FCC CFR47 PART 15 CERTIFICATION

TEST REPORT

FOR

UTILITY METER READER WITH DIRECT SEQUENCE SPREAD SPECTRUM RADIO

MODEL: MXU MODEL 505-C

FCC ID: KCHMXU505C

REPORT NUMBER: 01U1004-1

ISSUE DATE: OCTOBER 22, 2001

Prepared for
INVENSYS METERING SYSTEMS
450 N. GALLATIN AVE.
UNIONTOWN, PA 15401
USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885
FAX: (408) 463-0888

LAB CODE:200065-0

TABLE OF CONTENT

1. TEST RESULT CERTIFICATION ---- 4

2. EUT DESCRIPTION ---- 5

3. TEST METHODOLOGY ---- 5

4. TEST FACILITY ---- 5

5. ACCREDITATION AND LISTING ---- 5

5.1. Laboratory Accreditations and Listings ---- 6

6. MEASURING INSTRUMENT CALIBRATION ---- 7

6.1. Measurement Uncertainty ---- 7

7. SUPPORT EQUIPMENT / TEST DIAGRAM ---- 8

8. APPLICABLE RULES AND BRIEF TEST RESULT ---- 9

9. TEST SETUP, PROCEDURE AND RESULT ---- 14

9.1. CONDUCTED POWER ---- 14
9.2. 6 dB BANDWIDTH MEASUREMENT ---- 17
9.3. CONDUCTED SPURIOUS EMISSION ---- 19
9.4. PEAK POWER SPECTRAL DENSITY ---- 23
9.5. PROCESSING GAIN ---- 27
9.6. BAND EDGE MEASUREMENT ---- 28
9.7. RADIATED EMISSION ---- 32
9.8. POWER LINE CONDUCTED EMISSION ---- 37
9.9. SETUP PHOTOS ---- 38

ATTACHMENTS

- EUT PHOTOGRAPHS
- PROPOSED FCC ID LABEL
- AGENT AUTHORIZATION LETTER
- REQUEST FOR CONFIDENTIALITY
- ANTENNA SPECIFICATION
- USER'S MANUAL
- PART LIST
- PRODUCT SPECIFICATION
- PROCESSING GAIN
- THEORY OF OPERATION

This report shall not be reproduced except in full, without the written approval of CCS.

- BLOCK DIAGRAM & SCHEMATIC DIAGRAM

This report shall not be reproduced except in full, without the written approval of CCS.

1. TEST RESULT CERTIFICATION

COMPANY NAME: **INVENSYS METERING SYSTEMS**
450 N. GALLATIN AVE
UNIONTOWN, PA 15401 USA

CONTACT PERSON: **T.N. COKENIAS/AGENT FOR INVENSYS**

TELPHONE NO: **650-726-1263**

EUT DESCRIPTION: **UTILITY METER READER WITH DSSS RADIO**

MODEM NAME: **MXU MODEL 505-C**

DATE TESTED: **OCTOBER 22, 2001**

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	903.8 TO 926.2MHz TRANSCEIVER
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CERTIFICATION
FCC RULE	CFR 47 PART 15.247

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 15.247. The equipment in the configuration described in this report, shows the measured emission levels emanating from the equipment do not exceed the specified limit.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Approved & Released For CCS By:

STEVE CHENG
EMC ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

JESSE SALDIVAR
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

This report shall not be reproduced except in full, without the written approval of CCS.

2. EUT DESCRIPTION

The model MXU (Meter Transceiver Unit) 505C is a utility meter reading system that uses a 902-928 MHz spread spectrum transceiver operating under 15.247 of the FCC Rules, and an AM receiver operating in the 952-956 MHz MAS band. The MXU uses the spread spectrum transmitter for remote meter reading data transmission.

3. TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

4. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2))

This report shall not be reproduced except in full, without the written approval of CCS.

5.1. Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	FCC Part 15, CISPR 22, AS/NZS 3548,IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, CNS 13438	NVLAP 200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	FC 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	VCCI R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	N ELA 117
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	N ELA-171
Taiwan	BSMI	CNS 13438	商檢 SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

*No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government

This report shall not be reproduced except in full, without the written approval of CCS.

6. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

TEST EQUIPMENTS LIST

Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Spectrum Analyzer	HP100Hz - 22GHz	8566B	2140A01296	5/4/02
Spectrum Display	HP	85662A	2152A03066	4/10/02
Quasi-Peak Detector	HP9K - 1GHz	85650A	2811A01155	5/4/02
Pre-Amplifier, 25 dB	HP 0.1 - 1300MHz	8447D (P_1M)	2944A06833	11/21/01
Antenna, BiLog	Chase 30 - 2000MHz	CBL6112	2049	12/11/01
LISN	Fisher Cus. Comm.	LISN-50/250-25-2	2023	8/5/02
EMI Test Receiver	Rohde & Schwarz	ESHS 20	827129/006	2/28/02
EMC Receiver (9K-26.5GHz)	HP	8593EM	3710A00205	6/20/02
Horn Antenna(1 - 18GHz)	EMCO	3115	2238	6/20/02
Horn Antenna,(18 - 26GHz)	Antenna Research Associate	MWH 1826/B	1013	7/26/02
Power Meter	HP	436A	2709A29209	2/8/02
High pass filter	ESM Microwave	HM 4570-9SS	3	N.C.R.

6.1. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

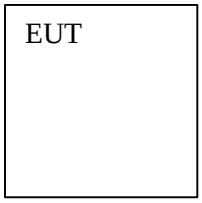
Radiated Emission	
30MHz – 200 MHz	+/- 3.3dB
200MHz – 1000MHz	+4.5/-2.9dB
1000MHz – 2000MHz	+4.6/-2.2dB
Power Line Conducted Emission	
150kHz – 30MHz	+/-2.9

Any results falling within the above values are deemed to be marginal.

This report shall not be reproduced except in full, without the written approval of CCS.

7. SUPPORT EQUIPMENT / TEST DIAGRAM

N/A



This report shall not be reproduced except in full, without the written approval of CCS.

8. APPLICABLE RULES AND BRIEF TEST RESULT

§15.247- POWER LIMIT

(b) The maximum peak output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, all frequency hopping systems in the 5725-5850 MHz band, and all direct sequence systems: 1 watt.

Spec limit: As specified above, 1W maximum.
Test result: No non-compliance noted.

Channel	*Frequency (MHz)*	*Output Power(milliwatts)*
LOW	***903.87***	***187***
MID	***915.11***	***177***
HIGH	***926.31***	***166***

§15.247- BANDDWIDTH LIMITATION

(2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

Spec limit: > 500 kHz.
Test result: No non-compliance noted.

Channel	*Frequency (MHz)*	*Bandwidth(MHz)*
Low	***903.92***	***1.138***
Mid	***915.11***	***1.150***
High	***926.31***	***1.150***

§15.247- PEAK POWER SPECTRAL DENSITY

(d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Spec limit: < 8dBm.
Test result: No non-compliance noted.

Channel	*Frequency (MHz)*	*Results (dBm)*
Low	***903.8***	***7.5***
Mid	***915.00***	***7.9***
High	***926.2***	***7.2***

This report shall not be reproduced except in full, without the written approval of CCS.

§15.247- PROCESS GAIN

(e) The processing gain of a direct sequence system shall be at least 10 dB. The processing gain represents the improvement to the received signal-to-noise ratio, after filtering to the information bandwidth, from the spreading/dispreading function.

Spec limit: >10dBm.
Test result: Complies. Refer to separate attachment.

§15.205- RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]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
6.215 - 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	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Spec limit: As specified above,
Test result: No non-compliance noted. See section 9.7 Radiated Emission.

This report shall not be reproduced except in full, without the written approval of CCS.

§15.209- RADIATED EMISSION LIMITS; GENERAL REQUIREMENTS

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (Microvolts/meter)	Measurement Distance (Meters)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional Radiators operating under this Section shall not be located in the frequency Bands: 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation Within these frequency bands is permitted under other sections of this Part, e.g., Sections: 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

This report shall not be reproduced except in full, without the written approval of CCS.

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Spec limit: As specified above.
Test result: No non-compliance noted.

This report shall not be reproduced except in full, without the written approval of CCS.

§15.207- CONDUCTED LIMITS

(a) For an intentional radiator, which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

FCC CLASS A

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-1.705MHz	1000	60
1.705MHz - 30MHz	3000	69.54

FCC CLASS B

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-30MHz	250	48

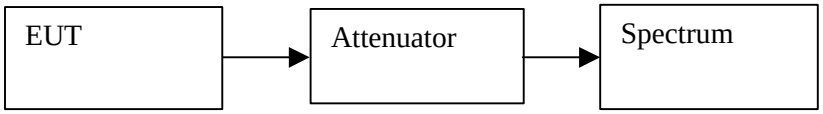
Spec limit: As specified above.
Test result: No Line conduction performed because EUT is battery operated.

This report shall not be reproduced except in full, without the written approval of CCS.

9. TEST SETUP, PROCEDURE AND RESULT

9.1. CONDUCTED POWER

TEST SETUP



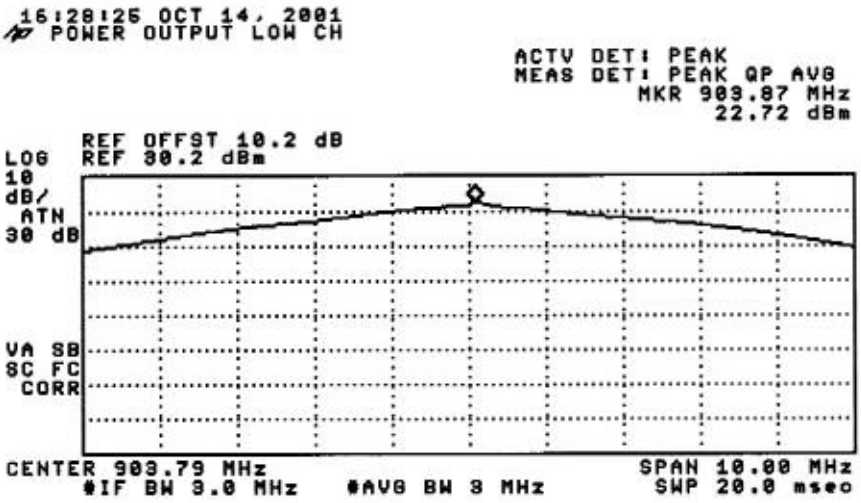
TEST PROCEDURE

The EUT is configured on a test bench as shown above in a continuously transmitting / receiving mode.

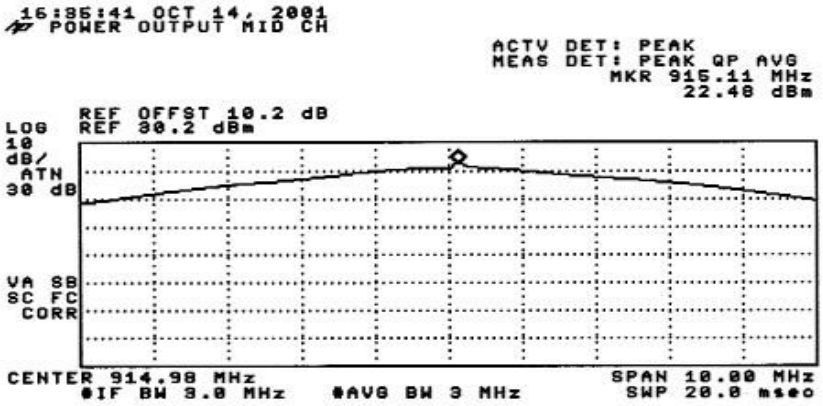
RESULT

No non-compliance noted.

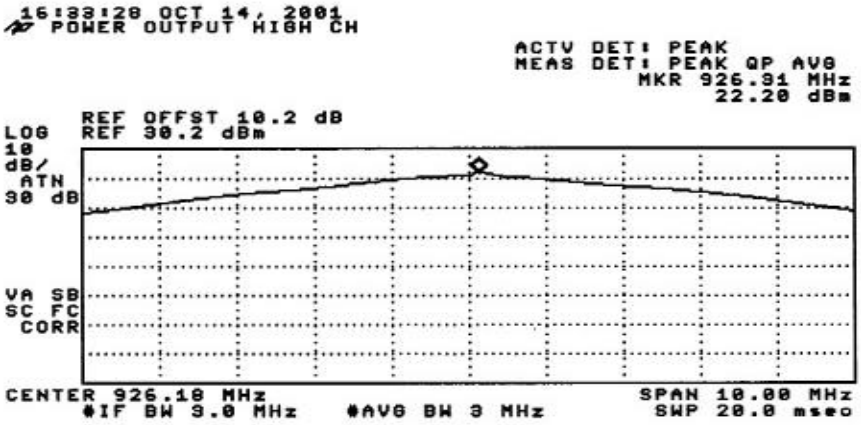
Channel	*Frequency (MHz)*	*Output Power (milliwatts)*
Low	***903.87***	***187***
Mid	***915.11***	***177***
High	***926.31***	***166***



This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.



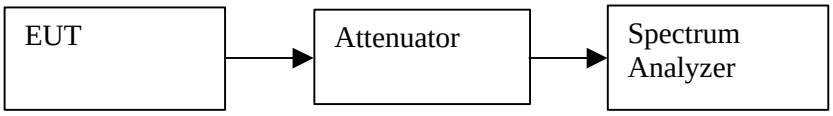
This report shall not be reproduced except in full, without the written approval of CCS.

9.2. 6 dB BANDWIDTH MEASUREMENT

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak ☐ Average	☒ 100 kHz ☐ 1 MHz	☒ 100 kHz ☐ 1 MHz

TEST SETUP



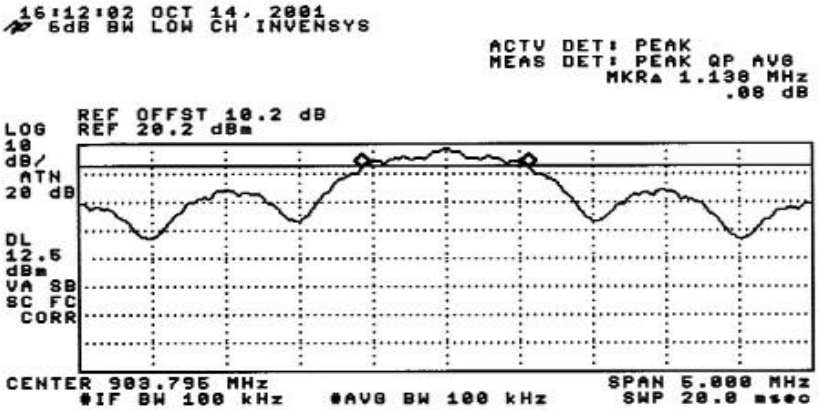
TEST PROCEDURE

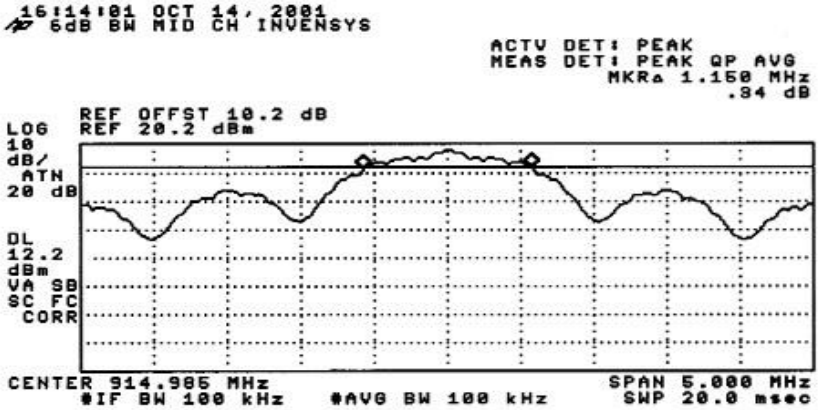
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 kHz RBW and 100 kHz VBW. The 6 dB bandwidth is defined as the total spectrum the power off which is higher than peak power minus 6 dB.

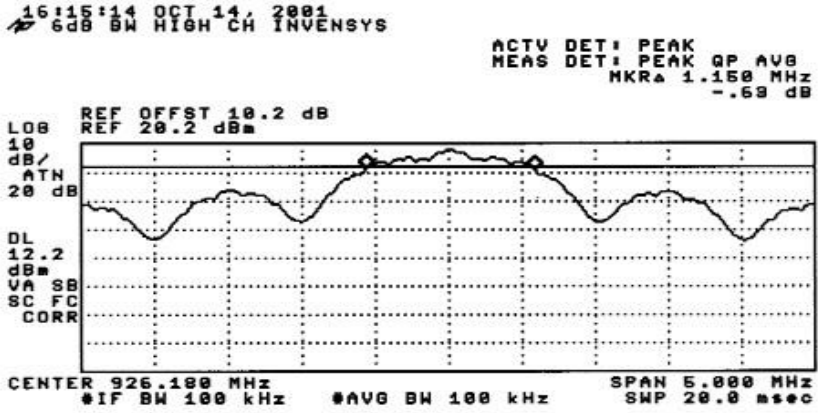
RESULT

No non-compliance noted.

This report shall not be reproduced except in full, without the written approval of CCS.







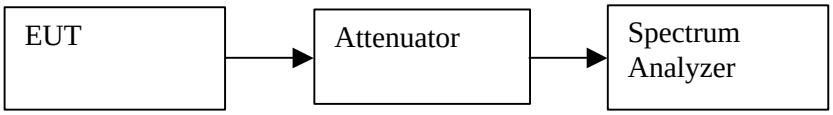
This report shall not be reproduced except in full, without the written approval of CCS.

9.3. CONDUCTED SPURIOUS EMISSION

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Below 1000	☒ Peak ☐ Average	☒100 kHz ☐ 1 MHz	☒ 100 kHz ☐ 10 Hz
Above 1000	☒ Peak ☐ Average	☒100 kHz ☐ 1 MHz	☒ 100 kHz ☐ 10 Hz

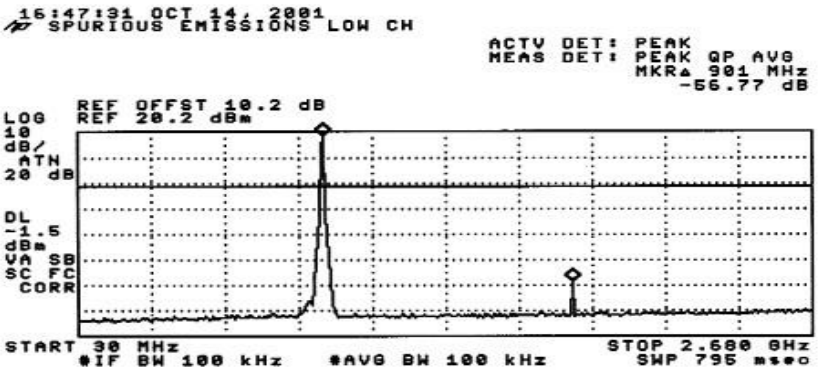
TEST SETUP

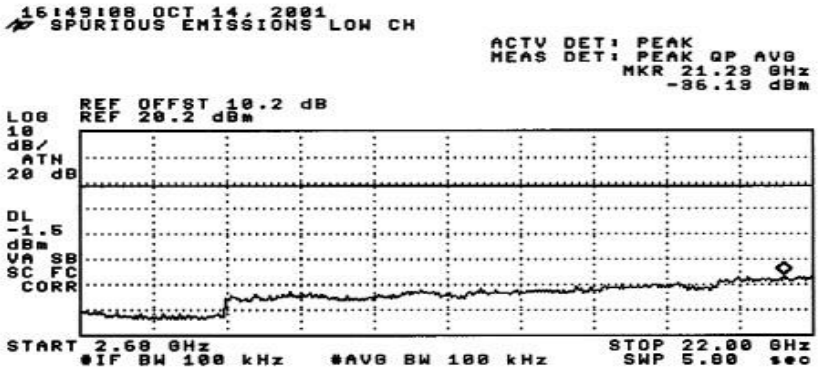


TEST PROCEDURE

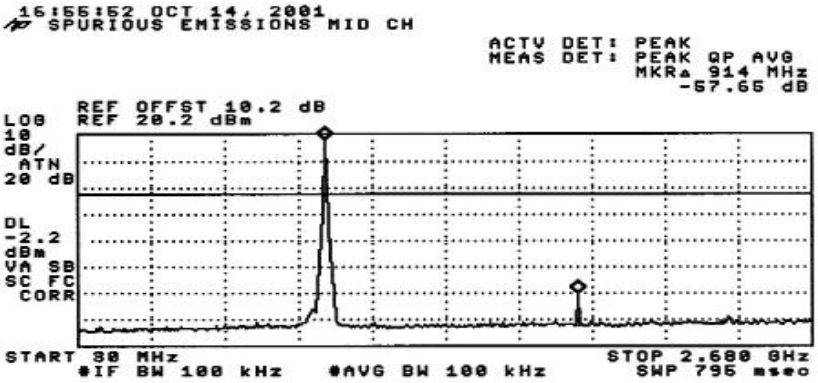
Connect the Eut's antenna port to the Spectrum Analyzer's input put.
Investigate the entire frequency of the carrier frequency band.

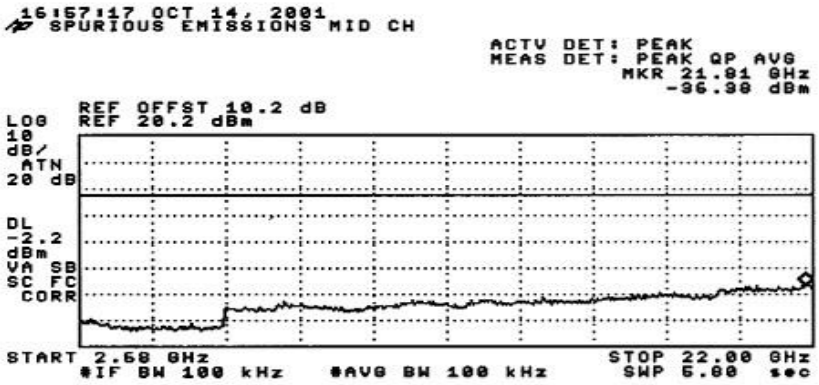
This report shall not be reproduced except in full, without the written approval of CCS.



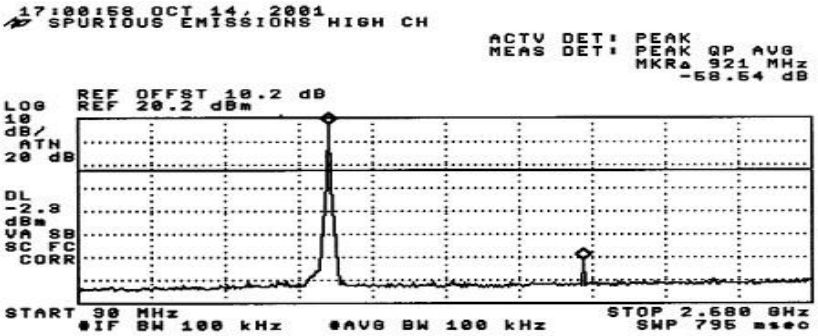


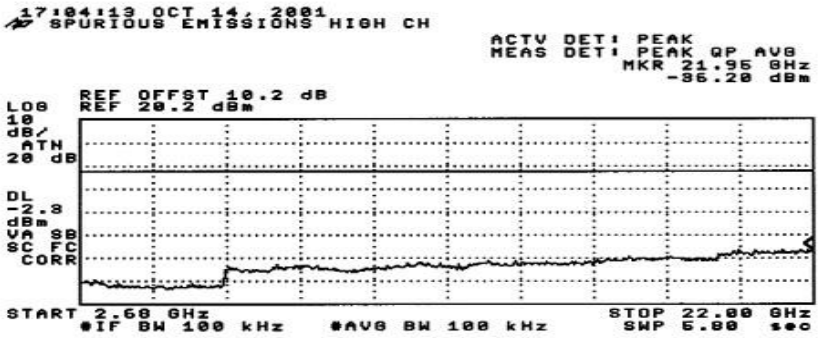
This report shall not be reproduced except in full, without the written approval of CCS.





This report shall not be reproduced except in full, without the written approval of CCS.





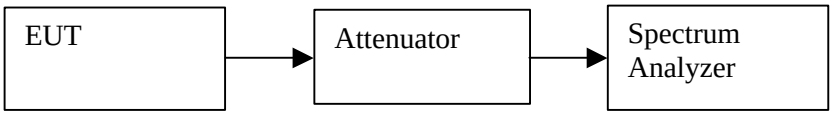
This report shall not be reproduced except in full, without the written approval of CCS.

9.4. PEAK POWER SPECTRAL DENSITY

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak ☐ Average	☒ 3 kHz ☐ 1 MHz	☒ 3 kHz ☐ 10 Hz

TEST SETUP

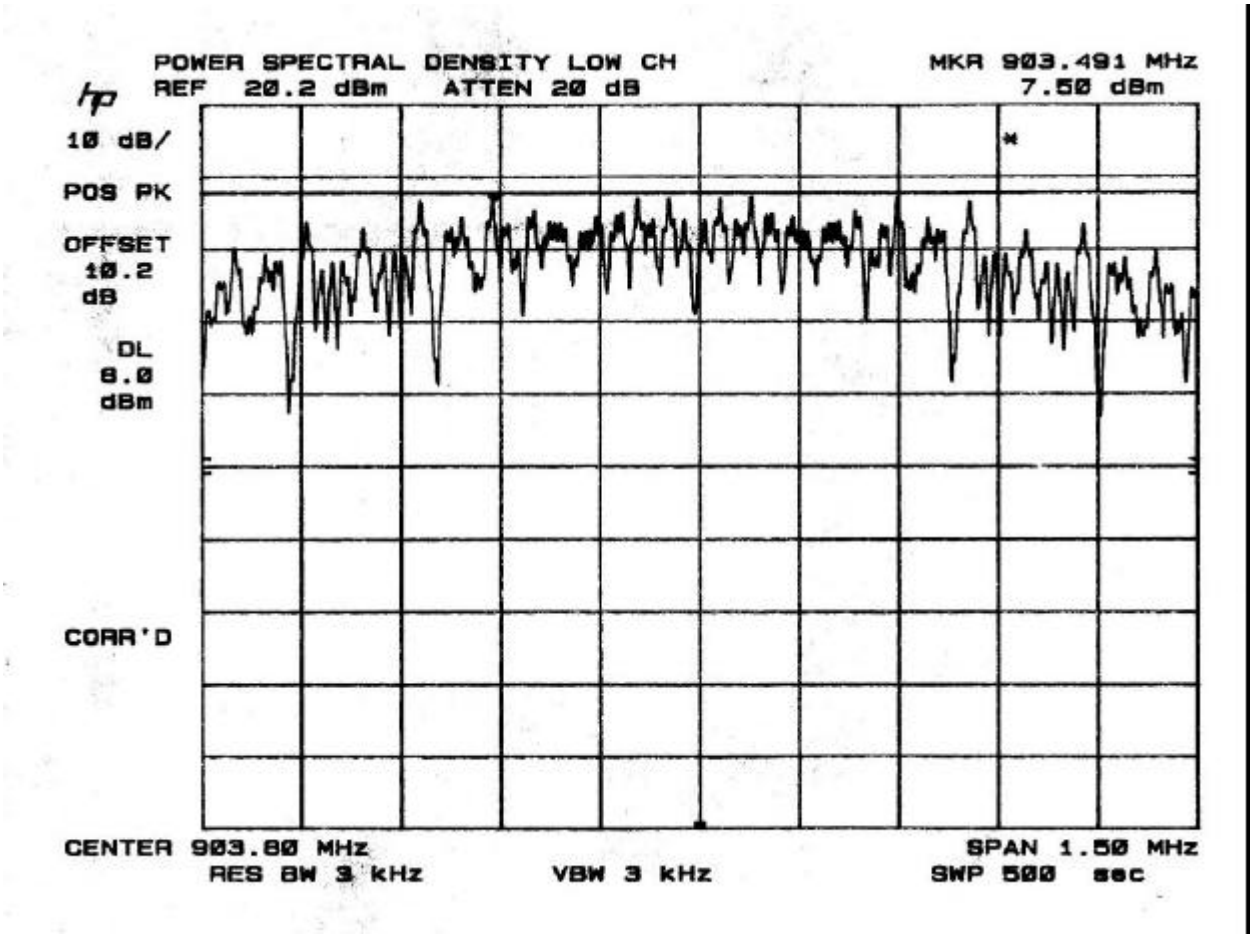


TEST PROCEDURE

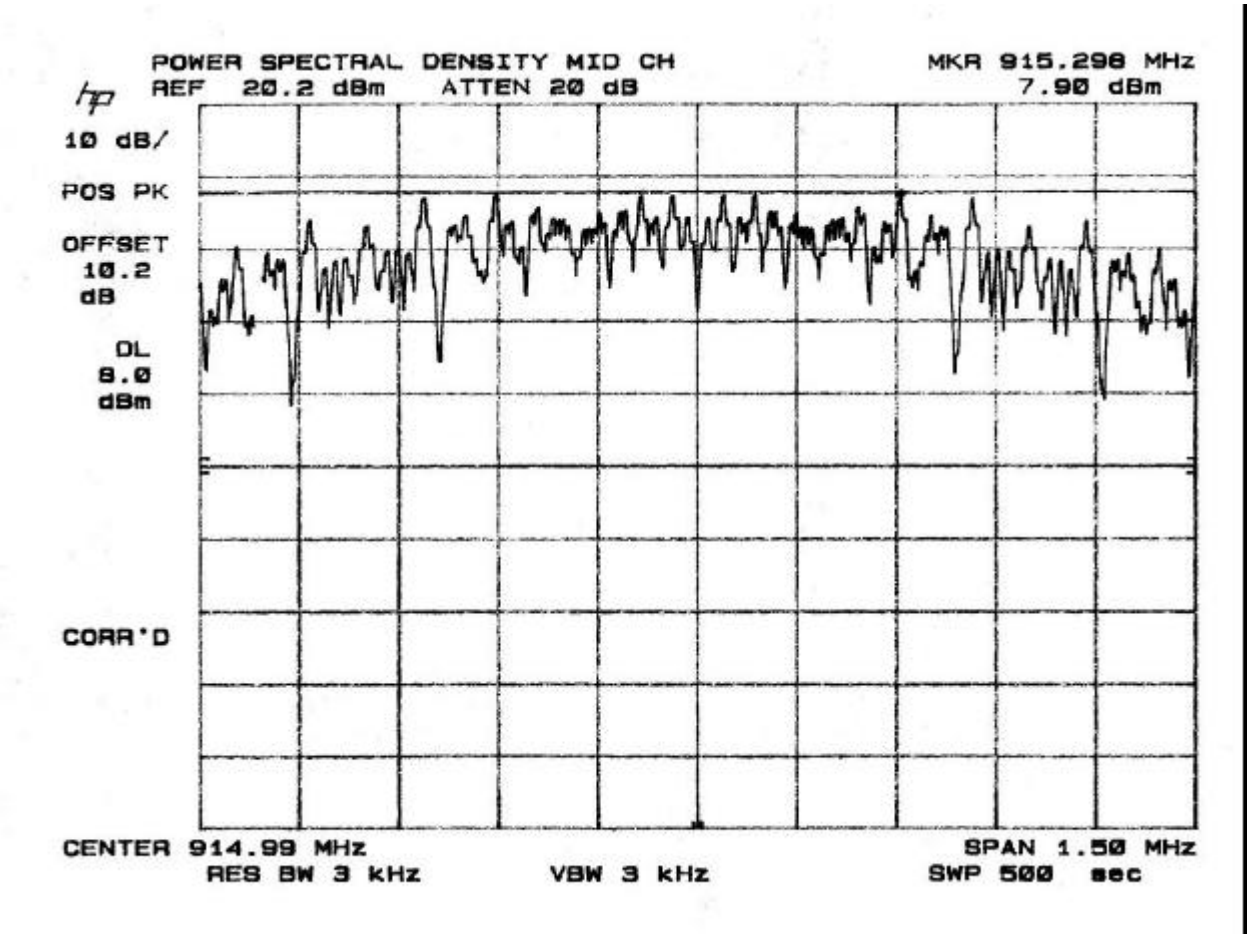
The transmitter output was connected to the spectrum analyzer through an attenuator, the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3 kHz RBW and 30 kHz VBW, set sweep time=span/3kHz. The power spectral density was measured and recorded.
The sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

Result:
No non-compliance noted. See plots:

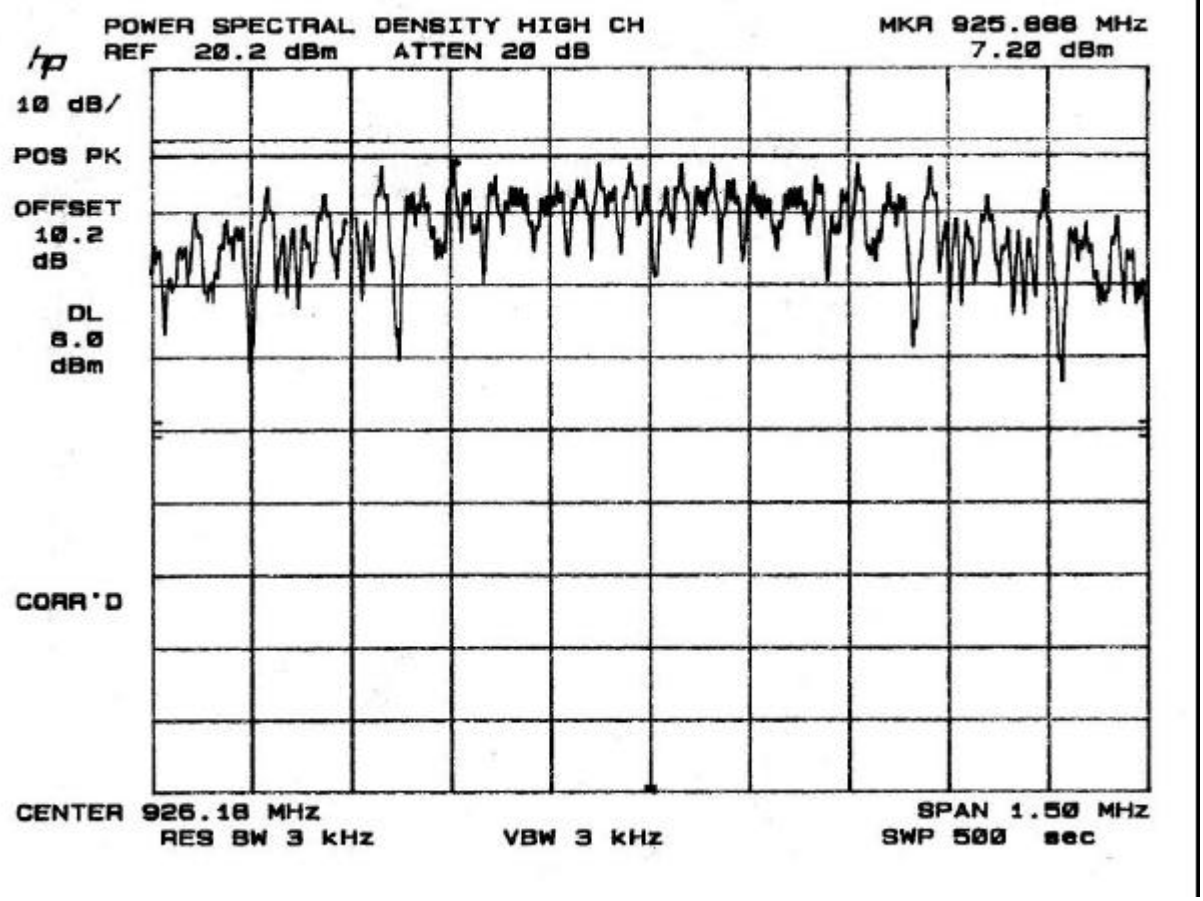
This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.

9.5. PROCESSING GAIN

Refer to separate attachment

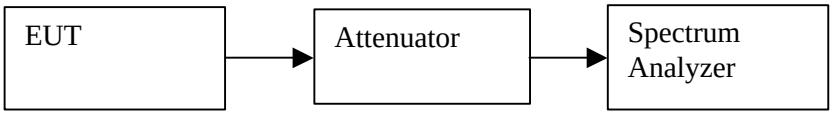
This report shall not be reproduced except in full, without the written approval of CCS.

9.6. BAND EDGE MEASUREMENT

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak ☐ Average	☒ 100 kHz ☐ 1 MHz	☒ 100 kHz ☐ 10 Hz

TEST SETUP

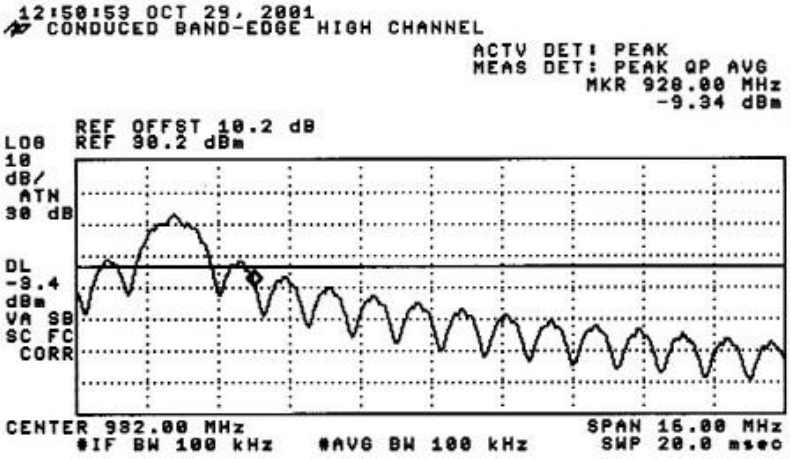


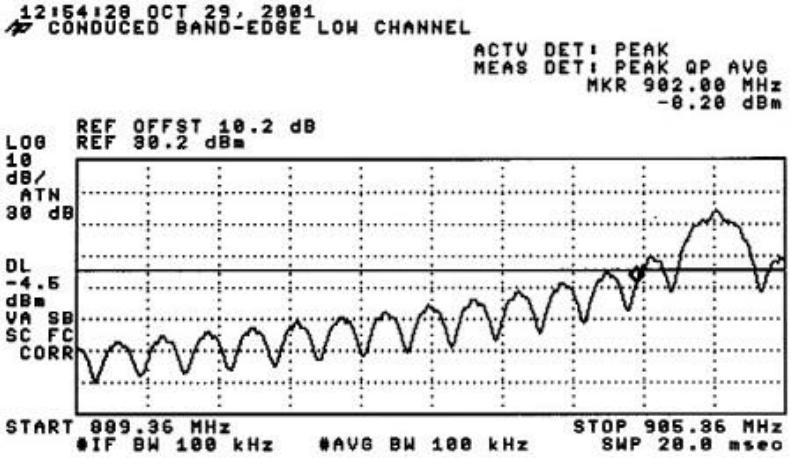
TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator; the lower and upper band edge of the EUT is investigated.
The resolutions and video bandwidth were set to 100kHz.

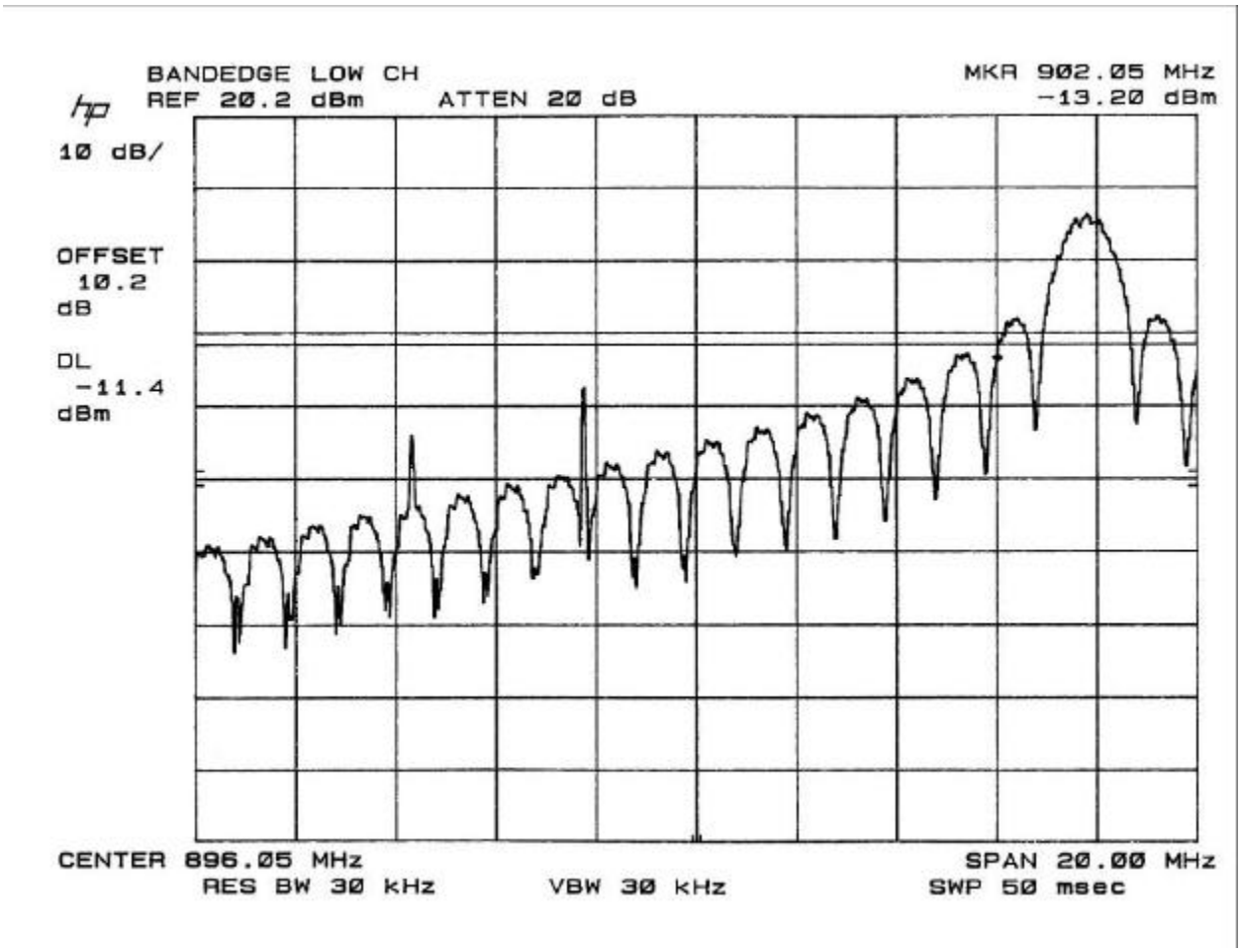
RESULT
No non-compliance noted. See plots:

This report shall not be reproduced except in full, without the written approval of CCS.

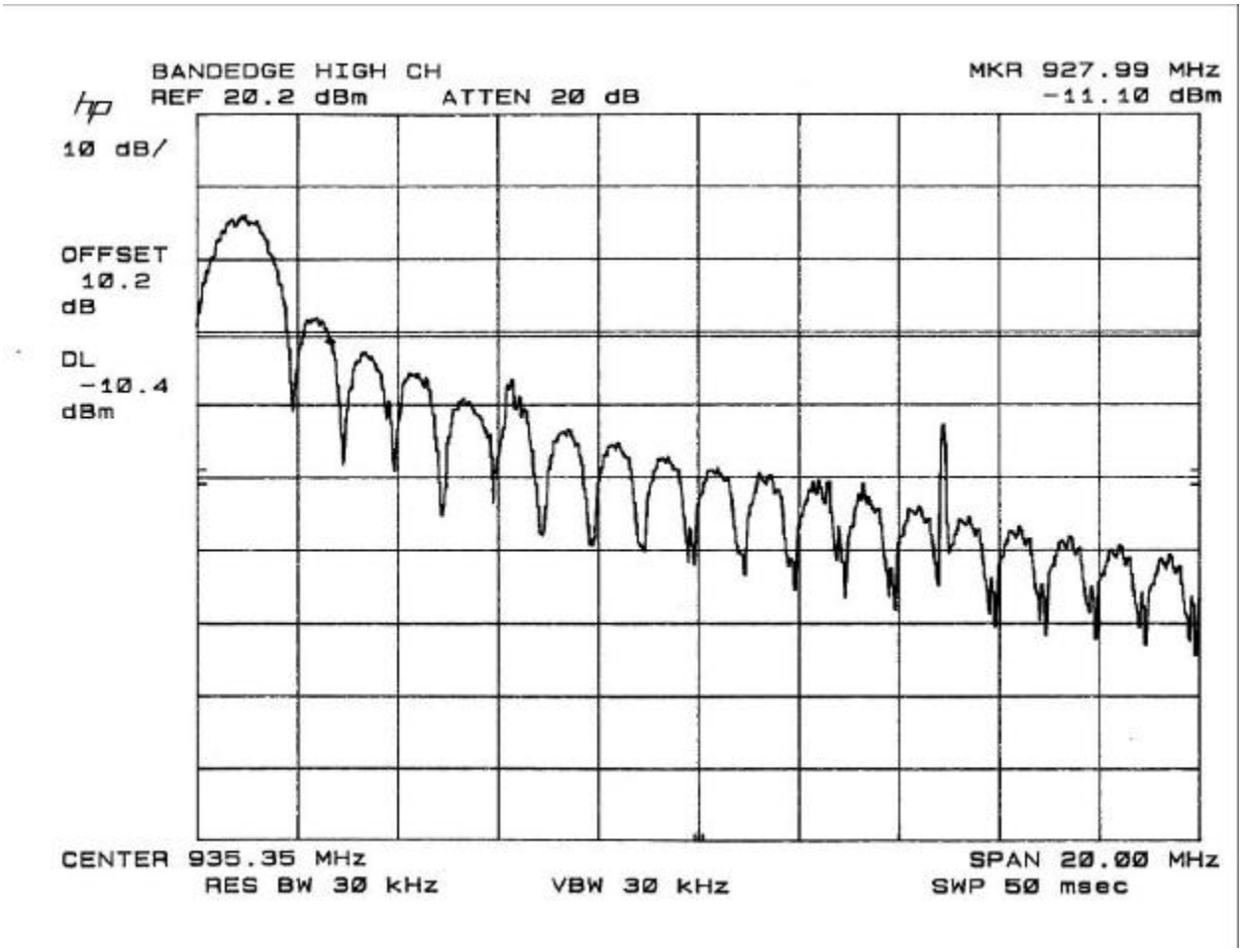




This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.

9.7. RADIATED EMISSION

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	☒ Peak ☐ Quasi Peak	☒ 100 KHz ☐ 120 KHz	☒ 100 KHz ☐ 120 KHz
Above 1000	☒ Peak ☐ Average	☒ 1 MHz ☐ 1 MHz	☒ 1 MHz ☐ 10 Hz

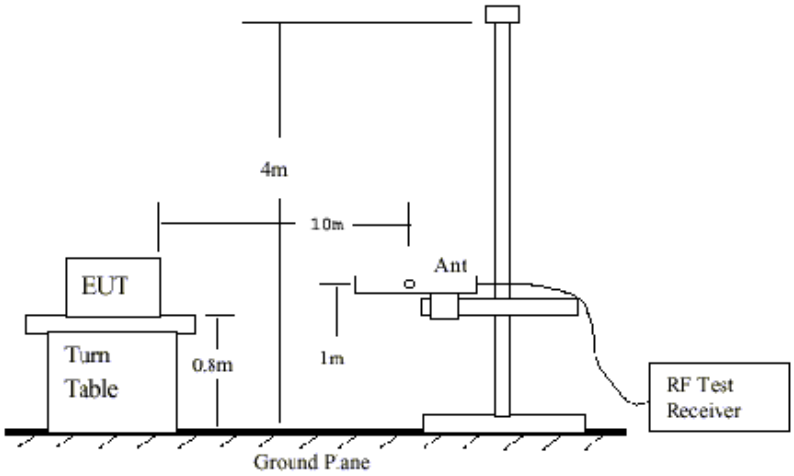


Fig 1: Radiated Emission Measurement 30 to 1000 MHz

This report shall not be reproduced except in full, without the written approval of CCS.

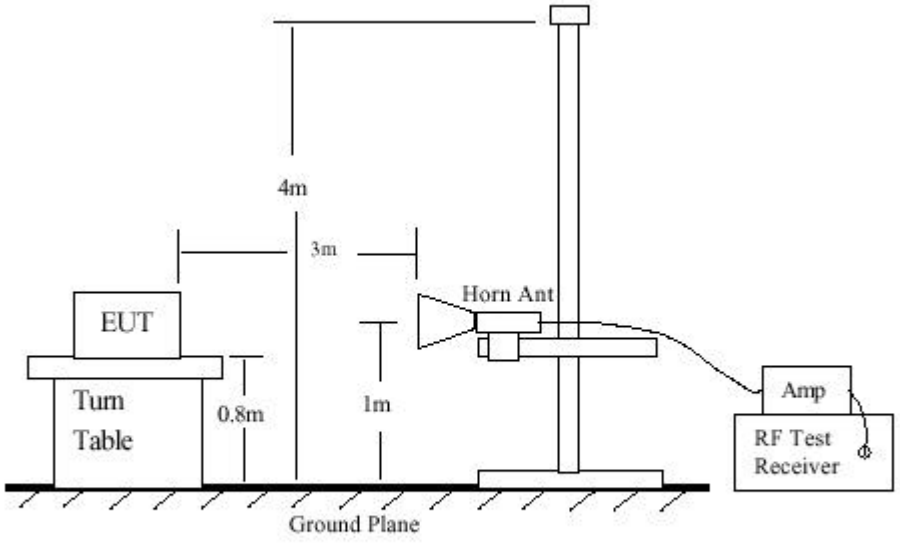


Fig 2: Radiated Emission Above 1000 MHz

This report shall not be reproduced except in full, without the written approval of CCS.

TEST SETUP & PROCEDURE

1. The EUT was placed on the turn table 0.8 meter above ground in 3 meter open area test site.
2. Set the resolution bandwidth to 120KHz in the test receiver and select Peak function to scan the frequency below 1 GHz.
3. Shift the interference-receiving antenna located in antenna tower upwards and downwards between 1 and 4 meters above ground and find out the local peak emission on frequency domain.
4. Locate the interference-receiving antenna at the position where the local peak reach the maximum emission.
5. Rotate the turn table and stop at the angle where the measurement device has maximum reading
6. Shift the interference-receiving antenna again to detect the maximum emission of the local peak
7. If the reading of the local peak under Peak function is lower than limit by 6dB, then Quasi Peak detection is not needed and this reading should be recorded. And if it is higher than Peak limit, then the test is fail. Others, switch the receiver to Quasi Peak function, set the resolution bandwidth to 100kHz and repeat the procedures C ~ F. If the reading is lower than limit, this reading should be recorded, otherwise, the test is fail.
8. Set the resolution and video bandwidth of the spectrum analyzer to 1MHz and repeat procedures C ~ F for frequency band from 1 GHz to 10 times carrier frequency.
9. If the reading for the local peak is lower than the Average limit, no further testing is needed in this local peak and this reading should be recorded. If it is higher than Average limit but lower than Peak limit, then set the resolution bandwidth to 1MHz and video bandwidth to 300Hz. Repeat procedures C ~ F. If the maximum reading is lower than Average limit, then this reading should be recorded. If it is higher, then the test is fail.

RESULT

No non-compliance noted, as shown below.

This report shall not be reproduced except in full, without the written approval of CCS.

COMPLIANCE Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #: 01U1004-1
Report #: 011025C1
Date& Time: 10/25/01 2:53 PM
Test Engr: Jesse Saldivar

Company: Invensys
EUT Description: 903.8 to 926.2MHz DSSS Radio
Test Configuration : EUT/ Meters
Type of Test: FCC Class B
Mode of Operation: Continuous Transmit

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit EN_A	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
216.00	49.70	11.50	1.98	26.80	36.38	40.00	-3.62	3mH	180.00	1.00	P
224.00	47.30	11.98	2.03	26.77	34.54	40.00	-5.46	3mH	180.00	1.00	P
224.00	45.80	12.49	2.03	26.77	33.56	40.00	-6.44	3mV	0.00	1.00	P
216.00	44.60	12.12	1.98	26.80	31.90	40.00	-8.10	3mV	180.00	1.00	P
231.97	48.80	12.46	2.08	26.74	36.61	47.00	-10.39	3mH	180.00	1.00	P
247.97	47.50	13.43	2.19	26.67	36.45	47.00	-10.55	3mH	180.00	1.00	P
6 Worst Data											

This report shall not be reproduced except in full, without the written approval of CCS.

INVENSYS METERING SYSTEMS RADIATED EMISSION WITH 1.4dBi ANTENNA (data taken at 1m)

Frequency	SA Peak Reading (dBuV)	SA Ave Reading (dBuV)		cable loss (dB)	Filter Loss (dB)	Antenna Factor (dB)	Amp Gain (dB)	Distance Factor (dB)	Corrected 3m PK reading (dBuV)	Corrected 3m AV reading (dBuV)	Peak limit (dBuV)	Average limit (dBuV)	Peak Margin (dB)	Average Margin (dB)
Low Channel (903.79 MHz)														
1807.58	57.59	54.7		2.08	1	26.1	31.25	9.5	46.02	43.13	74	54	-27.98	-10.87
2711.3	48.71	39.68		3.2	1	30.2	31.25	9.5	42.36	33.33	74	54	-31.64	-20.67
3615.1	44.42	35.48		4	1	32.9	31.25	9.5	41.57	32.63	74	54	-32.43	-21.37
4518.9	48.2	40.02		4.67	1	32.5	31.25	9.5	45.62	37.44	74	54	-28.38	-16.56
5422.7	48.55	44.2		4.8	1	35.1	31.25	9.5	48.7	44.35	74	54	-25.3	-9.65
6405.1	39.81	28.48	n	5.76	1	36.2	31.25	9.5	42.02	30.69	74	54	-31.98	-23.31
7320.2	42.3	32.84	n	5.92	1	37.3	31.25	9.5	45.77	36.31	74	54	-28.23	-17.69
8235.3	46.56	33.1	n	6.67	1	38.2	31.25	9.5	51.68	38.22	74	54	-22.32	-15.78
9150	42.3	34.13	n	6.88	1	38.3	31.25	9.5	47.73	39.56	74	54	-26.27	-14.44
Middle Channel (914.97 MHz)														
1830	57.13	53.99		2.08	1	26.1	31.25	9.5	45.56	42.42	74	54	-28.44	-11.58
2745.08	64.54	49.2		3.2	1	30.2	31.25	9.5	58.19	42.85	74	54	-15.81	-11.15
3660.1	43.67	34.6		4	1	32.9	31.25	9.5	40.82	31.75	74	54	-33.18	-22.25
4575.2	46.06	37.9		4.67	1	32.5	31.25	9.5	43.48	35.32	74	54	-30.52	-18.68
5490	43	36.1		4.8	1	35.1	31.25	9.5	43.15	36.25	74	54	-30.85	-17.75
6405.1	39.81	28.48	n	5.76	1	36.2	31.25	9.5	42.02	30.69	74	54	-31.98	-23.31
7320.2	42.3	32.84	n	5.92	1	37.3	31.25	9.5	45.77	36.31	74	54	-28.23	-17.69
8235.3	46.56	33.1	n	6.67	1	38.2	31.25	9.5	51.68	38.22	74	54	-22.32	-15.78
9150	42.3	34.13	n	6.88	1	38.3	31.25	9.5	47.73	39.56	74	54	-26.27	-14.44
High Channel (926.15 MHz)														
1852.3	71.66	69.81		2.08	1	26.1	31.25	9.5	60.09	58.24	74	54	-13.91	4.24
2778.5	69.18	57.1		3.2	1	30.2	31.25	9.5	62.83	50.75	74	54	-11.17	-3.25
3704.7	44.6	33.16		4	1	32.9	31.25	9.5	41.75	30.31	74	54	-32.25	-23.69
4630.8	46.39	34.95		4.67	1	32.5	31.25	9.5	43.81	32.37	74	54	-30.19	-21.63
5557	43.6	31.98		4.8	1	35.1	31.25	9.5	43.75	32.13	74	54	-30.25	-21.87
6405.1	39.81	28.48	n	5.76	1	36.2	31.25	9.5	42.02	30.69	74	54	-31.98	-23.31
7320.2	42.3	32.84	n	5.92	1	37.3	31.25	9.5	45.77	36.31	74	54	-28.23	-17.69
8235.3	46.56	33.1	n	6.67	1	38.2	31.25	9.5	51.68	38.22	74	54	-22.32	-15.78
9150	42.3	34.13	n	6.88	1	38.3	31.25	9.5	47.73	39.56	74	54	-26.27	-14.44

NF: Measured noise floor
DISTANCE FACTOR: 1M to 3M measurement distance: -9.5dB
Correction to extrapolate reading to 3m specification distance

INSTRUMENT USED
ANTENNA: EMCO, 3115, S/N:2238 & ARA, MWH-1826/B, S/N:1013
SPECTRUM ANALYZER: HP8593EM, S/N3710A00205
PRE-AMP: MITEQ, NSP2600-44, S/N:646456
PRE-AMP: HP8449B, S/N:3008A00369
CL: Cable loss (15ft)
HPF: High pass filter insertion loss (4.6GHz) FSY (S/N: 001)

ANALYZER SETTINGS

	Res bw	Avg. bw
PEAK(Pk):	1MHz	1MHz
AVERAGE(Avg):	1MHz	10Hz

CORRECTED FIELD STRENGTH = SA reading +Cable Loss+ Filter Loss +Ant Factor - Amp Gain - (1 to 3 m conversion factor)
LIMIT: 500 uV = 20 x log 500 = 53.98 dBuV

NOTE: MEASURED HORIZONTAL (H) AND VERTICAL (V) (worse case vertical)

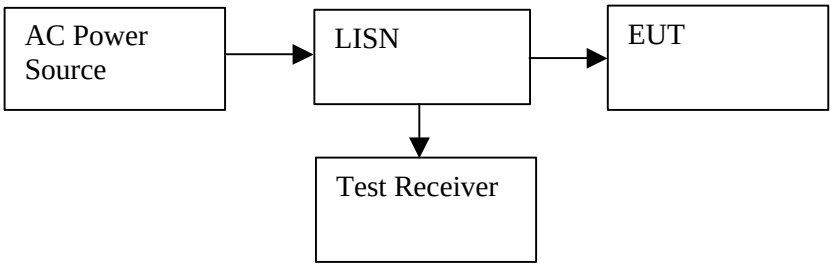
This report shall not be reproduced except in full, without the written approval of CCS.

9.8. POWER LINE CONDUCTED EMISSION

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
450 K to 30 MHz	☒ Peak ☐ CISPR Quasi Peak	☒ 9 KHz	☒ 9 KHz

TEST SETUP



TEST PROCEDURE

1. The EUT was placed on a wooden table 40 cm from a vertical ground plane and approximately 80 cm above the horizontal ground plane on the floor. The EUT was set to transmit in a continuous mode.

2. Line conducted data was recorded for both NEUTRAL and HOT lines.

RESULT

No line conducted emissions test conducted because EUT is battery powered.

This report shall not be reproduced except in full, without the written approval of CCS.

9.9. SETUP PHOTOS

Radiated Emission photos.

This report shall not be reproduced except in full, without the written approval of CCS.

No Line conducted testing done because EUT is battery operated.

Line Conducted Emission Photos

This report shall not be reproduced except in full, without the written approval of CCS.

FCC testing to antenna port

This report shall not be reproduced except in full, without the written approval of CCS.

FCC testing above 1GHz

This report shall not be reproduced except in full, without the written approval of CCS.