CETECOM™

FCC Test Report

FOR:

Model Name: OMR-WAVE-UNIT

FCC ID: XZU9734

47 CFR Part 90M

TEST REPORT #: EMC_CETE4_012_90M_Rev1
DATE: 2010-02-22

Bluetooth
Qualification Test
Facility
(BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed
A2LA Accredited

IC recognized #
3462B

1   <u>TABLE OF CONTENTS</u>

2 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Parts 90M of Title 47 of the Code of Federal Regulations.

Company	Description	Model #
KAPSCH TrafficCom AG	Wireless Radio	OMR-WAVE-UNIT

Responsible for Testing Laboratory:

Heiko Strehlow

2010-02-22	Compliance	(Director)	
Date	**Section**	**Name**	**Signature**

Responsible for the Report:

Marc Douat

2010-02-22	Compliance	(Test Lab Manager)	
Date	**Section**	**Name**	**Signature**

3 Administrative Data

3.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Responsible Test Lab Manager:	Heiko Strehlow
Responsible Project Leader:	Marc Douat

3.2 Identification of the Client

Applicant's Name:	Kapsch TrafficCom AG
Street Address:	Am Europlatz 2
City/Zip Code	1120 Wien
Country	Austria
Contact Person:	Herbert Diemling
Phone No.	+43508117857
Fax:	+43508112209
e-mail:	herbert.diemling@kapsch.net

3.3 Identification of the Manufacturer

Manufacturer's Name:	Same as above
Manufacturers Address:	
City/Zip Code	
Country	

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4   Equipment under Test (EUT)

4.1   Specification of the Equipment under Test

Marketing Name:	OMR-WAVE-UNIT
Model No:	OMR-WAVE-UNIT
Product Type:	Wireless Radio
Hardware Revision :	Rev201
Software Revision :	1.0
FCC-ID:	XZU9734
Frequency:	5860 MHz – 5920 MHz
Type(s) of Modulation:	OFDM
Number of channels:	7
Antenna Type:	Circularly Polarized
Equipment Classification:	☐Fixed ☐Vehicular ■Portable ☐Module
Power Supply:	Powered by host
Temperature Range:	-30ºC to 55ºC

4.2   Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version
1	GZQ00708	Rev201	1.0

4.3   Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	Host	Kapsch	Gotive H42TW	H4205686

5   Subject Of Investigation

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 90M of Title 47 of the Code of Federal Regulations.

This test report is to support a request for new equipment authorization under the FCC ID XZU9734**.** All testing was performed on the product referred to in Section 3 as EUT.

Measurements in this report are made with the EUT transmitting with the lowest data rate, worst case.

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6   Measurements

6.1   Radiated Measurement Procedure
Ref: TIA-603C 2004 -2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)
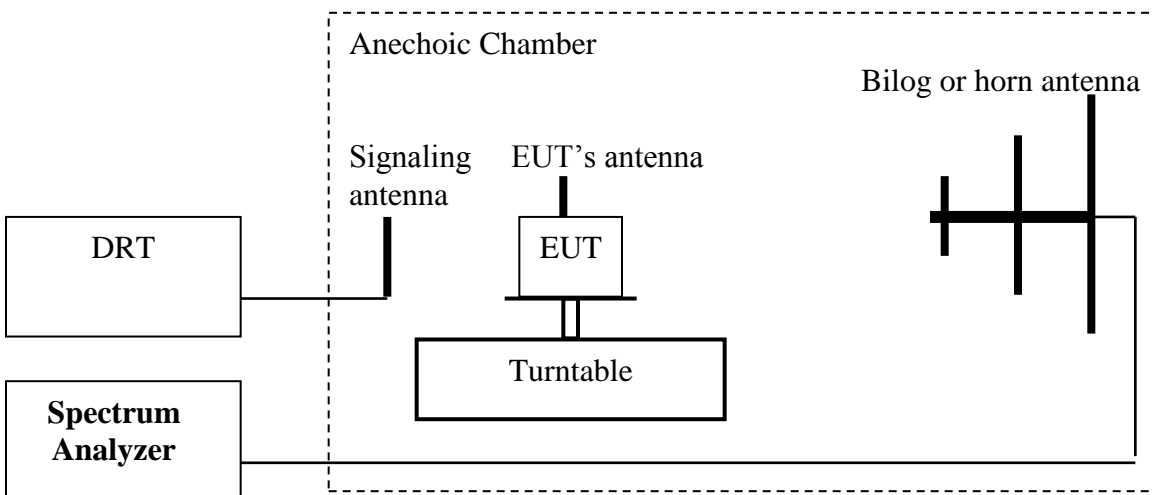
1.   Connect the equipment as shown in the above diagram with the EUT's antenna in a vertical orientation.
2.   Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3.   Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4.   Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5.   Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6.   Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7.   Determine the ERP using the following equation:
       ERP (dBm) = **LVL** (dBm) + **LOSS** (dB)
8.   Determine the EIRP using the following equation:
       EIRP (dBm) = **ERP** (dBm) + 2.14 (dB)
9.   Measurements are to be performed with the EUT set to the low, middle and high channels.
Spectrum analyzer settings: RBW=VBW=3MHz

6.2   Maximum Peak Output Power

6.2.1   Limits
EIRP: 20dBm, Class C

6.2.2   Test Conditions:
Tnom: 22$^{\mathrm{o}}$C; Vnom

6.2.3   Test Result:

Frequency (MHz)	Max Peak Output Power- Conducted (dBm)	Max Peak Output Power- EIRP (dBm)
5860	18.5	19.89
5870	18.9	19.37
5880	18.2	19.12
5890	18.2	18.73
5900	19.0	18.46
5910	18.8	18.82
5920	18.9	18.07
Measurement Uncertainty: ±3dB		

RBW and VBW set to 10 MHz. Peak detector.

5860 MHz

EIRP 5850

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5870 MHz

EIRP 5850

5.871783567 GHz
19.366 dBm

Level in dBm vs Frequency in MHz
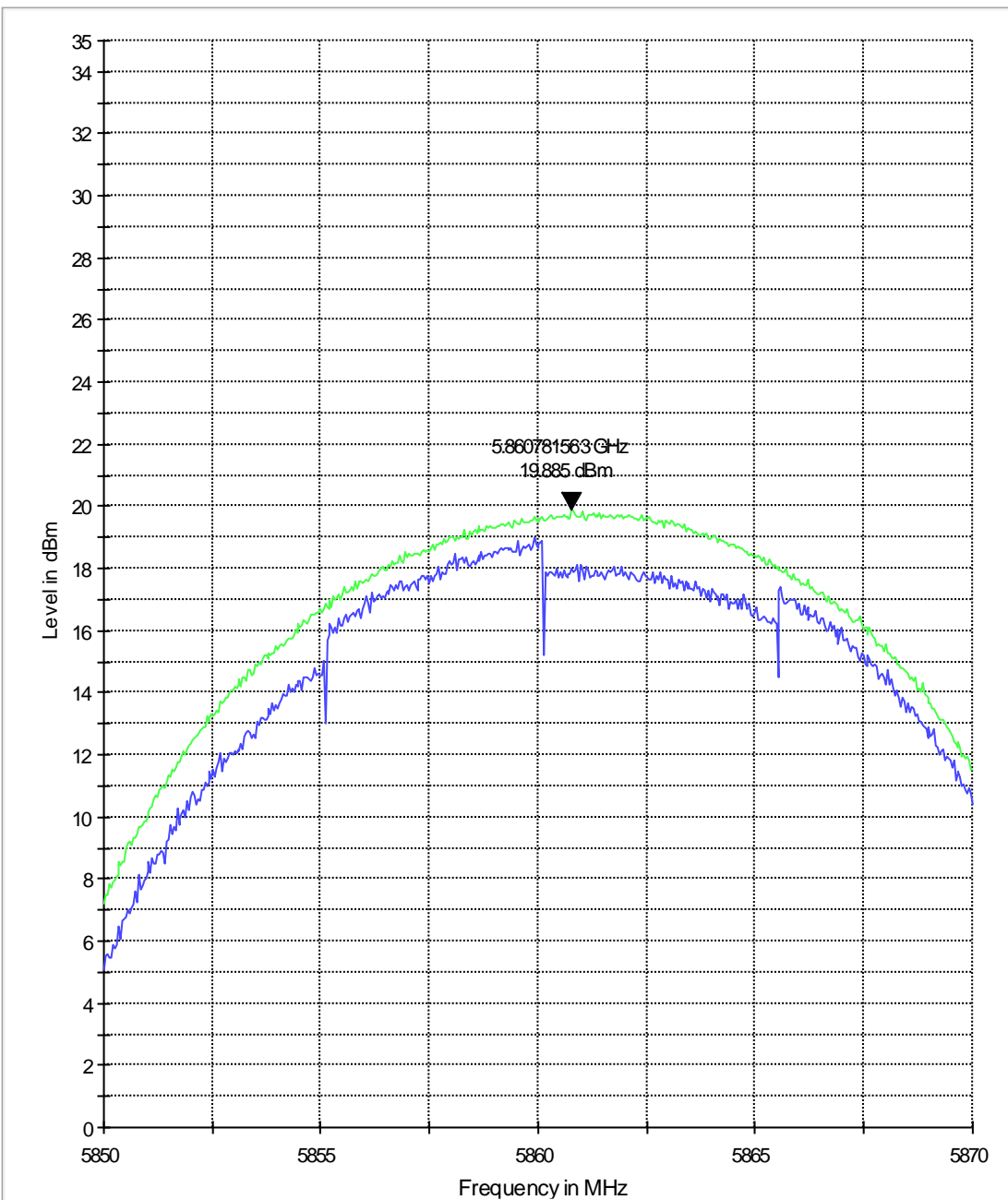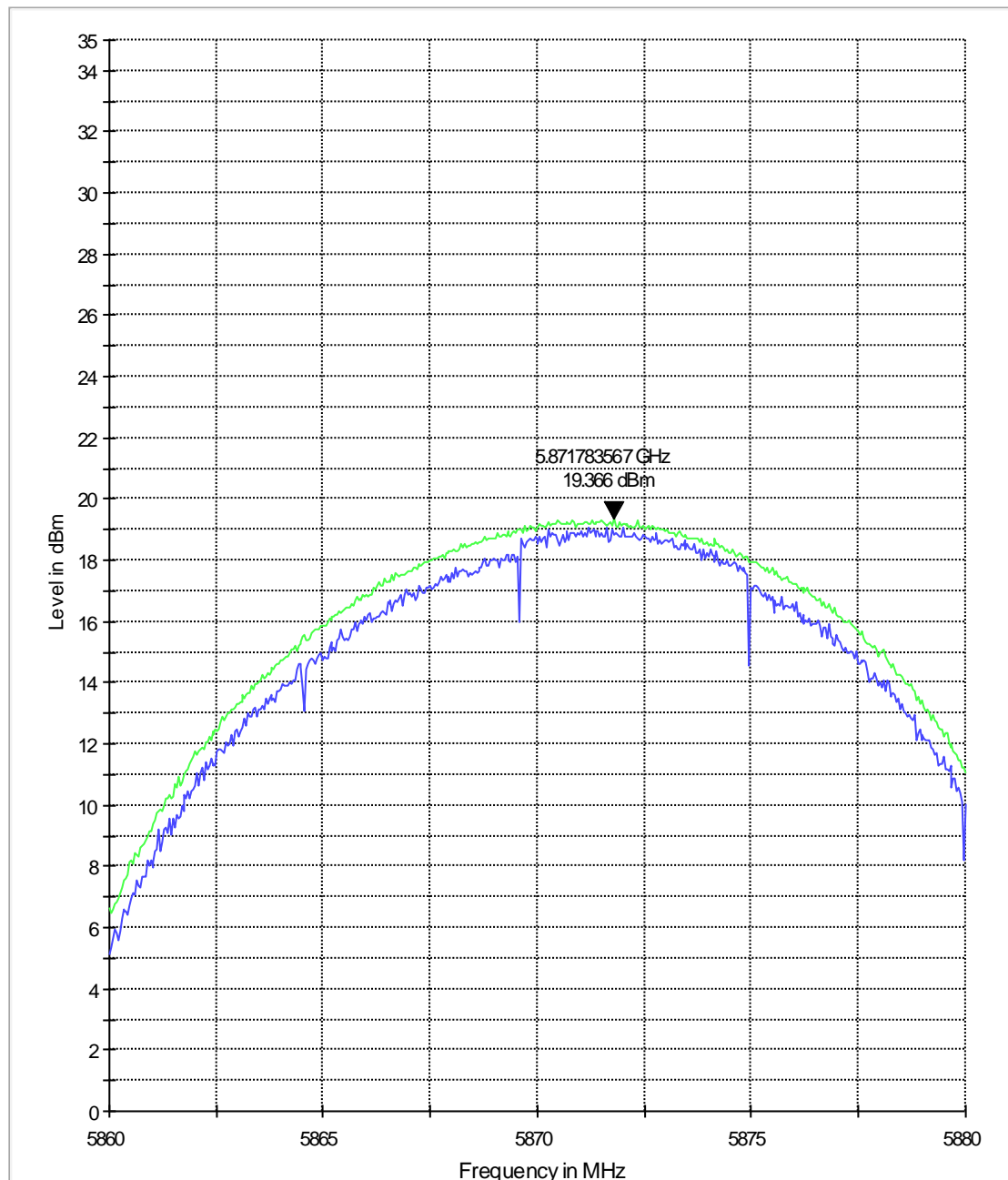
RMS-ClearWrite   RMS-MaxHold

5880 MHz

EIRP 5850
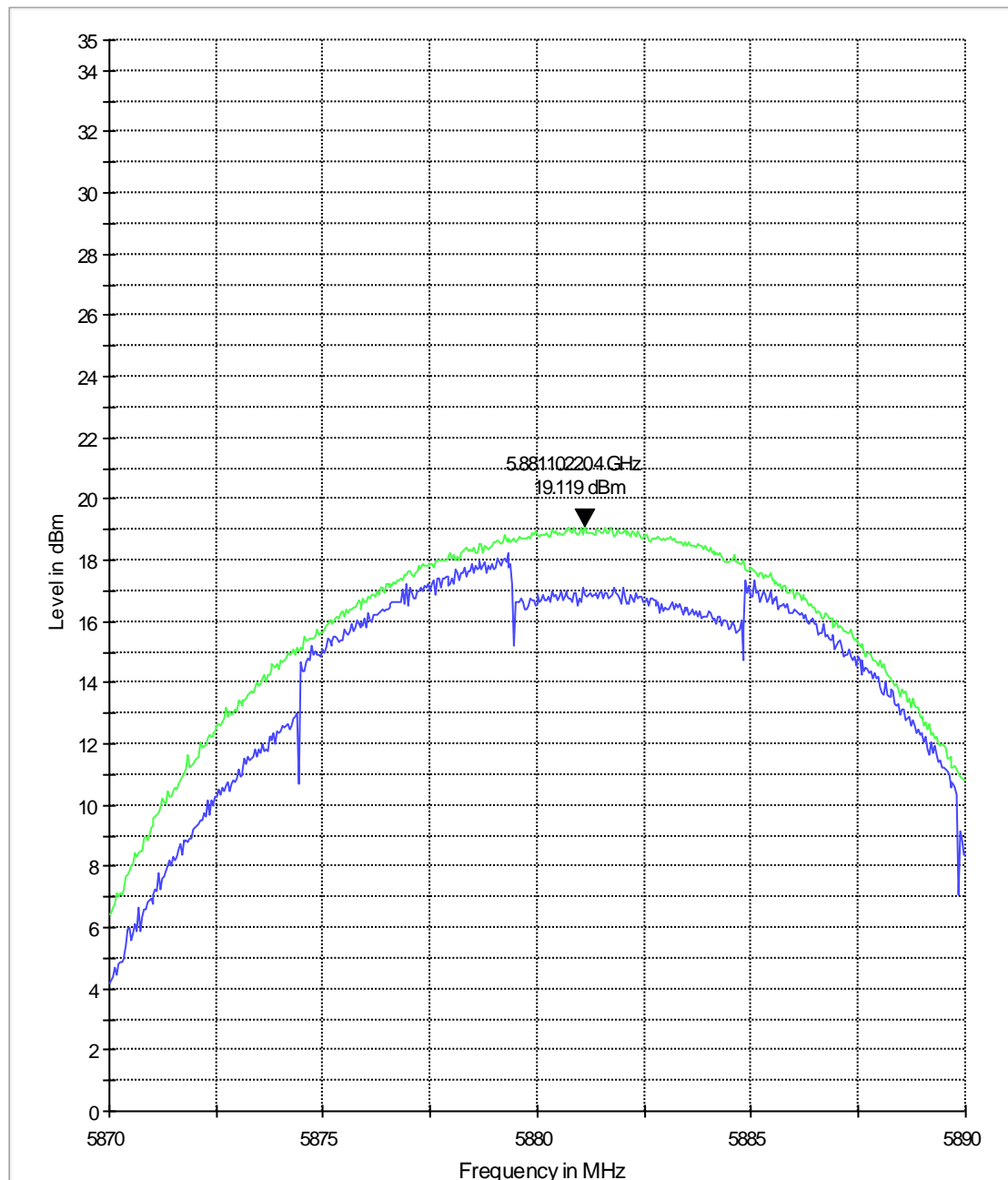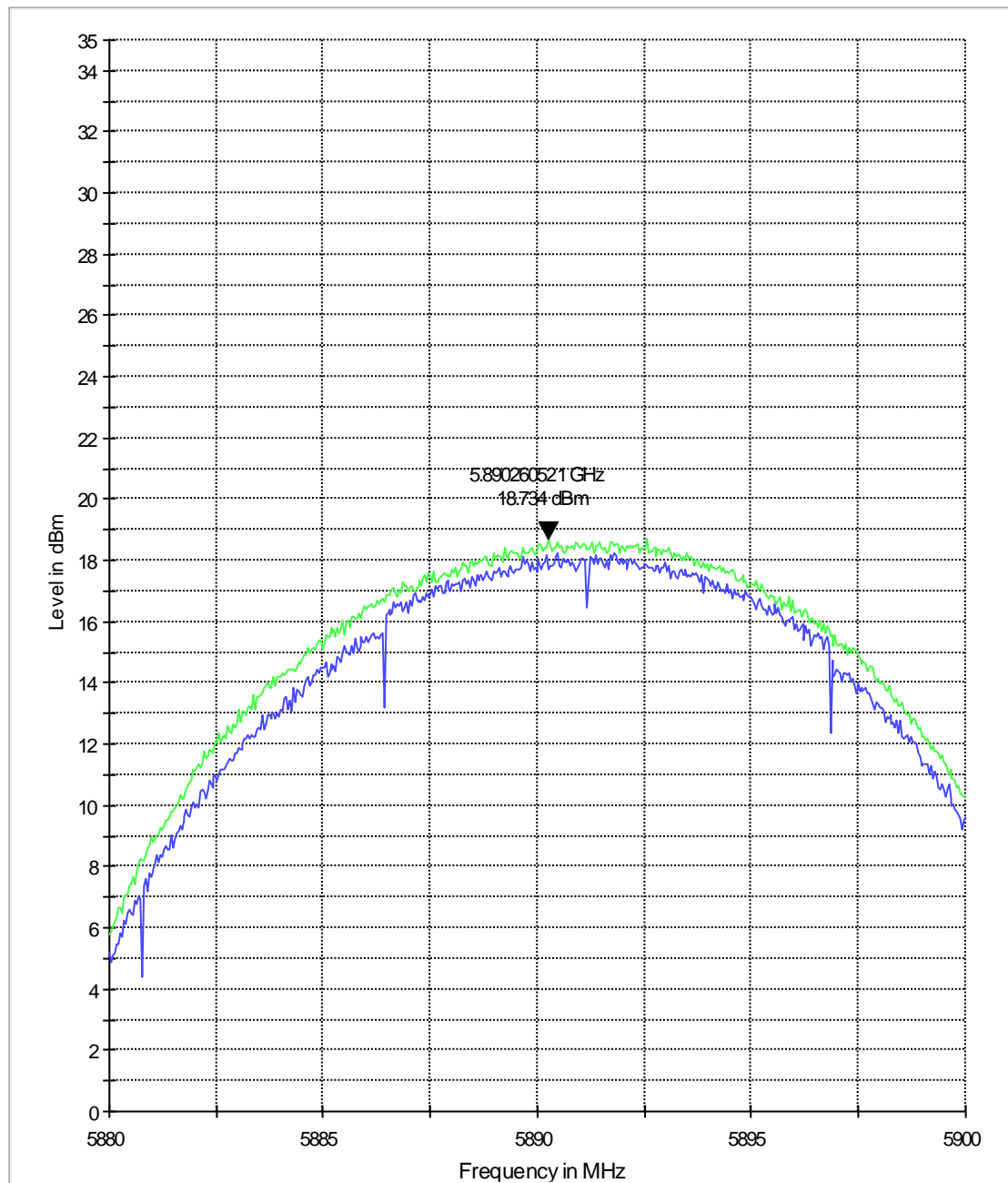
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5890 MHz

EIRP 5850

Chart showing Level in dBm versus Frequency in MHz (5880 to 5900). Marker at 5.890260521 GHz, 18.734 dBm. Legend: RMS-ClearWrite (blue), RMS-MaxHold (green).

5900 MHz
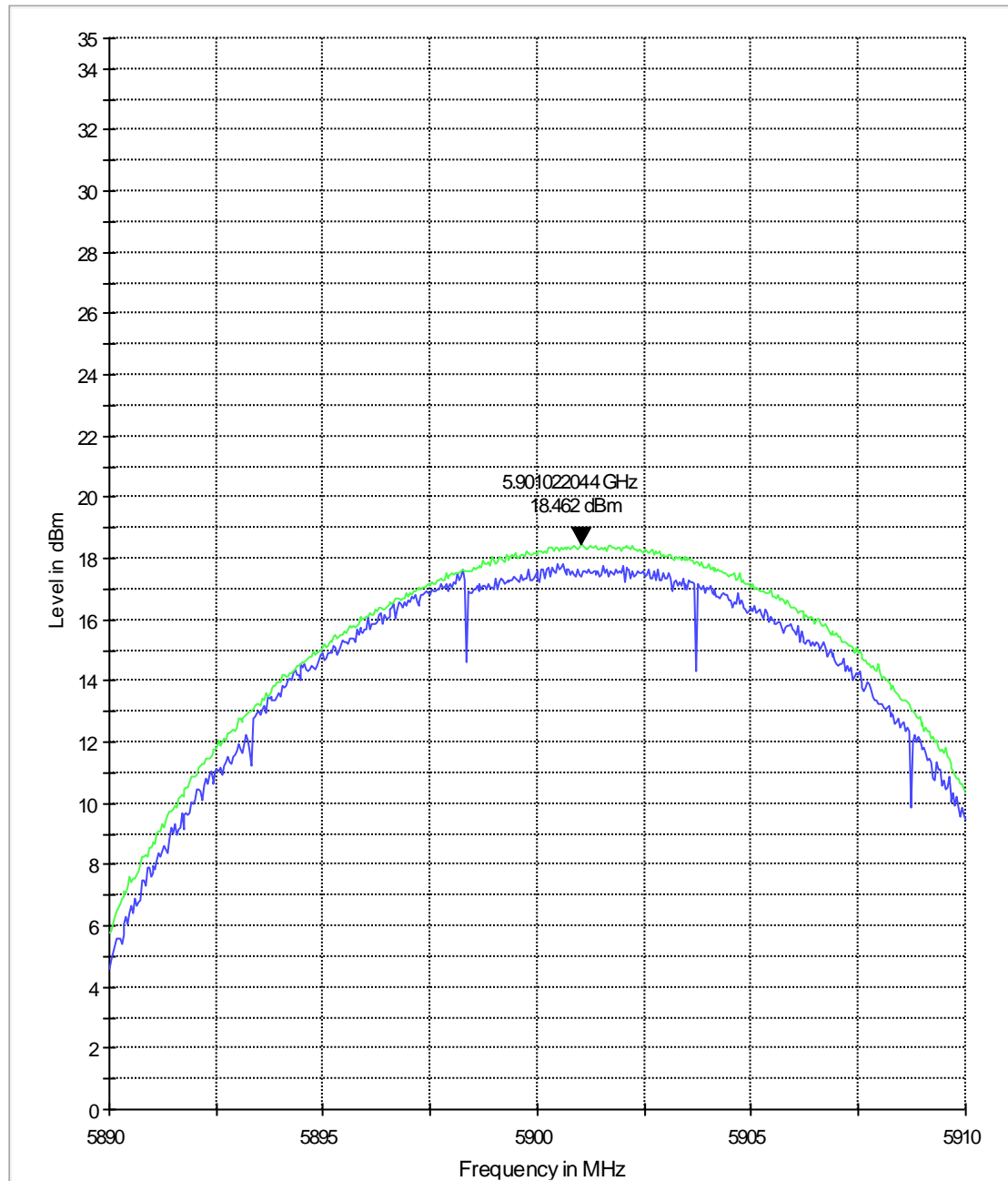
EIRP 5850

Legend: RMS-ClearWrite, RMS-MaxHold

5910 MHz
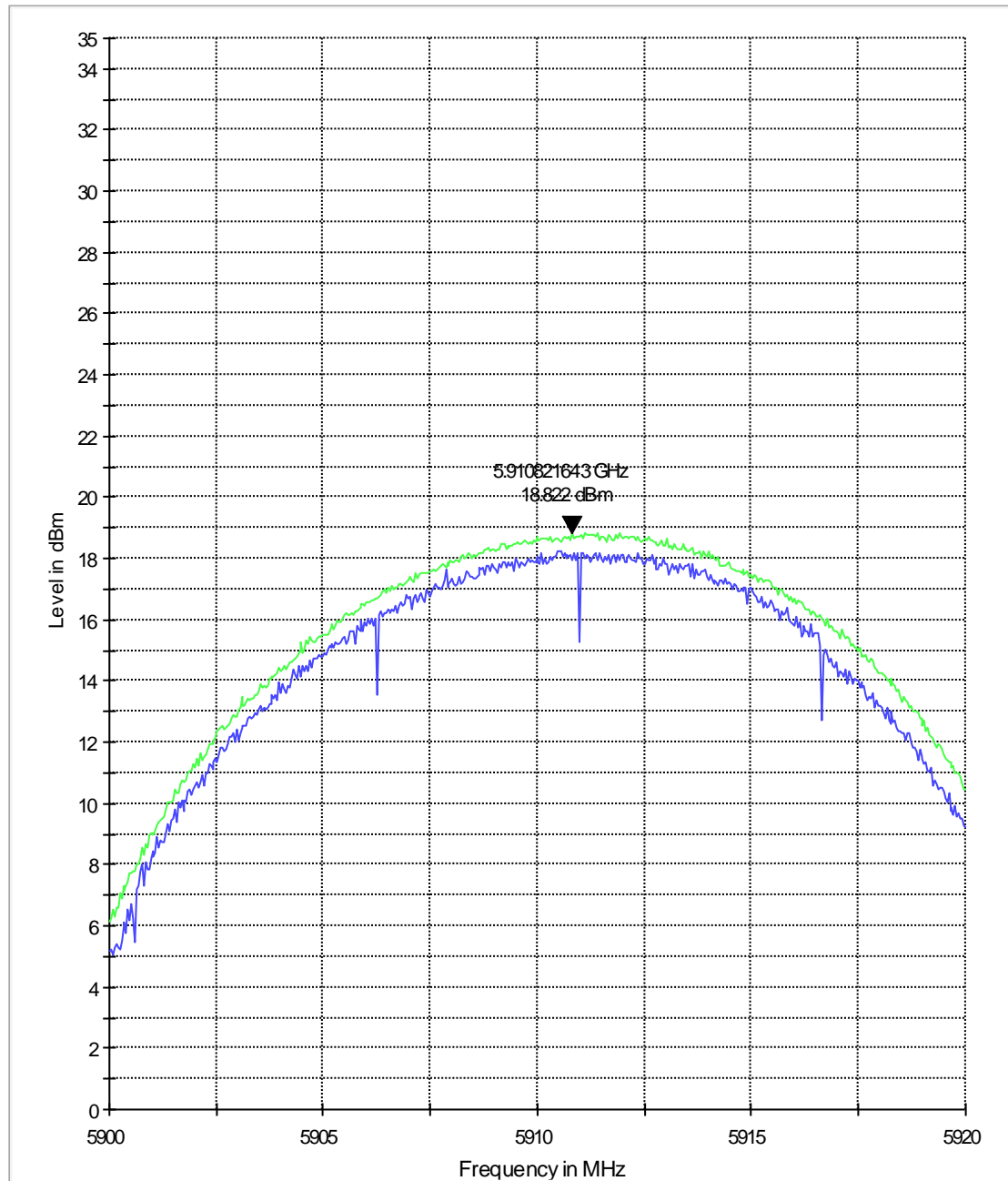
EIRP 5850

5920 MHz

EIRP 5850
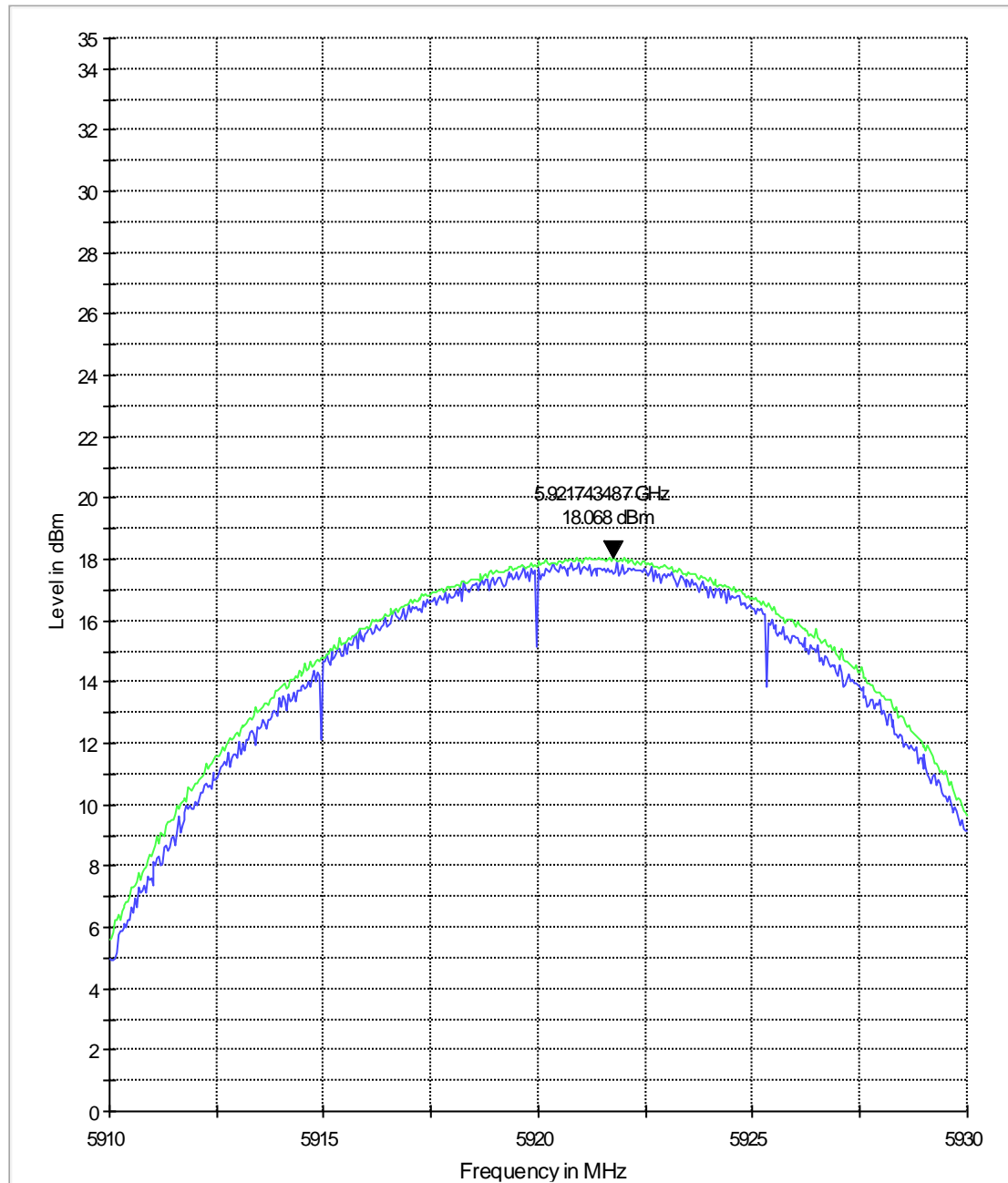
6.3   Modulation Characteristics

The carrier signal is OFDM. The sub-carriers have the following data rates and modulations:

Data Rate (Mbit/s)	Modulation
3	BPSK
4.5	BPSK
6	QPSK
9	QPSK
12	16QAM
18	16QAM
24	64QAM
27	64QAM

6.4 Occupied Bandwidth

2.1049, 90.209, 90.379, ASTM E2213

6.4.1 Test Result:

99% Occupied Bandwidth (MHz)		
Frequency (MHz)		
5860	**5890**	**5920**
8.387	8.417	8.417
Measurement Uncertainty: ±1 kHz		

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6.4.2 Test Data/plots:
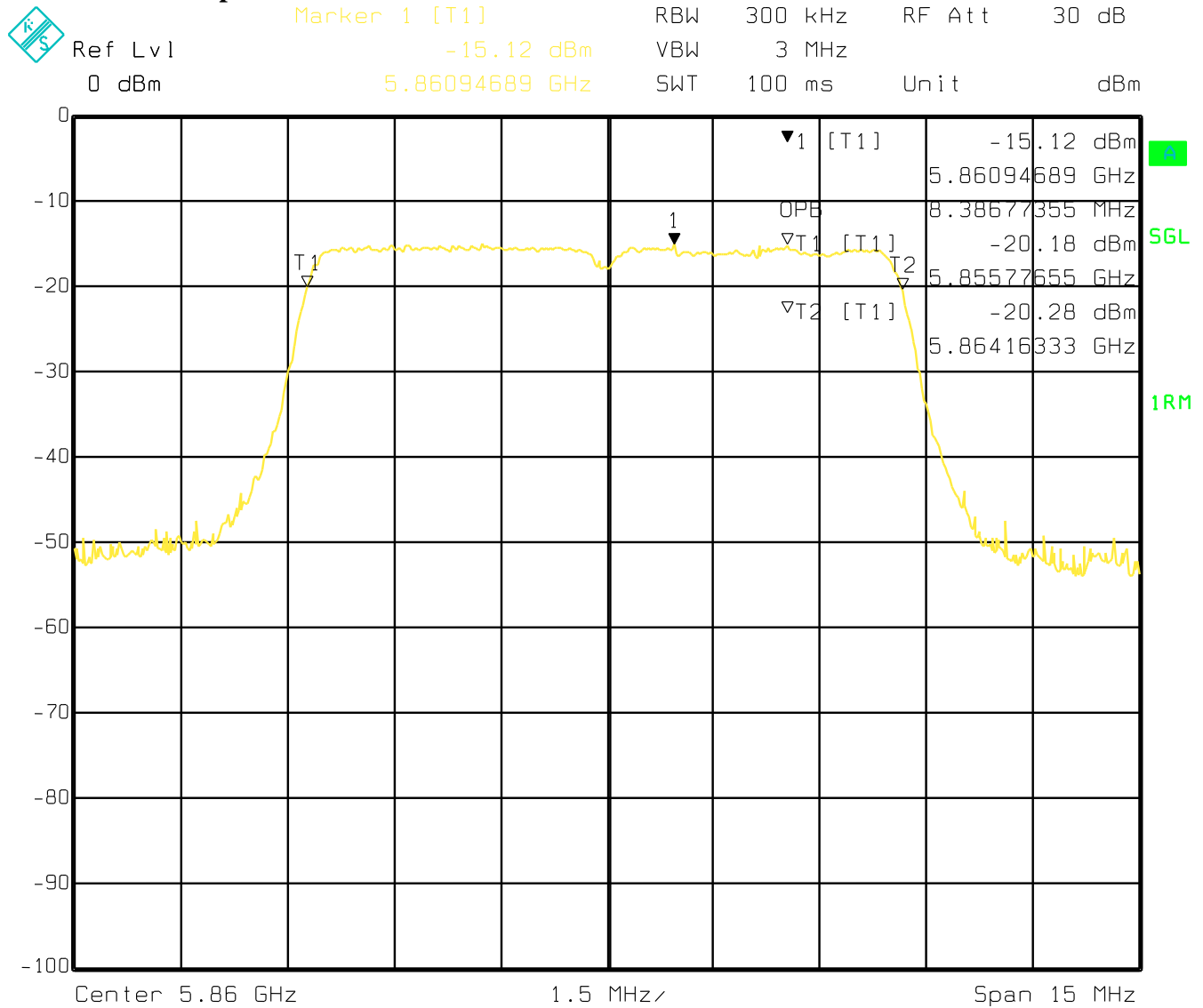
Marker 1 [T1]   RBW   300 kHz   RF Att   30 dB

Ref Lvl   -15.12 dBm   VBW   3 MHz

0 dBm   5.86094689 GHz   SWT   100 ms   Unit   dBm

▼1 [T1]	-15.12 dBm	
	5.86094689 GHz	
OPB	8.38677355 MHz	
▽T1 [T1]	-20.18 dBm	
	5.85577655 GHz	
▽T2 [T1]	-20.28 dBm	
	5.86416333 GHz	

A

SGL

1RM

Center 5.86 GHz   1.5 MHz/   Span 15 MHz

Date: 03.DEC.2009   09:46:00

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	Marker 1 [T1]		RBW	300 kHz	RF Att	30 dB
Ref Lvl		-15.52 dBm	VBW	3 MHz		
0 dBm		5.88694890 GHz	SWT	100 ms	Unit	dBm


```
  0
                                              ▼1  [T1]        -15.52 dBm      ▲
                                                            5.88694890 GHz
 -10                                          OPB            8.41683367 MHz   SGL
                        1                     ▽T1 [T1]        -20.27 dBm
 -20      T 1                                      T2        5.88577655 GHz
                                              ▽T2 [T1]        -20.91 dBm
                                                            5.89419339 GHz
 -30
                                                                             1RM
 -40

 -50

 -60

 -70

 -80

 -90

-100
      Center 5.89 GHz              1.5 MHz/              Span 15 MHz
```

Date: 03.DEC.2009   09:46:52

Marker 1 [T1]		RBW	300 kHz	RF Att	30 dB
Ref Lvl	-15.52 dBm	VBW	3 MHz		
0 dBm	5.88694890 GHz	SWT	100 ms	Unit	dBm

▼1 [T1]   -15.52 dBm
                 5.88694890 GHz
OPB   8.41683367 MHz
▽T1 [T1]   -20.27 dBm
                 5.88577655 GHz
▽T2 [T1]   -20.91 dBm
                 5.89419339 GHz

SGL

1RM

Center 5.89 GHz   1.5 MHz/   Span 15 MHz
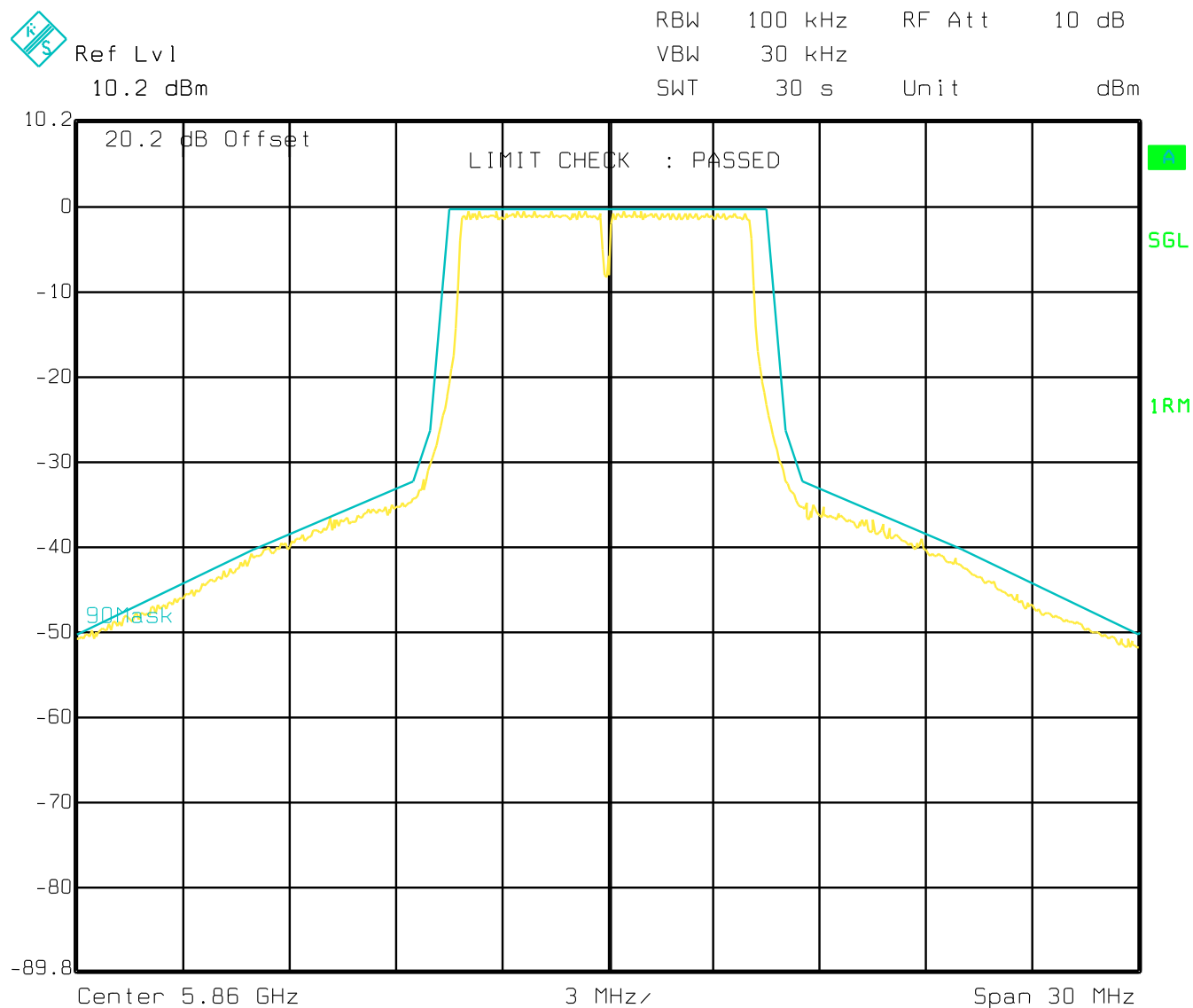
Date: 03.DEC.2009   09:46:52

CETECOM™
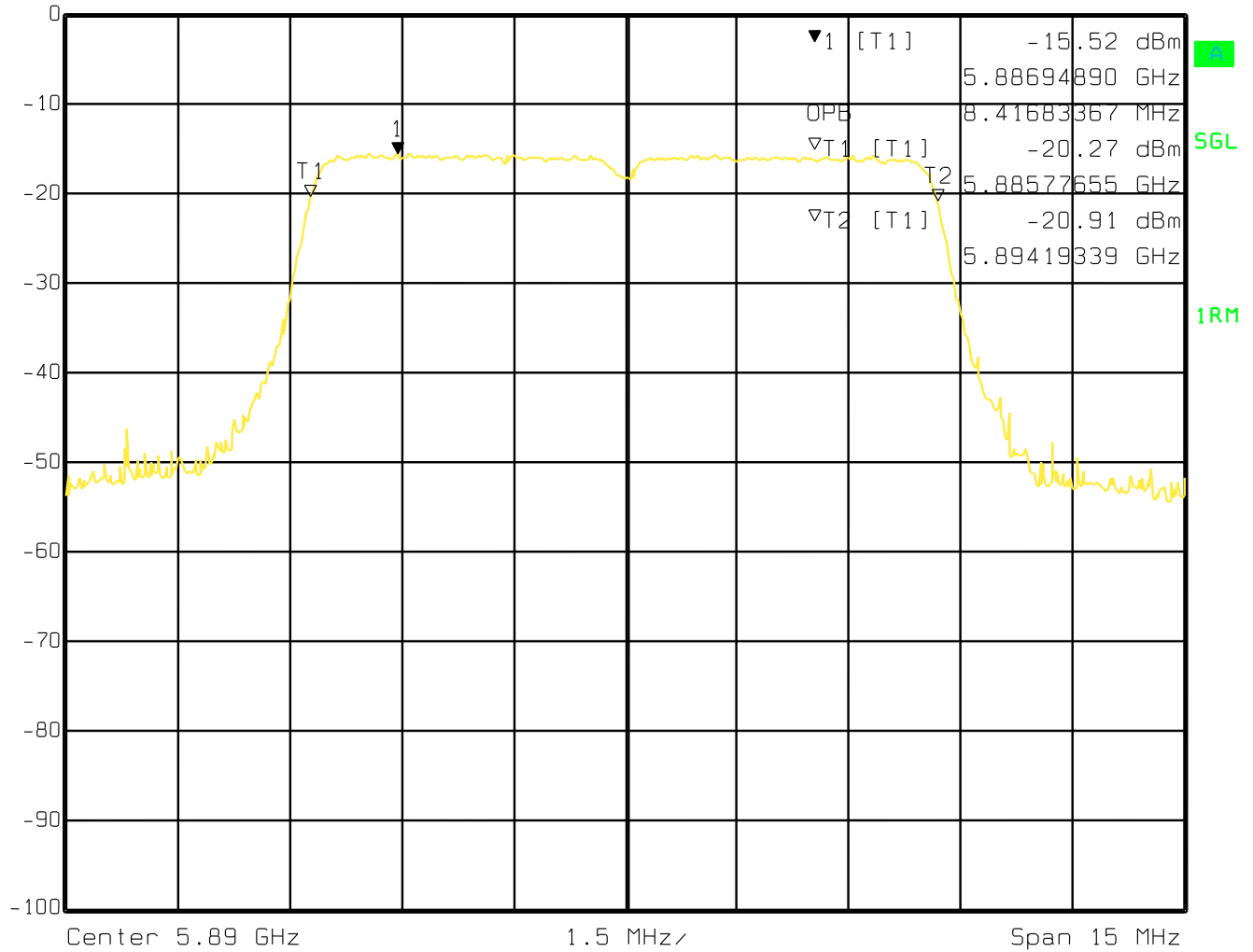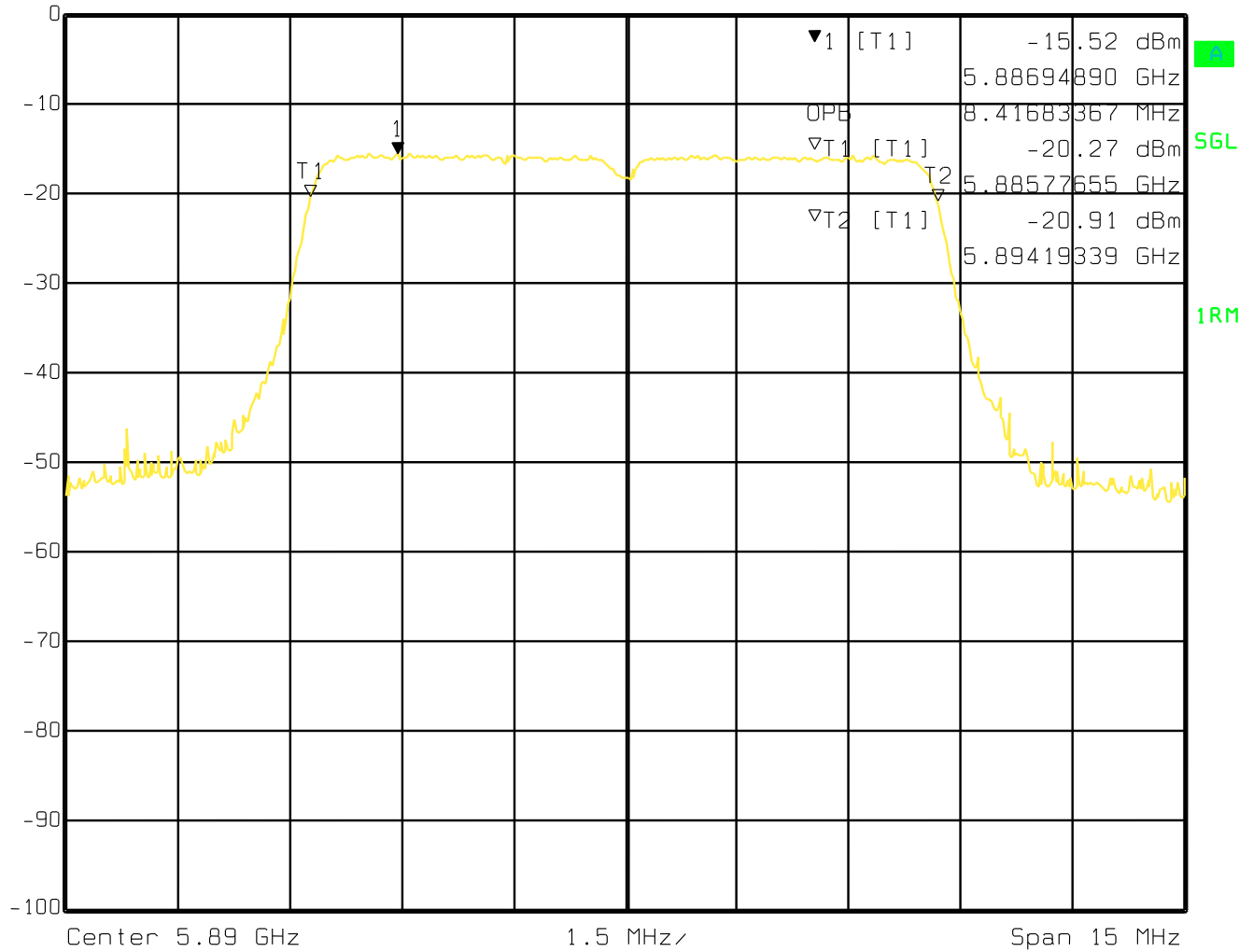
6.5   Transmit Spectrum Mask
90.210, 90.379, ASTM 8.9.2

EUT is Class C equipment

Date: 02.DEC.2009   10:54:52

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		RBW	100 kHz	RF Att	10 dB
Ref Lvl		VBW	30 kHz		
10.2 dBm		SWT	30 s	Unit	dBm

20.2 dB Offset   LIMIT CHECK : PASSED

90Mask

Center 5.89 GHz   3 MHz/   Span 30 MHz

Date: 02.DEC.2009   11:04:59

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RBW	100 kHz	RF Att	10 dB
VBW	30 kHz		
SWT	30 s	Unit	dBm

Ref Lvl

10.2 dBm

20.2 dB Offset   LIMIT CHECK : PASSED

SGL

1RM

90Mask

Center 5.92 GHz   3 MHz/   Span 30 MHz
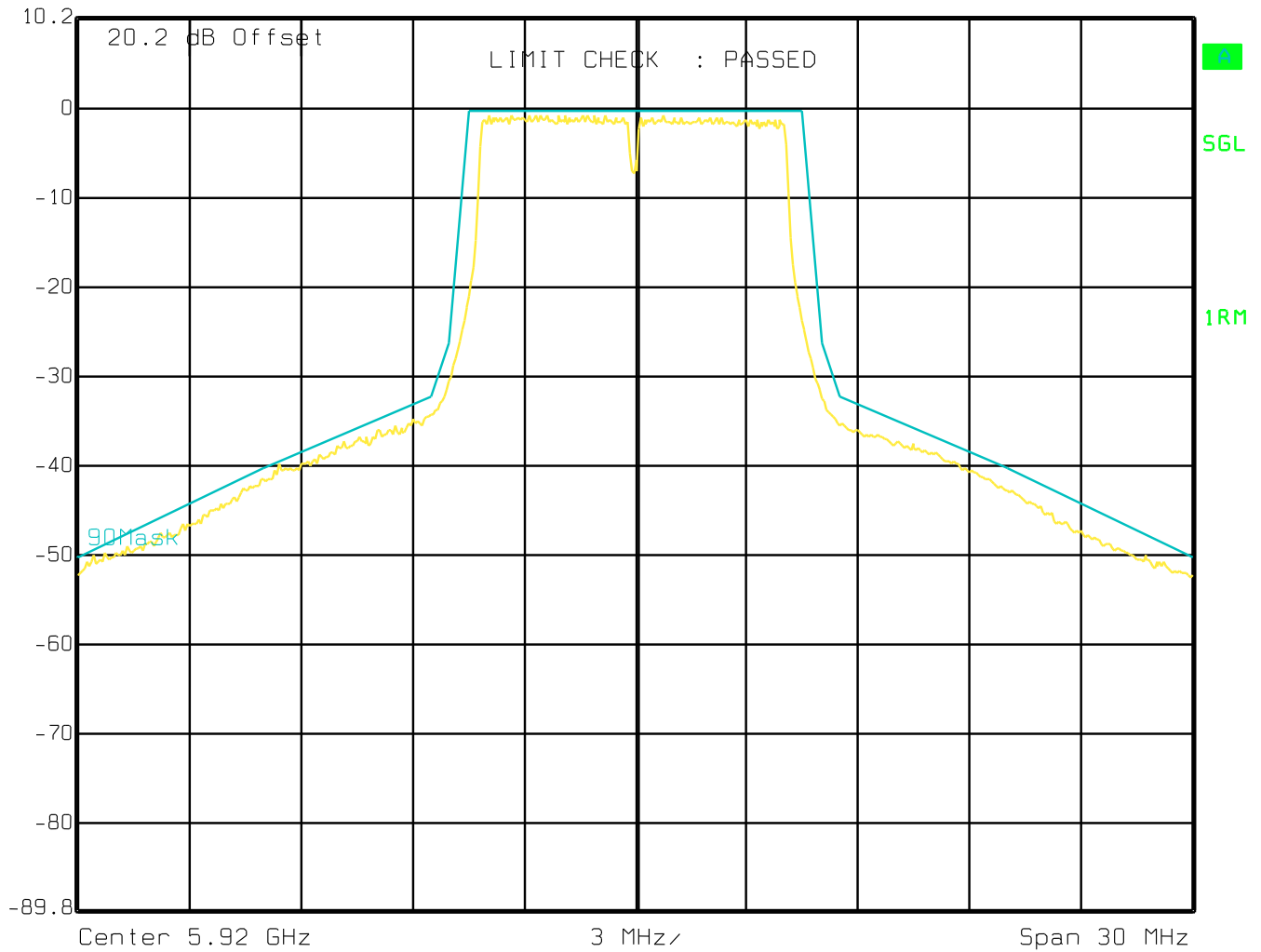
Date: 02.DEC.2009   11:00:26

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6.6   Frequency Tolerance
FCC 2.1055, 90.213, 90.379, ASTM 8.9.4

6.6.1   Limits:
10 ppm

6.6.2   Results:

Expected Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (kHz)	Frequency Error (ppm)
5860	5859.9979	-2.067	-0.3527
5870	5869.9979	-2.067	-0.3521
5880	5879.9978	-2.192	-0.3728
5890	5889.9981	-1.94	-0.3294
5900	5899.9979	-2.067	-0.3503
5910	5909.9971	-2.943	-0.4980
5920	5919.9978	-2.192	-0.3703

Temperature ºC	Frequency (MHz)	Frequency Error (kHz)	Frequency Error (ppm)
55	5889.9716	-28.357	-4.8144
50	5889.9716	-28.357	-4.8144
40	5889.9801	-19.852	-3.3705
30	5889.9817	-18.349	-3.1153
20	5889.9981	-1.94	-0.3294
10	5890.0071	7.114	1.2078
0	5890.0183	18.337	3.1132
-10	5890.0258	25.752	4.3722
-20	5890.0187	18.737	3.1812
-30	5890.0007	0.701	0.1190

6.7 Transmitter Spurious Emissions- Conducted
6.7.1 Limits
-25 dBm

6.7.2 Test data/ plots:

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	Marker 2 [T2]	RBW	100 kHz	RF Att	30 dB
Ref Lvl	-26.73 dBm	VBW	30 kHz		
20.4 dBm	5.85496994 GHz	SWT	68 ms	Unit	dBm

20.4 dB Offset
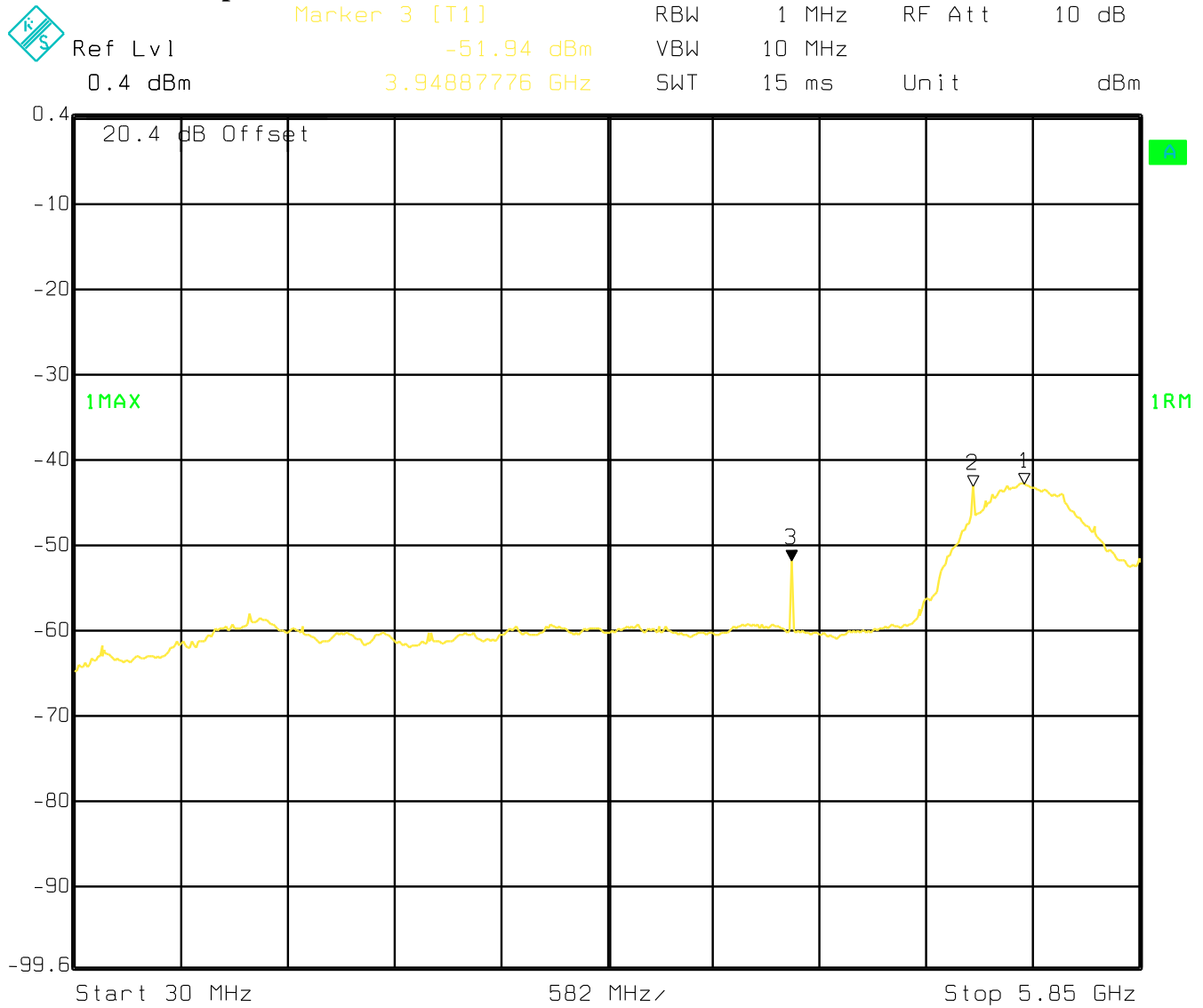
▼2 [T2]   -26.73 dBm
5.85496994 GHz
▽1 [T1]   -25.80 dBm
5.92503006 GHz

1VIEW
2VIEW

1RM
2RM

Start 5.85 GHz   8 MHz/   Stop 5.93 GHz
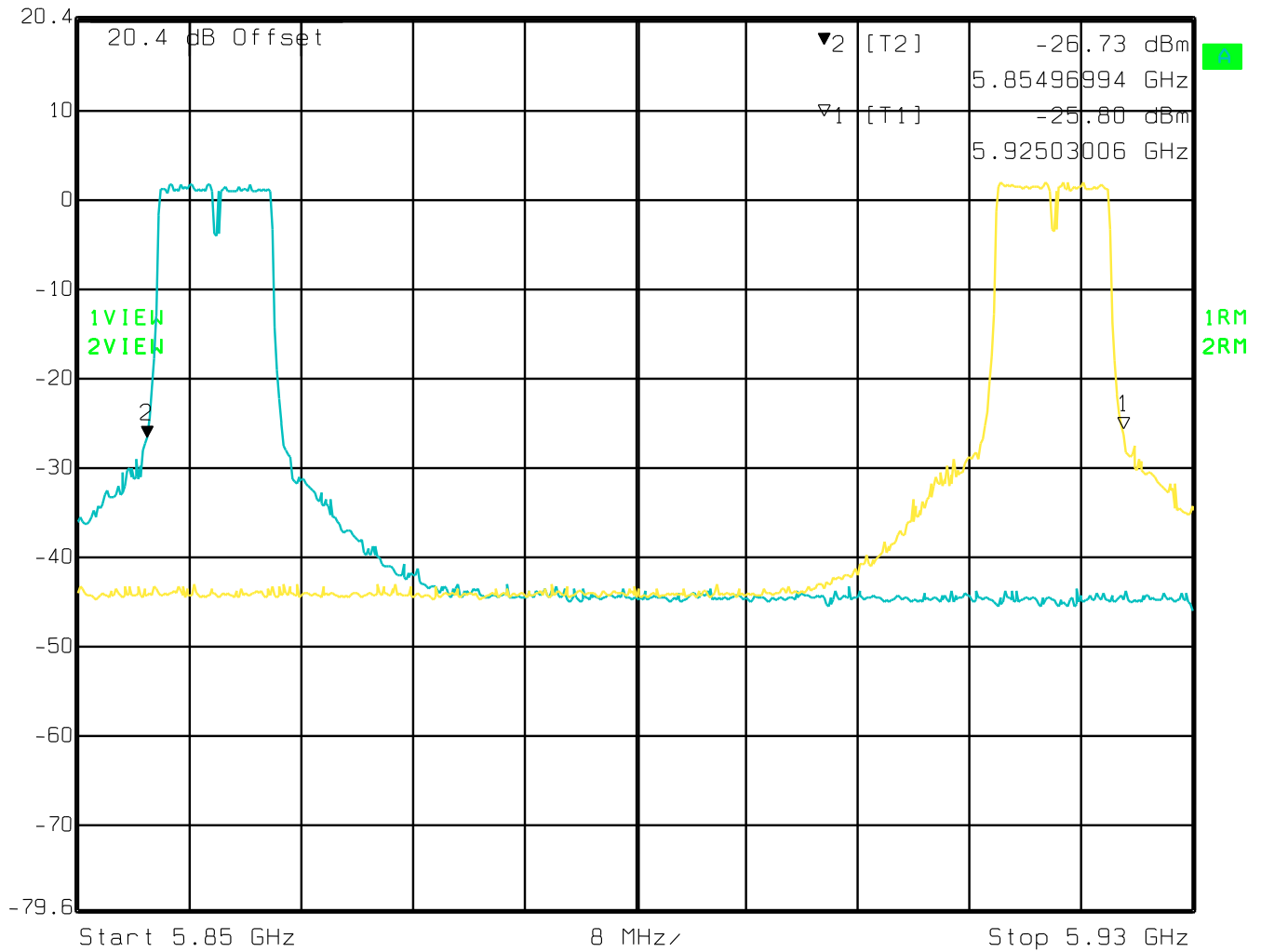
Date: 03.DEC.2009   10:02:08

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	Marker 1 [T1]	RBW	100 kHz	RF Att	20 dB
Ref Lvl	-54.80 dBm	VBW	30 kHz		
10.4 dBm	6.58955912 GHz	SWT	17.5 s	Unit	dBm

```
10.4
      20.4 dB Offset                              ▼1 [T1]        -54.80 dBm    ▲
                                                               6.58955912 GHz
   0
                                                                              1RM
 -10

 -20

 -30

 -40

 -50
    1
    ▼
 -60

 -70

 -80

-89.6
    Start 5.93 GHz              2.057 GHz/            Stop 26.5 GHz
```
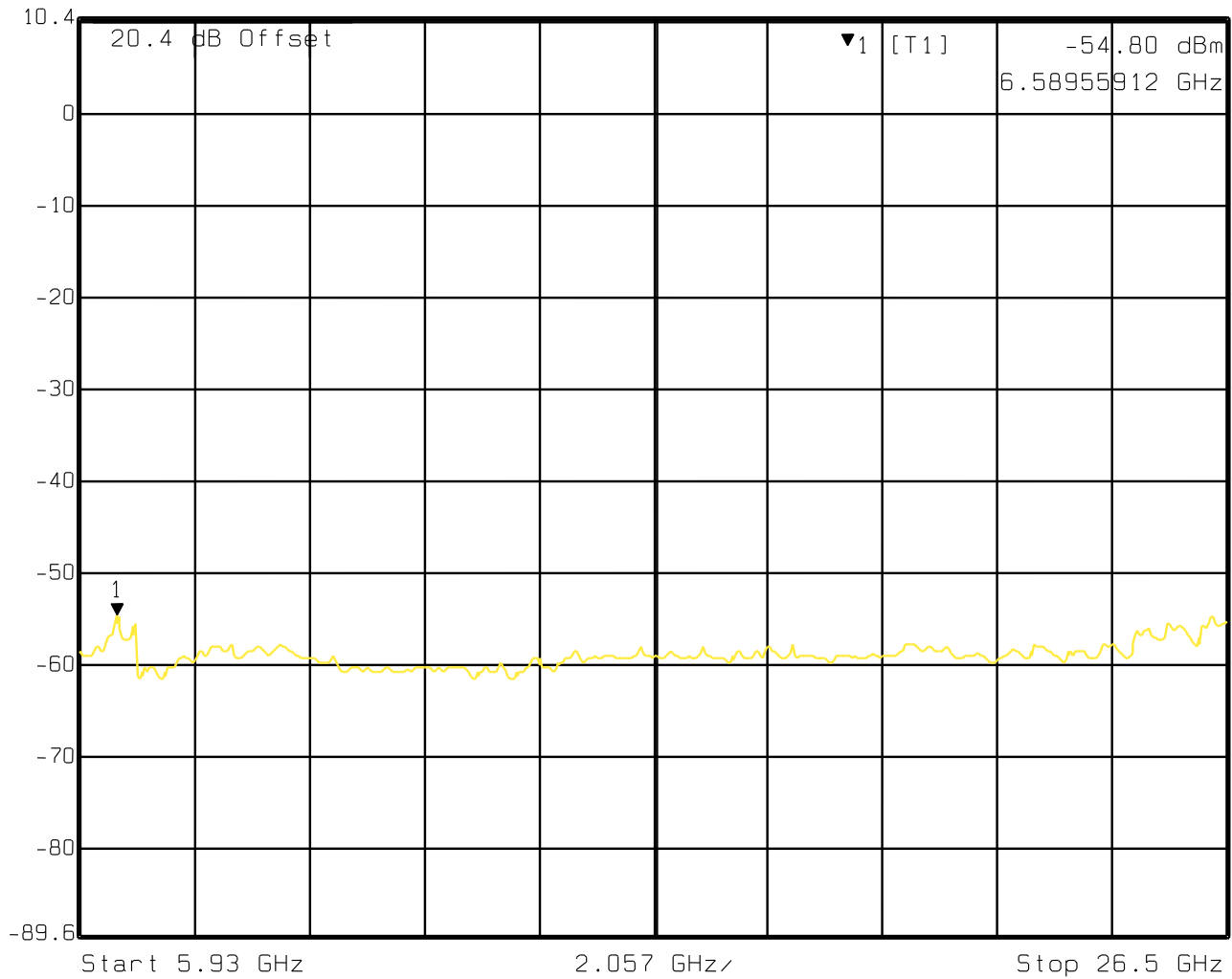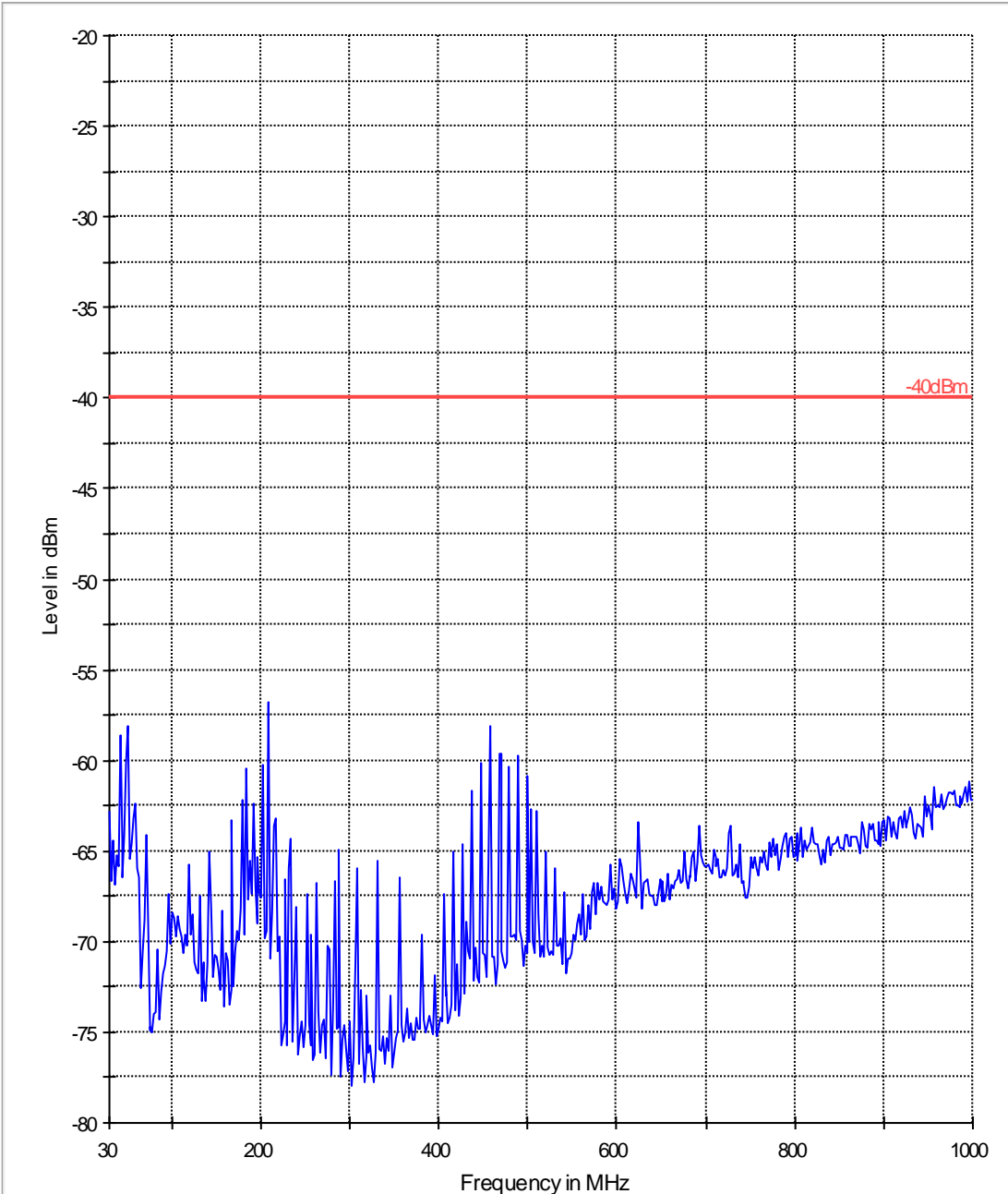
Date: 03.DEC.2009   10:04:50

6.8   Transmitter Spurious Emissions- Radiated
6.8.1   Test Result:

30-1

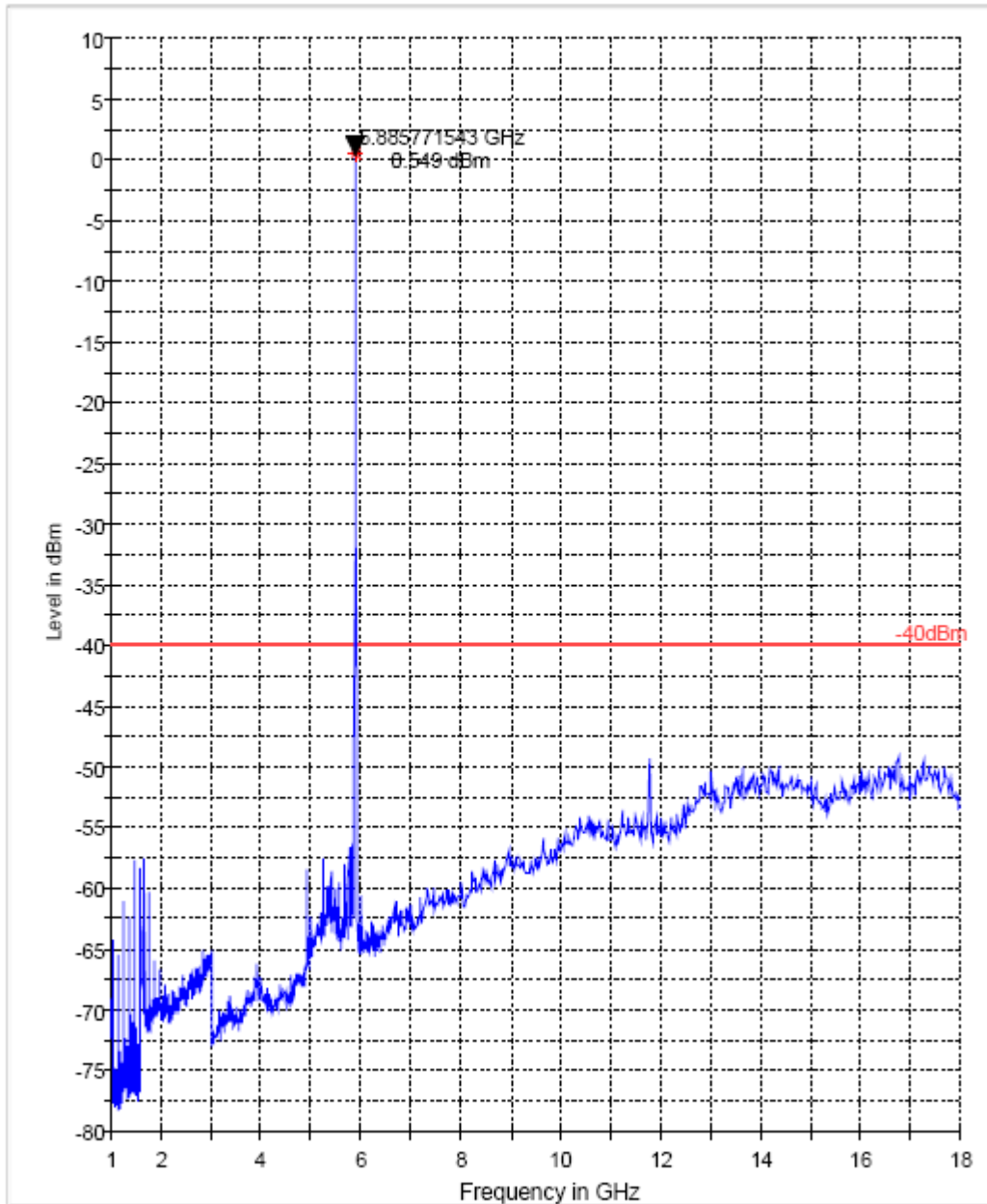FCC 90 30-1GHz

-40dBmLimitLine   Preview Result 1

5860

FCC 90 1-18GHz

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5890

FCC 90 1-18GHz

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5920

FCC 90 1-18GHz

CETECOM™

FCC 90 18-40GHz

Horizontal and Vertical Polarizations, Worst case for all channels

7   Test Equipment and Ancillaries used for tests
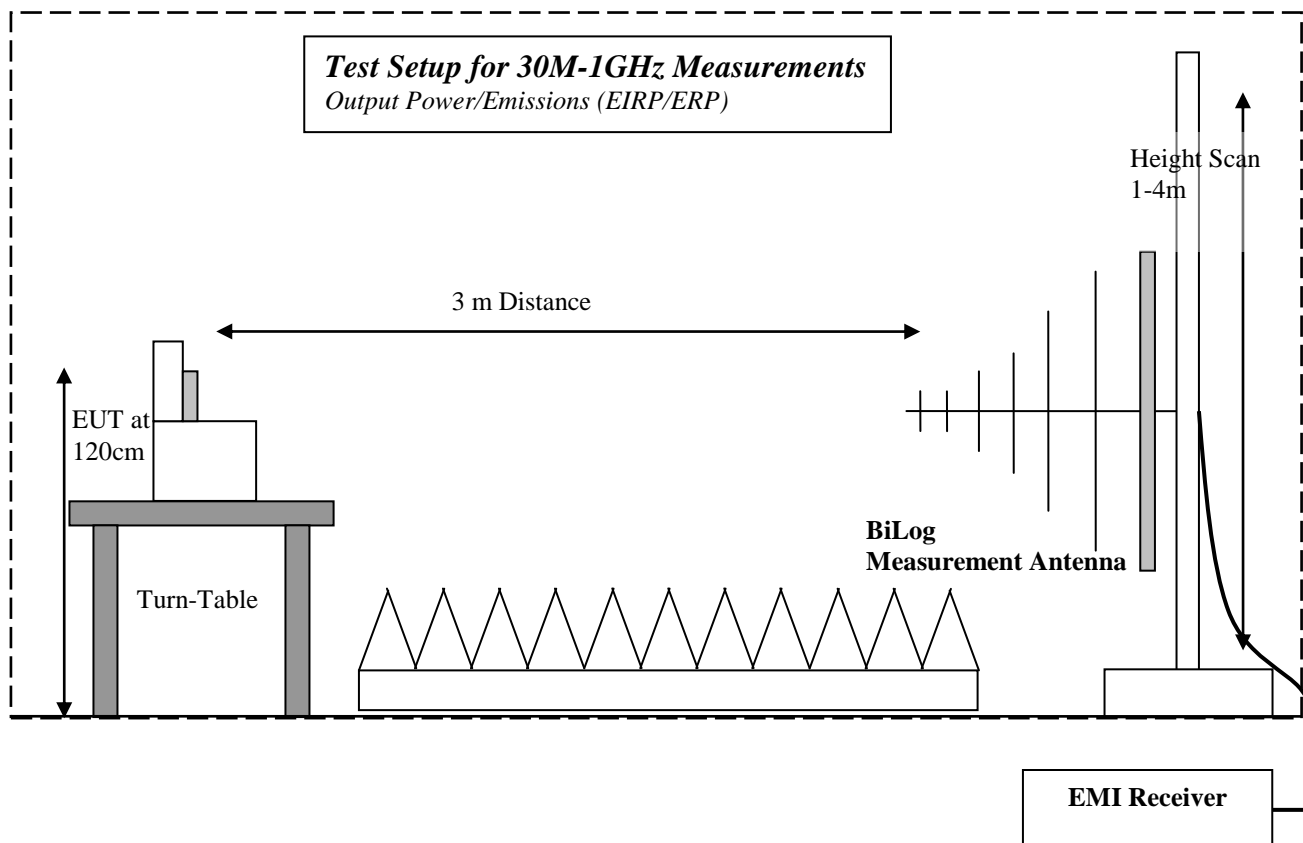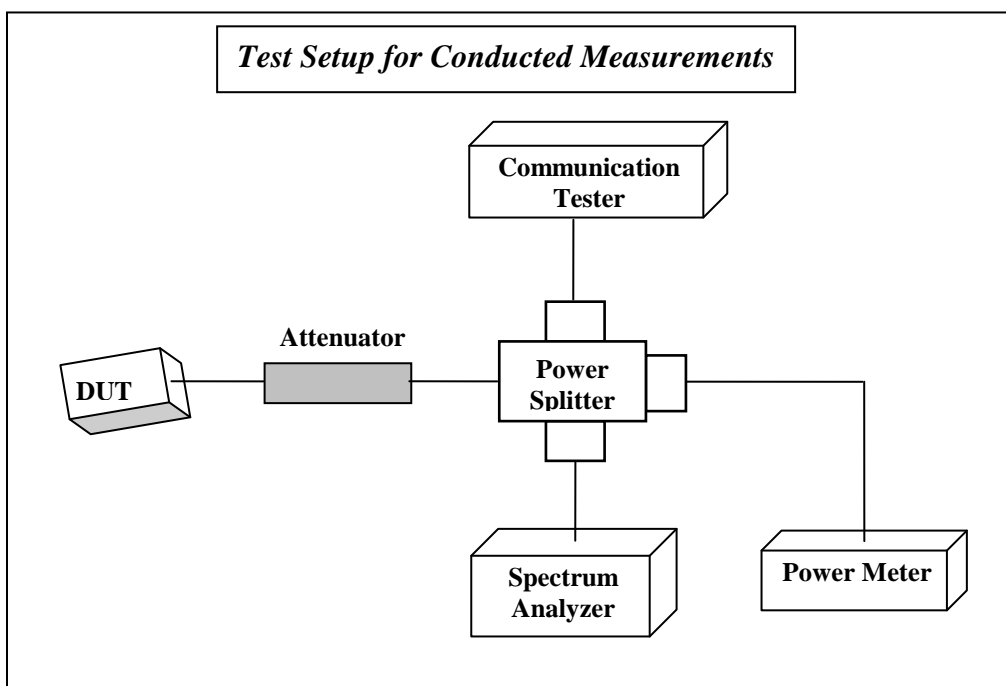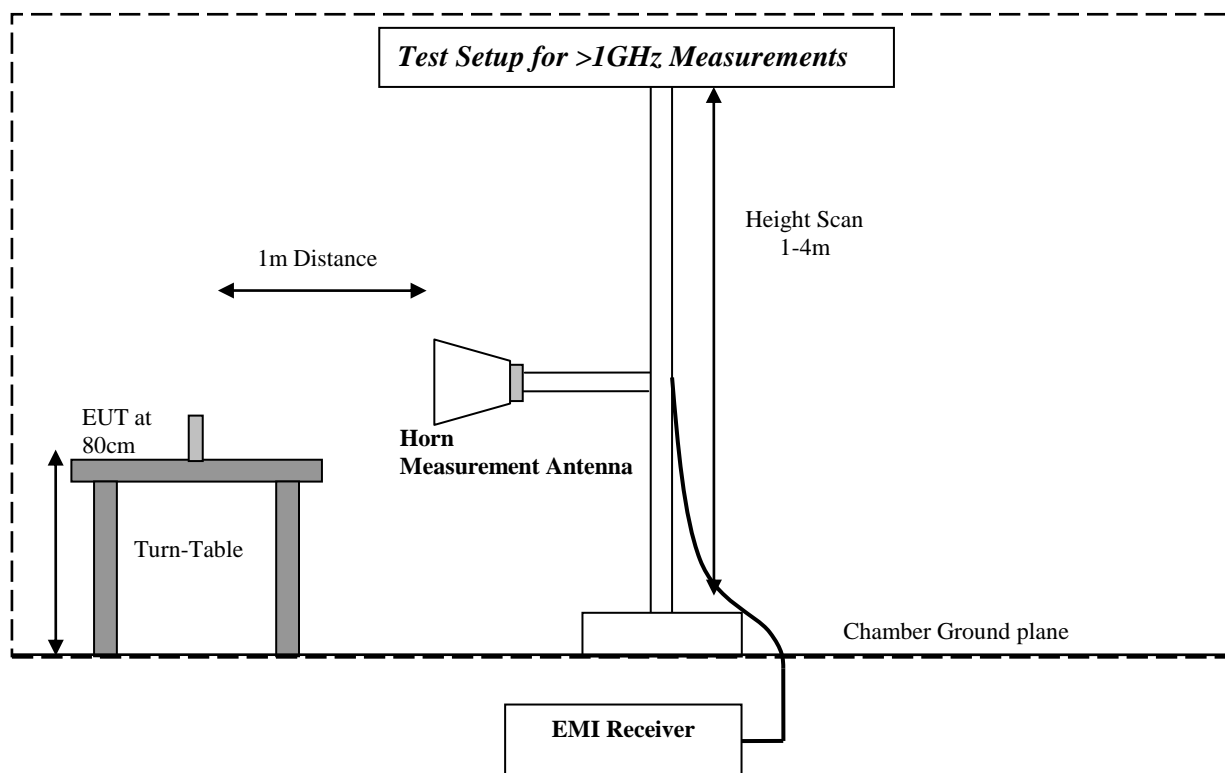
No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due	Interval
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2010	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	May 2010	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2010	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2010	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2010	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2010	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2010	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2010	1 year
10	High Pass Filter	5HC2700	Trilithic Inc.	9926013	n/a	n/a
11	High Pass Filter	4HC1600	Trilithic Inc.	9922307	n/a	n/a
12	Pre-Amplifier	JS4-00102600	Miteq	00616	May 2010	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2010	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2010	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2010	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2010	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2010	2 years

8   BLOCK DIAGRAMS

Test Setup for Conducted Measurements

Test Setup for 30M-1GHz Measurements
Output Power/Emissions (EIRP/ERP)

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Test Setup for >1GHz Measurements

Height Scan
1-4m

1m Distance

EUT at
80cm

**Horn
Measurement Antenna**

Turn-Table

Chamber Ground plane

EMI Receiver

9   <u>Revision History</u>

Date	Report Name	Changes to report	Report prepared by
2010-02-08	EMC_CETE4_012_90M	Original	Marc
2010-02-22	EMC_CETE4_012_90M_Rev1	Updated output power, added modulation characteristics	Marc