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RICERCA & SVILUPPO

RAPPORTO DI PROVA / TEST REPORT

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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 12	
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Marchio commerciale / Trade mark :		
Fabbricante / Manufacturer :	RADIO ACTIVITY S.R.L.	
Prodotto / Product :	Base station / Repeater	
Modello / Model :	KA-450	
Data ricevimento campioni / Date of test sample receipt:	18/03/2015	
Campioni verificati / No. of tested samples	1	
Data verifiche / Testing date :	22/07/2015 – 28/07/2015	
Sito di prova / Testing site :	Prima Ricerca & Sviluppo Via Campagna - 92 I-22020 FALOPPIO (CO) IC Site number: 5347A	
Esito delle valutazioni / Assessment results :	CONFORME / COMPLIANT	
Verifiche effettuate da / Verifications carried out by :	Andrea Bortolotti Tecnico Laboratorio EMC e RADIO/ EMC and RADIO Laboratory technician	
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_141214-0	Original release	28/07/2015
FCCTR_141214-1	Editorial Change	03/09/2015
FCCTR_141214-2	Editorial Change	09/09/2015

1 TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

1.1 EUT Identification

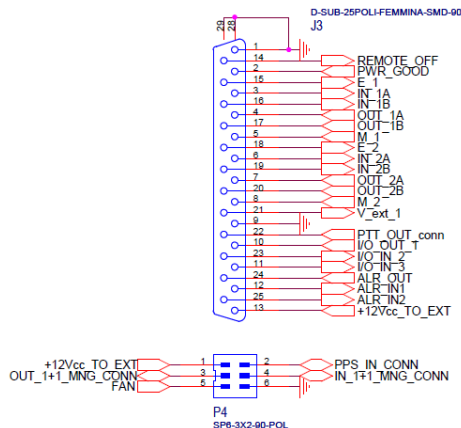
Description	Base station / Repeater
Model name or No.	KA-450
Part number / Serial No.	Not present (prototype)
Brand name	 Radio Activity
Manufacturer	RADIO ACTIVITY S.R.L.
Single Unit or System	Single unit
Country of manufacturer	Italy

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 for fixed installation or mobile station		
Type:	Private Land Mobile Radio Services		
Frequency range of Operation	406.1÷430MHz & 450÷470MHz		
Output Power	1-25 W / 100% duty cycle / selectable per channel		
Channelization	12,5KHz		
Modulation	FM / 4FSK		
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 12	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
ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

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

FCC	CANADA	Description	Operative conditions	Results
Transmitter modulation, output power and other characteristics				
§ 2.1033 (c) (5) § 90.35	RSS-119	Frequency range(s)	406.1÷430MHz & 450÷470MHz	Compliant
§ 2.1033 (c) (6) § 2.1033 (c) (7) § 2.1046 § 90.205	RSS-119	RF power outputs at the antenna terminals	#1 #2 #3	Compliant
§ 2.1033 (c) (4) § 2.1047 § 90.210	RSS-119	Emission mask D	#1 #2 #3	Compliant
§ 90.221	---	Adjacent channel power	Applicable only to transmitter designed to operate with a 25KHz channel bandwidth.	
§ 2.1049 § 90.209	RSS-GEN 6.6 RSS-119	Occupied bandwidth	#1 #2 #3	Compliant
§ 90.214	RSS-119	Transient frequency Behavior	#1 #2 #3	Compliant
Transmitter spurious emission				
§ 2.1051 § 2.1057	RSS-119	At the antenna terminals	#1 #2 #3	Compliant
§ 2.1053 § 2.1057	RSS-119	Field strenght	#1 #2 #3	Compliant
Receiver spurious emission				
§ 15.109	RSS-GEN 7.1.3	At the antenna terminals	#4	Compliant
§ 15.109	RSS-GEN 7.1.2 Table 2	Field strenght	#4	Compliant
Other details				
§ 2.1055 § 90.213	RSS-119	Frequency stability	#1 #2 #3	Compliant

5 TEST RESULTS

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**TEST
1.**

RF POWER OUTPUT AT THE ANTENNA TERMINALS

- **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)

MODULATION: FM

Voltage: 13,5Vdc

Frequency (MHz)	Power (W)	Power (dBm)	Declared (W)	Declared Power (dBm)	Limit (W)		RESULT
					Fixed	Mobile	
406.1	23.90	43.78	25	44	125	30	PASS
418.0	22.38	43.50	25	44	125	30	PASS
430.0	22.24	43.47	25	44	125	30	PASS
450.0	22.79	43.58	25	44	125	30	PASS
460.0	22.45	43.51	25	44	125	30	PASS
470.0	22.68	43.56	25	44	125	30	PASS

Voltage: 10,8Vdc

Frequency (MHz)	Power (W)	Power (dBm)	Declared (W)	Declared Power (dBm)	Limit (W)		RESULT
					Fixed	Mobile	
406.1	22.54	43.53	25	44	125	30	PASS
418.0	21.87	43.40	25	44	125	30	PASS
430.0	22.12	43.45	25	44	125	30	PASS
450.0	21.45	43.31	25	44	125	30	PASS
460.0	21.76	43.38	25	44	125	30	PASS
470.0	21.43	43.31	25	44	125	30	PASS

Voltage: 15Vdc

Frequency (MHz)	Power (W)	Power (dBm)	Declared (W)	Declared Power (dBm)	Limit (W)		RESULT
					Fixed	Mobile	
406.1	24.12	43.82	25	44	125	30	PASS
418.0	24.56	43.90	25	44	125	30	PASS
430.0	24.75	43.94	25	44	125	30	PASS
450.0	23.98	43.80	25	44	125	30	PASS
460.0	24.62	43.91	25	44	125	30	PASS
470.0	24.11	43.82	25	44	125	30	PASS

MODULATION: 4FSK

Voltage: 13,5Vdc

Frequency (MHz)	Power (W)	Power (dBm)	Declared (W)	Declared Power (dBm)	Limit (W)		RESULT
					Fixed	Mobile	
406.1	24.04	43.81	25	44	125	30	PASS
418.0	22.47	43.52	25	44	125	30	PASS
430.0	22.50	43.52	25	44	125	30	PASS
450.0	22.36	43.49	25	44	125	30	PASS
460.0	22.24	43.47	25	44	125	30	PASS
470.0	23.92	43.79	25	44	125	30	PASS

Voltage: 10,8Vdc

Frequency (MHz)	Power (W)	Power (dBm)	Declared (W)	Declared Power (dBm)	Limit (W)		RESULT
					Fixed	Mobile	
406.1	23.18	43.65	25	44	125	30	PASS
418.0	21.45	43.31	25	44	125	30	PASS
430.0	22.11	43.45	25	44	125	30	PASS
450.0	21.95	43.41	25	44	125	30	PASS
460.0	21.32	43.29	25	44	125	30	PASS
470.0	21.74	43.37	25	44	125	30	PASS

Voltage: 15Vdc

Frequency (MHz)	Power (W)	Power (dBm)	Declared (W)	Declared Power (dBm)	Limit (W)		RESULT
					Fixed	Mobile	
406.1	25.02	43,98	25	44	125	30	PASS
418.0	24.51	43,89	25	44	125	30	PASS
430.0	23.95	43,79	25	44	125	30	PASS
450.0	24.74	43,93	25	44	125	30	PASS
460.0	23.54	43,72	25	44	125	30	PASS
470.0	22.98	43,61	25	44	125	30	PASS

Note1: As required by RSS-119 issue 12 sec. 5.4: The most extreme measurements of the Output power is 21.32W = 43.3dBm which is within ± 1 dB of the rated output power (25W = 44 dBm)

Note2: max permitted assembly gain: 2.94dBi for mobile station; 9.14dBi for fixed installation

**TEST
2.**

EMISSION MASK

- **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

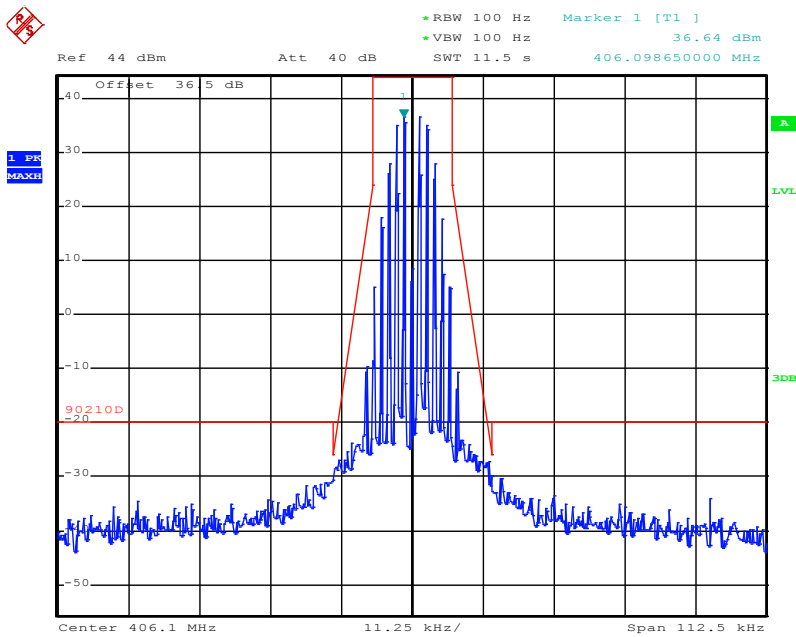
MEASUREMENT PROCEDURE

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).

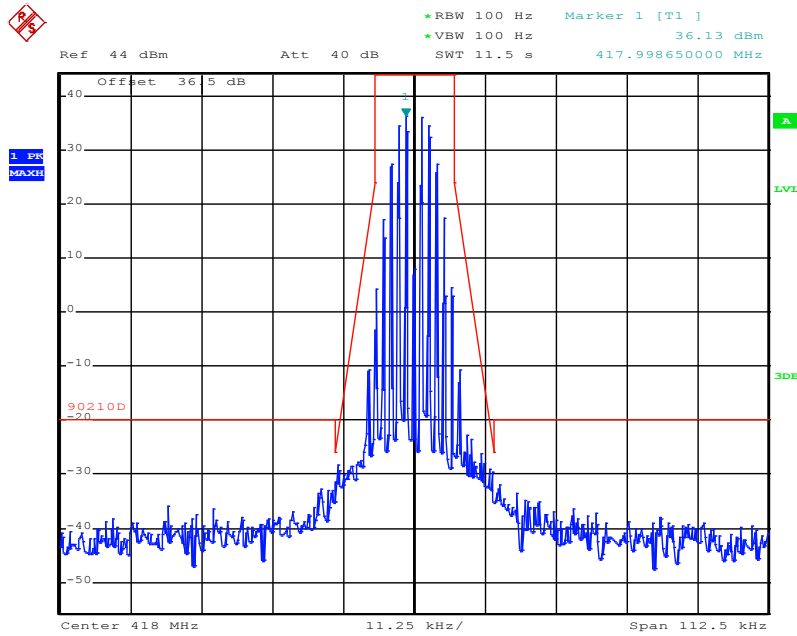
TEST RESULTS

Modulation: FM
Frequency channel: 406.1MHz



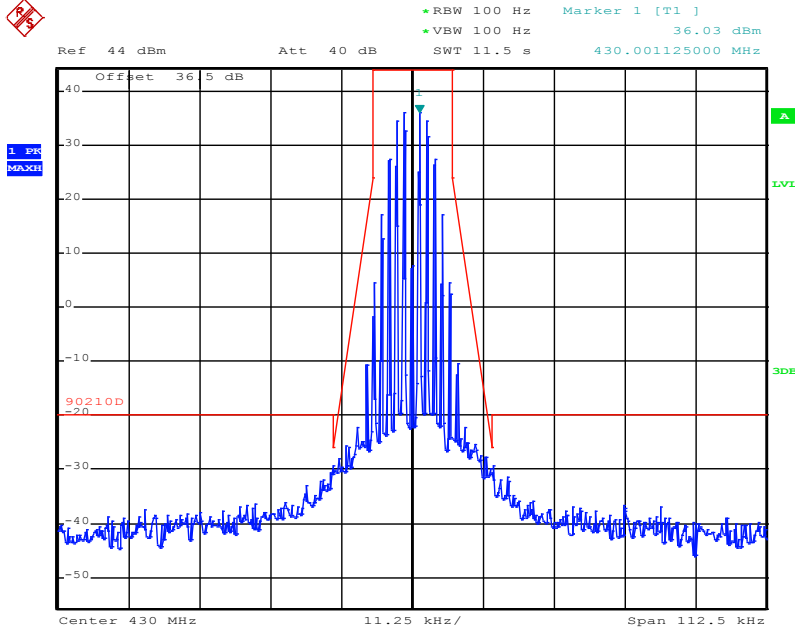
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Modulation: FM
Frequency channel: 418MHz



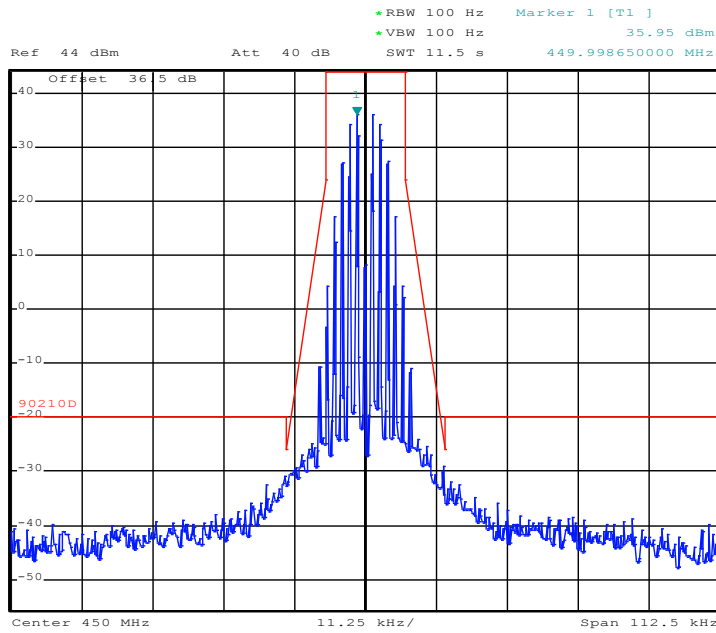
Date: 4.SEP.2015 17:09:14

Modulation: FM
Frequency channel: 430MHz



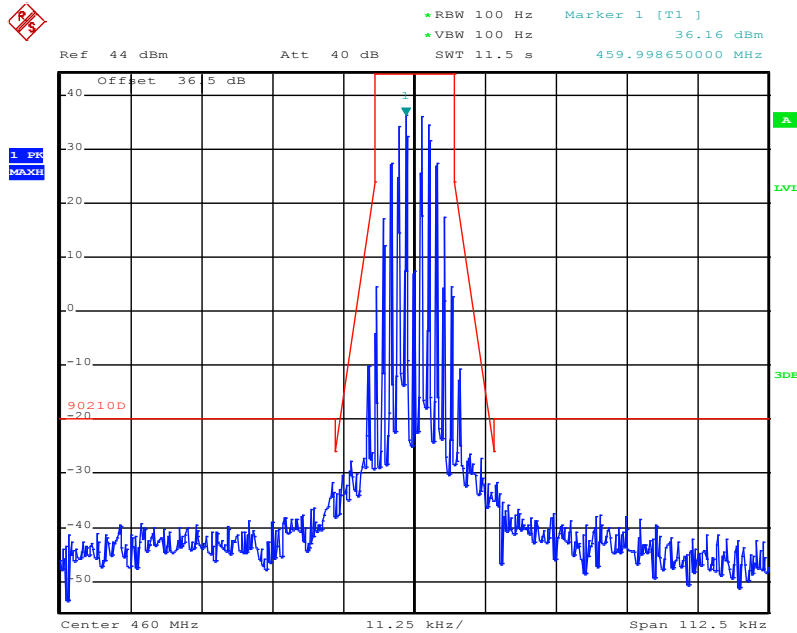
Date: 4.SEP.2015 17:12:11

Modulation: FM
Frequency channel: 450MHz



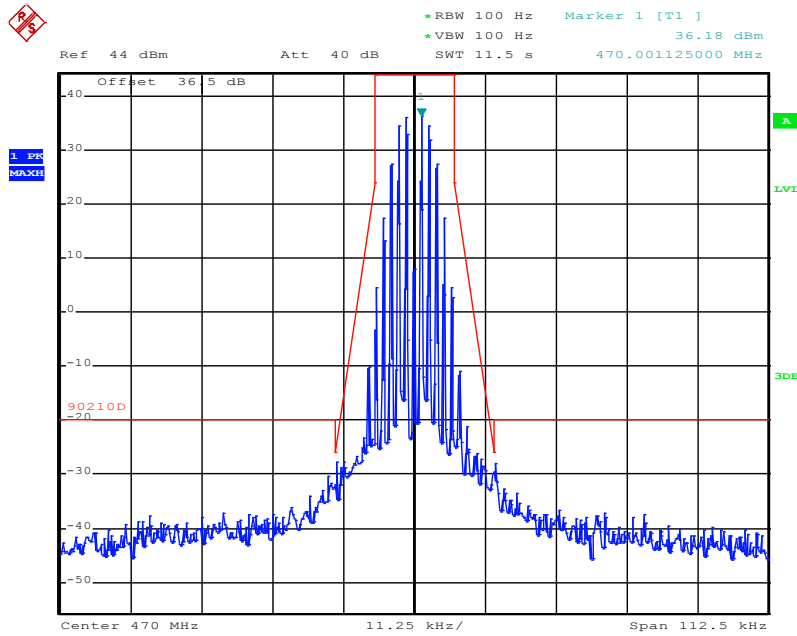
Date: 4.SEP.2015 17:17:22

Modulation: FM
Frequency channel: 460MHz



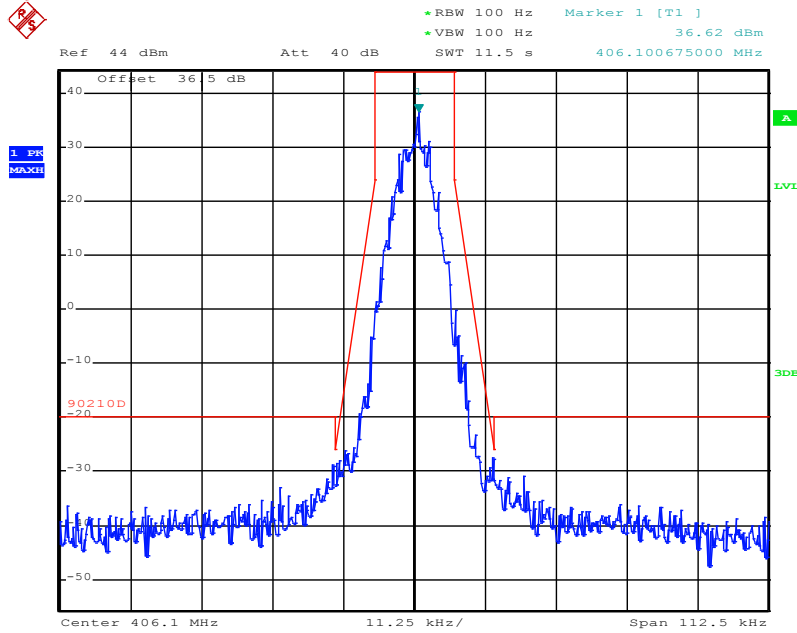
Date: 4.SEP.2015 17:18:46

Modulation: FM
Frequency channel: 470MHz



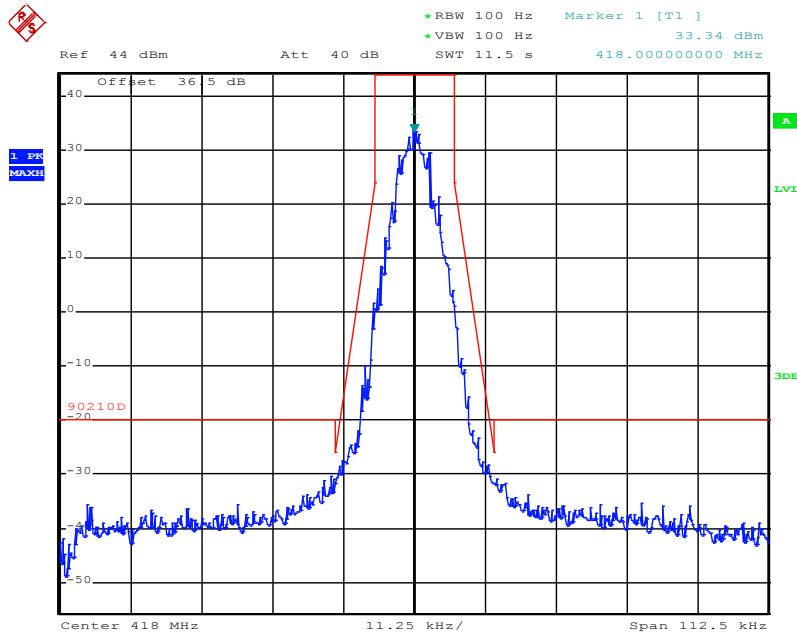
Date: 4.SEP.2015 17:24:44

Modulation: 4FSK
Frequency channel: 406.1MHz



Date: 4.SEP.2015 17:04:31

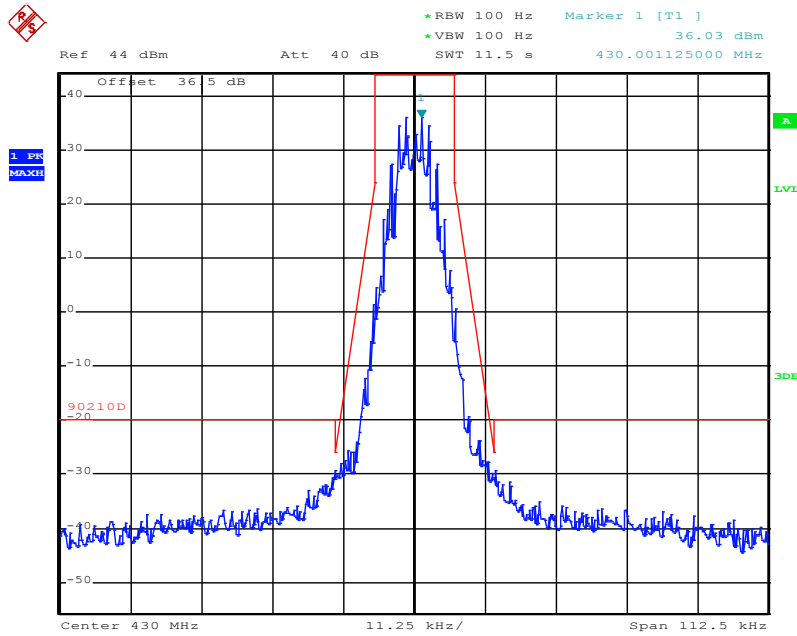
Modulation: 4FSK
Frequency channel: 418MHz



Date: 4.SEP.2015 17:08:09

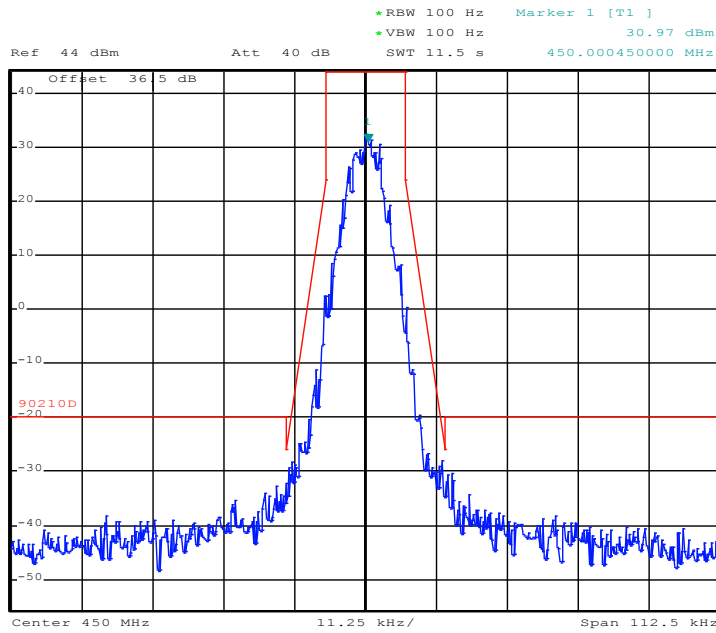
Modulation: 4FSK

Frequency channel: 430MHz



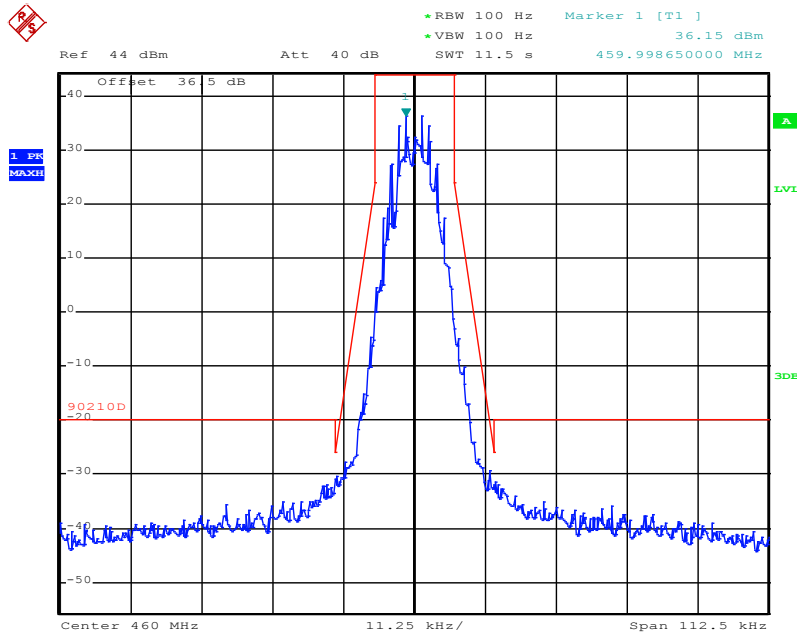
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Modulation: 4FSK
Frequency channel: 450MHz



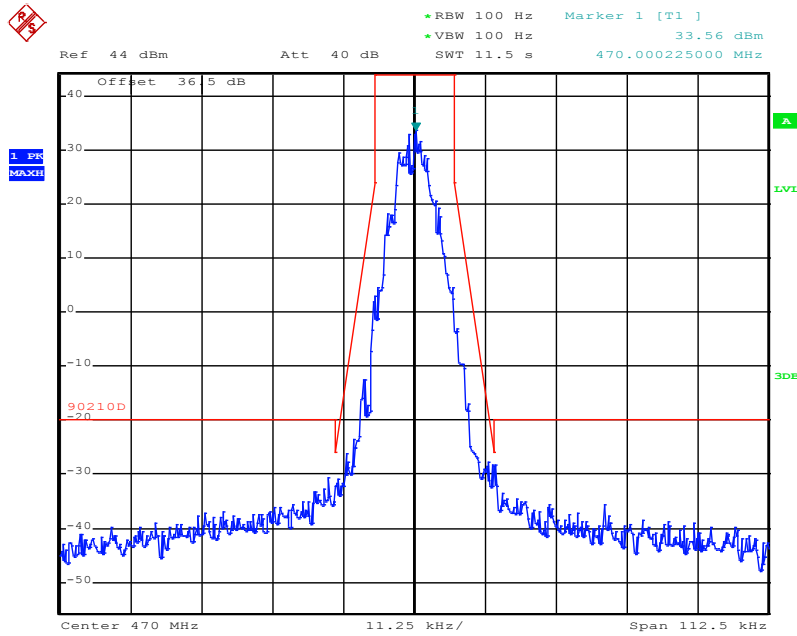
Date: 4.SEP.2015 17:16:19

Modulation: 4FSK
Frequency channel: 460MHz



Date: 4.SEP.2015 17:21:16

Modulation: 4FSK
Frequency channel: 470MHz



Date: 4.SEP.2015 17:23:20

**TEST
3.**

OCCUPIED BANDWIDTH

- **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

MODULATION: FM

26 dB Bandwidth Measurement

Operating Frequency (MHz)	12.5 KHz Channel Separation		
	26 dB Bandwidth (kHz)	Limits (kHz)	Result
406.1	10.25	11.25	Compliant
418.0	9.48	11.25	Compliant
430.0	10.43	11.25	Compliant
450.0	9.81	11.25	Compliant
460.0	9.25	11.25	Compliant
470.0	9.67	11.25	Compliant

MODULATION: 4FSK

26 dB Bandwidth Measurement			
Operating Frequency (MHz)	12.5 KHz Channel Separation		
	26 dB Bandwidth (kHz)	Limits (kHz)	Result
406.1	10.74	11.25	Compliant
418.0	9.58	11.25	Compliant
430.0	9.81	11.25	Compliant
450.0	9.67	11.25	Compliant
460.0	9.49	11.25	Compliant
470.0	9.54	11.25	Compliant

**TEST
4.**

TRANSMITTER FREQUENCY BEHAVIOR

- **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

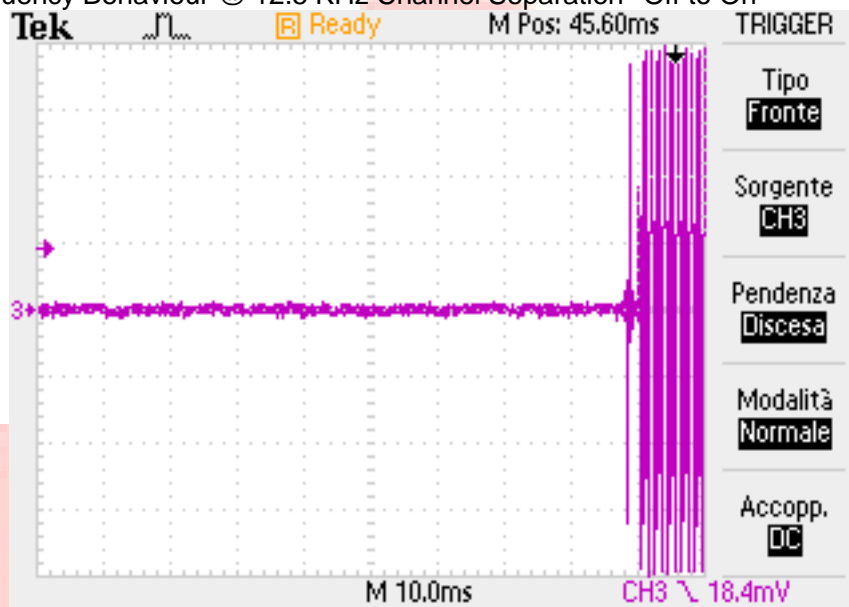
RESULT: WITHIN THE LIMITS

MEASUREMENT PROCEDURE

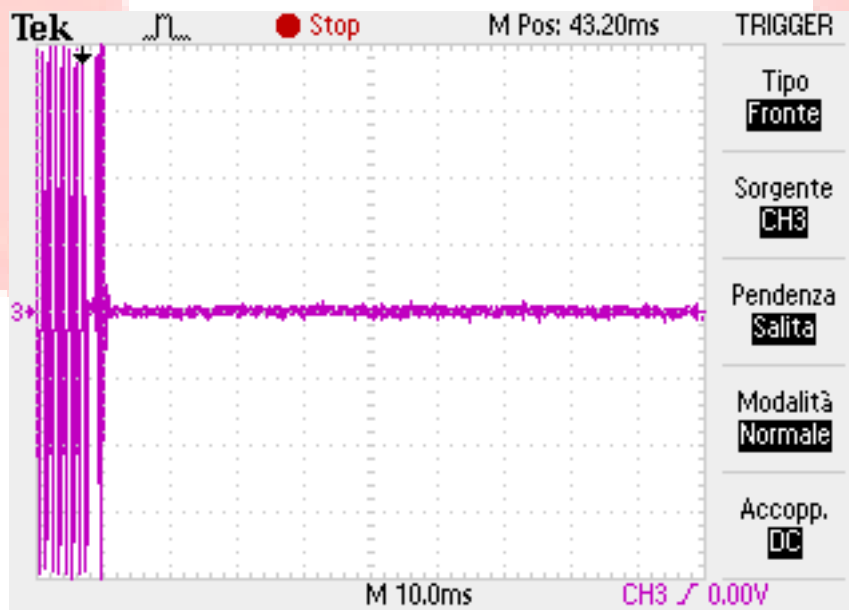
In acc. To TIA/EIA-603 2.2.19

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
5.**

RADIATED EMISSIONS

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

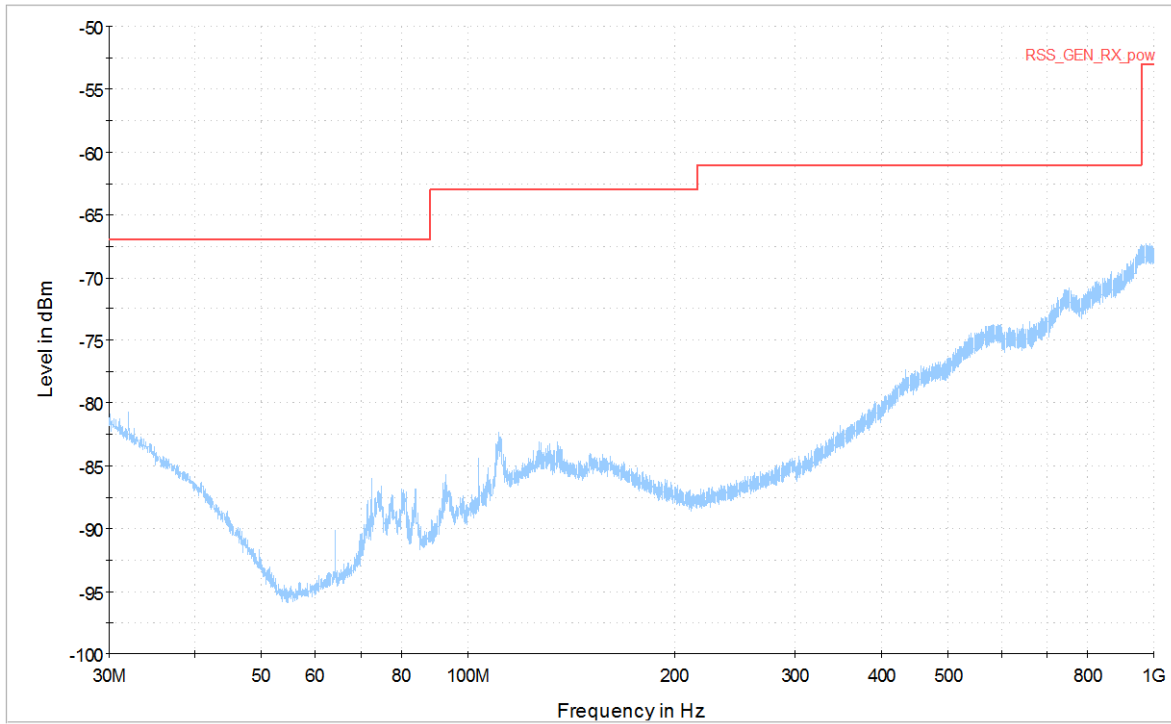
- TESTED PORT: Enclosure
- FREQUENCY RANGE: 30 - 1000 MHz
- MEASUREMENT DISTANCE : 3mt
- EMISSION LIMITS: Acc. to Section 15.109 of reference document
- UNCERTAINTY OF MEASURE: Level of confidence = 95%
Degree of freedom = 10
Coverage factor $k_p = 2,28$
Combined uncertainty = 4,49 dB

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

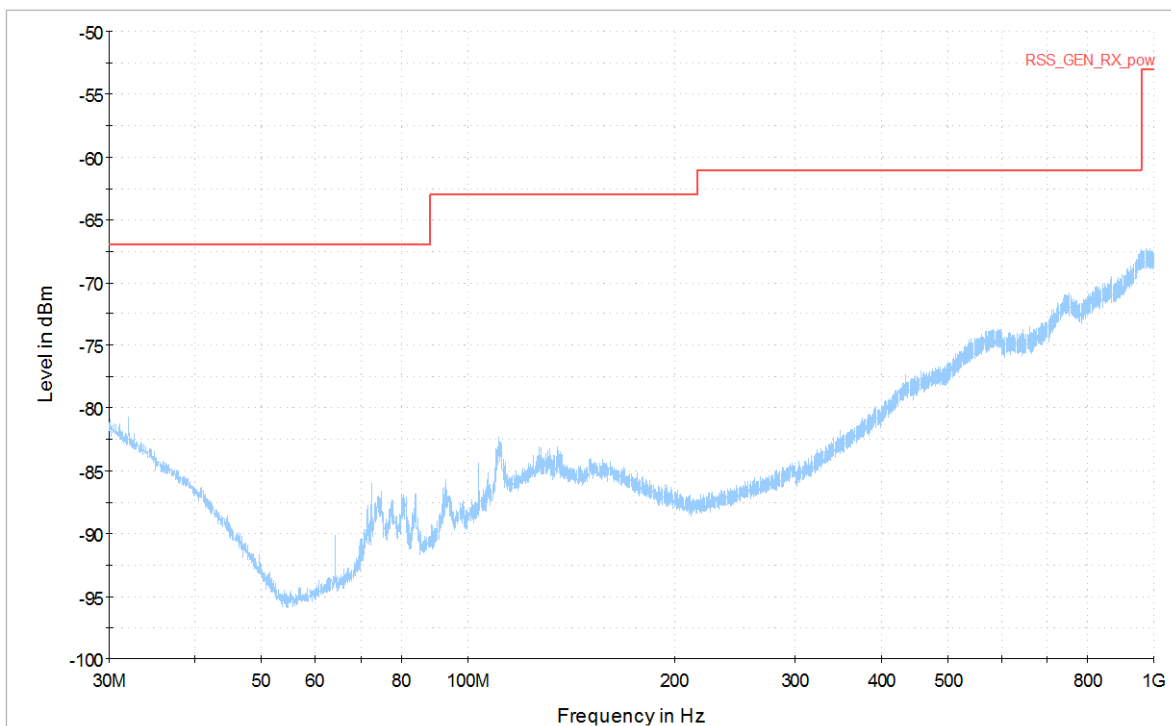
OPERATING CONDITION (Rif. Section.3) : #4

RESULT: **WITHIN THE LIMIT**

Vertical polarization



Horizontal polarization



**TEST
6.**

FREQUENCY STABILITY

- **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 band 1 Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	406,099950425	-49,6	-0,122
-20	406,099945687	-54,3	-0,134
-10	406,099945875	-54,1	-0,133
0	406,099912475	-87,5	-0,216
10	406,099989540	-10,5	-0,026
20	406,099960625	-39,4	-0,097
30	406,099944375	-55,6	-0,137
40	406,099939375	-60,6	-0,149
50	406,099971250	-28,8	-0,071
60	406,100084325	84,3	0,208

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10.8	406,099925475	-74,5	-0,184
15	406,099947545	-52,5	-0,129

MIDDLE CHANNEL band 1 Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	418,000045785	45,8	0,110
-20	418,000035650	35,6	0,085
-10	418,000065245	65,2	0,156
0	418,000035690	35,7	0,085
10	417,999998755	-1,2	-0,003
20	417,999955000	-45,0	-0,108
30	417,999939375	-60,6	-0,145
40	417,999928750	-71,3	-0,170
50	417,999976250	-23,8	-0,057
60	418,000086875	86,9	0,208

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10.8	418,000045875	45,9	0,110
15	418,000023645	23,6	0,057

UPPER CHANNEL band 1 Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	430,000004575	4,6	0,011
-20	429,999936555	-63,4	-0,148
-10	429,999954785	-45,2	-0,105
0	429,999945725	-54,3	-0,126
10	429,999955475	-44,5	-0,104
20	429,999955000	-45,0	-0,105
30	429,999928750	-71,3	-0,166
40	429,999923750	-76,3	-0,177
50	429,999976250	-23,8	-0,055
60	430,000092500	92,5	0,215

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10.8	429,999900245	-99,8	-0,232
15	429,999913565	-86,4	-0,201

LOWER CHANNEL band 2 Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	449,999945175	-54,8	-0,122
-20	449,999945680	-54,3	-0,121
-10	449,999941250	-58,7	-0,131
0	449,999923655	-76,3	-0,170
10	449,999956875	-43,1	-0,096
20	449,999955000	-45,0	-0,100
30	449,999933750	-66,2	-0,147
40	449,999923125	-76,9	-0,171
50	449,999991875	-8,1	-0,018
60	450,000108125	108,1	0,240

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10.8	449,999965465	-34,5	-0,077
15	449,999923695	-76,3	-0,170

MIDDLE CHANNEL band 2 Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	459,999976985	-23,0	-0,050
-20	459,999974245	-25,8	-0,056
-10	459,999925645	-74,4	-0,162
0	459,999945790	-54,2	-0,118
10	459,999945785	-54,2	-0,118
20	459,999955450	-44,5	-0,097
30	459,999933750	-66,2	-0,144
40	459,999923125	-76,9	-0,167
50	460,000002500	2,5	0,005
60	460,000108125	108,1	0,235

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10.8	460,000054785	54,8	0,119
15	460,000047455	47,5	0,103

UPPER CHANNEL band 2 Channel separation 12,5KHz

Temp (C°)	Frequency @13,5Vdc (MHz)	Drift (Hz)	Drift(PPM)
-30	470,000036250	36,2	0,077
-20	470,000065475	65,5	0,139
-10	470,000025475	25,5	0,054
0	469,999947855	-52,1	-0,111
10	469,999954875	-45,1	-0,096
20	469,999954780	-45,2	-0,096
30	469,999928750	-71,3	-0,152
40	469,999918125	-81,9	-0,174
50	470,000013125	13,1	0,028
60	470,000103125	103,1	0,219

Voltage (DC)	Frequency@20° (MHz)	Drift (Hz)	Drift(PPM)
10.8	469,999932645	-67,4	-0,143
15	469,999955545	-44,5	-0,095

**TEST
7.**

UNWANTED RADIATION

- **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.

Detector: MaxPeak
RBW: $f \leq 1\text{GHz}$: 100KHz – $f > 1\text{GHz}$: 1MHz

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 (fd in KHz) fo of more than 12.5 KHz: At least 50+10 log(P) dB or 70 dB, which ever is lesser attenuation.

CONDUCTED

LOWER CHANNEL band 1

Emission frequency (MHz)	Measurement result (dBm)	Measurement result below the carrier (dB)	Limit	Result
406,10	43,84	-----	---	---
812,20	-43,58	87,42	≥64	Within the limit
1218,30	-39,42	83,26	≥64	Within the limit
1624,40	-31,49	75,33	≥64	Within the limit
2030,50	-50,98	94,82	≥64	Within the limit
2436,60	-49,25	93,09	≥64	Within the limit
2842,70	-48,68	92,52	≥64	Within the limit
3248,80	-41,91	85,75	≥64	Within the limit
3654,90	-49,65	93,49	≥64	Within the limit
4061,00	-48,77	92,61	≥64	Within the limit

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

MIDDLE CHANNEL band 1

Emission frequency (MHz)	Measurement result (dBm)	Measurement result below the carrier (dBc)	Limit (dBc)	Result
418,00	43,50	-----		---
836,00	-49,07	92,57	≥64	Within the limit
1254,00	-37,55	81,05	≥64	Within the limit
1672,00	-49,52	93,02	≥64	Within the limit
2090,00	-49,69	93,19	≥64	Within the limit
2508,00	-49,41	92,91	≥64	Within the limit
2926,00	-45,00	88,50	≥64	Within the limit
3344,00	-48,79	92,29	≥64	Within the limit
3762,00	-49,22	92,72	≥64	Within the limit
4180,00	-50,11	93,61	≥64	Within the limit

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

UPPER CHANNEL band 1

Emission frequency (MHz)	Measurement result (dBm)	Measurement result below the carrier (dB)	Limit	Result
430,00	43,47	-----		---
860,00	-40,61	84,08	≥64	Within the limit
1290,00	-28,62	72,09	≥64	Within the limit
1720,00	-47,83	91,30	≥64	Within the limit
2150,00	-48,33	91,80	≥64	Within the limit
2580,00	-53,87	97,34	≥64	Within the limit
3010,00	-47,84	91,31	≥64	Within the limit
3440,00	-48,41	91,88	≥64	Within the limit
3870,00	-46,96	90,43	≥64	Within the limit
4300,00	-46,75	90,22	≥64	Within the limit

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

LOWER CHANNEL band 2

Emission frequency (MHz)	Measurement result (dBm)	Measurement result below the carrier (dB)	Limit	Result
450,00	43,58	-----	---	---
900,00	-45,57	89,15	≥64	Within the limit
1350,00	-36,99	80,57	≥64	Within the limit
1800,00	-57,24	100,82	≥64	Within the limit
2250,00	-47,56	91,14	≥64	Within the limit
2700,00	-51,53	95,11	≥64	Within the limit
3150,00	-46,93	90,51	≥64	Within the limit
3600,00	-47,59	91,17	≥64	Within the limit
4050,00	-48,03	91,61	≥64	Within the limit
4500,00	-48,51	92,09	≥64	Within the limit

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

MIDDLE CHANNEL band 2

Emission frequency (MHz)	Measurement result (dBm)	Measurement result below the carrier (dBc)	Limit (dBc)	Result
460,00	43,51	-----		---
920,00	-54,11	97,62	≥64	Within the limit
1380,00	-44,01	87,52	≥64	Within the limit
1840,00	-55,36	98,87	≥64	Within the limit
2300,00	-55,23	98,74	≥64	Within the limit
2760,00	-54,13	97,64	≥64	Within the limit
3220,00	-48,26	91,77	≥64	Within the limit
3680,00	-47,21	90,72	≥64	Within the limit
4140,00	-47,72	91,23	≥64	Within the limit
4600,00	-47,73	91,24	≥64	Within the limit

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

UPPER CHANNEL band 2

Emission frequency (MHz)	Measurement result (dBm)	Measurement result below the carrier (dB)	Limit	Result
470,00	43,56	-----		---
940,00	-53,43	96,99	≥64	Within the limit
1410,00	-47,81	91,37	≥64	Within the limit
1880,00	-56,08	99,64	≥64	Within the limit
2350,00	-56,30	99,86	≥64	Within the limit
2820,00	-56,14	99,70	≥64	Within the limit
3290,00	-48,29	91,85	≥64	Within the limit
3760,00	-49,27	92,83	≥64	Within the limit
4230,00	-47,48	91,04	≥64	Within the limit
4700,00	-46,75	90,31	≥64	Within the limit

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

RADIATED MEASUREMENTS

(ANTENNA PORT TERMINATED ON NON RADIATIVE 50Ohm LOAD)

LOWER CHANNEL band 1

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dB)	Limit	Result
406.1	44.0	----	-----	----	-----
812,20	-39.4	H	83.4	≥64	Within the limit
1218,30	-49.9	V	93.9	≥64	Within the limit
1624,40	-45.3	V	89.3	≥64	Within the limit
2030,50	-49.2	V	93.2	≥64	Within the limit
2436,60	-42.0	V	86.0	≥64	Within the limit
2842,70	-49.7	V	93.7	≥64	Within the limit
3248,80	-49.6	V	93.6	≥64	Within the limit
3654,90	----	----		≥64	Within the limit
4061,00	-----	-----		≥64	Within the limit

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

MIDDLE CHANNEL band 2

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dBc)	Limit (dBc)	Result
418,00	44.0	-----	-----	-----	-----
836,00	-46.7	H	90.7	≥64	Within the limit
1254,00	-48.0	V	92.0	≥64	Within the limit
1672,00	-43.4	V	87.4	≥64	Within the limit
2090,00	-51.6	V	95.6	≥64	Within the limit
2508,00	-45.9	V	89.9	≥64	Within the limit
2926,00	-42.7	V	86.7	≥64	Within the limit
3344,00	-----	-----	-----	≥64	Within the limit
3762,00	-----	-----	-----	≥64	Within the limit
4180,00	-----	-----	-----	≥64	Within the limit

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

UPPER CHANNEL band 1

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dB)	Limit	Result
430.0	44.0	-----	-----	-----	-----
860,00	-40.0	H	84.0	≥64	Within the limit
1290,00	-51.3	H	95.3	≥64	Within the limit
1720,00	-50.0	H	94.0	≥64	Within the limit
2150,00	-53.0	H	97.0	≥64	Within the limit
2580,00	-49.4	V	93.4	≥64	Within the limit
3010,00	-48.5	V	92.5	≥64	Within the limit
3440,00	-----	-----	-----	≥64	Within the limit
3870,00	-----	-----	-----	≥64	Within the limit
4300,00	-----	-----	-----	≥64	Within the limit

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

LOWER CHANNEL band 2

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dB)	Limit	Result
450.0	44.0	-----	-----	-----	-----
900,00	-33.0	H	77.0	≥64	Within the limit
1350,00	-50.5	V	94.5	≥64	Within the limit
1800,00	-49.1	V	93.1	≥64	Within the limit
2250,00	-49.6	V	93.6	≥64	Within the limit
2700,00	-----	-----	-----	≥64	Within the limit
3150,00	-43.9	H	87.9	≥64	Within the limit
3600,00	-----	-----	-----	≥64	Within the limit
4050,00	-----	-----	-----	≥64	Within the limit
4500,00	-----	-----	-----	≥64	Within the limit

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

MIDDLE CHANNEL band 2

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dBc)	Limit (dBc)	Result
460.0	44.0	-----	-----	-----	-----
920,00	-35.4	H	79.4	≥64	Within the limit
1380,00	-49.5	H	93.5	≥64	Within the limit
1840,00	-41.3	V	85.3	≥64	Within the limit
2300,00	-53.9	H	97.9	≥64	Within the limit
2760,00	-52.7	H	96.7	≥64	Within the limit
3220,00	-47.2	V	91.2	≥64	Within the limit
3680,00	-----	-----	-----	≥64	Within the limit
4140,00	-----	-----	-----	≥64	Within the limit
4600,00	-----	-----	-----	≥64	Within the limit

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

UPPER CHANNEL band 2

Emission frequency (MHz)	Measurement result (dBm)	Polarization	Measurement result below the carrier (dB)	Limit	Result
470.0	44.0	-----	-----	-----	-----
940,00	-36.0	V	80	≥64	Within the limit
1410,00	-51.4	H	95.4	≥64	Within the limit
1880,00	-39.3	V	83.3	≥64	Within the limit
2350,00	-51.3	H	95.3	≥64	Within the limit
2820,00	-53.7	V	97.7	≥64	Within the limit
3290,00	-50.5	V	94.5	≥64	Within the limit
3760,00	-----	-----	-----	≥64	Within the limit
4230,00	-----	-----	-----	≥64	Within the limit
4700,00	-----	-----	-----	≥64	Within the limit

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

6 LIST OF EQUIPMENT USED

EQUIPMENT	IDENTIFICATION NUMBER	CAL. DUE
EMI TEST RECEIVER 20HZ 40GHZ	EMC.359	AUG.2016
ARTIFICIAL MAINS NETWORK	EMC.173	AUG-2016
RF SEMI-ANECHOIC CHAMBER (CSSA)	EMC.191	AUG 2016
BILOG ANTENNA	EMC.023	MAY 2016
LOG PERIODICA ANTENNA	EMC.391	DEC 2015
VOLTAGE GENERATOR	EMC.397	FEB.2016
SPECTRUM ANALYZER	EMC.332	APR.2016