FCC CFR47 PART 15 CERTIFICATION

TEST REPORT

FOR

HUB OUTDOOR TRANSCEIVERS

MODEL: AR1255

FCC ID: PLRAR 125500

REPORT NUMBER: 01U1019-1

ISSUE DATE: FEBRUARY 25, 2002

Prepared for
ADVANCED RADIO CELLS,INC.
910 CAMPISI WAY STE. 1F
CAMPBELL, CA 95008
USA

Prepared by
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1. TEST RESULT CERTIFICATION

COMPANY NAME: **ADVANCED RADIO CELLS, INC.**
910 CAMPISI WAY STE. 1F
CAMPBELL, CA 95008 USA

CONTACT PERSON: **LEON LOUIE / DIRECTOR OF OPERATIONS**

TELPHONE NO: **408-558-2764**

EUT DESCRIPTION: **HUB OUTDOOR TRANSCEIVERS**

MODEM NAME: **AR1255**

DATE TESTED: **DECEMBER 28, 2001**

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	5.8 GHz TRANSCEIVER
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CERTIFICATION
FCC RULE	CFR 47 PART 15.E

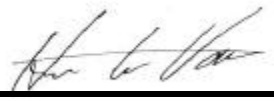
Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 15, Subpart E. The equipment in the configuration described in this report, shows the measured emission levels emanating from the equipment do not exceed the specified limit.

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:



HUE LY VANG
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The EUT is a Wireless HUB (also known as the wireless Modem Termination system, or WMTS). It controls the flow of data between the gateway to the internet and each subscriber wireless modem. It transmits a continuous downstream of user data interspersed with modem commands to each wireless modem in the system When a user has data to transmit upstream to the internet, the modem awaits it's time slot (as assigned by the wireless hub), turns on the transmitter, sends its data to the hub, and then turns off its transmitter.

The carrier frequency tuning range of the Hub transmitter ranges from 5729 to 5819 MHz, in 6 MHz increments.

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 15.401.

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	200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	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	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	ELA-171
Taiwan	BSMI	CNS 13438	SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	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. 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.

6.1. 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.

7. SUPPORT EQUIPMENT / TEST DIAGRAM

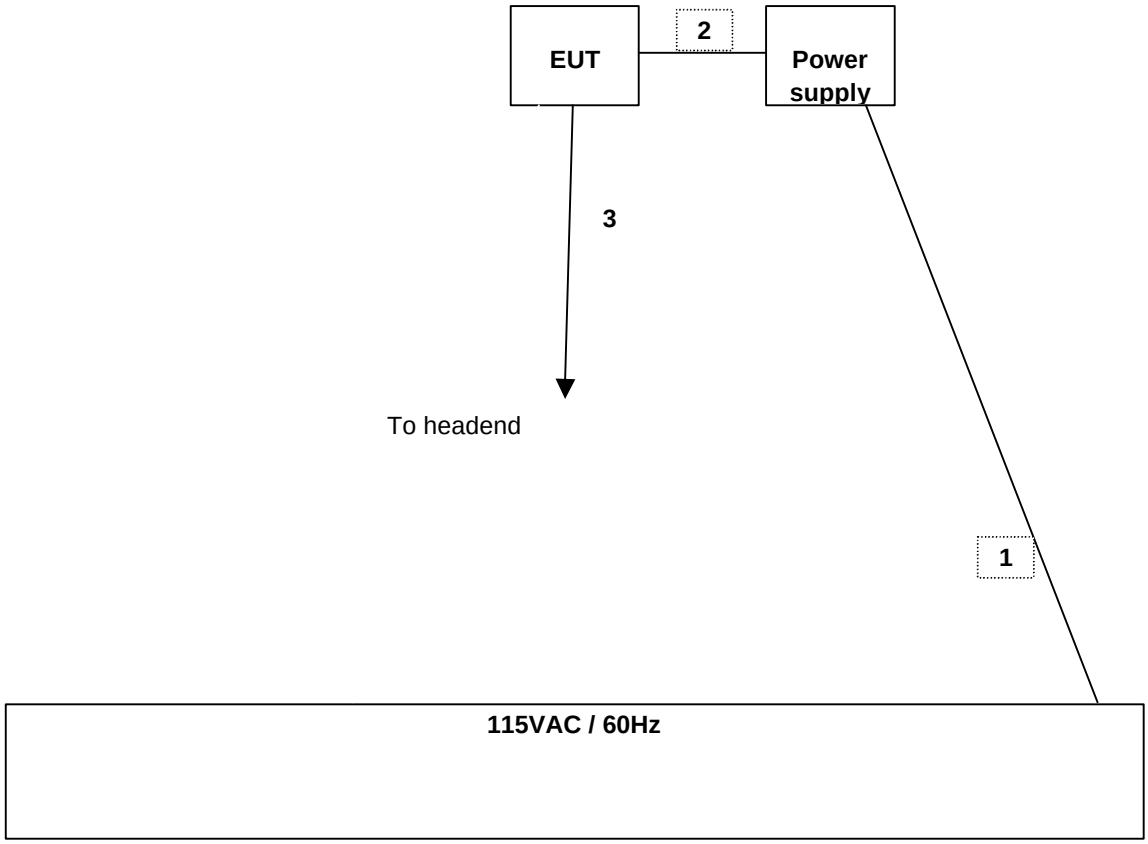
Support Equipment

TEST PERIPHERALS				
Device Type	Manufacturer	Model Number	Serial Number	FCC ID
DOCSIS PROCESSOR	VYYO	P3000	9123064	DoC
UHF TRANSVERTER	CADCO	VYYO VERSION	U2162	DoC
HUB	LINKSYS	EZX588R	90000198	DoC
MONITOR	VIEWMATE	L5032LA	9BMLB0011669	DoC
KEYBOARD	MICROSOFT	RT9410V56TW	5167700956909	DoC
MOUSE	LOGITECH	P04-1136006	LZE94503596	DoC
DC POWER SUPPLY	AGILENT	E3610A	MY40001557	DoC
WIRELESS MODEM	VYYO	V251	07A004454	DoC
LAPTOP	IBM	1171	AA-FXZGX 00/08	DoC
PORT ADAPTER	ENTREGA	U1-S9	N/A	DoC
SPECTRUM ANALYZER	ANRITSU	MS2711A	115024	DoC
POWER METER	HP	436A	2709A26544	DoC
MODEM/PC TEST SET	SENCORE	MSM980	6715992	DoC

Test Equipment

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	5/10/02
Quasi-Peak Detector	HP9K - 1GHz	85650A	2811A01155	5/4/02
Pre-Amplifier, 25 dB	HP 0.1 - 1300MHz	8447D (P_1M)	2944A06833	8/21/02
Antenna, BiLog	Chase 30 - 2000MHz	CBL6112	2049	8/2/02
Line Filter	Lindgren 10k - 10GHz	LMF-3489	497	N.C.R.
LISN	Fisher Cus. Comm.	LISN-50/250-25-2	2023	8/2/02
EMI Test Receiver	Rohde & Schwarz	ESHS 20	827129/006	4/2/02
Pre-amplifier,35.5 dB (1 - 26.5GHz)	HP	8449B	3008A00369	5/30/02
Horn Antenna(1 - 18GHz)	EMCO	3115	9001-3245	6/20/02
Horn Antenna,(18 - 26GHz)	Antenna Research Associate	MWH 1826/B	1013	7/26/02
Harmonic Mixer (26.5-40GHz)	HP	11970A	3003A04190	9/23/02
Horn Antenna(26.5 - 40GHz)	Dico	1149	2	9/22/02
High Pass Filter(7.6GHz)	FSY Microwave	7600-9SS	1	N.C.R.
10 dB Attenuator	Mini-Circuits	MCL BW-S10W2	0026	In House Cal
Environmental Chamber	Thermotron	SE 600-10-10	29800	3/23/02
Spectrum Analyzer	HP	8593E	3710A00205	6/2/02

Test Diagram



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	AC	1	US 115V	Un-shielded	2m	No	Yes	Bundled in LC test only
2	DC	1	Twisted Paired	Un-shielded	4m	No	No	N/A
3	F-Type	1	Coxial	Shielded	20m	Yes	No	N/A

8. APPLICABLE RULES AND BRIEF TEST RESULT

§14.403(c)- EMISSION BANDWIDTH

Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Test result:

Channel	*Frequency (MHz)*	*Bandwidth(MHz)*
58	***5729***	***5.8***
63	***5759***	***5.75***
73	***5819***	***5.76***

§15.407(a)- POWER LIMIT

(3) For the band 5.725-5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Spec limit: As specified above
For Channel 58, B is 5.8 MHz and the antenna gain is 13 dBi
therefore the limit is 17 dBm + 10log(5.8) dB – 7 dB = 17.63 dBm
For Channel 63, B is 5.75 MHz and the antenna gain is 13 dBi
therefore the limit is 17 dBm + 10log(5.75) dB – 7 dB = 17.60 dBm
For Channel 73, B is 5.76 MHz and the antenna gain is 13 dBi
therefore the limit is 17 dBm + 10log(5.76) dB – 7 dB = 17.60 dBm

Channel	*Frequency (MHz)*	*Power Limit*
58	*5729*	*57.94 mW (17.63 dBm)*
63	*5759*	*57.54 mW (17.60 dBm)*
73	*5819*	*57.54 mW (17.60 dBm)*

Test result: No non-compliance noted.

Channel	*Frequency (MHz)*	*Measured Power*
58	*5729*	*17.52 mW (12.43 dBm)*
63	*5759*	*33.86 mW (15.30 dBm)*
73	*5819*	*19.52 mW (12.90 dBm)*

§15.407(a)- PEAK POWER SPECTRAL DENSITY

(3) For the band 5.725-5.825 GHz, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Spec limit:the antenna gain is 13 dBi, therefore the limit is 10 dBm.
Test result: No non-compliance noted.

Channel	*Frequency (MHz)*	*Results (dBm)*
58	***5729***	***3***
63	***5759***	***6.9***
73	***5819***	***4***

§15.407(a)- PEAK EXCURSION

(6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Spec limit: <13 dB.
Test result: No non-compliance noted.

Channel	*Frequency (MHz)*	*Results (dBm)*
58	***5729***	***5.8***
63	***5759***	***5.5***
73	***5819***	***5.6***

§15.407(b)- UNDESIRABLE EMISSION LIMITS

(3) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

Spec limit: <-17 dBm/MHz EIRP within 10MHz of band edge,
<-27 dBm/MHz EIRP greater than 10Mhz from band edge
Test result: No non-compliance noted.

Measurement using Marker-Delta procedure

Band Edge	Fundamental Reading	Antenna Gain	Fundamental Level	Delta	EIRP	Limit	Margin
	(dBm)	(dBi)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
< 10 MHz below 5.715 GHz	9.33	13	22.33	-48.49	-26.16	-17	-9.16

Measurements using Standard procedure

Band Edge	Reading	Antenna Gain	EIRP	Limit	Margin
	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
> 10 MHz below 5.715 GHz	-48.91	13	-35.91	-27	-8.91
< 10 MHz above 5.835 GHz	-43.41	13	-30.41	-17	-13.41
> 10 MHz above 5.835 GHz	-45.69	13	-32.69	-27	-5.69

§15.407(g)- FREQUENCY STABILITY

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

Spec limit: Emission remains within the range of 5.725 to 5.825 GHz over the temperature range of -30°C ***to*** +50°C**.**
Test result: No non-compliance noted.

Temperature	*Signal*	*Frequency (MHz)*	*Limit Frequency(MHz)*
+25°C (ref)	***Lower Edge of Channel 58***	***5726.2424***	***5725 to 5825***
-30°C	***Lower Edge of Channel 58***	***5726.2422***	***5725 to 5825***
+50°C	***Lower Edge of Channel 58***	***5726.2615***	***5725 to 5825***
+25°C (ref)	***Upper Edge of Channel 73***	***5821.5905***	***5725 to 5825***
-30°C	***Upper Edge of Channel 73***	***5821.6039***	***5725 to 5825***
+50°C	***Upper Edge of Channel 73***	***5821.6041***	***5725 to 5825***

§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.

§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 PART 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 (microvolts/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.

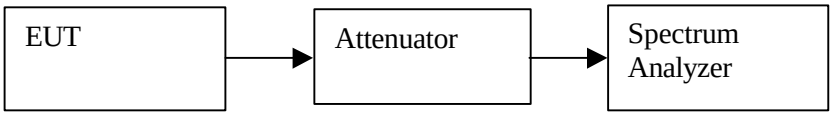
9. TEST SETUP, PROCEDURE AND RESULT

9.1. EMISSION BANDWIDTH

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



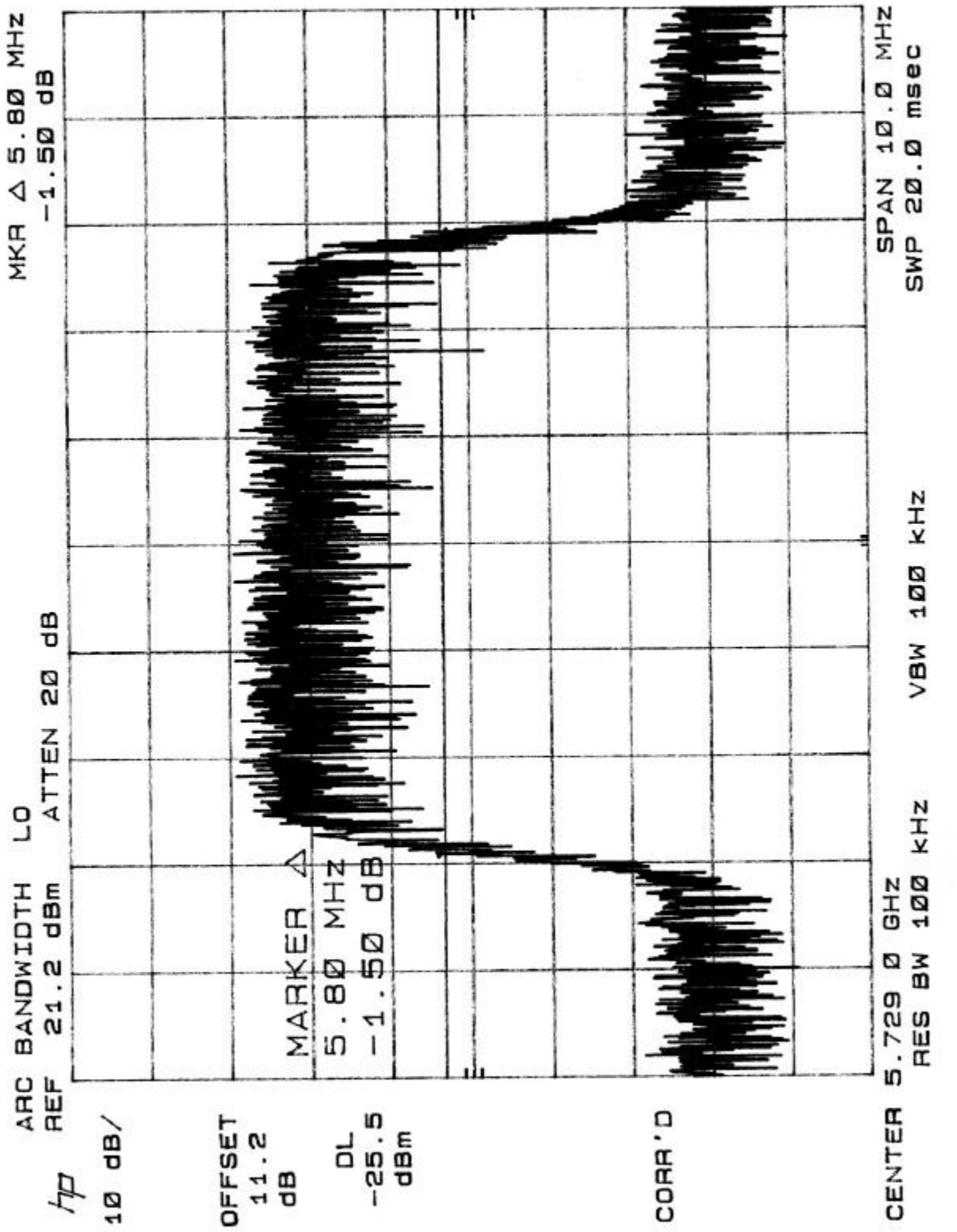
TEST PROCEDURE

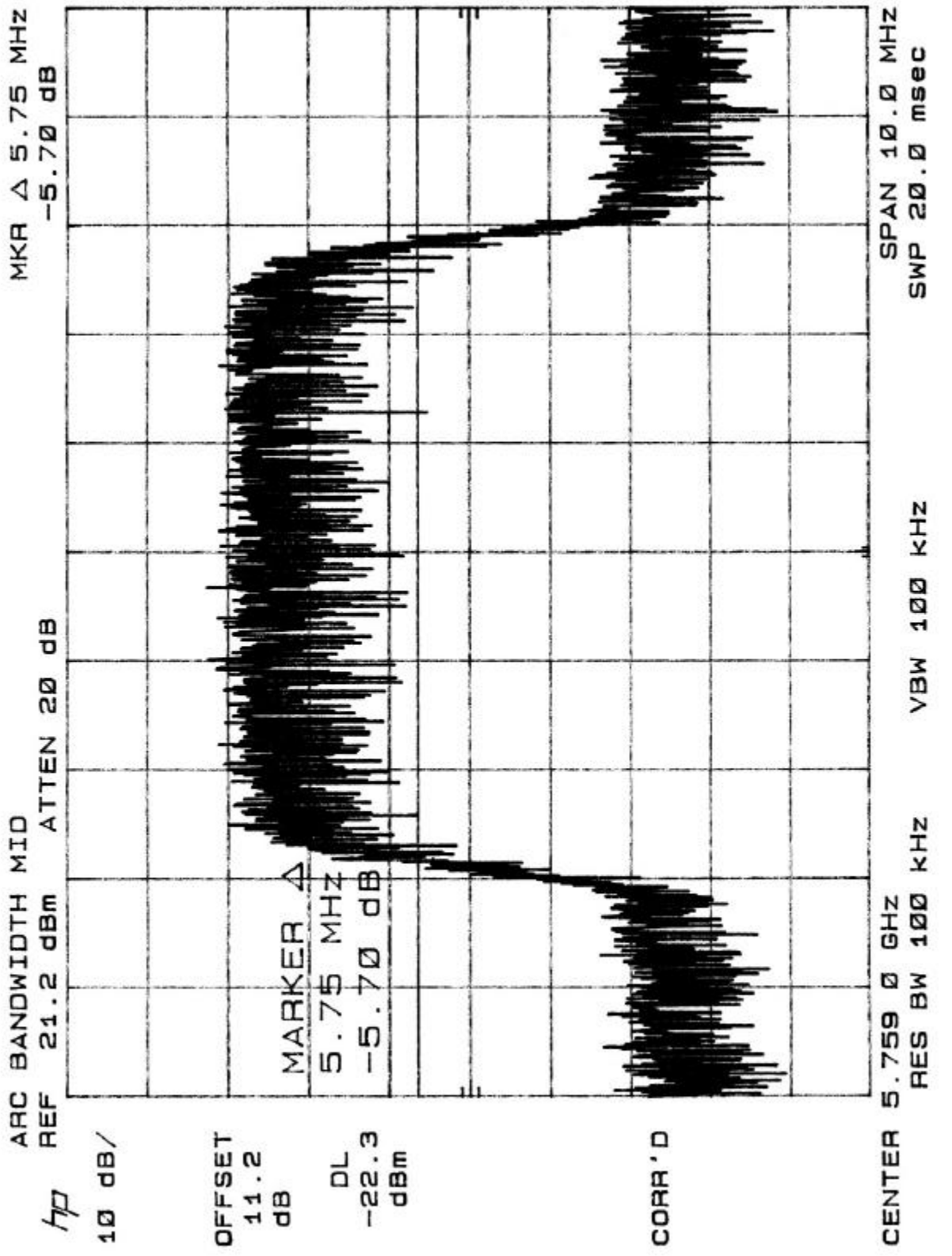
The transmitter output was connected to the spectrum analyzer through an attenuator. The resolution bandwidth is set to approximately 1% of the emission bandwidth. The emission bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 dB.

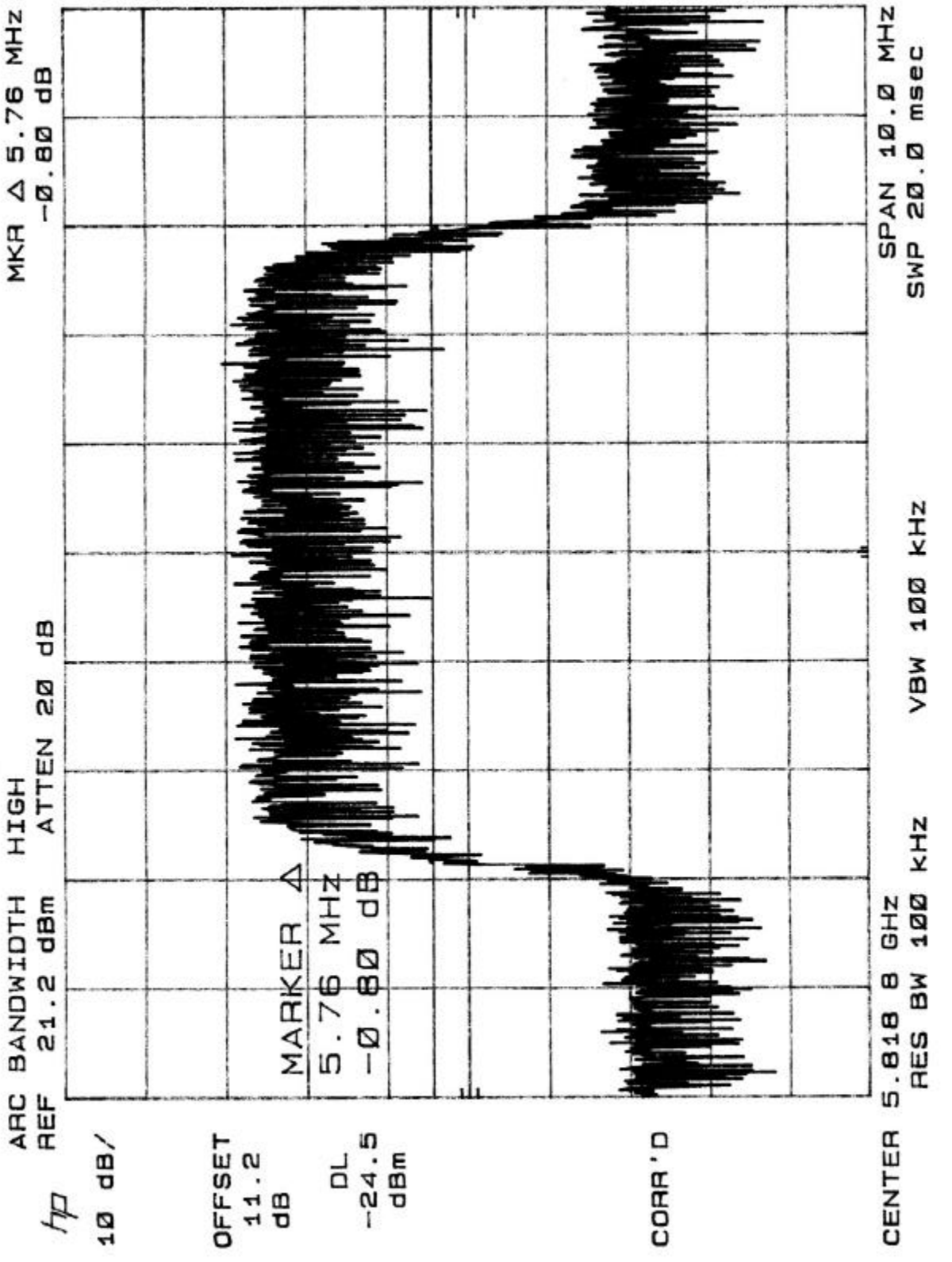
RESULT

Main unit

Channel	***Frequency (MHz)***	***Bandwidth(MHz)***
58	***5729***	***5.8***
63	***5759***	***5.75***
73	***5819***	***5.76***

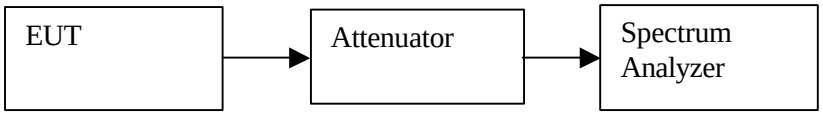






9.2. PEAK POWER

TEST SETUP



Detector Function Setting of Test Receiver

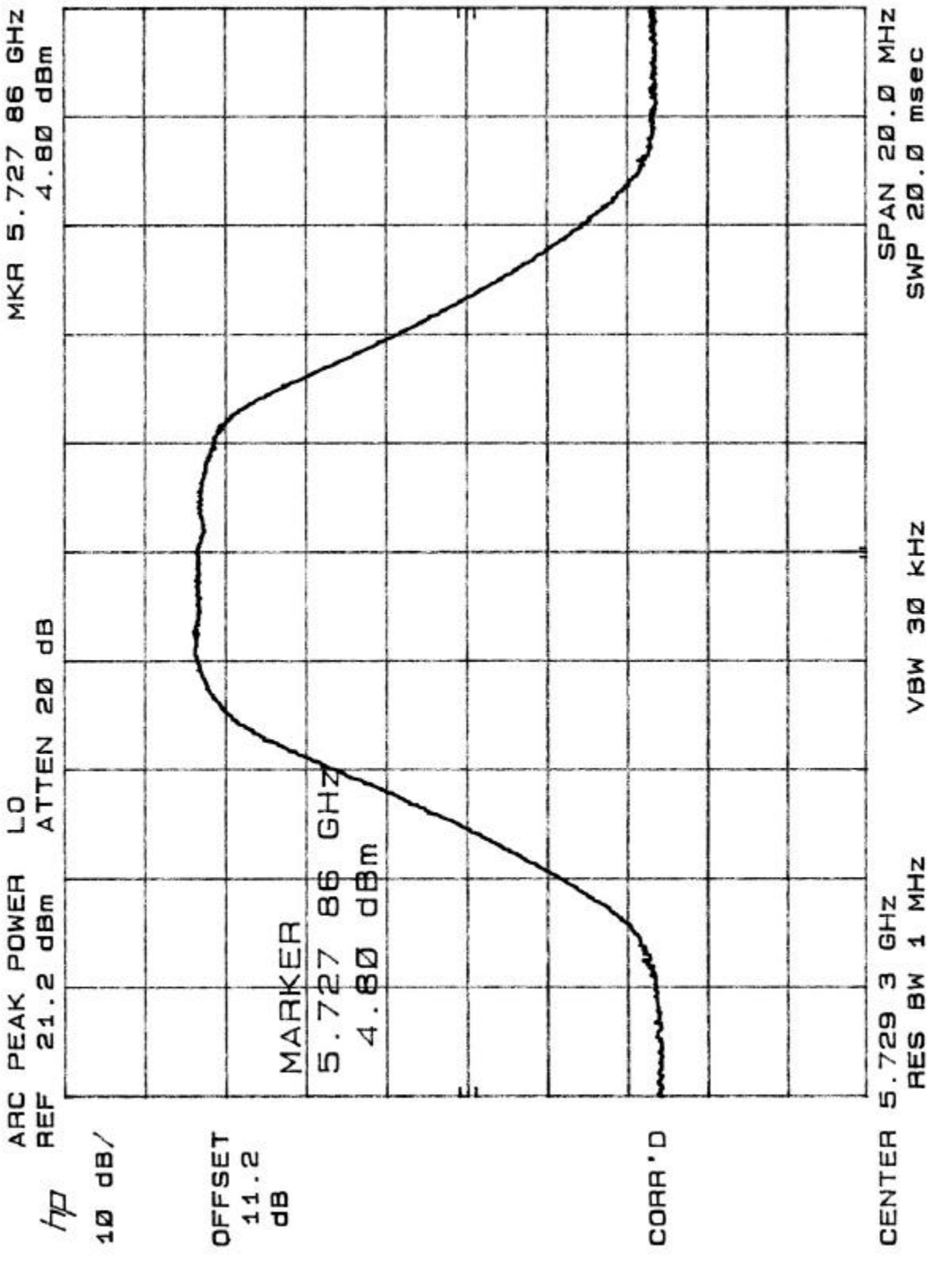
Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak	☒ 1 MHz	☒ 30 kHz

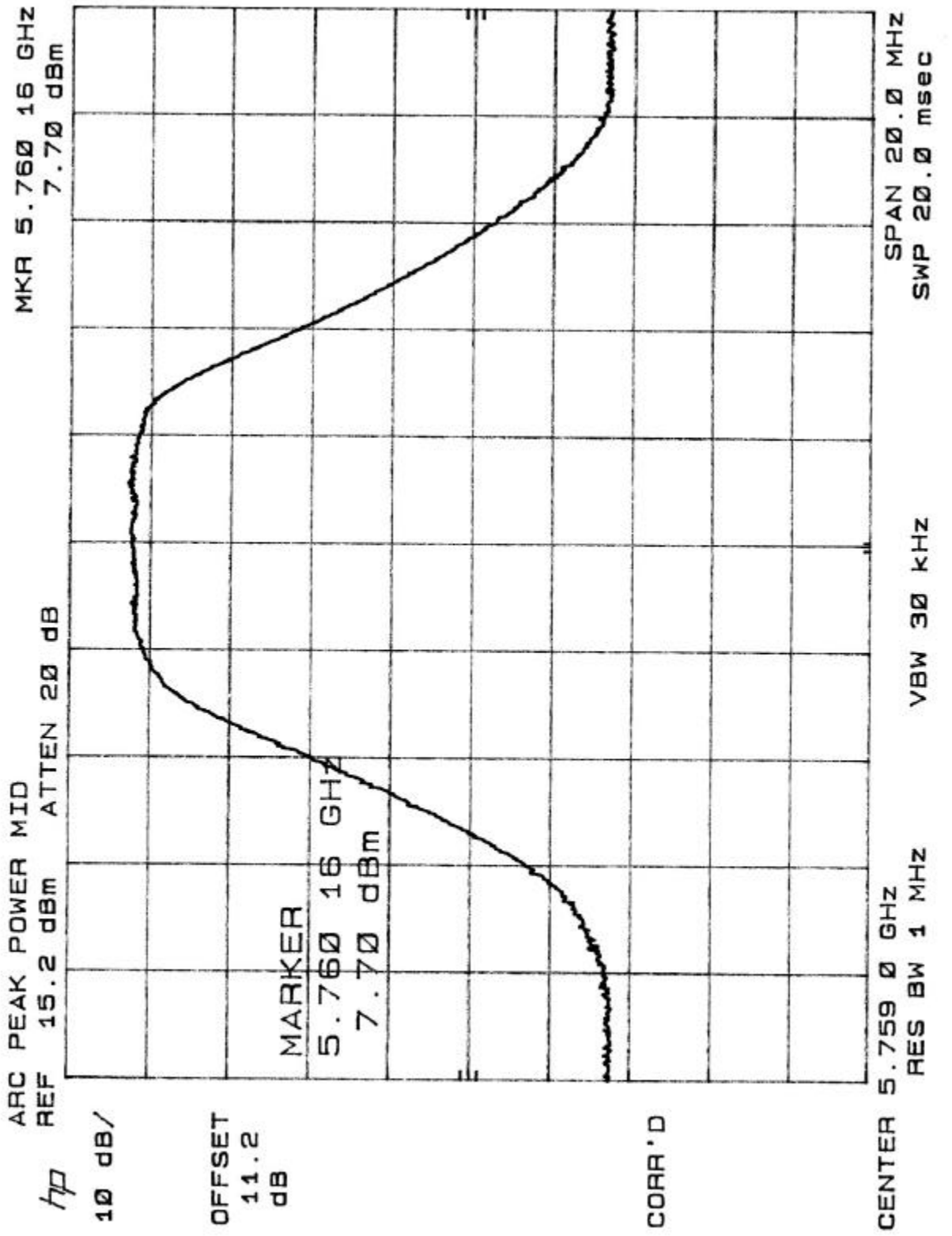
TEST PROCEDURE

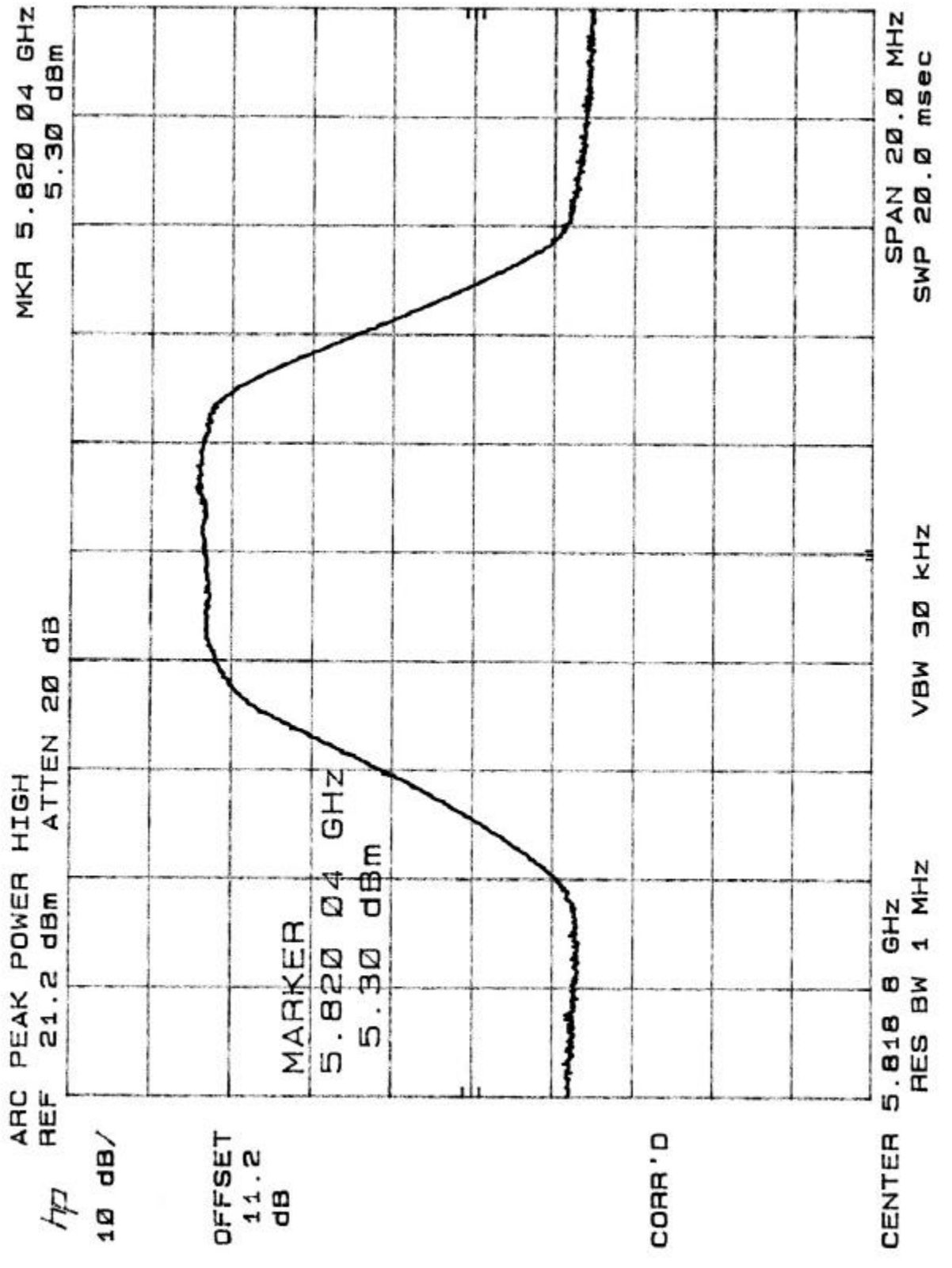
The EUT is configured on a test bench as shown above in a continuously transmitting / receiving mode. For each channel measured, the highest reading is corrected for the emissions bandwidth of that channel to yield the peak power.

Peak Power = measured reading + 10 log (B), B as measured in Section 9.1.

Channel	***Frequency (MHz)***	***Measured Power (dBm)***	***B (MHz)***	***Peak Power***
58	***5729***	***4.8***	***5.8***	***(12.43 dBm)17.52 mW***
63	***5759***	***7.7***	***5.75***	***(15.30 dBm) 33.86 mW***
73	***5819***	***5.3***	***5.76***	***(12.90 dBm) 19.52 mW***





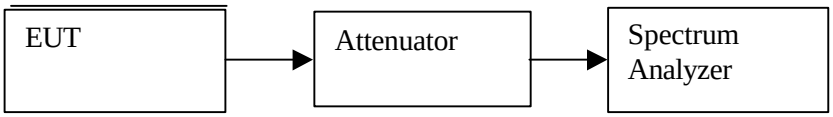


9.3. PEAK POWER SPECTRAL DENSITY

Detector Function Setting of Test Receiver

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

TEST SETUP

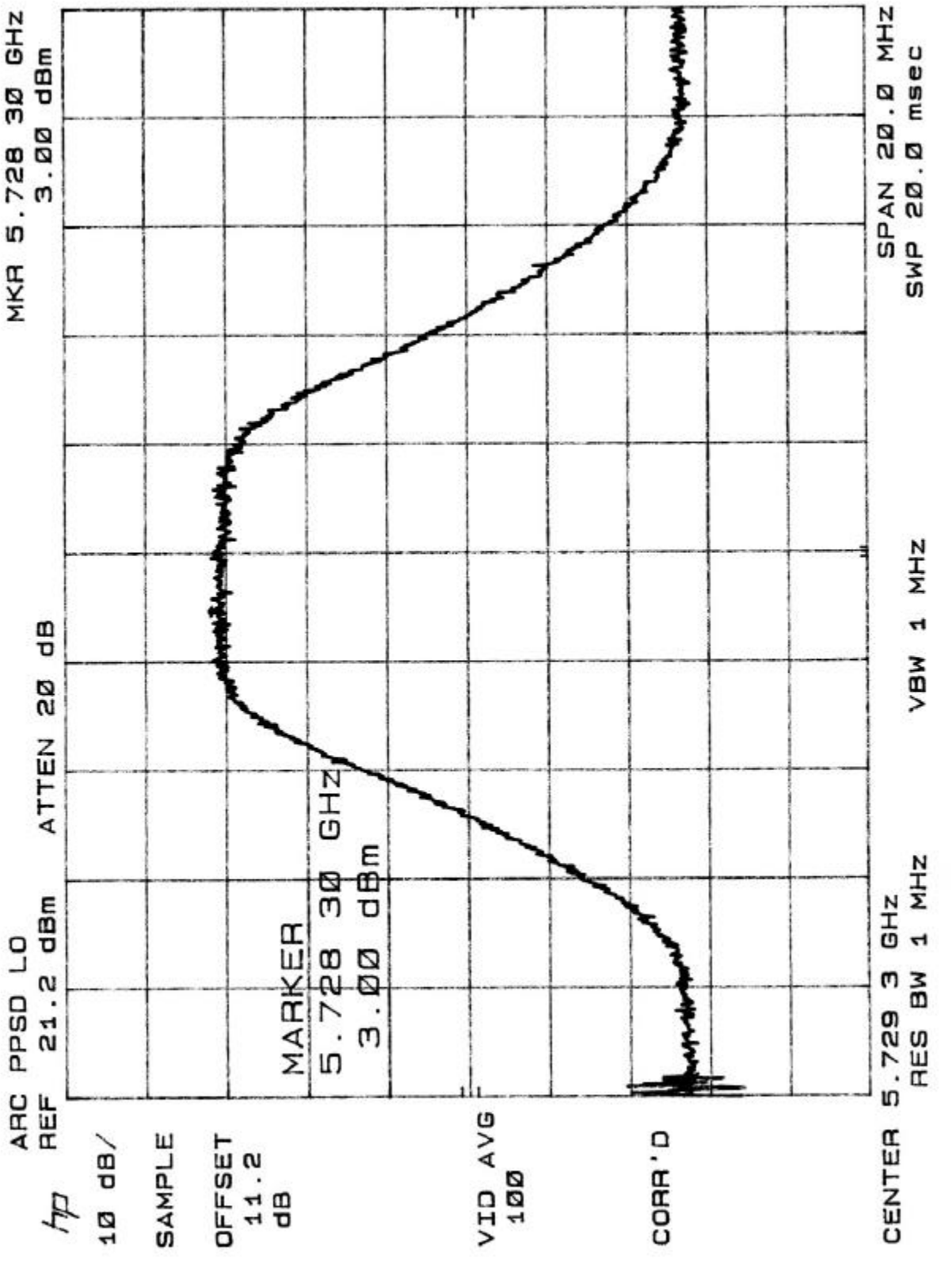


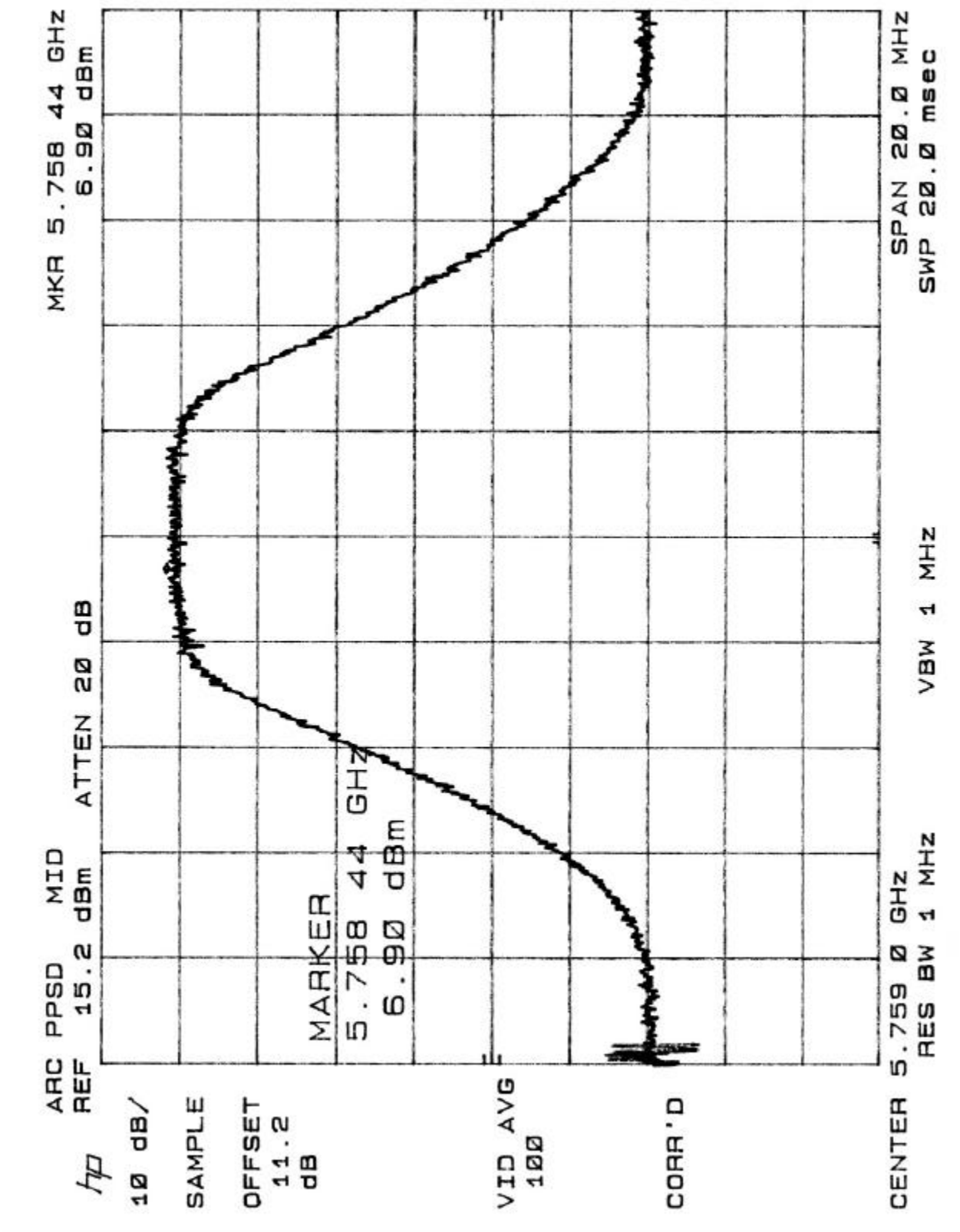
TEST PROCEDURE

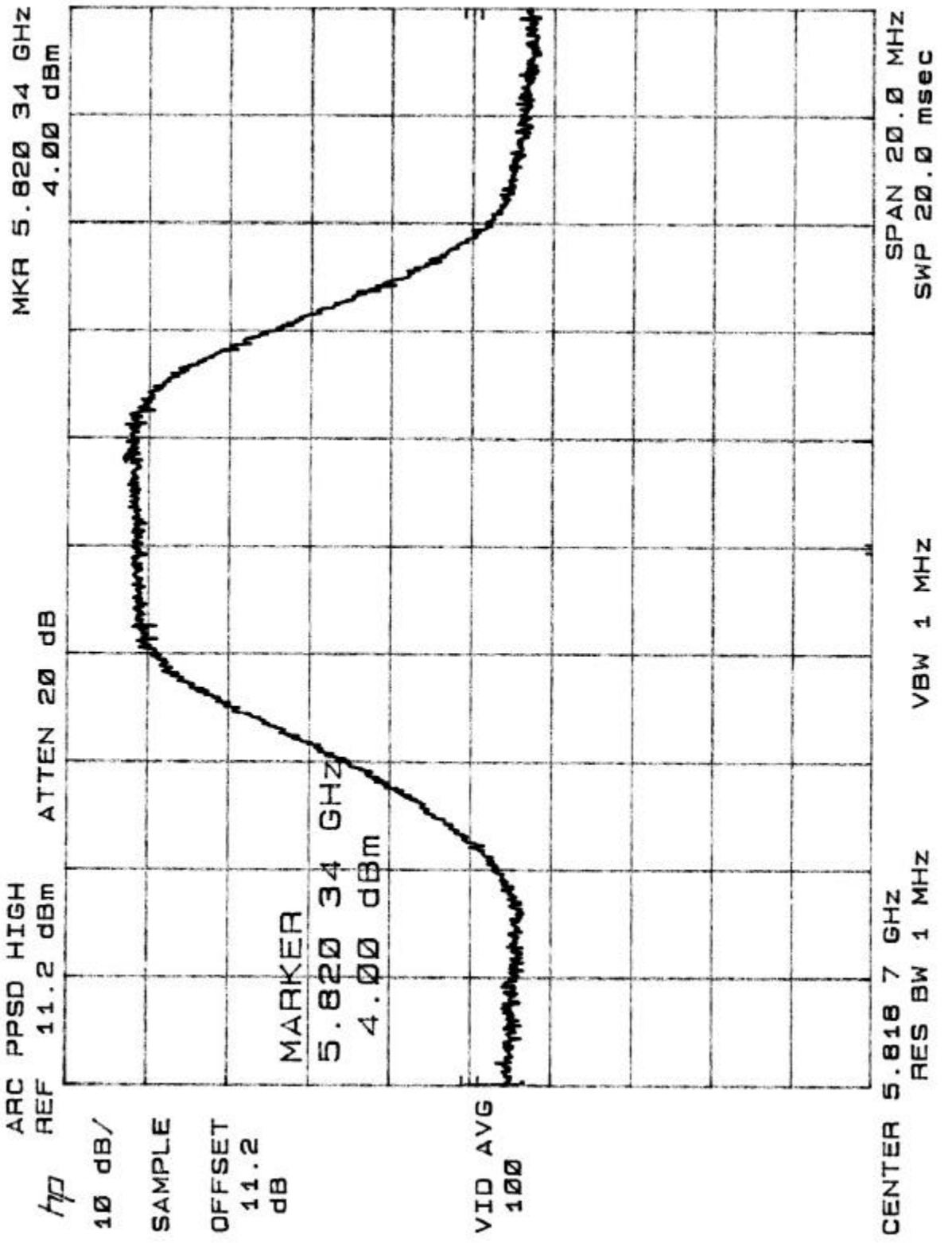
The transmitter output was connected to the spectrum analyzer through an attenuator, the maximum level in a 1 MHz bandwidth was measured with the spectrum analyzer using 1 MHz RESOLUTION BW and 1 MHz VIDEO BW.

Result:
No non-compliance noted. See plots:

Channel	***Frequency (MHz)***	***Results (dBm)***
58	***5729***	***3***
63	***5759***	***6.9***
73	***5819***	***4***





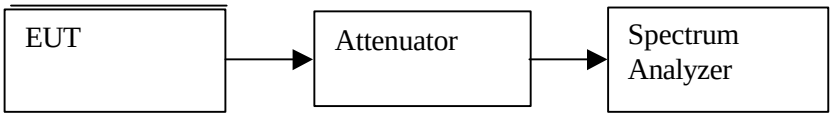


9.4. PEAK EXCURSION

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak ☒ Average	☒ 1 MHz ☒ 1 MHz	☒ 1 MHz ☒ 30 Hz

TEST SETUP



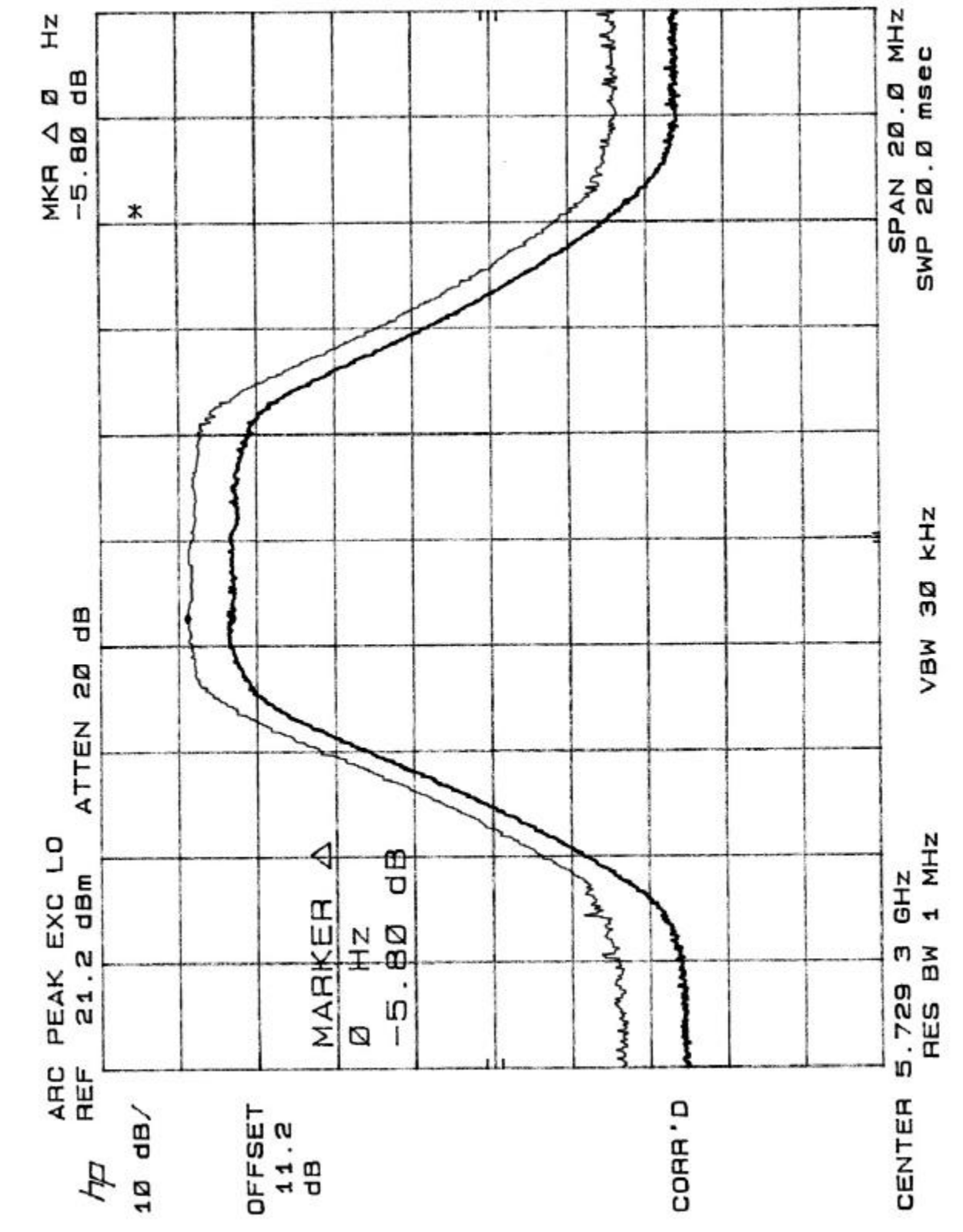
TEST PROCEDURE

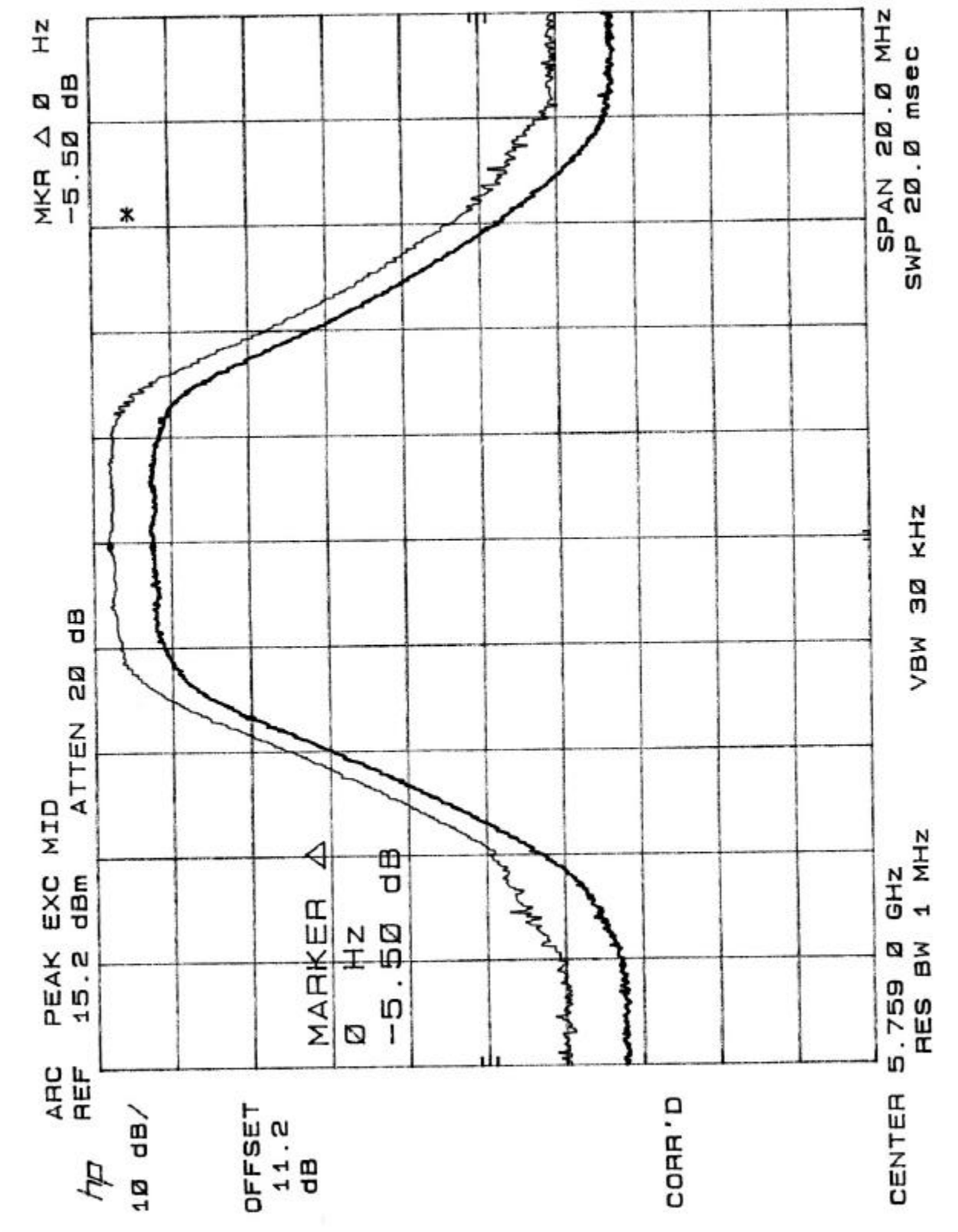
The transmitter output was connected to the spectrum analyzer through an attenuator. The spectrum analyzer was set to 1 MHz RESOLUTION BW and 1MHz VIDEO BW. Trace A is set to Max Hold, then to View. The VIDEO BW is readjusted to 30 kHz, and the signal under this measurement condition is captured in Trace B.

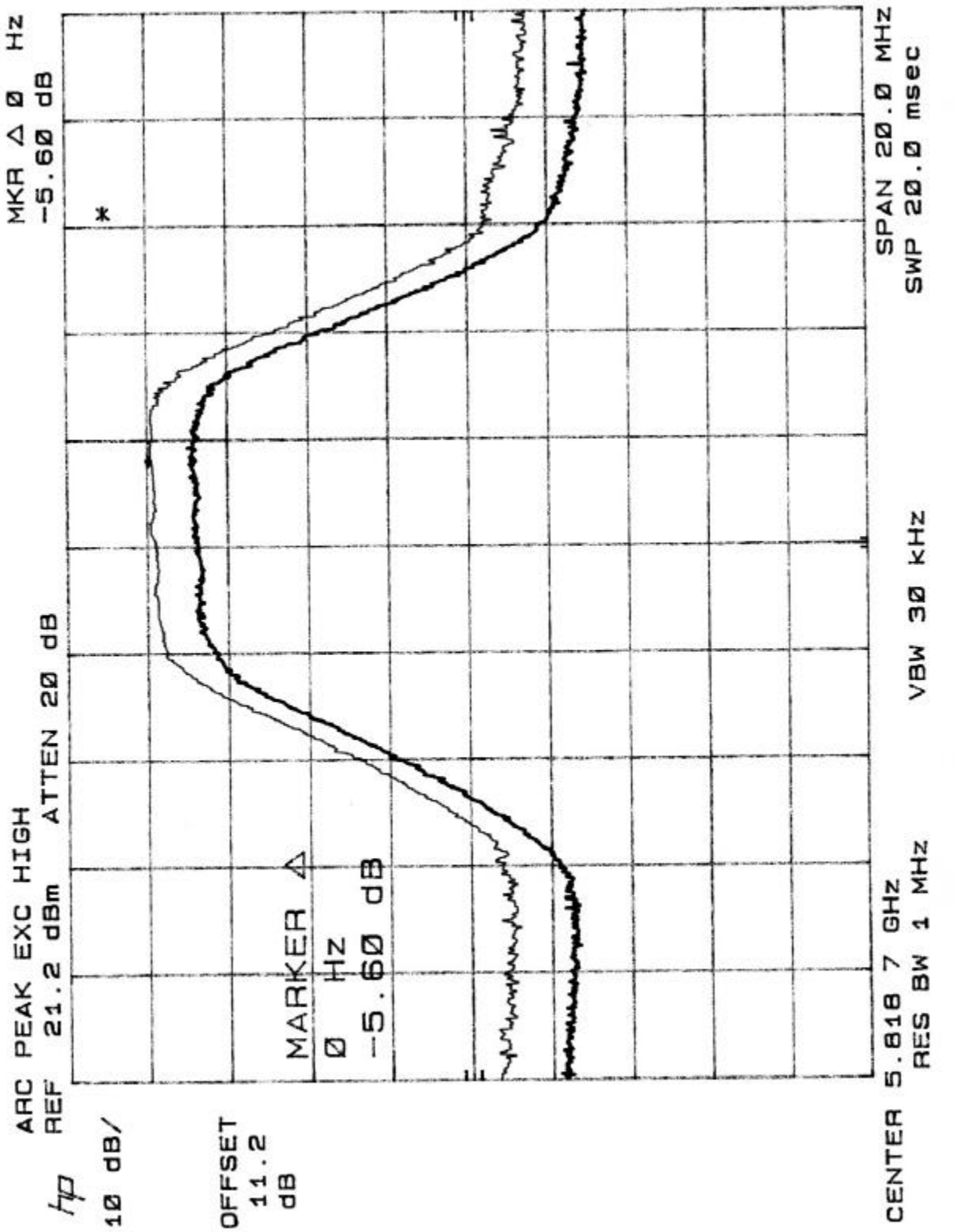
The difference between the traces is investigated. The marker is placed at the frequency which shows the largest difference. The amplitude delta between the traces at this frequency is the peak excursion.

Result:
No non-compliance noted. See plots:

Channel	***Frequency (MHz)***	***Results (dBm)***
58	***5729***	***5.8***
63	***5759***	***5.5***
73	***5819***	***5.6***

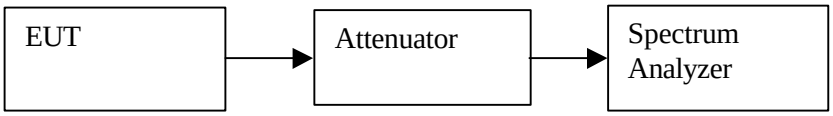






9.5. UNDESIRABLE EMISSION - BAND EDGE

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 resolution and video bandwidth were set to 1MHz.

If the specified resolution bandwidth captures some in-band signals, the Marker-Delta method may be used to determine compliance. The Marker-Delta procedure is valid for emissions that are up to two "standard" bandwidths away from the band edge.

1. Perform an in-band measurement of the fundamental emission using 1 MHz resolution and video bandwidths.

2. Choose a span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e. run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.

3. Subtract the delta measured in step (2) from the fundamental measured in step (1).

RESULT

No non-compliance noted. See plots:

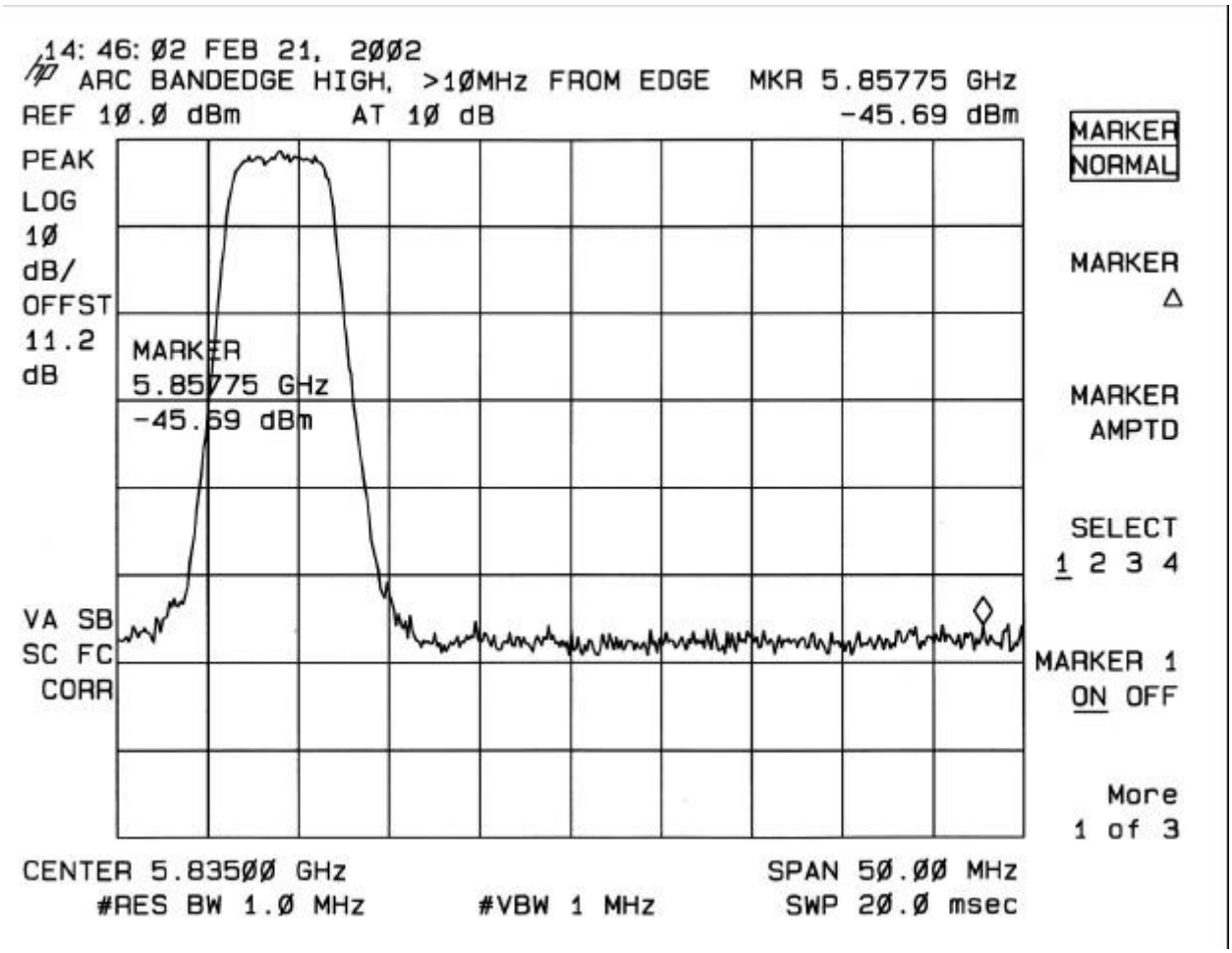
At the edge of the 5.715 GHz band, the specified resolution bandwidth captured some in-band signals. Since this measurement is made at the band edge, it is within two "standard" bandwidths, therefore the Marker-Delta procedure is valid.

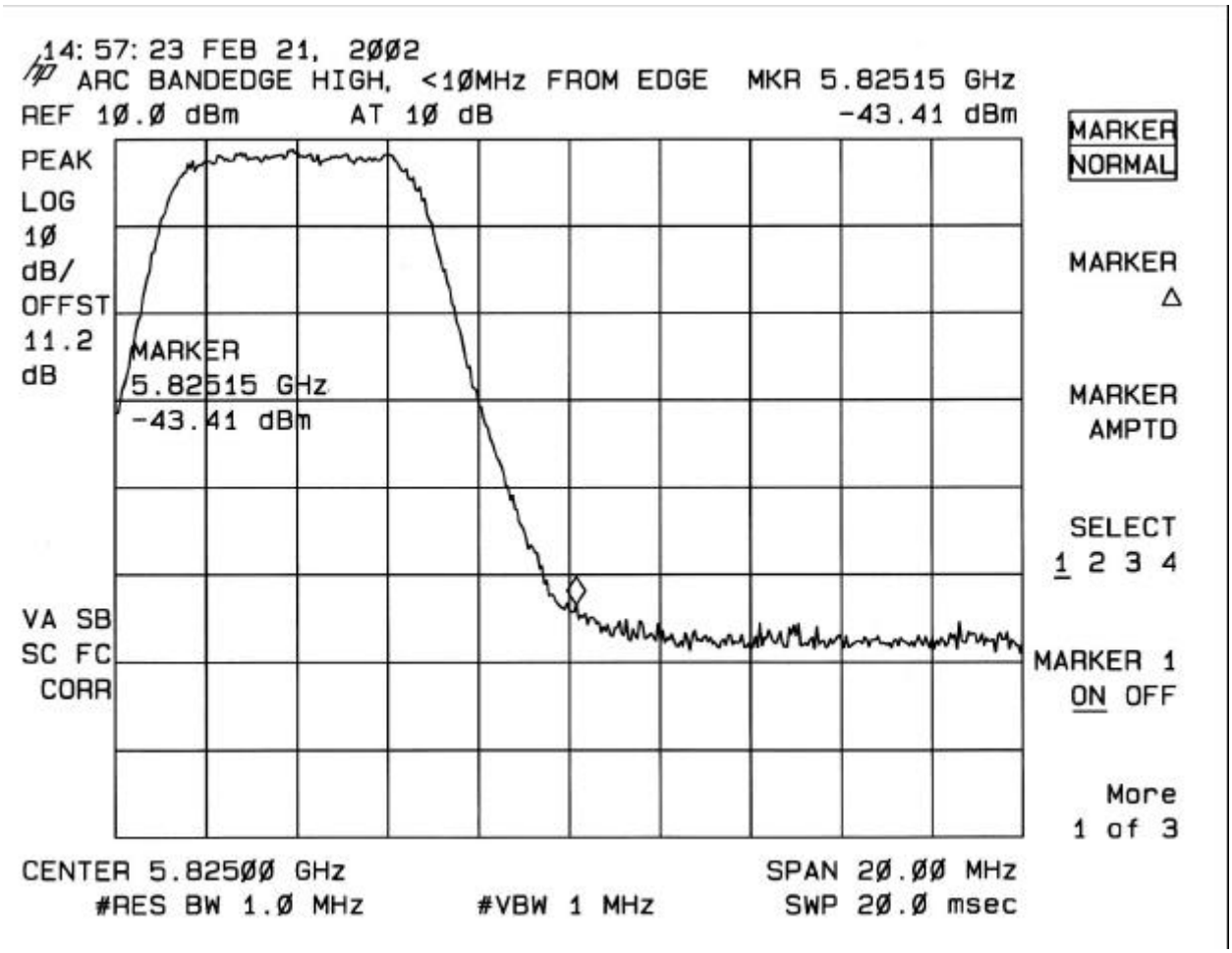
Measurement using Marker-Delta procedure

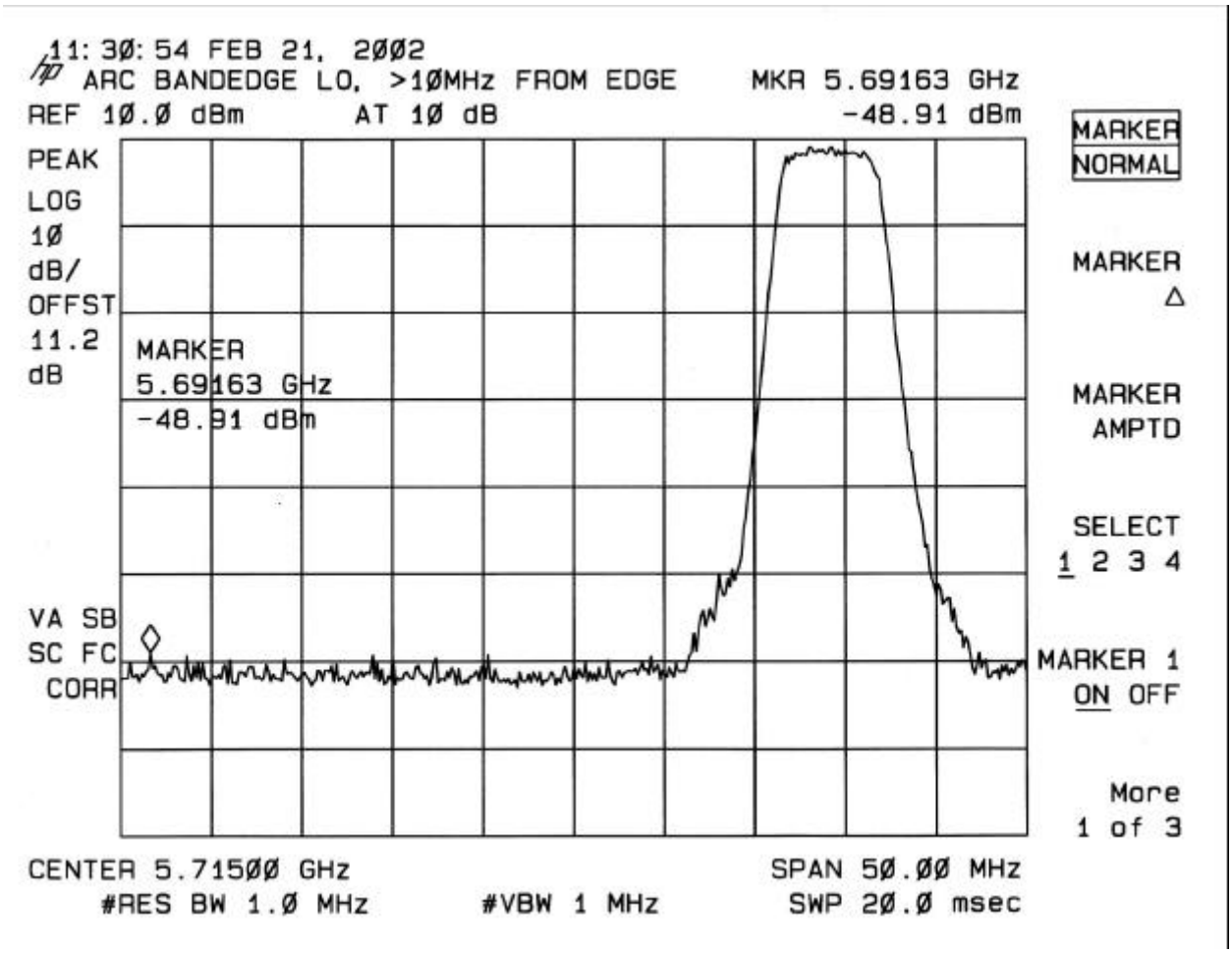
Band Edge	Fundamental Reading	Antenna Gain	Fundamental Level	Delta	EIRP	Limit	Margin
	(dBm)	(dBi)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
< 10 MHz below 5.715 GHz	9.33	13	22.33	-48.49	-26.16	-17	-9.16

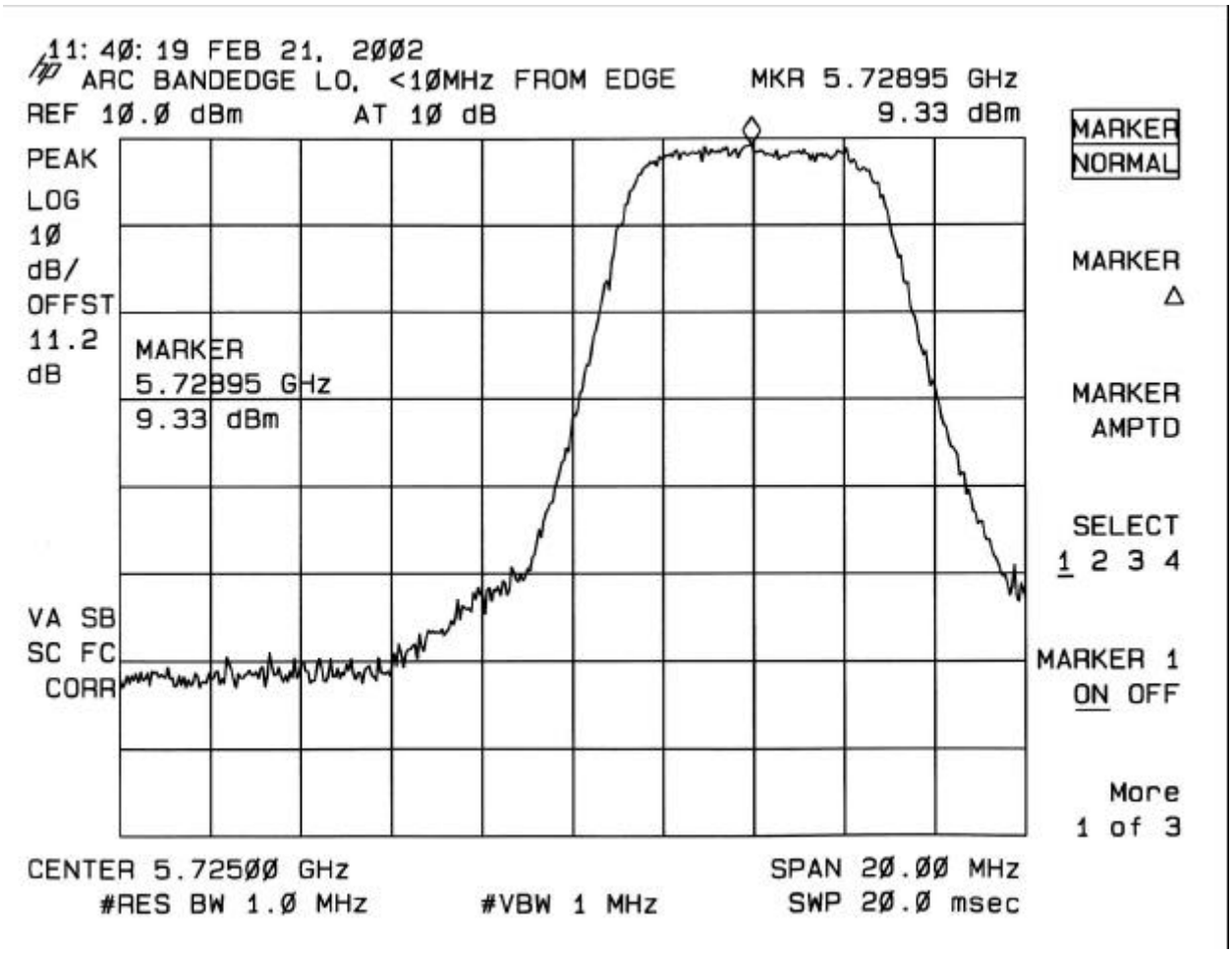
Measurements using Standard procedure

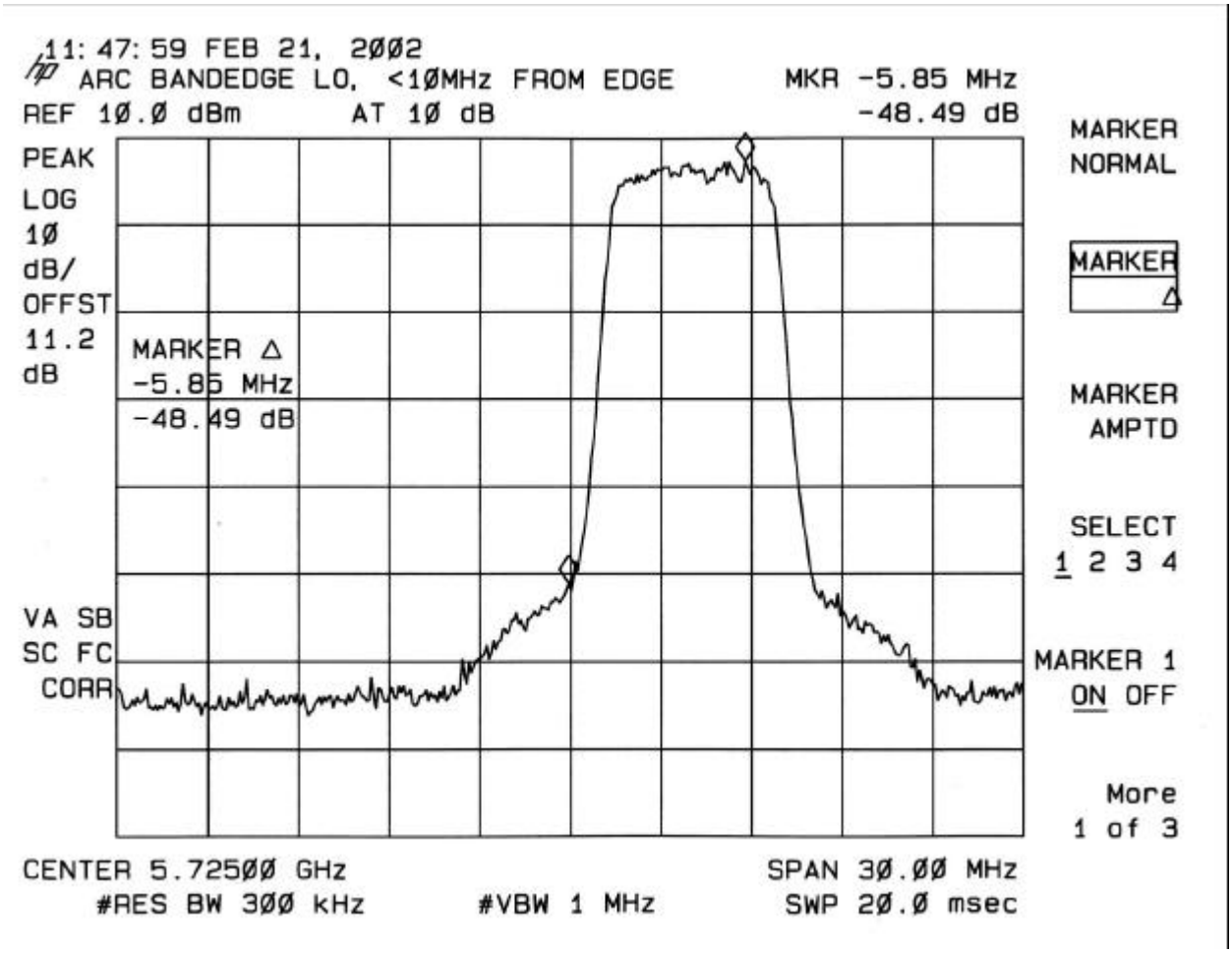
Band Edge	Reading	Antenna Gain	EIRP	Limit	Margin
	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
> 10 MHz below 5.715 GHz	-48.91	13	-35.91	-27	-8.91
< 10 MHz above 5.835 GHz	-43.41	13	-30.41	-17	-13.41
> 10 MHz above 5.835 GHz	-45.69	13	-32.69	-27	-5.69





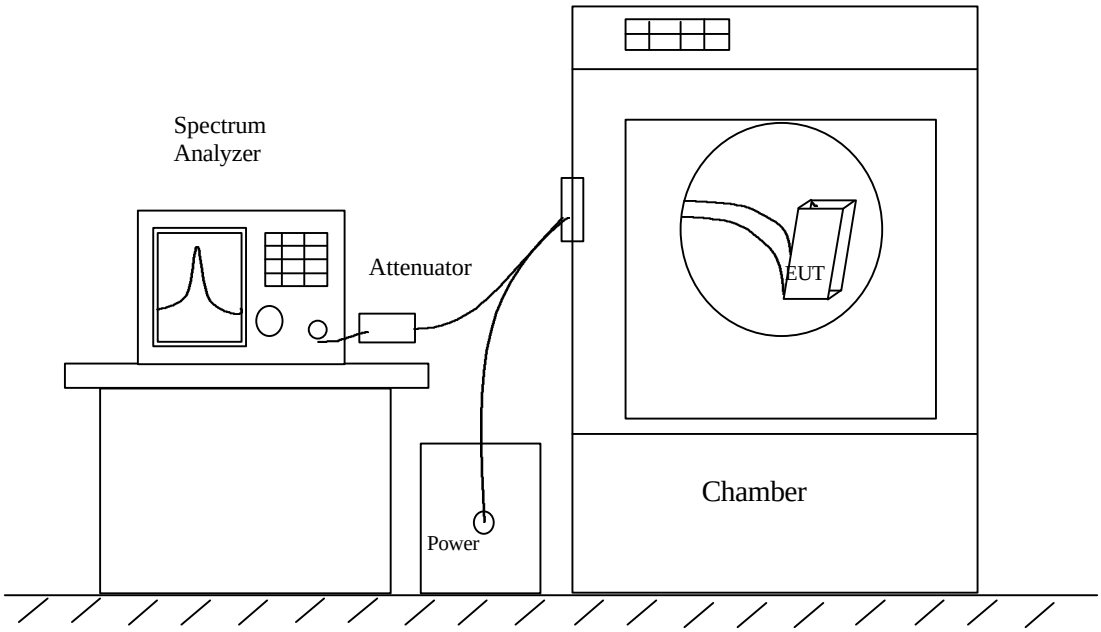


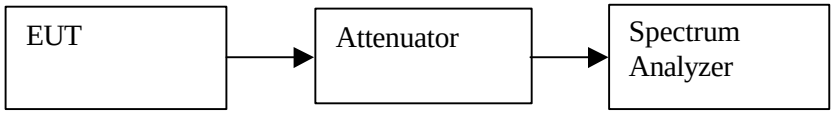




9.6. FREQUENCY STABILITY

TEST SETUP





TEST PROCEDURE

1 Place the EUT in the environmental chamber. All measuring equipment is placed outside the environmental chamber.

2 Connect the transmitter output to the spectrum analyzer through the attenuator.

3 Turn the EUT on and set to Channel 58 (5729 MHz).

4 Set the temperature of chamber to +25°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize.

5 Set SA Resolution Bandwidth to 10 KHz and Video Bandwidth to 100 KHz. Set SA center frequency to display the signal. Record the frequency of the lower edge of the modulated signal.

6 Set the temperature of chamber to -30°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. Record the frequency of the lower edge of the modulated signal.

7 Repeat step 6 with the temperature of the chamber set to +50°C.

8 Set the EUT to Channel 73 (5819 MHz).

9 Set the temperature of chamber to +25°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize.

10 Set SA center frequency to display the signal. Record the frequency of the upper edge of the modulated signal.

11 Set the temperature of chamber to -30°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. Record the frequency of the upper edge of the modulated signal.

12 Repeat step 11 with the temperature of the chamber set to +50°C.

Result:
No non-compliance noted. See data :

Temperature	***Signal***	***Frequency (MHz)***	***Limit Frequency(MHz)***
+25°C (ref)	***Lower Edge of Channel 58***	***5726.2424***	***5725 to 5825***
-30°C	***Lower Edge of Channel 58***	***5726.2422***	***5725 to 5825***
+50°C	***Lower Edge of Channel 58***	***5726.2615***	***5725 to 5825***
+25°C (ref)	***Upper Edge of Channel 73***	***5821.5905***	***5725 to 5825***
-30°C	***Upper Edge of Channel 73***	***5821.6039***	***5725 to 5825***
+50°C	***Upper Edge of Channel 73***	***5821.6041***	***5725 to 5825***

9.7. UNDESIRABLE EMISSION

Conducted RF measurements of the transmitter output were made over the 0 to 2.9 GHz band and the 2.75 to 26 GHz band in order to identify any spurious signals that require further investigation or measurements on the radiated emissions site. Signals that are outside the 15.205 restricted bands are measured for compliance with the out-of-band EIRP limit using the substitution method. Signals that are within the 15.205 restricted bands are measured for compliance with 15.209 limits.

MEASUREMENT PROCEDURE (Substitution Method)

1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.

2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.

3). The output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.

4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.

5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.

6). The transmitter shall than be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.

7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.

8). The maximum signal level detected by the measuring receiver shall be noted.

9). The transmitter shall be replaced by a tuned dipole (substitution antenna). For frequencies above 1 GHz, at which a tuned dipole is impracticable, a horn antenna shall be used.

10). The substitution antenna shall be oriented for vertical polarization and the length of the substitution dipole antenna shall be adjusted to correspond to the frequency of the transmitter.

11). The substitution antenna shall be connected to a calibrated signal generator.

12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.

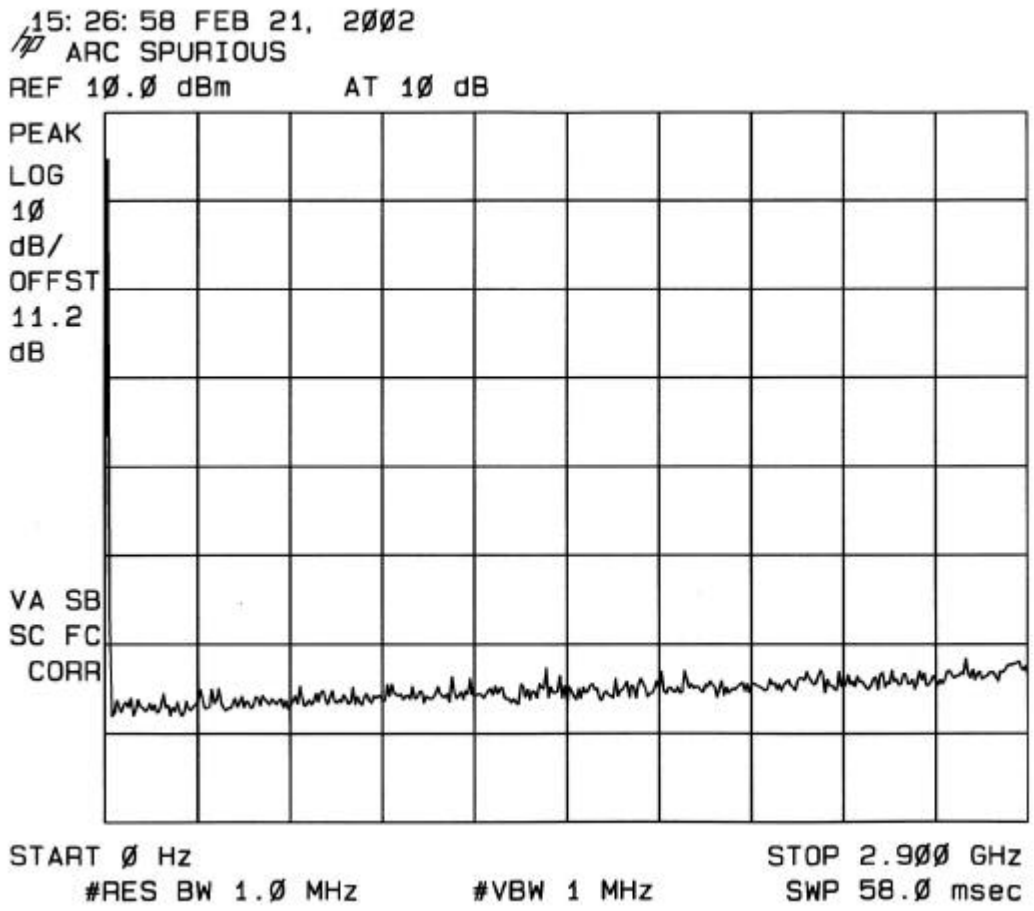
13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.

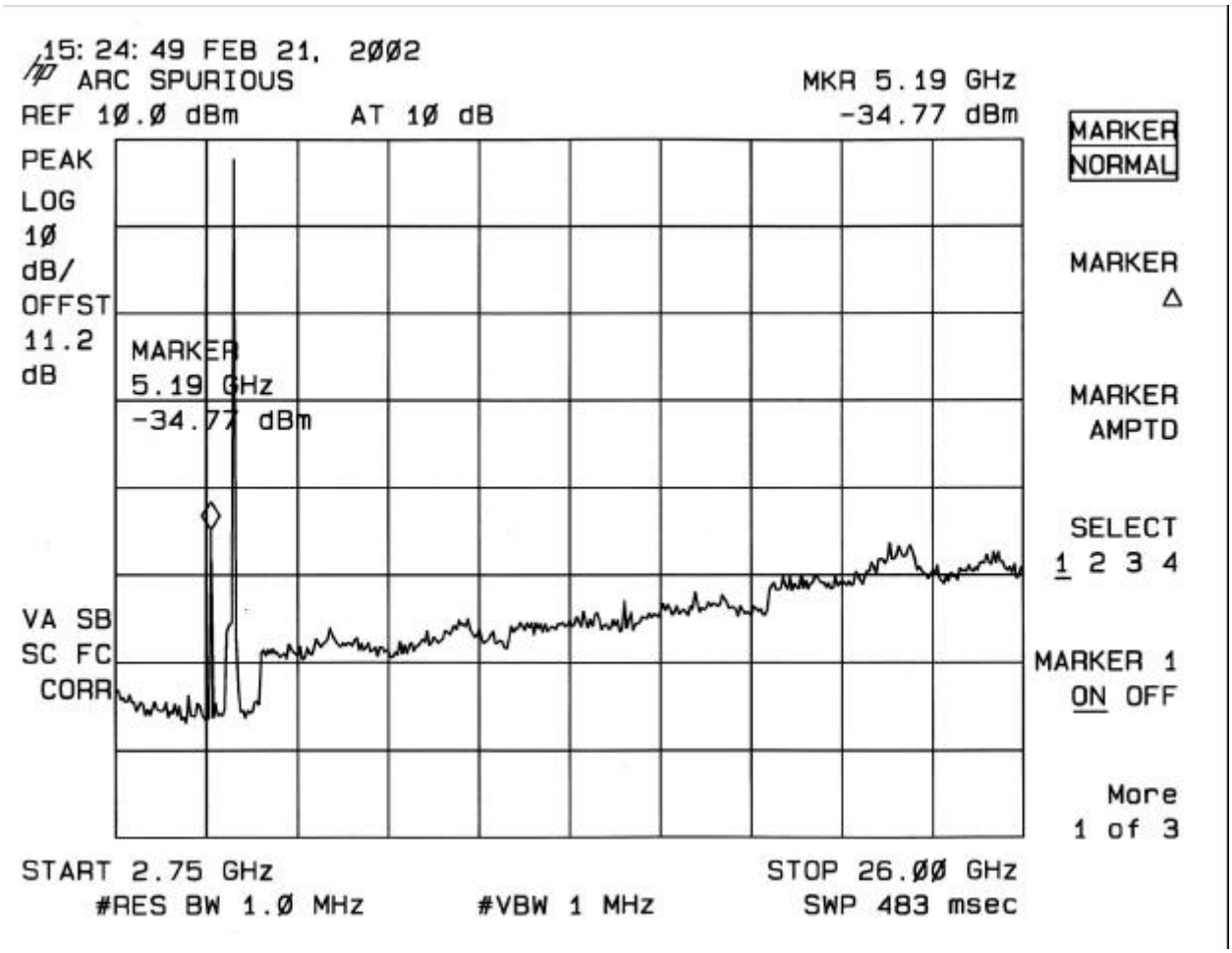
14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.

15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.

16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.





The signals in the 2.75 to 26 GHz conducted spurious plot were identified as the local oscillator feedthrough and the intended transmit signal. A radiated measurement of the out-of-band EIRP level of the local oscillator feedthrough was made using the substitution method. The vertically polarized signal was the strongest.

Vertical polarization – substitution measurement

Signal: Local Oscillator	**Spectrum Analyzer Reading**	**Signal Generator Level**	**Cable**	**Antenna Gain**	**EIRP**	**Limit**	**Margin**
Freq (MHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
5.248 GHz	-54.89	-47.5	-2.3	10.0	-39.8	-27	-12.8

Detector Function Setting of Test Receiver

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

TEST SETUP

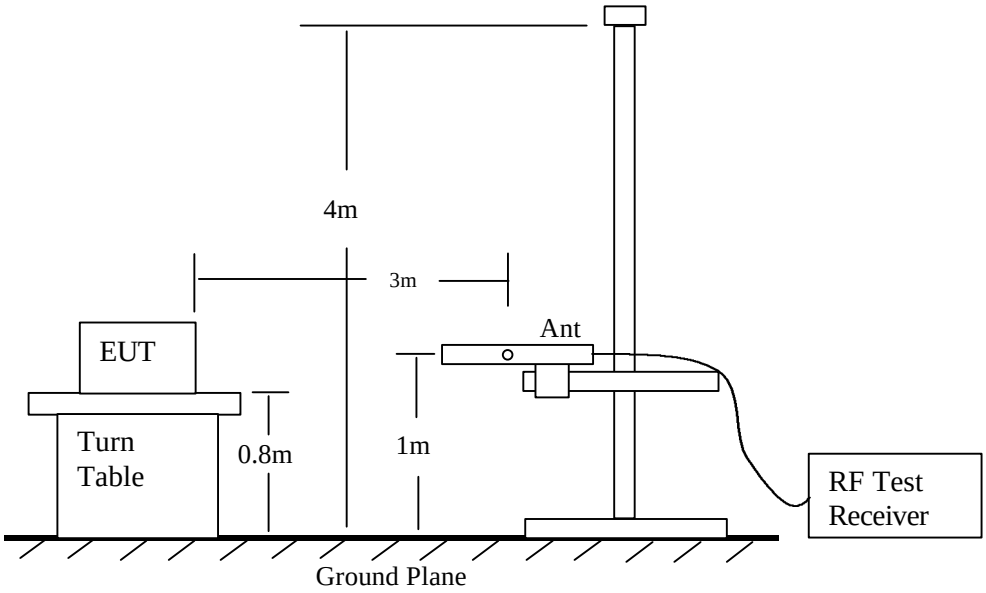


Fig 1: Radiated Emission Measurement 30 to 1000MHz.

TEST SETUP

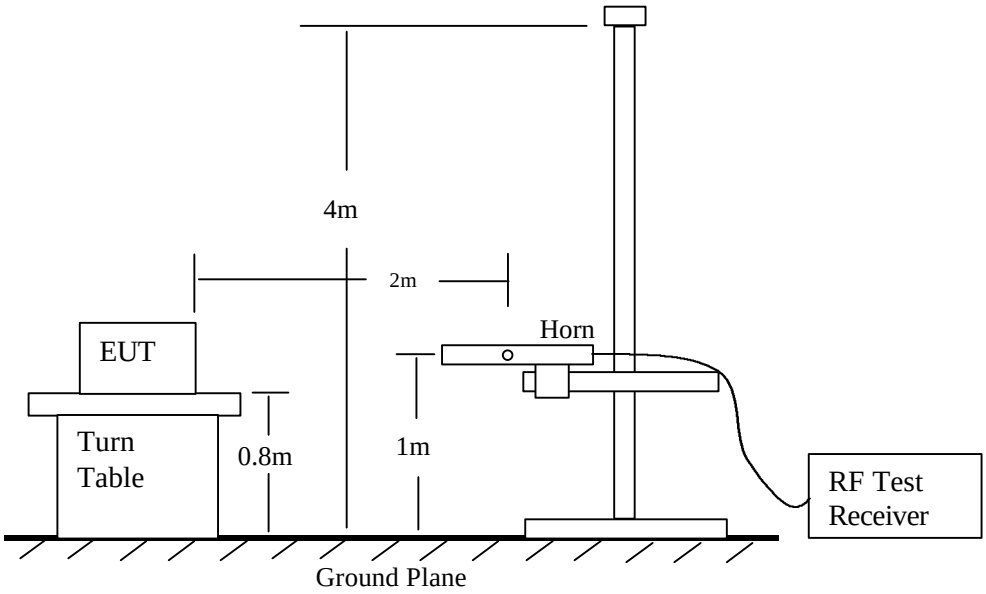


Fig 2: Radiated Emission Above 1000MHz

TEST PROCEDURE

The EUT and all other support equipment were placed on a wooden table 80 cm above the ground screen. The antenna to EUT distance was 10 meters During the test, the table was rotated 360 degrees to maximize emissions and the antenna was positioned from 1 to 4 meters above the ground screen to further maximize emissions. Measurements were made with the antenna polarized in both the vertical and the horizontal positions.

The EUT test configuration was according to Section 8 of ANSI C63.4/1992.

The following procedure was used to make the measurements: The frequency range of interest was monitored at a fixed antenna height and EUT azimuth. The Frequency span was set small enough to easily differentiate between broadcast stations, intermittent ambient signals and EUT emissions. The EUT was rotated through 360 degrees to maximize emissions received. During the rotation if emission increased by more than 1 dB, or if another emission appeared that was greater by 1 dB, the EUT was returned to the azimuth where the maximum occurred, and additional cable manipulation was performed to further maximize received emissions.

The antenna was moved up and down to further maximize the suspected highest amplitude signal. If the emission increased by 1 dB or more, or if another emission appeared that was greater by 1dB or more, the antenna was returned to the height where maximum signal was observed, and, cables were manipulated to produce highest emissions, noting frequency and amplitude.

RESULT

No non-compliance noted.

FCC Measurement

Compliance Certification Services, Morgan Hill Open Field Site

Advance Radio Cells 12/21/01

Cable length

17.0 feet

Distance to Antenna

6.6 feet

Average Measurements: Peak Measurements:

1 MHz Resolution Bandwidth 1MHz Resolution Bandwidth

10Hz Video Bandwidth 1MHz Video Bandwidth

Low Channel: 58

Fo: 5729

f	Peak R.	Avg. R.	AF	CL	Amp	D Corr	HPF	Peak	Avg	Pk Lim	Avg Lim	Peak Mar	Avg Mar	Notes
GHz	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	
11.458	44.7	34.4	39.4	10.5	-39.6	-3.5	1.0	52.6	42.3	74.0	54.0	-21.4	-11.7	H
17.187	50.0	38.3	43.6	14.1	-44.1	-3.5	1.0	61.1	49.4	74.0	54.0	-12.9	-4.6	H
11.458	46.1	34.5	39.4	10.5	-39.6	-3.5	1.0	54.0	42.4	74.0	54.0	-20.0	-11.6	V
17.187	49.1	38.3	43.6	14.1	-44.1	-3.5	1.0	60.2	49.4	74.0	54.0	-13.8	-4.6	V
22.916	49.0	37.9	32.7	17.6	-44.3	-3.5	1.0	52.5	41.4	74.0	54.0	-21.5	-12.6	Noise Floor
28.645	46.0	36.2	32.5	20.4	-44.3	-3.5	1.0	52.1	42.3	74.0	54.0	-21.9	-11.7	Noise Floor
34.374	38.5	28.6	24.2	20.4	-44.4	-3.5	1.0	36.3	26.4	74.0	54.0	-37.7	-27.6	Noise Floor
40.103	38.8	27.9	24.2	20.4	-44.4	-3.5	1.0	36.5	25.6	74.0	54.0	-37.5	-28.4	Noise Floor

f	Measurement Frequency	HPF	High Pass filter
Peak R.	Analyzer Peak Reading	Peak	Calculated peak field Strength
Avg. R.	Analyzer Avg.Reading	Avg	Calculated average field Strength
AF	Antenna Factor	Pk Lim	Peak Field Strength Limit
CL	Cable Loss	Avg Lim	Average Field Strength Limit
Amp	Pre amp gain	Pk Mar	Margin vs. Peak Limit
D Corr	Discorrections to 3 meter	Avg Mar	Margin vs. Average Limit

		FCC Measurement												
Compliance Certification Services, Morgan Hill Open Field Site														
Advance Radio Cells					12/21/01									
	Cable length													
		17.0		feet										
	Distance to Antenna													
		6.6		feet										
Average Measurements:						Peak Measurements:								
	1 MHz Resolution Bandwidth						1MHz Resolution Bandwidth							
	10Hz Video Bandwidth						1MHz Video Bandwidth							
	Mid Channel:		63											
	Fo:		5759											

f	Peak R.	Avg. R.	AF	CL	Amp	D Corr	HPF	Peak	Avg	Pk Lim	Avg Lim	Peak Mar	Avg Mar	Notes
GHz	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	
11.517	46.6	34.7	39.5	10.5	-39.6	-3.5	1.0	54.5	42.6	74.0	54.0	-19.5	-11.4	H
17.276	49.7	38.2	43.8	14.1	-44.1	-3.5	1.0	61.1	49.6	74.0	54.0	-12.9	-4.4	H
11.517	45.8	34.7	39.5	10.5	-39.6	-3.5	1.0	53.7	42.6	74.0	54.0	-20.3	-11.4	V
17.276	48.9	38.2	43.8	14.1	-44.1	-3.5	1.0	60.3	49.6	74.0	54.0	-13.7	-4.4	V
22.976	49.3	37.9	32.7	17.7	-44.3	-3.5	1.0	52.9	41.5	74.0	54.0	-21.1	-12.5	Noise Floor
28.735	46.2	36.3	32.5	20.4	-44.3	-3.5	1.0	52.3	42.4	74.0	54.0	-21.7	-11.6	Noise Floor
34.494	38.7	28.5	24.2	20.4	-44.4	-3.5	1.0	36.5	26.3	74.0	54.0	-37.5	-27.7	Noise Floor
40.253	38.8	27.8	24.2	20.4	-44.4	-3.5	1.0	36.5	25.5	74.0	54.0	-37.5	-28.5	Noise Floor

f	Measurement Frequency	HPF	High Pass filter
Peak R.	Analyzer Peak Reading	Peak	Calculated peak field Strength
Avg. R.	Analyzer Avg.Reading	Avg	Calculated average field Strength
AF	Antenna Factor	Pk Lim	Peak Field Strength Limit
CL	Cable Loss	Avg Lim	Average Field Strength Limit
Amp	Pre amp gain	Pk Mar	Margin vs. Peak Limit
D Corr	Discorrections to 3 meter	Avg Mar	Margin vs. Average Limit

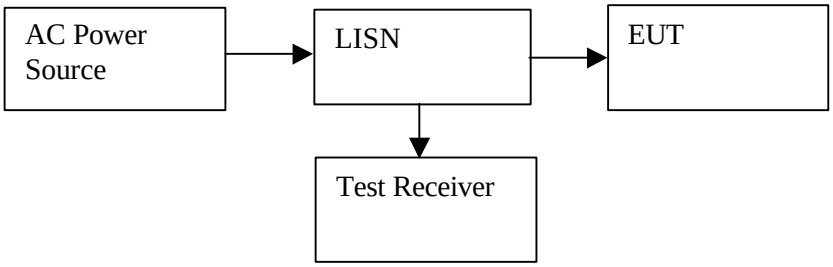
		FCC Measurement													
Compliance Certification Services, Morgan Hill Open Field Site															
Customer					11/07/01										
	Cable length														
		16.0		feet											
	Distance to Antenna														
		6.6		feet											
Average Measurements:						Peak Measurements:									
	1 MHz Resolution Bandwidth						1MHz Resolution Bandwidth								
	10Hz Video Bandwidth						1MHz Video Bandwidth								
	High Channel:	73													
	Fo:	5819													
f	Peak R.	Avg. R.	AF	CL	Amp	D Corr	HPF	Peak	Avg	Pk Lim	Avg Lim	Peak Mar	Avg Mar	Notes	
GHz	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB		
11.638	46.3	34.5	39.4	9.9	-39.7	-3.5	1.0	53.5	41.7	74.0	54.0	-20.5	-12.3	H	
17.457	49.8	38.3	44.2	13.4	-44.1	-3.5	1.0	60.8	49.3	74.0	54.0	-13.2	-4.7	H	
11.638	46.1	34.5	39.4	9.9	-39.7	-3.5	1.0	53.3	41.7	74.0	54.0	-20.7	-12.3	V	
17.457	49.7	38.2	44.2	13.4	-44.1	-3.5	1.0	60.7	49.2	74.0	54.0	-13.3	-4.8	V	
23.276	49.3	37.8	32.8	16.9	-44.3	-3.5	1.0	52.1	40.6	74.0	54.0	-21.9	-13.4	Noise Floor	
29.095	46.2	36.4	32.5	19.2	-44.3	-3.5	1.0	51.1	41.3	74.0	54.0	-22.9	-12.7	Noise Floor	
34.914	38.5	28.7	32.5	19.2	-44.4	-3.5	1.0	43.4	33.6	74.0	54.0	-30.6	-20.4	Noise Floor	
40.733	38.7	28.0	24.2	19.2	-44.4	-3.5	1.0	35.2	24.5	74.0	54.0	-38.8	-29.5	Noise Floor	
f	Measurement Frequency							HPF		High Pass filter					
Peak R.	Analyzer Peak Reading							Peak		Calculated peak field Strength					
Avg. R.	Analyzer Avg.Reading							Avg		Calculated average field Strength					
AF	Antenna Factor							Pk Lim		Peak Field Strength Limit					
CL	Cable Loss							Avg Lim		Average Field Strength Limit					
Amp	Pre amp gain							Pk Mar		Margin vs. Peak Limit					
D Corr	Discorrections to 3 meter							Avg Mar		Margin vs. Average Limit					

9.8. POWER LINE CONDUCTED EMISSION

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
450 KHz 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.

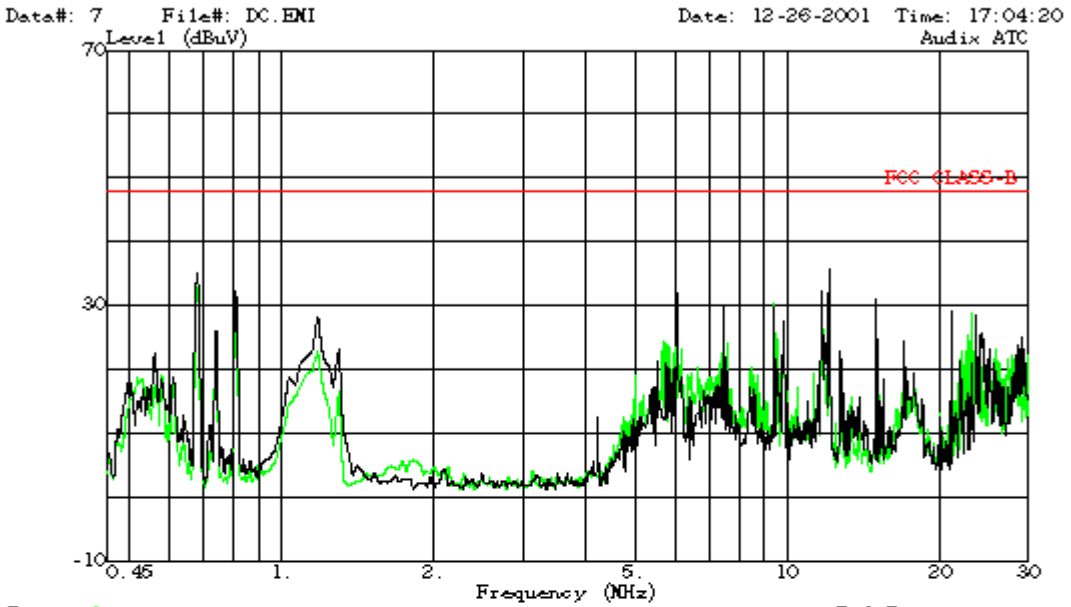
RESULT

No non-compliance noted. See plot Line Conduction.

CONDUCTED EMISSIONS DATA for HUB (115VAC 60Hz)

Freq.	Reading			Closs	Limit	FCC B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.68	32.90	--	--	0.00	48.00	--	-15.10	--	L1
1.17	23.40	--	--	0.00	48.00	--	-24.60	--	L1
9.45	29.50	--	--	0.00	48.00	--	-18.50	--	L1
0.69	35.00	--	--	0.00	48.00	--	-13.00	--	L2
1.17	29.30	--	--	0.00	48.00	--	-18.70	--	L2
12.06	33.72	--	--	0.00	48.00	--	-14.28	--	L2
6 Worst Data									

1366 Bordeaux Dr.
Sunnyvale, CA 94089-1006 USA
Tel: (408) 752-8166
Fax: (408) 752-8168



Trace: 3 Ref Trace:

Report	: 0112261c
Project#	: 01U1019-1
Tested By	: Hue Ly Vang
Manufacture	: ADVANCED RADIO CELLS INC.
EUT Description	: HUB
Model	: AR3155
Test Configuration	: EUT/DC power supply
Test Target	: FCC CLASS B
Mode of Operation	: +58dBmV, 6.4MHz IF, CONTINUOUS TX
	: Peak: L1(Green), L2(Blue)
	: 115Vac, 60Hz

9.9. 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

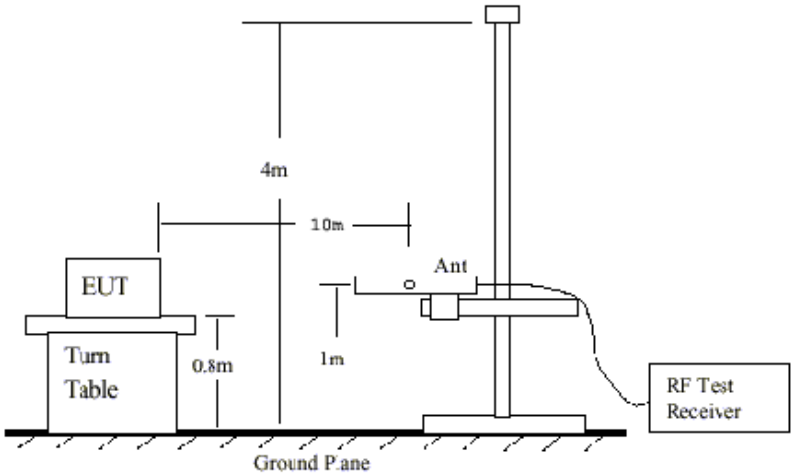


Fig 1: Radiated Emission Measurement 30 to 1000 MHz

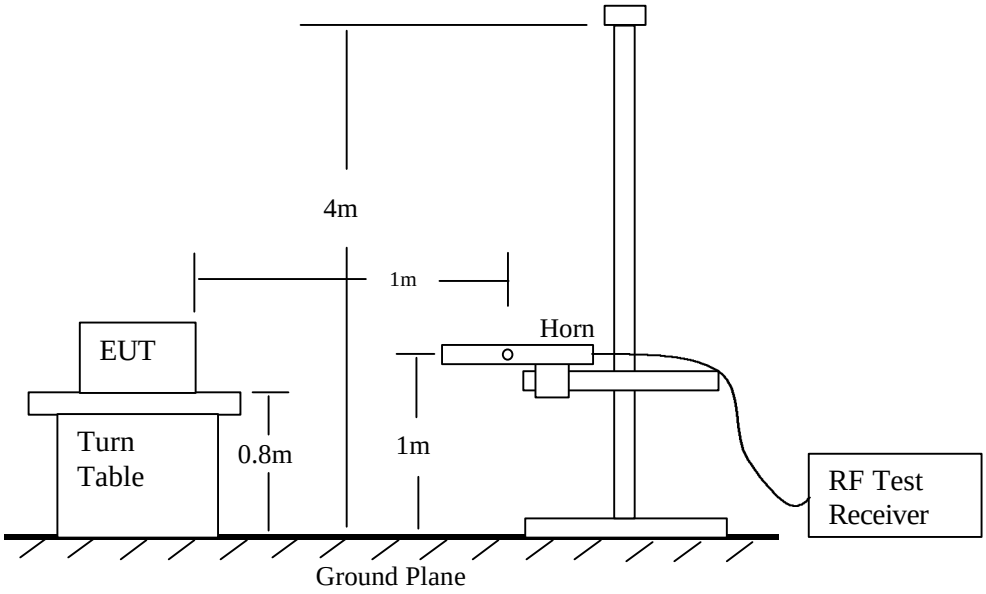


Fig 2: Radiated Emission Above 1000MHz

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.

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 #:	01U1019-1
Report #:	011220b
Date& Time:	12/20/01 2:30 PM
Test Engr:	HLV

Company:	Advanced Radio Cells
EUT Description:	HUB Outdoor Transceivers
Test Configuration :	EUT/Power supply/Headend/
Type of Test:	FCC Class B
Mode of Operation:	TX

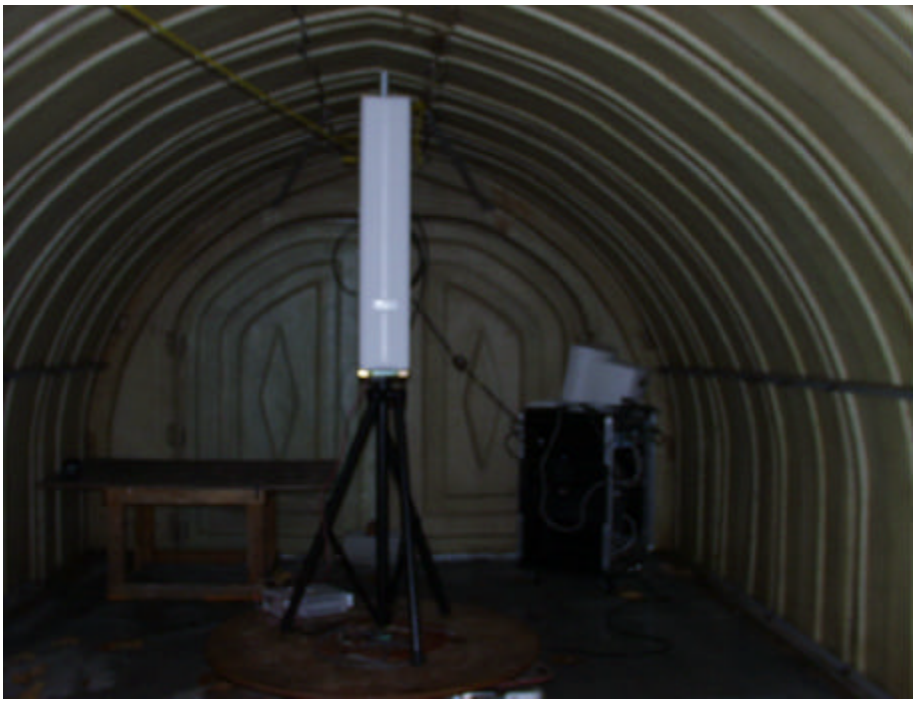
( ) A-Site (•) B-Site ( ) C-Site ( ) F-Site [6 Worst Data] [Descending]

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC_B	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
51.00	41.00	5.85	1.77	29.68	18.94	40.00	-21.06	3mV	90.00	1.00	P
75.20	42.90	5.27	2.03	29.61	20.58	40.00	-19.42	3mV	90.00	1.00	P
139.00	41.00	11.86	2.49	29.43	25.91	43.50	-17.59	3mV	90.00	1.00	P
160.20	43.50	8.49	2.67	29.34	25.32	43.50	-18.18	3mV	90.00	1.00	P
174.90	37.00	10.21	2.78	29.30	20.69	43.50	-22.81	3mH	90.00	1.00	P
900.00	35.40	20.68	7.62	28.91	34.79	46.00	-11.21	3mH	90.00	1.00	P

Total data #: 6
V.2b

9.10. SETUP PHOTOS

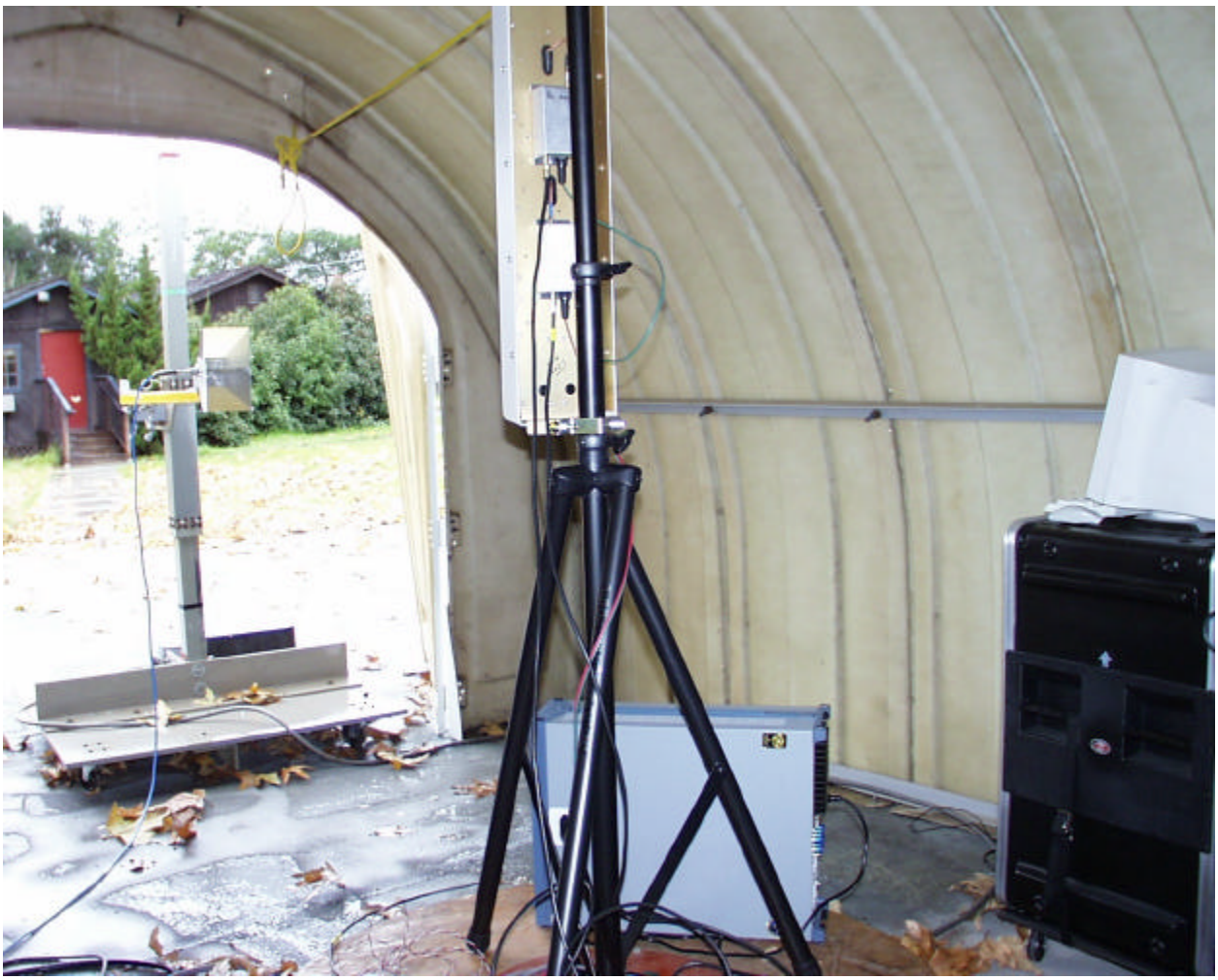
Radiated Emission photos



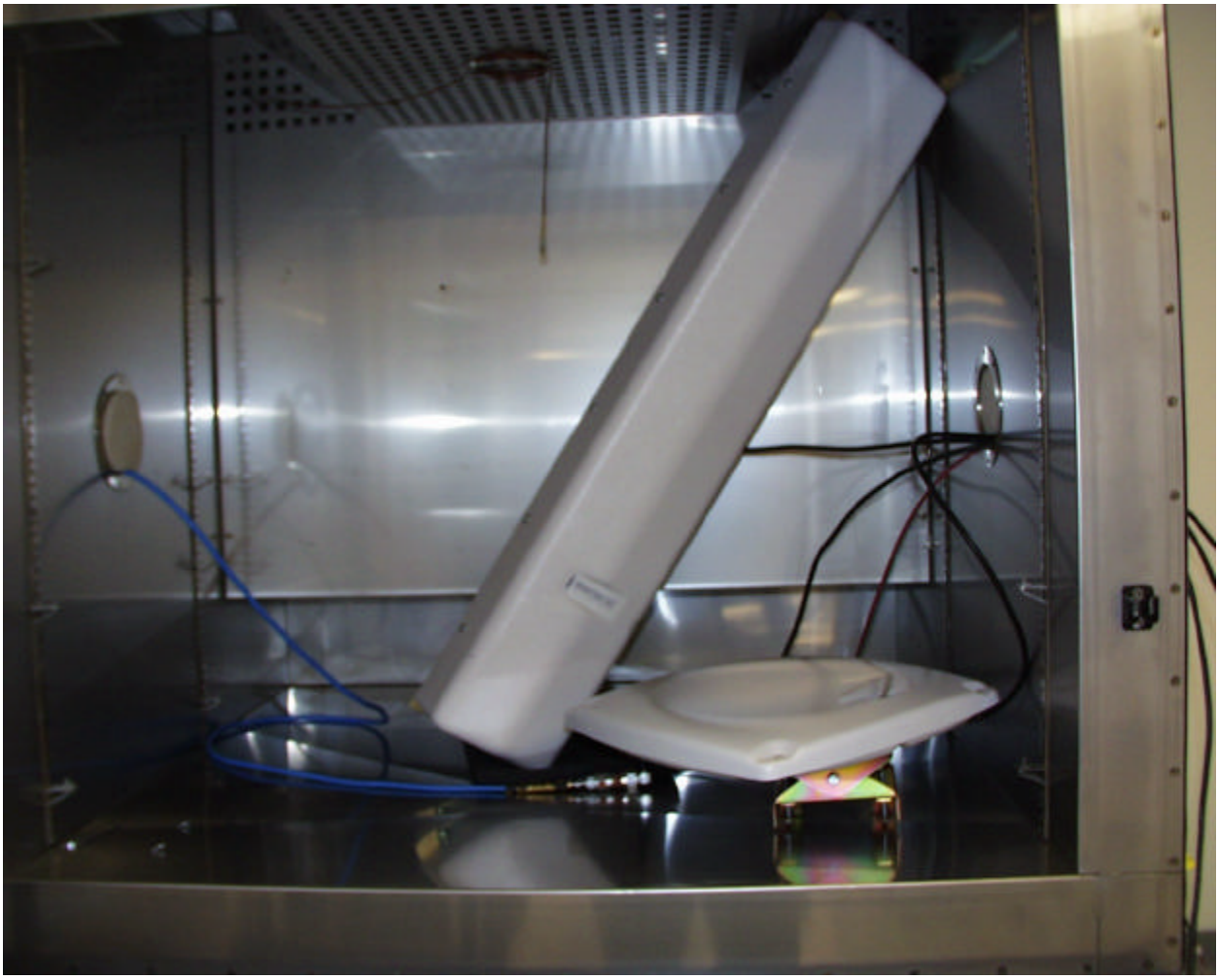
Conducted Emission Photos

FCC testing to antenna port

FCC testing above 1GIGHz



Frequency Stability



ATTACHMENTS

EUT PHOTOGRAPHS

PROPOSED FCC ID LABEL

MPE CALCULATION

REQUEST FOR CONFIDENTIALITY

AGENT AUTHORIZATION LETTER

ANTENNA SPECIFICATIONS

USER'S MANUAL

PRODUCT SPECIFICATION

THEORY OF OPERATION

BLOCK DIAGRAM & SCHEMATIC DIAGRAM