



Nemko Test Report: 103127RUS1

Applicant: Magneti Marelli Sistemi Elettronici
Viale C. Emanuele II, 148
IT 10078 – Venaria
Italy

**Equipment Under Test:
(E.U.T.)** N145BT

In Accordance With: **FCC Part 15, Subpart C, 15.247 and
Industry Canada, RSS-210, Issue 7**
Frequency Hopping Transmitters

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, Texas 75057-3136

TESTED BY:



David Light, Senior Wireless Engineer

DATE: 30 June 2008

APPROVED BY:



DATE: 1 July, 2008

Total Number of Pages: 31

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Section 1. Summary of Test Results

Manufacturer: Magneti Marelli Sistemi Elettronici

Model No.: N145BT

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 and Industry Canada RSS-210 for Frequency Hopping Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

New Submission

Production Unit

Class II Permissive Change

Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



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Summary of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	FCC 15.207(a) & RSS Gen 7.2.3.1	Complies
Channel Separation	FCC 15.247(a)(1) & RSS-210 A8.1(a)	Complies
Time of Occupancy	FCC 15.247(a)(1) & RSS-210 A8.1(d)	Complies
20 dB Occupied Bandwidth	FCC 15.247(a)(1) & RSS-210 A8.1(a)	Complies
Peak Power Output	FCC 15.247(b) & RSS-210 A8.4(2)	Complies
Spurious Emissions(Conducted)	FCC 15.247(d) & A8.5	Complies
Spurious Emissions (Radiated)	FCC 15.247(d) & A8.5	Complies
Receiver Spurious Emissions	RSS-Gen 7.2.2	Complies

Footnotes:

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band: 902 – 928 MHz
 2400 – 2483.5 MHz
 5725 – 5850 MHz

Operating Frequency Range: 2402 to 2480 MHz

Number of Channels: 79

Channel Spacing: 1 MHz

Antenna: Integral antenna, gain -1.7 dBi (The radio was provided with a 50 ohm test connection for test purposes)

User Frequency Adjustment: None

Description of EUT

N145BT Multi Media System includes the vehicle radio system with AUDIO CD player/CD ROM drive/MP3 CD player, GSM Dual Band mobile telephone (also available in USA version), navigator, onboard computer and MP3 jukebox.

The GSM radio module is a previously certified radio module FCC ID.: O9EQ24AU001.

Section 3. Channel Separation

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1) & RSS-210 A8.1(a)
TESTED BY: David Light	DATE: 30 June 2008

Test Results: Complies.

Measurement Data: See 20 dB BW plot

Measured 20 dB bandwidth: 1 MHz
Channel Separation: 1 MHz

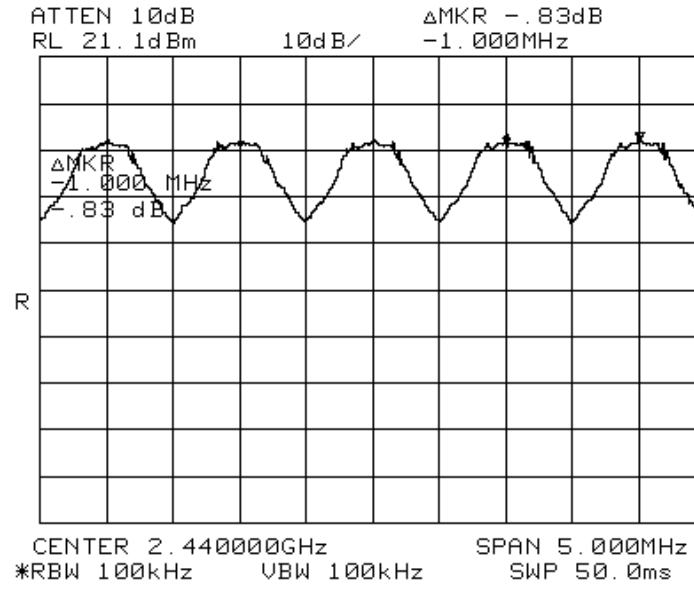
Equipment Used: 1464-1472-1082

Measurement Uncertainty: 1X10⁻⁷ppm

Temperature: 22 °C

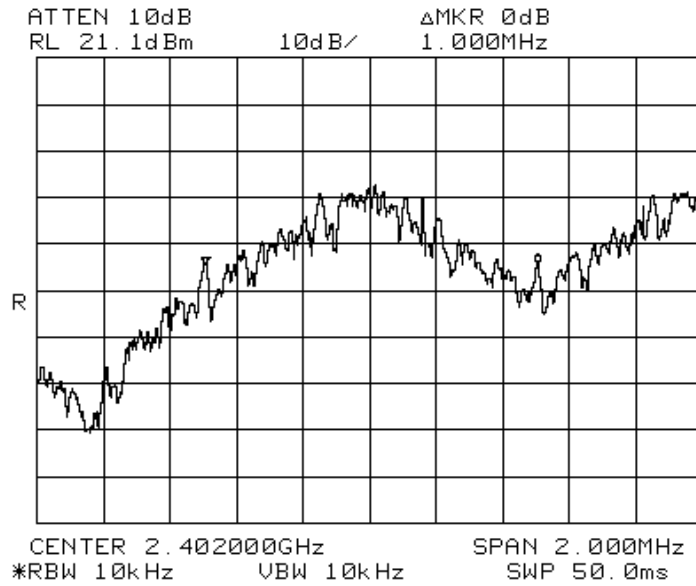
Relative Humidity: 35 %

Test Data – Channel Separation



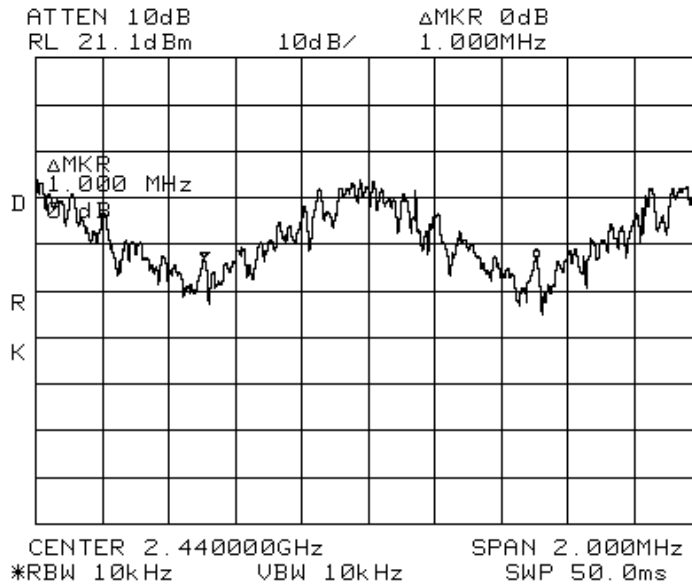
Test Data – 20 dB Bandwidth

Low Channel

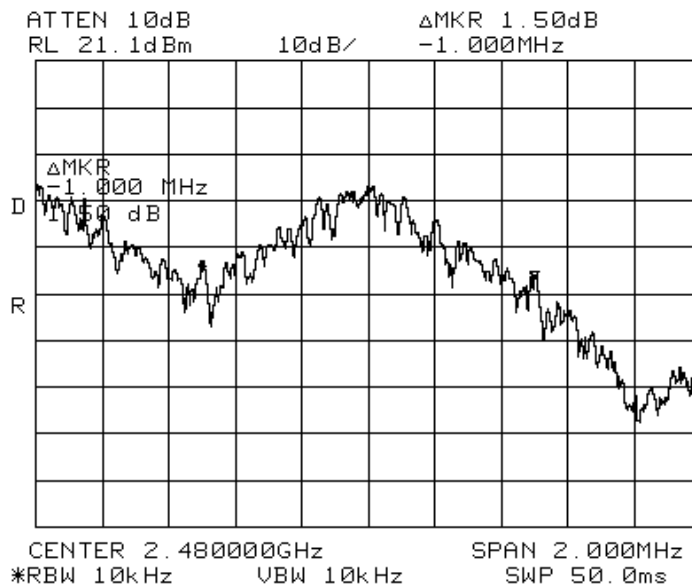


Test Data – 20 dB Bandwidth

Mid Channel

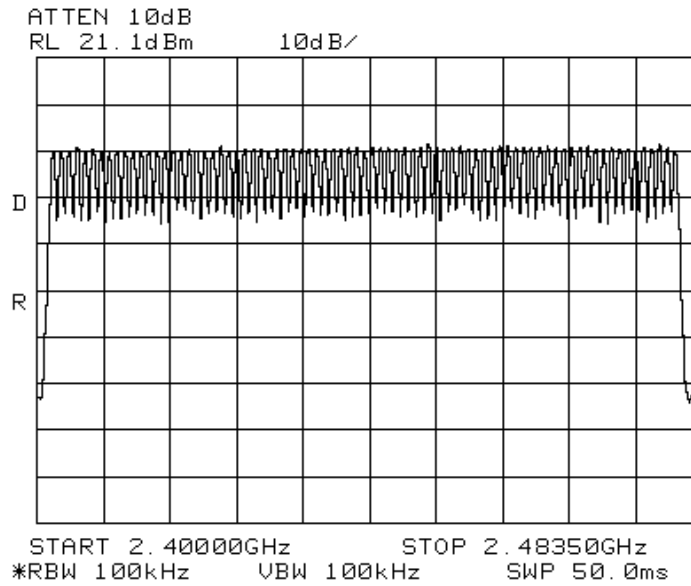


High Channel



Test Data – Time of Occupancy

79 Channels.



Section 6. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b) & RSS-210 A8.4(2)
TESTED BY: David Light	DATE: 30 June 2008

Test Results: Complies.

Measurement Data:

Detachable antenna? Yes No
 If yes, state the type of non-standard connector used:

Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Gain (dBi)	E.I.R.P. (dBm)	E.I.R.P. (mW)
2402	2.9	1.95	-1.7	1.2	1.3
2441	3.6	2.29	-1.7	1.9	1.5
2480	3.1	2.04	-1.7	1.4	1.4
Maximum EIRP (W): 1.5 mW					

Analyzer Settings: RBW = VBW = 2 MHz, Peak detector

- This device was tested at +/- 15% input power per 15.31(e), with no variation in output power.
- For battery powered equipment, the device was tested with a fresh battery per 15.31(e).
- The device was tested on three channels per 15.31(l).
- This test was performed radiated.

Equipment Used: 1464-1472-1082

Measurement Uncertainty: 1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

Section 6. Spurious Emissions (Antenna Conducted)

NAME OF TEST: Spurious Emissions (Conducted)	PARA. NO.: 15.247(d) & RSS-210 A8.5
TESTED BY: David Light	DATE: 30 June 2008

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used: 1464-1082-1472

Measurement Uncertainty: 1X10⁻⁷ppm

Temperature: 22 °C

Relative Humidity: 35 %

Section 7. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(d) & RSS-210 A8.5
TESTED BY: David Light	DATE: 27 June 2008

Test Results: Complies.

Measurement Data: See attached table.

Notes:

- For handheld devices, the EUT was tested on three orthogonal axis'
- The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33
- The device was tested on three channels per 15.31(l).
- No emissions were detected within 20 dB of the specification limit therefore none are reported per 15.31(o). Band edge data (noise floor) is presented below.

Equipment Used: 1464-1484-1485-1016-993

Measurement Uncertainty: +/-3.6 dB

Temperature: 22 °C

Relative Humidity: 35 %

Test Data - Radiated Emissions

Freq MHz	Rdng dBµV	Cable dB	Cable dB	AF dB	Pre-Amp dB	Corr dBµV/m	Spec dBµV/m	Margin dB	Antenna Polarity
2483.5	42.3	+0.8	+2.3	+29.0	-32.8	41.6	54.0 TX 2480	-12.4	Vert
2483.5	44.3	+0.8	+2.3	+29.0	-32.8	43.6	54.0 TX 2480	-10.4	Horiz

Corrected reading = Rdng + Cable loss + AF + PreAmp

Analyzer Settings: RBW = VBW = 1 MHz, Peak detector.

All measurements are peak unless otherwise noted.

Section 8. Receiver Spurious Emissions

NAME OF TEST: Receiver Spurious Emissions	PARA. NO.: RSS-Gen 7.2.2
TESTED BY: David Light	DATE: 30 June 2008

Test Results: Complies. There were no emissions detected. The data presented is with the radio in receive scan mode.

Test Data: Refer to attached plots

Equipment Used: 1464-1082

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/24/07	01/24/09
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1484	Cable	Storm PR90-010-072	N/A	05/07/08	05/07/09
1485	Cable	Storm PR90-010-216	N/A	05/07/08	05/07/09
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/07/08	05/07/09
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/30/08

ANNEX A - TEST DETAILS

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
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Minimum Standard:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)
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Minimum Standard:

Frequency Band (MHz)	20 dB Bandwidth	No. of Hopping Channels	Average Time of Occupancy
902 - 928	<250 kHz	50	=<0.4 sec. in 20 sec.
902 - 928	=>250 kHz	25	=<0.4 sec. in 10 sec.
2400 - 2483.5	-----	75	=<0.4 sec. in 0.4 seconds multiplied by the number of hopping channels employed.
5725 - 5850	-----	75	=<0.4 sec. in 30 sec.

Method Of Measurement:

The spectrum analyzer is set as follows:

- RBW: 1 MHz
- VBW: = RBW
- Span: 0 Hz
- LOG dB/div.: 10 dB
- Sweep: Sufficient to see one hop time sequence.
- Trigger: Video

The occupancy time of one hop is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table

Avg. time of occupancy = (period from table/duration of one hop)/no. of channels multiplied by the duration of one hop.

For instance:

If a 2.4 GHz system has a measured hop duration time of 1 msec. and uses 75 channels, then the average time of occupancy would be:

$$(30 \text{ sec.}/.001 \text{ sec.})/75 \text{ chan.} = 400 \times 1 \text{ msec.} = 400 \text{ msec. or } 0.4 \text{ sec. in } 30 \text{ sec.}$$

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(1)
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Minimum Standard:

Frequency Band (MHz)	Maximum 20 dB Bandwidth
902 - 928	500 kHz
2400 – 2483.5	Not defined
5725 – 5850	1 MHz

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: At least 1% of span/div.

VBW: >RBW

Span: Sufficient to display 20 dB bandwidth

LOG dB/div.: 10 dB

Sweep: Auto

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247(b)
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Minimum Standard:

Frequency Band (MHz)	No. of Hopping Channels	Maximum Peak Power Output at Antenna Port
902 - 928	at least 50	1 watt
902 – 928	25 - 49	0.25 watts
2400 – 2483.5	75	1 watt
5725 – 5850	75	1 watt

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

Calculation Of EIRP For Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 20 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Spurious Emissions at Antenna Terminals PARA. NO.: 15.247(d)

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

Method Of Measurement:

30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level below center frequency.

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level above center frequency.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247(d)
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Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

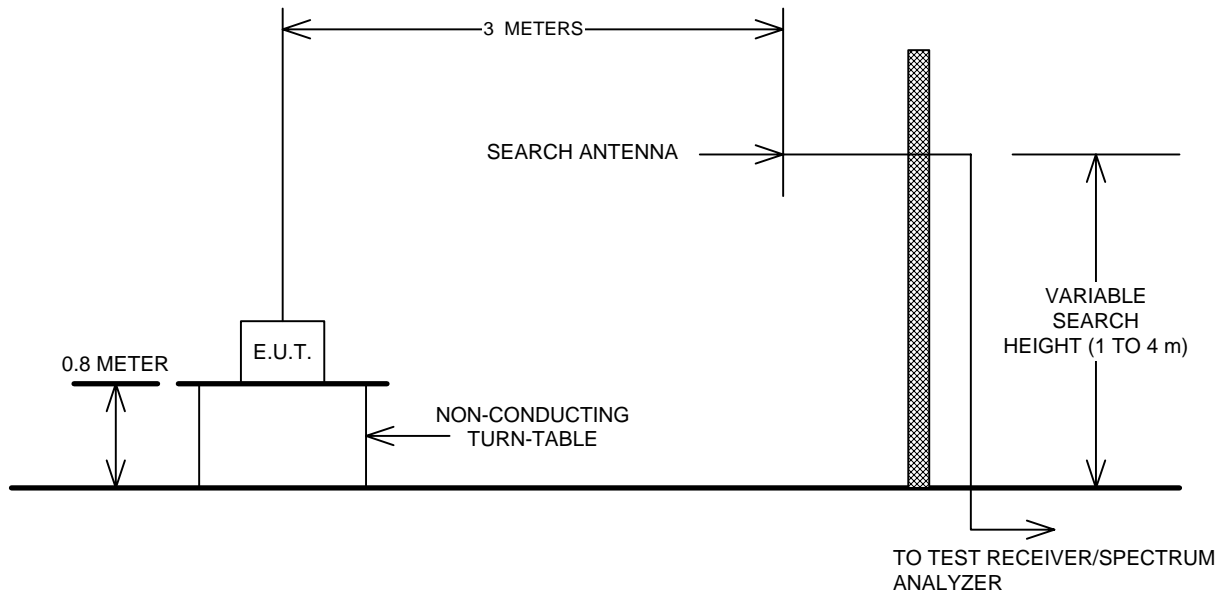
MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

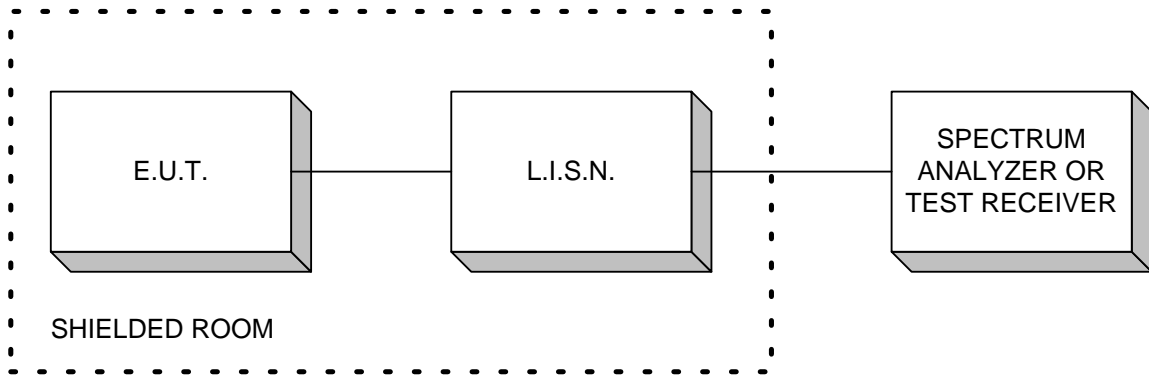
Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions



Conducted Emissions



Peak Power at Antenna Terminals

