www.nemko.com

Report Reference ID:	253922-1TRFWL

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

Applicant:	TEKO Telecom Srl. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Remote Unit
FCC ID:	XM2-EP6B
Model:	TRE7S8SC8A9S19AWAS

Testing laboratory:	**Nemko Italy S.p.A.** Via Carroccio, 4 I-20853 Biassono (Italy)

	Name and title	**Date**
Tested by:	G. Curioni, Wireless/EMC Specialist	2014/03/27
Reviewed by:	P. Barbieri, Wireless/EMC Specialist	2014/03/27

Table of contents

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
---	---

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.

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Section 2: Summary of test results

2.1 FCC Part 27, test results

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

Notes:

a) NO Antenna provided

b) NOT APPLICABLE: 728-746MHz working band

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

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

3.1 Applicant details

Applicant complete business name	Name:	Teko Telecom Srl
	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:	-EP6B
Equipment class	B2I	
Description of product as it is marketed	Remote Unit for optical system	
	Model name/number:	TRE7S8SC8A9S19AWAS
	Serial number:	132059001

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

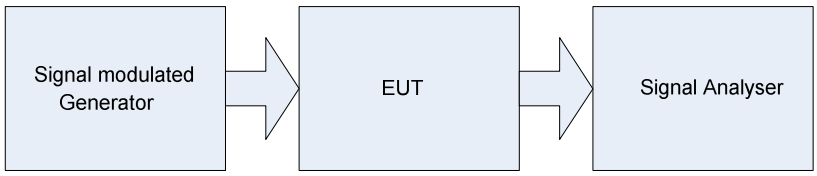
Receipt date:	2014-03-03

Nemko sample ID number:	-----

3.7 EUT technical specifications	
Operating band:	Down Link: 728–746 MHz, Up Link: 698-716 MHz
Operating frequency:	Wideband
Modulation type:	LTE (QAM and QPSK)
Occupied bandwidth:	1,4 MHz – 3 MHz – 5 MHz – 10MHz
Channel spacing:	standard
Emission designator:	D7W
RF Output	Down Link: 31dBm (1,25W) Up Link: N.A. (The EUT does not transmit over the air in the up-link direction)
Gain	Down Link: 36dB 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:	100-240 Vac

3.8 Operation of the EUT during testing	
Details:	In down-link direction, normal working at max gain with max RF power output

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 °C Relative humidity: 30–60 % 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

Client's property:

Identification number	***Description***	***Manufacturer model***	***s/n***	***Cal. Due***
1a	Vector Signal Generator	Agilent N5182A MXG	MY48180714	May 2015
1b	Vector Signal Generator	Agilent E4438C ESG	MY45094485	Ago 2016
2a	Spectrum Analyzer	Agilent E4440A	US40420470	May 2015
2b	Spectrum Analyzer	Agilent E9020A MXA	MY48011812	Ago 2015
3	Network Analyzer	Agilent E5071B	MY42301133	Ago 2016
4	Climatic chamber	Angelantoni Hygros 600	7237	Nov 2014

Property of Nemko Italy:

Equipment	**Manufacturer**	**Model no.**	**Asset no.**	**Cal cycle months**	**Next cal.**
Trilog Broad Band Antenna 25-2000 MHz	Schwarzbeck	VULB 9168	VULB 9168-242	36	02/2015
Trilog Broad Band Antenna 25-8000 MHz	Schwarzbeck	VULB 9162	VULB 9162-25	36	05/2015
Antenna 1-18 GHz	Schwarzbeck	STLP 9148	STPL 9148-123	36	02/2015
Double ridge waveguide horn	RFspin	DRH40	061106A40		08/2016
Preamplifier 18-40 GHz	Miteq	JS44	1648665		09/2014
Broadband preamplifier 1-18 GHz	Schwarzbeck	BBV 9718	9718-137	36	09/2014
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	12	02/2015
EMI receiver 20 Hz ÷ 3 GHz	R&S	ESCI	100888	12	08/2014
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		08/2014
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530		08/2014
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	Rohde & Schwarz	ESH2-Z5	872 460/041	12	09/2014
Note: N/A = Not applicable, NCR = No cal required, COU = Cal on use					

Section 8: Testing data

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

§ 27.50(c) Operation within the bands: 698-746 MHz.

(1) Fixed and base stations transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an effective radiated power (ERP) of 1000 watts and an antenna height of 305 m height above average terrain (HAAT), except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section;

(2) Fixed and base stations located in a 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, and transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an ERP of 2000 watts 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 2000 watts ERP in accordance with Table 2 of this section;

(3) Fixed and base stations transmitting a signal 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 in accordance with Table 3 of this section;

(4) Fixed and base stations located in a 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, and transmitting a signal with an emission bandwidth greater than 1MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section;

(5) Licensees seeking to operate a fixed or base station located in a 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, and transmitting a signal at an ERP greater than 1000 watts must:
(i) coordinate in advance with all licensees authorized to operate in the 698–763 MHz, 775–793, and 805–806 MHz bands within 120 kilometers (75 miles) of the base or fixed station;
(ii) coordinate in advance with all regional planning committees, as identified in §§ 90.527 of this chapter, with jurisdiction within 120 kilometers (75 miles) of the base or fixed station.

(6) Licensees of fixed or base stations transmitting a signal at an ERP greater than 1000 watts and greater than 1000 watts/MHz must comply with the provisions of paragraph (c)(8) of this section and § 27.55(b), except that licensees of fixed or base stations located in a 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, must comply with the provisions of paragraph (c)(8) of this section and § 27.55(b) only if transmitting a signal at an ERP greater than 2000 watts and greater than 2000 watts/MHz;

(7) A licensee authorized to operate in the 710–716, 716–722, or 740–746 MHz bands, or in any unpaired spectrum blocks within the 698–746 MHz band, may operate a fixed or base station at an ERP up to a total of 50 kW within its authorized, 6 MHz spectrum block if the licensee complies with the provisions of § 27.55(b). The antenna height for such stations is limited only to the extent required to satisfy the requirements of § 27.55(b).

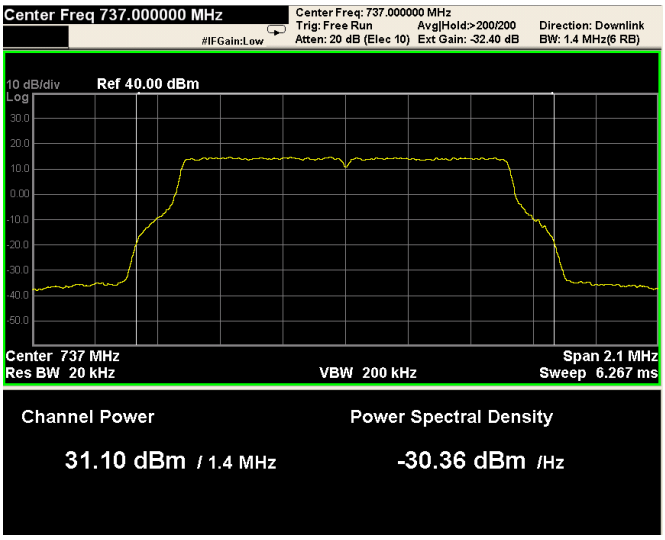
(8) Licensees intending to operate a base or fixed station at a power level permitted under the provisions of paragraph (c)(6) of this section must provide advanced notice of such operation. to the Commission and to licensees authorized in their area of operation. Licensees who must be notified are all licensees authorized under this part to operate on an adjacent spectrum block within 75 km of the base or fixed station. Notifications must provide the location and operating parameters of the base or fixed station, including the station's ERP, antenna coordinates, antenna height above ground, and vertical antenna pattern, and such notifications must be provided at least 90 days prior to the commencement of station operation.
(9) Control and mobile stations are limited to 30 watts ERP.
(10) Portable stations (hand-held devices) are limited to 3 watts ERP; and
(11) 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..

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

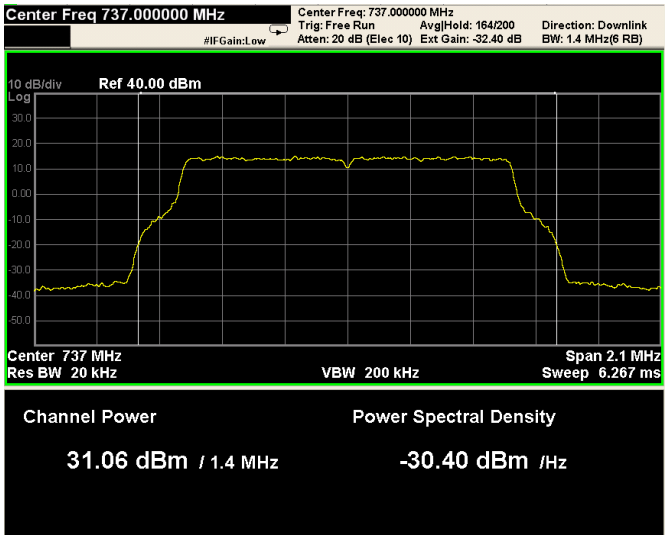
Test data

Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PAR (dB)
Down-link	LTE (QAM, 1,4MHz)	737	31.10	1.29	10.39
Down-link	LTE (QPSK, 1,4MHz)	737	31.06	1.28	9.76
Down-link	LTE (QAM, 3MHz)	737	31,18	1.31	10,62
Down-link	LTE (QPSK, 3MHz)	737	31,10	1.29	10,82
Down-link	LTE (QAM, 5MHz)	737	31,14	1.30	11,18
Down-link	LTE (QPSK, 5MHz)	737	31,11	1.29	10,58
Down-link	LTE (QAM, 10MHz)	737	31,12	1.29	11,59
Down-link	LTE (QPSK, 10MHz)	737	31,13	1.30	11,21

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

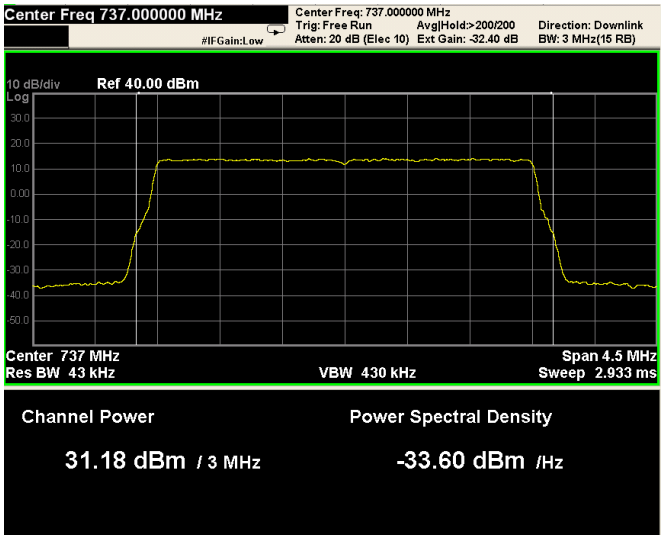


QAM

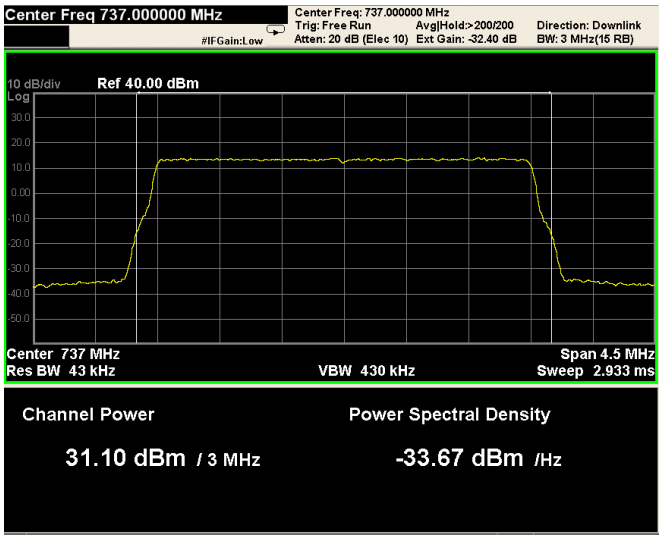


QPSK

Mod. LTE 3MHz (Down-link)

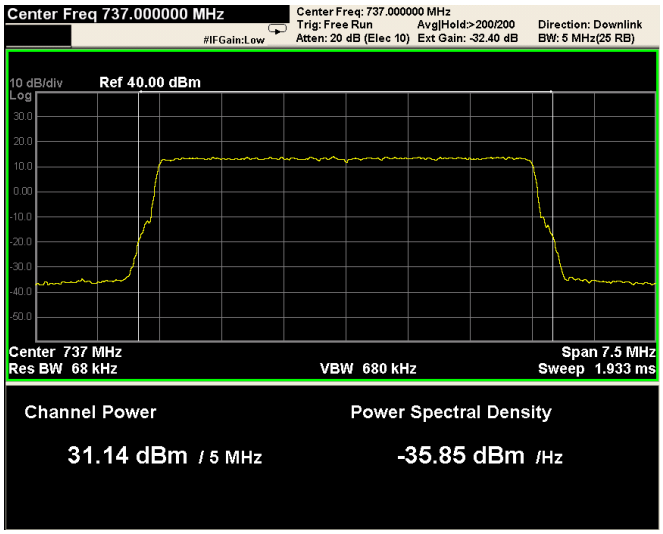


QAM

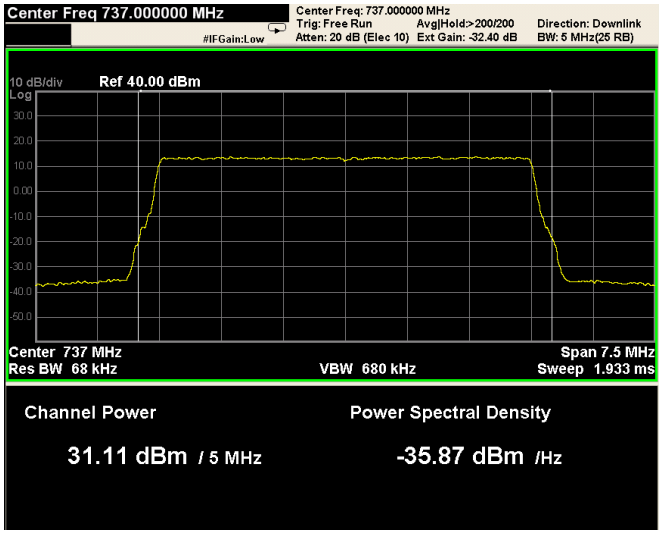


QPSK

Mod. LTE 5MHz (Down-link)

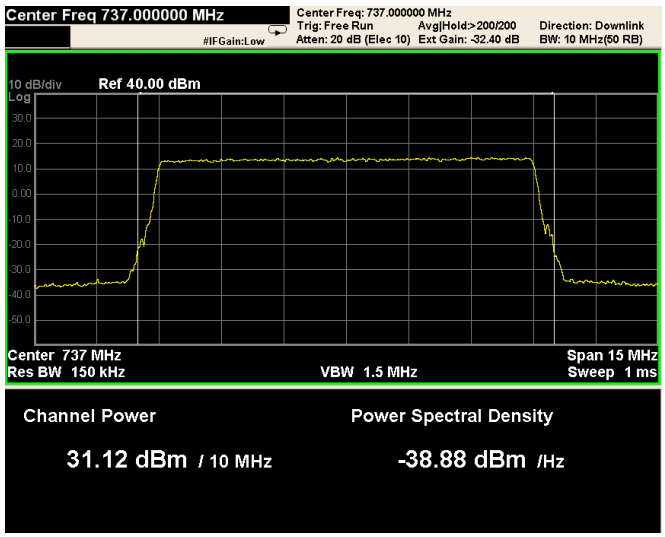


QAM

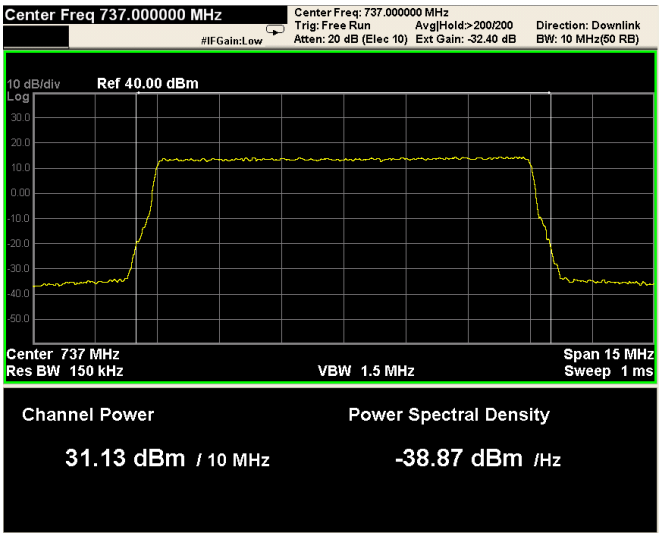


QPSK

Mod. LTE 10MHz (Down-link)



QAM



QPSK

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 is not provided

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

(g) For operations in the 698–746 MHz band and the 776–788 MHz band, the power of any emission outside a 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, by at least 43 + 10 log (P) dB.

Compliance with the provisions 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.

Special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- RBW within 30–1000 MHz was 100 kHz and 30 kHz for bandedge; 1 MHz above 1 GHz. VBW was wider than RBW.

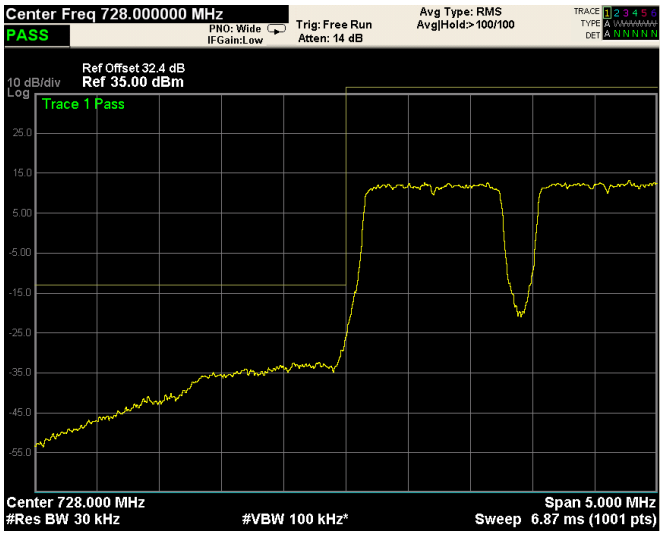
Test data			
Insert plots here			
Spurious emissions measurement results:			
Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)	Margin (dB)
Low channel			
First channel Down-link	Negligible	-13	
First channel Up-link	Negligible	-13	
Mid channel			
737 MHz Down-link	Negligible	-13	
707 MHz Down-link	Negligible	-13	
High channel			
Last channel Down-link	Negligible	-13	
Last channel Up-link	Negligible	-13	

See Plots below

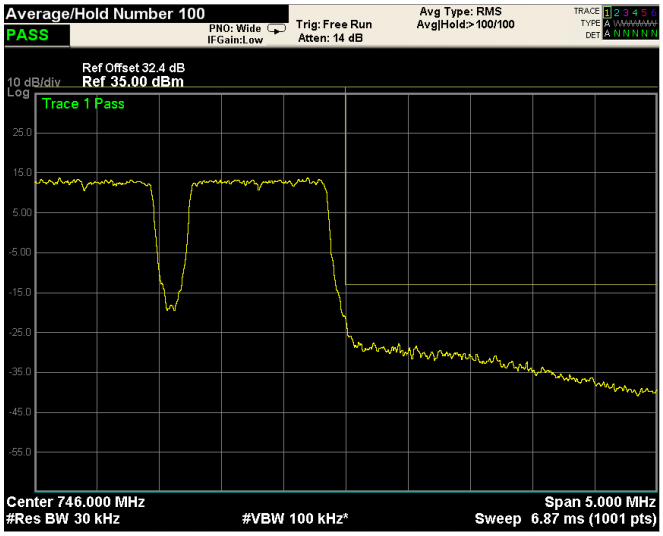
Nemko	**Section 8:** Testing data		**Product: TRE7S8SC8A9A19AWAS**
	Test name: Clause 27. 53 (g) Spurious emissions at RF antenna connector		
	Test date: 03-27 March 2014		**Test engineer:** G. Curioni
	Verdict: Pass		**Supply input:** 100-240 Vac
	Temperature: 25 °C	**Air pressure:** 860-1060 hPa	**Relative humidity:** 50 %
	Specification: FCC Part 27		

Test data, continued band edges Inter modulation:

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

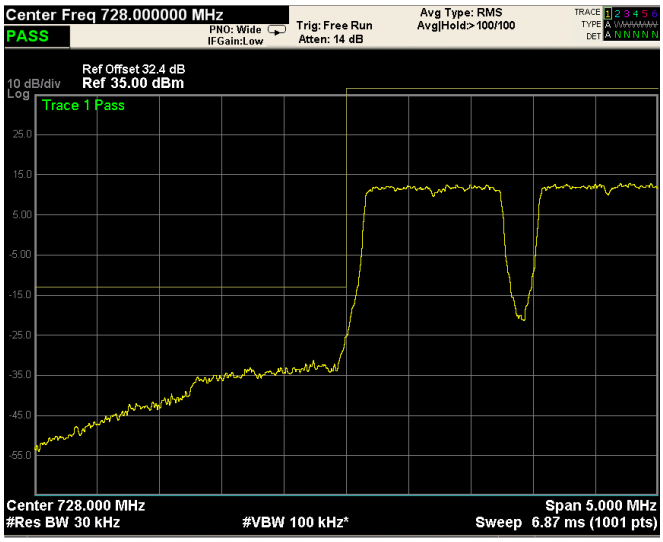


Low Band Edge

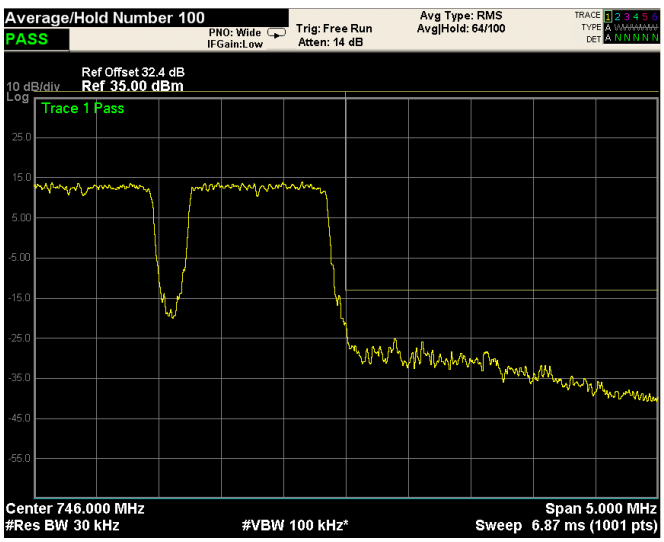


High Band Edge

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

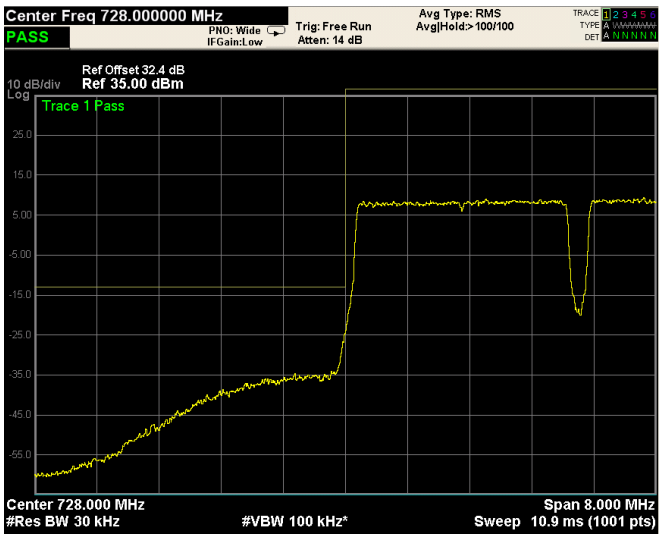


Low Band Edge

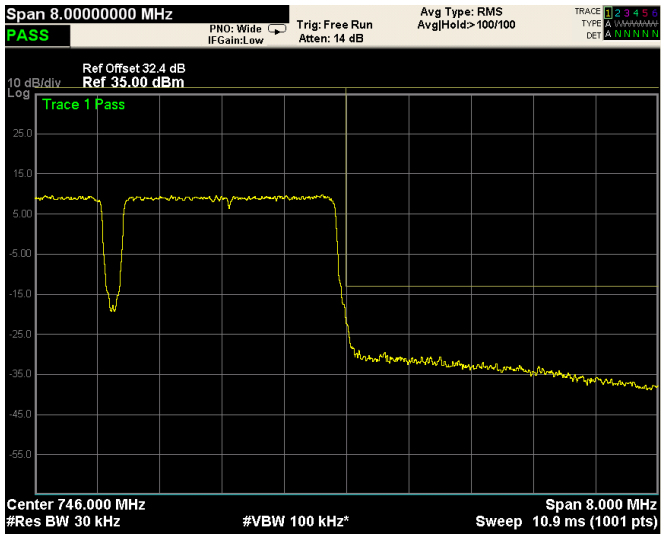


High Band Edge

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

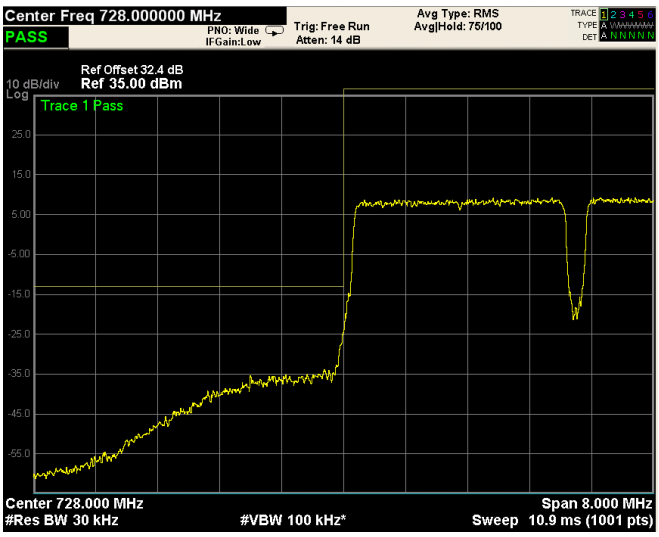


Low Band Edge

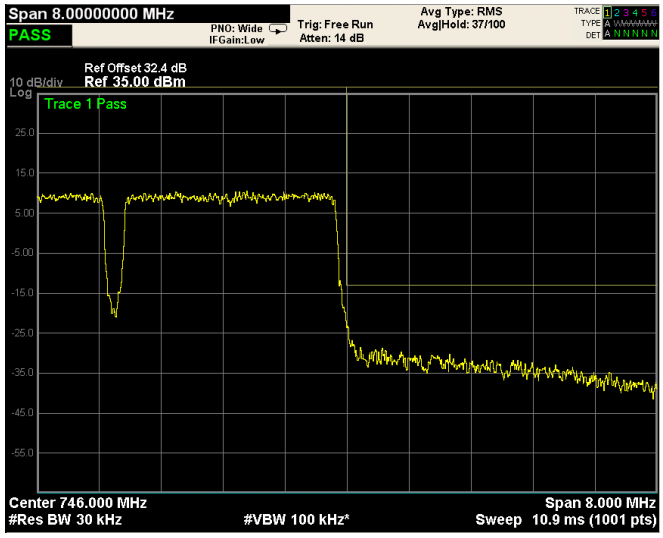


High Band Edge

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

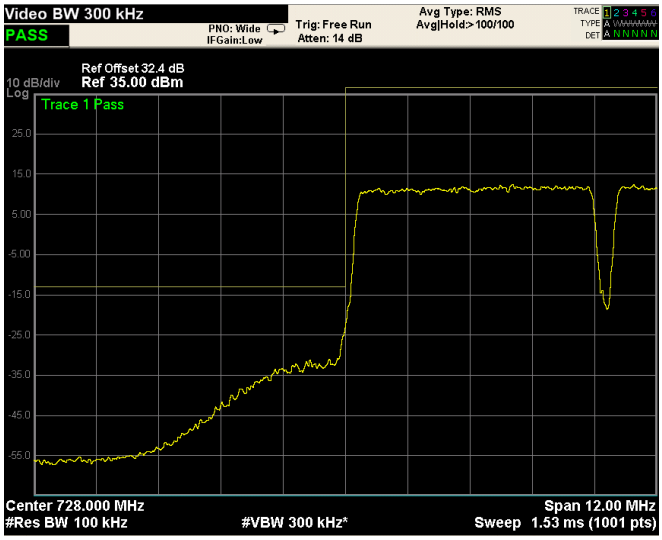


Low Band Edge

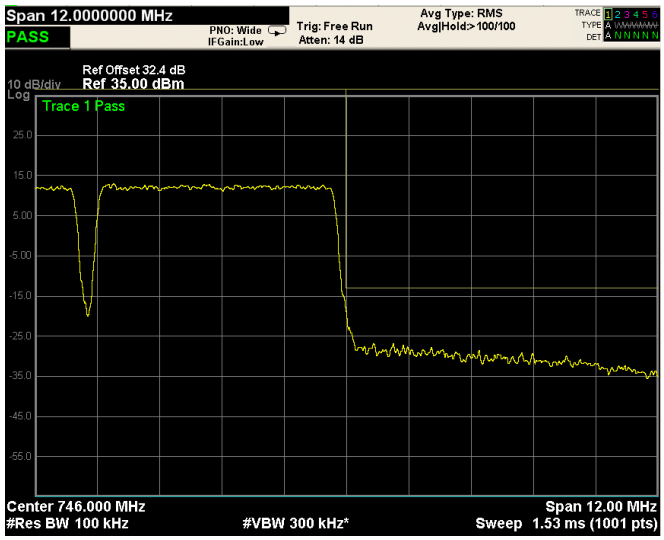


High Band Edge

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

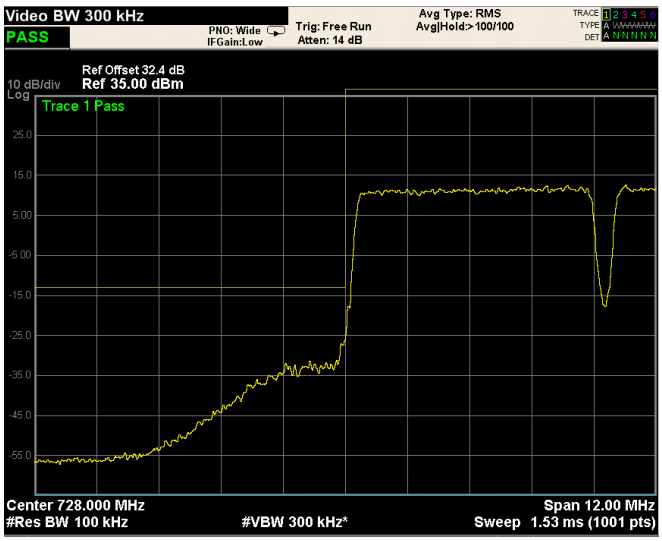


Low Band Edge

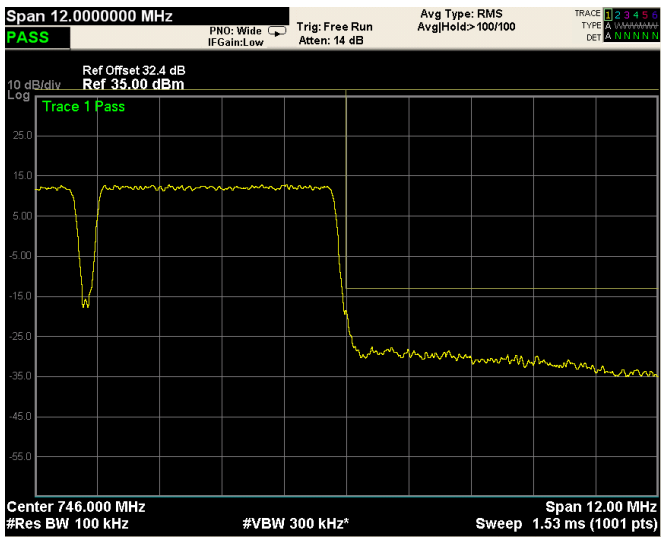


High Band Edge

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

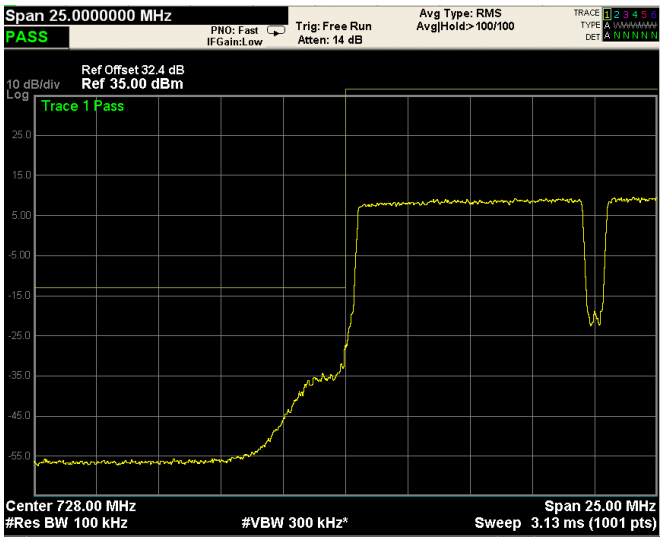


Low Band Edge

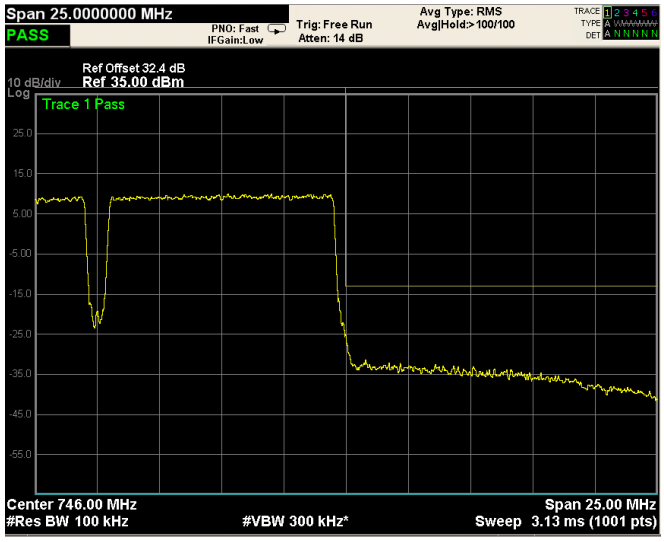


High Band Edge

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

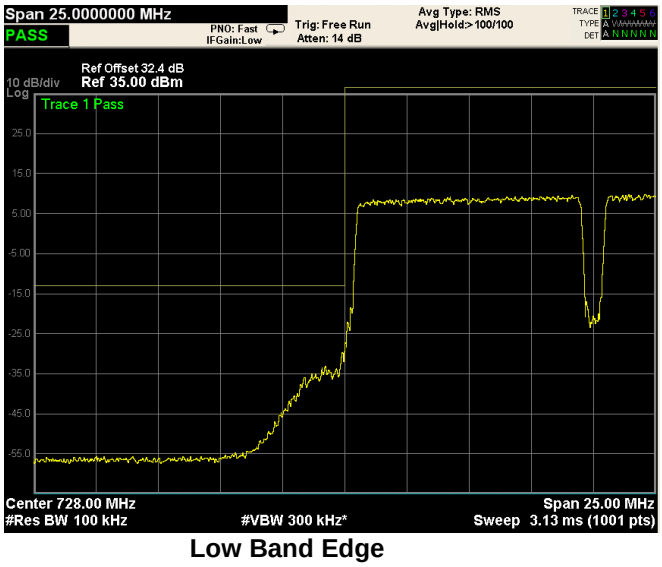


Low Band Edge

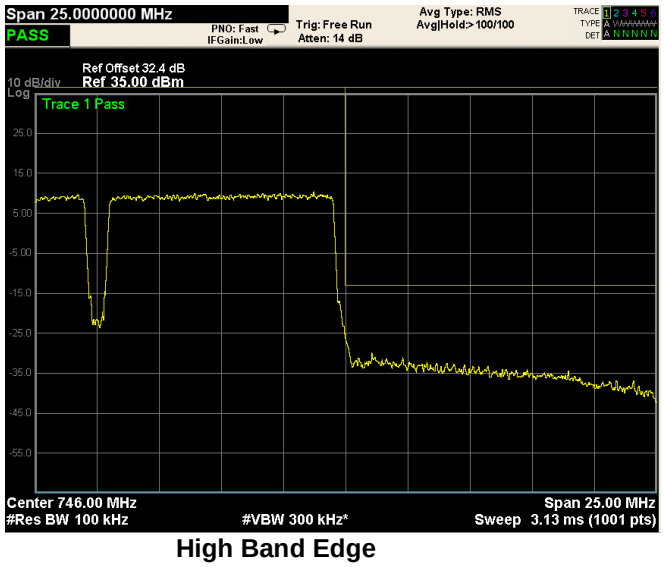


High Band Edge

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



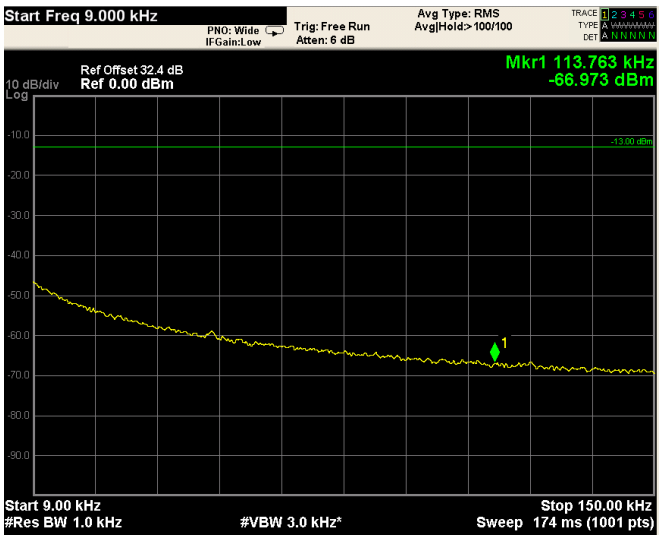
Low Band Edge



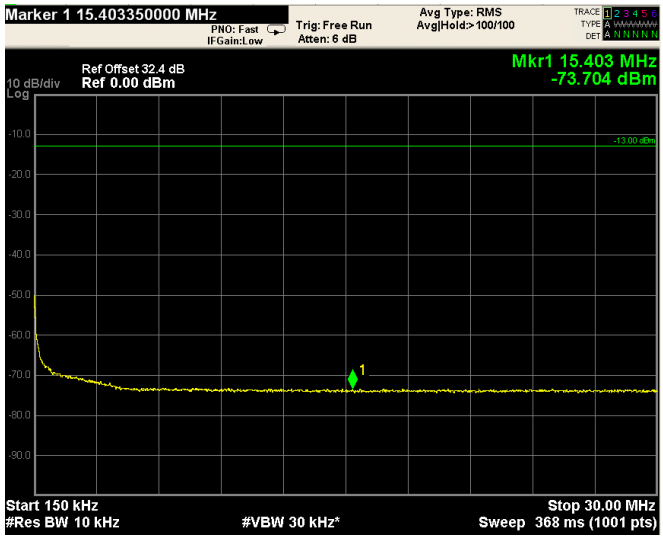
High Band Edge

Clause 24.238 Spurious emissions at antenna terminal,

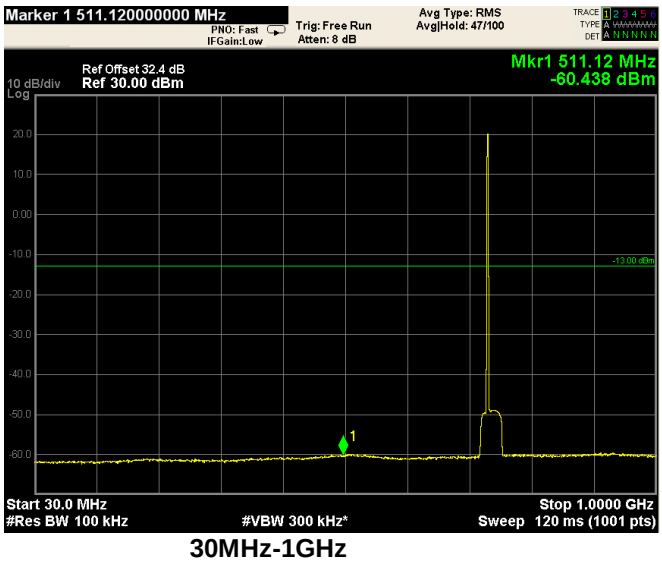
Mod. LTE 1.4MHz (QAM) (Down-link)



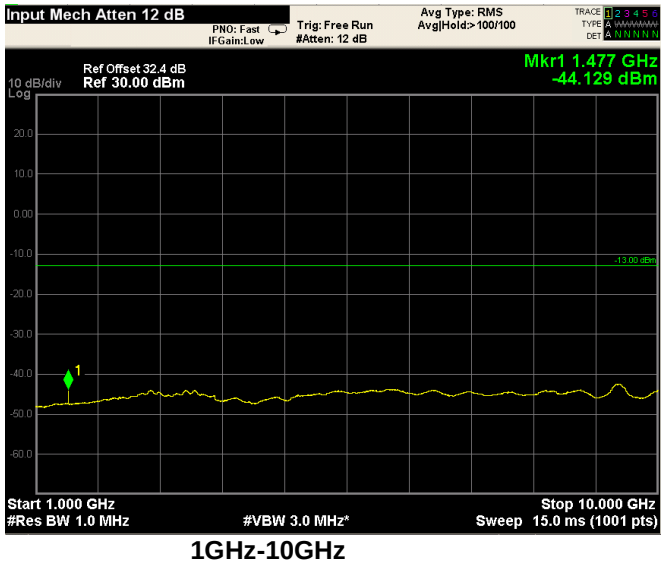
9kHz-150kHz



150kHz-30MHz

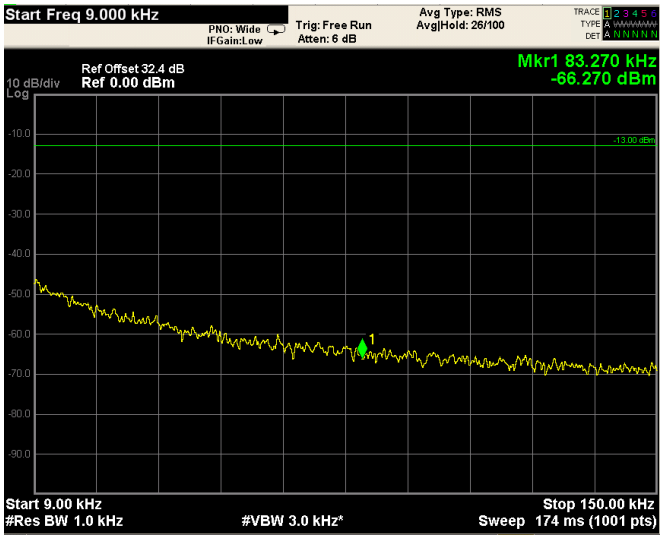


30MHz-1GHz

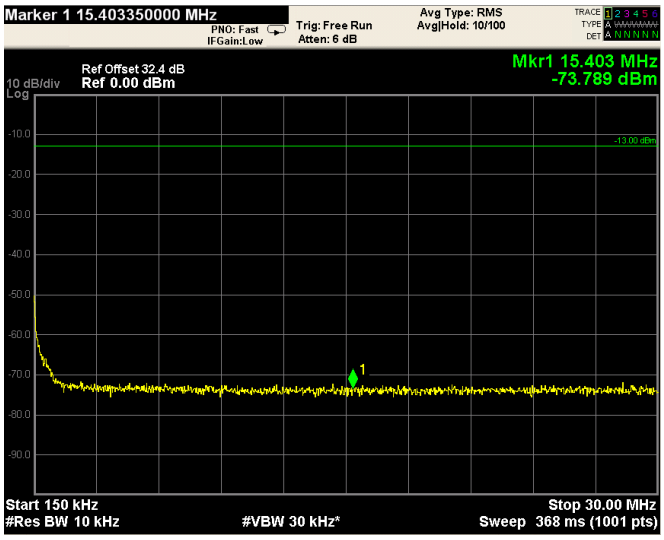


1GHz-10GHz

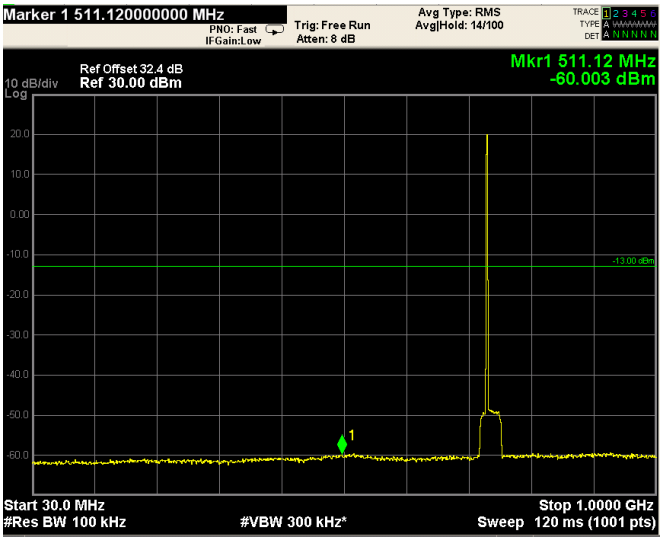
Mod. LTE 1.4MHz (QPSK) (Down-link)



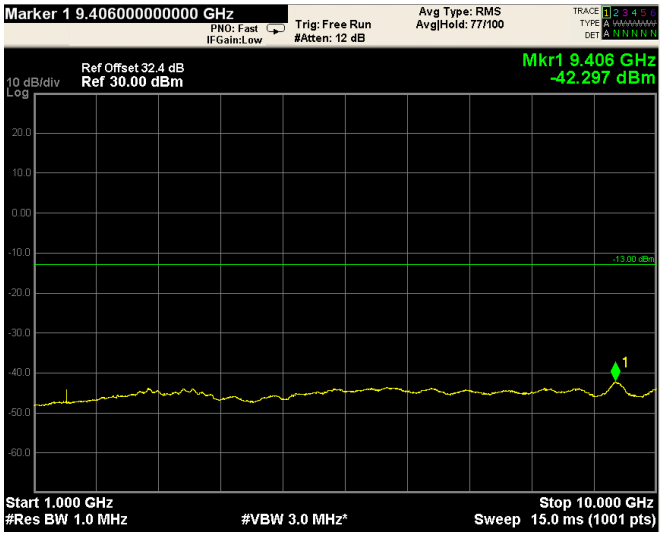
9kHz-150kHz



150kHz-30MHz

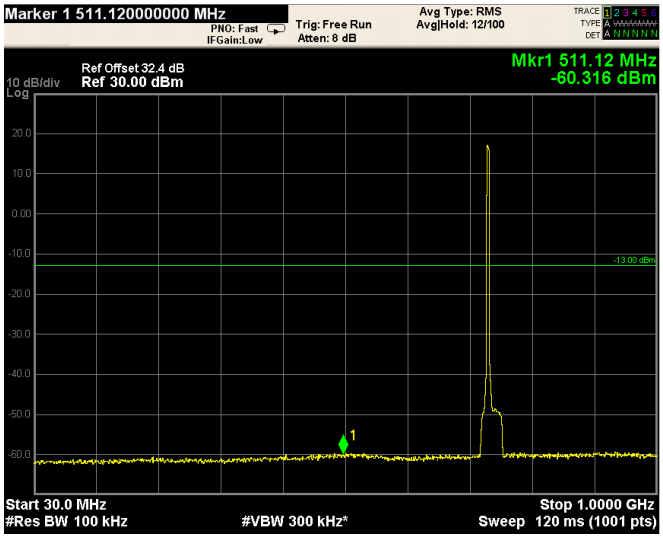


30MHz-1GHz

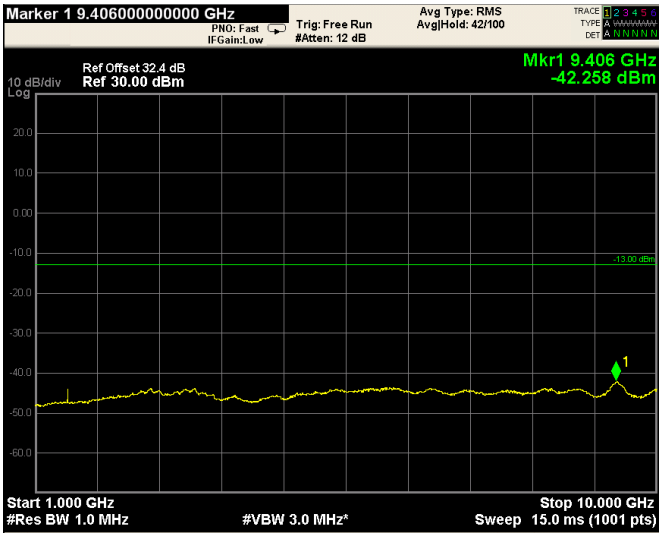


1GHz-10GHz

Mod. LTE 3MHz, only 30M-10G plot (Down-link)

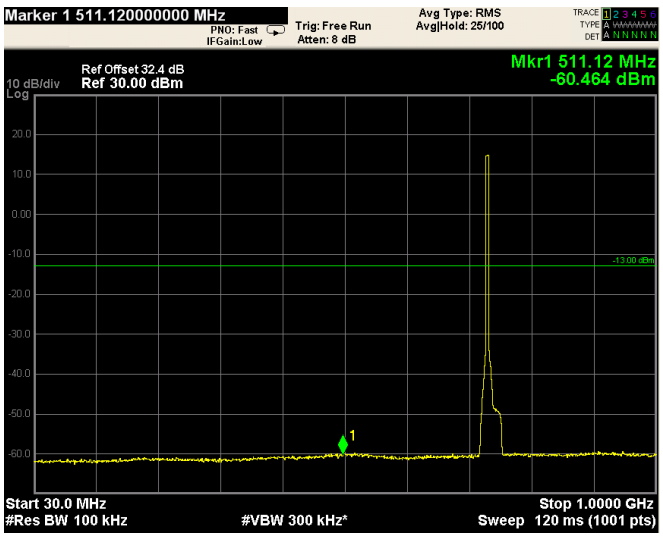


30MHz-1GHz

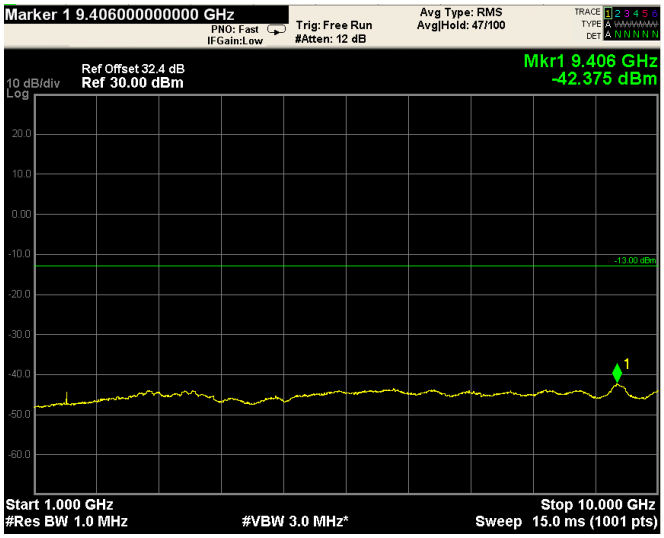


1GHz-10GHz

Mod. LTE 5MHz, only 30M-10G plot (Down-link)

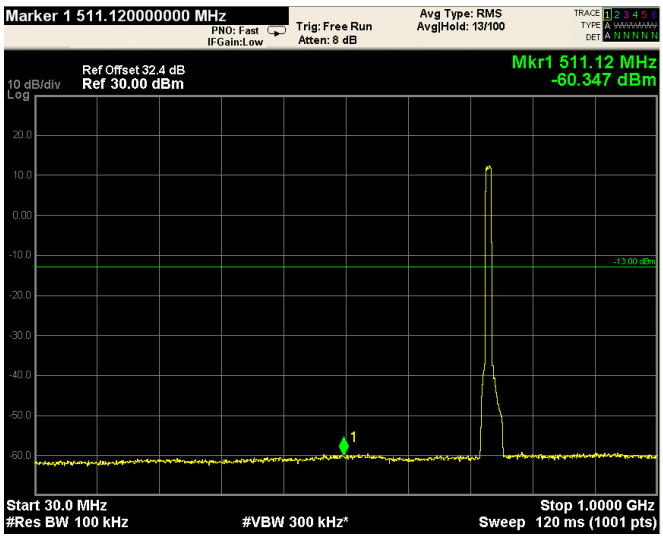


30MHz-1GHz

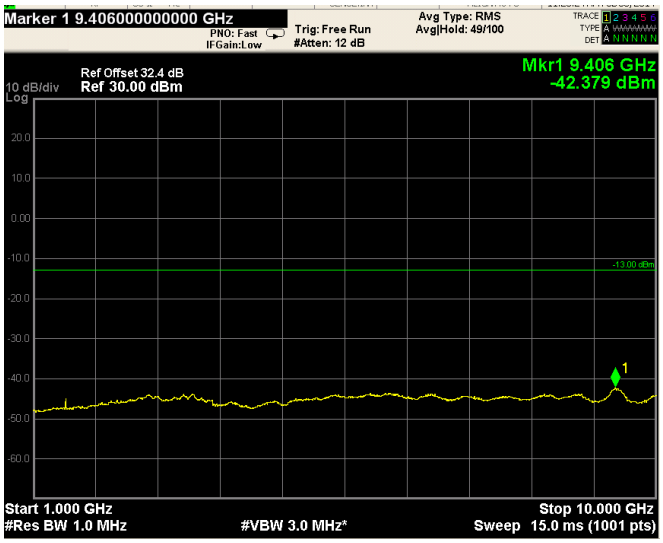


1GHz-10GHz

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



30MHz-1GHz



1GHz-10GHz

8.4 Clause 27.53 (g) Radiated spurious emissions

(g) For operations in the 698–746 MHz band and the 776–788 MHz band, the power of any emission outside a 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, by at least 43 + 10 log (P) dB.

Compliance with the provisions 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.

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.

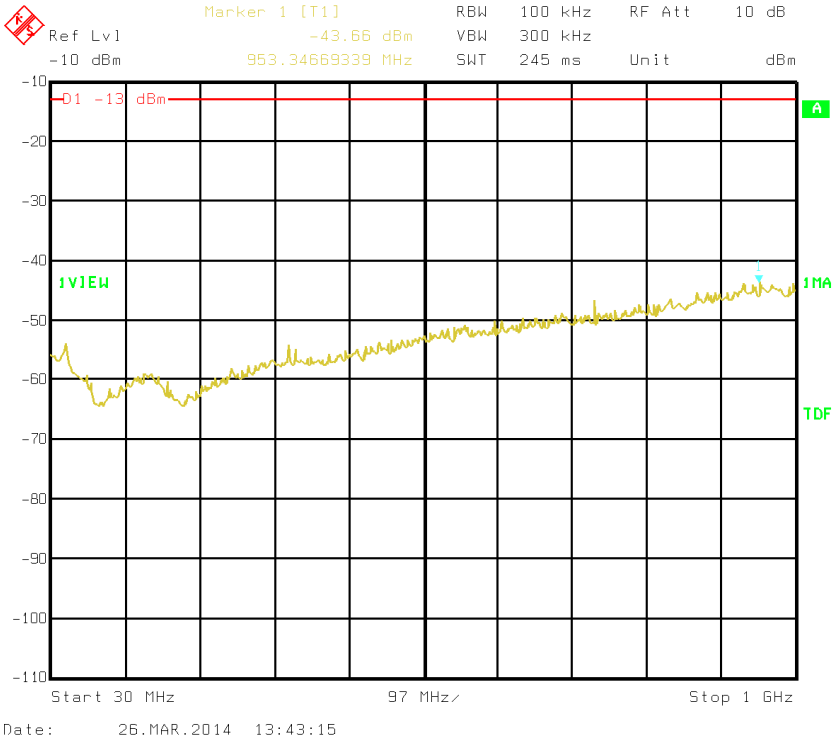
Test Data

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

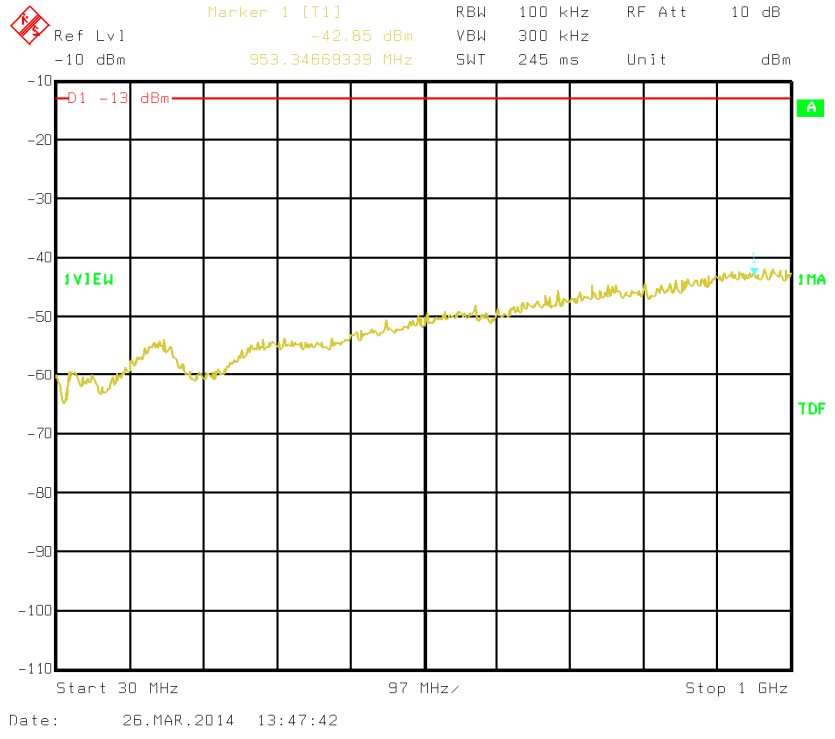
The D.U.T. antenna connector was terminated by a 50 Ω shielded dummy load.

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.

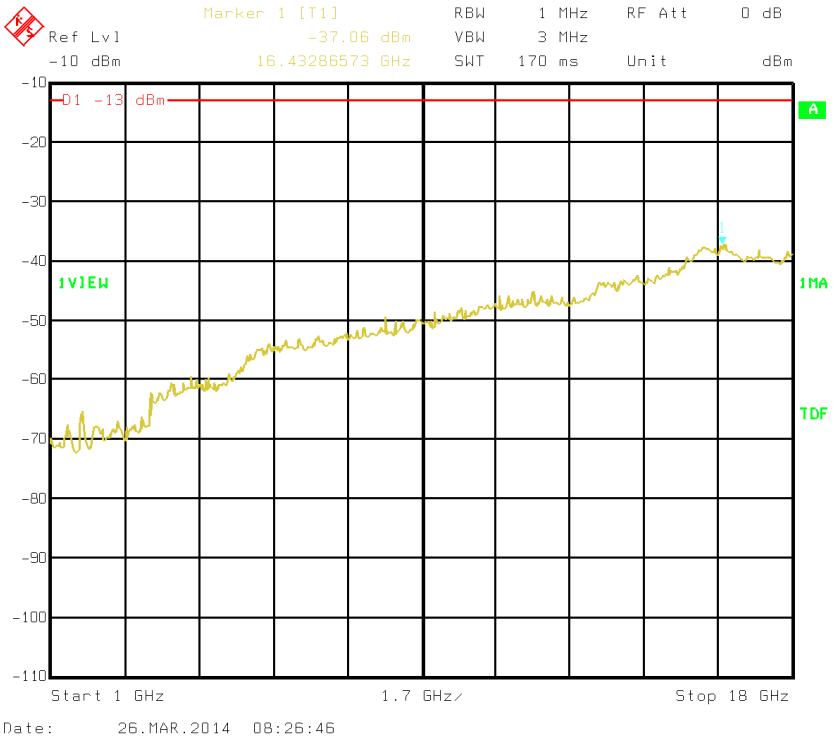
There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.



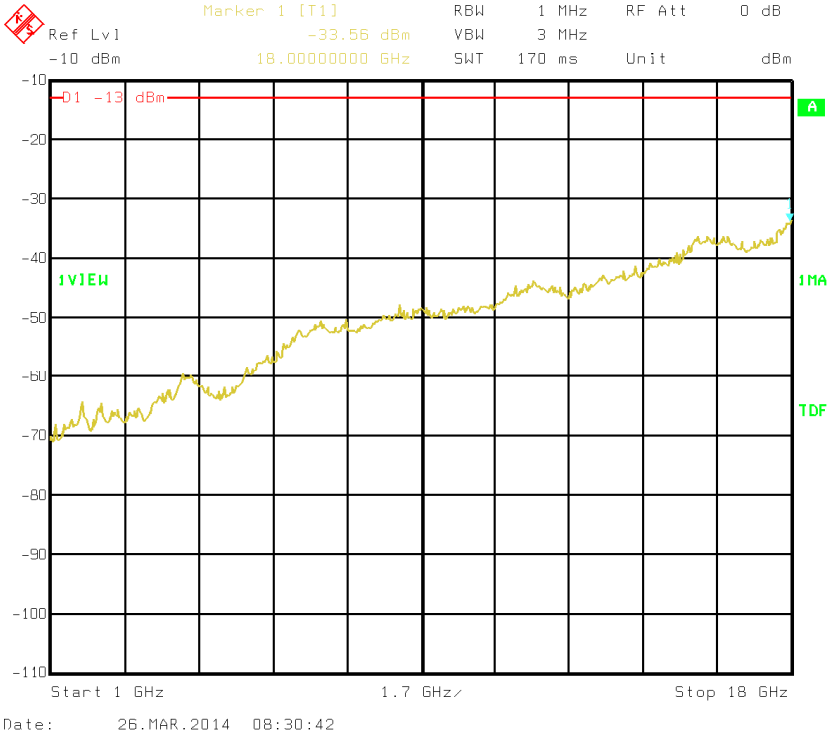
30MHz-1GHz – H Pol



30MHz-1GHz – V Pol



1GHz-18GHz – H Pol



1GHz-18GHz – V Pol

8.5 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.

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.

Test data

Insert plots here

Spurious emissions measurement results:

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.

NOT APPLICABICABLE: the EUT doesn't work in these bands.

8.6 Clause 27.54 Frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Special notes

– 26 dBc points including frequency tolerance were assessed to remain within assigned band.
- The resolution bandwidth was set to 100 kHz, video bandwidth was set to 100 kHz

Test data

26 dBc points measurement:

Frequency tolerance measurements:

Test conditions	Δ Frequency (Hz)	Offset (Hz)
+50 °C, Nominal		
+40 °C, Nominal		
+30 °C, Nominal		
+20 °C, +15 %		
+20 °C, Nominal		
+20 °C, -15 %		
+10 °C, Nominal		
0 °C, Nominal		
-10 °C, Nominal		
-20 °C, Nominal		
-30 °C, Nominal		

:

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

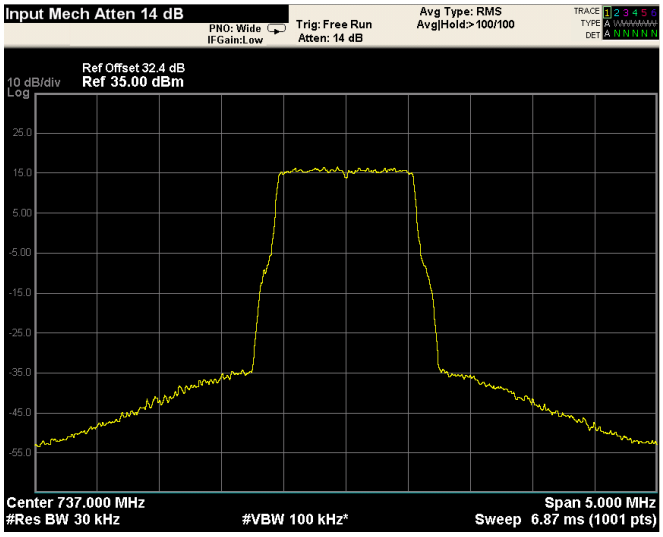
8.7 Clause 2.1049 Occupied bandwidth

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.

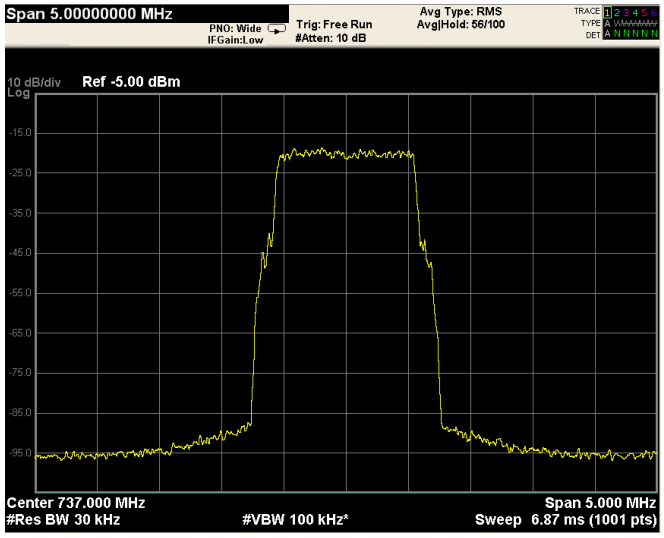
Special notes

- 26 dBc points provided in terms of attenuation below unmodulated carrier.
- RBW was set to 1 % of emissions bandwidth.

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

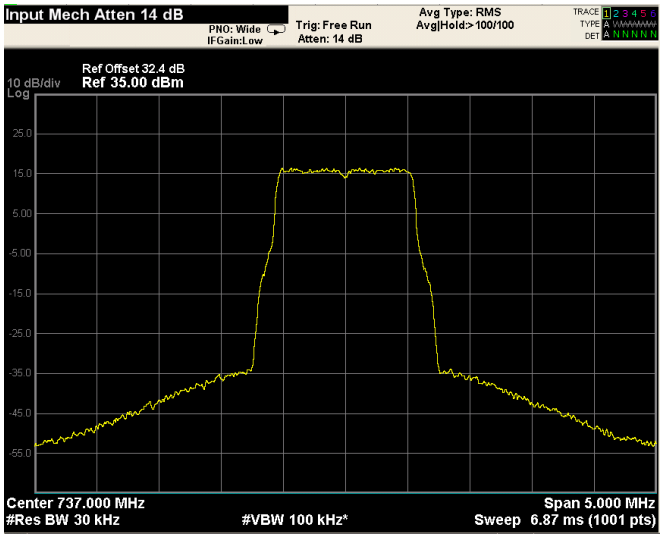


Output

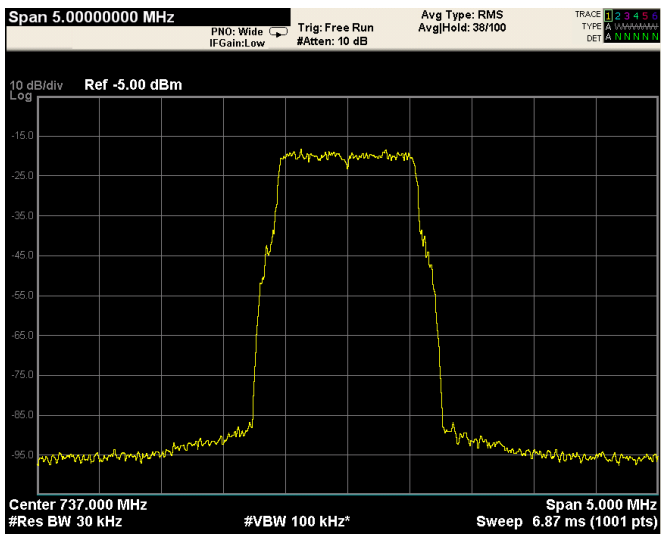


Input

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

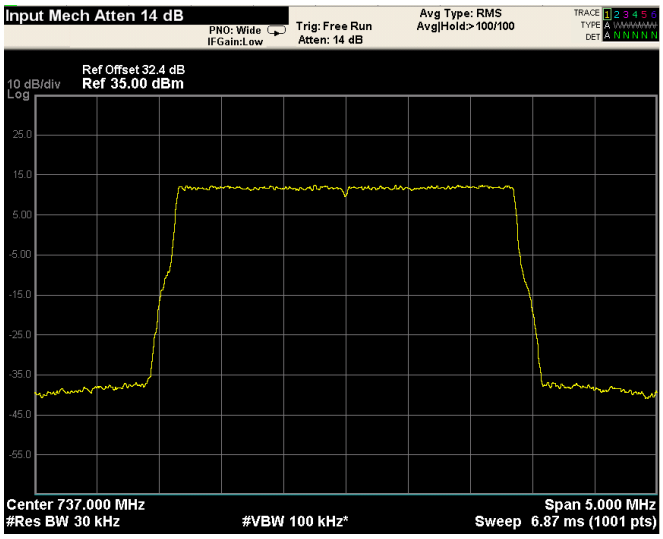


Output

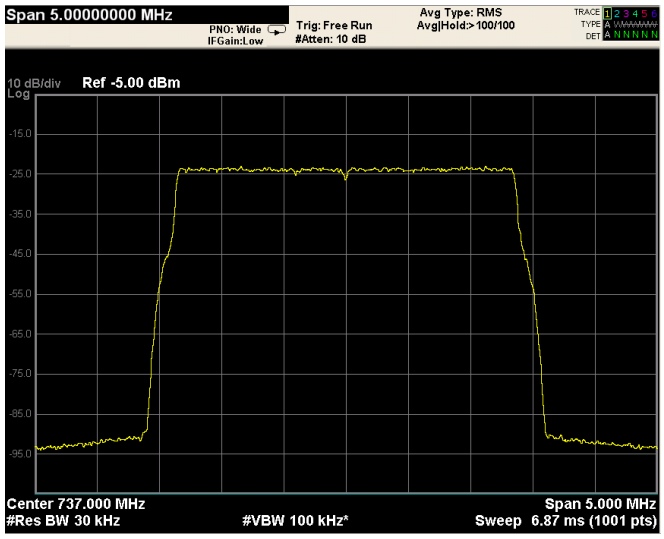


Input

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

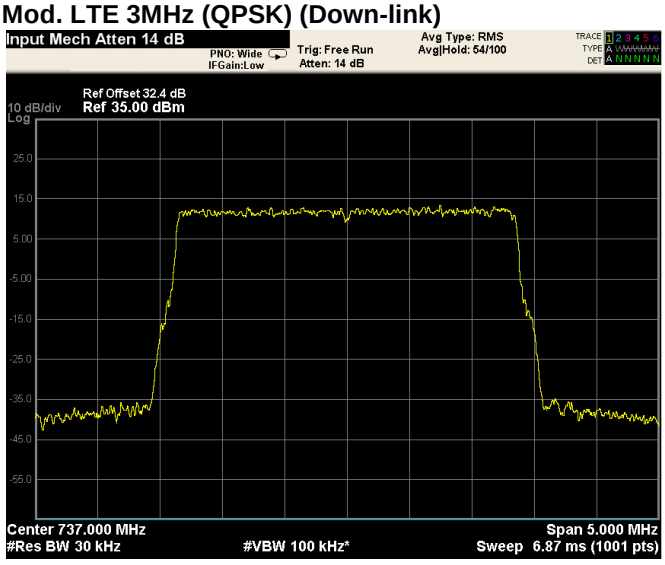


Output

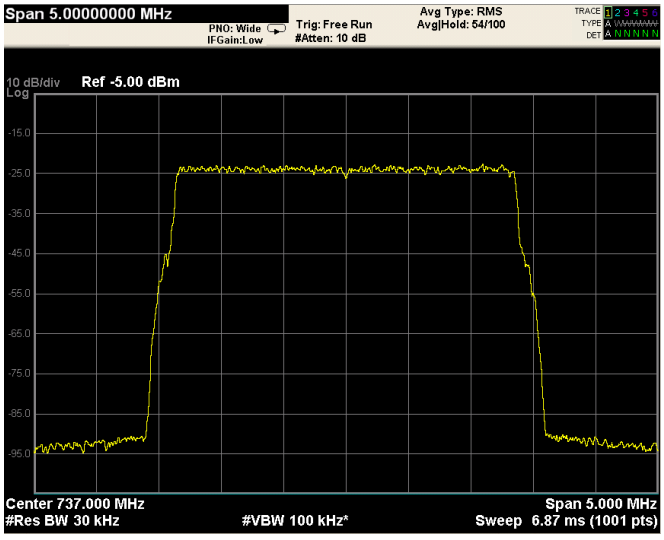


Input

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

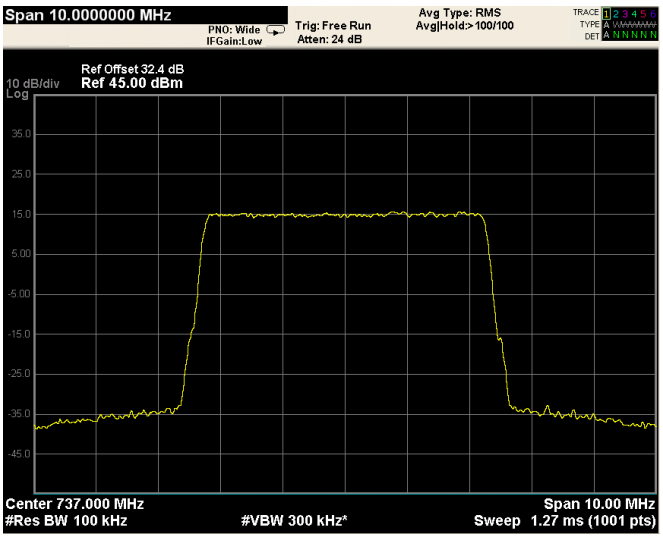


Output

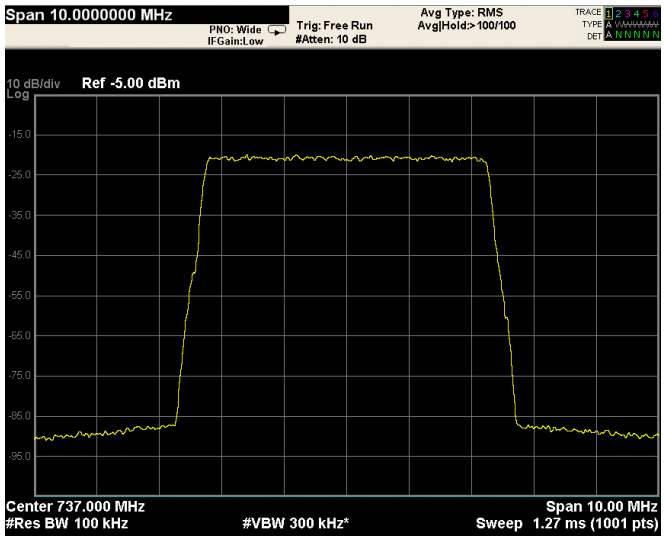


Input

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

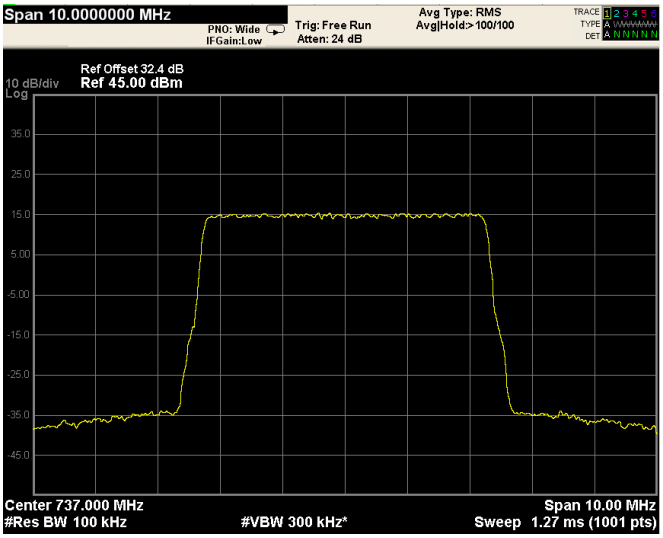


Output

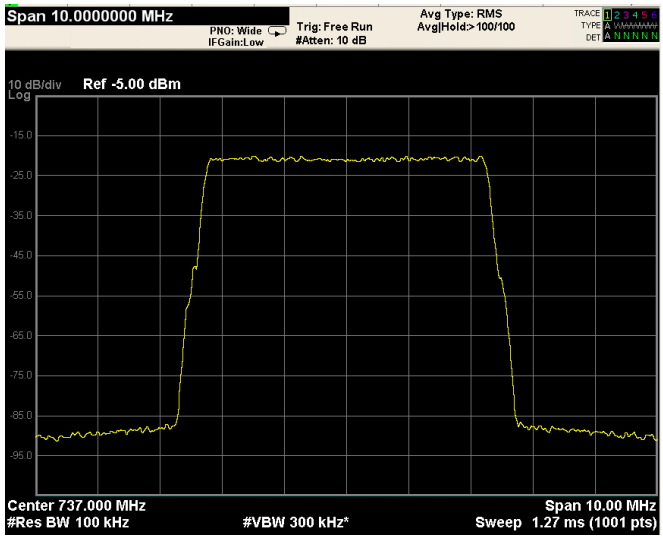


Input

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

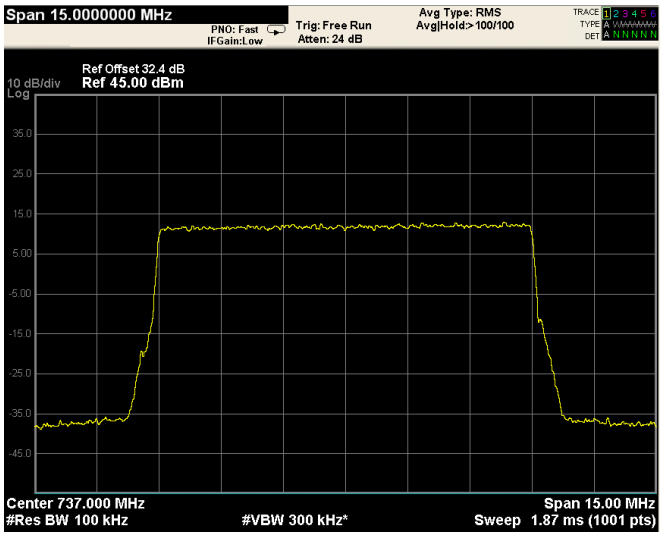


Output

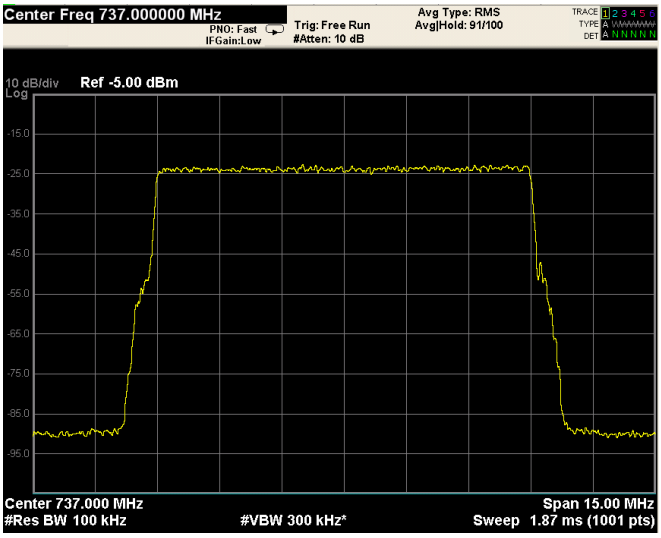


Input

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

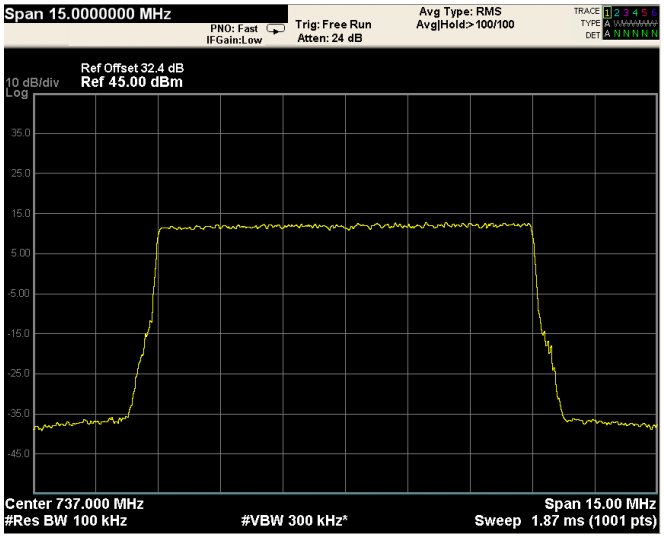


Output

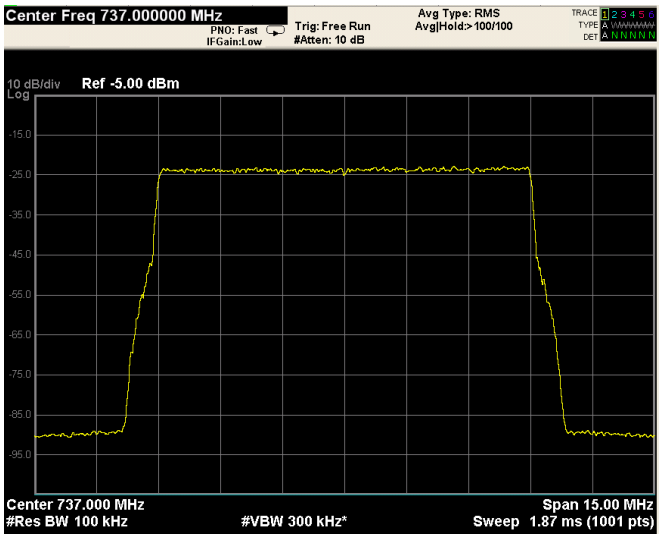


Input

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

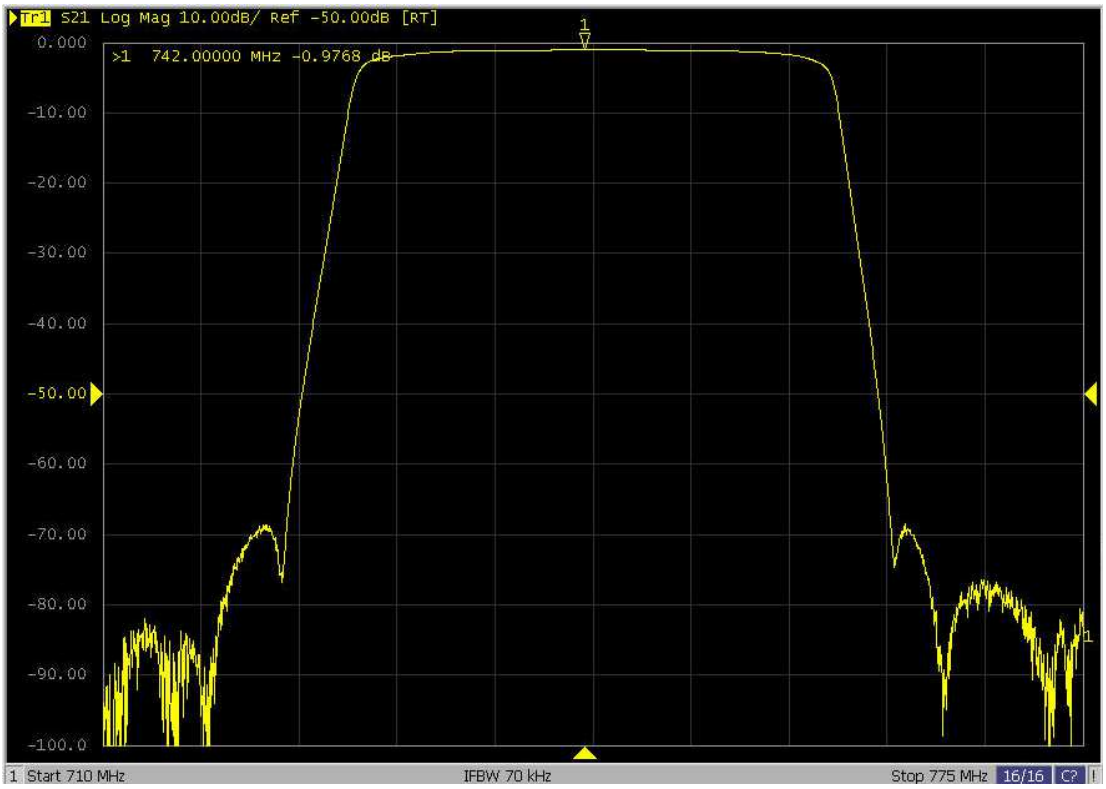


Output



Input

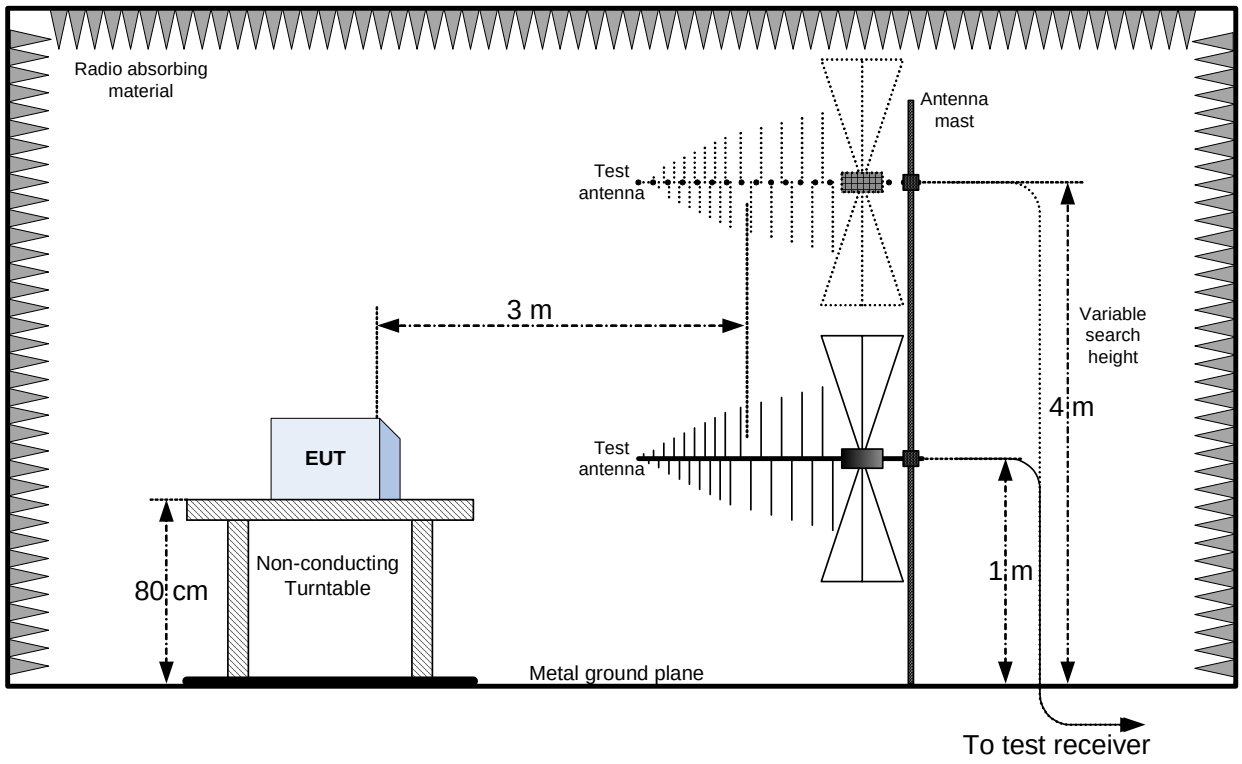
Section 9: Filter Frequency Response



Down-link

Section 10: Block diagrams of test set-ups

Radiated emissions set-up



Section 11: EUT photos

Photo Set up

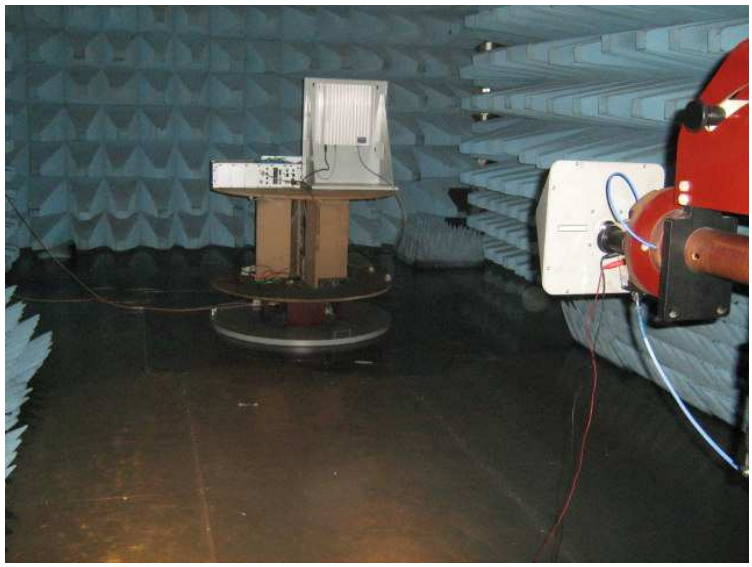


Photo EUT


Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007
OPTICAL DL/UL WDM
CLASS 1 LASER PRODUCT
TEKO TELECOM
MADE IN ITALY
EXT IN
EXT OUT
RS232
LED
TEKO TELECOM
MODEL: TRE7S8SC8A9S19AWAS
FCC ID: XM2-EP6B
Model:TRE7S8SC8A9S19AWAS
AC MAINS
(100-240V~; 50-60Hz; 2A)
Frequency Range:
698 ÷ 787MHz
817 ÷ 869MHz
824 ÷ 894MHz
896 ÷ 941MHz
1850 ÷ 1995MHz
1710 ÷ 2155MHz
Nemko
Manufacturing Date:
Serial n°
RF PORT