

CERTIFICATION TEST REPORT FOR A 902-928 MHz TRANSCEIVER

Applicant: Sensus Technologies Inc.
 450 N. Gallitin Ave.
 Uniontown, PA 15401

Model: AR4002
FCC ID: KCH-4002-A

Operating Frequency: 903.080 MHz to 927.69 MHz (15.249 transceiver)
 902-928 MHz (Spread spectrum receiver only)
 952.000 MHz - 956.256 MHz Part 101 120 mW
 transceiver

RF Output: 50,000 uV/m (94 dBuV/m) at 3 meters

FCC Rule Part: LP TX: 15.205, 15.249 RX: 15.101, 15.109
 Part 101 TX: 101.139(e) (<250 mW no certification req.)

Used For: Hand-held utility meter reader

Power Source: Battery operation only
 Has separate battery charging cradle when not in use

Test Location: Compliance Consulting Services
 951F Monterey Road
 Morgan Hill, CA 95087

All tests were performed by me or under my supervision. The Sensus AR4002 meets all emissions and modulation requirements specified under Parts 2 and 15 of the Commission's Rules.

THOMAS N. COKENIAS

28 September 1999

EXHIBITS

EXHIBIT A: Letter Requesting Confidentiality under Sec. 0.457(d)

EXHIBIT B: Information for which Confidentiality is Requested

B1: Schematics
B2: Block Diagrams
B3: Theory of Operation

EXHIBIT C: Product Photographs

EXHIBIT D: User Manual and FCC ID Label

EXHIBIT E: Report of Measurements

EXHIBIT A: Letter Requesting Confidentiality under Sec. 0.457(d)

see attachment 40024002conf

EXHIBIT B: Information for which Confidentiality is Requested

B1: Schematics

B2: Block Diagrams

B3: Theory of Operation

EXHIBIT C: Product Photographs

- see attachments *EUTphoto*.jpg*

EXHIBIT D: User Manual and FCC ID Label

- see attachments *User manual and label*

EXHIBIT E: Report of Measurements

EMISSIONS TEST REPORT FOR A LOW POWER TRANSCEIVER

I. GENERAL INFORMATION

Requirement: FCC: 47CFR, Parts 2 and 15
Industry Canada: RSS-210

Applicant: Sensus Technologies Inc.
450 N. Gallitin Ave.
Uniontown, PA 15401

Product ID: KCH-4002-A

Model Numbers: AR4002

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The AR4002 is a hand-held battery operated utility meter reader that uses the RF communications link to transfer meter data.

III. TEST LOCATION

All emissions tests were performed at:

Compliance Certification Services
561F Monterey Road
Morgan Hill, CA 95087
Phone: 408-752-8166 Fax: 408-752-8168

CCS has site descriptions on file with the FCC for 30 m, 10m and 3m site configurations. CCS is a NVLAP accredited facility.

Radiated emissions from the digital portion of the EUT were performed on site B, one of the 3m/10 m sites.

IV. TEST PROCEDURES

TX Radiated Emissions

Test Requirement: FCC: 15.205, 15.249(a)

Industry Canada: RSS-210

Measurement Equipment Used:

HP 8563E Spectrum Analyzer

HP8447 D Preamplifier, .1 - 1300 MHz

HP 8449 B Preamplifier, 1-26 GHz

EMCO 3146 Log Periodic antenna, 200 - 1000 MHz

ARA DRG-118/A Double Ridged Horn antenna, 1 - 18 GHz

Flexco low loss cable, 16ft (loss: 0.85 dB/ft@ 26 GHz)

Test Set-Up

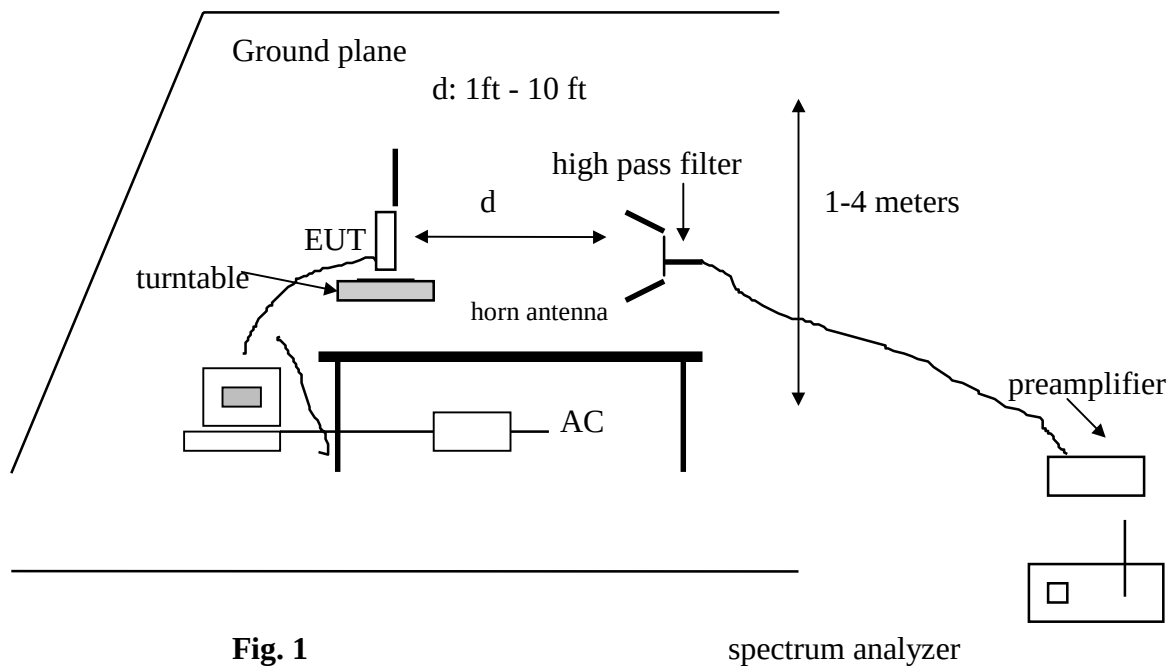


Fig. 1

spectrum analyzer

Test Procedures

1. The EUT was set to MID channel and was placed on a wooden table located on the test site ground plane. The search antenna was placed 3 ft from the EUT. The EUT antenna was mounted vertically as per normal installation.

Note: The 15.249 transceiver board was tested separately outside of its meter case. The reason for this

was that the meter software was not able to sustain a steady-state transmission mode, but a stand-alone board connected to a laptop could do so. The measurements represent worst-case emissions, as there is no shadowing or shielding from the meter circuit boards and other internal assemblies.

2. The turntable was slowly rotated to locate the direction of maximum emission at each emission in the 902 - 9280 MHz frequency range.
3. Once maximum emission azimuth was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.
4. Steps 1 - 3 were repeated for LOW channel and HI channel.

Test Results

PASS. Refer to tabulated test results below.

HI channel: 927.69 MHz
MID channel: 914.87 MHz
LOW channel: 903.08 MHz

TX Radiated Emission Test Results, fo - 10 fo

COMPLIANCE ENGINEERING SERVICES, INC.

Out of Band
15.247

09/24/99
Jesse Saldivar
B site

Sensus Technologies
AR4002
FCC ID: KCH-4002-A
fo, MHz= 903.08

F(MHz)	READING		AF	CL	AMP	DIST	HPF	TOTAL		LIMIT		MARGIN	
	(dBuV)		(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)		(dBuV/m)		(dB)	
1806.16	65.6	66.2	28	2.5	-35	-20	0	40.6	41.2	74	54	-33.4	-12.8
2709.24	62	56.2	32	3.5	-35	-20	0	42.2	36.4	74	54	-31.8	-17.6
3612.32	50.1	45.2	32	3.8	-35	-20	0	30.9	26	74	54	-43.1	-28
4515.4	41.1	34.9	35	5.6	-35	-20	0	26.9	20.7	74	54	-47.1	-33.3
5418.48	44.2	32.7	37	7	-35	-20	0	33.3	21.8	74	54	-40.7	-32.2
6321.56	43.5	33.7	37	7	-35	-20	0	32.6	22.8	74	54	-41.4	-31.2
7224.64	47	37.8	37	7	-35	-20	0	36.1	26.9	74	54	-37.9	-27.1
8127.72	43.6	35.4	37	7	-35	-20	0	32.7	24.5	74	54	-41.3	-29.5

NOTE: ALL READINGS ARE VERTICAL

DIST: Correction to extrapolate reading to 3m specification distance

1.0M measurement distance: **-10.45dB**

AF: Antenna Factor

AMP: Pre-amp gain

CL: Cable loss

HPF: High pass filter insertion loss (4.6GHz)

FSY (S/N: 001)

ANALYZER SETTINGS

Res
bw

PEAK(Pk): 1MHz
AVERAGE(Avg): 1MHz

1MHz
10Hz

COMPLIANCE ENGINEERING SERVICES, INC.

Out of Band
15.247

09/24/99
Jesse Saldivar
B site

Sensus Technologies
AR4002
FCC ID: KCH-4002-A
fo= 914.87 MHz

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF (dB)	TOTAL (dBuV/m)		LIMIT (dBuV/m)		MARGIN (dB)	
1829.7	67.9	67.6	28	2.5	-35	-20	0	42.9	42.6	74	54	-31.1	-11.4
2744.6	61.8	54.8	32	3.5	-35	-20	0	42	35	74	54	-32	-19
3659.5	49.9	44.1	32	3.8	-35	-20	0	30.7	24.9	74	54	-43.3	-29.1
4575.3	41.9	32.8	35	5.6	-35	-20	0	27.7	18.6	74	54	-46.3	-35.4
5489.2	43.3	28.9	37	7	-35	-20	0	32.4	18	74	54	-41.6	-36
6404.1	41.8	32.9	37	7	-35	-20	0	30.9	22	74	54	-43.1	-32
7319	46.2	37.1	37	7	-35	-20	0	35.3	26.2	74	54	-38.7	-27.8
8233.8	43.3	36.1	37	7	-35	-20	0	32.4	25.2	74	54	-41.6	-28.8

NOTE: ALL READINGS ARE VERTICAL

DIST: Correction to extrapolate reading to 3m specification distance

1.0M measurement distance: **-10.45dB**

AF: Antenna Factor

AMP: Pre-amp gain

CL: Cable loss

HPF: High pass filter insertion loss (4.6GHz)

FSY (S/N: 001)

ANALYZER SETTINGS

Res Avg. bw
bw

PEAK(Pk): 1MHz 1MHz
AVERAGE(Avg): 1MHz 10Hz

COMPLIANCE ENGINEERING SERVICES, INC.

Out of Band
15.247

09/24/99
Jesse Saldivar
B site

Sensus Technologies
AR4002
FCC ID: KCH-4002-A
fo, MHz= 927.69

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF (dB)	TOTAL (dBuV/m)		LIMIT (dBuV/m)		MARGIN (dB)	
1855.38	64.9	67.6	28	2.5	-35	-20	0	39.9	42.6	74	54	-34.1	-11.4
2783.07	61.8	62	32	3.5	-35	-20	0	42	42.2	74	54	-32	-11.8
3710.76	51	43.7	32	3.8	-35	-20	0	31.8	24.5	74	54	-42.2	-29.5
4638.45	41.1	32.8	35	5.6	-35	-20	0	26.9	18.6	74	54	-47.1	-35.4
5566.14	45	31.2	37	7	-35	-20	0	34.1	20.3	74	54	-39.9	-33.7
6493.83	45.7	32.7	37	7	-35	-20	0	34.8	21.8	74	54	-39.2	-32.2
7421.52	46.8	37.7	37	7	-35	-20	0	35.9	26.8	74	54	-38.1	-27.2
8349.21	44.4	37.2	37	7	-35	-20	0	33.5	26.3	74	54	-40.5	-27.7

NOTE: ALL READINGS ARE VERTICAL

DIST: Correction to extrapolate reading to 3m specification distance

1.0M measurement distance: **-10.45dB**

AF: Antenna Factor

AMP: Pre-amp gain

CL: Cable loss

HPF: High pass filter insertion loss (4.6GHz)

FSY (S/N: 001)

ANALYZER SETTINGS

Res
bw

PEAK(Pk): 1MHz
AVERAGE(Avg): 1MHz

1MHz
10Hz

TX Out of Band Emissions

Test Requirement: FCC: 15.249(c)

Industry Canada: RSS 210

Measurement Equipment Used:

HP 8563E Spectrum Analyzer

Flexco low loss cable, 16ft (loss: 0.85 dB/ft@ 26 GHz)

Test Set-up

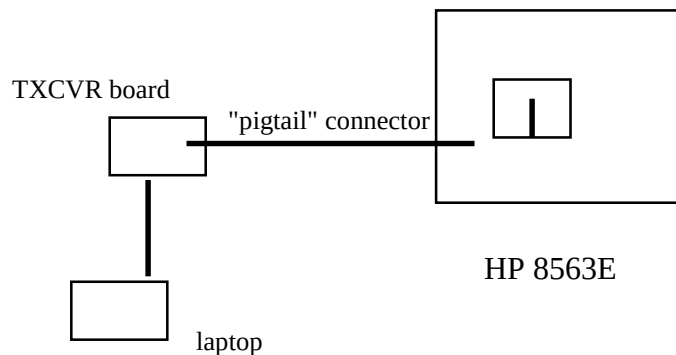


Figure 2

Test Procedures

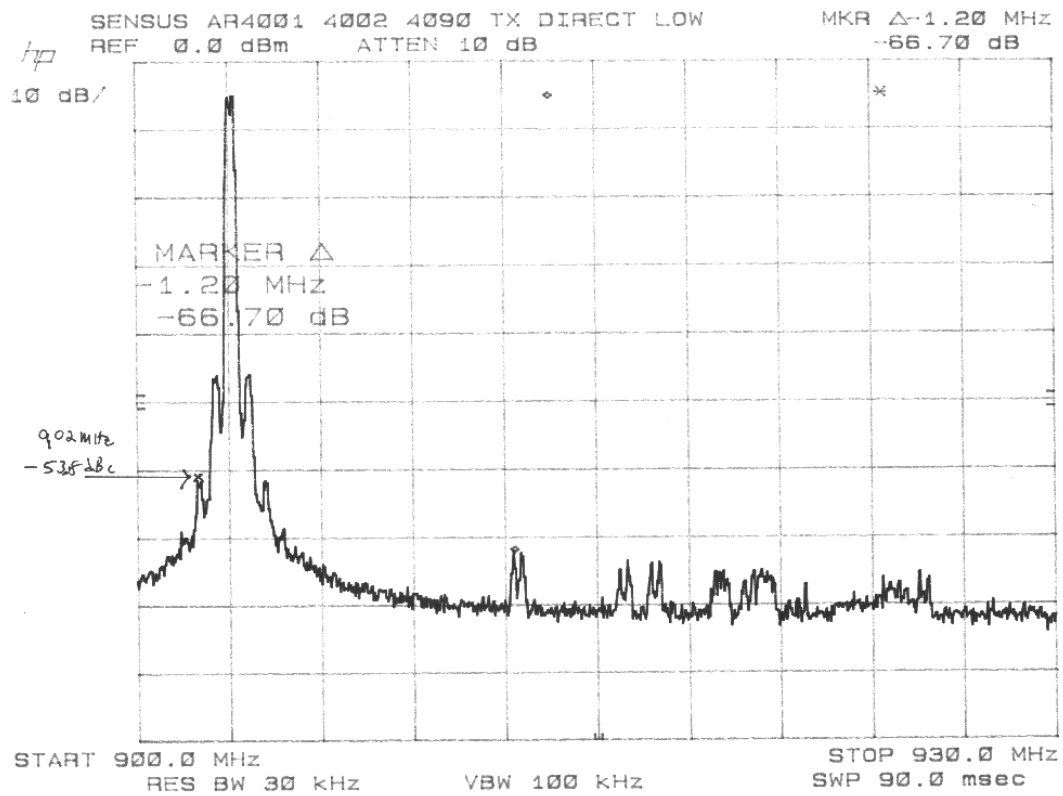
1. The EUT was configured on a test bench as shown in Figure 1. The transmitter was set to a LOW channel. While the transmitter broadcast a steady stream of data, the analyzer MAX HOLD function was used to capture the envelope of the transmission occupied bandwidth.
2. The process in (1) was repeated for MID and HI channel.

Test Results:

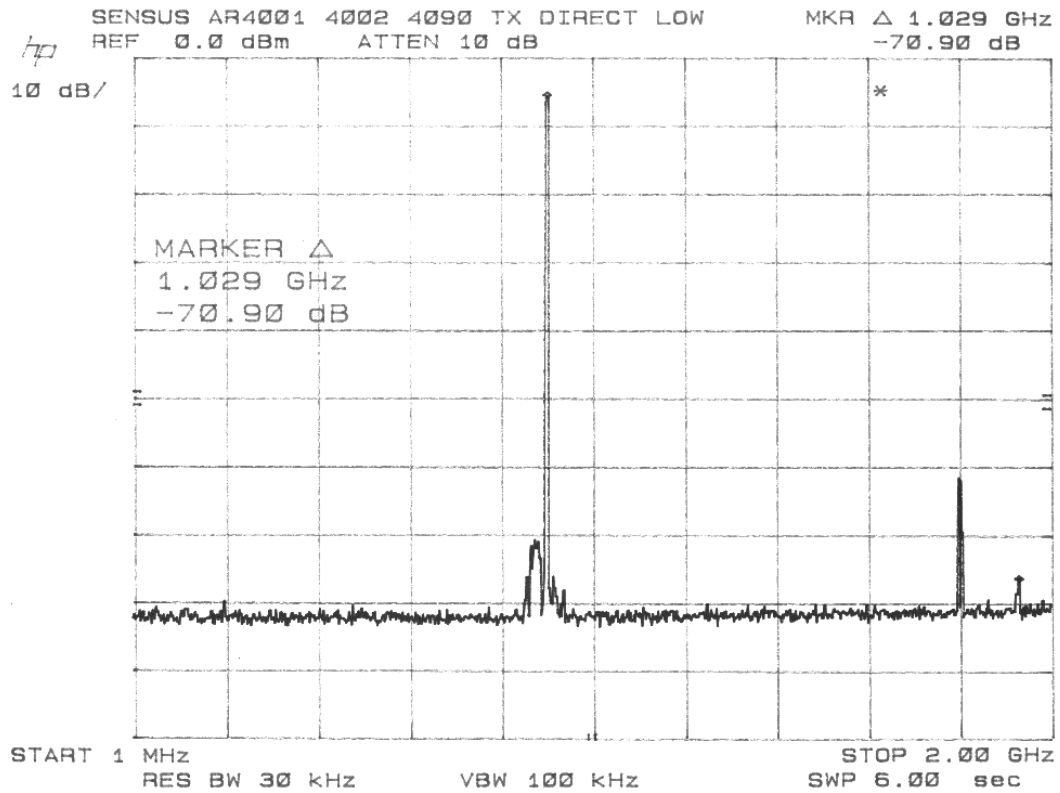
PASS. All emissions outside the band (except for harmonics, measured previously) were attenuated more than 50 dB below the level of the fundamental.

Refer to attached spectrum analyzer graphs.

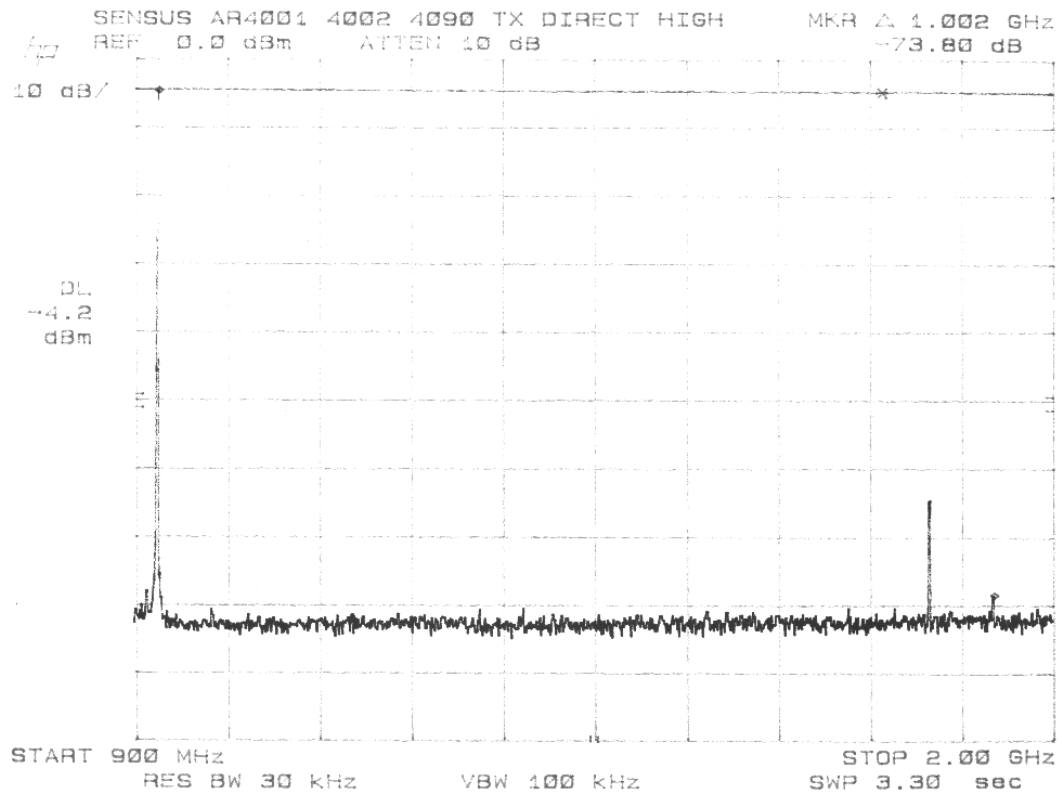
Out of Band Emissions – 903.08 MHz



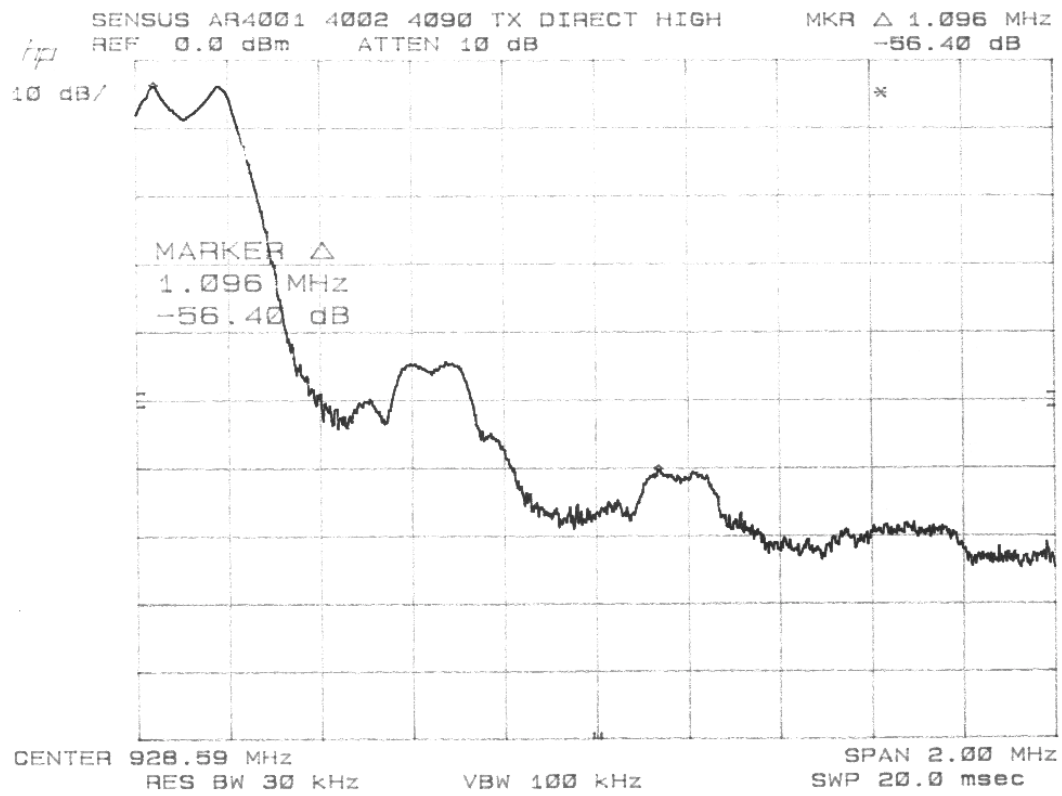
Out of Band Emissions – 903.08 MHz



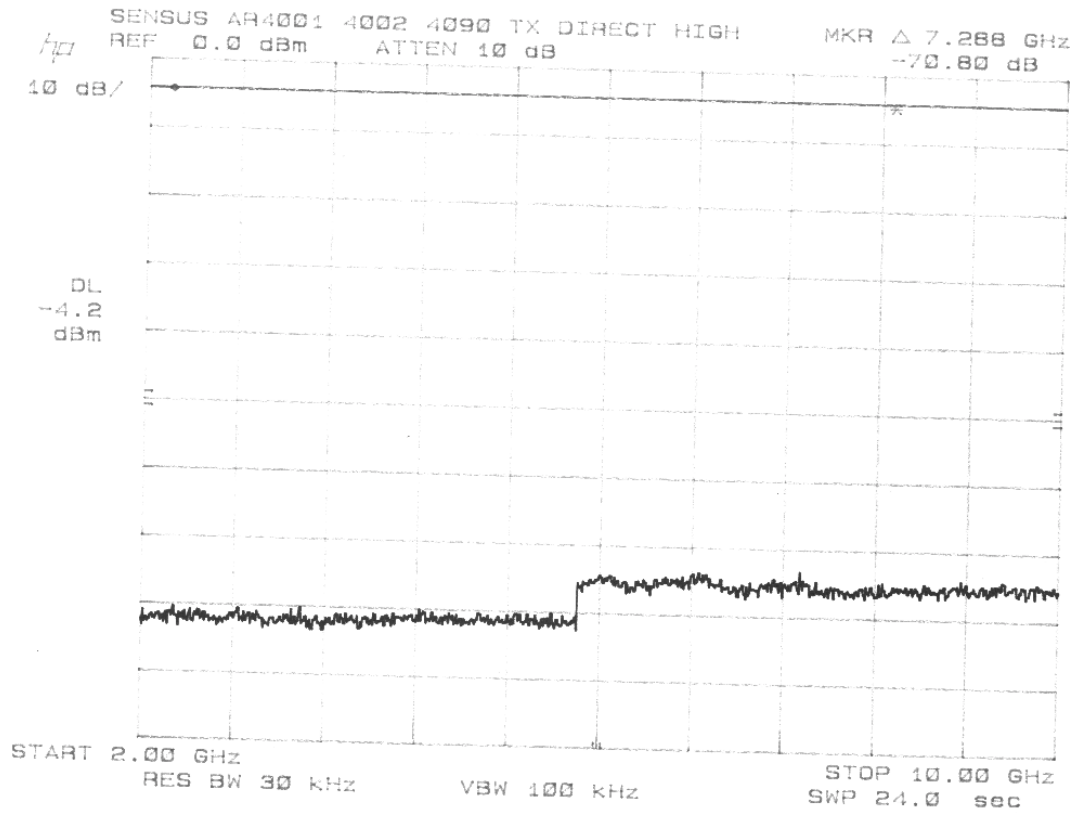
Out of Band Emissions – 927.69 MHz



Out of Band Emissions – 927.69 MHz



Out of Band Emissions – 927.69 MHz



Receiver Related Emissions

Test Requirement: FCC: 15.101, 15.109

Industry Canada: RSS 210

Per 15.101(b) for a transceiver, the transmitter portion of which is subject to certification, the receiver section is subject to verification and no data need be submitted to the Commission. The Sensus Technologies transceiver referenced above uses an RFM "ASH" receiver, which is basically a tuned radio frequency (TRF) receiver that uses no oscillators, hence no separate measurements were made on the receiver portion of the product.

The Part 101 receiver section of the transceiver is also subject to verification and no data need be submitted to the Commission.

V. CERTIFICATION OF DATA

All radiated and conducted measurements described in this report were performed by, or were witnessed and supervised by, the undersigned. To the best of his knowledge and belief, test equipment calibrations, test procedures, and test data were accurate and as reported here.

T.N. COKENIAS

28 September 1999