

Report Reference ID:	283384-4TRFWL
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Test specification:	Title 47-Telecommunication Chapter I – Federal Communications Commission Subchapter A – General Part 22 – Public Mobile Services Subpart H – Cellular Radiotelephone Service
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Applicant:	TEKO Telecom Srl. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Very Very High Power Module Amplifier
Model:	MWHPA0001AMPS-D
FCC ID:	XM2-WHPA8A

Testing laboratory:	Nemko Italy Spa Via del Carroccio, 4 20853 Biassono (MB) – Italy Telephone: +39 039 2201201 Facsimile: +39 039 2201221
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	Name and title	Date
Tested by:	 G. Curioni, Wireless/EMC Specialist	2015-05-22
Reviewed by:	 P. Barbieri, Wireless/EMC Specialist	2015-05-22

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Section 1: Report summary

This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Spa.

Test specification:

FCC Part 22 Subpart H, Cellular Radiotelephone Service

Compliance status:	Complies
Exclusions:	None
Non-compliances:	None
Report release history:	Original release
Test location:	Nemko Spa Via Del Carroccio, 4 – 20853 Biassono (MB) - Italy
Registration number:	481407 (10 m Semi anechoic chamber)

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.

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Section 2: Equipment under test

2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

Type of equipment:	Booster
Product marketing name:	Teko Telecom Srl
Model number:	MWHPA0001AMPS-D
Serial number:	1001116001
Nemko sample number:	-----
FCC ID:	XM2-WHPA8A
Date of receipt:	2015-05-18

2.2 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

No other FCC-ID equipment are used to exercise the EUT during testing

Item # 1

Type of equipment:	Power Supply
Brand name:	TDK Lambda
Model name or number:	Z36-24-L-E
Serial number:	LOC-535A218-0001
Nemko sample number:	-----
Connection port:	To supply amplifier
Cable length and type:	-----

Item # 2

Type of equipment:	Power supply
Brand name:	DF
Model name or number:	DF1731SB
Serial number:	na
Nemko sample number:	na
Connection port:	To supply cooling fan of heatsink
Cable length and type:	-----

Item # 3

Type of equipment:	
Brand name:	
Model name or number:	
Serial number:	
Nemko sample number:	
Connection port:	
Cable length and type:	

Item # 4

Type of equipment:	
Brand name:	
Model name or number:	
Serial number:	
Nemko sample number:	
Connection port:	
Cable length and type:	

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Section 2: Equipment under test, continued

2.3 EUT description

See confidential block diagram and operational description

2.4 Technical specifications of the EUT

Operating band:	Down Link 869-894 MHz; Up Link 824-849 MHz
Operating frequencies:	Wideband
Modulation type:	GSM, EDGE, CDMA, WCDMA, LTE (QAM and QPSK)
Occupied bandwidth:	GSM and EDGE: 200 kHz; CDMA: 1,25 MHz, WCDMA: 5 MHz LTE: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz
Channel spacing:	Standard
Emission designator:	GSM and EDGE: GXW; CDMA, WCDMA: F9W, LTE: D7W
RF Output	Down Link: 46dBm (40W) Up Link: N.A. (The EUT does not transmit over the air in the up-link direction)
Gain	Down Link: 51dB Up Link: N.A. (The EUT does not transmit over the air in the up-link direction)
Antenna data:	No antenna provided
Antenna type:	No antenna provided External Antenna (Equipment that has an external 50 Ω RF connector)
Power source	28-30 Vdc

Section 2: Equipment under test, continued

2.5 EUT setup diagram

In this system, Very Very High Power Amplifier is the EUT and it is intended for mounting in Remote Unit and Digital Service Front-End (optical system with Master Unit that includes only management module and optical module, to convert RF signal in optical signal in down link direction and viceversa optical signal in RF signal in up link direction). As described in "Operational description", master unit is connected directly to base station, so the system doesn't use another equipment (under another FCC ID) to exercise the EUT. Signal generator is linked directly to the RF input connector.

Test setup for output power, occupied bandwidth, spurious emissions:



Procedure

Connect the signal modulated generator to the input of the EUT, so that the EUT works at the max gain. Raise the input level to the EUT until reach the maximum output power. Connect the spectrum analyzer to the RF output connector of the EUT.

2.6 Operation of the EUT during testing

In down-link direction, normal working at max gain with max RF power output

2.7 Modifications incorporated in the EUT

None

There were no modifications performed to the EUT during this assessment

Section 3: Test conditions

3.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

3.2 Test conditions, power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa 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 $\pm 5\%$, for which the equipment was designed.

Section 3: Test conditions, continued

3.3 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 can be found in Nemko S.p.A. document WML1002.

3.4 Test equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Vector Signal Generator	Agilent	N5172B EXG	MY53050534	Feb 2017
Vector Signal Generator	Agilent	E4438C ESG	MY45094485	Ago 2016
Spectrum Analyzer	Agilent	N9030A PXA	MY53120882	May 2015
Network Analyzer	Agilent	E5071B ENA	MY46418709	Jan 2016
EMI Receiver	R & S	ESCI	100888	08/2015
V-network	R & S	ESH2-Z5	872 460/041	09/2015
Trilog Broad Band Antenna 25-2000 MHz	Schwarzbeck	VULB 9168	VULB 9168-242	06/2015
Trilog Broad Band Antenna 25-8000 MHz	Schwarzbeck	VULB 9162	VULB 9162-25	05/2015
Antenna 1-18 GHz	Schwarzbeck	STLP 9148	STPL 9148-123	06/2015
Double ridge waveguide horn	RFspin	DRH40	061106A40	08/2016
Preamplifier 18-40 GHz	Miteq	JS44	1648665	11/2015
Broadband preamplifier 1-18 GHz	Schwarzbeck	BBV 9718	9718-137	10/2015
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	04/2016
EMI receiver 20 Hz ÷ 3 GHz	R&S	ESCI	100888	08/2015
Hydraulic revolving platform	Nemko	RTPL 01	4.233	NCR
Turning-table	R&S	HCT	835 803/03	NCR
Antenna mast	R&S	HCM	836 529/05	NCR
Controller	R&S	HCC	836 620/7	NCR
Spectrum Analyzer 9kHz ÷ 40GHz	R&S	FSEK	848255/005	08/2015
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	09/2016
Shielded room	Siemens	10m control room	1947	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	70	NCR
Shielded Room	Siemens	3m semi-anechoic chamber	3	NCR
Motor controller	Emco	1051-25	9012-1559	NCR
Motor controller	Emco	1061-1.521	9012-1508	NCR
Antenna Tower	Emco	2071-2	9601-1940	NCR
Controller pole/table	Emco	2090	9511-1099	NCR
V-Network	R & S	ESH2-Z5	872 460/041	09/2015

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use
(*) Equipment supplied by manufacturer's

Section 4: Result summary

4.1 Test results

The apparatus was assessed against the following specifications:

FCC Part 2 Subpart J, Equipment Authorization Procedures
FCC Part 22 Subpart H Cellular Radiotelephone Service

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N	No : not applicable / not relevant.
Y	Yes : Mandatory i.e. the apparatus shall conform to these tests.
N/T	Not Tested, mandatory but not assessed. (See report summary)

Part	Test description	Required	Result
§22.913(a)	Effective radiated power limits (500 W erp)	Y	Pass
§2.1049	Occupied bandwidth (Input/Output)	Y	Pass
§22.917	Out of band emissions (antenna terminals)	Y	Pass
§22.917	Field Strength of Spurious Emissions	Y	Pass
§22.355	Frequency tolerance	N	N/A a)
§ 935210 D02v02r01 (D.3)(I)	Out of band rejection	Y	Pass

Notes:

- a) NOT APPLICABLE: Modulation/frequency conversion circuitry not in use. No frequency change in EUT (input and output have same frequency)

Appendix A: Test results

Clause 22.913(a) Effective radiated power limits

The effective radiated power (ERP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

- (a) Maximum ERP. In general, the effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts (57 dBm).

Test date: 2015-05-21

Test results: Pass

Special notes

Conducted measurement were performed:

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

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

Only conducted measurement at antenna connector was possible, no antenna provided by manufacturer

Clause 22.913(a) Effective radiated power limits, continued

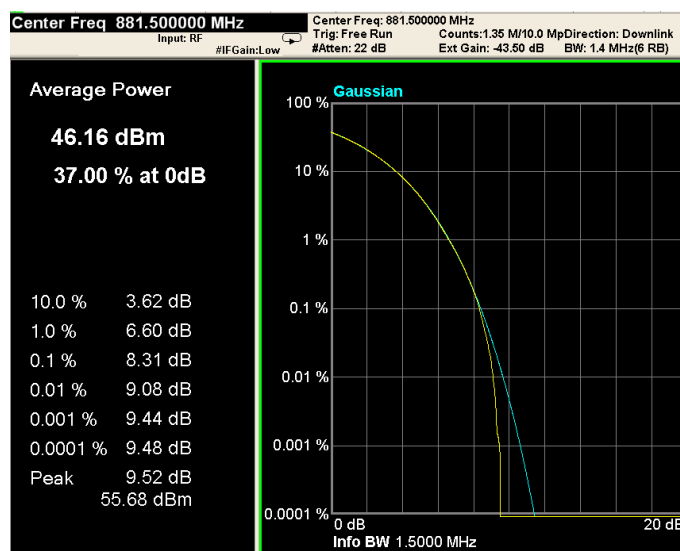
Test data

Conducted measurements

Test data

Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PAR (dB)
Down-link	GSM (200 kHz)	881.5	46.13	41.02	0.06
Down-link	EDGE (200 kHz)	881.5	46.13	41.02	3.48
Down-link	CDMA (1,25MHz)	881.5	46.17	41.40	8.72
Down-link	WCDMA (5MHz)	881.5	46.15	41.21	9.82
Down-link	LTE (QAM, 1,4MHz)	881.5	46.16	41.30	9.52
Down-link	LTE (QPSK, 1,4MHz)	881.5	46.15	41.21	9.19
Down-link	LTE (QAM, 3MHz)	881.5	46.19	41.59	9.35
Down-link	LTE (QPSK, 3MHz)	881.5	46.12	40.93	9.52
Down-link	LTE (QAM, 5MHz)	881.5	46.21	41.78	9.72
Down-link	LTE (QPSK, 5MHz)	881.5	46.18	41.50	9.56
Down-link	LTE (QAM, 10MHz)	881.5	46.23	41.98	9.53
Down-link	LTE (QPSK, 10MHz)	881.5	46.17	41.40	9.58

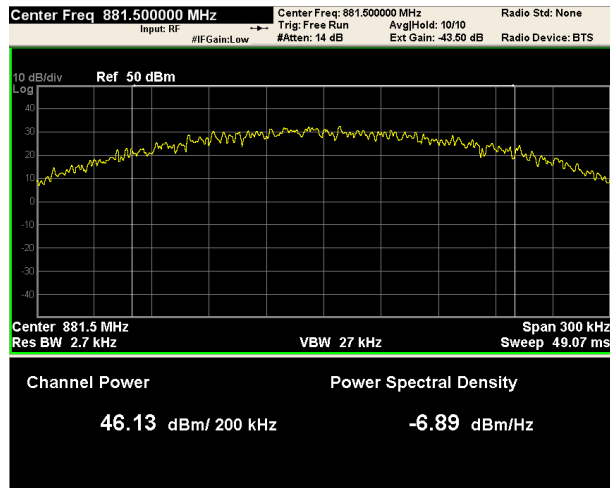
PAR measure is performed by the “CCDF” function installed on Spectrum analyzer that provides average power (the same measured with “Channel power” function), peak power and PAR. Below an example:



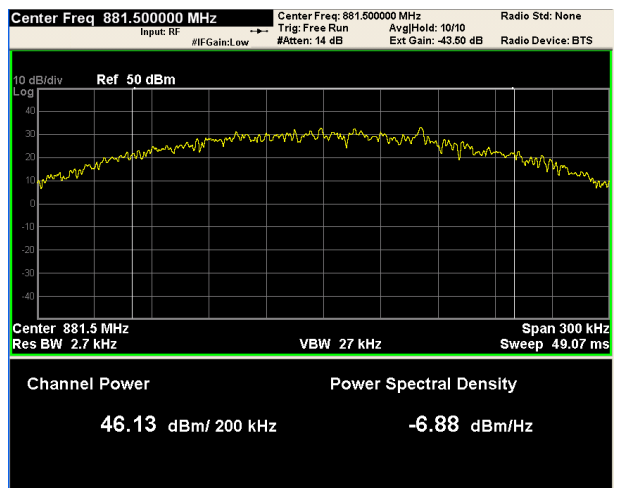
PAR measure example (LTE 1,4MHz QAM)

Test data

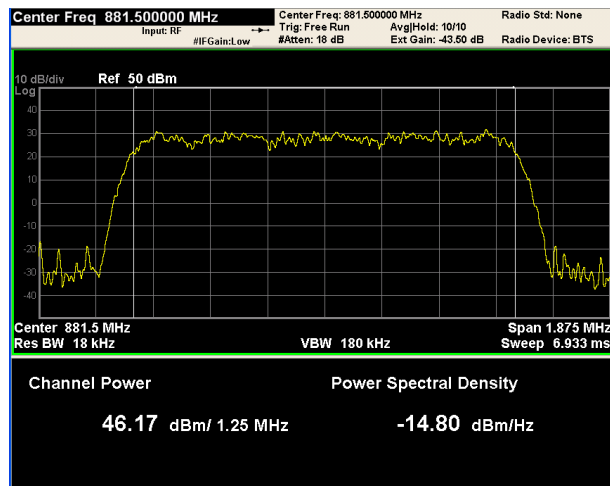
Mod. GSM



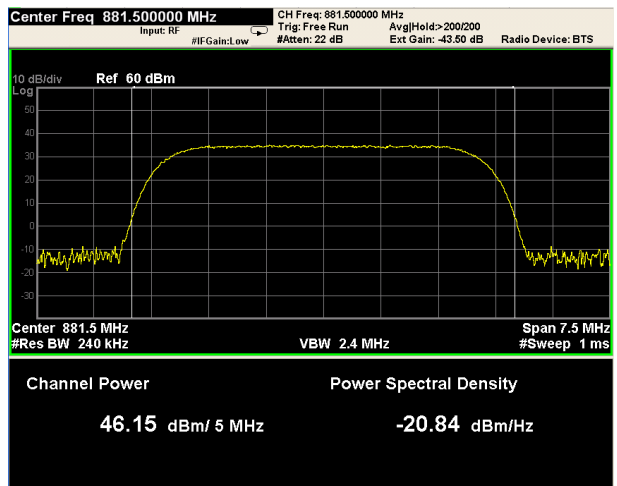
Mod. EDGE



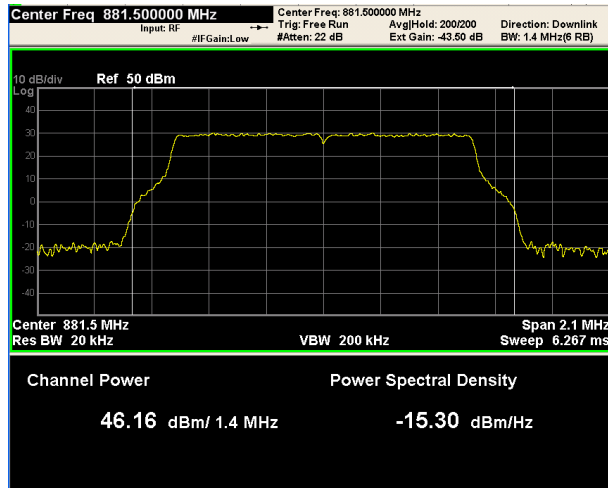
Mod. CDMA



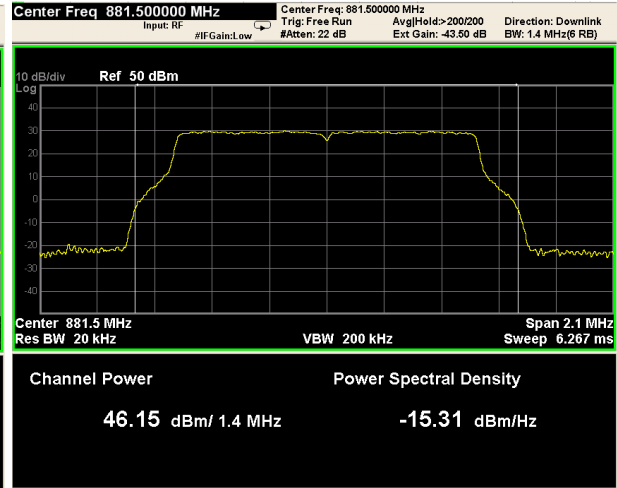
Mod. WCDMA



Mod. LTE 1,4MHz (Down-link)

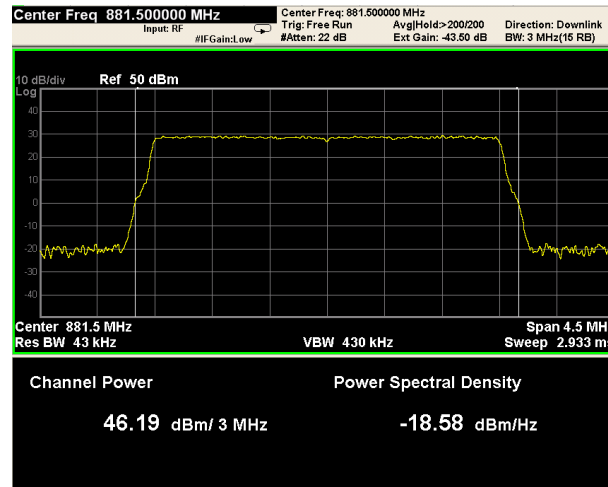


QAM

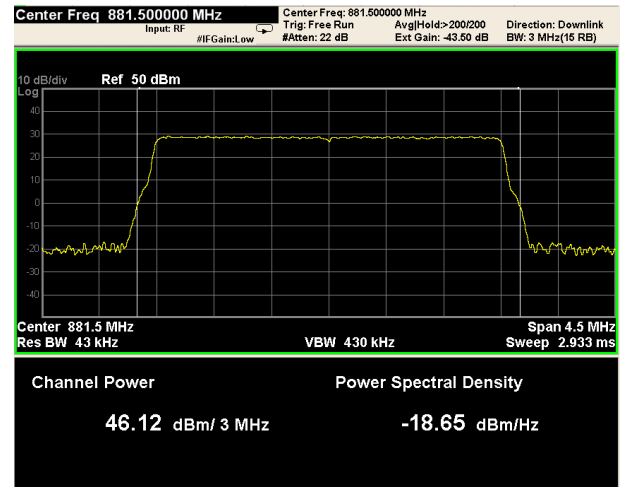


QPSK

Mod. LTE 3MHz (Down-link)

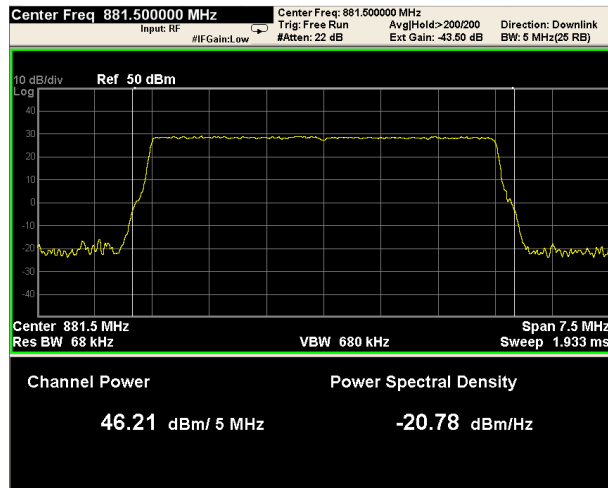


QAM

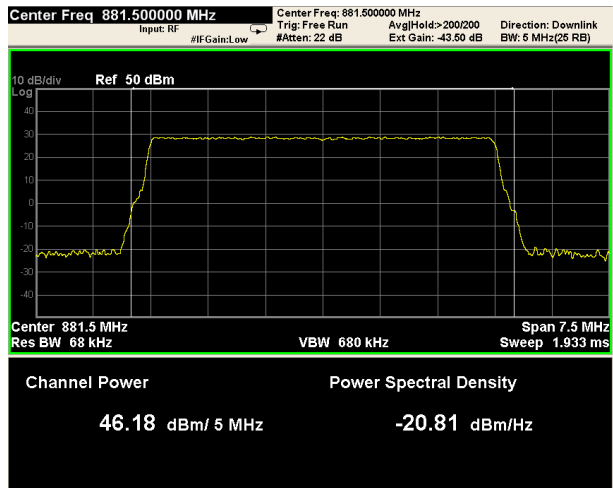


QPSK

Mod. LTE 5MHz (Down-link)

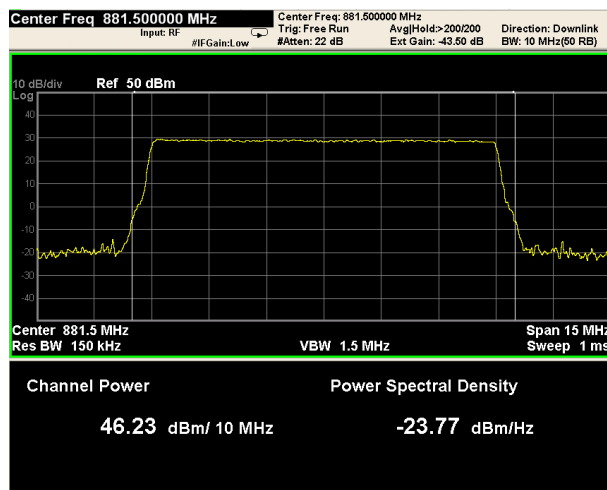


QAM

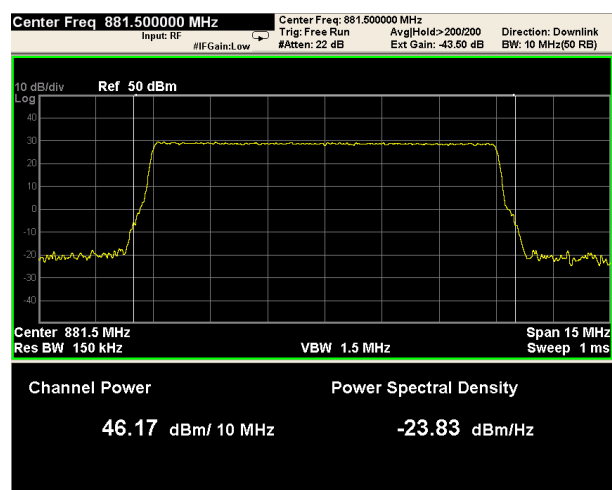


QPSK

Mod. LTE 10MHz (Down-link)



QAM



QPSK

Clause 2.1049 Occupied bandwidth

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.

Test date: 2015-05-21

Test results: Pass

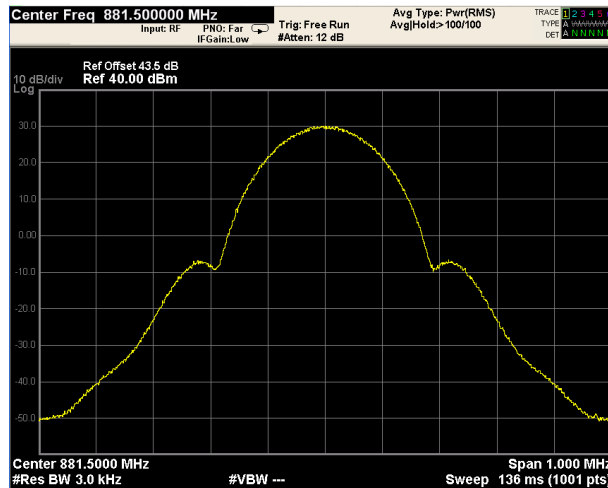
Special notes

Resolution bandwidth was set wider than occupied bandwidth.

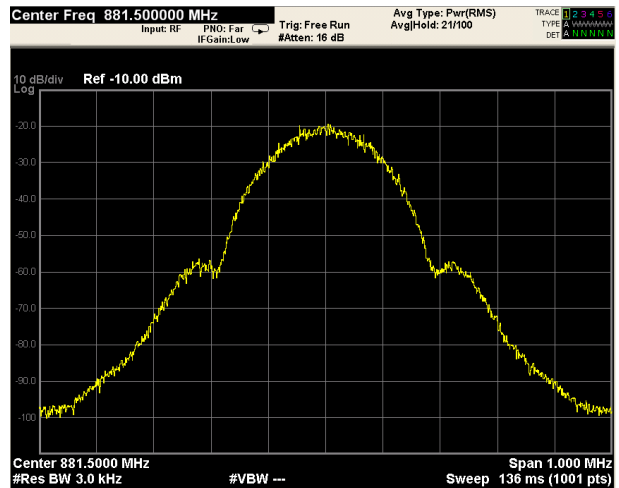
Clause 2.1049 Occupied bandwidth, continued

Test data

Mod. GSM (Down-link)

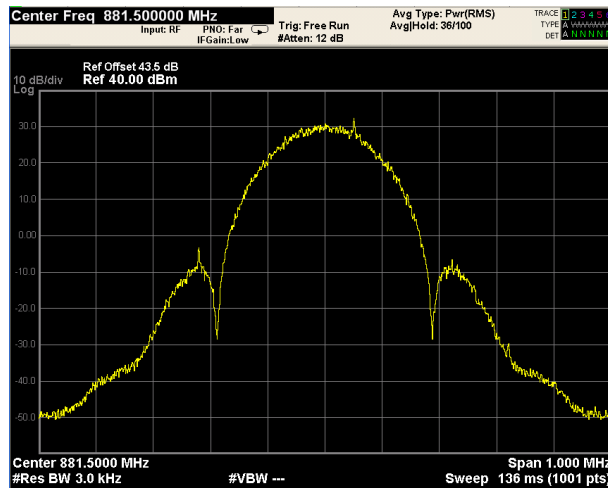


Output

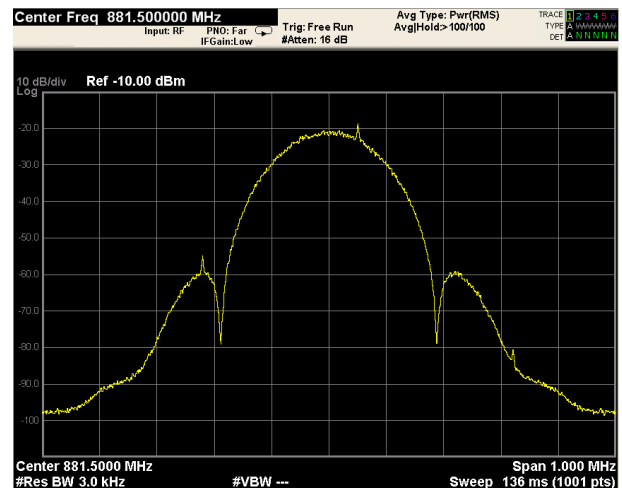


Input

Mod. EDGE (Down-link)

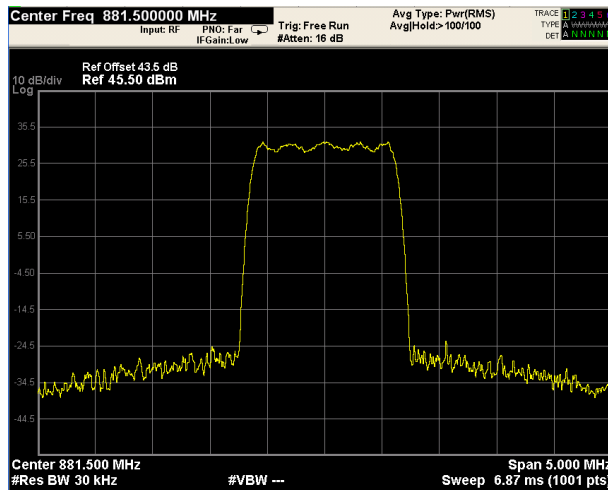


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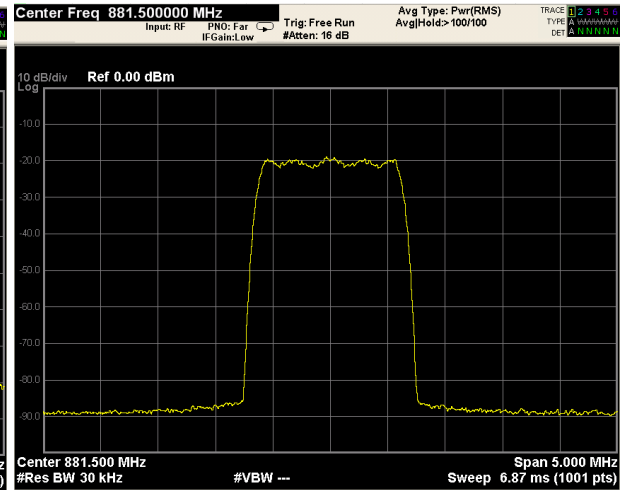


Input

Mod. CDMA (Down-link)

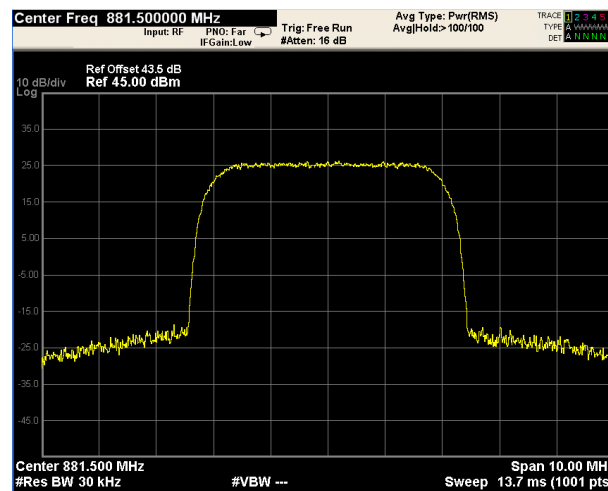


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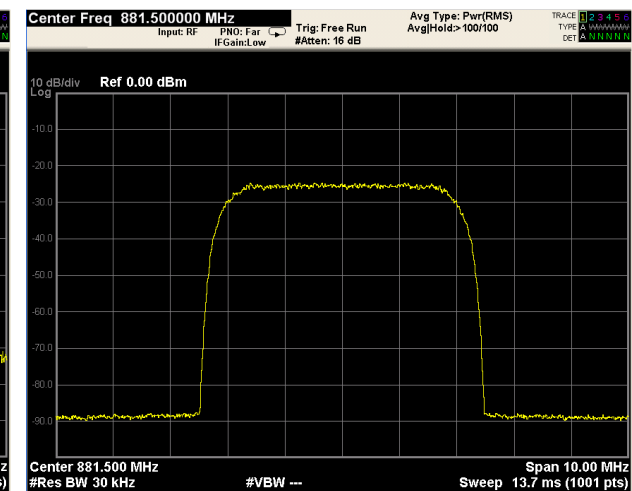


Input

Mod. WCDMA (Down-link)

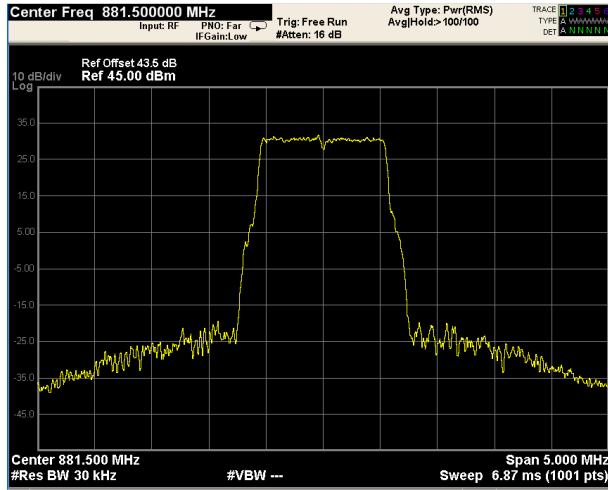


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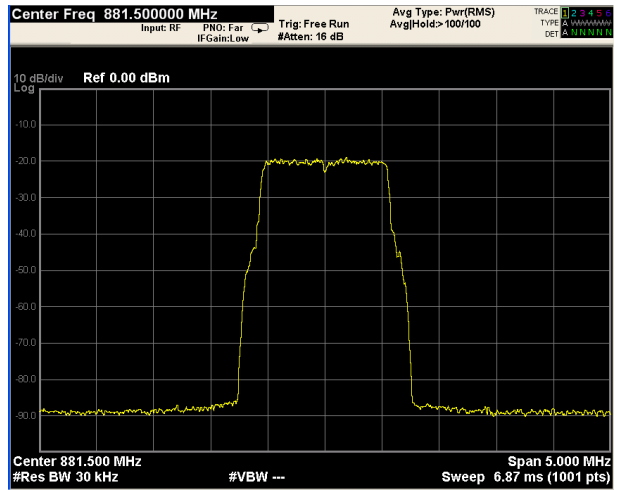


Input

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

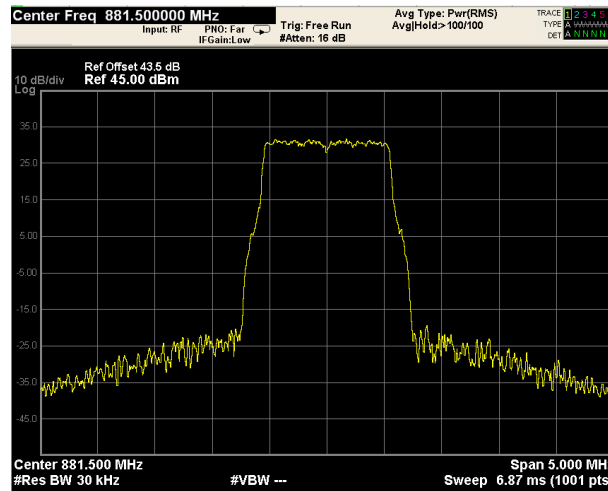


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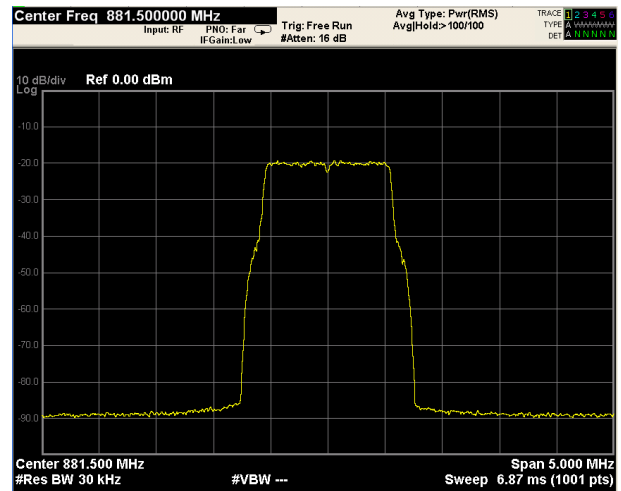


Input

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

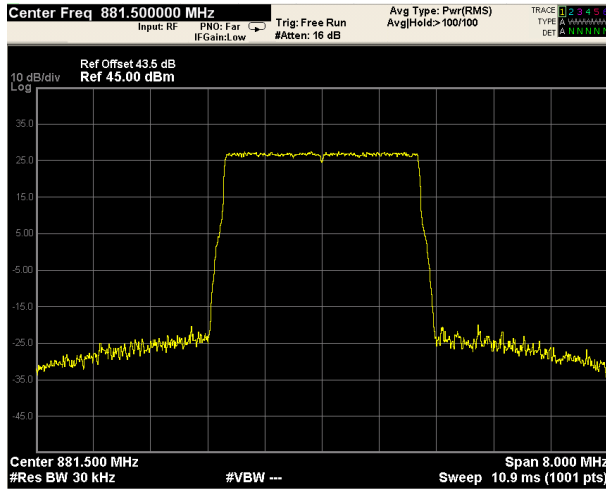


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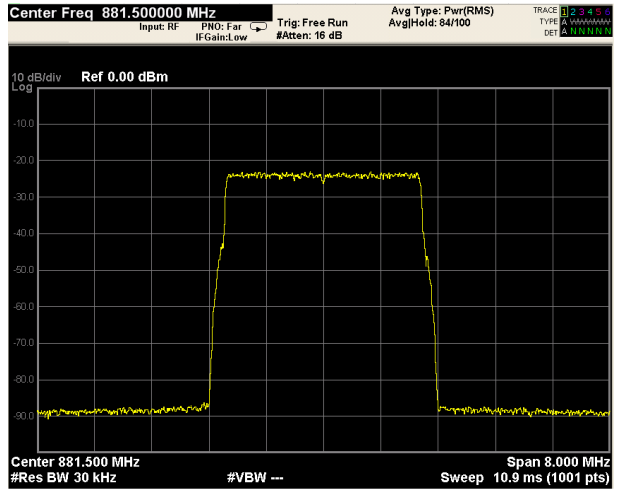


Input

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

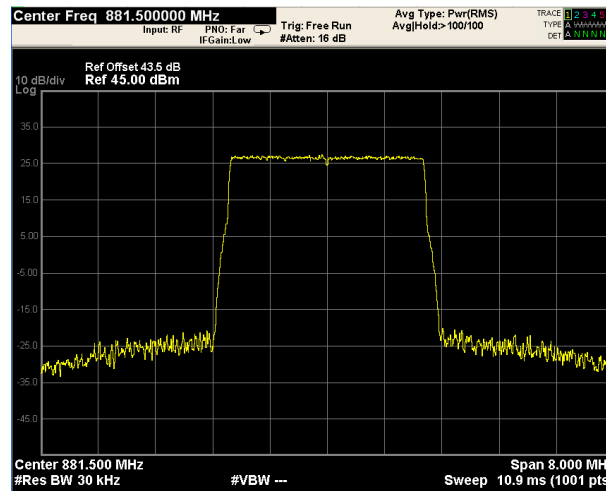


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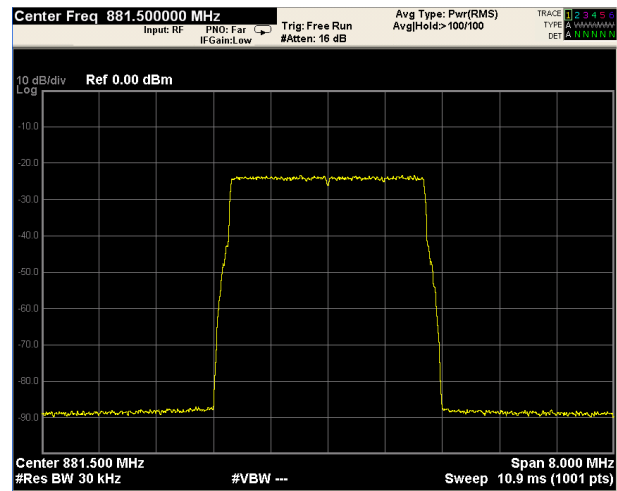


Input

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

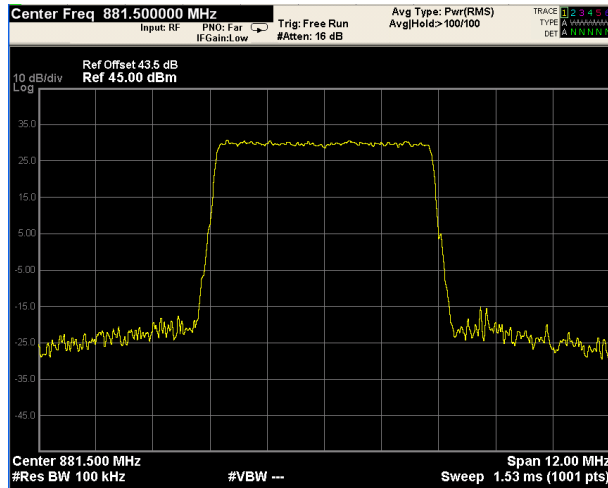


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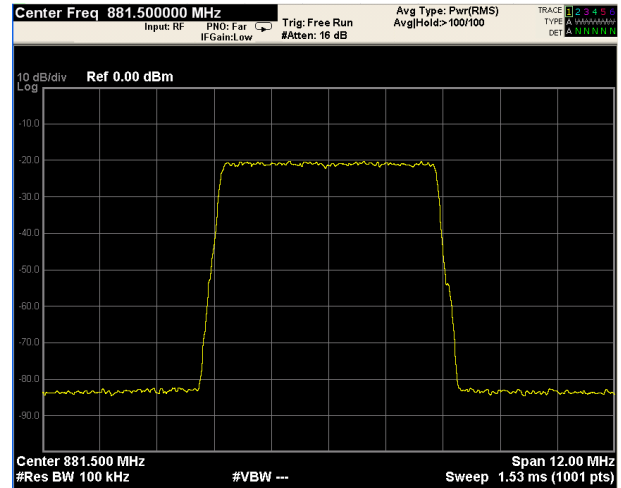


Input

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

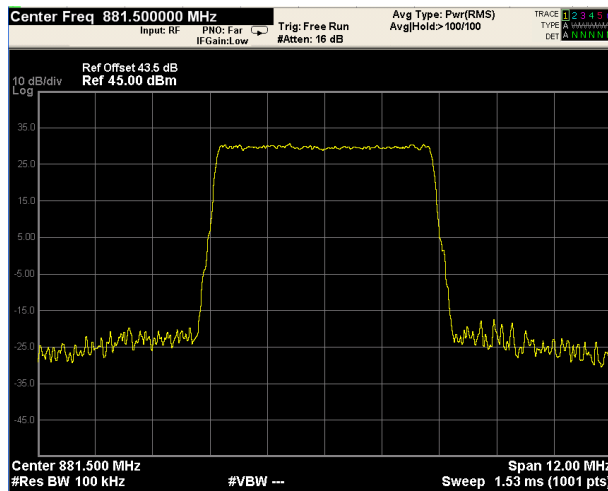


Output

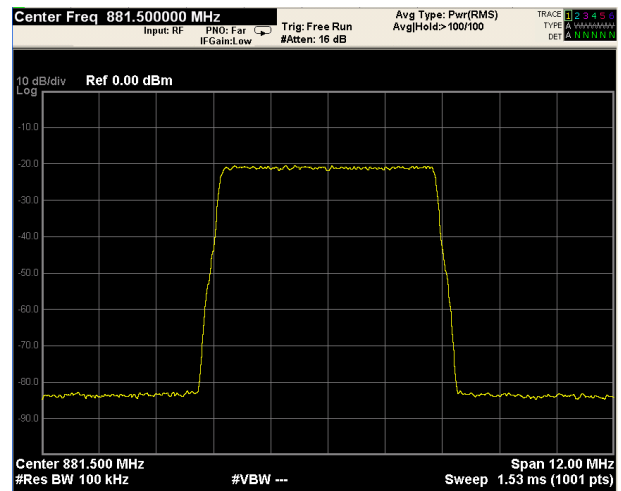


Input

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

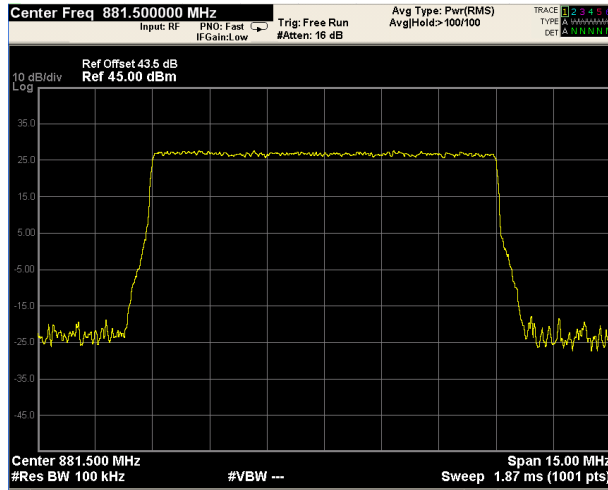


Output

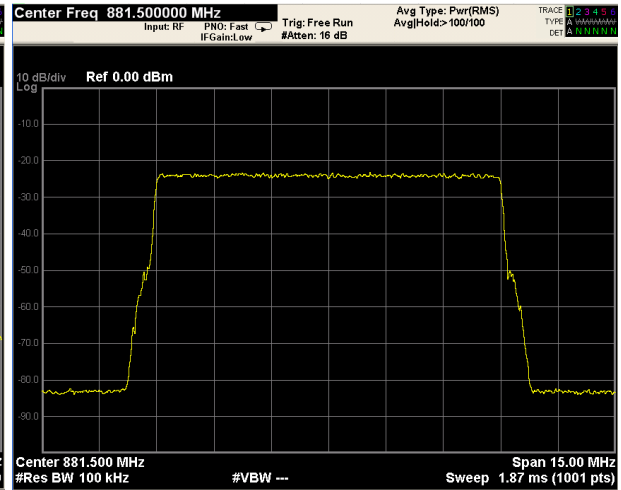


Input

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

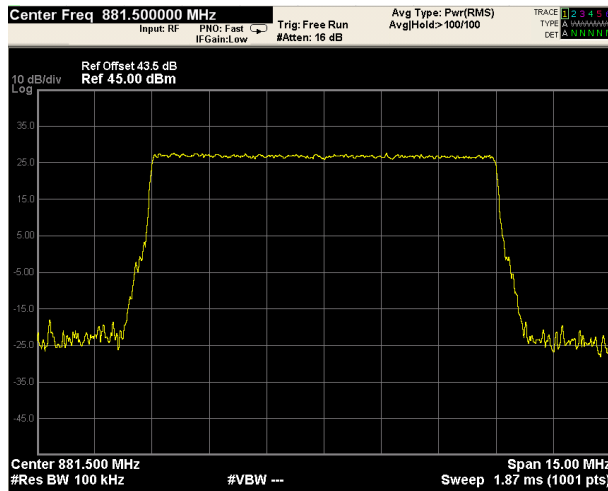


Output

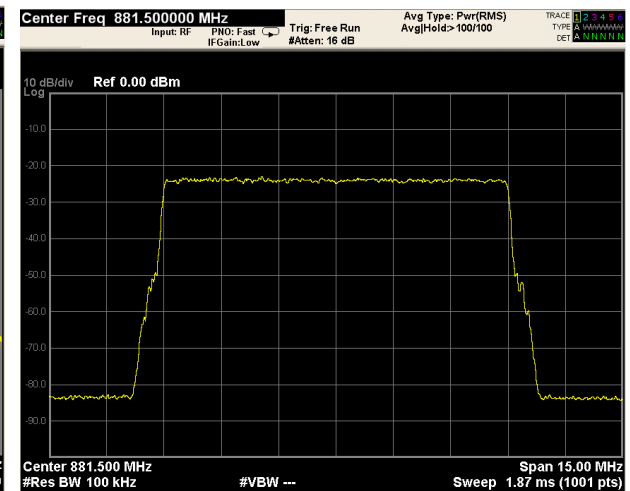


Input

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



Output



Input

Clause 22.917 Out of band emissions at antenna terminal

- (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).

Test date: 2015-05-21

Test results: Pass

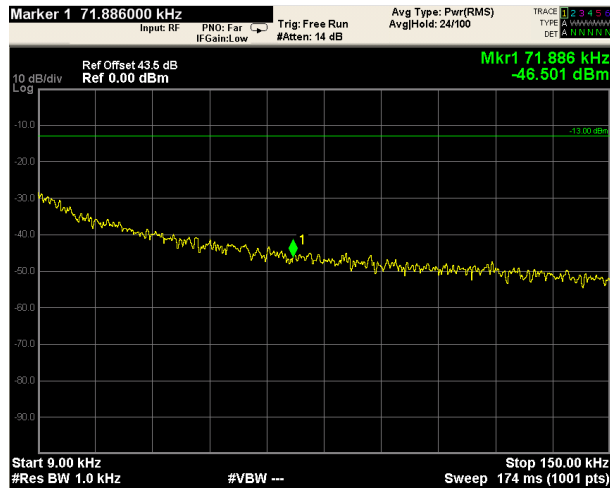
Special notes

- The spectrum was searched from 30 MHz up to 10th harmonic
- Only the worst data presented in the test report.
- **VBW = 3 x RBW**

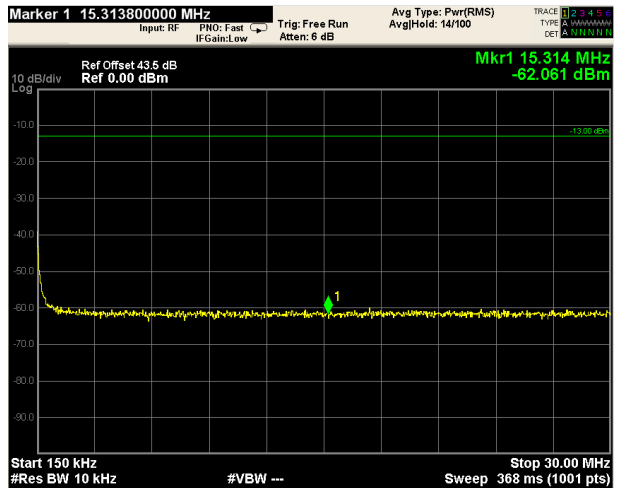
Clause 22.917 Out of band emissions at antenna terminal, continued

Test data

Mod. GSM (Down-link)



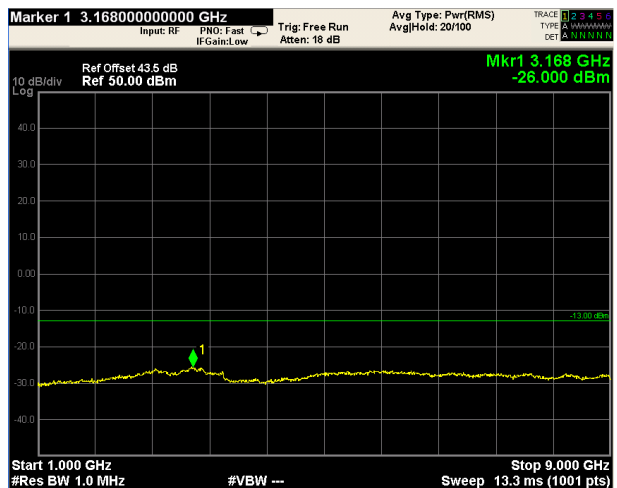
9kHz-150kHz



150kHz-30MHz

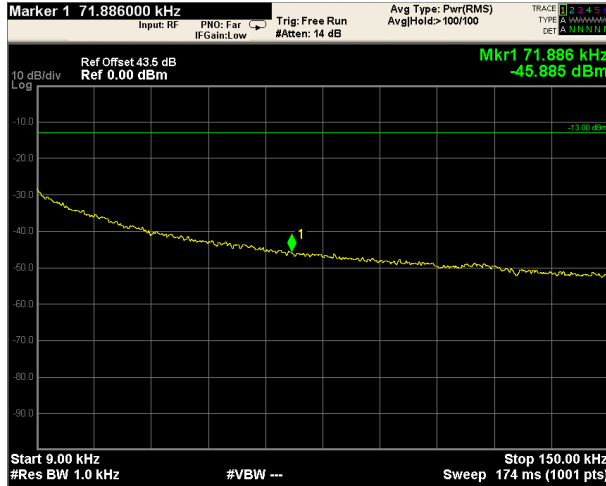


30MHz-1GHz

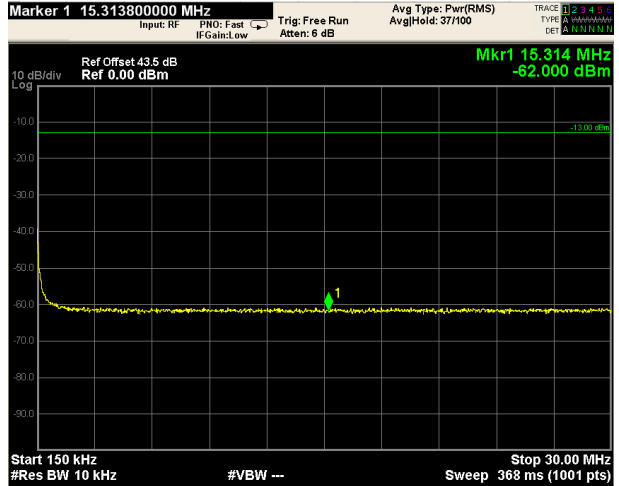


1GHz-9GHz

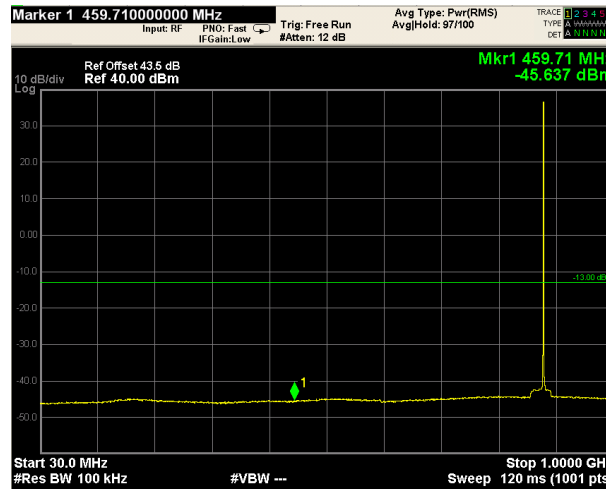
Mod. EDGE (Down-link)



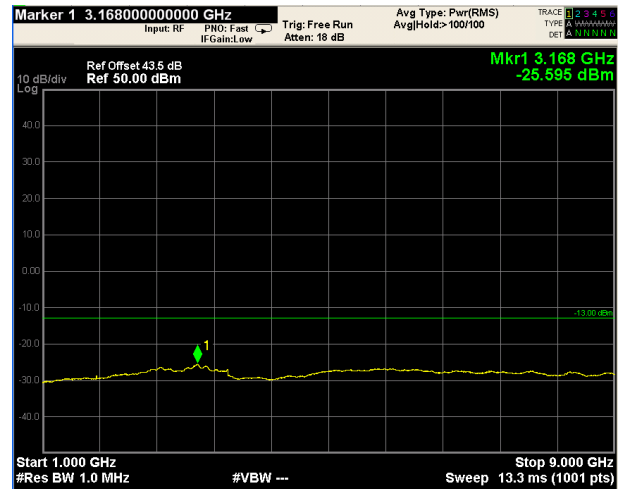
9kHz-150kHz



150kHz-30MHz

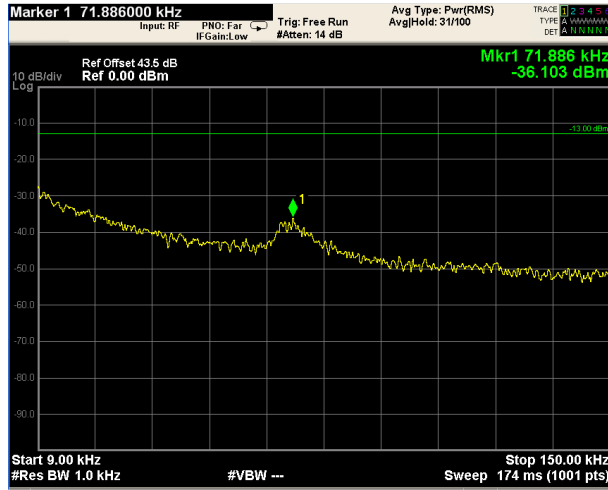


30MHz-1GHz

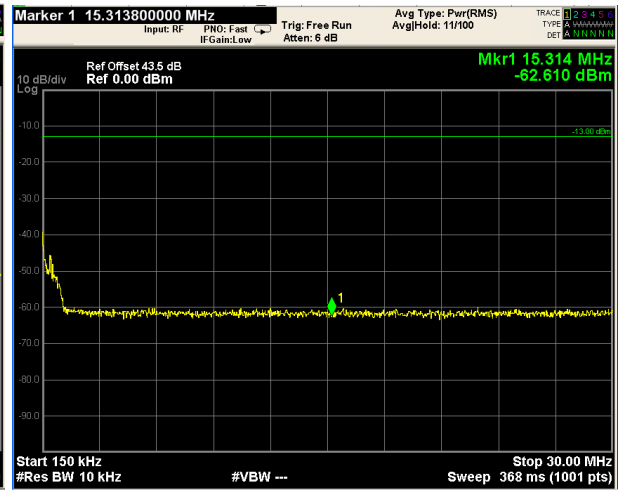


1GHz-9GHz

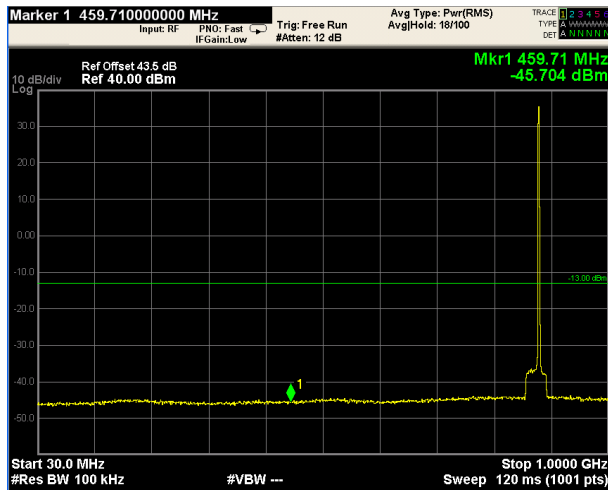
Mod. CDMA (Down-link)



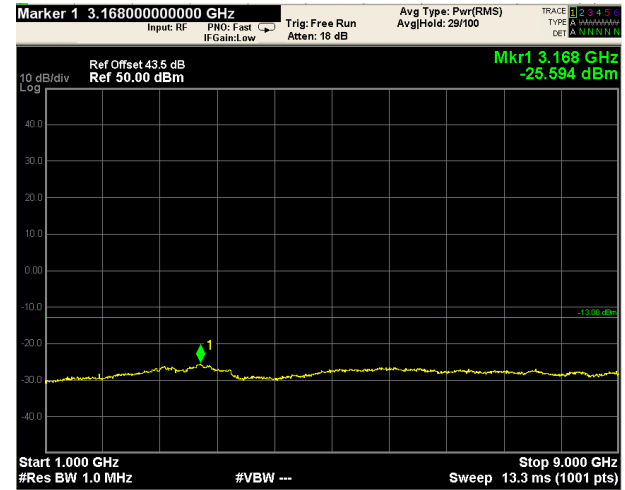
9kHz-150kHz



150kHz-30MHz

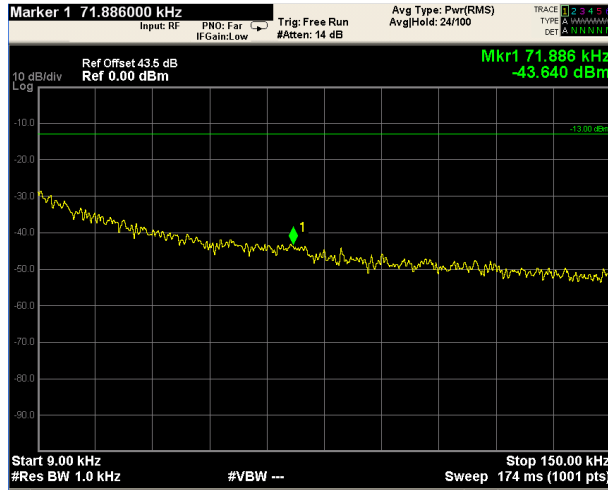


30MHz-1GHz

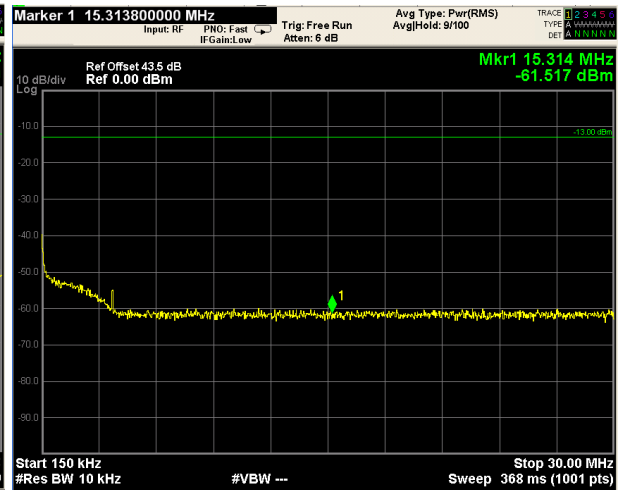


1GHz-9GHz

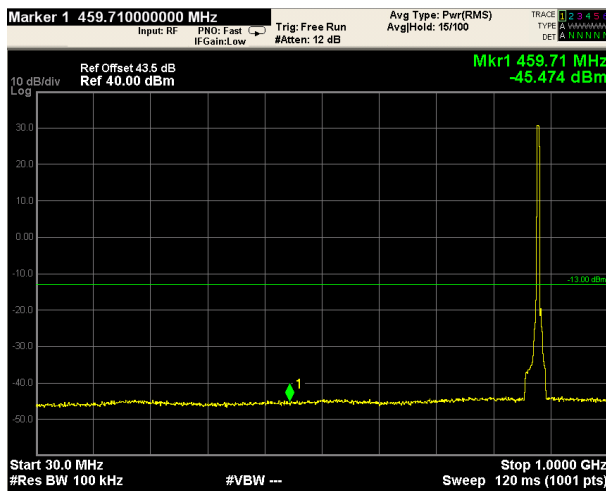
Mod. WCDMA (Down-link)



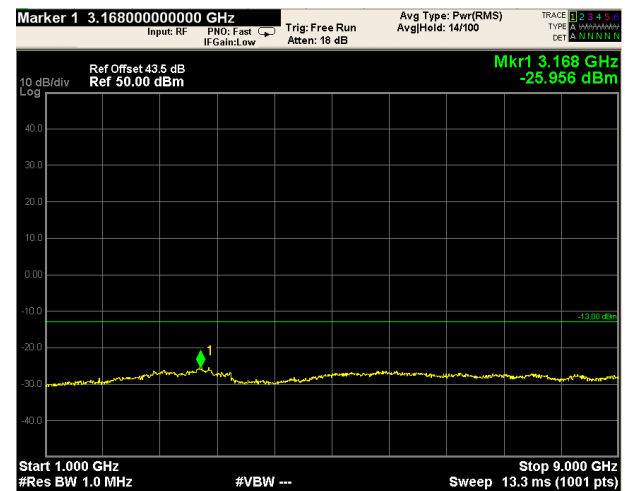
9kHz-150kHz



150kHz-30MHz

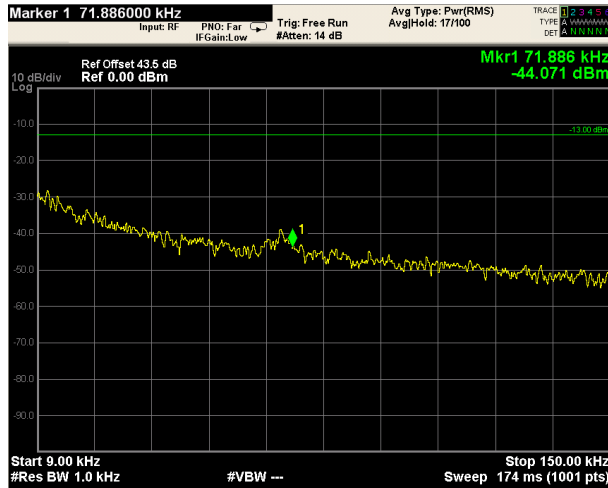


30MHz-1GHz

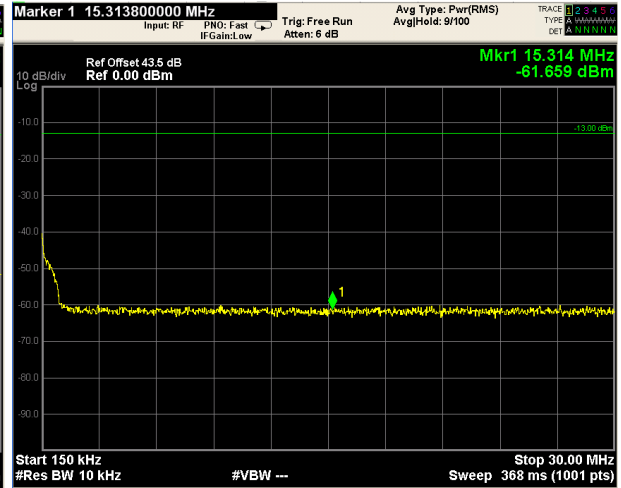


1GHz-9GHz

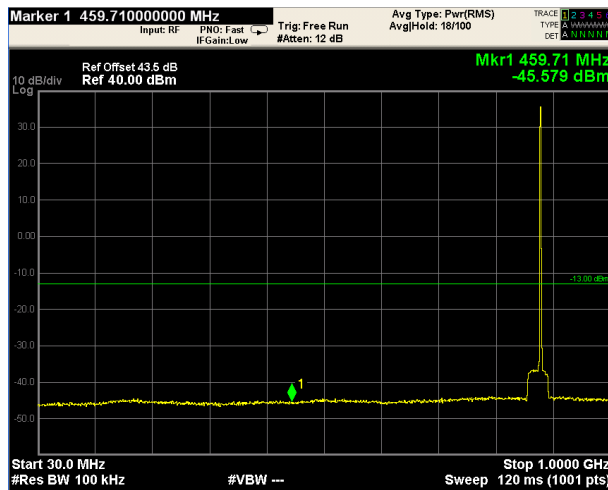
Mod. LTE 1.4MHz (QAM) (Down-link)



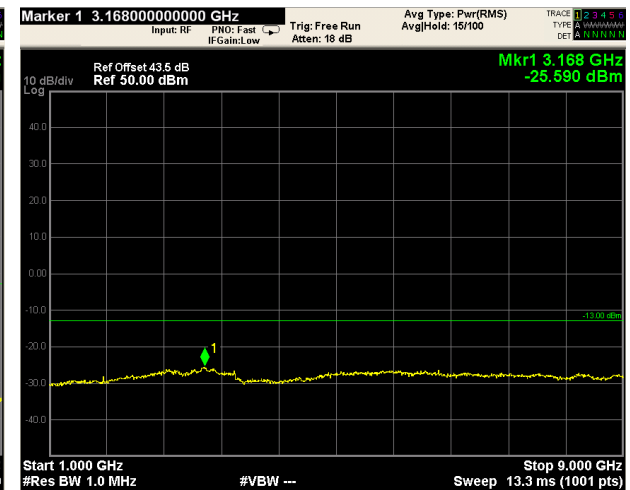
9kHz-150kHz



150kHz-30MHz

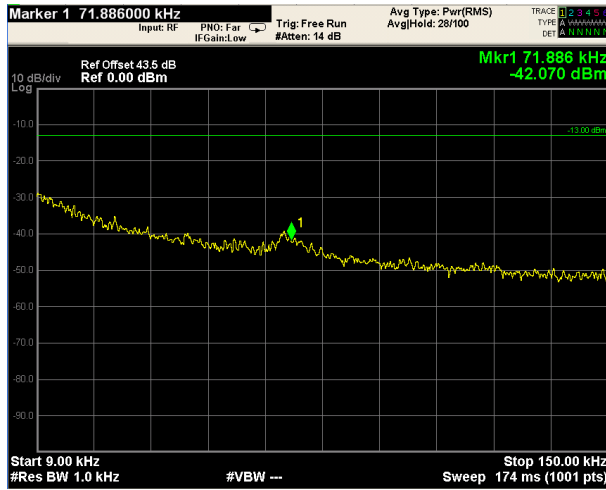


30MHz-1GHz

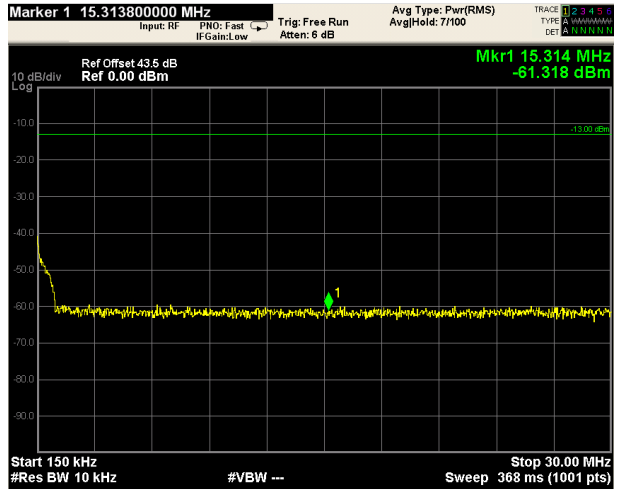


1GHz-9GHz

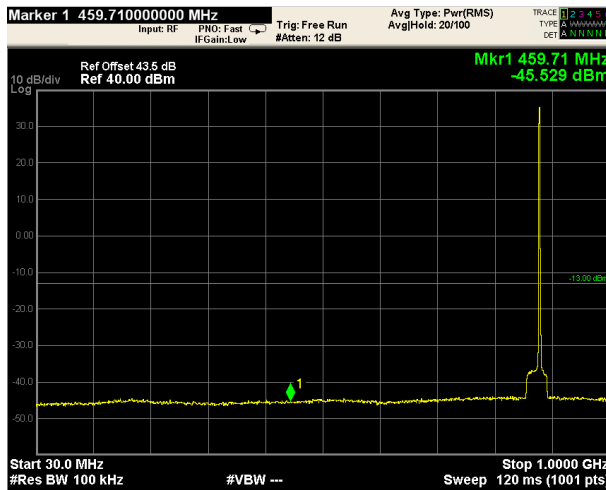
Mod. LTE 1.4MHz (QPSK) (Down-link)



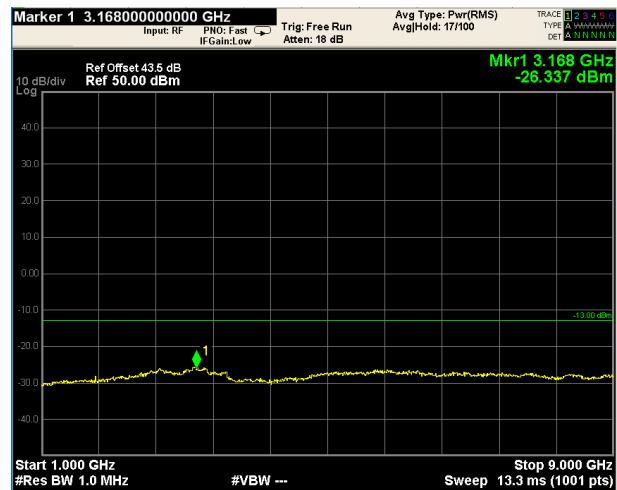
9kHz-150kHz



150kHz-30MHz

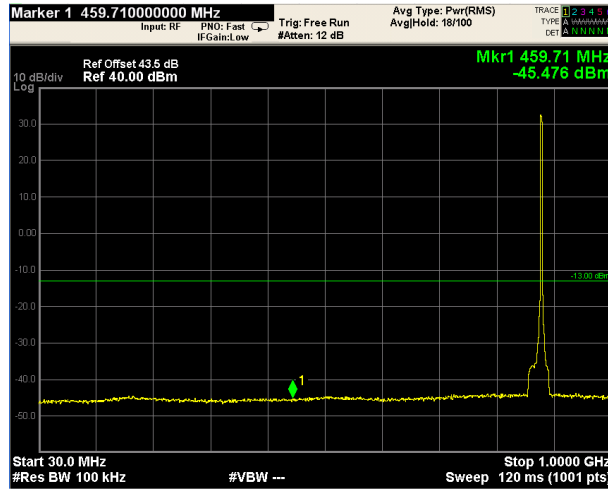


30MHz-1GHz

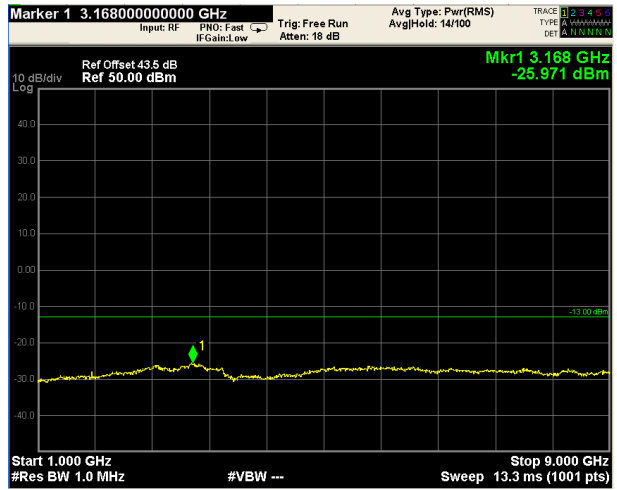


1GHz-9GHz

Mod. LTE 3MHz, only 30M-9G plot (Down-link)

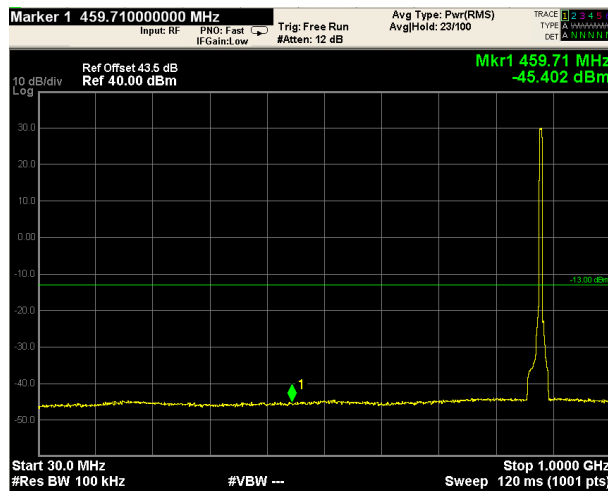


30MHz-1GHz

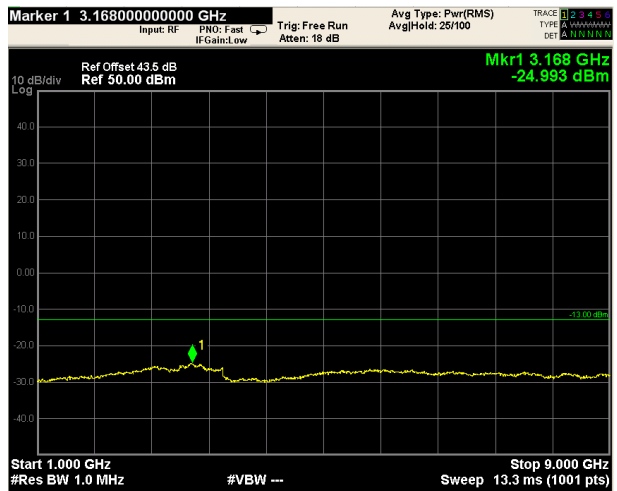


1GHz-9GHz

Mod. LTE 5MHz, only 30M-9G plot (Down-link)

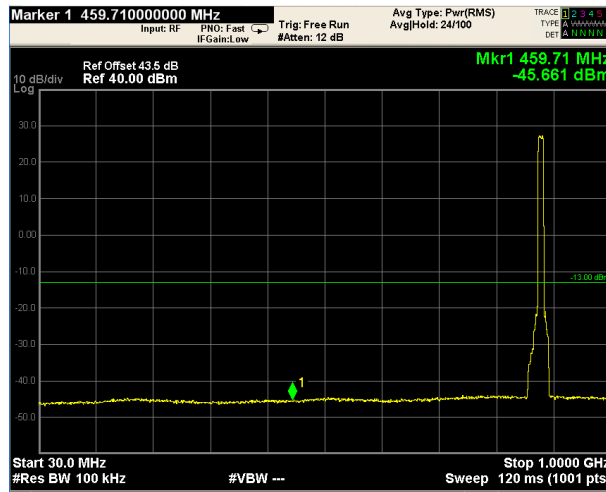


30MHz-1GHz

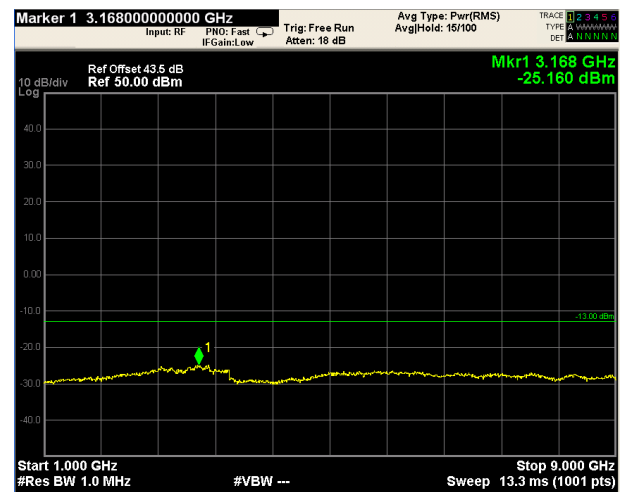


1GHz-9GHz

Mod. LTE 10MHz, only 30M-9G plot (Down-link)



30MHz-1GHz

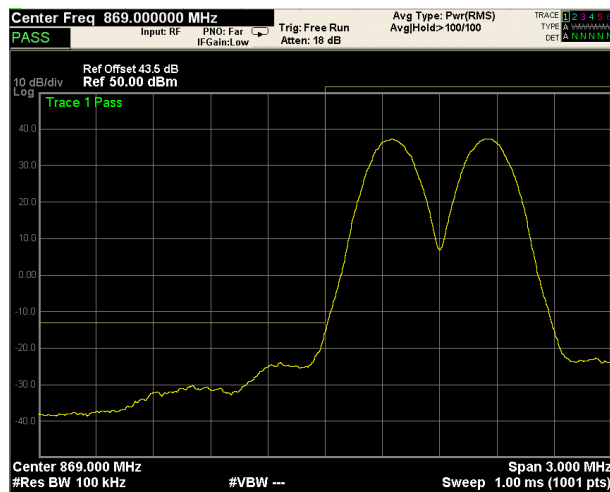


1GHz-9GHz

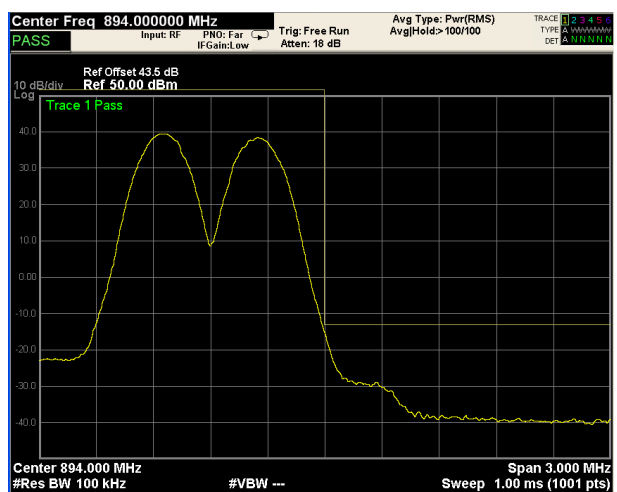
Clause 22.917(a) Out of band emissions at antenna terminal, continued

Test data, continued band edges Inter modulation:

Mod. GSM (Down-link)

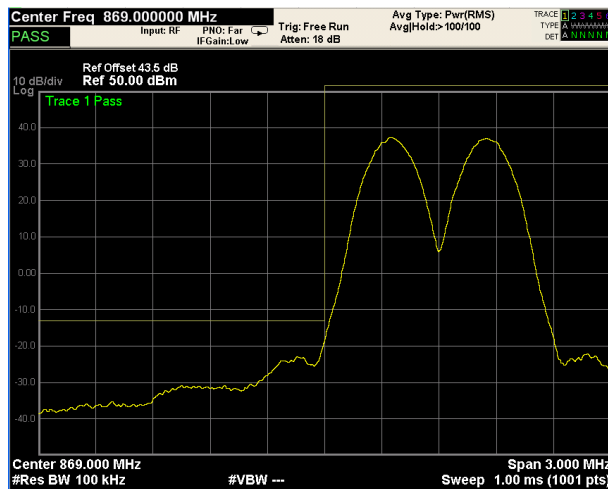


Low Band Edge

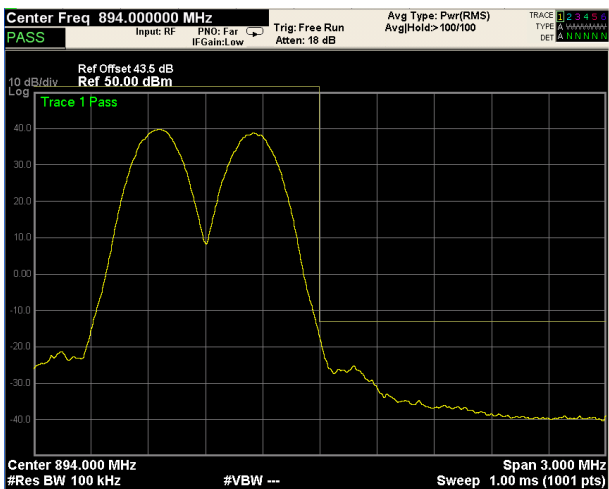


High Band Edge

Mod. EDGE (Down-link)

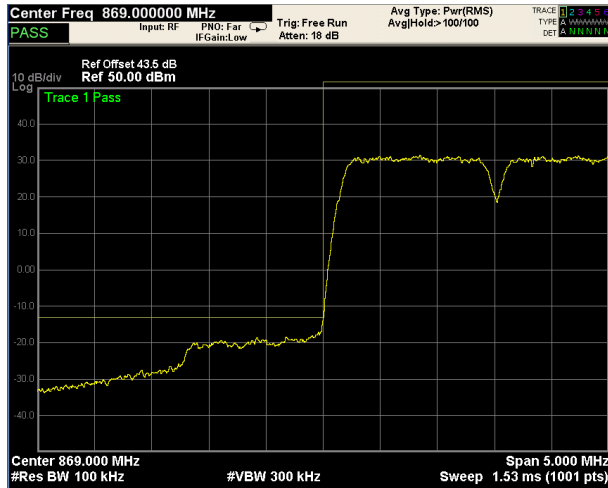


Low Band Edge

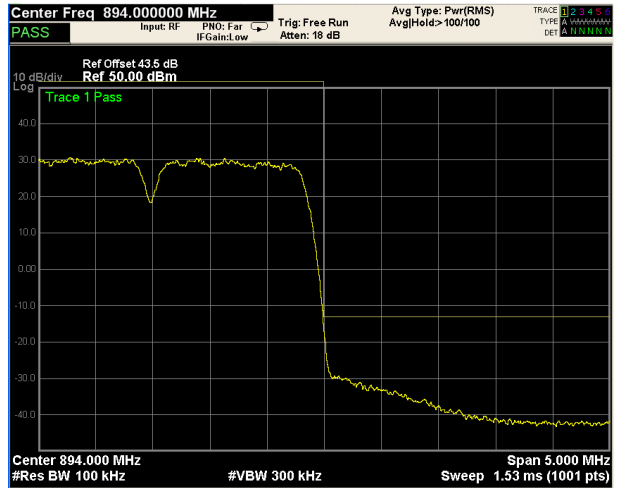


High Band Edge

Mod. CDMA (Down-link)

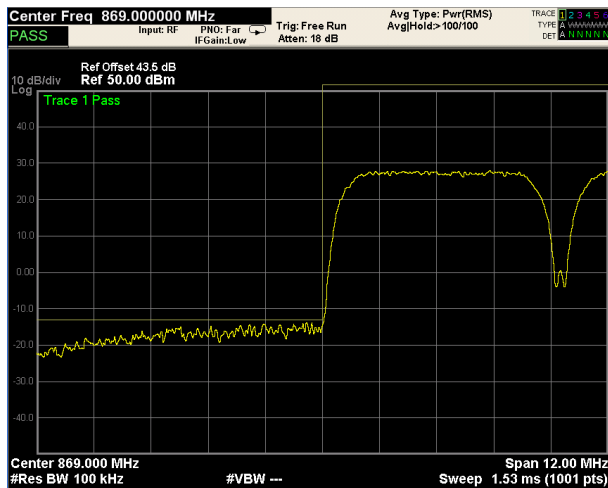


Low Band Edge

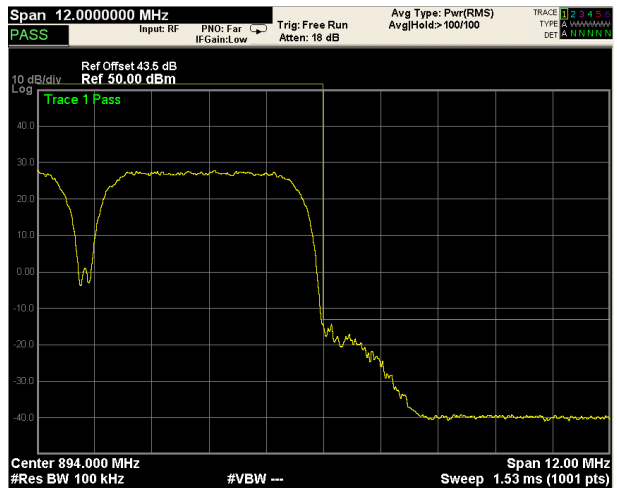


High Band Edge

Mod. WCDMA (Down-link)

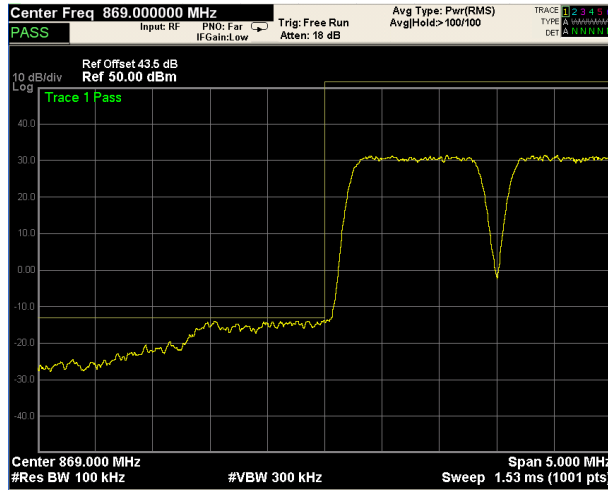


Low Band Edge

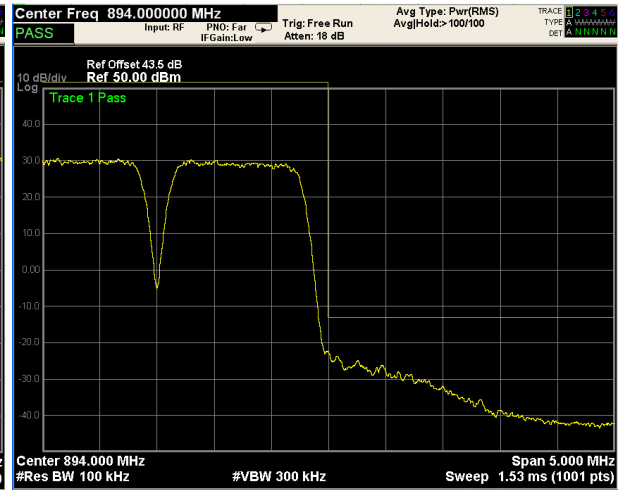


High Band Edge

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

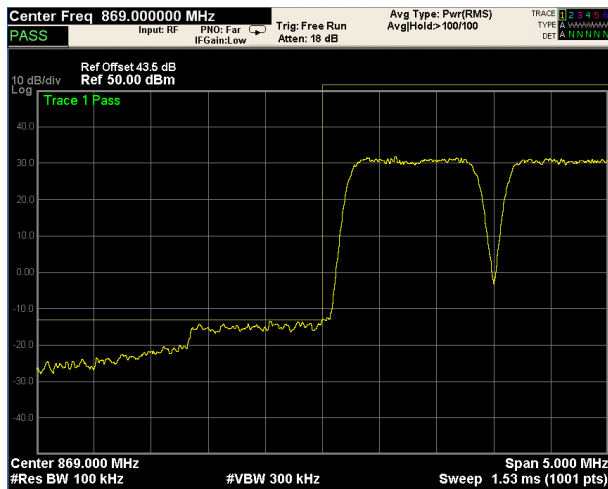


Low Band Edge

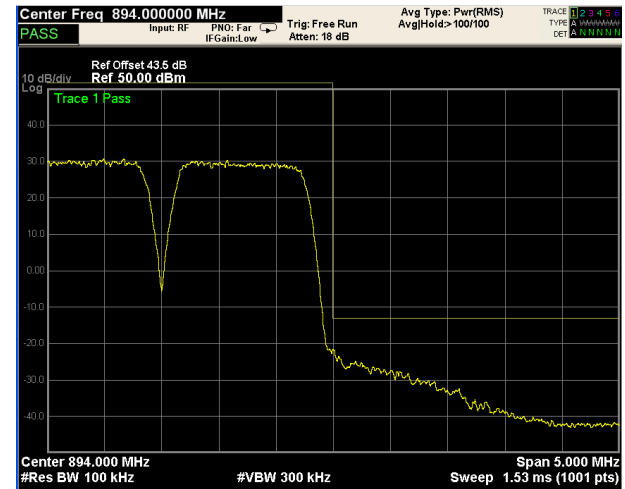


High Band Edge

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

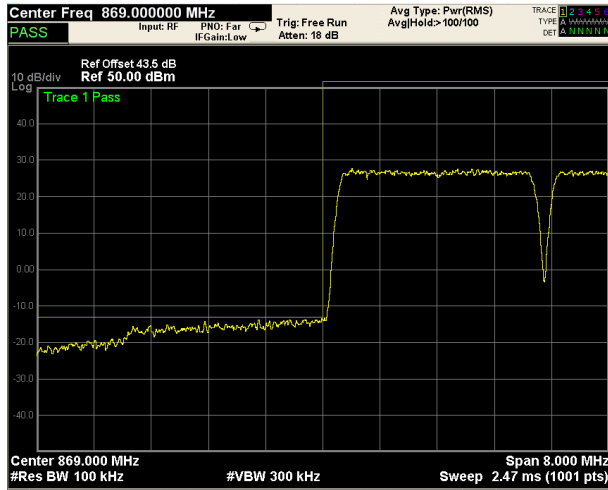


Low Band Edge

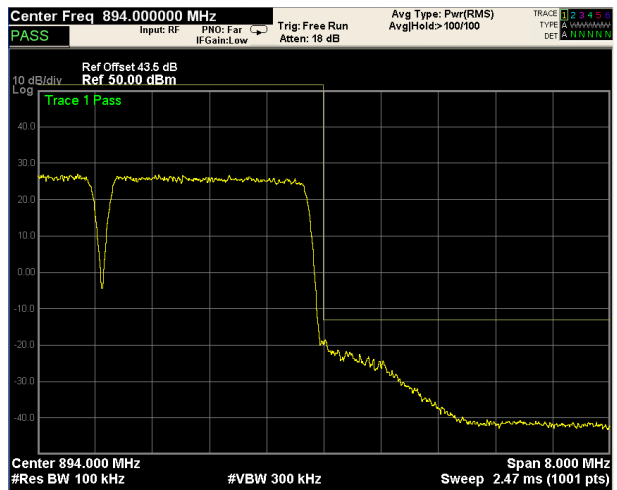


High Band Edge

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

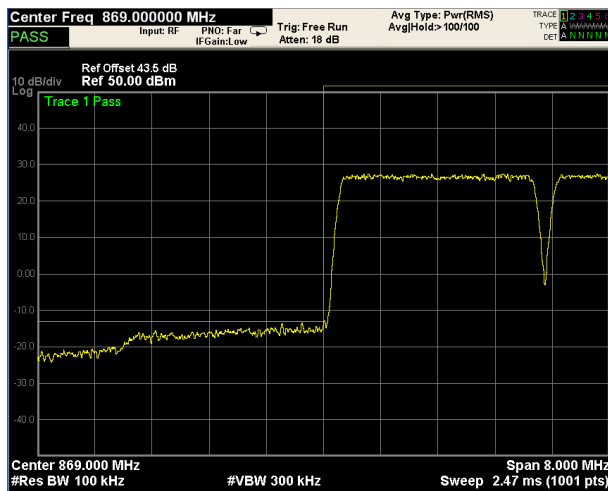


Low Band Edge

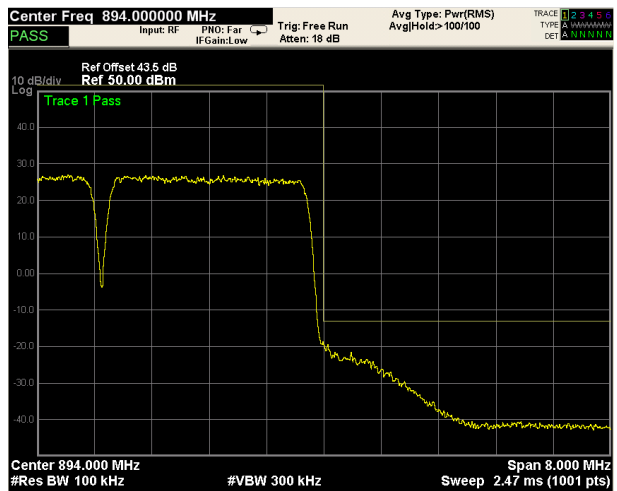


High Band Edge

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

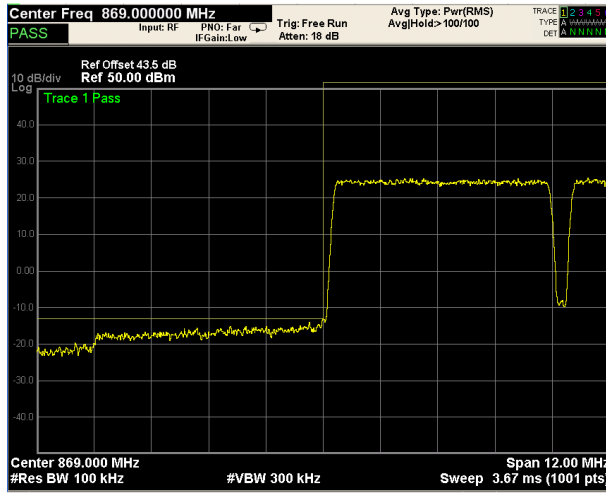


Low Band Edge

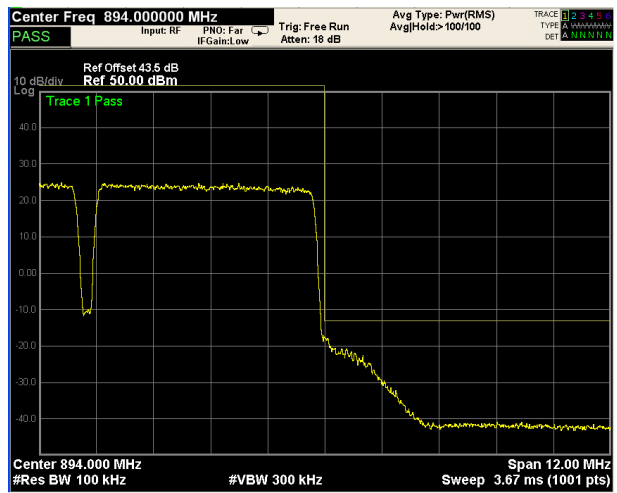


High Band Edge

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

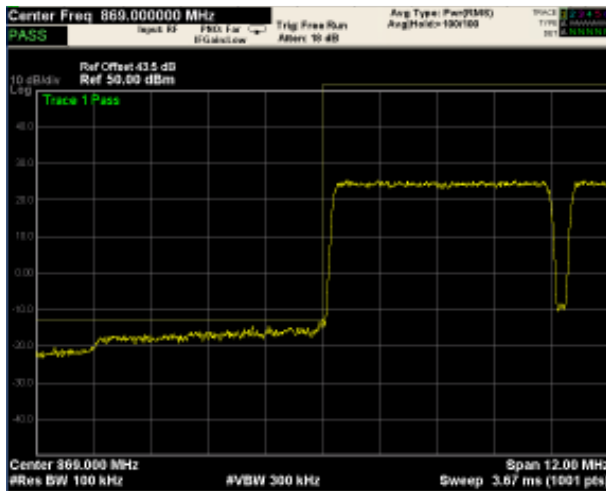


Low Band Edge

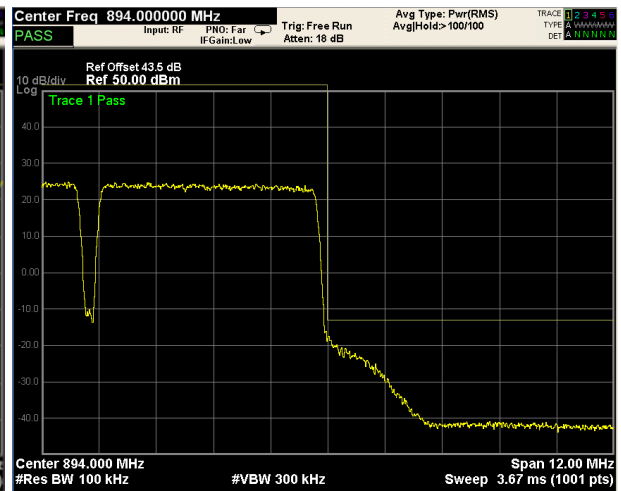


High Band Edge

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

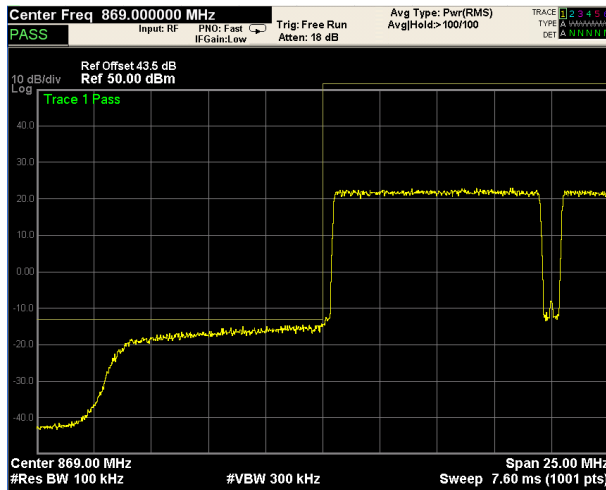


Low Band Edge

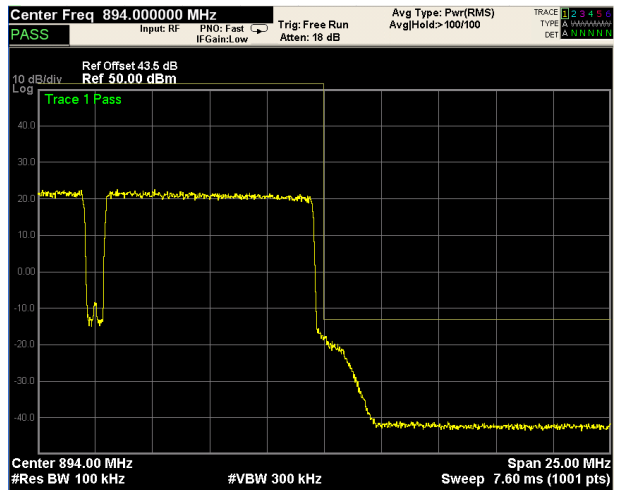


High Band Edge

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

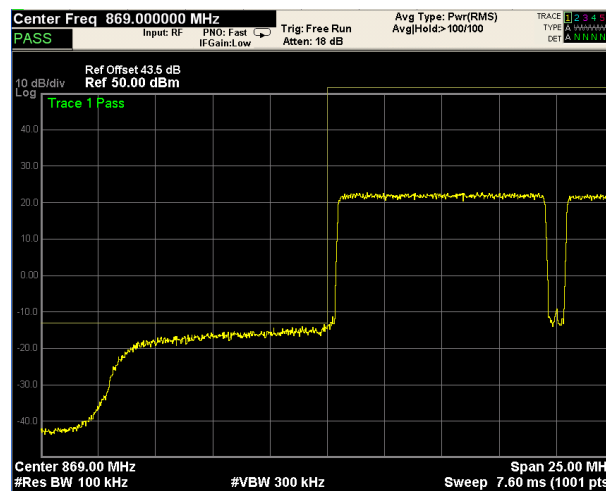


Low Band Edge

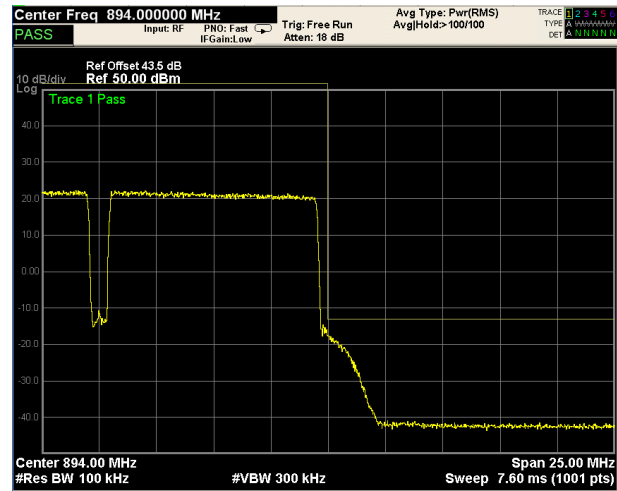


High Band Edge

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



Low Band Edge



High Band Edge

Clause 22.917 Field strength of emissions

(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).

Test date: 2015-05-19

Test results: Pass

Special notes

- The spectrum was searched from 30 MHz up to 10th harmonic
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- Only the worst data presented in the test report.
- The EUT's antenna port was terminated with 50 Ω termination.

Clause 22.917 Field strength of emissions, continued

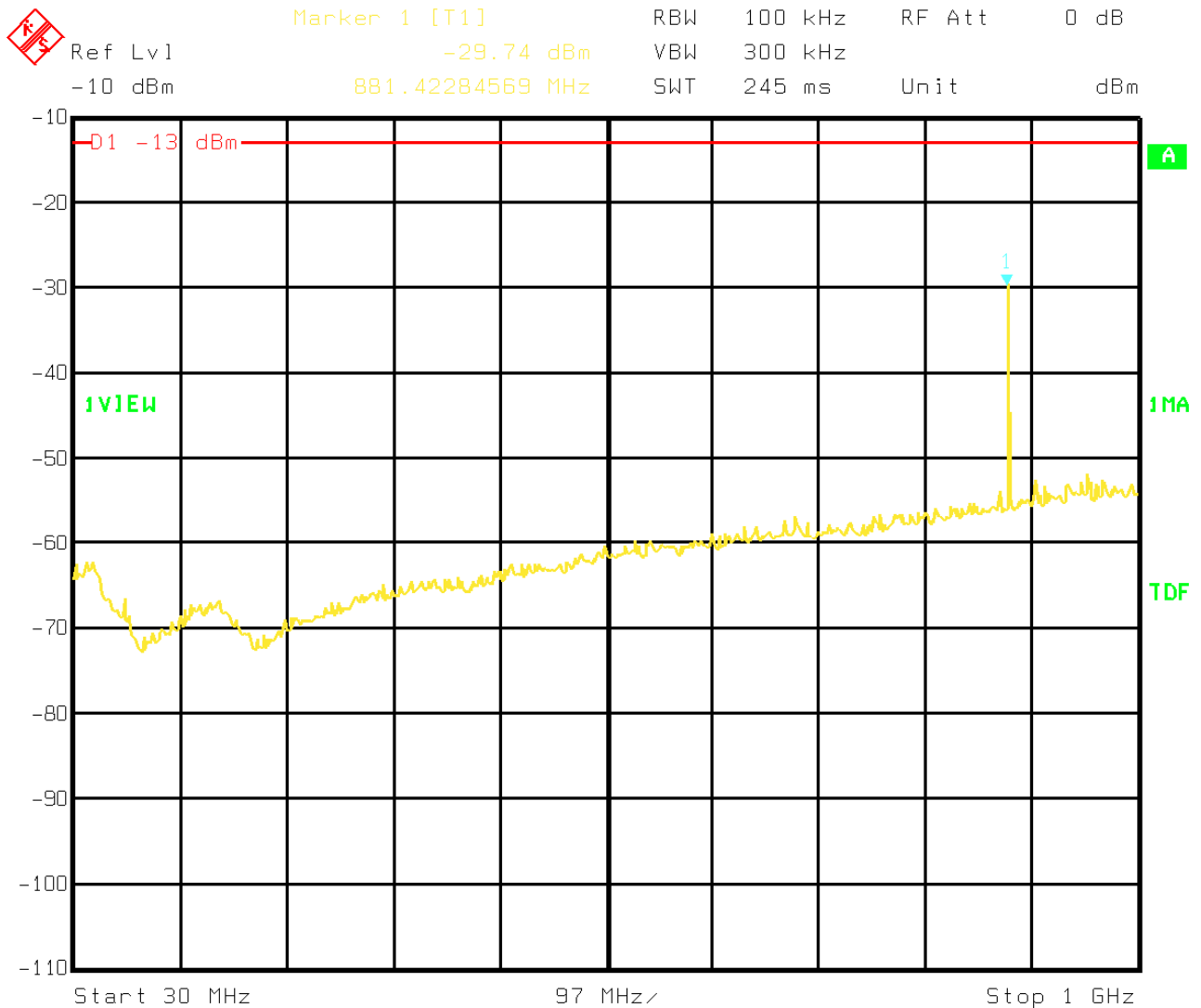
Test data

The D.U.T. was positioned according to the radiated emissions set-up

The D.U.T. antenna connector was terminated by a 50 Ω shielded dummy load.

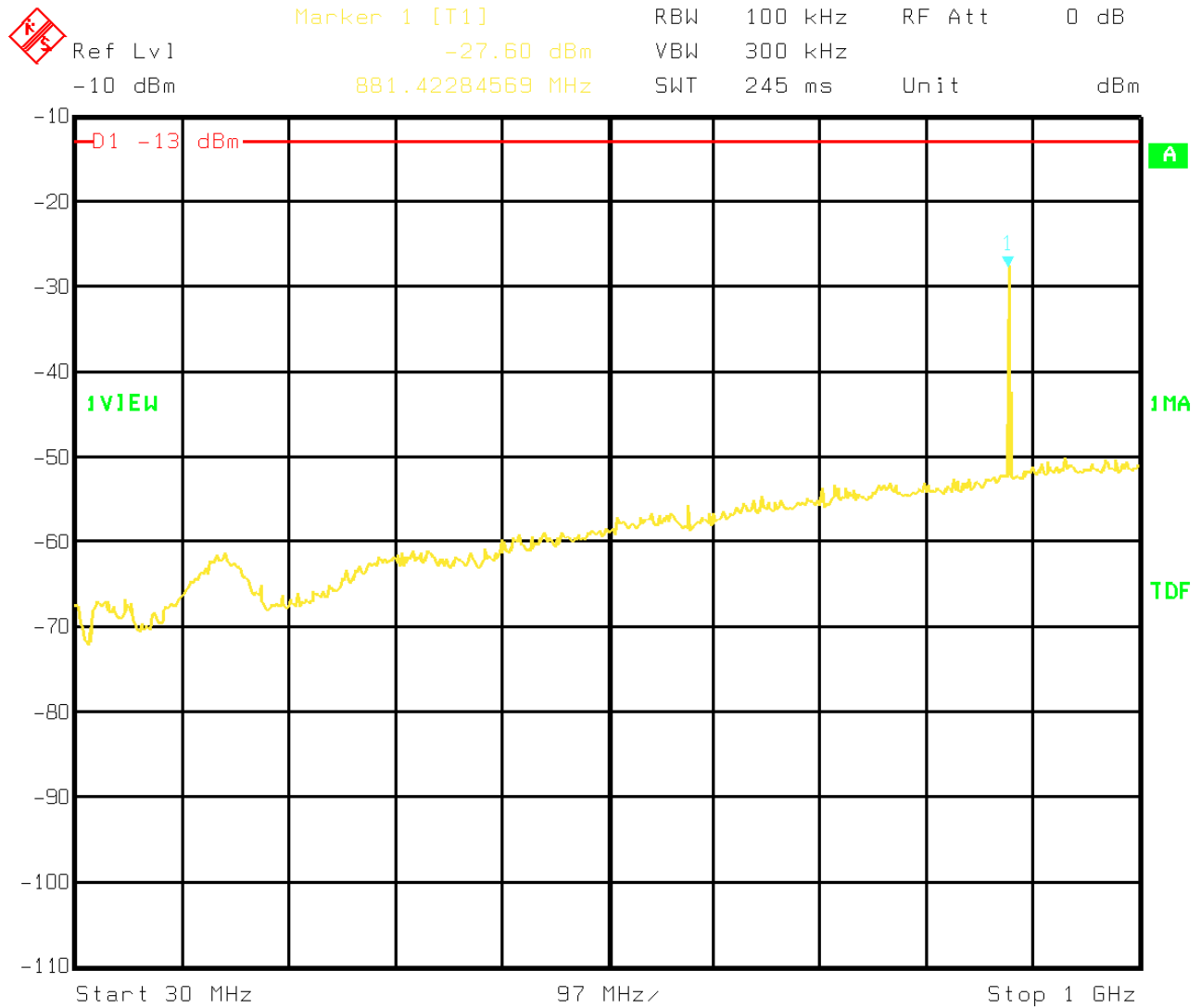
The spectrum was searched from 30 MHz to 1 GHz (RBW 100 kHz) & 1 GHz (RBW 1 MHz) to the tenth harmonic of the carrier.

There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.



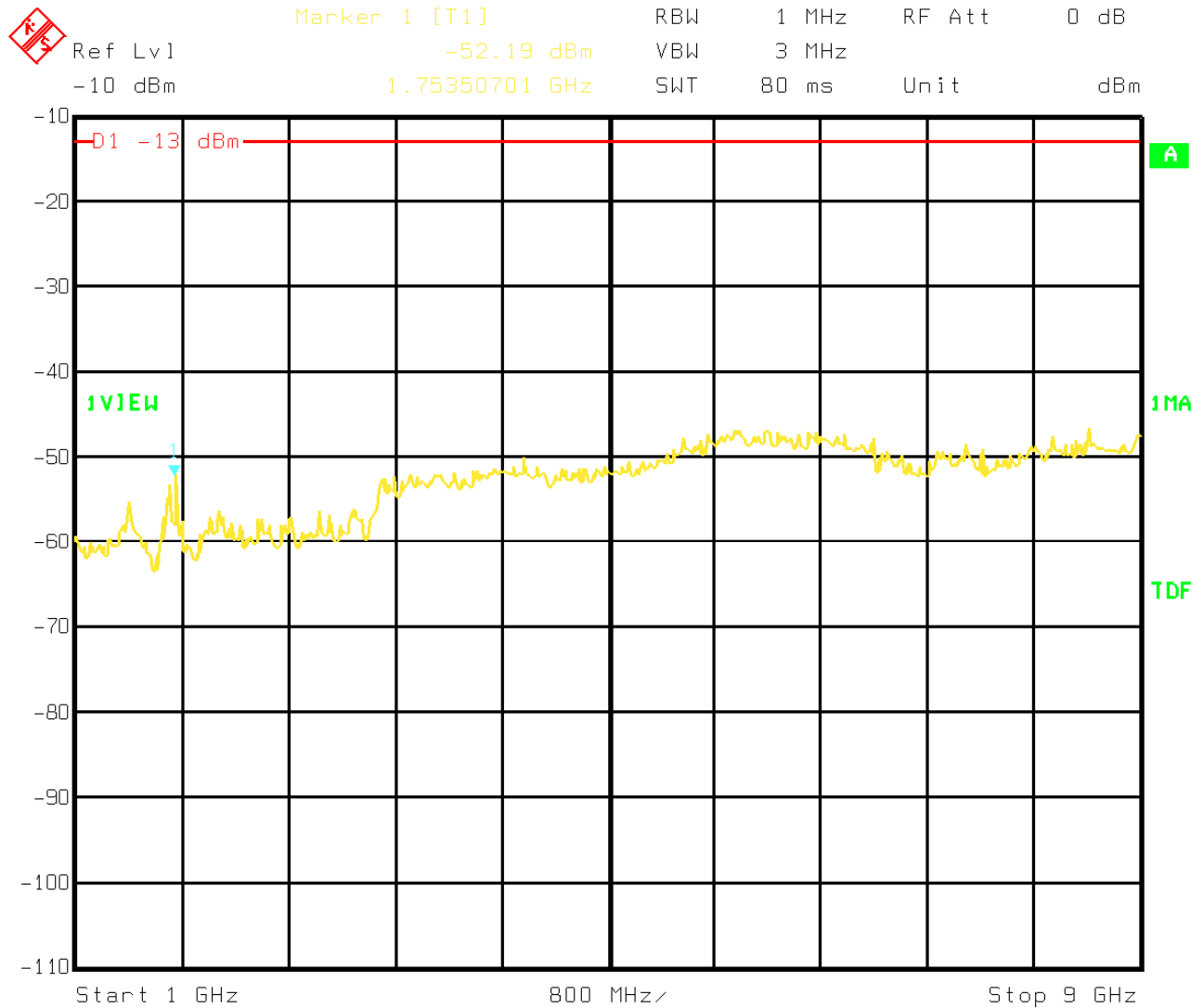
Date: 19.MAY 2015 07:04:01

30MHz-1GHz – H Pol



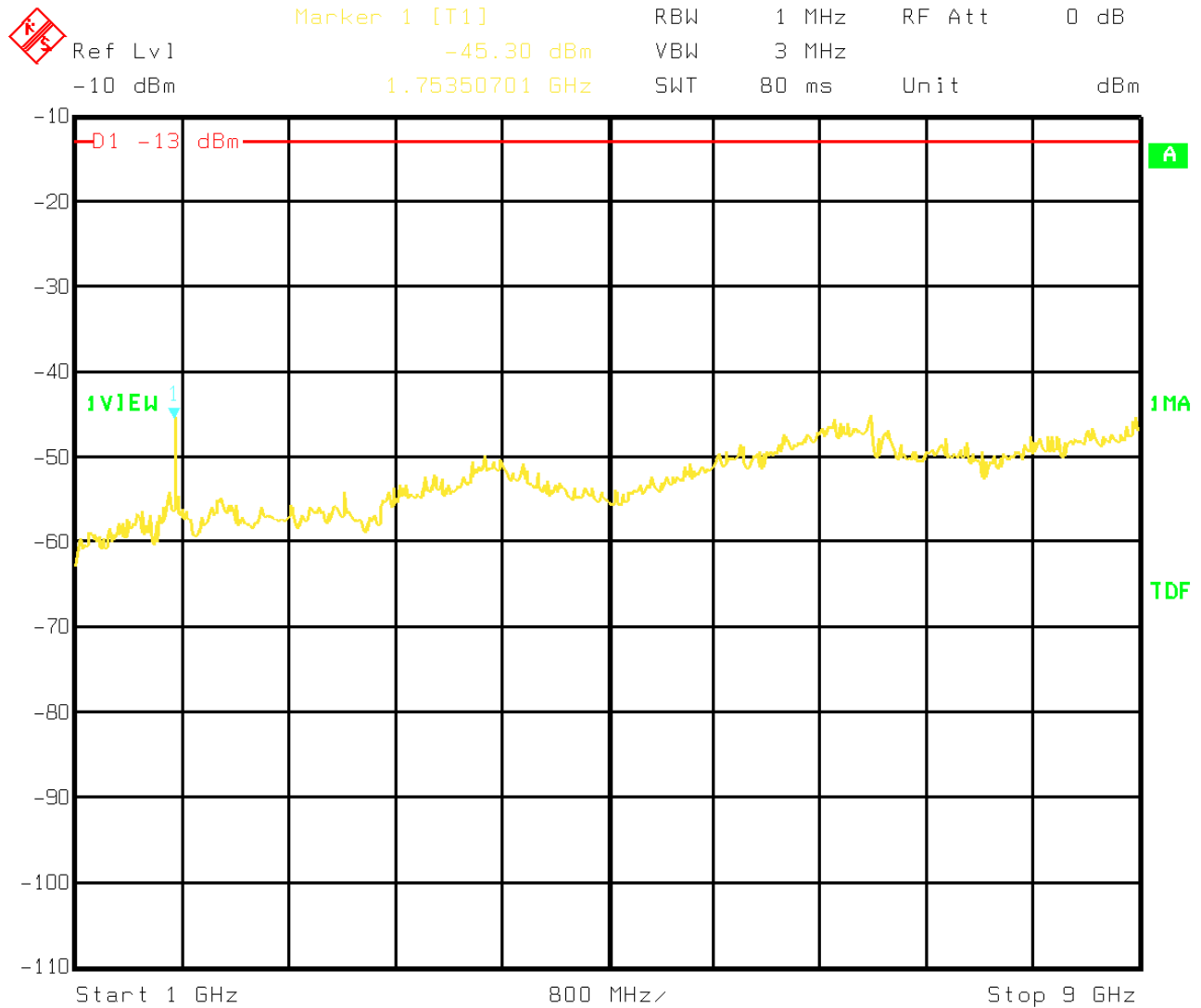
Date: 19.MAY 2015 07:08:36

30MHz-1GHz – V Pol



Date: 19.MAY 2015 08:53:21

1GHz-9GHz – H Pol



Date: 19.MAY 2015 08:57:16

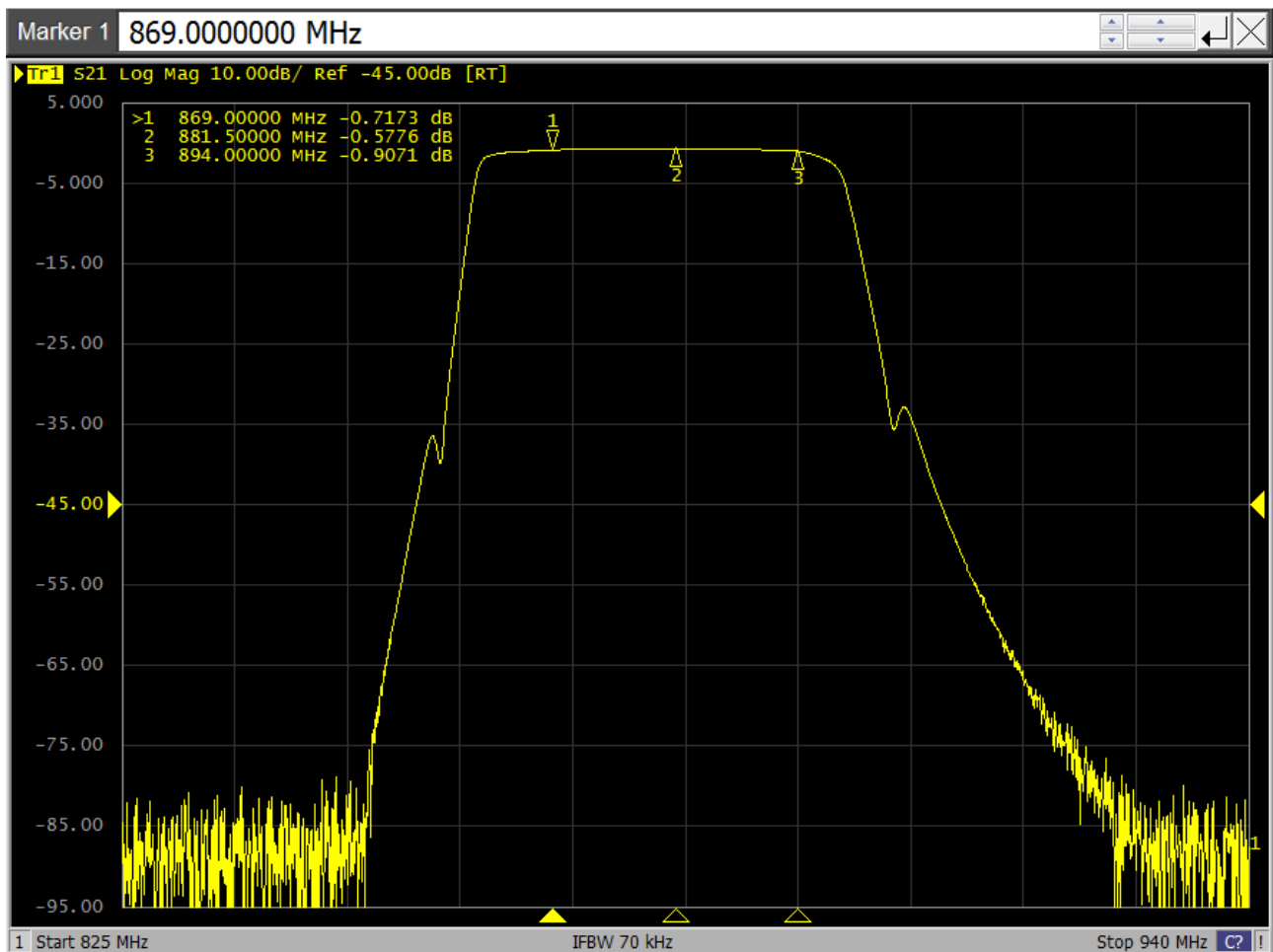
1GHz-9GHz – V Pol

Clause 935210 D02v02r01 (D.3)(I) Out of band rejection

Out of Band Rejection – Test for rejection of out of band signals.
Filter frequency response plots are acceptable.

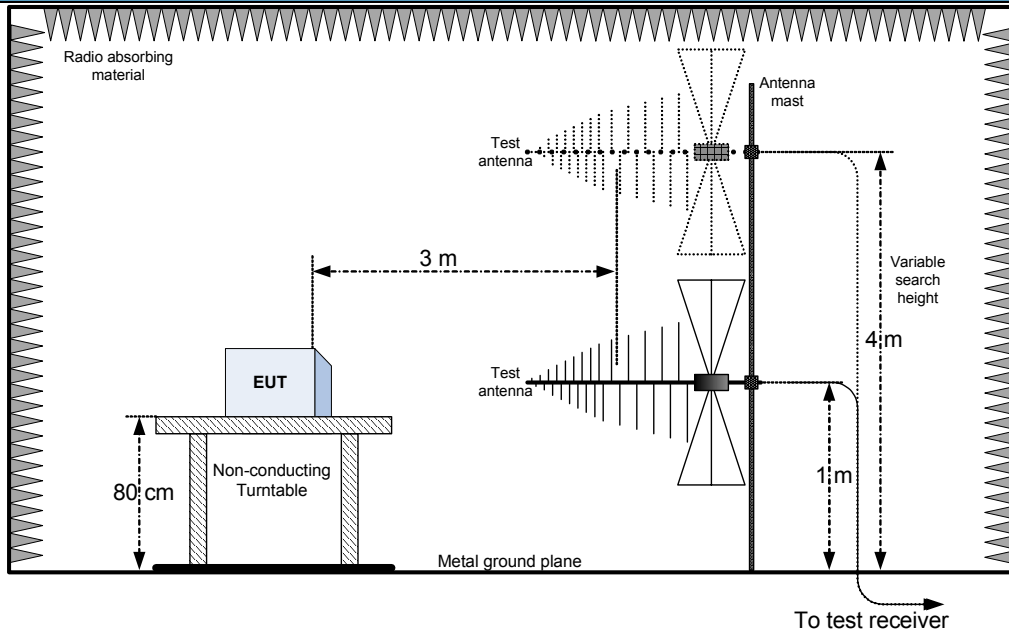
Test date: 2015-05-21

Test results: Pass

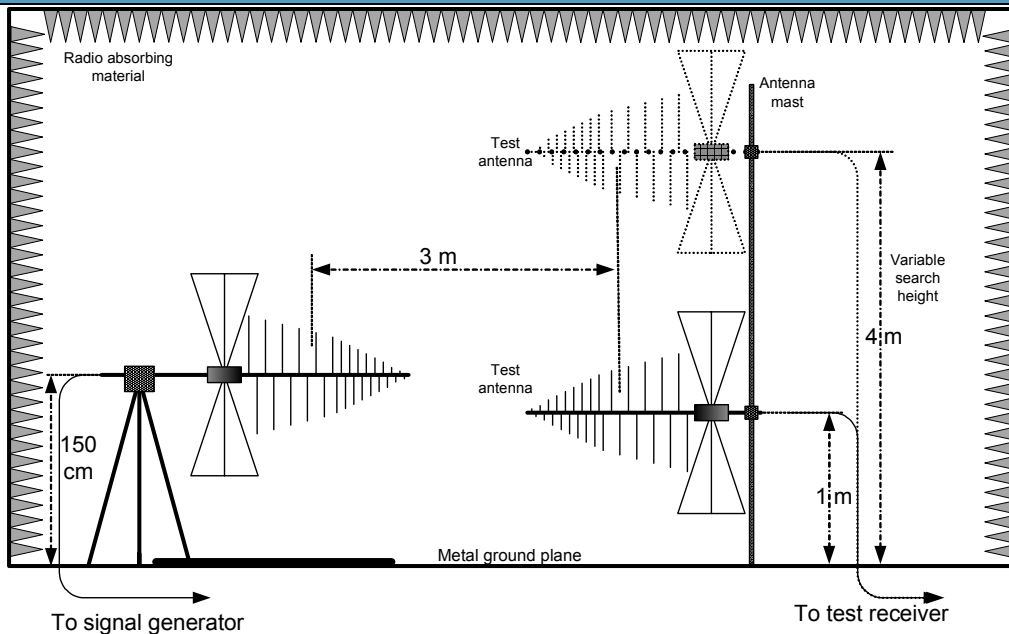


Appendix B: Block diagrams of test set-ups

Radiated emissions set-up



Substitution method set-up



Appendix C: EUT Photos

Photo Set up





Photo EUT



