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Report Reference ID:	**209925-8TRFWL**

Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter B – Common carrier services – **Part 27 – Miscellaneous wireless communications services**

Applicant:	TEKO Telecom S.p.A. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Digital Donor Front-End
FCC ID:	XM2-DFE
Model:	TDFE-AW

Testing laboratory:	**Nemko Italy S.p.A.** Via Carroccio, 4 I-20046 Biassono (Italy)

	Name and title	**Date**
Tested by:	G. Curioni, Wireless/EMC Specialist	2012/06/21
Reviewed by:	P. Barbieri, Wireless/EMC Specialist	2012/06/21

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Section 1: Report summary

1.1 Test specification

Specifications	**Part 27 – Miscellaneous wireless communications services**

1.2 Statement of compliance

Compliance	In the configuration tested the EUT was found compliant Yes ☒ No ☐ This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 27. Radiated tests were conducted in accordance with ANSI C63.4-2003.

1.3 Exclusions

Exclusions	None

1.4 Registration number

Registration number:	481407 (10 m Semi anechoic chamber)

1.5 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
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1.6 Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 2: Summary of test results

2.1 FCC Part 27, test results

Part	Test description	Verdict
§27.50(d)	Peak output power at RF antenna connector	Pass
§27.52	RF safety	N/A a)
§27.53(h)	Spurious emissions at RF antenna connector	Pass
§27.53(h)	Radiated spurious emissions	Pass
§27.53(f)	Radiated spurious emissions within 1559–1610 MHz band	N/A b)
§27.54	Frequency stability	Pass
§2.1049	Occupied bandwidth	Pass
§2.1047	Modulation characteristics	Pass
§2-11-04/EAB/RF	Filter Frequency Response	Pass

Notes:

a) NO Antenna provided

b) AWS band

Section 3: Equipment under test (EUT) and application details

3.1 Applicant details		
Applicant complete business name	Name:	Teko Telecom S.p.A.
	Federal Registration Number (FRN):	0018963462
	Grantee code	XM2
Mailing address	Address: City: Province/State: Post code: Country:	Via Meucci, 24/a Castel S. Pietro Terme Bologna 40024 Italy

3.2 Modular equipment	
a) Single modular approval	Single modular approval Yes ☐ No ☒
b) Limited single modular approval	Limited single modular approval Yes ☐ No ☒

3.3 Product details		
FCC ID	Grantee code:	XM2
	Product code:	-DFE
Equipment class	TNB	
Description of product as it is marketed	Digital Donor Front-End	
	Model name/number:	TDFE-AW
	Serial number:	120803001

3.4 Application purpose	
Type of application	☒ Original certification ☐ Change in identification of presently authorized equipment Original FCC ID: Grant date: ☐ Class II permissive change or modification of presently authorized equipment

3.5 Composite/related equipment	
a) Composite equipment	The EUT is a composite device subject to an additional equipment authorization Yes ☐ No ☒
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization Yes ☒ No ☐
c) Related FCC ID	If either of the above is "yes": ☐ has been granted under the FCC ID(s) listed below: ☐ is in the process of being filled under the FCC ID(s) listed below: ☐ is pending with the FCC ID(s) listed below: ☐ has a mix of pending and granted statues under the FCC ID(s) listed below: i FCC ID: ii FCC ID:

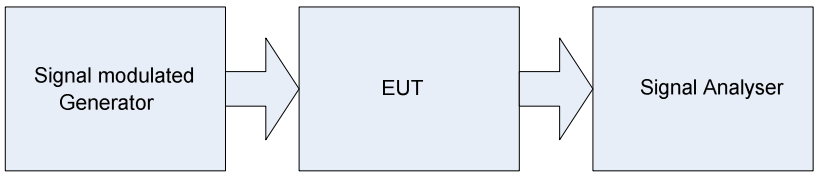
3.6 Sample information	
Receipt date:	2012-06-11

Nemko sample ID number:	-----

3.7 EUT technical specifications	
Operating band:	AWS: Down Link: 2110–2155 MHz, Up Link: 1710-1755 MHz
Operating frequency:	Wideband
Modulation type:	CDMA, WCDMA, LTE (QAM and QPSK)
Occupied bandwidth:	CDMA: 1,25 MHz, WCDMA: 5 MHz LTE: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
Channel spacing:	standard
Emission designator:	CDMA, WCDMA: F9W, LTE: D7W
RF Output	Down Link: 10dBm (0,010W) Up Link: 26dBm (0,400W)
Gain	Down Link: 63dB Up Link: 64dB
Antenna type:	External Antenna is not provided, equipment that has an external 50 Ω RF connector
Power source:	28-30 Vdc stand alone 100-240 Vac in subrack with external Ac/Dc power supply

3.8 Operation of the EUT during testing	
Details:	Normal working at max gain with max RF power output (down link and up link)

3.9 EUT setup diagram



Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT

Modifications	Modifications performed to the EUT during this assessment None ☒ Yes ☐, performed by Client ☐ or Nemko ☐ Details:

4.2 Deviations from laboratory tests procedures

Deviations	Deviations from laboratory test procedures None ☒ Yes ☐ - details are listed below:

4.3 Technical judgment

Judgment	None

Section 5: Test conditions

5.1 Power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 ℃ Relative humidity: 20–75 % Air pressure: 860–1060 hPa When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6: Measurement uncertainty

Nemko S.p.A. measurement uncertainty has been calculated using the standard CISPR 16-4-2 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modeling – Uncertainty in EMC measurements“. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko S.p.A. document WML1002.

Section 7: Test equipment

Identification number	***Description***	***Manufacturer model***	***s/n***	***Cal. Due***
1a	Vector Signal Generator	Agilent N5182A MXG	MY48180714	May 2013
1b	Vector Signal Generator	Agilent E4438C ESG	MY45094485	Ago 2013
2a	Spectrum Analyzer	Agilent E4440A	US40420470	Jul 2012
2b	Spectrum Analyzer	Agilent E9020A MXA	MY48011812	Jul 2012
3	Network Analyzer	Agilent E5071B	MY42301133	Jan 2013
4	Climatic chamber	Angelantoni Hygros 600	7237	Nov 2014

Client's property

Identification number	***Equipment***	***Manufacturer***	***Model***	***Serial N°***	***Cal. due***
1	Trilog Broadband Antenna	Schwarzbeck	VULB 9163	VULB 9163-286	04/2013
2	Bilog antenna	Schwarzbeck	STLP 9148-123	123	09/2012
3	Double ridge waveguide horn	Spin	DRH40	061106A40	09/2013
4	Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	05/2013
5	Broadband preamplifier	Miteq	JS44	1648665	05/2013
6	Spectrum Analyzer 9kHz-40GHz	R&S	FSEK	848255/005	09/2012
7	Controller	EMCO	2090	9511-1099	NSC
8	Antenna Tower	EMCO	2071-2	9601-1940	NSC
9	Turning table Controller	EMCO	1061-1.521	9012-1508	NSC
10	Semi-anechoic chamber	Nemko	3m semi-anechoic chamber	70	04/2013
11	Control room	Siemens	3m control room	3	NSC

Property of Nemko Italy

Section 8: Testing data

8.1 Clause 27.50(d) Peak output power at RF antenna connector

(1) The power of each fixed or base station transmitting in the 2110-2155 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to a peak equivalent isotropically radiated power (EIRP) of 3280 watts. The power of each fixed or base station transmitting in the 2110-2155 MHz band from any other location is limited to a peak EIRP of 1640 watts. A licensee operating a base or fixed station utilizing a power of more than 1640 watts EIRP must coordinate such operations in advance with all Government and non-Government satellite entities in the 2025-2110 MHz band. Operations above 1640 watts EIRP must also be coordinated in advance with the following licensees within 120 kilometers (75 miles) of the base or fixed station: all Broadband Radio Service (BRS) licensees authorized under Part 27 in the 2155-2160 MHz band and all AWS licensees in the 2110-2155 MHz band.

(2) Fixed, mobile, and portable (handheld) stations operating in the 1710–1755MHz band are limited to a peak EIRP of 1 watt. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground, and mobile and portable stations must employ a means for limiting power to the minimum necessary for successful communications.

In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13dB.

Special notes

– The power was measured using spectrum analyzer with RMS detector / average power meter.

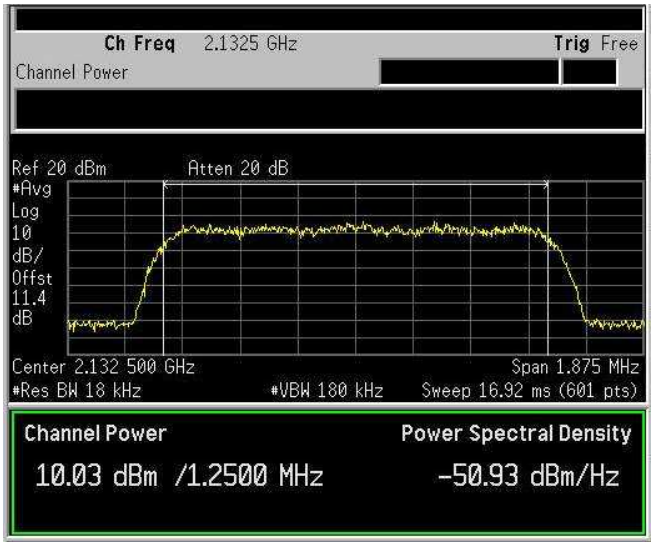
RF Output Power at RF connectors

Test data

Direction	Modulation	Frequency (MHz)	RF output Power (W/MHz)	RF output channel Power (W)	PAR (dB)
Down-link	CDMA (1,25MHz)	2132.5	0.008	0.010	8.89
Down-link	WCDMA (5MHz)	2132.5	0.002	0.010	10.56
Down-link	LTE (QAM, 1,4MHz)	2132.5	0.008	0.011	10.09
Down-link	LTE (QPSK, 1,4MHz)	2132.5	0.008	0.011	9.43
Down-link	LTE (QAM, 3MHz)	2132.5	0.003	0.010	10.49
Down-link	LTE (QPSK, 3MHz)	2132.5	0.003	0.010	10.57
Down-link	LTE (QAM, 5MHz)	2132.5	0.002	0.010	10.92
Down-link	LTE (QPSK, 5MHz)	2132.5	0.002	0.010	10.47
Down-link	LTE (QAM, 10MHz)	2132.5	0.001	0.010	10.02
Down-link	LTE (QPSK, 10MHz)	2132.5	0.001	0.010	10.32
Down-link	LTE (QAM, 15MHz)	2132.5	$6.67x10^{-4}$	0.010	10.96
Down-link	LTE (QPSK, 15MHz)	2132.5	$6.67x10^{-4}$	0.010	11.13
Down-link	LTE (QAM, 20MHz)	2132.5	0.0005	0.010	10.68
Down-link	LTE (QPSK, 20MHz)	2132.5	0.00055	0.011	11.23
Up-link	CDMA (1,25MHz)	1732.5	0.3248	0.406	8.81
Up-link	WCDMA (5MHz)	1732.5	0.0822	0.411	10.26
Up-link	LTE (QAM, 1,4MHz)	1732.5	0.29	0.406	9.49
Up-link	LTE (QPSK, 1,4MHz)	1732.5	0.30	0.417	9.17
Up-link	LTE (QAM, 3MHz)	1732.5	0.14	0.419	9.94
Up-link	LTE (QPSK, 3MHz)	1732.5	0.135	0.406	9.94
Up-link	LTE (QAM, 5MHz)	1732.5	0.0814	0.407	9.99
Up-link	LTE (QPSK, 5MHz)	1732.5	0.0814	0.407	9.59
Up-link	LTE (QAM, 10MHz)	1732.5	0.0417	0.417	10.28
Up-link	LTE (QPSK, 10MHz)	1732.5	0.0419	0.419	9.56
Up-link	LTE (QAM, 15MHz)	1732.5	0.0276	0.414	10.75
Up-link	LTE (QPSK, 15MHz)	1732.5	0.0271	0.407	11.41
Up-link	LTE (QAM, 20MHz)	1732.5	0.02085	0.417	9.95
Up-link	LTE (QPSK, 20MHz)	1732.5	0.02055	0.411	10.41

Transmitting these powers by a λ/2 dipole tuned on the carriers' frequency we get: erp.

Mod. CDMA



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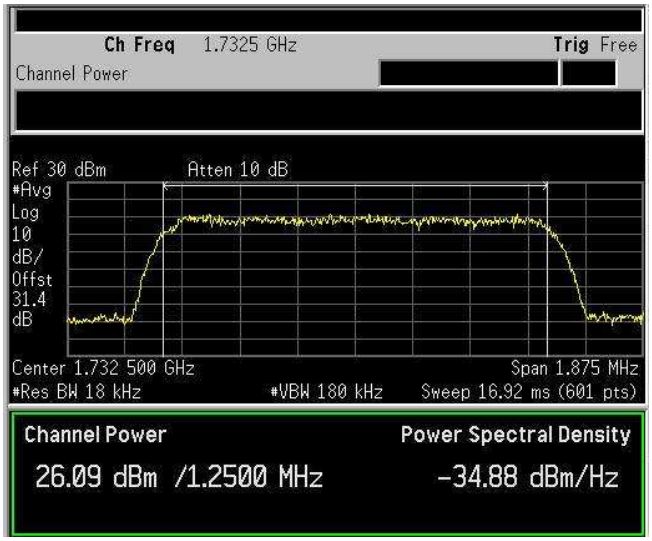
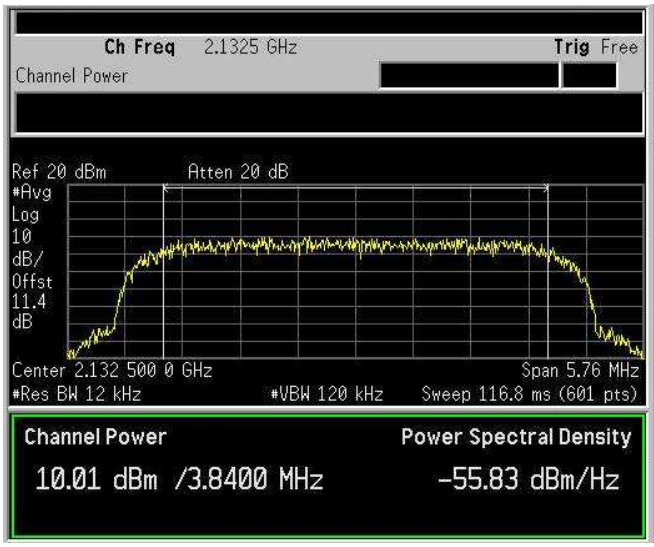


Up-link

Mod. WCDMA



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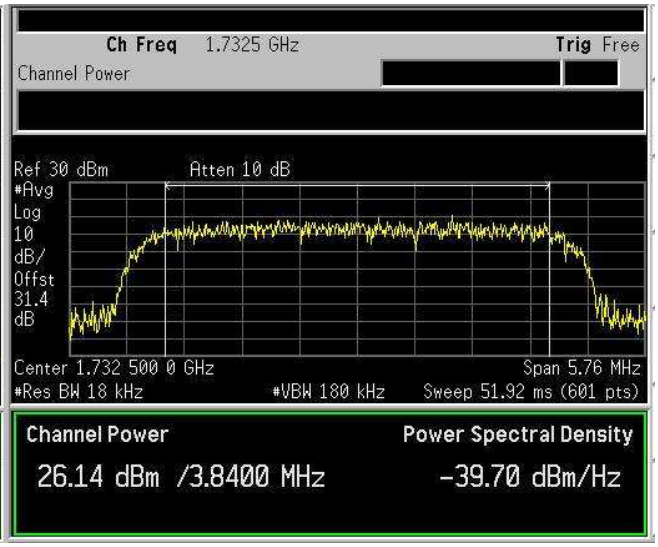

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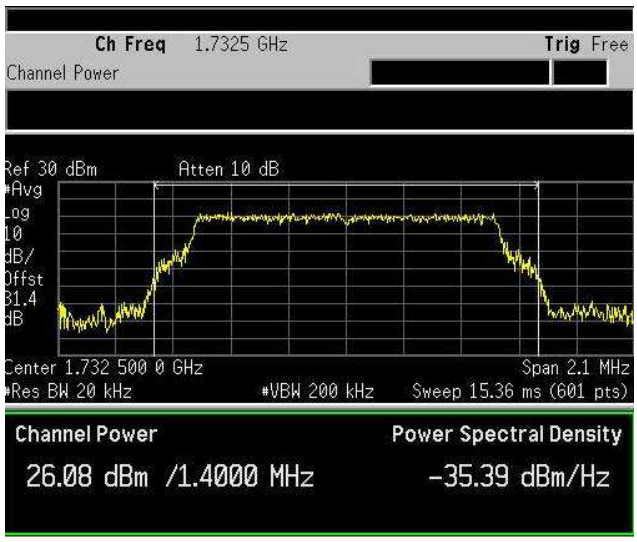
Mod. LTE 1,4MHz (QAM)

Down-link



Up-link

Mod. LTE 1,4MHz (QPSK)

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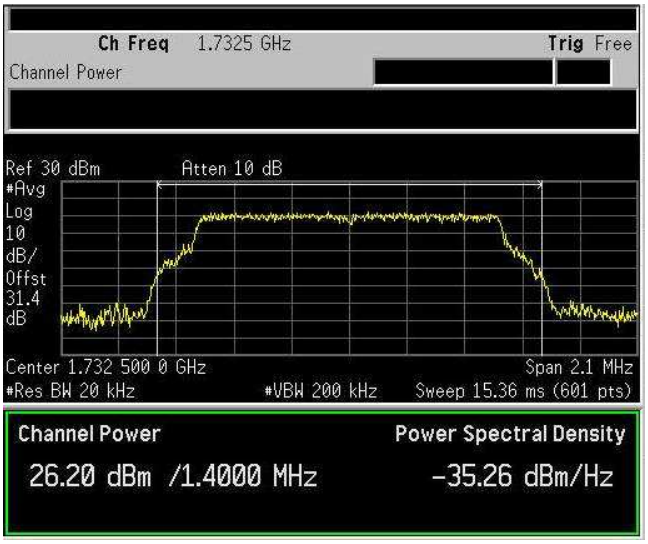
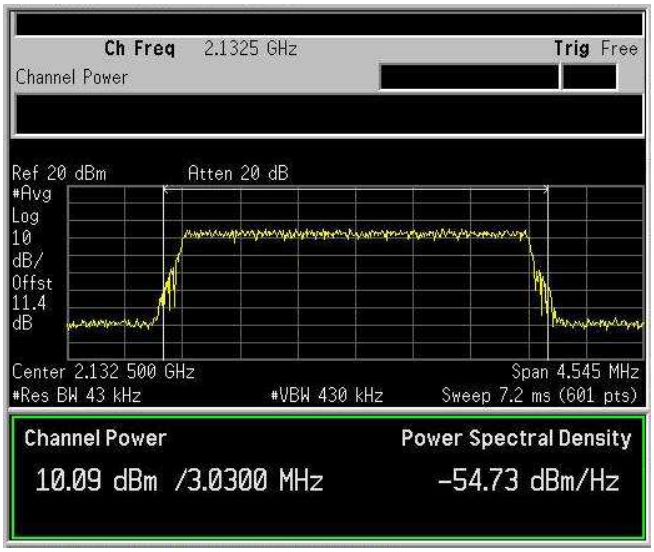


Up-link

Mod. LTE 3MHz (QAM)



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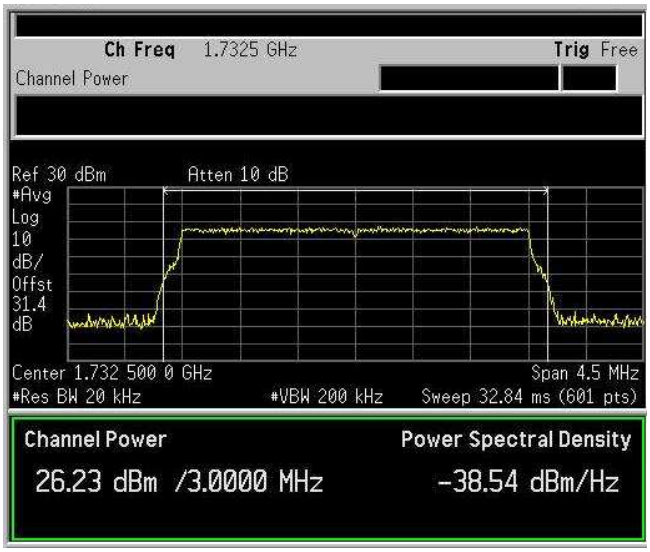
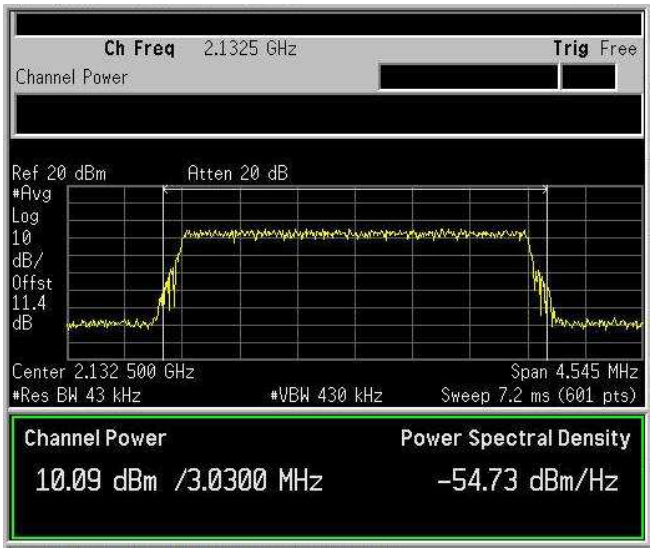


Up-link

Mod. LTE 3MHz (QPSK)



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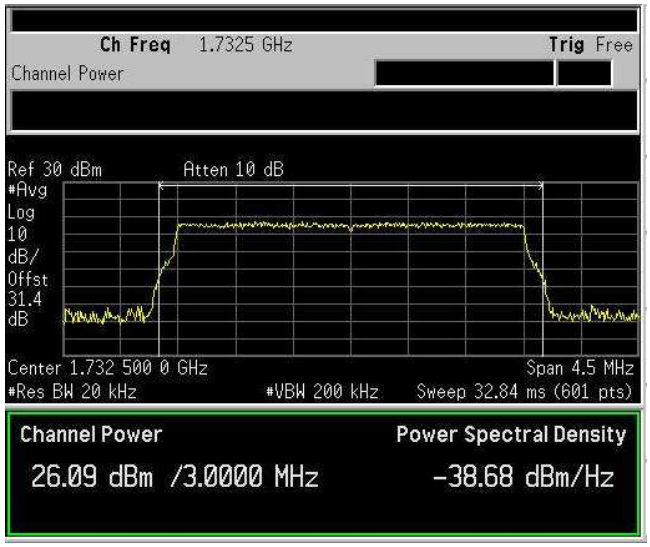

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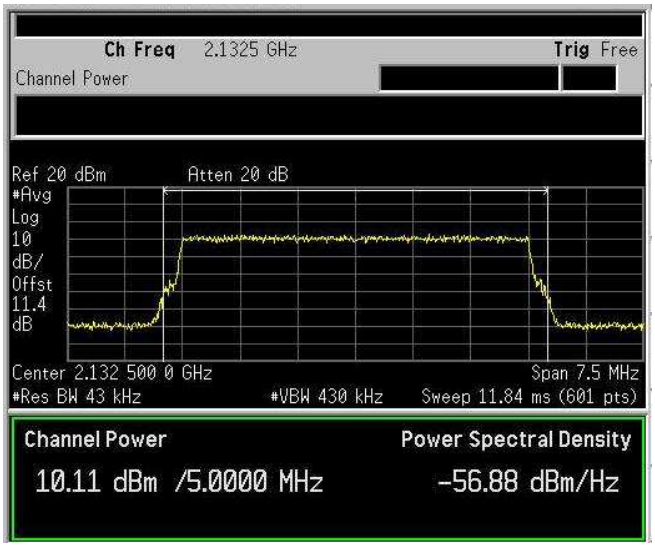
Mod. LTE 5MHz (QAM)



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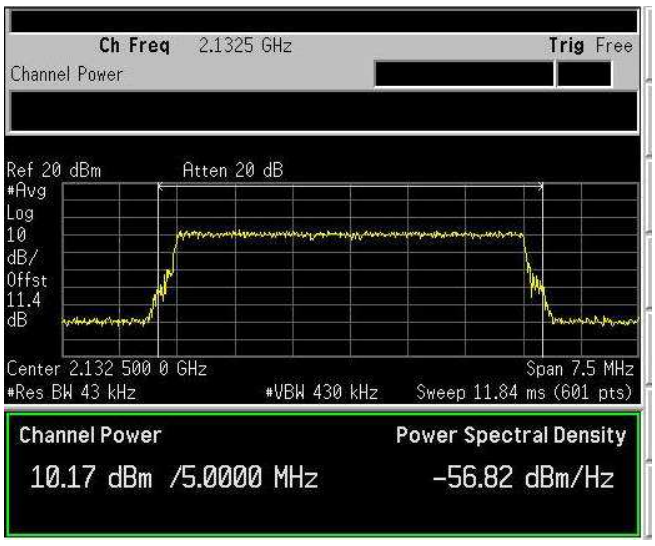
Mod. LTE 5MHz (QPSK)



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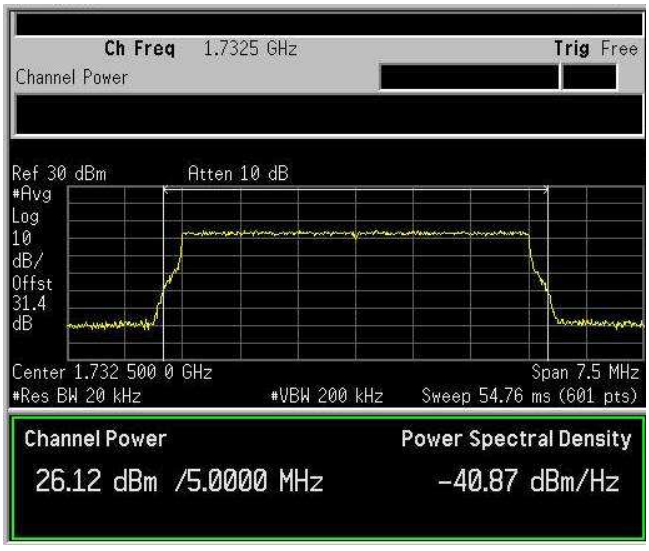

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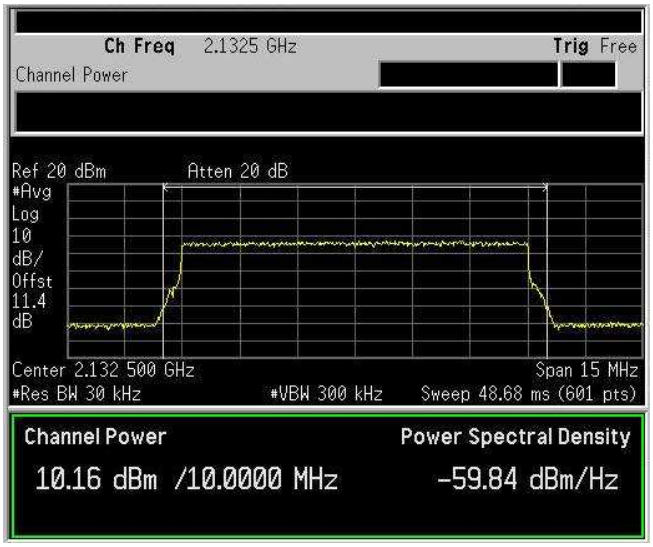
Mod. LTE 10MHz (QAM)



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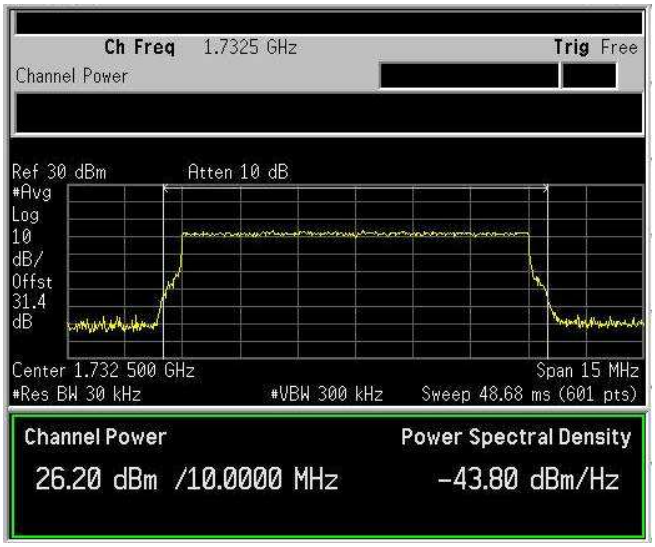

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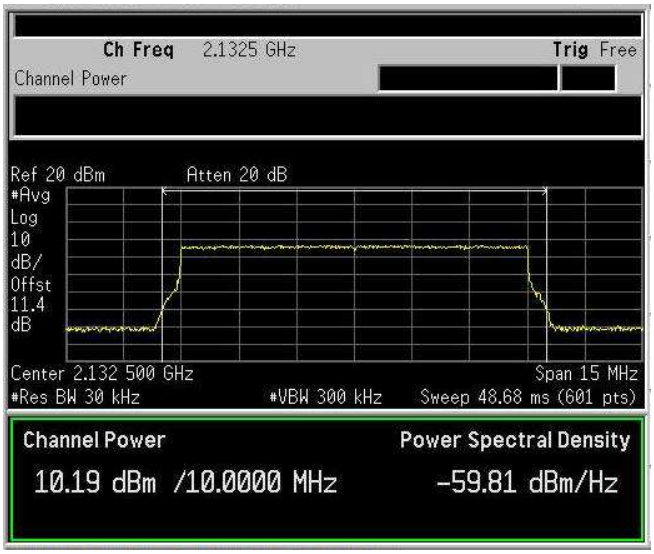
Mod. LTE 10MHz (QPSK)



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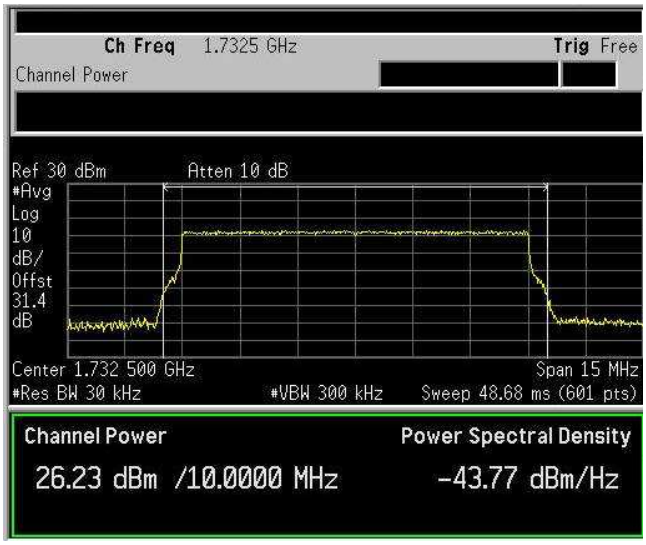
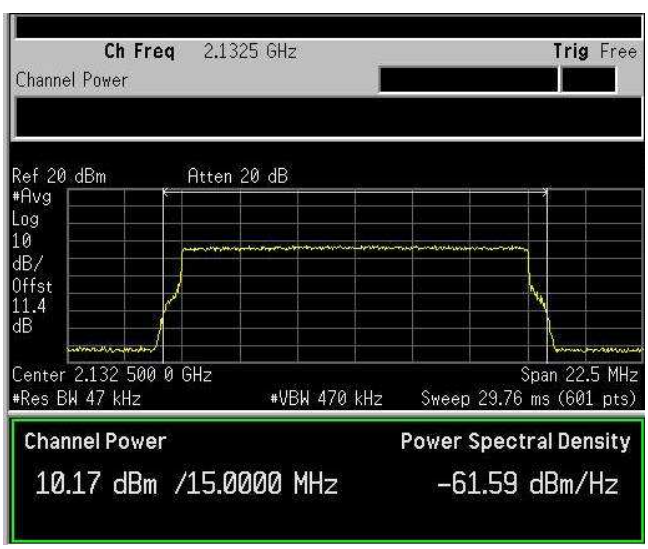


Up-link

Mod. LTE 15MHz (QAM)



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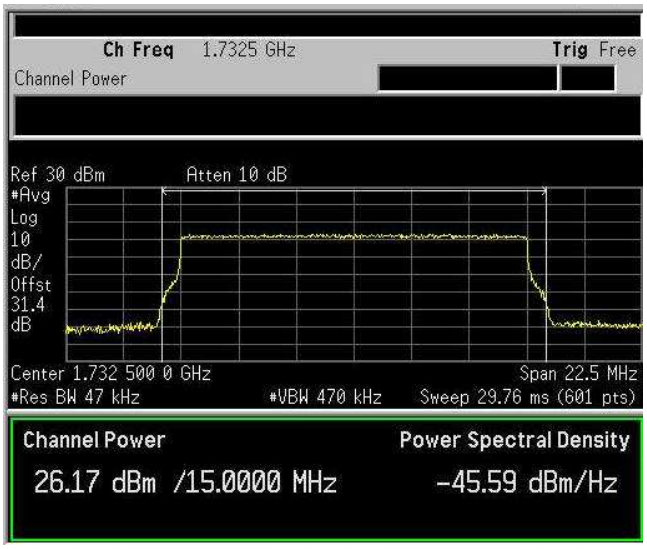

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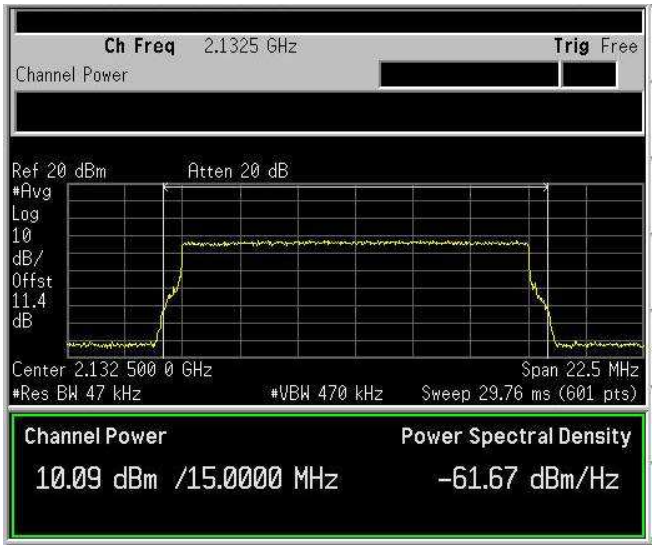
Mod. LTE 15MHz (QPSK)



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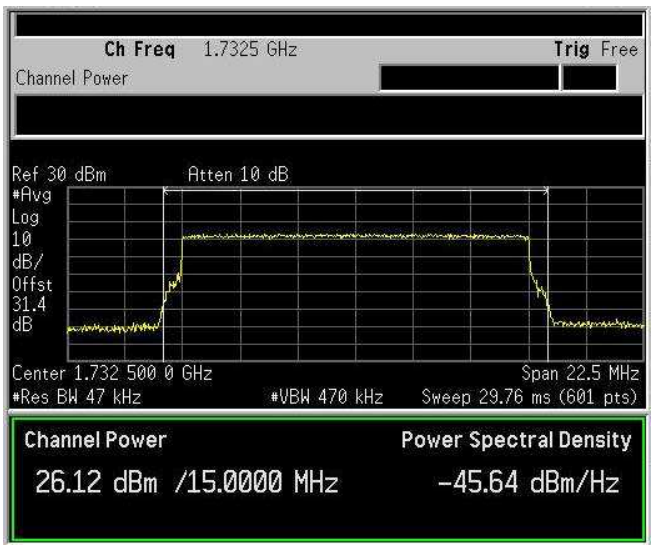
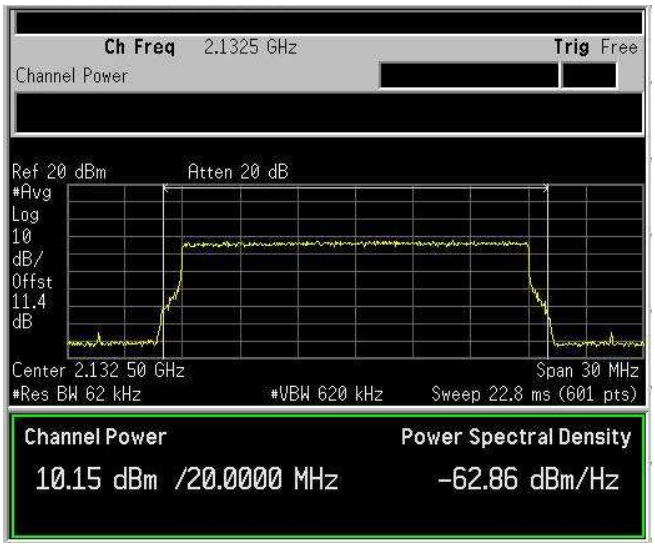


Up-link

Mod. LTE 20MHz (QAM)



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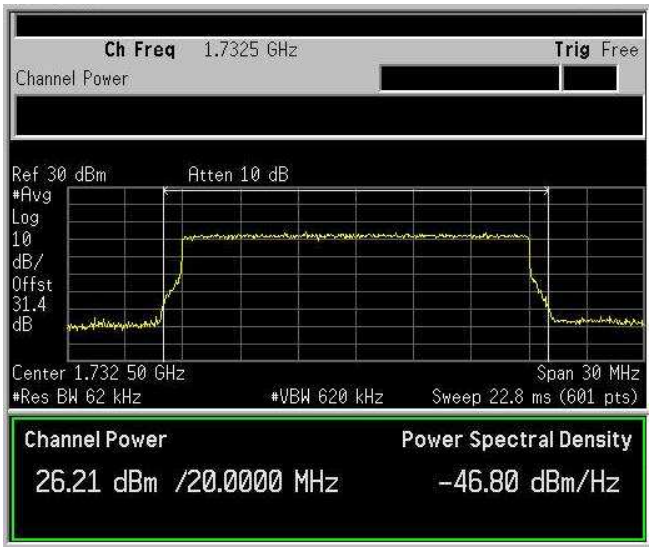

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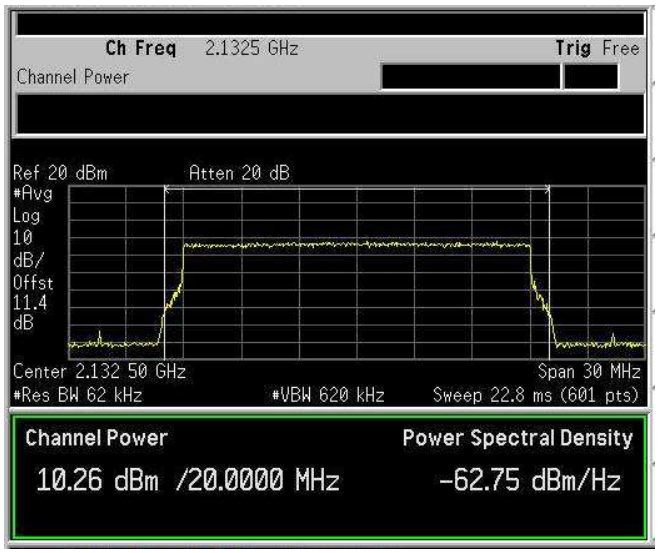
Mod. LTE 20MHz (QPSK)



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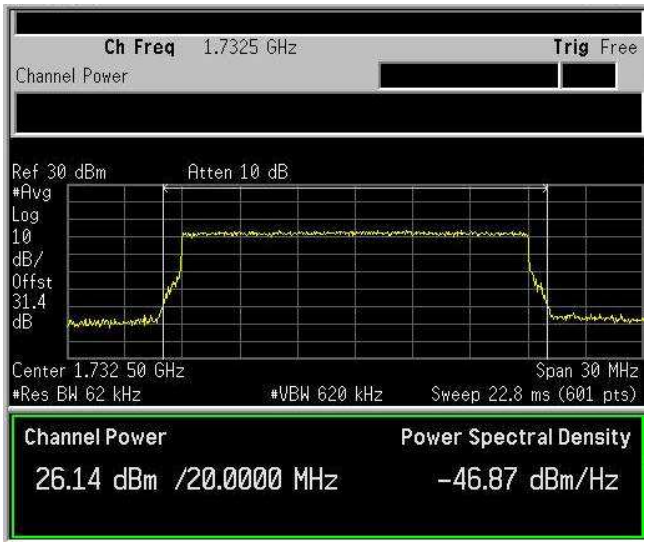


Up-link

8.2 Clause 27.52 RF safety

Licensees and manufacturers are subject to the radio frequency radiation exposure requirements specified in sections 1.1307(b), 2.1091, and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Special notes

The test was performed using E-field probe slowly moving towards the EUT until E-field equivalent to the maximum permitted power density was measured

Equivalent power density was calculated from electric field strength as follows:

$$S_{[mW/cm^2]} = \frac{0.1 \times E^2_{[V/m]}}{120 \times \pi}$$ S[W/m^2] = E^2[V/m]/377[Ω]

where S is power density and E is electric field strength.

Test data

Test distance (cm)	Field strength (V/m)	Equivalent power density (mW/cm²)	Limit (mW/cm²)	Margin (mW/cm²)
300				
250				
200				
150				
100				
50				
30				
20				
10				
5				

NOT APPLICABICABLE; External Antenna not provided

8.3 Clause 27.53 (h) Spurious emissions at RF antenna connector

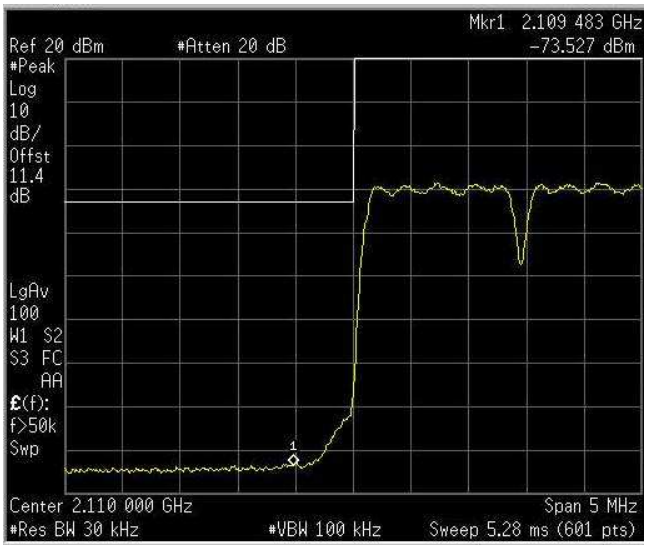
For operations in the 1710-1755 MHz and 2110-2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB.
(1) Compliance with the provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

Special notes

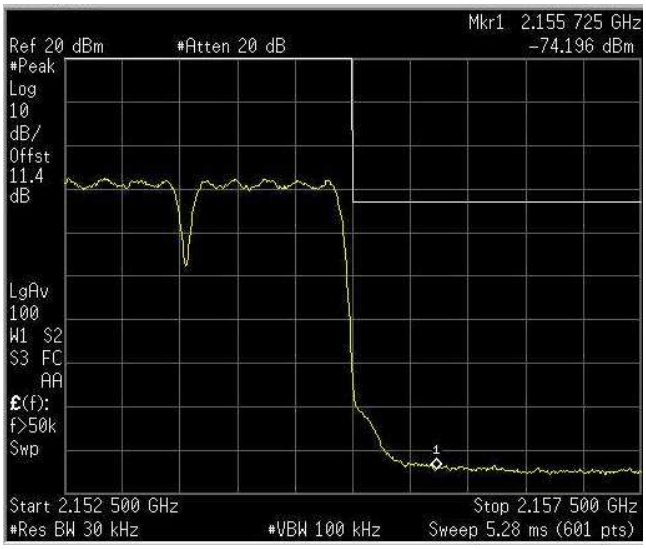
- The spectrum was searched from 30 MHz to the 10th harmonic.
- All measurements were performed using a peak detector.
- RBW within 30–1000 MHz was 100 kHz 1 MHz above 1 GHz. VBW was wider than RBW.

Test data, continued band edges Inter modulation:

Mod. CDMA (Down-link)

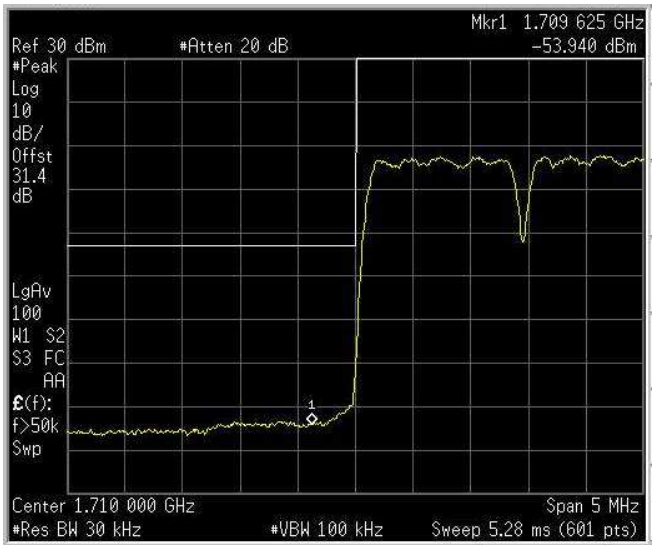


Low Band Edge

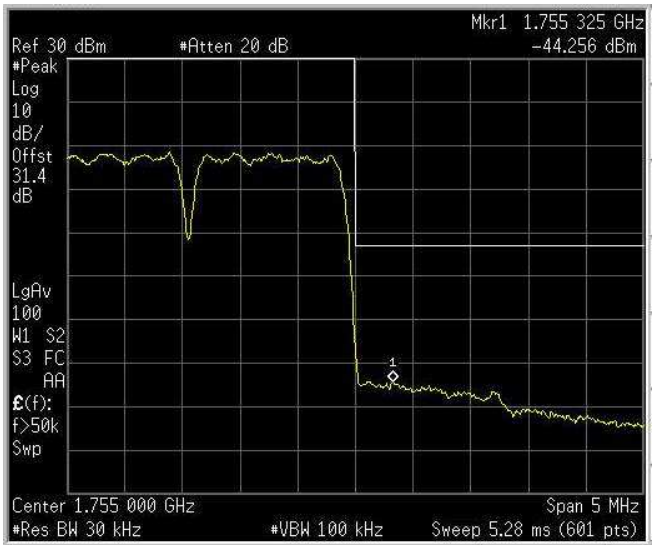


High Band Edge

Mod. CDMA (Up-link)

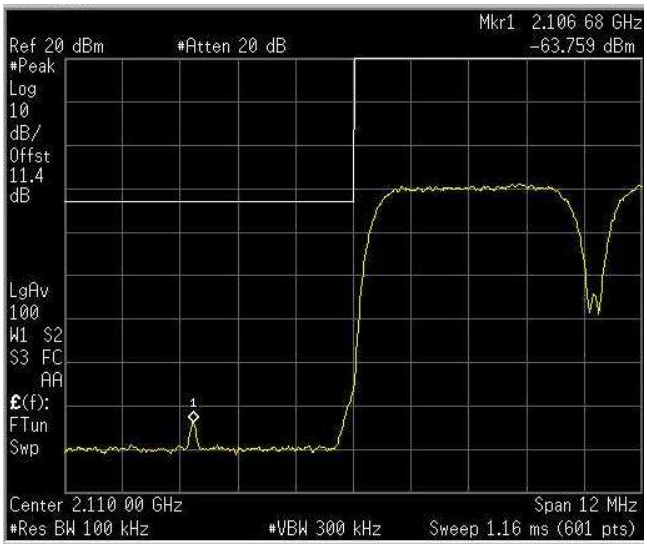


Low Band Edge

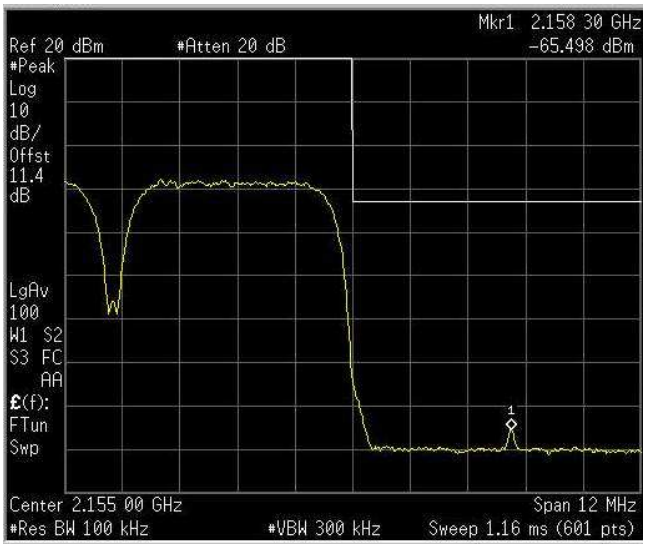


High Band Edge

Mod. WCDMA (Down-link)

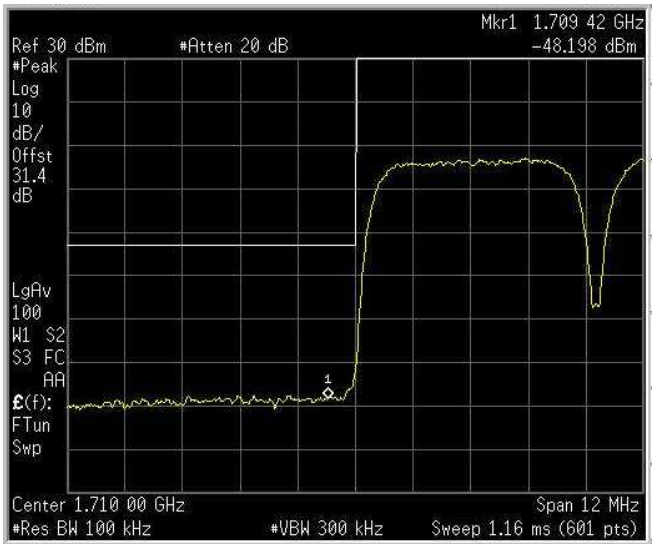


Low Band Edge

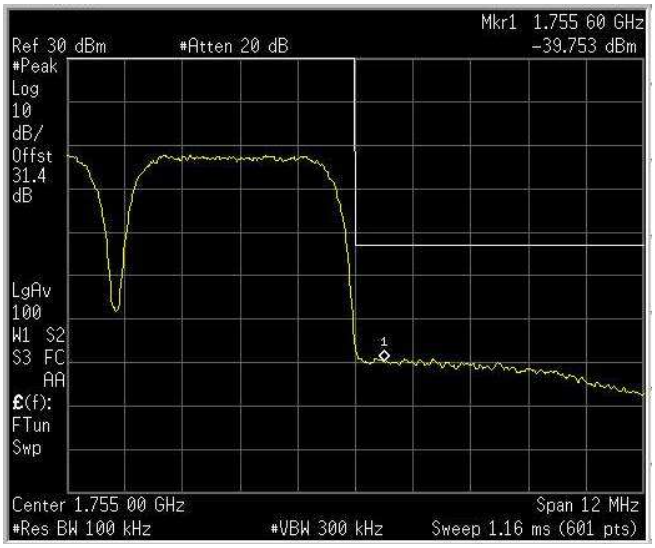


High Band Edge

Mod. WCDMA (Up-link)

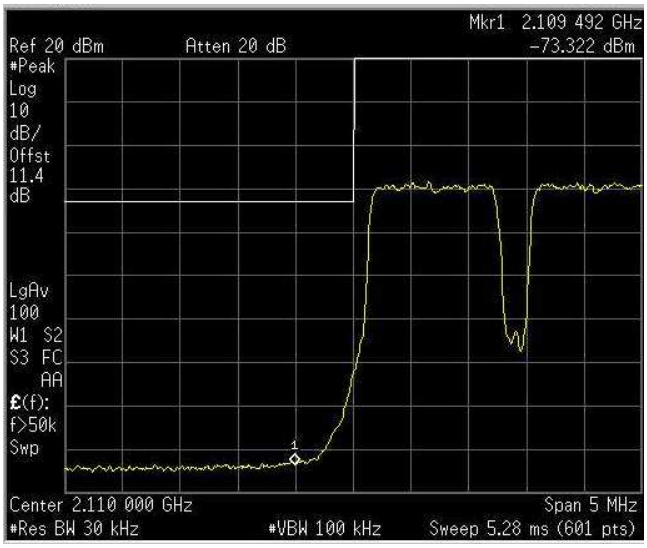


Low Band Edge

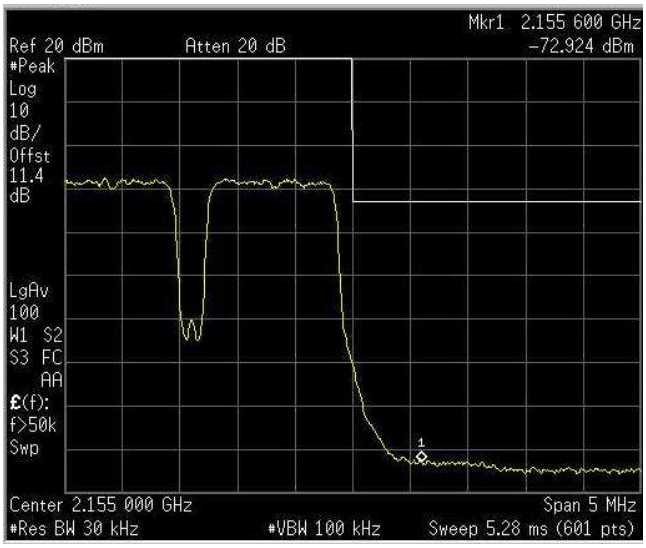


High Band Edge

Mod. LTE 1.4MHz (QAM) (Down-link)

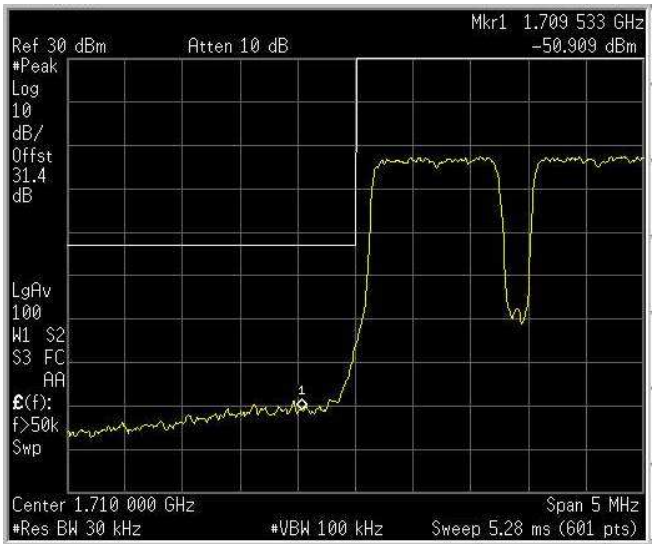


Low Band Edge

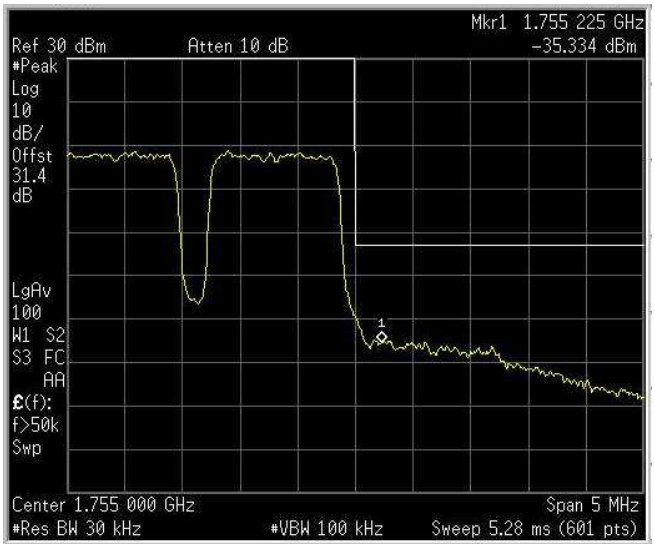


High Band Edge

Mod. LTE 1.4MHz (QAM) (Up-link)

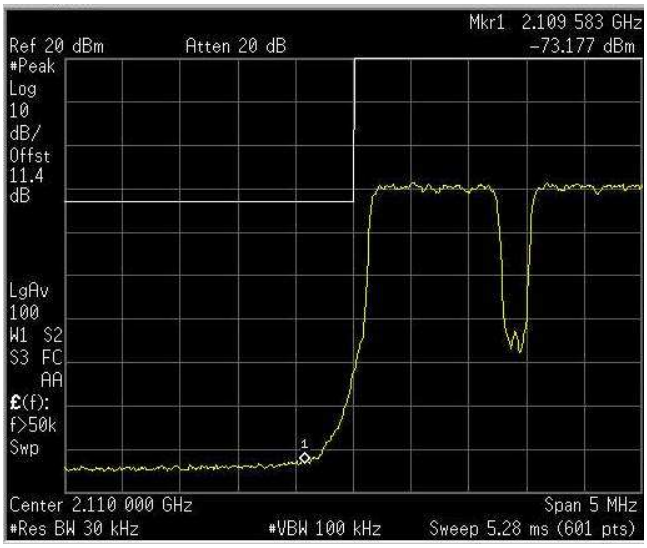


Low Band Edge

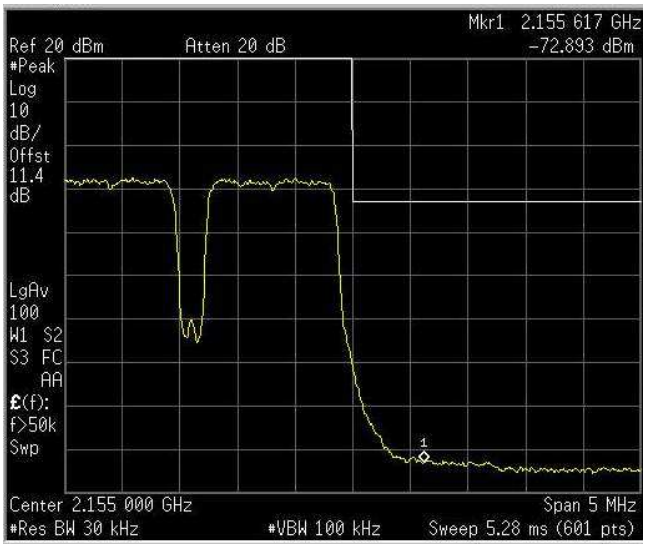


High Band Edge

Mod. LTE 1.4MHz (QPSK) (Down-link)

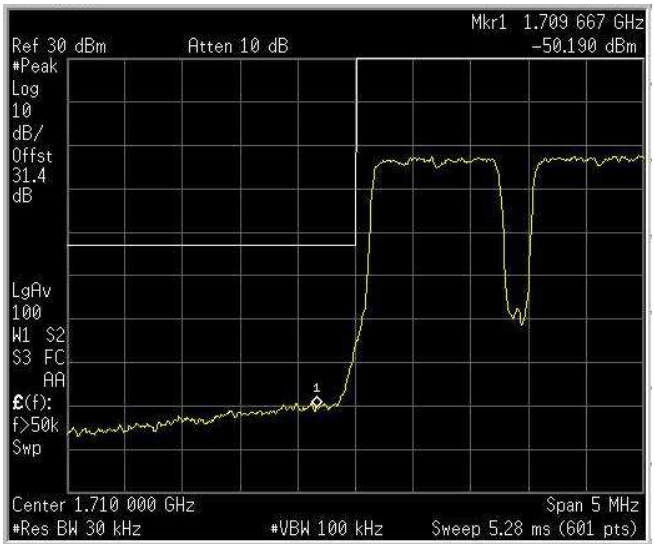


Low Band Edge

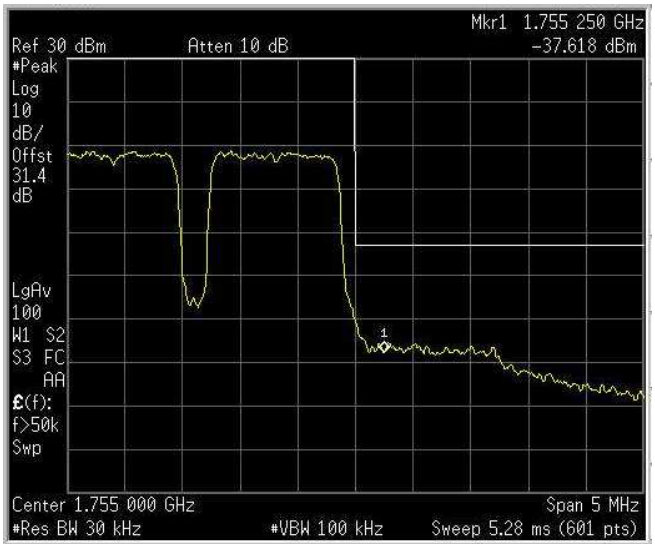


High Band Edge

Mod. LTE 1.4MHz (QPSK) (Up-link)

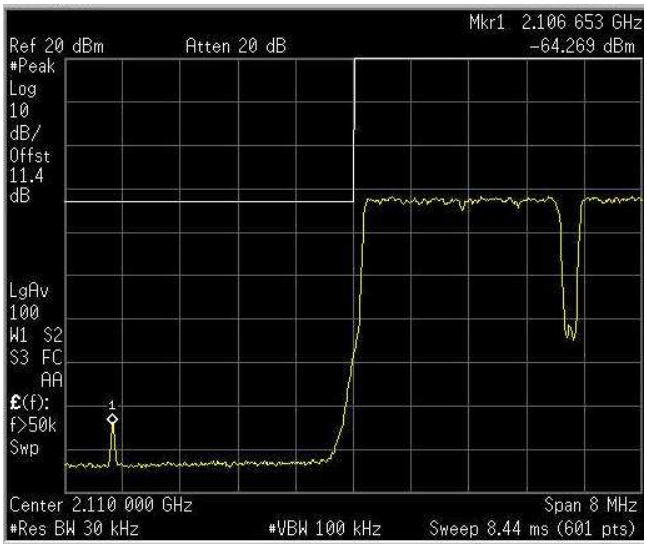


Low Band Edge

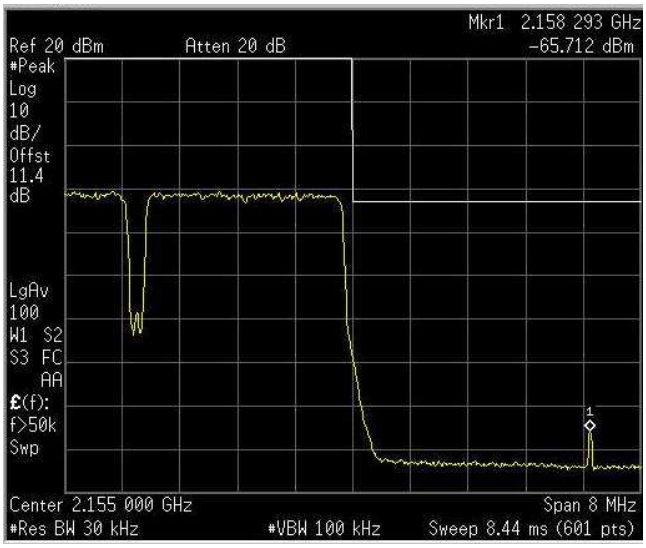


High Band Edge

Mod. LTE 3MHz (QAM) (Down-link)

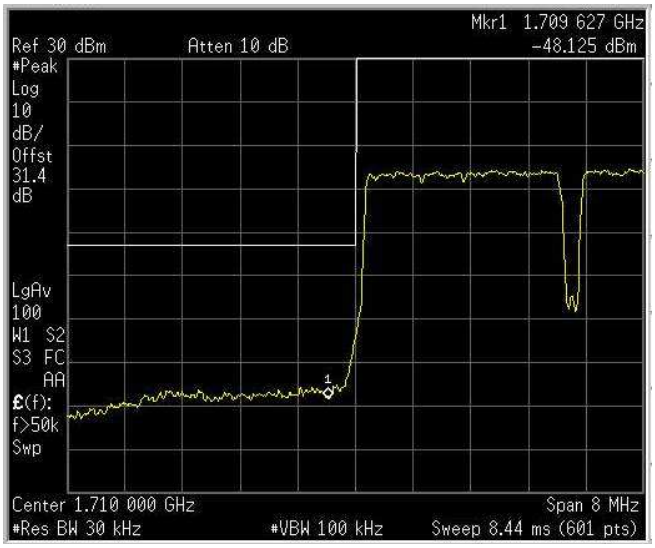


Low Band Edge

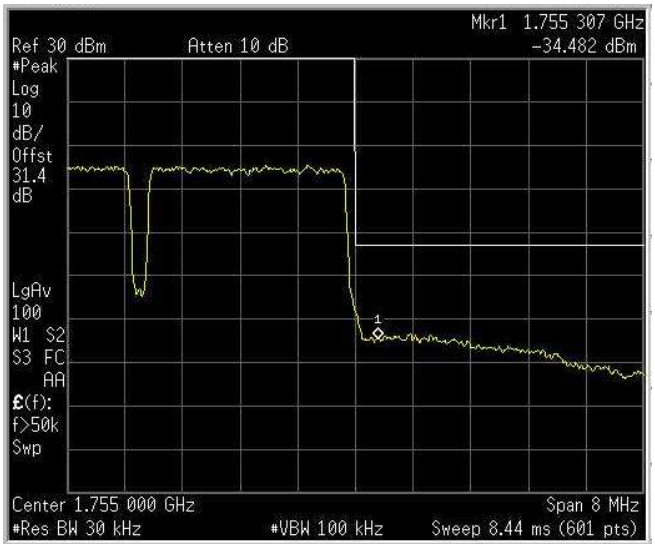


High Band Edge

Mod. LTE 3MHz (QAM) (Up-link)

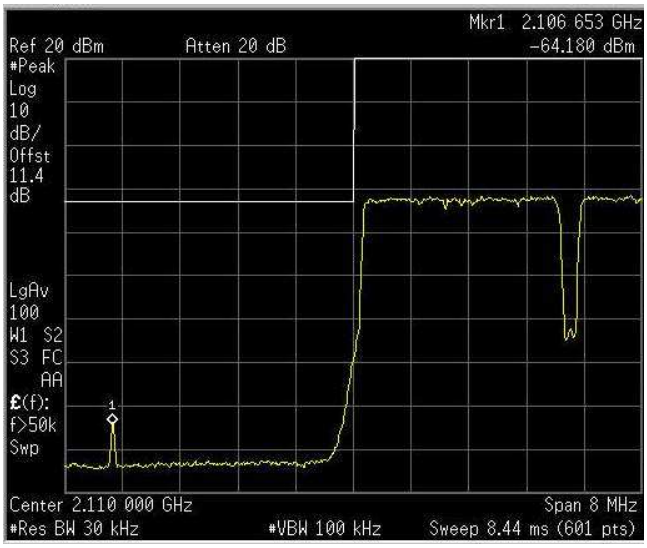


Low Band Edge

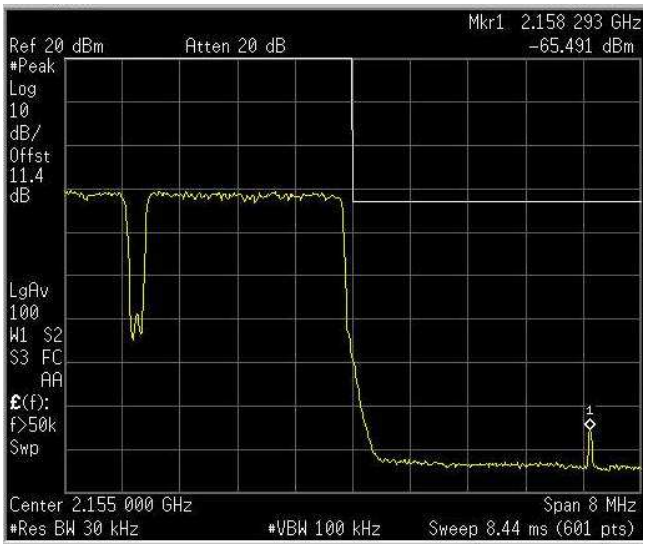


High Band Edge

Mod. LTE 3MHz (QPSK) (Down-link)

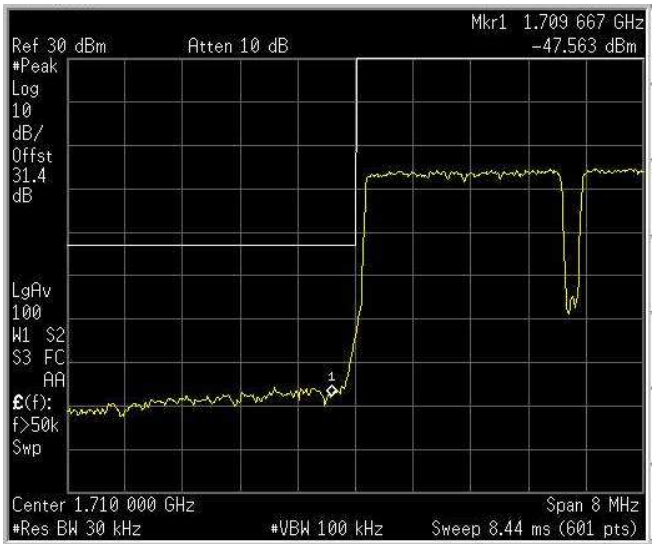


Low Band Edge

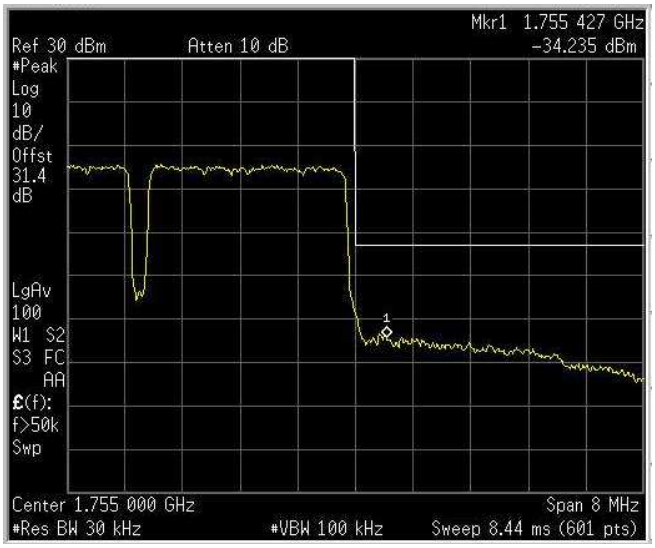


High Band Edge

Mod. LTE 3MHz (QPSK) (Up-link)

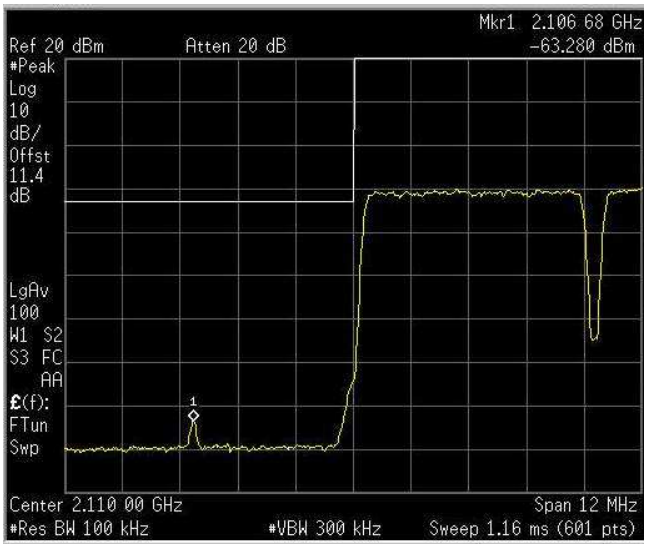


Low Band Edge

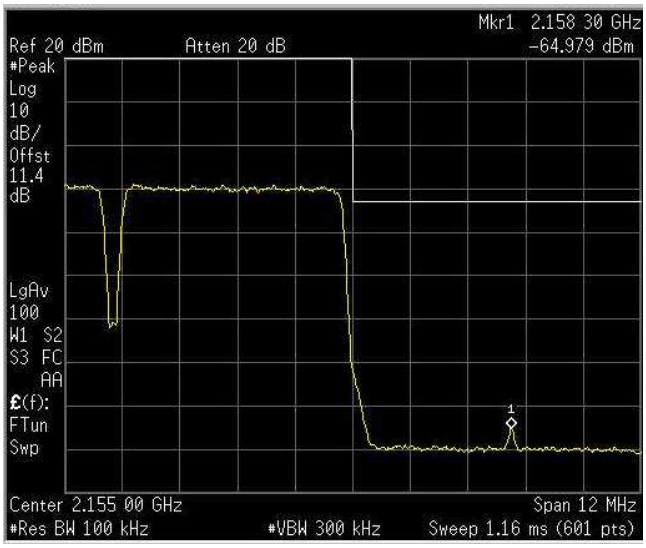


High Band Edge

Mod. LTE 5MHz (QAM) (Down-link)

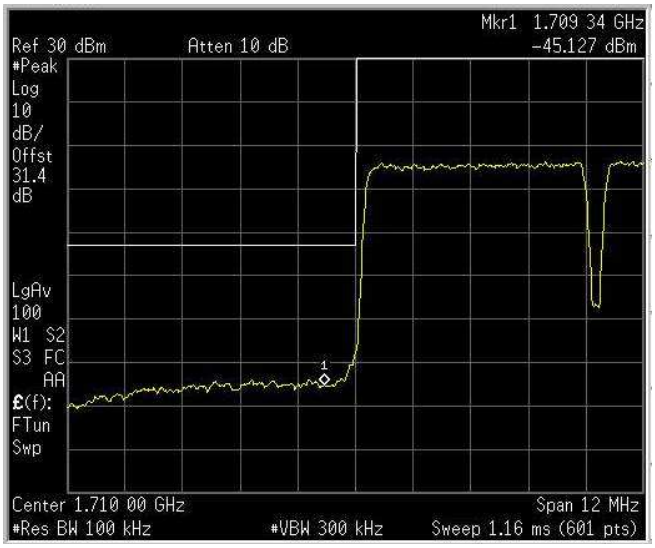


Low Band Edge

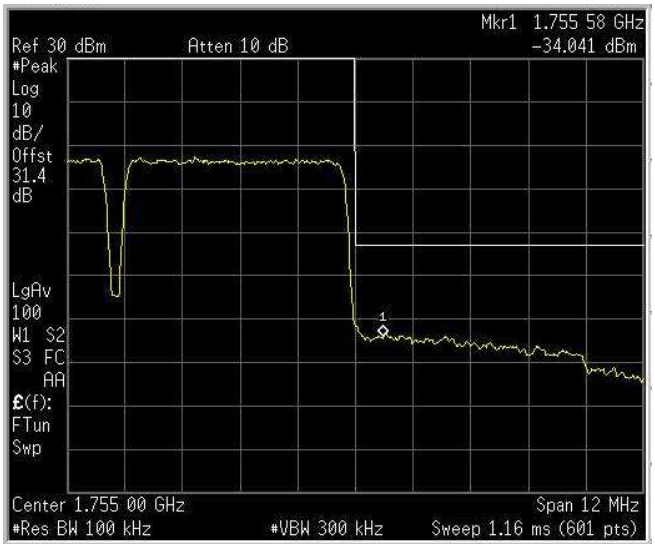


High Band Edge

Mod. LTE 5MHz (QAM) (Up-link)

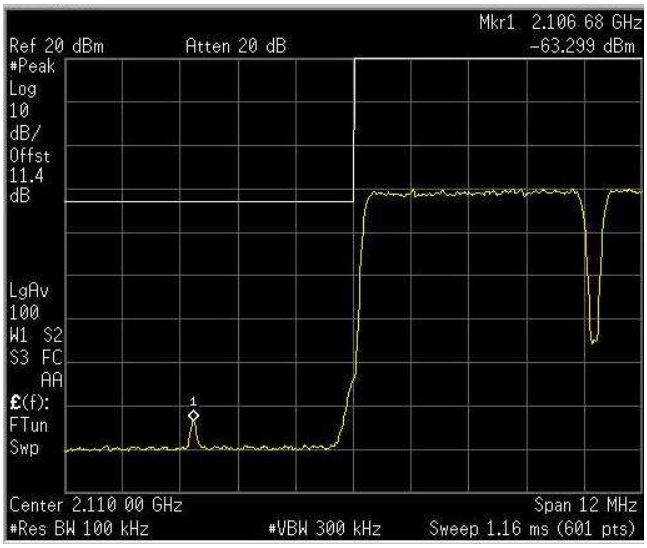


Low Band Edge

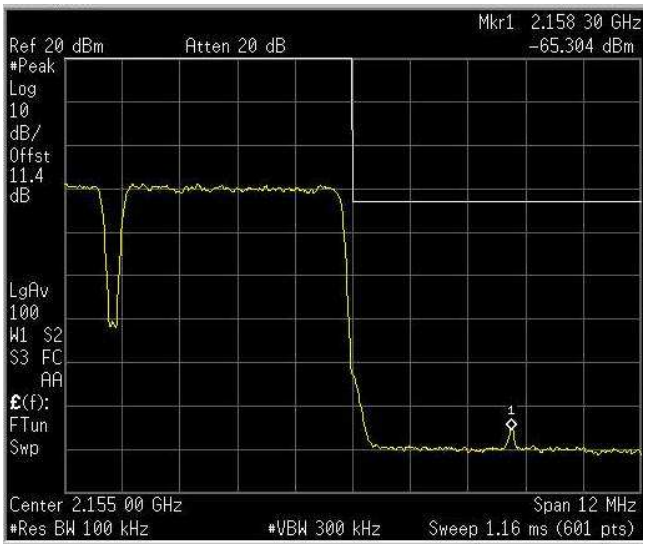


High Band Edge

Mod. LTE 5MHz (QPSK) (Down-link)

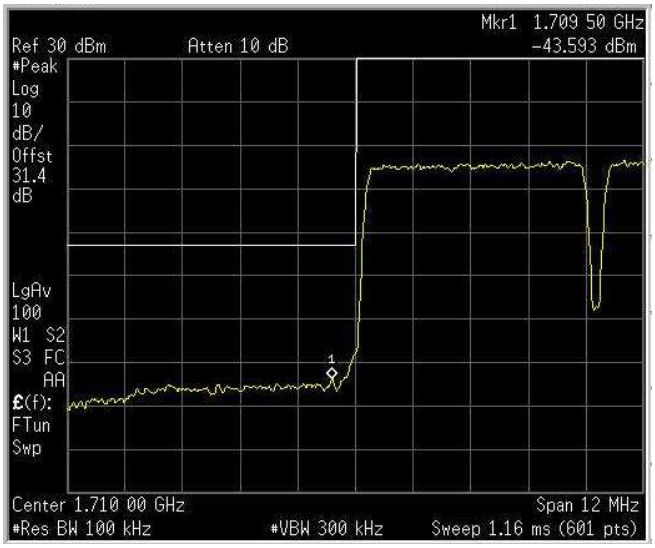


Low Band Edge

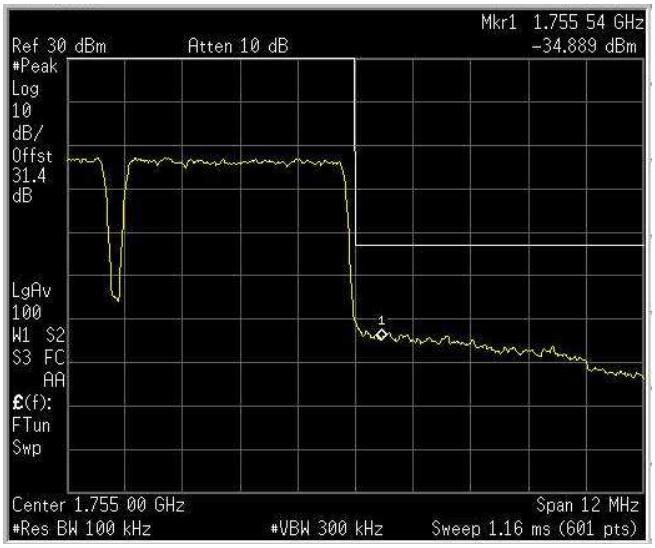


High Band Edge

Mod. LTE 5MHz (QPSK) (Up-link)

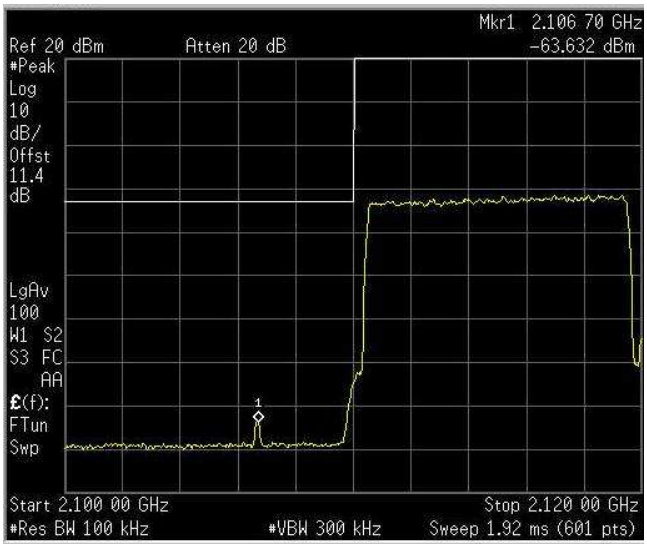


Low Band Edge

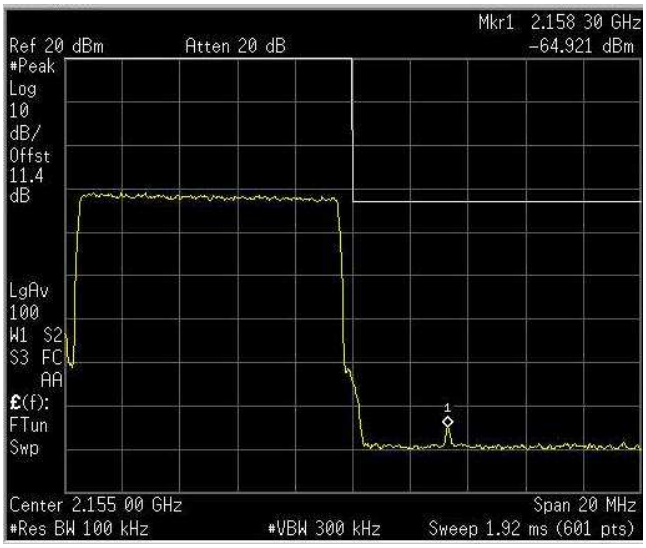


High Band Edge

Mod. LTE 10MHz (QAM) (Down-link)

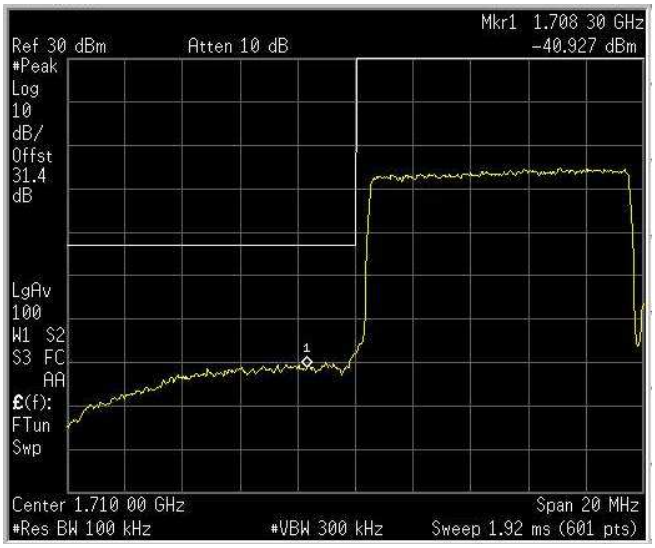


Low Band Edge

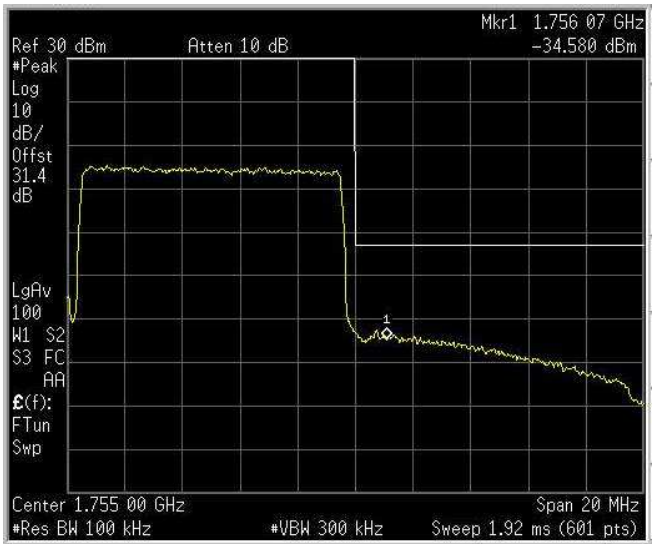


High Band Edge

Mod. LTE 10MHz (QAM) (Up-link)

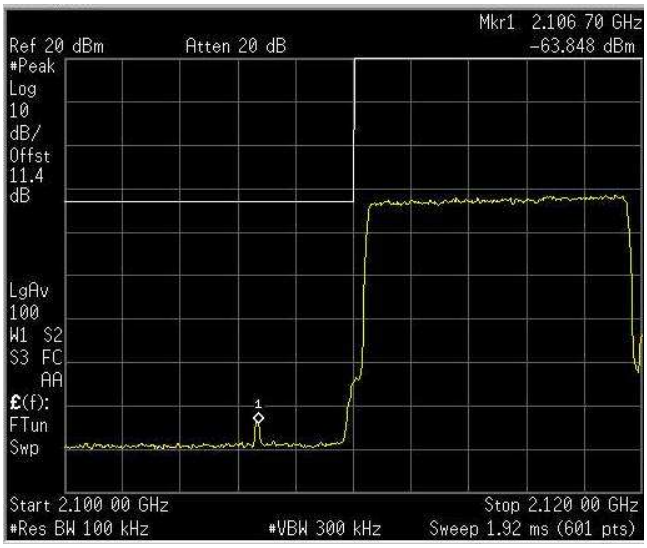


Low Band Edge

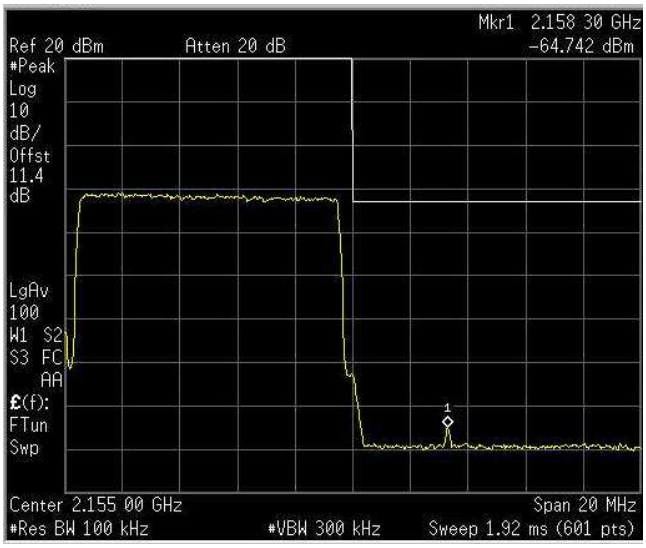


High Band Edge

Mod. LTE 10MHz (QPSK) (Down-link)

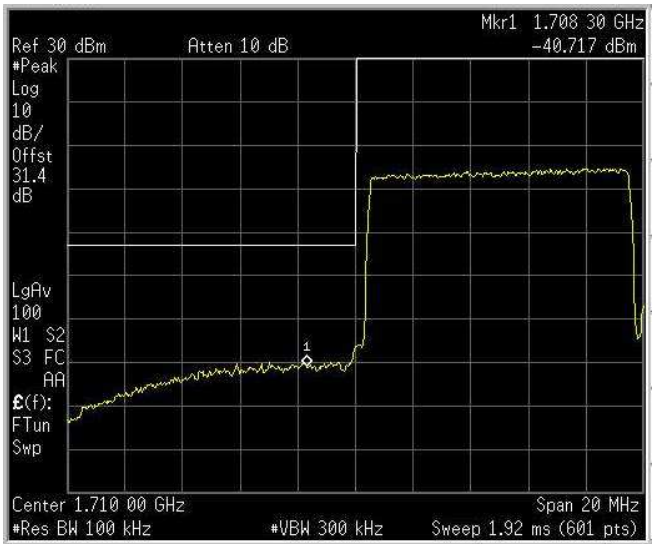


Low Band Edge

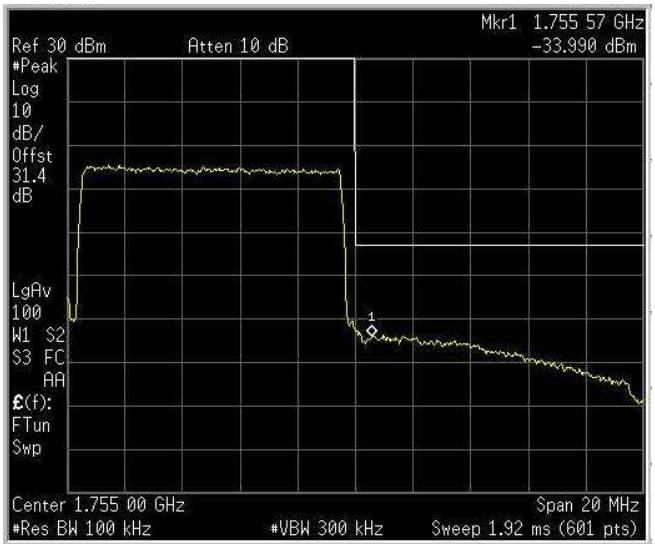


High Band Edge

Mod. LTE 10MHz (QPSK) (Up-link)

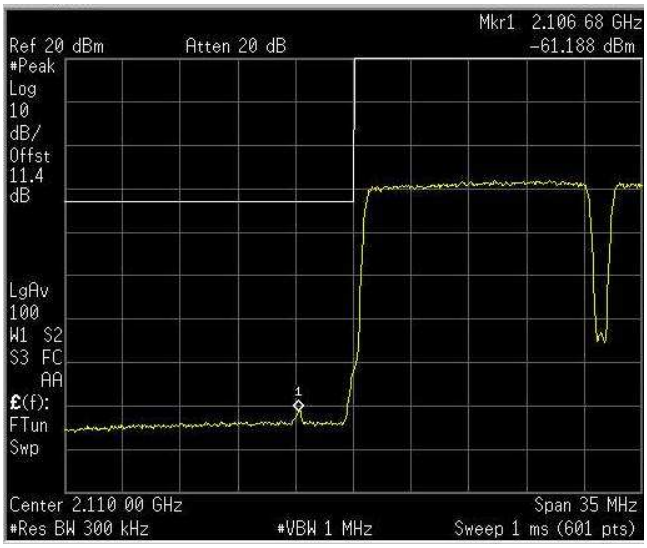


Low Band Edge

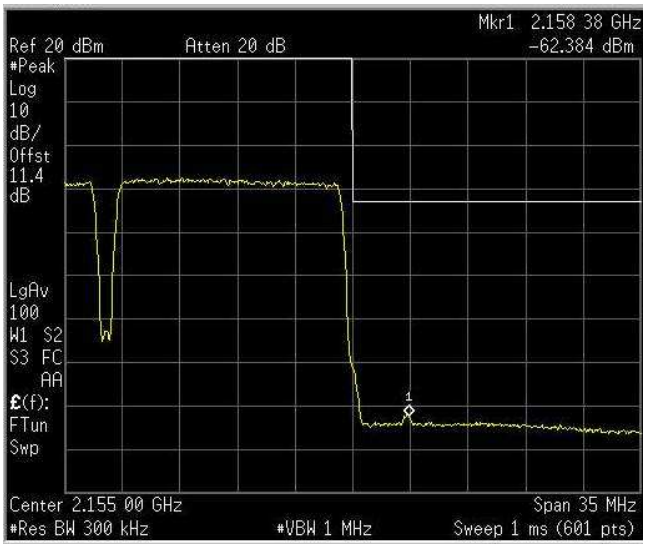


High Band Edge

Mod. LTE 15MHz (QAM) (Down-link)

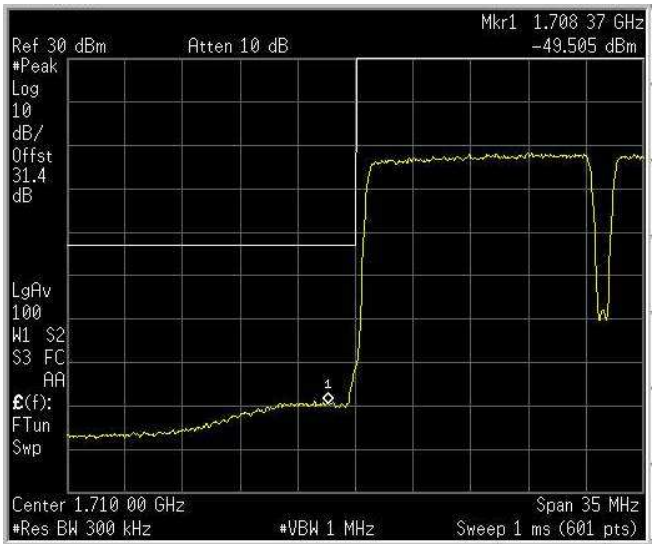


Low Band Edge

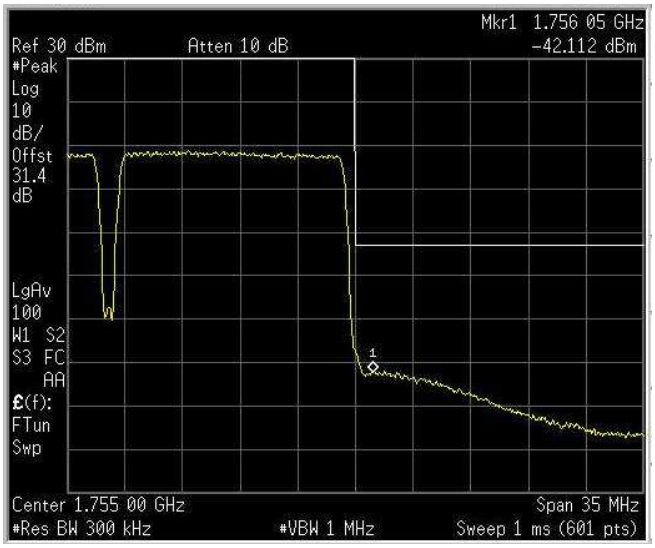


High Band Edge

Mod. LTE 15MHz (QAM) (Up-link)

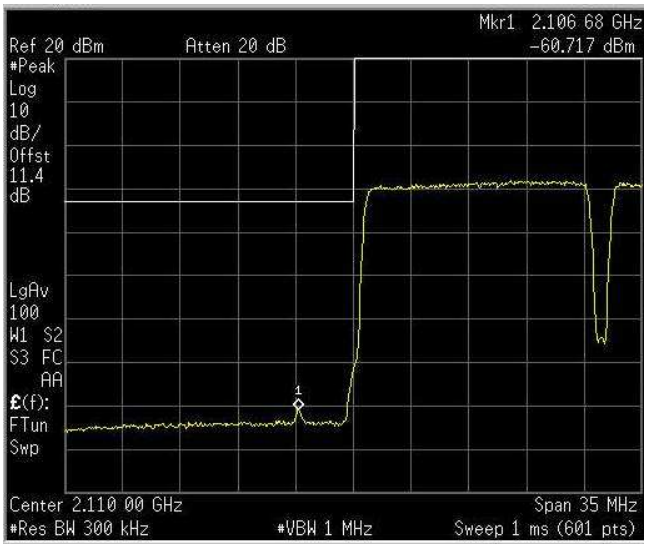


Low Band Edge

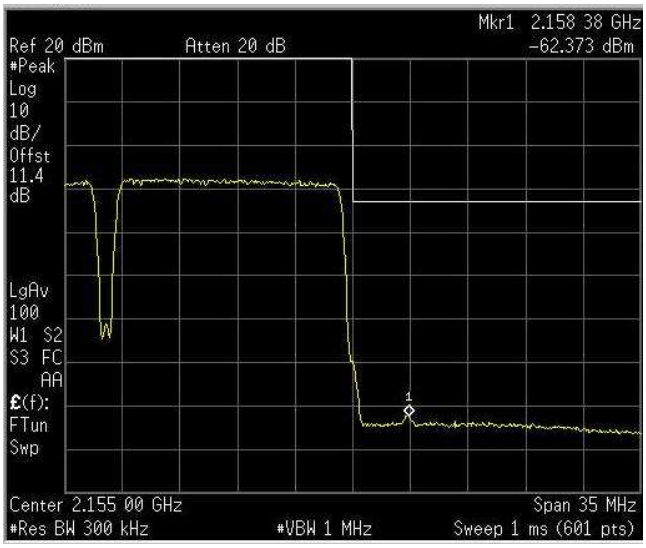


High Band Edge

Mod. LTE 15MHz (QPSK) (Down-link)

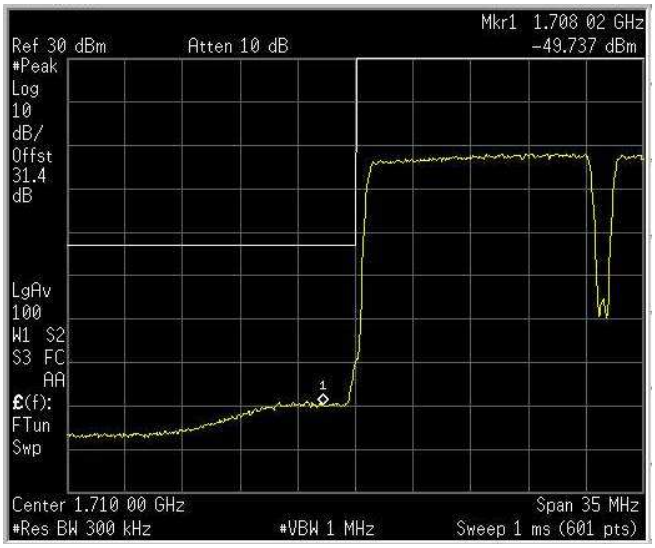


Low Band Edge

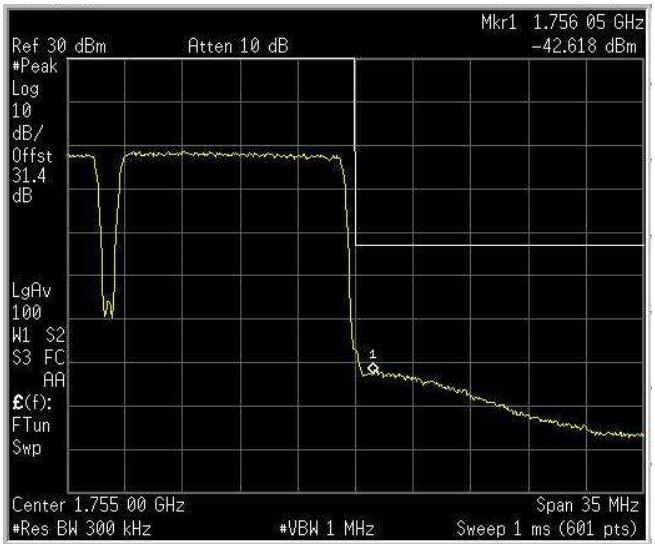


High Band Edge

Mod. LTE 15MHz (QPSK) (Up-link)

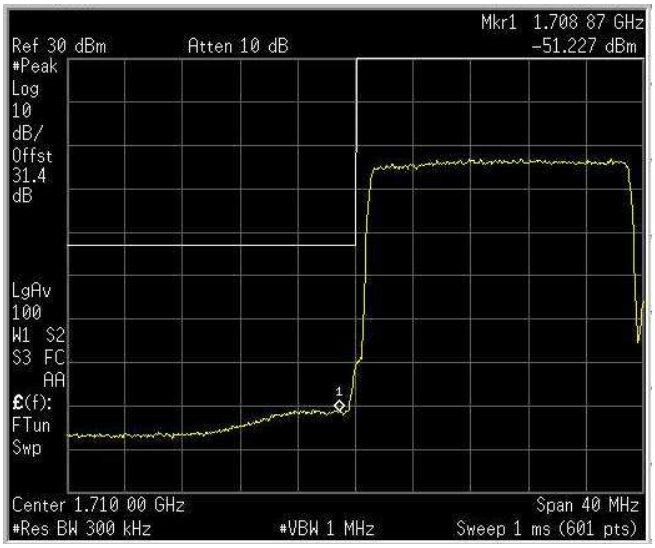


Low Band Edge

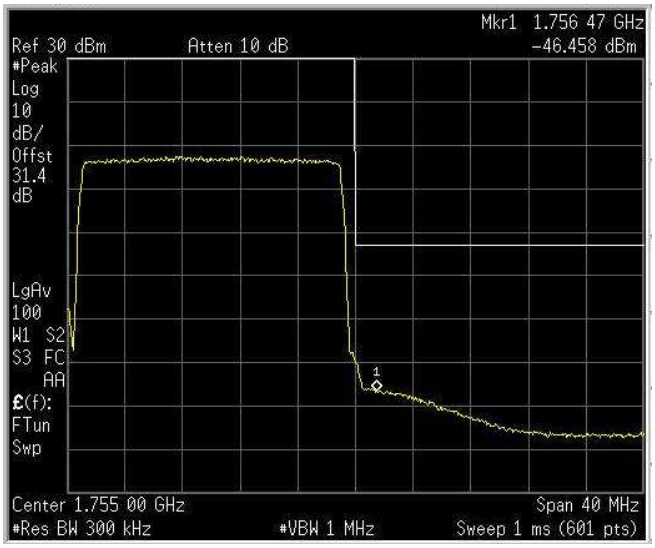


High Band Edge

Mod. LTE 20MHz (QAM) (Down-link)

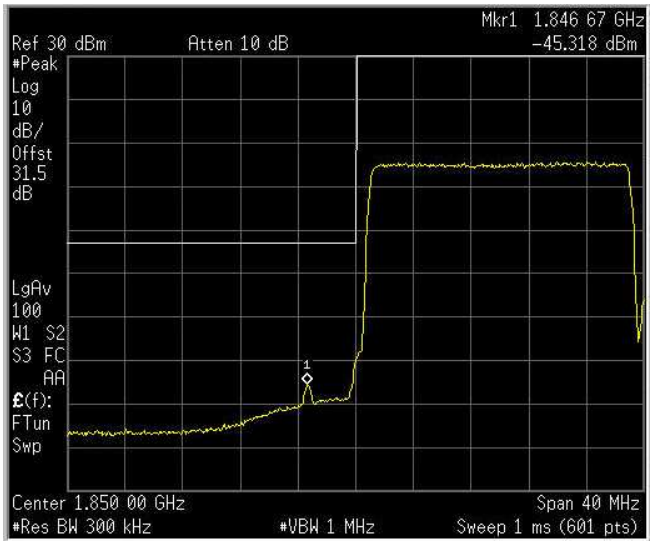


Low Band Edge

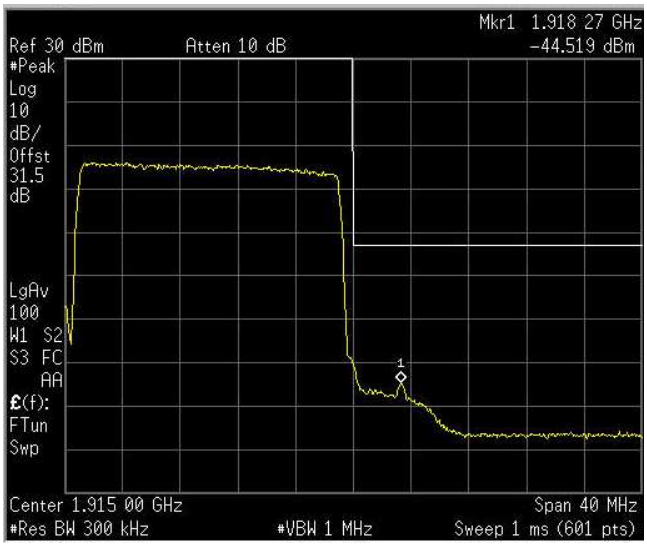


High Band Edge

Mod. LTE 20MHz (QAM) (Up-link)



Low Band Edge



High Band Edge