



## Test Report for RAY240 Radio

### CFR 47 Part 80: Conducted Emissions from Antenna Port

**Test Report Number: 552/1041**

Approved	Adil Abbas International Compliance Manager		02/06/2004
Technical Check	Peter Bowen Senior EMC Test Engineer		11/03/2004
Administrative Check	Chris Bird Approvals Manager		02/06/2004
Report	Andy Little EMC Engineer		04/03/04
Report Date	04/03/04	Test Date	04/03/04

The test data and results contained within this report relate only to the items tested.

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Any reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%. Any uncertainty evaluation has been carried out with reference to CISPR16-4:2002.

## 1 Purpose of Tests

Initial FCC compliance test of the RAY 240 Radio, in accordance with 47 CFR Parts 80.211, 2.1051

## 2 Description of Equipment under Test (EUT)

(To include all equipment being tested)

Date of Receipt:	23 <sup>rd</sup> February 2004
Client:	Raymarine Communications group
Brand Name:	Raymarine
Product Range:	Communications
Country of Manufacture:	England
Operational voltage range:	10.8 to 15.6V (Tolerant of 24V but will not transmit or receive)

### Unit 1

Model Name or Number:	<b>RAY240 VHF Transceiver (US Version)</b>	
Unique Type Identification:	R49129	
FCC ID Number	PJ5RAY240	
Serial Number:	EMC230204a	
Circuit Diagram Number(s) & Issue:	Processor Board	4552-007 Issue Y
	Interconnect Board	4552-022 Issue F
	RF Board	4552-039 Issue G
PCB Assembly Number(s) & Issue:	Processor Board	3015-291 Issue C
	Interconnect Board	3015-295 Issue D
	RF Board	4552-001 Issue D
Software Version:	V0.13	
Modifications to Unit:	None	

### Unit 2

Model Name or Number:	<b>RAY240 Handset (US Version)</b>	
Unique Type Identification:	E45009	
Serial Number:	EMC230204b	
Circuit Diagram Number(s) & Issue:	4552-008 Issue s	
PCB Assembly Number(s) & Issue:	3015-292 Issue e	
Software Version:	H0.06	
Modifications to Unit:	None	

### Unit 3

Model Name or Number:	<b>RAY240 Active Speaker</b>	
Unique Type Identification:	E45003	
Serial Number:	EMC230204c	
Circuit Diagram Number(s) & Issue:	4552-009j	
PCB Assembly Number(s) & Issue:	3015-294a	
Software Version:	N/A	
Modifications to Unit:	None	

## 3 Description of Auxiliary Equipment

(To include all equipment associated with the EUT(s) which are NOT directly subjected to the test)

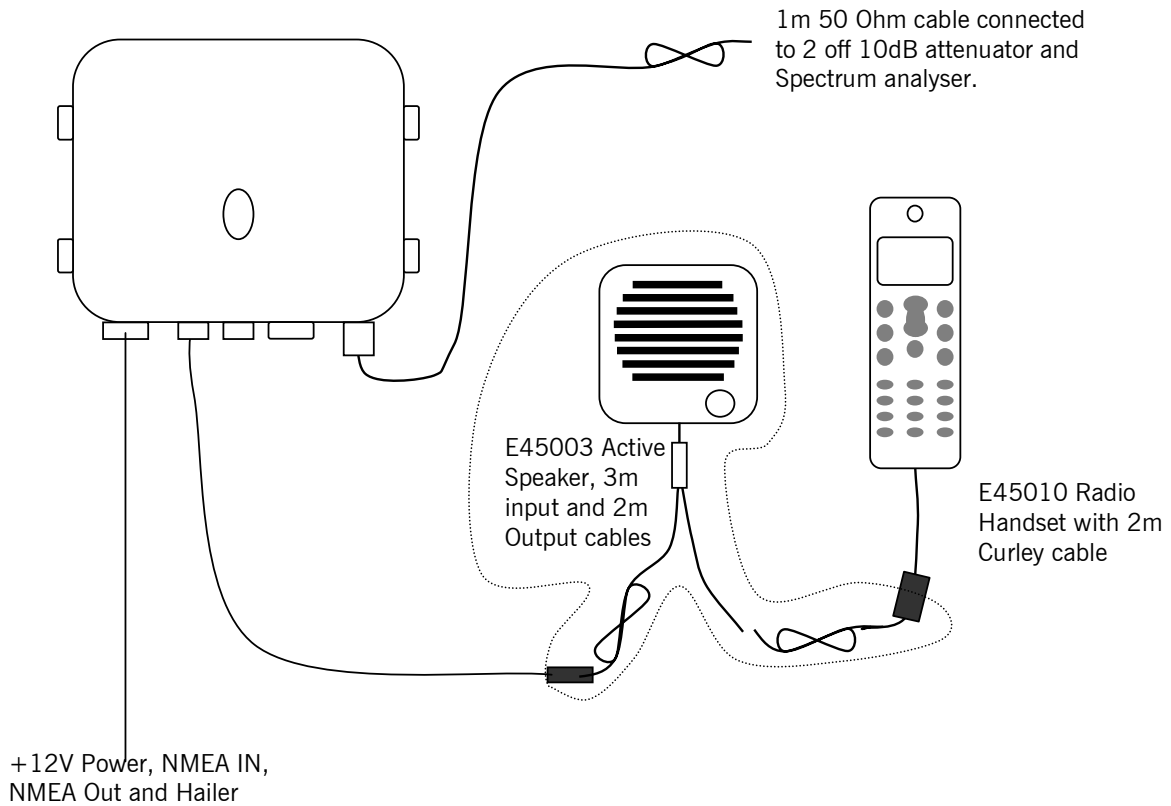
Item	Unique Type Identification & Serial Number
	None

### 4 General

Supply Voltage	Ambient Temperature	Relative Humidity
12V	24°C	25%

### 5 Test Configuration

(See Section 2 Description of Equipment under Test (EUT) and Section 2 Description of Auxiliary Equipment for Description of Equipment)



Title	Description
Test Setup and Operating Mode	Setup as per diagram Section 5 Operating mode of the radio was standard transmit at 25W on channel 68 (156.425MHz).

## 6 Transmit Mode Limit Line Calculation

Centre Frequency 156.425MHz  
 Declared Bandwidth 16kHz

Test frequency Range 9kHz to 1.56425GHz (Tested to 2GHz)

Mean power of Transmitter 23.4W

Therefore limit (dBc) =  $43 + 10 \log_{10}(\text{Mean Power}) = 56.69\text{dBc}$

Frequency (Band start)	Frequency (Band stop)	Limit (dBc)	Limit (dBm)
9kHz	156.385MHz	56.2dBc	-13dBm
156.385MHz	156.409MHz	35dBc	8.69dBm
156.409MHz	156.417MHz	25dBc	18.69dBm
156.417MHz	156.433MHz	Carrier	Carrier
156.433MHz	156.441MHz	25dBc	18.69dBm
156.441MHz	156.465MHz	35dBc	8.69dBm
156.465MHz	2GHz	56.2dBc	-13dBm

## 7 Test Results

Test Description	See Page	Result
9kHz to 2GHz FCC CFR47 Part 80.211 and Part 2.1051		
Graph of peak emissions and table of peak measurements	5	PASS

Resolution Bandwidths Used


9kHz to 150kHz	200Hz
150kHz to 30MHz	10kHz
30MHz to 1GHz	100kHz
1 to 2 GHz	1MHz
150 to 160MHz	3kHz
156.425MHz Span 200kHz	3kHz

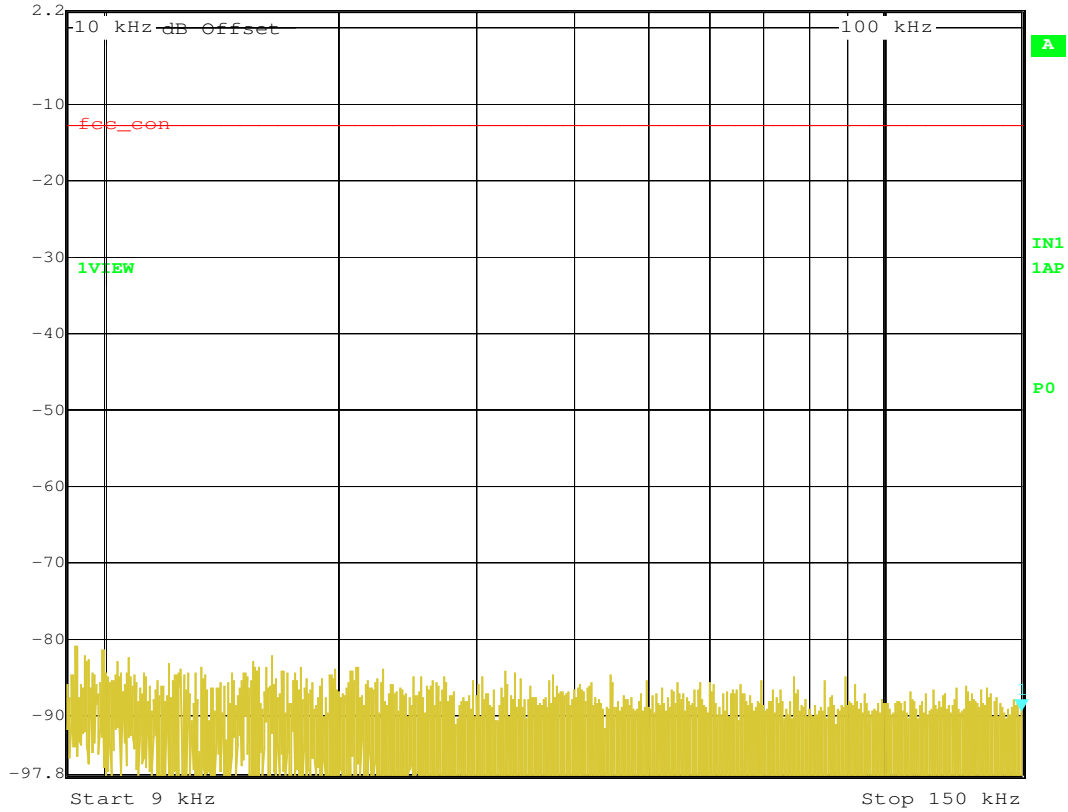
## 8 Comments and Circuit Modifications

The conducted emissions were measured over the band 9kHz to 2GHz; all emissions from the unit were greater than 20dB below the limit. The unit is therefore considered to meet the requirements of the standard.

## 9 Conducted Emissions Graphs


### 9.1 9kHz to 150kHz

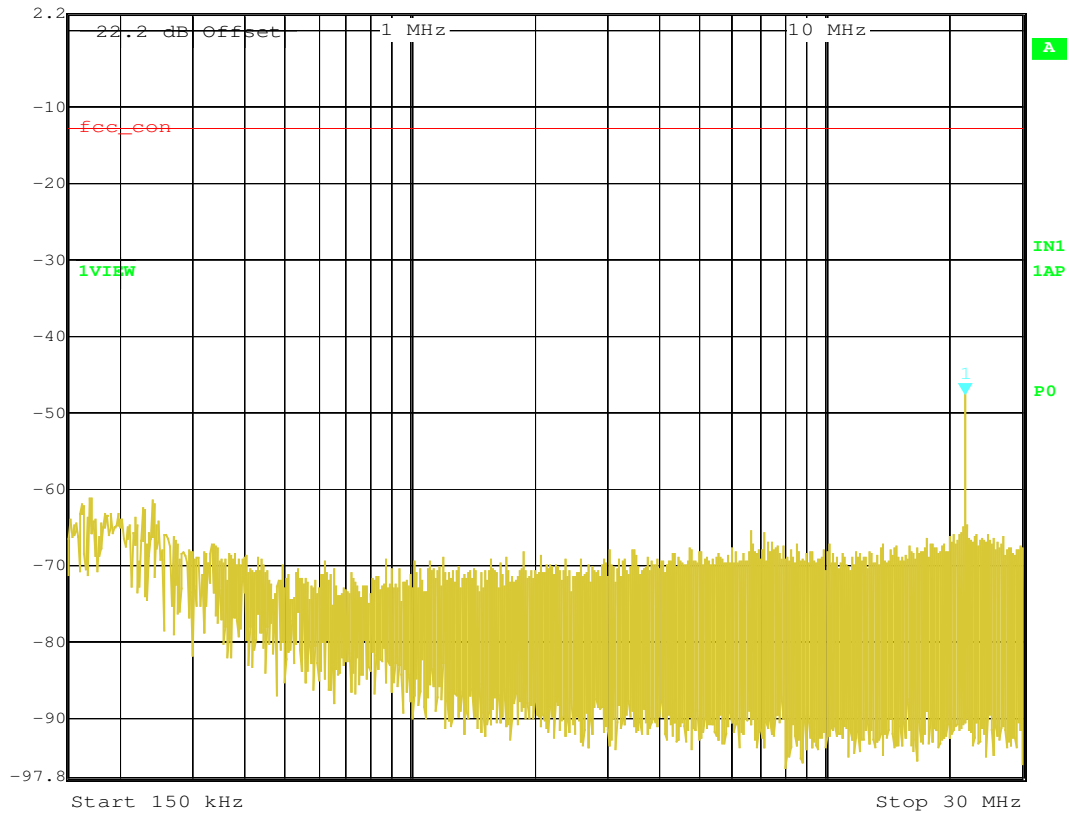
 Marker 1 [T1] RBW 200 Hz RF Att 20 dB  
Ref Lvl -89.47 dBm VBW 200 Hz  
2.2 dBm 150.00000000 kHz SWT 18 s Unit dBm



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### 9.2 150kHz to 30MHz

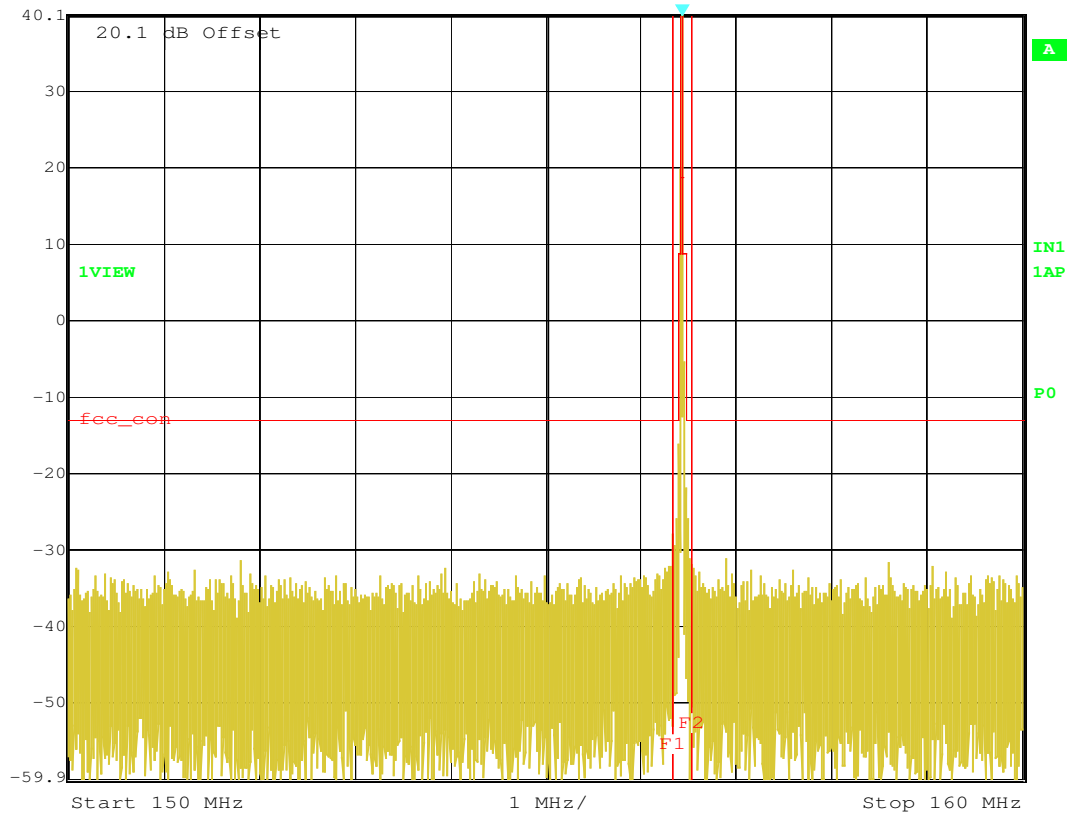
 Marker 1 [T1] RBW 10 kHz RF Att 20 dB  
Ref Lvl -47.70 dBm VBW 10 kHz  
2.2 dBm 21.81638444 MHz SWT 1.15 s Unit dBm



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### 9.3 150 to 160MHz

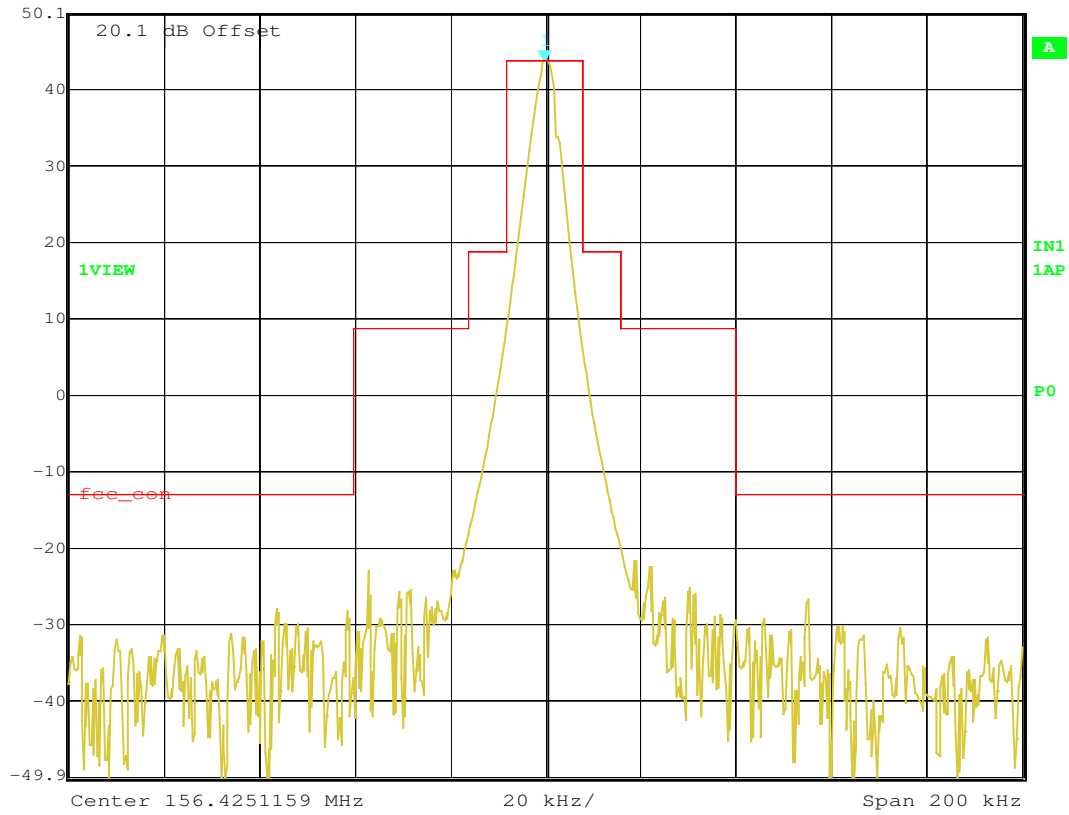
 Marker 1 [T1] RBW 3 kHz RF Att 60 dB  
Ref Lvl 43.65 dBm VBW 3 kHz  
40.1 dBm 156.42500000 MHz SWT 2.8 s Unit dBm



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### 9.4 156.425MHz Span 200kHz


 Marker 1 [T1] RBW 3 kHz RF Att 60 dB  
Ref Lvl 43.69 dBm VBW 3 kHz  
50.1 dBm 156.4250000 MHz SWT 56 ms Unit dBm

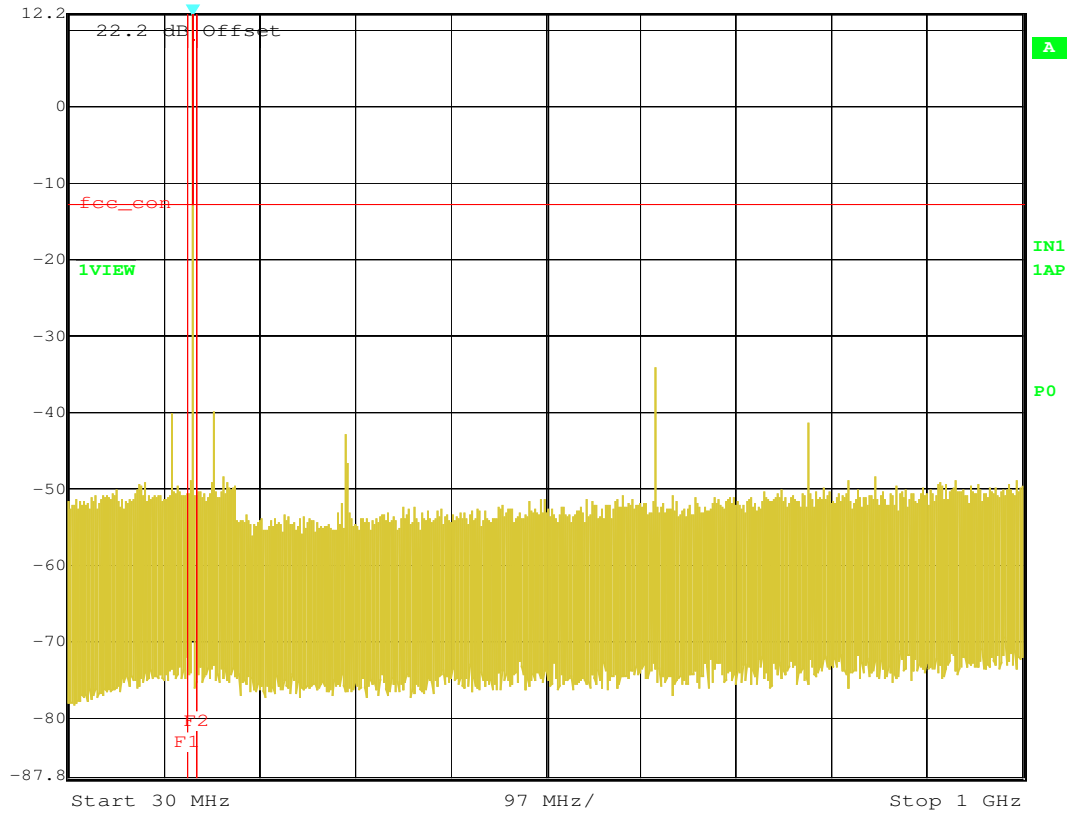


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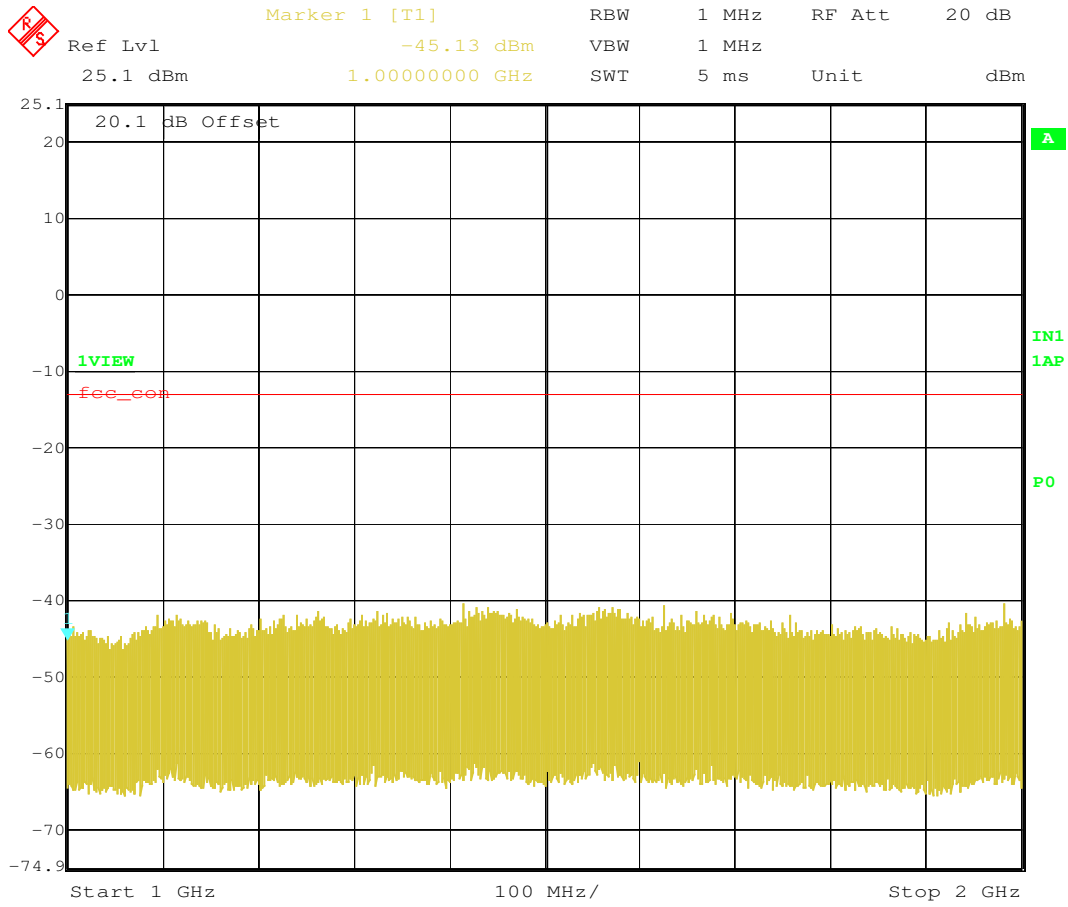
### 9.5 30MHz to 1GHz

 Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
Ref Lvl 11.94 dBm VBW 100 kHz  
12.2 dBm 156.4250000 MHz SWT 300 ms Unit dBm



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9.6 1GHz to 2GHz



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10 List of Test Equipment

Test Equipment Type	Manufacturer and Type Number	Serial Number	TE No.
EMI Test Receiver 20Hz to 26.5GHz	Rohde & Schwarz ESI	832692/006	886
DVM	Fluke Model 83	63550394	1420
Power Supply	Palstar PS30M	520350607	1238
Attenuator 1 (25W, 10dB)	Inmet Corp FSC64671 6N25W-10dB	Supplied by Customer, Combined Calibration results for both attenuators held on file	
Attenuator 2 (25W, 10dB)	Bird Electronics Corp Mod 25-A-MFW-10 0121		
Notch Filter	VHF Notch filter	Supplied by Customer, Calibration results held on file	

In accordance with UKAS requirements, all measuring equipment is on a calibration cycle.