band Edge Conducted Spurious Emissions – Band V



7 Radiated Spurious Emissions (Transmitter)

7.1 Test Limits

§ 2.1053

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

§ 22.917

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§ 24.238

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§ 27.53 (9)

(h) *AWS emission limits*—(1) *General protection levels.* Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB

7.2 Test Procedure

The EUT was placed on a non-conductive turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. The EUT was forced to transmit at its maximum output power setting. During the tests, the antenna height and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic was investigated in order to identify the spurious emission. Once the spurious emissions were identified, the power of the emission was determined using the substitution method described in TIA-603-C. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and at the spurious emissions frequency.

7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	9/26/2016	9/26/2017
Preamplifier	122005	Rohde&Schwarz	TS-PR18	11/17/2016	11/17/2017
Preamplifier	818535	Rohde&Schwarz	TS-PR40	11/17/2016	11/17/2017
Biconnilog Antenna	00051864	ETS	3142C	4/6/2016	4/6/2017
Biconnical Antenna	5028	Schwarzbeck	SBA 9113 B-191	2/31/2017	2/31/2018
Horn Antenna	156319	ETS	3117	6/1/2016	6/1/2017
Horn Antenna	6556	ETS	3115	11/14/2016	11/14/2017
Horn Antenna (18 - 40GHz)	117798	ETS	3116c	6/5/2016	6/5/2017
Horn Antenna (18 - 26.5GHz)	LM8621	ETS	3160-09	10/9/2016	10/9/2017
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required
Base Station Simulator	3956	Rohde&Schwarz	CMU 200	9/25/2016	9/15/2017
Signal Generator	3782	Rohde&Schwarz	SMB100A	9/20/2016	9/20/2017
High Pass Filter	013	Micro-Tronics	HPM50108	Time Of Use	Time Of Use
Band Reject Filter	109	Micro-Tronics	BRM50707	Time Of Use	Time Of Use
Environmental Chamber	3947	Test Equity	115A	Time Of Use	Time Of Use

7.4 Results:

All radiated spurious emissions were attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB which is equivalent to -13dBm. The emissions were measured using an RMS detector and the analyzer was gated so that the emission was only measured during the on-times of the transmitter.

Worst Case Spurious Measurements – Band II

Radiated Spurious Emissions Measurement								
Test Engineer: Bryan Taylor			**Start Date:** 3/13/2017			**End Date:** 3/14/2017		
Temperature: 23.4C			**Humidity:** 35.80%			**Pressure:** 988.7mBar		
RBW: 1MHz			**VBW:** 3MHz					
Notes: Results represent the worst case from 3 orthogonal axis positions.								
			A	**B**	**C**	**D**	**E**	**F**
Band/Channel	**Spurious Frequency (MHz)**	**Polarity**	**Device Reading (dBm)**	**Signal Generator Level (dBm)**	**Cable Loss (dB)**	**Tx Antenna Gain (dBd)**	**Limit (dBm)**	**Radiated Spurious Emission Level (dBm)**
Band 2 Low Ch 9262 (1852.4 MHz)	3704.8	H	-69.63	-58.28	4.57	8.26	-13	-54.59
	3704.8	V	-67.46	-55.58	4.57	8.26	-13	-51.89
	5557.2	H	-72.46	-56.74	5.90	10.40	-13	-52.25
	5557.2	V	-66.8	-51.79	5.90	10.40	-13	-47.30
	7409.6	H	-73.94	-55.16	6.77	11.84	-13	-50.09
	7409.6	V	-72.4	-55.41	6.77	11.84	-13	-50.34
	9262.0	H	-75.39	-54.63	7.95	13.19	-13	-49.39
	9262.0	V	-75.87	-56.64	7.95	13.19	-13	-51.40
	11114.4	H	-76.44	-53.16	9.30	13.23	-13	-49.23
	11114.4	V	-76.81	-55.1	9.30	13.23	-13	-51.17
Band 2 Mid Ch 9400 (1880 MHz)	3760.0	H	-66.82	-55.47	4.66	8.26	-13	-51.87
	3760.0	V	-70.55	-58.67	4.66	8.26	-13	-55.07
	5640.0	H	-71.25	-55.53	6.05	10.56	-13	-51.02
	5640.0	V	-71.84	-56.83	6.05	10.56	-13	-52.32
	7520.0	H	-74.17	-55.39	6.71	11.93	-13	-50.18
	7520.0	V	-73.94	-56.95	6.71	11.93	-13	-51.74
	9400.0	H	-75.64	-54.88	8.04	13.12	-13	-49.81
	9400.0	V	-76.24	-57.01	8.04	13.12	-13	-51.94
	11280.0	H	-76.17	-52.89	9.49	13.26	-13	-49.12
	11280.0	V	-75.91	-54.2	9.49	13.26	-13	-50.43
Band 2High Ch 9538 (1907.6 MHz)	3815.2	H	-68.17	-56.82	4.66	8.25	-13	-53.23
	3815.2	V	-68.43	-56.55	4.66	8.25	-13	-52.96
	5722.8	H	-72.34	-56.62	6.73	10.66	-13	-52.69
	5722.8	V	-70.36	-55.35	6.73	10.66	-13	-51.42
	7630.4	H	-72.71	-53.93	6.83	11.98	-13	-48.78
	7630.4	V	-70.18	-53.19	6.83	11.98	-13	-48.04
	9538.0	H	-75.82	-55.06	8.21	13.09	-13	-50.19
	9538.0	V	-76.06	-56.83	8.21	13.09	-13	-51.96
	11445.6	H	-76.15	-52.87	9.81	13.25	-13	-49.43
	11445.6	V	-76.64	-54.93	9.81	13.25	-13	-51.49
								F=B-C+D

Worst Case Spurious Measurements – Band IV

Radiated Spurious Emissions Measurement								
Test Engineer: Bryan Taylor		**Start Date:** 3/13/2017			**End Date:** 3/14/2017		
Temperature: 23.4C		**Humidity:** 35.80%			**Pressure:** 988.7mBar		
RBW: 1MHz		**VBW:** 3MHz					
Notes: Results represent the worst case from 3 orthogonal axis positions.							
		A	B	C	D	E	F
Band/Channel	**Spurious Frequency (MHz)**	**Polarity**	**Device Reading (dBm)**	**Signal Generator Level (dBm)**	**Cable Loss (dB)**	**Tx Antenna Gain (dBd)**	**Limit (dBm)**	**Radiated Spurious Emission Level (dBm)**
Band 4 Low Ch 1312 (1712.4 MHz)	3424.8	H	-71.66	-61.68	4.48	7.83	-13	-58.33
	3424.8	V	-70.87	-59.17	4.48	7.83	-13	-55.82
	5137.2	H	-48.83	-35.17	5.71	10.12	-13	-30.76
	5137.2	V	-44.07	-30.33	5.71	10.12	-13	-25.92
	6849.6	H	-74.18	-56.26	6.62	11.11	-13	-51.77
	6849.6	V	-73.36	-57.44	6.62	11.11	-13	-52.95
	8562.0	H	-73.81	-54.48	7.56	12.91	-13	-49.13
	8562.0	V	-73.61	-55.08	7.56	12.91	-13	-49.73
	10274.4	H	-74.57	-53.24	8.73	13.06	-13	-48.92
	10274.4	V	-74.71	-54.03	8.73	13.06	-13	-49.71
Band 4 Mid Ch 1427 (1735.4 MHz)	3470.8	H	-70.37	-60.39	4.48	7.83	-13	-57.04
	3470.8	V	-71.13	-59.43	4.48	7.83	-13	-56.08
	5206.2	H	-51.44	-37.78	5.71	10.27	-13	-33.22
	5206.2	V	-53.07	-39.33	5.71	10.27	-13	-34.77
	6941.6	H	-72.81	-54.89	6.63	11.26	-13	-50.26
	6941.6	V	-73.93	-58.01	6.63	11.26	-13	-53.38
	8677.0	H	-75.97	-56.64	7.61	12.98	-13	-51.27
	8677.0	V	-75.31	-56.78	7.61	12.98	-13	-51.41
	10412.4	H	-75.58	-54.25	9.06	13.06	-13	-50.25
	10412.4	V	-74.82	-54.14	9.06	13.06	-13	-50.14
Band 4 High Ch 1523 (1752.6 MHz)	3505.2	H	-69.43	-59.45	4.48	8.15	-13	-55.78
	3505.2	V	-71.05	-59.35	4.48	8.15	-13	-55.68
	5257.8	H	-52.15	-38.49	5.82	10.27	-13	-34.04
	5257.8	V	-56.42	-42.68	5.82	10.27	-13	-38.23
	7010.4	H	-72.65	-54.73	6.63	11.36	-13	-50.00
	7010.4	V	-72.66	-56.74	6.63	11.36	-13	-52.01
	8763.0	H	-74.37	-55.04	7.78	12.92	-13	-49.90
	8763.0	V	-75.1	-56.57	7.78	12.92	-13	-51.43
	10515.6	H	-76.08	-54.75	9.09	13.08	-13	-50.76
	10515.6	V	-75.71	-55.03	9.09	13.08	-13	-51.04
								F=B-C+D

Worst Case Spurious Measurements – Band V

Radiated Spurious Emissions Measurement

Test Engineer: Bryan Taylor **Start Date:** 3/13/2017 **End Date:** 3/14/2017
Temperature: 23.4C **Humidity:** 35.80% **Pressure:** 988.7mBar
RBW: 1MHz **VBW:** 3MHz
Notes: Results represent the worst case from 3 orthogonal axis positions.

			A	B	C	D	E	F
Band/Channel	**Spurious Frequency (MHz)**	**Polarity**	**Device Reading (dBm)**	**Signal Generator Level (dBm)**	**Cable Loss (dB)**	**Tx Antenna Gain (dBd)**	**Limit (dBm)**	**Radiated Spurious Emission Level (dBm)**
Band 5 Low Ch 4132 (826.4 MHz)	1652.8	H	-65.06	-60.75	2.95	5.64	-13	-58.06
	1652.8	V	-66.41	-61.85	2.95	5.64	-13	-59.16
	2479.2	H	-53.21	-43.32	3.74	5.87	-13	-41.19
	2479.2	V	-53.07	-41.92	3.74	5.87	-13	-39.79
	3305.6	H	-65.36	-55.7	4.22	7.67	-13	-52.25
	3305.6	V	-64.55	-53.59	4.22	7.67	-13	-50.14
	4132.0	H	-52.32	-41.07	5.11	8.91	-13	-37.27
	4132.0	V	-48.18	-36.44	5.11	8.91	-13	-32.64
	4958.4	H	-68.21	-54.37	5.61	9.90	-13	-50.08
	4958.4	V	-69.31	-55.8	5.61	9.90	-13	-51.51
Band 5 Mid Ch 4182 (836.5 MHz)	1672.8	H	-62.22	-57.91	2.95	5.64	-13	-55.22
	1672.8	V	-63.46	-58.9	2.95	5.64	-13	-56.21
	2509.2	H	-53.92	-44.03	3.74	5.65	-13	-42.12
	2509.2	V	-52.29	-41.14	3.74	5.65	-13	-39.23
	3345.6	H	-63.15	-53.49	4.34	7.67	-13	-50.16
	3345.6	V	-64.56	-53.6	4.34	7.67	-13	-50.27
	4182.0	H	-57.72	-46.47	5.11	8.91	-13	-42.67
	4182.0	V	-59.92	-48.18	5.11	8.91	-13	-44.38
	5018.4	H	-68.84	-55	5.61	9.99	-13	-50.62
	5018.4	V	-69.11	-55.6	5.61	9.99	-13	-51.22
Band 5 High Ch 4233 (846.6 MHz)	1693.2	H	-59.31	-55	2.95	5.64	-13	-52.31
	1693.2	V	-54.55	-49.99	2.95	5.64	-13	-47.30
	2539.8	H	-54.43	-44.54	3.64	5.65	-13	-42.53
	2539.8	V	-56.87	-45.72	3.64	5.65	-13	-43.71
	3386.4	H	-63.09	-53.43	4.34	7.67	-13	-50.10
	3386.4	V	-64.91	-53.95	4.34	7.67	-13	-50.62
	4233.0	H	-65.03	-53.78	4.97	9.01	-13	-49.74
	4233.0	V	-63.23	-51.49	4.97	9.01	-13	-47.45
	5079.6	H	-68.31	-54.47	5.92	9.99	-13	-50.40
	5079.6	V	-68.8	-55.29	5.92	9.99	-13	-51.22
								F=B-C+D

8 Frequency Stability

8.1 Test Limits

§ 2.1055, §22.355, §24.235, §27.54

The frequency stability of the transmitter was required to maintain a ±2.5ppm tolerance.

8.2 Test Procedure

The equipment under test was connected to an AC variac and the RF output was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for that purpose. After the temperature stabilized for approximately 30 minutes, the frequency error was read from the base station simulator. At 20C the input voltage was varied from 85% to 115% and the frequency stability vs input voltage was recorded.

8.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Base Station Simulator	3956	Rohde&Schwarz	CMU 200	9/25/2016	9/15/2017
Environmental Chamber	2149	Thermotron	SE-1000-5-5	3/2/2017	3/2/2018
Multimeter	3076	Fluke	87	8/3/2016	8/3/2017

8.4 Results:

The tables below show the frequency stability data. In all cases the test sample met the ±2.5ppm limit.

Frequency Stability for Band II

Operating Freqeuncy:	1,880,000,000	Hz			
Channel:	9400				
Reference Voltage:	115	VAC			
Deviation Limit:	2.5	ppm			
Notes:	Frequency Stability in Band II Mode				

Voltage (%)	Voltage (VAC)	Temp (°C)	Frequency Error (Hz)	Deviation (%)	Deviation (ppm)
100%	115	-30	-7	-0.0000004	-0.0037
100%	115	-20	7	0.0000004	0.0037
100%	115	-10	9	0.0000005	0.0048
100%	115	0	-19	-0.0000010	-0.0101
100%	115	10	13	0.0000007	0.0069
100%	115	20	-6	-0.0000003	-0.0032
100%	115	30	-8	-0.0000004	-0.0043
100%	115	40	9	0.0000005	0.0048
100%	115	50	6	0.0000003	0.0032
100%	115	60	-11	-0.0000006	-0.0059
115%	138	20	10	0.0000005	0.0053
85%	93.5	20	-6	-0.0000003	-0.0032

Frequency Stability Band IV

Operating Freqeuncy:	1,735,400,000	Hz			
Channel:	1427				
Reference Voltage:	115	VAC			
Deviation Limit:	2.5	ppm			
Notes:	Frequency Stability in Band IV Mode				

Voltage (%)	Voltage (VAC)	Temp (°C)	Frequency Error (Hz)	Deviation (%)	Deviation (ppm)
100%	115	-30	2	0.0000002	0.0024
100%	115	-20	5	0.0000006	0.0060
100%	115	-10	-3	-0.0000004	-0.0036
100%	115	0	12	0.0000014	0.0143
100%	115	10	8	0.0000010	0.0096
100%	115	20	-7	-0.0000008	-0.0084
100%	115	30	-6	-0.0000007	-0.0072
100%	115	40	9	0.0000011	0.0108
100%	115	50	-7	-0.0000008	-0.0084
100%	115	60	-10	-0.0000012	-0.0120
115%	138	20	-5	-0.0000006	-0.0060
85%	93.5	20	4	0.0000005	0.0048

Frequency Stability for Band V

Operating Freqeuncy:		836,400,000	Hz		
Channel:		4182			
Reference Voltage:		115	VAC		
Deviation Limit:		2.5	ppm		
Notes:	Frequency Stability in Band V Mode				

Voltage (%)	Voltage (VAC)	Temp (℃)	Frequency Error (Hz)	Deviation (%)	Deviation (ppm)
100%	115	-30	-9	-0.0000011	-0.0108
100%	115	-20	-3	-0.0000004	-0.0036
100%	115	-10	-9	-0.0000011	-0.0108
100%	115	0	-8	-0.0000010	-0.0096
100%	115	10	-10	-0.0000012	-0.0120
100%	115	20	-7	-0.0000008	-0.0084
100%	115	30	-5	-0.0000006	-0.0060
100%	115	40	-9	-0.0000011	-0.0108
100%	115	50	-6	-0.0000007	-0.0072
100%	115	60	-5	-0.0000006	-0.0060
115%	138	20	-6	-0.0000007	-0.0072
85%	93.5	20	-5	-0.0000006	-0.0060

9 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of k = 2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty	Notes
Radiated emissions, 30 to 1000 MHz	±3.9dB	
Radiated emissions, 1 to 18 GHz	±4.2dB	
Radiated emissions, 18 to 40 GHz	±4.3dB	
Power Port Conducted emissions, 150kHz to 30 MHz	+2.8dB	

10 Revision History

Revision Level	Date	Report Number	Notes
0	6/22/2017	102952641LEX-001	Original Issue