

Report Reference ID:	283384-2TRFWL
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Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter B – Common carrier services Part 27 – Miscellaneous wireless communications services
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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:	MWHPA0001S7-D	
FCC ID:	XM2-WHPA7S	

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
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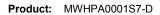
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Specification: FCC 27

Section 1: Report summary

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

Test site FCC
ID number

176392 (3 m Semi anechoic chamber)

Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
R1TRF	

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.

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Product: MWHPA0001S7-D

Section 2: Summary of test results

2.1 FCC Part 27, test results		
Part	Test description	Verdict
§27.50(b)	Peak output power at RF antenna connector	Pass
§27.53(c)	Spurious emissions at RF antenna connector	Pass
§27.53(c)	Radiated spurious emissions	Pass
§27.53(f)	Radiated spurious emissions within 1559–1610 MHz band	Pass
§27.54	Frequency stability	N/A a)
§2.1049	Occupied bandwidth	Pass
§ 935210	Filter Frequency Response	Pass
D02v02r01 (D.3)(I)		

Notes:

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



Specification: FCC 27

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

3.1 Applicant of	letails	
Applicant	Name:	Teko Telecom Srl
complete	Federal	TERO TELEGORII GII
business name	Registration	0018963462
	Number (FRN):	
	Grantee code	XM2
Mailing address	Address:	Via Meucci, 24/a
	City:	Castel S. Pietro Terme
	Province/State:	Bologna
	Post code:	40024
	Country:	Italy
3.2 Modular ed	quipment	
a) Single modular	Single modular appro	oval
approval	Yes 🗌	No ⊠
b) Limited single	Limited single modular approval	
modular approval	Yes 🗌	No ⊠
3.3 Product de	tails	
FCC ID	Grantee code:	XM2
	Product code:	-WHPA7S
Equipment class	B2I	
Description of	Booster	
product as it is	Model	MWHPA0001S7-D
marketed	name/number:	
	Serial number:	1001115002
3.4 Application		
Type of	Original certi	
application		entification of presently authorized equipment
	Original FCC	
	-	nissive change or modification of presently authorized
	equipment	



Specification: FCC 27

Section 3: Equipment under test

3.5 Composite/related equipment			
a) Composite	The EUT is a composite device subject to an additional equipment		
equipment	authorization		
	Yes ☐ No ⊠		
b) Related	The EUT is part of a system that operates with, or is marketed with,		
equipment	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:		
	listed below:		
	i FCC ID:		
	ii FCC ID:		
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 belo ☐ 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:		

3.6 Sample inf	ormation
Receipt date:	2015-05-18
Nemko sample ID number:	

3.7 EUT techn	ical specifications
Operating band:	Down Link 746–757 MHz, Up Link 776-787 MHz
Operating frequency:	Wideband
Modulation type:	LTE (QAM and QPSK)
Occupied bandwidth:	1,4 MHz – 3 MHz – 5 MHz – 10MHz
Channel spacing:	standard
Emission	D7W
designator:	
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 type:	External Antenna is not provided,
	equipment that has an external 50 Ω RF connector
Power source:	28-30 Vdc



Specification: FCC 27

Section 3: Equipment under test

3.8 Accessories and	d support equipment
	entifies accessories 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:	



Specification: FCC 27

3.9 Operation of the EUT during testing

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

3.10 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.



Product: MWHPA0001S7-D

Section 4: Engineering considerations

4.1 Modificatio	ns 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 j	udgment
Judgment	None



Specification: FCC 27

Section 5: Test conditions

Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

5.2 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 ±5 %, for which the equipment was designed.		





Section 5: Test conditions, continued

5.3 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.

5.4 Test equ	ipment			
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



Specification: FCC 27

Appendix A: Test results

Clause 27.50(b) Peak output power at RF antenna connector

§ 27.50(b) Operation within the bands: 746-758 MHz, 775-788 MHz and 805-806 MHz.

- 4) Fixed and base stations transmitting a signal in the 746–757 MHz and 776–787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP accordance with Table 3 of this section.
- 12) For transmissions in the 746–757, 776–7873 MHz bands, licensees may employ equipment operating in compliance with either the measurement techniques described in paragraph (b)(11) of this section or a Commission-approved average power technique. In both instances, equipment employed must be authorized in accordance with the provisions of §27.51

Test date: 2015-05-21
Test results: Pass

Special notes

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-toaverage ratio (PAR) of the transmission may not exceed 13dB



Clause 27.50(b) Peak output power at RF antenna connector, continued

Test data

Conducted measurements

Test data					
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PAR (dB)
Down-link	LTE (QAM, 1,4MHz)	751,5	46.15	41.21	9.41
Down-link	LTE (QPSK, 1,4MHz)	751,5	46.17	41.40	9.11
Down-link	LTE (QAM, 3MHz)	751,5	46.19	41.59	9.38
Down-link	LTE (QPSK, 3MHz)	751,5	46.12	40.93	9.51
Down-link	LTE (QAM, 5MHz)	751,5	46.21	41.78	9.64
Down-link	LTE (QPSK, 5MHz)	751,5	46.09	40.64	9.44
Down-link	LTE (QAM, 10MHz)	751,5	46.12	40.93	9.59
Down-link	LTE (QPSK, 10MHz)	751,5	46.12	40.93	10.03

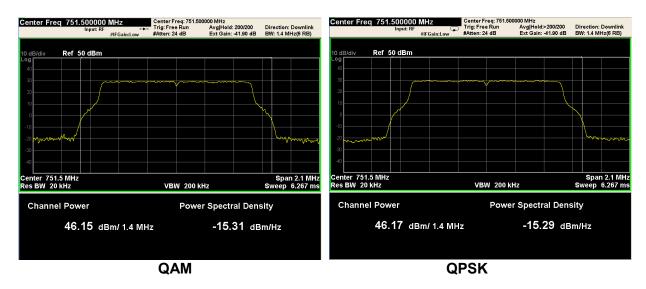
PAR measure is performed by the "CCDF" function installed on Spectrum analyzer that provides average power (the same measured with "Channel power" function), peak power and PAR. Below an example:



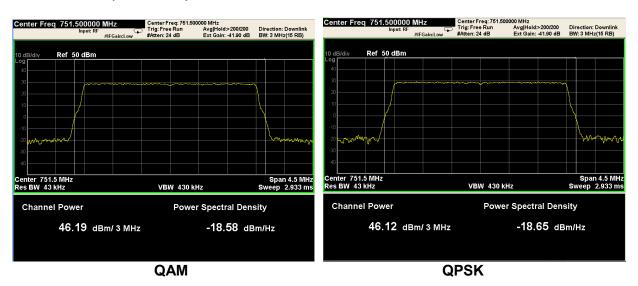
PAR measure example (LTE 1,4MHz QAM)



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

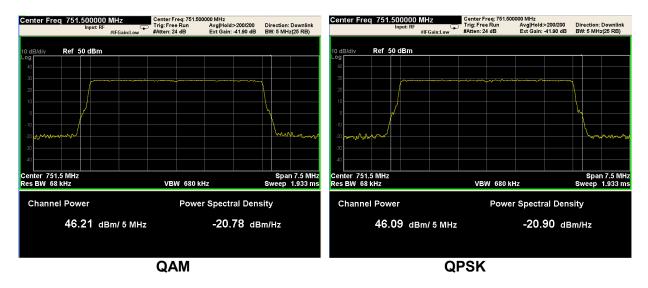


Mod. LTE 3MHz (Down-link)

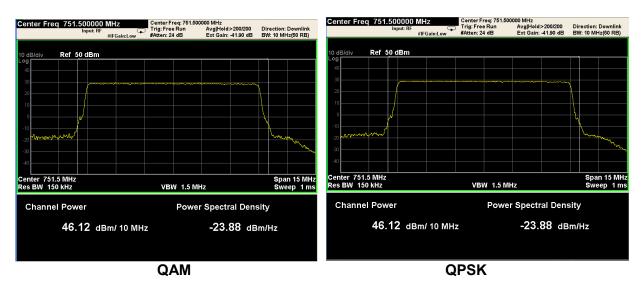




Mod. LTE 5MHz (Down-link)



Mod. LTE 10MHz (Down-link)





Specification: FCC 27

Clause 27.53(c) Spurious emissions at RF antenna connector

- (c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
 - (1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
 - (3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;
 - (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;
 - (6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

Test date: 2015-05-21
Test results: Pass

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 and 1 MHz above 1 GHz. VBW was wider than RBW.



Clause 27.53 Spurious emissions at RF antenna connector, continued

Test data					
	Insert pl	ots here			
Spurious emissions me	asurement results:				
Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)	Margin (dB)		
Low channel					
First channel	Negligible	-13			
Mid channel					
751,5 MHz	Negligible	-13			
High channel					
Last channel	Negligible	-13			

See Plots below

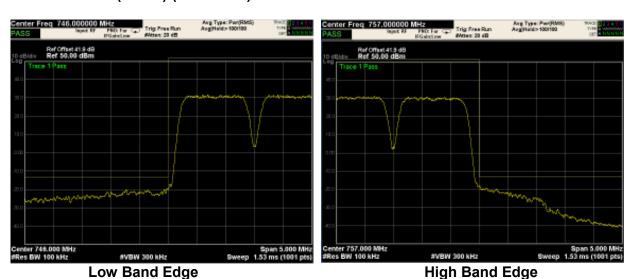


Test data, continued: band edges Inter modulation:

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

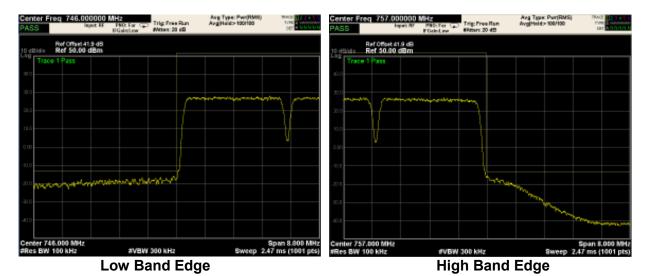


Mod. LTE 1.4MHz (QPSK) (Down-link)





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



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

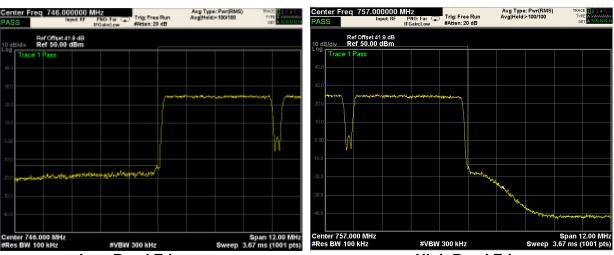




Mod. LTE 5MHz (QAM) (Down-link)



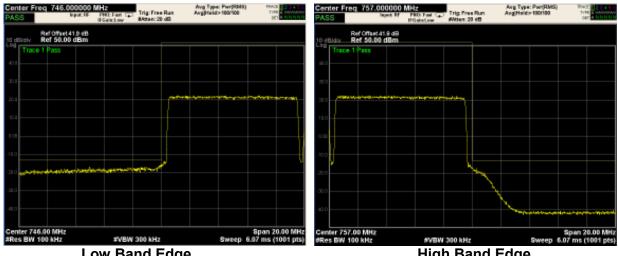
Mod. LTE 5MHz (QPSK) (Down-link)



High Band Edge



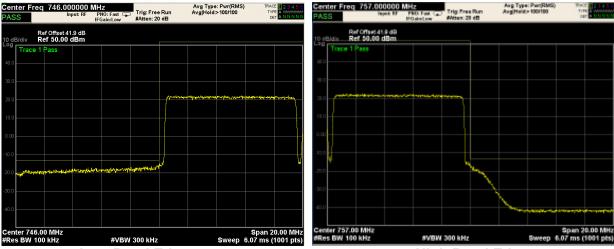
Mod. LTE 10MHz (QAM) (Down-link)



Low Band Edge

High Band Edge

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



Low Band Edge

High Band Edge



Test data, continued: spurious emissions at antenna terminal

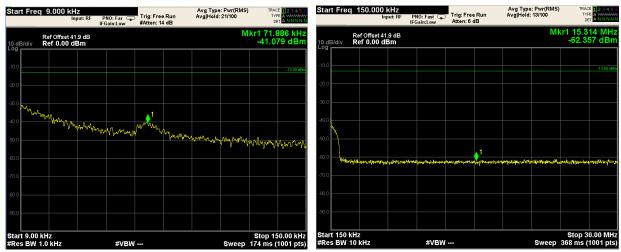
Mod. LTE 1.4MHz (QAM) (Down-link)



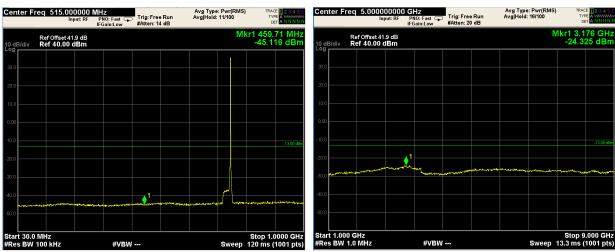




Mod. LTE 1.4MHz (QPSK) (Down-link)



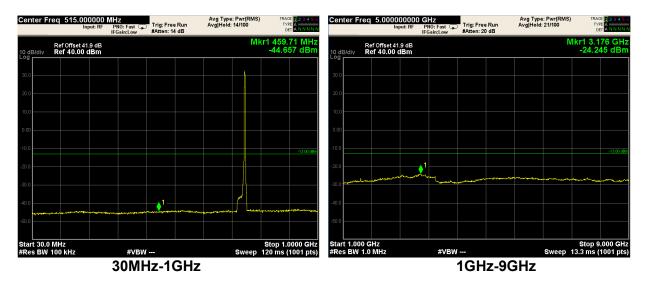
9kHz-150kHz 150kHz-30MHz



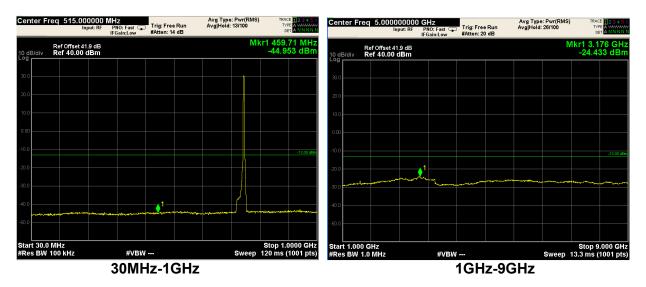
30MHz-1GHz 1GHz-9GHz



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

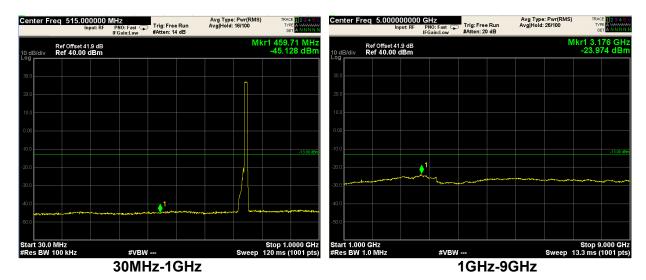


Mod. LTE 5MHz, only 30M-9G plot (Down-link)





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





Spurious emissions at antenna terminal, band 763-775MHz and 793-805MHz

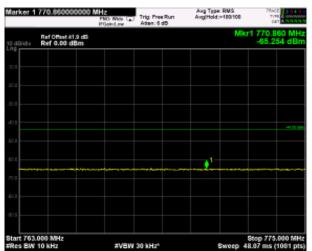
Special notes

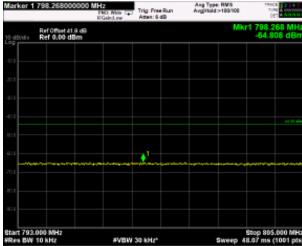
On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations

 $76 + 10 \log P(W) = 76 + 10 \log 40W = 92$

P(W) = 40W = 46 dBm

 \rightarrow limit: 46 – 92 = -46 dBm/6,25kHz = -44dBm/10kHz





763MHz-775MHz

793MHz-806MHz



Specification: FCC 27

Clause 27.53(c) Radiated spurious emissions

- (c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
 - (1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
 - (3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;
 - (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;
 - (6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

Test date: 2015-05-19
Test results: Pass

Special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- All measurements were performed using a peak detector.
- The measurements were performed at the distance of 3 m.
- RBW within 30–1000 MHz was 100 kHz and 1 MHz above 1 GHz. VBW was wider than RBW.



Specification: FCC 27

Clause 27.53 Radiated spurious 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.

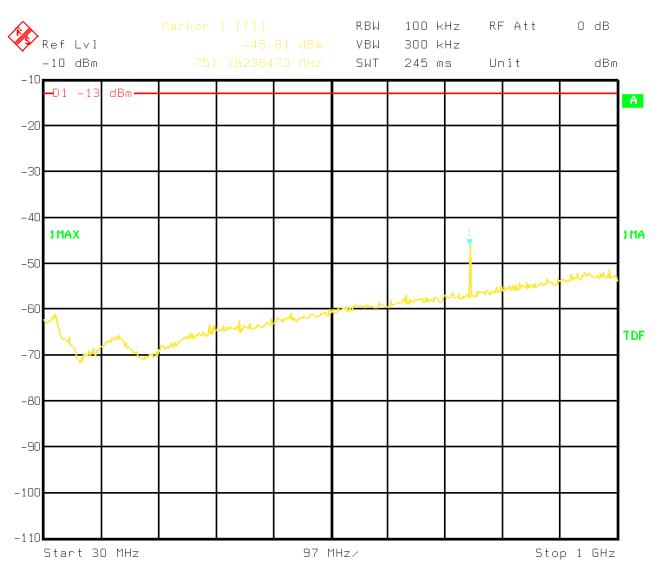
There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.

Spurious emissions measurement results:

	• 1110000000000000000000000000000000000			
Frequency (MHz)	Polarization. V/H	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low channel				
Mid channel				
High channel				

Note: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

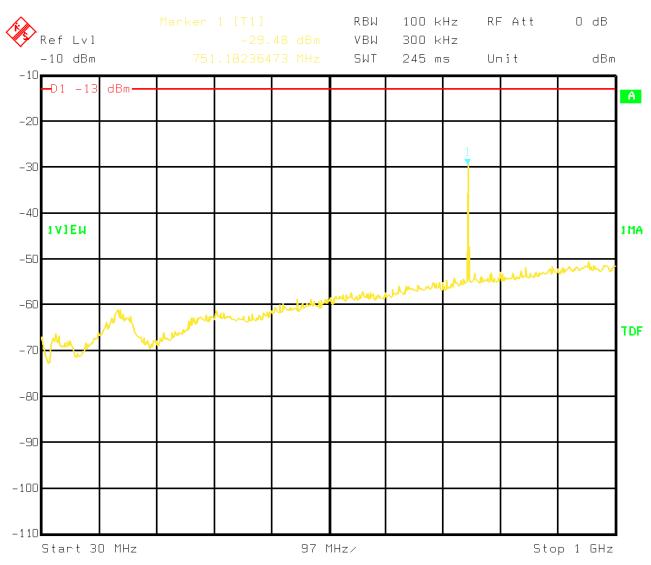




Date: 19.MAY 2015 06:35:15

30MHz-1GHz - H Pol

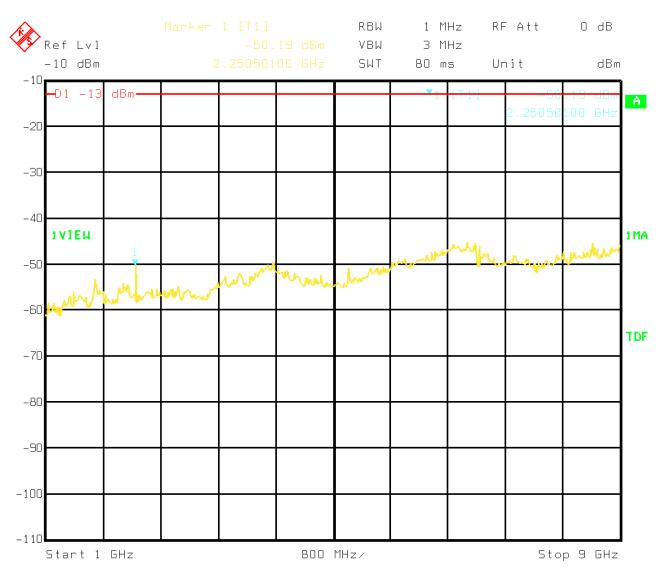




Date: 19.MAY 2015 06:39:03

30MHz-1GHz - V Pol

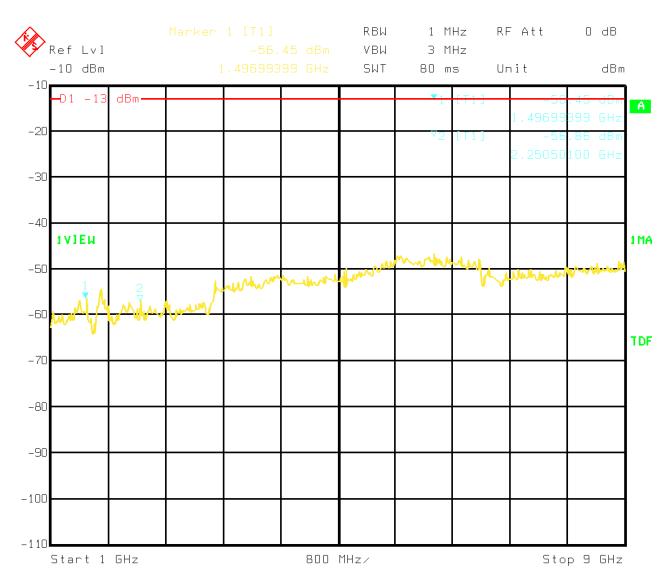




Date: 19.MAY 2015 09:37:48

1GHz-8GHz - H Pol





Date: 19.MAY 2015 09:43:56

1GHz-8GHz - V Pol



Specification: FCC 27

Clause 27.53(f) Radiated spurious emissions within 1559–1610 MHz band

(f) For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test date: 2015-05-21
Test results: Pass

Special notes

The spectrum was searched from 1559–1610 MHz.

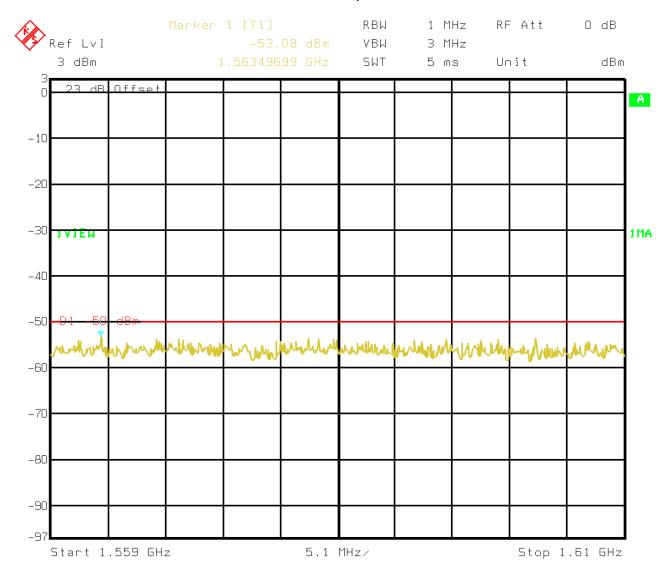
- All measurements were performed using a peak detector.
- The measurements were performed at the distance of 3 m.
- RBW was set to 1 MHz and VBW was wider than RBW.



Clause 27.53(f) Radiated spurious emissions within 1559–1610 MHz band, continued

Test data

Result of D.L. 46 dBm, 751.5 MHz, "1.4" QAM occupied bandwidth 1.2 MHz





Specification: FCC 27

	Spurious emissions measurement results:					
				Limit eirp (dBm)	Margin (dB)	
1563.49 V(max. eirp) -53.08 -50 -3.08	1563.49	V(max. eirp)	-53.08	-50	-3.08	

Note:

. Method of measurement according to TIA-603-C (EIRP in GNSS band: 1.556 to 1.610 GHz) .

 Δ Band = 51 MHz, Correction Factor calculated at central band 1604.5 MHz. in Fraunhofer Region.

Limit used for discrete emissions: -80 dBw = -50 dBm



Specification: FCC 27

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

26 dBc points provided in terms of attenuation below unmodulated carrier.

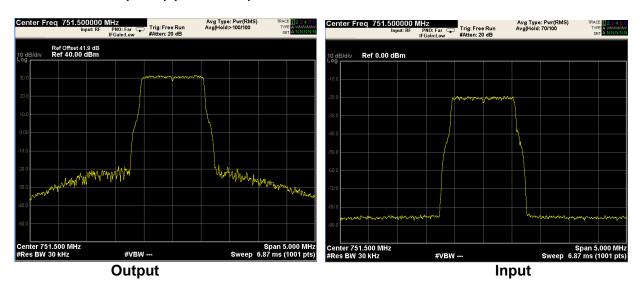
RBW was set to 1 % of emissions bandwidth.



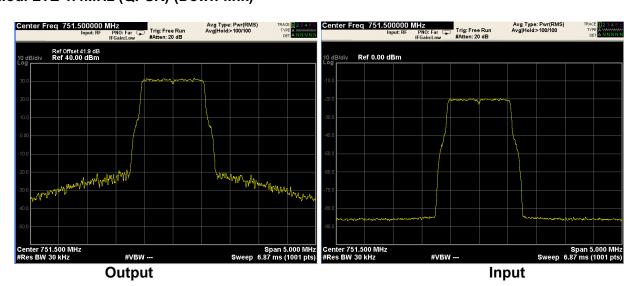
Clause 2.1049 Occupied bandwidth, continued

Test data

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



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

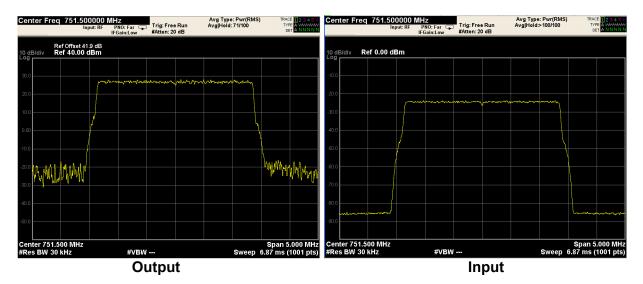




Mod. LTE 3MHz (QAM) (Down-link)

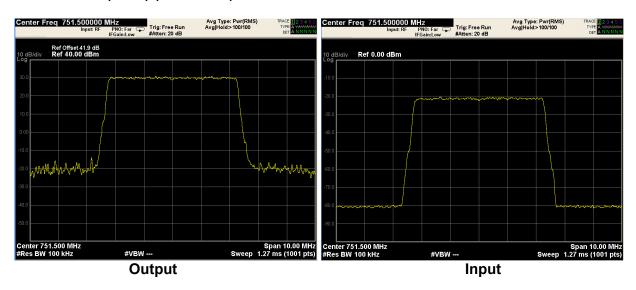


Mod. LTE 3MHz (QPSK) (Down-link)

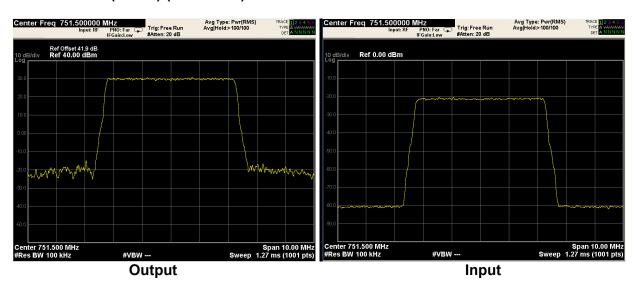




Mod. LTE 5MHz (QAM) (Down-link)



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

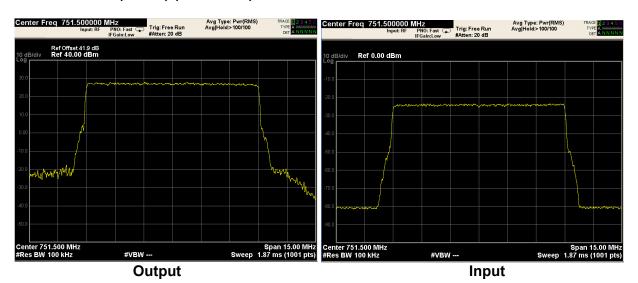




Mod. LTE 10MHz (QAM) (Down-link)



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

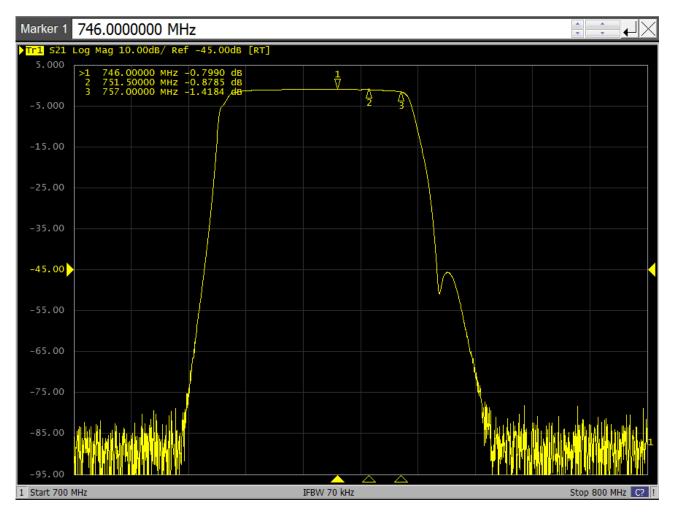




Clause 935210 D02v02r01 (D.3)(I) Out of band rejection

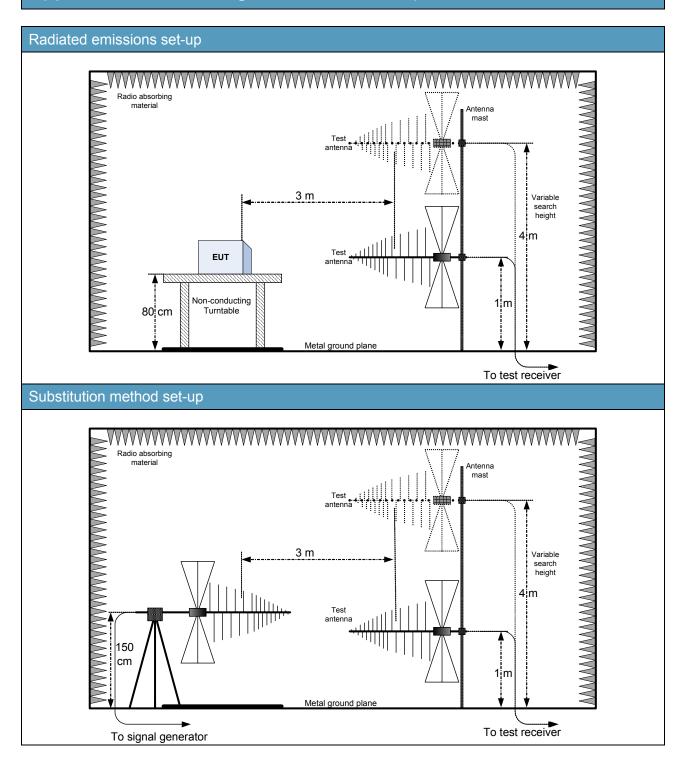
Out of Band Rejection – Test for rejection of out of band signals. Filter frequency response plots are acceptable.

Test date: 2015-05-21
Test results: Pass





Appendix B: Block diagrams of test set-ups





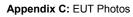
Specification: FCC 27

Appendix C: EUT Photos

Photo Set up







Nemko





Specification: FCC 27

Product: MWHPA0001S7-D







Photo EUT





Appendix C: EUT Photos

Product: MWHPA0001S7-D



Specification: FCC 27



