Nemko Test Report: 37346RUS1

Applicant: ION Geophysical Corporation
850 Dorothy, Suite 504
Richardson, Texas 75081
USA
FCC ID: FCC ID: MCV-FSU2E

Equipment Under Test: (E.U.T.) FSU-2E

In Accordance With: **FCC Part 90, Subpart I**

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

TESTED BY: _____ **DATE:** **30 October 2009**
David Light, Senior Wireless Engineer

APPROVED BY: _____ **DATE:** **2 November 2009**
Tom Tidwell, Telecom Direct

Total Number of Pages: 33

Table of Contents

Section 1. Summary of Test Results

Manufacturer: ION Geophysical Corporation

Model No.: FSU-2

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 FCC Part 90, Subpart I.

☒ 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".

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	90.205	Table 1	Complies
Occupied Bandwidth	90.210	Mask D	Complies
Spurious Emissions at Antenna Terminals	90.210 Mask	D	Complies
Field Strength of Spurious Emissions	90.210 Mask	D	Complies
Frequency Stability	90.213	5 ppm	Complies
Transient Frequency Behavior	90.214	Mask	Complies

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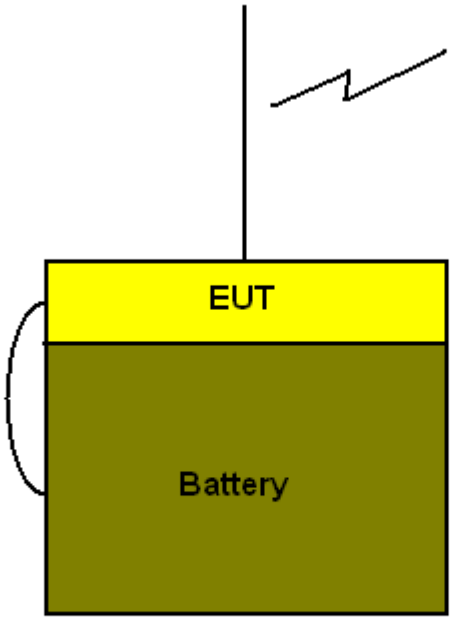
Section 2. General Equipment Specification

Supply Voltage Input:	12 Vdc Nominal
Frequency Range:	151.01 to 173.0 MHz
Necessary Bandwidth:	12.5 kHz
Emission Designator:	12K5GXW
Output Impedance:	50 ohms
RF Power Output (rated):	8 Watts
Channel Spacing(s):	12.5 kHz
Operator Selection of Operating Frequency:	Software controlled
Power Output Adjustment Capability:	Software controlled
Necessary BW [(data rate/2) x 2] + [deviation]:	(9600bps/2)x2 + 2900Hz = 12.5 kHz

System Description

Unit is a remote data collection system for Geophysical Survey utilizing a radio channel for command and control.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 29 October 2009

Measurement Results: Complies.

Measurement Data:

Frequency (MHz)	Measured Power (dBm)	Measured Power (Watts)	Rated Power (Watts)
151.01 39.1		8.1	8.0
160.00 38.8		7.6	8.0
173.00 39.4		8.7	8.0

Resolution BW: 300 kHz
Video BW: 300 kHz

Measurement Conditions:

Temperature: 20 °C
Humidity: 30 %

Measurement Uncertainty: +/- 1.7 dB

Test Equipment: 1036-1082-1472-1469

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 29 October 2009

Measurement Results: Complies.

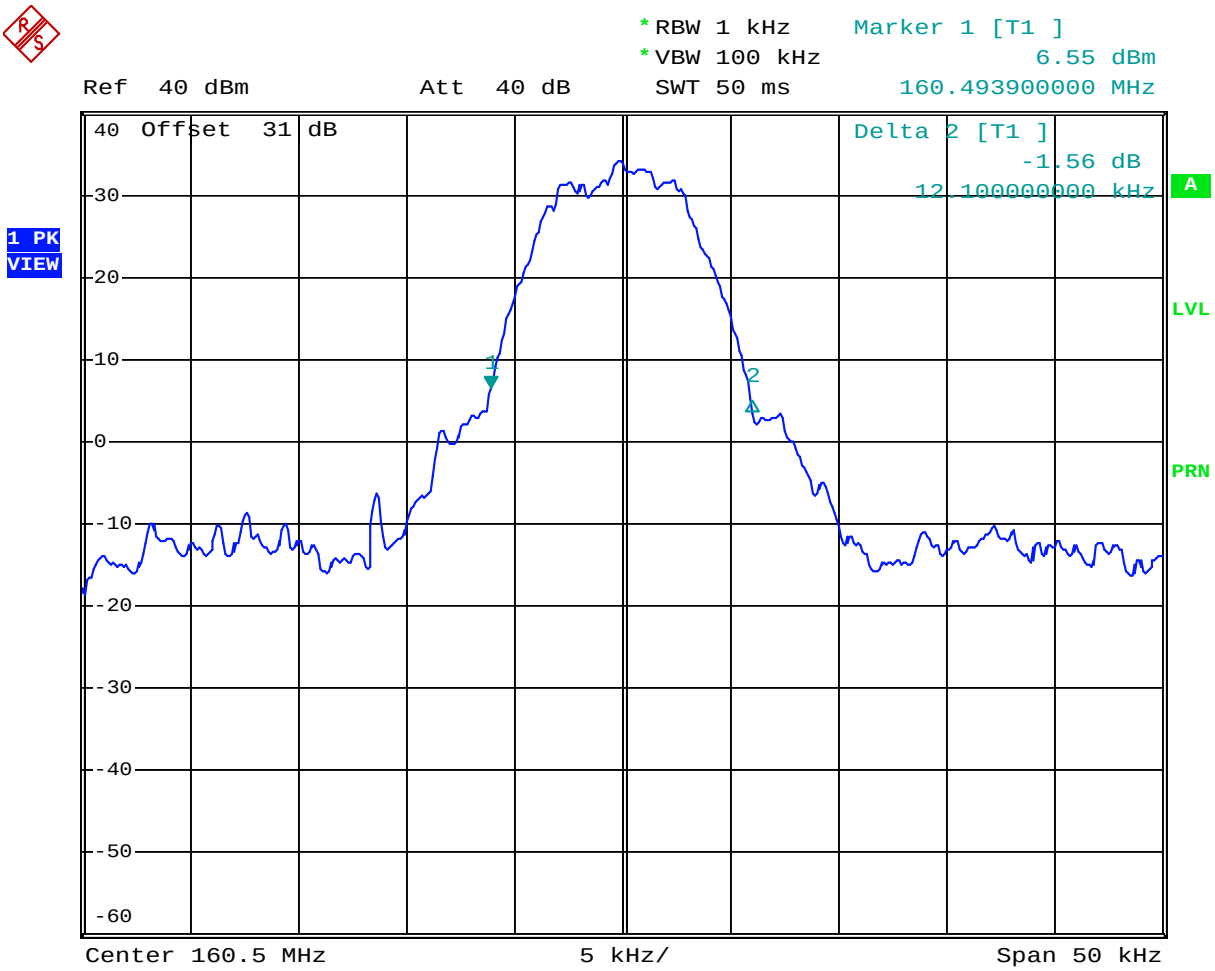
Measurement Data: See attached data

Measurement Conditions: Temperature: 20 °C
Humidity: 30 %

Measurement Uncertainty: **+/-** 1 X 10^{-7} ppm

Test Equipment: 1036-1082-1472-1469

Test Data – 99% Occupied Bandwidth



Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 29 October 2009

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: Temperature: 20 °C
Humidity: 30 %

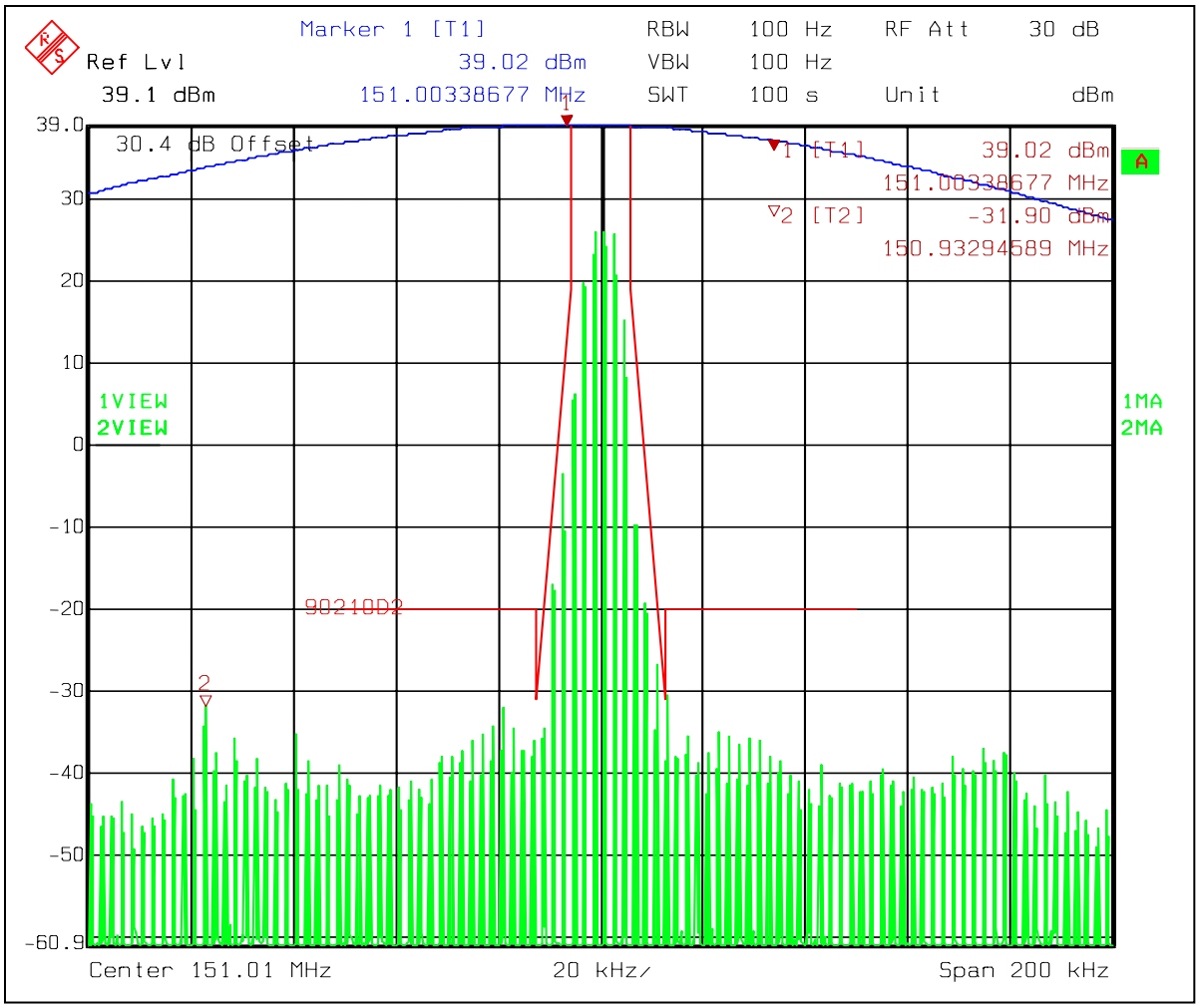
Measurement Uncertainty: **+/-** 1.7 dB

Test Equipment: 1036-1082-1472-1469

Test Data – Spurious Emissions

MASK D

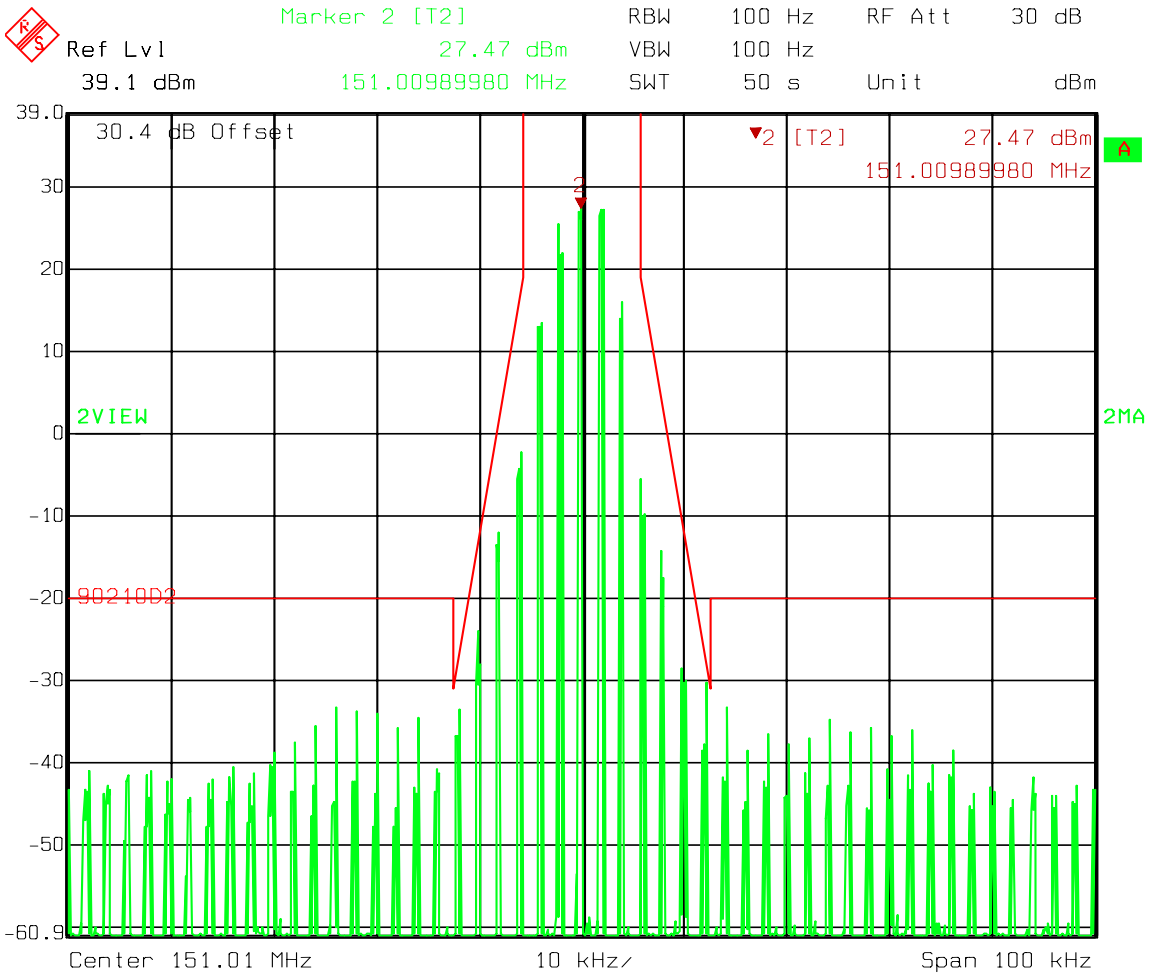
LOW CHANNEL



Test Data – Spurious Emissions

MASK D

LOW CHANNEL



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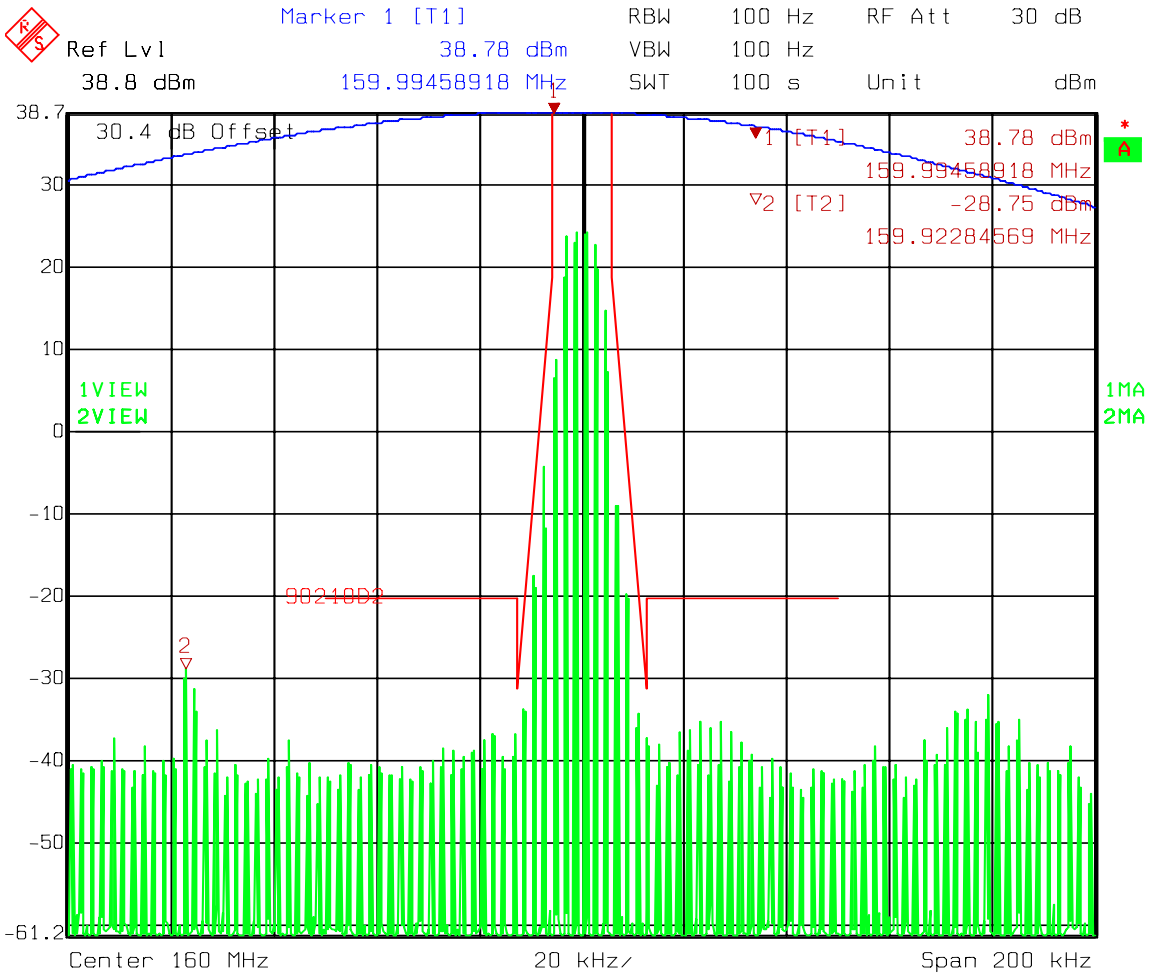
MID CHANNEL



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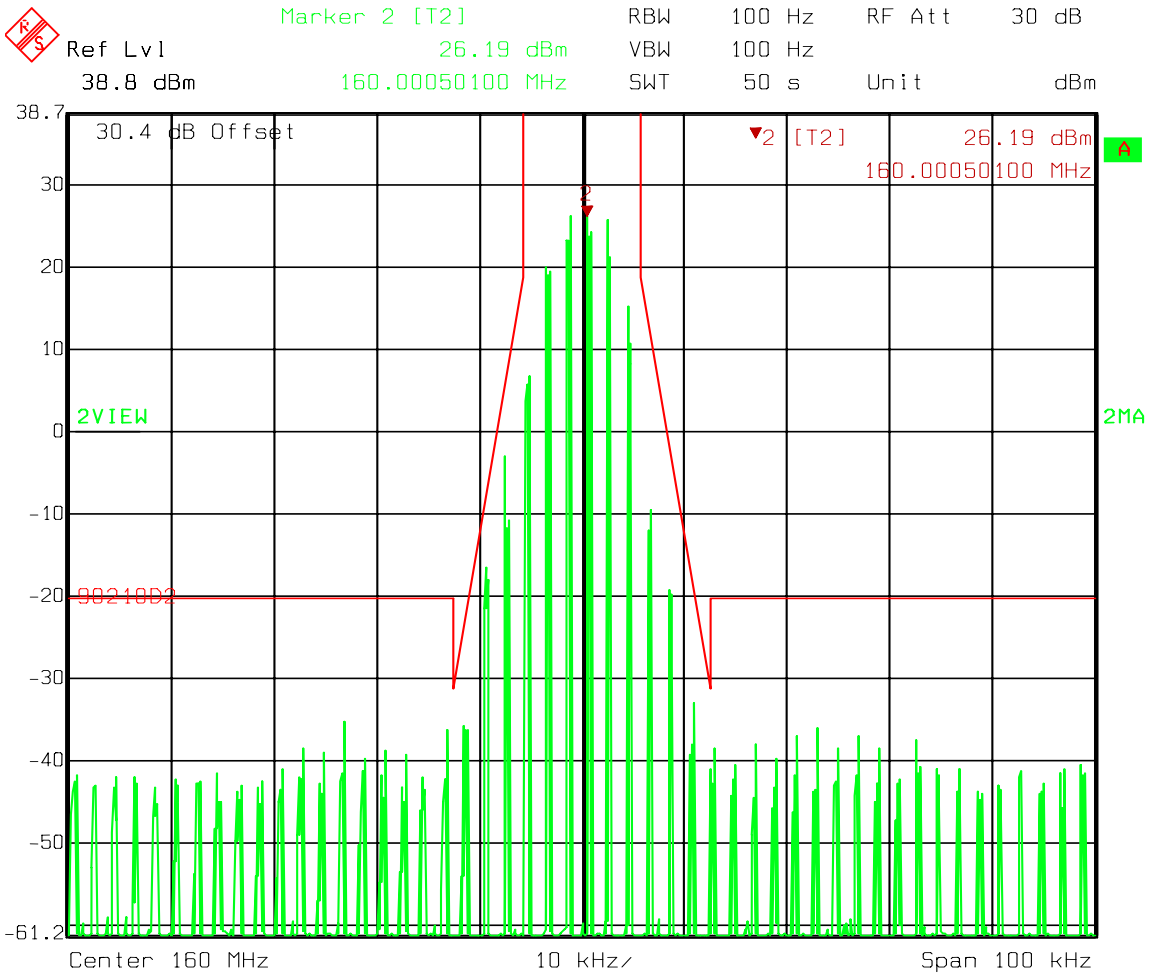
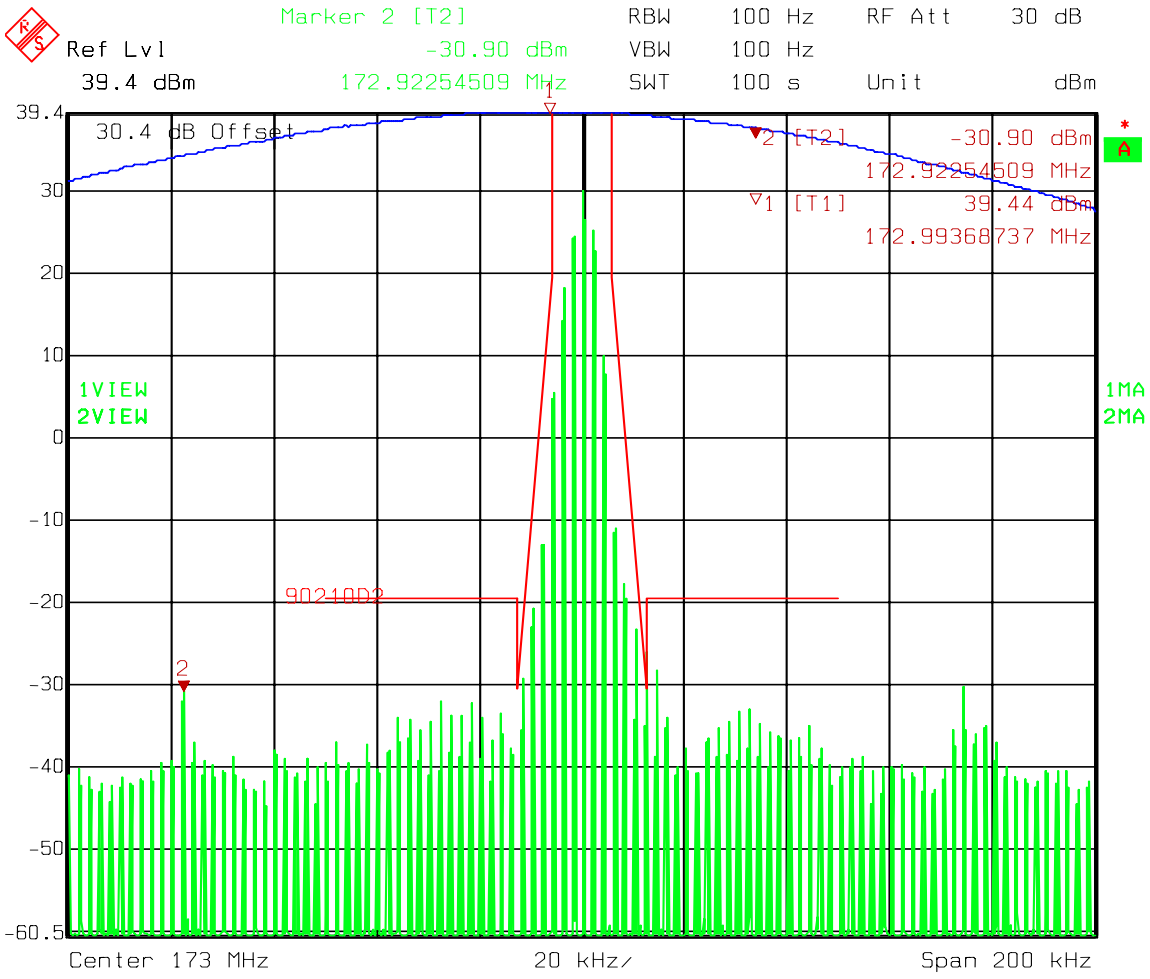
MID CHANNEL



Test Data – Spurious Emissions

MASK D

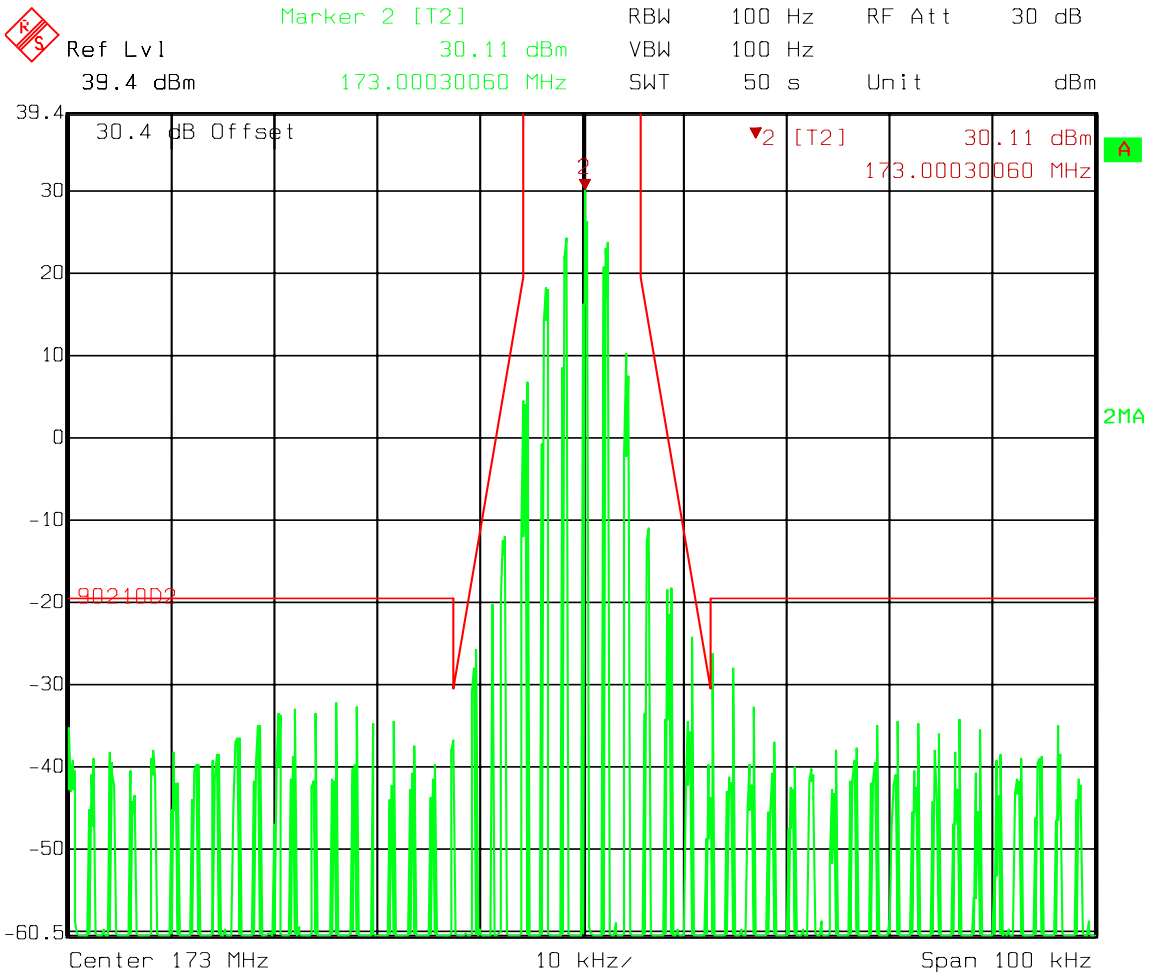
HIGH CHANNEL



Test Data – Spurious Emissions

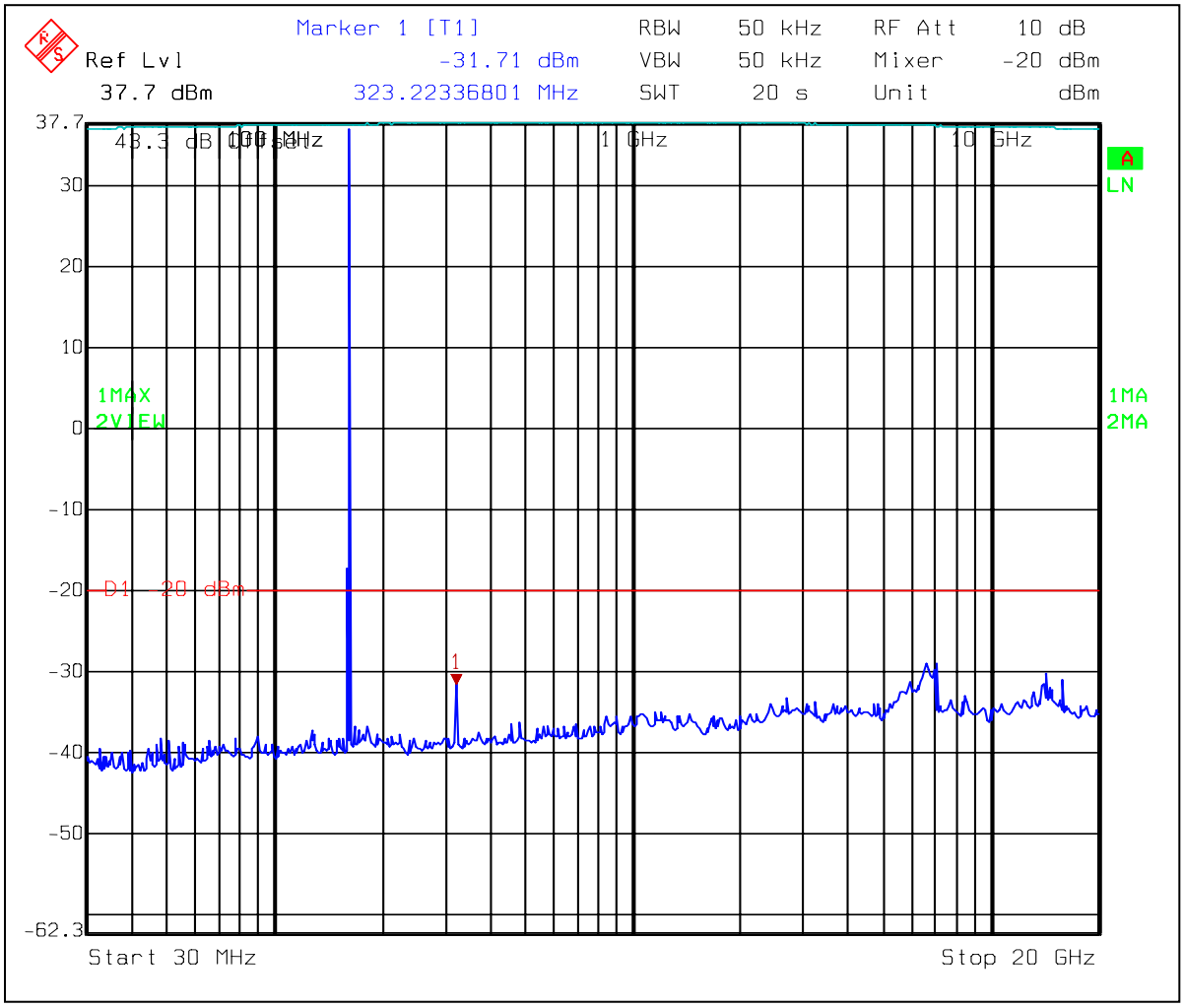
MASK D

HIGH CHANNEL



Test Data – Spurious Emissions

SPURS



Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 29 October 2009

Measurement Results: Complies.

Measurement Data: There were no emissions detected within 20 dB of the specification limit of 50 + 10 log P (watts) therefore none are reported per 2.1051

The spectrum was searched from 30 MHz to 2 GHz

Analyzer settings were RBW/VBW = 1 MHz, Peak detector

Measurement Conditions: Temperature: 20 °C
Humidity: 30 %

Measurement Uncertainty: **+/-** 1.7 dB

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

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY: David Light	DATE: 29 October 2009

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: Temperature: 20 °C
Humidity: 30 %

Measurement Uncertainty: **+/-** 1 X 10^{-7} ppm

Test Equipment: 1036-1082-1472-1469-283-619

Test Data – Frequency Stability

Limit: +/- 5 ppm

Measurement Uncertainty: $1x10^{-17}$ppm **Standard Test Frequency** 160.500000 **MHz**

Temp (°C)	Measured Frequency (MHz)		Test Voltage	Freqeuncy Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment
20	160.499756		12.0	-244	802.5	-1.5	Nominal
20	160.499728		4.0	-272	802.5	-1.7	Battery cutoff
20	160.499756		15.0	-244	802.5	-1.5	Fully charged battery
50	160.499820		12.0	-180	802.5	-1.1	
40	160.499684		12.0	-316	802.5	-2.0	
30	160.499712		12.0	-288	802.5	-1.8	
10	160.499724		12.0	-276	802.5	-1.7	
0	160.499692		12.0	-308	802.5	-1.9	
-10	160.499660		12.0	-340	802.5	-2.1	
-20	160.499668		12.0	-332	802.5	-2.1	
-30	160.499656		12	-344	802.5	-2.1	

Notes:

Section 8. Transient Frequency Behavior

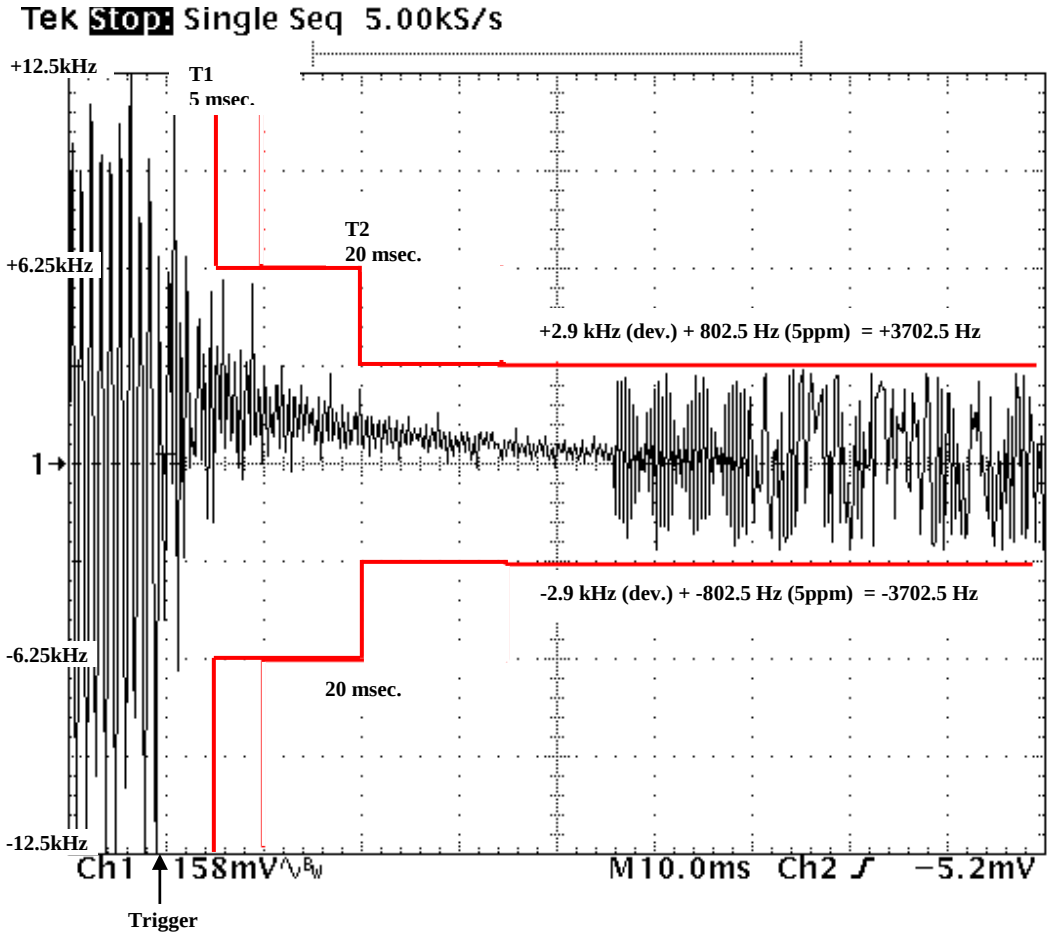
NAME OF TEST: Transient Frequency Behavior	PARA. NO.: 90.214
TESTED BY: David Light	DATE: 28 October 2009

Measurement Results: Complies.

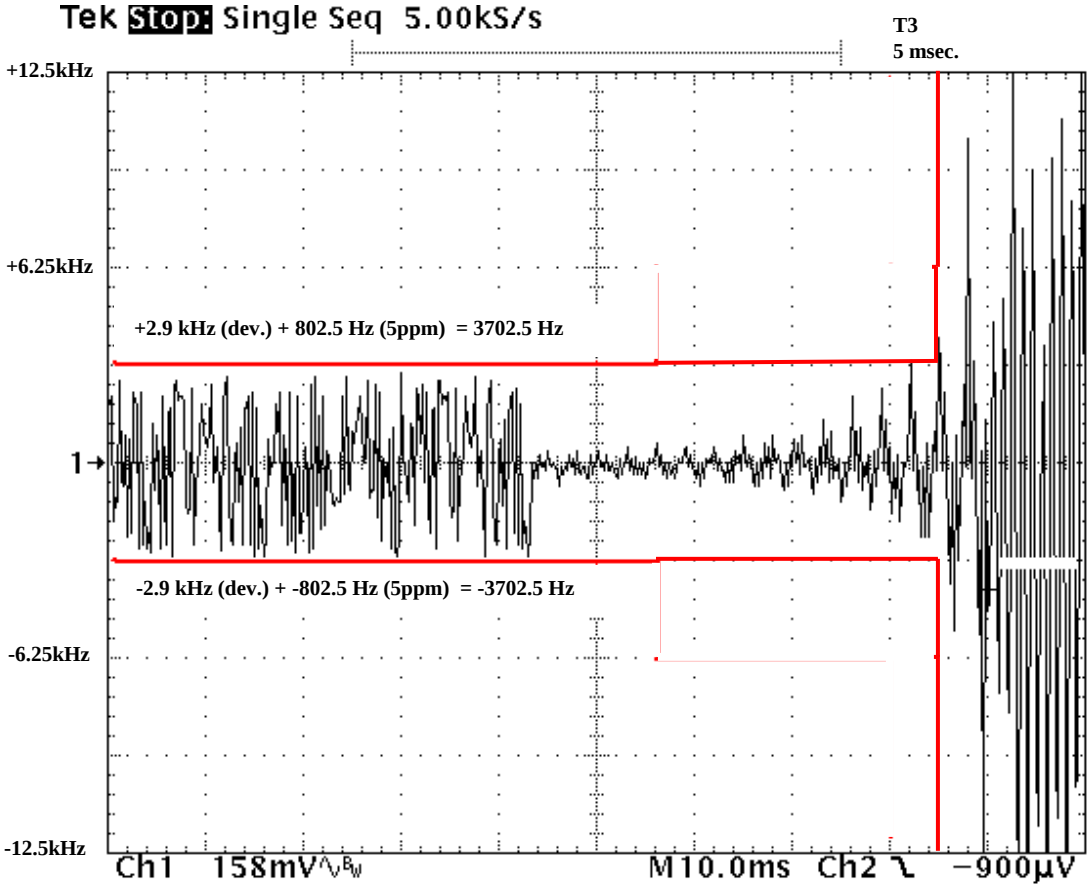
Measurement Data: See attached data

Measurement Conditions: Temperature: 20 °C
Humidity: 30 %

Test Data – Transient Frequency Behavior



Test Data – Transient Frequency Behavior



Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	01/19/09	01/20/11
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	CNR	NA
619	THERMOMETER	FLUKE 51	4520028	04/20/09	04/20/10
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/27/09	02/28/11
1484	Cable	Storm PR90-010-072	N/A	06/23/09	06/23/10
1485	Cable	Storm PR90-010-216	N/A	06/23/09	06/23/10
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	06/23/09	06/23/10
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	05/28/09	05/28/10
1480	Bilog Antenna	Schaffner-Chase CBL6111C	2572	11/17/08	11/17/09

ANNEX A - TEST METHODOLOGIES

NAME OF TEST: RF Power Output	**PARA. NO.: 2.985**

Minimum Standard: Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Method Of Measurement:

Detachable Antenna:
The peak power at antenna terminals is measured using an in-line peak power meter or spectrum analyzer. If a spectrum analyzer is used, the resolution bandwidth is set to at least 3 x the 99% occupied bandwidth of the transmitted waveform. Power output is measured with the maximum rated input level.

NAME OF TEST: Occupied Bandwidth PARA. NO.: 2.989

Minimum Standard: Para. No. 90.210, see table 1 below for applicable mask.

Table 1

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

Test Method:

RBW: 1% of emission bandwidth in 0 - 1 GHz range. 1 MHz at frequencies above 1 GHz.
VBW: $\geq$ RBW

The spectrum is search up to 10 times the fundamental frequency.

NAME OF TEST: Field Strength of Spurious	**PARA. NO.: 2.993**

Minimum Standard: Para. No. 90.210, see table 1 for applicable mask.

The substitution antenna method described in TIA-603C was used to determine the erp of spurious emissions. The EUT was placed on a turntable at a distance of 3 meters from the receive antenna. The turntable and the antenna were adjusted to obtain the worst-case orientations. The received signal level was recorded. The EUT was then replaced with a reference antenna with known gain. The reference antenna was fed with a signal generator. The signal generator output was adjusted to the frequency of the emission in question and the level was adjusted to repeat the above measurement. The erp is the signal generator output level after adjustment for gain of the reference antenna and cable loss.

NAME OF TEST: Frequency Stability PARA. NO.: 2.995

Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-

NAME OF TEST: Transient Frequency Behaviour PARA. NO.: 2.214

Minimum Standard:

Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels

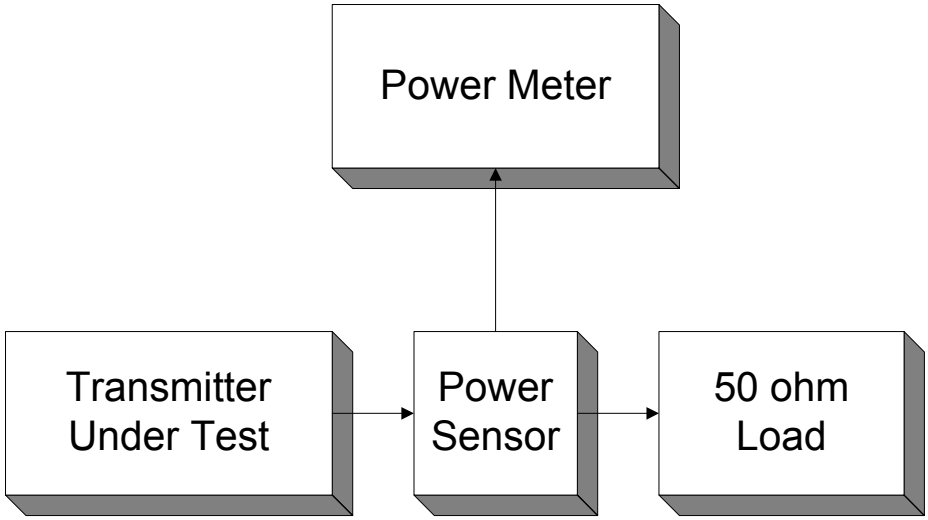
		Frequency ranges (MHz) All equipment					
	Maximum	Base station and portable radios			Mobile Radios		
Time intervals [1,2] Frequency	difference[3] (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t_1[4]	± 25	5.0	10.0	20.0	5.0	10.0	5.0
t_2	± 12	20.0	25.0	50.0	20.0	25.0	20.0
t_3[4]	± 25	5.0	10.0	10.0	5.0	10.0	5.0

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels

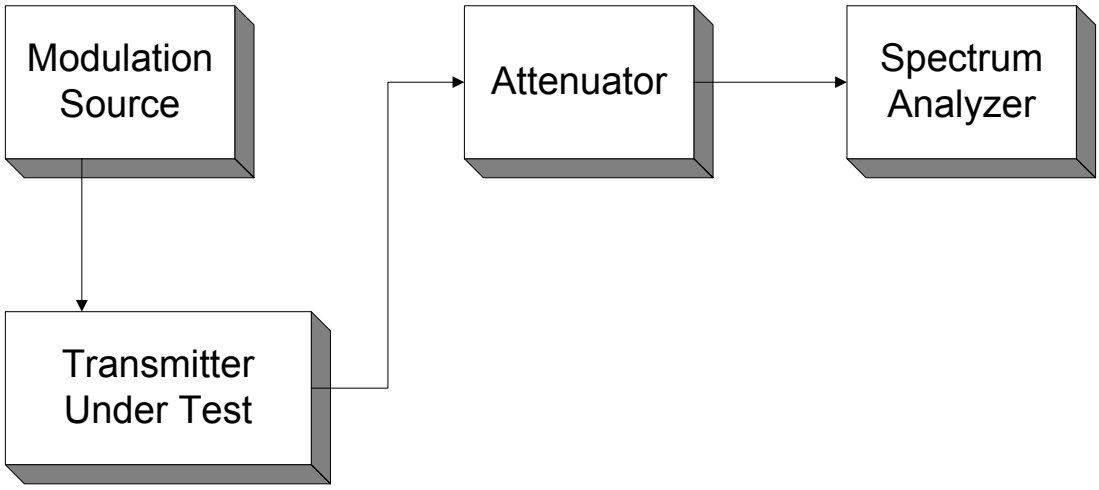
	Maximum	Frequency ranges (MHz) All equipment		
Time intervals [1,2] Frequency	difference[3] (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t_1[4]	± 12.5 / ± 6.25	5.0	10.0	20.0
t_2	± 6.25 / ± 3.125	20.0	25.0	50.0
t_3[4]	± 12.5 / ± 6.25	5.0	10.0	10.0

ANNEX B - TEST DIAGRAMS

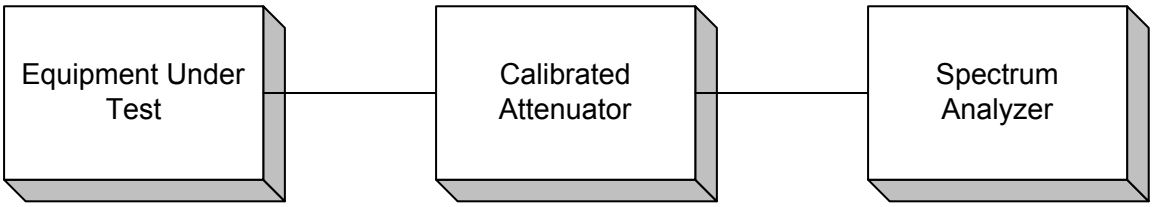
Para. No. 2.985 - R.F. Power Output



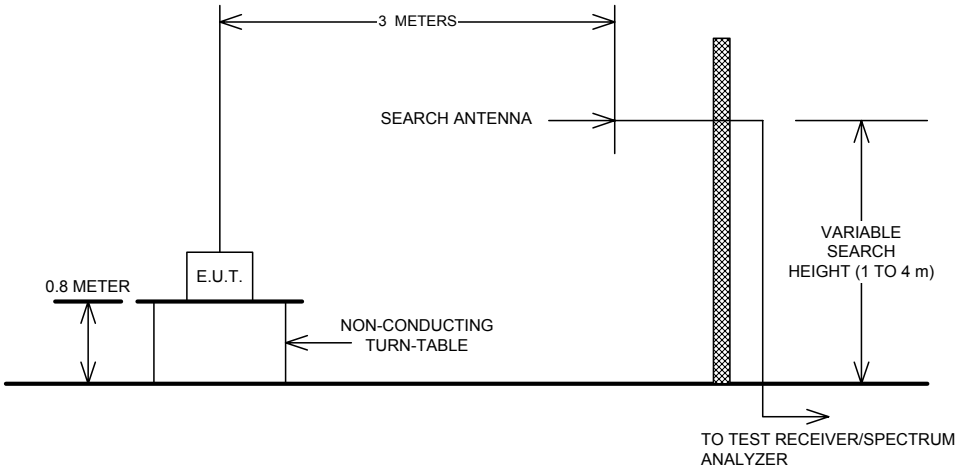
Para. No. 2.989 - Occupied Bandwidth



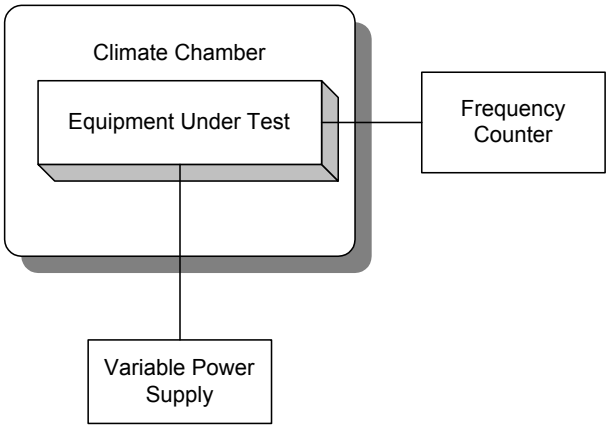
Para. No. 2.991 - Spurious Emissions at Antenna Terminals



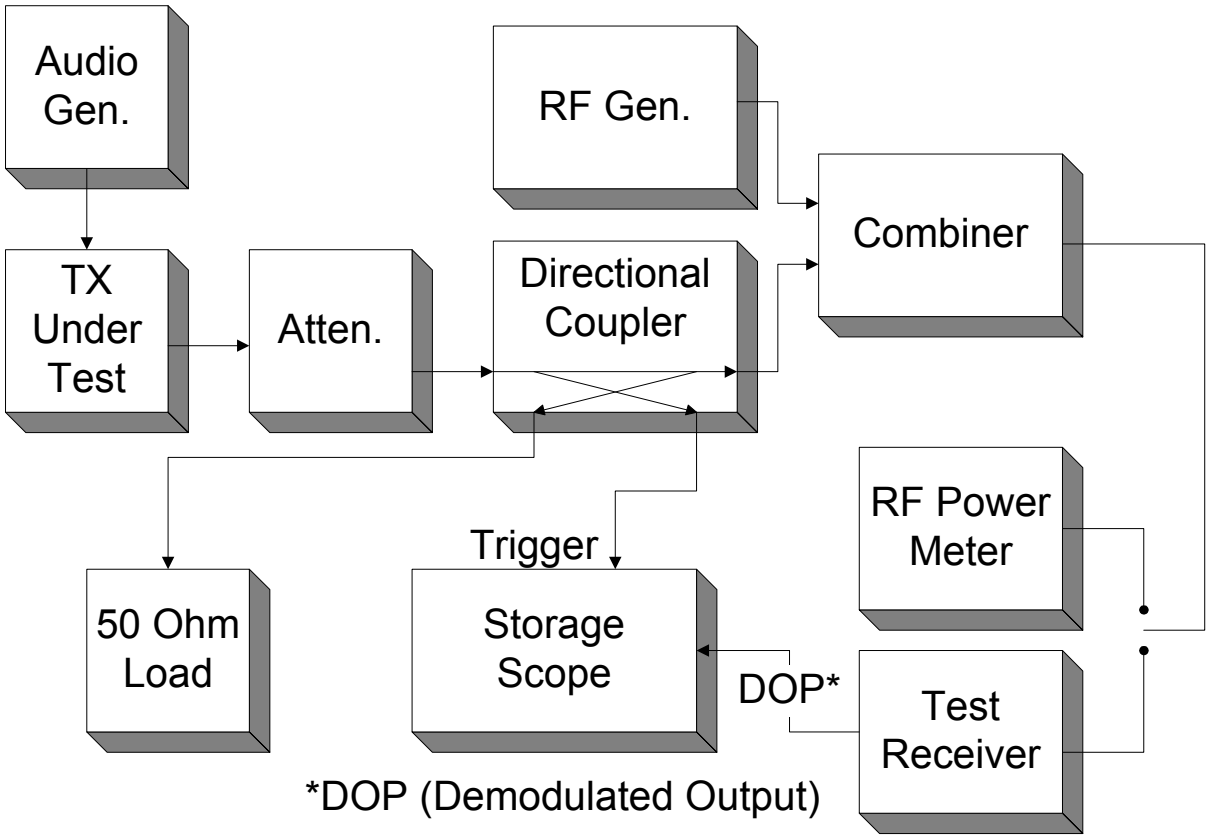
Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability



Para. No. 90.214 - Transient Frequency Behaviour



Voice

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters
Para. no. 2.2.19 Transient Frequency Behaviour (page no. 83).

Data

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behaviour (page no. 74).