Report Reference ID:	372837-8TRFWL

Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter B – Common carrier services Part 101 – Fixed Microwave Services

Applicant:	TEKO Telecom Srl. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Medium Power Remote Unit
Model:	TRU7FL8P9PWM/AC-WT
FCC ID:	XM2-MP7FL8P9PP

Testing laboratory:	**Nemko Italy Spa** Via del Carroccio, 4 20853 Biassono (MB) – Italy Telephone: +39 039 2201201 Facsimile: +39 039 2201221

	Name and title	**Date**
Tested by:	P. Barbieri, Wireless/EMC Specialist	06/24/2019
Reviewed by:	R. Giampaglia, Wireless/EMC Specialist	06/24/2019

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Section 1: Report summary

1.1 Test specification

Specifications	**Part 101 – Fixed Microwave 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 Spa. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 101. Radiated tests were conducted in accordance with ANSI C63.26-2015.

1.3 Exclusions

Exclusions	None

1.4 Registration number

Test site FCC ID number	682159

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.

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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 27, test results

Part	Methods	Test description	Verdict
	§ 935210 D05v01r03 (3.2)	AGC threshold	Pass
	§ 935210 D05v01r03 (3.3)	Out of band rejection	Pass
	§ 935210 D05v01r03 (3.4)	Occupied bandwidth	Pass
§101.113	§ 935210 D05v01r03 (3.5)	Peak output power at RF antenna connector	Pass
§101.111	§ 935210 D05v01r03 (3.6)	Spurious emissions at RF antenna connector	Pass
§101.111	§ 935210 D05v01r03 (3.8)	Radiated spurious emissions	Pass
§101.107	§ 935210 D05v01r03 (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: 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:	-MP7FL8P9PP
Equipment class	BOS	
Description of product as it is marketed	Booster	
	Model name/number:	TRU7FL8P9PWM/AC-WT
	Serial number:	1012793001

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: XM2-MP7FL8P9PP ii FCC ID:

3.6 Sample information

Receipt date:	05/27/2019
Nemko sample ID number:	------

3.7 EUT technical specifications

Operating band:	Down Link: 932-935 MHz
Operating frequency:	Narrowband
Modulation type:	P25, FM
Occupied bandwidth:	Standard
Channel spacing:	Standard
Emission designator:	F1E, F1D, F3E
RF Output	Down Link: 33dBm (2,00W) Up Link: N.A. (The EUT does not transmit over the air in the up-link direction)
Gain	Down Link: 38dB 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:	081063004
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

EUT	Type	Test	Range and Setup features	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	10 kHz ÷ 30 MHz	1.0 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.6 dB	(1)
		Conducted spurious emissions	10 kHz ÷ 26 GHz	3.0 dB	(1)
			26 GHz ÷ 40 GHz	4.5 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
	Radiated	Radiated spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 40 GHz	8.0 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26,5 GHz ÷ 40 GHz	8.0 dB	(1)
Receiver	Radiated	Radiated spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 40 GHz	8.0 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	10 kHz ÷ 26 GHz	3.0 dB	(1)
			26 GHz ÷ 40 GHz	4.5 dB	(1)

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2 which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %

5.4 Test equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Vector Signal Generator	Agilent	E4432B ESG	GB38450308	08/2019
Vector Signal Generator	Agilent	E4438C ESG	MY45094485	08/2019
Spectrum Analyzer	Agilent	N9030A PXA	MY53120882	12/2019
Trilog Broad Band Antenna 25-8000 MHz	Schwarzbeck	VULB 9162	VULB 9162-25	07/2021
Antenna 1-18 GHz	Schwarzbeck	STLP 9148	STPL 9148-123	07/2021
Double ridge horn antenna (4 ÷ 40 GHz)	RFSpin	DRH40	061106A40	02/2020
Broadband preamplifier (18 ÷ 40 GHz)	Miteq	JS44-18004000-35-8P-R	1.627	09/2019
Broadband preamplifier 1-18 GHz	Schwarzbeck	BBV 9718	9718-137	08/2019
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	01/2020
EMI receiver 2 Hz ÷ 44 GHz	R&S	ESW44	101620	05/2019
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
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	09/2021
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 D05v01r01 (3.2) AGC threshold

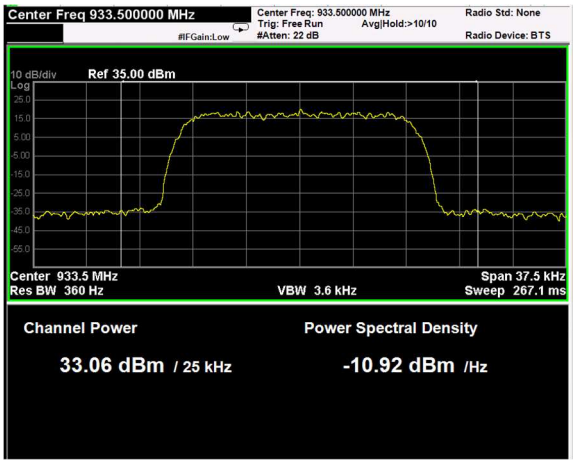
Measure of EUT AGC Threshold

Test date: 05/27/2019 to 06/24/2019

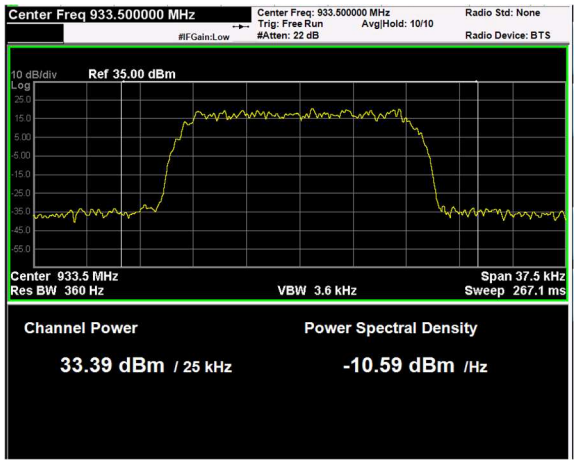
Test results: Pass

Special notes

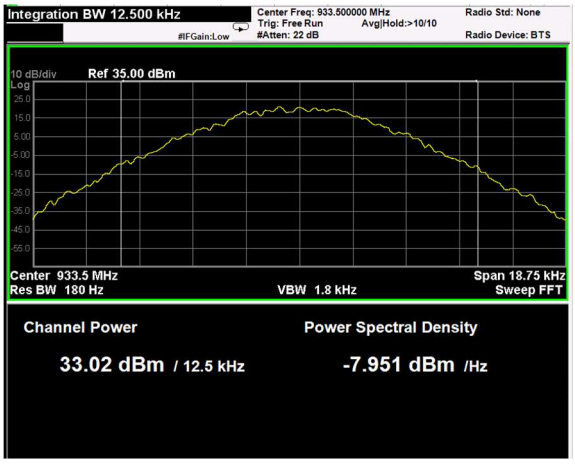
Test data



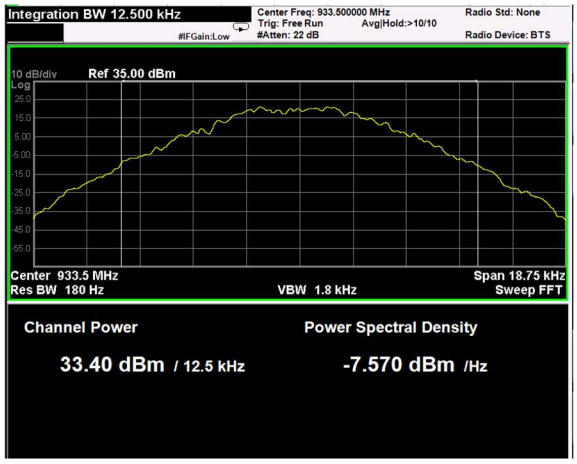
16k signal, nominal input signal



16k signal, nominal input signal + 1dB



P25 signal, nominal input signal



P25 signal, nominal input signal + 1dB

Clause 935210 D05v01r01 (3.3) Out of band rejection

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

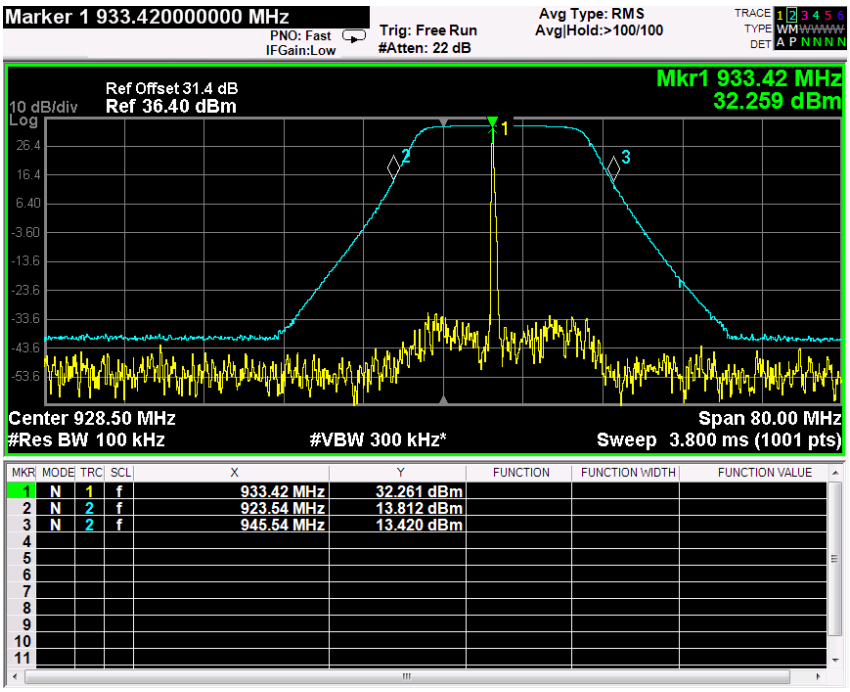
Test date: 05/27/2019 to 06/24/2019

Test results: Pass

Special notes

–

Test data



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	933.42 MHz	32.261 dBm			
2	N	2	f	923.54 MHz	13.812 dBm			
3	N	2	f	945.54 MHz	13.420 dBm			
4								
5								
6								
7								
8								
9								
10								
11								

Clause 935210 D05v01r01 (3.4) Occupied bandwidth

A 26 dB bandwidth measurement shall be performed on the input signal and the output signal; alternatively, the 99% OBW can be measured and used.

Test date: 05/27/2019 to 06/24/2019

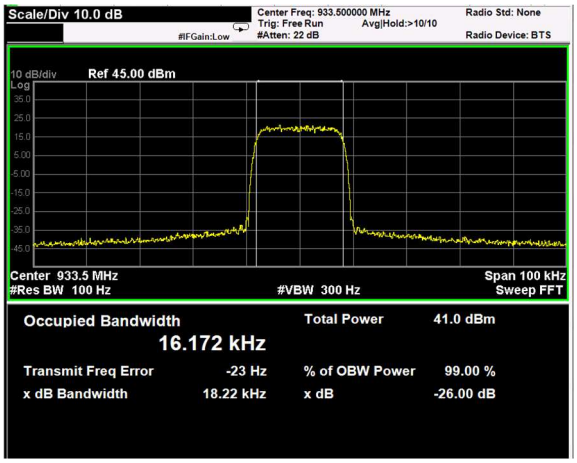
Test results: Pass

Special notes

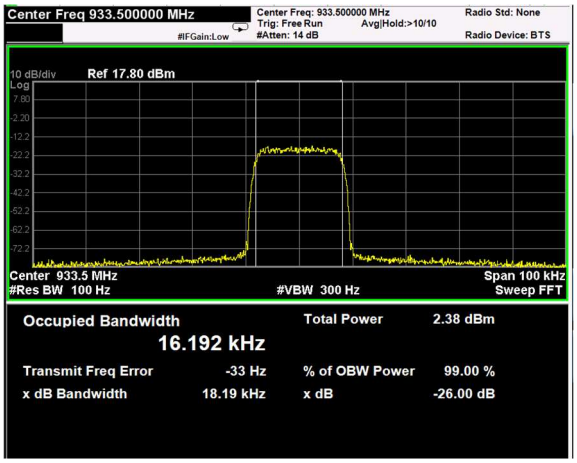
Clause 935210 D05v01r01 (3.4) Occupied bandwidth, continued

Test data

16k signal, nominal input signal

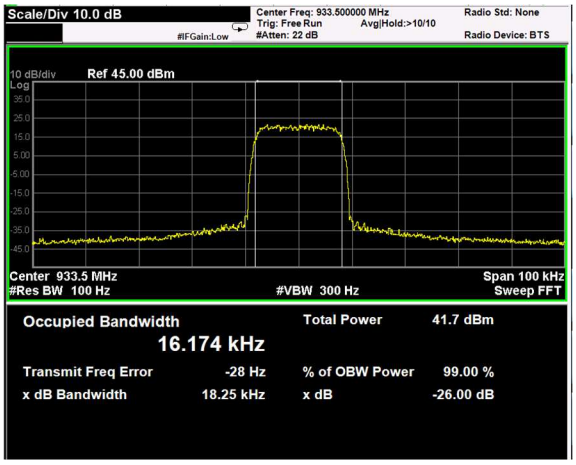


Output

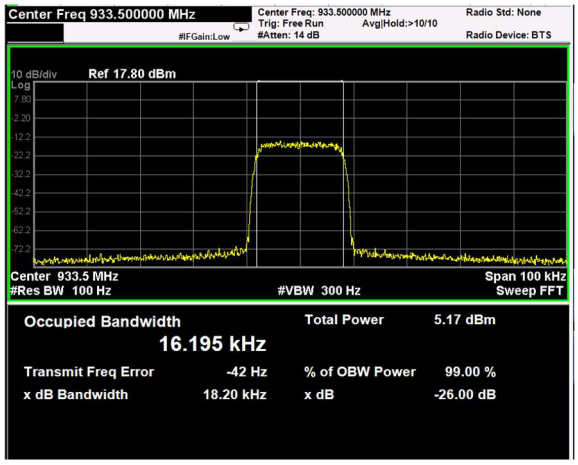


Input

16k signal, nominal input signal + 3dB

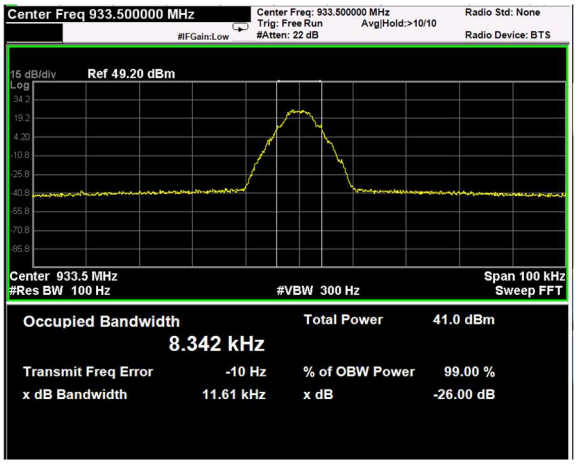


Output

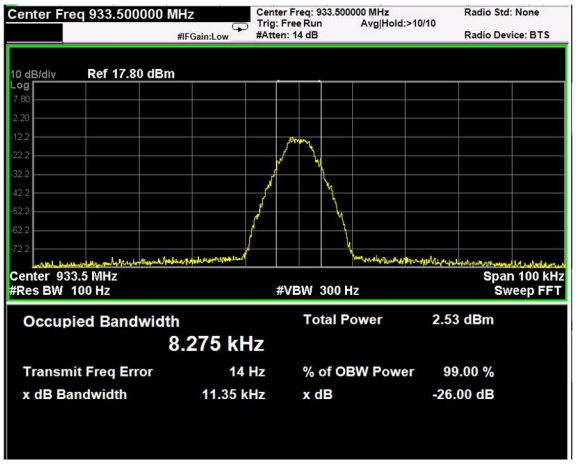


Input

P25 signal, nominal input signal

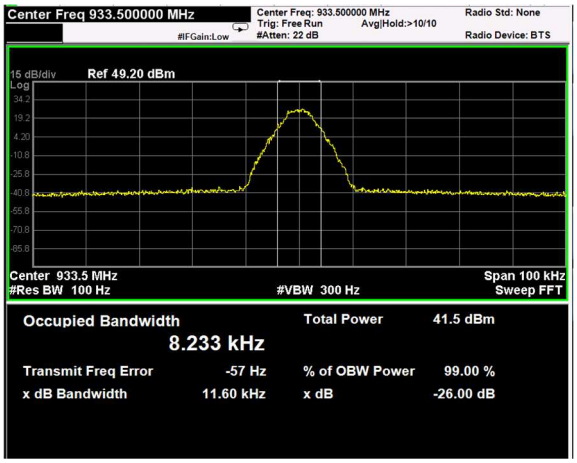


Output

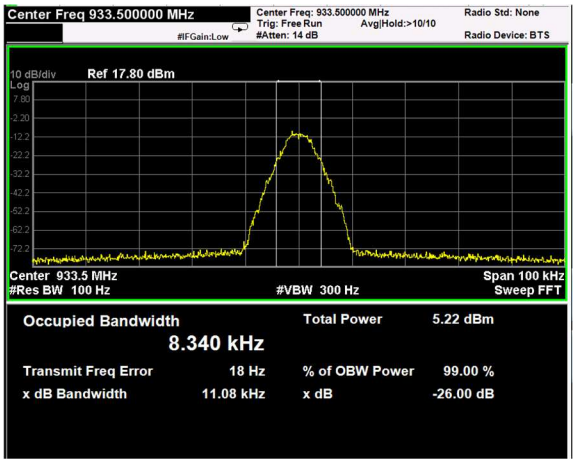


Input

P25 signal, nominal input signal + 3dB



Output



Input

Clause 101.113 Peak output power at RF antenna connector

§ 101.113 Transmitter power limitations.

(a) On any authorized frequency, the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified below. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of this station. Further, the output power of a transmitter on any authorized frequency in this service may not exceed the following table.

Test date: 05/27/2019 to 06/24/2019

Test results: Pass

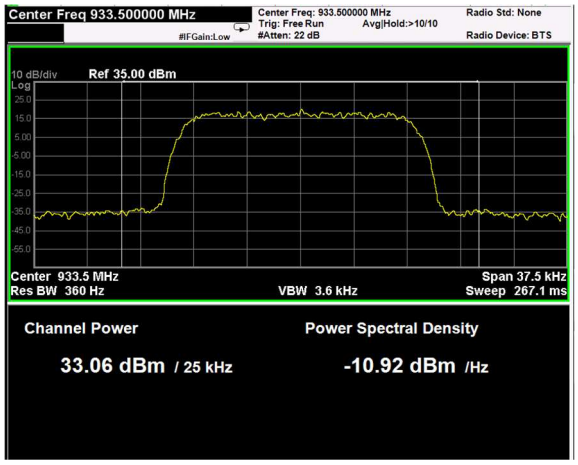
Special notes

Clause 101.113 Peak output power at RF antenna connector

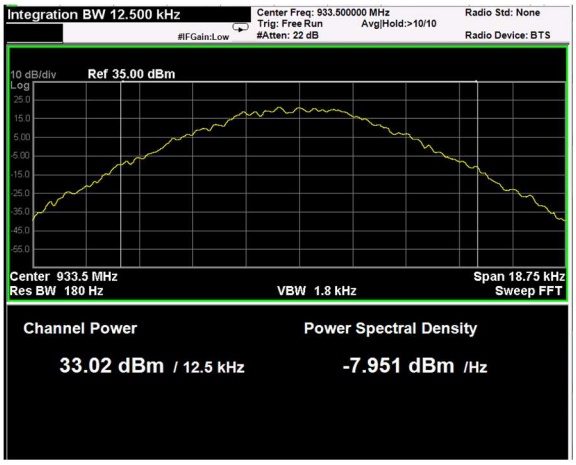
Test data

Nominal input signal

Test data				
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)
Down-link	16k	933.5	33.06	2.023
Down-link	P25	933.5	33.02	2.004



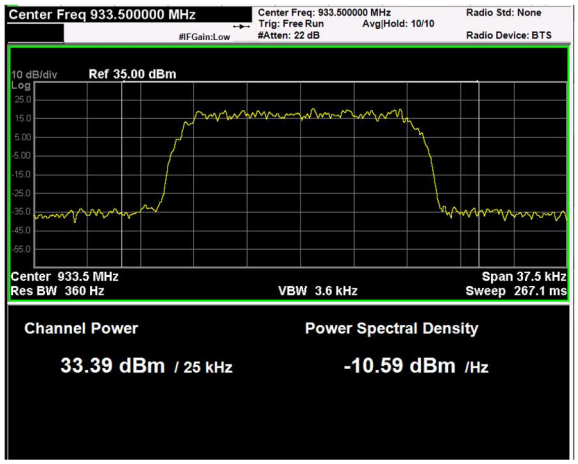
16k



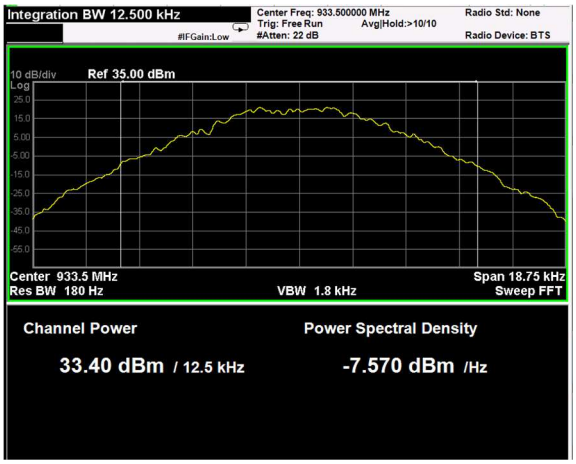
P25

Nominal input signal + 3dB

Test data				
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)
Down-link	16k	933.5	33.39	2.182
Down-link	P25	933.5	33.40	2.187



16k



P25

Clause 101.111 Spurious emissions at RF antenna connector

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(5) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a 12.5 KHz bandwidth, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 2.5 KHz up to and including 6.25 KHz: At least 53 log10 (fd/2.5) decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 6.25 KHz up to and including 9.5 KHz: At least 103 log10 (fd/3.9) decibels;

(iii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 9.5 KHz up to and including 15 KHz: At least 157 log10 (fd/5.3) decibels; and

(iv) On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus 10 log10(P) or 70 decibels, whichever is the lesser attenuation.

(6) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a bandwidth greater than 12.5 KHz, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 5 KHz up to and including 10 KHz: At least 83 log10 (fd/5) decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 10 KHz up to and including 250 percent of the authorized bandwidth: At least 116 log10 (fd/6.1) decibels or 50 plus 10 log10 (P) or 70 decibels, whichever is the lesser attenuation; and

(iii) On any frequency removed from the center of the authorized bandwidth by more that 250 percent of the authorized bandwidth: At least 43 plus 10 log10 (output power in watts) decibels or 80 decibels, whichever is the lesser attenuation.

Test date: 05/27/2019 to 06/24/2019

Test results: Pass

Special notes

Clause 101.111 Spurious emissions at RF antenna connector, continued

Test data

See Plots below

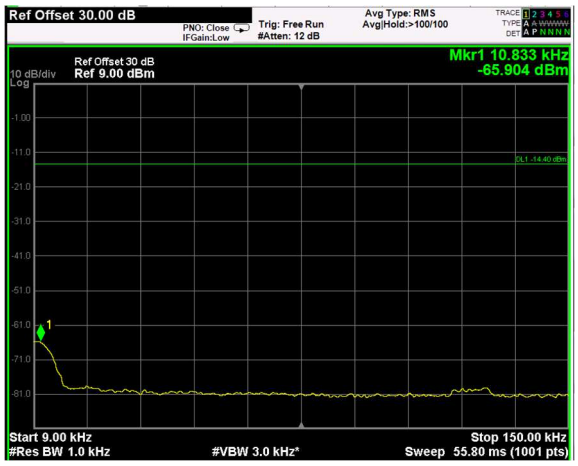
Spurious emissions measurement results:

Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)	Margin (dB)
Low channel			
First channel	Negligible	-13	
Mid channel			
933,5 MHz	Negligible	-13	
High channel			
Last channel	Negligible	-13	

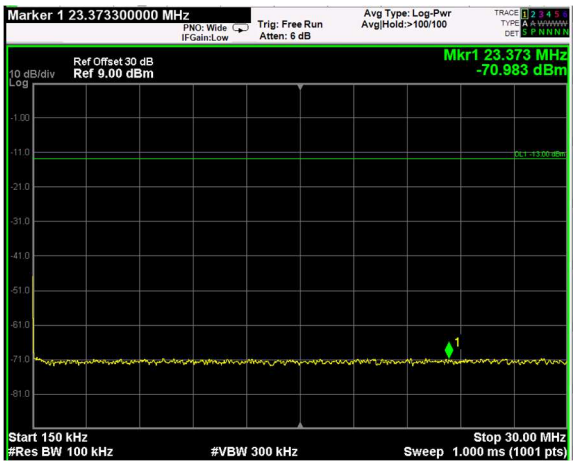
Test data, continued: spurious emissions at antenna terminal

16k signal

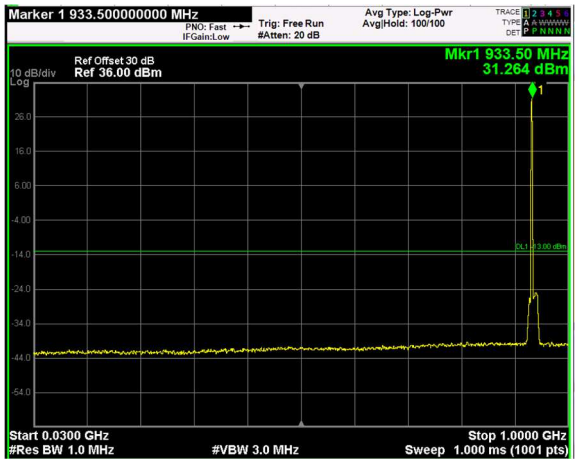
(Plots are referred to modulated carrier at the Middle Channel)



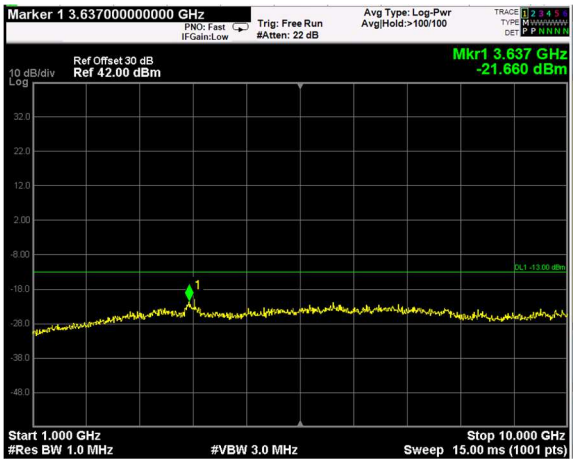
9KHz-150KHz



150KHz-30MHz



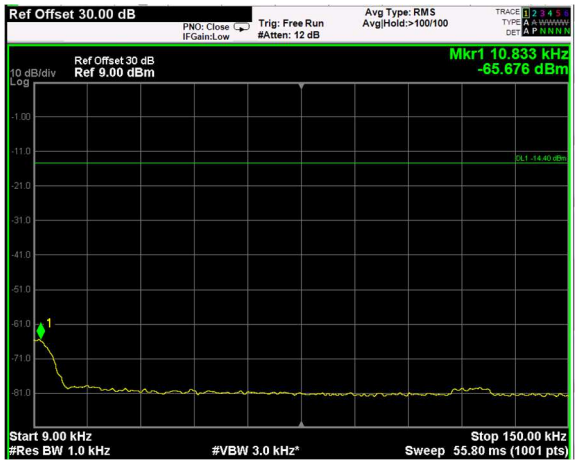
30MHz-1GHz



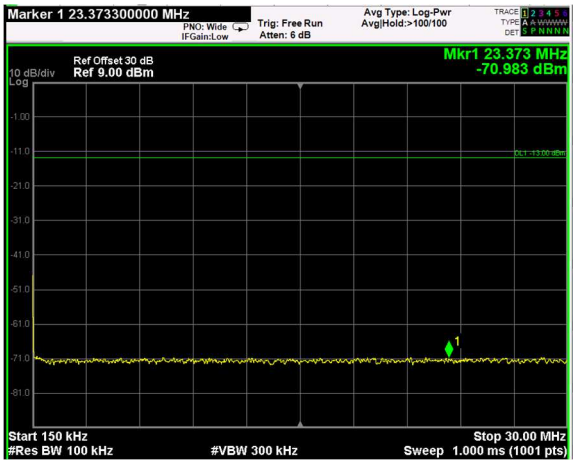
1GHz-10GHz

P25 signal

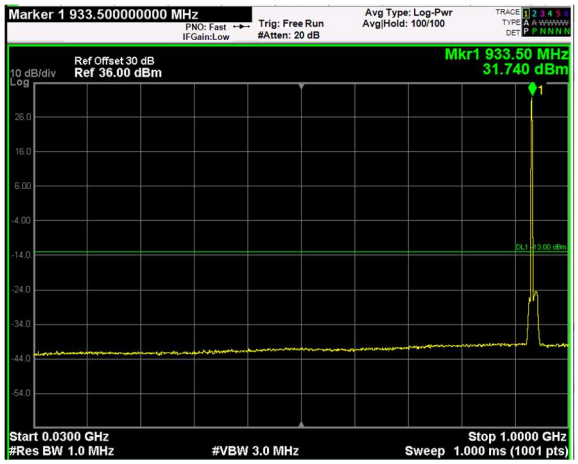
(Plots are referred to modulated carrier at the Middle Channel)



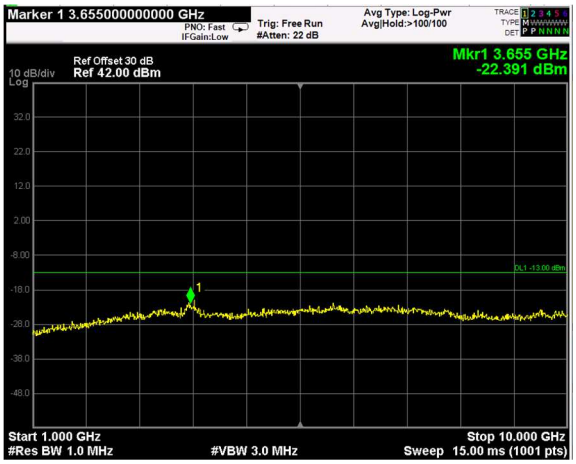
9KHz-150KHz



150KHz-30MHz



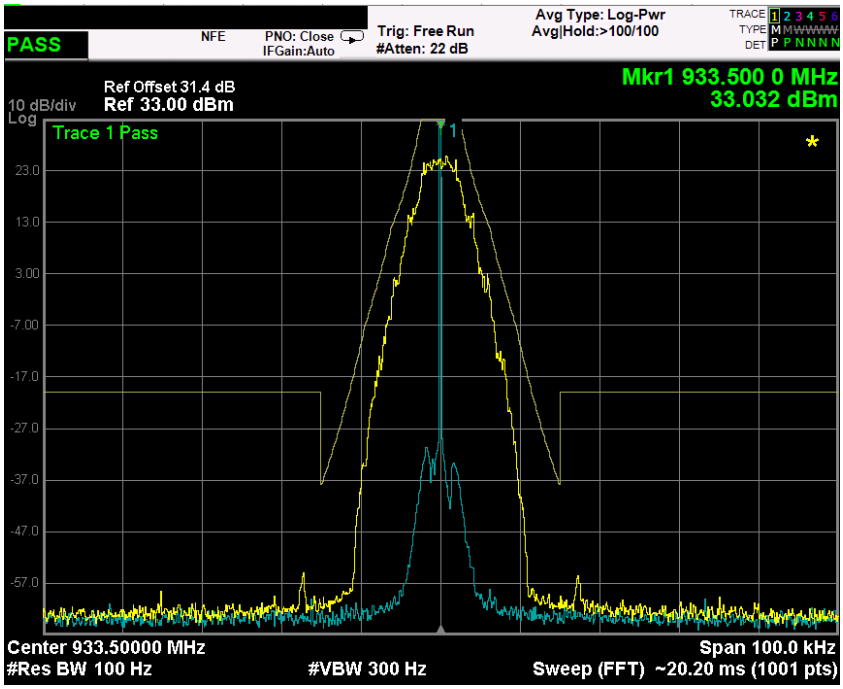
30MHz-1GHz



1GHz-10GHz

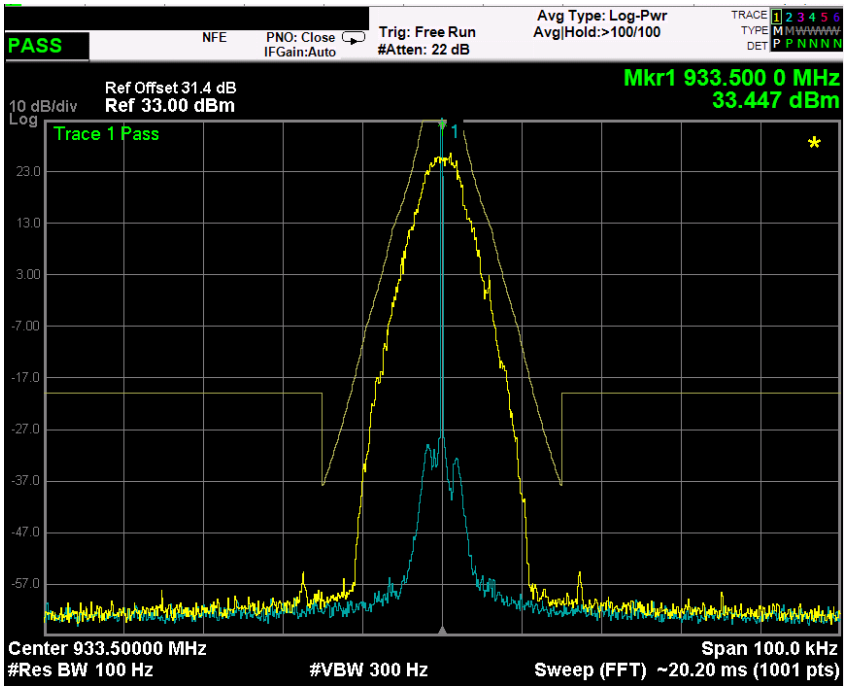
Test data, continued: Mask

P25 signal, nominal input signal (933,5MHz)



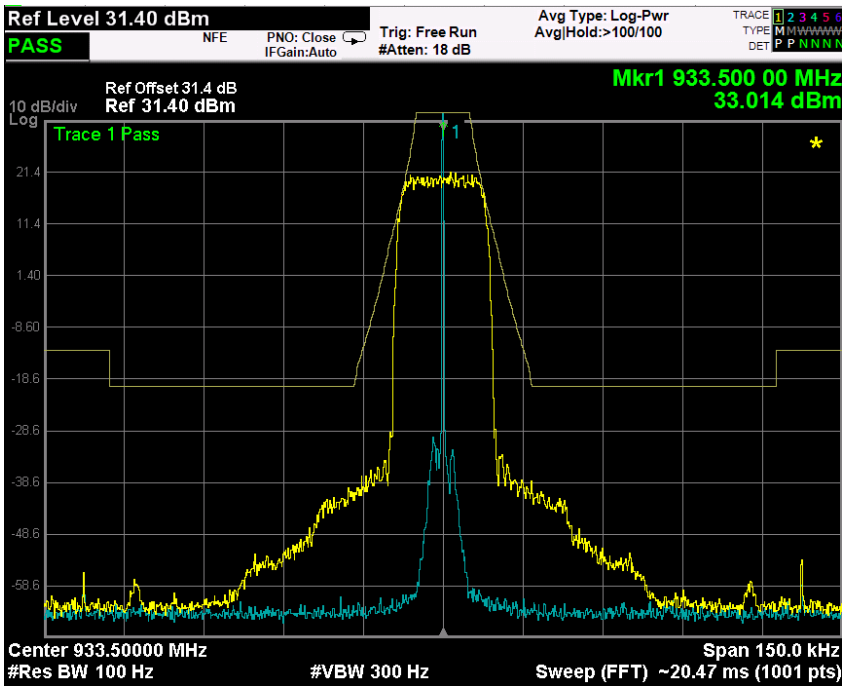
Mask with BW < 12,5kHz signal

P25 signal, nominal input signal + 3dB (933,5MHz)



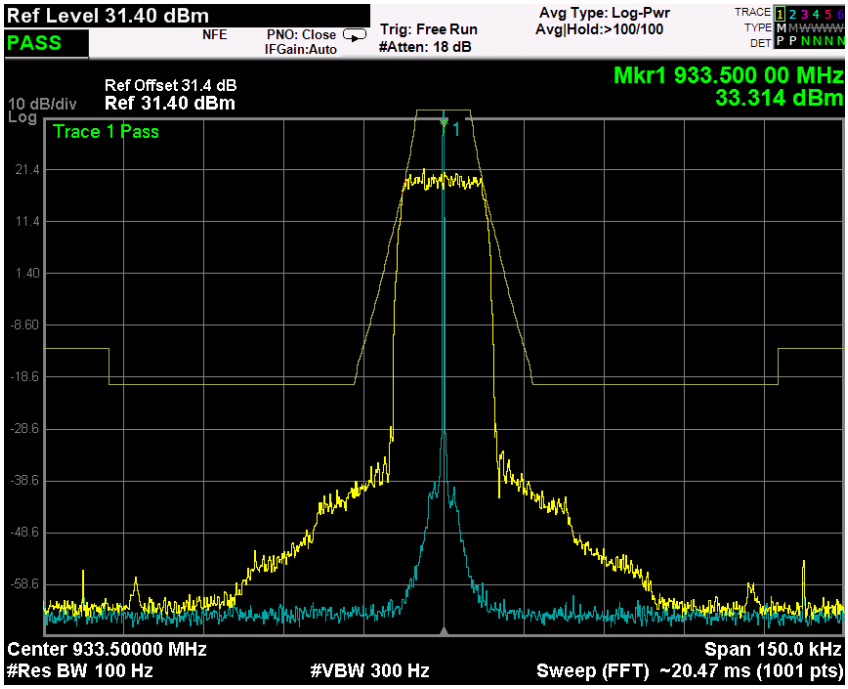
Mask with BW < 12,5kHz signal

16k signal, nominal input signal (933,5MHz)



Mask with BW > 12,5kHz signal

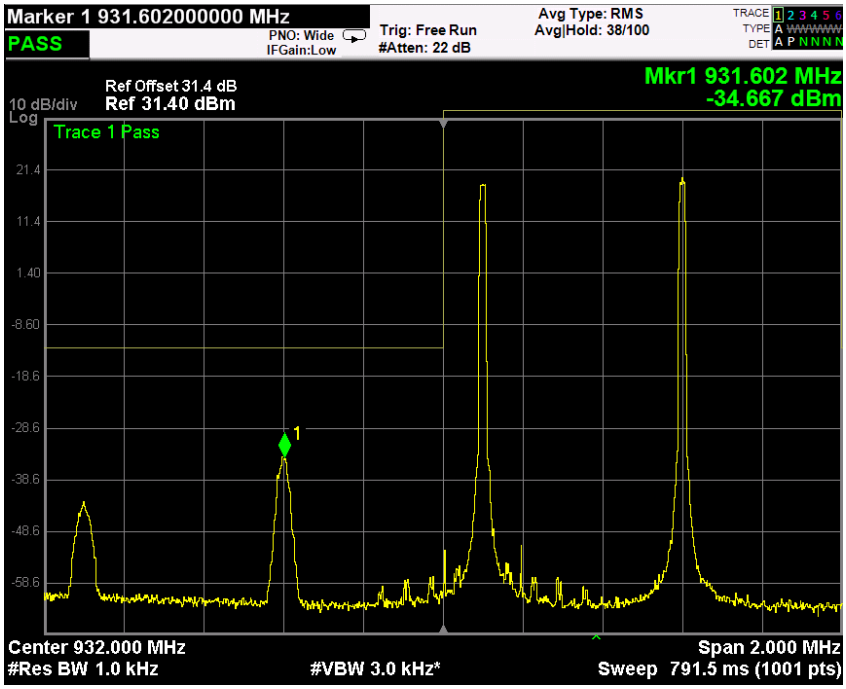
16k signal, nominal input signal + 3dB (933,5MHz)



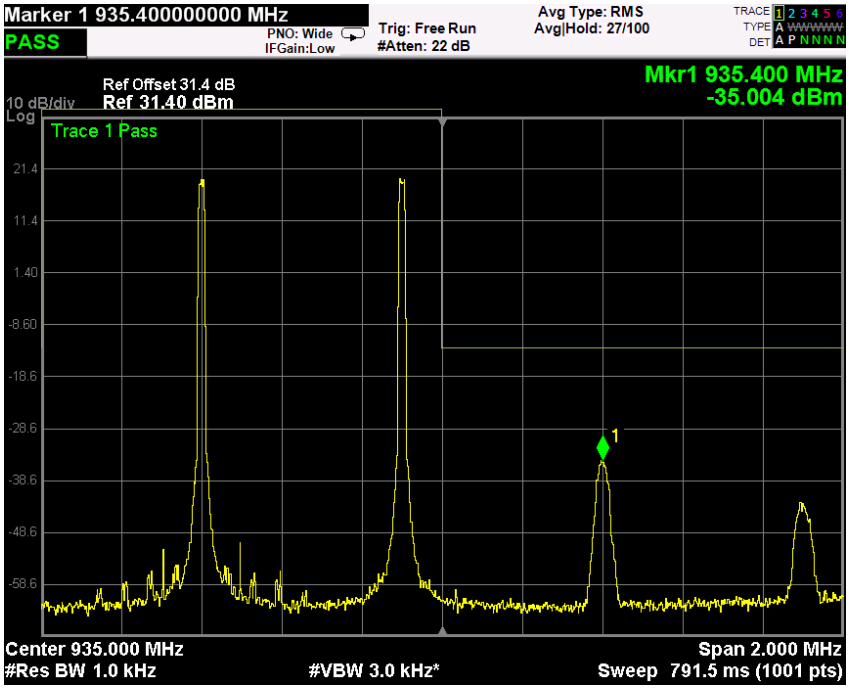
Mask with BW > 12,5kHz signal

Test data, continued: band edges Inter modulation

16k signal, nominal input signal

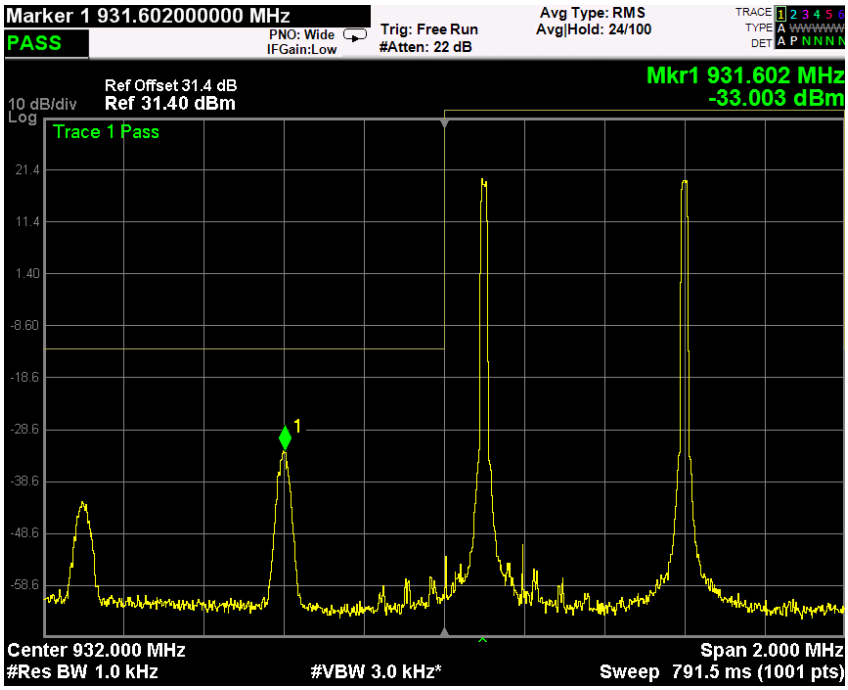


Low Band Edge

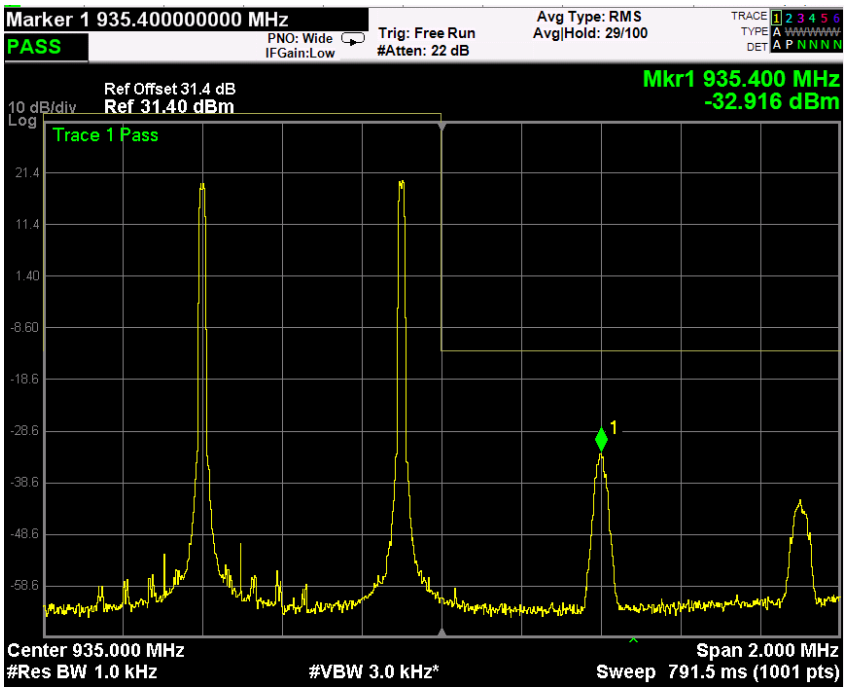


High Band Edge

16k signal, nominal input signal + 3dB

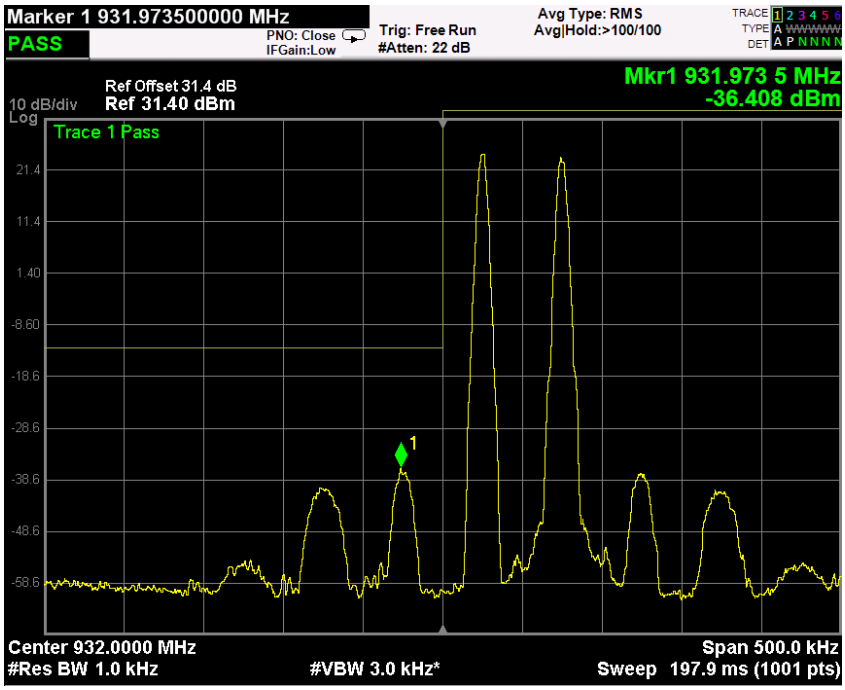


Low Band Edge

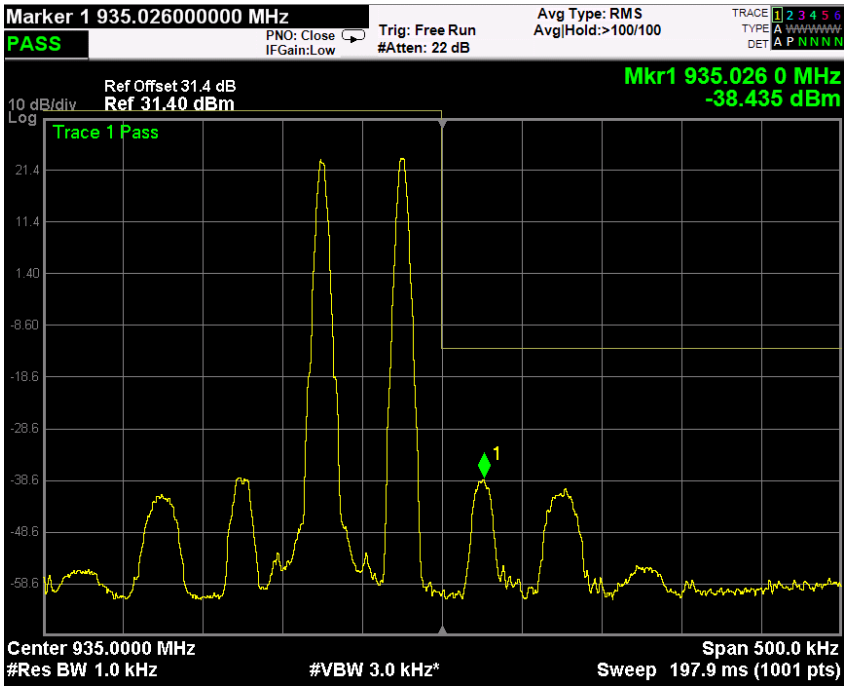


High Band Edge

P25 signal, nominal input signal

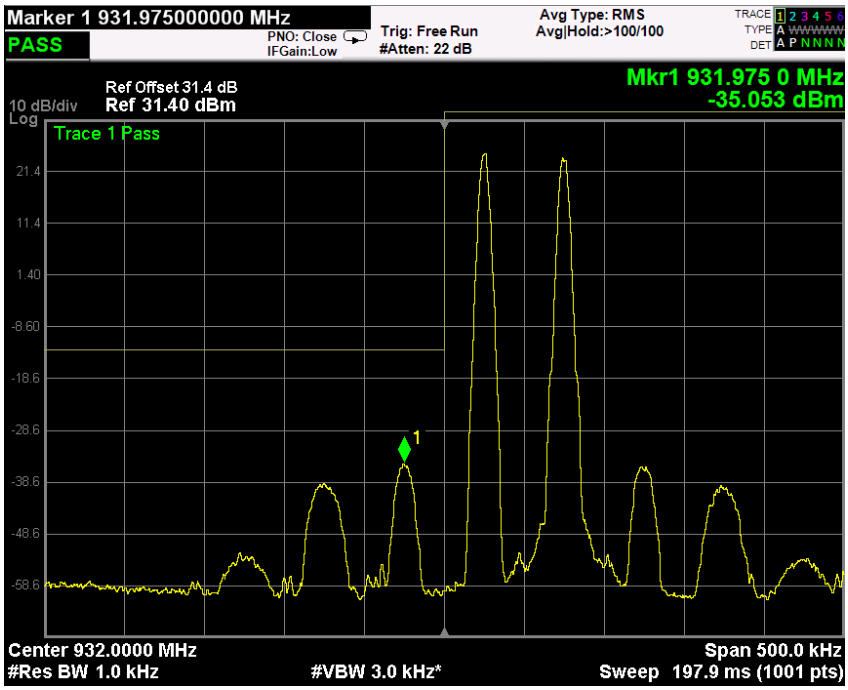


Low Band Edge

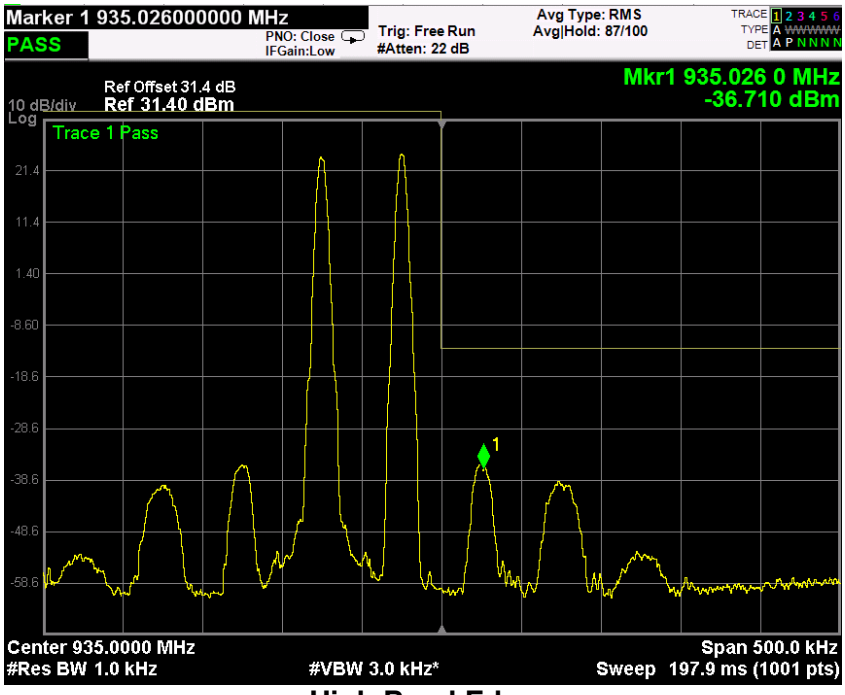


High Band Edge

P25 signal, nominal input signal + 3dB



Low Band Edge



High Band Edge

Clause 101.111 Radiated Spurious emissions

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(5) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a 12.5 KHz bandwidth, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 2.5 KHz up to and including 6.25 KHz: At least 53 log10 (fd/2.5) decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 6.25 KHz up to and including 9.5 KHz: At least 103 log10 (fd/3.9) decibels;

(iii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 9.5 KHz up to and including 15 KHz: At least 157 log10 (fd/5.3) decibels; and

(iv) On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus 10 log10(P) or 70 decibels, whichever is the lesser attenuation.

(6) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a bandwidth greater than 12.5 KHz, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 5 KHz up to and including 10 KHz: At least 83 log10 (fd/5) decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 10 KHz up to and including 250 percent of the authorized bandwidth: At least 116 log10 (fd/6.1) decibels or 50 plus 10 log10 (P) or 70 decibels, whichever is the lesser attenuation; and

(iii) On any frequency removed from the center of the authorized bandwidth by more that 250 percent of the authorized bandwidth: At least 43 plus 10 log10 (output power in watts) decibels or 80 decibels, whichever is the lesser attenuation.

Test date: 05/27/2019 to 06/24/2019

Test results: Pass

Special notes

Clause 101.111 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.

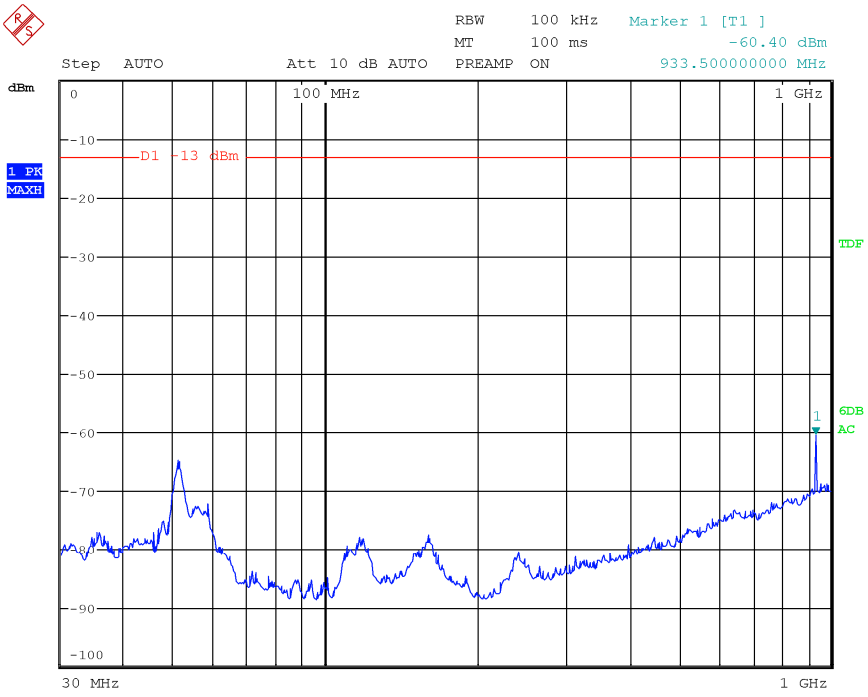
The spectrum was searched from 30 MHz to 1 GHz (RBW 100 kHz) & 1 GHz (RBW 1 MHz) to the tenth harmonic of the carrier.

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

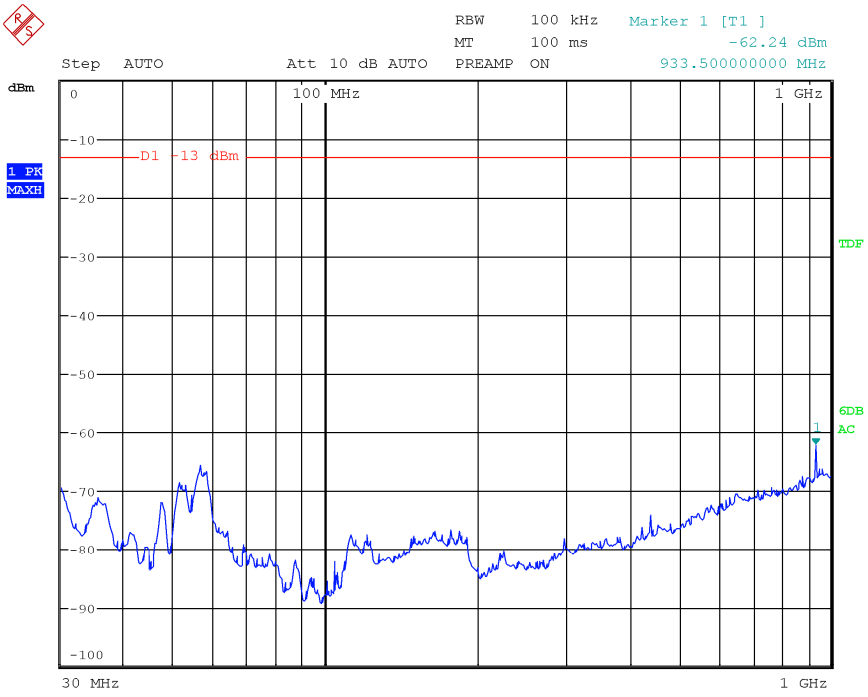
Spurious emissions measurement results:

Frequency (MHz)	Polarization. V/H	Field strength (dBm)	Limit (dBm)	Margin (dB)
Low channel				
First Channel	V/H	Negligible	-13	
Mid channel				
933.5	V/H	Negligible	-13	
High channel				
Last Channel	V/H	Negligible	-13	

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

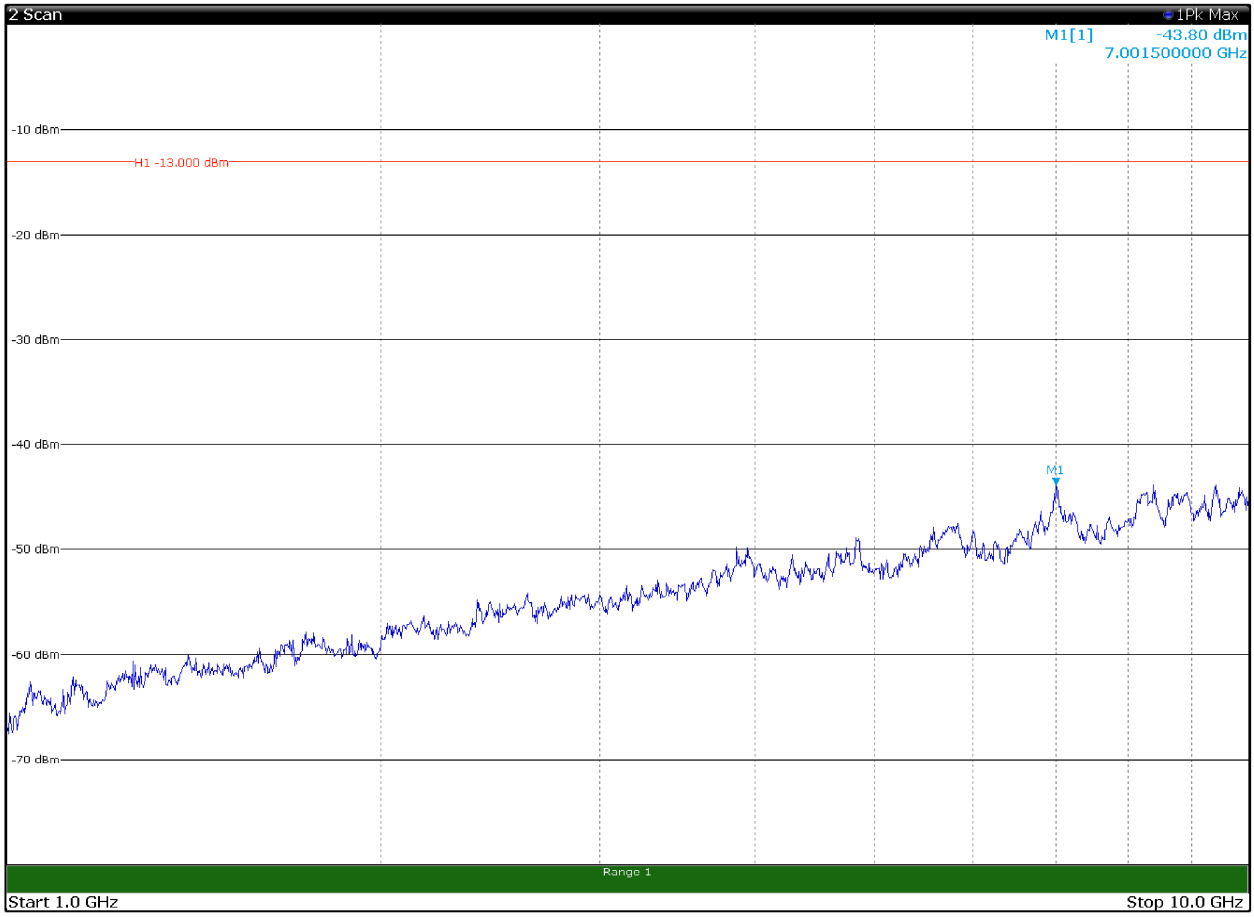


30MHz-1GHz – H Pol

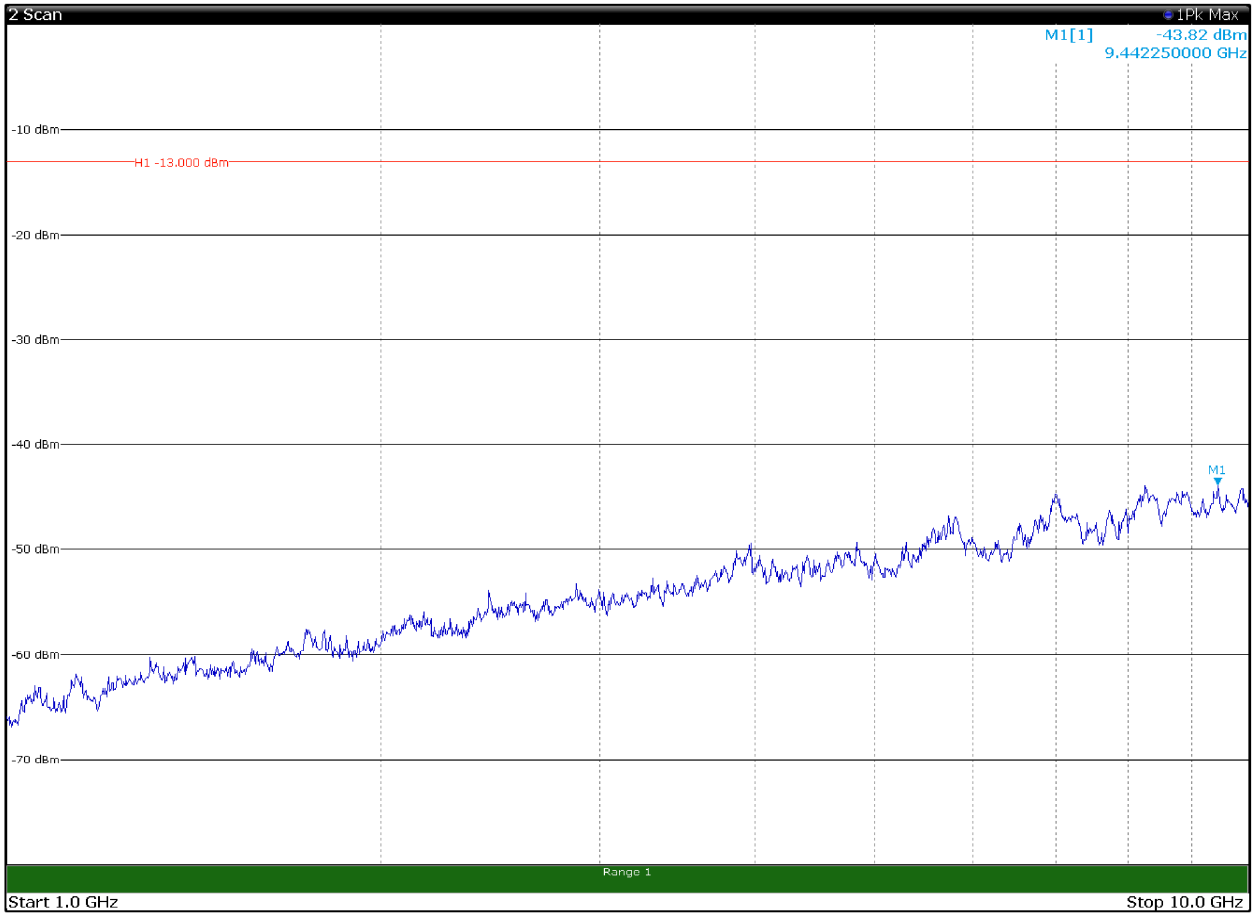


Date: 19.JUN.2019 12:19:31

30MHz-1GHz – V Pol



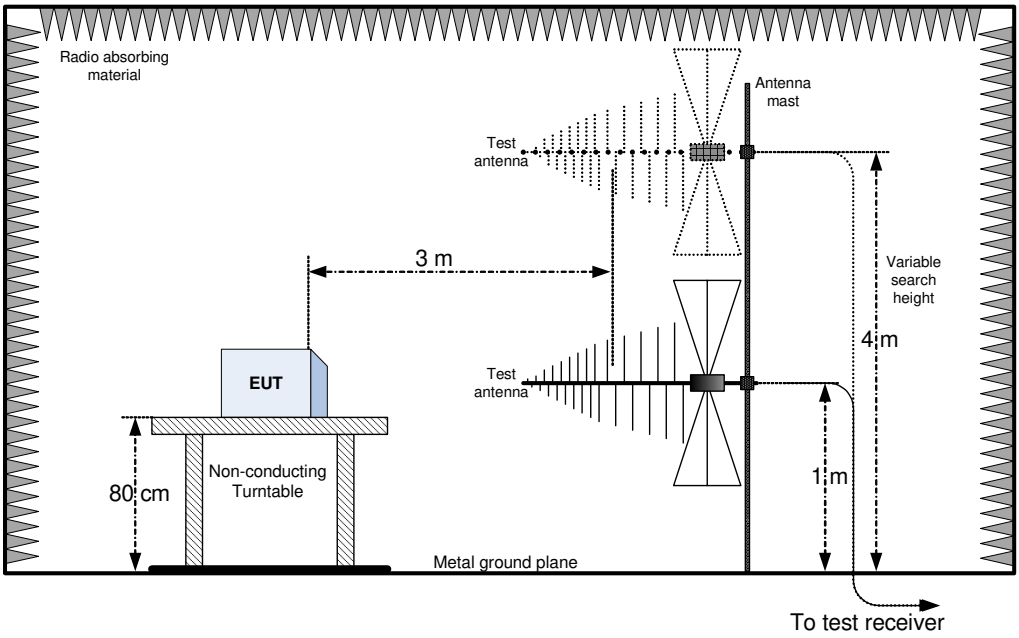
1GHz-10GHz – H Pol



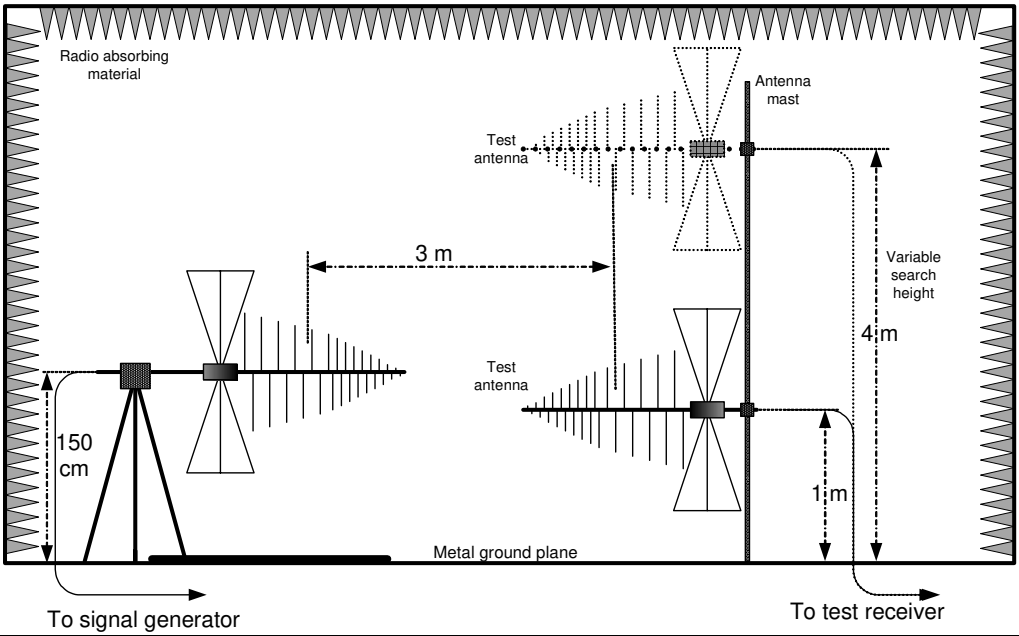
1GHz-10GHz – V Pol

Appendix B: Block diagrams of test set-ups

Radiated emissions set-up



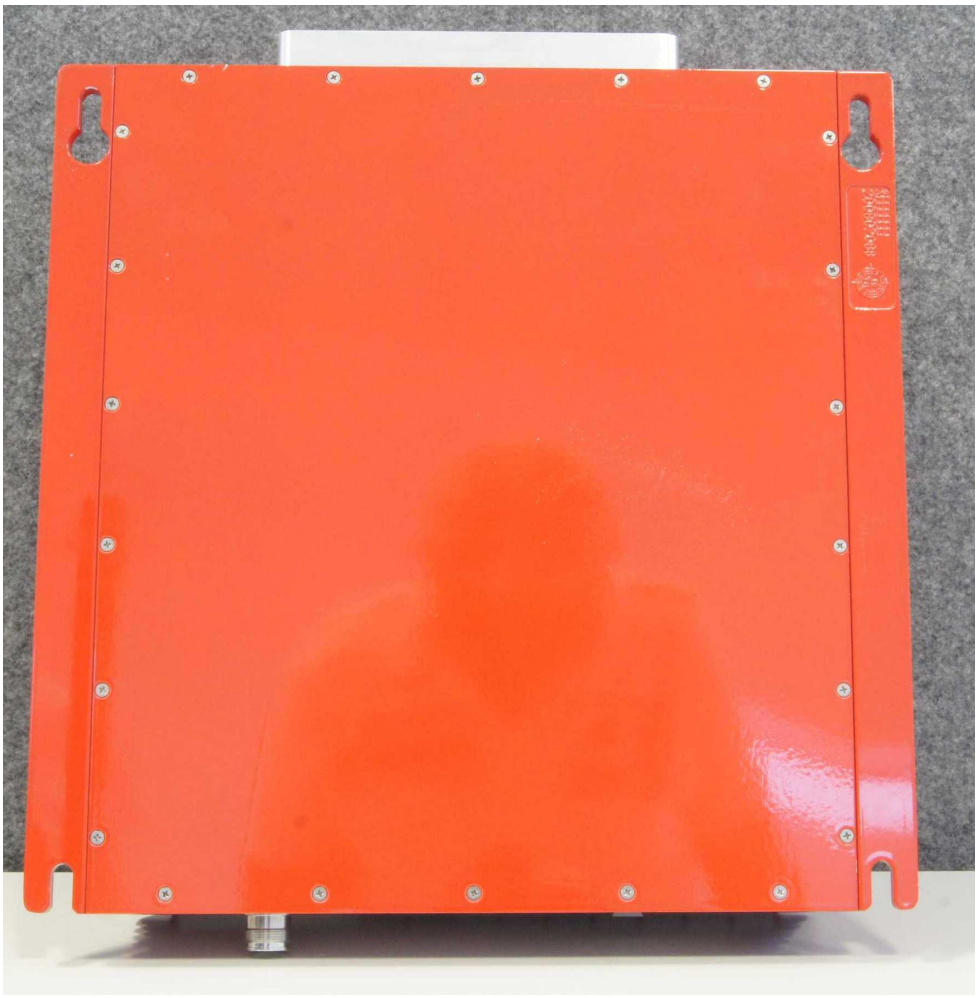
Substitution method set-up

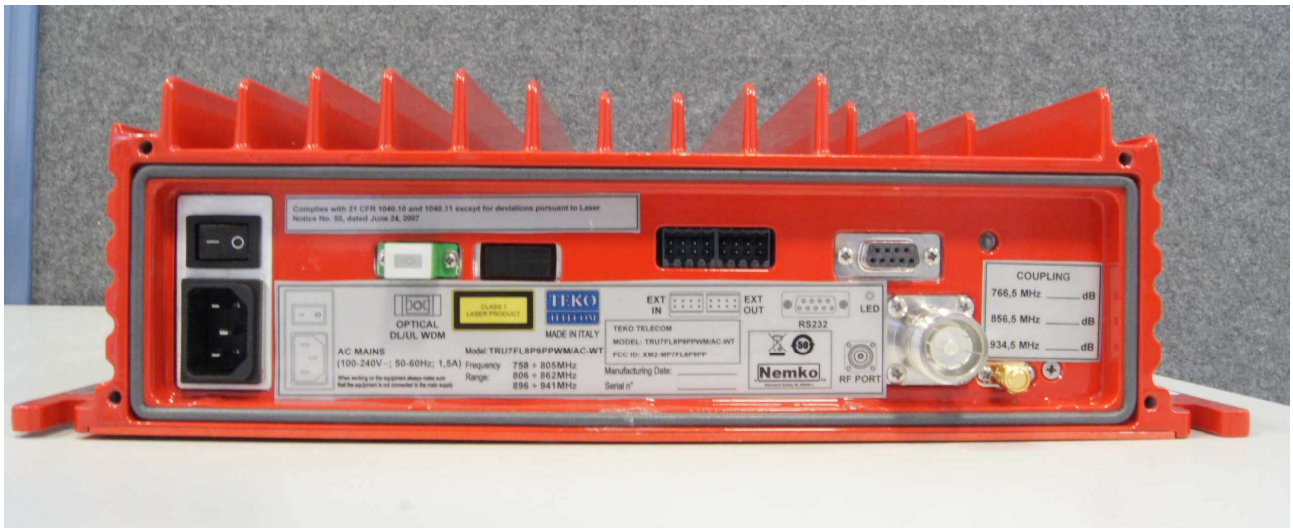


Appendix C: EUT Photos

Photo Set up

Photo EUT





END OF REPORT