CTMS Ltd.
3 Cardinal Park
Godmanchester
Huntingdon
Cambridgeshire
PE29 2XN

TEST REPORT ON
AR200

UHF Reflex Telemetry Module

FCC Authorization Procedures
Part 2 subpart J, Part 90, and Part 24

TEST REPORT NUMBER
CTMS 2002/2234
April 2002

Prepared for:

Advantra International
Flanders Language Valley 90,
8900 - Ieper,
Belgium

This results in this report refer to the tested unit only

Certificate of Test

Cambridge Test and Measurement Services Ltd., certifies that the product listed was fully tested to the relevant sections of Parts 2, 90, and 24 of the FCC Code of Regulations 47CFR, the results of which are contained in this test report No: CTMS 2002/2234

Advantra AR200

I certify that the application was prepared under my supervision and that to the best of my knowledge and belief, the facts set forth in this application and technical data, are true and correct.

Signature : 

Date : 25/03/02

Name : David Fisher

Title : Radio Technical Manager

General Test Information

Date Test Sample Received	:	19th March 2002
Date Testing Started	:	19th March 2002
Date Testing Finished	:	20th March 2002
Equipment Serial Number	:	A900 000 06006 / 000YB
CTMS Project Number	:	2002/2234
Test Engineer	:	M. Billis

Report Copy No. 1

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2.1033 **Application for Certification**

For use in accordance with FCC Rules and Regulations 47 CFR parts 2, 90, and part 24.

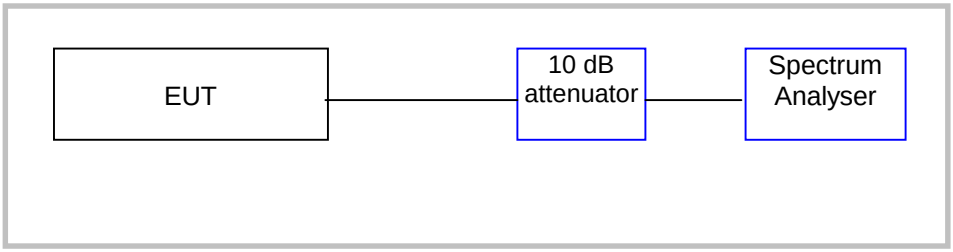
2.1033 (c) (1)	Name of applicant	:	Advantra
	Address of applicant	:	Advantra International, Flanders Language Valley, 8900 - Ieper, Belgium
	Contact	:	Frédéric Boes / Luc Van Asch / Els Ollevier
2.1033 (c) (2)	FCC Identifier	:	
	Model Type Number	:	AR200
2.1033 (c) (3)	Installation and operating instructions	:	User Guide, see appropriate exhibit
2.1033 (c) (4)	Type(s) of emission	:	Direct FSK, 12K5F1D --
2.1033 (c) (5)	Frequency range	:	929.000 - 942.000 MHz (RX) 896.000 - 902.000 MHz (TX)
2.1033 (c) (6)	Output power range	:	0.06 W - 1.92 W
2.1033 (c) (7)	Maximum power rating	:	1.92 W
2.1033 (c) (8)	dc voltage applied to power amplifier	:	5.0 V
	dc current to power amplifier	:	1.4 A
2.1033 (c) (9)	Tune-up procedure for RF power	:	n/a

RF Power Output at Antenna terminals - 47 CFR 2.1046(a)

The transmitter is operated under standard test conditions, using the standard test voltage, with the transmitter, tuned in accordance with the procedure described in the accompanying documentation. The transmitter was keyed in an unmodulated condition and the output was connected to a spectrum analyser, with resolution and video bandwidths set to 3 MHz and 30 Hz respectively, the RF power output was observed and recorded, accounting for the loss of the cable and the attenuator.

The RF Power Output was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)



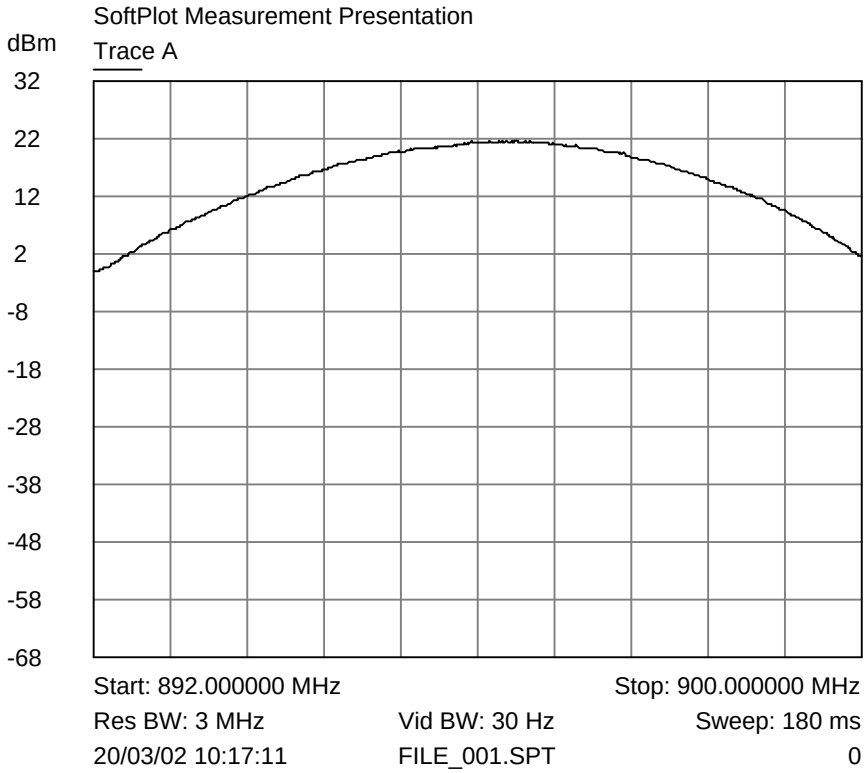
Test instruments used :

RF Spectrum Analyser : Advantest type R3271
RF Attenuator : Bird type 25-A-MFN-10

Results in accordance with Part 2.1046(a) Power and emissions

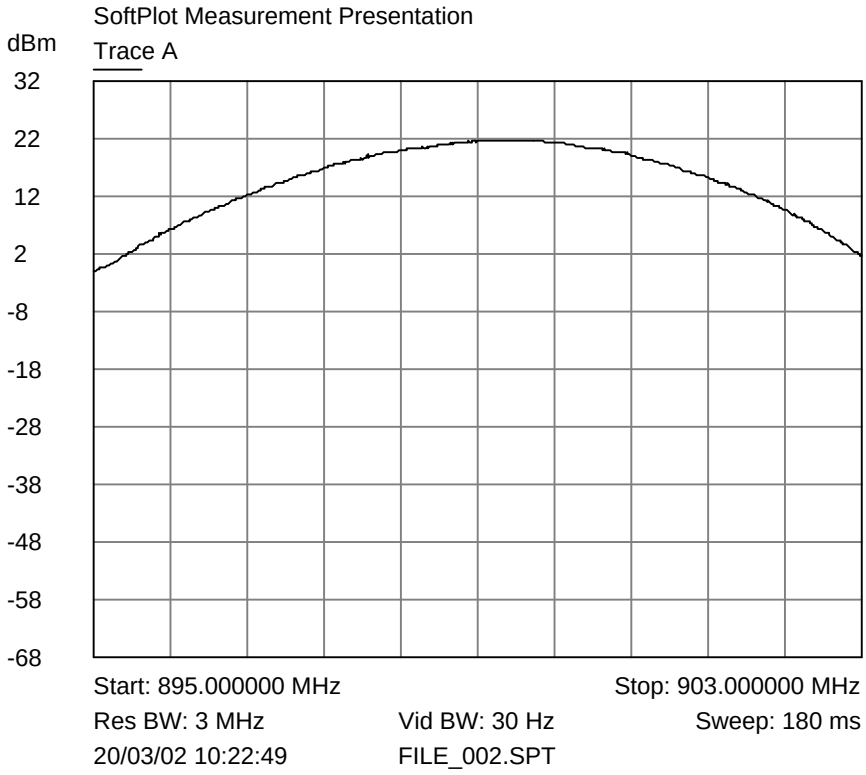
	TRANSMITTER OUTPUT POWER		
	896.000 MHz	899.000 MHz	902.000 MHz
Analyser reading	21.96 dBm	22.08 dBm	22.11 dBm
Cable and attenuator loss	10.66 dB	10.75 dB	10.69 dB
Result	32.62 dBm	32.83 dBm	32.80 dBm
Result (Watts)	**1.83**	**1.92**	**1.91**

RF Power Output at Antenna terminals - 47 CFR 2.1046(a)



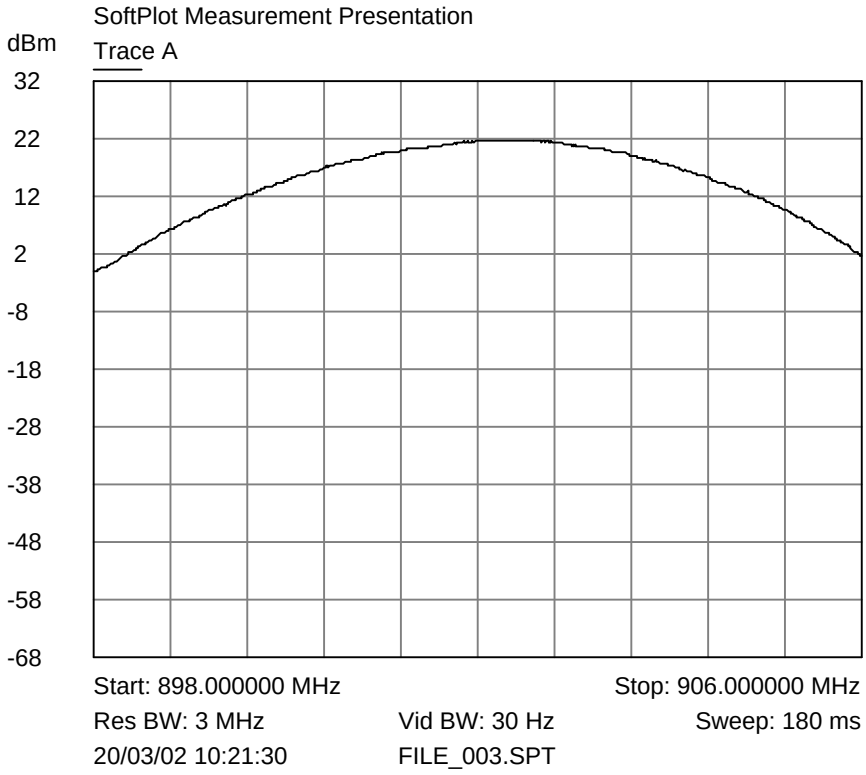
896.000 MHz with 10dB external attenuator in line.

RF Power Output at Antenna terminals - 47 CFR 2.1046(a)



899.000 MHz with 10dB external attenuator in line.

RF Power Output at Antenna terminals - 47 CFR 2.1046(a)



902.000 MHz with 10dB external attenuator in line.

Occupied Bandwidth - 47 CFR 2.1049(h), 90.209(b), 90.210(j), 24.133(a)(2)

The emission designator was defined by the applicant as 12K5F1D-- where 12.5 kHz is the authorised bandwidth.

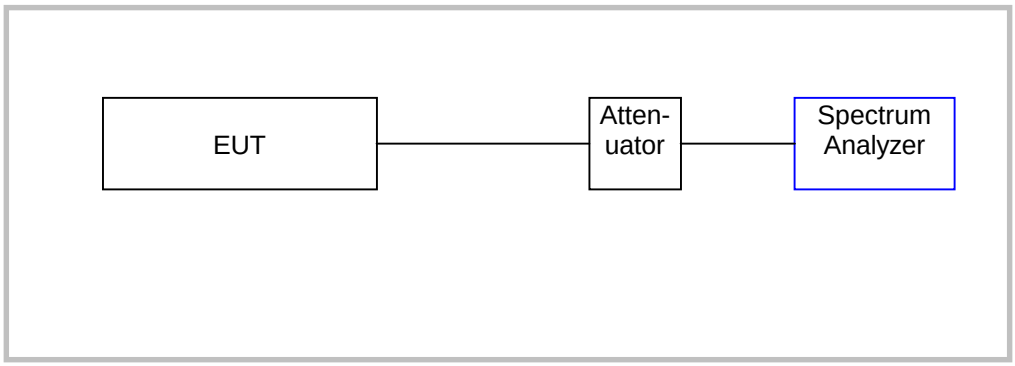
The transmitter is operated under standard test conditions, using an internally generated pseudo random data sequence to modulate the transmitter to it's maximum possible occupied bandwidth.

The output of the transmitter is connected to a spectrum analyser, via an attenuator of impedance matching that of the transmitter. The resolution and video bandwidths of the spectrum analyser are set to at least 10 times higher than the authorised bandwidth of the transmitter, and the reading obtained is used as a reference for emission mask measurements.

The resolution and video bandwidths of the spectrum analyser are set to at least 1 % of the emission bandwidth, and the occupied spectrum is then evaluated against the appropriate mask.

The occupied bandwidth was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)

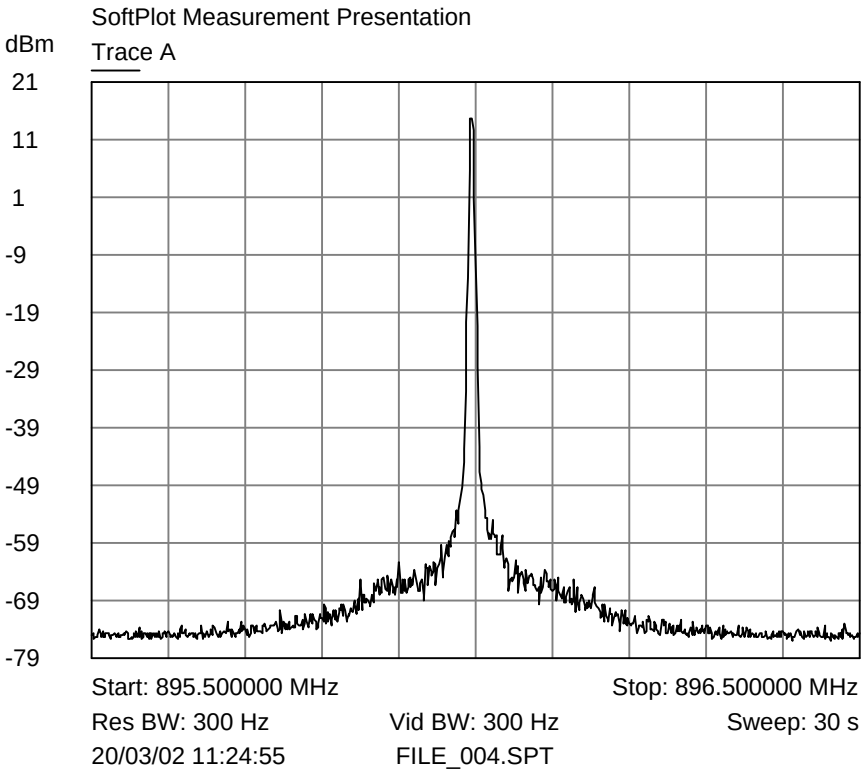


Test instruments used :

RF Attenuator : Bird type 25-A-MFN-10
Spectrum Analyzer : Advantest type R3271

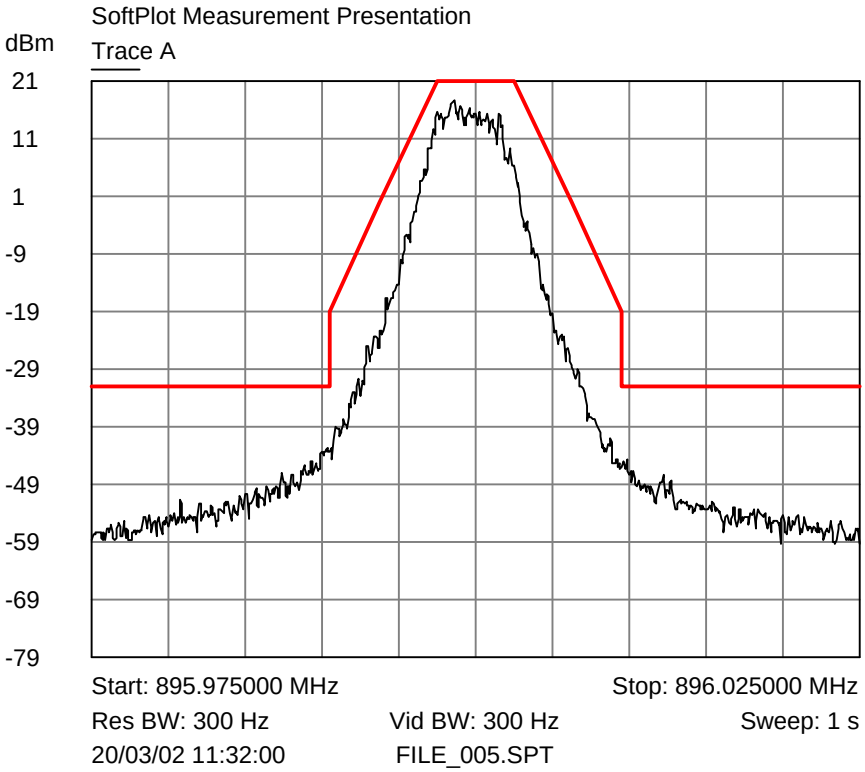
Results in accordance with 47 CFR 2.1049(h), 90.209(b), 90.210(j)

896.000 MHz (1MHz Span)



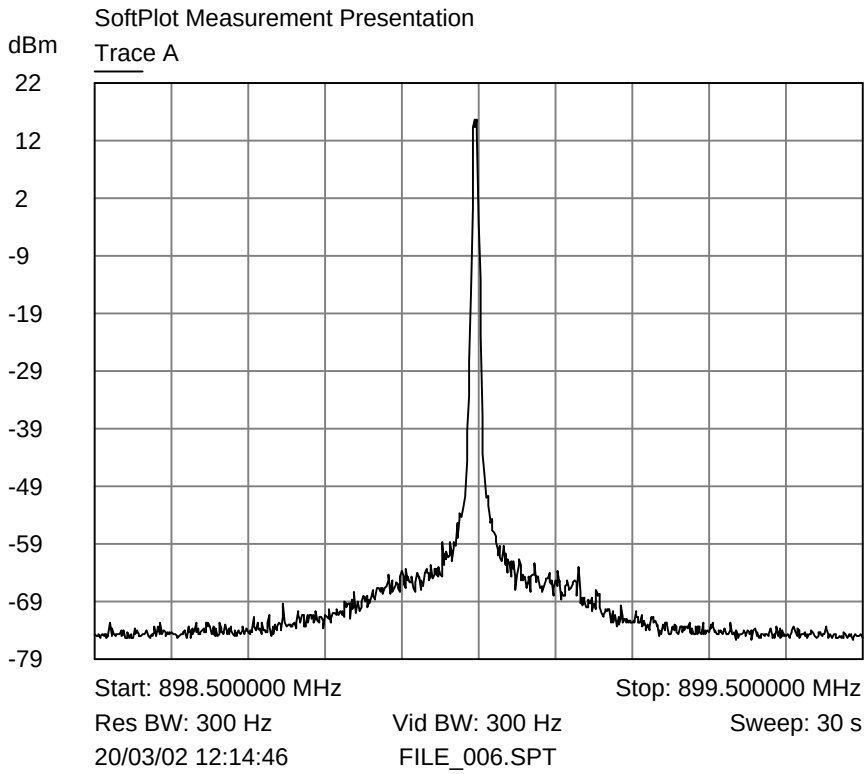
Results in accordance with 47 CFR 2.1049(h), 90.209(b), 90.210(j)

896.000 MHz (50kHz Span)



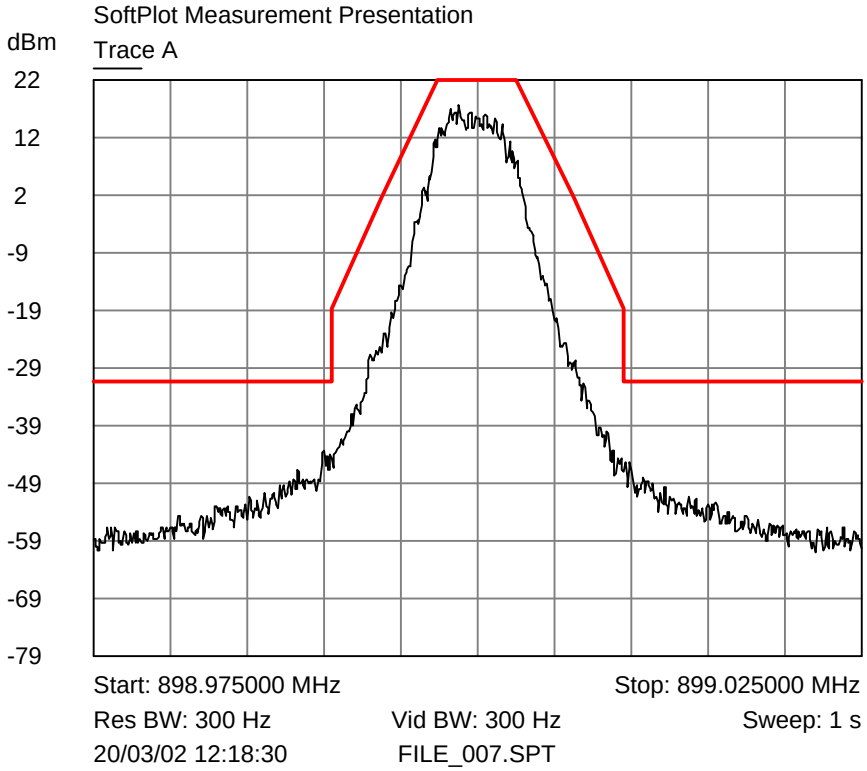
Results in accordance with 47 CFR 2.1049(h), 90.209(b), 90.210(j)

899.000 MHz (1MHz Span)



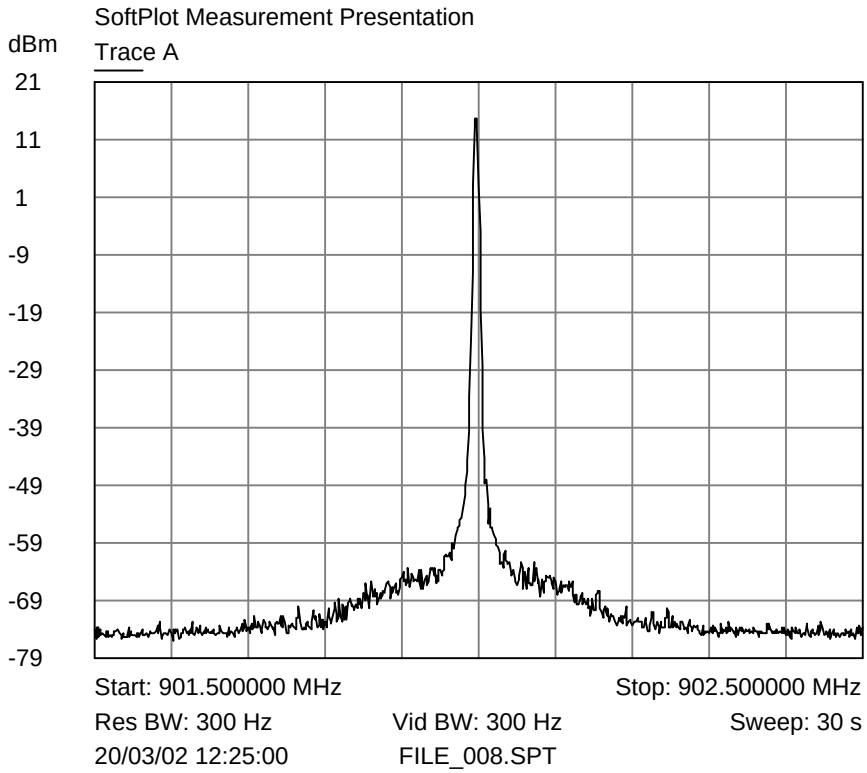
Results in accordance with 47 CFR 2.1049(h), 90.209(b), 90.210(j)

899.000 MHz 50 kHz Span)



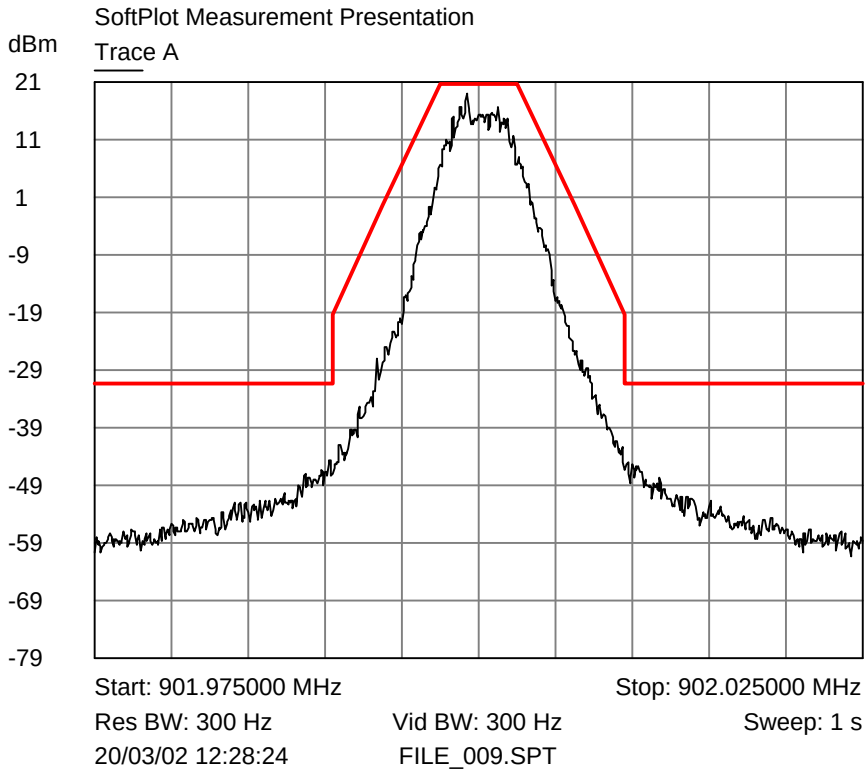
Results in accordance with 47 CFR 2.1049(h), 90.209(b), 90.210(j)

902.000 MHz (1MHz Span)



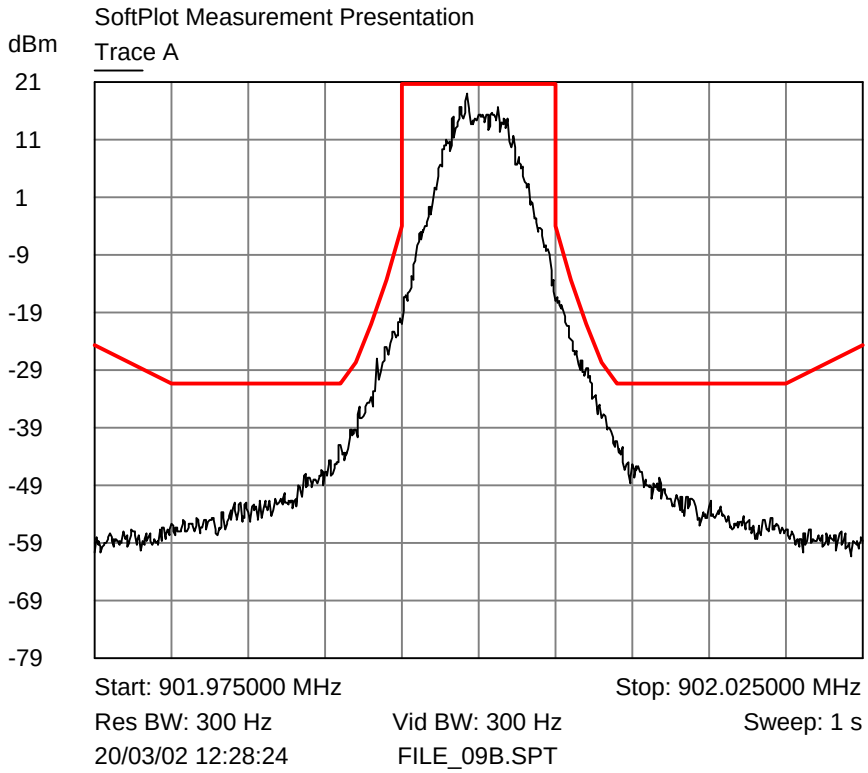
Results in accordance with 47 CFR 2.1049(h), 90.209(b), 90.210(j)

902.000 MHz (50kHz Span)



Results in accordance with 47 CFR 2.1049(h), 24.133(a)(2)

902.000 MHz (50kHz Span)

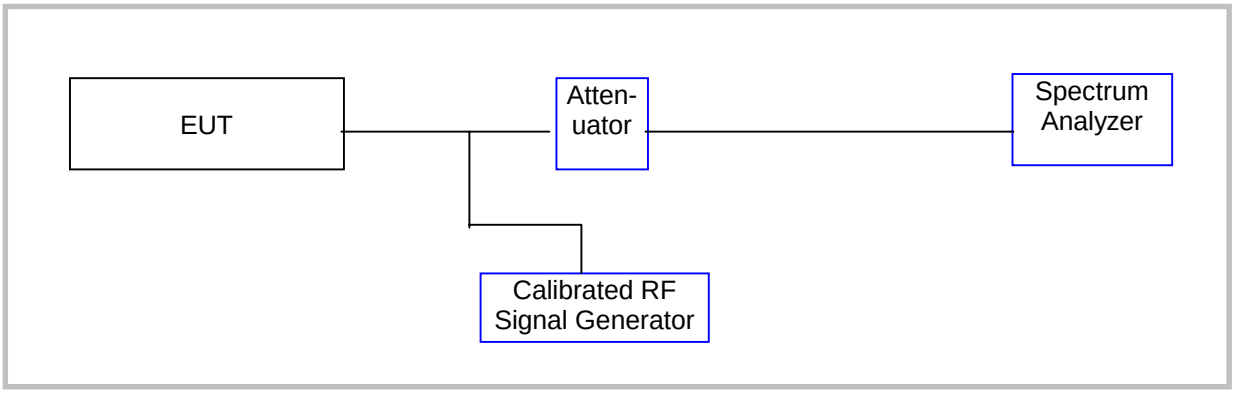


Spurious emissions at antenna terminals - 47 CFR 2.1051, 90.210(j)

The transmitter is operated under standard test conditions, using an internally generated pseudo random data sequence to modulate the transmitter to it's maximum possible occupied bandwidth. The output of the transmitter is connected to a spectrum analyser, via an attenuator of normal impedance matching that of the transmitter. The spurious emissions, including harmonics of the fundamental carrier frequency, are observed and recorded.

After ensuring that the spectrum analyser is not overloaded, for each emission found, a calibrated RF signal generator is put in place of the EUT, and the level of the signal generator is adjusted to achieve the same level as that measured on the spectrum analyser. The level on the signal generator is recorded as being the level of the spurious emission measured by the substitution method. This method is used to as to ensure that cable and attenuator losses are accounted for.

(Calibrated items are indicated in Blue)



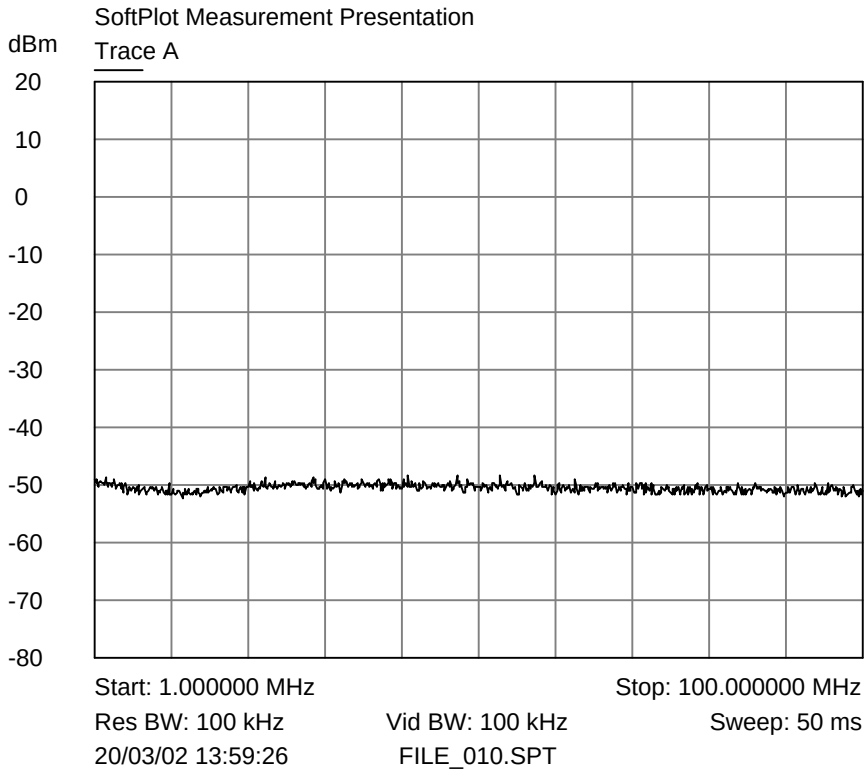
Test instruments used :

RF Attenuator : Bird type 25-A-MFN-10
RF Signal Generator : Rohde & Schwarz type SMH and Hewlett Packard type 8673B

Spectrum Analyzer : Advantest type R3271

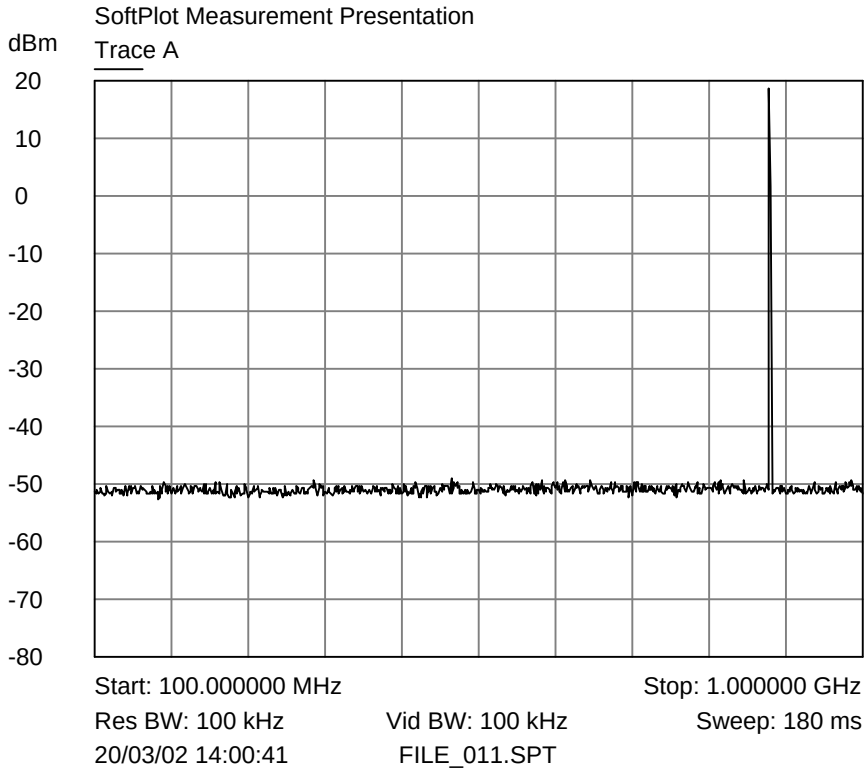
Spurious emissions at antenna terminals 1 MHz to 100 MHz

Transmitter Operating on 896.000 MHz



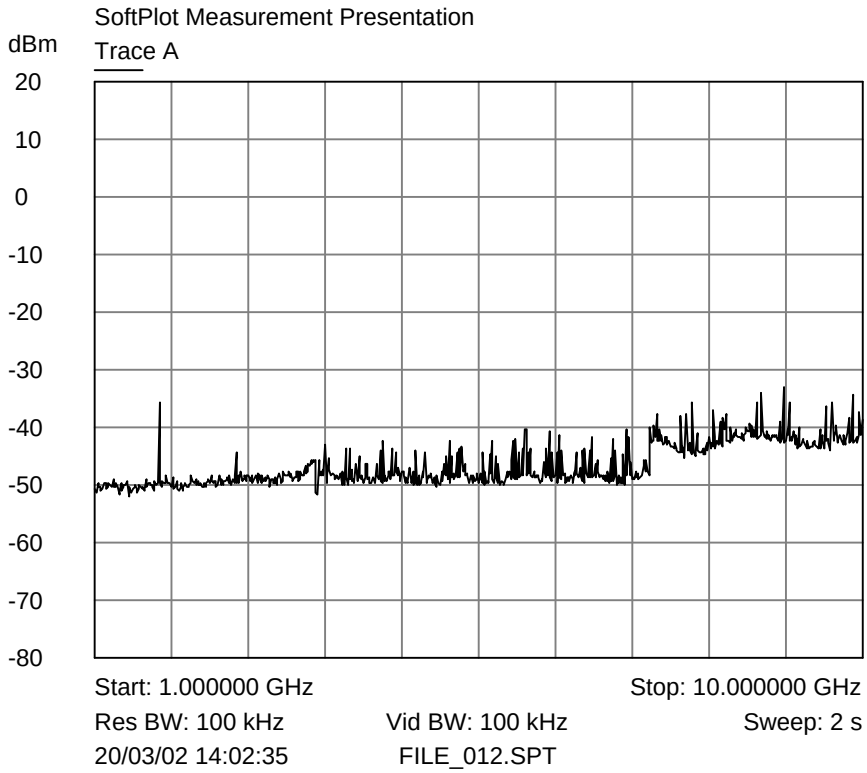
Spurious emissions at antenna terminals 100 MHz to 1 GHz

Transmitter Operating on 896.000 MHz



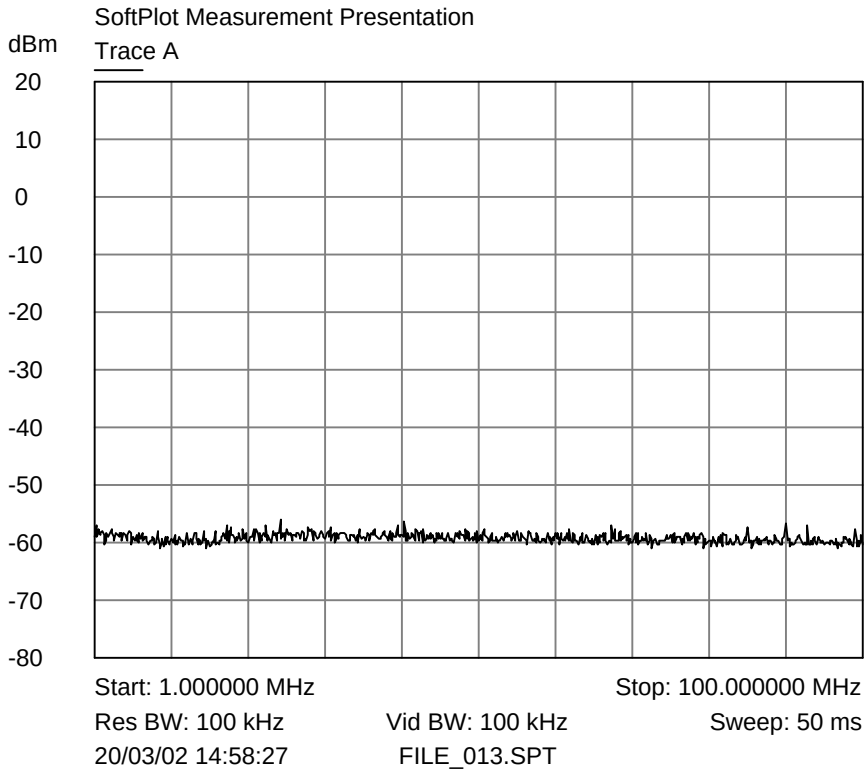
Spurious emissions at antenna terminals 1GHz to 10 GHz

Transmitter Operating on 896.000 MHz



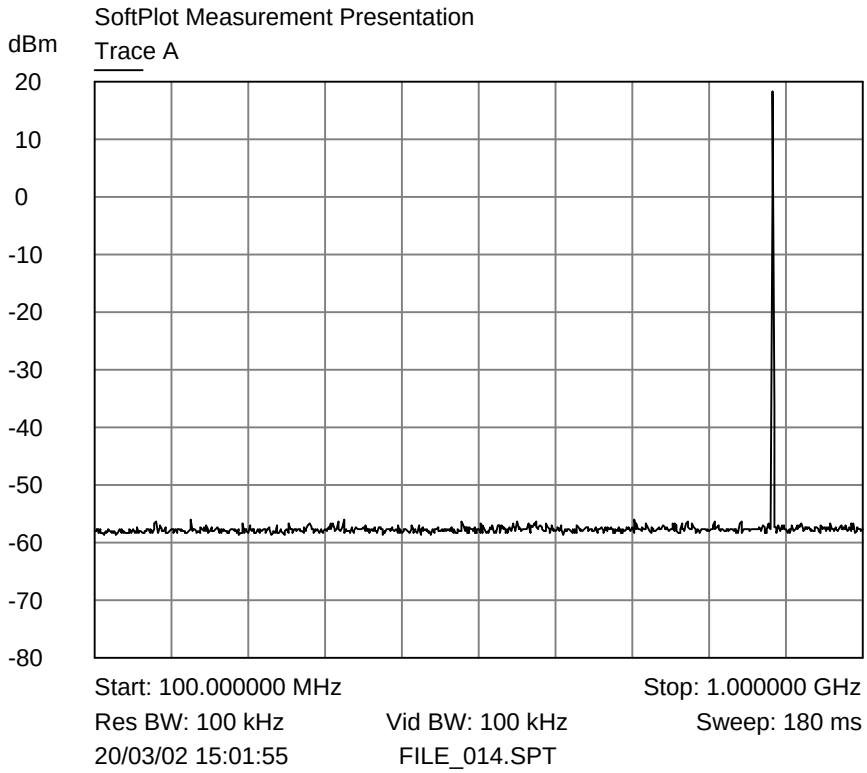
Spurious emissions at antenna terminals 1 MHz to 100 MHz

Transmitter Operating on 899.000 MHz



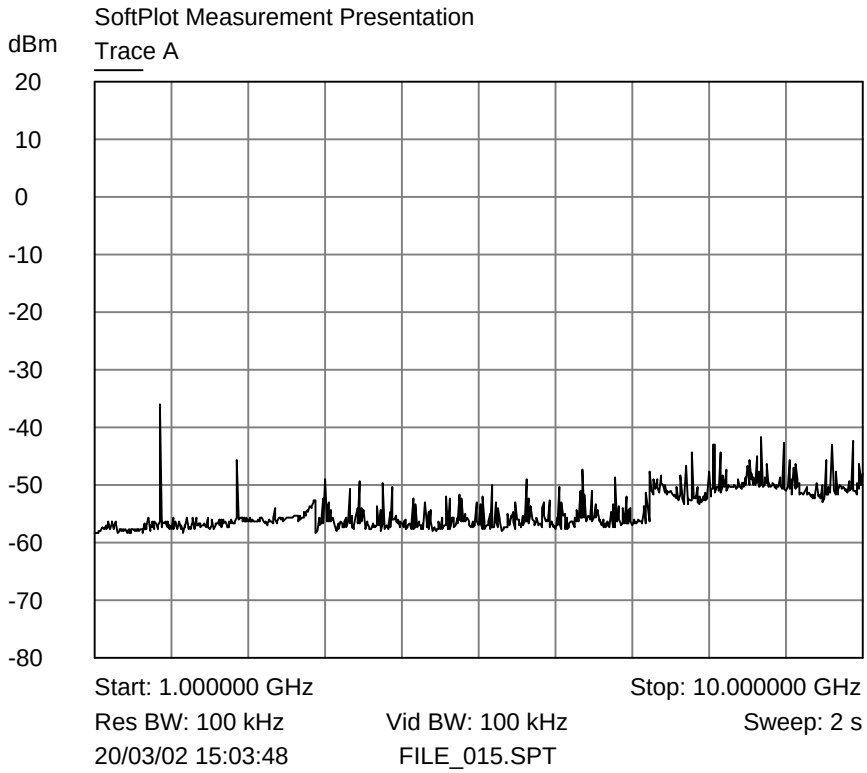
Spurious emissions at antenna terminals 100 MHz to 1 GHz

Transmitter Operating on 899.000 MHz



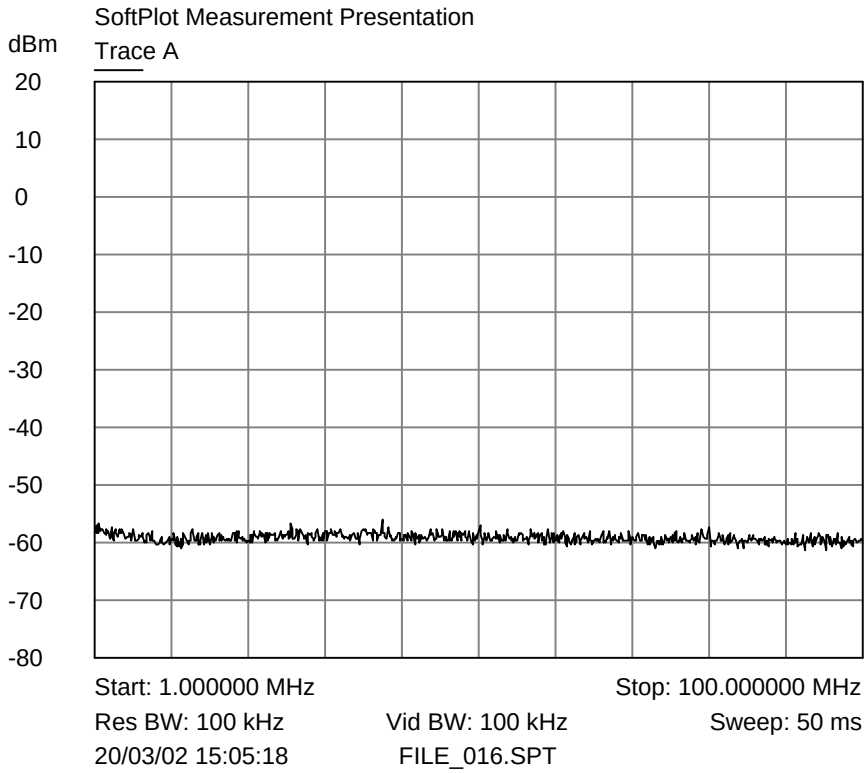
Spurious emissions at antenna terminals 1GHz to 10 GHz

Transmitter Operating on 899.000 MHz



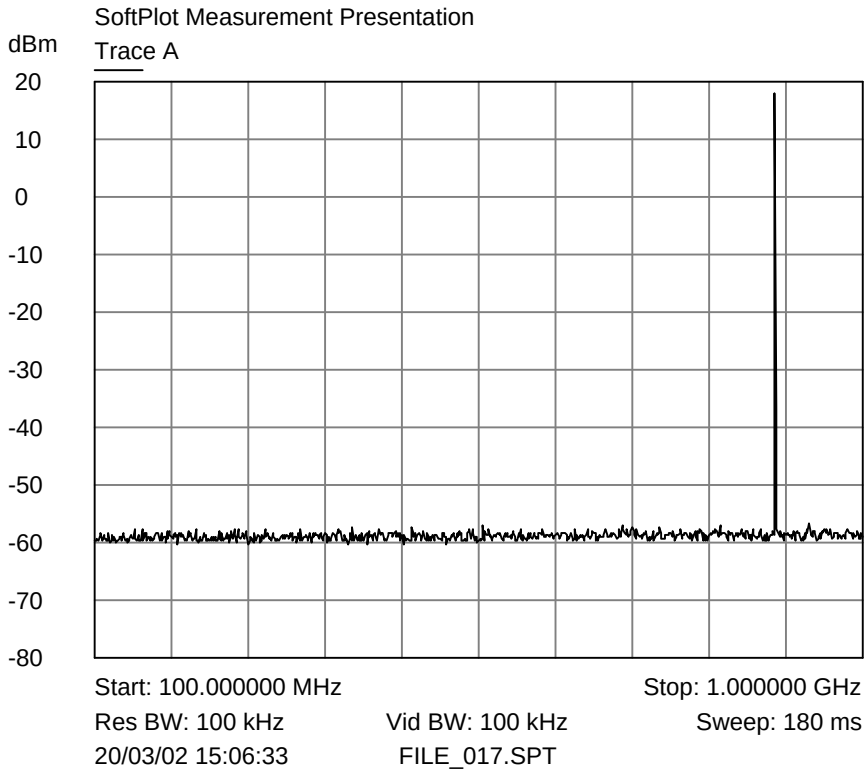
Spurious emissions at antenna terminals 1 MHz to 100 MHz

Transmitter Operating on 902.000 MHz



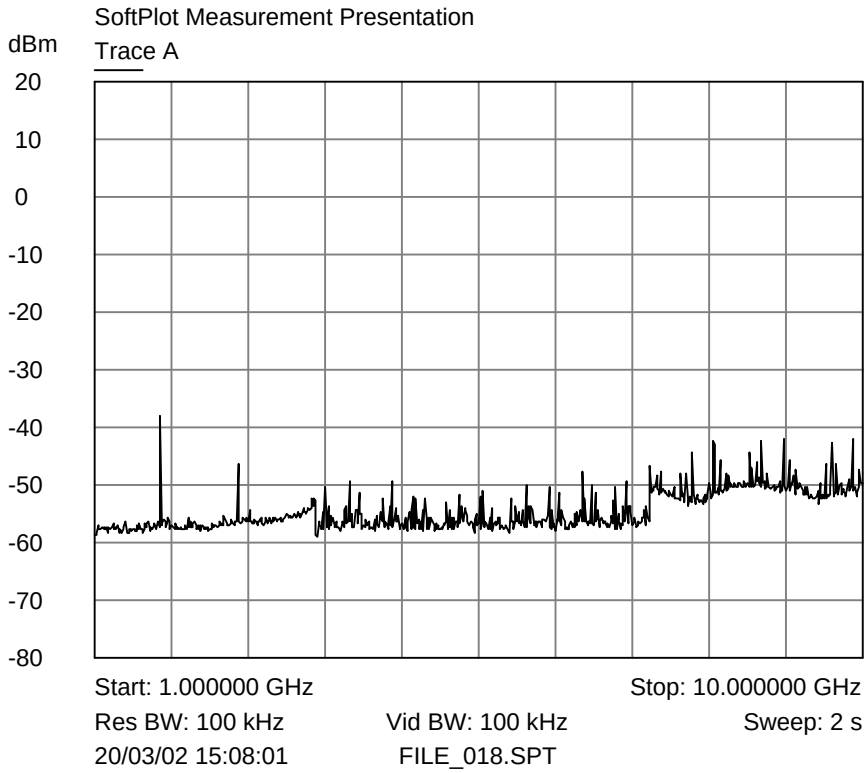
Spurious emissions at antenna terminals 100 MHz to 1 GHz

Transmitter Operating on 902.000 MHz



Spurious emissions at antenna terminals 1GHz to 10 GHz

Transmitter Operating on 902.000 MHz



Results in accordance with Part 2.1051 and 90.210(j) Emission Limits

Note: Emissions more than 20dB below limit are not required to be listed

Carrier Frequency (Fc): 896.000 MHz

Frequency (MHz)	Identity	**Absolute Level dBm**	**Limit (-) 50+10log(P) dBc**
1792.000	2Fc	**-24.5**	**-20.0 dBm**
2688.000	3Fc	**-28.2**	**-20.0 dBm**
All other emissions were more than 20 dB below the limit			

Carrier Frequency (Fc): 899.000 MHz

Frequency (MHz)	Identity	**Absolute Level dBm**	**Limit (-) 50+10log(P) dBc**
1798.000	2Fc	**-24.3**	**-20.0 dBm**
2697.000	3Fc	**-28.8**	**-20.0 dBm**
All other emissions were more than 20 dB below the limit			

Carrier Frequency (Fc): 902.000 MHz

Frequency (MHz)	Identity	**Absolute Level dBm**	**Limit (-) 50+10log(P) dBc**
1804.000	2Fc	**-24.1**	**-20.0 dBm**
2706.000	3Fc	**-28.8**	**-20.0 dBm**
All other emissions were more than 20 dB below the limit			

Field Strength of Spurious radiation - 47 CFR 2.1053

The transmitter (the EUT) is placed on a wooden table with cables suitably dressed. The output of the EUT is connected to a dummy, non-radiating, load of normal impedance matching that of the transmitter. At a distance of 3m from the transmitter (EUT), the radiated field from each spurious radiation, including harmonics from the carrier frequency, is detected and measured on a calibrated receiver which is fed from a calibrated log-periodic / horn antenna. The antenna is positioned in the horizontal polarisation plane and is raised and lowered so as to ensure the maximum level of the spurious emission is detected.

The EUT is rotated through 360°, the emission levels for each spurious, including harmonics of the carrier frequency, is observed on the receiver and recorded .

The test above is repeated with the receiving antenna in the vertical polarisation plane.

For each of the emissions detected the EUT is switched off to determine the emission was that of the EUT.

The measurement facilities at Cambridge Test and Measurement Services LTD, are in accordance with ANSI C63.4 and logged with the FCC under rule 2.948, a letter from the FCC recognising compliance with the requirements was dated March 02,1999 with the registration number 93385.

For measurements below 1 GHz the detector type was a Quasi Peak detector for the final measurements. For measurements above 1GHz an absorber lined screened room was used, which is acceptable in ANSI C63.4 in this frequency range. A minimum resolution and video bandwidth of 1MHz was used above 1 GHz, and the detector type was and Average detector.

Test instruments used :

Receiver(s)	:	Rohde & Schwarz Type(s) ESVS 10, ESHS 10
Spectrum Analyzer	:	Advantest type R3271
Antenna(s)	:	Schaffner Type CB2614A & EMCO Type 3115 horn and 6502 active loop.

Results in accordance with Part 2.1053 and 90.210(j) Emission Limits

Note: Emissions 20dB below the limit are not required to be listed

Limit based on 90.210(j), out of band emissions should be attenuated by 50+10log(P) dBc, equates to -20 dBm.

Results were taken in dBμV/m and converted to equivalent ERP values using free space theory, ERP=$(E.d/7.02)^2$, where ERP is the Effective Radiated Power in Watts, E is the field strength in V/m, d is the measurement distance in metres, and 7.02 is a constant to account for free space.

Carrier Frequency (Fc): 896.000 MHz

Emission Frequency (MHz) (polarisation)	Spectrum Analyser Reading (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amp Gain (dB)	Result (dBμV/m) @ 3m	**Result (ERP) (dBm)**	**Limit (ERP) (dBm)**
1792.000 (V)	61.13	28.20	3.09	36.20	56.22	**-41.2**	**-20.0**
2688.000 (H)	64.47	29.30	4.31	36.10	61.98	**-35.4**	**-20.0**
3584.000 (H)	61.66	32.20	4.35	36.30	61.91	**-35.5**	**-20.0**
4480.000 (H)	58.03	33.10	4.50	36.30	59.33	**-38.1**	**-20.0**
5376.000 (H)	52.00	34.90	5.47	36.10	56.27	**-41.1**	**-20.0**
6272.000 (V)	56.91	35.60	5.98	36.60	61.89	**-35.5**	**-20.0**
7168.000 (V)	53.81	36.70	5.07	36.60	58.98	**-38.4**	**-20.0**
8960.000 (V)	50.75	38.10	6.75	37.00	58.60	**-38.8**	**-20.0**

Carrier Frequency (Fc): 899.000 MHz

Emission Frequency (MHz) (polarisation)	Spectrum Analyser Reading (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amp Gain (dB)	Result (dBμV/m) @ 3m	**Result (ERP) (dBm)**	**Limit (ERP) (dBm)**
1798.000 (V)	61.13	28.20	3.09	36.20	56.22	**-41.2**	**-20.0**
2697.000 (H)	64.41	29.30	4.31	36.10	61.92	**-35.5**	**-20.0**
3596.000 (H)	58.75	32.20	4.35	36.30	59.00	**-38.4**	**-20.0**
4495.000 (H)	56.16	33.10	4.50	36.30	57.46	**-39.9**	**-20.0**
5394.000 (H)	52.84	34.90	5.47	36.10	57.11	**- 40.3**	**-20.0**
6293.000 (V)	55.19	35.60	5.98	36.60	60.17	**-37.2**	**-20.0**
7192.000 (V)	54.09	36.70	5.07	36.60	59.26	**-38.1**	**-20.0**

Carrier Frequency (Fc): 902.000 MHz

Emission Frequency (MHz) (polarisation)	Spectrum Analyser Reading (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amp Gain (dB)	Result (dBµV/m) @ 3m	**Result (ERP) (dBm)**	**Limit (ERP) (dBm)**
1804.000 (V)	61.84	28.20	3.09	36.20	56.93	**-40.5**	**-20.0**
2706.000 (H)	63.81	29.30	4.31	36.10	61.32	**-36.1**	**-20.0**
3608.000 (H)	58.78	32.20	4.35	36.30	59.03	**-38.4**	**-20.0**
4510.000 (H)	55.00	33.10	4.50	36.30	56.30	**-41.1**	**-20.0**
5412.000 (H)	54.00	34.90	5.47	36.10	58.27	**-39.1**	**-20.0**
6314.000 (V)	56.66	35.60	5.98	36.60	61.64	**-35.7**	**-20.0**
7216.000 (H)	52.00	36.70	5.07	36.60	57.17	**-40.2**	**-20.0**

Field Strength of Spurious Radiation in Receive Mode- 47 CFR 15.109(b)

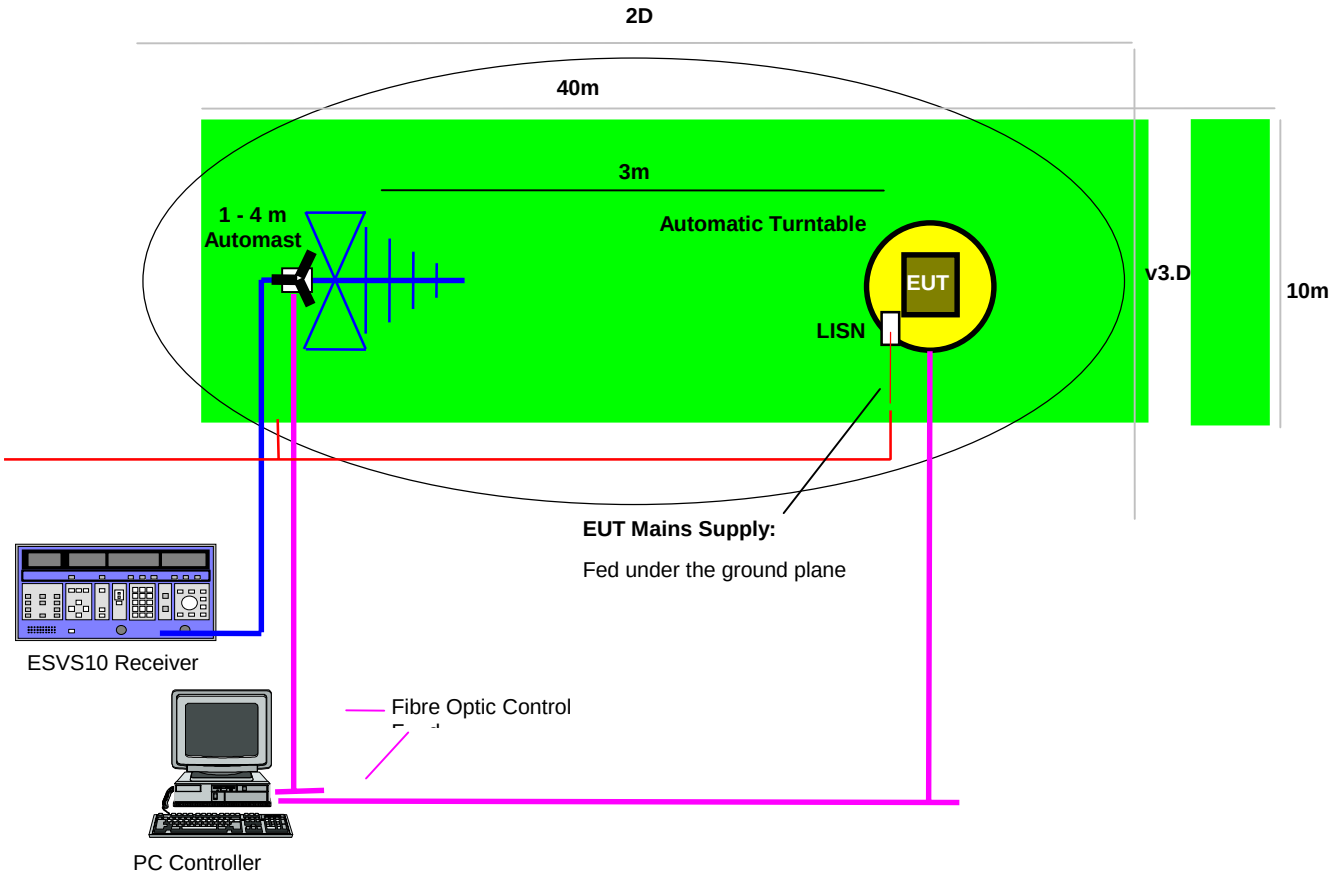
These results are for the device in it's non-intentionally radiating mode and do not form part of the Certification process, they are provided for information only.

Note: Emissions 20dB below the limit are not required to be listed.

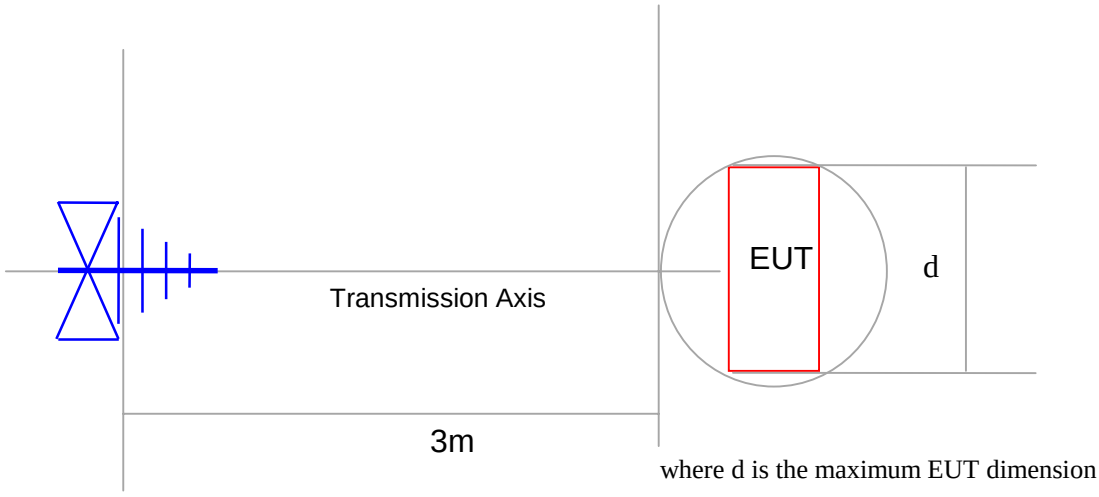
RX frequency (Fc): 935.000 MHz

Emission Frequency (MHz)	Polarisation of Emission	Field Strength μV/m	Field Strength Limit μV/m
42.60	Vertical	8.54	100
45.48	Horizontal	18.62	100
70.98	Horizontal	18.73	100
85.14	Horizontal	15.38	100
99.3	Horizontal	16.83	150
226.98	Horizontal	38.68	200
914.34	Horizontal	4.29	200

Open Area Test Site (OATS)



Equipment Test Set Up



Antenna to EUT Distance

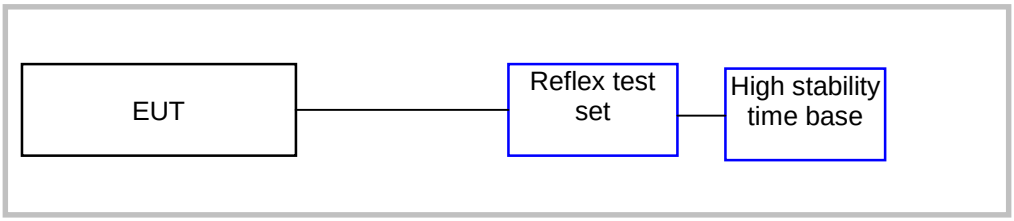
Frequency Stability with Temperature Variation - 47 CFR 2.1055 (a) (1) and 24.135

The transmitter is operated under standard test conditions, using the standard test voltage. The transmitter is connected to a Reflex test set which simulates a Reflex base station, and the frequency was measured over the range of -30° C to + 50 ° C in steps of 10°

The frequency drift of the EUT was observed and recorded.

The frequency drift was measured in accordance with the following test configuration, using the test instruments listed.

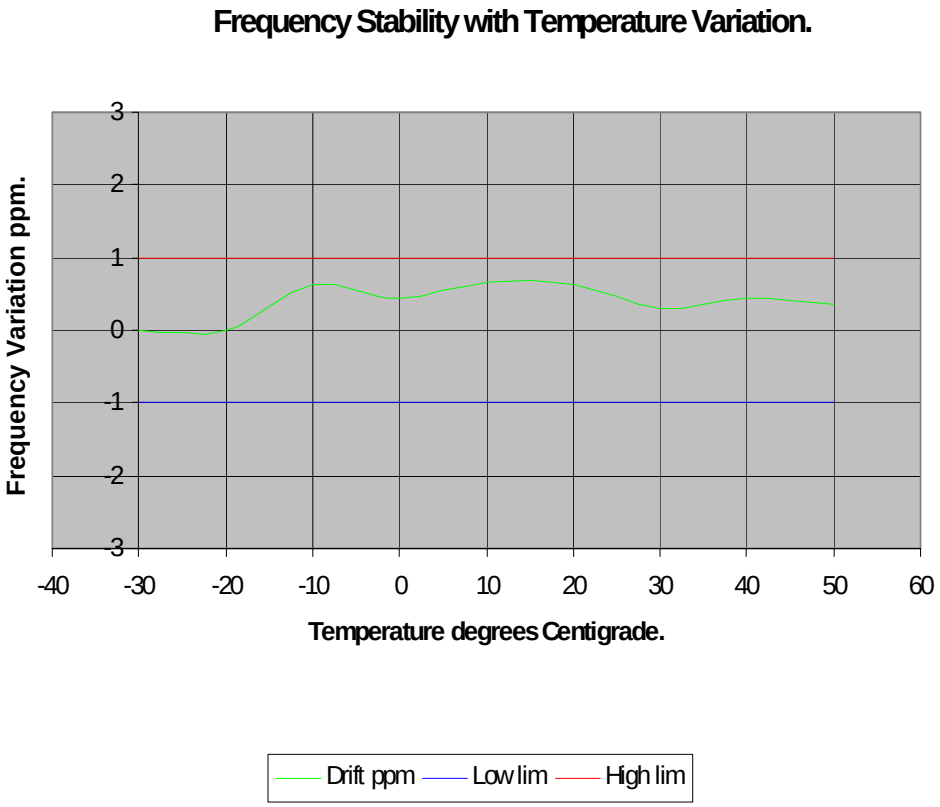
(Calibrated items are indicated in Blue)



Test instruments used :

Reflex test set	:	Type TC200A
Climatic Chamber	:	Heraeus Votsch Type VMT/04/240
High stability time base	:	Hewlett Packard Type 8656 signal generator

Results in accordance with Part 2.1055 (a) (1) and 24.135, Frequency Stability.



Frequency Stability with primary voltage variation - 47 CFR 2.1055 (d) (1) and 24.135

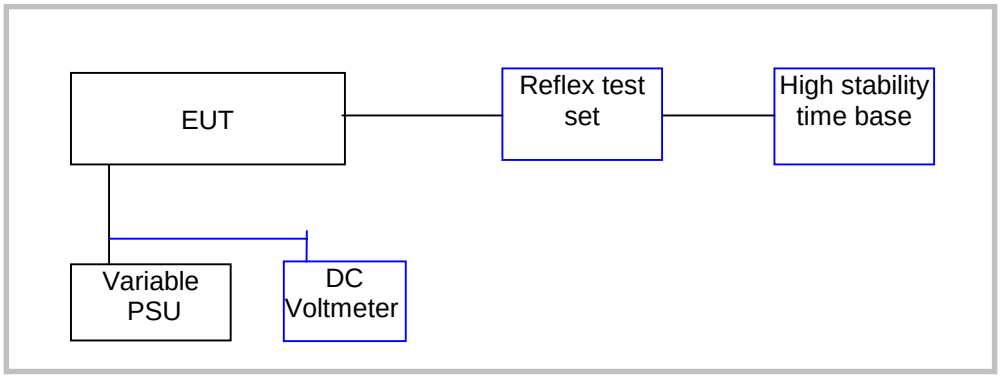
The transmitter is operated under standard test conditions, using the standard test voltage. The transmitter is connected to a Reflex test set which simulates a Reflex base station.

The primary voltage is varied from 85 % to 115% of the nominal, if the EUT does not function at 85 % of the nominal voltage, the voltage is increased to the point where it switches on, and this voltage point is recorded.

The Frequency drift of the EUT is observed and recorded.

The frequency drift was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)

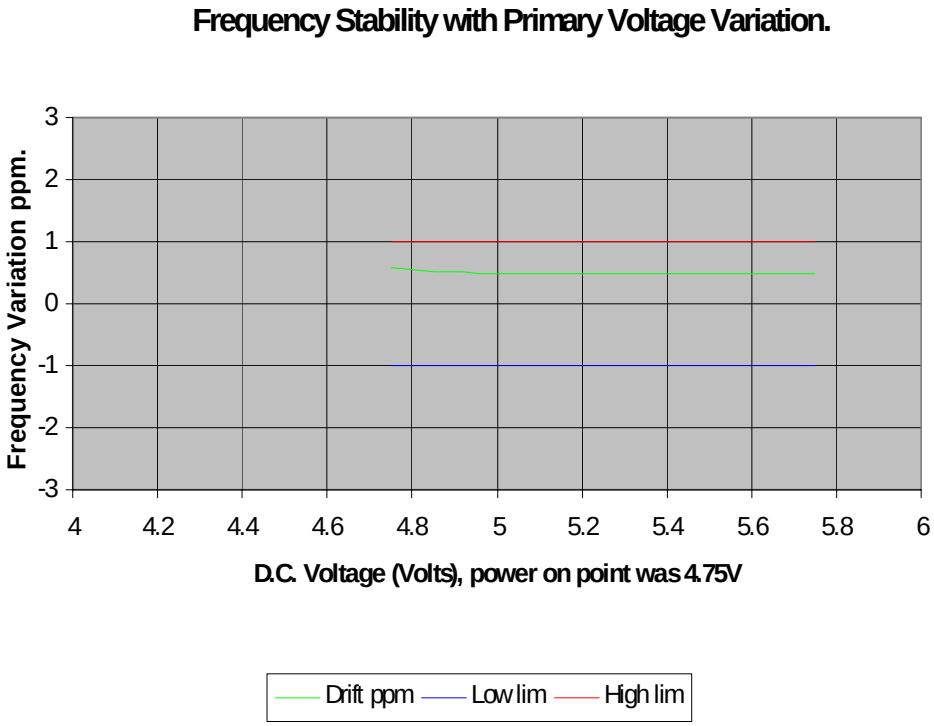


The attenuator was at the nominal impedance of the transmitter.

Test instruments used :

Reflex test set	:	Type TC200A
Climatic Chamber	:	Heraeus Votsch type VMT/04/240
High stability time base	:	Hewlett Packard type 8656 signal generator
Power Supply	:	Kingshill type 18V10
AC Voltmeter	:	Philips Type PM 2534

Results in accordance with Part 2.1055 (d) (1) and 24.135, Frequency Stability.



Frequency spectrum to be investigated - 47 CFR 2.1057

The level of frequency search is from the lowest radio frequency generated to the 10th Harmonic of the fundamental frequency of the highest carrier frequency.

General Test Conditions

Laboratory environment .

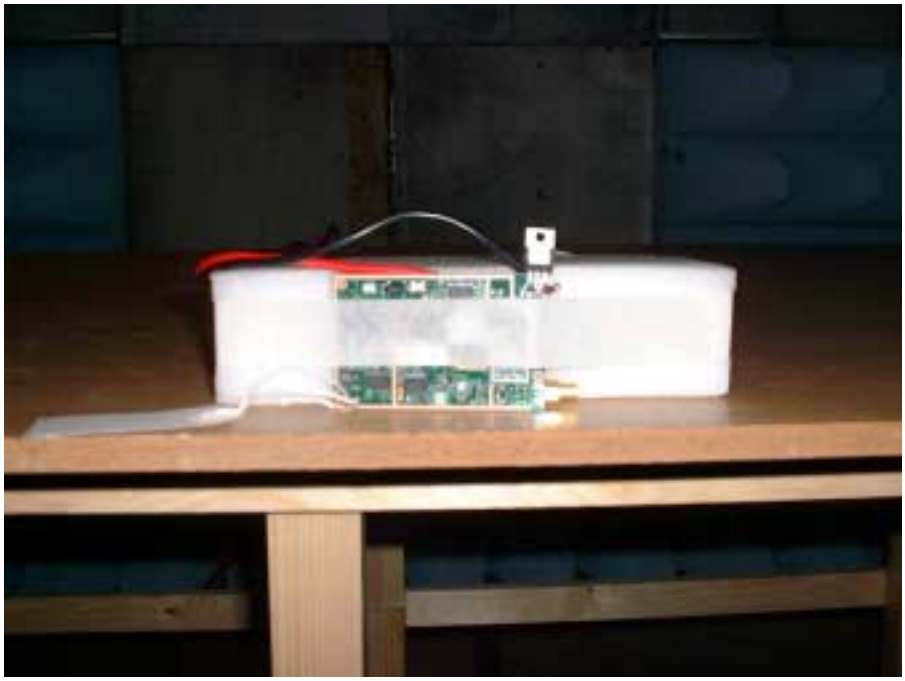
Ambient Temperature : 23 °C

Relative Humidity : 22 %

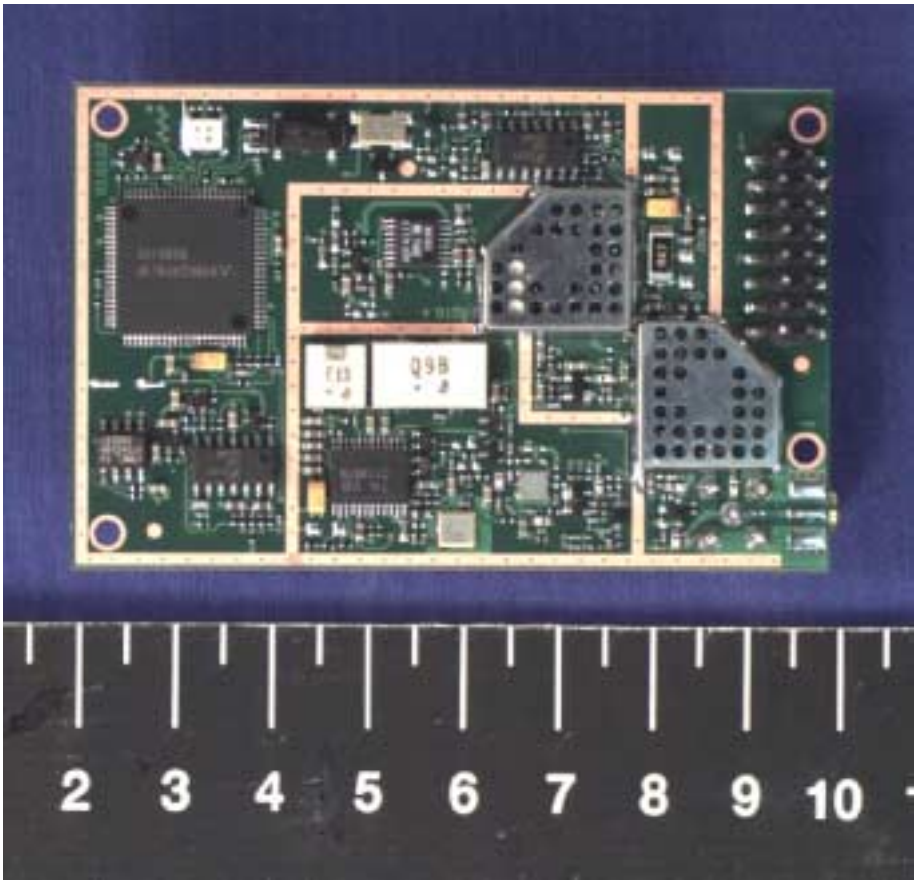
Open Area test Site : 15 °C

PHOTOGRAPHS OF EQUIPMENT

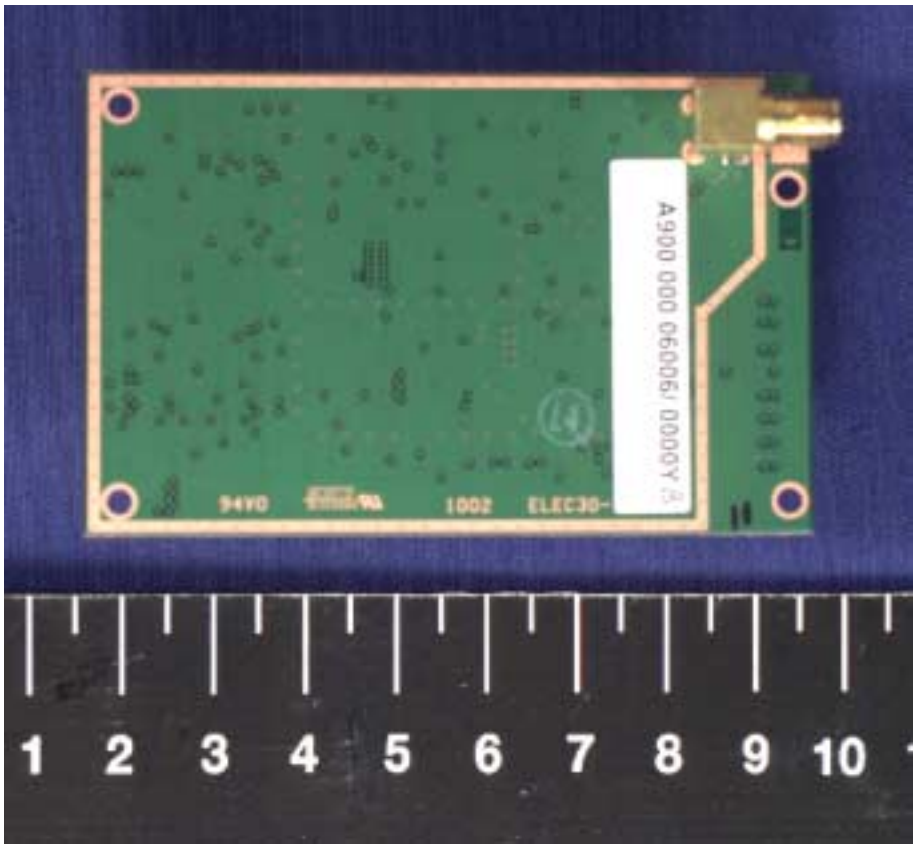
Transmitter Test Position For Radiated Measurements



Transmitter (front view)



Transmitter (rear view)



CTMS LTD, Company Accreditations & Credentials

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United Kingdom Accreditation Service

ACCREDITATION CERTIFICATE

NAMAS

TESTING
No. 1831

Cambridge Test and Measurement Services Ltd
PO Box 465
St Andrews Road
Cambridge
CB4 1ZJ

is accredited to undertake Category C testing in the above named permanent laboratory as detailed in the schedule bearing the above accreditation number and NAMAS logo. From time to time this schedule may be revised and reissued by the United Kingdom Accreditation Service.

This Accreditation shall remain in force until 10 JUNE 2001 subject to continuing compliance with the NAMAS Accreditation Standard, NAMAS Regulations and any further requirements specified by the United Kingdom Accreditation Service. Accredited organisations meet the requirements of EN45001, ISO/IEC Guide 25 and the relevant requirements of the BS EN ISO 9000 series of standards, including those of the model elsewhere in BS EN ISO 9002 when acting as suppliers producing test results.

Authorised to Manage the United Kingdom Accreditation Service

Issued on 12 October 1998 Initial Accreditation 11 June 1997

The Department of Trade and Industry (DTI) has entered into an agreement whereby the United Kingdom Accreditation Service (UKAS) through which UKAS is recognised as the national body responsible for providing National Accreditation of Measurement and Sampling (NAMAS).

SGS Yarsley
International Certification Services Limited

Certificate Number

Q10171

This is to certify that the
Quality Management systems of

Cambridge
Test and Measurement
Services Limited

have been assessed and registered as meeting the requirements of ISO 9002

The scope of registration is detailed on the Assessment Schedule bearing this certificate number.

SGS Yarsley International Certification Services Ltd
Signed by

R. R. Carey.

30 June 1997
This certificate remains valid subject to satisfactory maintenance of the system

Registered Office:
SGS Yarsley
International Certification Services Limited
SGS House, 217/221 London Road,
Camberley, Surrey GU15 3EY, United Kingdom.

Whilst all due care and skill was exercised in carrying out this assessment, SGS Yarsley ICS accepts responsibility only for proven gross negligence. This is not a legal document and cannot be used as such. The use of the Accreditation mark shown on this certificate indicates accreditation in the respect of those activities covered by the Accreditation Authority. This certificate remains the property of SGS Yarsley ICS to whom it must be returned on request.

NATIONAL ACCREDITATION OF CERTIFICATION BODIES
Registration Number
005