Laboratories GSD srl

CE MARKING

ELECTROMAGNETIC COMPATIBILITY
ELECTRICAL SAFETY
LASER SPECTROSCOPY
ENVIRONMENTAL PHYSIC

www.tuv.com TÜVRheinland ID:9105021519

Organizzazione con Sistema di Gestione certificato
Company with Management System certified
ISO 9001:2008

SINCERT

G.S.D. Srl **PISA - Italy**	***Test Report n. FCC-13178***	Rev. 02

Manufacturer	**CAEN RFID s.r.l.**
Address	Via Vetraia, 11 55049 Viareggio (LU) Italy
Test Family Name	**A528B**
Testing Laboratory Name	**G.S.D. S.r.l.**
Address	Via Marmiceto, 8 56121 Ospedaletto Pisa (PI) Italy
Tel/Fax	+39 050 984254 / +39 050 984262
P.IVA/VAT	01343950505
http – e-mail	www.gsd.it - info@gsd.it
	FCC Listed: Registration Number: 424037
Location and Date of Issue	Pisa, 2013 May 09

G.S.D. s.r.l.
Via Marmiceto, 8
56121 OSPEDALETTO - PISA
Tel. 050.984254 - Fax 050.984262
P. IVA 01343950505

SENIOR EMC TEST MANAGER
Dr. Gian Luca Genovesi

QUALITY MANAGER
Dr. David Pelliccia

INDEX

1. MANUFACTURER AND EUT IDENTIFICATION [1]

Manufacturer	**CAEN RFID s.r.l..**
Address	Via Vetraia, 11 55049 Viareggio (LU) Italy
Test Family Name	**A528B**
Date of reception	**2013 April 12**
Sampling	**Laboratory sample for certification**
Test Item Description	**RFID Device**
Nominal Input Voltage	**5 Vdc**
FCC ID	**UVECAENRFID016**

[1] A detailed documentation is preserved in the internal fascicle.

Fig. 1.1
Equipment Photo

2. REFERENCE STANDARDS

Tests and measurements are performed accordingly to the reference standards given in the table below:

TEST	***STANDARD***
Emissions: Conducted and Radiated – Section 15.207 and 15.209	FCC Rules ad Regulations, Title 47 (2008) Part 15 – Sub part B ANSI C63.4 2009 – American National Standard for Methods of Measuring of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz
Operation within the band 902-928 MHz: Alternative Test Procedures 15.247 (b) and (c) , and (a) Bandwidth and average time of occupancy, Band Edge 15.247 (d)	FCC Rules ad Regulations, Title 47 (2008) Part 15 – Sub part B DA 00-705 (30 March 2000) – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems ANSI C63.4 2009 – American National Standard for Methods of Measuring of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz
Maximum Permissible Exposure	OET Bulletin 65 Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields FCC Rules ad Regulations, Title 47 (2008) Part 15 – Sub part B DA 00-705 (30 March 2010) – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

3. RESULT, CONDITION, MEASUREMENT UNCERTAINTY

Summary of Test Results

TEST	*RESULT*
Emissions: conducted *Section 15.207*	*Pass*
Emissions: radiated *Section 15.209*	*Pass*
Bandwidth and Average Time of Occupancy *Section 15.247 (a)*	*Pass*
Operation within the band 902-928 MHz: *Section 15.247 (b) and (c)*	*Pass*
Band Edge *Section 15.247 (d)*	*Pass*

Measurement uncertainty

TEST	*EXPANDED UNCERTAINTY*
Conducted Emission – 50Ω/50µH (150 kHz - 30 MHz)	± 3.5 dB
Radiated Emission – (Semianechoic Room) (30 MHz - 18 GHz)	± 4.7 dB

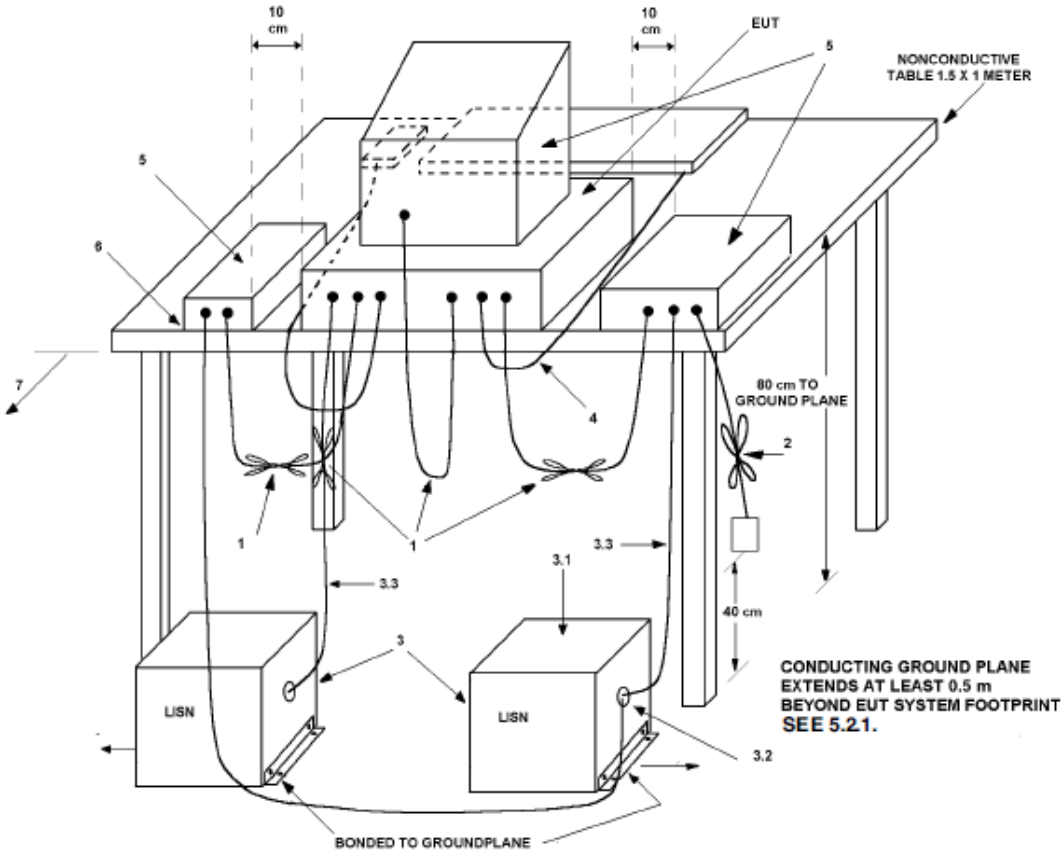
Climatic Conditions

PARAMETER	*VALUE*
Temperature	(293 ± 3) K
Relative humidity	(50 ± 5) %

Extensions

The results refer only to the sampled EUT and under the specified conditions.

Modulations:
Type 1: DB_ASK_FM0_TX160_RX400
Type 2: PR_ASK_M4_TX40RX250



Conducted and Radiated EUT Test Set-up example (ANSI C63.4 2009)

4. RADIATED EMISSIONS

In the following table you can find the limits established by the reference standard:

FREQUENCY RANGE *(MHz)*	***Field Strenght*** *QUASI-PEAK LIMITS* *[dB (μV/m)]*
30 ÷ 88	40
88 ÷ 216	43,5
216 ÷ 960	46
Above 960	54

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
EMI Receiver	HP	HP8546A	01/2014
EMI Receiver Filter Section	HP	HP85460A	01/2014
Anechoic Chamber	Comtest	CSA01	01/2014
Bilog Antenna	Schaffner	CBL6112B	01/2014
Horn Antenna	EMCO	3115	01/2014
Controller	Deisel	HD100	01/2014
Turn Table	Deisel	MA240	01/2014
LISN	GSD	NTW06	01/2014

Test procedure: RE22R02

Notes

Azimuth position EUT-Antenna corresponding to 0° identifies the rotating table orientation (TT) in which the instrument to be tested shows the front part turned towards the antenna. Positive grades individuate clockwise rotations of TT when this one is observed from the top. For negative degrees, TT rotation is anticlockwise.
Antenna height respect to the mass plane is conventionally individuated with: MA=XXX where XXX indicates the height (always positive for e>100) expressed in cm.
Antenna horizontal polarisation is indicated by POL=H.
Antenna vertical polarisation is indicated by POL=V.
EUT was tested in the three ortogonal planes.

Results and conclusions

In all the operative conditions, equipment complied with the standard limits. Graphics in following figures show the most significant registrations of the performed measurements.

Job Number	FCC-13178
Test Name	Radiated Emissions
EUT Name	CAEN RFID s.r.l. - A528B

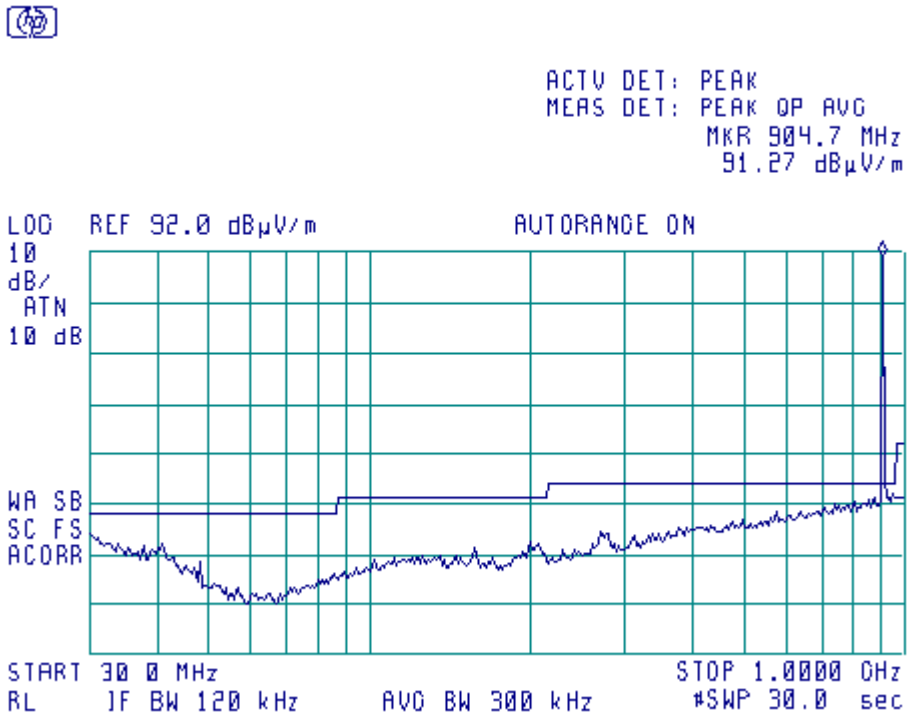


Fig. 4.1

Record of the measurement of radiated emissions (PK)
Maximum disturbance determined in the frequency range 30 – 1000 MHz, Pol. H.

Job Number	FCC-13178
Test Name	Radiated Emissions
EUT Name	CAEN RFID s.r.l. - A528B

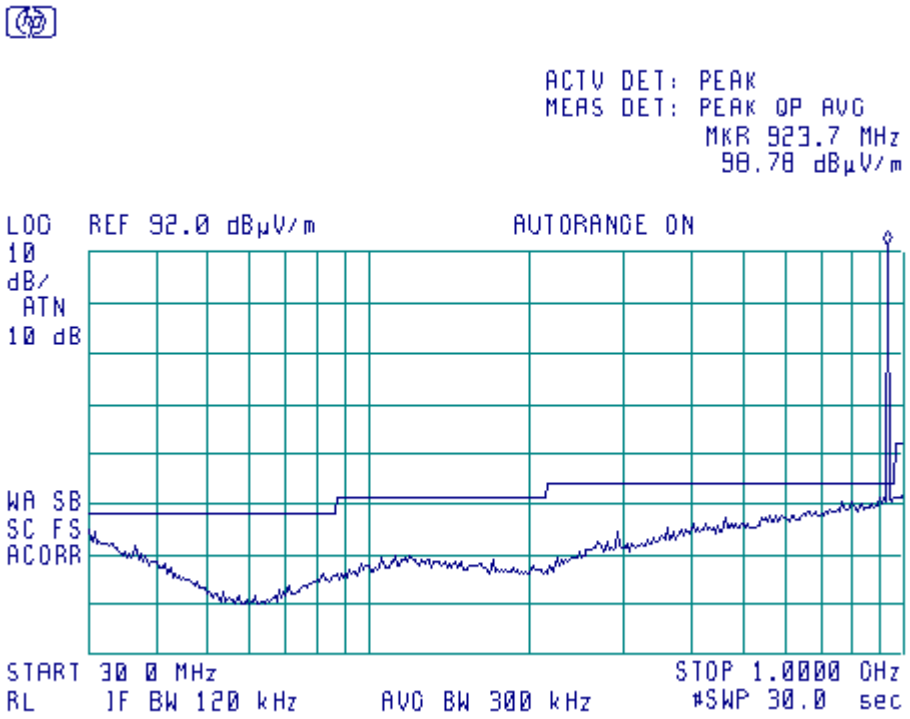


Fig. 4.2

Record of the measurement of radiated emissions (PK)
Maximum disturbance determined in the frequency range 30 – 1000 MHz, Pol. V.

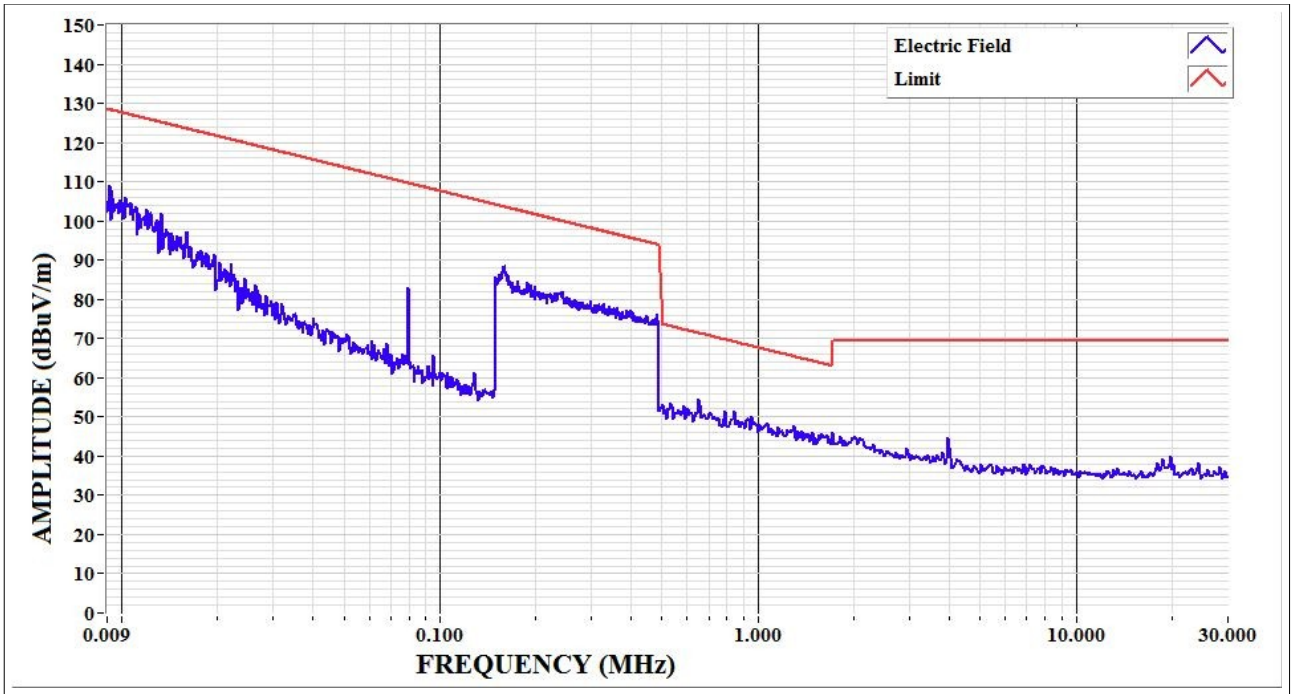


FIG. 4.3
LOOP ANTENNA PARALLEL

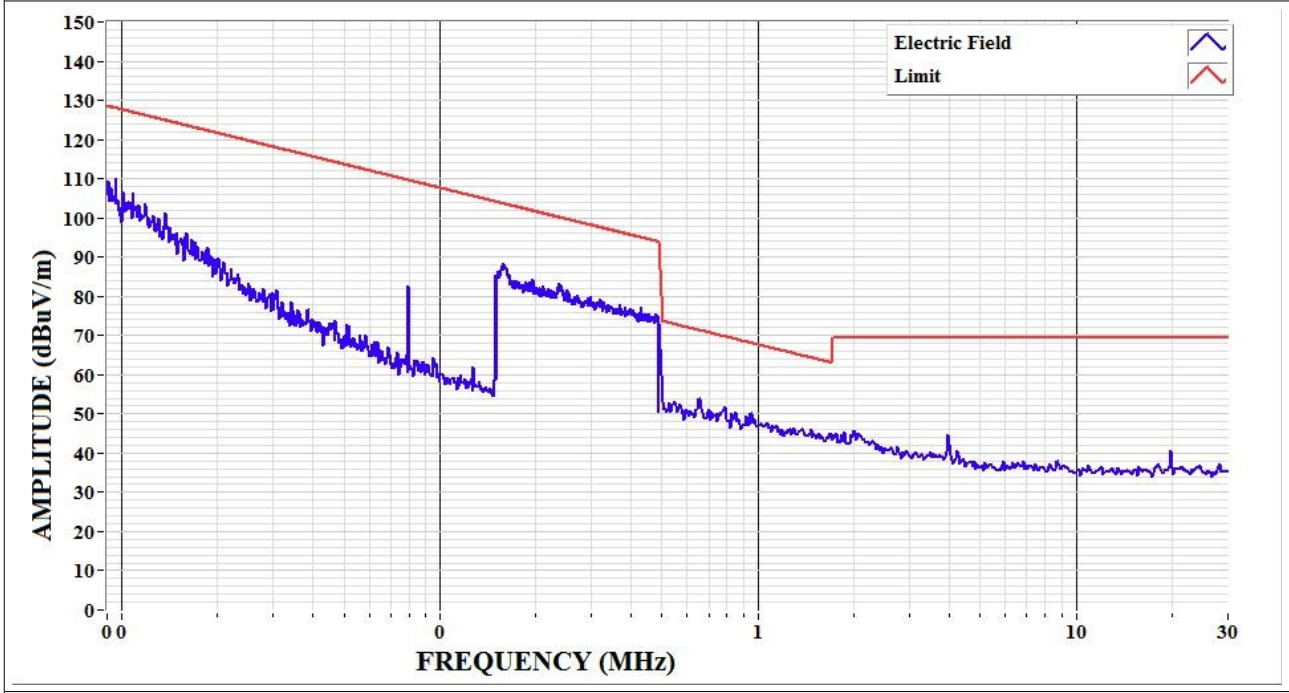


FIG. 4.4
LOOP ANTENNA ORTHOGONAL

5. POWERLINE CONDUCTED EMISSIONS

Equipment shall meet the limits below when using a CISPR16 quasi-peak and average detector receivers.

FCC, 15.207

FREQUENCY RANGE (MHz)	*QUASI-PEAK LIMIT* [dB (µV)]	*AVERAGE LIMIT* [dB (µV)]
0.15 ÷ 0.50	66 ÷ 56(*)	56 ÷ 46(*)
0.50 ÷ 5	56	46
5 ÷ 30	60	50

(*) *Limit decreasing linearly with logarithm of frequency*

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
EMI Receiver	HP	HP8546A	
EMI Receiver Filter Section	HP	HP85460A	
Screened Room	GSD	CSC01	
Transient Limiter	HP	11947A	01/2014
LISN	GSD	GSDA01	01/2014

Test procedure: CE22R01

The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a spectrum analyzer by a transient limiter. The conducted emissions from 150 kHz to 30 MHz were monitored and compared to the specification limits

Test method

Test method was in accordance with the reference standard.

EUT modes of operations were tested in order to achieve the maximum level of emission.

Results

Equipment complied with the test specification limits.

Graphics in following figures show some registrations of the frequency spectrum of the conducted emissions.

Job Number	FCC-13178
Test Name	Powerline Conducted Emissions FCC, 15.207
EUT Name	A528B

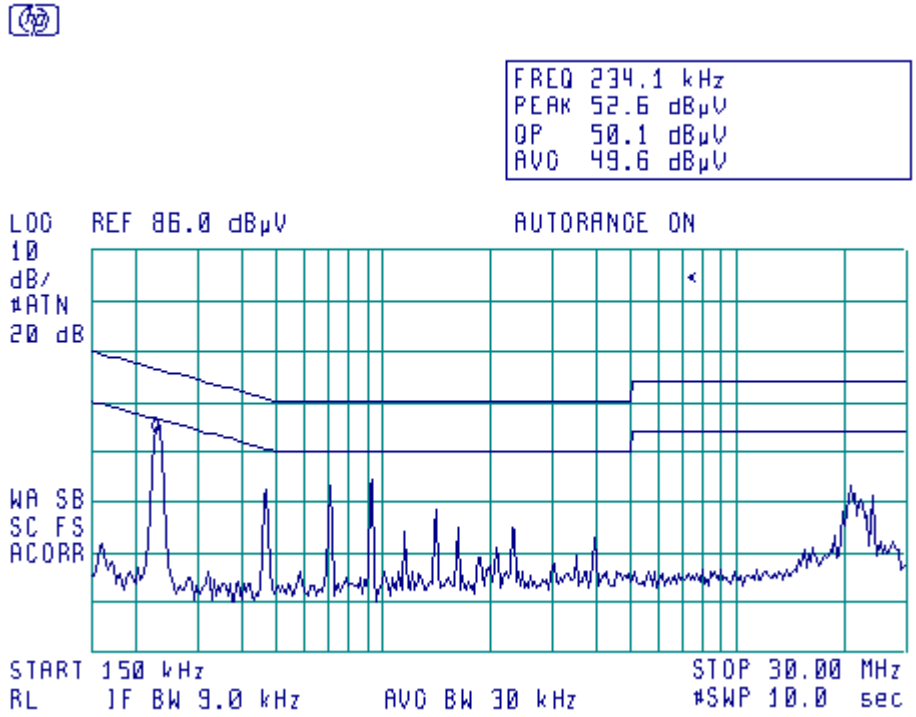


Fig. 5.1

B Band (0.15 – 30 MHz): phase 1

Job Number	FCC-13178
Test Name	Powerline Conducted Emissions FCC, 15.207
EUT Name	A528B

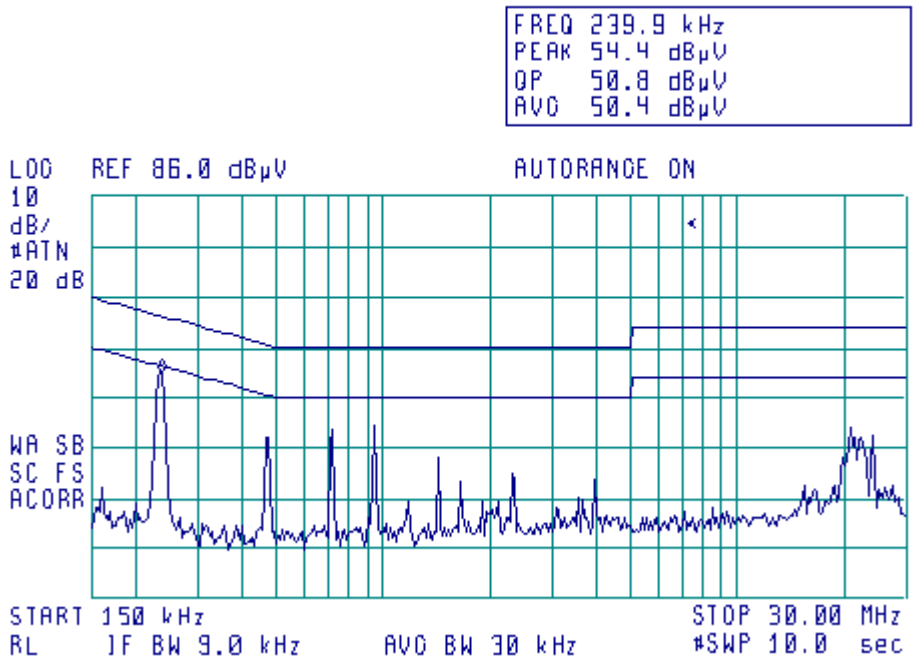


Fig. 5.2

B Band (0.15 – 30 MHz): phase 2

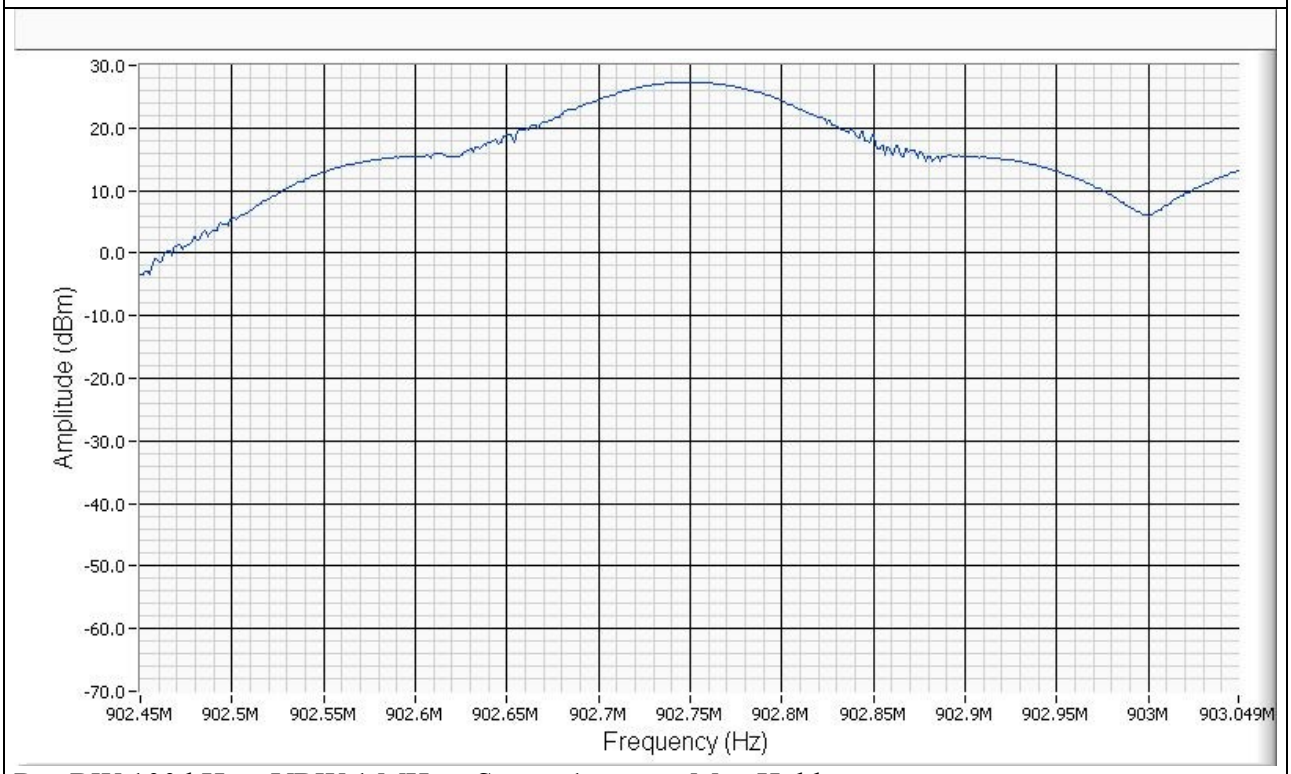
6. PERATION WITHIN THE BAND 902-928 MHZ: PEAK OUTPUT POWER – SPURIOUS RF EMISSION – BAND EDGE

Peak Output Power

Equipment shall meet the limits below .

FREQUENCY RANGE (MHz)	RF power output Limit dBm
902 - 928	30,0

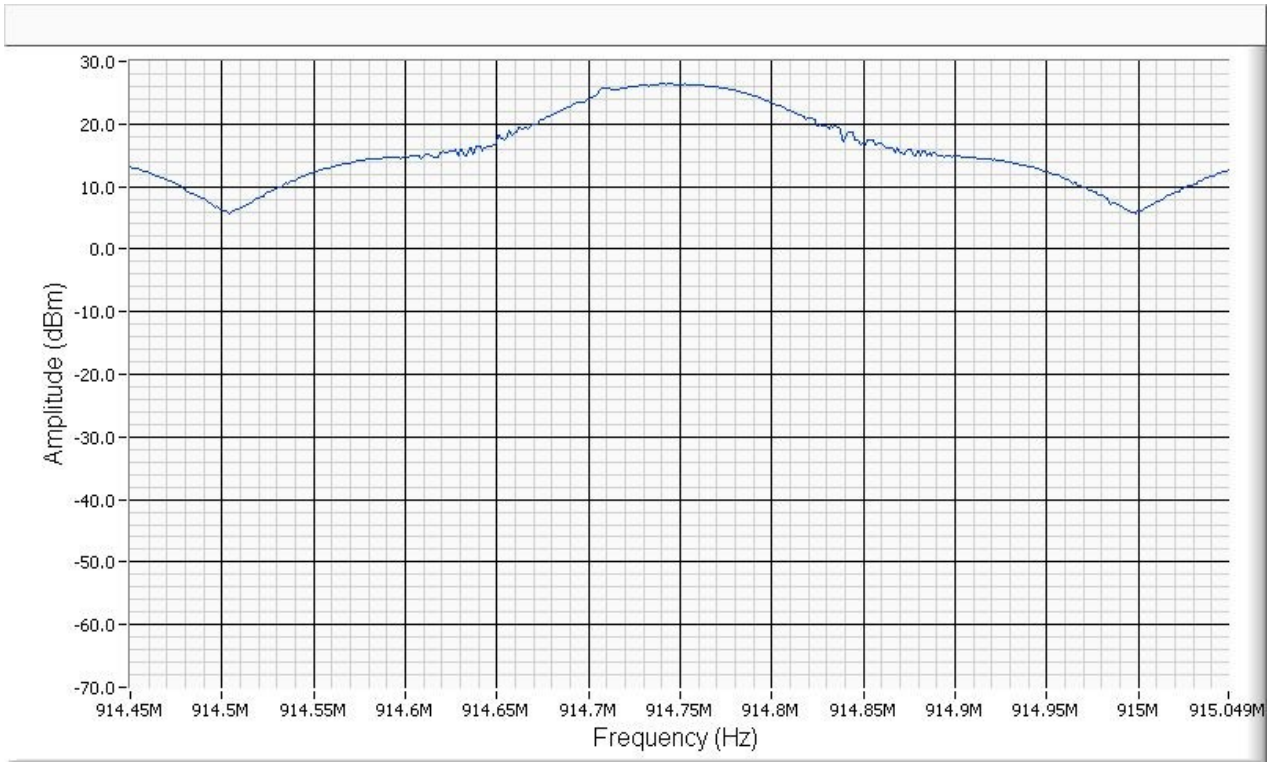
Channel	Output Power Modulation type1/2	
0	27,3	27,3
25	26,4	26,4
49	26,2	26



Res BW 100 kHz – VBW 1 MHz – Sweep 1 msec – Max Hold

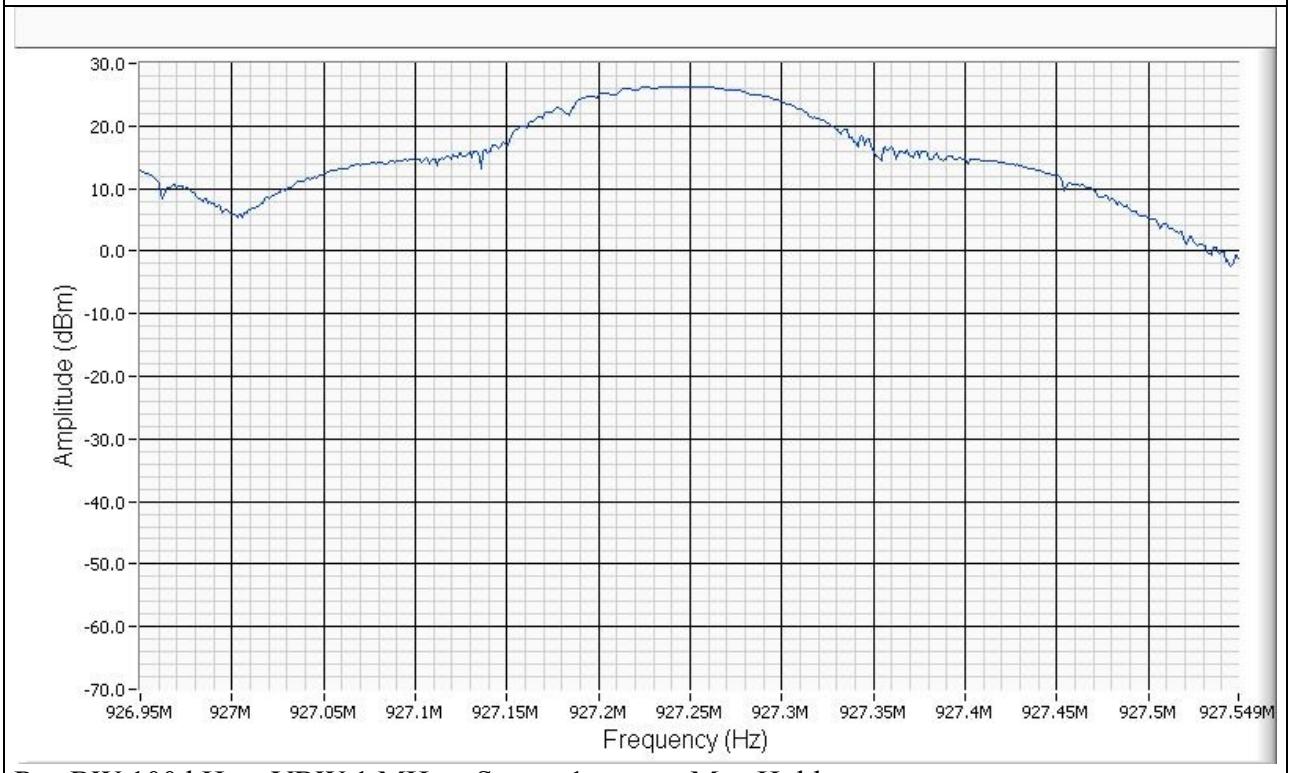
Fig. 6.1

Modulation Type 1, Channel 0



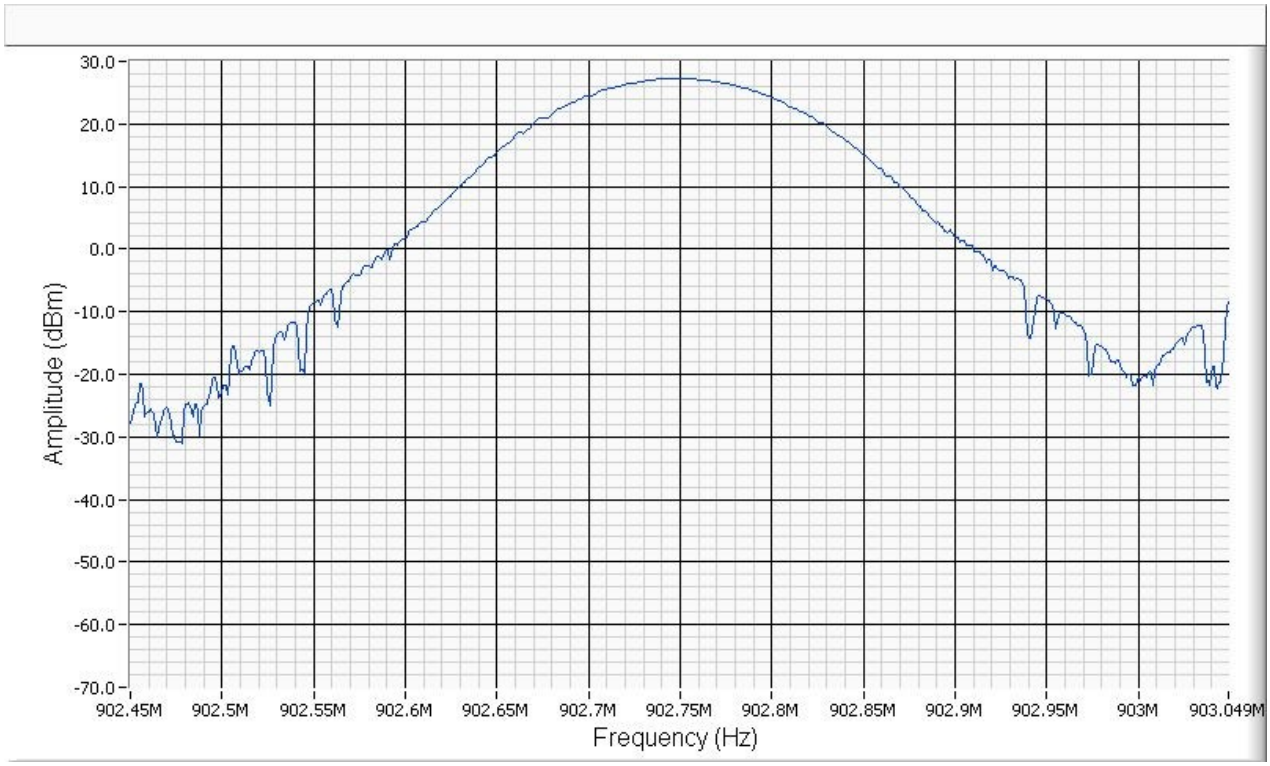
Res BW 100 kHz – VBW 1 MHz – Sweep 1 msec – Max Hold

Fig. 6.2
Modulation Type 1, Channel 25



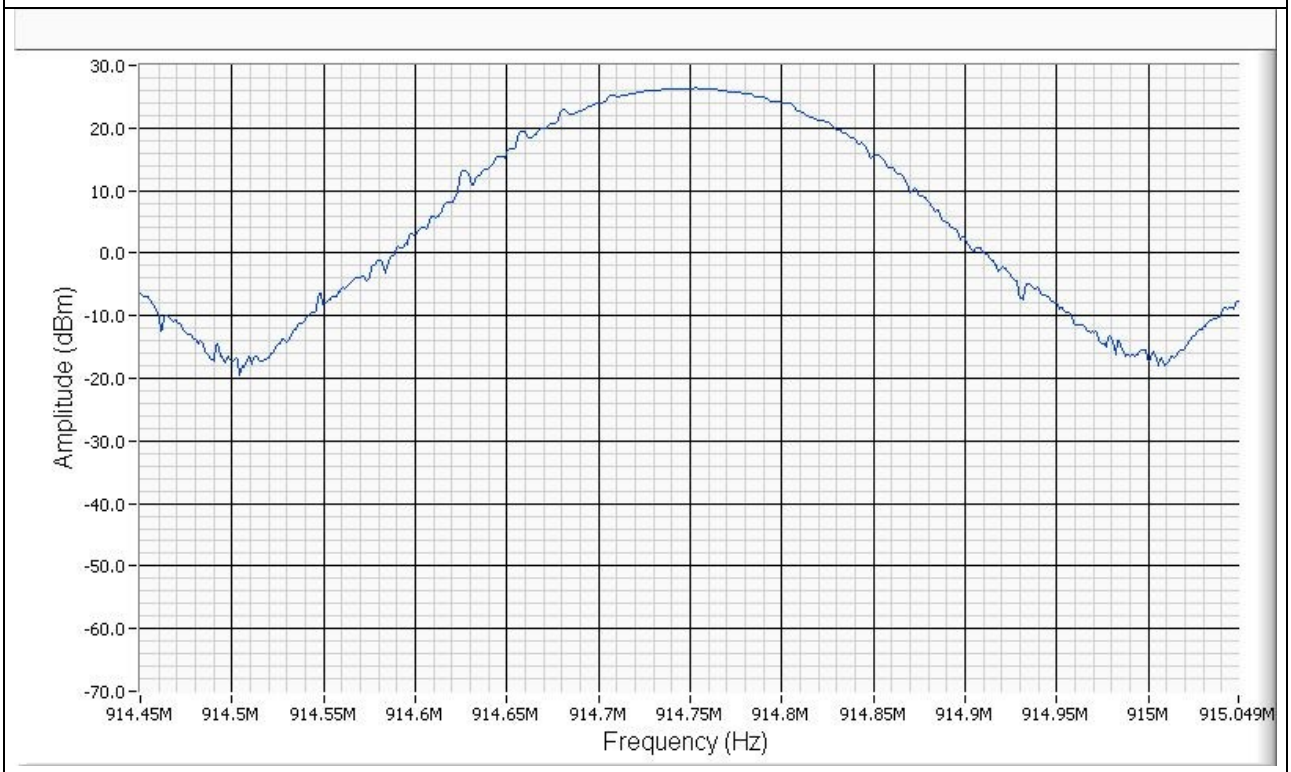
Res BW 100 kHz – VBW 1 MHz – Sweep 1 msec – Max Hold

Fig. 6.3
Modulation Type 1, Channel 49



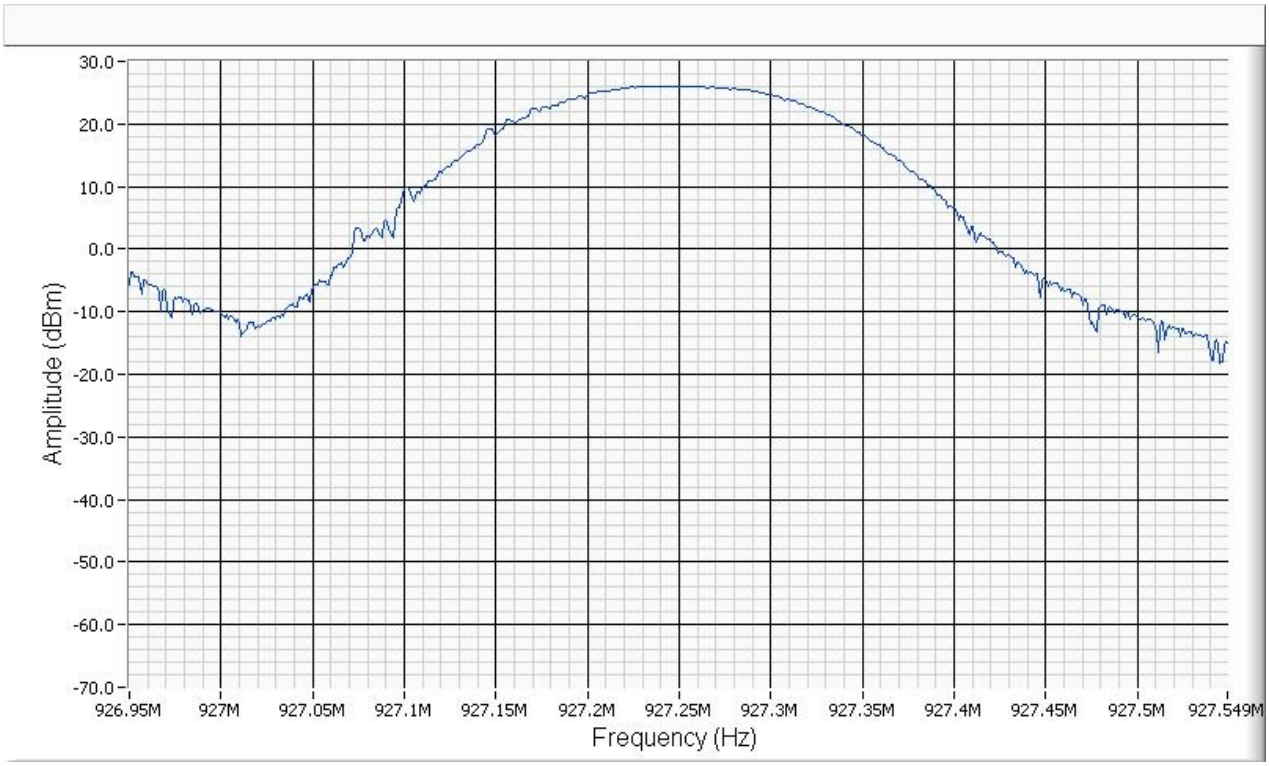
Res BW 100 kHz – VBW 1 MHz – Sweep 1 msec – Max Hold

Fig. 6.4
Modulation Type 2, Channel 0



Res BW 100 kHz – VBW 1 MHz – Sweep 1 msec – Max Hold

Fig. 6.5
Modulation Type 2, Channel 25



Res BW 100 kHz – VBW 1 MHz – Sweep 1 msec – Max Hold

Fig. 6.6
Modulation Type 2, Channel 49

Spurious Emissions

Nr Harmonics	AV Level (dBµV/m)						AV Limits (dBµV/m)	Remark
	Ch 0		Ch 25		Ch 49			
	F (MHz)	(dBµV/m)	F (MHz)	(dBµV/m)	F (MHz)	(dBµV/m)		
2	1805.5	--	1830.5	--	1854.5	--	54.0	
3		--		--		--	54.0	
4		--		--		--	54.0	
5		--		--		--	54.0	
6		--		--		--	54.0	
7		--		--		--	54.0	
8		--		--		--	54.0	
9		--		--		--	54.0	
10		--		--		--	54.0	

Note: Levels below 20 dB of limits are indicated with (--).

Nr Harmonics	Peak Level (dBµV/m)						AV Limits (dBµV/m)	Remark
	Ch 0		Ch 25		Ch 49			
	F (MHz)	(dBµV/m)	F (MHz)	(dBµV/m)	F (MHz)	(dBµV/m)		
2	1805.5	--	1830.5	--	1854.5	--	74.0	
3		--		--		--	74.0	
4		--		--		--	74.0	
5		--		--		--	74.0	
6		--		--		--	74.0	
7		--		--		--	74.0	
8		--		--		--	74.0	
9		--		--		--	74.0	
10		--		--		--	74.0	

Note: Levels below 20 dB of limits are indicated with (--).

Spurious Emissions – Peak limit

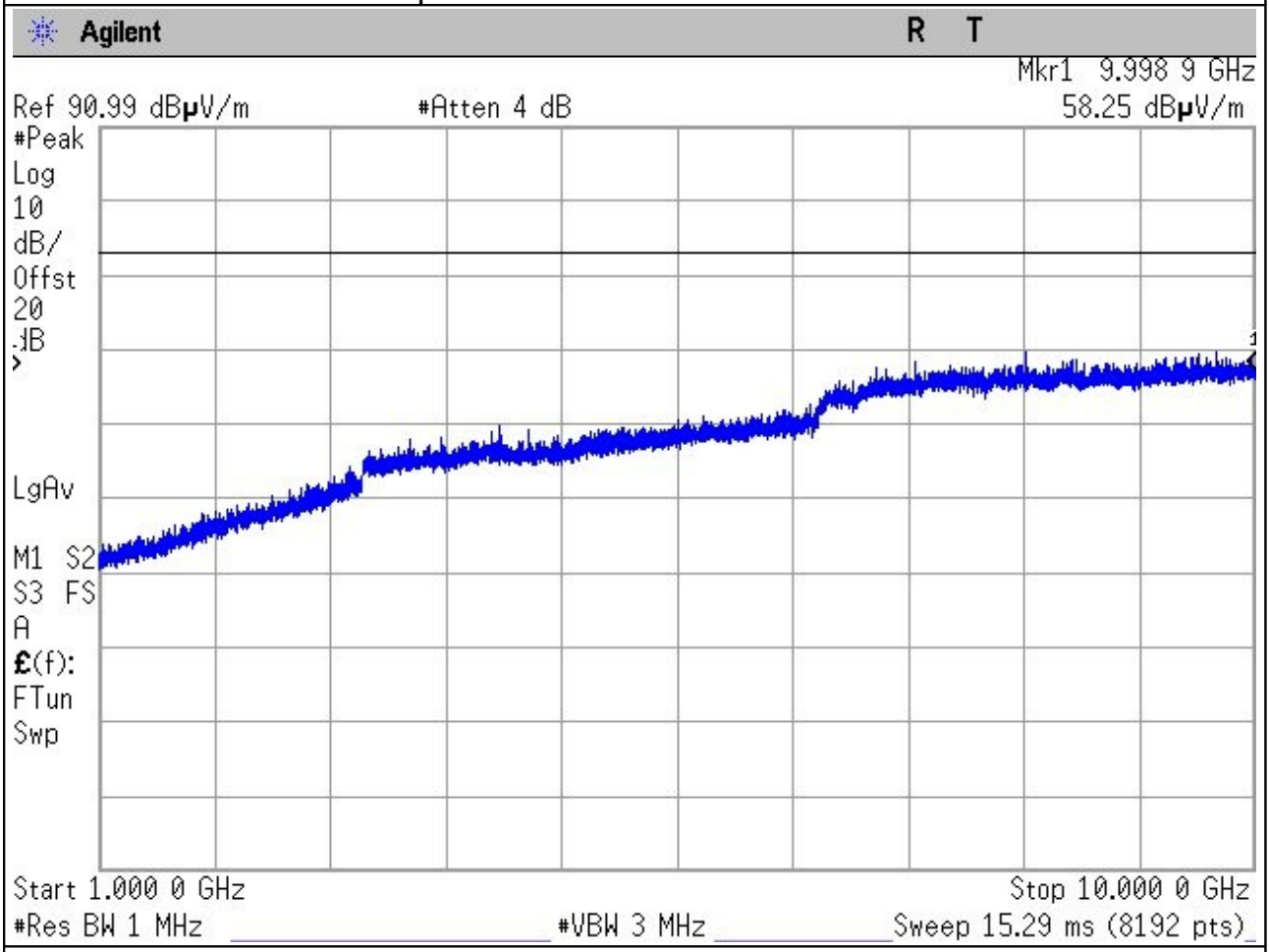


Fig. 6.7

Note:

Range: 1 GHz - 10 GHz
Pol. = V

Spurious Emissions – AVG limit

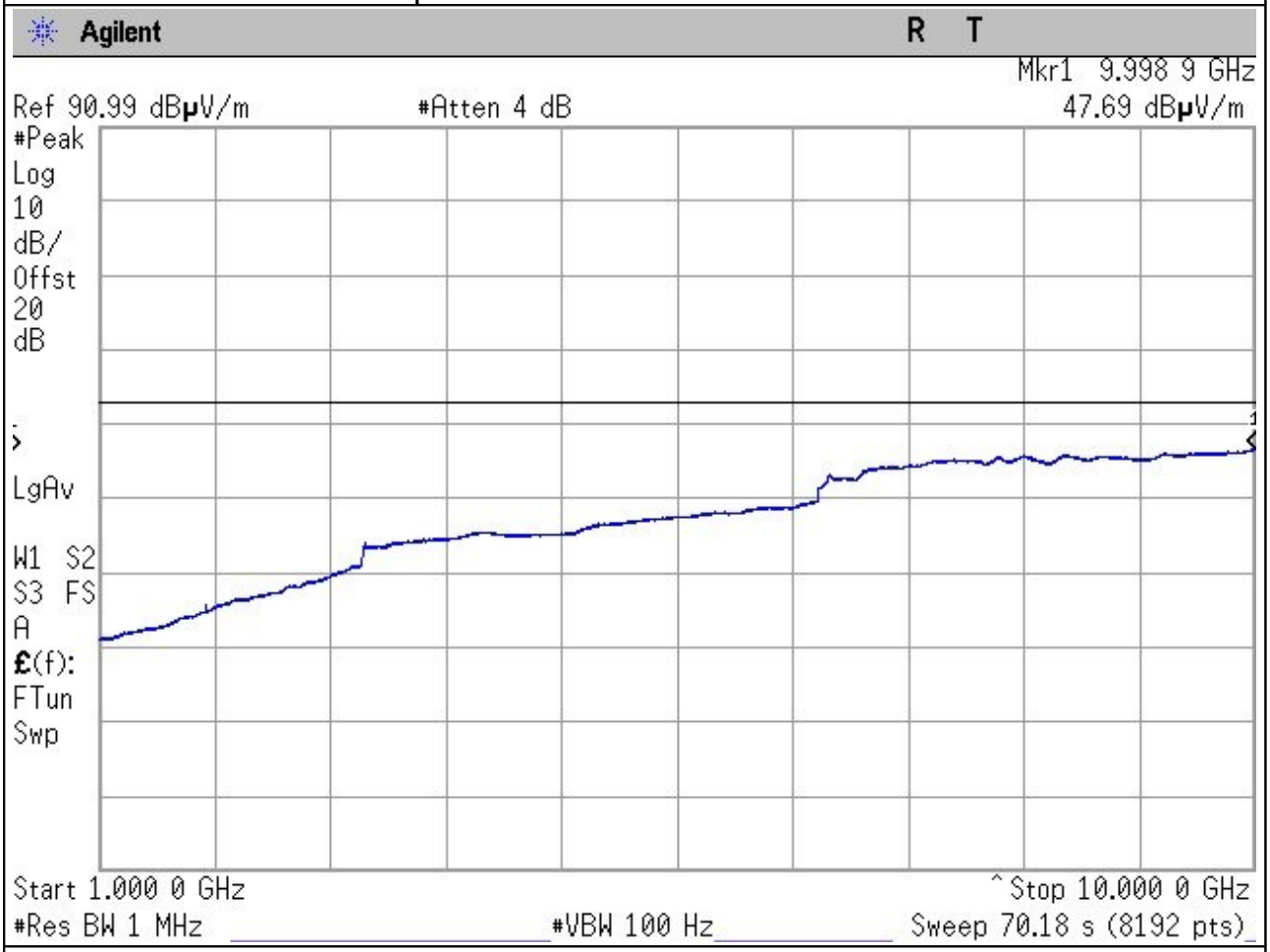


Fig. 6.8

Note:

Range: 1 GHz - 10 GHz
Pol. = V

Spurious Emissions – Peak limit

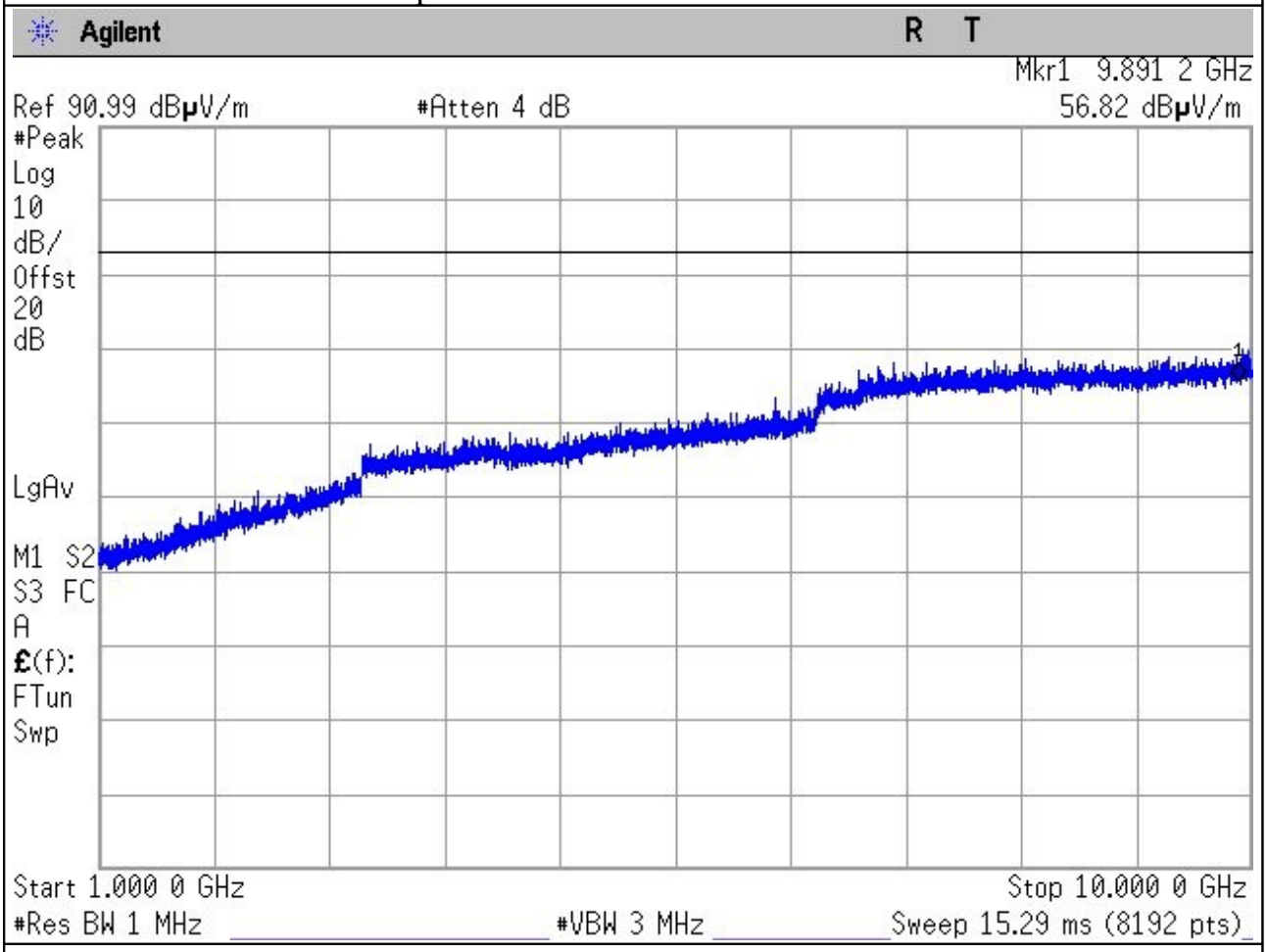


Fig. 6.9

Note:

Range: 1 GHz - 10 GHz
Pol. = H

Spurious Emissions – AVG limit

Fig. 6.10

Note:

Range: 1 GHz - 10 GHz
Pol. = H

Band Edge

Emissions must be within the band 902-928 MHz.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits.

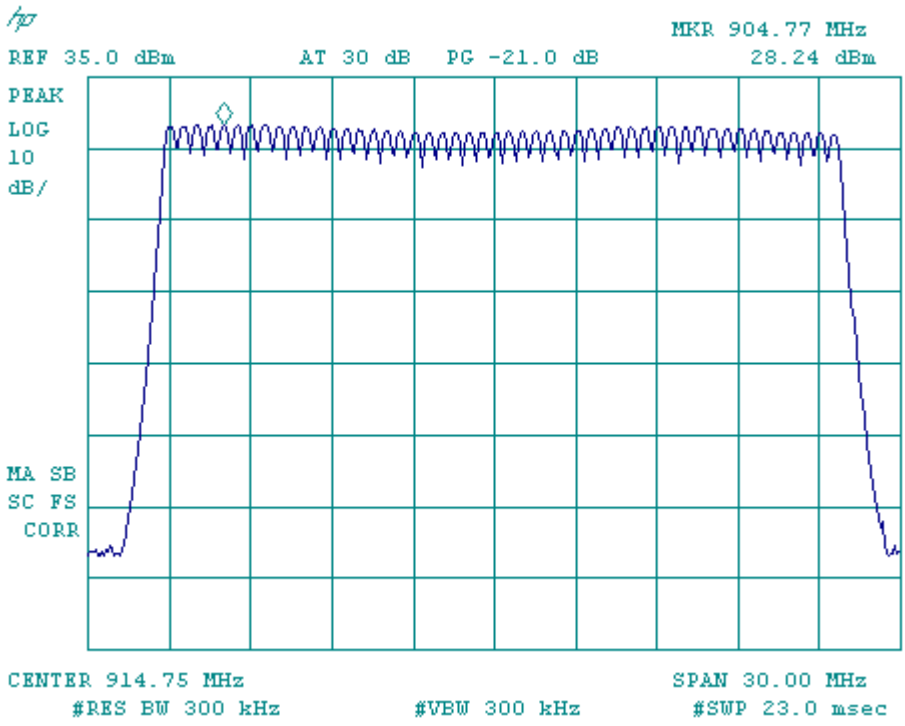


Fig. 6.11
Modulation Type: PR_ASK_M4_TX40RX250

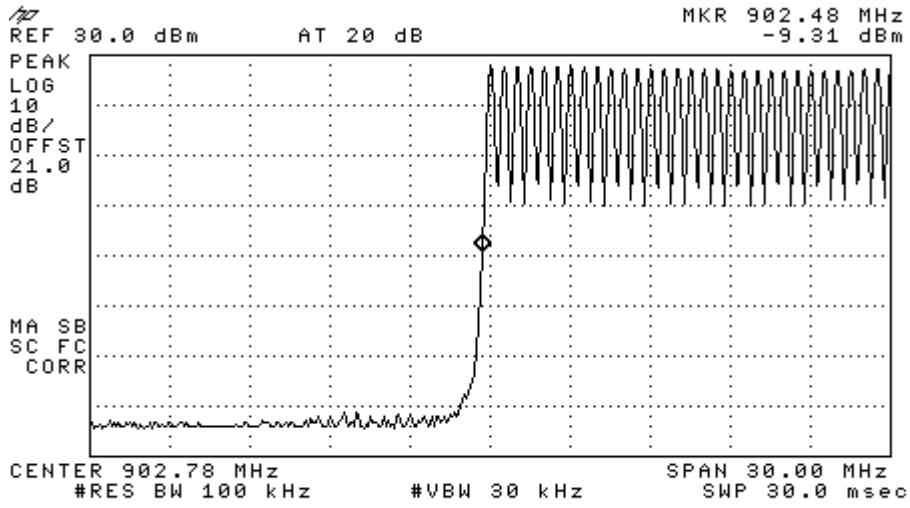


Fig. 6.12
Modulation Type: PR_ASK_M4_TX40RX250

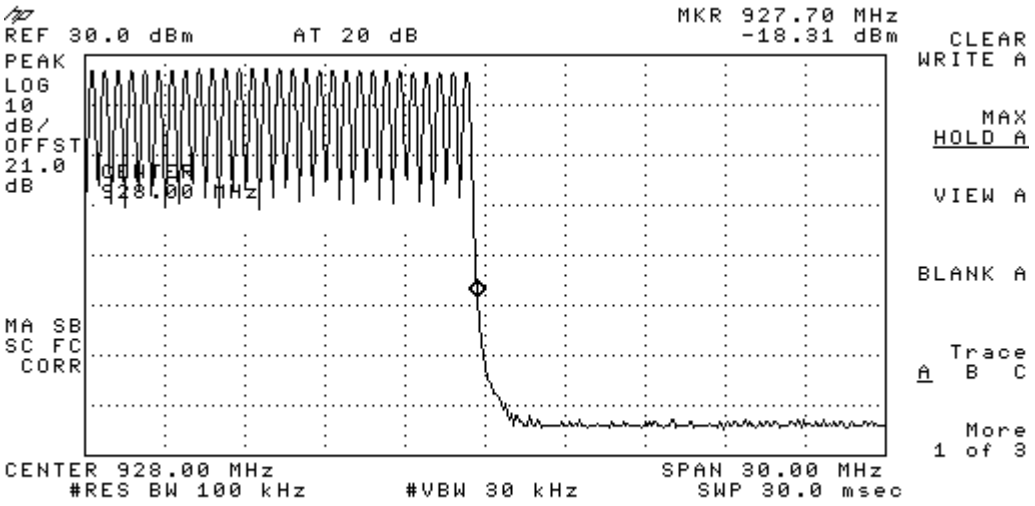


Fig. 6.13
Modulation Type: PR_ASK_M4_TX40RX250

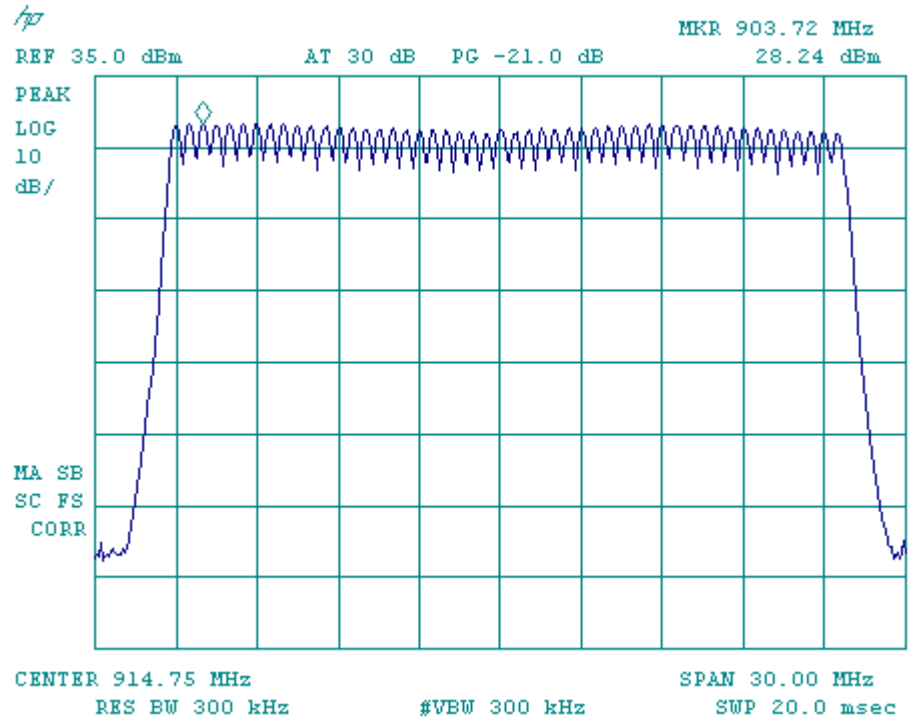


Fig. 6.14
Modulation Type: DSB_ASK_FM0_TX160RX400

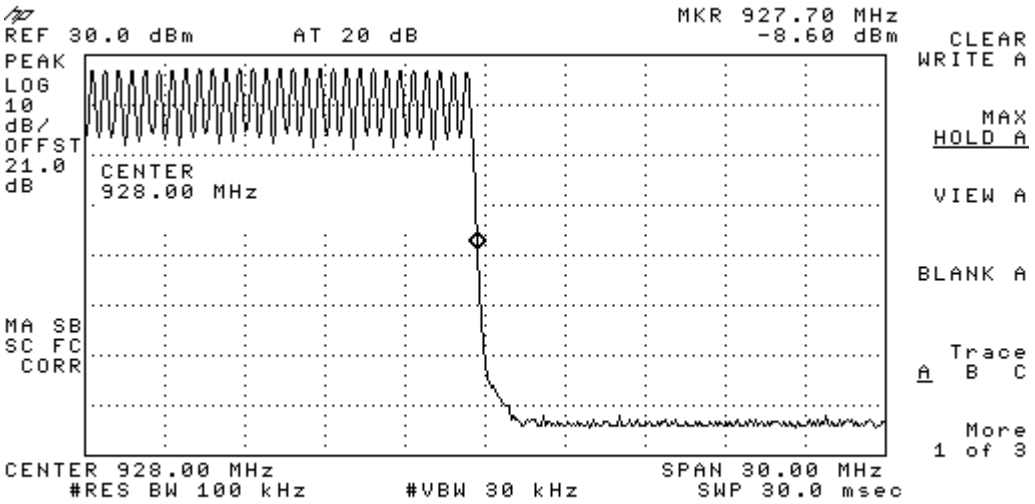


Fig. 6.15
Modulation Type: DSB_ASK_FM0_TX160RX400

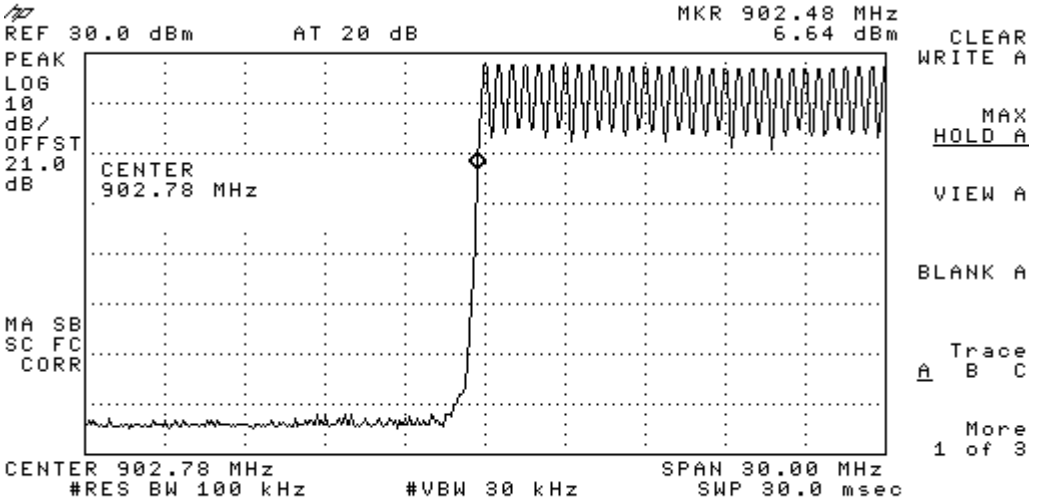


Fig. 6.16
Modulation Type: DSB_ASK_FM0_TX160RX400

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
EMI Receiver	HP	HP8546A	01/2014
EMI Receiver Filter Section	HP	HP85460A	01/2014
Anechoic Chamber	Comtest	CSA01	01/2014
Bilog Antenna	Schaffner	CBL6112B	01/2014
Horn Antenna	EMCO	3115	01/2014
Controller	Deisel	HD100	01/2014
Turn Table	Deisel	MA240	01/2014
LISN	GSD	NTW06	01/2014

Test procedure: CE22R01

7. Bandwidth and Average Time of Occupancy

Equipment shall meet the limits below.

Systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Bandwidth

Channel	Frequency	Bandwidth (Type1/Type2) [kHz]
0	902.743 MHz	52,5/38,3
25	914.737 MHz	57/38,3
49	927.237 MHz	57/53,3

Ch 0: Bandwidth

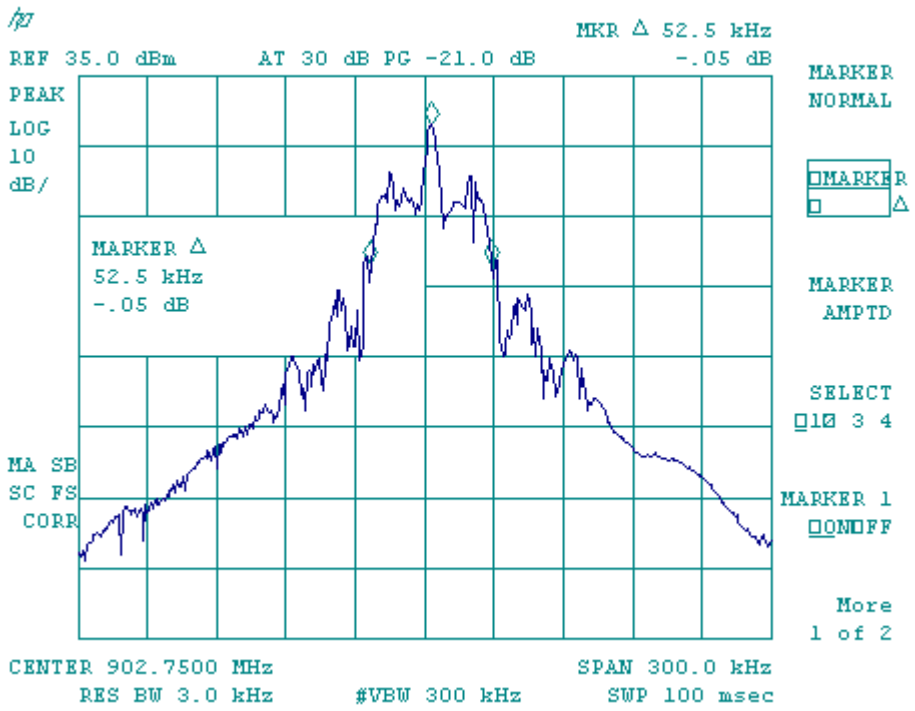


Fig. 7.1
Modulation Type: PR_ASK_M4_TX40RX250

Ch 25: Bandwidth

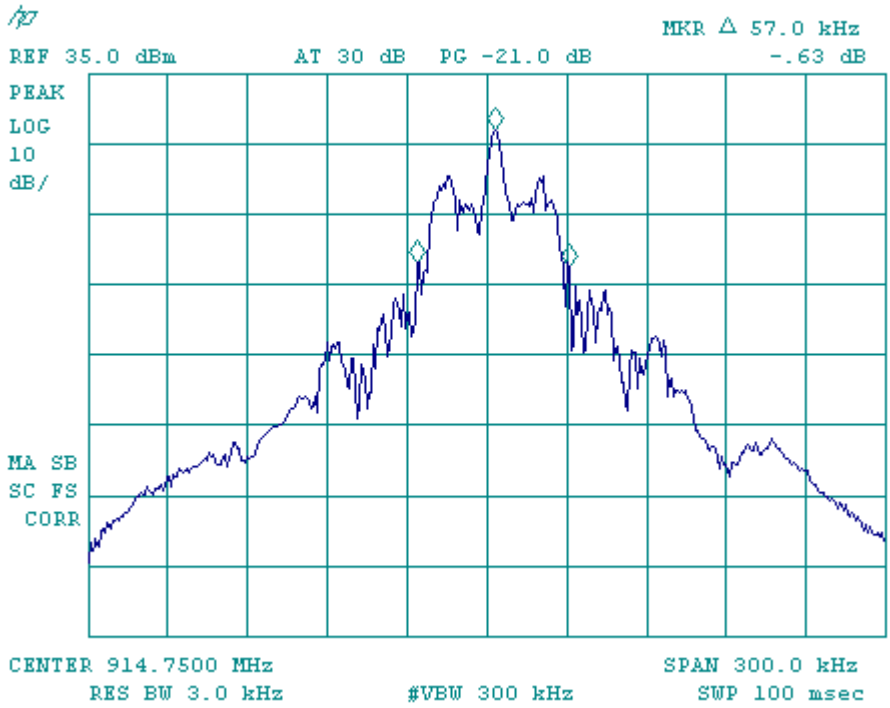


Fig. 7.2
Modulation Type: PR_ASK_M4_TX40RX250

Ch 49: Bandwidth

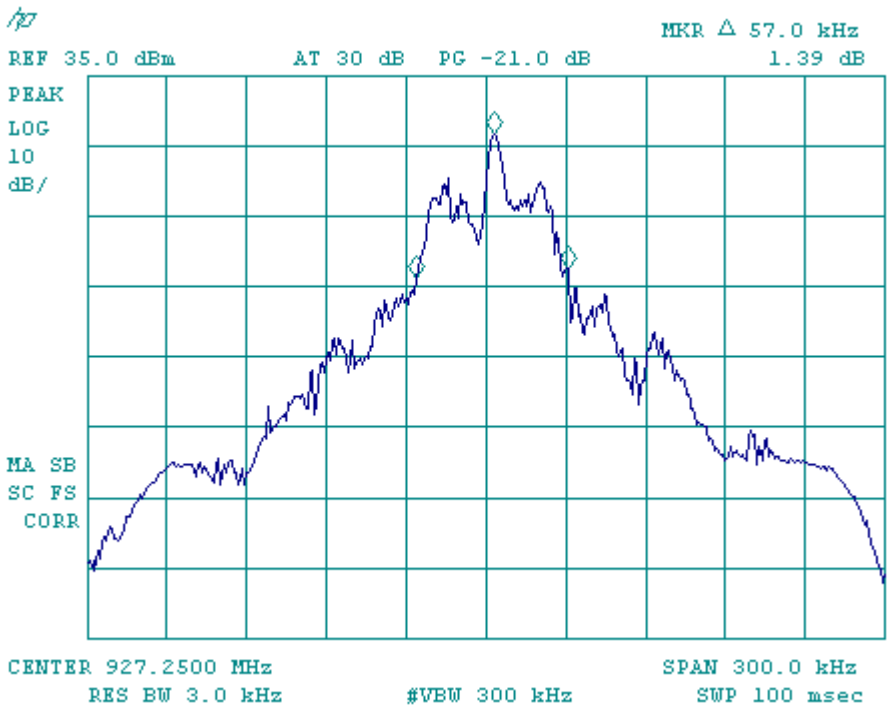


Fig. 7.3
Modulation Type: PR_ASK_M4_TX40RX250

Ch 0: Bandwidth

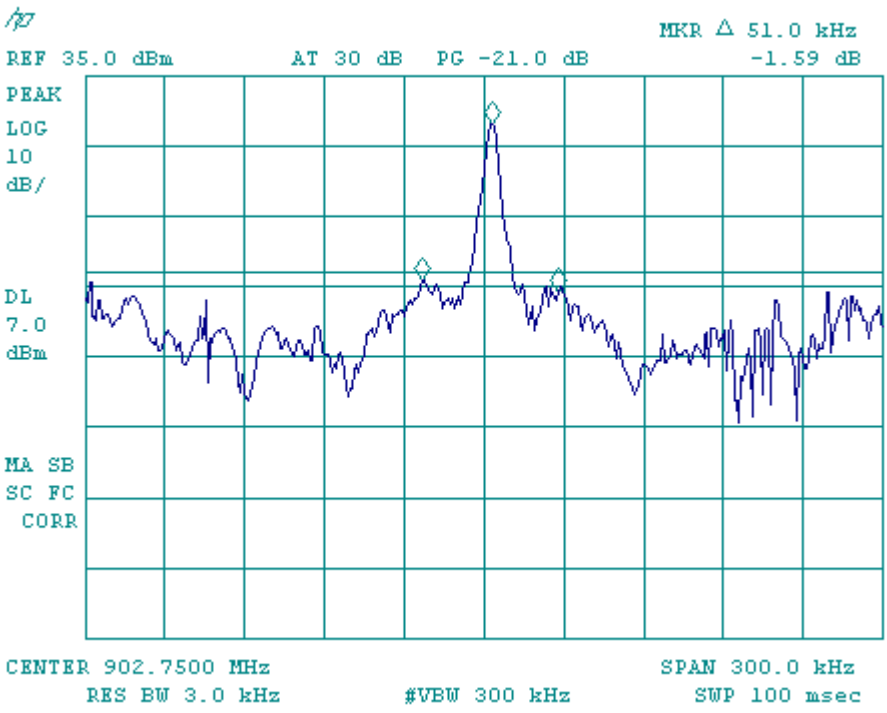


Fig. 7.4
Modulation Type: DSB_ASK_FM0_TX160RX400

Ch 25: Bandwidth

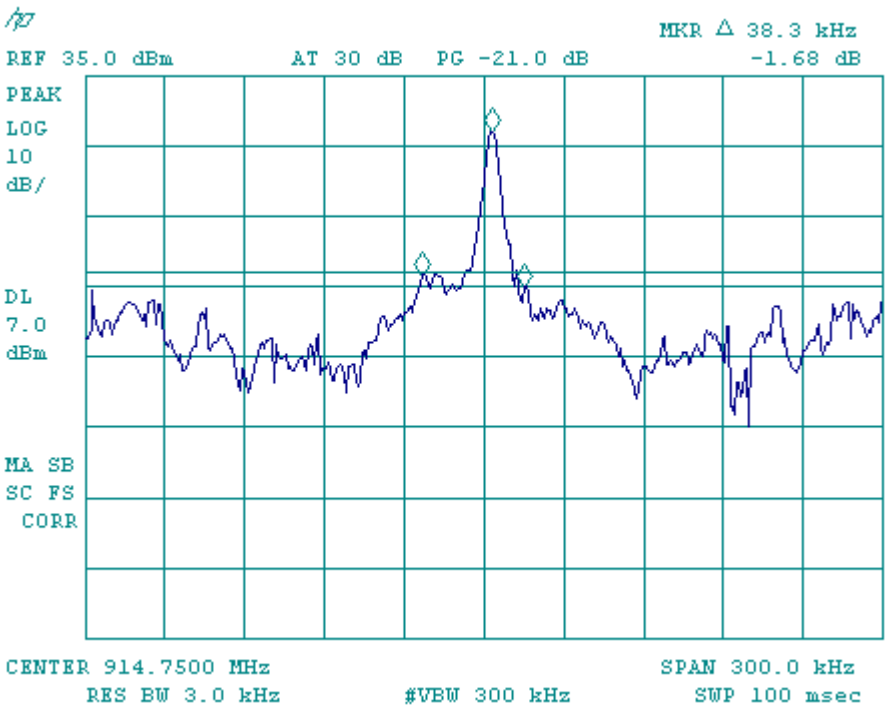


Fig. 7.5
Modulation Type: DSB_ASK_FM0_TX160RX400

Ch 49: Bandwidth

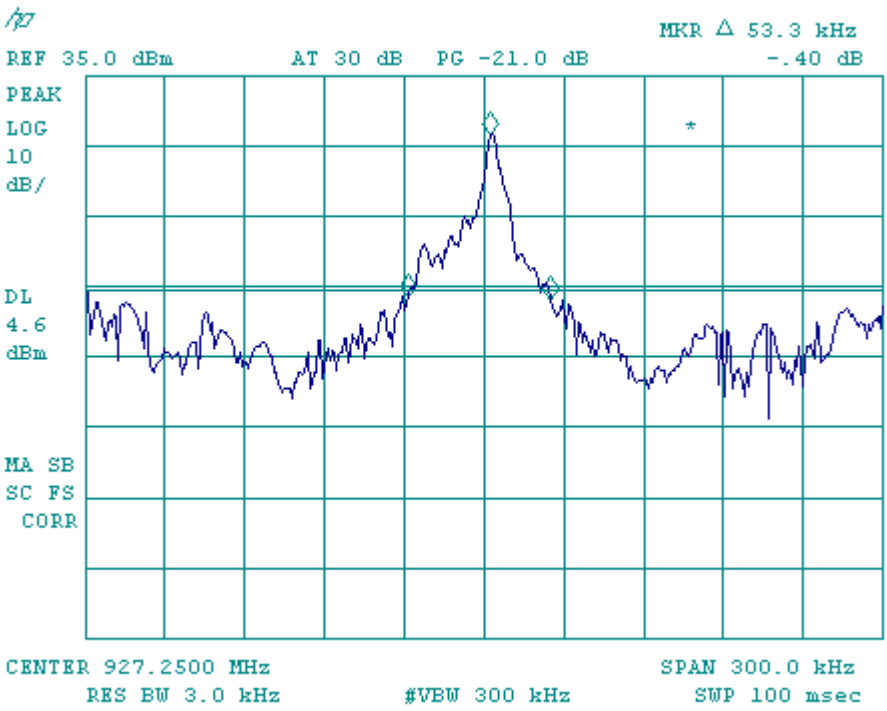


Fig. 7.6
Modulation Type: DSB_ASK_FM0_TX160RX400

Average Time of Occupancy:

Channel	Dwell Time msec	Nr. of Transmission for channel	Modulation	Time of Occupancy msec
25	30,5	8	Type 1	244
25	10,67	13	Type 2	139

Time of transmission

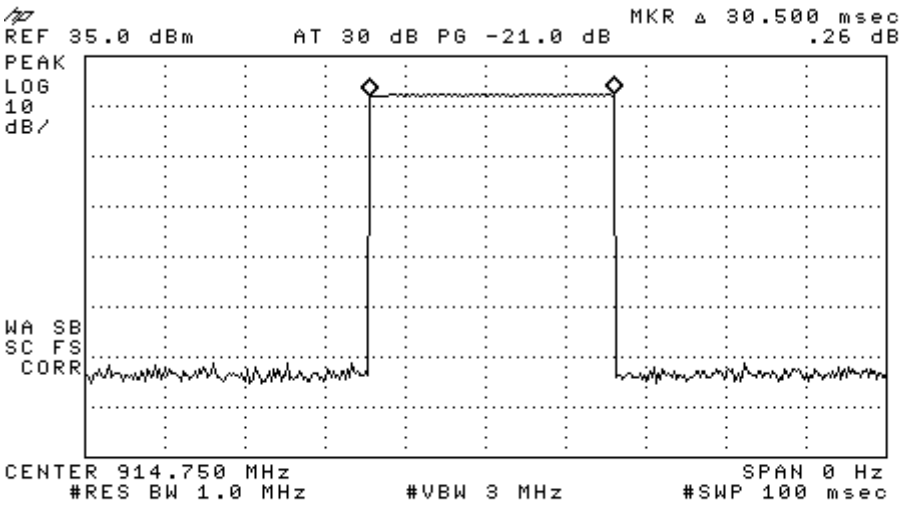


Fig. 7.7
Modulation Type: PR_ASK_M4_TX40RX250

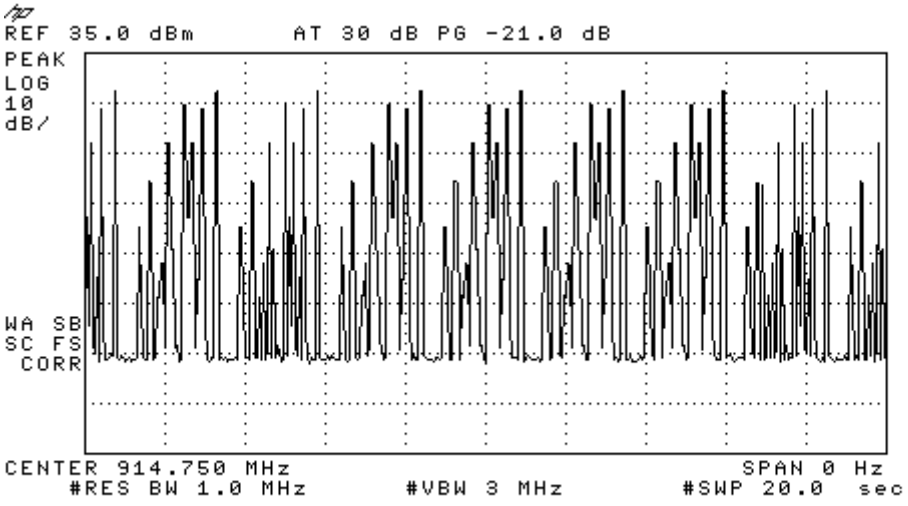


Fig. 7.8
Modulation Type: PR_ASK_M4_TX40RX250

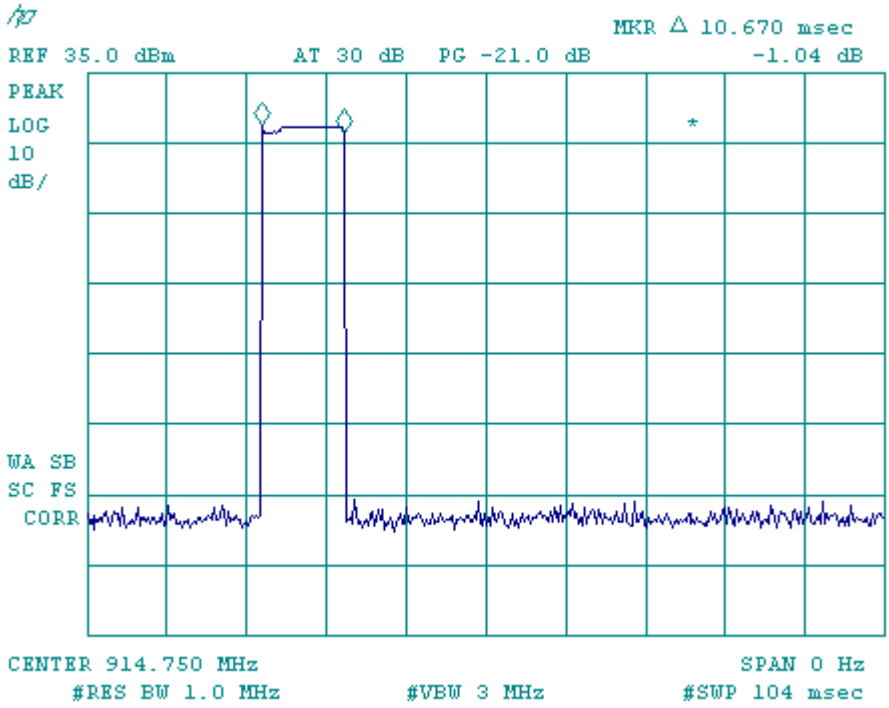


Fig. 7.9
Modulation Type: DSB_ASK_FM0_TX160RX400

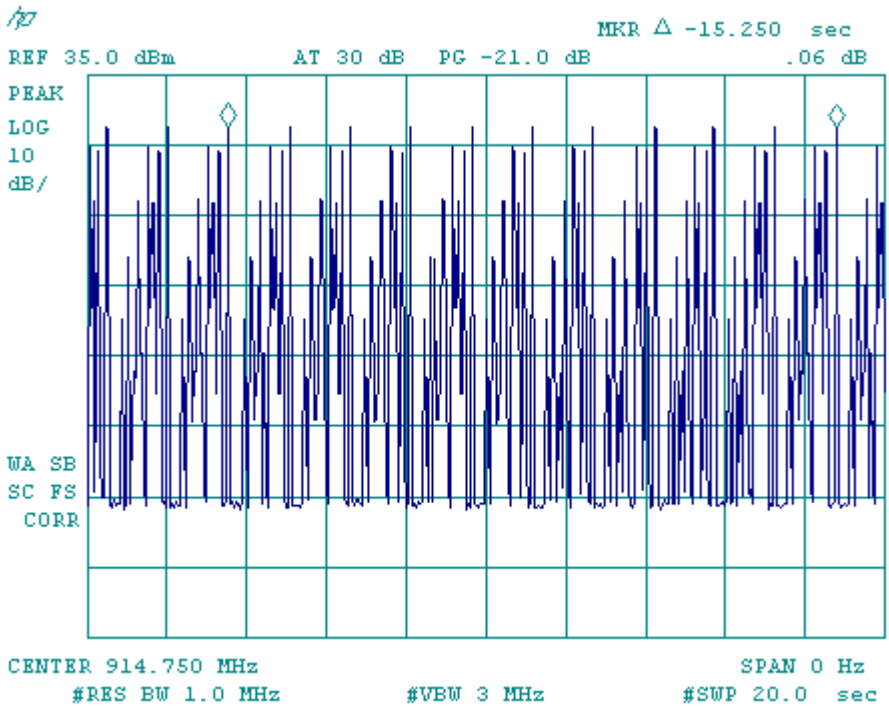


Fig. 7.10
Modulation Type: DSB_ASK_FM0_TX160RX400

Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	CAL. DUE
EMI Receiver	HP	HP8546A	01/2014
EMI Receiver Filter Section	HP	HP85460A	01/2014
Anechoic Chamber	Comtest	CSA01	01/2014
Bilog Antenna	Schaffner	CBL6112B	01/2014
Horn Antenna	EMCO	3115	01/2014
Controller	Deisel	HD100	01/2014
Turn Table	Deisel	MA240	01/2014
LISN	GSD	NTW06	01/2014

Test procedure: CE22R01

8. PHOTO

Fig. 8.1
Conducted Emissions Test Set-up

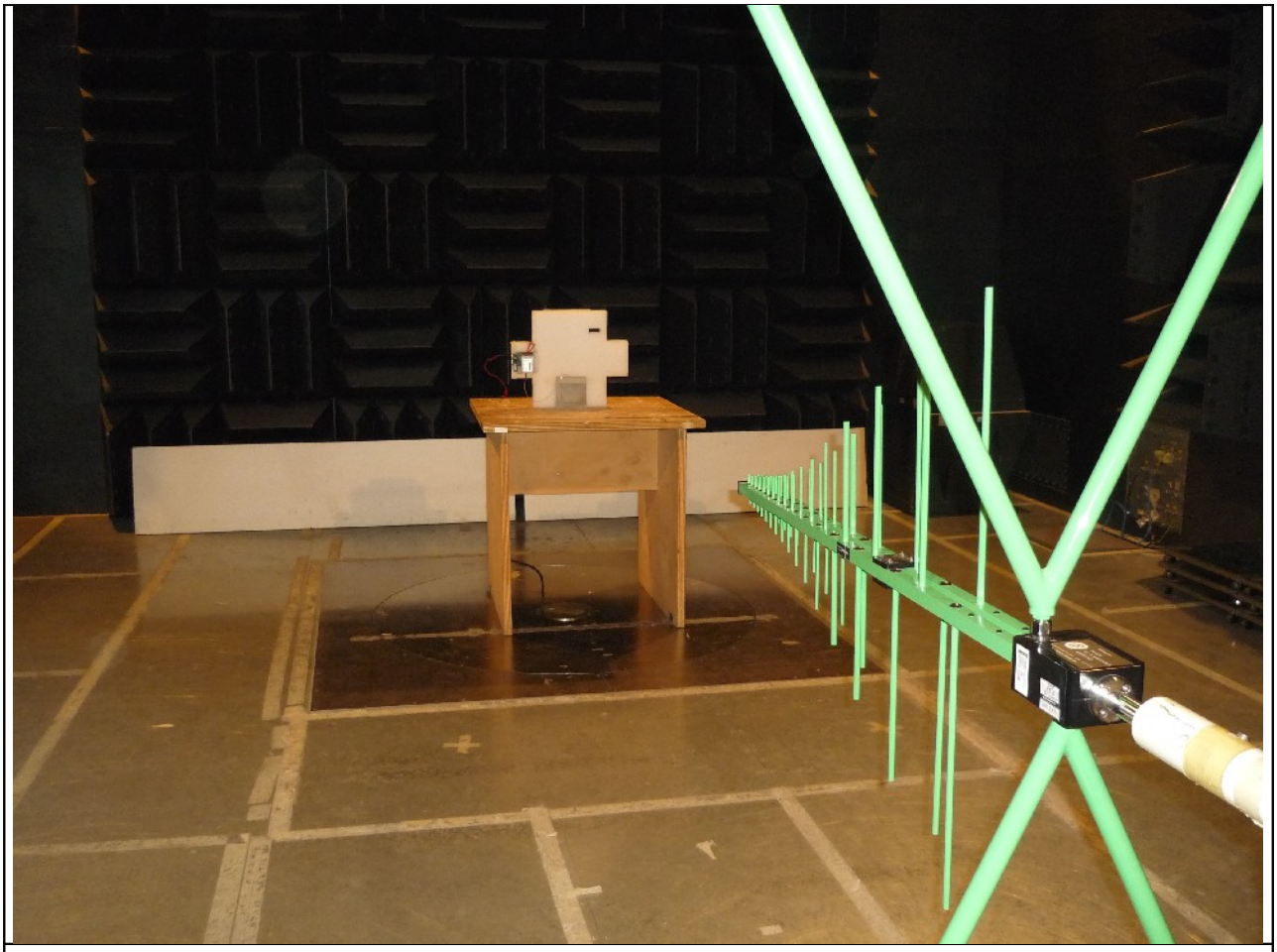


Fig. 8.2

Radiated Emissions Test Set-up