FCC CFR47 PART 15 CERTIFICATION

TEST REPORT

FOR

802.11b WLAN RF PORT

MODEL NUMBER: CCRF-5020

BRAND NAME: SYMBOL MOBIUS™ ACCESS PORT

FCC ID: H9PCCRF5020

REPORT NUMBER: 02U1260-1

ISSUE DATE: MAY 8, 2002

Prepared for
SYMBOL TECHNOLOGIES, INC.
6480 VIA DEL ORO DRIVE
SAN JOSE, CA 95119
USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561 F MONTEREY ROAD
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TABLE OF CONTENT

1. TEST RESULT CERTIFICATION

COMPANY NAME: SYMBOL TECHNOLOGIES, INC.
6480 VIA DEL ORO DRIVE
SAN JOSE, CA 95119 USA

CONTACT PERSON: NORMAN H. NELSON / SR. EMC ENGINEER

TELEPHONE NO: (408) 528-2649

EUT DESCRIPTION: 802.11B WLAN RF PORT

MODEL NUMBER: CCRF-5020

DATE TESTED: ARPIL 16 – 30, 2002

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	2.4GHz TRANSCEIVER
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CERTIFICATION
FCC RULE	CFR 47 PART 15 Subpart C

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 15 Subpart C. 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:

MIKE HECKROTTE
CHIEF EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

KERWIN CORPUZ
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The 802.11b WLAN RF Port is a Direct Sequence Spread Spectrum Wireless Transceiver that operates on the 2400 – 2483.5 MHz band. There are two antennas in the unit, for both transmit and receive diversity. Both antennas are identical internally mounted PIFAs orthogannaly with 2.5 dBi gain for each antenna. This unit will be sold with two different type of power supply. One is model 4001, single port I/O, and the other is model 6012, multi port I/O.

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))

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	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

6. CALIBRATION AND UNCERTAINTY

6.1. 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.

6.2. 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.

6.3. Test and Measurement Equipment

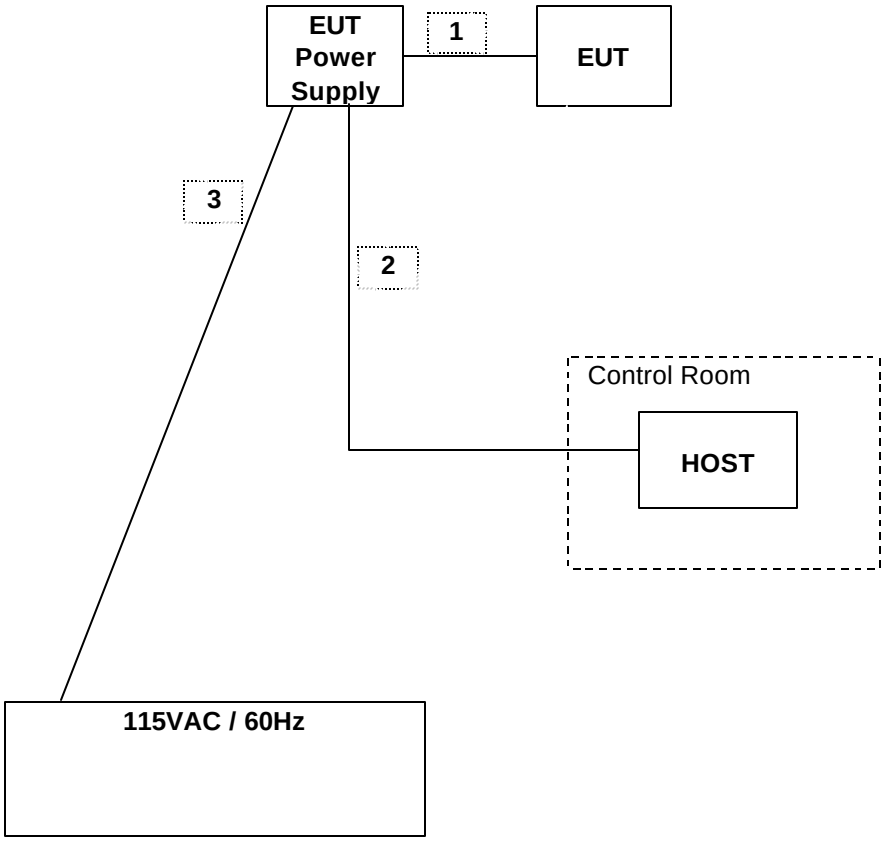
The following test and measurement equipment was utilized for the tests documented in this report:

TEST AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
Spectrum Analyzer	HP	8566B	3014A06685	6/28/02
Spectrum Display	HP	85662A	3026A19146	6/28/02
Quasi-Peak Detector	HP	85650A	3145A01654	6/28/02
Preamplifier	HP	8447D	2944A06589	8/10/02
Bilog Antenna	Chase	CBL6112B	2586	8/2/02
Line Filter	Lindgren	LMF-3489	497	N.C.R.
LISN	Fisher Custom Communication	LISN-50/250-25-2	2023	8/2/02
EMI Test Receiver	Rohde & Schwarz	ESHS 20	827129/006	4/17/03
Preamplifier (1 - 26.5GHz)	MITEQ	NSP2600-44	646456	4/26/03
Horn Antenna (1 - 18GHz)	EMCO	3115	6739	1/31/03
Horn Antenna (18 - 26GHz)	Antenna Research Associates	MWH 1826/B	1013	7/26/02
Harmonic Mixer (18-26.5GHz)	HP	11970K	3003A03109	9/23/02
Microwave Amplifier	HP	11975A	2517A01067	8/23/02
High Pass Filter (4.57GHz)	FSY Microwave	FM-4570-9SS	003	N.C.R.
Power Meter	Agilent	E4416A	GB41291025	1/5/03
Power Sensor	Agilent	E9323A	US40410703	3/21/03

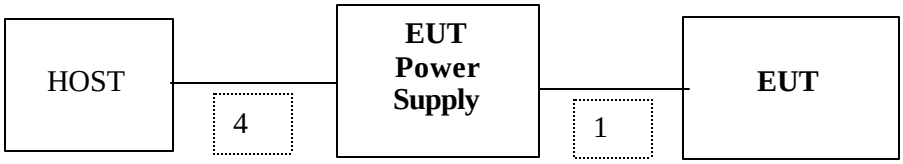
7. SUPPORT EQUIPMENT / EUT SETUP

The following peripheral support equipment was utilized to operate the equipment under test:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
PC Laptop	DELL	Latitude PPL	0012087	DoC



SETUP BELOW 1 GHz TEST



SETUP ABOVE 1 GHz TEST

I/O CABLES

TEST I / O CABLES								
Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	OUTPUT	1	RJ45	Unshielded	1.5m	Yes	Yes	N/A
2	INPUT	1	RJ45	Shielded	30m	Yes	No	Underground cable
3	AC	1	USA	Unshielded	2.0m	No	Yes	N/A
4	INPUT	1	RJ45	Unshielded	1.5m	Yes	No	use above 1 GHz only

8. APPLICABLE RULES AND BRIEF TEST RESULT

§15.247 (a) (2) - BANDWIDTH LIMITATION

(a) (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.

Antenna Port number	*Frequency (MHz)*	*Bandwidth (MHz)*
1	*2412*	*10.84*
1	*2437*	*10.98*
1	*2462*	*10.82*
2	*2412*	*11.12*
2	*2437*	*11.04*
2	*2462*	*10.74*

§15.247 (b) (1) - POWER OUTPUT

(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 or 5725-5850 MHz band, and all direct sequence systems: 1 watt.

Spec limit: As specified above, 1W maximum.
Test result: Measured by Peak Power Meter. No non-compliance noted.

Antenna Port number	*Frequency (MHz)*	*Output Power (watts)*
1	*2412*	*0.0575 (17.61 dBm)*
1	*2437*	*0.0562 (17.50 dBm)*
1	*2462*	*0.0563 (17.51 dBm)*
2	*2412*	*0.0562 (17.50 dBm)*
2	*2437*	*0.0546 (16.37 dBm)*
2	*2462*	*0.0523 (17.19 dBm)*

§15.247 (c) – SPURIOUS EMISSION

(c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test result: No non-compliance noted. See section 9.5 and 9.7.

§15.247 (d) - 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.

Antenna Port number	*Frequency (MHz)*	*Results (dBm)*
1	*2412*	*-5.50*
1	*2437*	*-6.30*
1	*2462*	*-5.50*
2	*2412*	*-6.00*
2	*2437*	*-5.60*
2	*2462*	*-6.10*

§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.

§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 15.207

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

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

§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 (micro volts/meter)	Measurement Distance (meters)
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.

FCC PART 15.209

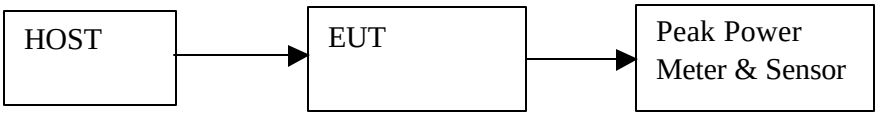
MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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

9. TEST SETUP, PROCEDURE AND RESULT

9.1. PEAK POWER OUTPUT

TEST SETUP

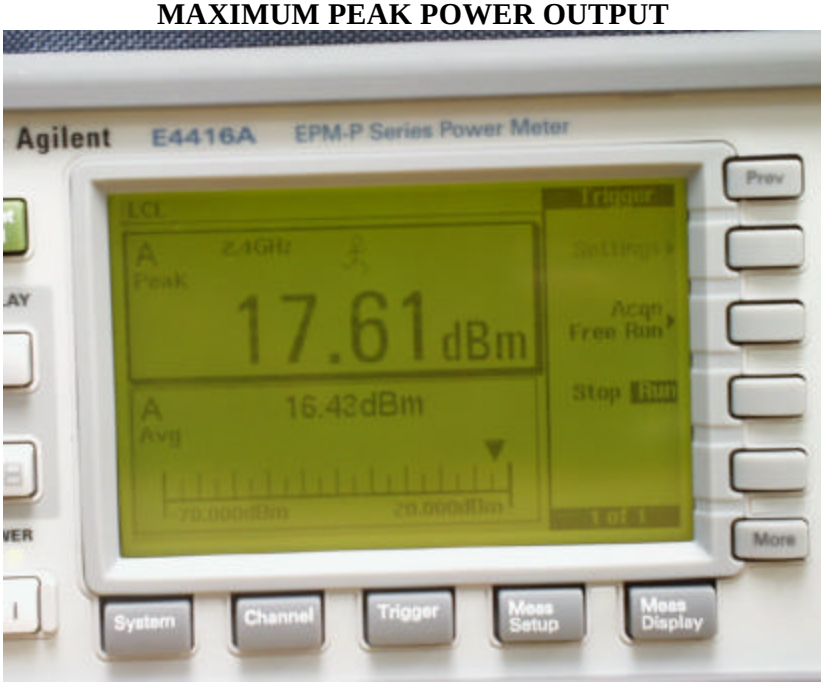


TEST PROCEDURE

The EUT is configured on a test bench as shown above in a continuously transmitting mode.
While the transmitter is on, the Peak Power Meter captures the emission displaying the value on screen.
Recorded the value on a template below.

Antenna Port number	*Frequency (MHz)*	*Output Power (watts)*
1	*2412*	*0.0575 (17.61 dBm)*
1	*2437*	*0.0562 (17.50 dBm)*
1	*2462*	*0.0563 (17.51 dBm)*
2	*2412*	*0.0562 (17.50 dBm)*
2	*2437*	*0.0546 (16.37 dBm)*
2	*2462*	*0.0523 (17.19 dBm)*

MAXIMUM PEAK POWER OUTPUT

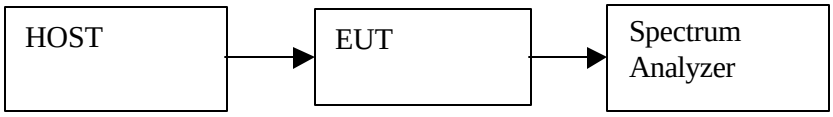


9.2. 6 dB BANDWIDTH MEASUREMENT

TEST SETUP

Detector Function Setting of Test Receiver

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



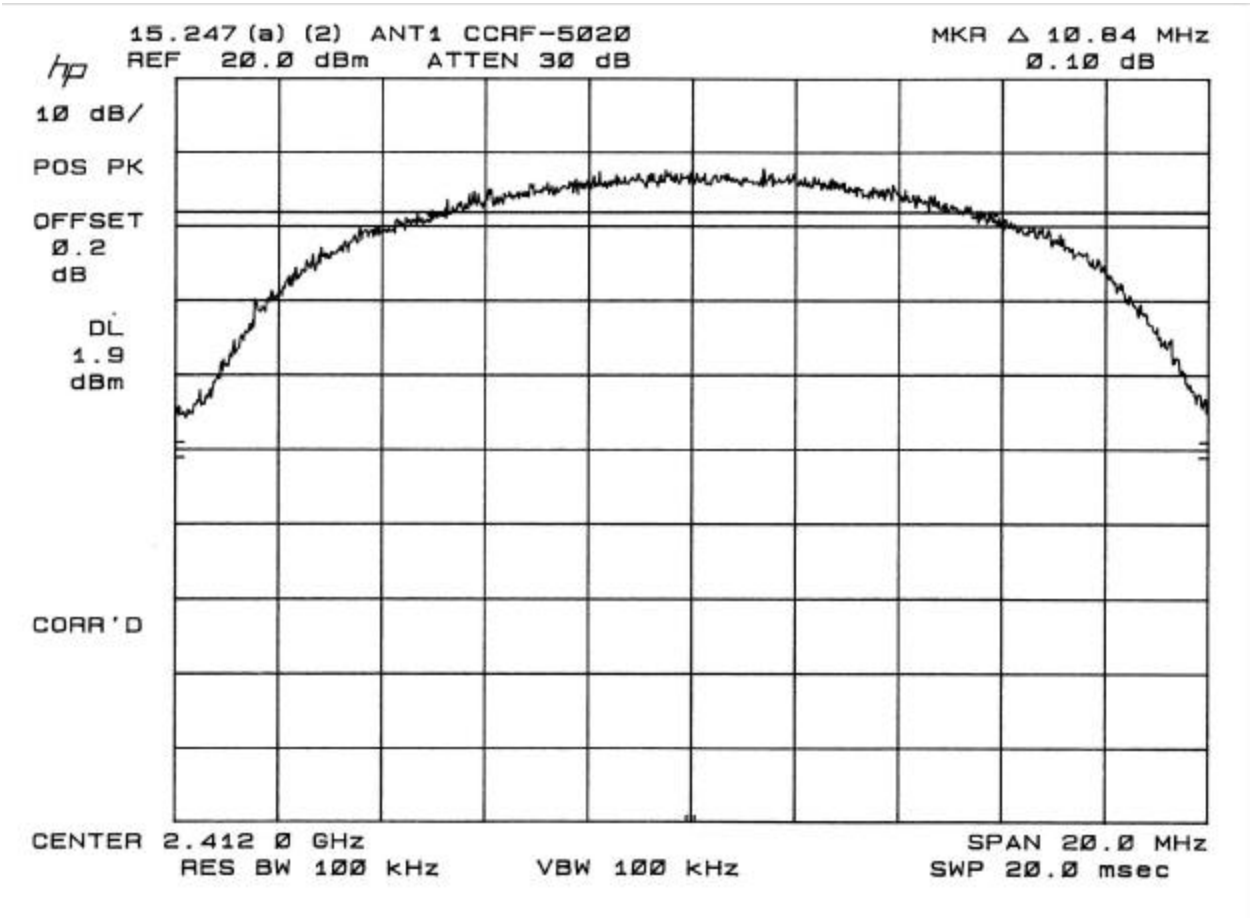
TEST PROCEDURE

The EUT transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 kHz RBW and 100 kHz VBW.

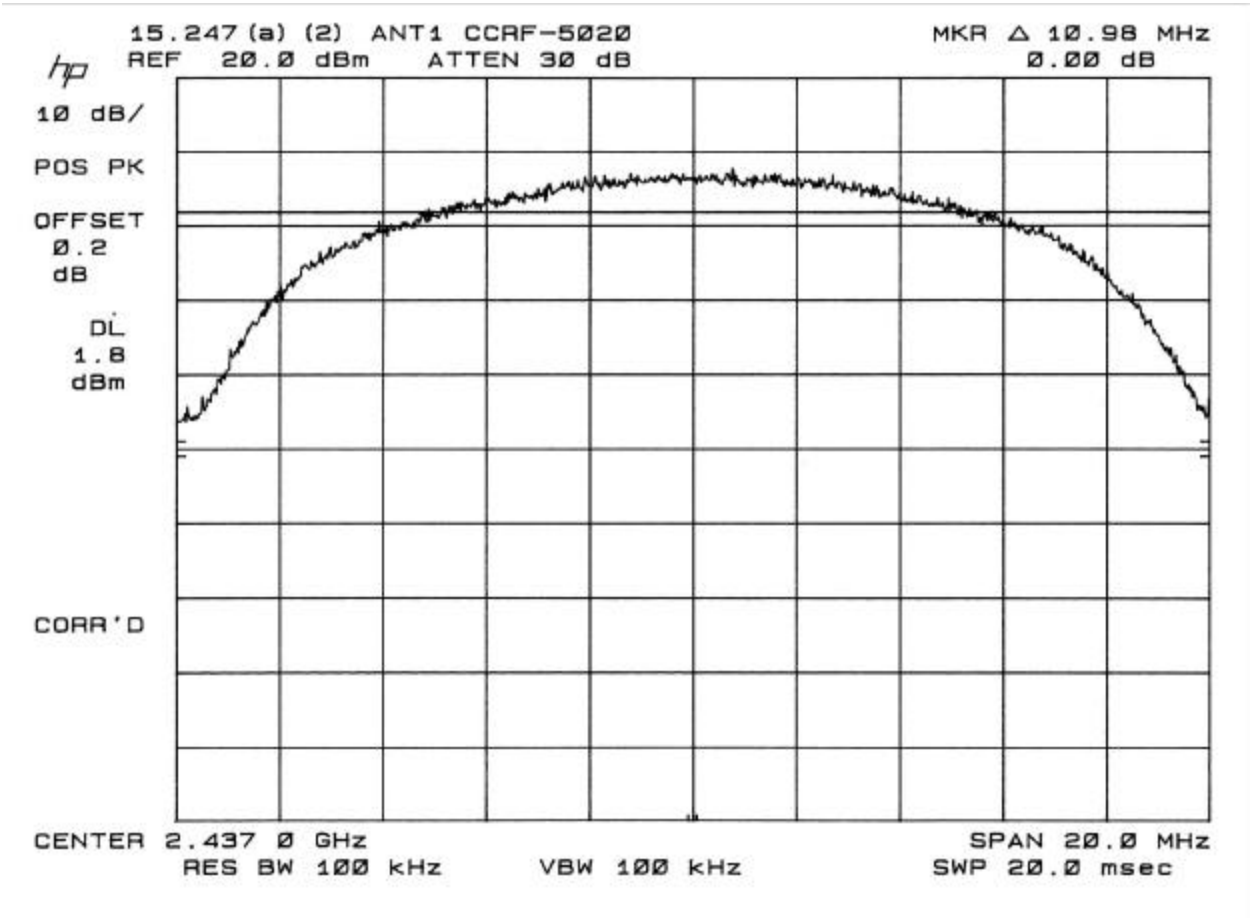
RESULT

No non-compliance noted. See plots below.

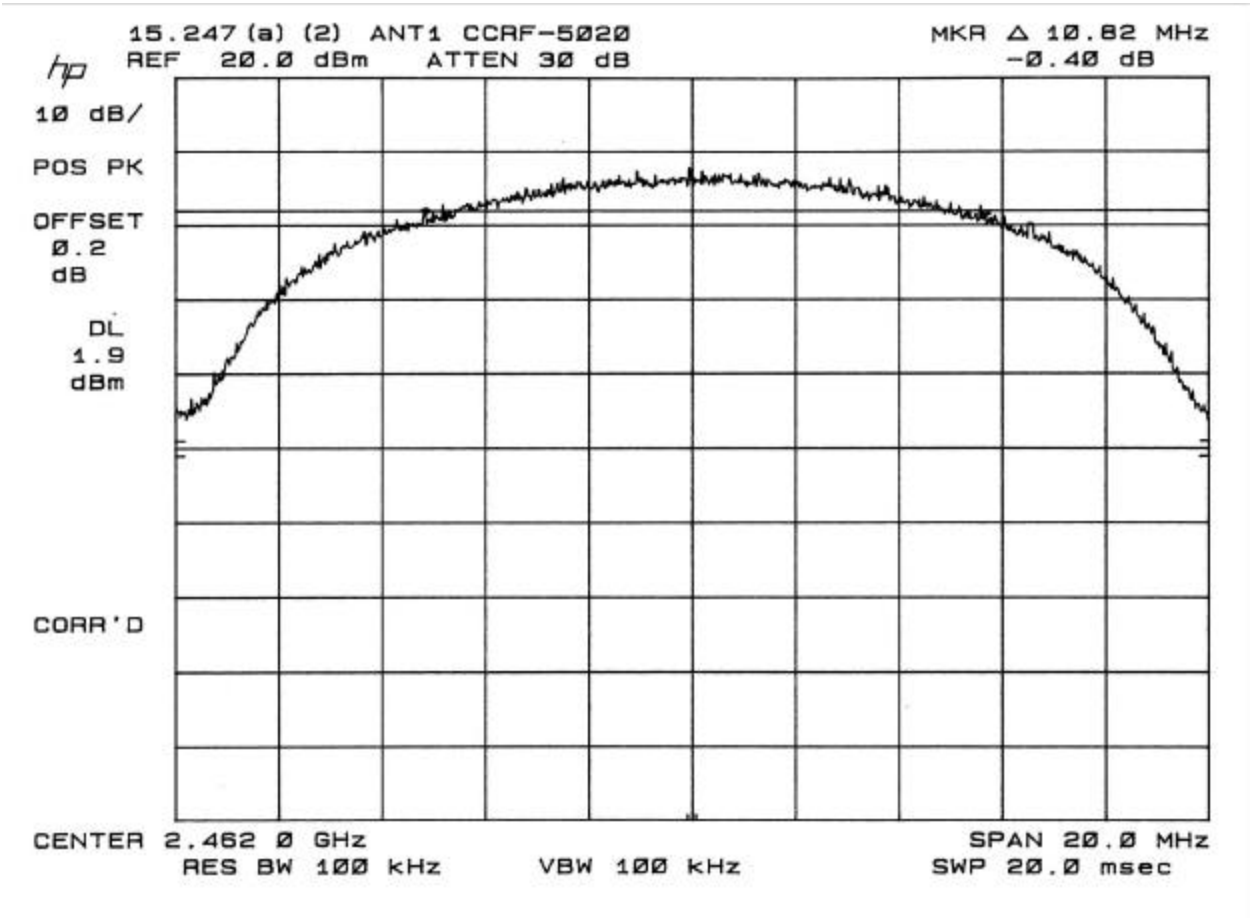
ANTENNA 1 LOW CHANNEL



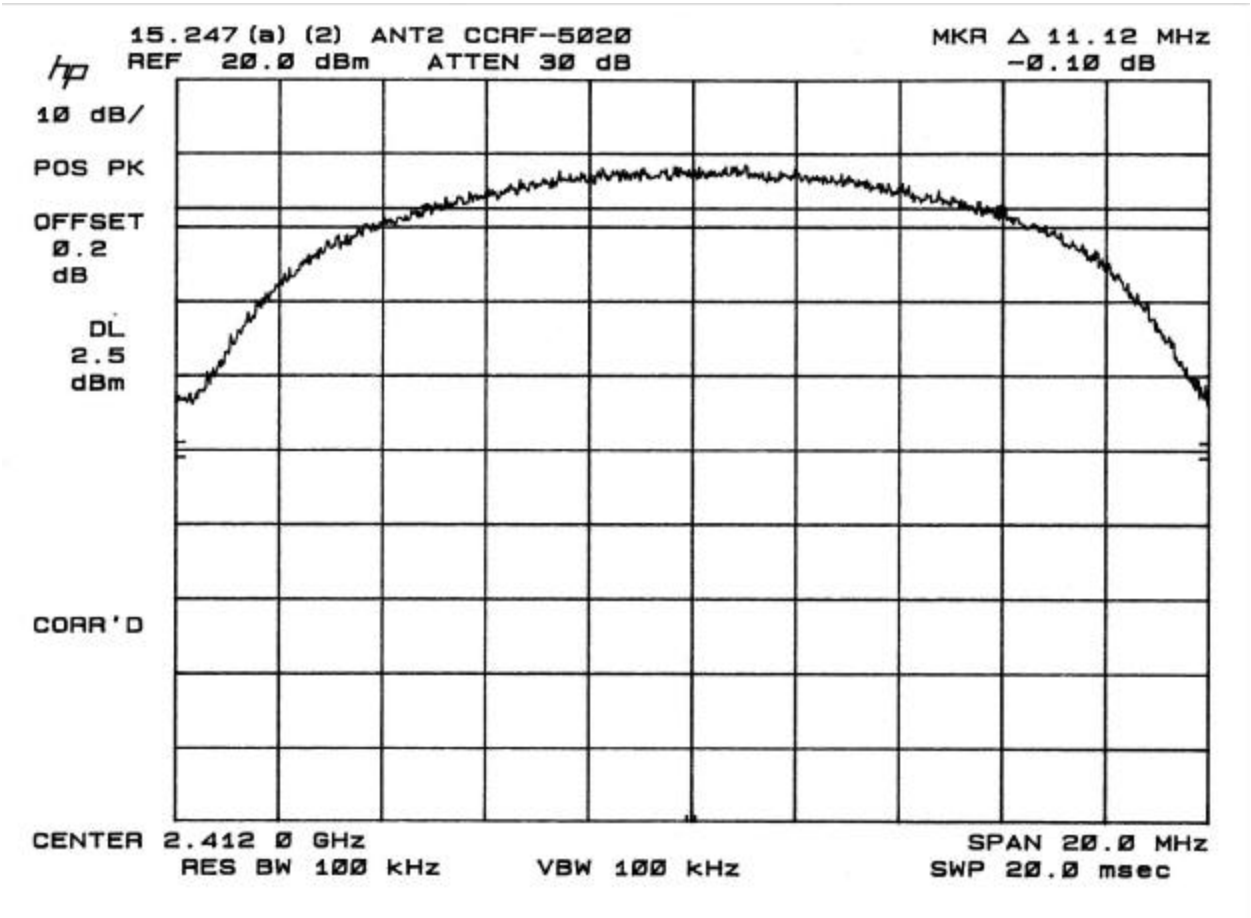
ANTENNAT 1 MID CHANNEL



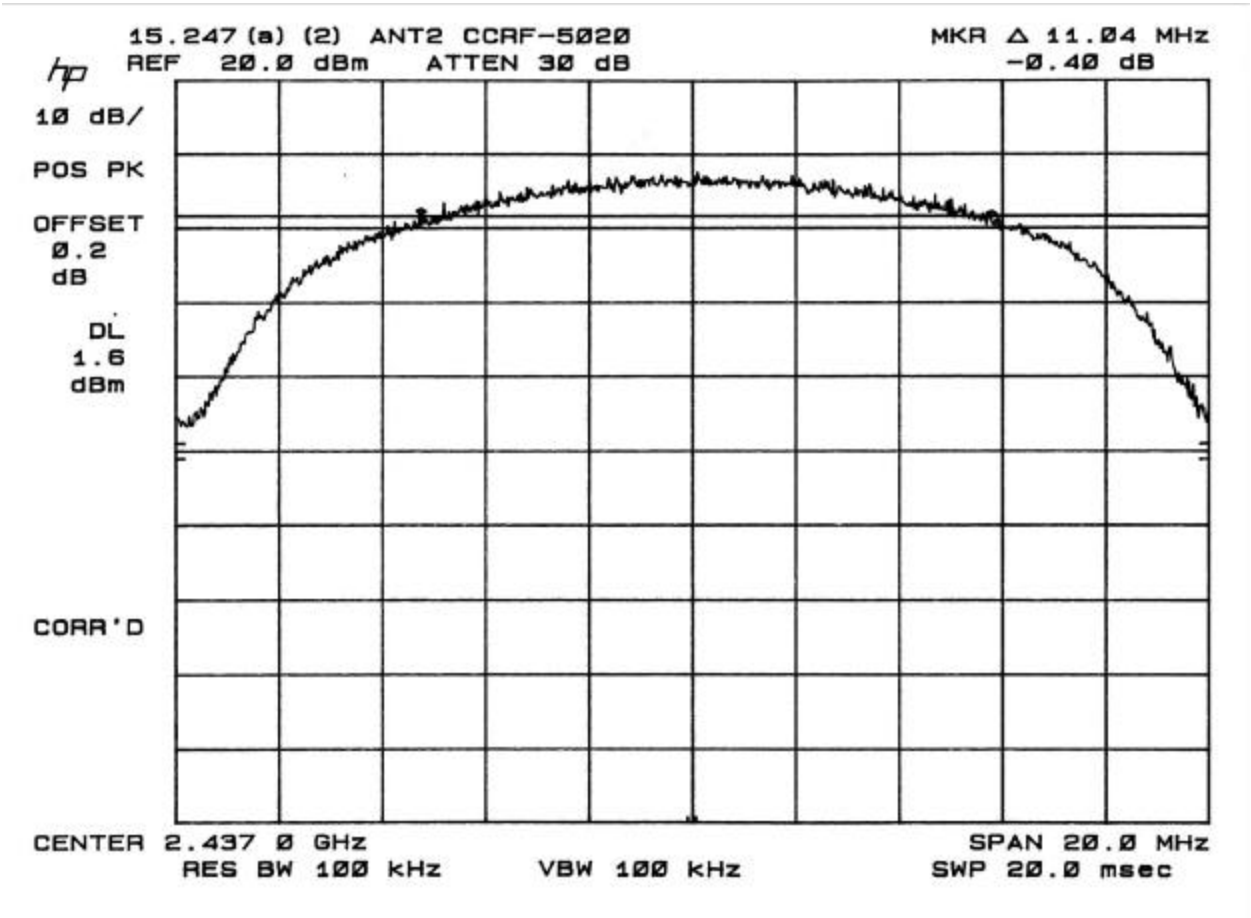
ANTENNA 1 HIGH CHANNEL



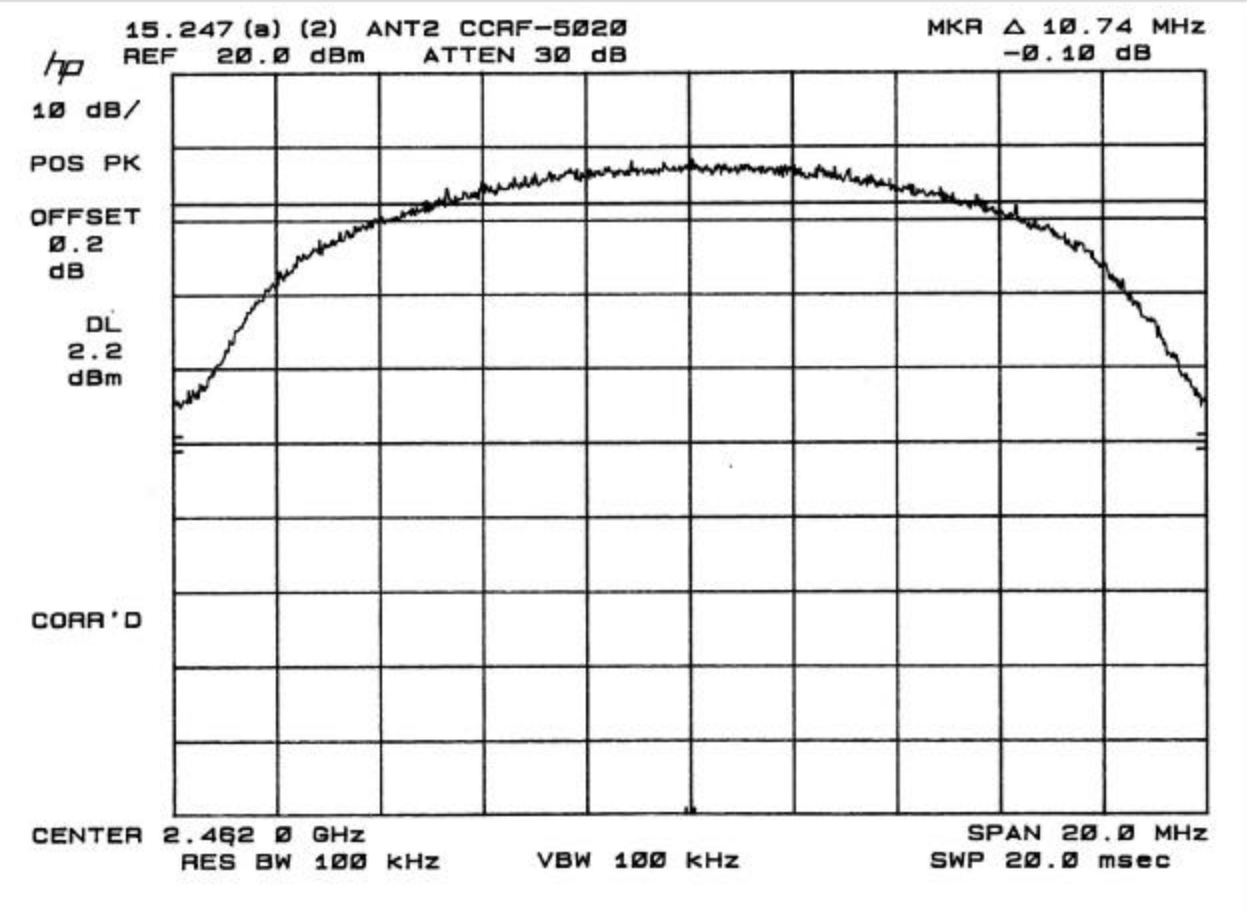
ANTENNA 2 LOW CHANNEL



ANTENNA 2 MID CHANNEL



ANTENNA 2 HIGH CHANNEL

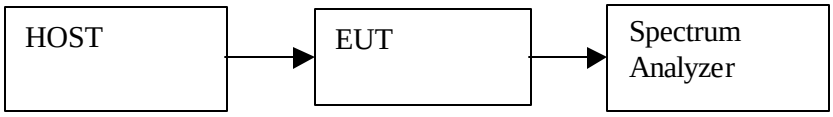


9.3. CONDUCTED SPURIOUS EMISSION

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 - 24000	☒ Peak	☒ 100 kHz	☒ 100 kHz



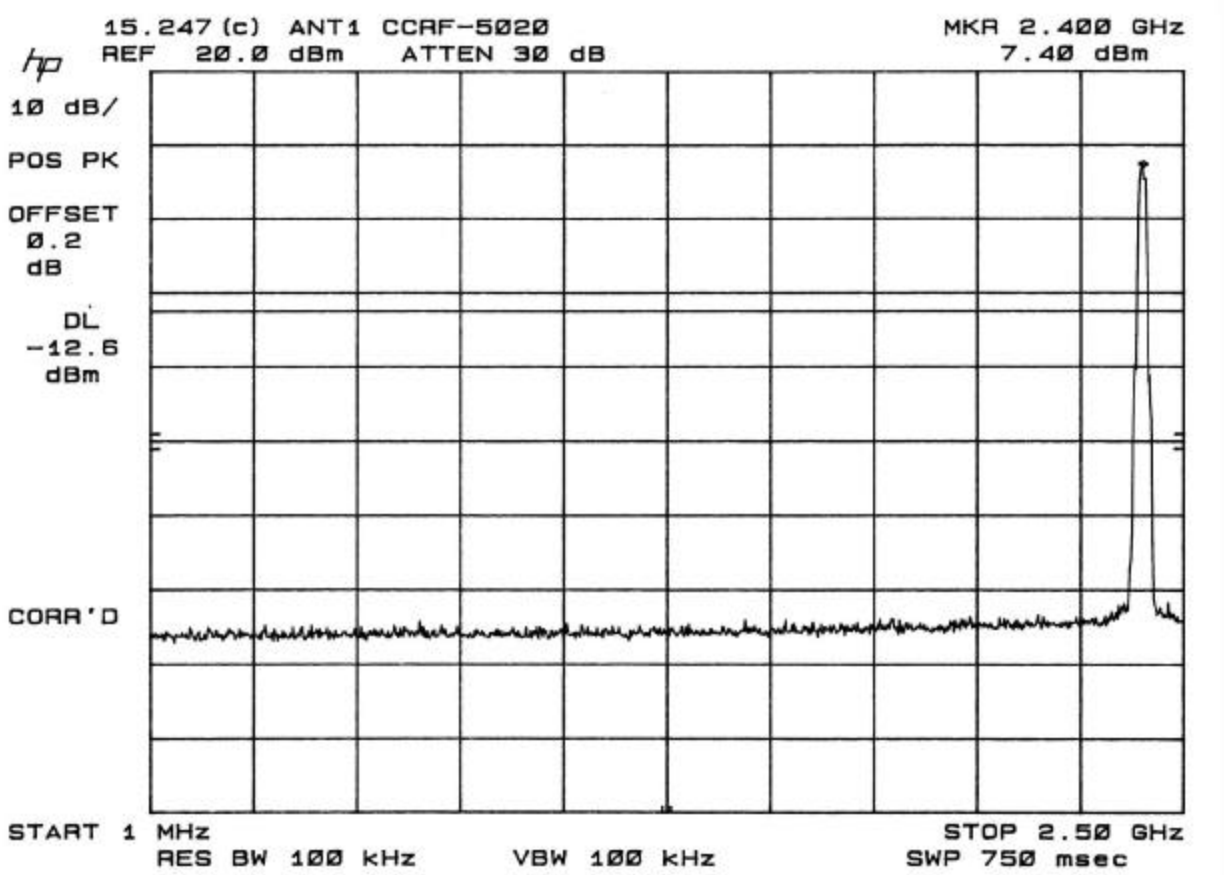
TEST PROCEDURE

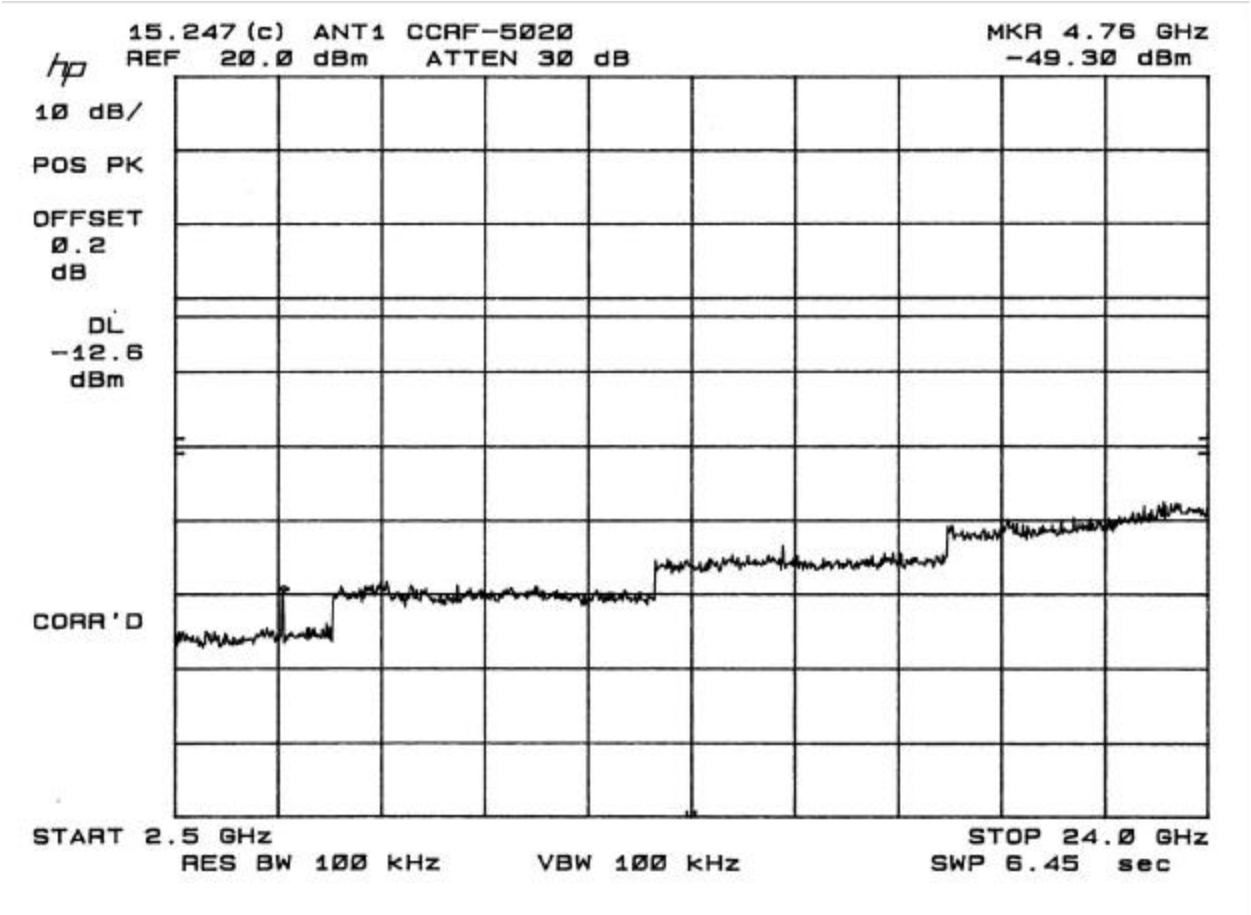
Connect the Eut's antenna port to the Spectrum Analyzer's input port.
Investigate the entire frequency of the carrier frequency, up to the tenth harmonic.

RESULT

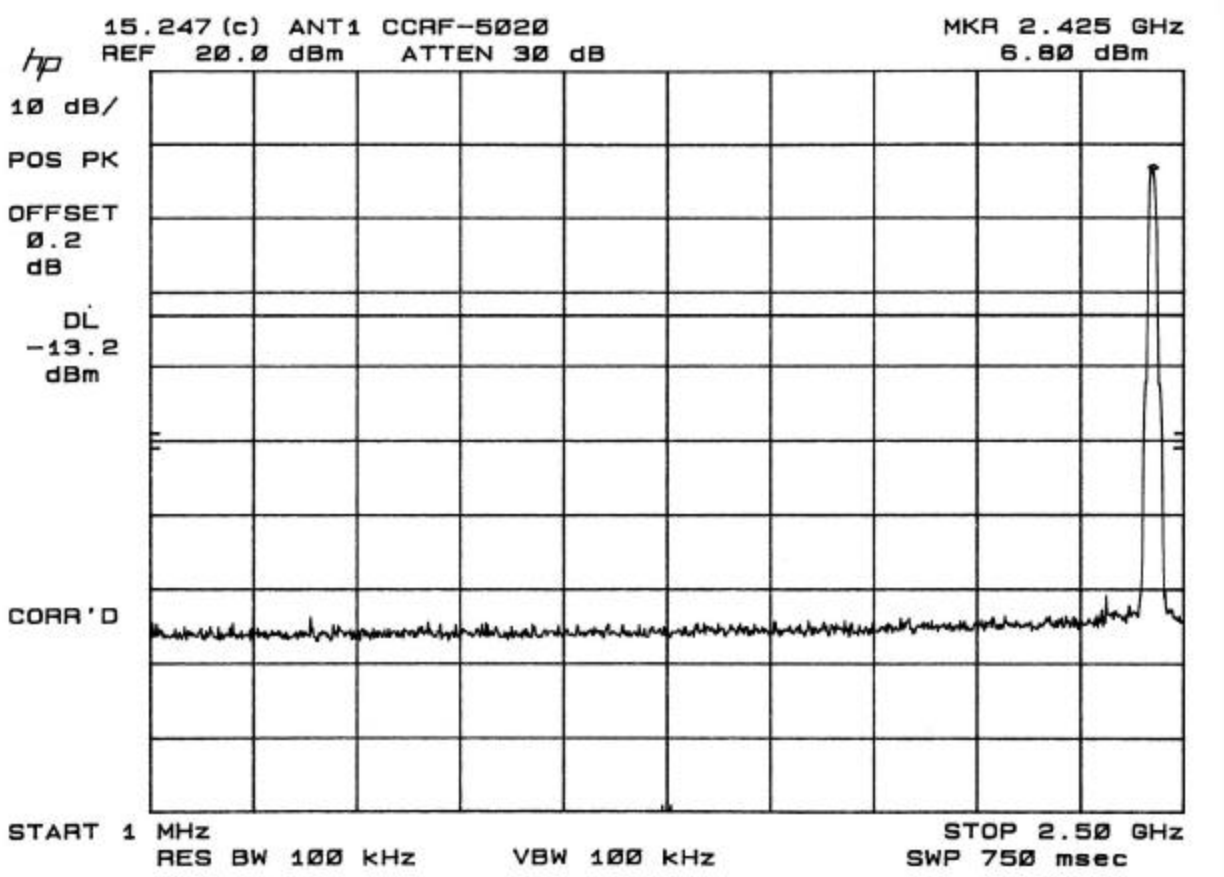
No non-compliance noted. See below plots for ANTENNA 1 and 2; LOW, MID, HIGH channels.

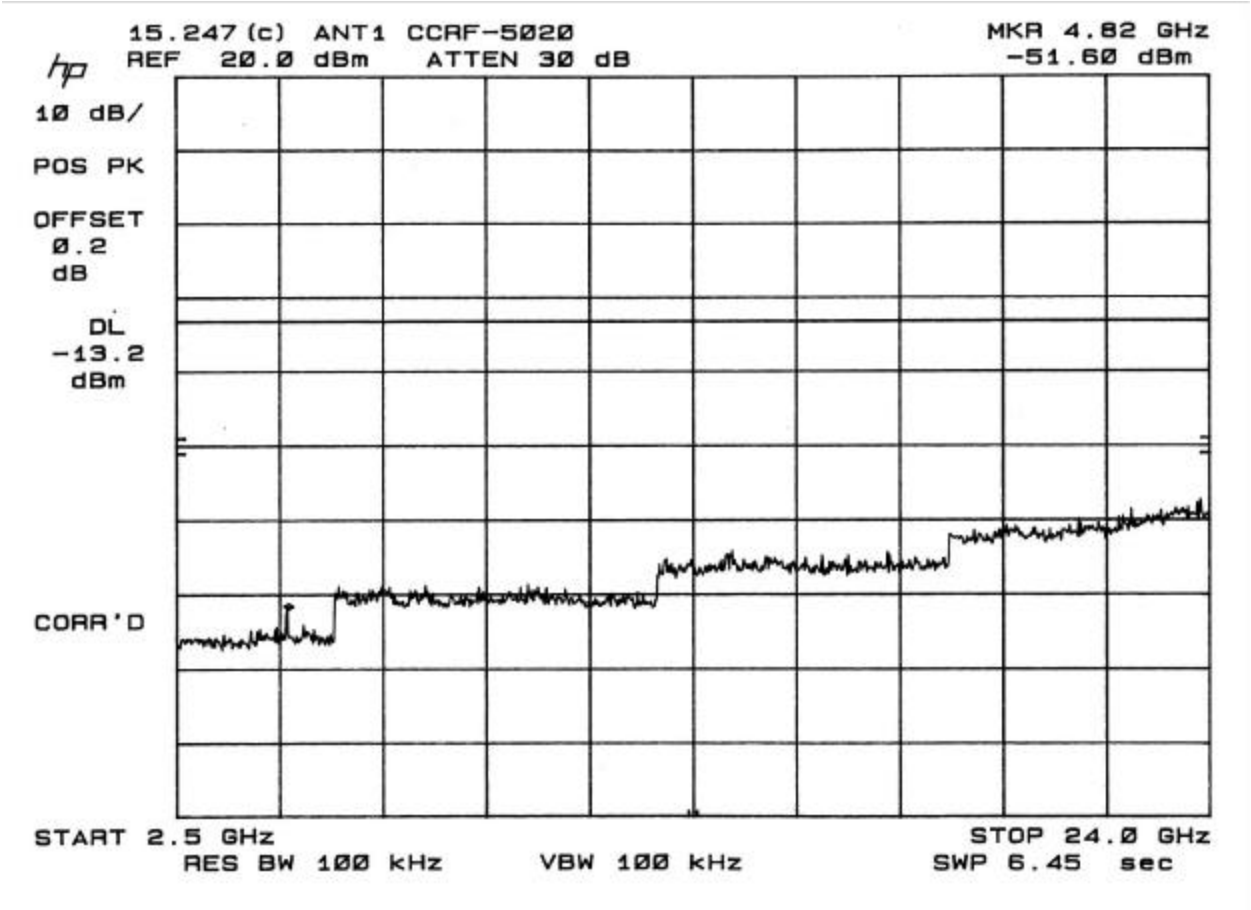
ANTENNA 1 LOW CHANNEL



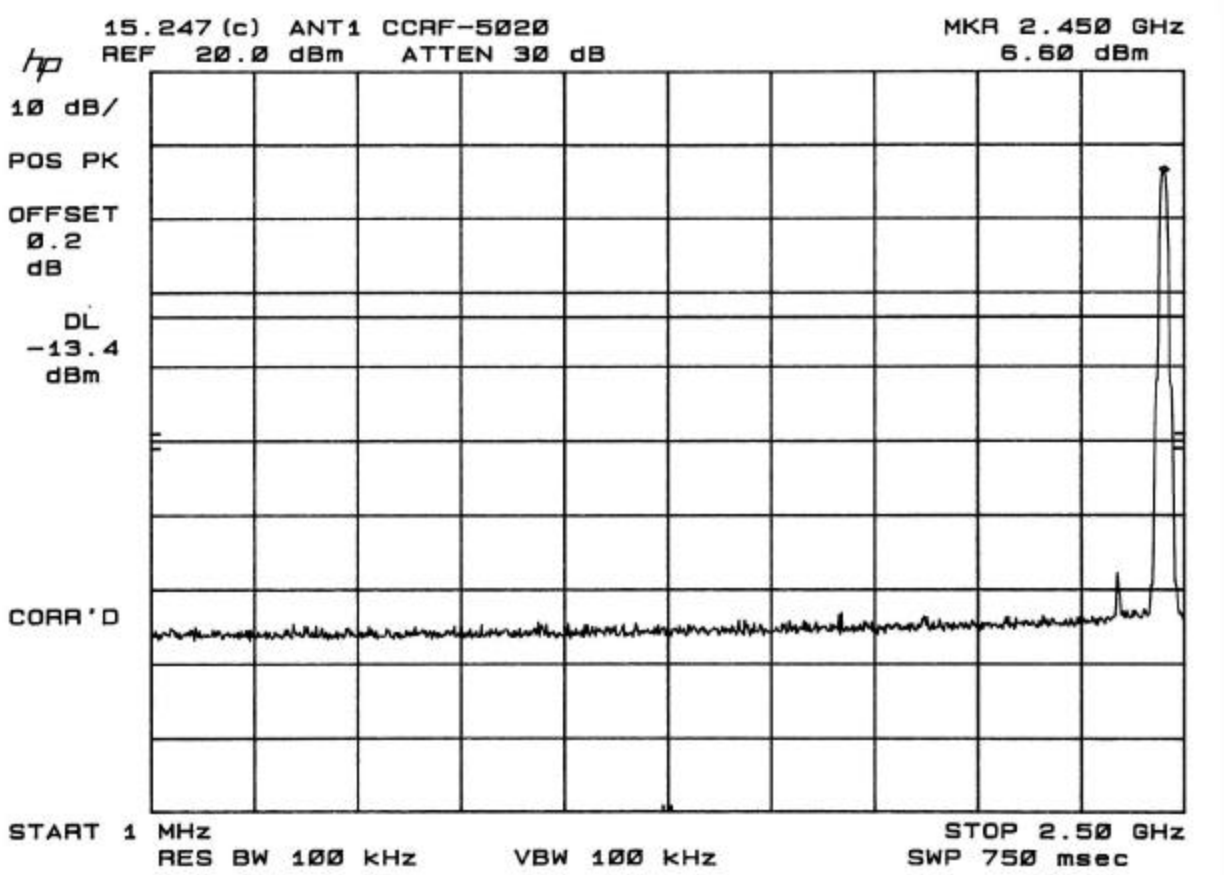


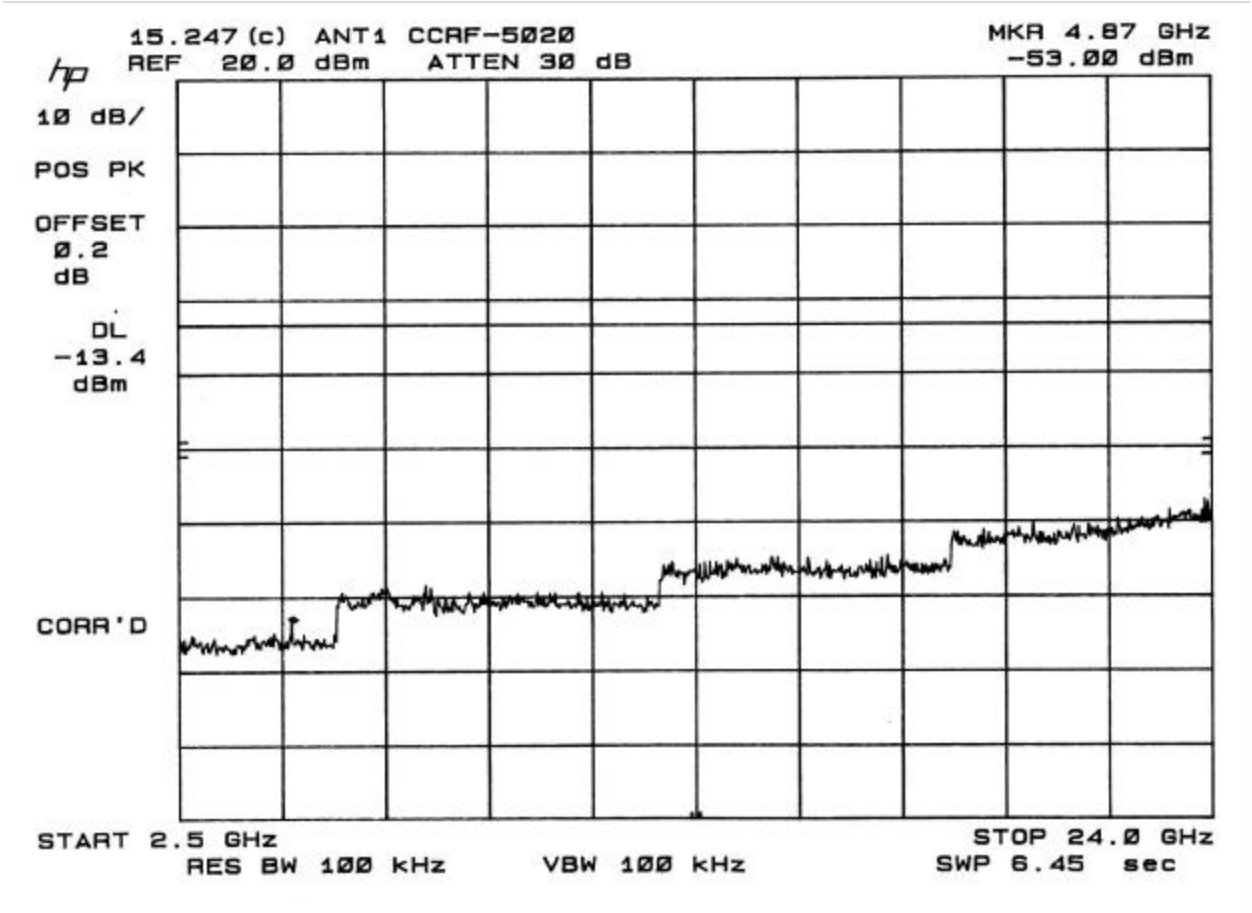
ANTENNA 1 MID CHANNEL



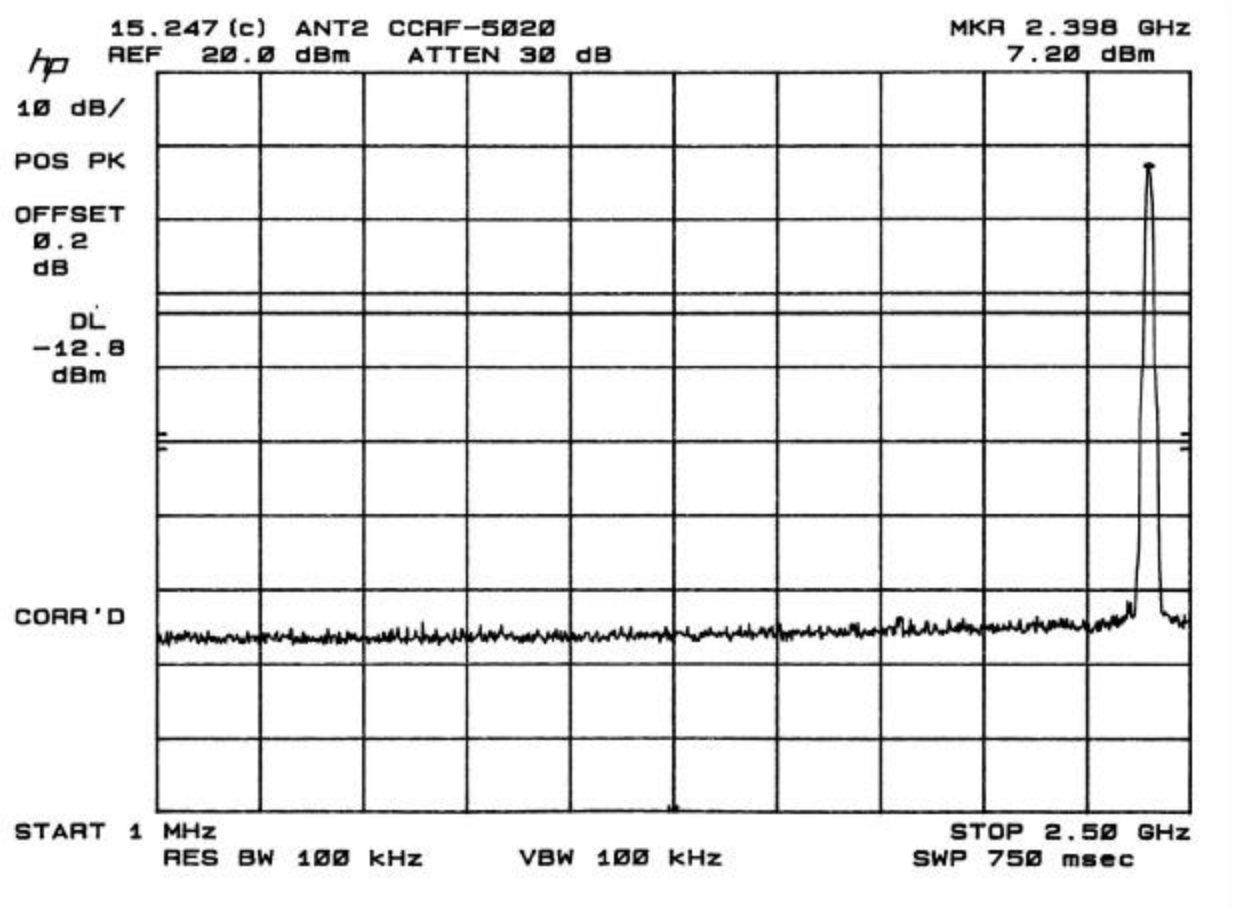


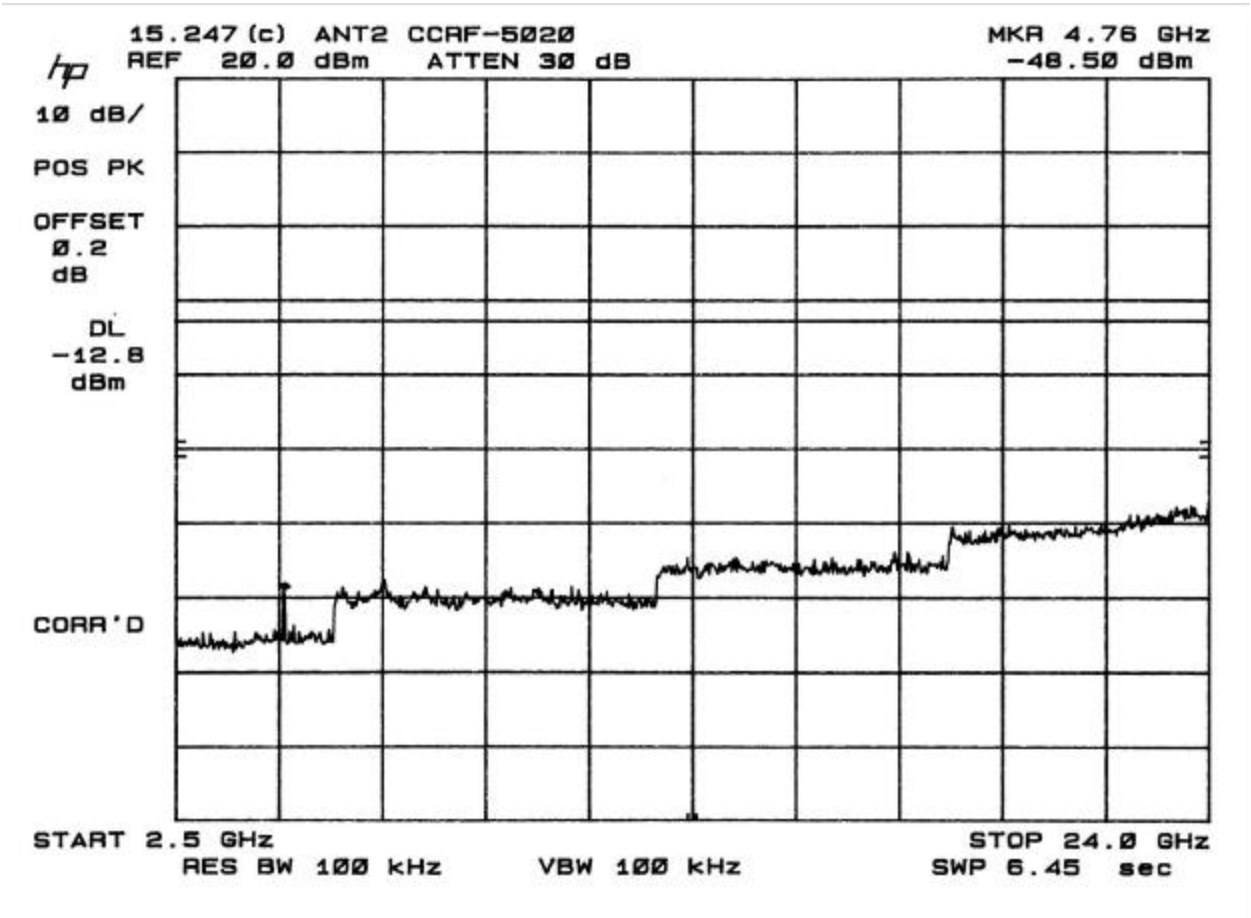
ANTENNA 1 HIGH CHANNEL



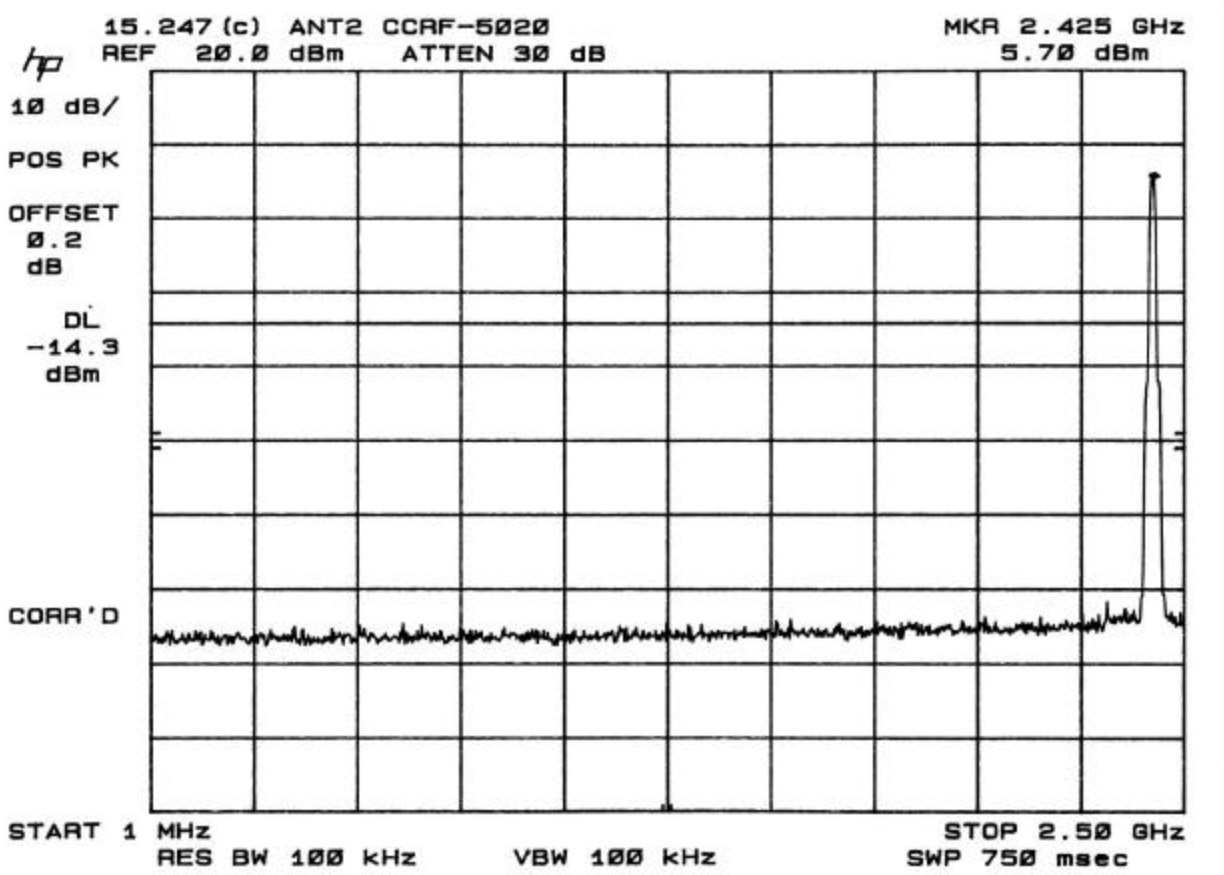


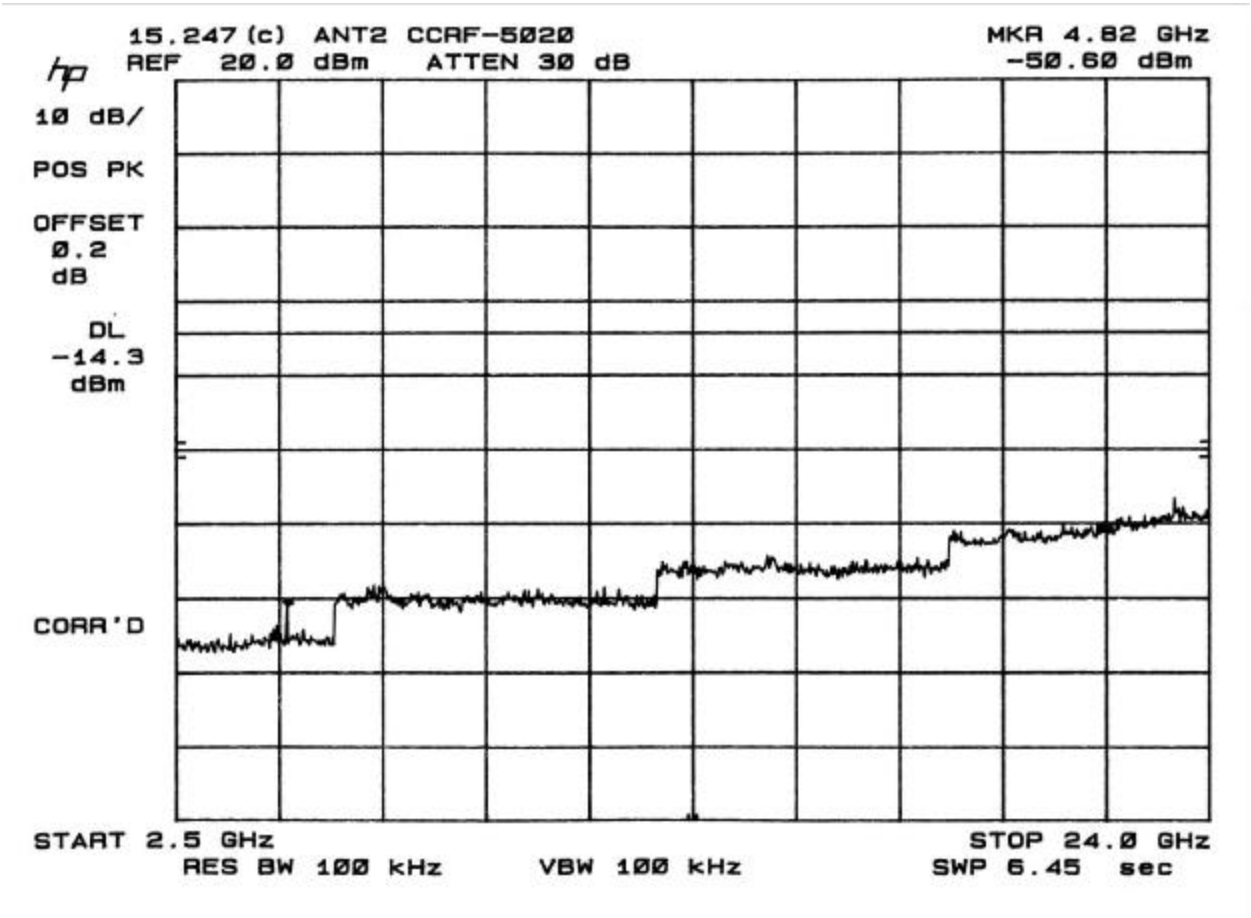
ANTENNA 2 LOW CHANNEL



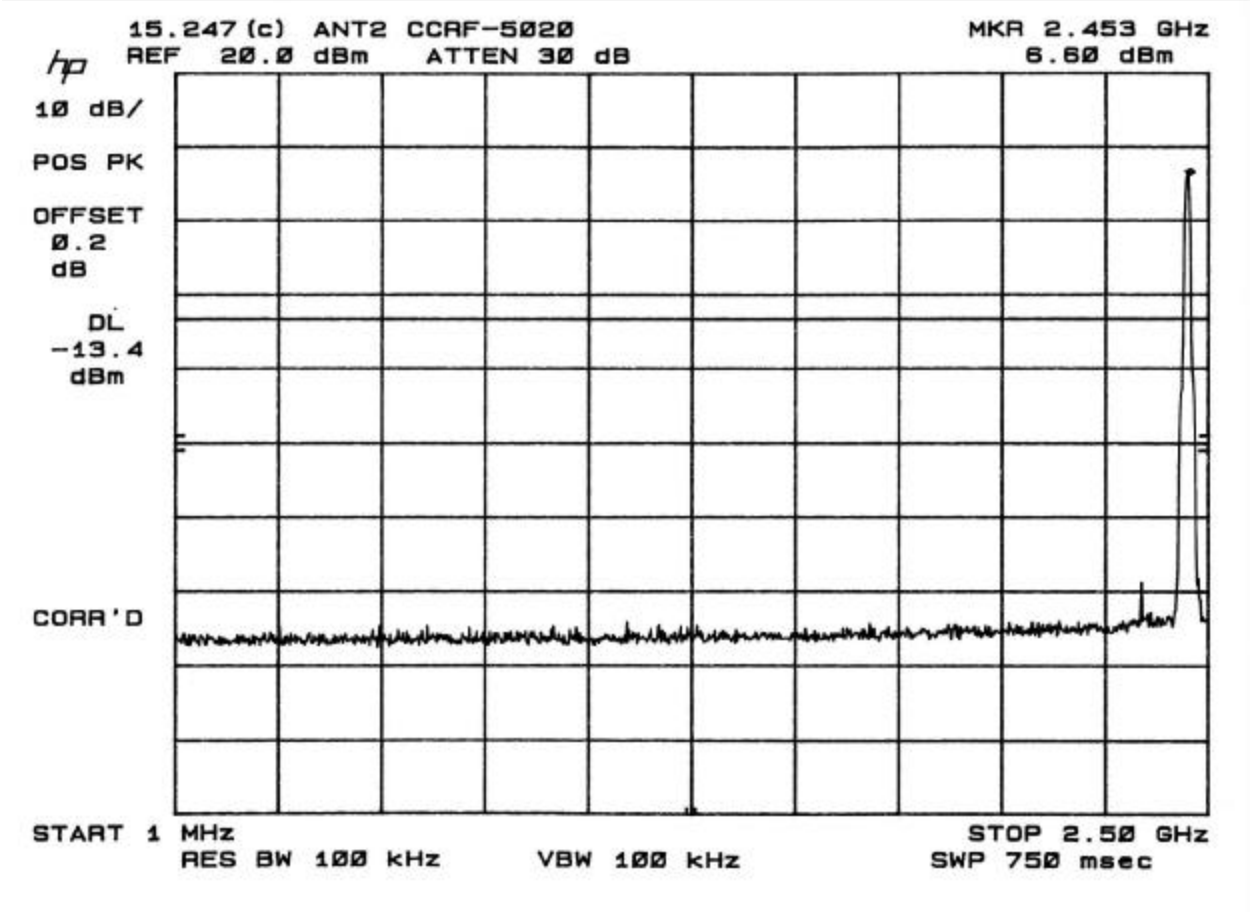


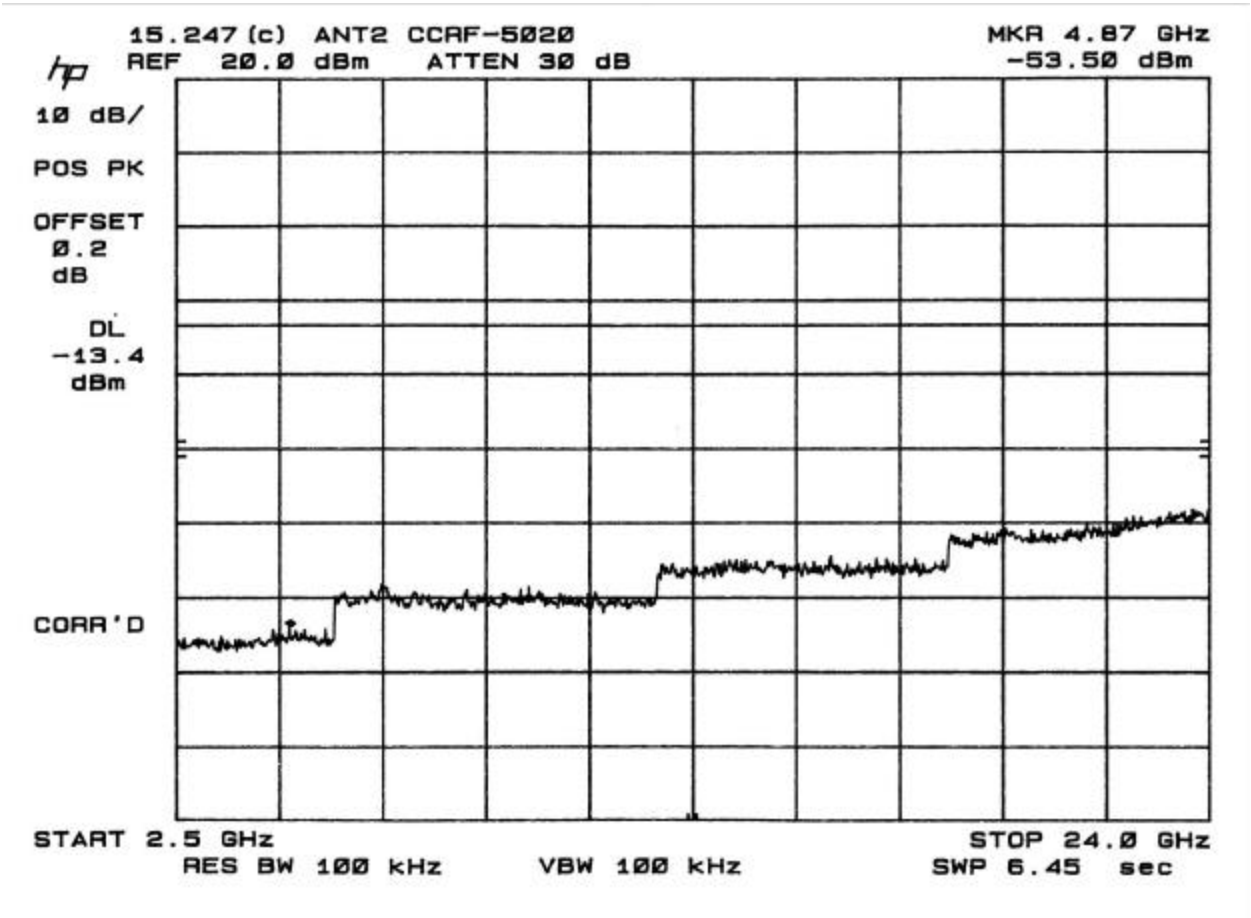
ANTENNA 2 MID CHANNEL





ANTENNA 2 HIGH CHANNEL



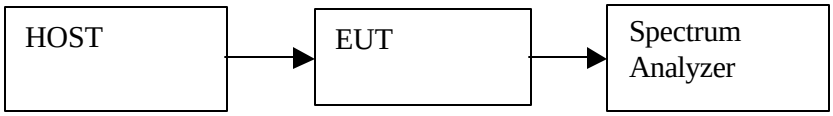


9.4. PEAK POWER SPECTRAL DENSITY

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak	☒ 3 kHz	☒ 3 kHz



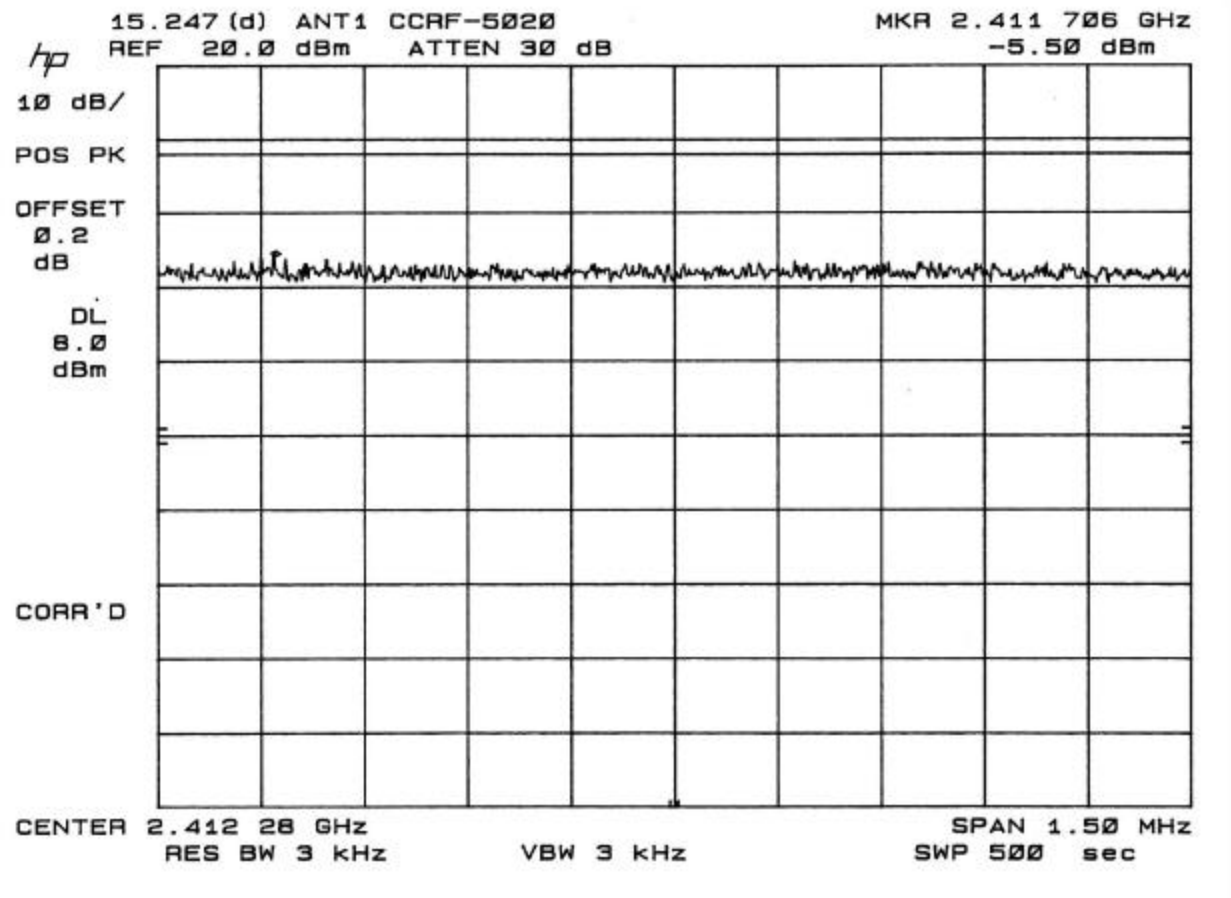
TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3 kHz RBW and 3 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.

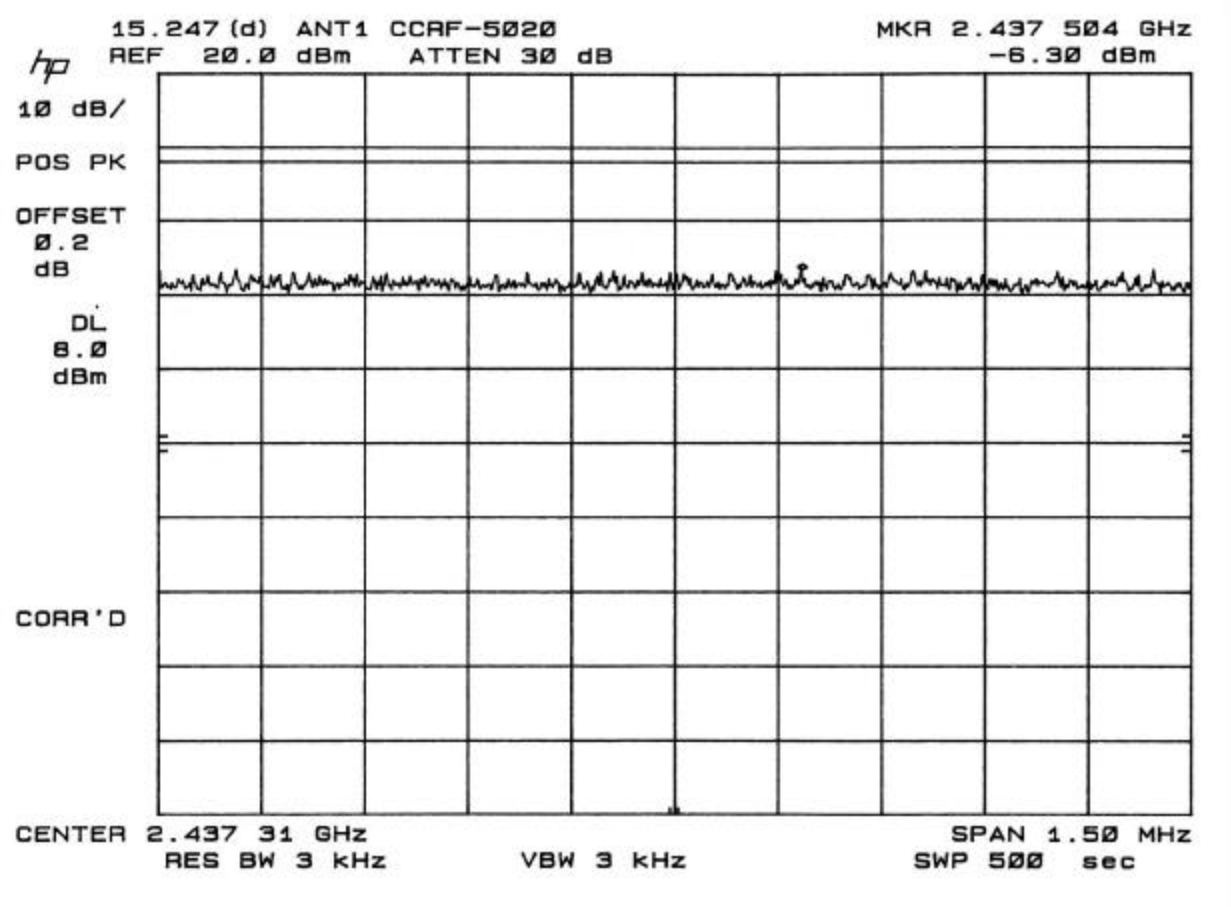
Result:

No non-compliance noted. See below plots for ANTENNA 1 and 2; LOW, MID, HIGH channels

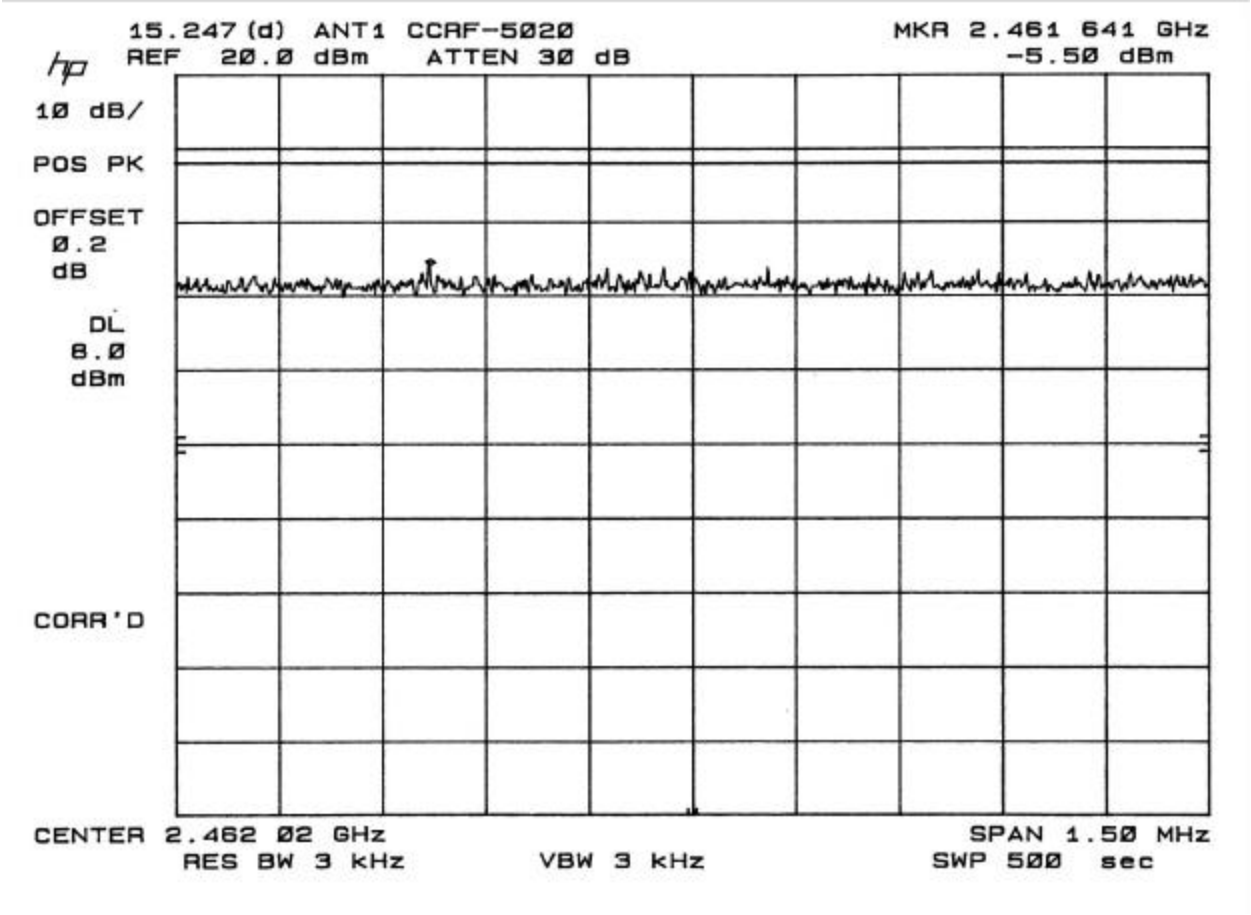
ANETNNA 1 LOW CHANNEL



ANTENNA 1 MID CHANNEL



ANTENNA 1 HIGH CHANNEL



ANTENNA 2 LOW CHANNEL