

Report Reference ID:	372837-10TRFWL
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Title 47 – Telecommunication

Chapter I - Federal Communications Commission **Test specification:**

Subchapter A – General

Part 24 - Personal Communication Services

Subpart D - Narrowband PCS

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

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

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

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Specification: FCC 24

Section 1: Report summary

Test specification

Specifications

Part 24 Subpart D, Narrowband PCS

1.2 Statement of compliance

Compliance

In the configuration tested the EUT was found compliant

Yes X 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 24. Radiated tests were conducted in accordance with ANSI C63.26-2015.

1.3 **Exclusions**

Exclusions

None

Registration number 1.4

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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Section 2: Summary of test results

2.1 FCC Part 24, test results			
Part	Methods	Test description	Verdict
	§ 935210 D05v01r03 (3.2)	AGC threshold	Pass
	§ 935210 D05v01r03 (3.3)	Out of band rejection	Pass
§24.131	§ 935210 D05v01r03 (3.4)	Occupied bandwidth	Pass
§24.132(c)	§ 935210 D05v01r03 (3.5)	Peak output power at RF antenna connector	Pass
§24.133	§ 935210 D05v01r03 (3.6)	Spurious emissions at RF antenna connector	Pass
§24.133	§ 935210 D05v01r03 (3.8)	Radiated spurious emissions	Pass
§24.135	§ 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)



Specification: FCC 24

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

2.1 Applicant	lotoilo		
3.1 Applicant of			
Applicant	Name:	Teko Telecom Srl	
complete	Federal		
business name	Registration	0018963462	
	Number (FRN):		
	Grantee code	XM2	
Mailing address	Address:	Via Meucci, 24/a	
	City:	Castel S. Pietro Terme	
	Province/State:	Bologna	
	Post code:	40024	
	Country:	Italy	
3.2 Modular ed	quipment		
a) Single modular	Single modular appro	oval	
approval	Yes ☐ No ⊠		
b) Limited single	Limited single modular approval		
modular approval	Yes □ No ⊠		
• •			
O O Duo di iot do	Jelle		
3.3 Product de			
FCC ID	Grantee code:	XM2	
	Product code:	-MP7FL8P9PP	
Equipment class	B2I		
Description of	Booster		
product as it is	Model	TDUZELOBODIANA/AO INT	
marketed	name/number:	TRU7FL8P9PWM/AC-WT	
	Serial number:	1012793001	
3.4 Application purpose			
Type of	Original certi	fication	
application		entification of presently authorized equipment	
	Original FCC		
		nissive change or modification of presently authorized	
	equipment	isono shango or modification of prosontly authorized	



Specification: FCC 24

Section 3: Equipment under test

3.5 Composite/related equipment		
a) Composite	The EUT is a composite device subject to an additional equipment	
equipment	authorization	
	Yes ⊠ No □	
b) Related	The EUT is part of a system that operates with, or is marketed with,	
equipment	another device that requires an equipment authorization	
	Yes □ No ⊠	
c) Related FCC ID	If either of the above is "yes":	
	\square 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 inf	Sample information	
Receipt date:	05/27/2019	
Nemko sample ID number:		

3.7 EUT techn	ical specifications
Operating band:	Down Link 940-941 MHz; Up Link 901-902 MHz
Operating frequency:	Narrowband
Modulation type:	iDEN
Occupied bandwidth:	standard
Channel spacing:	standard
Emission designator:	D7W
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



Specification: FCC 24

Section 3: Equipment under test

3.8 Accessories an	d support equipment
	dentifies 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:	



Specification: FCC 24

3.9 Operation of the EUT during testing

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

output.

3.10 EUT setup diagram

In this system, 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.



Specification: FCC 24

Section 4: Engineering considerations				
4.1 Modificatio	ns incorporated in the EUT			
Modifications	Modifications performed to the EUT during this assessment None ☑ Yes ☐, performed by Client ☐ or Nemko ☐ Details:			
4.2 Deviations	from laboratory tests procedures			
Deviations	Deviations from laboratory test procedures None Yes - details are listed below:			
4.3 Technical j	udgment			
Judgment	None			



Specification: FCC 24

Section 5: Test conditions

Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

5.2 Test conditions, power source and ambient temperatures				
Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa			
	When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.			
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.			





Section 5: Test conditions, continued

5.3 Measurement uncertainty						
EUT	Туре	Test	Range and Setup features	Measurement Uncertainty	Notes	
		Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)	
			10 kHz ÷ 30 MHz	1.0 dB	(1)	
		Carrier power	30 MHz ÷ 18 GHz	1.5 dB	(1)	
		RF Output Power	18 MHz ÷ 40 GHz	3.0 dB	(1)	
		Adjacent channel power	1 MHz ÷ 18 GHz	1.6 dB	(1)	
			10 kHz ÷ 26 GHz	3.0 dB	(1)	
		Conducted spurious emissions	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)	
	Conducted	Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)	
Transmitter	Conducted	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 spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)	
	Radiated	riadiated sparious erilissions	26.5 GHz ÷ 40 GHz	8.0 dB	(1)	
	Tiadiated	Effective radiated power	10 kHz ÷ 26.5 GHz	6.0 dB	(1)	
		transmitter	26,5 GHz ÷ 40 GHz	8.0 dB	(1)	
		Radiated spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)	
	Radiated	riadiated spurious erriissions	26.5 GHz ÷ 40 GHz	8.0 dB	(1)	
Receiver		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)	
	Conducted	Conducted spurious emissions	10 kHz ÷ 26 GHz	3.0 dB	(1)	
	Conducted	Conducted Spanious emissions	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 %



Specification: FCC 24

5.4 Test equ	inment			
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



Specification: FCC 24

Appendix A: Test results

Clause 935210 D05v01 (3.2) AGC threshold

Measure of EUT AGC Threshold

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

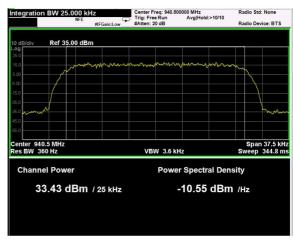
Test results: Pass

Special notes

Test data



iDEN signal, nominal input signal



iDEN signal, nominal input signal + 1dB



Specification: FCC 24

Clause 935210 D05v01 (3.3) Out of band rejection

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

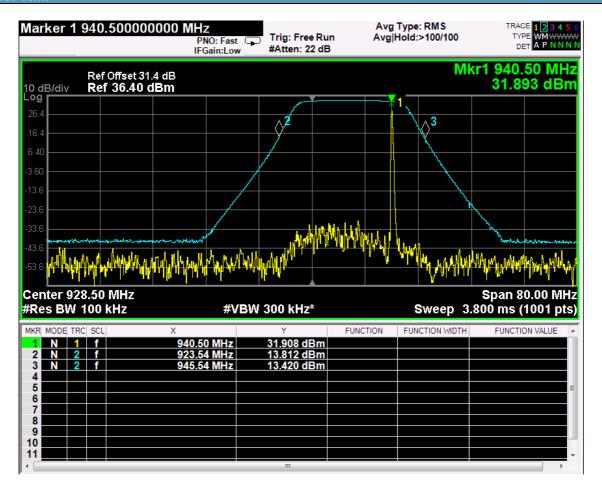
Test date: 05/27/2019 to 06/24/2019

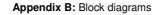
Test results: Pass

Special notes

_

Test data







Specification: FCC 24

Clause 24.131 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: 05/27/2019 to 06/24/2019

Test results: Pass

Special notes

Specification: FCC 24

Span 100 kHz Sweep FFT

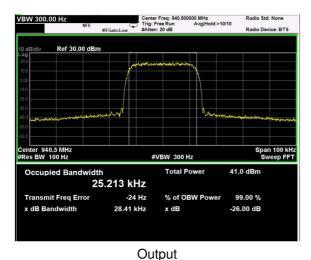
99.00 %

-26.00 dB

Clause 24.131 Occupied bandwidth, continued

Test data

iDEN signal, nominal input signal





25.285 kHz

-22 Hz

Input

28.41 kHz

% of OBW Power

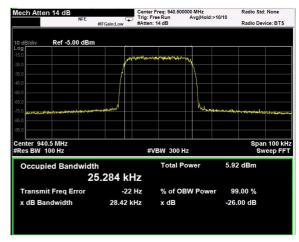
Ref -5.00 dBm

enter 940.5 MHz Res BW 100 Hz

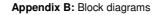
Transmit Freq Error

iDEN signal, nominal input signal + 3dB





Output Input





Specification: FCC 24

Clause 24.132(c) Peak output power at RF antenna connector

(c) Base stations transmitting in the 930-931 MHz and 940-941 MHz bands are limited to 3500 watts e.r.p. per authorized channel and are unlimited in antenna height except as provided in paragraph (d) of this section.

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

Test results: Pass

Special notes



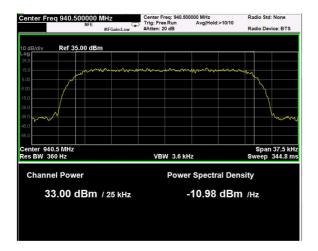
Specification: FCC 24

Clause 24.132(c) Peak output power at RF antenna connector

Test data

iDEN signal, nominal input signal

Test data					
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PAR (dB)
Down-link	iDEN (25kHz)	940.5	33.00	2.00	5.78





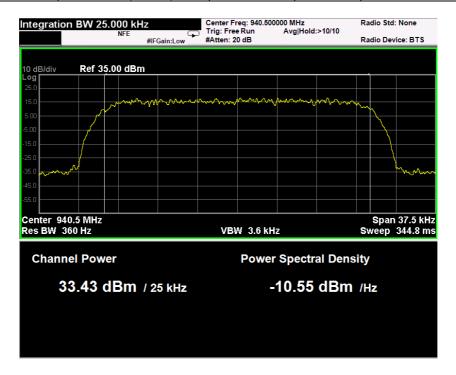
PAR measure is performed by the "CCDF" function installed on Spectrum analyzer that provides average power (the same measured with "Channel power" function), peak power and PAR.



Specification: FCC 24

iDEN signal, nominal input signal + 3dB

Test data				
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)
Down-link	iDEN (25kHz)	940.5	33.43	2.20





Specification: FCC 24

Clause 24.133 Spurious emissions at RF antenna connector

- (a) The power of any emission shall be attenuated below the transmitter power (P), as measured in accordance with §24.132(f), in accordance with the following schedule:
 - (1) For transmitters authorized a bandwidth greater than 10 kHz:
 - (i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of up to and including 40 kHz: at least 116 Log10 ((fd+10)/6.1) decibels or 50 plus 10 Log10 (P) decibels or 70 decibels, whichever is the lesser attenuation;
 - (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz: at least 43+10 Log10 (P) decibels or 80 decibels, whichever is the lesser attenuation.
 - (2) For transmitters authorized a bandwidth of 10 kHz:

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

Test results: Pass

- (i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of up to and including 20 kHz: at least 116×Log10 ((fd+5)/3.05) decibels or 50+10×Log10 (P) decibels or 70 decibels, whichever is the lesser attenuation;
- (ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 20 kHz: at least 43+10 Log 10 (P) decibels or 80 decibels, whichever is the lesser attenuation.

1000100001011000	
Special notes	

Nemko

Product: TRU7FL8P9PWM/AC-WT

Specification: FCC 24

Clause 24.133 Spurious emissions at RF antenna connector, continued

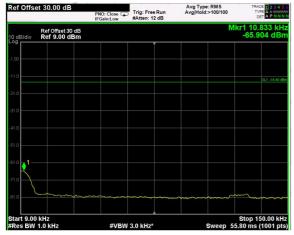
Test data			
See Plots below			
Spurious emissions me	asurement results:		
Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)	Margin (dB)
Low channel			
First channel	Negligible	-13	
Mid channel			
940,5 MHz	Negligible	-13	
High channel			
Last channel	Negligible	-13	

Specification: FCC 24

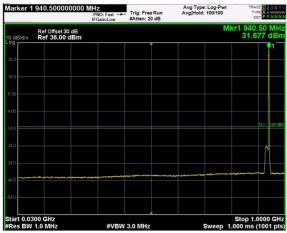
Test data: spurious emissions at antenna terminal

iDEN signal

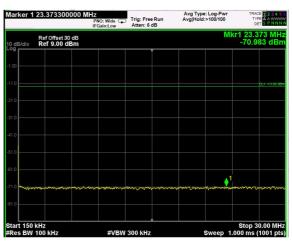
(Plots are referred to modulated carrier at the Middle Channel)



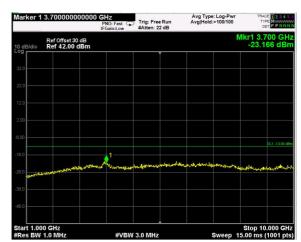
9KHz-150KHz



30MHz-1GHz



150KHz-30MHz

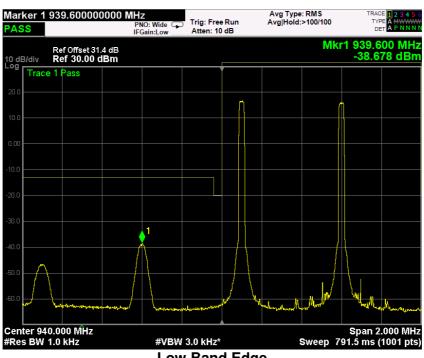


1GHz-10GHz

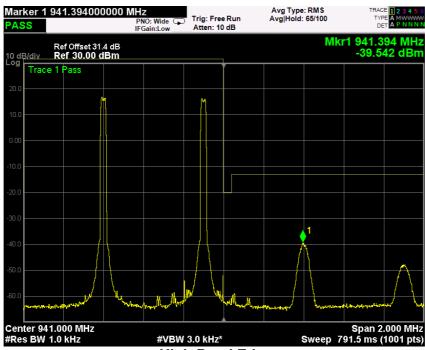


Test data, continued: band edges Inter modulation

iDEN signal, nominal input signal



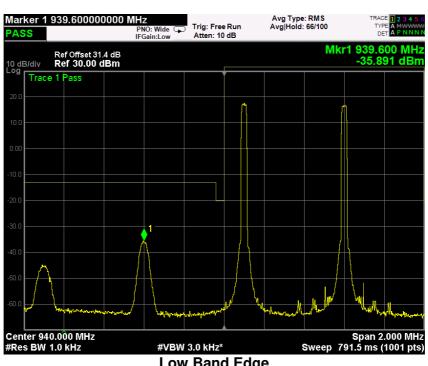
Low Band Edge



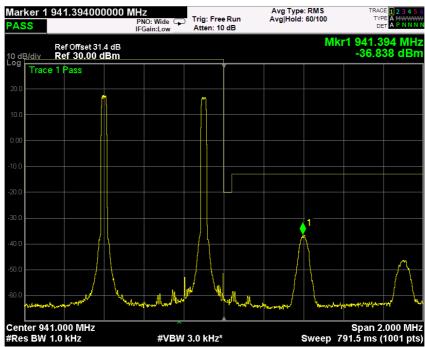
High Band Edge



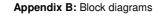
MSK signal, nominal input signal + 3dB



Low Band Edge



High Band Edge





Specification: FCC 24

Clause 24.133 Radiated Spurious emissions

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

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 \pm 10 Log (P) dB.

Test results: Pass		
Special notes		



Specification: FCC 24

Clause 24.133 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.

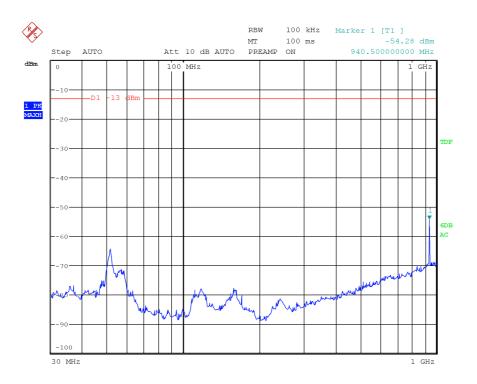
There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.

Sourious emissions measurement results:

Spurious erriissioi	is illeasurement rest			
Frequency	Polarization.	Field strength	Limit	Margin
(MHz)	V/H	(dBm) o	(dBm)	(dB)
Low channel			1	1
First Channel	V/H	Negligible	-13	
Mid channel			T	T
763.0	V/H	Negligible	-13	
700.0	V/II	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.

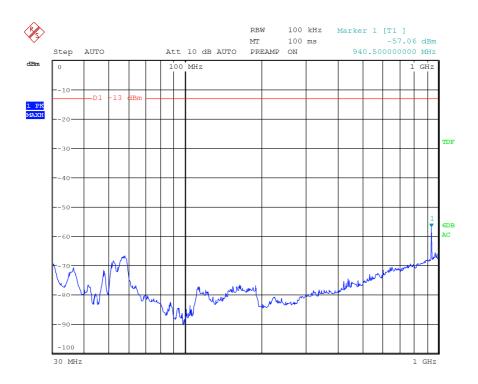




Date: 19.JUN.2019 12:31:07

30MHz-1GHz - H Pol

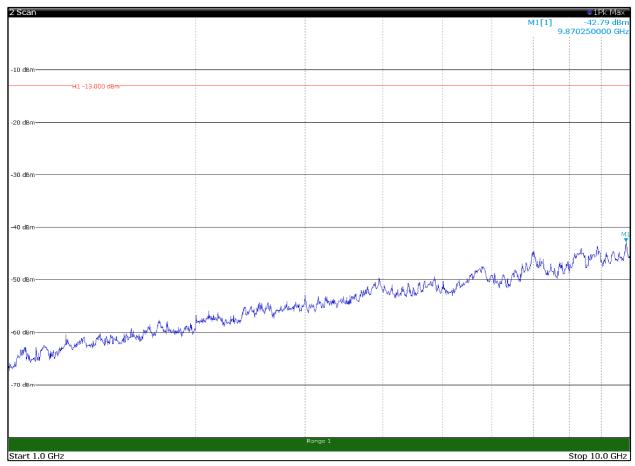




Date: 19.JUN.2019 12:30:24

30MHz-1GHz - V Pol

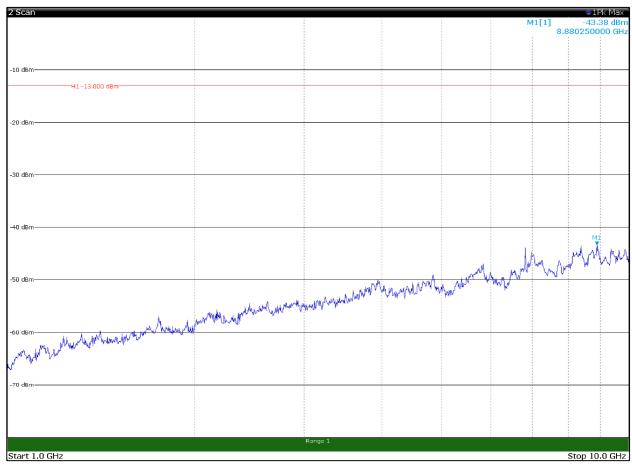




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1GHz-10GHz - H Pol



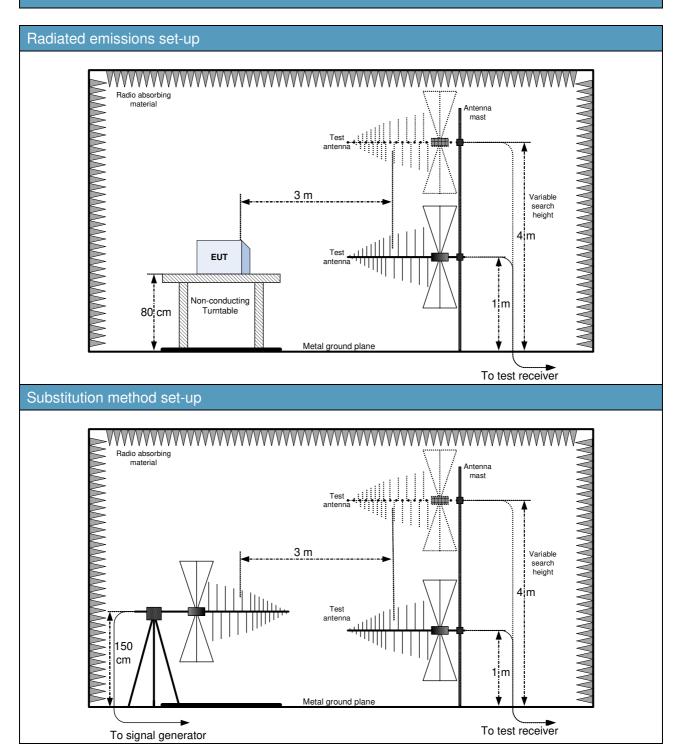


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1GHz-10GHz - V Pol



Appendix B: Block diagrams of test set-ups







Appendix C: EUT Photos

Photo Set up









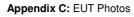
Photo EUT















END OF REPORT