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RAPPORTO DI PROVA / TEST REPORT

Rif./Ref.No. FCCTR_141206-2	Data / Date: 24/04/2015	Pagine / Pages : 45
Scopo delle prove / Test object :	Prove di tipo in accordo a / Type test according to FCC Cfr 47 part 90 Subpart I IC - RSS 119 Issue 11	
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Marchio commerciale / Trade mark :		
Fabbricante / Manufacturer :	RADIO ACTIVITY S.R.L.	
Prodotto / Product :	Base station / Repeater	
Modello / Model :	KA-160	
Data ricevimento campioni / Date of test sample receipt:	22/10/2014	
Campioni verificati / No. of tested samples	1	
Data verifiche / Testing date :	22-23-24/10/2014 14/04/2015	
Sito di prova / Testing site :	Prima Ricerca & Sviluppo Via Campagna - 92 I-22020 FALOPPIO (CO)	
Esito delle valutazioni / Assessment results :	CONFORME / COMPLIANT	
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Approvato / Approved by :	Giacomo ARMELLINI Responsabile Laboratorio EMC e RADIO/ EMC and RADIO Laboratory Manager	

I risultati delle prove riportati nel presente rapporto di prova si riferiscono solo ai campioni esaminati. / The test results reported in this test report shall refer only to the samples tested

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0 RELEASE CONTROL RECORD

TEST REPORT NUMBER	REASON OF CHANGE	DATE OF ISSUE
FCCTR_141206-0	Original release	28/11/2014
FCCTR_141206-1	Photographic section has been inserted in TSupPhotos_141206-0	12/03/2015
FCCTR_141206-2	Editorial change	24/04/2015

1 TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

1.1 EUT Identification

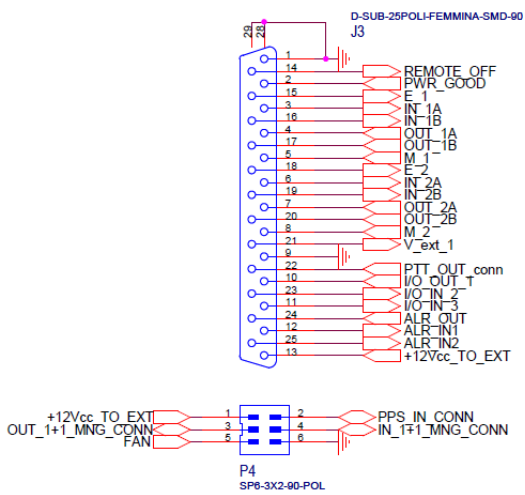
Description	Base station / Repeater
Model name or No.	KA-160
Part number / Serial No.	Not present (prototype)
Brand name	 Radio Activity
Manufacturer	RADIO ACTIVITY S.R.L.
Single Unit or System	Single unit
Country of manufacturer	Italy

1.2 EUT Technical Data

Power source	External Power Supply		
Power supply nominal voltage	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>
	11Vdc	13.8Vdc	15Vdc
Nominal power or absorbing current	TX: 60 W @25W RF / RX: 5 W @Main+Div enabled		
Dimensions	160x200x45mm / 3.2kg		
Typical usage :	Radio equipment		
Type:	Private Land Mobile Radio Services		
Frequency range of Operation	150-174MHz		
Output Power	1-25 W / 100% duty cycle / selectable per channel		
Channelization	12,5KHz		
Frequency stability	0,5 p.p.m. (without GPS)		
Data rate	9600 bps		
Type of antenna	Not provided by the customer		

1.3 EUT ports identification

This section contains descriptions of all ports, the length and the type of the cable provided by manufacturer needed for the tests. Moreover it is specified if the ports are ever or optionally connected.

Port	Description	Connection	Cable lenght
Enclosure	Metallic	Screw and snaps	<3mt
AC power ports	Port not present	---	---
DC power ports IN	11÷15Vdc	Connector	<3mt
Signal line			<3mt
Telecommunication line	Ethernet 10BT/100TX (auto MDI/MDI X)	RJ45 socket	<3mt
Antenna port	RX main RX diversity TX	Female SMA-type connector	<3mt

Note: During the tests all cables must be what provided the manufacturer or the same that used in the real employment of the EUT.

1.4 Modifications incorporated in E.U.T.

The following items are the modifications introduced in the equipment under test :

- None

1.5 Auxiliary equipment

- None

2 REFERENCE STANDARD

CODE OF FEDERAL REGULATIONS	
Title 47 Part 90 Subpart I	Private land mobile radio services - General technical standards
RSS-119 Issue 11	Spectrum Management and Telecommunications Radio Standards Specification Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz

In the following table there are the operating conditions adopted during tests identified by an indicator (#..) at which has been referred the item "Operating condition of the equipment under test"

3 OPERATING TEST MODES AND CONDITIONS

OPERATING CONDITION	DESCRIPTION
#1	Set to lower channel, continuous transmitting @ maximum power (25W)
#2	Set to middle channel, continuous transmitting @ maximum power (25W)
#3	Set to upper channel, continuous transmitting @ maximum power (25W)
#4	Receiver mode

4 SUMMARY OF TEST RESULTS

Phenomena	FCC Rules	Operating condition	Result
	IC Rules		
Radiated Emission	§15.109	#4	Within the limits
	RSS-119 issue 11 §5.8		
Conducted Emission	§15.107	Not applicable	
Maximum Transmitter Power	§90.205	#1 #2 #3	Compliant
	RSS-119 issue 11 §5.4.1		
Modulation Characteristic	§90.207	#1 #2 #3	Compliant
	RSS-119 issue 11 §5.2		
Occupied Bandwidth	§90.209	#1 #2 #3	Compliant
	RSS-119 issue 11 §5.5		
Emission Mask	§90.210	#1 #2 #3	Compliant
	RSS-119 issue 11 §5.8		
Frequency Tolerance	§90.213	#1 #2 #3	Compliant
	RSS-119 issue 11 §5.3		
Transient Frequency Behaviour	§90.214	#1 #2 #3	Compliant
	RSS-119 issue 11 §5.9		
Radiated Emission On Receiving Mode	§90.214	#4	Within the limits
	RSS-119 issue 11 §5.11		
Conducted antenna port emission	§2.1051	#1 #2 #3	Compliant

5 TEST RESULTS

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**TEST
1.**

RADIATED EMISSIONS

REFERENCE DOCUMENT FCC cfr 47 §15.109; IC RSS-119 §5.8

- TEST SETUP: In according to ref doc.
- TEST LOCATION: Test site
- TEST EQUIPMENT USED FOR TEST: EMC.359; EMC.191; EMC.123; EMC.391

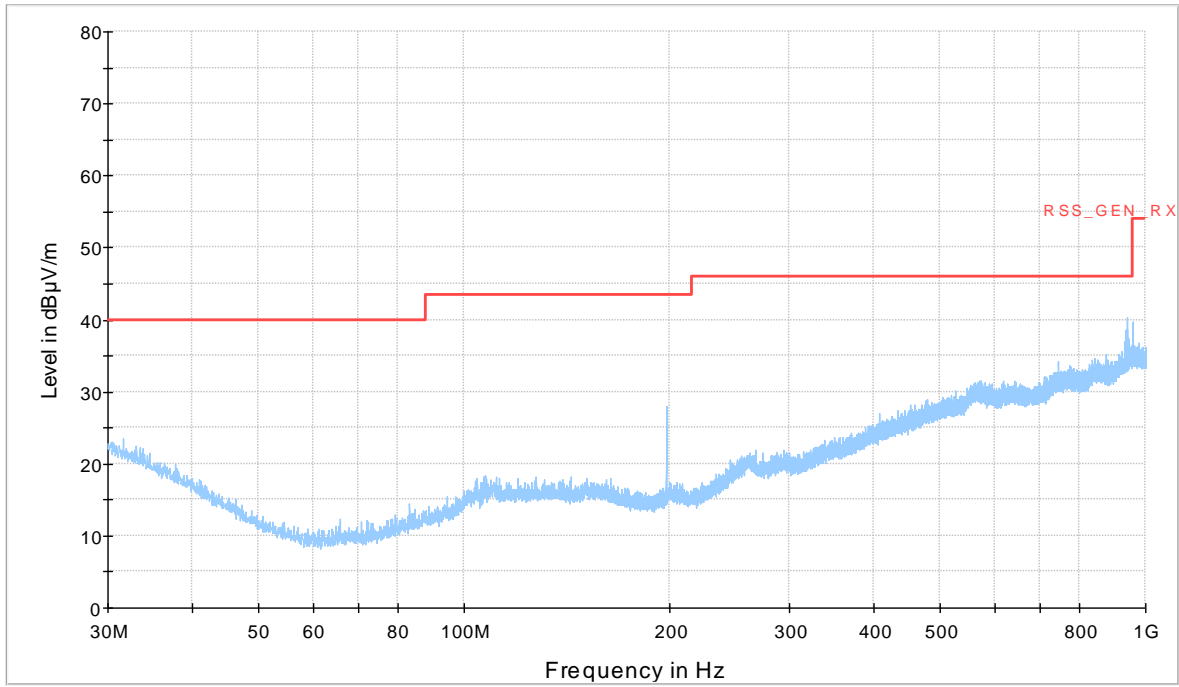
- TESTED PORT: Enclosure
- FREQUENCY RANGE: 30 - 1000 MHz
- MEASUREMENT DISTANCE : 3mt
- EMISSION LIMITS: Acc. to Section 15.109 of reference document
- UNCERTAINTY OF MEASURE: Level of confidence = 95%
Degree of freedom = 10
Coverage factor $k_p = 2,28$
Combined uncertainty = 4,49 dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	13.8Vdc

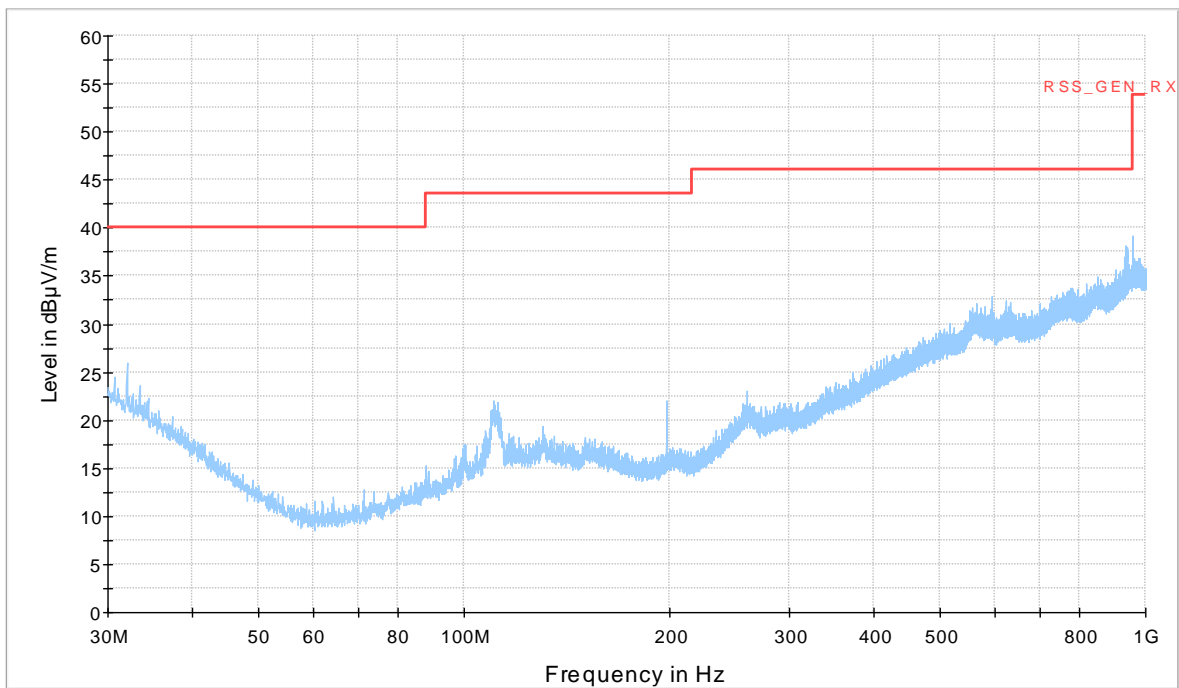
OPERATING CONDITION (Rif. Section.3) : #4

RESULT: **WITHIN THE LIMIT**

Vertical polarization



Horizontal polarization



**TEST
2.**

FREQUENCY TOLERANCE

REFERENCE DOCUMENT FCC cfr 47 §90.213 IC RSS-119 issue 11 §5.3

- **TEST SETUP:** In according to FCC Part 2 section 2.1055 (a)(1) – 2.1055 (d)(2) – FCC part 90 Section 90.213
- **TEST LOCATION:** Radio test area
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture
- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 ± 3 °C
Ambient humidity :	25 - 75 %rH	40 ± 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :		13.8Vdc

OPERATING CONDITION (Rif. Section. 3) : #1 #2 #3

RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

Frequency stability versus environmental temperature

1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1 KHz and Frequency Span to 50KHz. Record this frequency as reference frequency.
3. Set the temperature of chamber to 50°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measured frequencies on each temperature step.

Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15°C to 25°C. Otherwise, an environment chamber set for a temperature of 20°C shall be used. The EUT shall be powered by DC 13.8V
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1 KHz. Record this frequency as reference frequency.
3. Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

TEST RESULTS

LOWER CHANNEL Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	150,049985	-15,0	-0,100
-20	150,050030	30,0	0,200
-10	150,050017	17,0	0,113
0	150,049983	-17,0	-0,113
10	150,049987	-13,0	-0,087
20	150,050013	13,0	0,087
30	150,050015	15,0	0,100
40	150,050011	11,0	0,073
50	150,049930	-70,0	-0,467
60	150,049953	-47,0	-0,313

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10,8	150,050045	45,0	0,300
15	150,050017	17,0	0,113

MIDDLE CHANNEL Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	161,999991	-9,0	-0,056
-20	161,999986	-14,0	-0,086
-10	162,000000	0,0	0,000
0	162,000024	24,0	0,148
10	162,000018	18,0	0,111
20	162,000014	14,0	0,086
30	161,999962	-38,0	-0,235
40	161,999956	-44,0	-0,272
50	161,999956	-44,0	-0,272
60	161,999956	-44,0	-0,272

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10,8	162,000014	14,0	0,086
15	162,000016	16,0	0,099

UPPER CHANNEL Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	174,000040	40,0	0,230
-20	174,000000	0,0	0,000
-10	174,000040	40,0	0,230
0	173,999982	-18,0	-0,103
10	173,999986	-14,0	-0,080
20	174,000024	24,0	0,138
30	174,000018	18,0	0,103
40	174,000010	10,0	0,057
50	173,999996	-4,0	-0,023
60	173,999952	-48,0	-0,276

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10,8	174,000020	20,0	0,115
15	174,000020	20,0	0,115

**TEST
3.**

EMISSION BANDWIDTH

REFERENCE DOCUMENT FCC cfr 47 §90.209 IC RSS-119 issue 11 §5.5

- **TEST SETUP:** In according to FCC part 90 Section 90.209
- **TEST LOCATION:** Test site
- **TEST EQUIPMENT USED FOR TEST:** EMC.359; EMC.191; EMC.123; EMC.391

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 ± 3 °C
Ambient humidity :	25 - 75 %rH	40 ± 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :		13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#1 #2 #3

RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

- 1). The EUT was placed on a turn table which is 0.8m above ground plane.
- 2). The EUT was modulated by 3.0 KHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5 kHz channel spacing) .
- 3). Set SPA Center Frequency = fundamental frequency, RBW=VBW= 300 Hz, Span =50 KHz.
- 4). Set SPA Max hold. Mark peak, -26 dB.

TEST RESULTS

26 dB Bandwidth Measurement

Operating Frequency (MHz)	12.5 KHz Channel Separation		
	26 dB Bandwidth (kHz)	Limits (kHz)	Result
150.05	10.624	11.25	Compliant
162	10.633	11.25	Compliant
174	10.631	11.25	Compliant

**TEST
4.**

UNWANTED RADIATION

REFERENCE DOCUMENT FCC cfr 47 §90.210 IC RSS-119 issue 11 §5.8

- **TEST SETUP:** In according to FCC part 90 Section 90.210
- **TEST LOCATION:** Test site
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#1 #2 #3

RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

- (1) On a test site, the EUT shall be placed on a turntable and in the position closest to the normal use as declared by the user.
- (2) The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3) The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- (4) The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5) The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
- (6) The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7) The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8) The maximum signal level detected by the measuring receiver shall be noted.
- (9) The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10) Replace the antenna with a proper Antenna (substitution antenna).
- (11) The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12) The substitution antenna shall be connected to a calibrated signal generator.
- (13) If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14) The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15) The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- (16) The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (17) The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

TEST RESULTS

Measurement Result for 12.5 KHz Channel Separation

On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (f_d in KHz) f_o of more than 12.5 KHz: At least $50+10 \log(P)$ dB or 70 dB, which ever is lesser attenuation.

LOWER CHANNEL

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dB)	Limit	Result
150.089	43.800	----	(carrier)	---	---
299.951	-53.474	V	97.274	≥ 64	Within the limit
450.100	-42.887	H	86.687	≥ 64	Within the limit
599.972	-38.774	H	82.574	≥ 64	Within the limit
794.934	-42.050	H	85.580	≥ 64	Within the limit
899.993	-38.026	H	81.826	≥ 64	Within the limit
1049.800	-53.613	V	97.413	≥ 64	Within the limit
1199.900	-32.786	V	76.586	≥ 64	Within the limit
1350.300	-51.800	V	95.600	≥ 64	Within the limit
1499.600	-57.619	H	101.419	≥ 64	Within the limit

Limit: At least $50+10 \log(P) = 50+10\log(25) = 64$ (dBc)

MIDDLE CHANNEL

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dBc)	Limit (dBc)	Result
162.017	43.400	----	(carrier)	---	---
324.007	-48.505	V	91.905	≥ 64	Within the limit
485.997	-44.840	H	88.240	≥ 64	Within the limit
647.987	-42.612	V	86.012	≥ 64	Within the limit
809.977	-49.237	H	92.637	≥ 64	Within the limit
972.064	-44.787	V	88.187	≥ 64	Within the limit
1133.900	-53.081	V	96.481	≥ 64	Within the limit
1295.900	-53.774	V	97.174	≥ 64	Within the limit
1458.000	-51.702	V	95.102	≥ 64	Within the limit
1620.174	-56.745	V	100.145	≥ 64	Within the limit

Limit: At least $50+10 \log(P) = 50+10\log(25) = 64$ (dBc)

UPPER CHANNEL

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dB)	Limit	Result
173.984	43.700	----	(carrier)	---	---
347.966	-43.381	V	87.081	≥ 64	Within the limit
521.984	-39.821	V	83.081	≥ 64	Within the limit
696.002	-41.951	H	85.651	≥ 64	Within the limit
870.020	-46.965	H	90.665	≥ 64	Within the limit
1043.800	-52.626	V	96.326	≥ 64	Within the limit
1218.000	-44.035	V	87.735	≥ 64	Within the limit
1391.872	-60.154	V	103.854	≥ 64	Within the limit
1494.200	-58.134	H	101.834	≥ 64	Within the limit
1739.840	-49.887	V	93.587	≥ 64	Within the limit

Limit: At least $50+10 \log(P) = 50+10\log(25) = 64$ (dBc)

**TEST
5.**

EMISSION MASK

REFERENCE DOCUMENT FCC cfr 47 §90.210 IC RSS-119 issue 11 §5.8

- **TEST SETUP:** In according to FCC part 90 Section 90.210
- **TEST LOCATION:** Radio test area
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#2

RESULT: WITHIN THE LIMITS

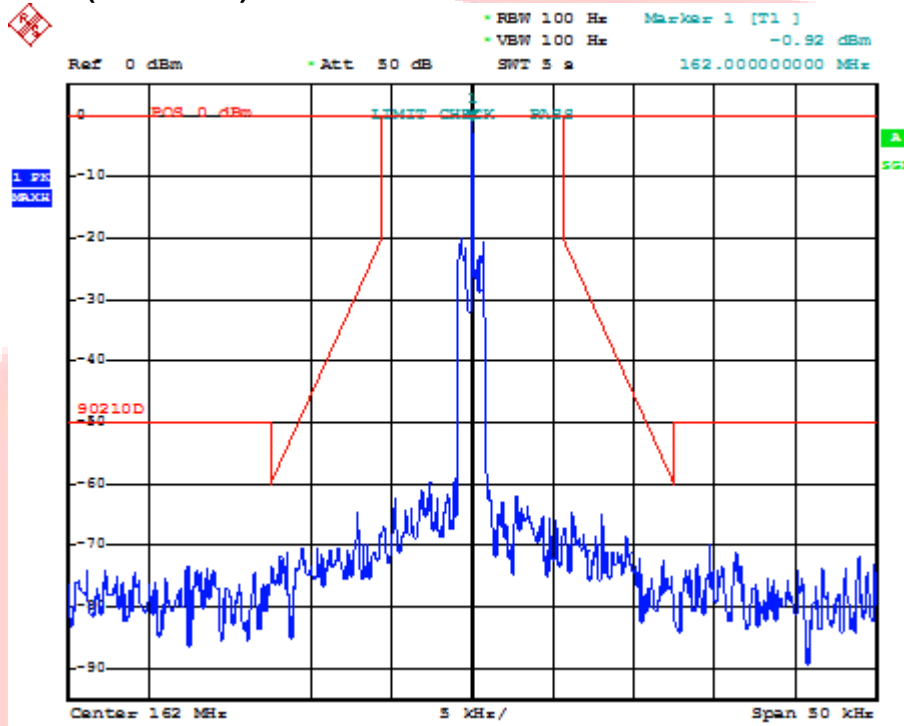
MEASUREMENT PROCEDURE

The detailed procedure employed for Emission Mask measurements are specified as following:

- The transmitter shall be modulated by a 2.5 KHz audio signal,
- The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 KHz (12.5 KHz channel spacing).

TEST RESULTS

MEDIUM CHANNEL (worst case)



**TEST
6.**

MODULATION CHARACTERISTICS

REFERENCE DOCUMENT FCC cfr 47 §90.207 IC RSS-119 issue 11 §5.2

- **TEST SETUP:** In according to CFR 47 section 2.1047(a)
- **TEST LOCATION:** Radio test area
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#2

RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

Modulation Limit

(1). Configure the EU, adjust the audio input for 60% of rated system deviation at 1KHz using this level as a reference (0dB) and vary the input level from -20 to +20dB. Record the frequency deviation obtained as a function of the input level.

(2). Repeat step 1 with input frequency changing to 300, 1000, 1500 and 3000Hz in sequence.

Audio Frequency Response

(1). Configure the EUT as shown in figure 1.

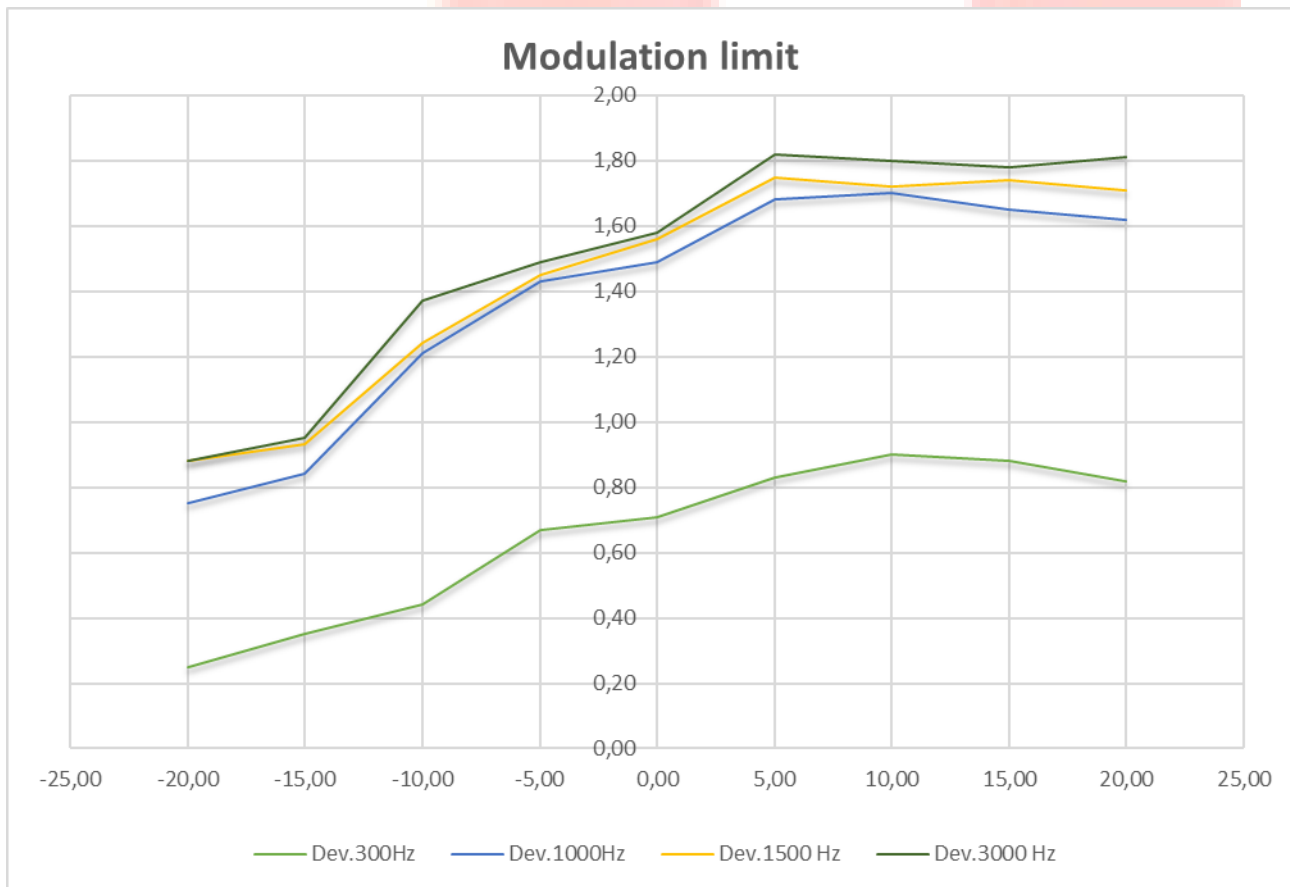
(2). Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0dB).

(3). Vary the Audio frequency from 100 Hz to 10 KHz and record the frequency deviation.

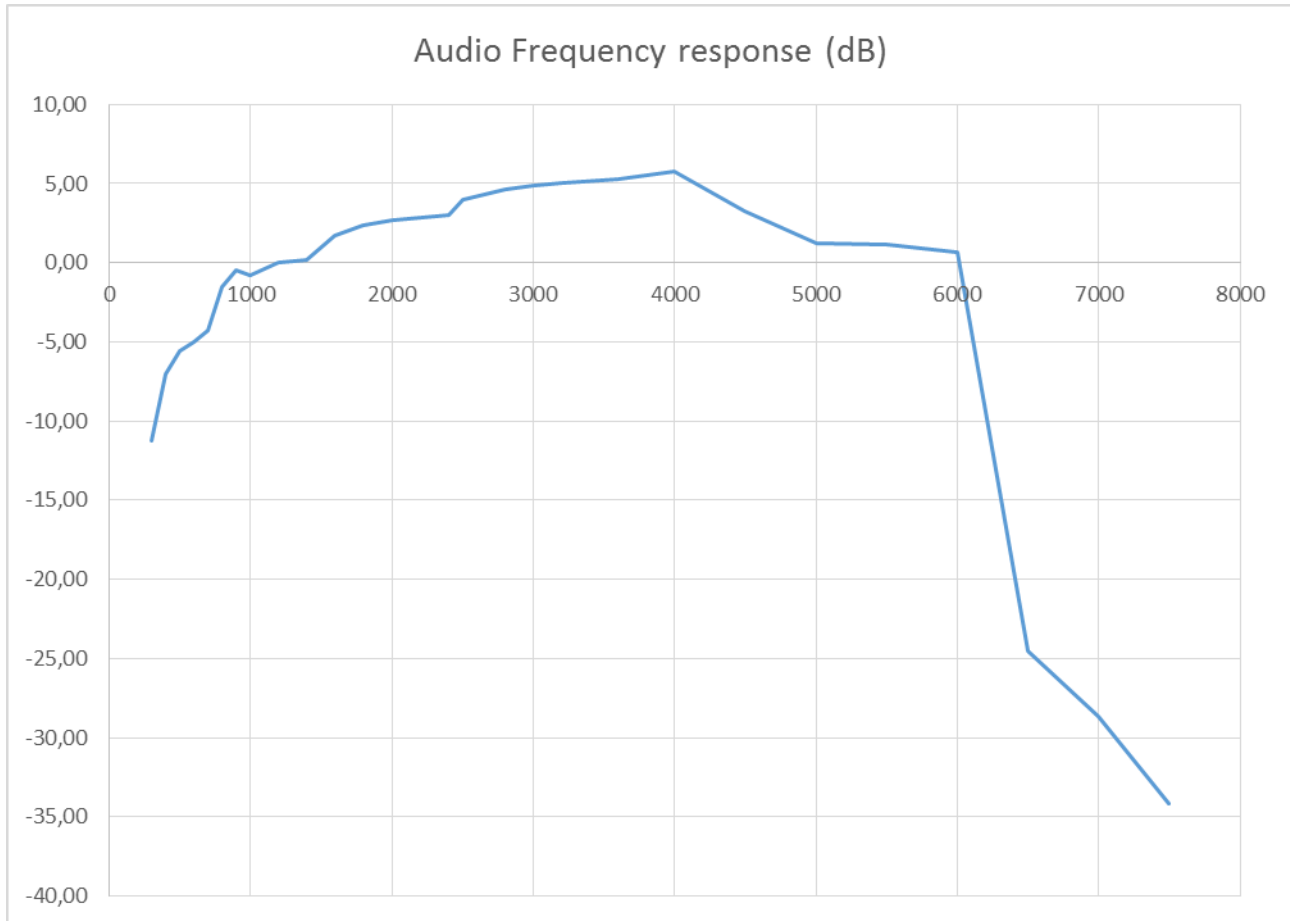
(4). Audio Frequency Response = $20\log_{10}$ (Deviation of test frequency/Deviation of 1 KHz reference).

TEST RESULTS

Mod.Level	Peak frequency deviation @300Hz	Peak frequency deviation @1000Hz	Peak frequency deviation @1500Hz	Peak frequency deviation @3000Hz
-20,00	0,25	0,75	0,88	0,88
-15,00	0,35	0,84	0,93	0,95
-10,00	0,44	1,21	1,24	1,37
-5,00	0,67	1,43	1,45	1,49
0,00	0,71	1,49	1,56	1,58
5,00	0,83	1,68	1,75	1,82
10,00	0,90	1,7	1,72	1,78
15,00	0,88	1,65	1,74	1,76
20,00	0,82	1,62	1,71	1,65



Frequency (Hz)	Deviation (KHz)	Audio Frequency response (dB)
100	----	----
200	----	----
300	0,14	-11,22883300
400	0,21	-7,07065400
500	0,27	-5,57498500
600	0,29	-4,97632000
700	0,32	-4,25798400
800	0,43	-1,48203440
900	0,47	-0,45875610
1000	0,51	-0,75698740
1200	0,52	0,00000000
1400	0,62	0,16874596
1600	0,67	1,69875640
1800	0,69	2,38798745
2000	0,74	2,65874960
2400	0,77	3,05478964
2500	0,8	3,98795885
2800	0,85	4,59778931
3000	0,88	4,87987541
3200	0,91	5,02547892
3600	0,94	5,32141258
4000	0,99	5,76543985
4500	0,77	3,25698746
5000	0,64	1,23659898
5500	0,6	1,11259876
6000	0,55	0,65598796
6500	0,03	-24,56897725
7000	0,02	-28,69789369
7500	0,01	-34,13699795
9000		
10000		
14000		
18000		
20000		
30000		



**TEST
7.**

MAXIMUM TRANSMITTER POWER (CONDUCTED OUTPUT POWER)

REFERENCE DOCUMENT FCC cfr 47 §90.205 IC RSS-119 issue 11 §5.4.1

- **TEST SETUP:** In according to CFR 47 section 2.1046 and 90.205
- **TEST LOCATION:** Radio test area
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#2

RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

The RF output was connected to a spectrum analyzer through an appropriate attenuator. The transmitter shall be modulated by a 2.5 KHz audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 KHz (12.5 KHz channel spacing). Measure and record the transmitter output power, using a measurement (resolution) bandwidth at least two to three times the occupied bandwidth for transmitters equipped to capture the true peak emission of the equipment under test.

TEST RESULTS (Conducted)

Voltage: 13,5Vdc

Frequency (MHz)	Power (W)	Declared (W)	Limit (W)
150MHz	23.99	25	30
162MHz	23.01	25	30
174MHz	21.62	25	30

Voltage: 10,8Vdc

Frequency (MHz)	Power (W)	Declared (W)	Limit (W)
150MHz	21.88	25	30
162MHz	18.07	25	30
174MHz	15.52	25	30

Voltage: 15Vdc

Frequency (MHz)	Power (W)	Declared (W)	Limit (W)
150MHz	23.93	25	30
162MHz	23.17	25	30
174MHz	21.72	25	30

Note: based on worst case measurements the max permitted assembly gain is 0.77dB

**TEST
8.**

TRANSMITTER FREQUENCY BEHAVIOR

REFERENCE DOCUMENT FCC cfr 47 §90.214 IC RSS-119 issue 11 §5.9

- **TEST SETUP:** In according to CFR 47 section 90.214
- **TEST LOCATION:** Radio test area
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#2

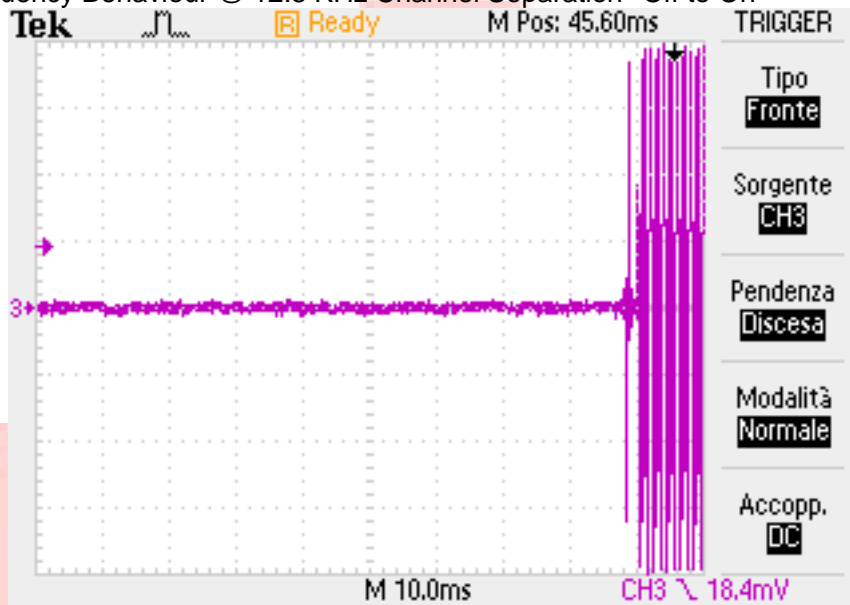
RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

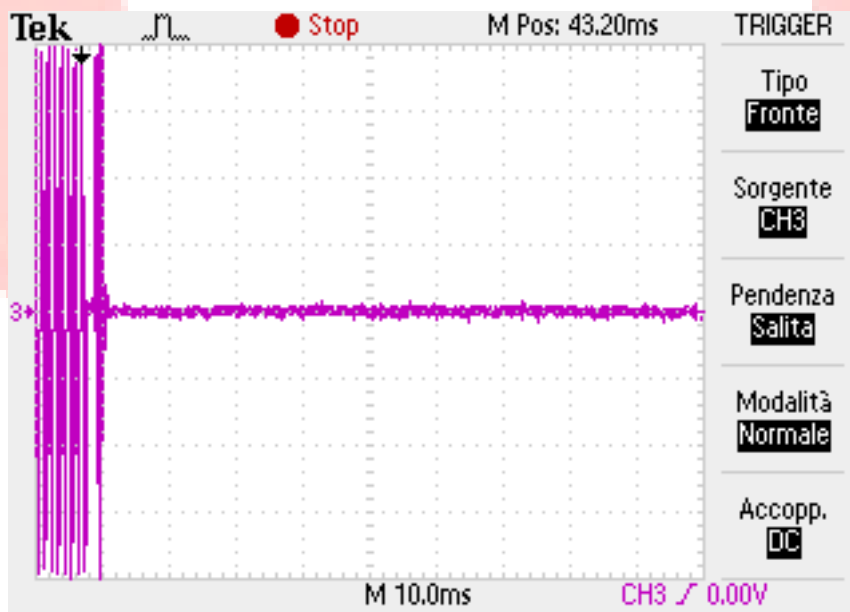
In acc. To TIA/EIA-603 2.2.19

TEST RESULTS

Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation--Off to On



Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation--On to Off



Limits:

Time intervals ^{1, 2}	Maximum frequency difference ³	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1^4	± 25.0 kHz	5.0 ms	10.0 ms
t_2	± 12.5 kHz	20.0 ms	25.0 ms
t_3^4	± 25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1^4	± 12.5 kHz	5.0 ms	10.0 ms
t_2	± 6.25 kHz	20.0 ms	25.0 ms
t_3^4	± 12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1^4	± 6.25 kHz	5.0 ms	10.0 ms
t_2	± 3.125 kHz	20.0 ms	25.0 ms
t_3^4	± 6.25 kHz	5.0 ms	10.0 ms

¹ t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on} .

t_2 is the time period immediately following t_1 .

t_3 is the time period from the instant when the transmitter is turned off until t_{off} .

t_{off} is the instant when the 1 kHz test signal starts to rise.

² During the time from the end of t_2 to the beginning of t_3 , the frequency difference must not exceed the limits specified in §90.213.

³ Difference between the actual transmitter frequency and the assigned transmitter frequency.

⁴ If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

**TEST
9.**

RADIATED EMISSION ON RECEIVING MODE

REFERENCE DOCUMENT FCC cfr 47 §90.214 IC RSS-119 issue 11 §5.11

- **TEST SETUP:** In according to CFR 47 section 90.214
- **TEST LOCATION:** Radio test area
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 ± 3 °C
Ambient humidity :	25 - 75 %rH	40 ± 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :		13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#2

RESULT: WITHIN THE LIMITS

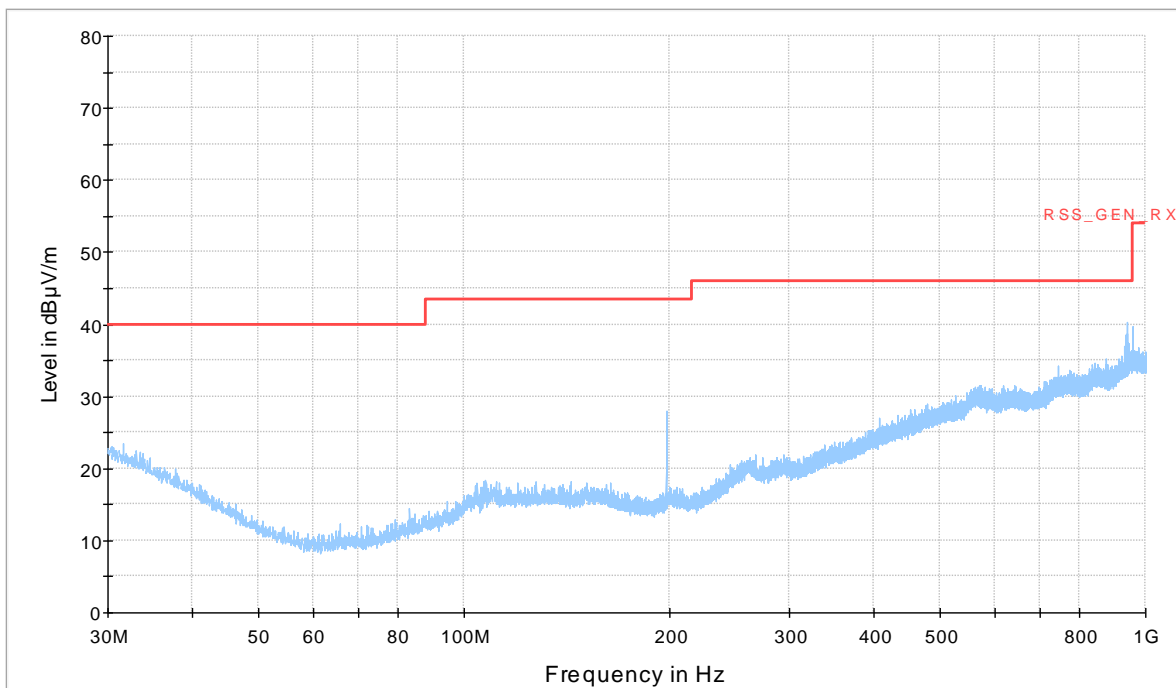
MEASUREMENT PROCEDURE

In acc. To ANSI C 63.4: 2003

TEST RESULTS

Vertical polarization

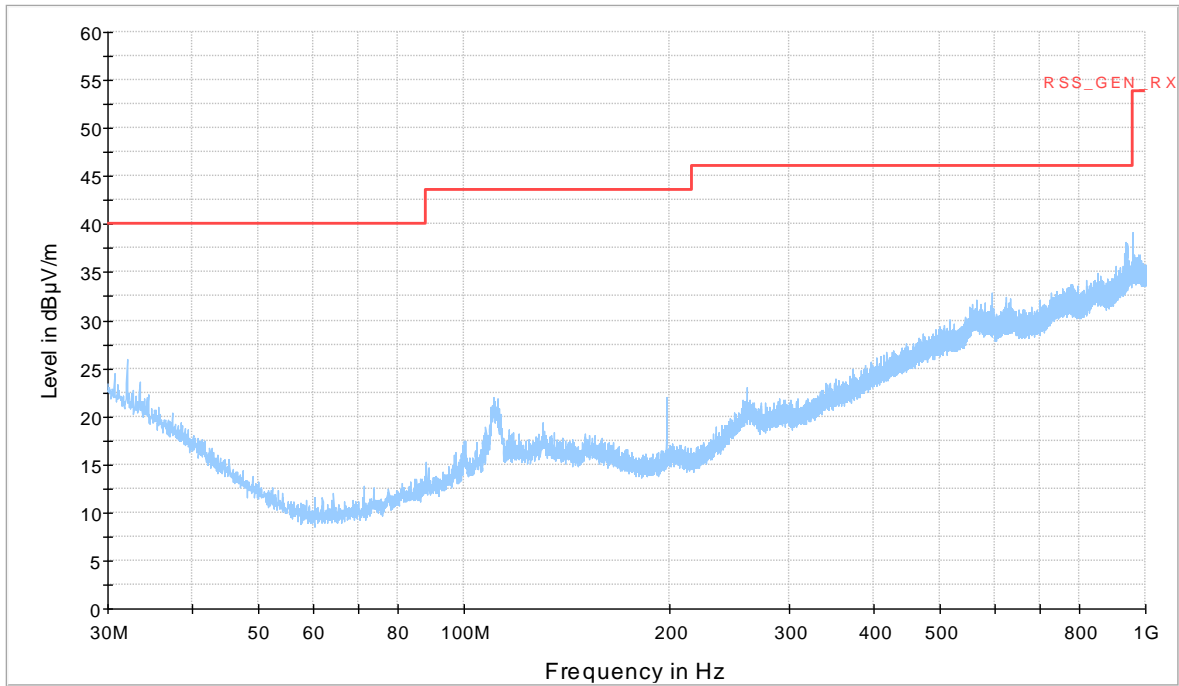
FCC_15_109_RADIATED_EMISSIONS_VERTICAL



No spurious are detected over 1GHz

Horizontal polarization

FCC_15_109_RADIATED_EMISSIONS_HORIZONTAL



No spurious are detected over 1GHz

**TEST
10.**

AUDIO LOW PASS FILTER RESPONSE

REFERENCE DOCUMENT FCC cfr 47 §90.214 IC RSS-119 issue 11 §5.9

- **TEST SETUP:** In according to CFR 47 section 90.214
- **TEST LOCATION:** Radio test area
- **TEST EQUIPMENT USED FOR TEST:** EMC.332; EMC.397; PRS Test fixture

- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 ± 3 °C
Ambient humidity :	25 - 75 %rH	40 ± 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :		13.8Vdc

OPERATING CONDITION (Rif. Section. 3) :#2

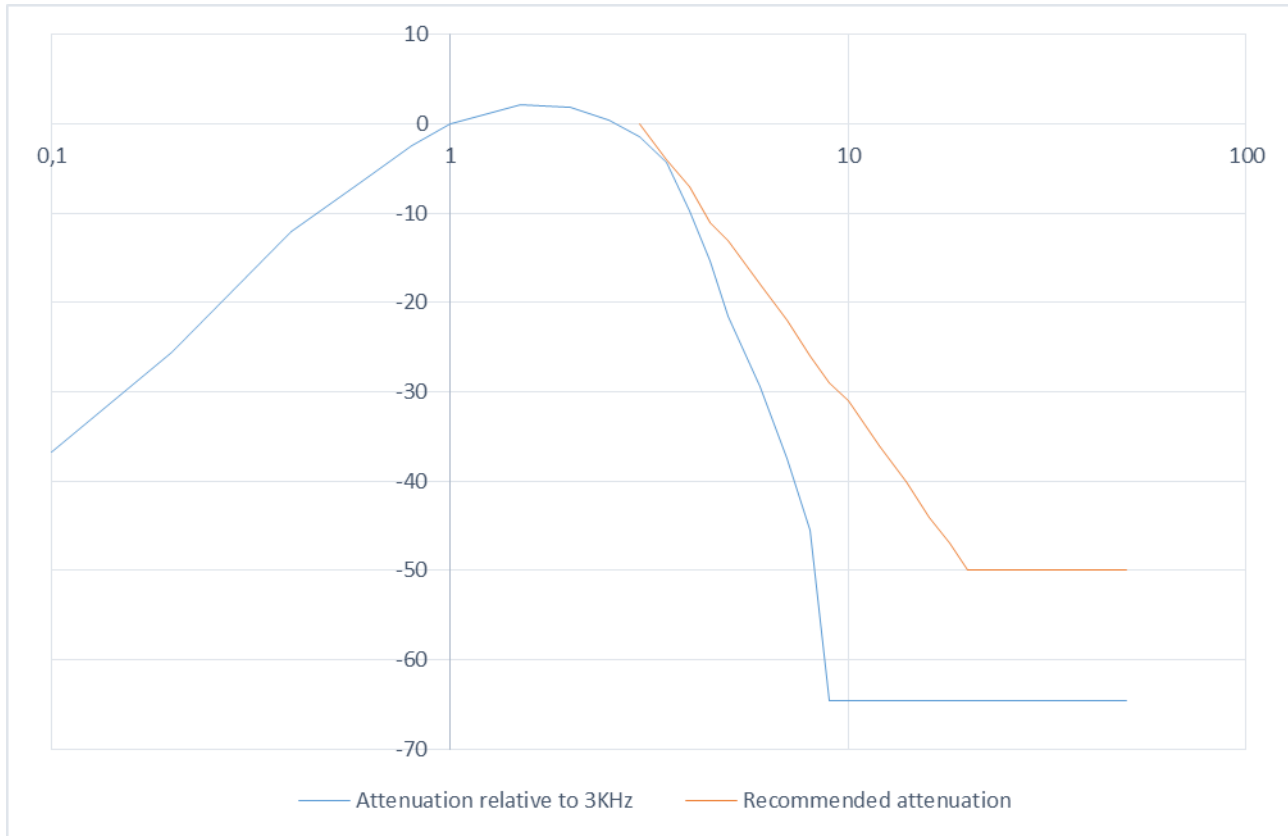
RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

The rated audio input signal was applied to the input of the audio low-pass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT Digital Spectrum Analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 KHz.

TEST RESULTS

Frequency (KHz)	Attenuation relative to 3KHz	Recommended attenuation
0,1	-36,7	---
0,2	-25,5	---
0,4	-12	---
0,6	-6,4	---
0,8	-2,4	---
1	0	---
1,5	2,1	---
2	1,9	---
2,5	0,5	---
3	-1,4	0
3,5	-4,3	-4
4	-9,7	-7
4,5	-15,3	-11
5	-21,5	-13
6	-29,4	-18
7	-37,5	-22
8	-45,5	-26
9	-64,6	-29
10	-64,6	-31
12	-64,6	-36
14	-64,6	-40
16	-64,6	-44
18	-64,6	-47
20	-64,6	-50
25	-64,6	-50
30	-64,6	-50
35	-64,6	-50
40	-64,6	-50
45	-64,6	-50
50	-64,6	-50



LIMITS:

2.1047(a): Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

90.242(b)(8): Recommended audio filter attenuation characteristics are given below:

Audio band	Minimum Attenuation Rel. to 1 KHz Attenuation
3 – 20 KHz	$60 \log_{10}(f/3)$ dB where f is in KHz
20 – 30 KHz	50dB

**TEST
11.**

CONDUCTED ANTENNA PORT EMISSION

REFERENCE DOCUMENT FCC cfr 47 part 2 sec. 1051

- **TEST SETUP:** In according to FCC part 2 sec. 1051
- **TEST LOCATION:** Test site
- **TEST EQUIPMENT USED FOR TEST:** EMC.359; EMC.191; EMC.123; EMC.391

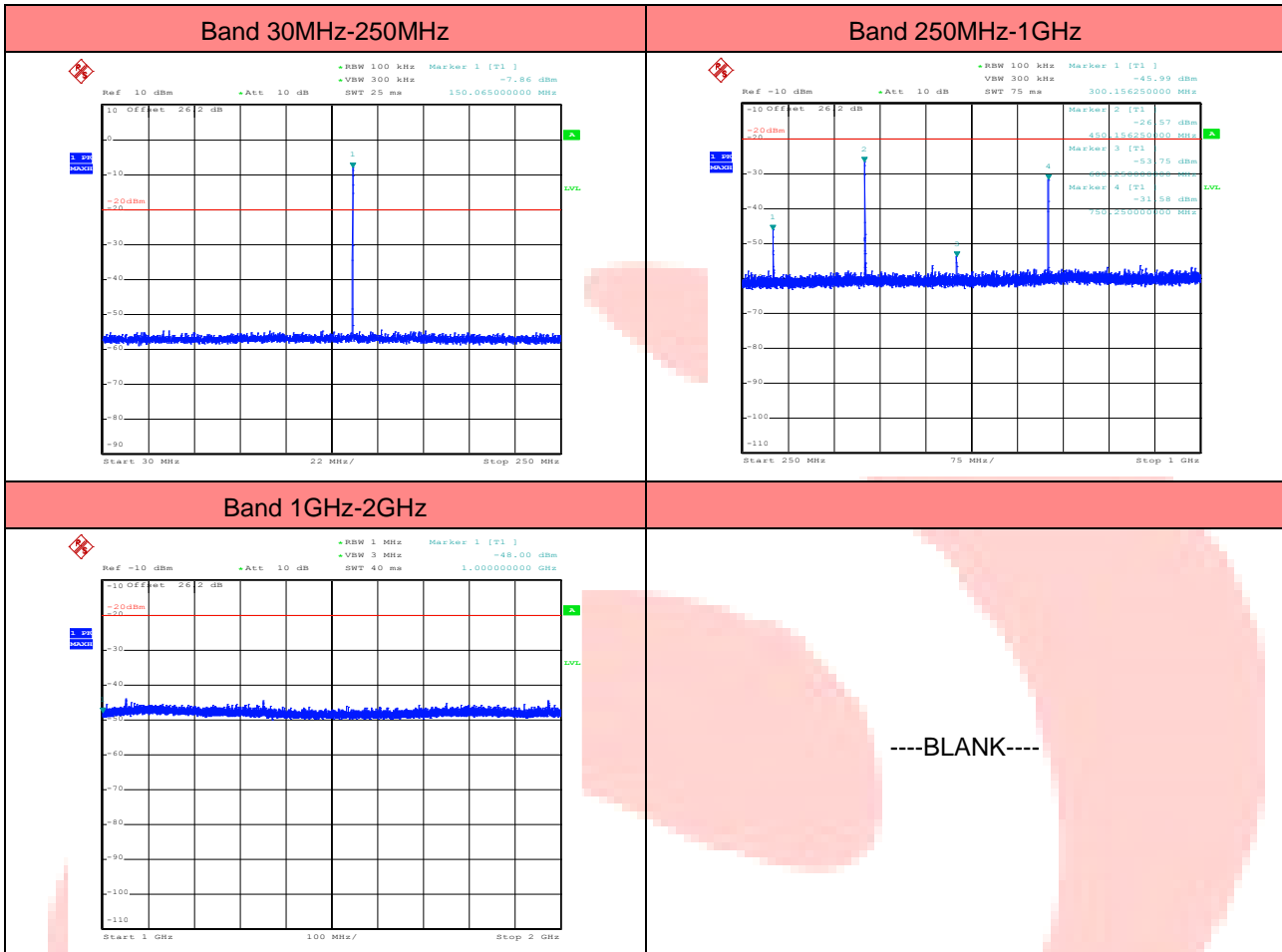
- **UNCERTAINTY OF MEASURE:**
 - Level of confidence = 95%
 - Degree of freedom = 10
 - Coverage factor $k_p = 2,28$
 - Combined uncertainty = 4,49 dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	13.8Vdc

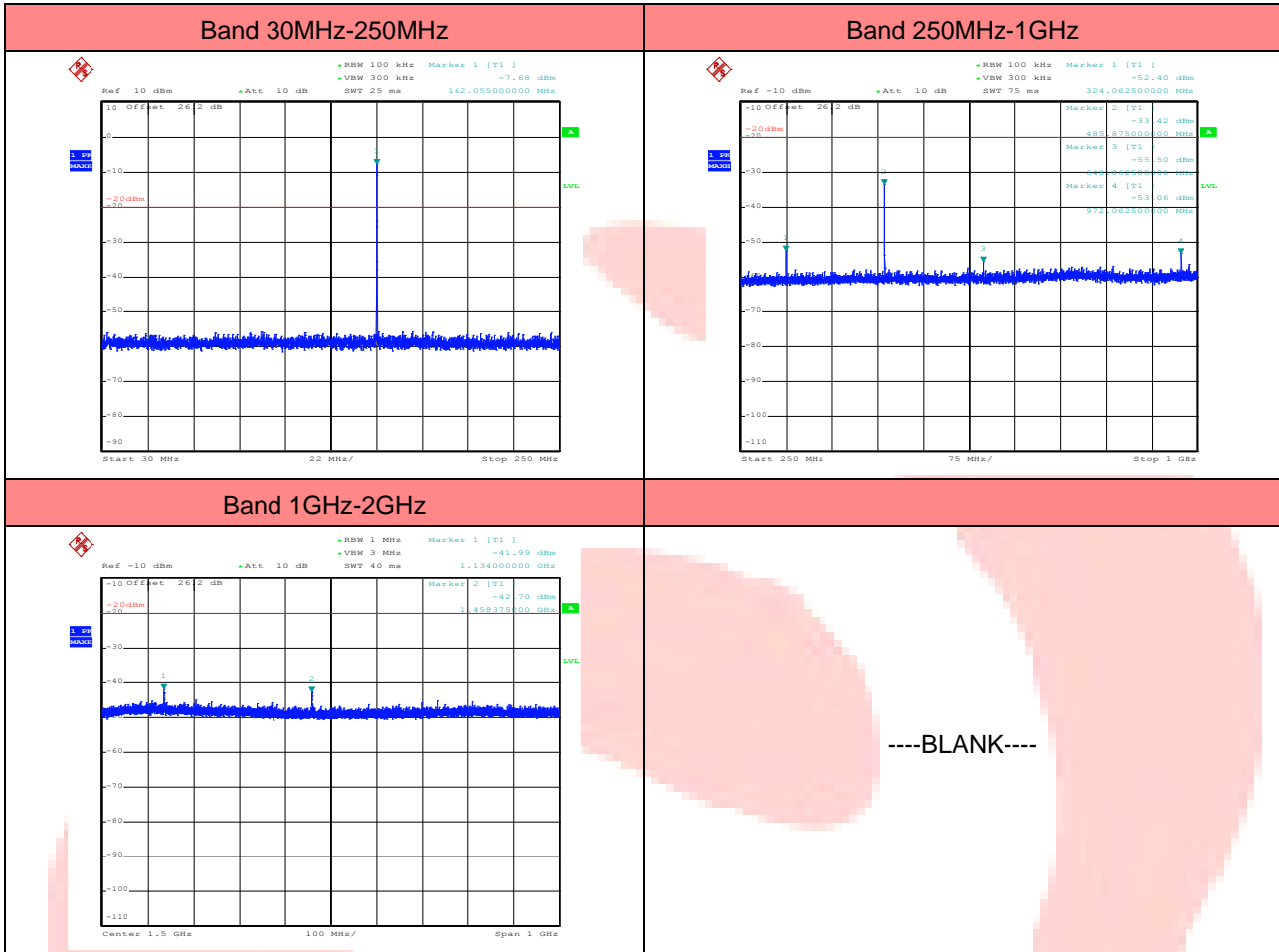
OPERATING CONDITION (Rif. Section. 3) :#1 #2 #3

RESULT: WITHIN THE LIMITS

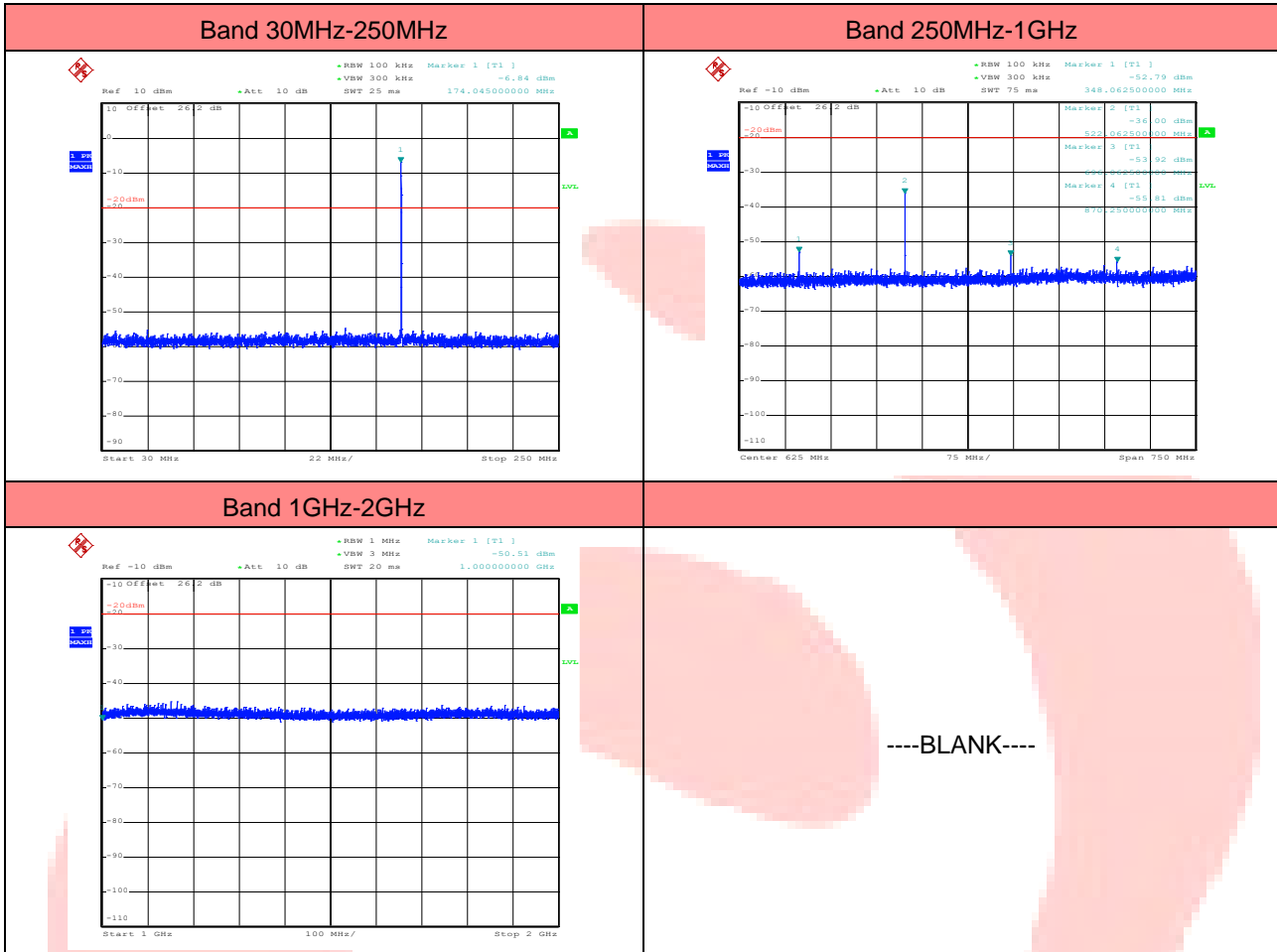
Frequency channel: 150.05MHz – Power: 25W –Limit: -20dBm



Frequency channel: 162MHz – Power: 25W –Limit: -20dBm



Frequency channel: 174MHz – Power: 25W –Limit: -20dBm



6 LIST OF EQUIPMENT USED

EQUIPMENT	IDENTIFICATION NUMBER	CAL. DUE	CERTIFICATE NUMBER
EMI TEST RECEIVER 20HZ 40GHZ	EMC.359	AUG.2015	INRIM 11-0490-05
ARTIFICIAL MAINS NETWORK	EMC.173	AUG-2015	INRIM 11-0490-04
RF SEMI-ANECHOIC CHAMBER (CSSA)	EMC.191	AUG 2015	PRS NSA-2010
BILOG ANTENNA	EMC.023	MAY 2015	SAIBERSDORF EH- A315/11
LOG PERIODICA ANTENNA	EMC.391	DEC 2015	RHODE & S.
VOLTAGE GENERATOR	EMC.397	FEB.2015	SPS A4909D
SPECTRUM ANALYZER	EMC.332	APR.2015	PRS EMC332_2011