

Report Reference ID:	318716-2TRFWL
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Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter A – General Part 24 – Personal Communication Services Subpart E – Broadband PCS
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Applicant:	TEKO Telecom Srl. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Enhanced Power Remote Unit
Model:	TRU8A19AWEWE/AC-WT
FCC ID:	XM2-EP8A19AWE

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	2016-12-16
Reviewed by:	 P. Barbieri, Wireless/EMC Specialist	2016-12-16

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Section 1: Report summary

1.1 Test specification

Specifications	Part 24 Subpart E, Broadband PCS
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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 24. Radiated tests were conducted in accordance with ANSI C63.4-2003.
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1.3 Exclusions

Exclusions	None
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1.4 Registration number

Test site FCC ID number	176392 (3 m Semi anechoic chamber)
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1.5 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. This test report has been completed in accordance with the requirements of ISO/IEC 17025. Nemko Spa 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 Spa 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 24, test results

Part	Methods	Test description	Verdict
	§ 935210 D05v01 (3.2)	AGC threshold	Pass
	§ 935210 D05v01 (3.3)	Out of band rejection	Pass
§24.238(b)	§ 935210 D05v01 (3.4)	Occupied bandwidth	Pass
§24.232(a)	§ 935210 D05v01 (3.5)	Peak output power at RF antenna connector	Pass
§24.238(a)	§ 935210 D05v01 (3.6)	Spurious emissions at RF antenna connector	Pass
§24.238(a)	§ 935210 D05v01 (3.8)	Radiated spurious emissions	Pass
§24.235	§ 935210 D05v01 (3.7)	Frequency stability	N/A a)

Notes:

- a) 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:	Via Meucci, 24/a
	City:	Castel S. Pietro Terme
	Province/State:	Bologna
	Post code:	40024
	Country:	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:	-EP8A19AWE
Equipment class	B2I	
Description of product as it is marketed	Booster	
	Model name/number:	TRU8A19AWEWE/AC-WT
	Serial number:	1005539001

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

Section 3: Equipment under test

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:	2016-12-14
Nemko sample ID number:	-----

3.7 EUT technical specifications

Operating band:	Down Link 1930-1995 MHz; Up Link 1850-1915 MHz
Operating frequency:	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, 15 MHz, 20 MHz
Channel spacing:	standard
Emission designator:	GSM and EDGE: GXW; CDMA, WCDMA: F9W, LTE: 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

Section 3: Equipment under test

3.8 Accessories and support equipment

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

Item # 1	
Type of equipment:	Master Unit - Subrack
Brand name:	Teko Telecom srl
Model name or number:	SUB-TRX-PSU
Serial number:	101083001
Nemko sample number:	-----
Connection port:	-----
Cable length and type:	-----
Item # 2	
Type of equipment:	Master Unit – Management Module
Brand name:	Teko Telecom srl
Model name or number:	TSPV-R
Serial number:	110942253
Nemko sample number:	-----
Connection port:	LAN port
Cable length and type:	-----
Item # 3	
Type of equipment:	Master Unit – Optical Module
Brand name:	Teko Telecom srl
Model name or number:	TTRU4W-S-M
Serial number:	110679007
Nemko sample number:	-----
Connection port:	DL/UL RF connector (to connect to the base station) Optical port (to connect to remote unit)
Cable length and type:	-----
Item # 4	
Type of equipment:	Master Unit – Power Supply
Brand name:	Teko Telecom srl
Model name or number:	TPSU/AC
Serial number:	100012284
Nemko sample number:	-----
Connection port:	-----
Cable length and type:	-----

3.9 Operation of the EUT during testing

Details:

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

3.10 EUT setup diagram

In this system, Remote Unit is the EUT. Master Unit 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 connector of optical module in the Master Unit.

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.

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 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 equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Vector Signal Generator	Agilent	N5182A MXA	MY48180714	Jun 2018
Vector Signal Generator	Agilent	E4438C ESG	MY45094485	Aug 2019
Spectrum Analyzer	Agilent	N9030A PXA	MY53120882	Nov 2017
Network Analyzer	Agilent	E5071C ENA	MY46106183	Aug 2017
V-network	R & S	ESH2-Z5	872 460/041	10/2017
Trilog Broad Band Antenna 25-2000 MHz	Schwarzbeck	VULB 9168	VULB 9168-242	06/2018
Trilog Broad Band Antenna 25-8000 MHz	Schwarzbeck	VULB 9162	VULB 9162-25	07/2018
Antenna 1-18 GHz	Schwarzbeck	STLP 9148	STPL 9148-123	06/2018
Double ridge waveguide horn	RFspin	DRH40	061106A40	10/2017
Preamplifier 18-40 GHz	Miteq	JS44	1648665	12/2016
Broadband preamplifier 1-18 GHz	Schwarzbeck	BBV 9718	9718-137	12/2017
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	04/2017
EMI receiver 20 Hz ÷ 3 GHz	R&S	ESCI	100888	08/2017
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	01/2017
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	10/2018
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

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

Appendix A: Test results

Clause 935210 D05v01 (3.2) AGC threshold

Measure of EUT AGC Threshold

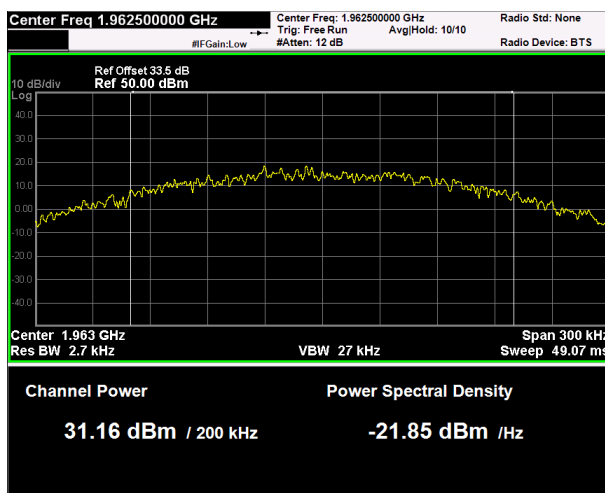
Test date: 2016-12-14

Test results: Pass

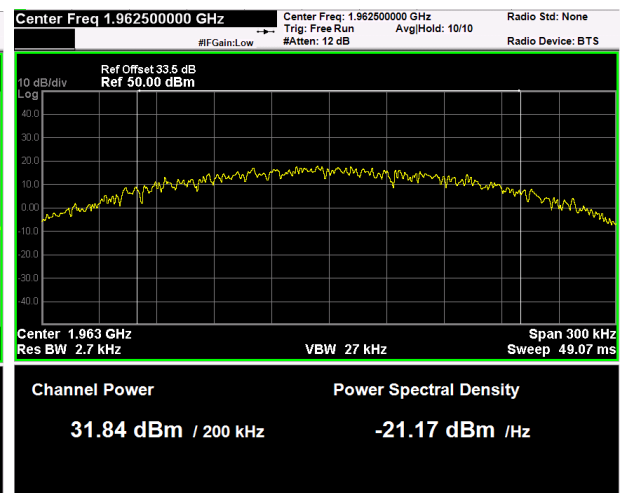
Special notes

- Narrowband amplifiers: MSK test signal used (GSM-TDMA signal)
- Broadband amplifiers: AWGN test signal used (5 MHz LTE channel)

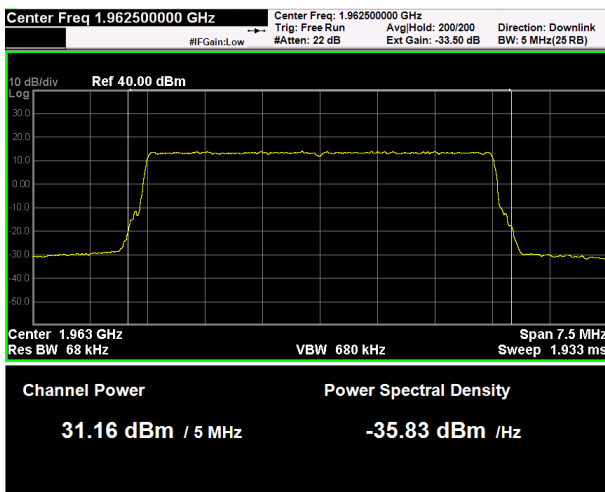
Test data



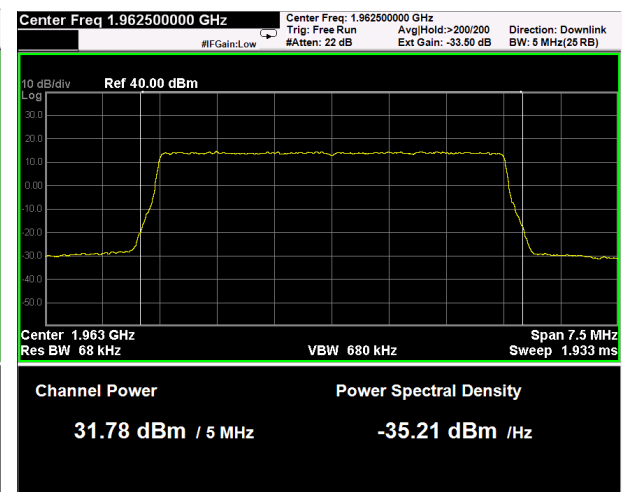
MSK signal, nominal input signal



MSK signal, nominal input signal +1 dB



AWGN signal, nominal input signal



AWGN signal, nominal input signal +1 dB

Clause 935210 D05v01 (3.3) Out of band rejection

Out of Band Rejection – Test for rejection of out of band signals.

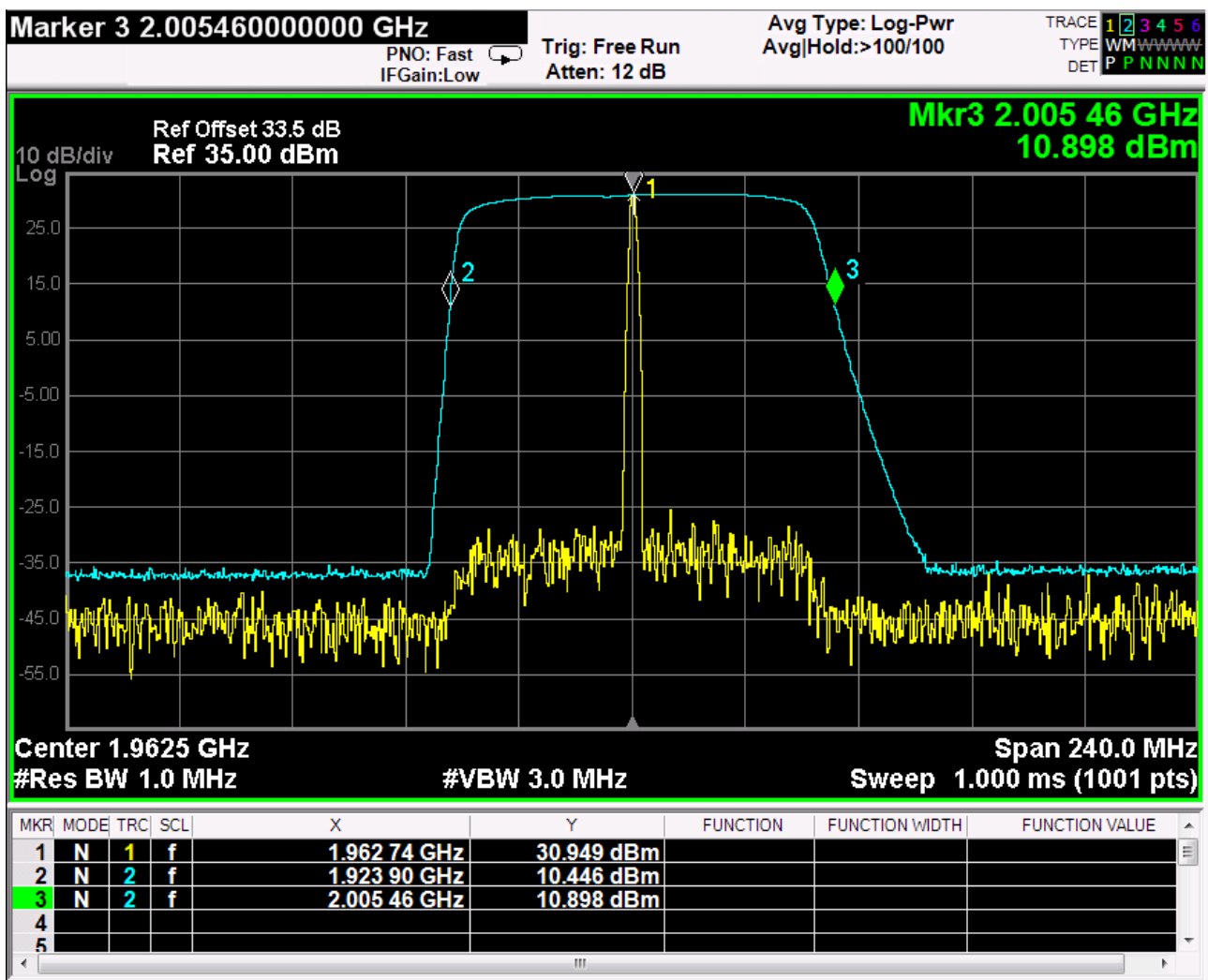
Test date: 2016-12-14

Test results: Pass

Special notes

–

Test data



Clause 24.238(b) 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: 2016-12-14

Test results: Pass

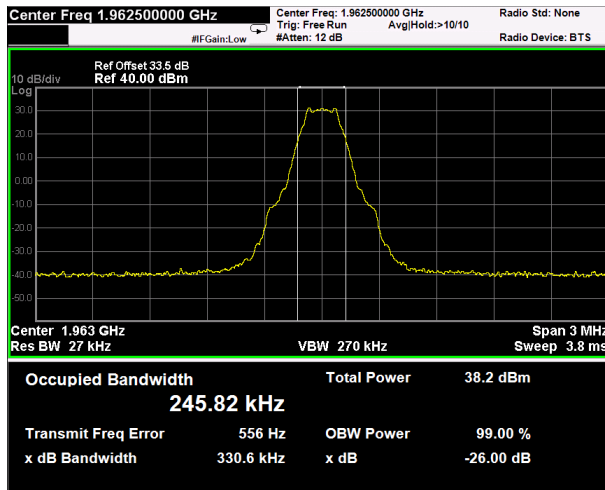
Special notes

- Narrowband amplifiers: MSK test signal used (GSM-TDMA signal)
- Broadband amplifiers: AWGN test signal used (5 MHz LTE channel)

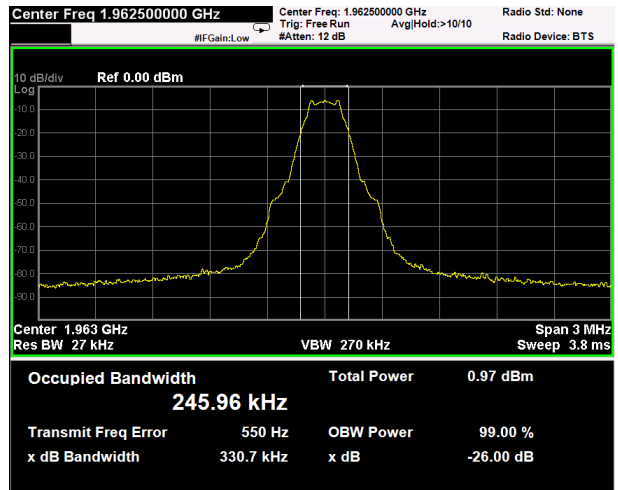
Clause 24.238(b) Occupied bandwidth, continued

Test data

MSK signal, nominal input signal

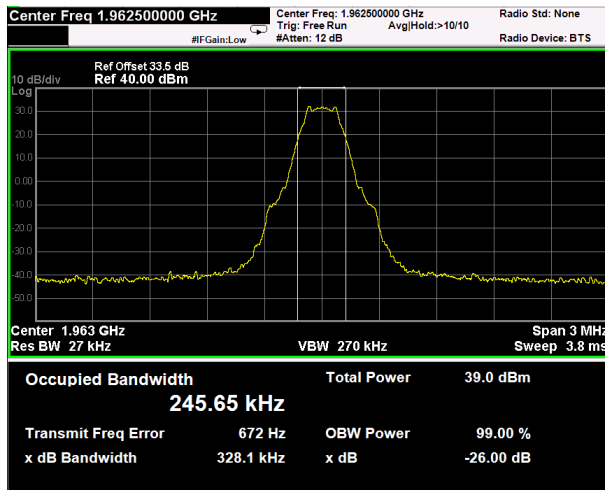


Output

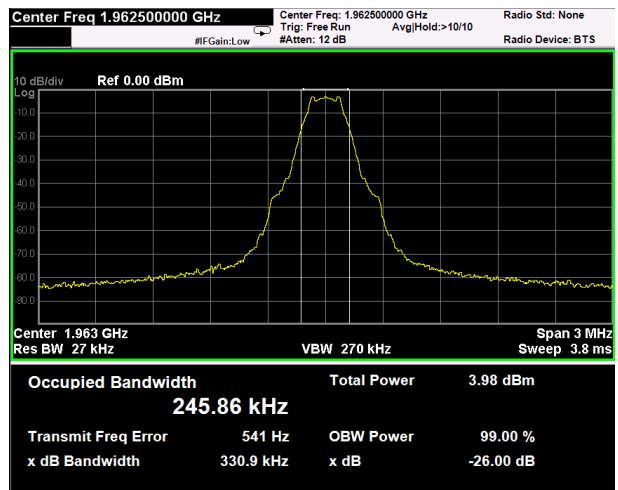


Input

MSK signal, nominal input signal + 3dB

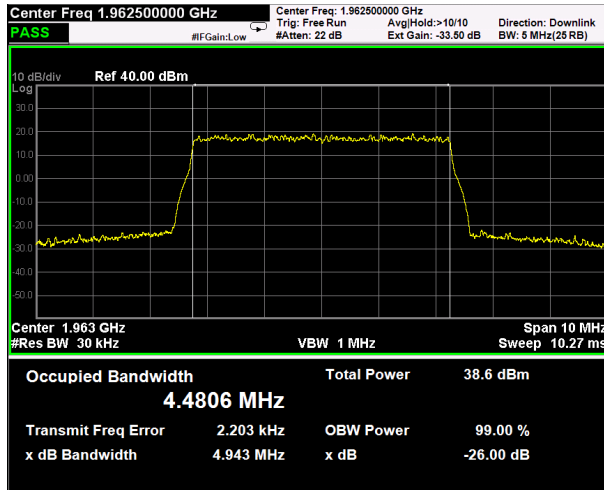


Output

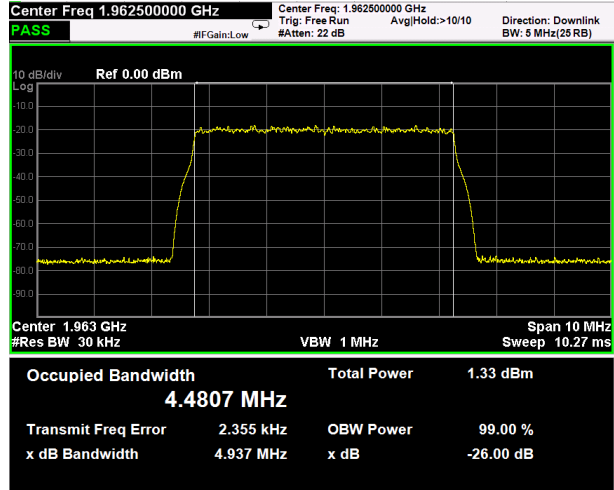


Input

AWGN signal, nominal input signal

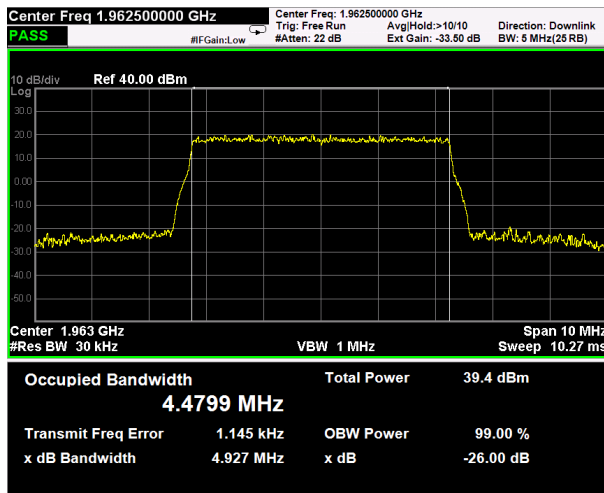


Output

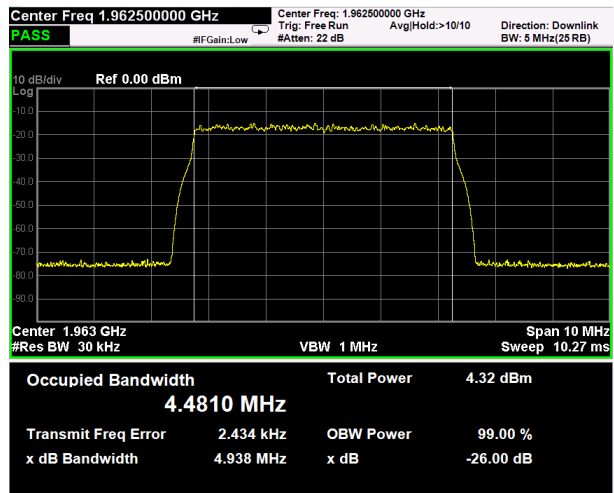


Input

AWGN signal, nominal input signal + 3dB



Output



Input

Clause 24.232(a) Peak output power at RF antenna connector

(a) (1) Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(a) (2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

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

Test date: 2016-12-14

Test results: Pass

Special notes

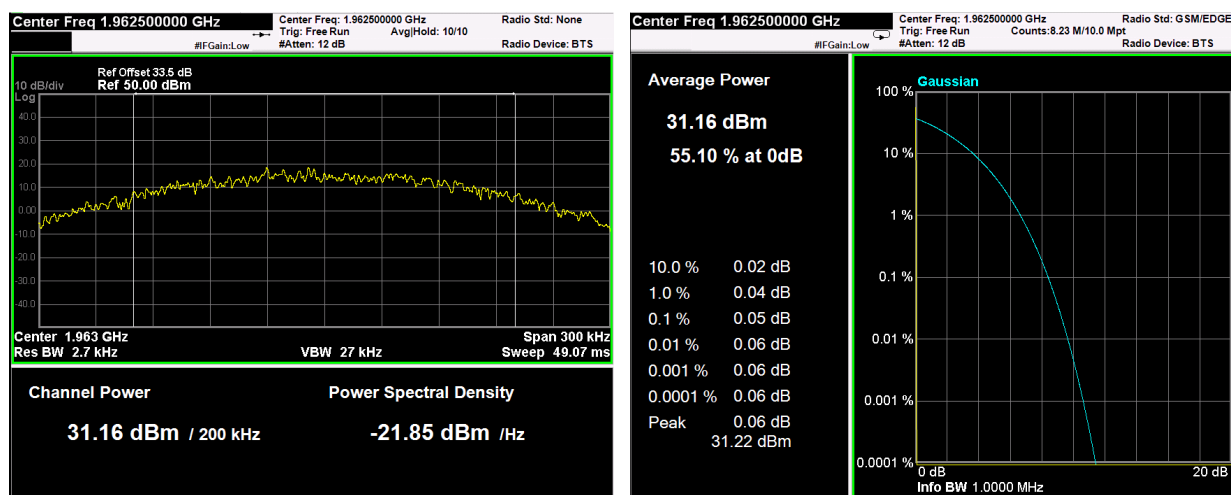
- Narrowband amplifiers: MSK test signal used (GSM-TDMA signal)
- Broadband amplifiers: AWGN test signal used (5 MHz LTE channel)

Clause 24.232(a) Peak output power at RF antenna connector

Test data

MSK signal, nominal input signal

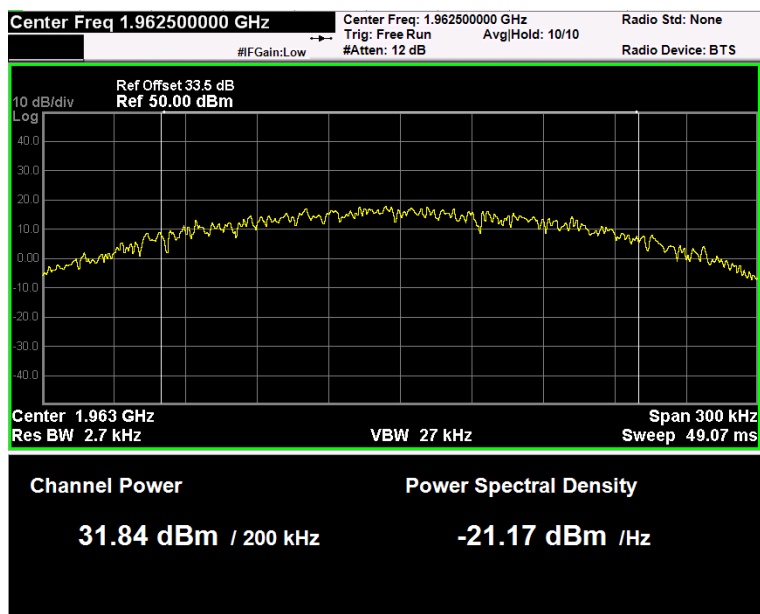
Test data					
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PAR (dB)
Down-link	MSK (GSM, 200kHz)	1962.5	31.16	1,31	0,06



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.

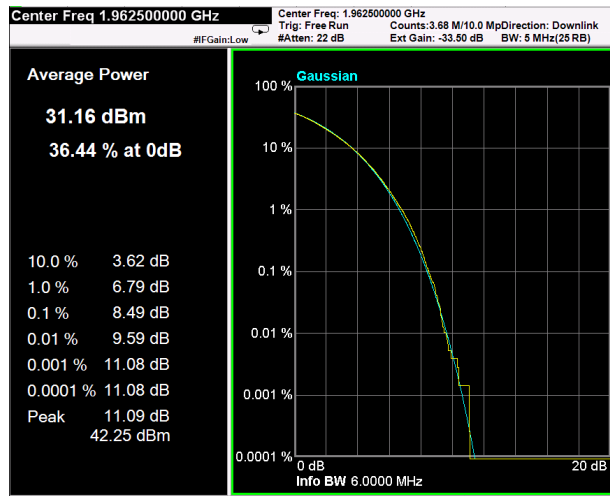
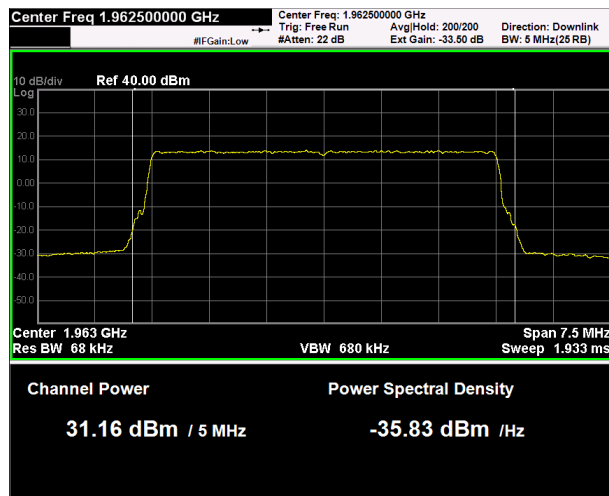
MSK signal, nominal input signal + 3dB

Test data				
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)
Down-link	MSK (GSM, 200kHz)	1962.5	31.84	1.53



AWGN signal, nominal input signal

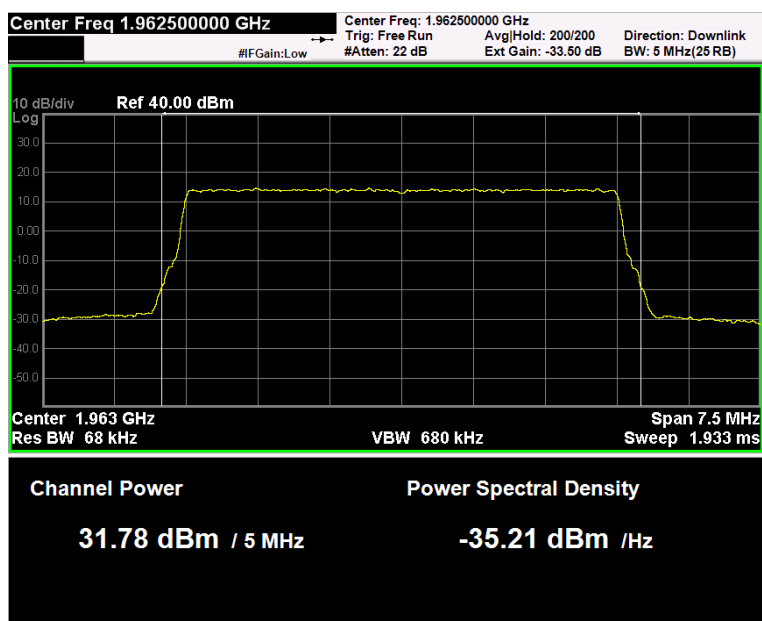
Test data						
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	RF output Power (W/MHz)	PAR (dB)
Down-link	AWGN (LTE, 5MHz)	1962.5	31.16	1.31	0.26	11.09



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.

AWGN signal, nominal input signal + 3dB

Test data					
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	RF output Power (W/MHz)
Down-link	AWGN (LTE, 5MHz)	1962.5	31.78	1.51	0.302



Clause 24.238(a) Spurious emissions at RF antenna connector

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.

Test date: 2016-12-14

Test results: Pass

Special notes

- Narrowband amplifiers: MSK test signal used (GSM-TDMA signal)
- Broadband amplifiers: AWGN test signal used (5 MHz LTE channel)

Clause 24.238(a) Spurious emissions at RF antenna connector, continued

Test data

See Plots below

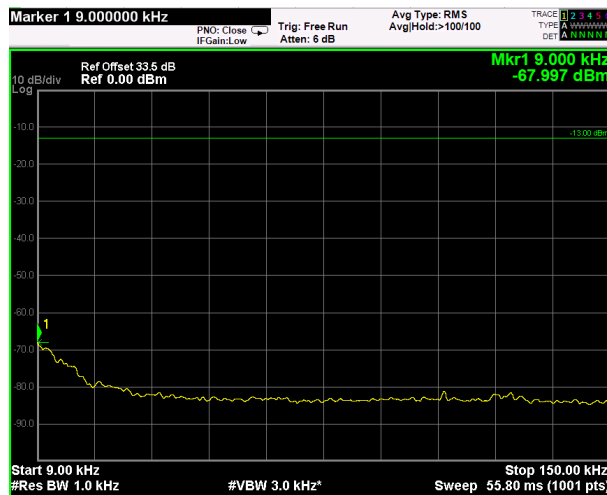
Spurious emissions measurement results:

Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)	Margin (dB)
Low channel			
First channel	Negligible	-13	
Mid channel			
1962,5 MHz	Negligible	-13	
High channel			
Last channel	Negligible	-13	

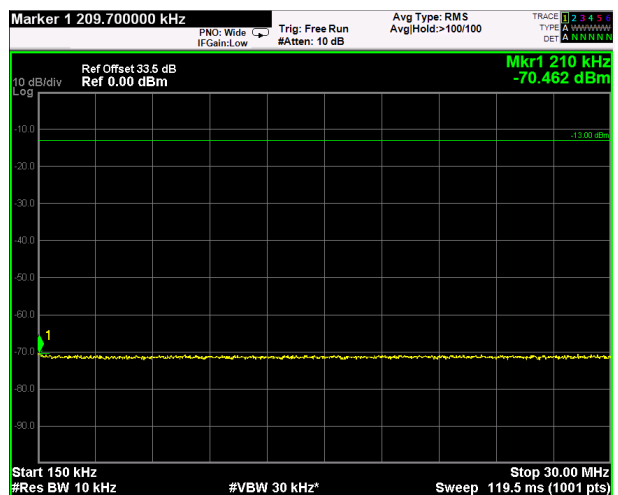
Test data: spurious emissions at antenna terminal

MSK signal

(Plots are referred to modulated carrier at the Middle Channel)



9kHz-150kHz



150kHz-30MHz



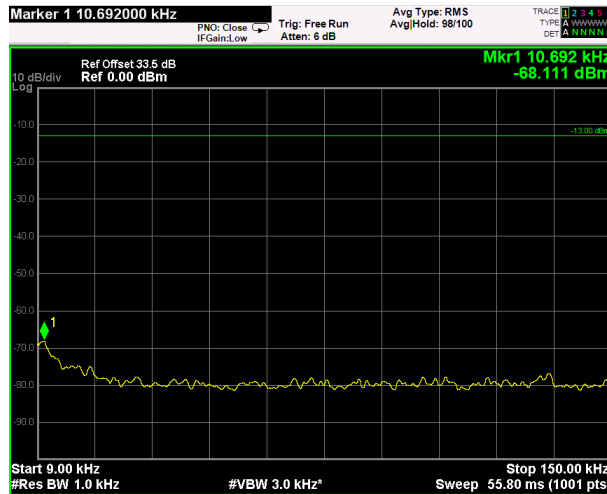
30MHz-1GHz



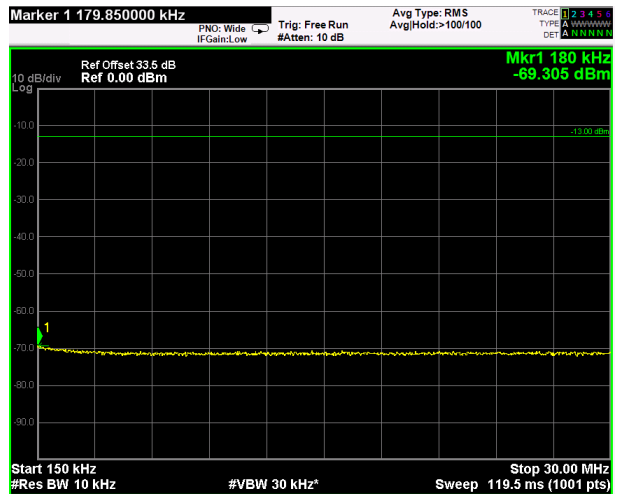
1GHz-20GHz

AWGN signal

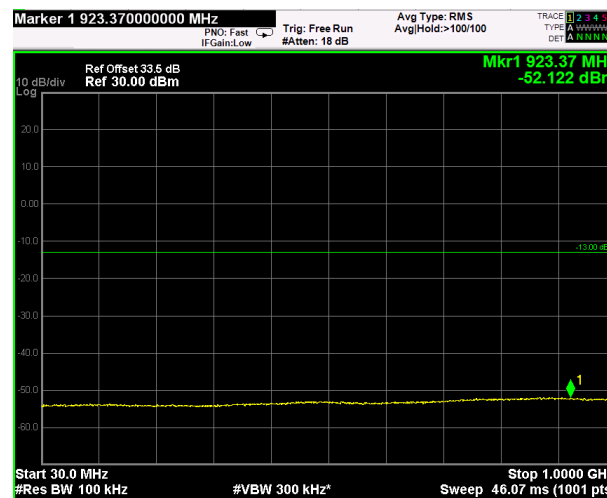
(Plots are referred to modulated carrier at the Middle Channel)



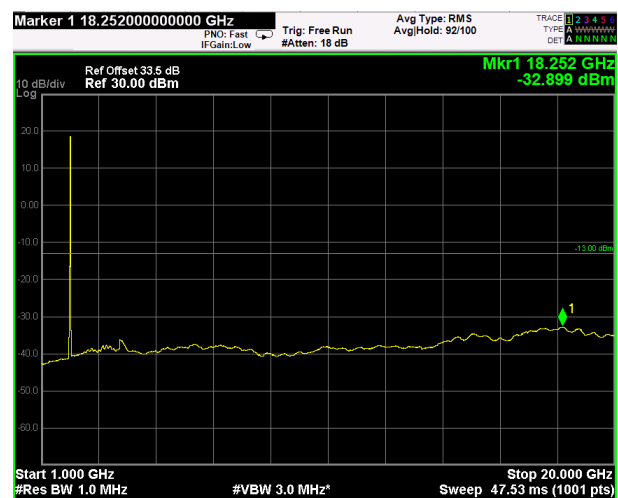
9kHz-150kHz



150kHz-30MHz



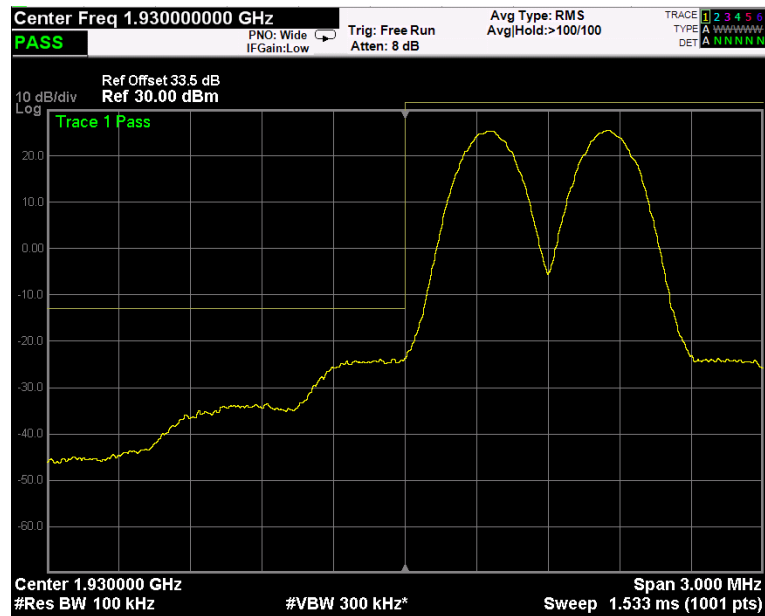
30MHz-1GHz



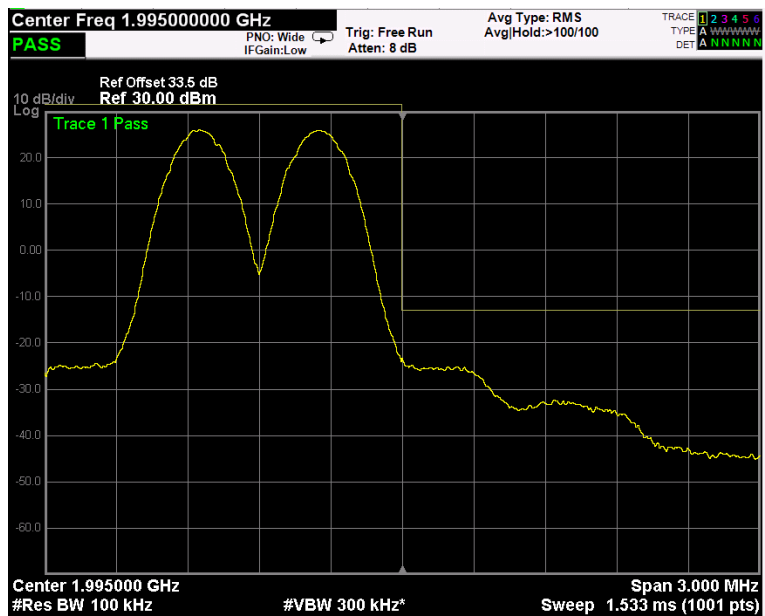
1GHz-20GHz

Test data, continued: band edges Inter modulation

MSK signal, nominal input signal

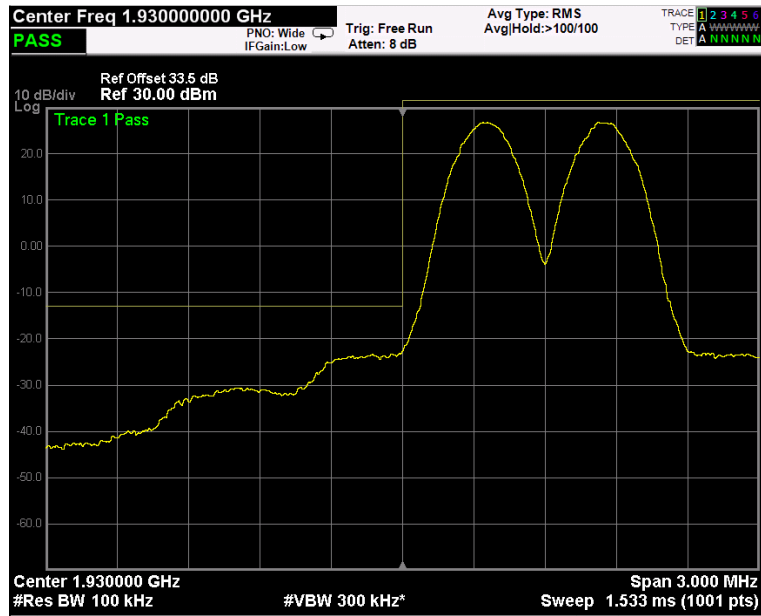


Low Band Edge

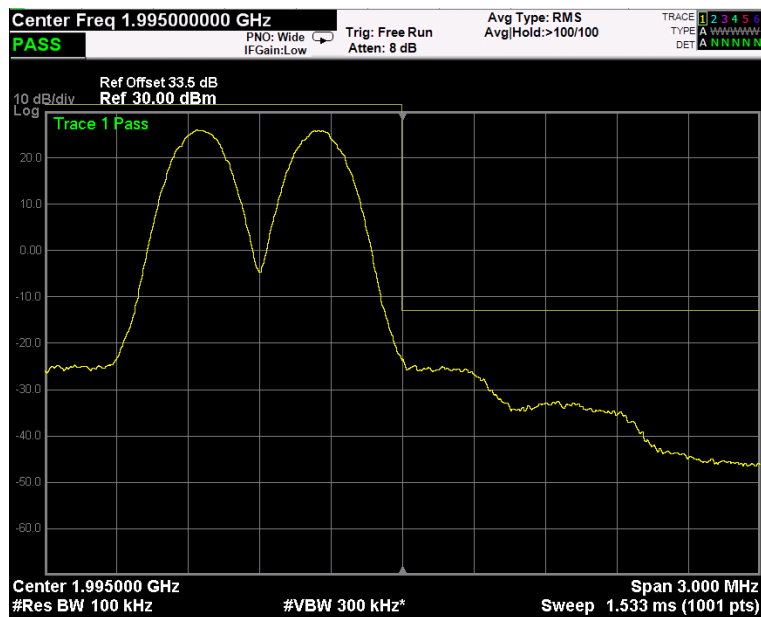


High Band Edge

MSK signal, nominal input signal + 3dB

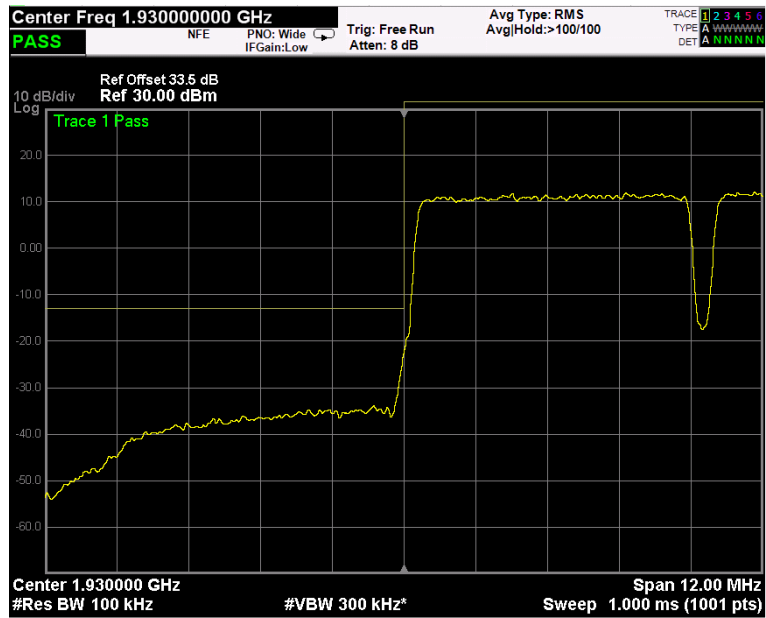


Low Band Edge

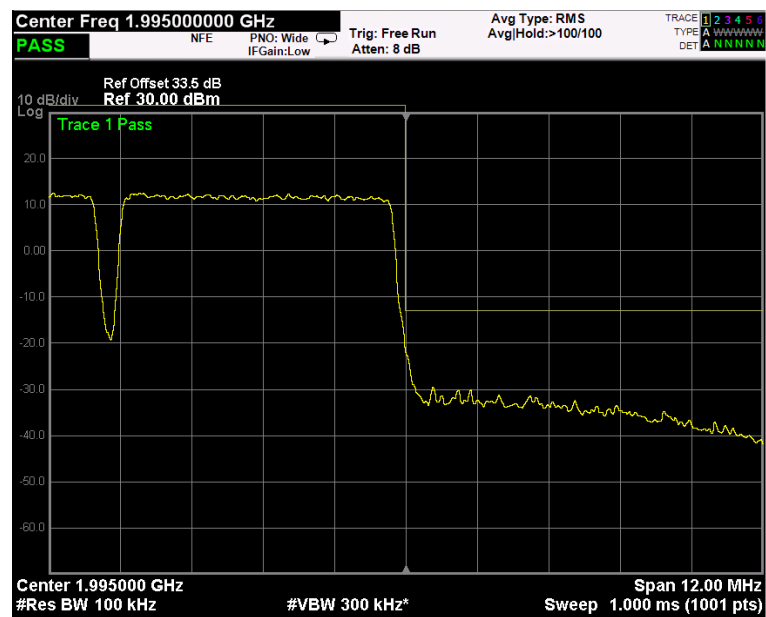


High Band Edge

AWGN signal, nominal input signal

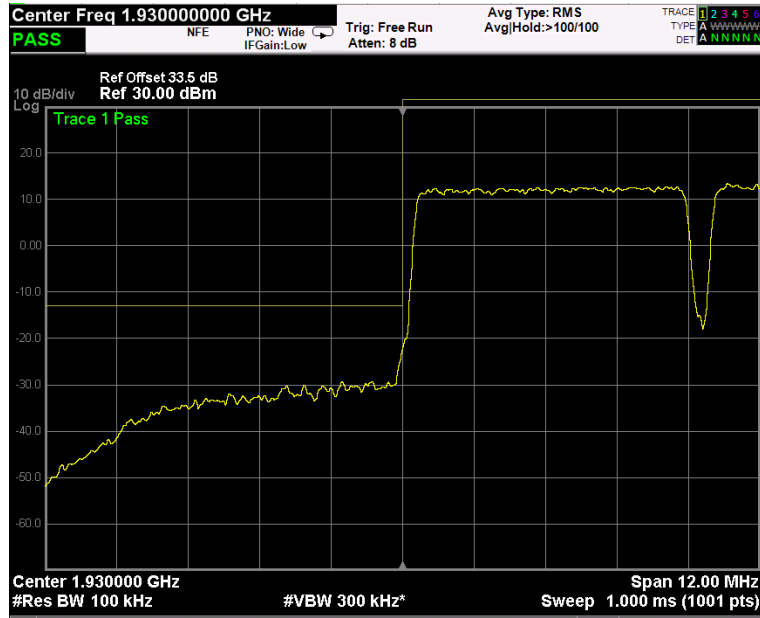


Low Band Edge

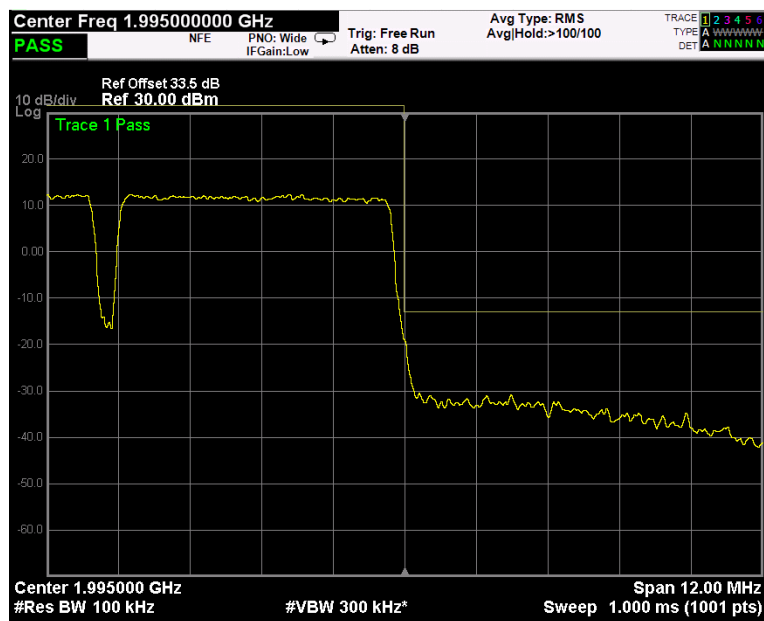


High Band Edge

AWGN signal, nominal input signal + 3dB



Low Band Edge



High Band Edge

Clause 24.238(a) Radiated Spurious 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.

Test date: 2016-12-15

Test results: Pass

Special notes

Clause 24.238(a) 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.

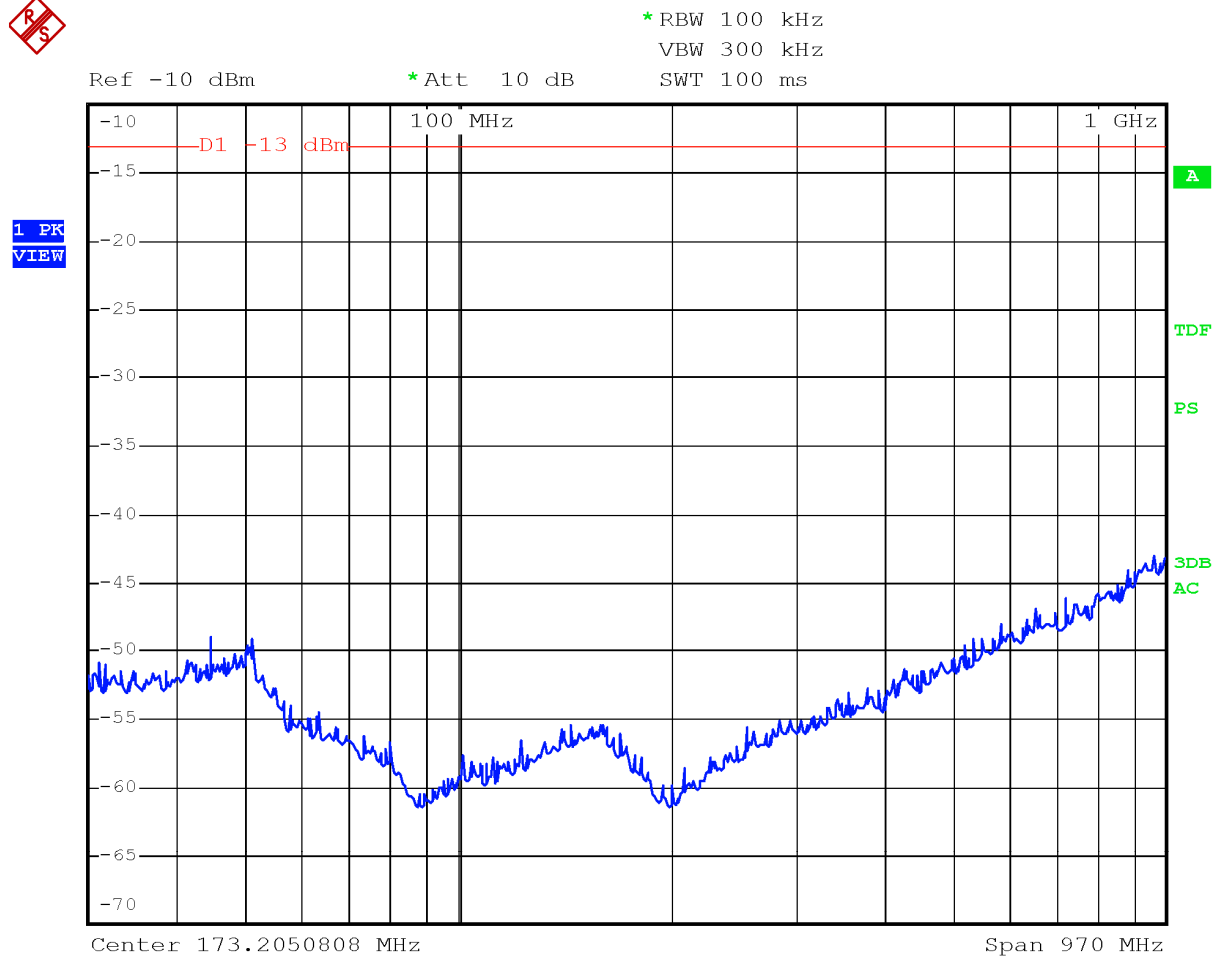
The spectrum was searched from 30 MHz to 1 GHz (RBW 100 kHz) & 1 GHz (RBW 1 MHz) to the tenth harmonic of the carrier.

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

Spurious emissions measurement results:

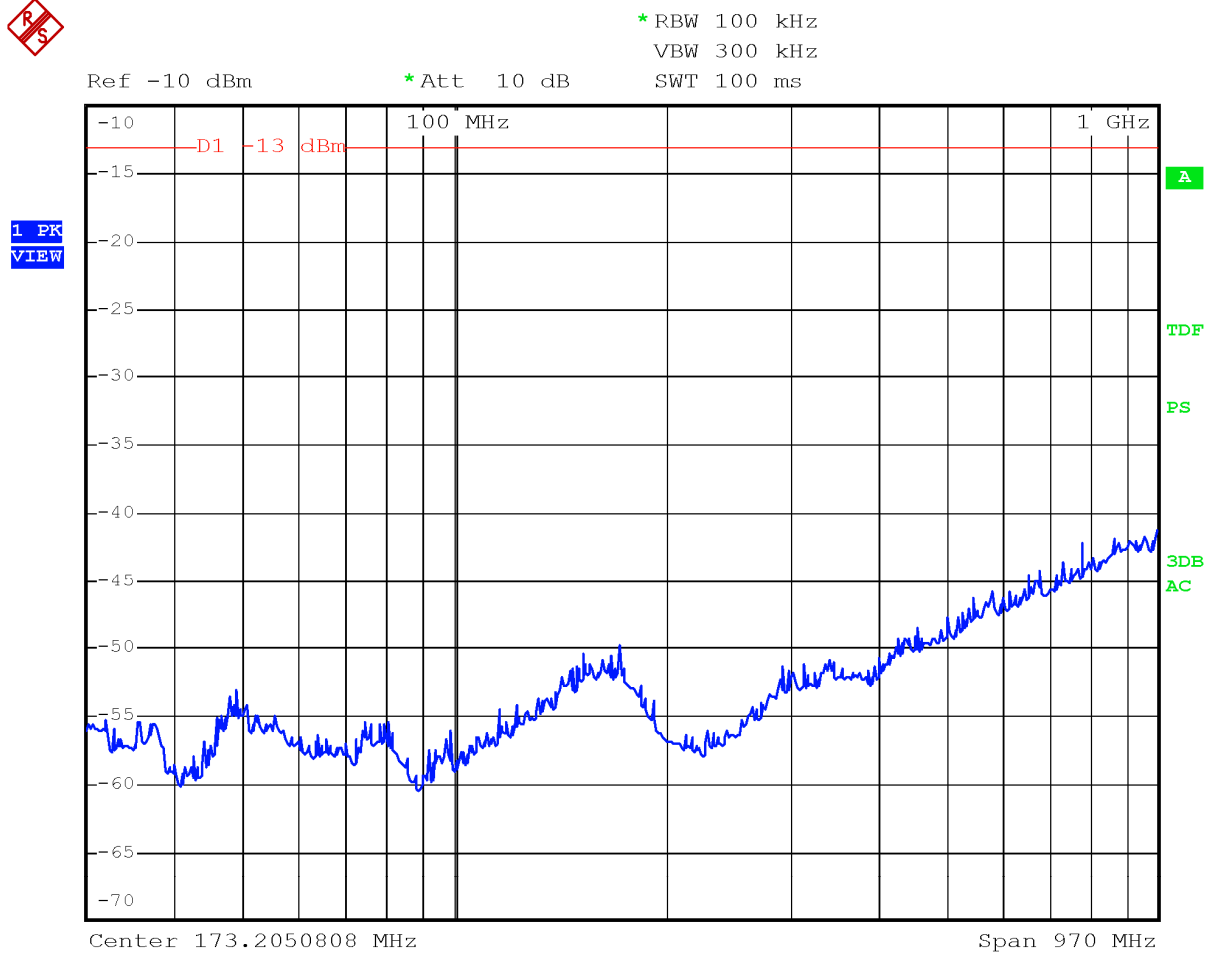
Frequency (MHz)	Polarization. V/H	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Low channel				
Mid channel				
High channel				

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



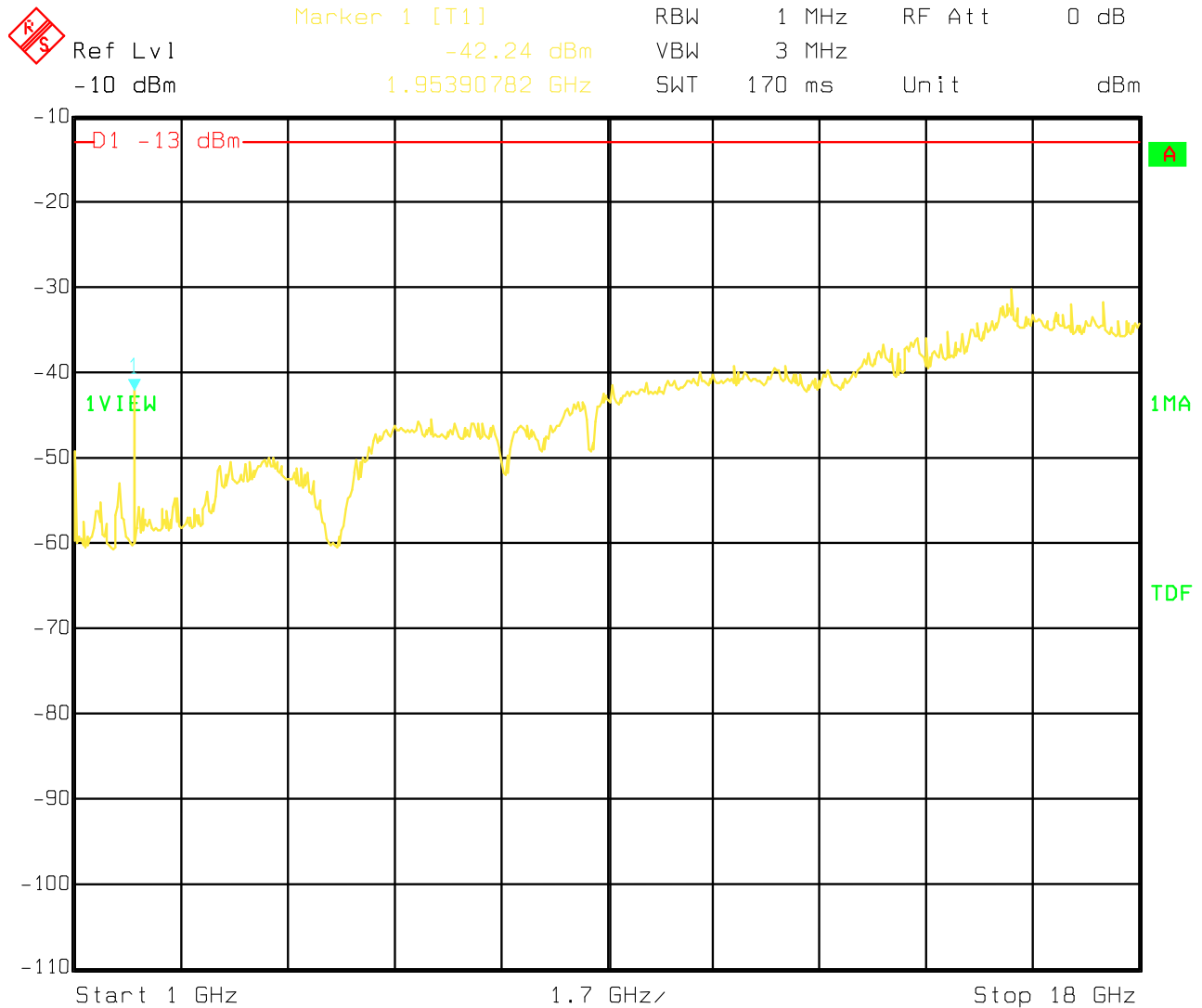
Date: 15.DEC.2016 11:56:37

30MHz-1GHz – H Pol



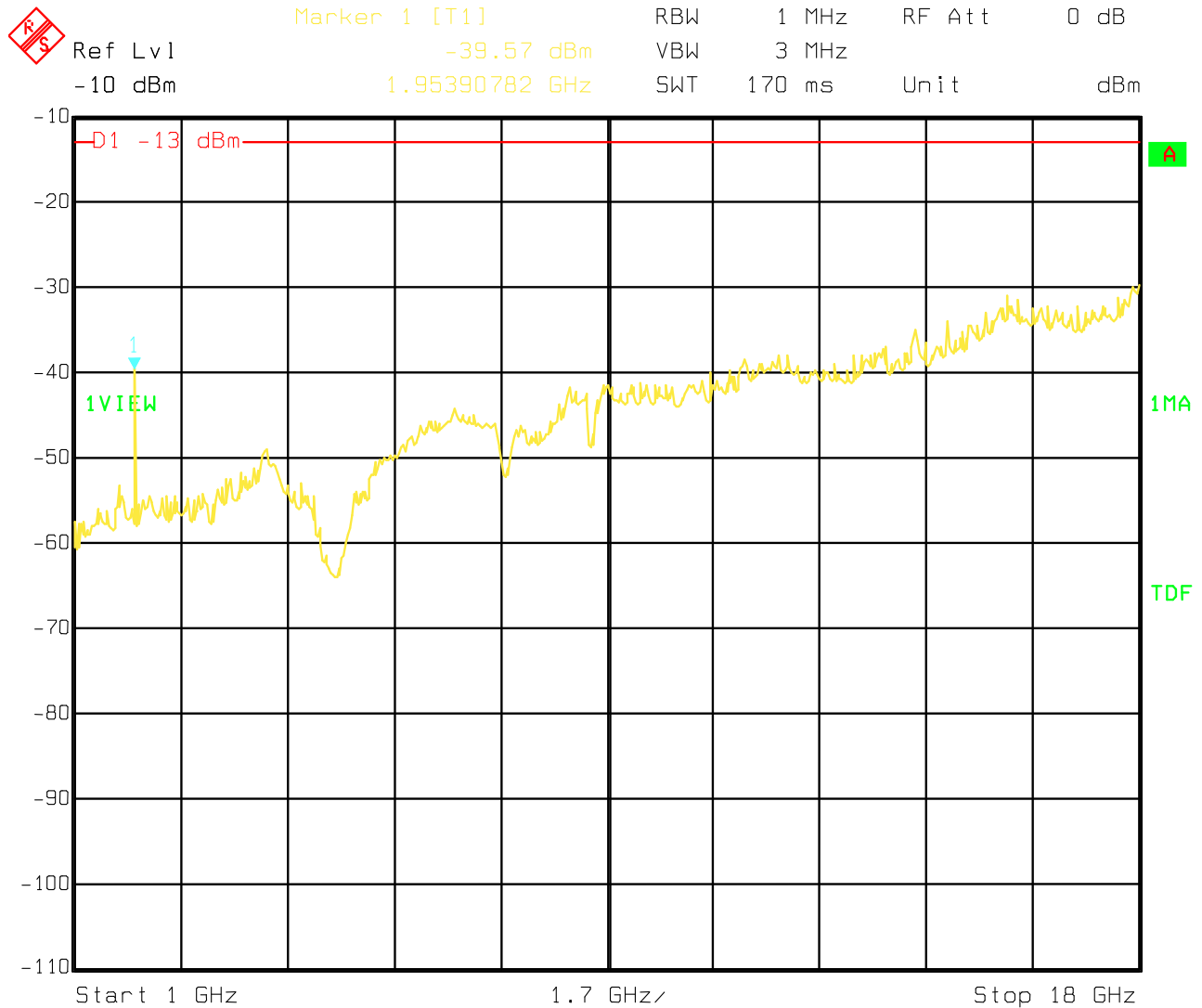
Date: 15.DEC.2016 12:00:22

30MHz-1GHz – V Pol



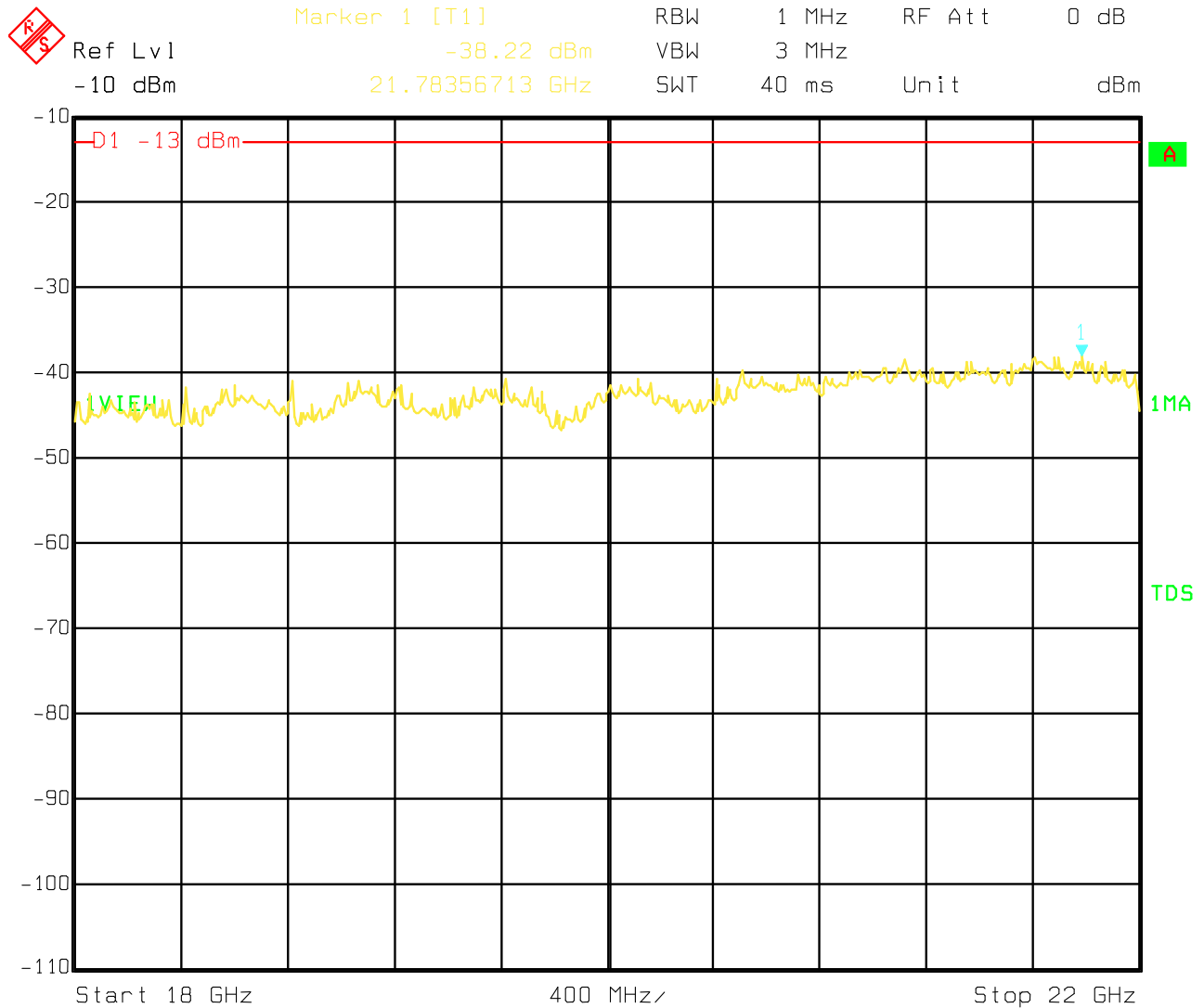
Date: 15.DEC.2016 12:04:59

1GHz-18GHz – H Pol



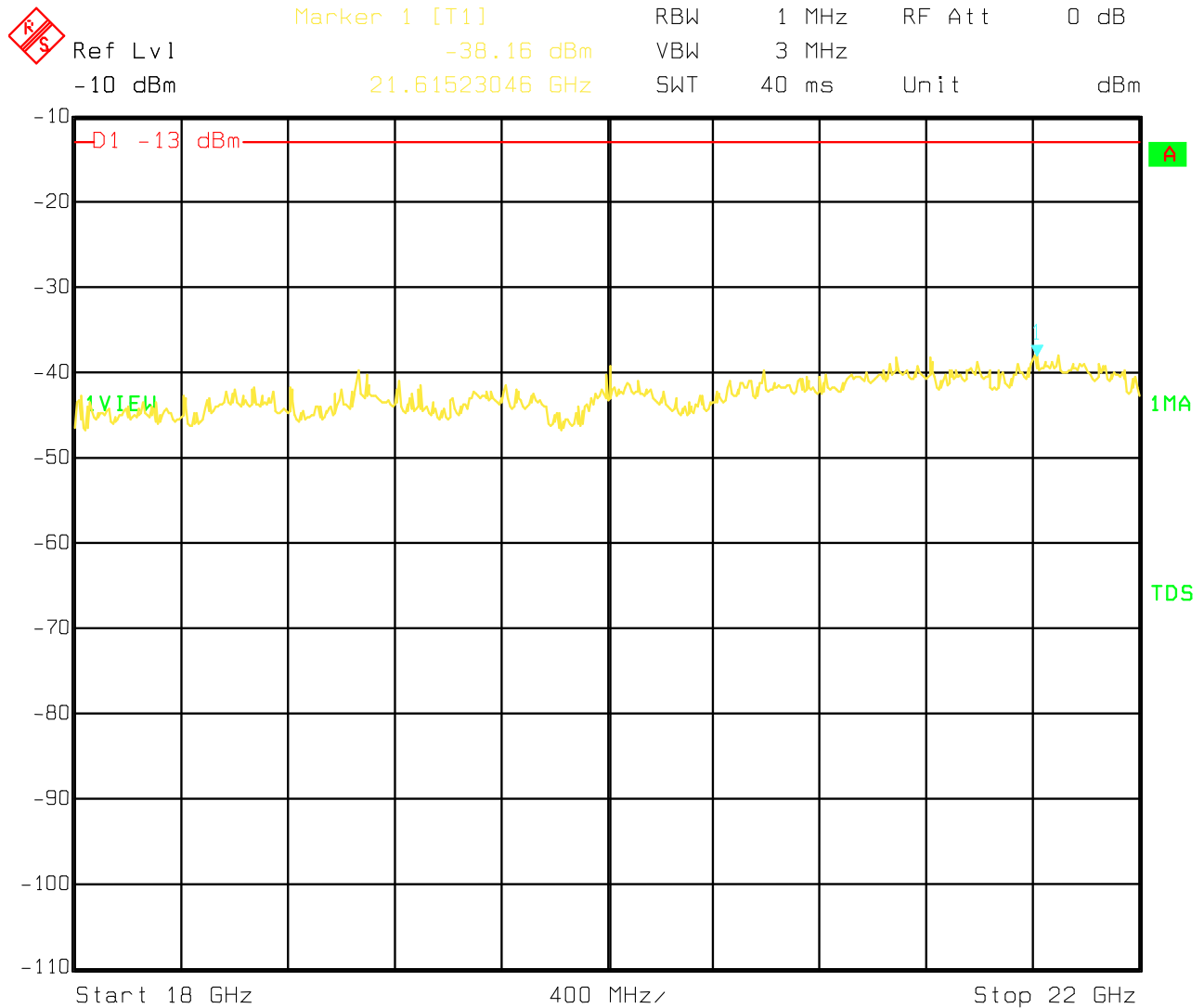
Date: 15.DEC.2016 11:55:39

1GHz-18GHz – V Pol



Date: 15.DEC.2016 13:27:37

18GHz-22GHz – H Pol

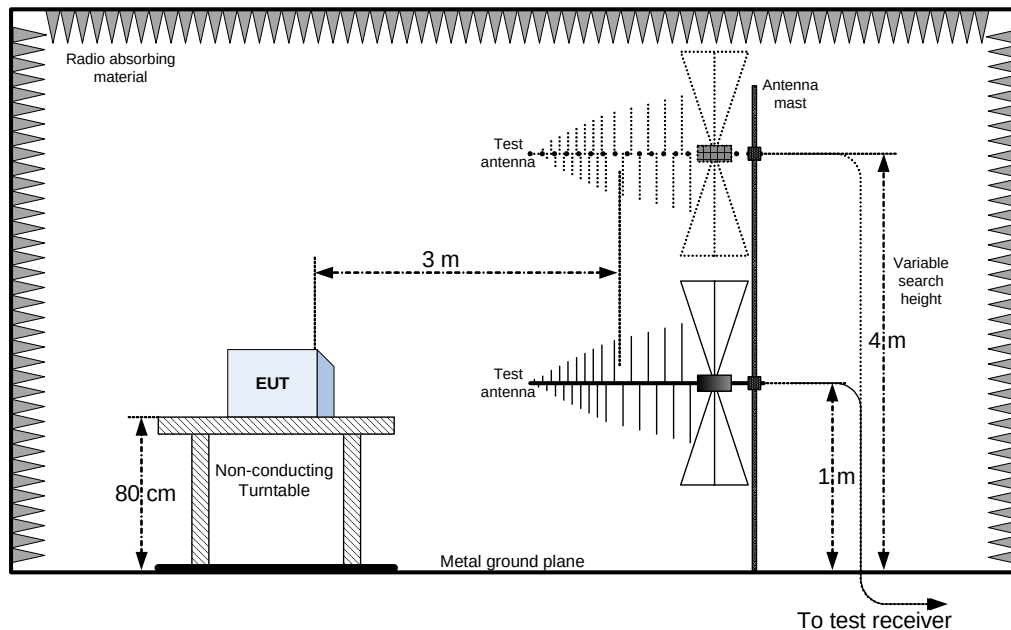


Date: 15.DEC.2016 13:21:09

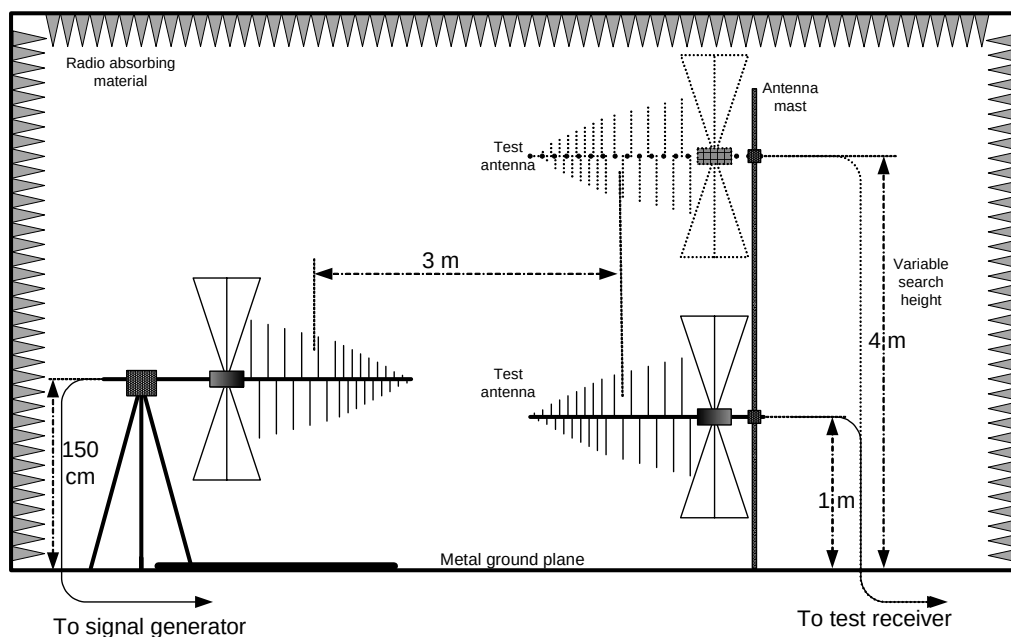
18GHz-22GHz – V Pol

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



