Test Report of the rescueME MOB1 to the requirements of RTCM SC11901 Annex A

Test report №: TA0004-1

Summary of Test Conditions

RTCM Standard SC11901.1
Maritime Survivor Locating Devices (MSLD)
Annex A: DSC type MSLD

Model: rescueME MOB1
Serial Number: PCB7
Dates Of Test: 05/12/14 to 10/12/14

Frequencies of Operation

Channel 70 156.525MHz

Extreme Conditions

Upper Temperature = 55°C
Lower Temperature = -20°C

Rated Voltage = 6.0V
Upper Voltage = 6.6V
Lower Voltage = 3.8V

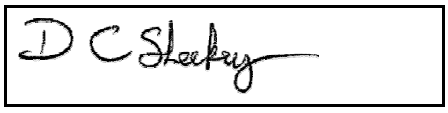
Dates of Test : 05/12/14 to 10/12/14
Report Issued: 15/1/15

Tested By

Stefan Kennedy
Simon Nolan

Approved by

David Sheekey

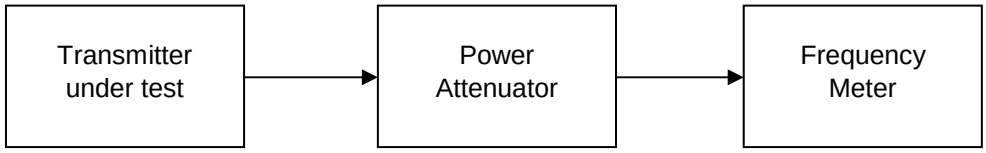


Clause A4.1: Frequency Error

Date of test: 05/12/14 to 10/12/14 **Temperature:** 22.1 **Humidity:** 36.7

Method
The carrier frequency shall be measured in the absence of of modulation, with the transmitter connected to an artificial and tuned to channel 70.

The measurement was made under normal test conditions and extreme test conditions.



Results

Freq (MHz)	Normal	-20°C		55°C		Max Error	Pass / Fail
		6.6V	3.8V	6.6V	3.8V		
156.525	-40.0Hz	40.0Hz	40.0Hz	-140.0Hz	-140.0Hz	140.0Hz	Pass

Limit
The frequency error under normal conditions shall not exceed ±1.5 kHz, and under extreme test conditions shall not exceed ±1.5 kHz.

Equipment used
1, 2, 4, 5, 6,

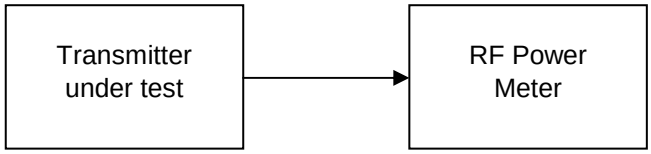
Clause A4.4: Conducted Power

Date of test: 05/12/14 to 10/12/14 **Temperature:** 22.1 **Humidity:** 36.7

Method
The transmitter shall be connected to an artificial antenna (see clause 6.4) and the average or mean power delivered to this artificial antenna shall be measured under normal conditions (see clause 6.8), and at the extremes of temperature (see clause 6.9.1).

The mean power under normal conditions P_{Norm} shall be measured.
The mean power under extreme conditions P_{-20} and P_{+55} shall be measured.
The differences between the normal and extreme conditions shall be determined:

$P_{diff1} = P_{Norm} - P_{-20}$ and $P_{diff2} = P_{Norm} - P_{+55}$



Results

Freq (MHz)	Normal	-20°C		55°C		Error	Pass / Fail
		6.6V	3.8V	6.6V	3.8V		
156.525	25.9dBm	26.7dBm	26.5dBm	25.1dBm	25.5dBm	1.1dB	Pass

Limit
The carrier power shall remain between 0.1 and 0.5Watts ±1.5dB of the rated power. The output power shall never however drop below 0.1Watts

Equipment used
1, 2, 4, 5, 6,

Clause A4.7:Adjacent Channel Power

Date of test: 5/12/14 **Temperature:** 22.1 **Humidity:** 36.7

Method

The adjacent channel power can be measured with a power measuring receiver which conforms to annex B (referred to in clause 8.7.2 and annex B as the "receiver"), in Recommendation ITU-R SM.332-4:

a) The transmitter shall be operated at the carrier power determined in clause 8.2 under normal test conditions.
The output of the transmitter shall be linked to the input of the "receiver" by a connecting device such that the impedance presented to the transmitter is 50 Ω and the level at the "receiver" input is appropriate.
b) With the transmitter unmodulated, the tuning of the "receiver" shall be adjusted so that a maximum response is obtained. This is the 0 dB response point. The "receiver" attenuator setting and the reading of the meter shall be recorded.
The measurement may be made with the transmitter modulated with normal test modulation, in which case this fact shall be recorded with the test results.
c) The tuning of the "receiver" shall be adjusted away from the carrier so that the "receiver" -6dB response nearest to the transmitter carrier frequency is located at a displacement from the nominal carrier frequency of 17 kHz for 25 kHz channels or 8,25 kHz for 12,5 kHz channels.
d) The transmitter shall be modulated with the test signal specified in EN301 025-1 v1.5.2, using a continuous 01010101 data sequence.
e) The "receiver" variable attenuator shall be adjusted to obtain the same meter reading as in step b) or a known relation to it.
f) The ratio of adjacent channel power to carrier power is the difference between the attenuator settings in steps b) and e), corrected for any differences in the reading of the meter.
g) The measurement shall be repeated with the "receiver" tuned to the other side of the carrier.

Results

Freq (MHz)	Normal	-20°C		55°C		ACP	Pass / Fail
		6.6V	3.8V	6.6V	3.8V		
156.550	70.1dBc					70.1dBc	Pass
156.500	70.1dBc					70.1dBc	Pass

Limit
The adjacent channel power shall not exceed a value of:
• 25 kHz channel: 70 dB below the carrier power of the transmitter without any need to be below 0,2µW.

Equipment used
4, 5, 6

RTCM 11901.1 Clause A.4.10: Conducted spurious emissions conveyed to the antenna

Date of test: 9/12/14 **Temperature:** 21.9 **Humidity:** 35.2

Method

Conducted spurious emissions shall be measured with the unmodulated transmitter connected to the artificial antenna. The measurements shall be made over a range from 9 kHz to 2 GHz, excluding the channel on which the transmitter is operating and its adjacent channels. The measurements for each spurious emission shall be made using a tuned radio measuring instrument or a spectrum analyzer.

Results

Frequency (MHz)	Level (dBm)	Pass/Fail
19.2	-50	Pass
77.00846	-43.4	Pass
80.84	-42.4	Pass
132.00738	-49.2	Pass
150.685	-44.7	Pass
153.605	-43.2	Pass
157.125	-44.04	Pass
159.445	-44.8	Pass
162.365	-40	Pass
170.0066	-42.15	Pass
182.00636	-48.65	Pass
313.05	-53.88	Pass
469.575	-59.47	Pass
626.1	-68.14	Pass
782.625	-67.07	Pass
939.15	-73.41	Pass
1095.67	-73.62	Pass
1721.775	-75.71	Pass

No conducted spurious emissions exceeded -36dBm
Refer to annex C plots 3 to 7 for results

Limit

The power of any conducted spurious emission shall not exceed 0.25uW (-36dBm)

Equipment used

3, 5, 6, 22, 23

Clause A4.13: Cabinet radiation and conducted spurious emissions other than those conveyed to the antenna

Date of test: 16/12/14 **Temperature:** 6.6 **Humidity:** 44

Method

Spurious emissions shall be measured using a test site described in annex A.
The measurement shall be performed with the locating device in its standard position (see annex A) and according to the requirements of clause A.4 of annex A for equipment intended to be worn on a person.
The method of measurement described in clause 8.3 shall be used to search for spurious emissions in the frequency band 30 MHz to 2 GHz, excluding the frequency band tested in 8.4.
The measuring receiver shall have a bandwidth of 100 kHz to 120 kHz.
The measurement shall only be performed under normal test conditions, the locating device being rotated until the maximum emission is detected. The measurement is also made when the locating device has been activated but is not transmitting.

Search scan carried out in anechoic chamber and significant emissions measured on OATS using RTCM 11901.1 E.7.3 Method, mounted on floatation device on using RTCM 11901.1 E.7.3 Method, mounted on floatation device resting on groundplane with antenna base at 100mm.

Results

Frequency	Level	Pass / Fail
169.8MHz	0.081uW	Pass
313.2MHz	0.004uW	Pass
469.8MHz	0.008uW	Pass
624.6MHz	0.018uW	Pass
783.0MHz	0.029uW	Pass
1094.0MHz	0.632nW	Pass

Refer to Annex D plots 8 and 9 for search scan results.

Limit

The power of any spurious emission component when transmitting shall not exceed [0,2] µW.
The power of any spurious emission component when not transmitting shall not exceed 2 nW between 30 MHz and 1 GHz and 20 nW between 1 GHz and 2 GHz.

Equipment used
3, 10, 11, 12, 13, 14, 20, 21

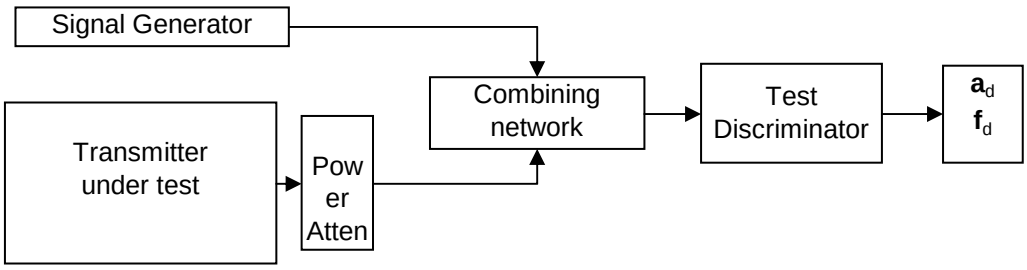
Clause A4.16: Transmitter transient behaviour

Date of test: 9/12/14 **Temperature:** 21.9 **Humidity:** 35.2

Method

Two signals shall be connected to the test discriminator via a combining network (see clause 6.1).
The transmitter shall be connected to a 50 Ω power attenuator.
A test signal generator shall be connected to the second input of the combining network.
The test signal shall be adjusted to the nominal frequency of the transmitter.
The test signal shall be modulated by a frequency of 1 kHz with a deviation of ±25 kHz.

The test signal level shall be adjusted to correspond to 0,1 % of the power of the transmitter under test measured at the input of the test discriminator. This level shall be maintained throughout the measurement.
The amplitude difference (ad) and the frequency difference (fd) output of the test discriminator shall be connected to a storage oscilloscope.
The storage oscilloscope shall be set to display the channel corresponding to the (fd) input up to ±25 kHz.
The storage oscilloscope shall be set to a sweep rate of 10 ms/division and set so that the triggering occurs at one division from the left edge of the display.
The storage oscilloscope shall then be set to trigger on the channel corresponding to the amplitude difference (ad) input at a low input level, rising.
The transmitter shall then be switched on, without modulation, to produce the trigger pulse and a picture on the display.
The result of the change in the ratio of power between the test signal and the transmitter output will, due to the capture ratio of the test discriminator, produce two separate sides on the picture, one showing the 1 kHz test signal, the other the frequency difference of the transmitter versus time.
The moment when the 1 kHz test signal is completely suppressed is considered to provide t_{on}.
The periods of time t_1 and t_2 as defined in table 2 shall be used to define the appropriate template.



Results

Transient Period		Max Dev	Pass / Fail
t_1(ms)	0 - 5 ms	0.934kHz	Pass
t_2(ms)	5 -20 ms	0.065kHz	Pass
	>20mS	0.096kHz	Pass
t_3(ms)	5mS	0.063kHz	Pass

Refer to Annex B plots 1 and 2 for results

Limit

t_1(ms)	0 - 5 ms	<25.00kHz
t_2(ms)	5 -20 ms	<12.50kHz
	>20mS	<01.50kHz
t_3(ms)	5mS	<25.00kHz

Equipment used
3, 5, 6, 22

Clause A4.19 Residual Modulation

Date of test: 11/12/14 **Temperature:** 22.6 **Humidity:** 31.4

Method

The normal test modulation defined in clause 6.4 (EN301 025-1 v1.5.2, using a continuous 01010101 data sequence)shall be applied to the transmitter. The high frequency signal produced by the transmitter shall be applied, via an appropriate coupling device, to a linear demodulator with a de-emphasis network of 6 dB per octave. The time constant of this de-emphasis network shall be at least 750 µs.
Precautions shall be taken to avoid the effects of emphasizing the low audio frequencies produced by internal noise.
The signal shall be measured at the demodulator output using an r.m.s. voltmeter.
The modulation shall then be switched off and the level of the residual audio frequency signal at the output shall be measured again.

Results

Freq (MHz)	Normal	-20°C		55°C		Diff	Pass / Fail
		6.6V	3.8V	6.6V	3.8V		
156.525	-43.1dB					3.1dBm	Pass

Limit

The residual modulation shall not exceed -40 dB

Equipment used

4, 5, 6

Clause A4.22 Frequency Error (demodulated DSC signal)

Date of test: 05/12/14 to 10/12/14 **Temperature:** 22.1 **Humidity:** 36.7

Method

The transmitter shall be connected to the artificial antenna as specified in clause 6.5 and a suitable FM demodulator. The transmitter shall be set to channel 70.
The transmitter shall be set to transmit a continuous B- or Y- state.
The measurement shall be performed by measuring the demodulated output, for both the continuous B- and Y-state.
The measurements shall be carried out under normal test conditions (see clause 6.13) and extreme test conditions (see clauses 6.14.1 and 6.14.2 applied simultaneously).

Results

	Normal	**-20°C**		**55°C**		Error	**Pass / Fail**
		6.6V	**3.8V**	**6.6V**	**3.8V**		
B-State	2100.1Hz	2099.7Hz	2100.4Hz	2100.1Hz	2100.1Hz	0.4Hz	Pass
Y-State	1299.7Hz	1300.2Hz	1300.1Hz	1300.5Hz	1300.5Hz	0.5Hz	Pass

Limit

The measured frequency from the demodulator at any time for the B-state shall be within 2 100 Hz ± 10 Hz and for the Y-state within 1 300 Hz ± 10 Hz.

Equipment used

1, 2, 4, 5, 6

Clause A4.25 Modulation Index for DSC

Date of test: 09/12/14 **Temperature:** 21.9 **Humidity:** 35.2

Method
The transmitter shall be set to transmit continuous B and then Y signals. The frequency deviations shall be measured.

Results

	Normal	-20°C		55°C		Mod Index	Pass / Fail
		6.6V	3.8V	6.6V	3.8V		
B-State	4190.0Hz					1.995	Pass
Y-State	2530.0Hz					1.946	Pass

Limit

The modulation index shall be 2,0 ± 10 %.

Equipment used
4, 5, 6

Clause A4.28 Modulation Rate for DSC

Date of test: 09/12/14 **Temperature:** 21.9 **Humidity:** 35.2

Method
The transmitter shall be set to transmit continuous dot pattern.
The RF output terminal of the transmitter, suitably attenuated, shall be connected via a linear FM demodulator to a calibrated FSK demodulator. The output of the FSK demodulator shall be limited in bandwidth by a low pass filter with a cut-off frequency of 1 kHz and a slope of 12 dB/octave.
The frequency of the output shall be measured

Results

Wanted	Value	Error	Pass/Fail
600	600.0003	1ppm	**Pass**

Limit

The frequency shall be 600 Hz ± 30 ppm corresponding to a modulation rate of 1 200 baud.

Equipment used
4, 5, 6, 7, 17

A4.31 Testing of generated Test Sequences

Method

The measurement is made under normal conditions (see clause 6.8).
GNSS data to the EUT shall be inhibited.
Activate The EUT shall be activated in active mode and shall record transmissions from the EUT for 10 minutes.

First Individual Distress Relav transmission

Results

	Yes/No
a) The EUT transmits an individual distress relay within 10 seconds after activation,, and the message contains the following fields:	Pass
a.i) The format specifier is set to 120.	Pass
a.i) The format specifier is set to 120.	Pass
a.ii) The destination address MMSI is the Own vessel MMSI (section 4.5) configured in the EUT.	Pass
a.iii) The category is set to 112.	Pass
a.iv) The Self ID is as configured in the EUT.	Pass
a.v) The first telecommand is set to 112.	Pass
a.vi) The Distress MMSI is the self ID as configured in the EUT.	Pass
a.vii) The nature of distress is set to 110.	Pass
a.viii) The position = 9999999999.	Pass
a.ix) The time = 8888.	Pass
a.x) The subsequent communications field is set to 126.	Pass

Second Individual Distress Relay transmission

Results

	Yes/No
a) The EUT transmits an individual distress relay within 10 seconds after activation	Pass
b) The EUT transmits another individual distress relay within 5 minutes after activation, and the message contains the following fields:	Pass
b.i) The format specifier is set to 120.	Pass
b.ii) The destination address MMSI is the Own vessel MMSI (section 4.5) configured in the EUT.	Pass
b.iii) The category is set to 112.	Pass
b.iv) The Self ID is as configured in the EUT	Pass
b.v) The first telecommand is set to 112.	Pass
b.vi) The Distress MMSI is the self ID as configured in the EUT.	Pass
b.vii) The nature of distress is set to 110.	Pass
b.viii) The position = position of EUT	Pass
b.ix) The time = UTC time	Pass
b.x) The subsequent communications field is set to 126	Pass

Group call sent after 30 minutes

	Yes/No
a) The EUT transmits an individual distress relay within 10 seconds after	Pass
a.i) The format specifier is set to 114.	Pass
a.i) The format specifier is set to 114.	Pass
a.ii) The destination address MMSI is thegroup MMSI configured in the EUT.	Pass
a.iii) The category is set to 100.	Pass
a.iv) The Self ID is as configured in the EUT.	Pass
a.v) The first telecommand is set to 100.	Pass
a.vi) The second telecommand is set to 126	Pass
a.vii) The frequnecy is set to 126, 6 times	Pass

Annex A: ERP

Radiated Power. Set up as per RTCM 11901.1, Clause E.7.3.1.2

Measured at 156.55MHz to avoid interfering with Channel 70

Antenna Parameters

Frequency (MHz)	156.55
λ (m)	1.92
Dipole Length for 156.55MHz (m)	0.48
Antenna Factor (dB)	12.75
Antenna Gain	**1.36**

$P_r = P_{REC} - G_{REC} + L_C + L_P$

$L_P = 10\text{Log}(4\pi r/\lambda)^2$

where;

P_r is the radiated power level from the AU (Alerting Unit)

P_{REC} is the measured power level from spectrum analyser (dBm);

G_{REC} is the antenna gain of search antenna (dB);

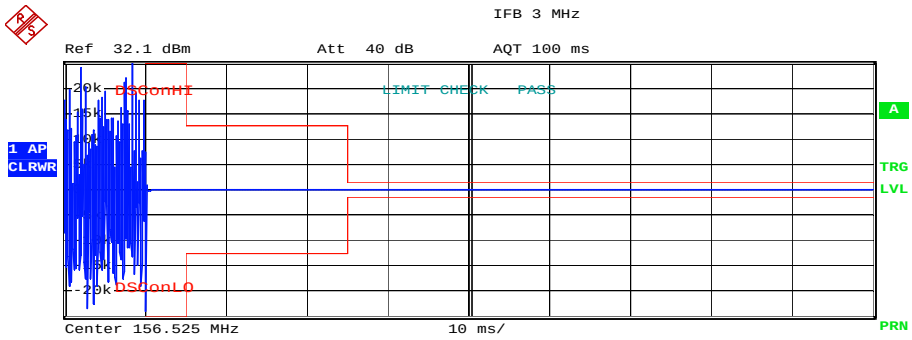
L_C is the receive system attenuator and cable loss (dB);

L_P is the free space propagation loss (dB).

Antenna Gain												
1.36												
Cable Loss												
2.13	**RADIATED POWER EIRP (dBm))**											
Plane Height (m)	**Elevation Angles (Degrees)**											
0.1	**8**		**10**		**15**		**20**		**25**		**30**	
	5		**5**		**5**		**5**		**5**		**5**	
Antenna Height (m)	**0.81**		**0.99**		**1.44**		**1.92**		**2.44**		**2.99**	
Path Length	**5.05**		**5.08**		**5.18**		**5.33**		**5.52**		**5.78**	
Azimuth Angle (Degrees)	**P_{REC} (dBm)**	**EIRP (dBm)**	**P_{REC} (dBm)**	**EIRP (dBm)**	**P_{REC} (dBm)**	**EIRP (dBm)**	**PREC (dBm)**	**EIRP (dBm)**	**PREC (dBm)**	**EIRP (dBm)**	**PREC (dBm)**	**EIRP (dBm)**
0	-3.9	27.25	-4.4	26.81	-4.8	26.54	-5.4	26.27	-6.2	25.70	-7.9	24.43
30	-4.2	26.95		31.21		31.37		31.62		31.93		32.33
60	-4.0	27.15		31.21		31.37		31.62		31.93		32.33
90	-4.3	26.85		31.21		31.37		31.62		31.93		32.33
Minimum Azimuth Level		**26.85**		**26.81**		**26.54**		**26.27**		**25.70**		**24.43**
Maximum Elevation Level	26.85 **dBm**		0.48 **W**									

Table 1: DSC Transmitter EIRP results of height search

Annex B: Transmitter transient behaviour

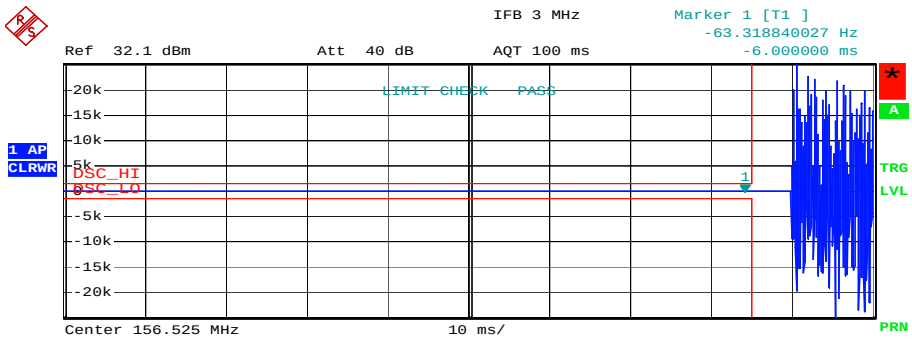


Frequency Modulation Summary

Coupling	DC		Carrier Offset	-24.241 Hz
Deviation	+peak	24.92 kHz	Carrier Power	-4.03 dBm
	-peak	-23.97 kHz	Modulation Frequency	--- Hz
	⇧peak/2	24.45 kHz	Sampling Rate	31.25 kHz
	RMS	3.081 kHz	Record Length	3126
			Demod Bandwidth	25 kHz

Date: 9.DEC.2014 11:18:11

Plot 1: Transmitter transient behaviour "turn on" under normal conditions



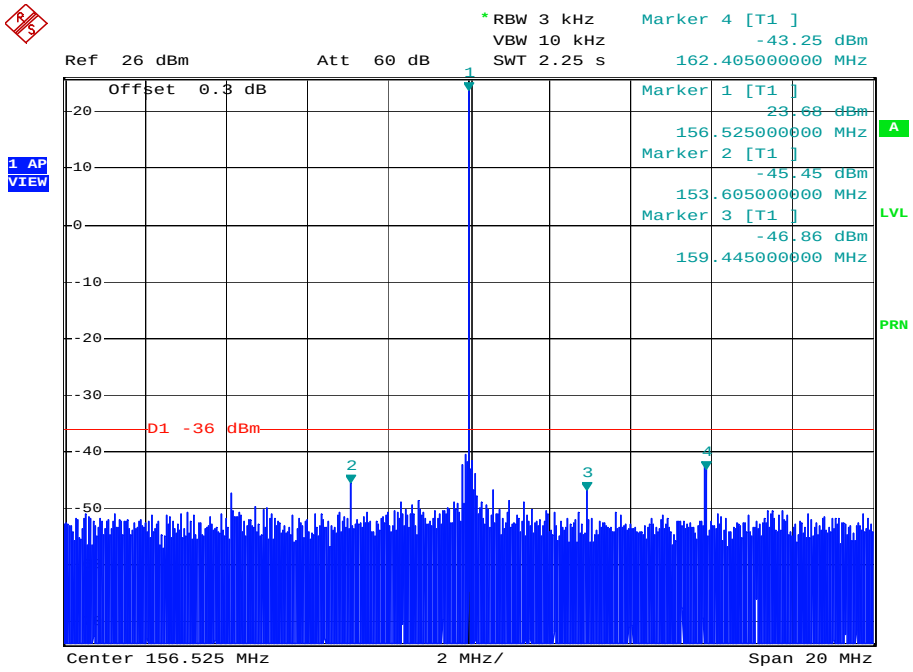
Frequency Modulation Summary

Coupling	DC		Carrier Offset	-40.952 Hz
Deviation	+peak	26.13 kHz	Carrier Power	-3.98 dBm
	-peak	-25.36 kHz	Modulation Frequency	--- Hz
	⇧peak/2	25.74 kHz	Sampling Rate	31.25 kHz
	RMS	3.177 kHz	Record Length	3126
			Demod Bandwidth	25 kHz

Date: 9.DEC.2014 11:22:06

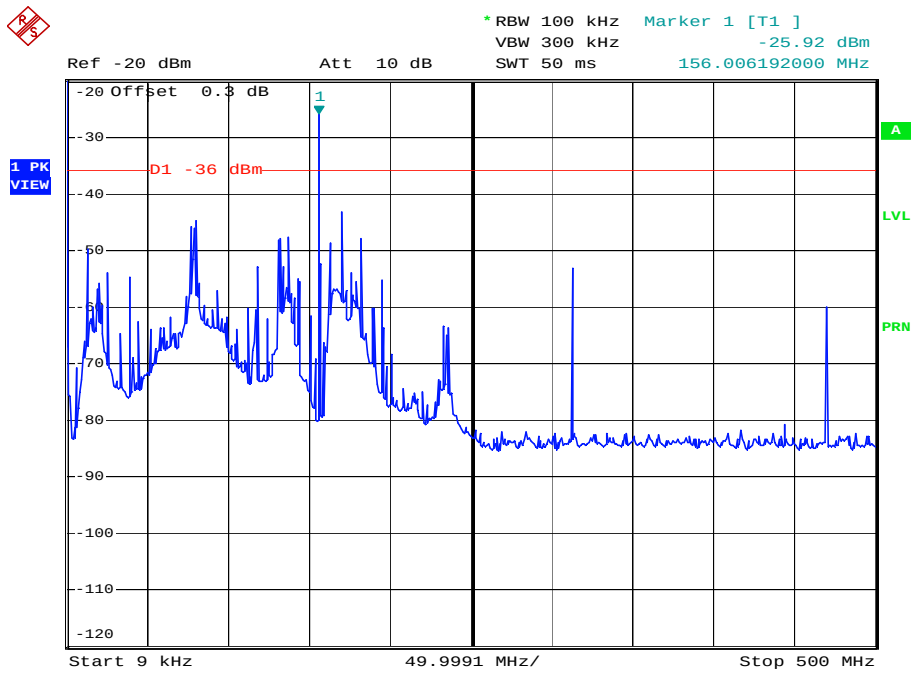
Plot 2: Transmitter transient behaviour "turn off" under normal conditions

Annex C: Conducted spurious emissions conveyed to the antenna (RTCM 11901.1 Clause A.4.10:)



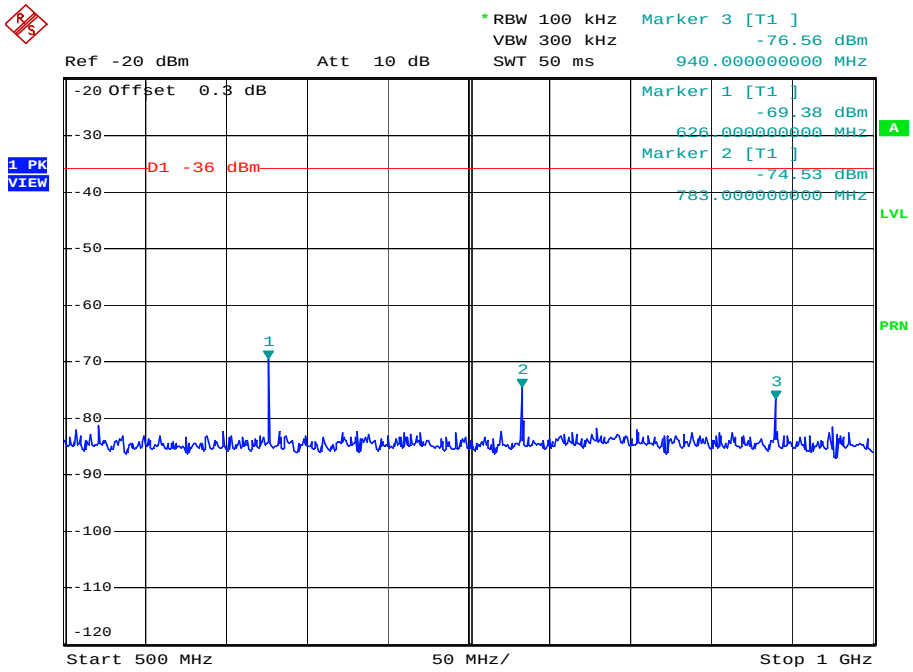
Date: 9.DEC.2014 12:56:28

Plot 3: Conducted spurious emissions 146.525MHz to 166.525 MHz, (without 8MHz bandstop filter at 156.525MHz)



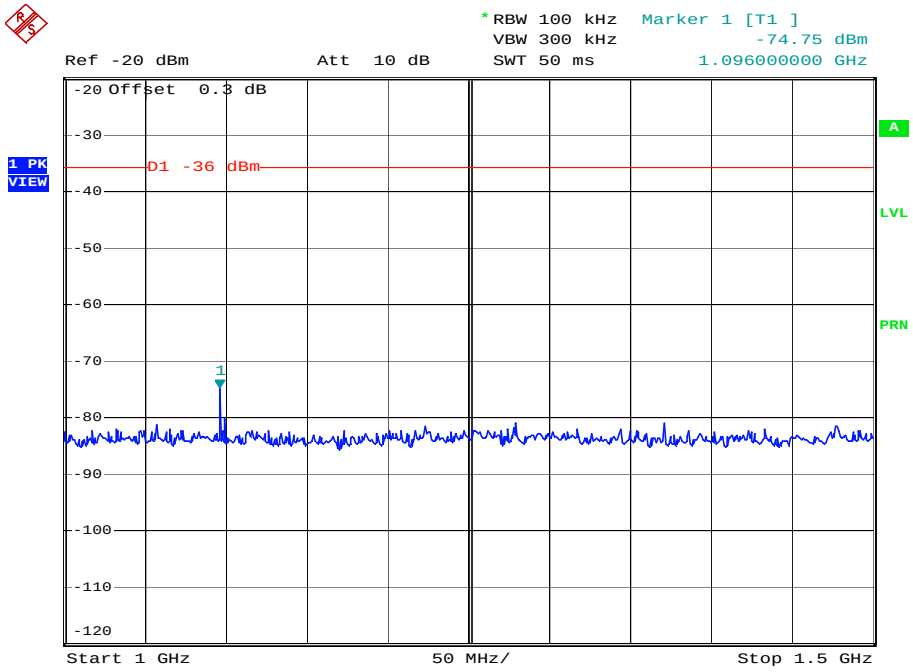
Date: 9.DEC.2014 12:46:42

Plot 4: Conducted spurious emissions 9KHz to 500MHz (with 8MHz bandstop filter at 156.525MHz)



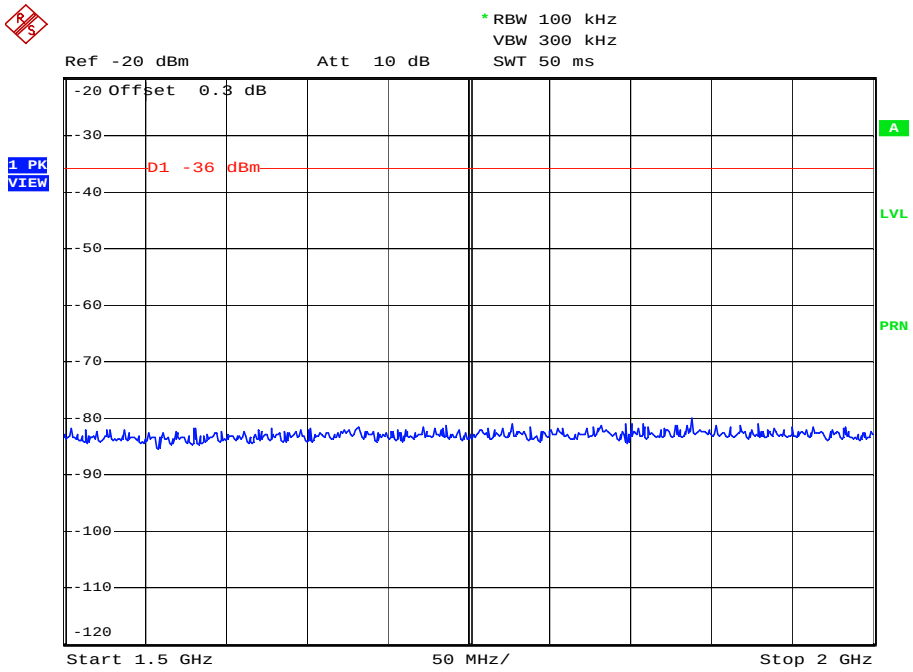
Date: 9.DEC.2014 12:49:02

Plot 5: Conducted spurious emissions 500MHz to 1000MHz
(with 8MHz bandstop filter at 156.525MHz)



Date: 9.DEC.2014 12:50:32

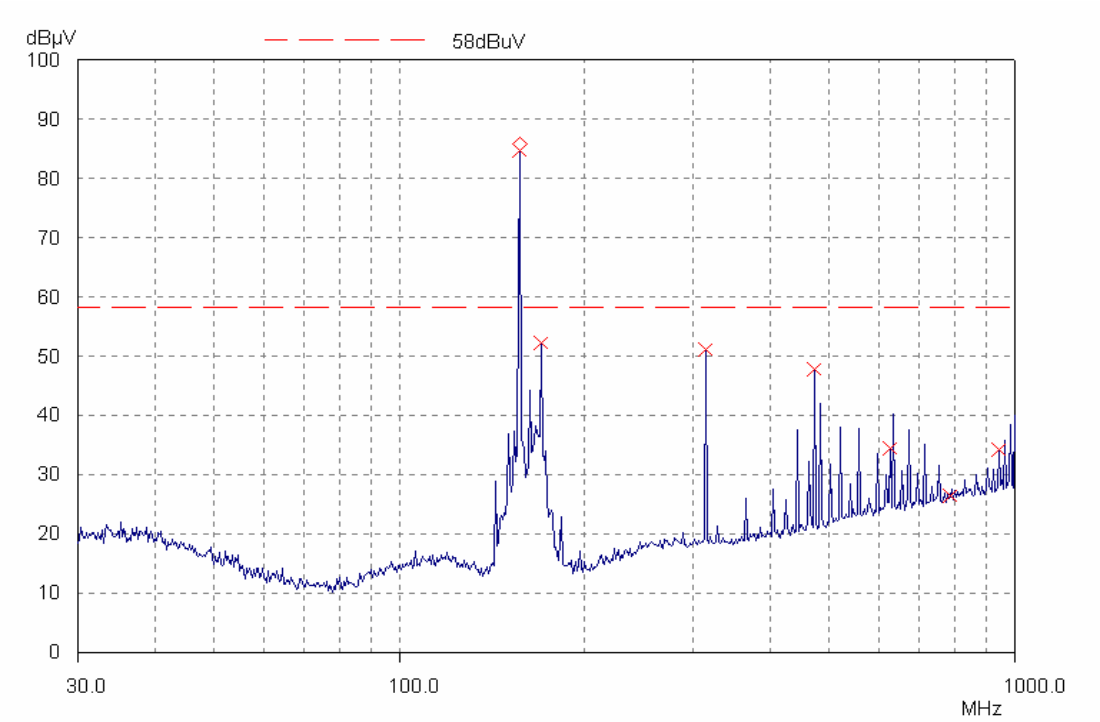
Plot6: Conducted spurious emissions 1000MHz to 1500MHz
(with 8MHz bandstop filter at 156.525MHz)



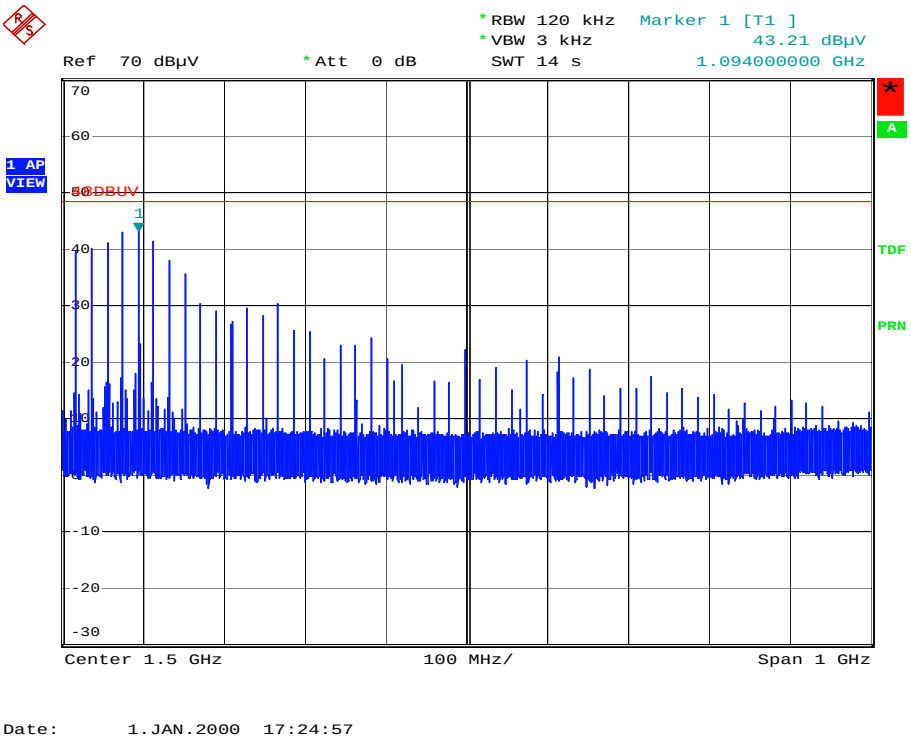
Date: 9.DEC.2014 12:51:34

Plot7: Conducted spurious emissions 1500MHz to 2000MHz
(with 8MHz bandstop filter at 156.525MHz)

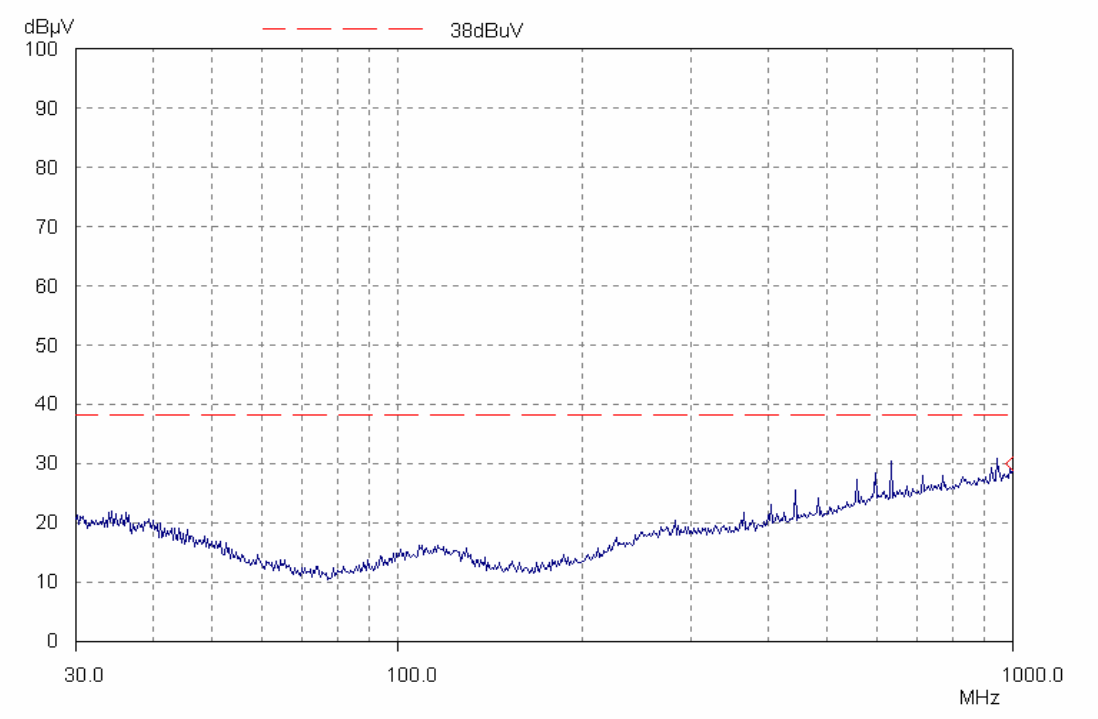
Annex D: Transmitter Spurious Emissions



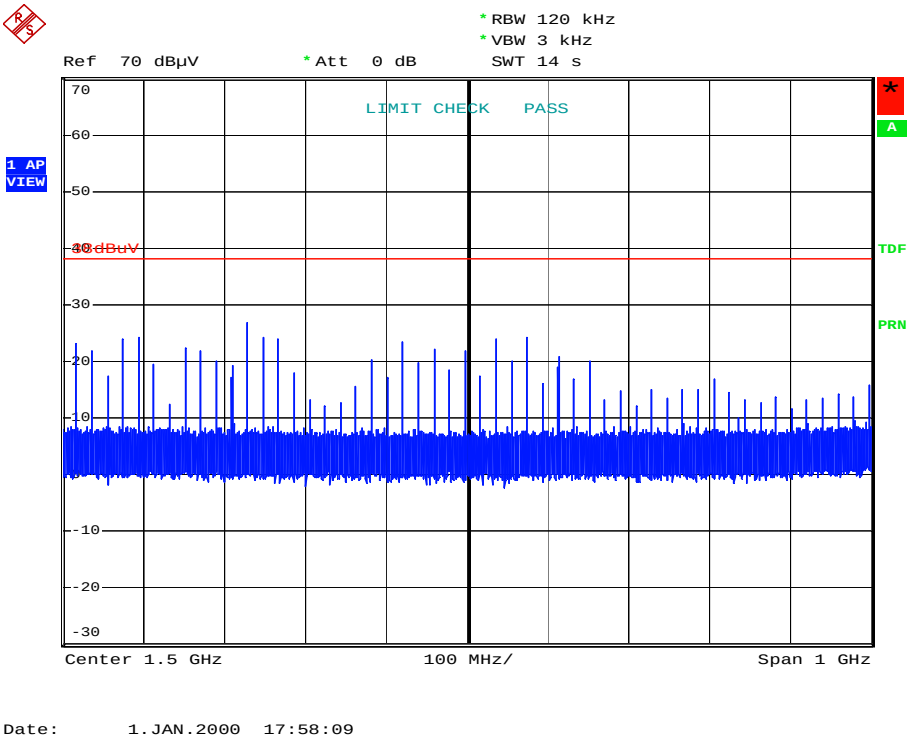
Plot 8: Radiated spurious emissions search scan in TX Mode 30.0MHz to 1.0GHz



Plot 9 : Radiated spurious emissions search scan in TX Mode 1.0GHz to 2.0GHz



Plot 10: Radiated spurious emissions search scan in STBY Mode 30.0MHz to 1.0GHz



Date: 1.JAN.2000 17:58:09

Plot 11: Radiated spurious emissions search scan in STBY Mode 1.0GHz to 2.0GHz

№	Item	Description	Serial №	Cal Date
1	BS-125-40	Environmental Chamber	A2420	-
2	Fluke 52	Thermometer	4340437	17/02/2014
3	R&S FSP	Spectrum Analyser	100404	17/02/2014
4	R&S CMTA54	Radio Communication Analyser	825852004	17/02/2014
5	TTI TS3031S	Power Supply	079055	14/02/2013
6	Fluke 73	Multimeter	41330839	17/02/2014
7	Racal-Dana 1991	Universal Frequency Counter	8691	17/02/2014
8	IFR 2023B	Low Noise Signal Generator	202301052	17/02/2014
9	Chauvin Arnoux CA43	Fieldmeter	5398Z	
10	R&S HF906	Horn Antenna	100287	31/07/2014
11	ARA LPB-2513	Bi-Log Antenna	1156	01/08/2014
12	Schwarzbeck VHA9103	VHF Diplole Antenna	7320	05/08/2014
13	Schwarzbeck UHA9105	UHF Dipole Antenna	7326	04/08/2014
14	R&S ESVS10	EMI Test Reciever	837948013	17/02/2014
15	IFI SMX100	RF Power Amplifer 0.01MHz to 1GHz	9551P	-
16	IFI S41-50	RF Power Amplifer 0.8GHz to 4.2GHz	J031-0505	-
17	V23 modem	DSC Modem (In house)	-	-
18	Sine Qua Non	AIS Installation Test Set	010201 0121	-
19	Sailor RT5022	DSC Radio	05726755	-
20	MPE (C1162-D1)	Anechoic Chamber	C1162-D1	-
21	Reseda PC	PC Running ESXS K1/CIS9941 Software	980724SK1747	-
22	Spinner BN 74 53 85	25W 30dB Attenuator	13960	-
23	157MHz SNo1	8MHz Bandstop filter 157MHz (In house)	SNo1	
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