



Test report no. : 93193/11

Item tested : Tron SART20

Type of equipment : Search And Rescue Transponder 9GHz

Client : Jotron AS



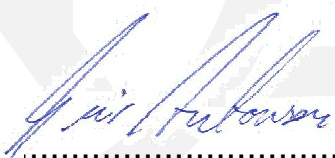
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under registration number TEST 033

Parts of (clause 9 and 10)

**IEC 60945 Maritime navigation and radiocommunication equipment and systems
– General requirements – Methods of testing and required results
(Third edition, 1996-11; Fourth edition, 2004)**

11th March 2008

Authorized by :


Geir Antonsen
Technical Verificator

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1 GENERAL INFORMATION

1.1 Testhouse Info

Name : Nemko A/S
Address : Nemko Comlab
Gåsevikveien 8, Box 96
N-2027 Kjeller, NORWAY
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
E-mail: comlab@nemko.com
Number of Pages: 25

1.2 Client Information

Name : Jotron AS
Address : P.O Box 54, Østbyveien 1,
NO-3280 Tjodalyng, Norway
Telephone : +47 33 13 97 00
Fax : +47 33 12 67 80

Contact:

Name : Eirik Storjordet
Telephone : +47 33 13 97 14
E-mail : eirik.storjordet@jotron.com

1.3 Manufacturer (if other than client)

Name : /
Address : /
Telephone : /
Fax : /
E-mail : /

2 Test Information

2.1 Tested Item

Name :	Tron SART20
Model/version :	
Serial number :	NA
Hardware identity and/or version:	
Software identity and/or version :	
Frequency Range :	9200 – 9500 MHz
Type of Power Supply :	Internal primary battery (2 x 3,6 V Lithium)
Desktop Charger :	NA

Description of Tested Device(s)

The tested EUT is transponder for marine search and rescue (SART).

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	21,2 – 25,1 °C
Relative humidity:	12,5 – 48,1 %
Atmospheric pressure:	961 – 1028 hPa
Normal test voltage:	NA

All testing has been carried out with the supplied batteries.

The values are the limit registered during the test period.

2.3 Test Period

Item received date: 2007-09-19

Test period : from 2007-09-19 to 2008-01-30

2.4 Standards and Regulations

IEC 60945 Maritime navigation and radiocommunication equipment and systems –
General requirements – Methods of testing and required results.
(Third edition, 1996-11; Fourth edition, 2004)

2.5 Test Engineer(s)

Egil Hauger, Tore Løvlien

2.6 Additional information

2.6.1 Test Methods

Described in the relevant standards.


2.6.2 Test Equipment

List of used test equipment, see clause 6.



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

**Deviations from, additions to, or exclusions from the test specifications are
described in “Summary of Test Data”.**

TESTED BY : 
Egil Hauger, Test Engineer

DATE: 5th March 2008

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3 TEST REPORT SUMMARY

3.1 Abbreviations

- P** Passed, the equipment fulfils the requirement
F Failed, the equipment does not fulfil the requirement
I Inconclusive, the test does not give a conclusive verdict
NA Not applicable, the requirement is not applicable
NT Not tested, the test is not performed even though the requirement is relevant

3.2 List of measurements

Standard		Measurement	Result (Pass/Fail)
IEC 60 945	9.3	Radiated Disturbance 0,15 - 2000 MHz, Enclosure port	Pass
IEC 60 945	9.2	Conducted Disturbance 0,01 - 30 MHz, Mains Port	NA
IEC 60 945	10.4	Radiated, radio-frequency electromagnetic field - Immunity test	Pass
IEC 60 945	10.3	RF common mode, induced by radio-frequency fields - Immunity test	NA
IEC 60 945	10.9	Electrostatic discharge (ESD) immunity test	Pass
IEC 60 945	10.5	Electrical fast transient/burst (EFT/B) immunity test	NA
IEC 60 945	10.6	Surge immunity tests	NA
IEC 60 945	10.7 and 10.8	Power supply short term variations and failure	NA

3.3 Conclusion

The tested equipment complies with the requirements of relevant standards.

3.4 OTHER COMMENTS

General:

The spurious emissions measurements and RF field immunity test have both been performed according to IEC 60 945 in a semi anechoic chamber.

EUT (Equipment Under Test):

During spurious emissions measurement and immunity test the EUT was in normal operating mode. A pulsed RF signal at 9350 MHz was transmitted to the EUT and the response signal from the EUT was monitored.

List of ports:

Signal port:	Internal antenna
Power ports:	Internal battery

RF immunity tests.

The RF field immunity tests are performed in a 10m semi anechoic room with absorbers on the floor. The distance between EUT and field generating antenna was 3 meters and the floor was covered with absorbers. The EUT was turned from 0 to 360 degrees and the polarity of the field was horizontal and vertical.

Performance criteria

Operate as intended during test.
Operate as intended after the tests.
No unintentional transmission.

4 EMISSION MEASUREMENTS

4.1 Radiated disturbance

IEC 60945

Frequency (MHz)	Detector / Polarisation	Level (dB μ V/m)	Result (Pass/Fail)
16,43	Q-peak /	25,6	Pass
40,00	Q-peak /	12,1	Pass
160,00	Q-peak /	14,7	Pass
All others 0,15 -2000	Q-peak / Vert./Hor.	< Limit	Pass
Limits: 0,15 – 0,30 0,3 – 30 30 – 2000 156 – 165 156 – 165	Q-peak Q-peak Q-peak Q-peak Peak	80 – 52 52 – 34 54 24 30	
Measurement Uncertainty 30-200 MHz 200-2000 MHz		$\pm 4,7$ dB $\pm 4,8$ dB	

Cable configuration during test:

NA

EUT mode during test:

The EUT was in normal operating mode, i.e. receiving interrogating radar pulses and responding with a swept signal

Results:

The EUT complies with the requirements. See plots in annex I.

Comments:

Test Equipment Used: 15, 17, 18, 19, 20, 21

5 IMMUNITY TESTS

5.1 Immunity to Radiated RF-disturbance

IEC 60945

The EUT has been tested according IEC 60945 clause 10.4.

The EUT was tested in a semi-anechoic chamber where absorbers were placed on the floor between EUT and field generating antenna. The EUT was exposed to horizontal and vertical polarised field.

The test is performed in a 10 meter semi anechoic chamber.

Test signal:

Test generator settings:

Frequency			Settings		
Start	Stop	Step	Modulation	Mod. freq.	Field strength
80 MHz	2000 MHz	1 %	80 %	400 Hz	10 V/m (+2 dB) (-0/+6dB)

Dwell time 1,6 sec.

Exclusion band (if any):

NA

Cable configuration during test:

NA

EUT configuration during test:

EUT was placed vertically on a pedestal and exposed to both horizontal and vertical RF field. The EUT was 0,8 meters above ground and floor between EUT and field generating antenna was covered with absorbers.

EUT mode during test:

The EUT was tested in normal operating mode receiving interrogation "radar" pulses and responding with the swept burst

Test Level:

Test level was 10 V/m (+2 dB)

Performance criteria for EUT:

During test: Operation as intended

After test: Operate as intended.

No loss of functions

No degradation of performance

No loss of stored data or user programmable functions

Results:

Frequency (MHz)	EUT side facing the RF field and polarity of the RF field	Field strength (V/m)	Performance (se Note)	
			During test	After test
80 - 2000	Hor/Vert	10 (+ 2dB)	1)	1)
Measurement Uncertainty (generating disturbing signal):			+2,1 / -2,4 dB	

Note:

1) Within the performance criteria described above.

Test Equipment Used: 4, 7, 8, 10, 12, 13, 16

5.2 Electrostatic Discharge (ESD) Immunity Test.

IEC 60945

The Electrostatic Discharges were applied according to the following test plan:

Discharges applied to EUT		ESD generator:			Result
Application mode:	Test point	Voltage (kV)	Coupling mode:	Number of discharges	
DA	EUT Enclosure, metallic screws	+/- 6,6	CD	> 10	P
DA	EUT Enclosure, all sides	+/- 8,6	AD	> 10	P
IA	Horizontal Coupling Plane (HCP)	+/- 6,6	CD	> 10	P
IA	Vertical Coupling Plane (VCP)	+/- 6,6	CD	> 10	P

ABBREVIATIONS USED IN THE TABLE:

Application mode: DA = Direct application of discharges; IA = Indirect application of discharges
Coupling mode: CD = Contact discharges mode; AD = Air discharges mode

Cable configuration during test:

NA

Test set-up:

The test set-up was according to EN 61000-4-2 clause 7.1. A Ground Reference Plane (GRP) of 5 mm thick aluminium (2mx4m) was placed on the floor. The GRP was connected to the protective earth with a 10 mm² thick copper cable.

The EUT was tested as a TABLE TOP EQUIPMENT according to EN 61000-4-2, clause 7.1.1 and the test set-up consists of the following: A wooden table (0.8 m high) was located on the GRP. A Horizontal Coupling Plane (HCP) consisting of 1.5mm thick aluminium (0.8mx1.6m) was placed on the table. An insulating bakelite plate (0.5 mm thick) was placed on the HCP and the EUT was placed on the insulating plate during the test.

EUT mode during test:

The EUT was switched on during test but not in interrogated mode.

Test Level:

The test level was selected on basis of IEC 60945.

Performance criteria for EUT:

After each exposure: NA
After the test: Operate as intended.
No loss of functions
No degradation of performance
No loss of stored data or user programmable functions

Results:

The EUT was interrogated after the test for performance check.

The EUT complies with the requirements.

Test Equipment Used: 14

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory.

No	Instrument/Ancillary	Type	Manufacturer	Ref. No.
1	Spectrum analyzer	FSEK30	R&S	LR 1337
2	Spectrum analyzer	R3271	Advantest	LR 1188
3	RF-generator	SMP04	R&S	LR 1336
4	RF-generator	7200	Gigatronics	LR 1188
5	AF-generator	SPN	R&S	LR 1018
6	Antenna	HL 023A1	R&S	LR 282
7	Horn antenna	3161-01	EMCO	LR 1178
8	EMC software	SI-200	EMC Automation	LR 1353
9	Field probe	FP4000	Amplifier Research	LR 1352
10	Generator	SMT 03	R&S	LR 1230
11	Horn antenna	PM7320X	Sivers Lab	LR 102 / 103
12	Amplifier	500W AF500	Amplifier Research	LR 1354
13	Amplifier	25S1G4A	Amplifier Research	LR 1432
14	ESD generator	NSG435	Schaffner	LR 1281
15	Antenna Horn	3115	EMCO	LR 1330
16	Power meter	NRVD	R&S	LR 1347
17	Test Receiver	ESN	R&S	LR 1237
18	Amplifier	8449B	HP	LR 1322
19	Antenna Loop	HFH Z-2	R&S	LR 285
20	Antenna Biconical	HK 116	R&S	LR 1260
21	Antenna Logperiodic	HL 223	R&S	LR 1261
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7 Measurement results

7.1 EUT Active mode

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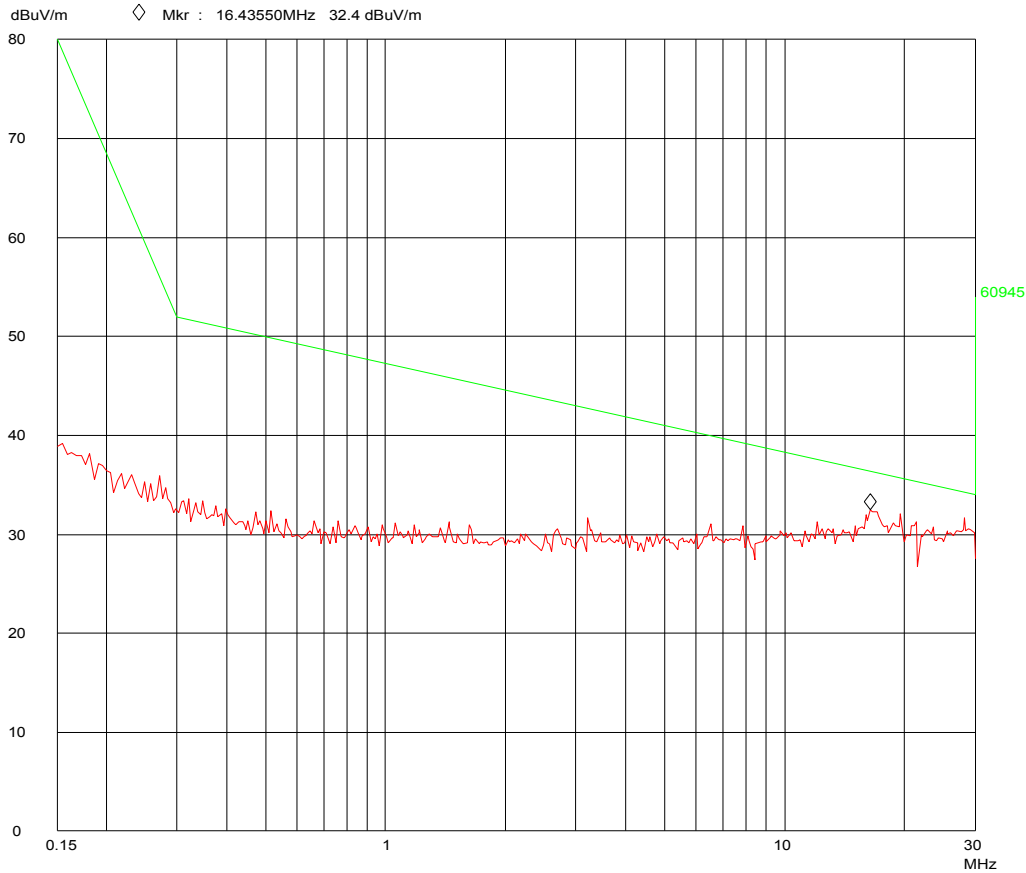
19. Sep 07 16:14

Peak

Operator: Egh
Comment: Tron SART20
Jotron
VP
60945
Active Radar Transponder

Scan Settings (1 Range)
----- Frequencies -----||----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
150k 30M 4.5k 9k PK 50ms AUTO LN OFF 60dB

Transducer No. Start Stop Name
13 10k 30M HFH2Z2



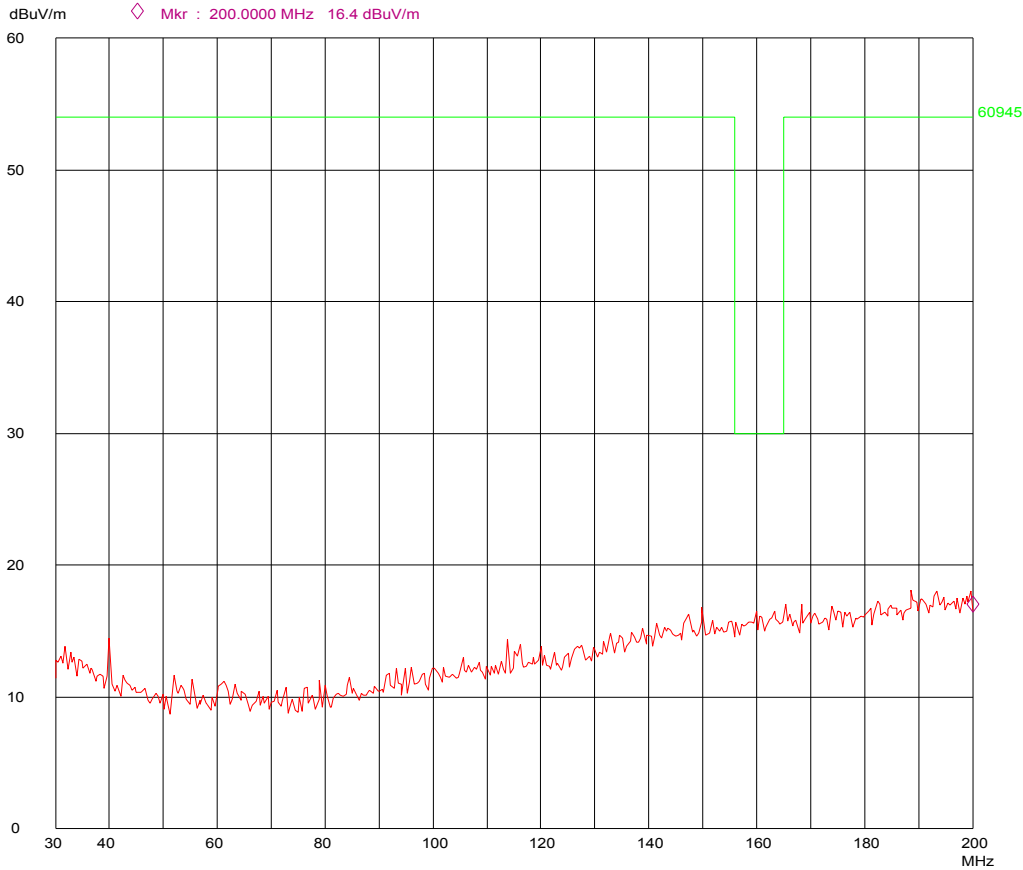
Nemko Comlab
PK

19. Sep 07 13:36

EUT: Tron SART20
Manuf: Jotron AS
Op Cond: 1 m VP
Operator: Egh
Test Spec: 60945 Table Clause 9.3
Comment: Active Radar Transponder

Scan Settings (1 Range)
----- Frequencies -----|----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 200M 50k 120k PK 50ms AUTO LN ON 60dB

Transducer No. Start Stop Name
20 30M 200M HK116



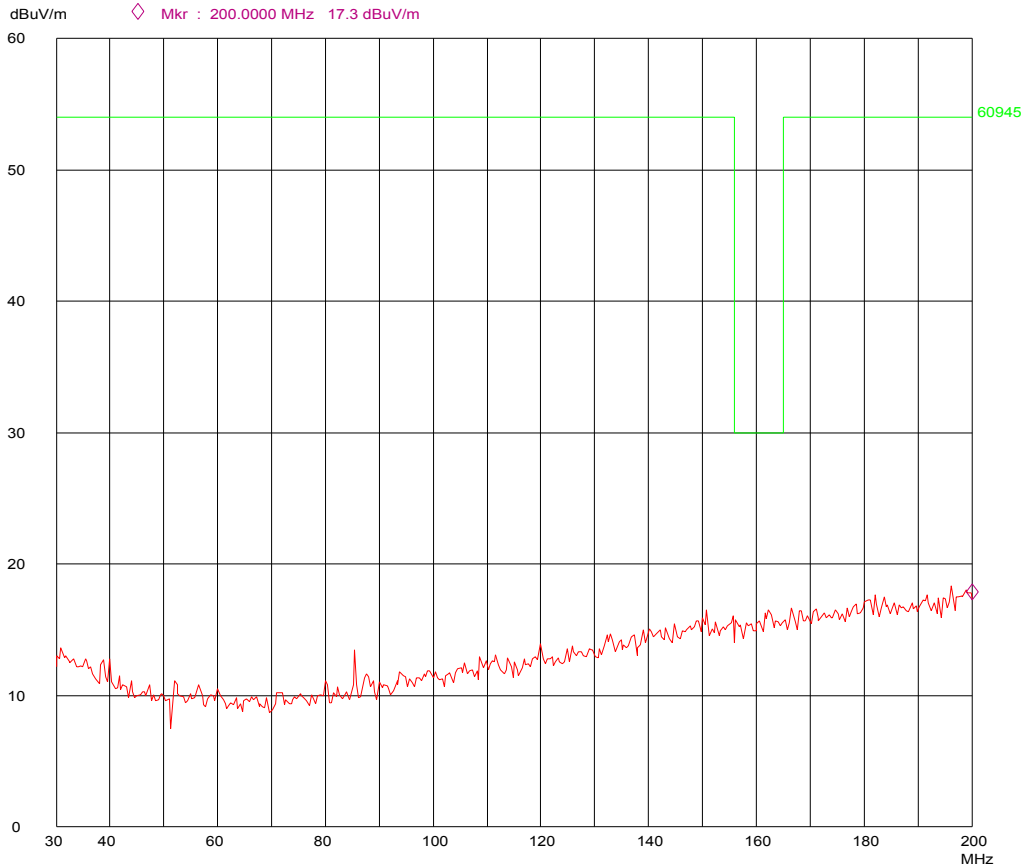
Nemko Comlab
PK

19. Sep 07 13:48

EUT: Tron SART20
Manuf: Jotron AS
Op Cond: 1 m HP
Operator: Egh
Test Spec: 60945 Table Clause 9.3
Comment: Active Radar Transponder

Scan Settings (1 Range)
----- Frequencies -----||----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 200M 50k 120k PK 50ms AUTO LN ON 60dB

Transducer No. Start Stop Name
20 30M 200M HK116

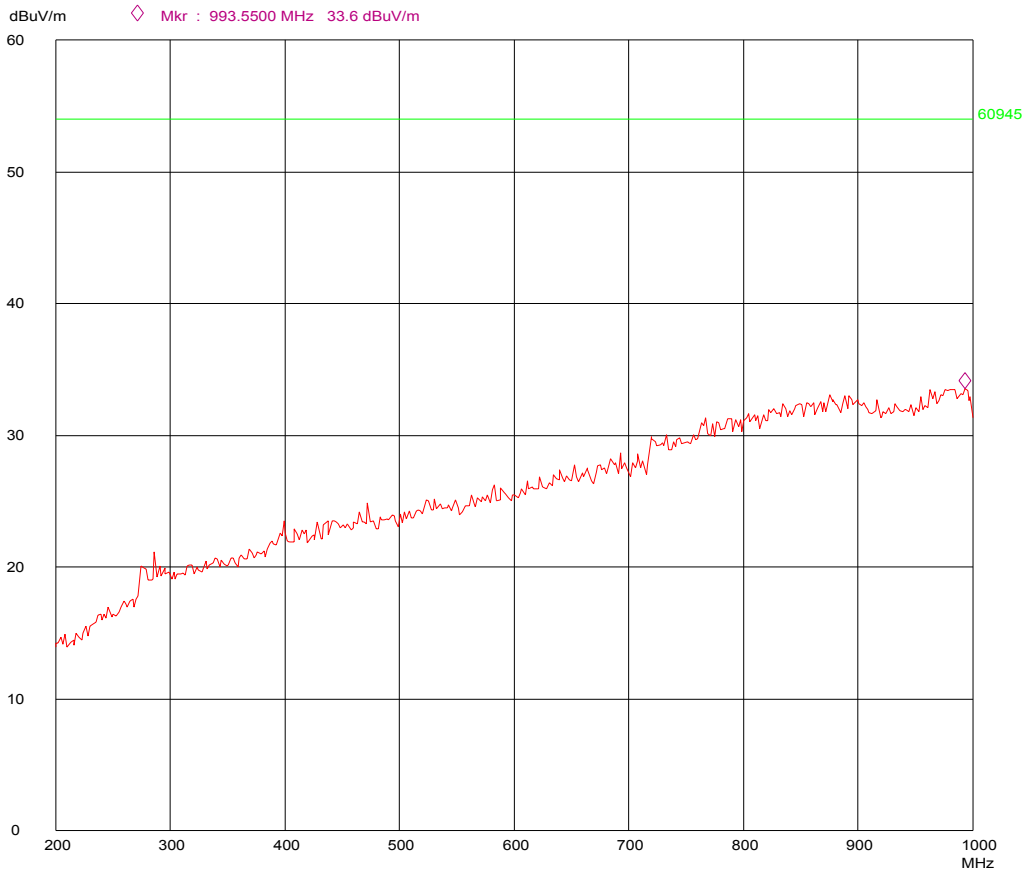


Nemko Comlab
PK

19. Sep 07 14:10

EUT: Tron SART20
Manuf: Jotron AS
Op Cond: 1 m VP
Operator: Egh
Test Spec: 60945 Table Clause 9.3
Comment: Active Radar Transponder

Scan Settings (1 Range)									
Frequencies					Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB	
Transducer No. Start Stop Name									
21	200M	1000M	HL223						



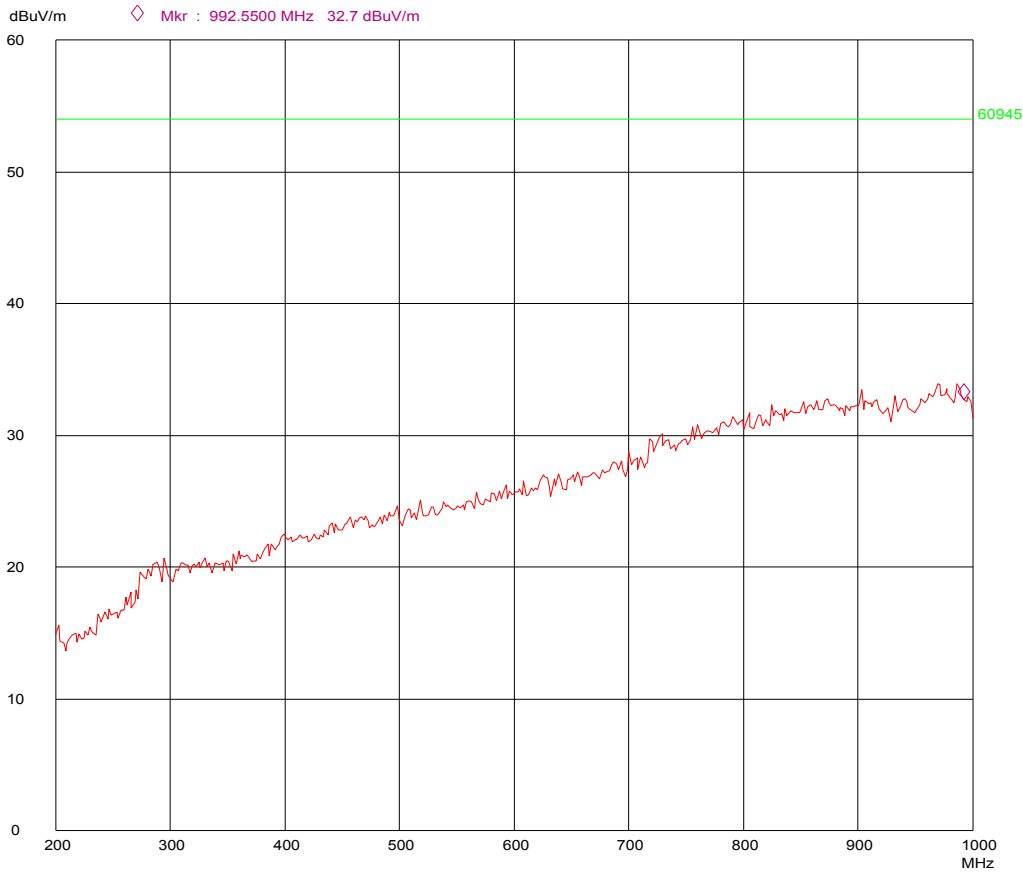
Nemko Comlab
PK

19. Sep 07 14:25

EUT: Tron SART20
Manuf: Jotron AS
Op Cond: 1 m HP
Operator: Egh
Test Spec: 60945 Table Clause 9.3
Comment: Active Radar Transponder

Scan Settings (1 Range)
----- Frequencies -----|----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
200M 1000M 50k 120k PK 50ms AUTO LN ON 60dB

Transducer No. Start Stop Name
21 200M 1000M HL223



NEMKO COMLAB

19. Sep 07 15:06

Peak

Operator: Egh

Comment: SatLink 8550
Tron SART20
VP
60945
Active Radar Transponder

Scan Settings (1 Range)									
Frequencies					Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
1000M	2000M	50k	120k	PK	50ms	AUTO	LN OFF	60dB	

Transducer No.

Start

Stop

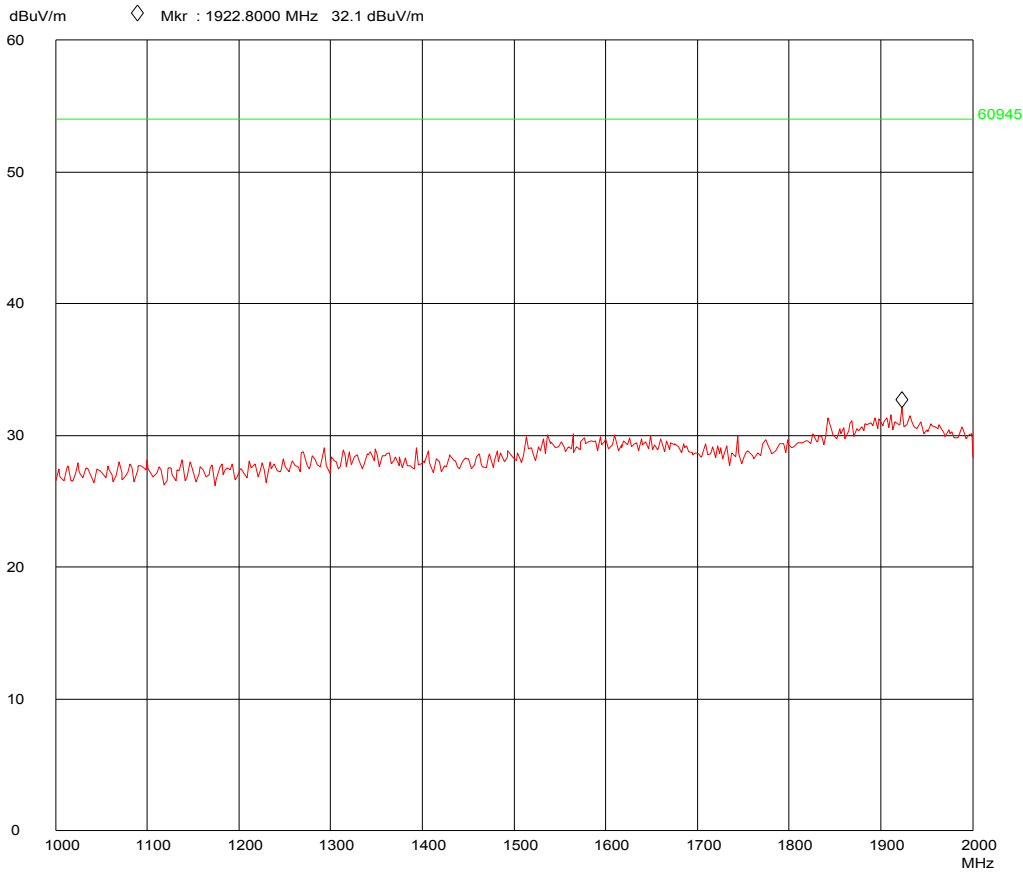
Name

10

1000M

2000M

LR1330hp



NEMKO COMLAB

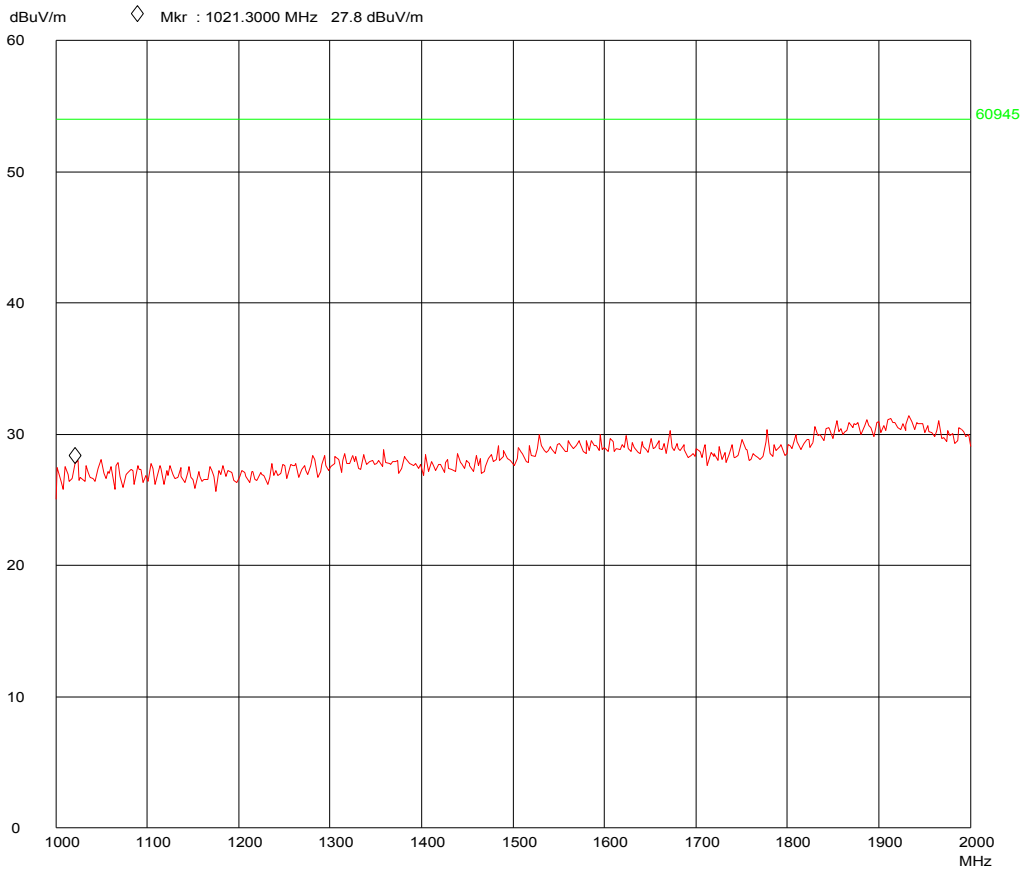
19. Sep 07 15:28

Peak

Operator: Egh
Comment: SatLink 8550
Tron SART20
HP
60945
Active Radar Transponder

Scan Settings (1 Range)
----- Frequencies -----|----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
1000M 2000M 50k 120k PK 50ms AUTO LN OFF 60dB

Transducer No. Start Stop Name
10 1000M 2000M LR1330hp



7.2 EUT Standby mode

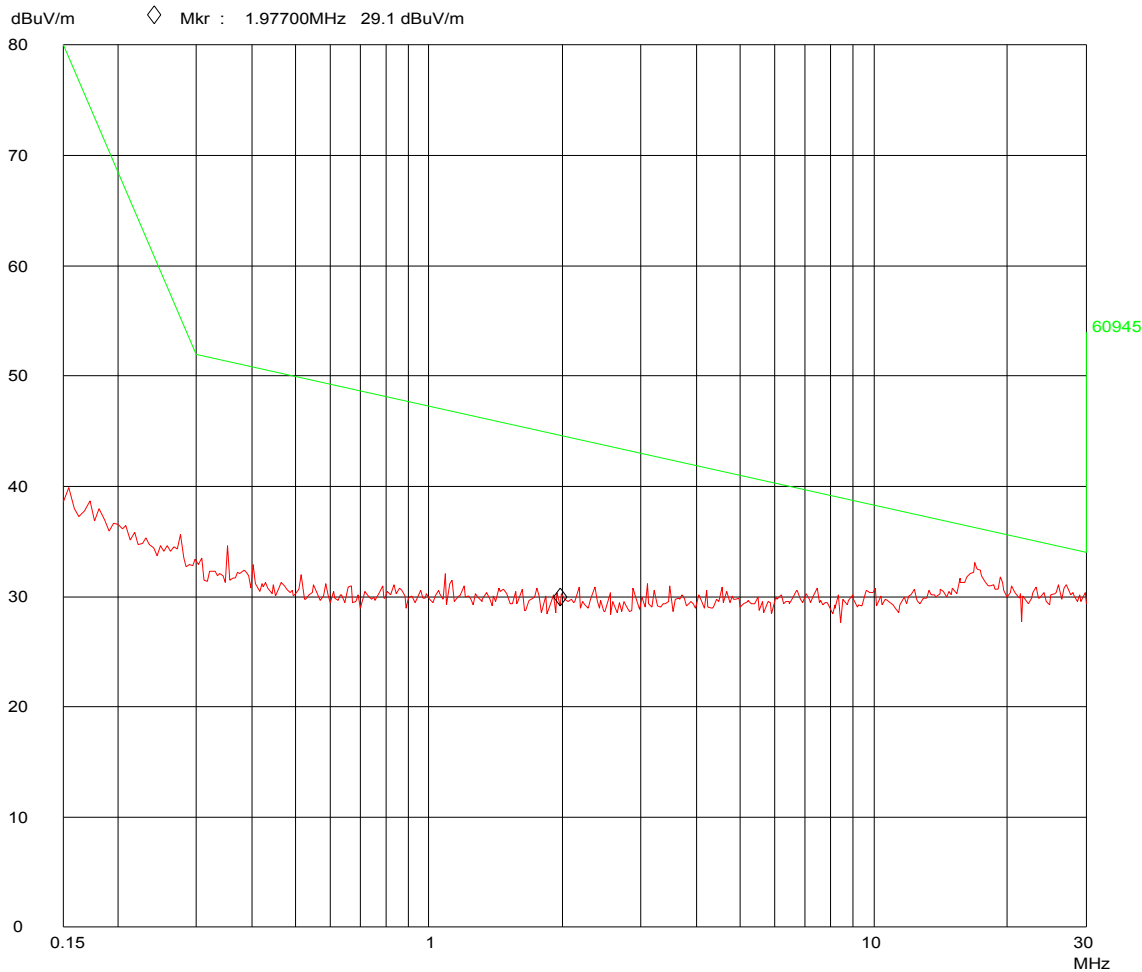
NEMKO COMLAB
Peak

19. Sep 07 16:24

Operator: Egh
Comment: Tron SART20
Jotron
VP
60945
Radar Transponder
Standby

Scan Settings (1 Range)
----- Frequencies -----|----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
150k 30M 4.5k 9k PK 50ms AUTO LN OFF 60dB

Transducer No. Start Stop Name
13 10k 30M HFH2Z2



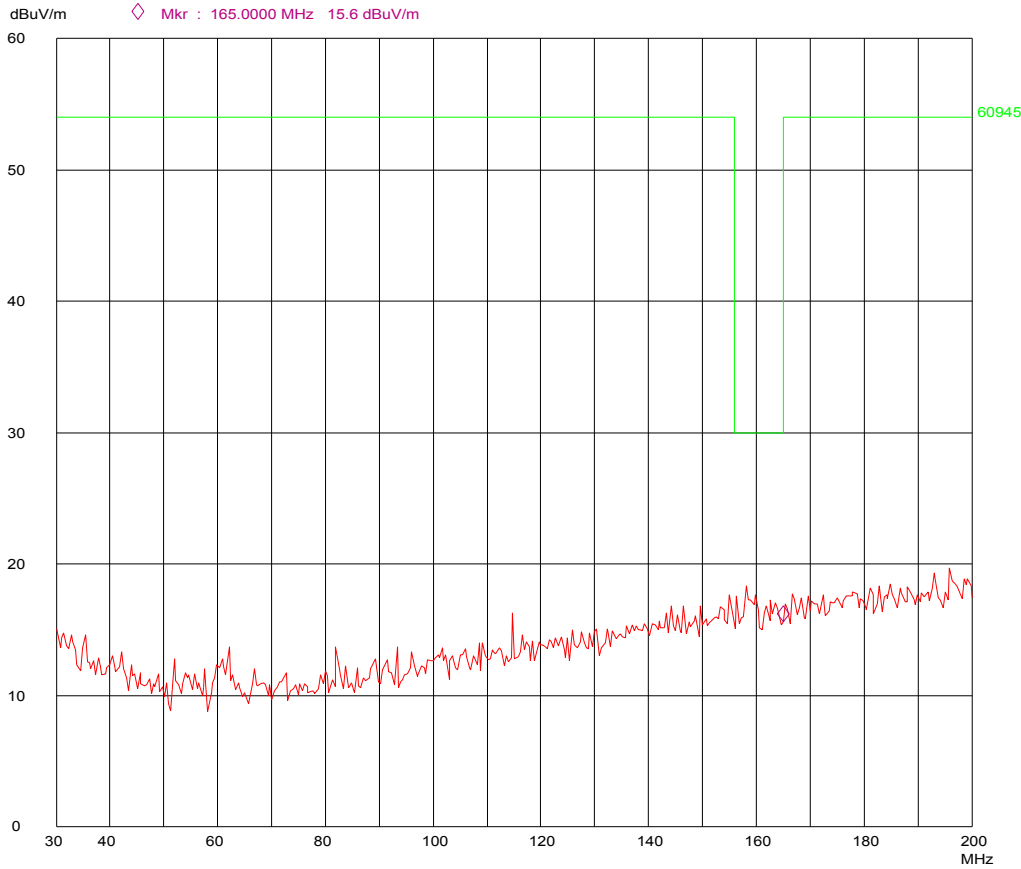
Nemko Comlab
PK

19. Sep 07 14:00

EUT: Tron SART20
Manuf: Jotron AS
Op Cond: 1 m HP
Operator: Egh
Test Spec: 60945 Table Clause 9.3
Comment: Radar Transponder Standby

Scan Settings (1 Range)
----- Frequencies -----||----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 200M 50k 120k PK 50ms 0dBLN ON 60dB

Transducer No. Start Stop Name
20 30M 200M HK116



Nemko Comlab

PK

19. Sep 07 14:41

EUT:Tron SART20

Manuf:Jotron AS

Op Cond:1 m HP

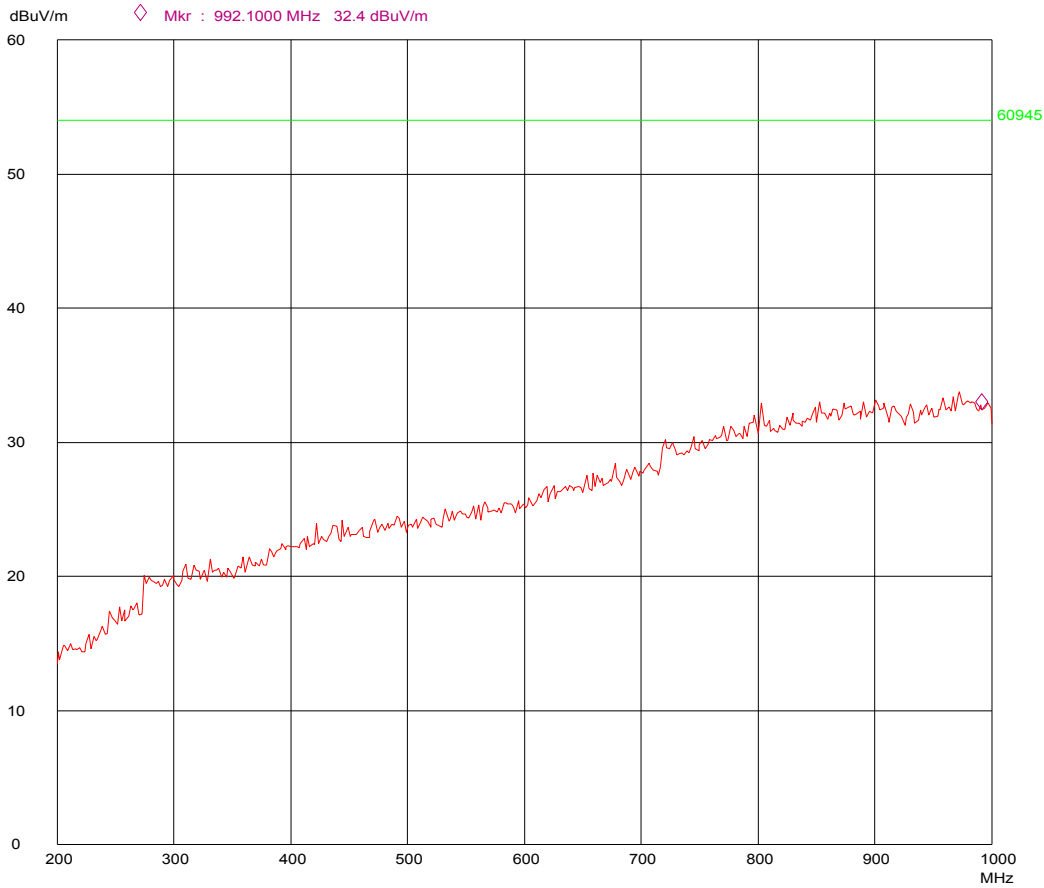
Operator:Egh

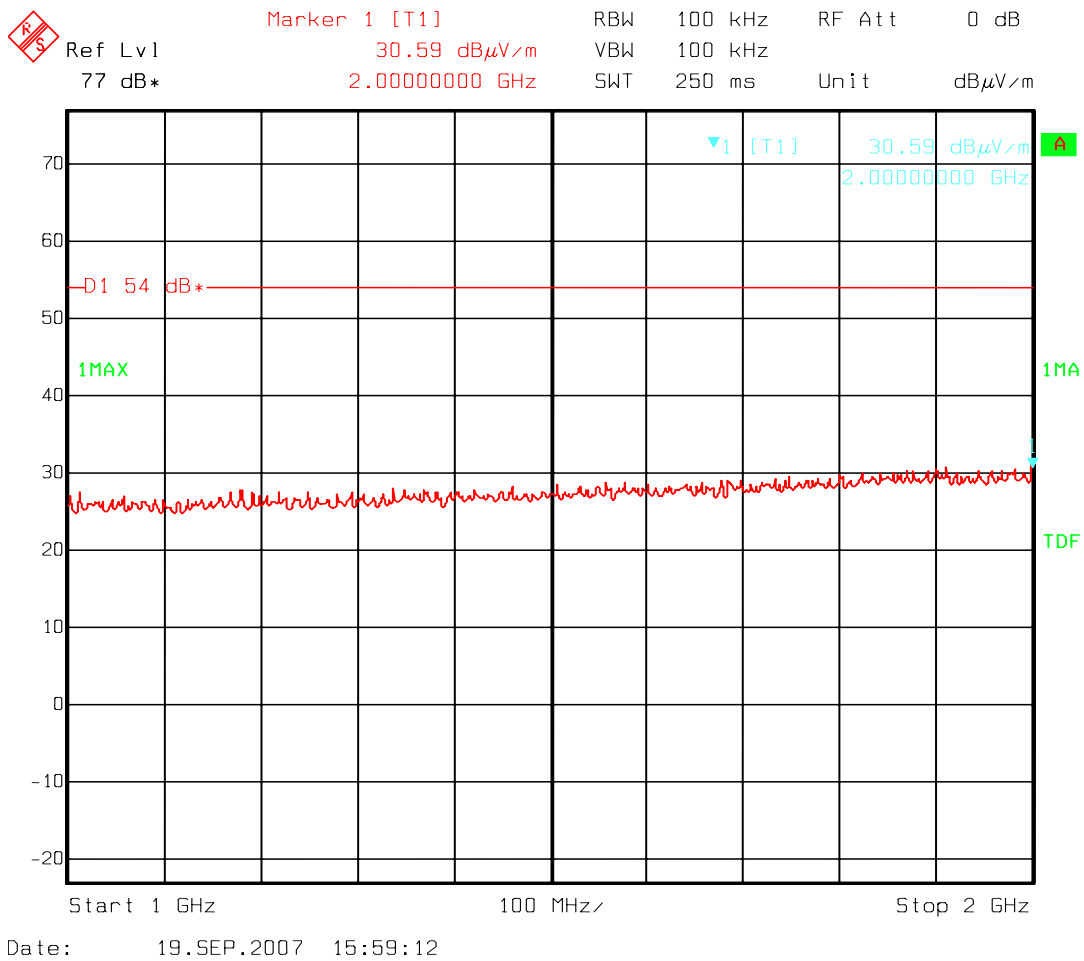
Test Spec:60945 Table Clause 9.3

Comment:Radar Transponder Standby mode

Scan Settings (1 Range)									
Frequencies					Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB	

Transducer No.	Start	Stop	Name
21	200M	1000M	HL223





8 TEST SETUP

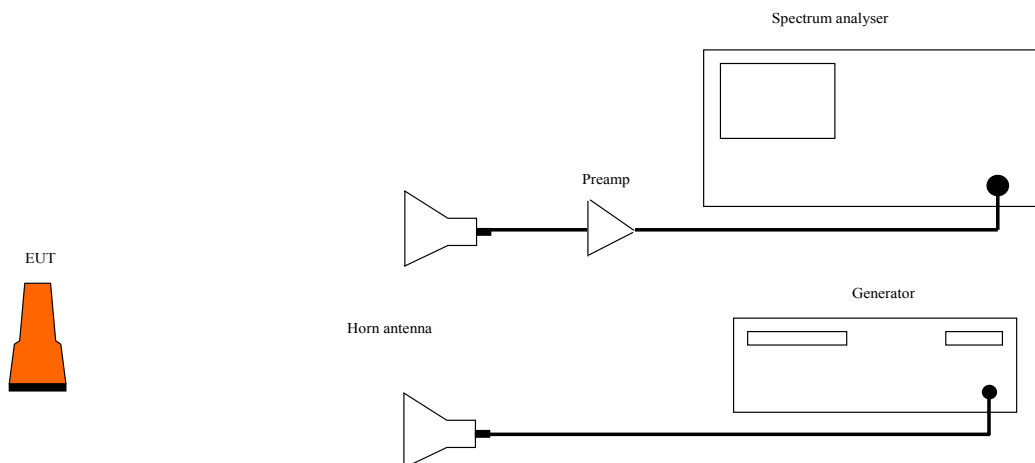


Figure 1: Shows the setup to interrogate and monitor during spurious emissions measurement and immunity test

9 PICTURES



Picture 1: Shows the measurement setup during spurious measurements, in this case the 30 – 200 MHz range.



Picture 2: Shows the measurement setup during immunity testing,
in this case the 80 – 1000 MHz range.