FCC Measurement/Technical Report on

NAR Compensor

FCC ID: RK7MBC-NAR
IC: 4774A-MBCNAR

Test Report Reference: MDE_NOVER_1615_FCCa_REV1

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Table of Contents

1 Applied Standards and Test Summary 4
1.1 Applied Standards 4
1.2 FCC-IC Correlation Table 5
1.3 Measurement Summary / Signatures 6

2 Administrative Data 15
2.1 Testing Laboratory 15
2.2 Project Data 15
2.3 Applicant Data 15
2.4 Manufacturer Data 15

3 Test object Data 16
3.1 General EUT Description 16
3.2 EUT Main components 17
3.3 Ancillary Equipment 17
3.4 Auxiliary Equipment 17
3.5 EUT Setups 18
3.6 Operating Modes 18
3.7 Product labelling 18

4 Test Results 19
4.1 Authorized Frequency Band 19
4.2 Maximum Power 27
4.3 Maximum Booster Gain 36
4.4 Intermodulation 39
4.5 Out-of-band Emission 47
4.6 Conducted Spurious Emissions 62
4.7 Maximum Transmitter Noise Power 73
4.8 Variable Uplink Noise Timing 81
4.9 Uplink Inactivity 86
4.10 Variable Booster Gain 90
4.11 Variable Uplink Gain Timing 95
4.12 Occupied Bandwidth 100
4.13 Oscillation Restart 113
4.14 Oscillation Shutdown or Mitigation 118
4.15 Radiated Spurious Emissions 123

5 Test Equipment 134

6 Antenna Factors, Cable Loss and Sample Calculations 137
6.1 LISN R&S ESH3-Z5 (150 kHz – 30 MHz) 137
6.2 Antenna R&S HFH2-Z2 (9 kHz – 30 MHz) 138

6.3 Antenna R&S HL562 (30 MHz – 1 GHz) 139
6.4 Antenna R&S HF907 (1 GHz – 18 GHz) 140
6.5 Antenna EMCO 3160-09 (18 GHz – 26.5 GHz) 141
6.6 Antenna EMCO 3160-10 (26.5 GHz – 40 GHz) 142

7 Measurement Uncertainties 143

8 Photo Report 143

1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Type of Authorization
Certification for a Wideband Consumer signal Booster.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 20, 22, 24, 27 (10-1-15 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 20, Commercial Mobiles Services

§ 20.21 Signal Boosters

Part 22, Subpart H – Cellular Radiotelephone Service

§ 22.905 – Channels for cellular service
$ 22.913 – Effective radiated power limits
§ 22.917 – Emission limitations for cellular equipment

Part 24 E – Personal Communication Services

§ 24.229 - Frequencies
§ 24.232 – Power and antenna height limits
§ 24.238 – Emission limitations for Broadband PCS equipment

Part 27 – Miscellaneous Wireless Communication Services

§ 27.5 (b), (c) - Frequencies
§ 27.50 (b) (c) – Power limits and duty cycle
§ 27.53 (c), (f), (g), (h) – Emission limits

The tests were selected and performed with reference to the **FCC Public Notice 935210** applying **"Wideband Consumer Signal Booster Compliance Measurement Guidance" 935210 D03 v04, 2016-02-12.**

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 1.3 Measurement Summary / Signatures.

1.2 FCC-IC CORRELATION TABLE

Correlation of measurement requirements for Wideband Consumer Signal Booster from FCC and ISED Canada

Measurement	FCC reference	ISED reference
Anti-oscillation	§20.21(e)(8)(ii)(A) §20.21(e)(5)	RSS-131 Issue 3: 5.1.1.1
Gain control	§20.21(e)(8)(ii)(B)	RSS-131 Issue 3: 5.1.1.2
Power down	§20.21(e)(8)(i)(H)	RSS-131 Issue 3: 5.1.1.3
Interference avoidance for wireless subsystems	§20.21(e)(8)(ii)(C)	RSS-131 Issue 3: 5.1.1.4
Bidirectional capability	§20.21(e)(8)(i)(B)	RSS-131 Issue 3: 5.1.2
Noise limits	§20.21(e)(8)(i)(A)	RSS-131 Issue 3: 5.1.3.1
Gain limits	§20.21(e)(8)(i)(C)(1)	RSS-131 Issue 3: 5.1.3.2
Power limits	§20.21(e)(8)(i)(D)	RSS-131 Issue 3: 5.1.3.3
Out-of-band emission limits	§20.21(e)(8)(i)(E)	RSS-131 Issue 3: 5.1.3.4
Intermodulation limits	§20.21(e)(8)(i)(F)	RSS-131 Issue 3: 5.1.3.5
Transmit power off mode	§20.21(e)(8)(i)(H)	RSS-131 Issue 3: 5.1.3.6
Uplink inactivity	§20.21(e)(8)(i)(I)	RSS-131 Issue 3: 5.1.3.7

1.3 MEASUREMENT SUMMARY / SIGNATURES

47 CFR CHAPTER I FCC PART 20 §20.21 **§ 20.21 (e)(3) Frequency Bands**

Authorized Frequency Band
The measurement was performed according to KDB 935210 D03 **Final Result**

OP-Mode	**Setup**	**FCC**	**IC**
Frequency Band, Direction			
Band 12, Downlink	S01_AA01	Performed	Performed
Band 12, Uplink	S01_AA01	Performed	Performed
Band 13, Downlink	S01_AA01	Performed	Performed
Band 13, Uplink	S01_AA01	Performed	Performed
Band 2, Downlink	S01_AA01	Performed	Performed
Band 2, Uplink	S01_AA01	Performed	Performed
Band 4, Downlink	S01_AA01	Performed	Performed
Band 4, Uplink	S01_AA01	Performed	Performed
Band 5, Downlink	S01_AA01	Performed	Performed
Band 5, Uplink	S01_AA01	Performed	Performed

47 CFR CHAPTER I FCC PART 20 §20.21 **§ 20.21 (e)(8)(i)(D) Power Limits; § 20.21 (e)(8)(i)(B) Bidirectional Capability**

Maximum Power
The measurement was performed according to KDB 935210 D03 **Final Result**

OP-Mode	**Setup**	**FCC**	**IC**
Frequency Band, Direction, Signal Type			
Band 12, Downlink, AWGN	S01_AA01	Passed	Passed
Band 12, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 12, Uplink, AWGN	S01_AA01	Passed	Passed
Band 12, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 13, Downlink, AWGN	S01_AA01	Passed	Passed
Band 13, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 13, Uplink, AWGN	S01_AA01	Passed	Passed
Band 13, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 2, Downlink, AWGN	S01_AA01	Passed	Passed
Band 2, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 2, Uplink, AWGN	S01_AA01	Passed	Passed
Band 2, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 4, Downlink, AWGN	S01_AA01	Passed	Passed
Band 4, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 4, Uplink, AWGN	S01_AA01	Passed	Passed
Band 4, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 5, Downlink, AWGN	S01_AA01	Passed	Passed
Band 5, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 5, Uplink, AWGN	S01_AA01	Passed	Passed
Band 5, Uplink, Pulsed CW	S01_AA01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21

§ 20.21 (e)(8)(i)(C)(2) Booster Gain Limits; § 20.21 (e)(8)(i)(B) Bidirectional Capability

Maximum Booster Gain
The measurement was performed according to KDB 935210 D03

Final Result

OP-Mode	**Setup**	**FCC**	**IC**
Frequency Band, Direction, Signal Type			
Band 12, Downlink, AWGN	S01_AA01	Passed	Passed
Band 12, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 12, Uplink, AWGN	S01_AA01	Passed	Passed
Band 12, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 13, Downlink, AWGN	S01_AA01	Passed	Passed
Band 13, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 13, Uplink, AWGN	S01_AA01	Passed	Passed
Band 13, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 2, Downlink, AWGN	S01_AA01	Passed	Passed
Band 2, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 2, Uplink, AWGN	S01_AA01	Passed	Passed
Band 2, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 4, Downlink, AWGN	S01_AA01	Passed	Passed
Band 4, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 4, Uplink, AWGN	S01_AA01	Passed	Passed
Band 4, Uplink, Pulsed CW	S01_AA01	Passed	Passed
Band 5, Downlink, AWGN	S01_AA01	Passed	Passed
Band 5, Downlink, Pulsed CW	S01_AA01	Passed	Passed
Band 5, Uplink, AWGN	S01_AA01	Passed	Passed
Band 5, Uplink, Pulsed CW	S01_AA01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 20.21 (e)(8)(i)(F) Intermodulation Limits

Intermodulation
The measurement was performed according to KDB 935210 D03

Final Result

OP-Mode Frequency Band, Direction, Input Power	Setup	FCC	IC
Band 12, Downlink, AGC	S01_AA01	Passed	Passed
Band 12, Uplink, AGC	S01_AA01	Passed	Passed
Band 12, Uplink, AGC+10dB	S01_AA01	Passed	Passed
Band 13, Downlink, AGC	S01_AA01	Passed	Passed
Band 13, Uplink, AGC	S01_AA01	Passed	Passed
Band 13, Uplink, AGC+10dB	S01_AA01	Passed	Passed
Band 2, Downlink, AGC	S01_AA01	Passed	Passed
Band 2, Uplink, AGC	S01_AA01	Passed	Passed
Band 2, Uplink, AGC+10dB	S01_AA01	Passed	Passed
Band 4, Downlink, AGC	S01_AA01	Passed	Passed
Band 4, Uplink, AGC	S01_AA01	Passed	Passed
Band 4, Uplink, AGC+10dB	S01_AA01	Passed	Passed
Band 5, Downlink, AGC	S01_AA01	Passed	Passed
Band 5, Uplink, AGC	S01_AA01	Passed	Passed
Band 5, Uplink, AGC+10dB	S01_AA01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 20.21 (e)(8)(i)(E) Out-of-bands Limits

Out-of-band Emission
The measurement was performed according to KDB 935210 D03

Final Result

OP-Mode Frequency Band, Direction, Signal Type, Band Edge	Setup	FCC	IC
Band 12, Downlink, CDMA, lower	S01_AB01	Passed	Passed
Band 12, Downlink, CDMA, upper	S01_AB01	Passed	Passed
Band 12, Downlink, GSM, lower	S01_AB01	Passed	Passed
Band 12, Downlink, GSM, upper	S01_AB01	Passed	Passed
Band 12, Downlink, LTE, lower	S01_AB01	Passed	Passed
Band 12, Downlink, LTE, upper	S01_AB01	Passed	Passed
Band 12, Uplink, CDMA, lower	S01_AB01	Passed	Passed
Band 12, Uplink, CDMA, upper	S01_AB01	Passed	Passed
Band 12, Uplink, GSM, lower	S01_AB01	Passed	Passed
Band 12, Uplink, GSM, upper	S01_AB01	Passed	Passed
Band 12, Uplink, LTE, lower	S01_AB01	Passed	Passed
Band 12, Uplink, LTE, upper	S01_AB01	Passed	Passed
Band 13, Downlink, CDMA, lower	S01_AB01	Passed	Passed
Band 13, Downlink, CDMA, upper	S01_AB01	Passed	Passed
Band 13, Downlink, GSM, lower	S01_AB01	Passed	Passed
Band 13, Downlink, GSM, upper	S01_AB01	Passed	Passed
Band 13, Downlink, LTE, lower	S01_AB01	Passed	Passed
Band 13, Downlink, LTE, upper	S01_AB01	Passed	Passed

Band 13, Uplink, CDMA, lower	S01_AB01	Passed	Passed
Band 13, Uplink, CDMA, upper	S01_AB01	Passed	Passed
Band 13, Uplink, GSM, lower	S01_AB01	Passed	Passed
Band 13, Uplink, GSM, upper	S01_AB01	Passed	Passed
Band 13, Uplink, LTE, lower	S01_AB01	Passed	Passed
Band 13, Uplink, LTE, upper	S01_AB01	Passed	Passed
Band 2, Downlink, CDMA, lower	S01_AB01	Passed	Passed
Band 2, Downlink, CDMA, upper	S01_AB01	Passed	Passed
Band 2, Downlink, GSM, lower	S01_AB01	Passed	Passed
Band 2, Downlink, GSM, upper	S01_AB01	Passed	Passed
Band 2, Downlink, LTE, lower	S01_AB01	Passed	Passed
Band 2, Downlink, LTE, upper	S01_AB01	Passed	Passed
Band 2, Uplink, CDMA, lower	S01_AB01	Passed	Passed
Band 2, Uplink, CDMA, upper	S01_AB01	Passed	Passed
Band 2, Uplink, GSM, lower	S01_AB01	Passed	Passed
Band 2, Uplink, GSM, upper	S01_AB01	Passed	Passed
Band 2, Uplink, LTE, lower	S01_AB01	Passed	Passed
Band 2, Uplink, LTE, upper	S01_AB01	Passed	Passed
Band 4, Downlink, CDMA, lower	S01_AB01	Passed	Passed
Band 4, Downlink, CDMA, upper	S01_AB01	Passed	Passed
Band 4, Downlink, GSM, lower	S01_AB01	Passed	Passed
Band 4, Downlink, GSM, upper	S01_AB01	Passed	Passed
Band 4, Downlink, LTE, lower	S01_AB01	Passed	Passed
Band 4, Downlink, LTE, upper	S01_AB01	Passed	Passed
Band 4, Uplink, CDMA, lower	S01_AB01	Passed	Passed
Band 4, Uplink, CDMA, upper	S01_AB01	Passed	Passed
Band 4, Uplink, GSM, lower	S01_AB01	Passed	Passed
Band 4, Uplink, GSM, upper	S01_AB01	Passed	Passed
Band 4, Uplink, LTE, lower	S01_AB01	Passed	Passed
Band 4, Uplink, LTE, upper	S01_AB01	Passed	Passed
Band 5, Downlink, CDMA, lower	S01_AB01	Passed	Passed
Band 5, Downlink, CDMA, upper	S01_AB01	Passed	Passed
Band 5, Downlink, GSM, lower	S01_AB01	Passed	Passed
Band 5, Downlink, GSM, upper	S01_AB01	Passed	Passed
Band 5, Downlink, LTE, lower	S01_AB01	Passed	Passed
Band 5, Downlink, LTE, upper	S01_AB01	Passed	Passed
Band 5, Uplink, CDMA, lower	S01_AB01	Passed	Passed
Band 5, Uplink, CDMA, upper	S01_AB01	Passed	Passed
Band 5, Uplink, GSM, lower	S01_AB01	Passed	Passed
Band 5, Uplink, GSM, upper	S01_AB01	Passed	Passed
Band 5, Uplink, LTE, lower	S01_AB01	Passed	Passed
Band 5, Uplink, LTE, upper	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 2.1051 Spurious emissions at antenna terminals

Conducted Spurious Emissions
The measurement was performed according to KDB 935210 D03

Final Result

OP-Mode Frequency Band, Direction	Setup	FCC	IC
Band 12, Downlink	S01_AB01	Passed	Passed
Band 12, Uplink	S01_AB01	Passed	Passed
Band 13, Downlink	S01_AB01	Passed	Passed
Band 13, Uplink	S01_AB01	Passed	Passed
Band 2, Downlink	S01_AB01	Passed	Passed
Band 2, Uplink	S01_AB01	Passed	Passed
Band 4, Downlink	S01_AB01	Passed	Passed
Band 4, Uplink	S01_AB01	Passed	Passed
Band 5, Downlink	S01_AB01	Passed	Passed
Band 5, Uplink	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 20.21 (e)(8)(i)(A) Noise Limits; § 20.21 (e)(8)(i)(H) Transmitter Power Off Mode

Maximum Transmitter Noise Power
The measurement was performed according to KDB 935210 D03

Final Result

OP-Mode Frequency Band, Direction, Signal Type	Setup	FCC	IC
Band 12, Downlink, None	S01_AB01	Passed	Passed
Band 12, Uplink, AWGN DL	S01_AB01	Passed	Passed
Band 12, Uplink, None	S01_AB01	Passed	Passed
Band 13, Downlink, None	S01_AB01	Passed	Passed
Band 13, Uplink, AWGN DL	S01_AB01	Passed	Passed
Band 13, Uplink, None	S01_AB01	Passed	Passed
Band 2, Downlink, None	S01_AB01	Passed	Passed
Band 2, Uplink, AWGN DL	S01_AB01	Passed	Passed
Band 2, Uplink, None	S01_AB01	Passed	Passed
Band 4, Downlink, None	S01_AB01	Passed	Passed
Band 4, Uplink, AWGN DL	S01_AB01	Passed	Passed
Band 4, Uplink, None	S01_AB01	Passed	Passed
Band 5, Downlink, None	S01_AB01	Passed	Passed
Band 5, Uplink, AWGN DL	S01_AB01	Passed	Passed
Band 5, Uplink, None	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 20.21 (e)(8)(i)(A) Noise Limits; § 20.21 (e)(8)(i)(H) Transmitter Power Off Mode

Variable Uplink Noise Timing
The measurement was performed according to KDB 935210 D03 **Final Result**

OP-Mode Frequency Band, Direction	Setup	FCC	IC
Band 12, Uplink	S01_AB01	Passed	Passed
Band 13, Uplink	S01_AB01	Passed	Passed
Band 2, Uplink	S01_AB01	Passed	Passed
Band 4, Uplink	S01_AB01	Passed	Passed
Band 5, Uplink	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 20.21 (e)(8)(i)(I) Uplink Inactivity

Uplink Inactivity
The measurement was performed according to KDB 935210 D03 **Final Result**

OP-Mode Frequency Band, Direction	Setup	FCC	IC
Band 12, Uplink	S01_AB01	Passed	Passed
Band 13, Uplink	S01_AB01	Passed	Passed
Band 2, Uplink	S01_AB01	Passed	Passed
Band 4, Uplink	S01_AB01	Passed	Passed
Band 5, Uplink	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 20.21 (e)(8)(i)(C)(1) Booster Gain Limits, § 20.21 (e)(8)(i)(H) Transmit Power Off Mode

Variable Booster Gain
The measurement was performed according to KDB 935210 D03 **Final Result**

OP-Mode Frequency Band, Direction	Setup	FCC	IC
Band 12, Uplink	S01_AB01	Passed	Passed
Band 13, Uplink	S01_AB01	Passed	Passed
Band 2, Uplink	S01_AB01	Passed	Passed
Band 4, Uplink	S01_AB01	Passed	Passed
Band 5, Uplink	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 20.21 (e)(8)(i)(C)(1) Booster Gain Limits; § 20.21 (e)(8)(i)(H) Transmit Power Off Mode

Variable Uplink Gain Timing
The measurement was performed according to KDB 935210 D03 **Final Result**

OP-Mode	Setup	FCC	IC
Frequency Band, Direction			
Band 12, Uplink	S01_AB01	Passed	Passed
Band 13, Uplink	S01_AB01	Passed	Passed
Band 2, Uplink	S01_AB01	Passed	Passed
Band 4, Uplink	S01_AB01	Passed	Passed
Band 5, Uplink	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 2.1049 Occupied Bandwidth

Occupied Bandwidth
The measurement was performed according to KDB 935210 D03 **Final Result**

OP-Mode	Setup	FCC	IC
Frequency Band, Direction, Signal Type			
Band 12, Downlink, CDMA	S01_AB01	Passed	Passed
Band 12, Downlink, GSM	S01_AB01	Passed	Passed
Band 12, Downlink, LTE	S01_AB01	Passed	Passed
Band 12, Uplink, CDMA	S01_AB01	Passed	Passed
Band 12, Uplink, GSM	S01_AB01	Passed	Passed
Band 12, Uplink, LTE	S01_AB01	Passed	Passed
Band 13, Downlink, CDMA	S01_AB01	Passed	Passed
Band 13, Downlink, GSM	S01_AB01	Passed	Passed
Band 13, Downlink, LTE	S01_AB01	Passed	Passed
Band 13, Uplink, CDMA	S01_AB01	Passed	Passed
Band 13, Uplink, GSM	S01_AB01	Passed	Passed
Band 13, Uplink, LTE	S01_AB01	Passed	Passed
Band 2, Downlink, CDMA	S01_AB01	Passed	Passed
Band 2, Downlink, GSM	S01_AB01	Passed	Passed
Band 2, Downlink, LTE	S01_AB01	Passed	Passed
Band 2, Uplink, CDMA	S01_AB01	Passed	Passed
Band 2, Uplink, GSM	S01_AB01	Passed	Passed
Band 2, Uplink, LTE	S01_AB01	Passed	Passed
Band 4, Downlink, CDMA	S01_AB01	Passed	Passed
Band 4, Downlink, GSM	S01_AB01	Passed	Passed
Band 4, Downlink, LTE	S01_AB01	Passed	Passed
Band 4, Uplink, CDMA	S01_AB01	Passed	Passed
Band 4, Uplink, GSM	S01_AB01	Passed	Passed
Band 4, Uplink, LTE	S01_AB01	Passed	Passed
Band 5, Downlink, CDMA	S01_AB01	Passed	Passed
Band 5, Downlink, GSM	S01_AB01	Passed	Passed
Band 5, Downlink, LTE	S01_AB01	Passed	Passed

Band 5, Uplink, CDMA	S01_AB01	Passed	Passed
Band 5, Uplink, GSM	S01_AB01	Passed	Passed
Band 5, Uplink, LTE	S01_AB01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21 — **§ 20.21 (e)(8)(ii)(A) Ant-Oscillation, § 20.21 (e)(5) Anti-Oscillation**

Oscillation Restart
The measurement was performed according to KDB 935210 D03 — **Final Result**

OP-Mode Frequency Band, Direction	**Setup**	**FCC**	**IC**
Band 12, Downlink	S01_AA01	Passed	Passed
Band 12, Uplink	S01_AA01	Passed	Passed
Band 13, Downlink	S01_AA01	Passed	Passed
Band 13, Uplink	S01_AA01	Passed	Passed
Band 2, Downlink	S01_AA01	Passed	Passed
Band 2, Uplink	S01_AA01	Passed	Passed
Band 4, Downlink	S01_AA01	Passed	Passed
Band 4, Uplink	S01_AA01	Passed	Passed
Band 5, Downlink	S01_AA01	Passed	Passed
Band 5, Uplink	S01_AA01	Passed	Passed

47 CFR CHAPTER I FCC PART 20 §20.21 — **§ 20.21 (e)(8)(ii)(A) Ant-Oscillation, § 20.21 (e)(5) Anti-Oscillation**

Oscillation Shutdown or Mitigation
The measurement was performed according to KDB 935210 D03 — **Final Result**

OP-Mode Frequency Band, Direction	**Setup**	**FCC**	**IC**
Band 12, Downlink	S01_AA01	Passed	Passed
Band 12, Uplink Remark: Input power too low for start of amplification	S01_AA01	Performed	Performed
Band 13, Downlink	S01_AA01	Passed	Passed
Band 13, Uplink Remark: Input power too low for start of amplification	S01_AA01	Performed	Performed
Band 2, Downlink	S01_AA01	Passed	Passed
Band 2, Uplink Remark: Input power too low for start of amplification	S01_AA01	Performed	Performed
Band 4, Downlink	S01_AA01	Passed	Passed
Band 4, Uplink Remark: Input power too low for start of amplification	S01_AA01	Performed	Performed
Band 5, Downlink	S01_AA01	Passed	Passed
Band 5, Uplink Remark: Input power too low for start of amplification	S01_AA01	Performed	Performed

47 CFR CHAPTER I FCC PART 20 §20.21	§ 2.1053 Field strength of Spurious Radiation

Radiated Spurious Emissions
The measurement was performed according to KDB 935210 D03

Final Result

OP-Mode Frequency Band, Direction	Setup	FCC	IC
Band 12, Downlink	S01_AB01	Passed	Passed
Band 12, Uplink	S01_AB01	Passed	Passed
Band 13, Downlink	S01_AB01	Passed	Passed
Band 13, Uplink	S01_AB01	Passed	Passed
Band 2, Downlink	S01_AB01	Passed	Passed
Band 2, Uplink	S01_AB01	Passed	Passed
Band 4, Downlink	S01_AB01	Passed	Passed
Band 4, Uplink	S01_AB01	Passed	Passed
Band 5, Downlink	S01_AB01	Passed	Passed
Band 5, Uplink	S01_AB01	Passed	Passed

N/A: Not applicable
N/P: Not performed

Revision History

Report version control			
Version	**Release date**	**Change Description**	**Version validity**
initial	2017-02-15	--	valid

REV1	2017-03-13	• Zoomed plots for Band 13 in test case "Spurious emissions at antenna terminal" added
		• Typo errors in the test description of test cases:
		  • "Spurious emissions at antenna terminal"
		  • "Occupied Bandwidth
		  • "Field strength of Spurious Radiation
		removed
			valid

MARCO KULLIK
2017.03.13
14:21:56 +01'00'

(responsible for accreditation scope)
Dipl.-Ing. Marco Kullik

DANIEL GALL
2017.03.13
14:19:58 +01'00'

(responsible for testing and report)
Dipl.-Ing. Daniel Gall

2 ADMINISTRATIVE DATA

2.1 TESTING LABORATORY

Company Name:	7layers GmbH
Address:	Borsigstr. 11 40880 Ratingen Germany

This facility has been fully described in a report submitted to the FCC and accredited under the test firm registration number 929146.
The corresponding FCC Designation Number is: DE0015

This facility has been fully described in a report submitted to the IC and accepted under the registration number: Site# 3699A-1.

The test facility is also accredited by the following accreditation organisation:

Laboratory accreditation no:	DAkkS D-PL-12140-01-00
Responsible for accreditation scope:	Dipl.-Ing. Marco Kullik
Report Template Version:	2016-06-07

2.2 PROJECT DATA

Responsible for testing and report:	Dipl.-Ing. Daniel Gall
Employees who performed the tests:	documented internally at 7Layers
Date of Report:	2017-03-13
Testing Period:	2016-12-13 to 2017-01-19

2.3 APPLICANT DATA

Company Name:	Laird Dabendorf GmbH
Address:	Märkische Str. 72 15806 Zossen Germany
Contact Person:	Mr. Raimo Jacobi

2.4 MANUFACTURER DATA

Company Name:	Please see applicant
Address:	
Contact Person:	

3 TEST OBJECT DATA

3.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Consumer Signal Booster supporting bands 2 ,4, 5, 12, 13
Product name	LTE-MBC-NAR
Type	-
Declared EUT data by the supplier	
General Product Description	The EUT is wideband consumer signal booster used in road vehicles.
Booster Type	Mobile Wideband Consumer Signal Booster
Booster Connection	Direct Contact Coupling (e.g. craddle type)
MSCL Value	7 dB
Voltage Type	DC
Voltage Level	14.0 V
Maximum Output Donor Port [Uplink]:	28.5 dBm (conducted power)
Maximum Output Server Port [Downlink]:	2.0 dBm (conducted power)
Maximum Gain [Uplink]	22.5 dB
Maximum Gain [Downlink]	22.5 dB
The EUT provides the following ports:	Donor Port: Input BS-Signal, Output MS-Signal Server Port: Input MS-Signal, Output BS-Signal DC Port

The main components of the EUT are listed and described in chapter 3.2 EUT Main components.

3.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
DE1010008aa01	aa01	1st test sample
Sample Parameter	**Value**	
Serial No:	FKW-00125.11.1600000043	
HW Version	004	
SW Version	0005	
Comment		

Sample Name	Sample Code	Description
DE1010008ab01	ab01	2nd test sample
Sample Parameter	**Value**	
Serial No:	FKW-00125.11.1600000040	
HW Version	004	
SW Version	0005	
Comment		

NOTE:The short description is used to simplify the identification of the EUT in this test report.

3.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Device	Details (Manufacturer, Type Model, OUT Code)	Description
-	-	-

3.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it.
But nevertheless Auxiliary Equipment can influence the test results.

Device	Details (Manufacturer, HW, SW, S/N)	Description
-	-	-

3.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	Combination of EUTs	Description and Rationale
S01_AB01	DE1010008ab01	
S01_AA01	DE1010008aa01	

3.6 OPERATING MODES

This chapter describes the operating modes of the EUTs used for testing.

3.6.1TEST CHANNELS

Band	Direction	Lower Frequency Band Edge [MHz]	Upper Frequency Band Edge [MHz]	Center Frequency [MHz]	Port
2	downlink	1930.00	1990.00	1960.00	Donor
4	downlink	2110.00	2155.00	2132.50	Donor
5	downlink	869.00	894.00	881.50	Donor
12	downlink	728.00	746.00	737.00	Donor
13	downlink	746.00	756.00	751.00	Donor
2	uplink	1850.00	1910.00	1880.00	Server
4	uplink	1710.00	1755.00	1732.50	Server
5	uplink	824.00	849.00	836.50	Server
12	uplink	698.00	716.00	707.00	Server
13	uplink	777.00	787.00	782.00	Server

3.7 PRODUCT LABELLING

3.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

3.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

4 TEST RESULTS

4.1 AUTHORIZED FREQUENCY BAND

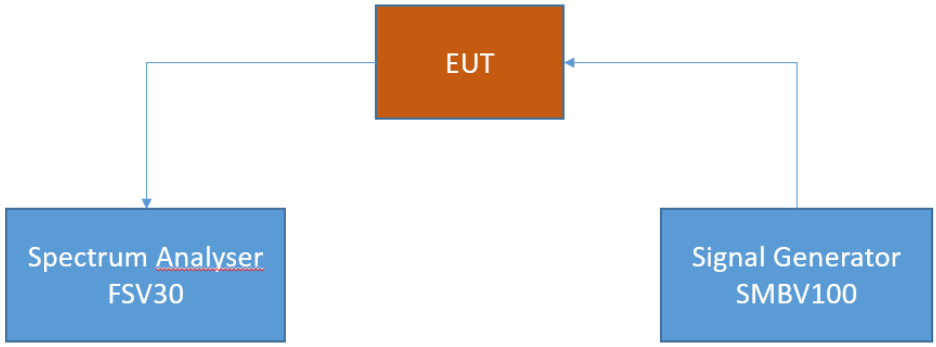
Standard

The test was performed according to:
KDB 935210 D03

4.1.1TEST DESCRIPTION

This test case is intended to confirm that the signal booster only operates on the CMRS frequency bands authorized for use by the NPS. In addition, this test will identify the frequency at which the maximum gain is realized within each CMRS operational band, which then serves as a basis for subsequent tests.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.1; Authorized Frequency Band Verification

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.1.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21 (e)(3) Frequency Bands

For this test case exists no applicable limit.

4.1.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, downlink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	1930.000	-4.9
Highest Power	1949.060	-2.0
Upper Band Edge	1990.000	-4.6

Band 4, downlink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	2110.000	-4.8
Highest Power	2131.303	-3.6
Upper Band Edge	2155.000	-4.6

Band 5, downlink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	869.000	-5.0
Highest Power	880.455	-3.7
Upper Band Edge	894.000	-6.0

Band 12, downlink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	728.000	-4.3
Highest Power	740.200	-1.3
Upper Band Edge	746.000	-4.3

Band 13, downlink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	746.000	-1.2
Highest Power	751.750	0.7
Upper Band Edge	756.000	-1.2

Band 2, uplink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	1850.000	19.2
Highest Power	1889.612	20.2
Upper Band Edge	1910.000	16.1

Band 4, uplink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	1710.000	16.0
Highest Power	1750.203	17.3
Upper Band Edge	1755.000	17.0

Band 5, uplink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	824.000	17.5
Highest Power	837.345	18.5
Upper Band Edge	849.000	15.9

Band 12, uplink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	698.000	15.7
Highest Power	705.700	18.0
Upper Band Edge	716.000	16.2

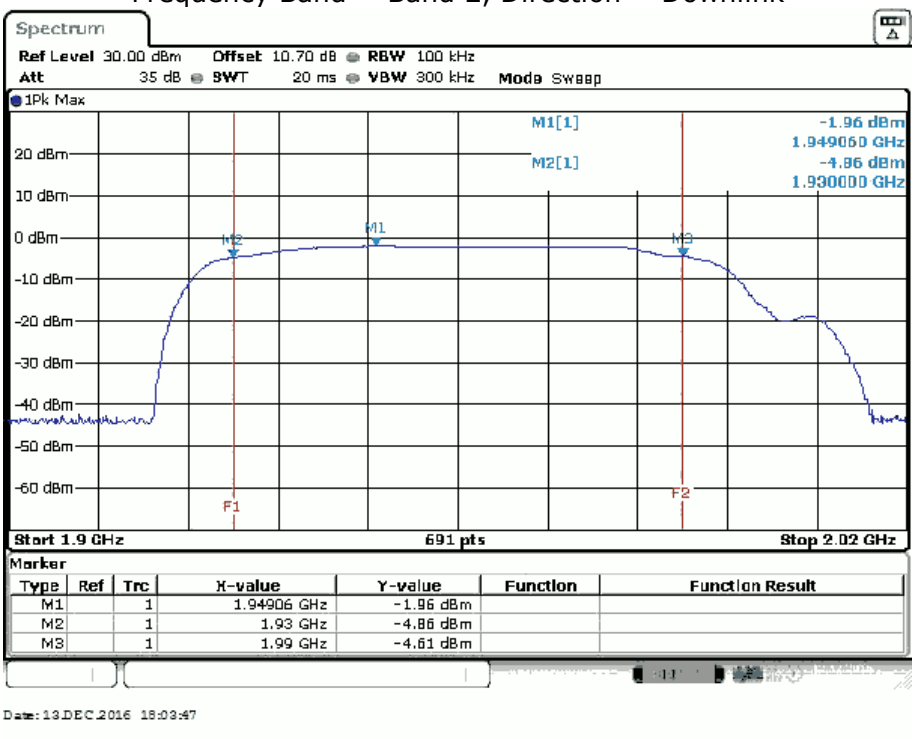
Band 13, uplink

Frequency	Frequency [MHz]	Output Power [dBm]
Lower Band Edge	777.000	16.8
Highest Power	782.350	18.1
Upper Band Edge	787.000	17.7

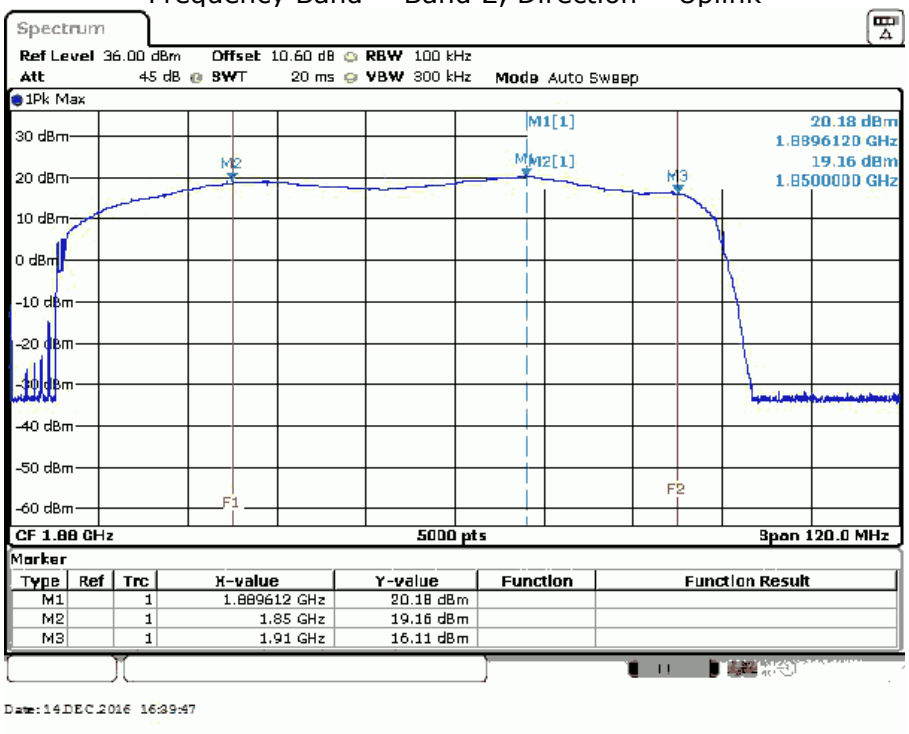
Remark: Please see next sub-clause for the measurement plot.

4.1.4MEASUREMENT PLOTS

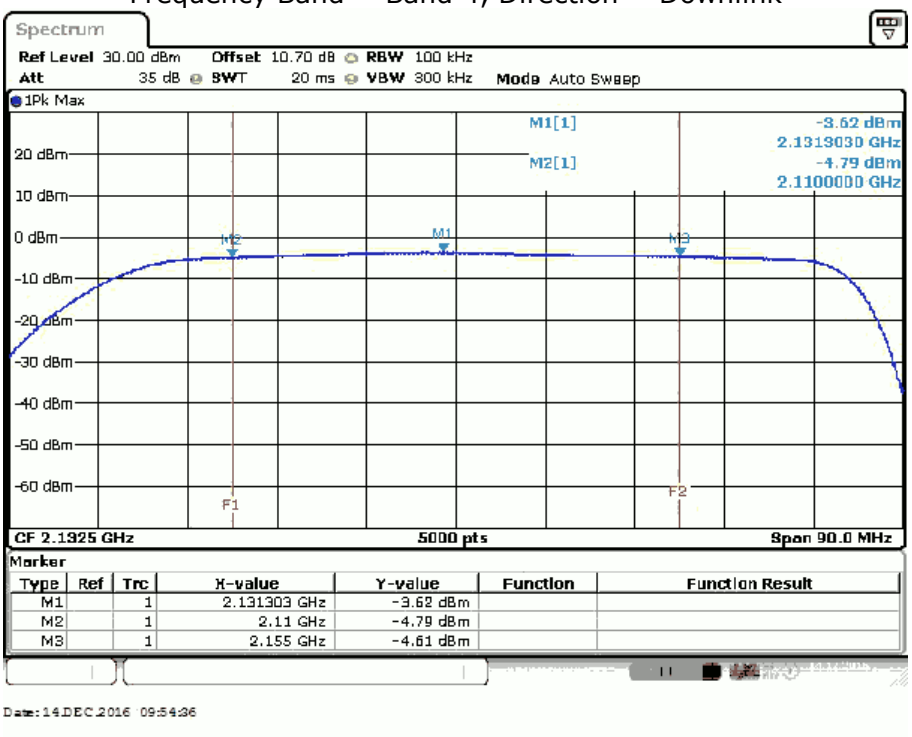
Frequency Band = Band 2, Direction = Downlink



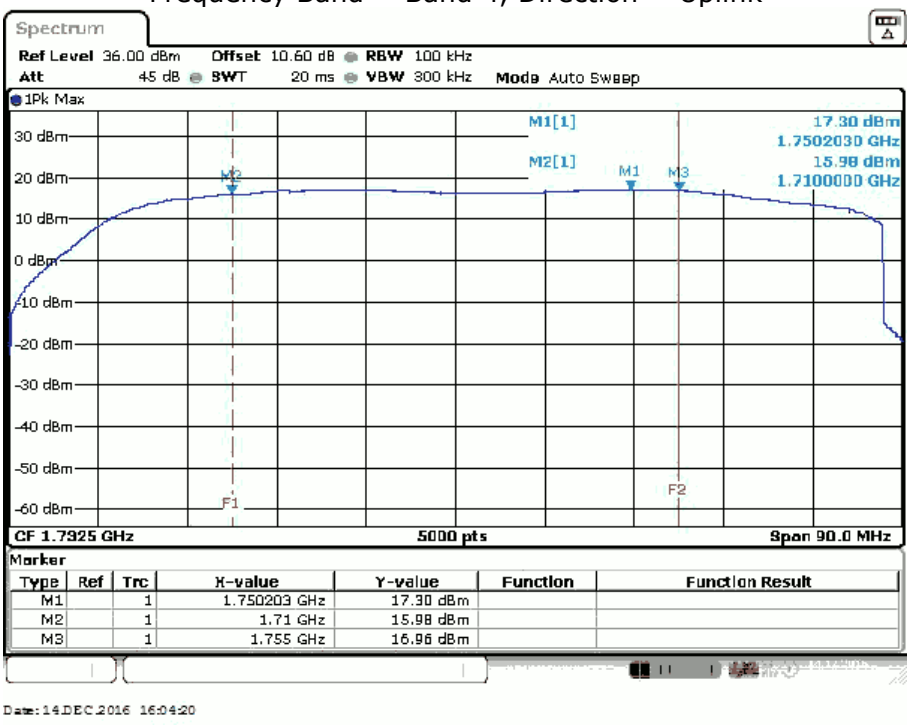
Frequency Band = Band 2, Direction = Uplink



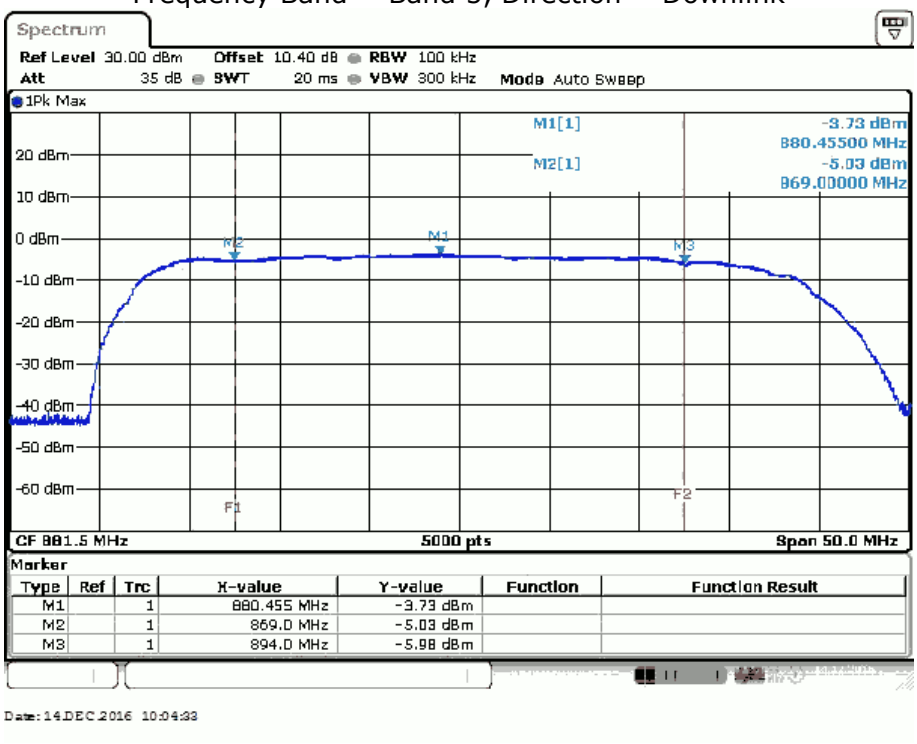
Frequency Band = Band 4, Direction = Downlink



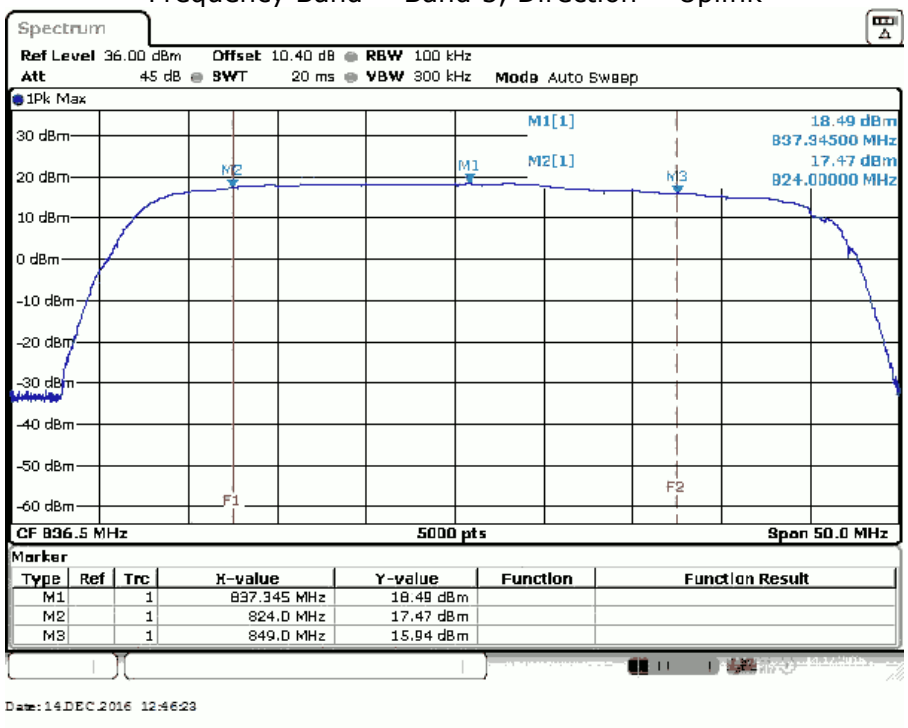
Frequency Band = Band 4, Direction = Uplink



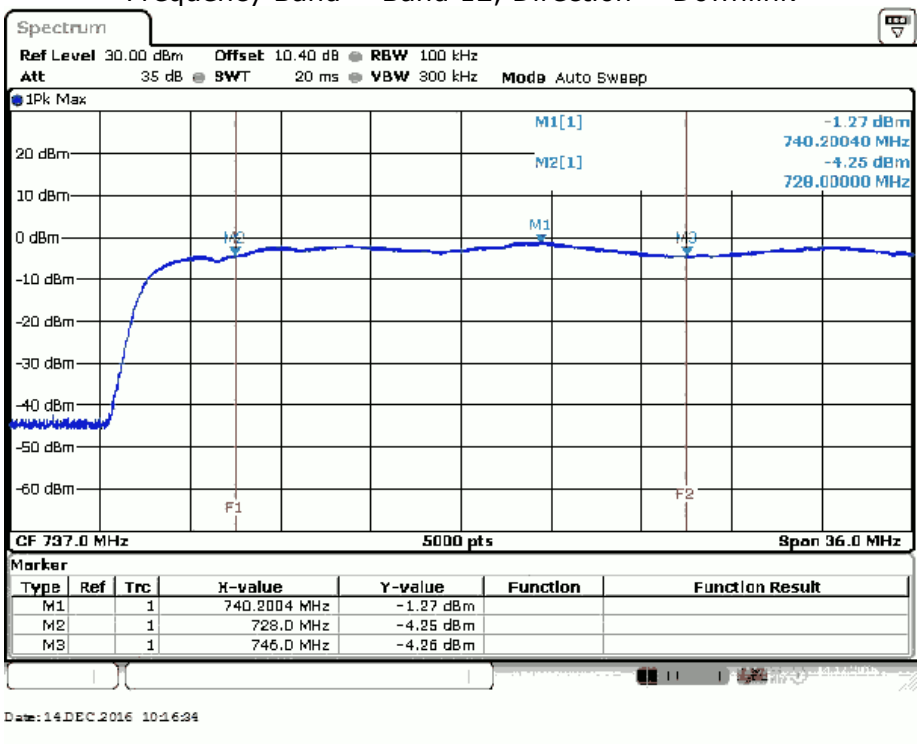
Frequency Band = Band 5, Direction = Downlink



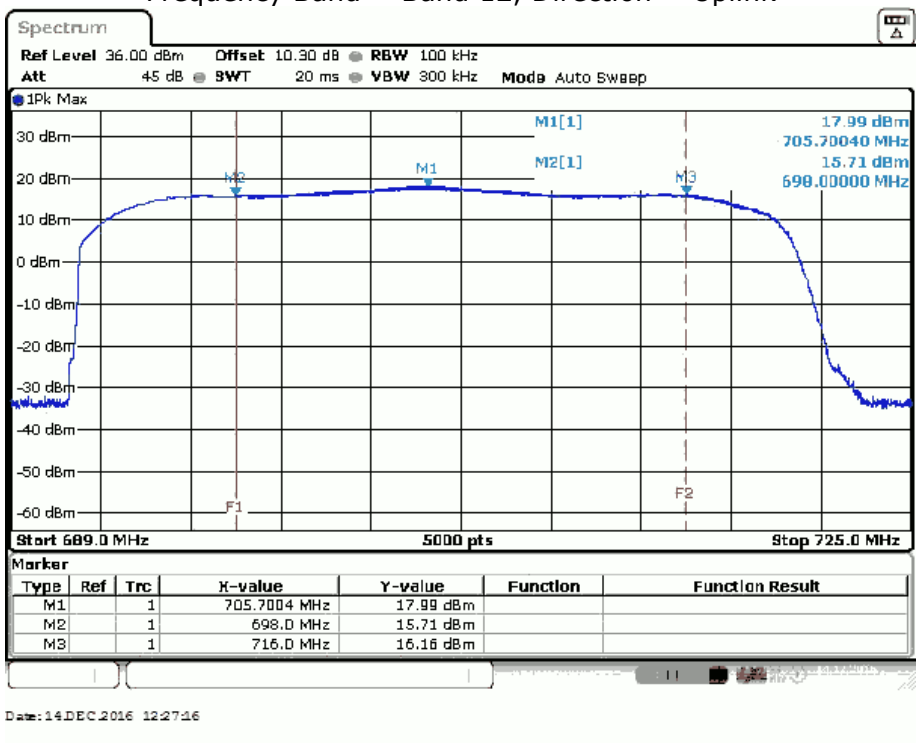
Frequency Band = Band 5, Direction = Uplink



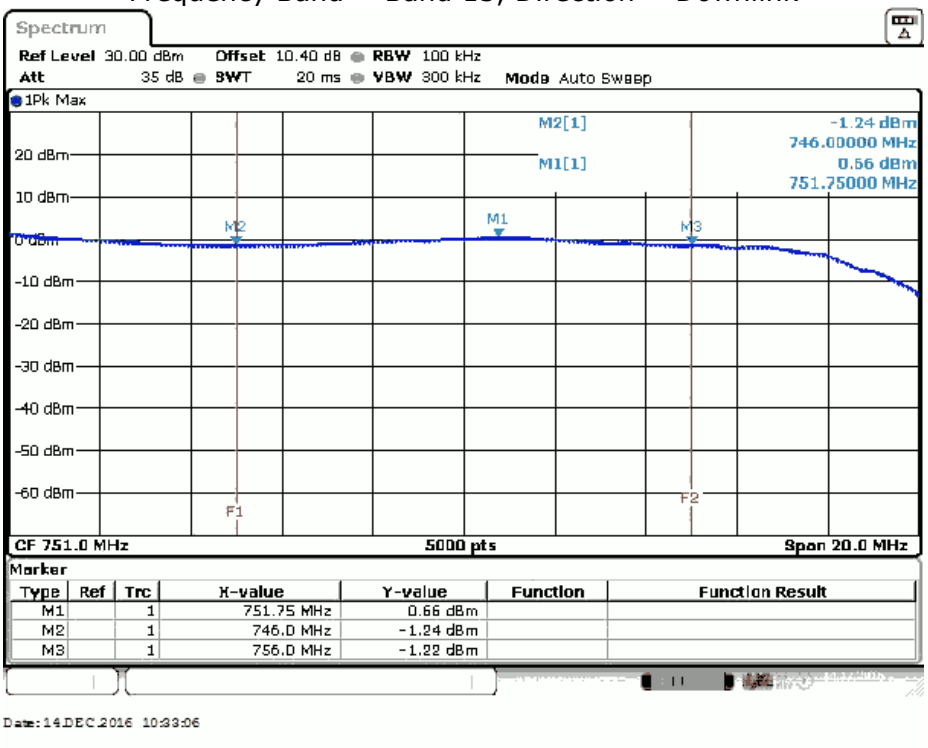
Frequency Band = Band 12, Direction = Downlink



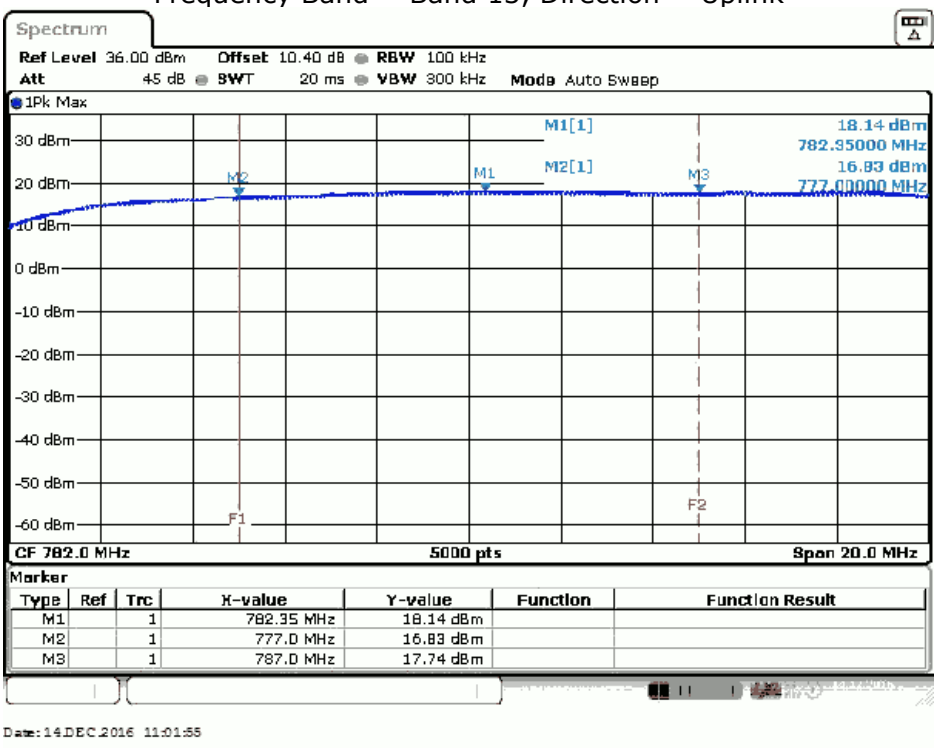
Frequency Band = Band 12, Direction = Uplink

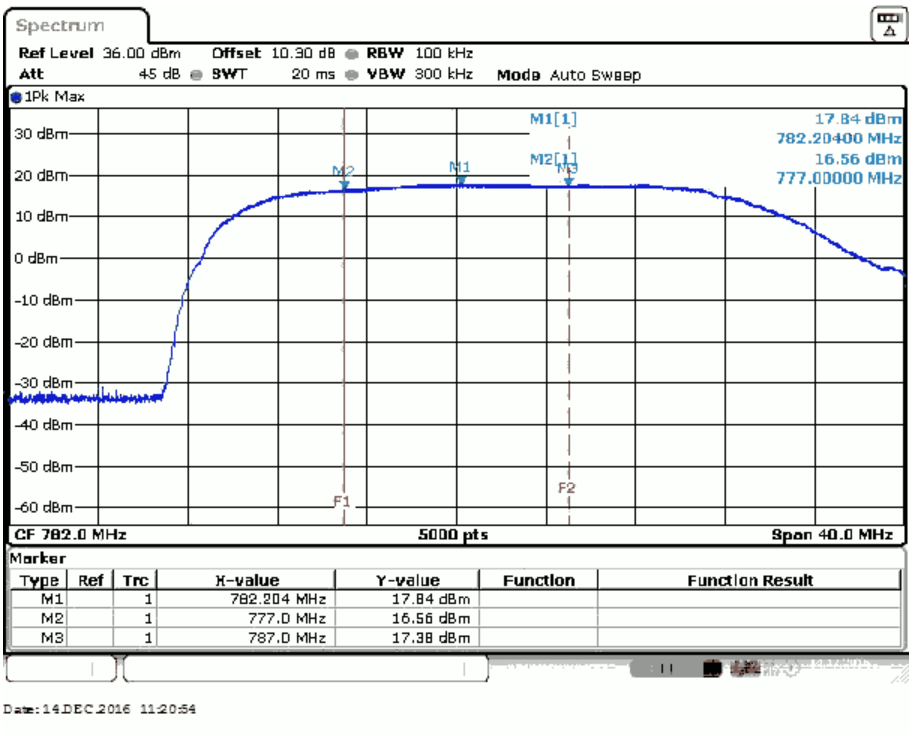


Frequency Band = Band 13, Direction = Downlink



Frequency Band = Band 13, Direction = Uplink





4.1.5TEST EQUIPMENT USED

R&S TS8997

4.2 MAXIMUM POWER

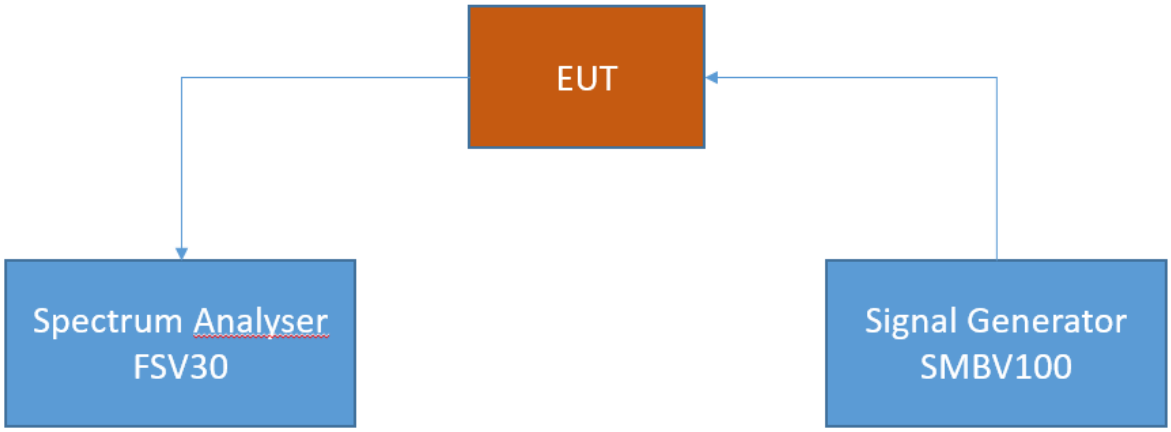
Standard

The test was performed according to:
KDB 935210 D03

4.2.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power limits and requirements as specified in §§ 20.21(e)(8)(i)(D) and 20.21(e)(8)(i)(B) for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.2; Maximum Power

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.2.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(D)

Power Limits. A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Composite downlink power shall not exceed 0.05 watt (17 dBm) conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

FCC Part 20, § 20.21(e)(8)(i)(B)

Bidirectional Capability. Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (*i.e.,* uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

4.2.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, downlink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	1949.060	-23.7 (AGC start)	-2.0	---	17.0	---	19.0
Pulsed CW	1949.060	-21.7	-0.8	---	17.0	---	17.8
Pulsed CW	1949.060	-20.0	**-0.3**	---	17.0	---	17.3
AWGN	1949.060	-29.6 (AGC start)	-8.1	---	17.0	---	25.1
AWGN	1949.060	-27.6	-6.3	---	17.0	---	23.3
AWGN	1949.060	-25.6	-4.7	---	17.0	---	21.7
AWGN	1949.060	-23.6	-3.5	---	17.0	---	20.5
AWGN	1949.060	-21.6	-2.5	---	17.0	---	19.5
AWGN	1949.060	-20.0	**-1.6**	---	17.0	---	18.6

Band 4, downlink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	2131.303	-23.1 (AGC start)	-1.6	---	17.0	---	18.6
Pulsed CW	2131.303	-21.1	-0.3	---	17.0	---	17.3
Pulsed CW	2131.303	-20.0	**0.0**	---	17.0	---	17.0
AWGN	2131.303	-29.6 (AGC start)	-8.3	---	17.0	---	25.3
AWGN	2131.303	-27.6	-6.4	---	17.0	---	23.4
AWGN	2131.303	-25.6	-4.9	---	17.0	---	21.9
AWGN	2131.303	-23.6	-3.5	---	17.0	---	20.5
AWGN	2131.303	-21.6	-2.3	---	17.0	---	19.3
AWGN	2131.303	-20.0	**-1.6**	---	17.0	---	18.6

Band 5, downlink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	880.5	-22.4 (AGC start)	-1.5	---	17.0	---	18.5
Pulsed CW	880.5	-20.4	-0.4	---	17.0	---	17.4
Pulsed CW	880.5	-20.0	**-0.3**	---	17.0	---	17.3
AWGN	880.5	-26.8 (AGC start)	-6.4	---	17.0	---	23.4
AWGN	880.5	-24.8	-4.8	---	17.0	---	21.8
AWGN	880.5	-22.8	-3.4	---	17.0	---	20.4
AWGN	880.5	-20.8	-2.2	---	17.0	---	19.2
AWGN	880.5	-20.0	**-1.8**	---	17.0	---	18.8

Band 12, downlink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	740.2	-22.1 (AGC start)	-0.1	---	17.0	---	17.1
Pulsed CW	740.2	-20.0	**1.6**	---	17.0	---	15.4
AWGN	740.2	-23.3 (AGC start)	-2.8	---	17.0	---	19.8
AWGN	740.2	-21.3	-1.1	---	17.0	---	18.1
AWGN	740.2	-20.0	**0.0**	---	17.0	---	17.0

Band 13, downlink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	751.8	-22.1 (AGC start)	-1.0	---	17.0	---	18.0
Pulsed CW	751.8	-20.0	**0.8**	---	17.0	---	16.2
AWGN	751.8	-23.2 (AGC start)	-3.7	---	17.0	---	20.7
AWGN	751.8	-21.2	-1.9	---	17.0	---	18.9
AWGN	751.8	-20.0	**-0.8**	---	17.0	---	17.8

Band 2, uplink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	1889.6	7.5 (AGC start)	27.5	17.0	30.0	10.5	2.5
Pulsed CW	1889.6	9.5	27.9	17.0	30.0	10.9	2.1
Pulsed CW	1889.6	11.5	27.9	17.0	30.0	10.9	2.1
Pulsed CW	1889.6	13.5	28.0	17.0	30.0	11.0	2.1
Pulsed CW	1889.6	15.5	27.9	17.0	30.0	10.9	2.1
Pulsed CW	1889.6	17.5	**28.0**	17.0	30.0	11.0	2.0
Pulsed CW	1889.6	19.5	26.5	17.0	30.0	9.5	3.6
Pulsed CW	1889.6	21.5	27.8	17.0	30.0	10.8	2.3
Pulsed CW	1889.6	23.0	27.8	17.0	30.0	10.8	2.2
AWGN	1889.6	1.0 (AGC start)	21.2	17.0	30.0	4.2	8.8
AWGN	1889.6	3.0	21.2	17.0	30.0	4.2	8.8
AWGN	1889.6	5.0	21.3	17.0	30.0	4.3	8.8
AWGN	1889.6	7.0	21.3	17.0	30.0	4.3	8.7
AWGN	1889.6	9.0	21.2	17.0	30.0	4.2	8.8
AWGN	1889.6	11.0	21.2	17.0	30.0	4.2	8.8
AWGN	1889.6	13.0	21.2	17.0	30.0	4.2	8.8
AWGN	1889.6	15.0	21.2	17.0	30.0	4.2	8.8
AWGN	1889.6	17.0	**19.8**	17.0	30.0	2.8	10.2
AWGN	1889.6	19.0	20.5	17.0	30.0	3.5	9.5
AWGN	1889.6	21.0	20.3	17.0	30.0	3.3	9.7
AWGN	1889.6	23.0	20.3	17.0	30.0	3.3	9.7

Band 4, uplink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	1750.2	-1.7 (AGC start)	20.1	17.0	30.0	3.1	9.9
Pulsed CW	1750.2	0.3	20.2	17.0	30.0	3.2	9.8
Pulsed CW	1750.2	2.3	20.3	17.0	30.0	3.3	9.7
Pulsed CW	1750.2	4.3	20.2	17.0	30.0	3.2	9.8
Pulsed CW	1750.2	6.3	20.2	17.0	30.0	3.2	9.8
Pulsed CW	1750.2	8.3	20.1	17.0	30.0	3.1	9.9
Pulsed CW	1750.2	10.3	20.3	17.0	30.0	3.3	9.7
Pulsed CW	1750.2	12.3	20.2	17.0	30.0	3.2	9.8
Pulsed CW	1750.2	14.3	20.2	17.0	30.0	3.2	9.8
Pulsed CW	1750.2	16.3	**19.6**	17.0	30.0	2.6	10.4
Pulsed CW	1750.2	18.3	19.7	17.0	30.0	2.7	10.3
Pulsed CW	1750.2	20.3	19.6	17.0	30.0	2.6	10.4
Pulsed CW	1750.2	22.3	21.0	17.0	30.0	4.0	9.0
Pulsed CW	1750.2	23.0	21.5	17.0	30.0	4.5	8.6
AWGN	1750.2	1.4 (AGC start)	19.1	17.0	30.0	2.1	10.9
AWGN	1750.2	3.4	19.3	17.0	30.0	2.3	10.7
AWGN	1750.2	5.4	19.3	17.0	30.0	2.3	10.7
AWGN	1750.2	7.4	19.3	17.0	30.0	2.3	10.7
AWGN	1750.2	9.4	19.4	17.0	30.0	2.4	10.6
AWGN	1750.2	11.4	19.3	17.0	30.0	2.3	10.7
AWGN	1750.2	13.4	19.1	17.0	30.0	2.1	10.9
AWGN	1750.2	15.4	19.1	17.0	30.0	2.1	10.9
AWGN	1750.2	17.4	19.1	17.0	30.0	2.1	10.9
AWGN	1750.2	19.4	18.7	17.0	30.0	1.7	11.4
AWGN	1750.2	21.4	**18.4**	17.0	30.0	1.4	11.6
AWGN	1750.2	23.0	20.0	17.0	30.0	3.0	10.0

Band 5, uplink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	837.3	10.2 (AGC start)	28.0	17.0	30.0	11.0	2.0
Pulsed CW	837.3	12.2	**28.4**	17.0	30.0	11.4	1.6
Pulsed CW	837.3	14.2	28.4	17.0	30.0	11.4	1.6
Pulsed CW	837.3	16.2	27.9	17.0	30.0	10.9	2.1
Pulsed CW	837.3	18.2	28.3	17.0	30.0	11.3	1.7
Pulsed CW	837.3	20.2	28.4	17.0	30.0	11.4	1.6
Pulsed CW	837.3	22.2	28.3	17.0	30.0	11.3	1.7
Pulsed CW	837.3	23.0	28.3	17.0	30.0	11.3	1.7
AWGN	837.3	2.4 (AGC start)	21.8	17.0	30.0	4.8	8.2
AWGN	837.3	4.4	22.0	17.0	30.0	5.0	8.0
AWGN	837.3	6.4	22.0	17.0	30.0	5.0	8.0
AWGN	837.3	8.4	22.0	17.0	30.0	5.0	8.0
AWGN	837.3	10.4	22.0	17.0	30.0	5.0	8.0
AWGN	837.3	12.4	22.0	17.0	30.0	5.0	8.0
AWGN	837.3	14.4	22.1	17.0	30.0	5.1	7.9
AWGN	837.3	16.4	21.9	17.0	30.0	4.9	8.1
AWGN	837.3	18.4	21.0	17.0	30.0	4.0	9.0
AWGN	837.3	20.4	21.0	17.0	30.0	4.0	9.0
AWGN	837.3	22.4	**20.8**	17.0	30.0	3.8	9.2
AWGN	837.3	23.0	21.9	17.0	30.0	4.9	8.1

Band 12, uplink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	705.7	1.1 (AGC start)	22.5	17.0	30.0	5.5	7.5
Pulsed CW	705.7	3.1	22.7	17.0	30.0	5.7	7.3
Pulsed CW	705.7	5.1	22.6	17.0	30.0	5.6	7.4
Pulsed CW	705.7	7.1	22.6	17.0	30.0	5.6	7.4
Pulsed CW	705.7	9.1	22.7	17.0	30.0	5.7	7.3
Pulsed CW	705.7	11.1	22.7	17.0	30.0	5.7	7.3
Pulsed CW	705.7	13.1	22.7	17.0	30.0	5.7	7.4
Pulsed CW	705.7	15.1	22.6	17.0	30.0	5.6	7.4
Pulsed CW	705.7	17.1	22.6	17.0	30.0	5.6	7.4
Pulsed CW	705.7	19.1	22.7	17.0	30.0	5.7	7.3
Pulsed CW	705.7	21.1	22.2	17.0	30.0	5.2	7.8
Pulsed CW	705.7	23.0	**22.2**	17.0	30.0	5.2	7.9
AWGN	705.7	1.7 (AGC start)	22.1	17.0	30.0	5.1	7.9
AWGN	705.7	3.7	22.4	17.0	30.0	5.4	7.6
AWGN	705.7	5.7	22.4	17.0	30.0	5.4	7.7
AWGN	705.7	7.7	22.4	17.0	30.0	5.4	7.6
AWGN	705.7	9.7	22.4	17.0	30.0	5.4	7.6
AWGN	705.7	11.7	22.4	17.0	30.0	5.4	7.6
AWGN	705.7	13.7	22.2	17.0	30.0	5.2	7.8
AWGN	705.7	15.7	22.3	17.0	30.0	5.3	7.7
AWGN	705.7	17.7	22.3	17.0	30.0	5.3	7.7
AWGN	705.7	19.7	22.3	17.0	30.0	5.3	7.8
AWGN	705.7	21.7	**21.2**	17.0	30.0	4.2	8.8
AWGN	705.7	23.0	21.9	17.0	30.0	4.9	8.1

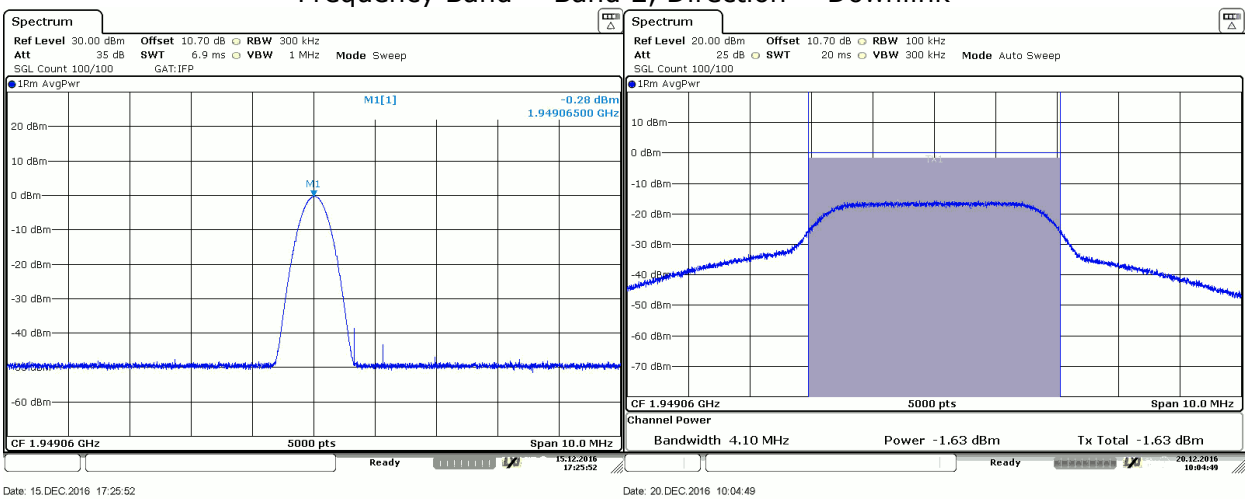
Band 13, uplink

Signal Type	Frequency [MHz]	Input Power [dBm]	Output Power [dBm]	Lower Limit Output Power [dBm]	Upper Limit Output Power [dBm]	Margin to Lower Limit [dB]	Margin to Upper Limit [dB]
Pulsed CW	782.4	1.2 (AGC start)	21.2	17.0	30.0	4.2	8.8
Pulsed CW	782.4	3.2	21.2	17.0	30.0	4.2	8.8
Pulsed CW	782.4	5.2	21.2	17.0	30.0	4.2	8.8
Pulsed CW	782.4	7.2	21.2	17.0	30.0	4.2	8.8
Pulsed CW	782.4	9.2	21.3	17.0	30.0	4.3	8.7
Pulsed CW	782.4	11.2	21.3	17.0	30.0	4.3	8.7
Pulsed CW	782.4	13.2	21.3	17.0	30.0	4.3	8.7
Pulsed CW	782.4	15.2	21.3	17.0	30.0	4.3	8.7
Pulsed CW	782.4	17.2	20.8	17.0	30.0	3.8	9.2
Pulsed CW	782.4	19.2	20.9	17.0	30.0	3.9	9.1
Pulsed CW	782.4	21.2	**20.7**	17.0	30.0	3.7	9.3
Pulsed CW	782.4	23.0	20.9	17.0	30.0	3.9	9.1
AWGN	782.4	1.1 (AGC start)	21.7	17.0	30.0	4.7	8.3
AWGN	782.4	3.1	21.7	17.0	30.0	4.7	8.3
AWGN	782.4	5.1	21.8	17.0	30.0	4.8	8.2
AWGN	782.4	7.1	21.9	17.0	30.0	4.9	8.1
AWGN	782.4	9.1	21.8	17.0	30.0	4.8	8.2
AWGN	782.4	11.1	21.8	17.0	30.0	4.8	8.2
AWGN	782.4	13.1	21.7	17.0	30.0	4.7	8.3
AWGN	782.4	15.1	21.7	17.0	30.0	4.7	8.3
AWGN	782.4	17.1	21.7	17.0	30.0	4.7	8.3
AWGN	782.4	19.1	21.6	17.0	30.0	4.6	8.4
AWGN	782.4	21.1	**20.6**	17.0	30.0	3.6	9.4
AWGN	782.4	23.0	22.2	17.0	30.0	5.2	7.8

Remark: Please see next sub-clause for the measurement plot.

4.2.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = Band 2, Direction = Downlink



Date: 15.DEC.2016 17:25:52 Date: 20.DEC.2016 10:04:49

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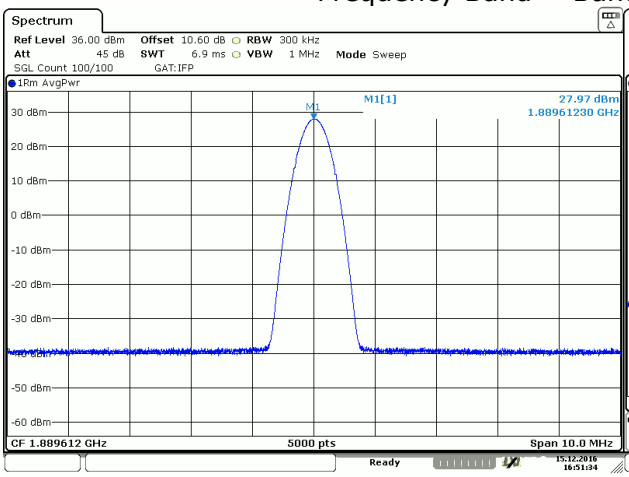
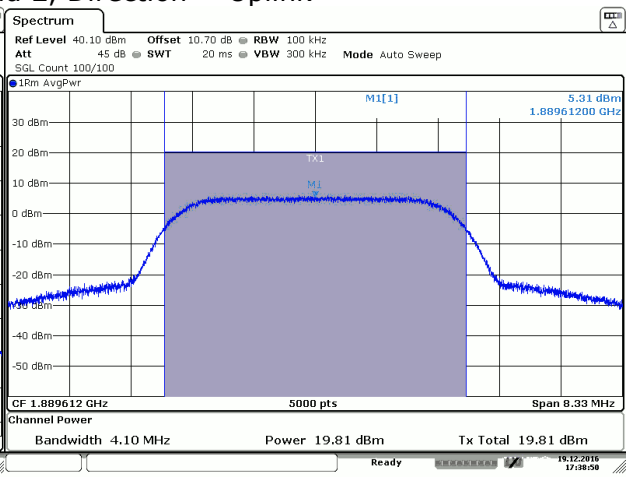
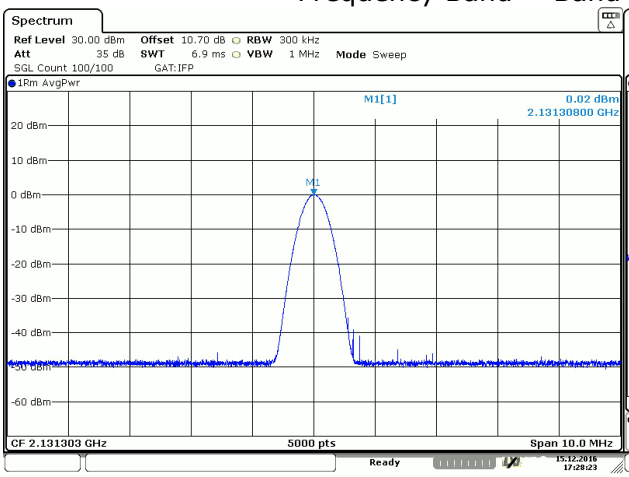
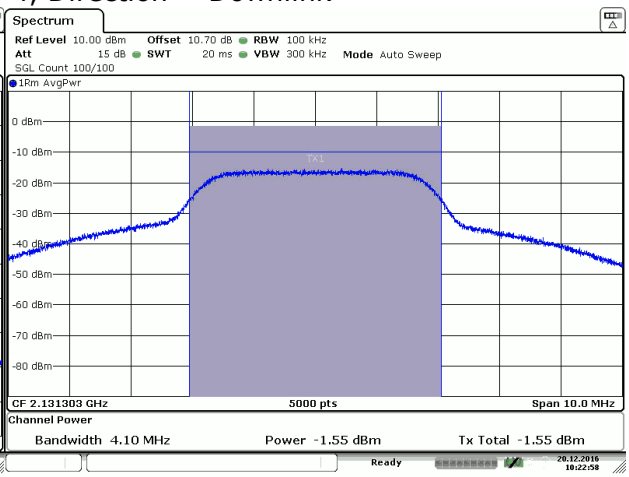


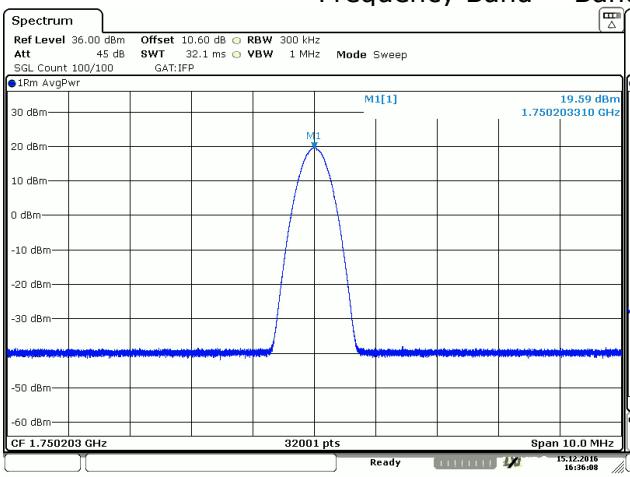


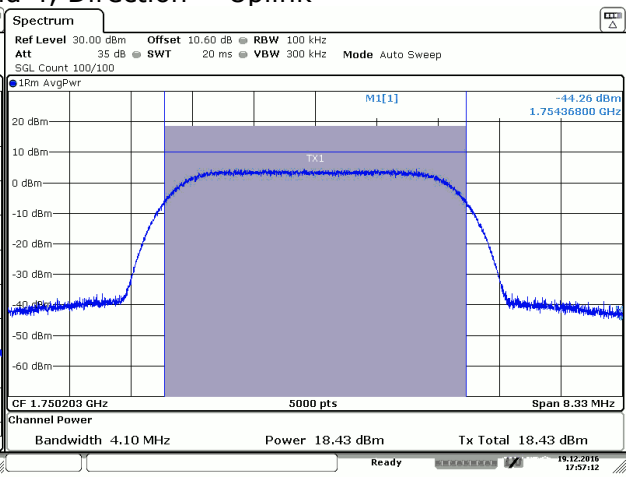
Frequency Band = Band 4, Direction = Downlink



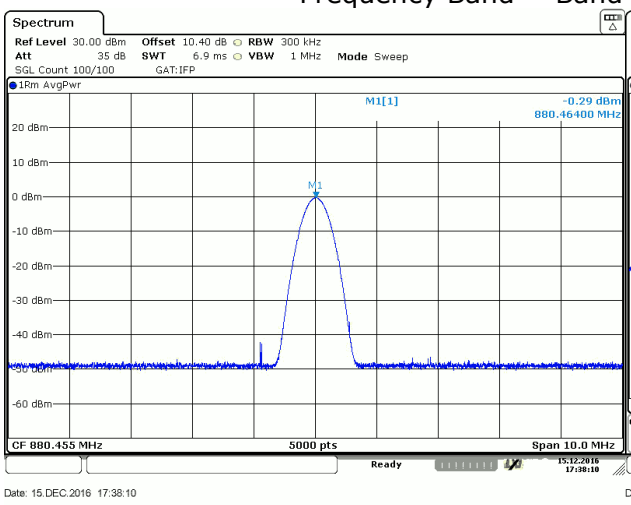


Frequency Band = Band 4, Direction = Uplink





Frequency Band = Band 5, Direction = Downlink



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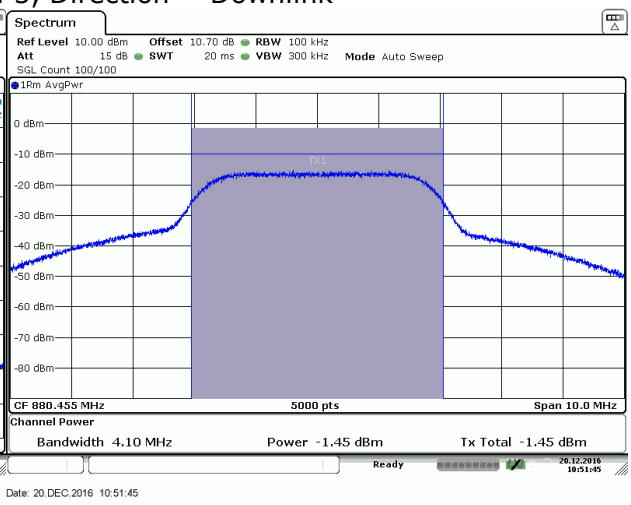

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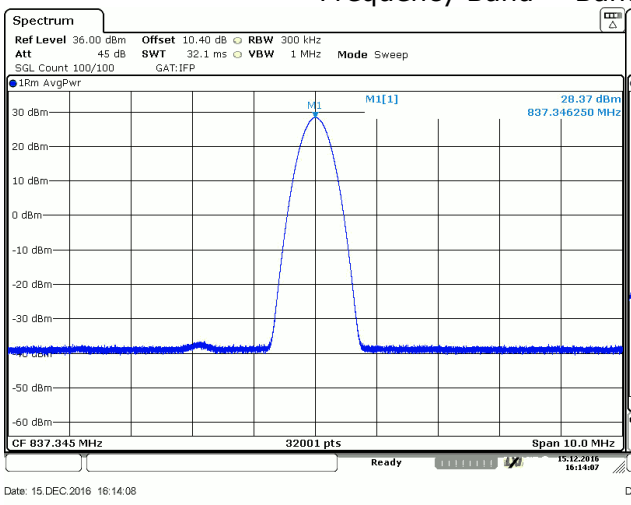
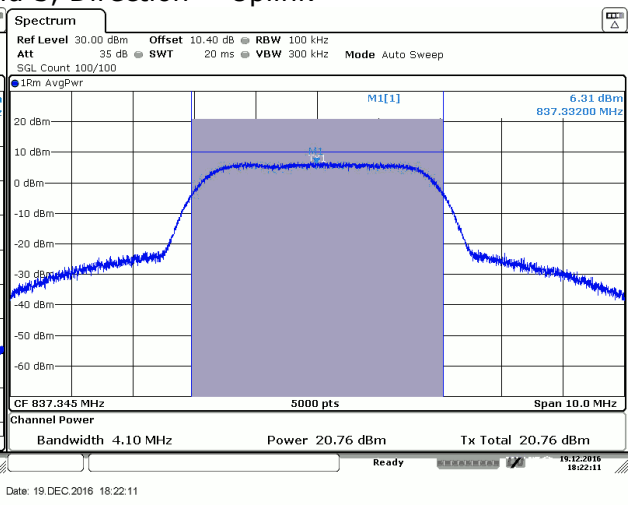
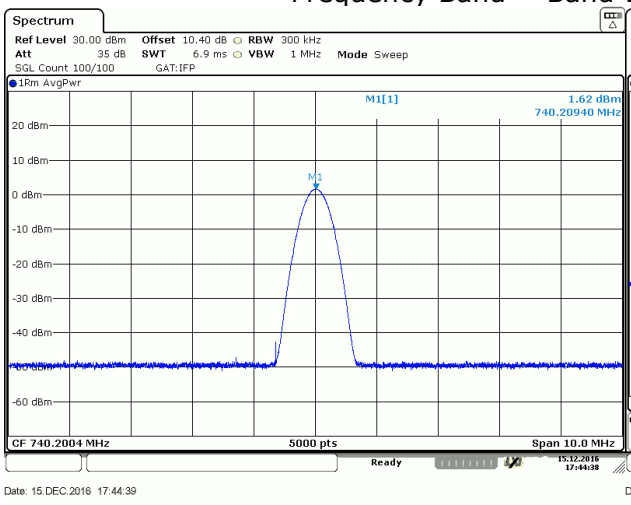


Date: 15.DEC.2016 16:14:08



Date: 19.DEC.2016 18:22:11

Frequency Band = Band 12, Direction = Downlink



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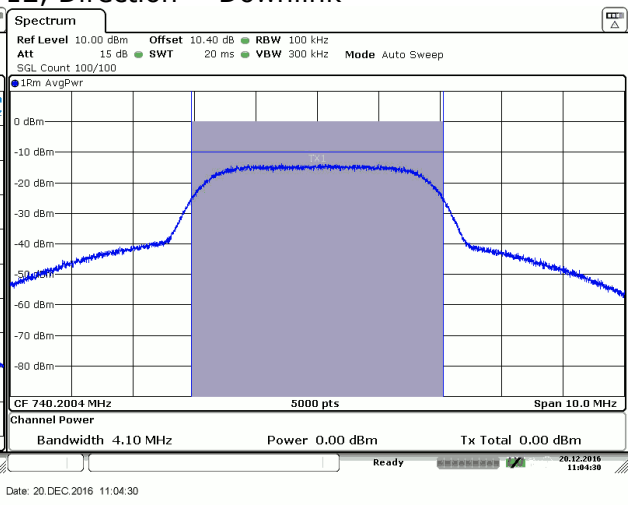
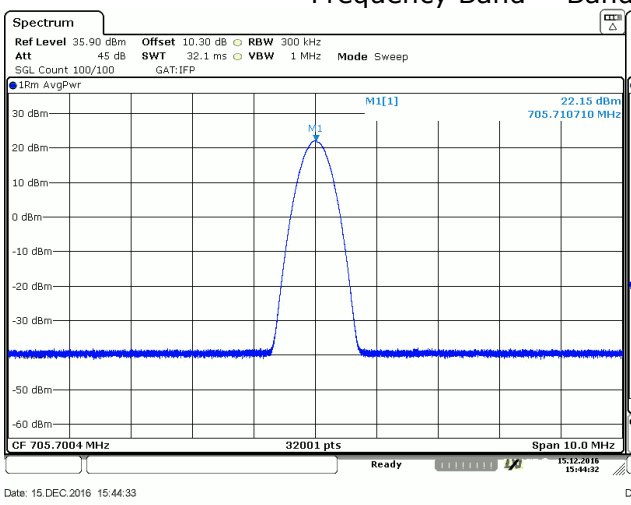
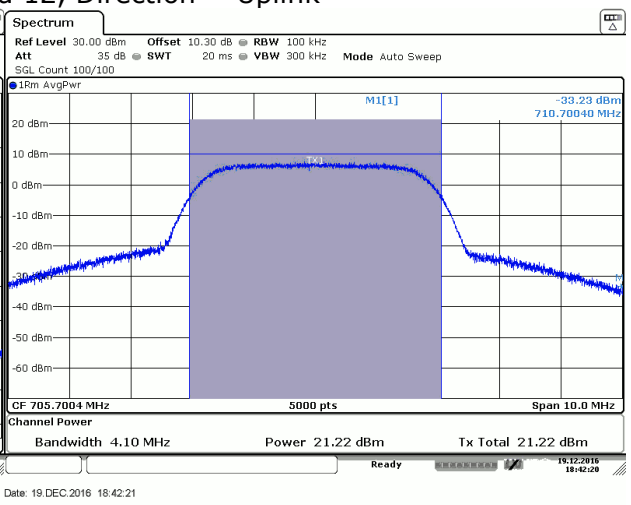


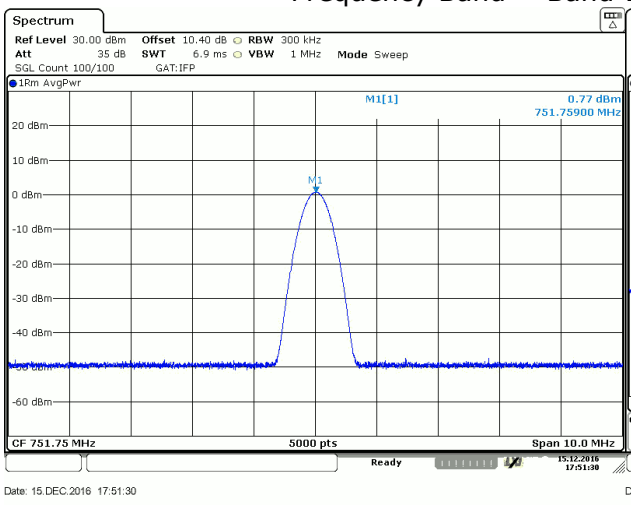
Date: 20.DEC.2016 11:04:30

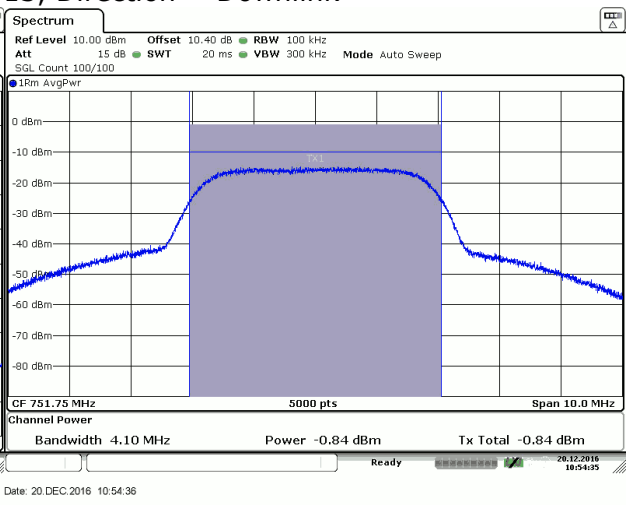
Frequency Band = Band 12, Direction = Uplink



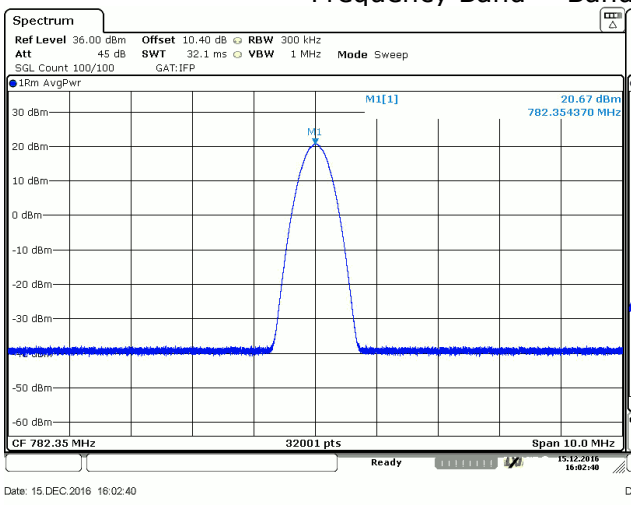


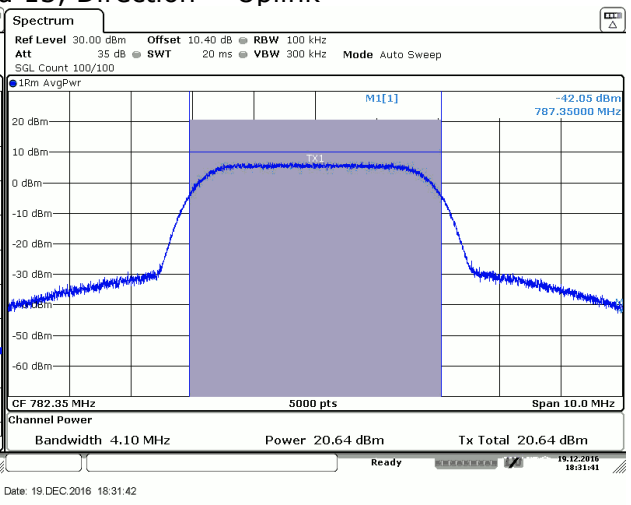
Frequency Band = Band 13, Direction = Downlink





Frequency Band = Band 13, Direction = Uplink





4.2.5TEST EQUIPMENT USED

R&S TS8997

4.3 MAXIMUM BOOSTER GAIN

Standard

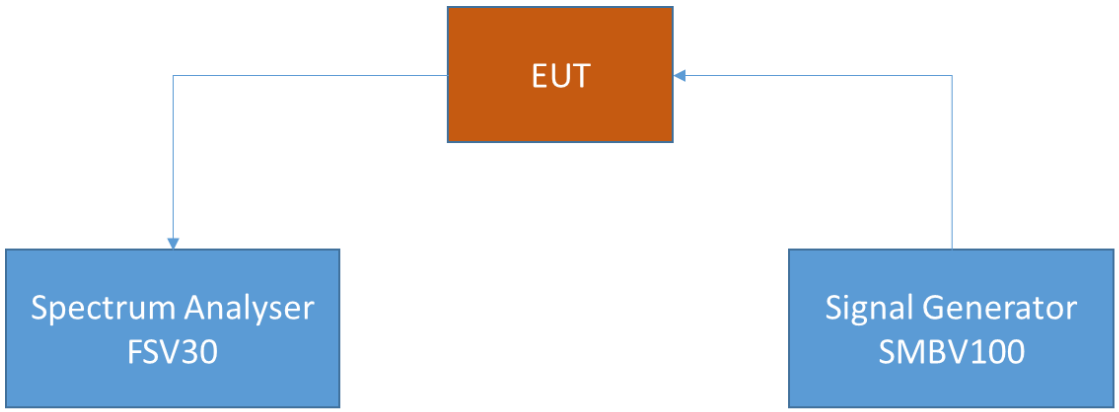
The test was performed according to:
KDB 935210 D03

4.3.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster gain limits and bidirectional capabilities as specified in § 20.21(e)(8)(i)(C)(2) and
§ 20.21(e)(8)(i)(B) for wideband consumer signal boosters.

The results of this test case are computed by the measurement values from test case 7.1 and 7.2.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.3; Maximum Booster Gain

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

4.3.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(C)(2)

Booster Gain Limits. The uplink and downlink maximum gain of a Consumer Booster referenced to its input and output ports shall not exceed the following limits:
(*i*) Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log_{10} (Frequency)
(*ii*) Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.
(*iii*) Mobile Booster maximum gain shall not exceed 50 dB when using an inside antenna (e.g., inside a vehicle), 23 dB when using direct contact coupling (e.g., cradle-type boosters), or 15 dB when directly connected (e.g., boosters with a physical connection to the phone).

FCC Part 20, § 20.21(e)(8)(i)(B)

Bidirectional Capability. Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (*i.e.,* uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

Note:
The margin for equivalent uplink and downlink gain is considered as 9 dB. This margin is a provisional specification determined by the ANSI ASC C63® task group working in collaboration and consultation with FCC OET Laboratory Division staff.

4.3.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1006 hPa
Humidity: 28 %

Band 2

Signal Type	Maximum Gain Downlink [dB]	Maximum Gain Uplink [dB]	Difference Gain [dB]	Absolut Gain Limit [dB]	Difference Gain Limit [dB]	Margin Absolute Gain Downlink [dB]	Margin Absolute Gain Uplink [dB]	Margin Difference Gain [dB]
Pulsed CW	21.7	20.0	1.7	23.0	9.0	1.3	3.0	7.3
AWGN	21.5	20.2	1.4	23.0	9.0	1.5	2.8	7.7

Band 4

Signal Type	Maximum Gain Downlink [dB]	Maximum Gain Uplink [dB]	Difference Gain [dB]	Absolut Gain Limit [dB]	Difference Gain Limit [dB]	Margin Absolute Gain Downlink [dB]	Margin Absolute Gain Uplink [dB]	Margin Difference Gain [dB]
Pulsed CW	21.5	21.5	0.0	23.0	9.0	1.5	1.5	9.0
AWGN	21.3	21.3	0.0	23.0	9.0	1.7	1.7	9.0

Band 5

Signal Type	Maximum Gain Downlink [dB]	Maximum Gain Uplink [dB]	Difference Gain [dB]	Absolut Gain Limit [dB]	Difference Gain Limit [dB]	Margin Absolute Gain Downlink [dB]	Margin Absolute Gain Uplink [dB]	Margin Difference Gain [dB]
Pulsed CW	20.9	17.8	3.1	23.0	9.0	2.1	5.2	5.9
AWGN	20.4	19.4	1.0	23.0	9.0	2.6	3.6	8.0

Band 12

Signal Type	Maximum Gain Downlink [dB]	Maximum Gain Uplink [dB]	Difference Gain [dB]	Absolut Gain Limit [dB]	Difference Gain Limit [dB]	Margin Absolute Gain Downlink [dB]	Margin Absolute Gain Uplink [dB]	Margin Difference Gain [dB]
Pulsed CW	22.0	21.4	0.6	23.0	9.0	1.0	1.6	8.4
AWGN	20.5	22.4	2.0	23.0	9.0	2.5	0.6	7.1

Band 13

Signal Type	Maximum Gain Downlink [dB]	Maximum Gain Uplink [dB]	Difference Gain [dB]	Absolut Gain Limit [dB]	Difference Gain Limit [dB]	Margin Absolute Gain Downlink [dB]	Margin Absolute Gain Uplink [dB]	Margin Difference Gain [dB]
Pulsed CW	21.1	20.0	1.2	23.0	9.0	1.9	3.0	7.9
AWGN	19.5	20.6	1.1	23.0	9.0	3.5	2.4	7.9

Remark: Please see next sub-clause for the measurement plot.

4.3.4TEST EQUIPMENT USED

R&S TS8997

4.4 INTERMODULATION

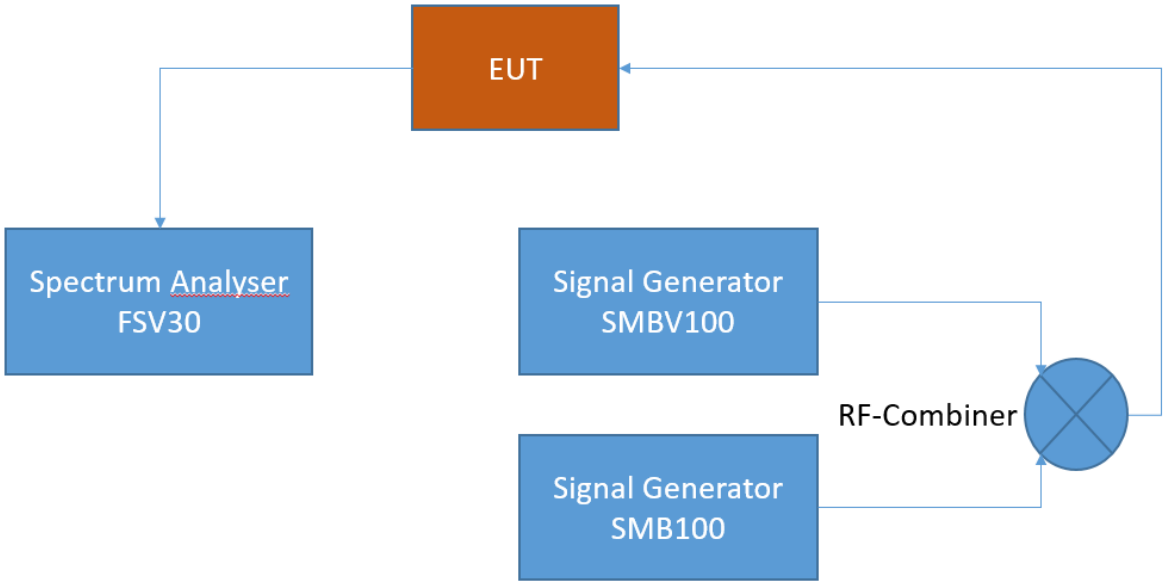
Standard

The test was performed according to:
KDB 935210 D03

4.4.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the intermodulation limit § 20.21(e)(8)(i)(F) for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.4; Intermodulation

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.4.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(F)

Intermodulation Limits. The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of −19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave (CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

4.4.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1006 hPa
Humidity: 31 %

Band 2, downlink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Intermodulation [dBm]	Intermodulation Limit [dBm]	Margin to Limit [dB]
AGC	1959.7	1960.3	-25.8	-39.8	-19.0	20.8
	1959.7	1960.3	-23.8	-30.0	-19.0	11.0
	1959.7	1960.3	-21.8	-24.7	-19.0	5.7
	1959.7	1960.3	-20.0	-21.7	-19.0	2.7

Band 4, downlink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Intermodulation [dBm]	Intermodulation Limit [dBm]	Margin to Limit [dB]
AGC	2132.2	2132.8	-26.3	-40.2	-19.0	21.2
	2132.2	2132.8	-24.3	-30.4	-19.0	11.4
	2132.2	2132.8	-22.3	-25.0	-19.0	6.0
	2132.2	2132.8	-20.3	-21.6	-19.0	2.6
	2132.2	2132.8	-20.0	-21.1	-19.0	2.1

Band 5, downlink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Intermodulation [dBm]	Intermodulation Limit [dBm]	Margin to Limit [dB]
AGC	881.2	881.8	-24.9	-38.2	-19.0	19.2
	881.2	881.8	-22.9	-30.1	-19.0	11.1
	881.2	881.8	-20.9	-25.0	-19.0	6.0
	881.2	881.8	-20.0	-25.0	-19.0	6.0

Band 12, downlink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Intermodulation [dBm]	Intermodulation Limit [dBm]	Margin to Limit [dB]
AGC	736.7	737.3	-25.1	-50.8	-19.0	31.8
	736.7	737.3	-23.1	-45.6	-19.0	26.6
	736.7	737.3	-21.1	-35.1	-19.0	16.1
	736.7	737.3	-20.0	-26.9	-19.0	7.9

Band 13, downlink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Intermodulation [dBm]	Intermodulation Limit [dBm]	Margin to Limit [dB]
AGC	750.7	751.3	-24.0	-49.9	-19.0	30.9
	750.7	751.3	-22.0	-45.5	-19.0	26.5
	750.7	751.3	-20.0	-34.5	-19.0	15.5

Band 2, uplink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Inter modulation [dBm]	Inter modulation Limit [dBm]	Margin to Limit [dB]
AGC	1879.7	1880.3	-0.2	-21.0	-19.0	2.0
	1879.7	1880.3	1.8	-22.2	-19.0	3.2
	1879.7	1880.3	3.8	-22.0	-19.0	3.0
	1879.7	1880.3	5.8	-22.0	-19.0	3.0
	1879.7	1880.3	7.8	-22.0	-19.0	3.0
AGC+10dB	1879.7	1880.3	9.8	-22.6	-19.0	3.6

Band 4, uplink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Inter modulation [dBm]	Inter modulation Limit [dBm]	Margin to Limit [dB]
AGC	1732.2	1732.8	-3.7	-22.5	-19.0	3.5
	1732.2	1732.8	-1.7	-22.5	-19.0	3.5
	1732.2	1732.8	0.3	-22.1	-19.0	3.1
	1732.2	1732.8	2.3	-22.1	-19.0	3.1
	1732.2	1732.8	4.3	-22.0	-19.0	3.0
AGC+10dB	1732.2	1732.8	6.3	-22.1	-19.0	3.1

Band 5, uplink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Inter modulation [dBm]	Inter modulation Limit [dBm]	Margin to Limit [dB]
AGC	836.2	836.8	-1.2	-23.9	-19.0	4.9
	836.2	836.8	0.8	-22.8	-19.0	3.8
	836.2	836.8	2.8	-22.5	-19.0	3.5
	836.2	836.8	4.8	-22.6	-19.0	3.6
	836.2	836.8	6.8	-22.3	-19.0	3.3
AGC+10dB	836.2	836.8	8.8	-22.6	-19.0	3.6

Band 12, uplink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Inter modulation [dBm]	Inter modulation Limit [dBm]	Margin to Limit [dB]
AGC	706.7	707.3	0.7	-23.1	-19.0	4.1
	706.7	707.3	2.7	-22.8	-19.0	3.8
	706.7	707.3	4.7	-22.4	-19.0	3.4
	706.7	707.3	6.7	-22.9	-19.0	3.9
	706.7	707.3	8.7	-23.2	-19.0	4.2
AGC+10dB	706.7	707.3	10.7	-22.4	-19.0	3.4

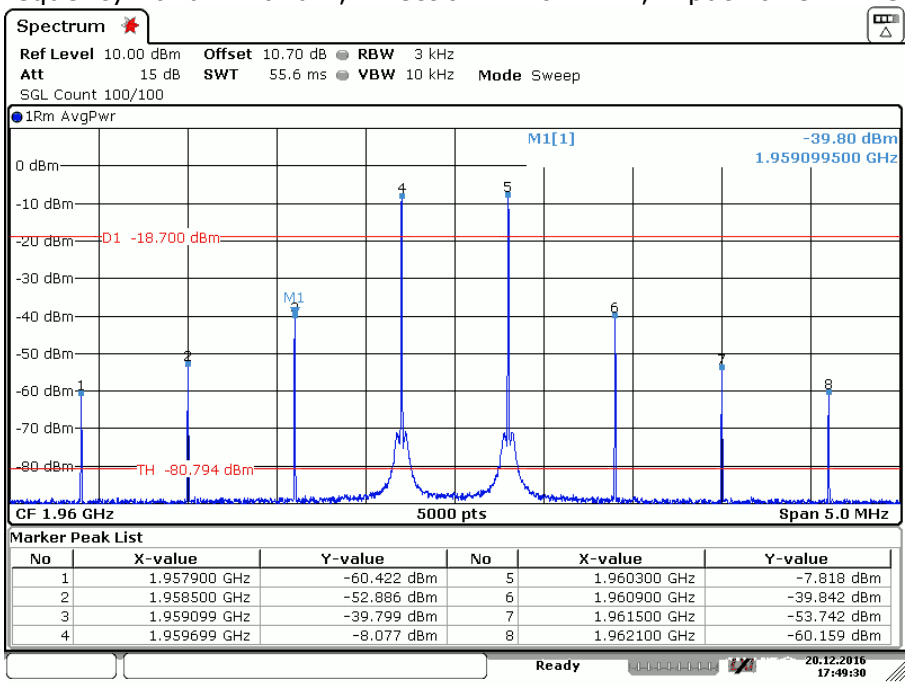
Band 13, uplink

Input Power	f1 [MHz]	f2 [MHz]	Input Power [dBm]	Maximum Inter modulation [dBm]	Inter modulation Limit [dBm]	Margin to Limit [dB]
AGC	781.7	782.3	1.0	-21.4	-19.0	2.4
	781.7	782.3	3.0	-21.3	-19.0	2.3
	781.7	782.3	5.0	-21.3	-19.0	2.3
	781.7	782.3	7.0	-21.2	-19.0	2.2
	781.7	782.3	9.0	-21.7	-19.0	2.7
AGC+10dB	781.7	782.3	11.0	-21.2	-19.0	2.2

Remark: Please see next sub-clause for the measurement plot.

4.4.4MEASUREMENT PLOTS

Frequency Band = Band 2, Direction = Downlink, Input Power = AGC



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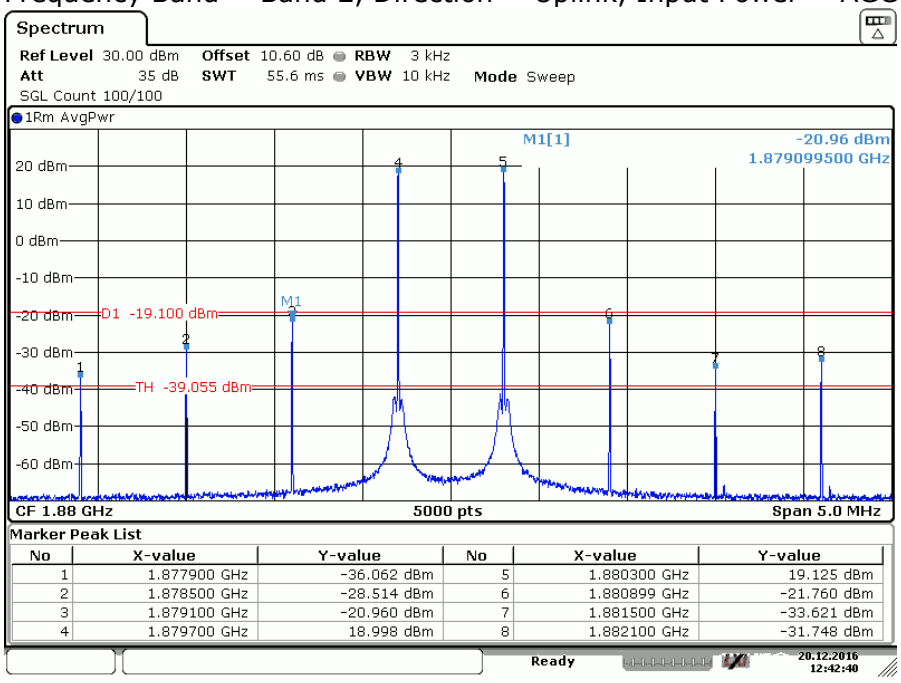

Date: 20.DEC.2016 12:42:40

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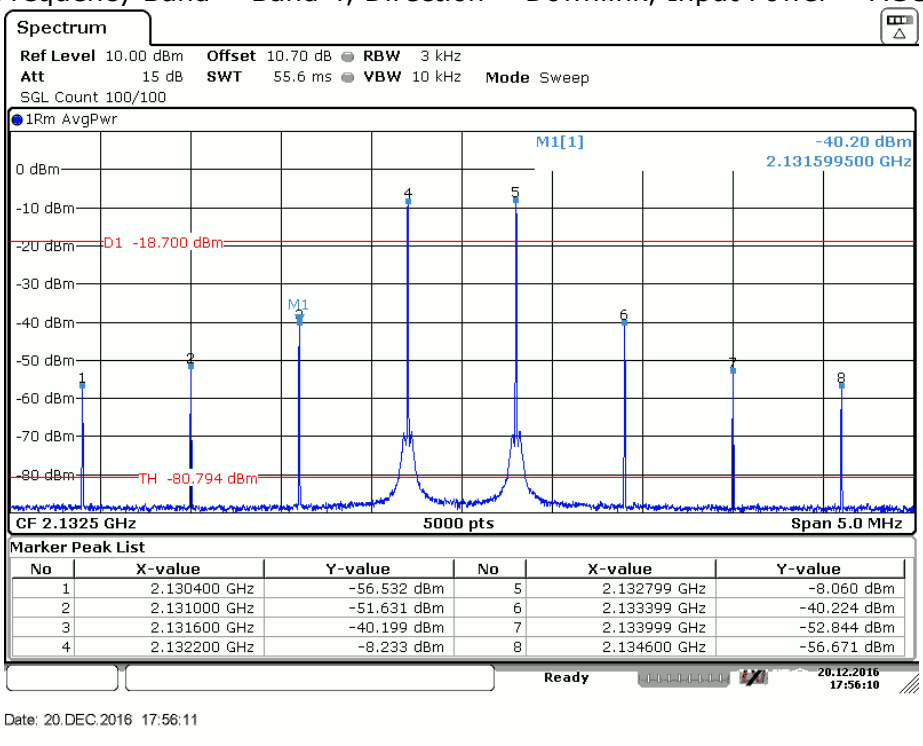

Date: 20.DEC.2016 17:56:11

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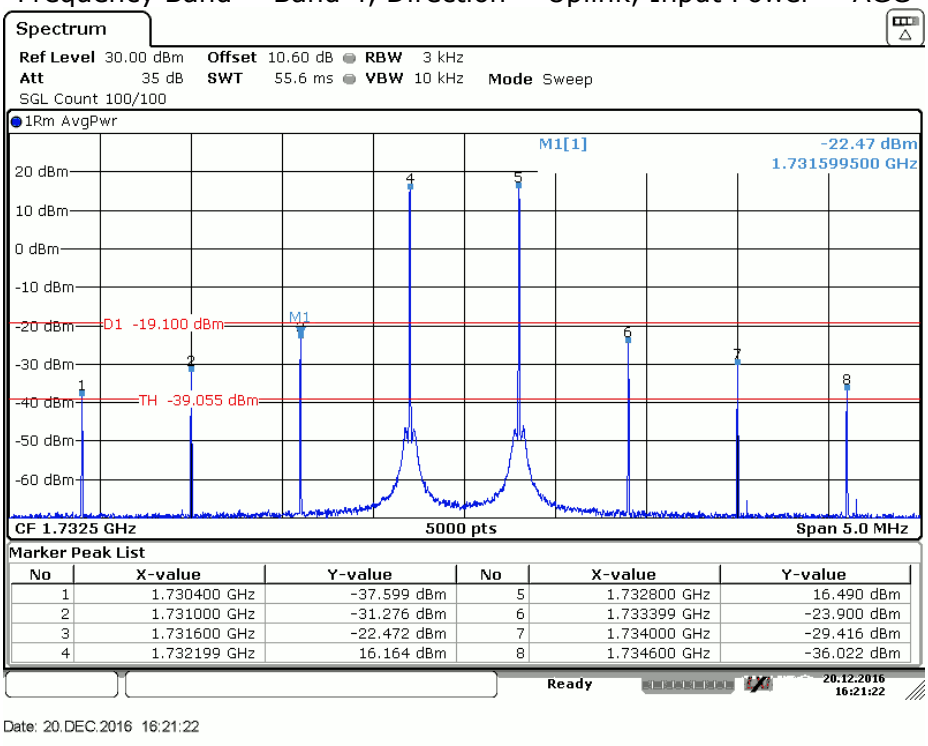

Date: 20.DEC.2016 16:21:22

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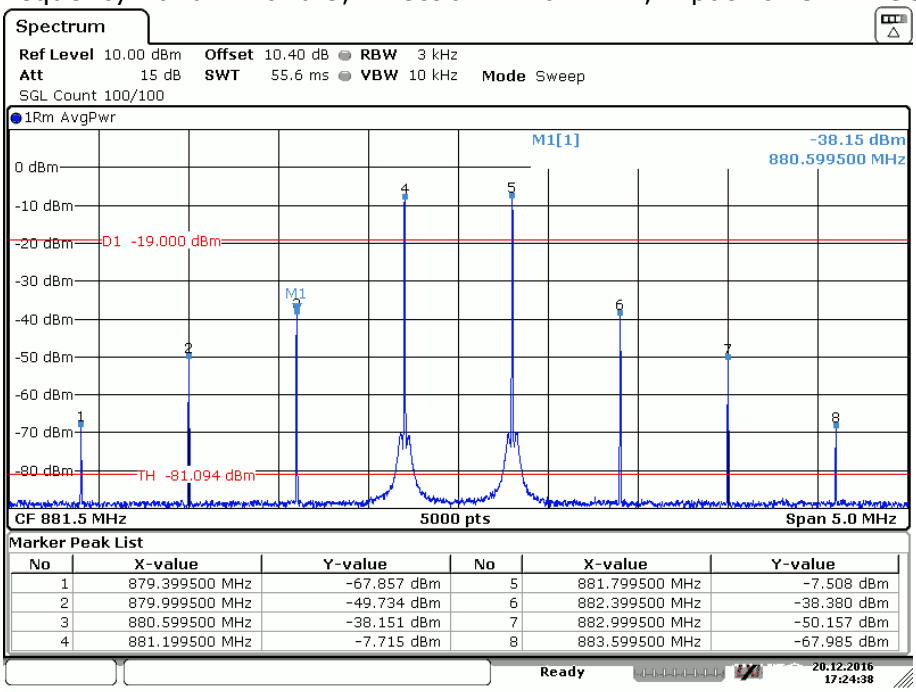

Date: 20.DEC.2016 17:24:39

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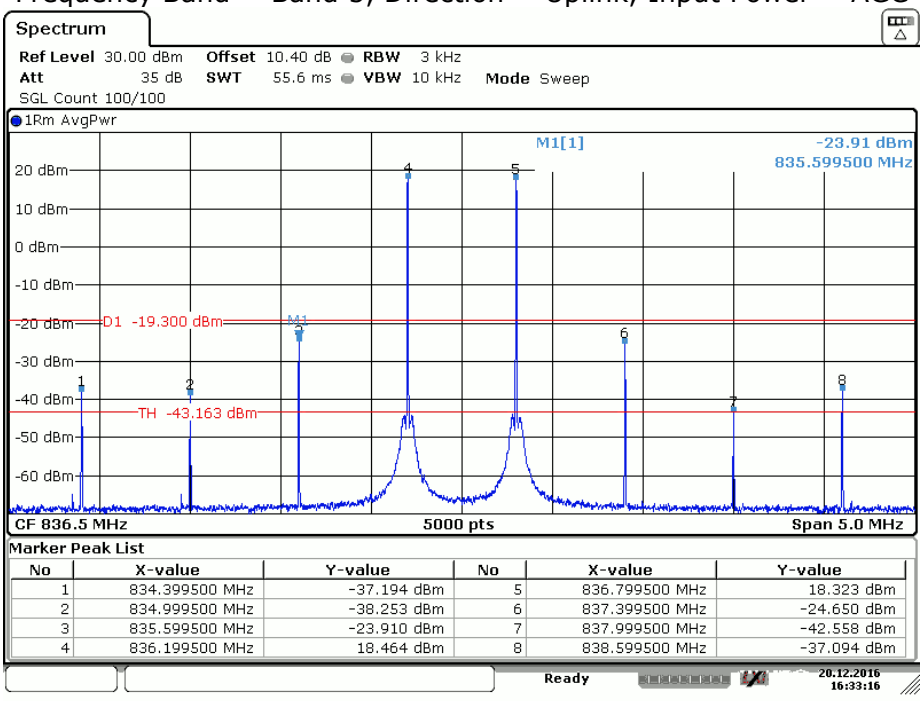
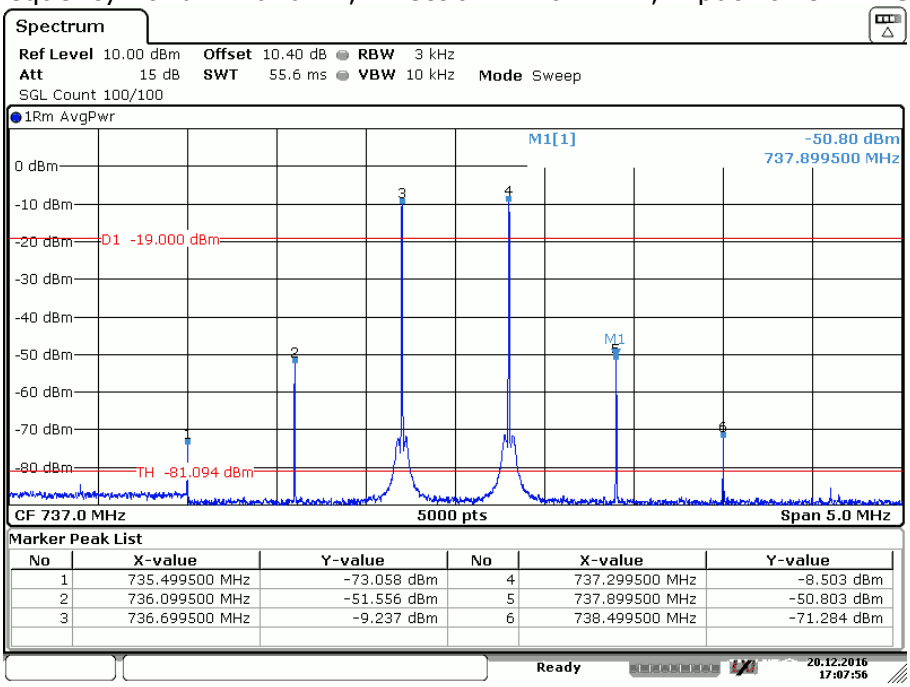


Date: 20.DEC.2016 16:33:17

Frequency Band = Band 12, Direction = Downlink, Input Power = AGC



Date: 20.DEC.2016 17:07:56

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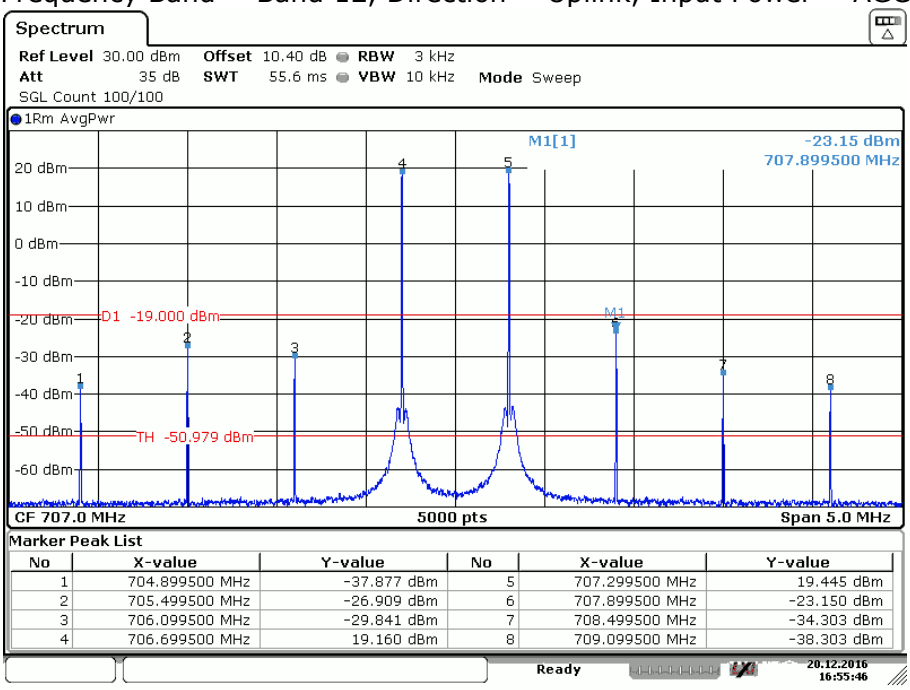

Date: 20.DEC.2016 16:55:46

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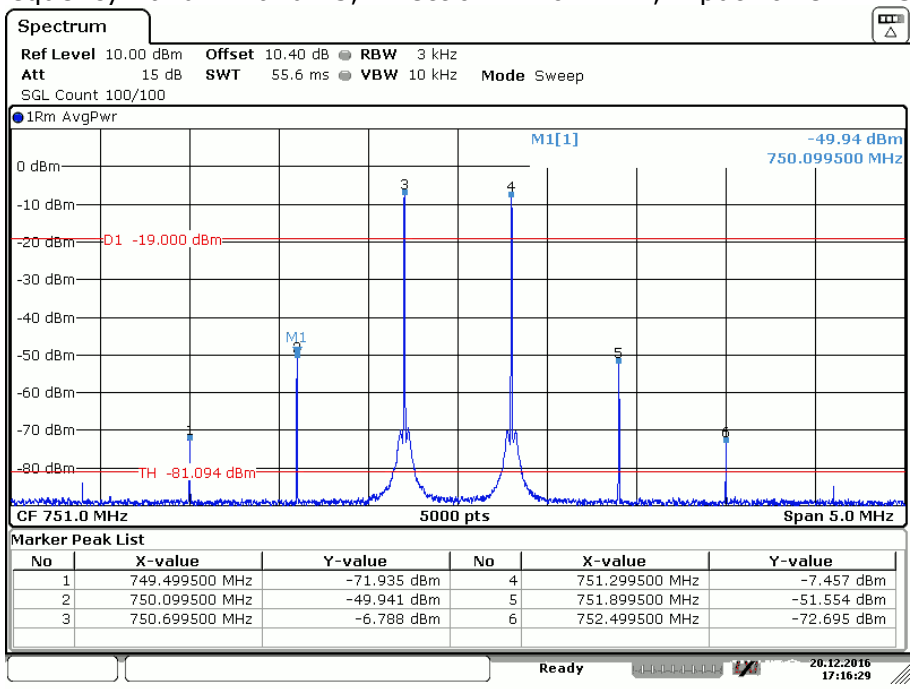
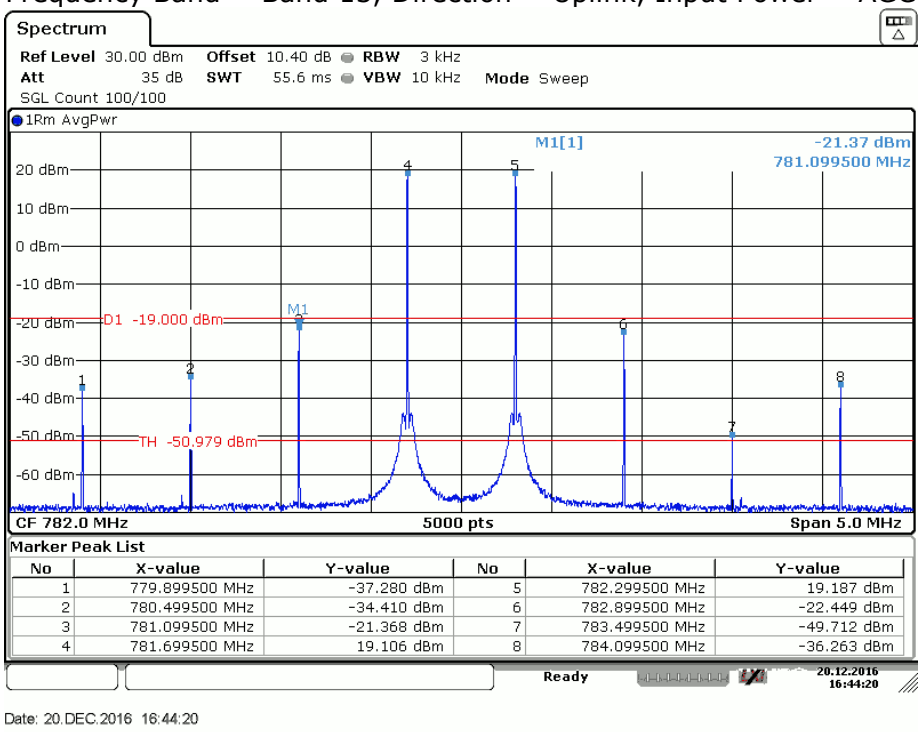


Frequency Band = Band 13, Direction = Uplink, Input Power = AGC



4.4.5TEST EQUIPMENT USED

R&S TS8997

4.5 OUT-OF-BAND EMISSION

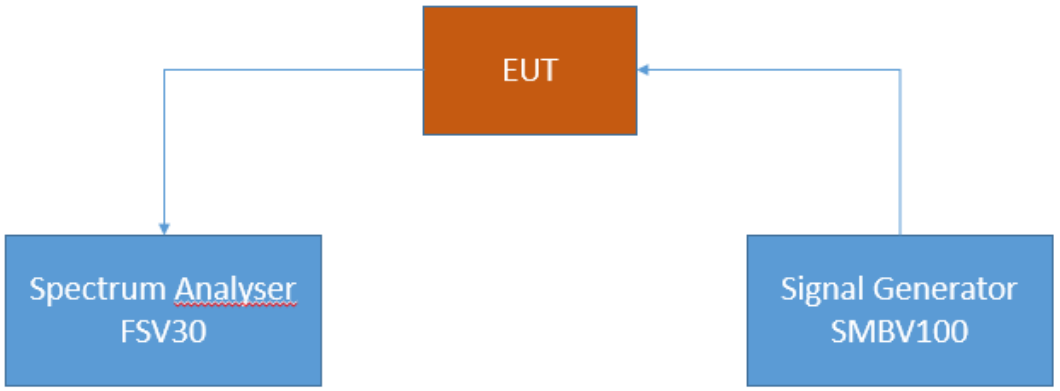
Standard

The test was performed according to:
KDB 935210 D03

4.5.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the out-of-band emission limit § 20.21(e)(8)(i)(E) for wideband consumer signal boosters. The limits itself come from the applicable rule for each operating as listed in Appendix A of KDB 935210 D03

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.5; Out-of-band emissions

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.5.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(E)

Out of Band Emission Limits. Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

Part 22, Subpart H – Cellular Radiotelephone Service; Band 5 (Cellular)

§ 22 917 – Emission limitations for cellular equipment

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 24 E – Personal Communication Services

§ 24.238 – Emission limitations for Broadband PCS equipment; Band 2 (Broadband PCS)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 27 – Miscellaneous Wireless Communication Services;

Band 4 (AWS-1)
§ 27.53 (h) – Emission limits

(1) *General protection levels.* Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.
(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.
(ii) For operations in the 2000-2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.
(iii) For operations in the 1915-1920 MHz band, the power of any emission between 1930-1995 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.
(iv) For operations in the 1995-2000 MHz band, the power of any emission between 2005-2020 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.

Band 12 (Lower 700 MHz)
§ 27.53 (g) – Emission limits

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

Band 13 (Upper 700 MHz)
§ 27.53 (c), (f) – Emission limits

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

4.5.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1006 hPa
Humidity: 31 %

Band 2, downlink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	1989.80	-23.7	-36.4	-19.0	17.4
LTE	upper	1987.50	-29.6	-54.9	-19.0	35.9
CDMA	upper	1988.75	-29.6	-68.1	-19.0	49.1
GSM	lower	1930.20	-23.7	-37.5	-19.0	18.5
LTE	lower	1932.50	-29.6	-55.0	-19.0	36.0
CDMA	lower	1931.25	-29.6	-65.4	-19.0	46.4

Band 4, downlink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	2154.80	-23.1	-34.2	-19.0	15.2
LTE	upper	2152.50	-29.6	-52.9	-19.0	33.9
CDMA	upper	2153.75	-29.6	-62.2	-19.0	43.2
GSM	lower	2110.20	-23.1	-35.0	-19.0	16.0
LTE	lower	2112.50	-29.6	-53.3	-19.0	34.3
CDMA	lower	2111.25	-29.6	-63.3	-19.0	44.3

Band 5, downlink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	893.80	-22.4	-35.7	-19.0	16.7
LTE	upper	891.50	-26.8	-49.0	-19.0	30.0
CDMA	upper	892.75	-26.8	-47.8	-19.0	28.8
GSM	lower	869.20	-22.4	-35.9	-19.0	16.9
LTE	lower	871.50	-26.8	-48.8	-19.0	29.8
CDMA	lower	870.25	-26.8	-47.0	-19.0	28.0

Band 12, downlink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	745.80	-22.1	-53.9	-19.0	34.9
LTE	upper	743.50	-23.3	-55.4	-19.0	36.4
CDMA	upper	744.75	-23.3	-63.9	-19.0	44.9
GSM	lower	728.20	-22.1	-55.4	-19.0	36.4
LTE	lower	730.50	-23.3	-51.0	-19.0	32.0
CDMA	lower	729.25	-23.3	-53.9	-19.0	34.9

Band 13, downlink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	755.80	-22.1	-52.9	-19.0	33.9
LTE	upper	753.50	-23.2	-54.8	-19.0	35.8
CDMA	upper	754.75	-23.2	-63.2	-19.0	44.2
GSM	lower	746.20	-22.1	-55.1	-19.0	36.1
LTE	lower	748.50	-23.2	-53.9	-19.0	34.9
CDMA	lower	747.25	-23.2	-60.5	-19.0	41.5

Band 2, uplink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	1909.80	7.5	-22.8	-19.0	3.8
LTE	upper	1907.50	1.0	-26.1	-19.0	7.1
CDMA	upper	1908.75	1.0	-21.5	-19.0	2.5
GSM	lower	1850.20	7.5	-22.3	-19.0	3.3
LTE	lower	1852.50	1.0	-24.7	-19.0	5.7
CDMA	lower	1851.25	1.0	-31.8	-19.0	12.8

Band 4, uplink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	1754.80	-1.7	-35.3	-19.0	16.3
LTE	upper	1752.50	1.4	-24.7	-19.0	5.7
CDMA	upper	1753.75	1.4	-30.4	-19.0	11.4
GSM	lower	1710.20	-1.7	-36.6	-19.0	17.6
LTE	lower	1712.50	1.4	-24.6	-19.0	5.6
CDMA	lower	1711.25	1.4	-30.5	-19.0	11.5

Band 5, uplink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	848.80	10.2	-35.4	-19.0	16.4
LTE	upper	846.50	2.4	-32.0	-19.0	13.0
CDMA	upper	847.75	2.4	-27.8	-19.0	8.8
GSM	lower	824.20	10.2	-37.6	-19.0	18.6
LTE	lower	826.50	2.4	-34.2	-19.0	15.2
CDMA	lower	825.25	2.4	-31.8	-19.0	12.8

Band 12, uplink

Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	715.80	1.1	-28.2	-19.0	9.2
LTE	upper	713.50	1.7	-26.3	-19.0	7.3
CDMA	upper	714.75	1.7	-27.9	-19.0	8.9
GSM	lower	698.20	1.1	-30.0	-19.0	11.0
LTE	lower	700.50	1.7	-24.6	-19.0	5.6
CDMA	lower	699.25	1.7	-26.1	-19.0	7.1

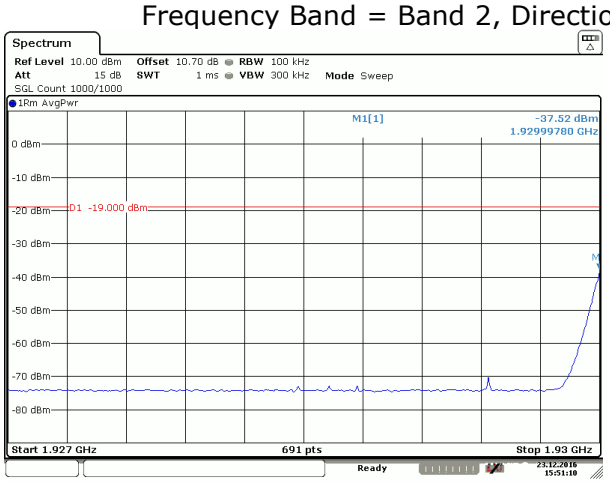
Band 13, uplink

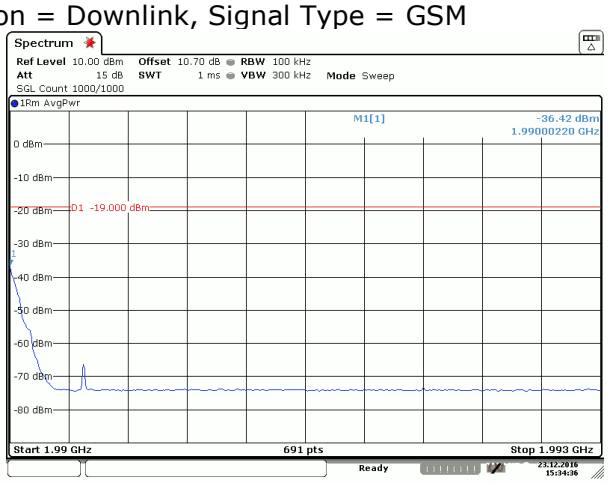
Signal Type	Band Edge	Signal Frequency [MHz]	AGC Start Input Power [dBm]	Maximum Out-of-band Power [dBm]	Limit Out-of-band Power [dBm]	Margin to Limit [dB]
GSM	upper	786.80	1.2	-28.3	-19.0	9.3
LTE	upper	784.50	1.1	-25.5	-19.0	6.5
CDMA	upper	785.75	1.1	-26.8	-19.0	7.8
GSM	lower	777.20	1.2	-31.3	-19.0	12.3
LTE	lower	779.50	1.1	-27.6	-19.0	8.6
CDMA	lower	778.25	1.1	-25.7	-19.0	6.7

Remark: Please see next sub-clause for the measurement plot.

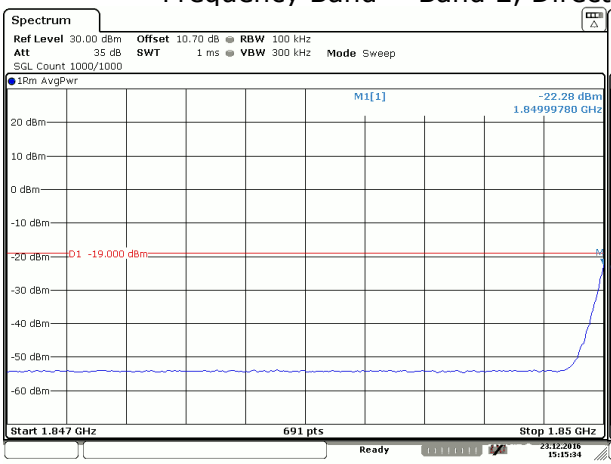
4.5.4MEASUREMENT PLOTS

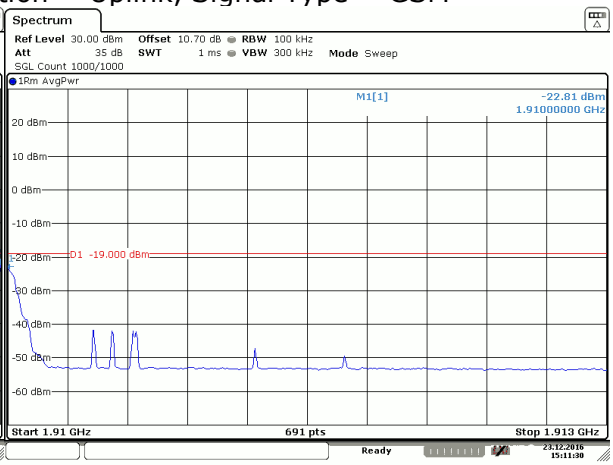
Frequency Band = Band 2, Direction = Downlink, Signal Type = GSM



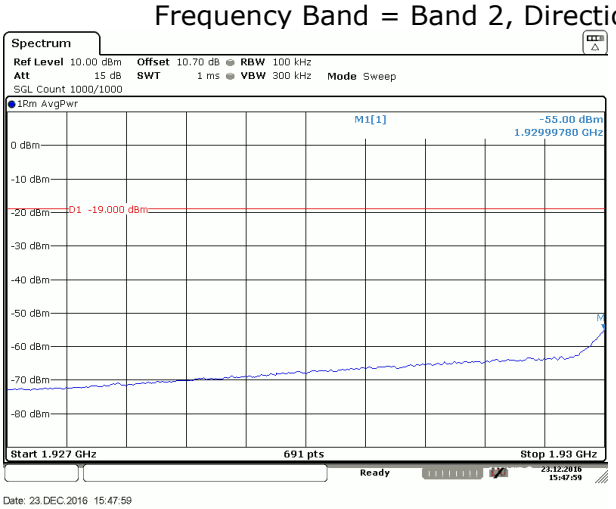


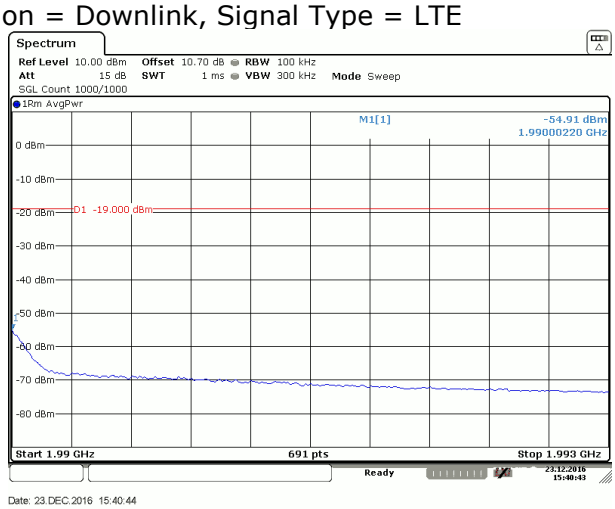
Frequency Band = Band 2, Direction = Uplink, Signal Type = GSM



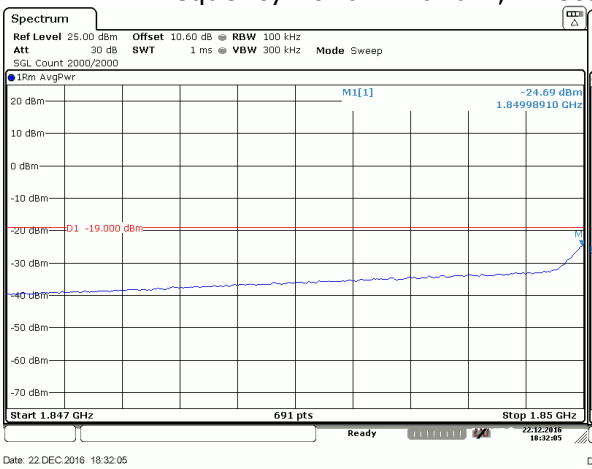


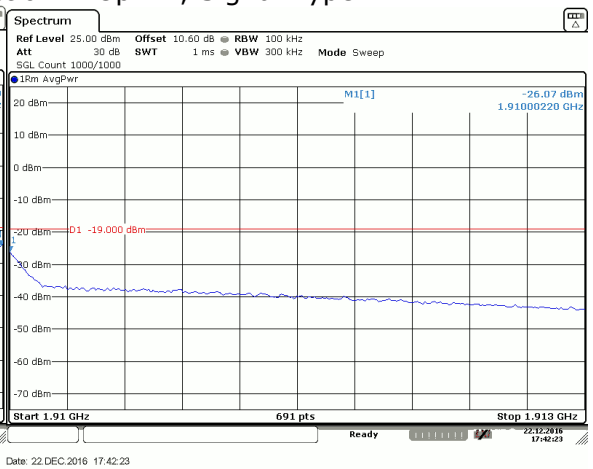
Frequency Band = Band 2, Direction = Downlink, Signal Type = LTE



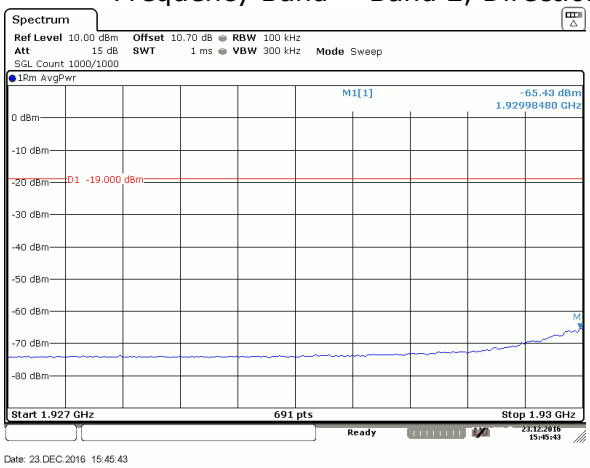


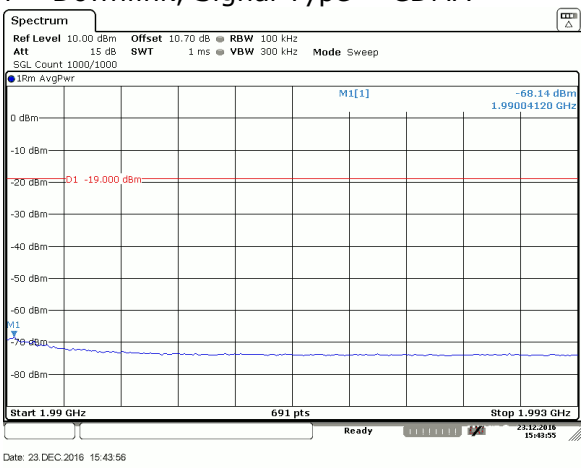
Frequency Band = Band 2, Direction = Uplink, Signal Type = LTE





Frequency Band = Band 2, Direction = Downlink, Signal Type = CDMA





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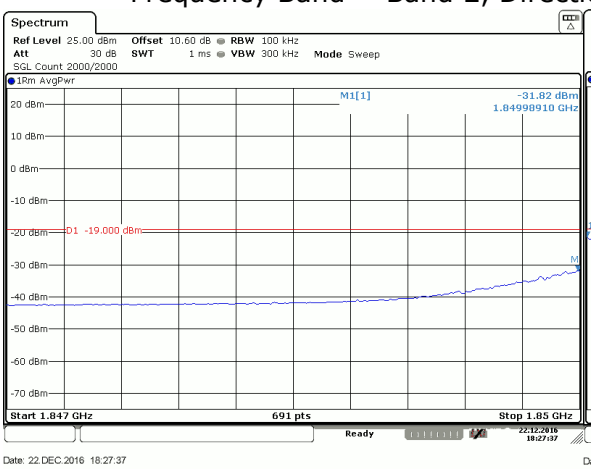

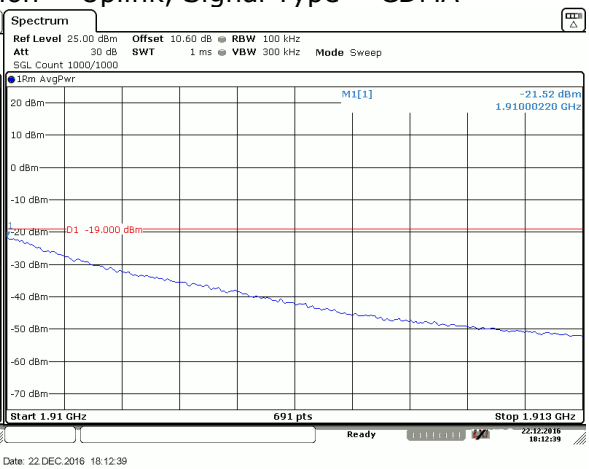

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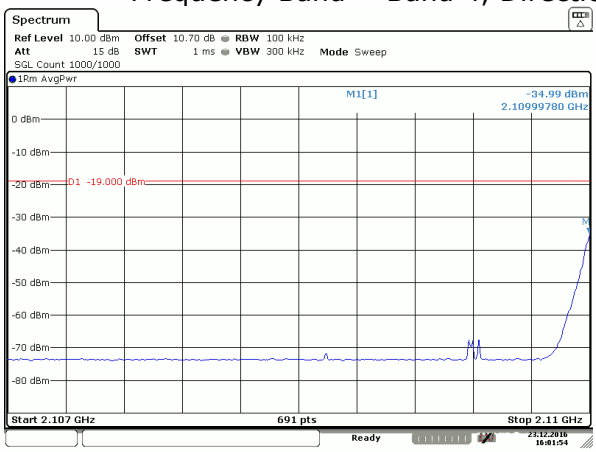

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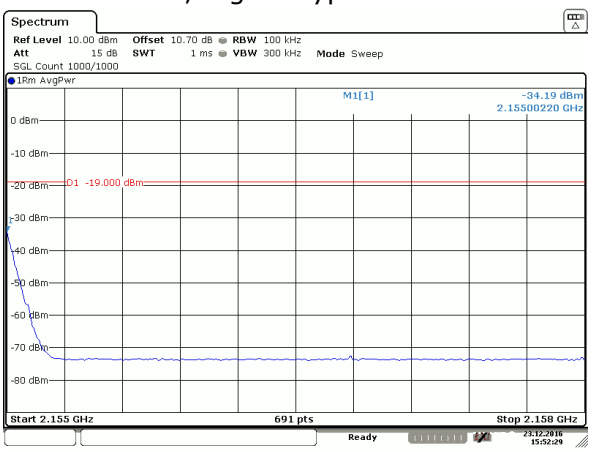

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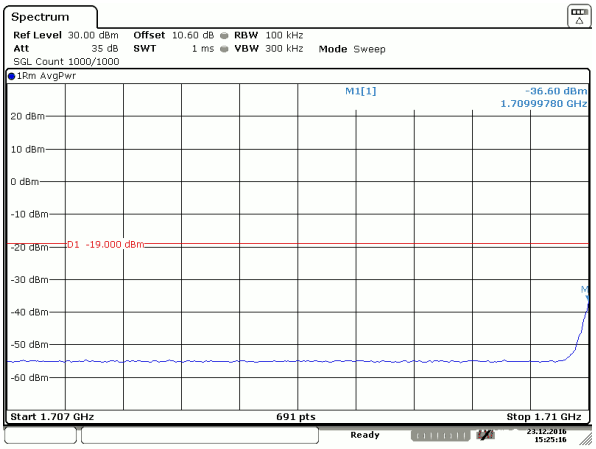

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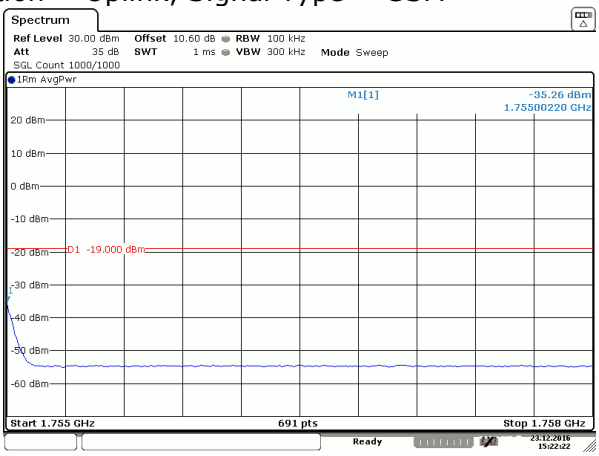

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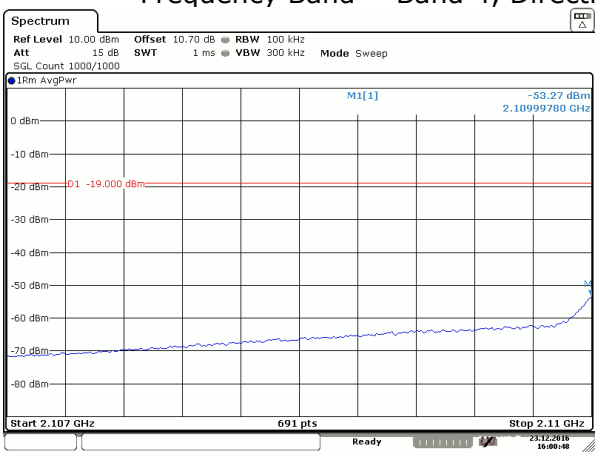

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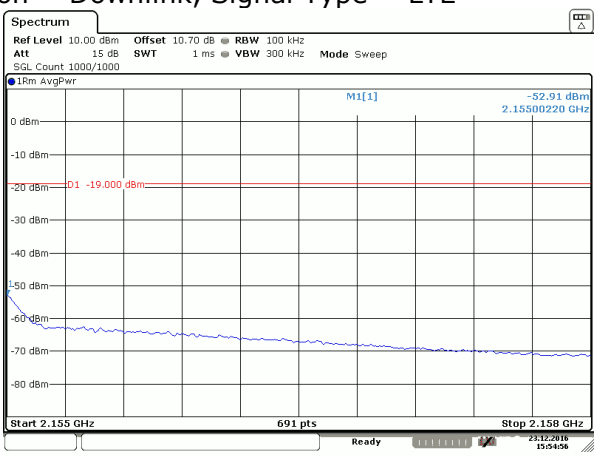

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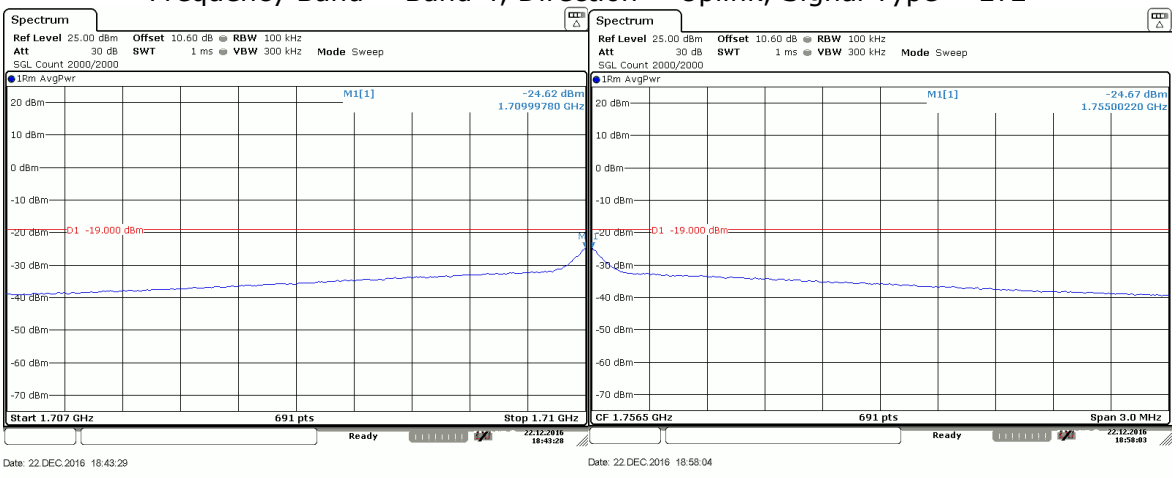

Date: 22.DEC.2016 18:43:29 Date: 22.DEC.2016 18:58:04

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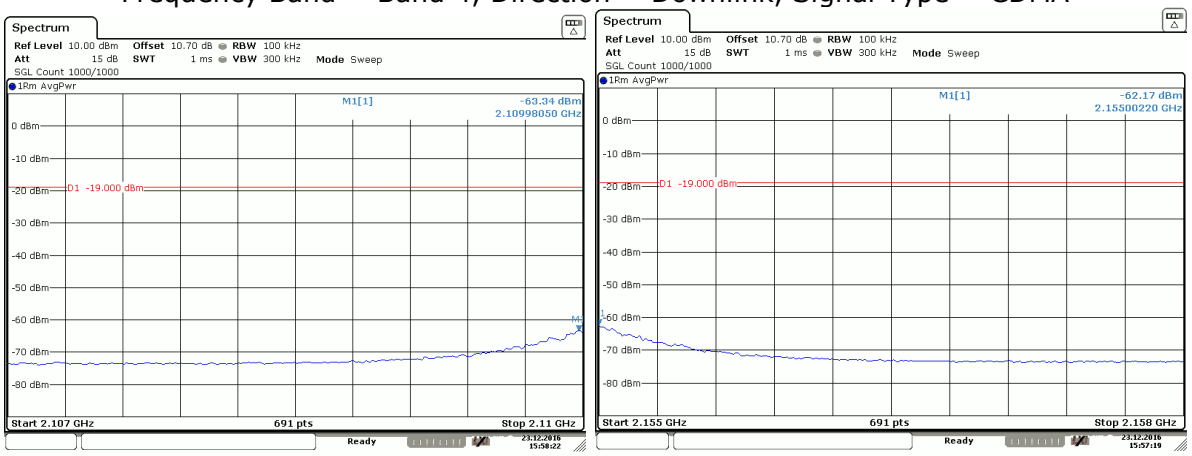

Date: 23.DEC.2016 15:58:22 Date: 23.DEC.2016 15:57:20

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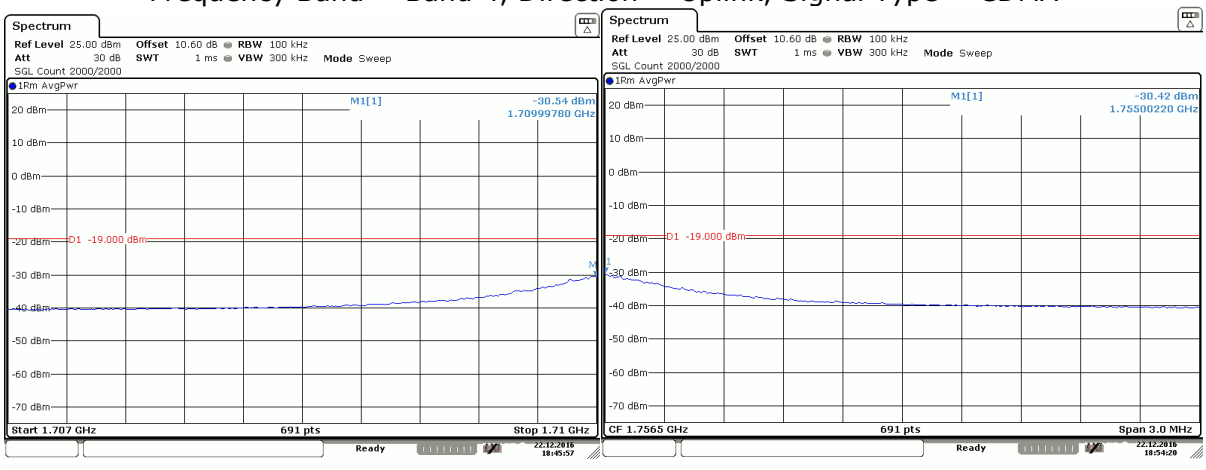

Date: 22.DEC.2016 18:45:57 Date: 22.DEC.2016 18:54:20

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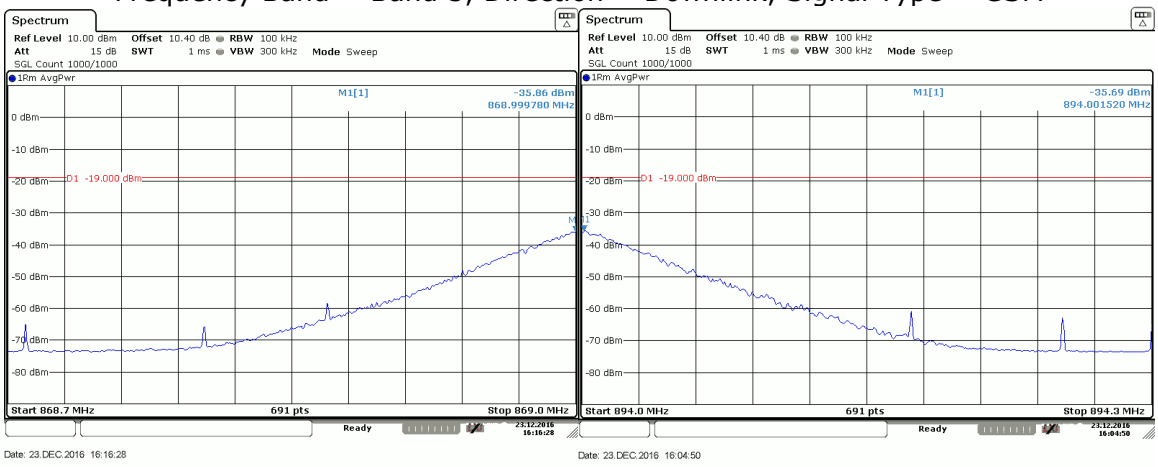

Date: 23.DEC.2016 16:16:28 Date: 23.DEC.2016 16:04:50

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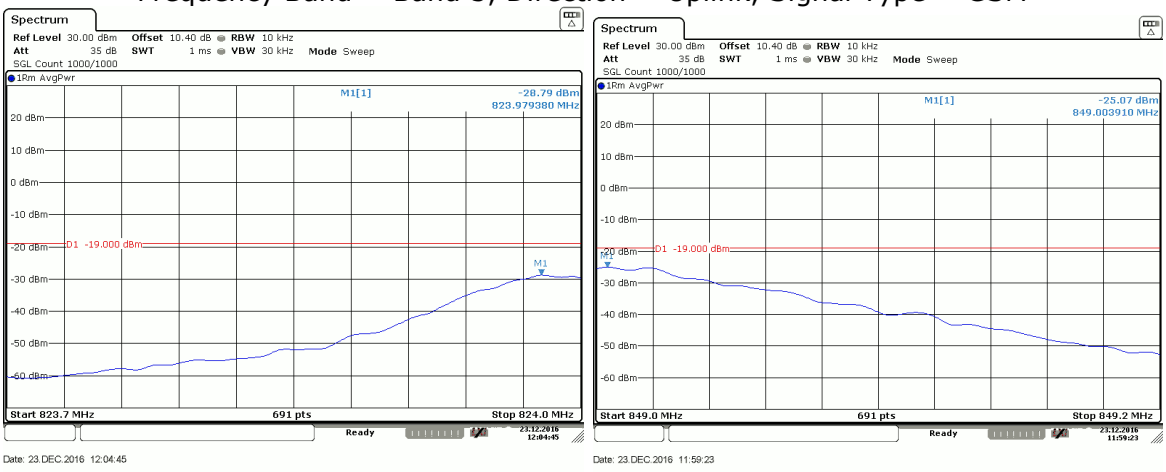

Date: 23.DEC.2016 12:04:45 Date: 23.DEC.2016 11:59:23

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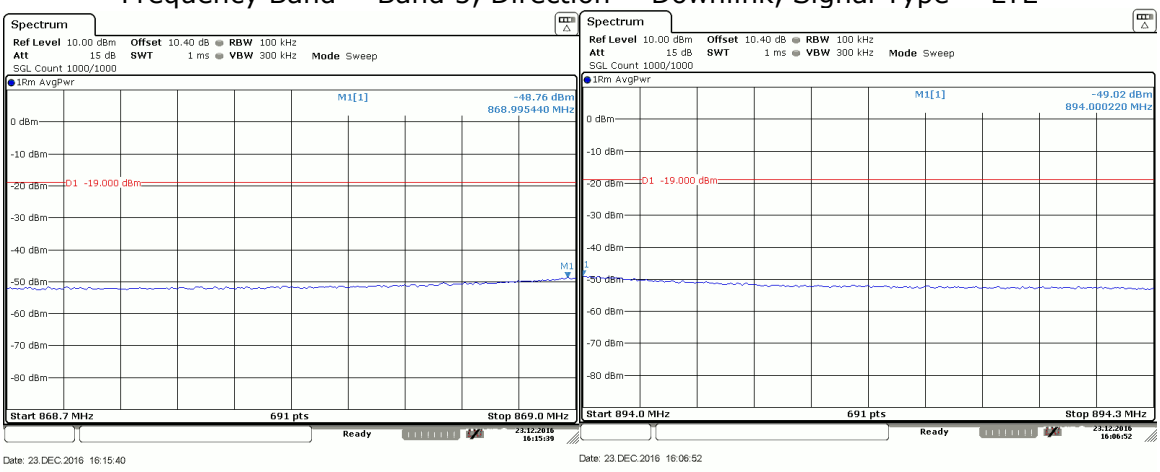

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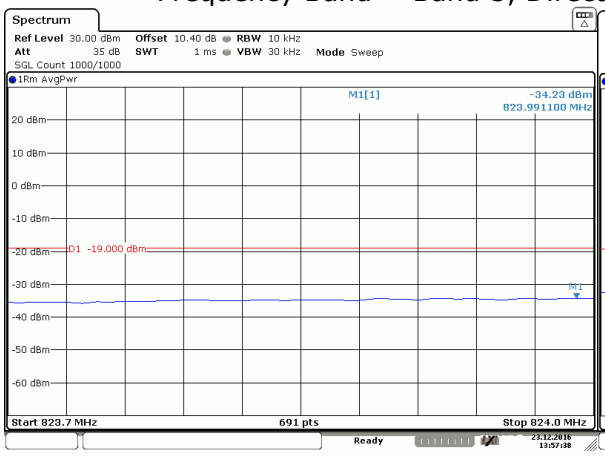

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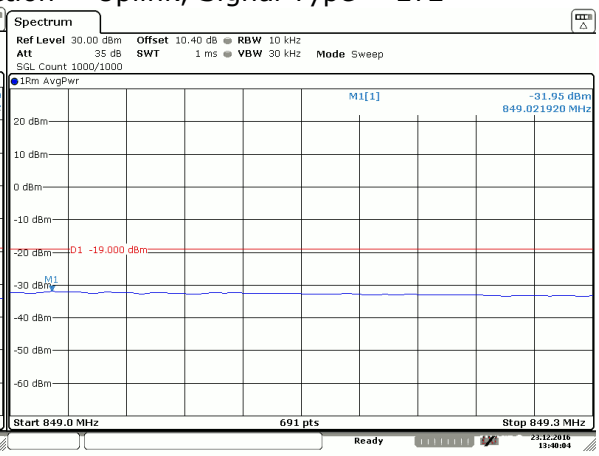

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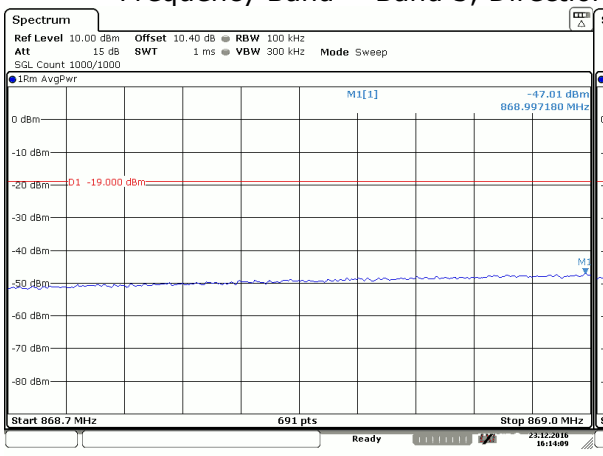

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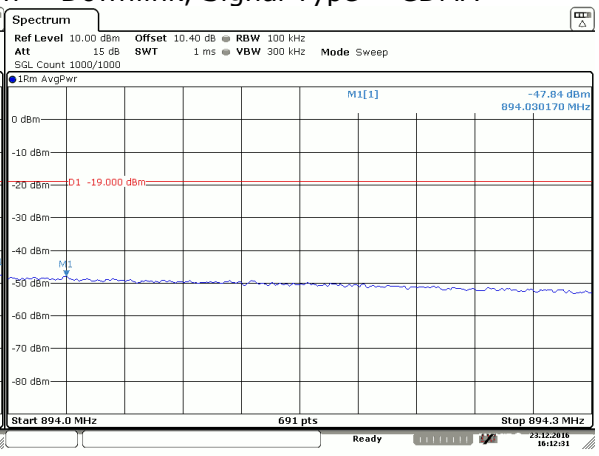

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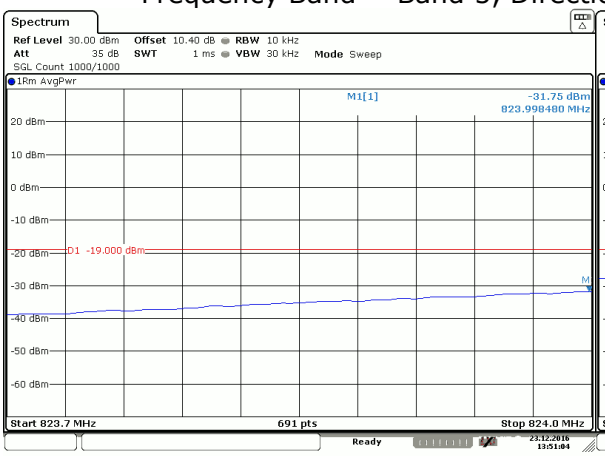

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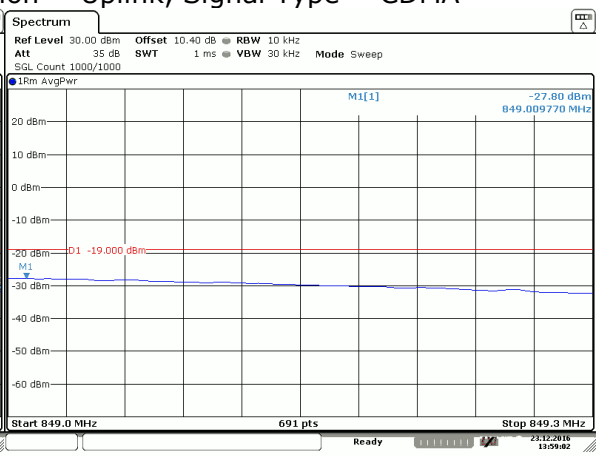

Date: 23.DEC.2016 13:59:02

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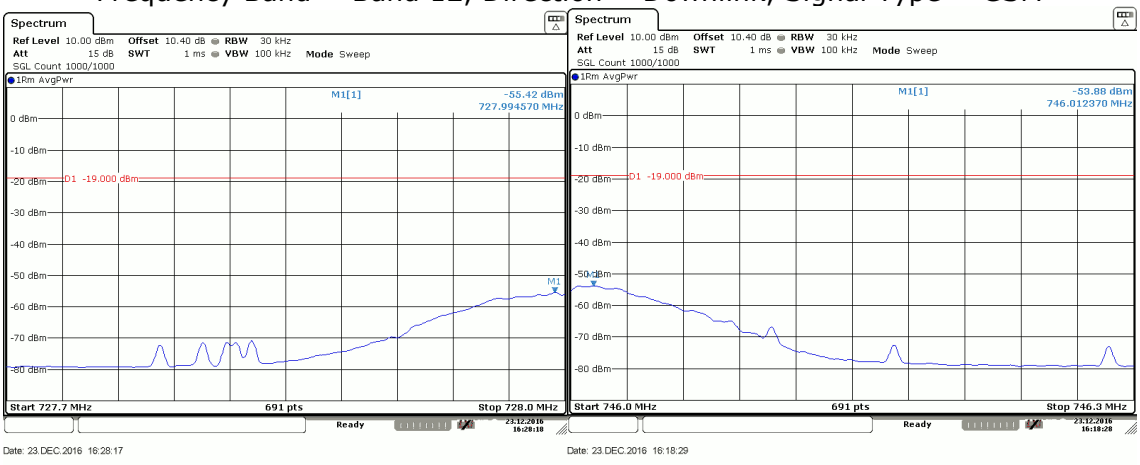

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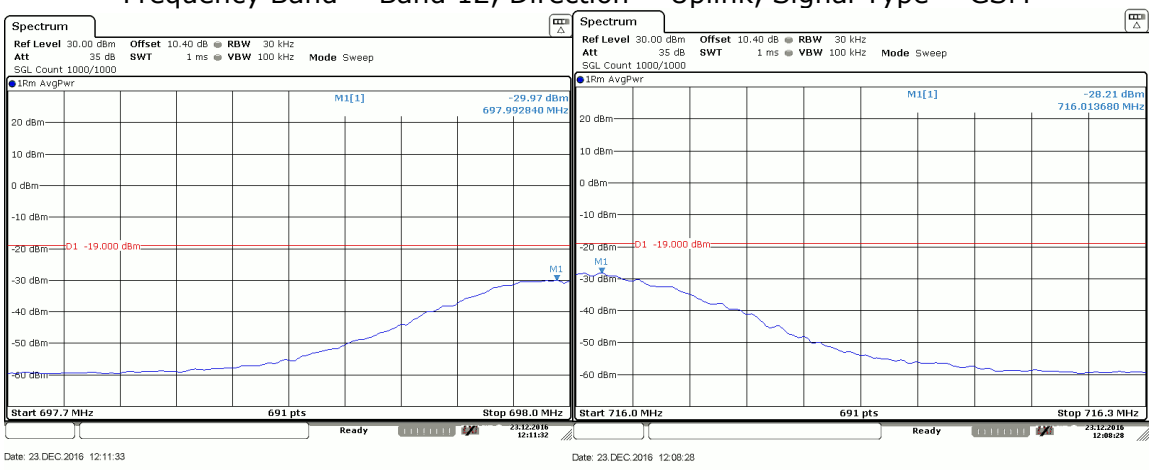
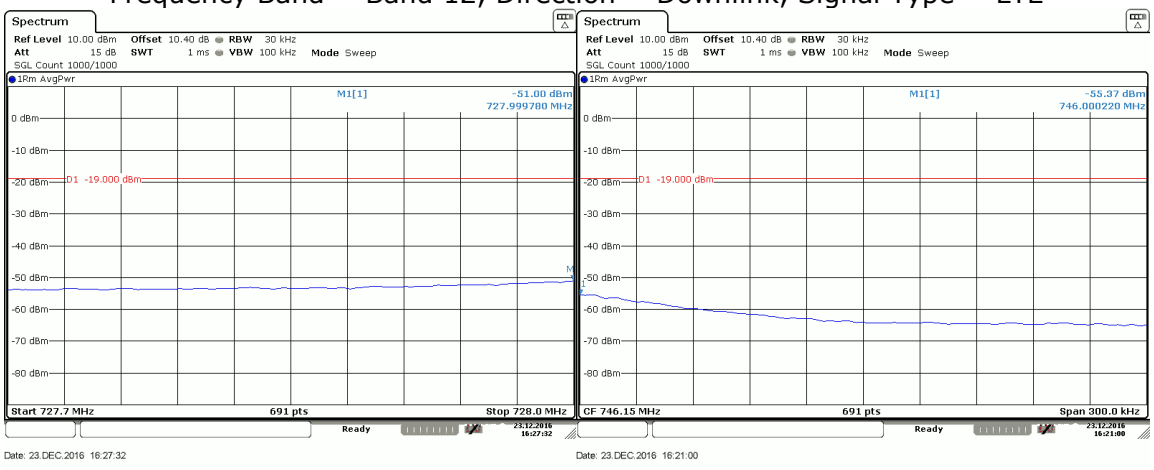


Frequency Band = Band 12, Direction = Downlink, Signal Type = LTE



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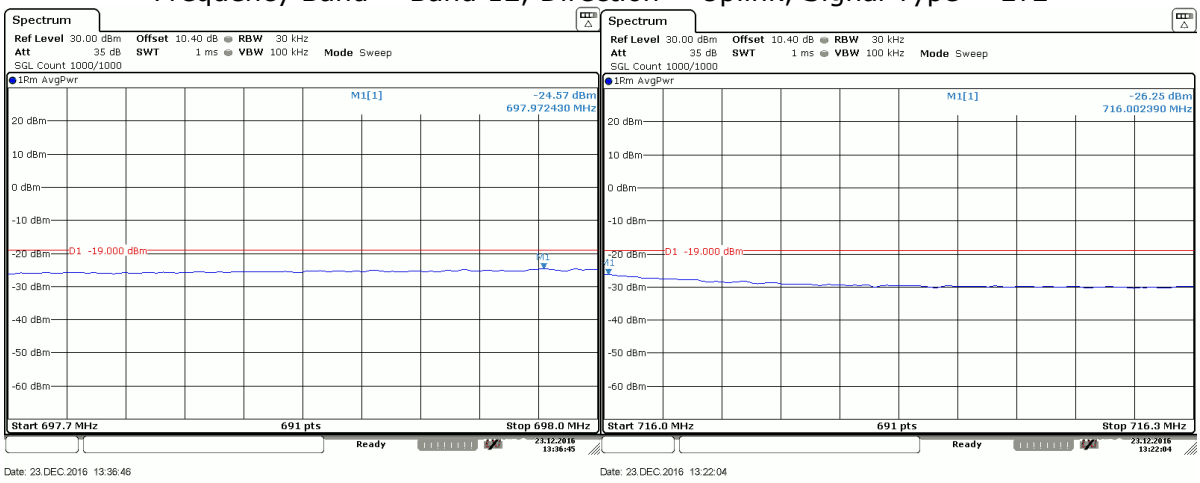

Date: 23.DEC.2016 13:36:46 Date: 23.DEC.2016 13:22:04

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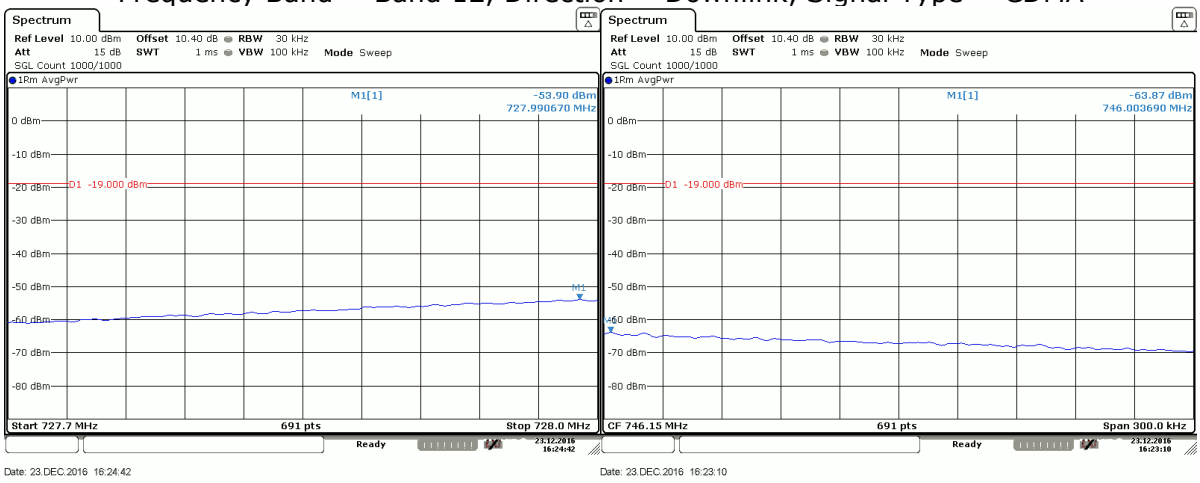

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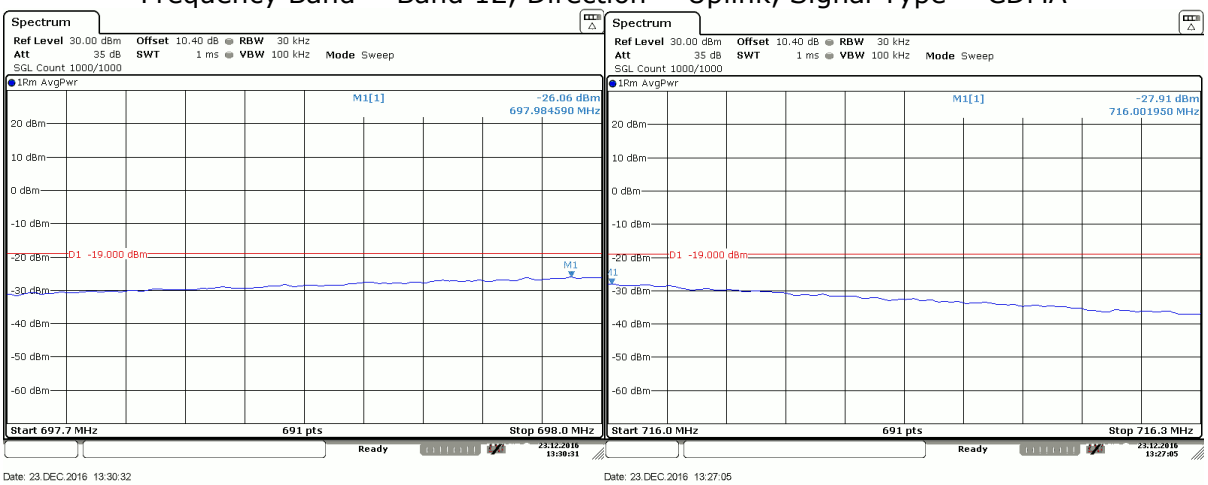

Date: 23.DEC.2016 13:30:32 Date: 23.DEC.2016 13:27:05

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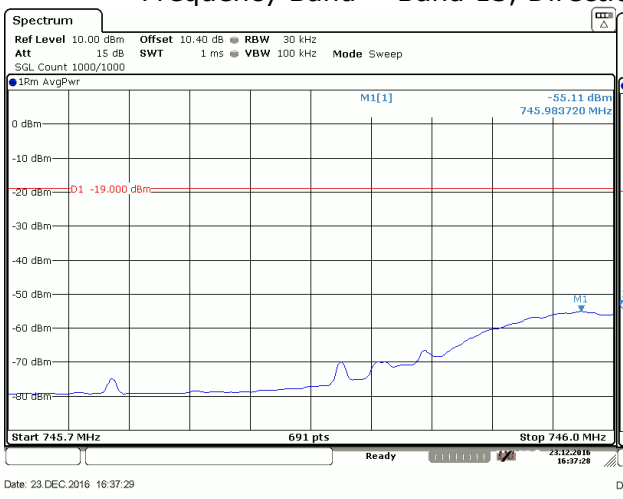
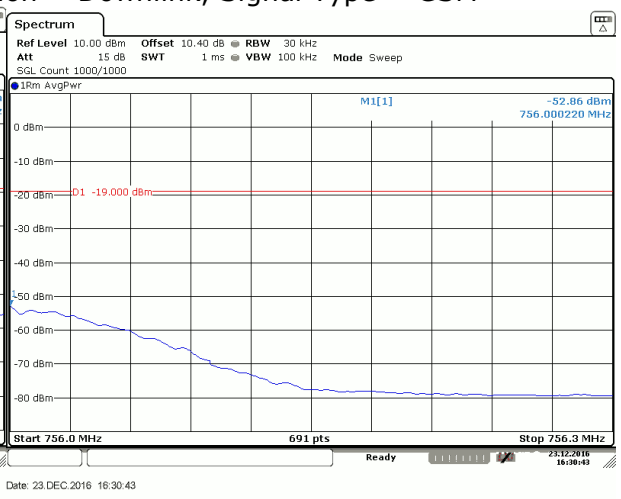
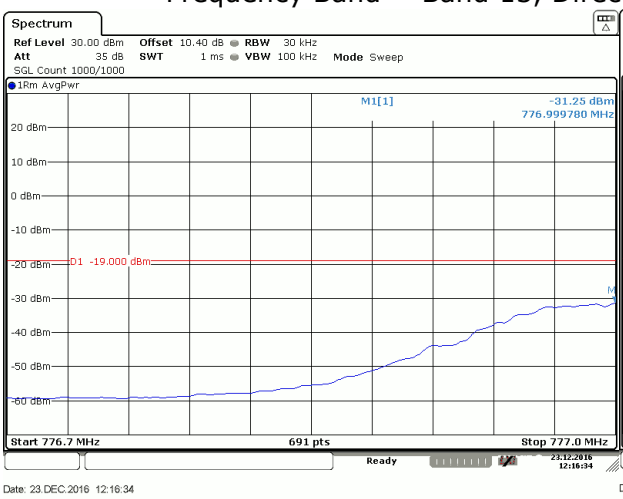
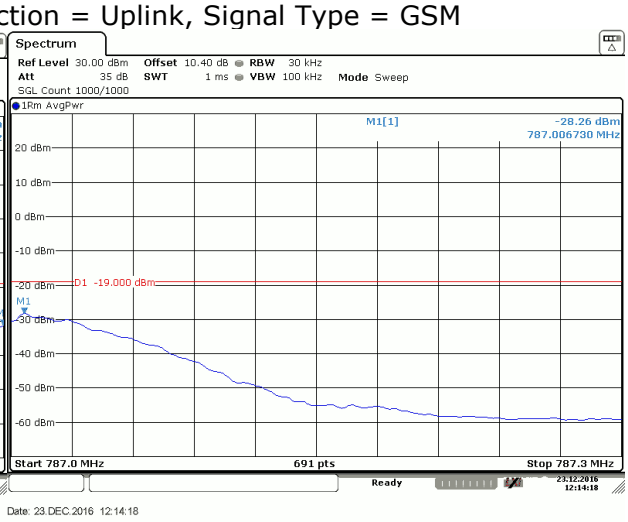


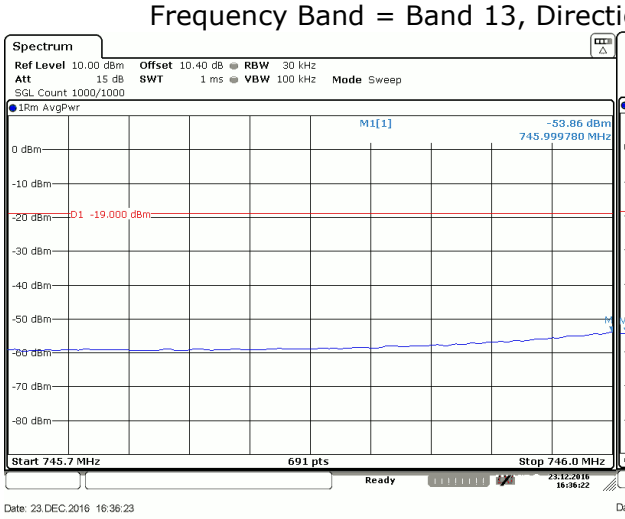


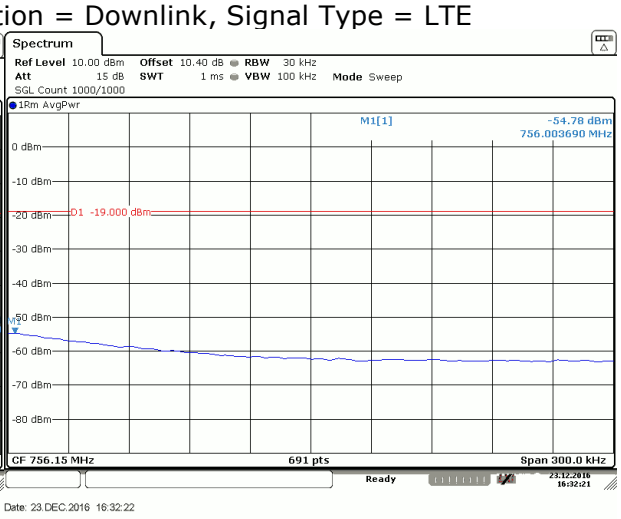
Frequency Band = Band 13, Direction = Uplink, Signal Type = GSM



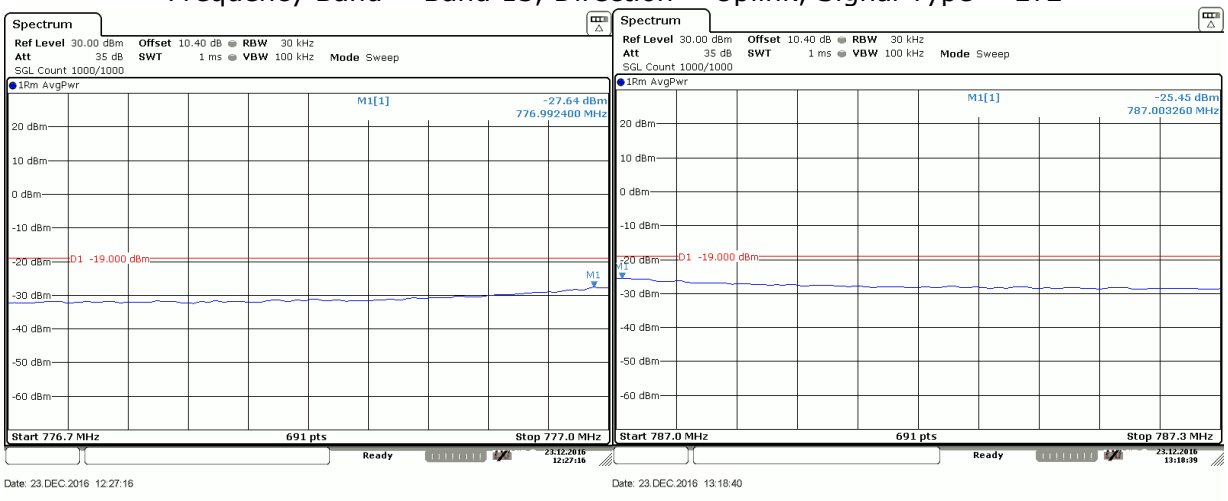


Frequency Band = Band 13, Direction = Downlink, Signal Type = LTE





Frequency Band = Band 13, Direction = Uplink, Signal Type = LTE



Date: 23.DEC.2016 12:27:16 Date: 23.DEC.2016 13:18:40

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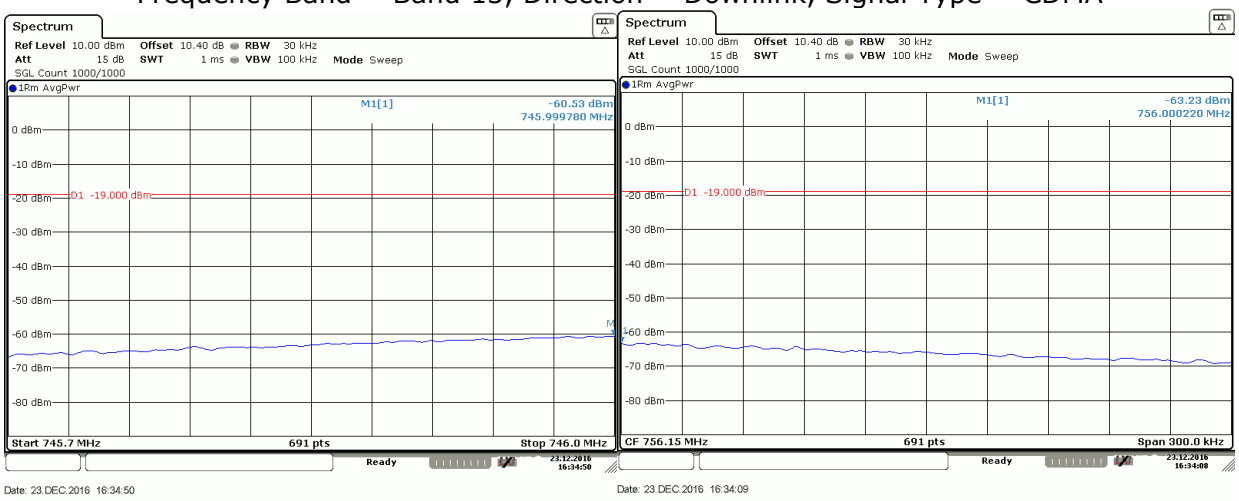

Date: 23.DEC.2016 16:34:50 Date: 23.DEC.2016 16:34:09

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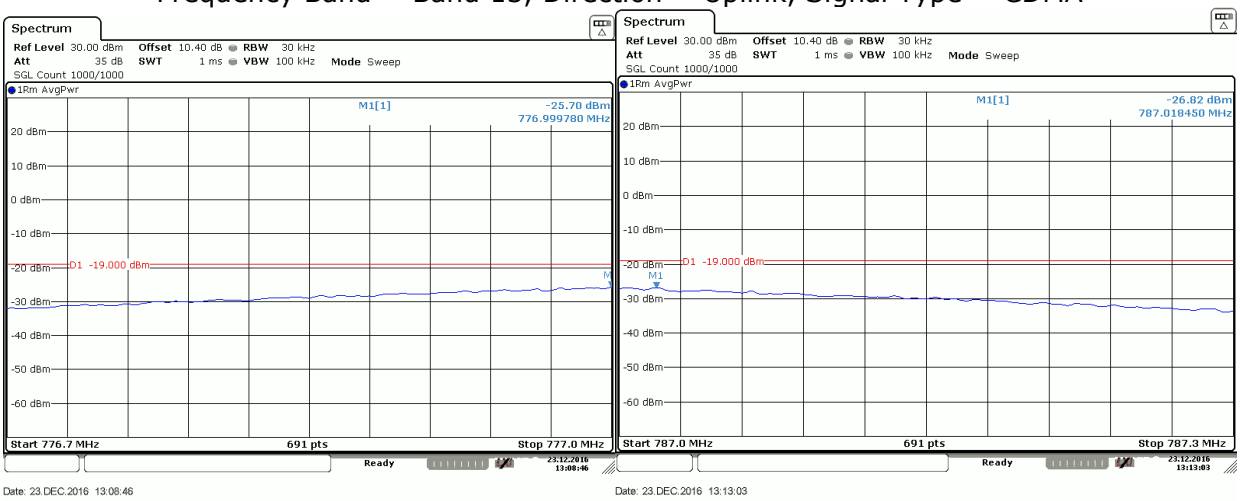


Date: 23.DEC.2016 13:08:46 Date: 23.DEC.2016 13:13:03

4.5.5TEST EQUIPMENT USED

R&S TS8997

4.6 CONDUCTED SPURIOUS EMISSIONS

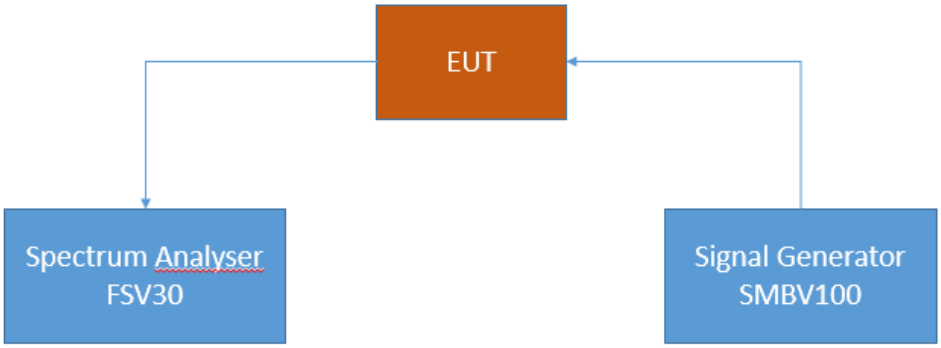
Standard

The test was performed according to:
KDB 935210 D03

4.6.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission limits per § 2.1051

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.6; Conducted Spurious Emissions

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.6.2TEST REQUIREMENTS / LIMITS

FCC Part 2.1051; Measurement required: Spurious emissions at antenna terminal:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 20, § 20.21(e)(8)(i)(E)

Out of Band Emission Limits. Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

Part 22, Subpart H – Cellular Radiotelephone Service; Band 5 (Cellular)

§ 22 917 – Emission limitations for cellular equipment

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 24 E – Personal Communication Services

§ 24.238 – Emission limitations for Broadband PCS equipment; Band 2 (Broadband PCS)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 27 – Miscellaneous Wireless Communication Services;

Band 4 (AWS-1)
§ 27.53 (h) – Emission limits

(1) *General protection levels.* Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) dB.
(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.
(ii) For operations in the 2000-2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
(iii) For operations in the 1915-1920 MHz band, the power of any emission between 1930-1995 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
(iv) For operations in the 1995-2000 MHz band, the power of any emission between 2005-2020 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
Band 12 (Lower 700 MHz)
§ 27.53 (g) – Emission limits

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed

Band 13 (Upper 700 MHz)
§ 27.53 (c), (f) – Emission limits

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

4.6.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, downlink; Center frequency: 1960.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
6898.3	-30.7	-29.6	RMS	1000	-13.0	17.7

Band 4, downlink; Center frequency: 2132.50 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
17494.8	-31.0	-29.6	RMS	1000	-13.0	18.0

Band 5, downlink; Center frequency: 881.5.0 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
6849.9	-40.6	-26.8	RMS	100	-13.0	27.6

Band 12, downlink; Center frequency: 737.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
6888.4	-38.9	-23.3	RMS	100	-13.0	25.9

Band 13, downlink; Center frequency: 751.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
6967.0	-40.1	-23.2	RMS	100	-13.0	27.1

Band 2, uplink; Center frequency: 1880.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
6870.3	-29.7	1.0	RMS	1000	-13.0	16.7

Band 4, uplink; Center frequency: 1732.50 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
3466.9	-25.9	1.4	RMS	1000	-13.0	12.9

Band 5, uplink; Center frequency: 836.50 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
6841.8	-41.0	2.4	RMS	100	-13.0	28.0

Band 12, uplink; Center frequency: 707.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
679.9	-39.1	1.7	RMS	100	-13.0	26.1

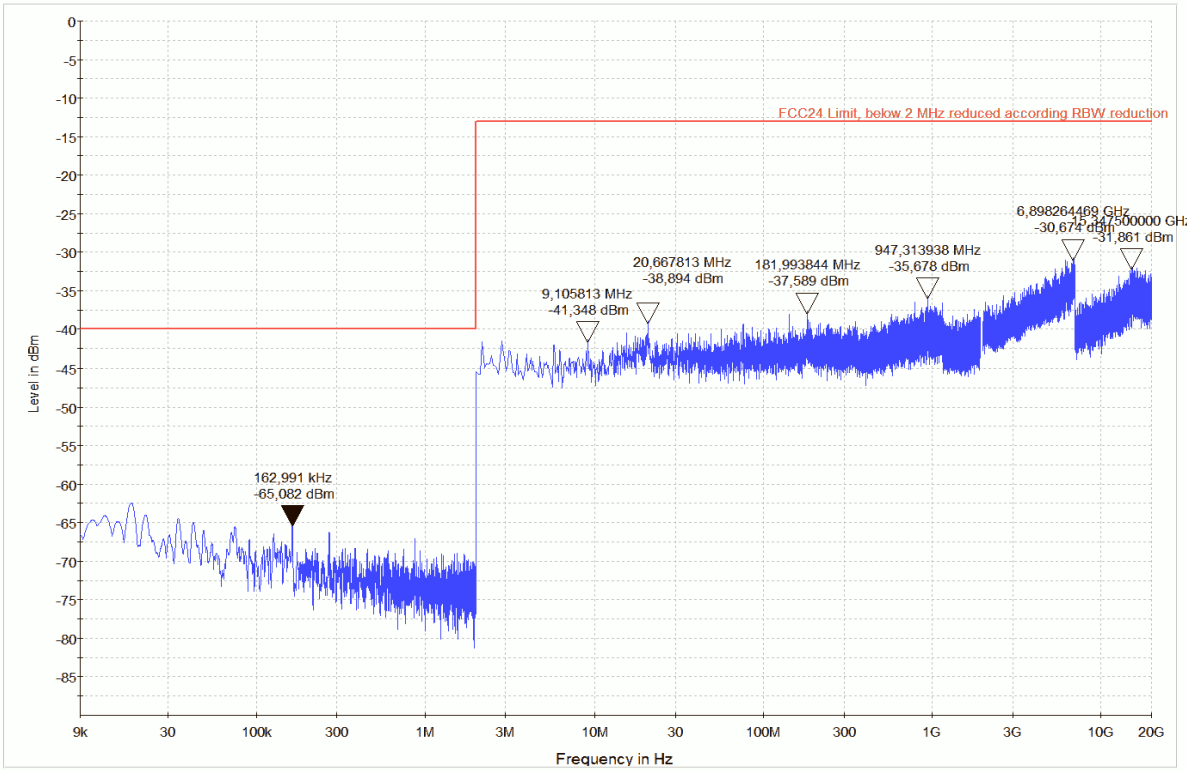
Band 13, uplink; Center frequency: 782.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
787.1	-23.4	1.1	RMS	100	-13.0	10.4

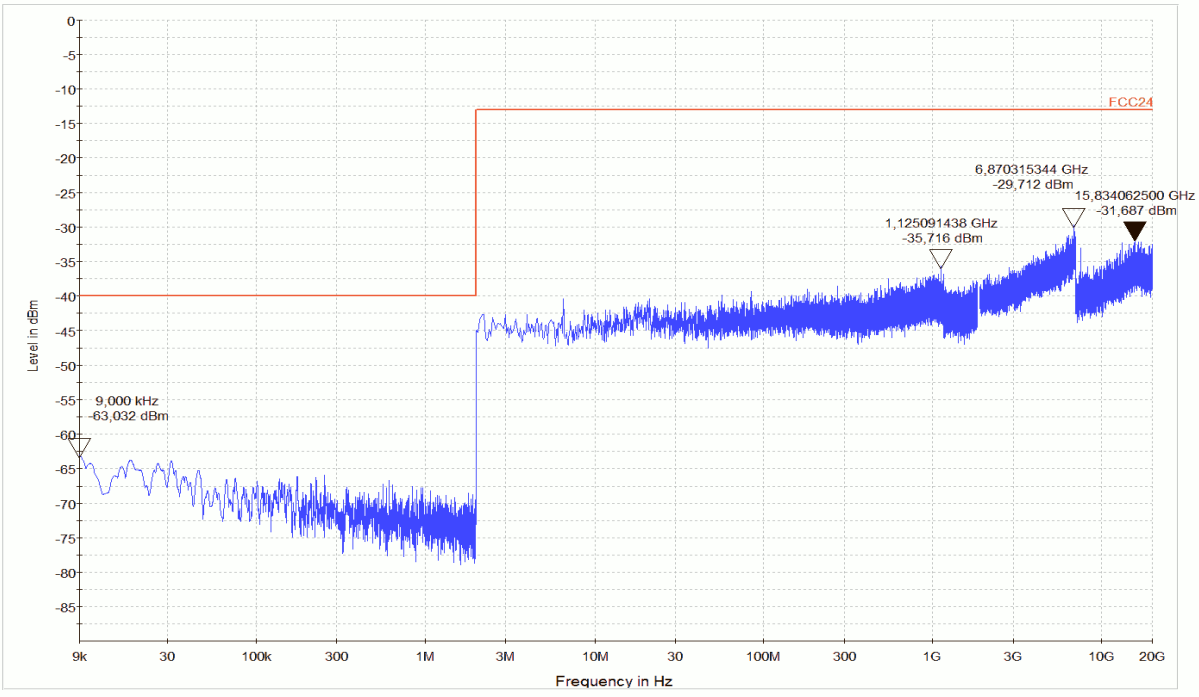
Remark: Please see next sub-clause for the measurement plot.

4.6.4MEASUREMENT PLOTS

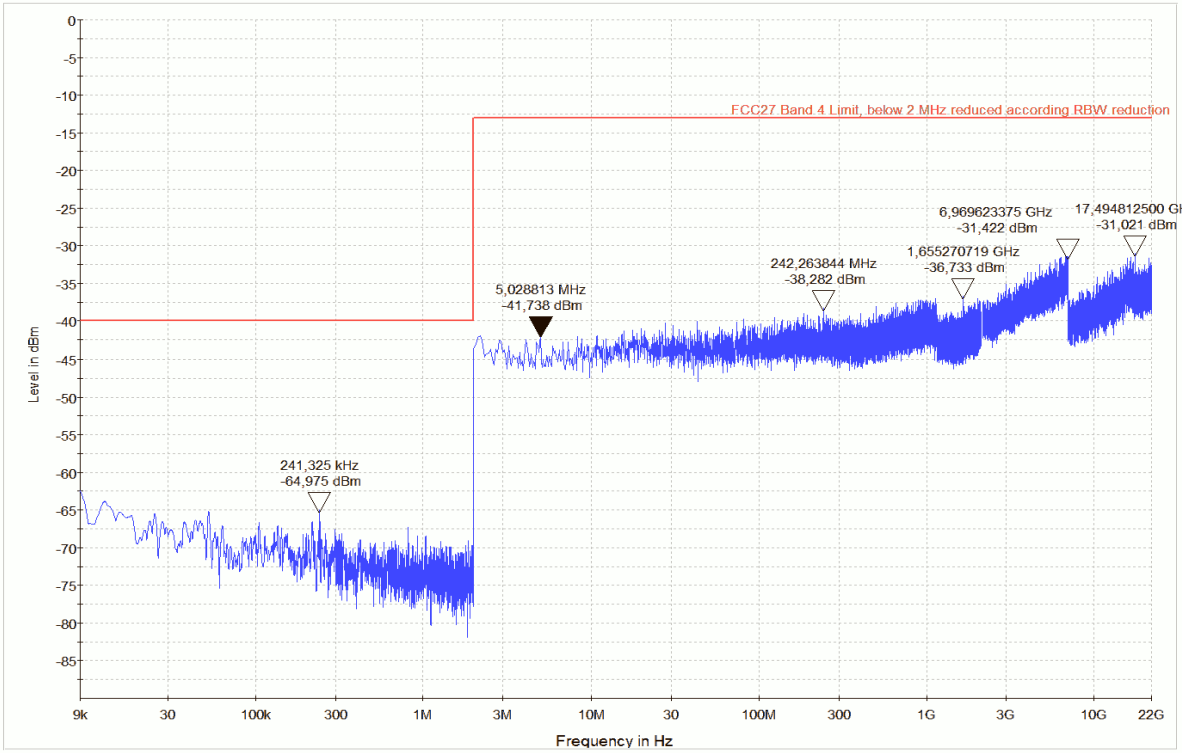
Frequency Band = Band 2, Direction = Downlink



Frequency Band = Band 2, Direction = Uplink

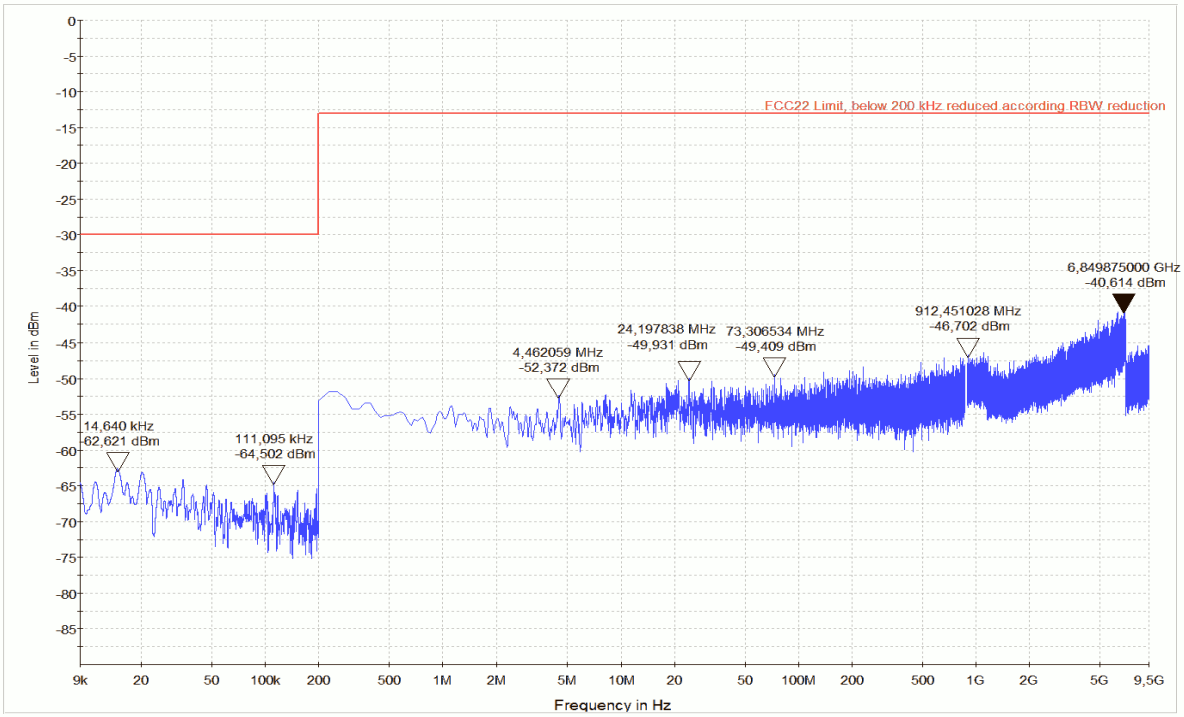


Frequency Band = Band 4, Direction = Downlink

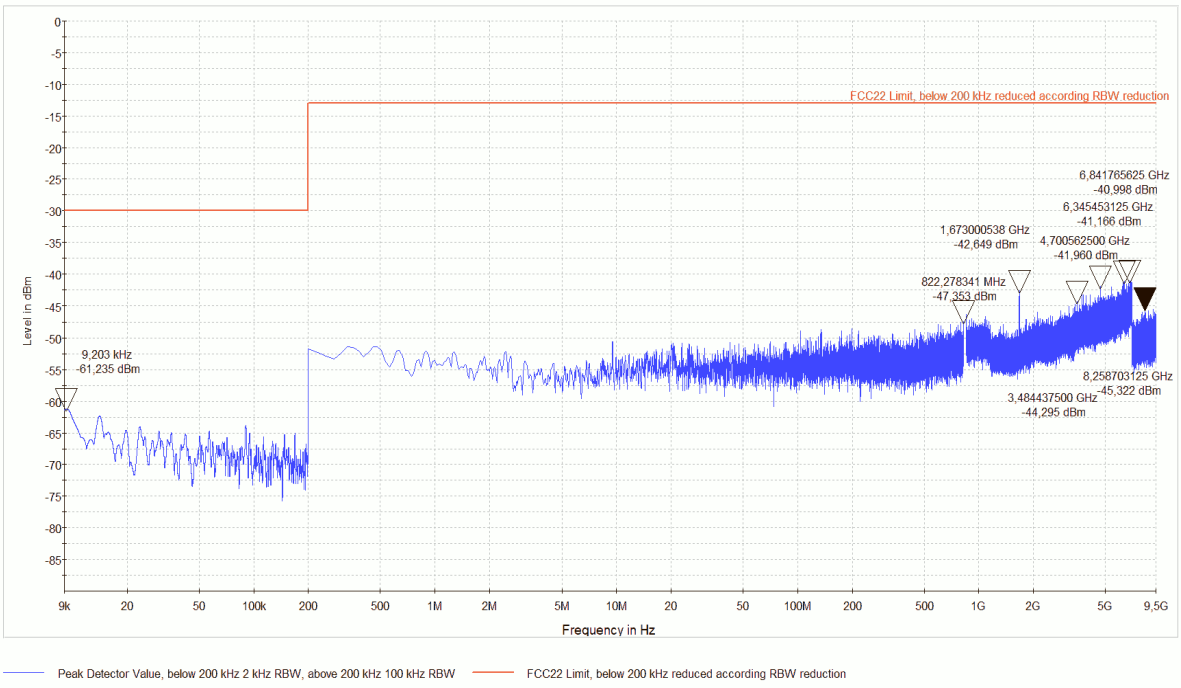


Frequency Band = Band 4, Direction = Uplink

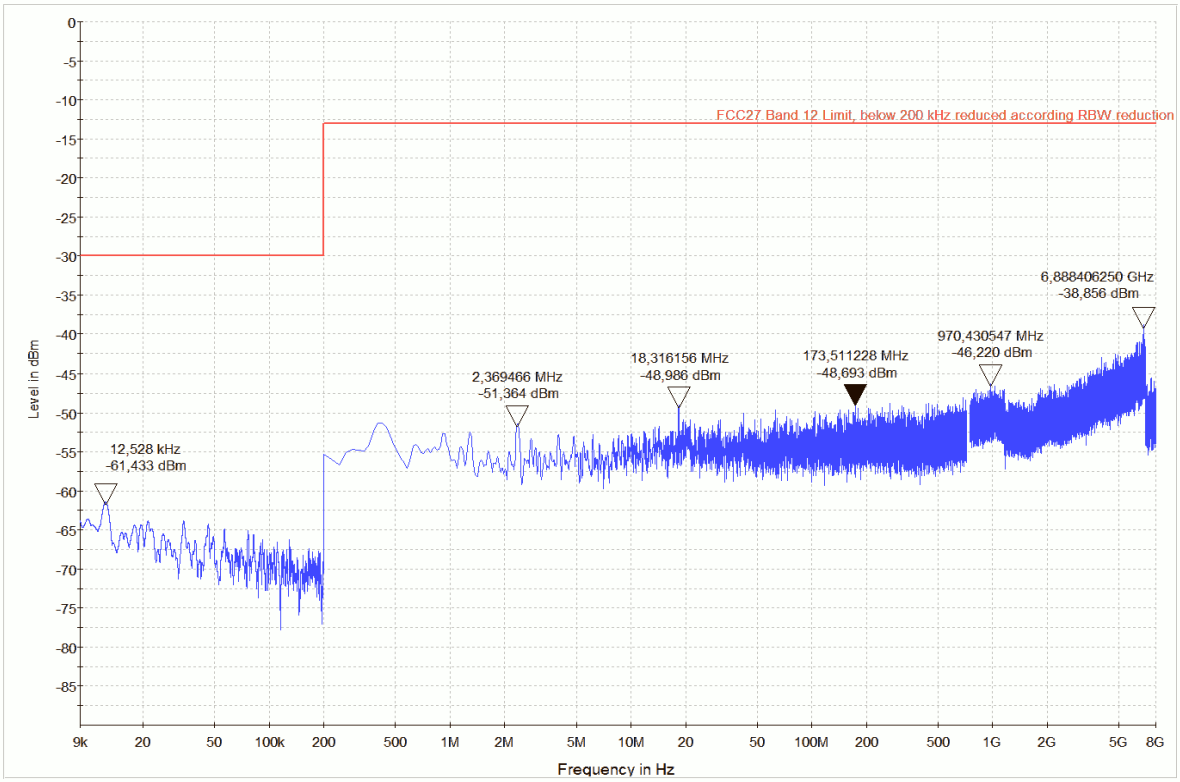
Frequency Band = Band 5, Direction = Downlink



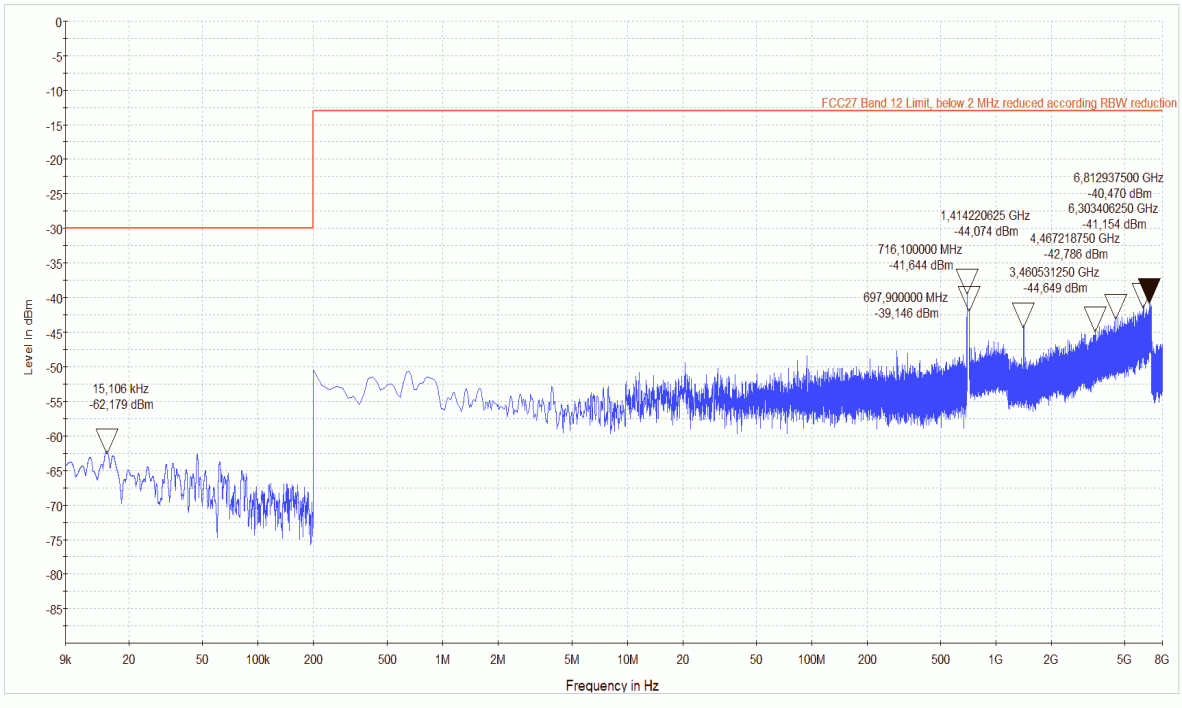
Frequency Band = Band 5, Direction = Uplink



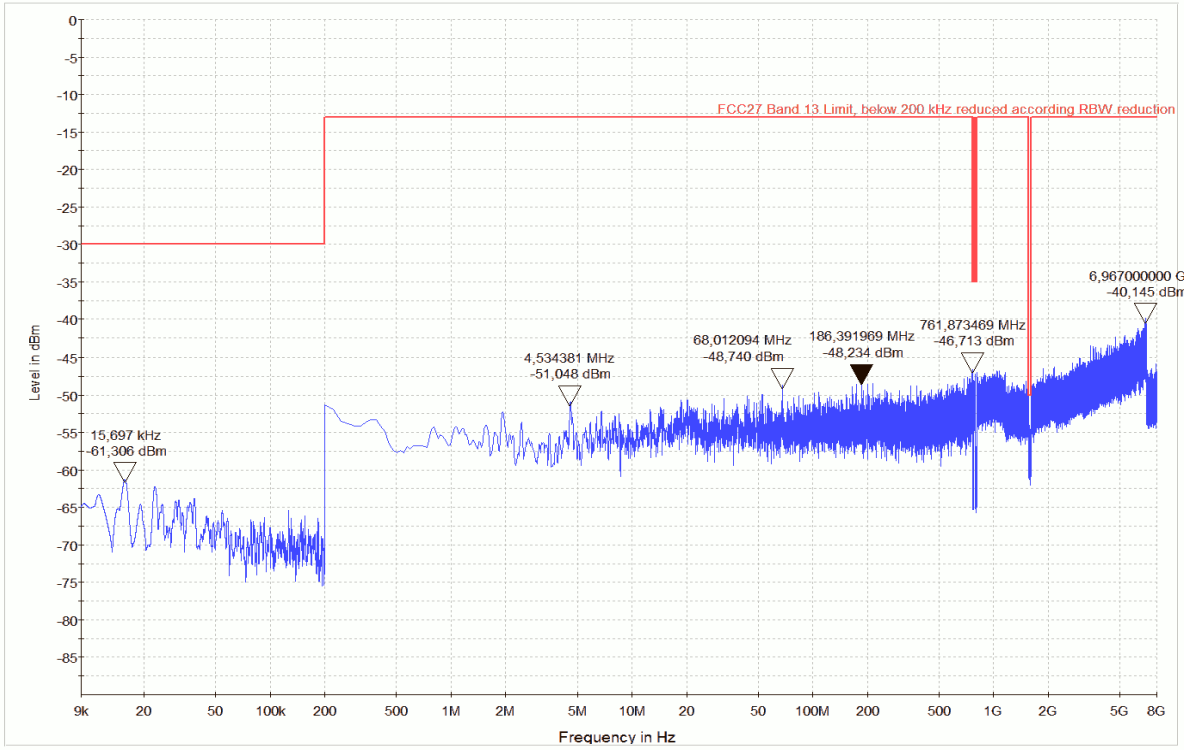
Frequency Band = Band 12, Direction = Downlink

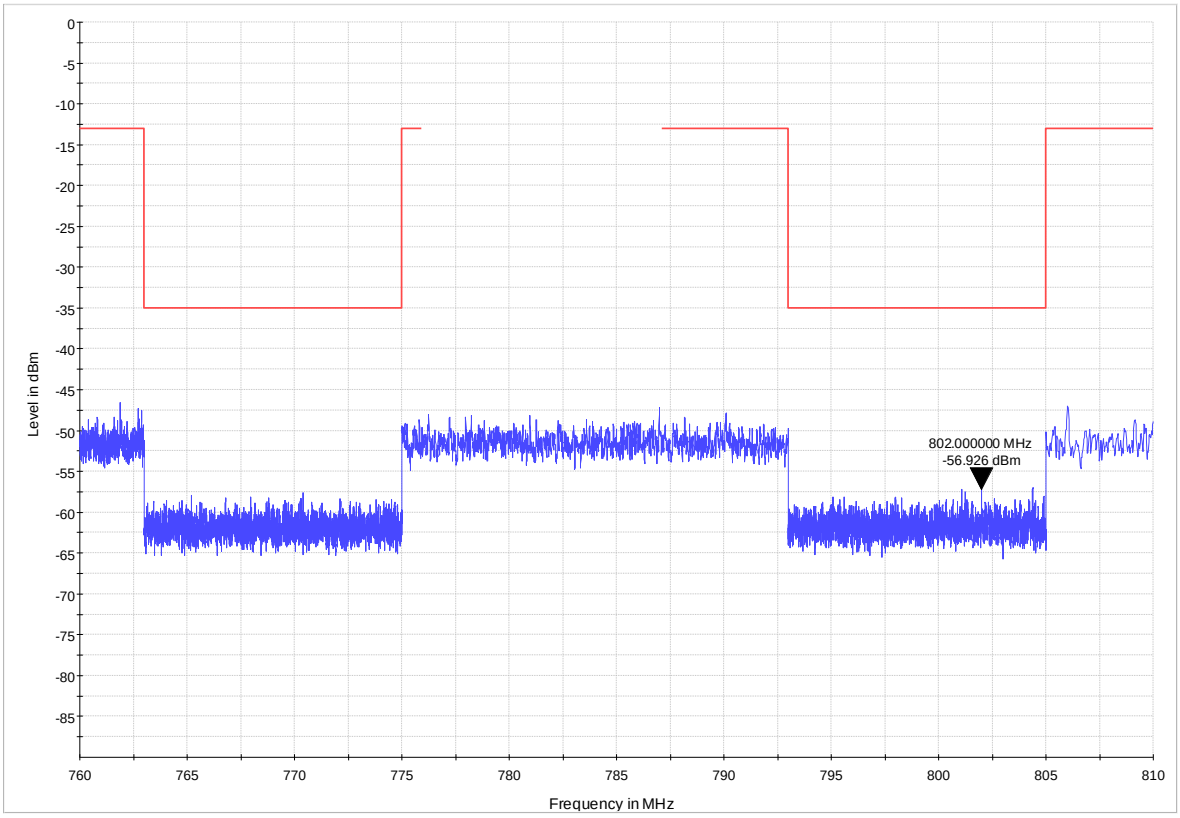


Frequency Band = Band 12, Direction = Uplink



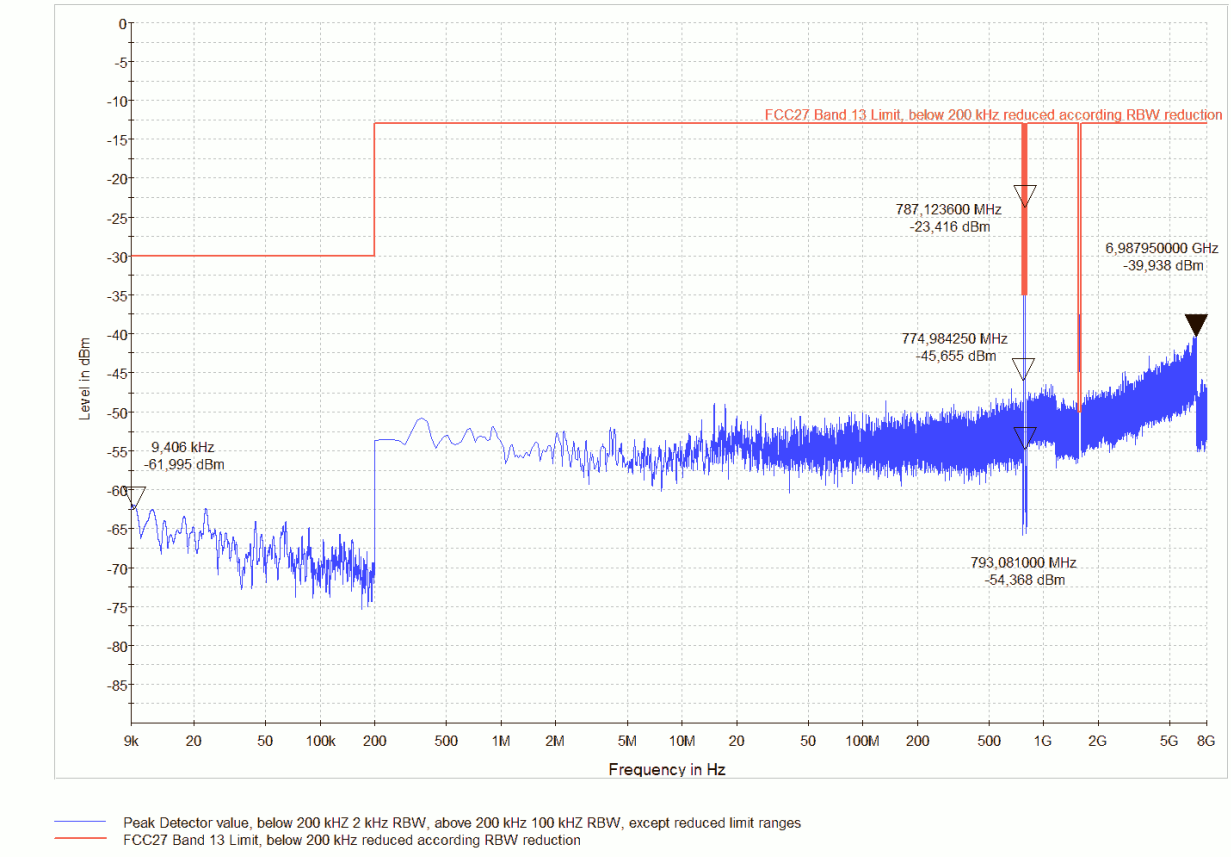
Frequency Band = Band 13, Direction = Downlink

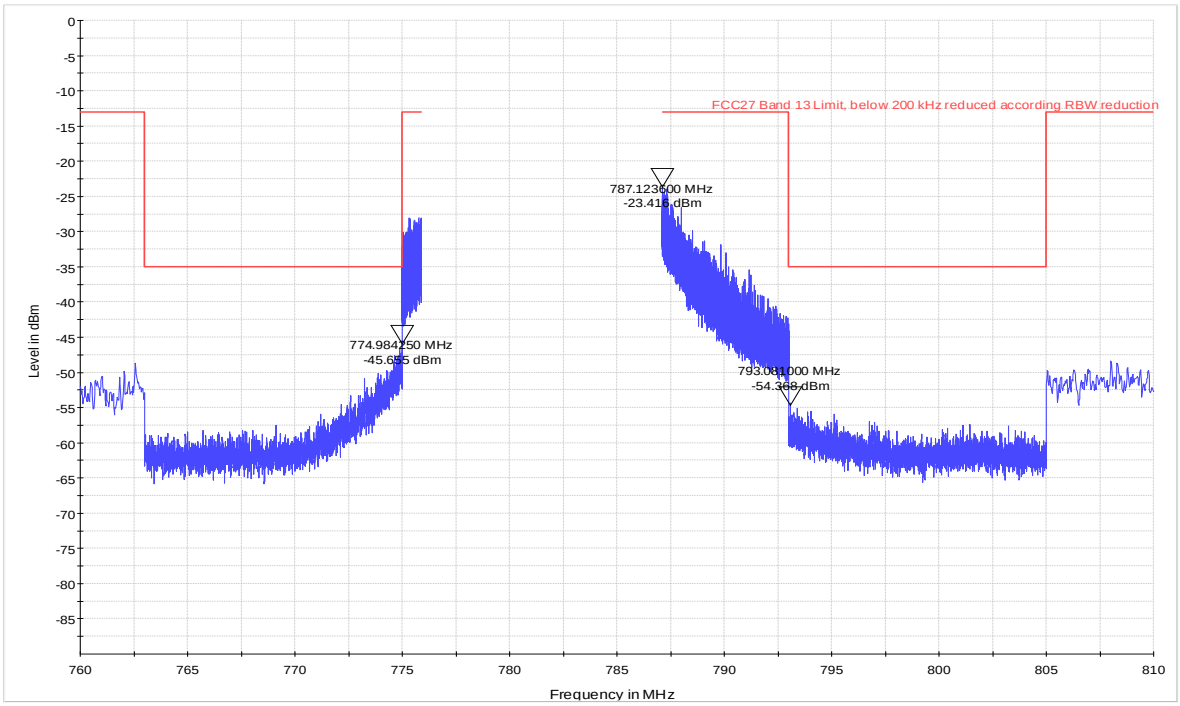




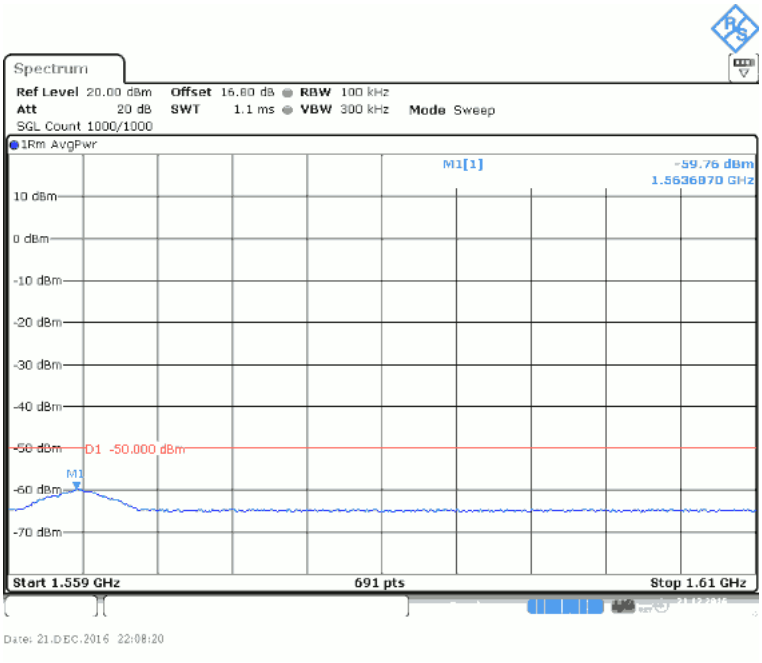
Zoom on range 760 – 810 MHz, ranges 763 – 775 MHz and 793 -805 MHz measured with 10 kHz RBW

Frequency Band = Band 13, Direction = Uplink





Zoom on range 760 – 810 MHz, ranges 763 – 775 MHz and 793 -805 MHz measured with 10 kHz RBW



4.6.5TEST EQUIPMENT USED

R&S TS8997

4.7 MAXIMUM TRANSMITTER NOISE POWER

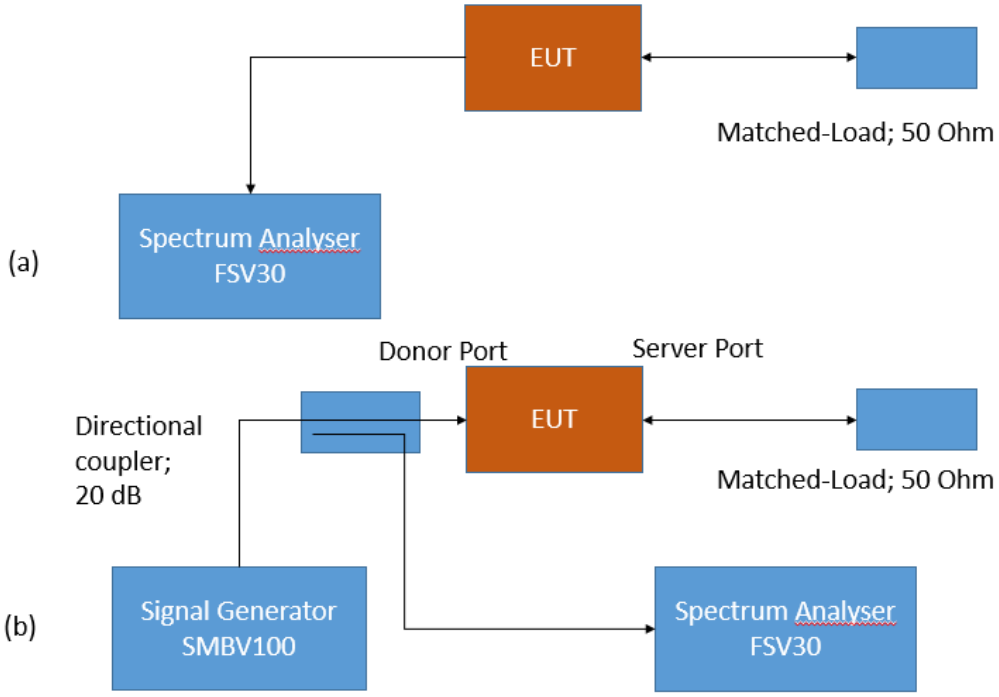
Standard

The test was performed according to:
KDB 935210 D03

4.7.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the noise limits (uplink) and Transmitter Power Off Mode limits (uplink and downlink noise power) according § 20.21(e)(8)(i)(A) and § 20.21 €(8)(i)(H) for wideband consumer signal boosters.

The EUT was connected to the test setups according to the following diagrams:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.7.1; Maximum Transmitter Noise Power Level

Setup (a); Downlink/uplink noise without presence of an input signal
Setup (b); Uplink noise in presence of an input signal

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.7.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(A)

Noise Limits. (1) The transmitted noise power in dBm/MHz of consumer boosters at their uplink port shall not exceed −103 dBm/MHz—RSSI. RSSI (received signal strength indication expressed in negative dB units relative to 1 mW) is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation.

(2) The transmitted maximum noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed the following limits:

(i) Fixed booster maximum noise power shall not exceed −102.5 dBm/MHz + 20 Log_{10} (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

(ii) Mobile booster maximum noise power shall not exceed−59 dBm/MHz.

(iii) Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

FCC Part 20, § 20.21(e)(8)(i)(H)

Transmit Power Off Mode. When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power Off Mode." In this mode of operation, the uplink and downlink noise power shall not exceed −70 dBm/MHz and both uplink and downlink gain shall not exceed the lesser of 23 dB or MSCL.

4.7.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, downlink

Input Signal	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-78.9	-59.0	19.9

Band 4, downlink

Input Signal	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-76.9	-59.0	17.9

Band 5, downlink

Input Signal	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-78.0	-59.0	19.0

Band 12, downlink

Input Signal	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-78.2	-59.0	19.2

Band 13, downlink

Input Signal	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-78.2	-59.0	19.2

Band 2, uplink

Input Signal	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-74.0	-59.0	15.0
AWGN DL	1960.0	-36.0	-74.0	-67.0	7.0
AWGN DL	1960.0	-35.0	-74.0	-68.0	6.0
AWGN DL	1960.0	-34.0	-74.0	-69.0	5.0
AWGN DL	1960.0	-33.0	-73.9	-70.0	3.9
AWGN DL	1960.0	-30.0	-74.0	-70.0	4.0
AWGN DL	1960.0	-20.0	-73.8	-70.0	3.8

Band 4, uplink

Input Power	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-74.2	-59.0	15.2
AWGN DL	2132.5	-36.0	-74.3	-67.0	7.3
AWGN DL	2132.5	-35.0	-74.4	-68.0	6.3
AWGN DL	2132.5	-34.0	-74.3	-69.0	5.3
AWGN DL	2132.5	-33.0	-74.2	-70.0	4.2
AWGN DL	2132.5	-30.0	-74.3	-70.0	4.3
AWGN DL	2132.5	-20.0	-74.3	-70.0	4.3

Band 5, uplink

Input Power	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-74.6	-59.0	15.6
AWGN DL	881.5	-36.0	-73.8	-67.0	6.8
AWGN DL	881.5	-35.0	-73.8	-68.0	5.8
AWGN DL	881.5	-34.0	-73.9	-69.0	4.9
AWGN DL	881.5	-33.0	-73.9	-70.0	3.9
AWGN DL	881.5	-30.0	-73.8	-70.0	3.8
AWGN DL	881.5	-20.0	-73.9	-70.0	3.9

Band 12, uplink

Input Power	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-74.6	-59.0	15.6
AWGN DL	737.0	-36.0	-74.6	-67.0	7.6
AWGN DL	737.0	-35.0	-74.6	-68.0	6.6
AWGN DL	737.0	-34.0	-74.6	-69.0	5.6
AWGN DL	737.0	-33.0	-74.6	-70.0	4.6
AWGN DL	737.0	-30.0	-74.6	-70.0	4.6
AWGN DL	737.0	-20.0	-74.7	-70.0	4.7

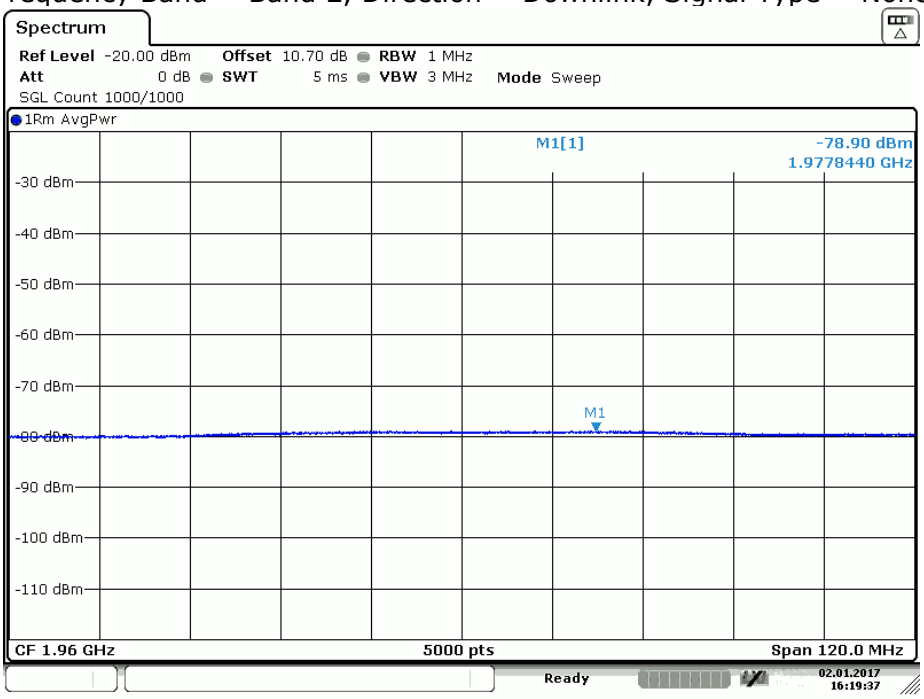
Band 13, uplink

Input Power	DL AWGN Signal [MHz]	Input Power [dBm]	Maximum Noise Power [dBm]	Noise Limit [dBm]	Margin to Limit [dB]
None	-	-	-74.0	-59.0	15.0
AWGN DL	751.0	-36.0	-73.2	-67.0	6.2
AWGN DL	751.0	-35.0	-73.2	-68.0	5.2
AWGN DL	751.0	-34.0	-73.2	-69.0	4.2
AWGN DL	751.0	-33.0	-73.2	-70.0	3.2
AWGN DL	751.0	-30.0	-73.2	-70.0	3.2
AWGN DL	751.0	-20.0	-73.2	-70.0	3.2

Remark: Please see next sub-clause for the measurement plot.

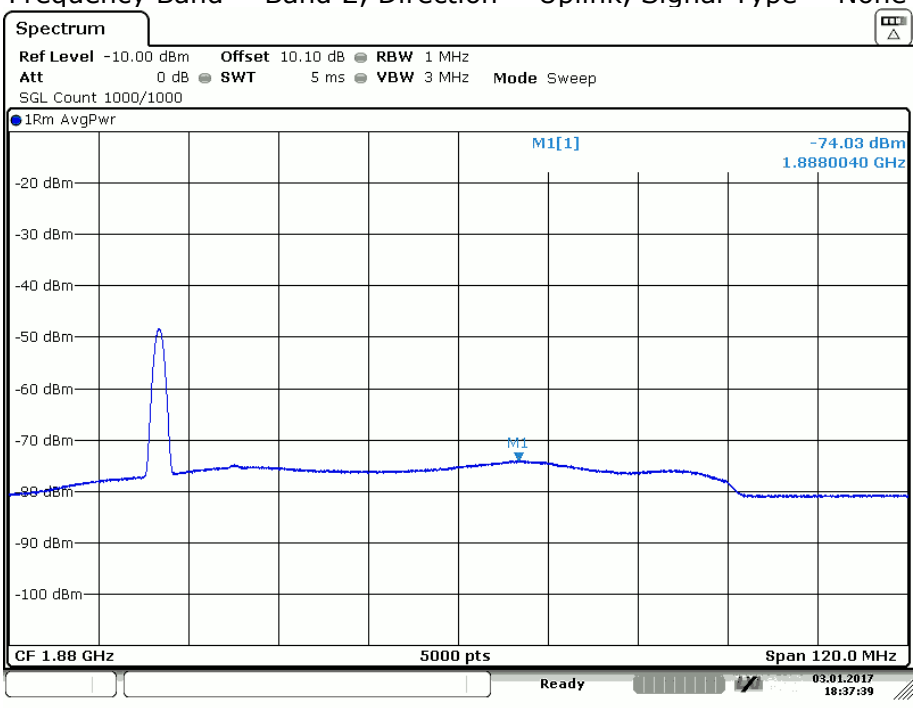
4.7.4MEASUREMENT PLOTS

Frequency Band = Band 2, Direction = Downlink, Signal Type = None



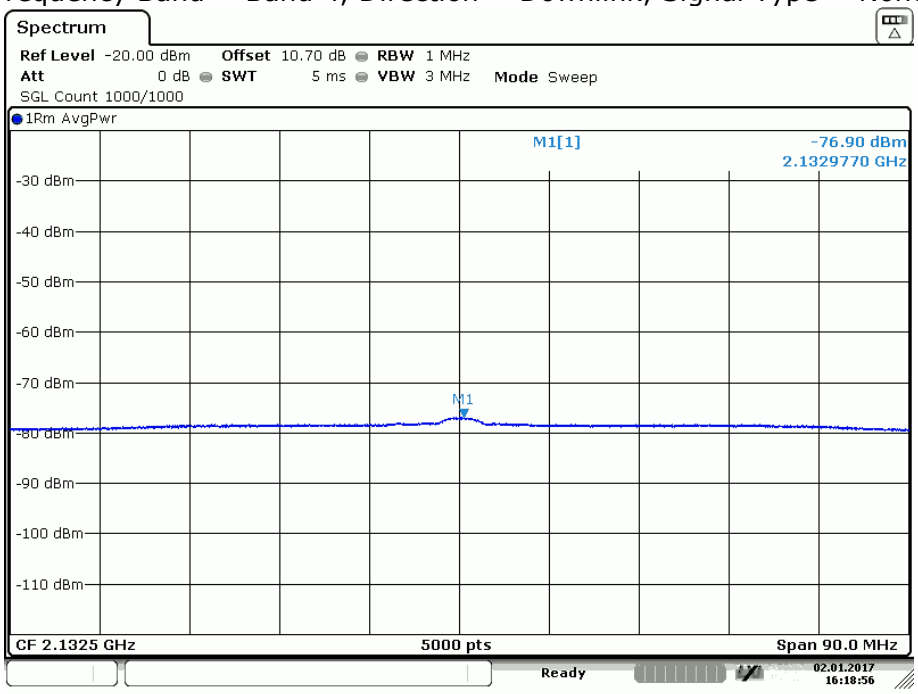
Date: 2.JAN.2017 16:19:37

Frequency Band = Band 2, Direction = Uplink, Signal Type = None



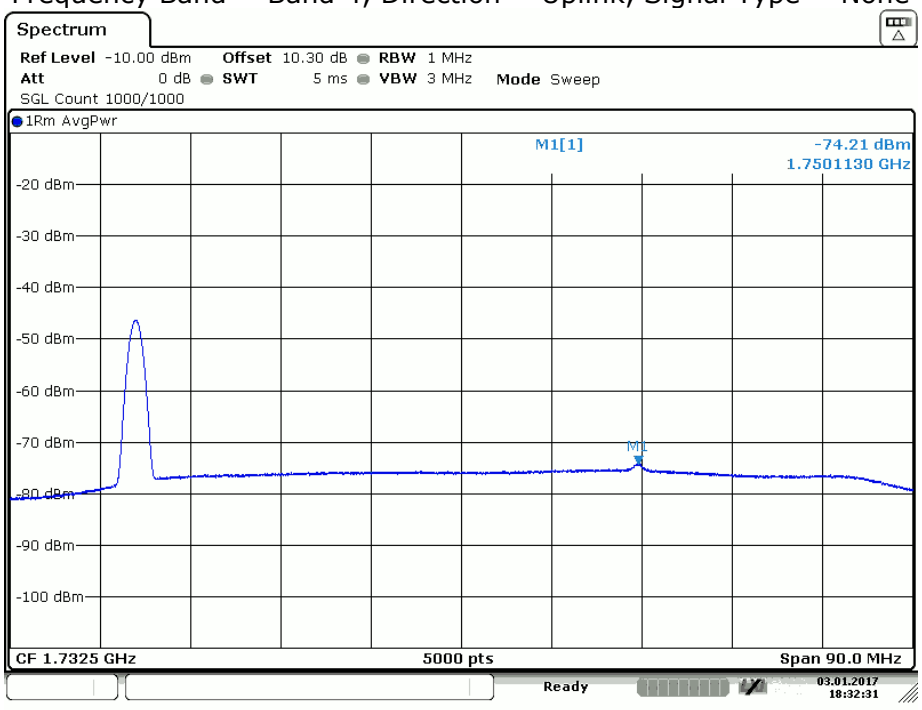
Date: 3.JAN.2017 18:37:40

Frequency Band = Band 4, Direction = Downlink, Signal Type = None



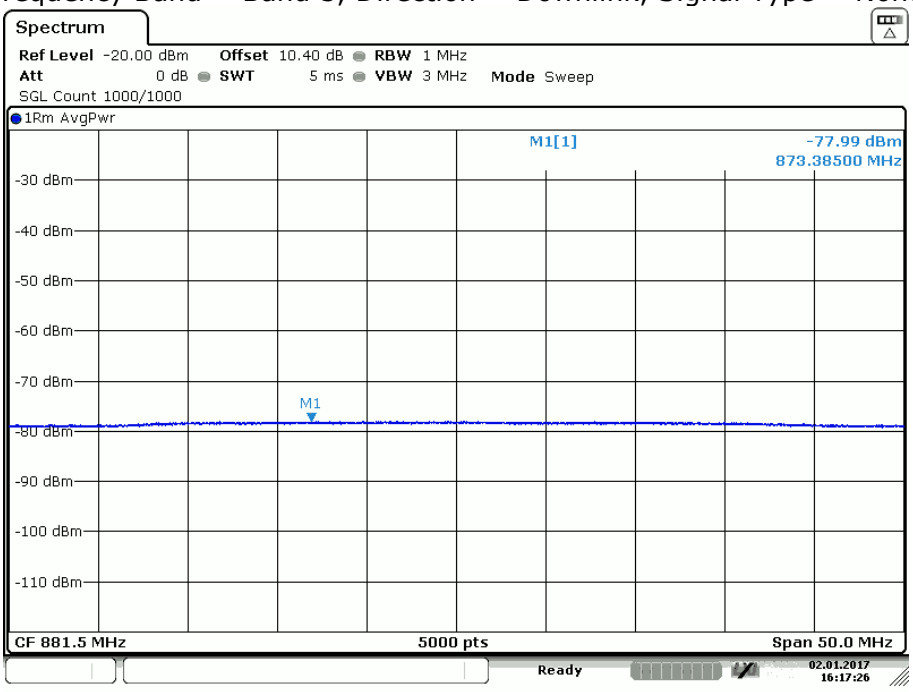
Date: 2.JAN.2017 16:18:56

Frequency Band = Band 4, Direction = Uplink, Signal Type = None



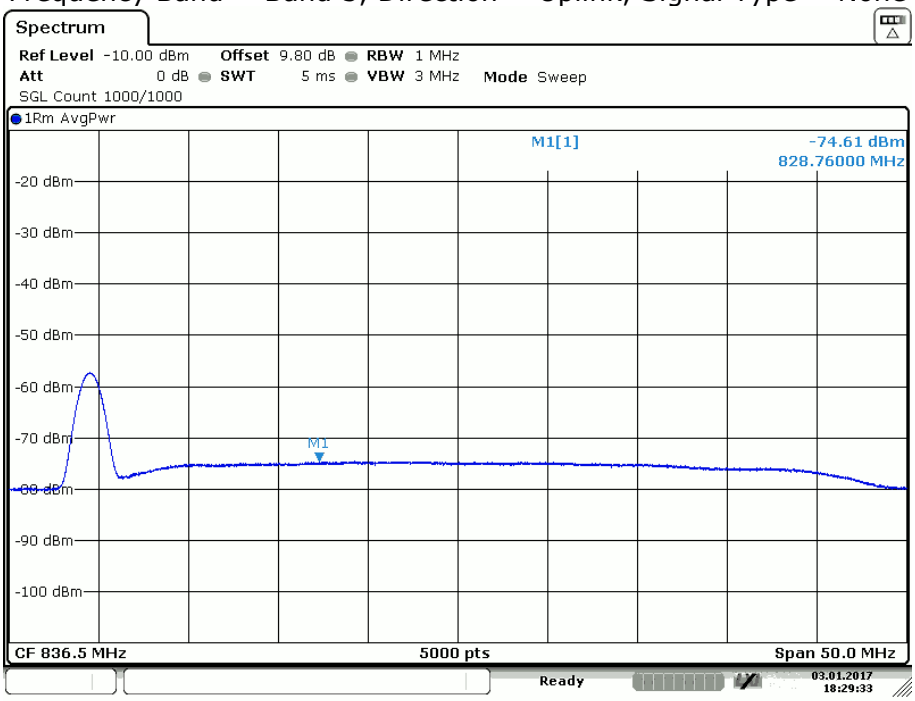
Date: 3.JAN.2017 18:32:31

Frequency Band = Band 5, Direction = Downlink, Signal Type = None



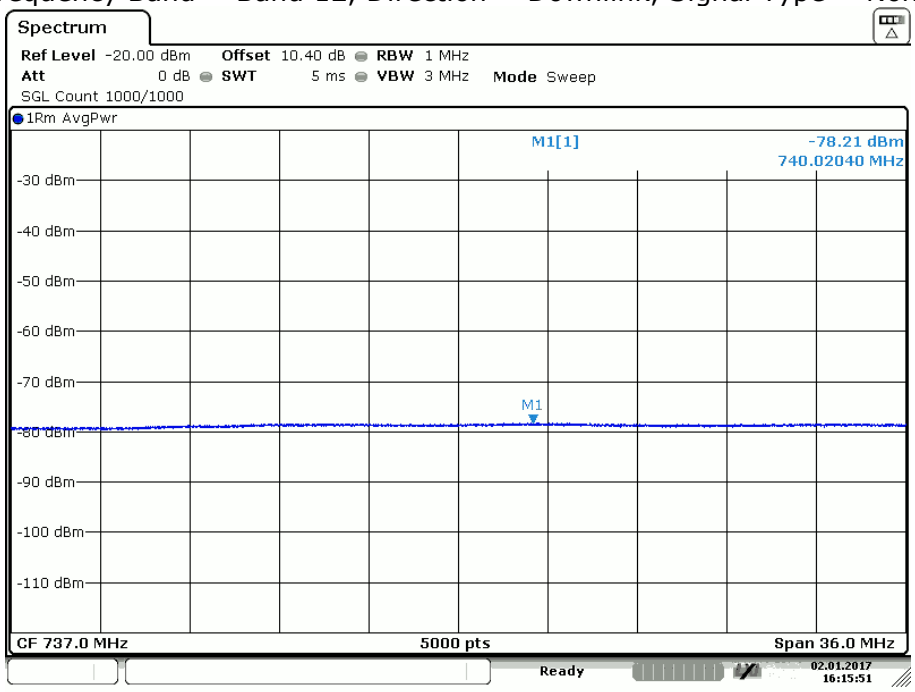
Date: 2.JAN.2017 16:17:26

Frequency Band = Band 5, Direction = Uplink, Signal Type = None



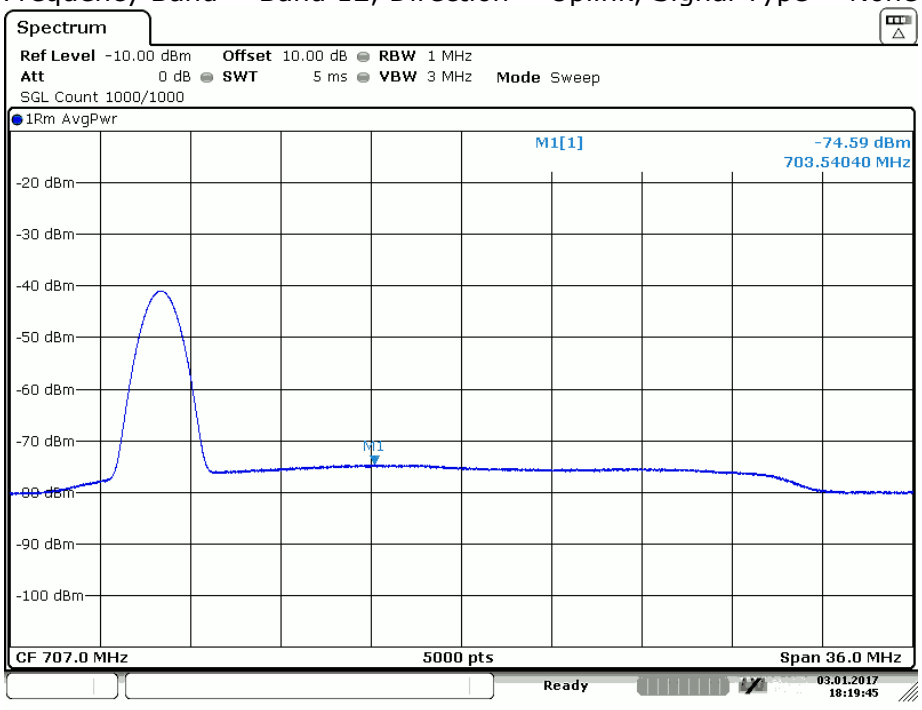
Date: 3.JAN.2017 18:29:33

Frequency Band = Band 12, Direction = Downlink, Signal Type = None



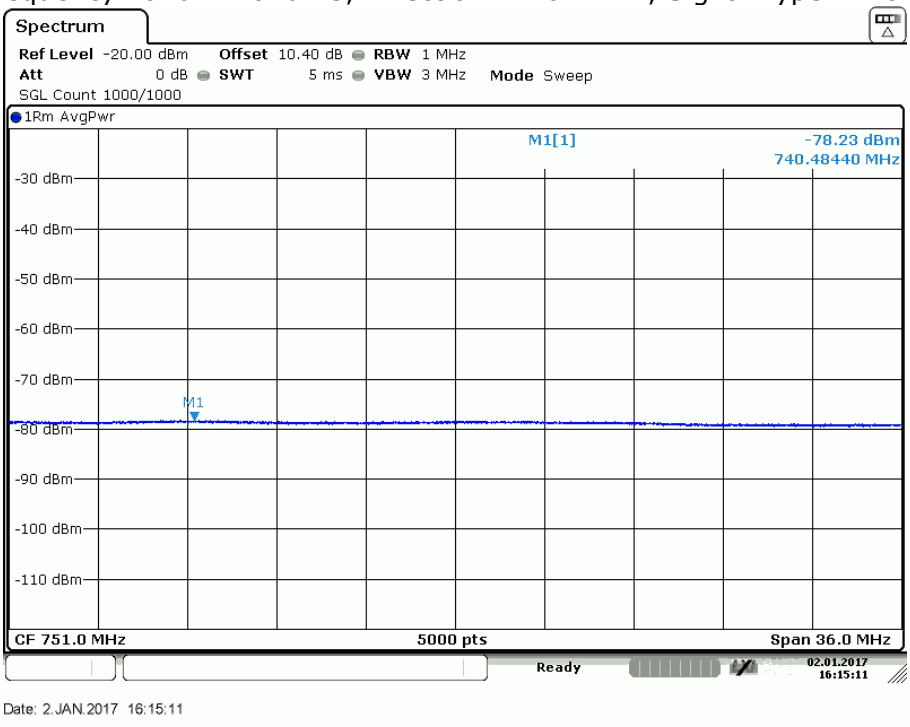
Date: 2.JAN.2017 16:15:51

Frequency Band = Band 12, Direction = Uplink, Signal Type = None

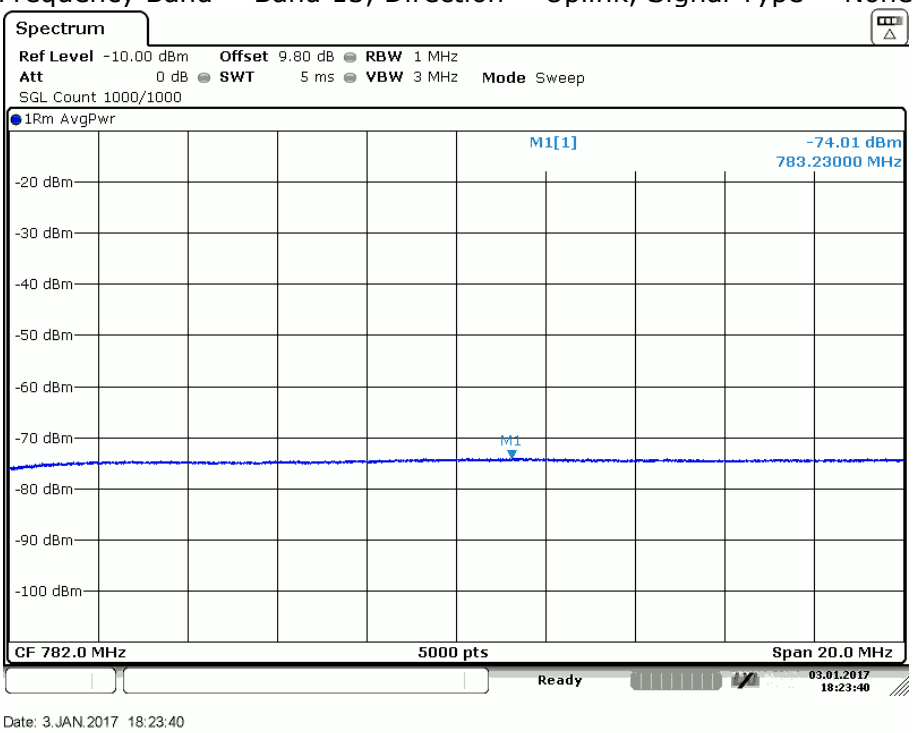


Date: 3.JAN.2017 18:19:46

Frequency Band = Band 13, Direction = Downlink, Signal Type = None



Frequency Band = Band 13, Direction = Uplink, Signal Type = None



4.7.5TEST EQUIPMENT USED

R&S TS8997

4.8 VARIABLE UPLINK NOISE TIMING

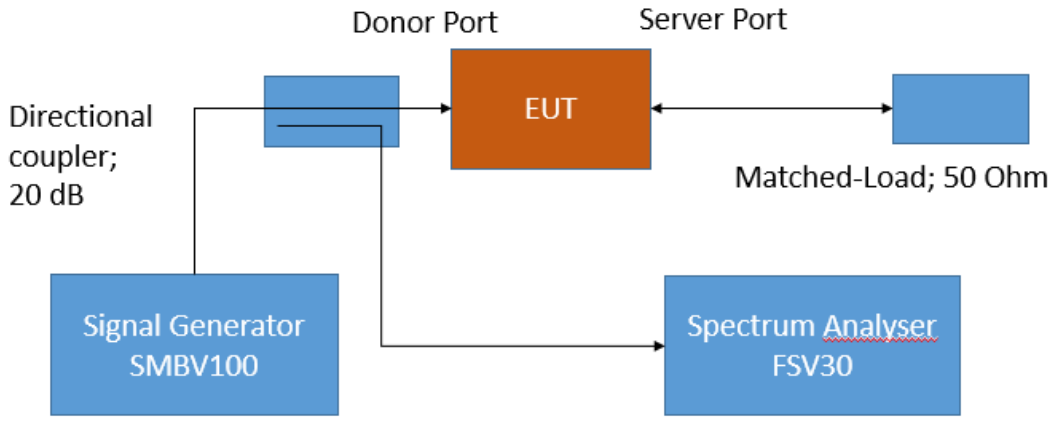
Standard

The test was performed according to:
KDB 935210 D03

4.8.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the noise limits (uplink) and Transmitter Power Off Mode limits (uplink and downlink noise power) according § 20.21(e)(8)(i)(A) and § 20.21 €(8)(i)(H) for wideband consumer signal boosters.

The EUT was connected to the test setup(s) according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.7.2; Variable Uplink noise Timing

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.8.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(A)

Noise Limits. (1) The transmitted noise power in dBm/MHz of consumer boosters at their uplink port shall not exceed −103 dBm/MHz—RSSI. RSSI (received signal strength indication expressed in negative dB units relative to 1 mW) is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation.

(2) The transmitted maximum noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed the following limits:

(i) Fixed booster maximum noise power shall not exceed −102.5 dBm/MHz + 20 Log_{10} (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum

bands in MHz.

(ii) Mobile booster maximum noise power shall not exceed−59 dBm/MHz.

(iii) Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

FCC Part 20, § 20.21(e)(8)(i)(H)

Transmit Power Off Mode. When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power Off Mode." In this mode of operation, the uplink and downlink noise power shall not exceed −70 dBm/MHz and both uplink and downlink gain shall not exceed the lesser of 23 dB or MSCL.

KDB 935210 D03 7.7.2 e)

Confirm that the uplink noise decreases to the specified level within 1 second for mobile devices, and within 3 seconds for fixed devices[1]

[1]The time response requirements are provisional and are as determined by the ANSI ASC C63® task group in collaboration and consultation with FCC OET Laboratory Division staff.

4.8.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
1880.0	-34.0	0.0	1000.0	1000.0

Band 4, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
1732.5	-34.0	0.0	1000.0	1000.0

Band 5, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
836.5	-34.0	0.0	1000.0	1000.0

Band 12, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
707.0	-34.0	0.0	1000.0	1000.0

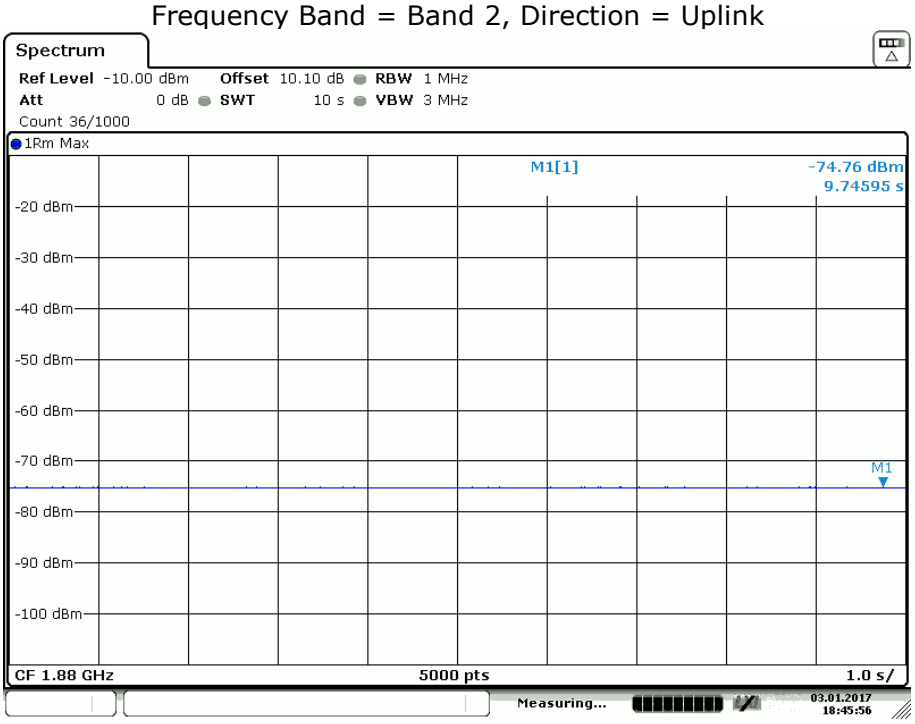
Band 13, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
782.0	-34.0	6.0	1000.0	994.0

Remark: Please see next sub-clause for the measurement plot.

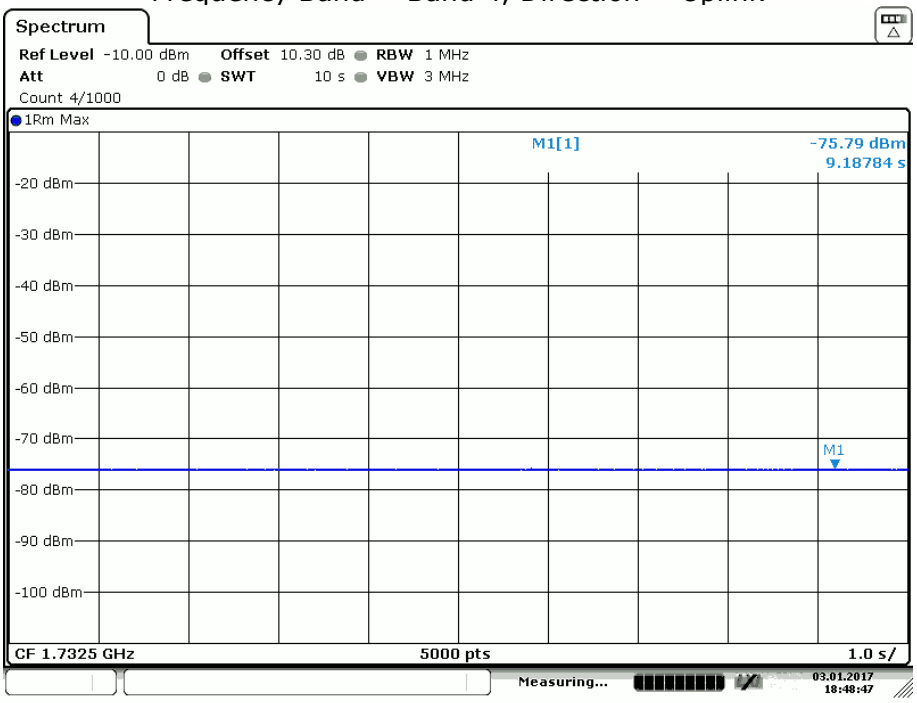
4.8.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = Band 2, Direction = Uplink



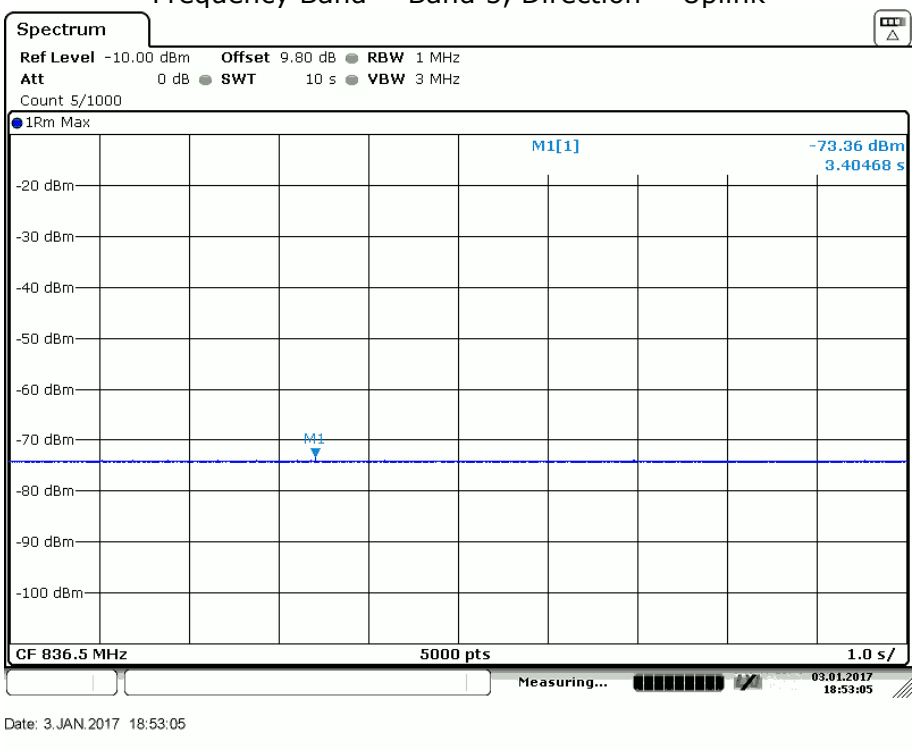
Date: 3.JAN.2017 18:45:56

Frequency Band = Band 4, Direction = Uplink



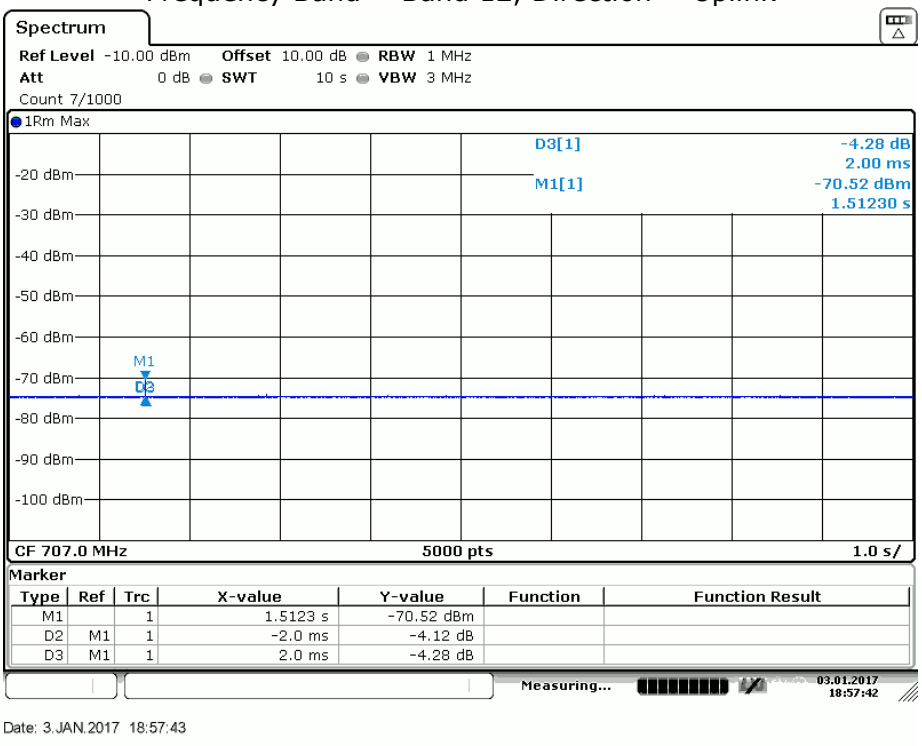
Date: 3.JAN.2017 18:48:48

Frequency Band = Band 5, Direction = Uplink



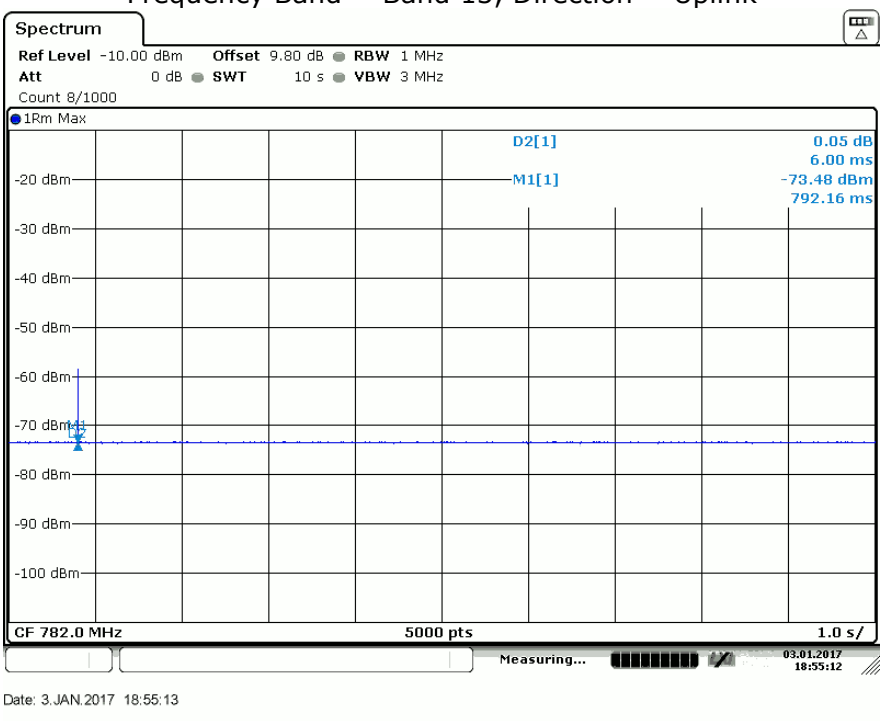
Date: 3.JAN.2017 18:53:05

Frequency Band = Band 12, Direction = Uplink



Date: 3.JAN.2017 18:57:43

Frequency Band = Band 13, Direction = Uplink



4.8.5TEST EQUIPMENT USED

R&S TS8997

4.9 UPLINK INACTIVITY

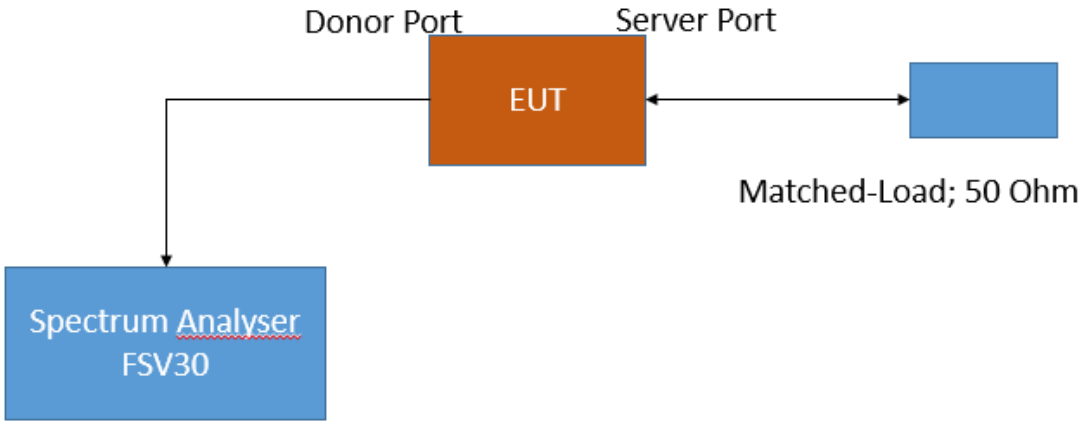
Standard

The test was performed according to:
KDB 935210 D03

4.9.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the Uplink Inactivity limit according § 20.21(e)(8)(i)(I) for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.8; Uplink Inactivity

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.9.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(i)(I)

Uplink Inactivity. When a consumer booster is not serving an active device connection after 5 minutes the uplink noise power shall not exceed −70 dBm/MHz.

4.9.3TEST PROTOCOL

Ambient temperature: 25 °C
Air Pressure: 992 hPa
Humidity: 30 %

Band 2, uplink

Center Frequency [MHz]	Noise Decrease Time [s]	Noise Decrease Time Limit [s]	Margin to Limit [s]
1880.0	1.01	300.00	298.99

Band 4, uplink

Center Frequency [MHz]	Noise Decrease Time [s]	Noise Decrease Time Limit [s]	Margin to Limit [s]
1732.5	1.01	300.00	298.99

Band 5, uplink

Center Frequency [MHz]	Noise Decrease Time [s]	Noise Decrease Time Limit [s]	Margin to Limit [s]
836.5	1.01	300.00	298.99

Band 12, uplink

Center Frequency [MHz]	Noise Decrease Time [s]	Noise Decrease Time Limit [s]	Margin to Limit [s]
707.0	1.02	300.00	298.98

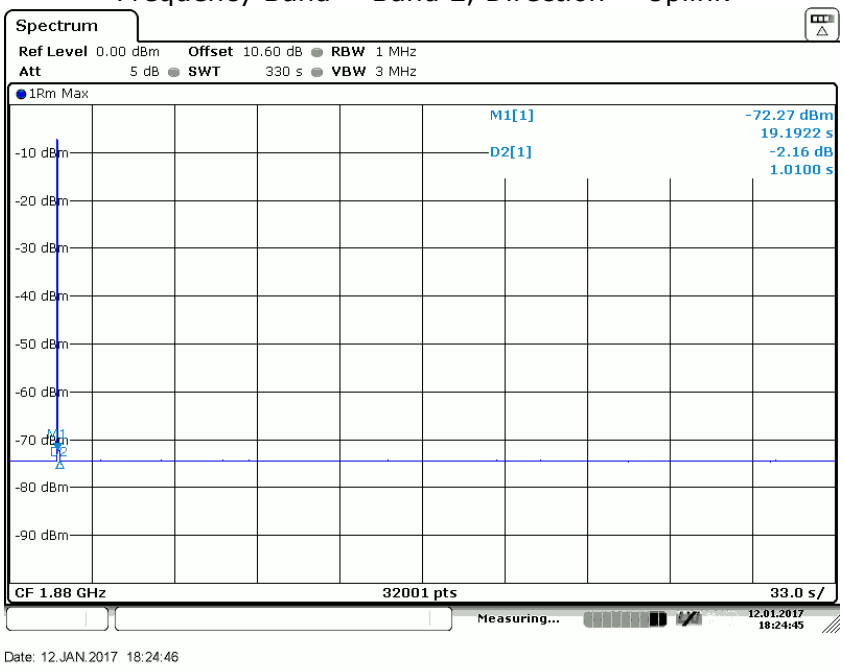
Band 13, uplink

Center Frequency [MHz]	Noise Decrease Time [s]	Noise Decrease Time Limit [s]	Margin to Limit [s]
782.0	1.01	300.00	298.99

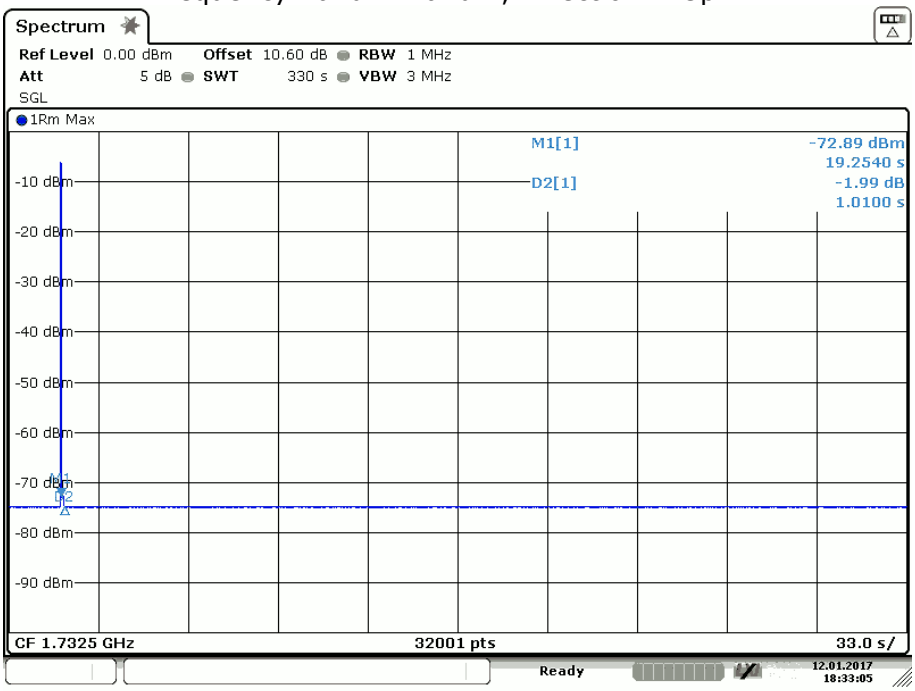
Remark: Please see next sub-clause for the measurement plot.

4.9.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = Band 2, Direction = Uplink

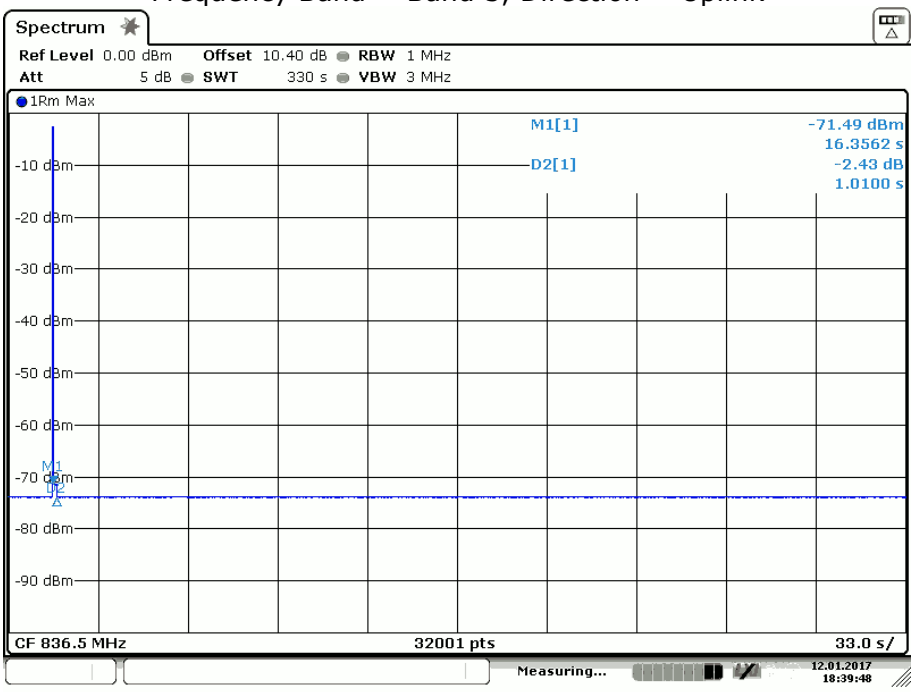


Frequency Band = Band 4, Direction = Uplink



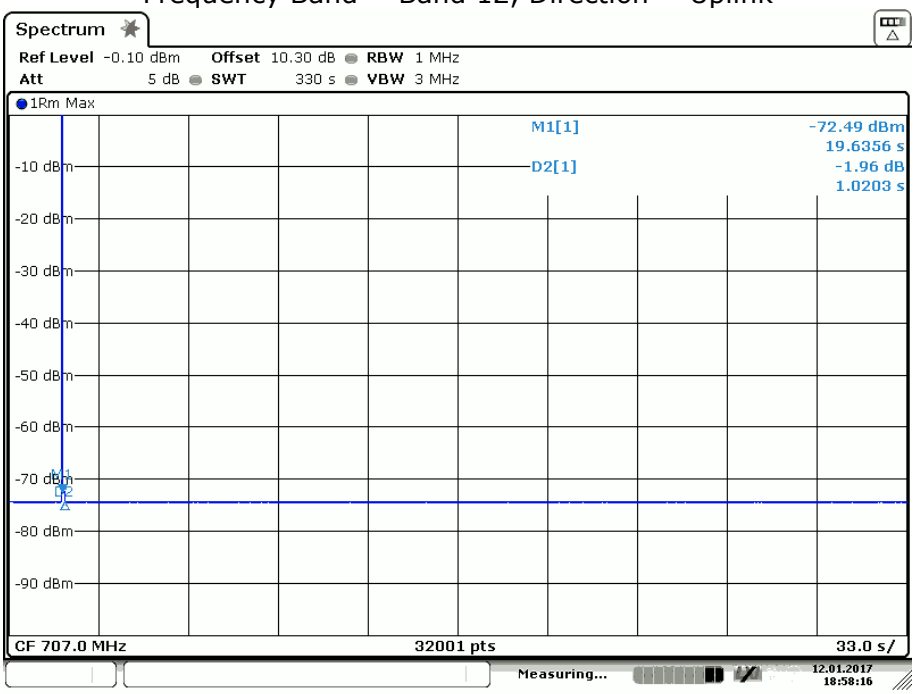
Date: 12.JAN.2017 18:33:05

Frequency Band = Band 5, Direction = Uplink



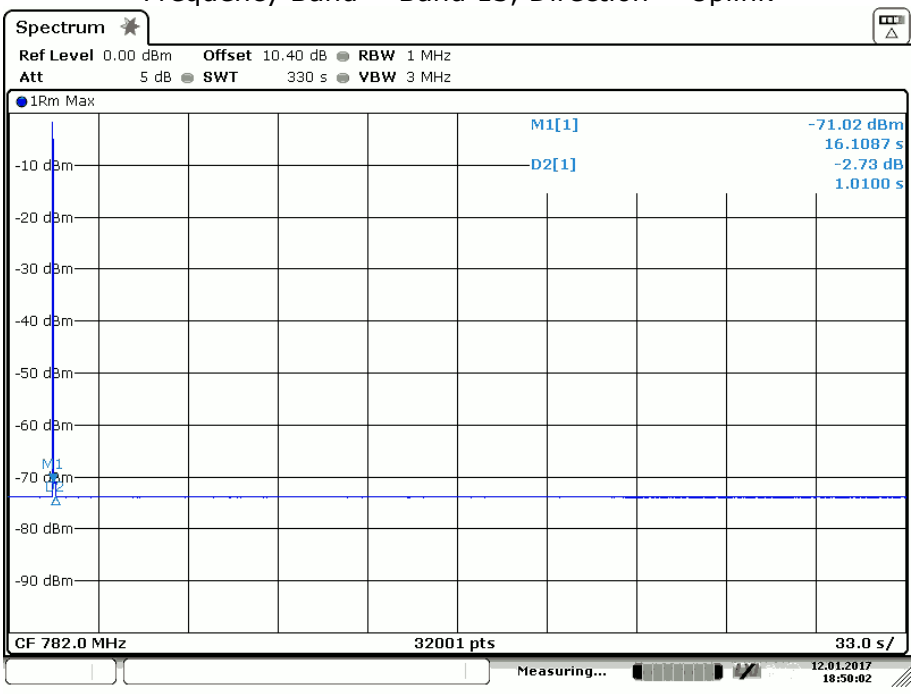
Date: 12.JAN.2017 18:39:49

Frequency Band = Band 12, Direction = Uplink



Date: 12.JAN.2017 18:58:16

Frequency Band = Band 13, Direction = Uplink



Date: 12.JAN.2017 18:50:02

4.9.5TEST EQUIPMENT USED

R&S TS8997

4.10 VARIABLE BOOSTER GAIN

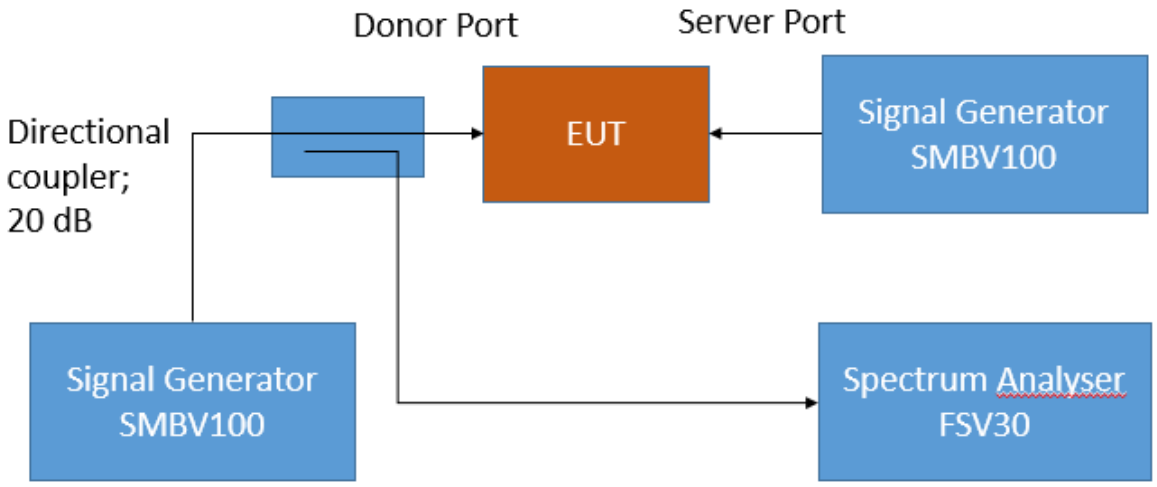
Standard

The test was performed according to:
KDB 935210 D03

4.10.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the Booster Gain limit according § 20.21(e)(8)(i)(C)(1) or Transmit Power Off Mode according § 20.21 €(8)(i)(H) for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.9.1; Variable Gain

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.10.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(C)(1)

Booster Gain Limits. (1) The uplink gain in dB of a consumer booster referenced to its input and output ports shall not exceed −34 dB—RSSI + MSCL.

(i) Where RSSI is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation. RSSI is expressed in negative dB units relative to 1 mW.

(ii) Where MSCL (Mobile Station Coupling Loss) is the minimum coupling loss in dB between the wireless device and input port of the consumer booster. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

FCC Part 20, § 20.21(e)(8)(i)(H)

Transmit Power Off Mode. When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power Off Mode." In this mode of operation, the uplink and downlink noise power shall not exceed −70 dBm/MHz and both uplink and downlink gain shall not exceed the lesser of 23 dB or MSCL.

4.10.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, uplink

UL AWGN Signal [MHz]	DL AWGN Signal [MHz]	Input Power UL [dBm]	Input Power DL [dBm]	Output Power UL [dBm]	Maximum UL Gain [dB]	Gain Limit [dBm]	Margin to Limit [dB]
1880.0	1960.0	-4.0	-90.0	15.0	19.0	23.0	4.0
1880.0	1960.0	-4.0	-80.0	15.0	19.0	23.0	4.0
1880.0	1960.0	-4.0	-35.0	-1.3	2.7	8.0	5.3
1880.0	1960.0	-4.0	-34.0	-1.3	2.7	7.0	4.3
1880.0	1960.0	-4.0	-30.0	1.4	5.4	7.0	1.6
1880.0	1960.0	-4.0	-20.0	**1.4**	5.4	7.0	1.6

Band 4, uplink

UL AWGN Signal [MHz]	DL AWGN Signal [MHz]	Input Power UL [dBm]	Input Power DL [dBm]	Output Power UL [dBm]	Maximum UL Gain [dB]	Gain Limit [dBm]	Margin to Limit [dB]
1732.5	2132.5	-3.6	-80.0	16.6	20.2	23.0	2.8
1732.5	2132.5	-3.6	-70.0	16.6	20.2	23.0	2.8
1732.5	2132.5	-3.6	-35.0	0.7	4.3	8.0	3.7
1732.5	2132.5	-3.6	-34.0	0.7	4.3	7.0	2.7
1732.5	2132.5	-3.6	-30.0	0.7	4.3	7.0	2.7
1732.5	2132.5	-3.6	-20.0	**0.7**	4.3	7.0	2.7

Band 5, uplink

UL AWGN Signal [MHz]	DL AWGN Signal [MHz]	Input Power UL [dBm]	Input Power DL [dBm]	Output Power UL [dBm]	Maximum UL Gain [dB]	Gain Limit [dBm]	Margin to Limit [dB]
836.5	881.5	-2.6	-90.0	17.3	19.9	23.0	3.1
836.5	881.5	-2.6	-80.0	17.3	19.9	23.0	3.1
836.5	881.5	-2.6	-35.0	1.8	4.4	8.0	3.6
836.5	881.5	-2.6	-34.0	1.8	4.4	7.0	2.6
836.5	881.5	-2.6	-30.0	1.8	4.4	7.0	2.6
836.5	881.5	-2.6	-20.0	**1.8**	4.4	7.0	2.6

Band 12, uplink

UL AWGN Signal [MHz]	DL AWGN Signal [MHz]	Input Power UL [dBm]	Input Power DL [dBm]	Output Power UL [dBm]	Maximum UL Gain [dB]	Gain Limit [dBm]	Margin to Limit [dB]
707.0	737.0	-3.3	-90.0	16.2	19.5	23.0	3.5
707.0	737.0	-3.3	-80.0	16.2	19.5	23.0	3.5
707.0	737.0	-3.3	-35.0	0.2	3.5	8.0	4.5
707.0	737.0	-3.3	-34.0	**0.7**	4.0	7.0	3.0
707.0	737.0	-3.3	-30.0	0.2	3.5	7.0	3.5
707.0	737.0	-3.3	-20.0	0.2	3.5	7.0	3.5

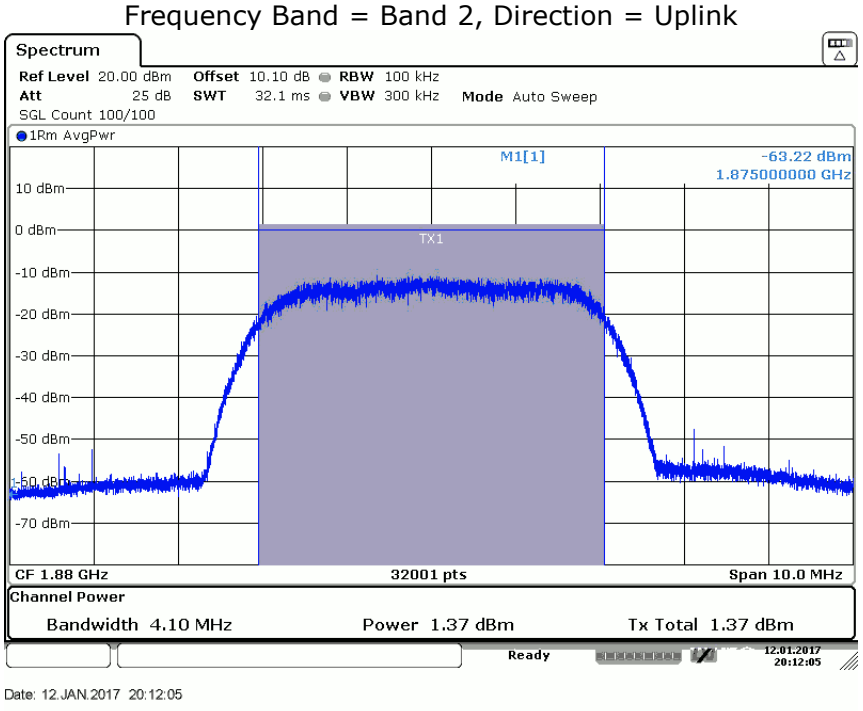
Band 13, uplink

UL AWGN Signal [MHz]	DL AWGN Signal [MHz]	Input Power UL [dBm]	Input Power DL [dBm]	Output Power UL [dBm]	Maximum UL Gain [dB]	Gain Limit [dBm]	Margin to Limit [dB]
782.0	751.0	-3.9	-70.0	16.2	20.1	23.0	2.9
782.0	751.0	-3.9	-60.0	16.2	20.1	23.0	2.9
782.0	751.0	-3.9	-35.0	0.5	4.4	8.0	3.6
782.0	751.0	-3.9	-34.0	0.5	4.4	7.0	2.6
782.0	751.0	-3.9	-30.0	0.5	4.4	7.0	2.6
782.0	751.0	-3.9	-20.0	**0.5**	4.4	7.0	2.6

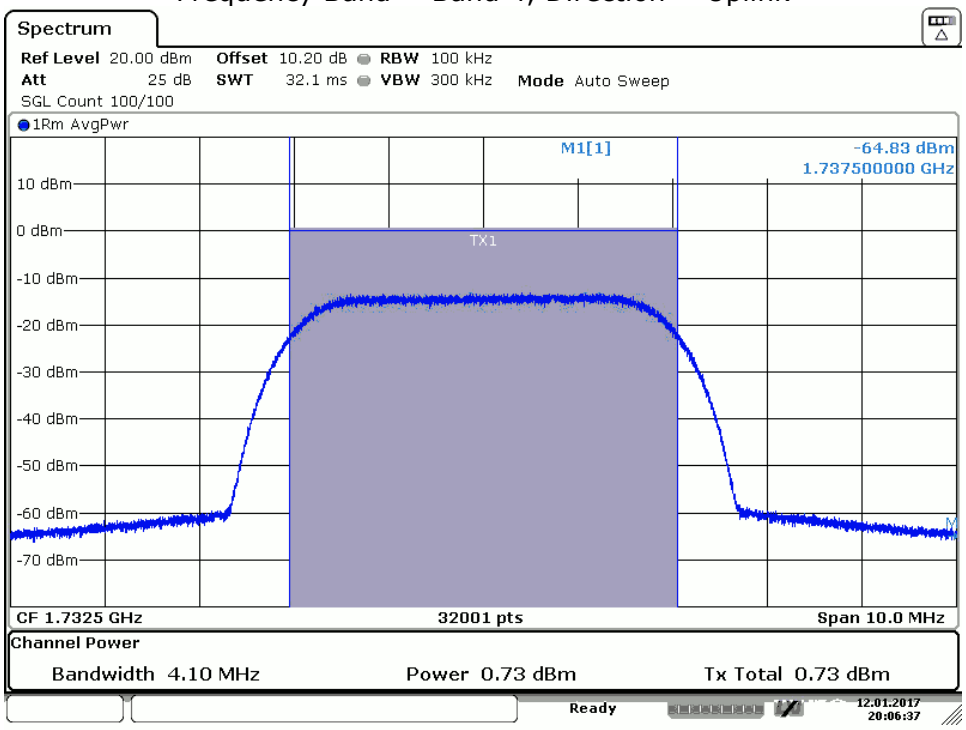
Remark: Please see next sub-clause for the measurement plot.

4.10.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = Band 2, Direction = Uplink

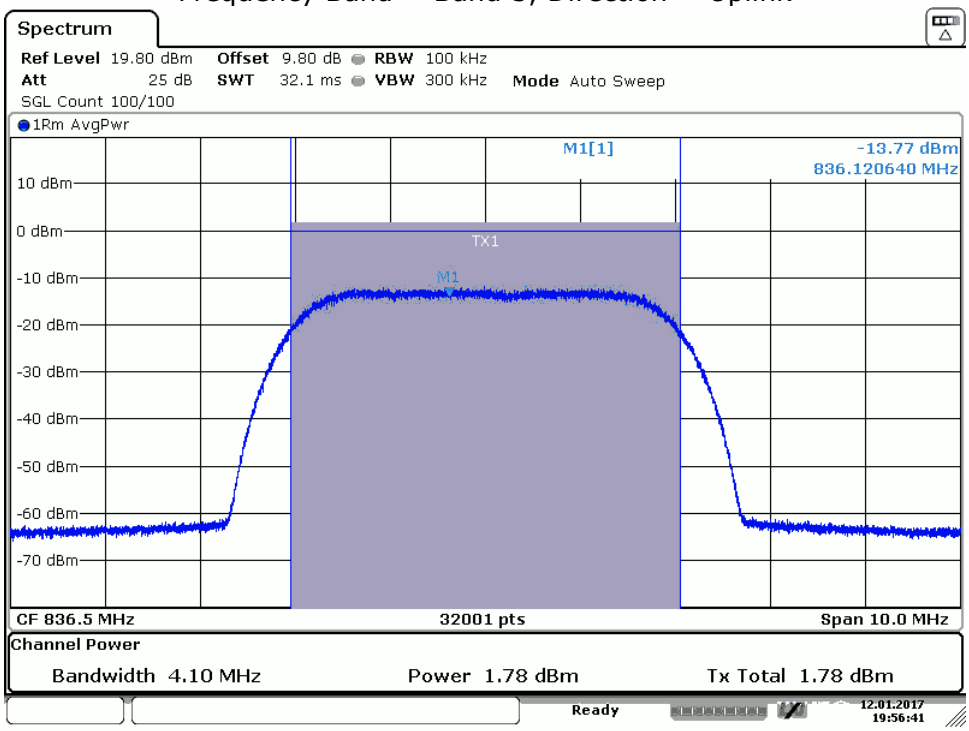


Frequency Band = Band 4, Direction = Uplink



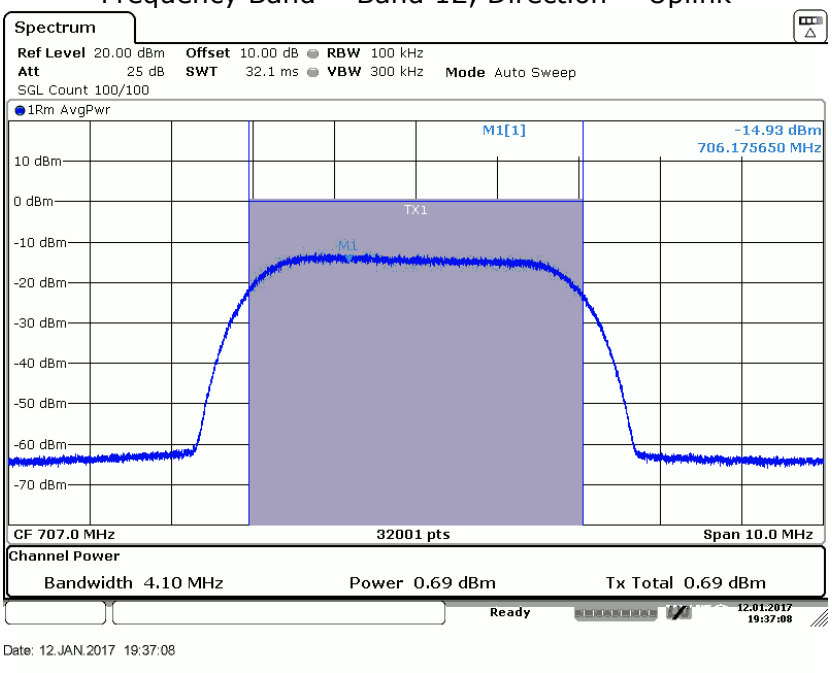
Date: 12.JAN.2017 20:06:37

Frequency Band = Band 5, Direction = Uplink



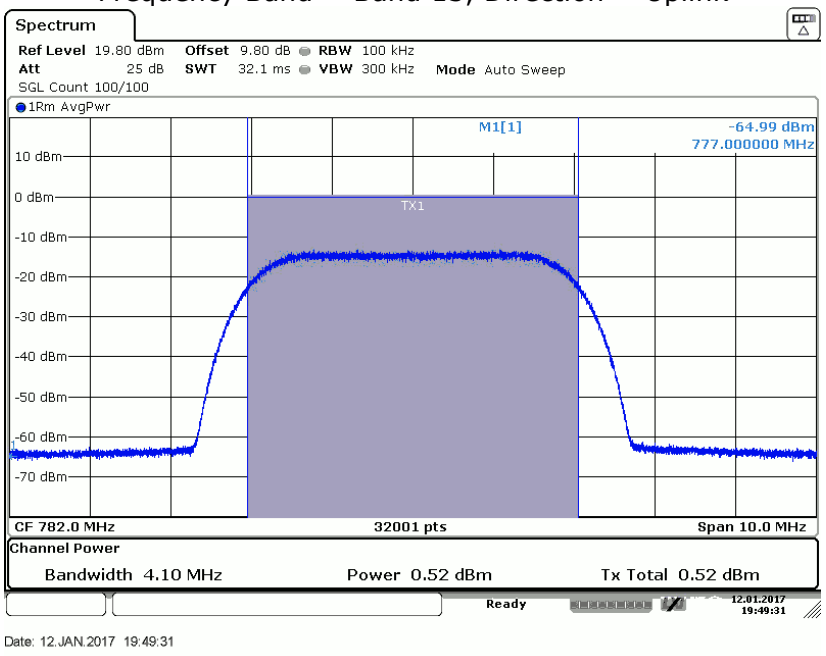
Date: 12.JAN.2017 19:56:42

Frequency Band = Band 12, Direction = Uplink



Date: 12.JAN.2017 19:37:08

Frequency Band = Band 13, Direction = Uplink



Date: 12.JAN.2017 19:49:31

4.10.5TEST EQUIPMENT USED

R&S TS8997

4.11 VARIABLE UPLINK GAIN TIMING

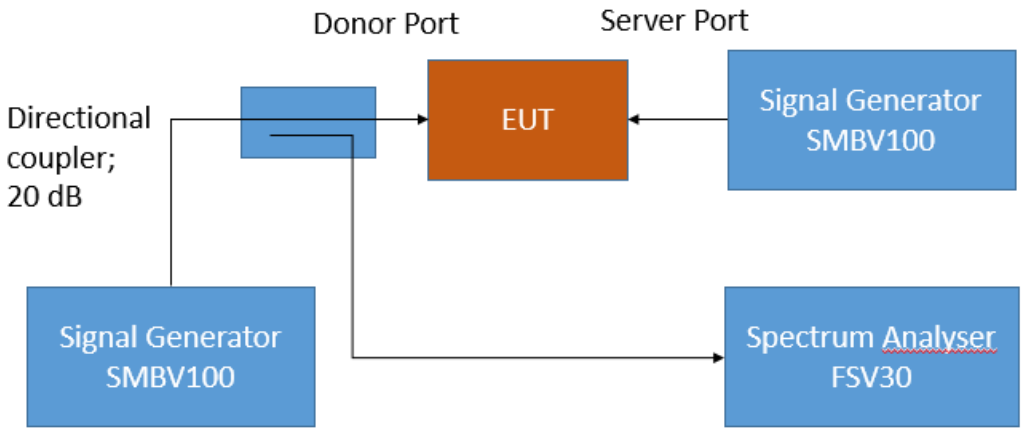
Standard

The test was performed according to:
KDB 935210 D03

4.11.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the Booster Gain limit according § 20.21(e)(8)(i)(C)(1) or Transmit Power Off Mode according § 20.21 €(8)(i)(H) for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.9.2; Variable Uplink Gain Timing

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.11.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21(e)(8)(C)(1)

Booster Gain Limits. (1) The uplink gain in dB of a consumer booster referenced to its input and output ports shall not exceed −34 dB—RSSI + MSCL.

(i) Where RSSI is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation. RSSI is expressed in negative dB units relative to 1 mW.

(ii) Where MSCL (Mobile Station Coupling Loss) is the minimum coupling loss in dB between the wireless device and input port of the consumer booster. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

FCC Part 20, § 20.21(e)(8)(i)(H)

Transmit Power Off Mode. When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power Off Mode." In this mode of operation, the uplink and downlink noise power shall not exceed −70 dBm/MHz and both uplink and downlink gain shall not exceed the lesser of 23 dB or MSCL.

KDB 935210 D03 7.9.2 e)

Confirm that the uplink noise decreases to the specified level within 1 second for mobile devices, and within 3 seconds for fixed devices[1]

[1]The time response requirements are provisional and are as determined by the ANSI ASC C63® task group in collaboration and consultation with FCC OET Laboratory Division staff.

4.11.3TEST PROTOCOL

Ambient temperature: 25 °C
Air Pressure: 996 hPa
Humidity: 29 %

Band 2, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
1880.0	-40.0	440.6	1000.0	559.4

Band 4, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
1732.5	-40.0	472.2	1000.0	527.8

Band 5, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
836.5	-40.0	340.6	1000.0	659.4

Band 12, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
707.0	-40.0	484.4	1000.0	515.6

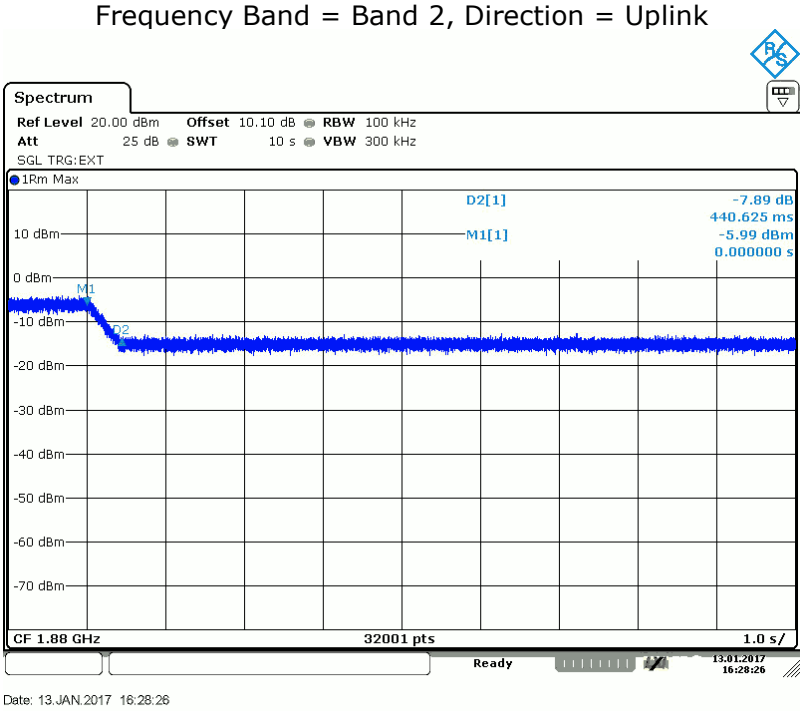
Band 13, uplink

Center Frequency [MHz]	Input DL Power [dBm]	Noise Decrease Time [ms]	Noise Decrease Time Limit [ms]	Margin to Limit [ms]
782.0	-40.0	442.2	1000.0	557.8

Remark: Please see next sub-clause for the measurement plot.

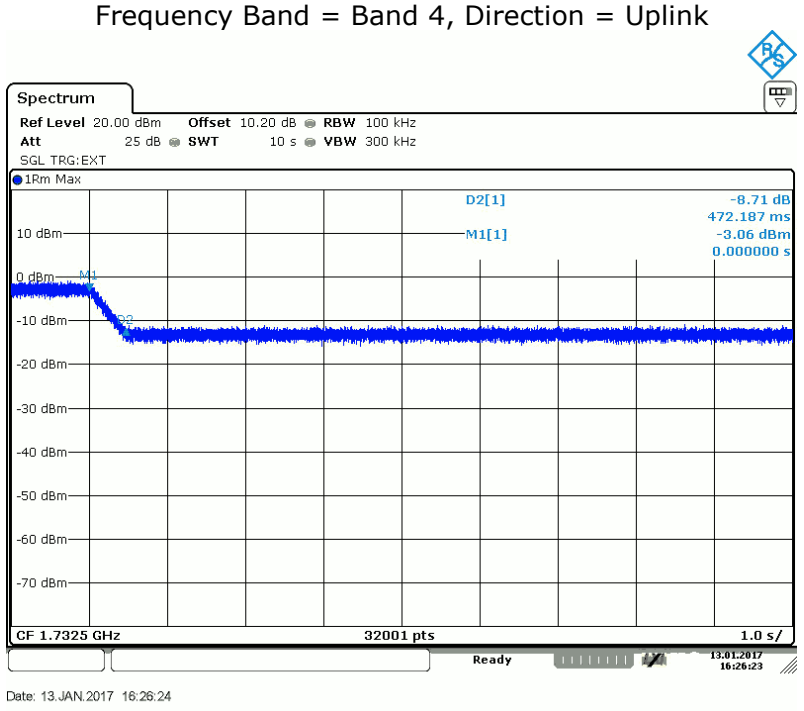
4.11.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, “WORST CASE”)

Frequency Band = Band 2, Direction = Uplink



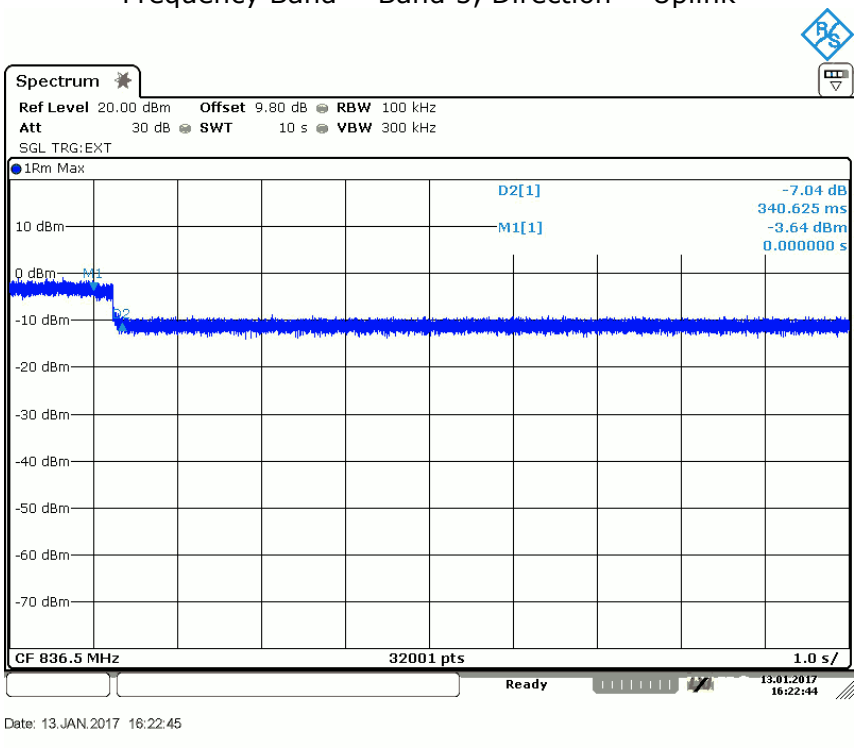
Date: 13.JAN.2017 16:28:26

Frequency Band = Band 4, Direction = Uplink



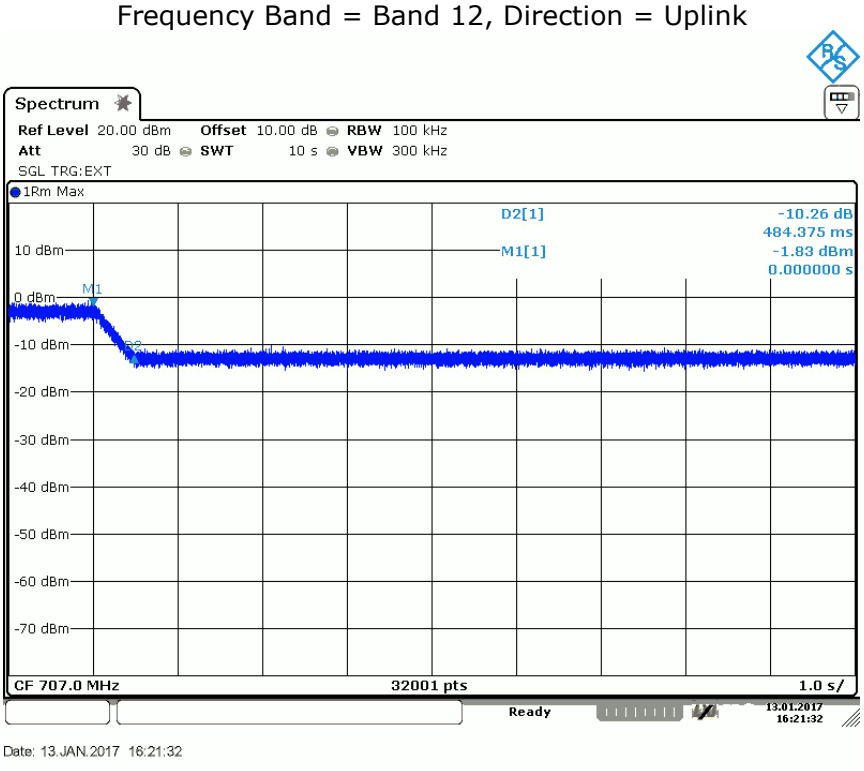
Date: 13.JAN.2017 16:26:24

Frequency Band = Band 5, Direction = Uplink



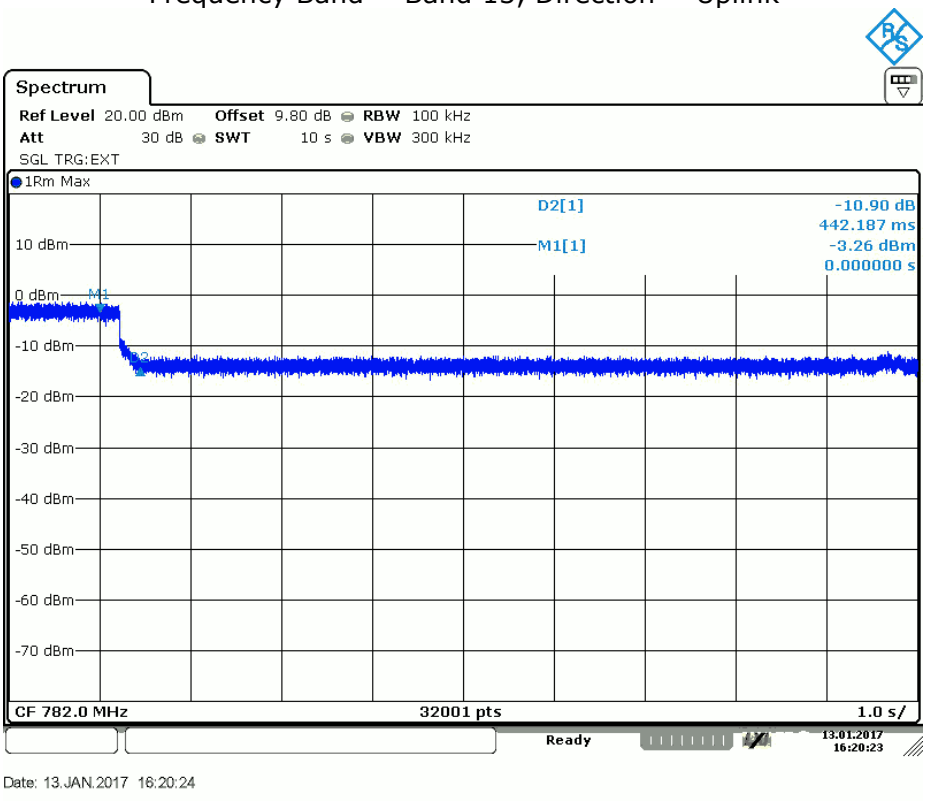
Date: 13.JAN.2017 16:22:45

Frequency Band = Band 12, Direction = Uplink



Date: 13.JAN.2017 16:21:32

Frequency Band = Band 13, Direction = Uplink



4.11.5TEST EQUIPMENT USED

R&S TS8997

4.12 OCCUPIED BANDWIDTH

Standard

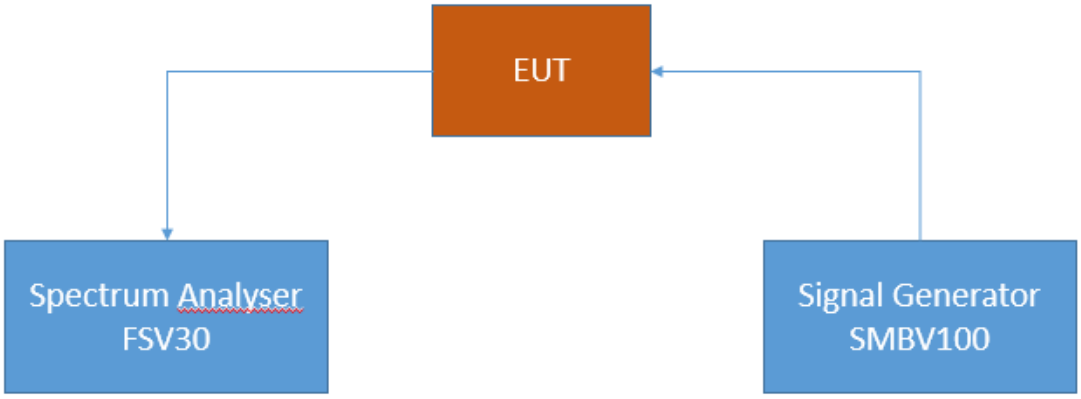
The test was performed according to:
KDB 935210 D03

4.12.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable occupied bandwidth requirements per § 2.1049

The EUT was connected to the test setups according to the following diagram:

FCC Part 20.21; Consumer Signal Booster
Setup Measuring characteristics of test signal 7.10



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.10; Occupied Bandwidth

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.12.2TEST REQUIREMENTS / LIMITS

FCC Part 2.1049; Occupied Bandwidth:

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

4.12.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, downlink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	1960.00	247.0	247.0	0.0	200.0	200.0
LTE	1960.00	4120.0	4154.0	34.0	200.0	166.0
CDMA	1960.00	1259.0	1259.0	0.0	200.0	200.0

Band 4, downlink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	2132.50	247.0	246.6	-0.4	200.0	199.6
LTE	2132.50	4120.0	4166.0	46.0	200.0	154.0
CDMA	2132.50	1259.0	1259.0	0.0	200.0	200.0

Band 5, downlink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	881.50	246.4	247.4	1.0	200.0	199.0
LTE	881.50	4128.0	4176.0	48.0	200.0	152.0
CDMA	881.50	1259.0	1259.0	0.0	200.0	200.0

Band 12, downlink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	737.00	246.8	246.6	-0.2	200.0	199.8
LTE	737.00	4101.0	4240.0	139.0	200.0	61.0
CDMA	737.00	1259.0	1259.0	0.0	200.0	200.0

Band 13, downlink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	751.00	246.8	246.6	-0.2	200.0	199.8
LTE	751.00	4130.0	4136.0	6.0	200.0	194.0
CDMA	751.00	1259.0	1259.0	0.0	200.0	200.0

Band 2, uplink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	1880.00	247.0	247.2	0.2	200.0	199.8
LTE	1880.00	4124.0	4144.0	20.0	200.0	180.0
CDMA	1880.00	1259.0	1259.0	0.0	200.0	200.0

Band 4, uplink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	1732.50	246.6	247.0	0.4	200.0	199.6
LTE	1732.50	4144.0	4144.0	0.0	200.0	200.0
CDMA	1732.50	1259.0	1259.0	0.0	200.0	200.0

Band 5, uplink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]]
GSM	836.50	246.8	247.0	0.2	200.0	199.8
LTE	836.50	4106.0	4178.0	72.0	200.0	128.0
CDMA	836.50	1259.0	1263.4	4.3	200.0	195.7

Band 12, uplink

Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	707.00	247.0	247.6	0.6	200.0	199.4
LTE	707.00	4122.0	4174.0	52.0	200.0	148.0
CDMA	707.00	1259.0	1259.0	0.0	200.0	200.0

Band 13, uplink

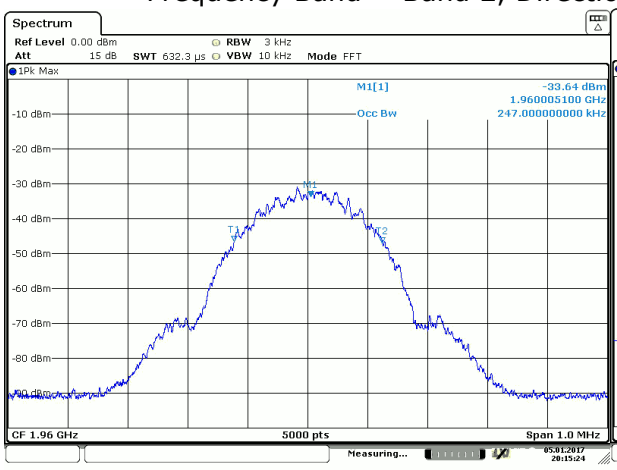
Signal Type	Signal Frequency [MHz]	Occupied Bandwidth SG [kHz]	Occupied Bandwidth Booster [kHz]	Delta Occupied Bandwidth [kHz]	Delta Limit Occupied Bandwidth [kHz]	Margin to Limit [kHz]
GSM	782.00	247.0	247.0	0.0	200.0	200.0
LTE	782.00	4138.0	4156.0	18.0	200.0	182.0
CDMA	782.00	1259.0	1259.0	0.0	200.0	200.0

Remark: Please see next sub-clause for the measurement plot.

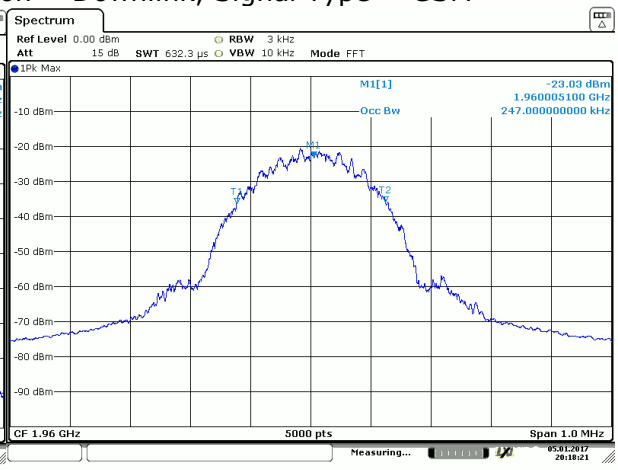
4.12.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

First plot shows bandwidth measured at signal generator output
Second plot shows bandwidth at output of EUT

Frequency Band = Band 2, Direction = Downlink, Signal Type = GSM

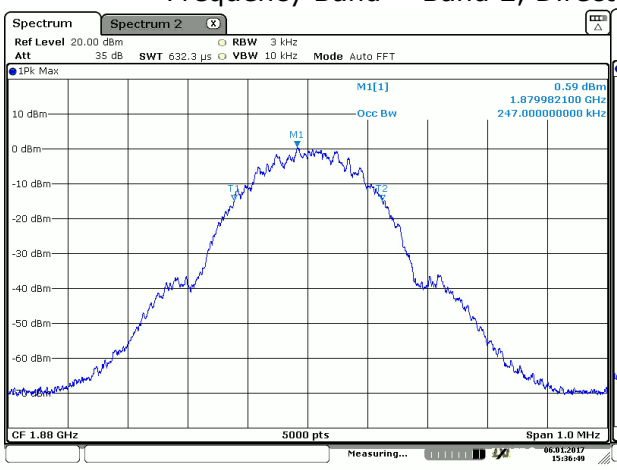


Date: 5.JAN.2017 20:15:25

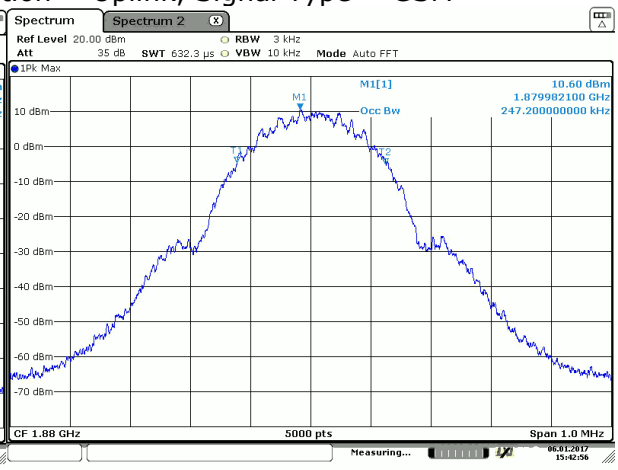


Date: 5.JAN.2017 20:18:21

Frequency Band = Band 2, Direction = Uplink, Signal Type = GSM

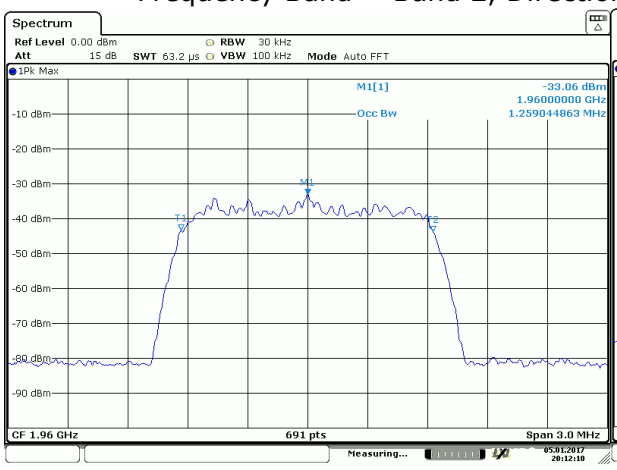


Date: 6.JAN.2017 15:36:49

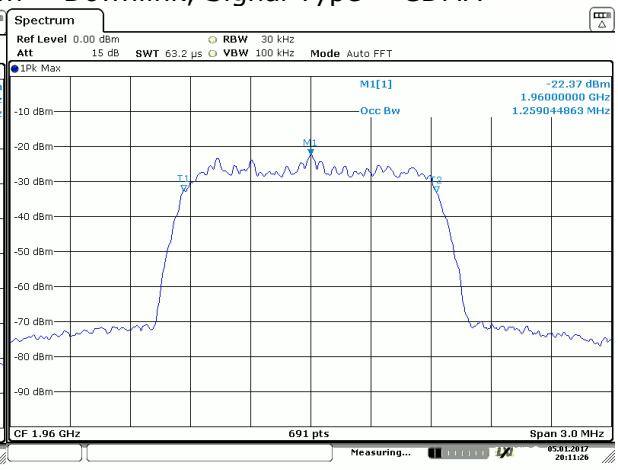


Date: 6.JAN.2017 15:42:56

Frequency Band = Band 2, Direction = Downlink, Signal Type = CDMA

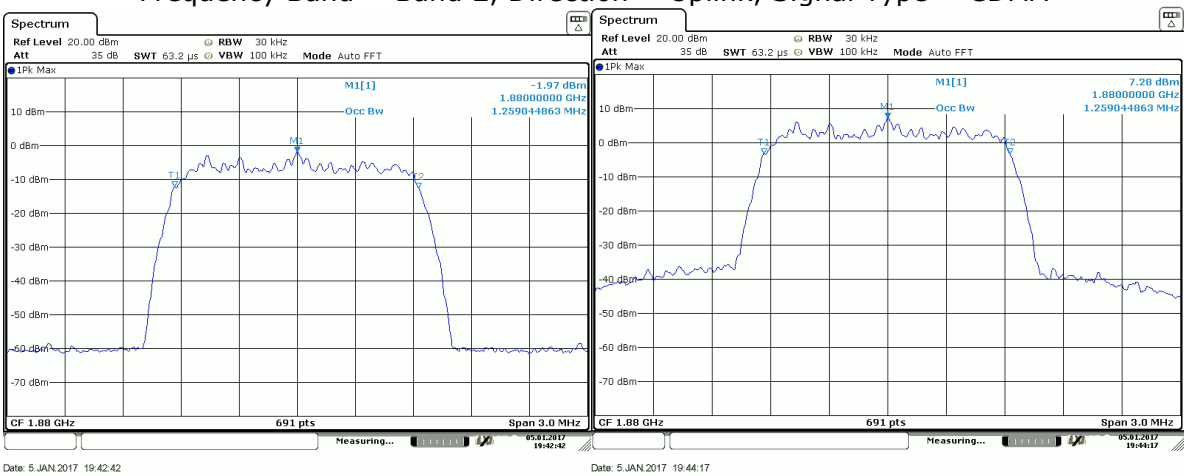


Date: 5.JAN.2017 20:12:10

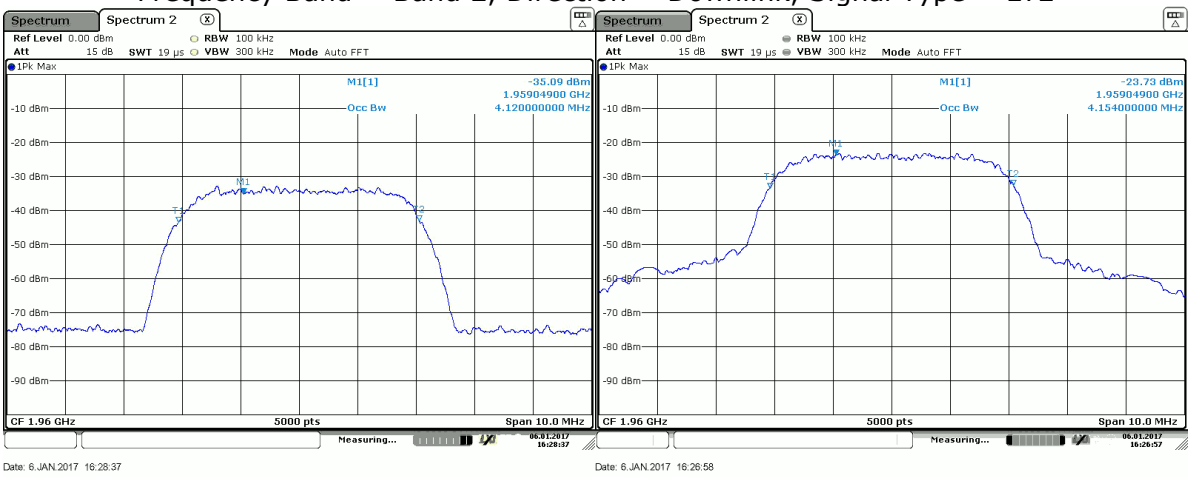


Date: 5.JAN.2017 20:11:26

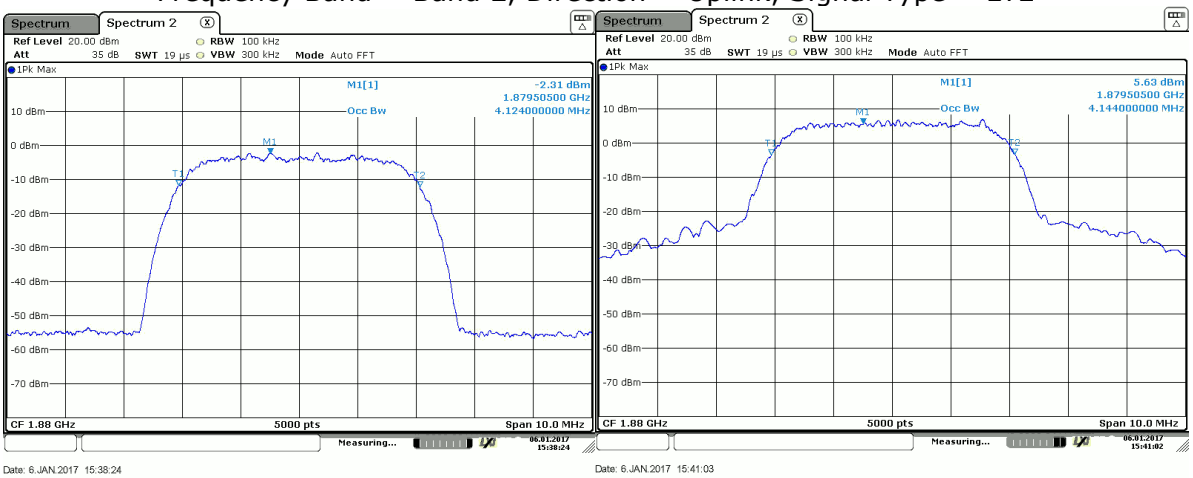
Frequency Band = Band 2, Direction = Uplink, Signal Type = CDMA



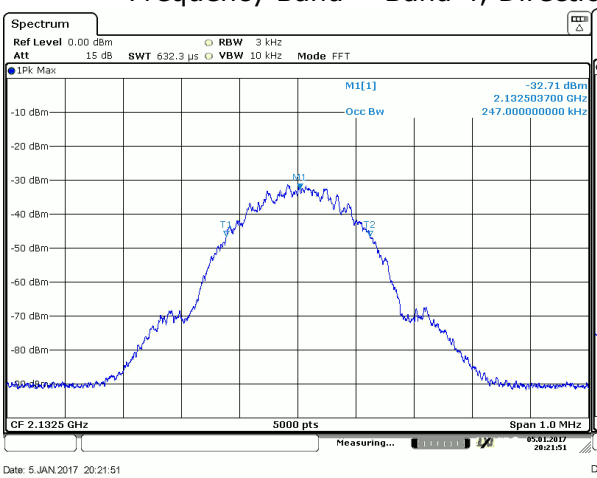
Frequency Band = Band 2, Direction = Downlink, Signal Type = LTE

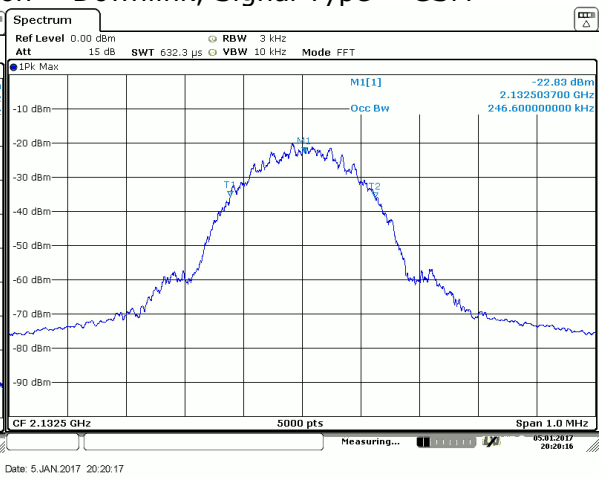


Frequency Band = Band 2, Direction = Uplink, Signal Type = LTE

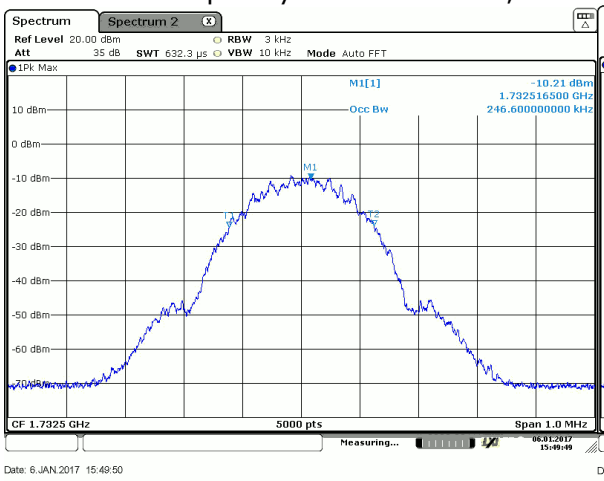


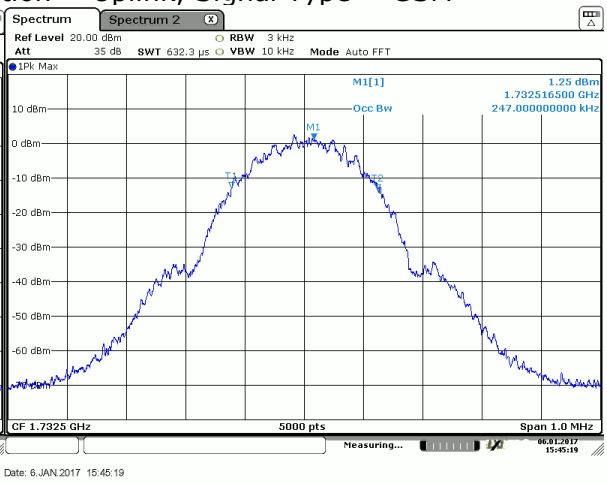
Frequency Band = Band 4, Direction = Downlink, Signal Type = GSM



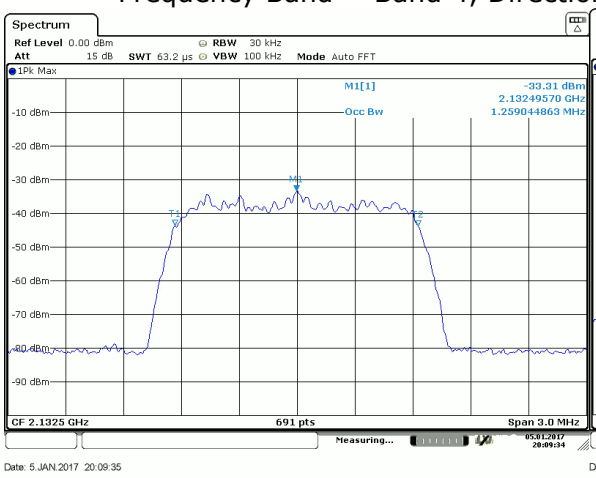


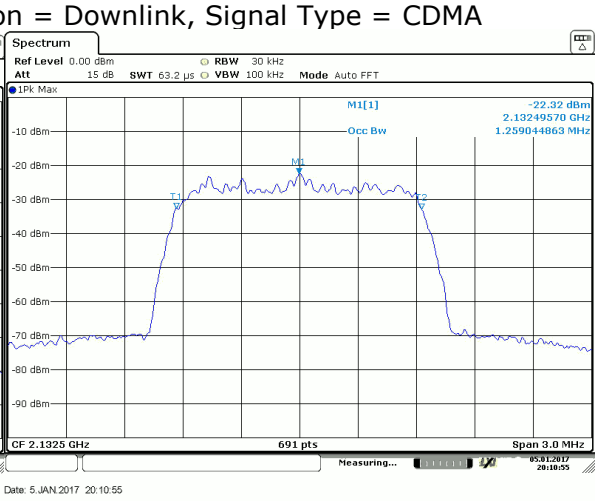
Frequency Band = Band 4, Direction = Uplink, Signal Type = GSM



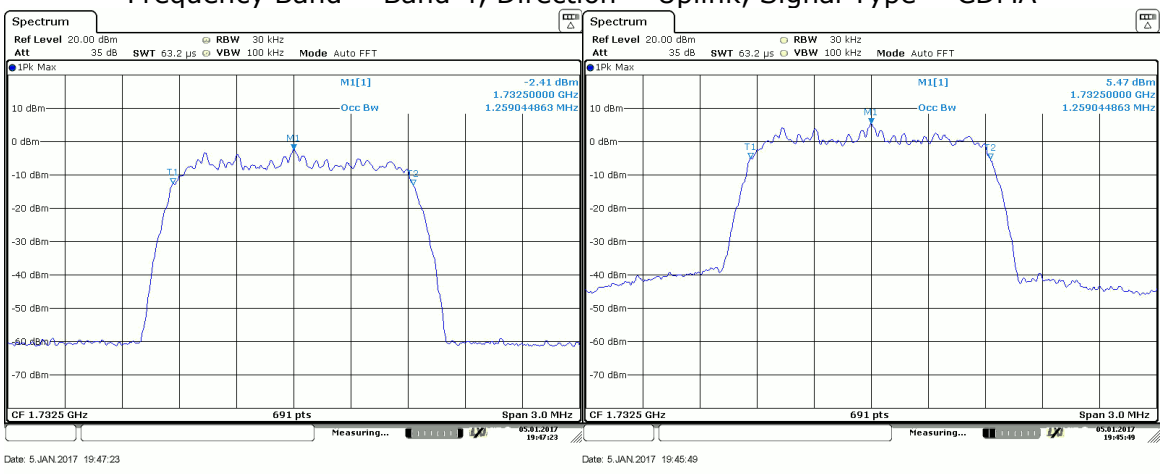


Frequency Band = Band 4, Direction = Downlink, Signal Type = CDMA

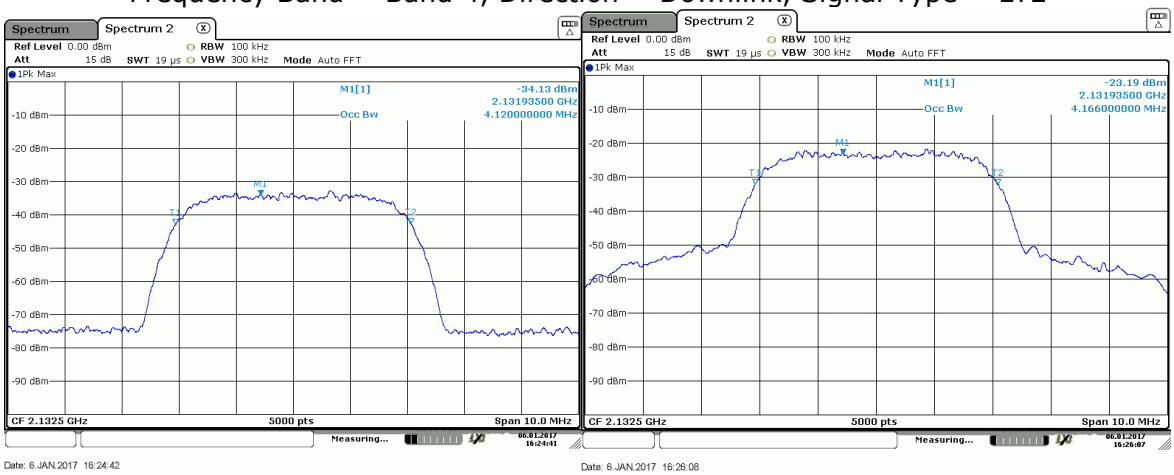




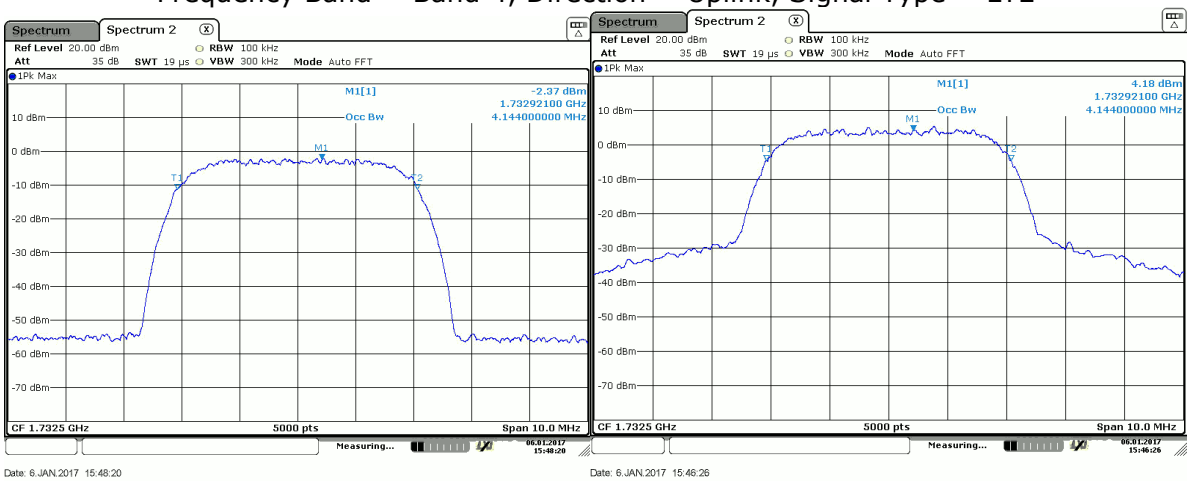
Frequency Band = Band 4, Direction = Uplink, Signal Type = CDMA



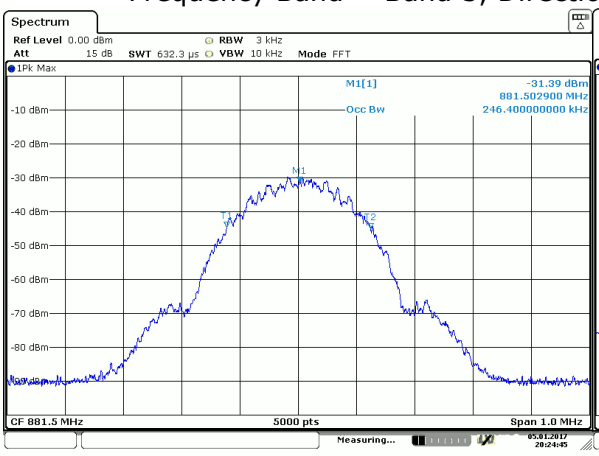
Frequency Band = Band 4, Direction = Downlink, Signal Type = LTE



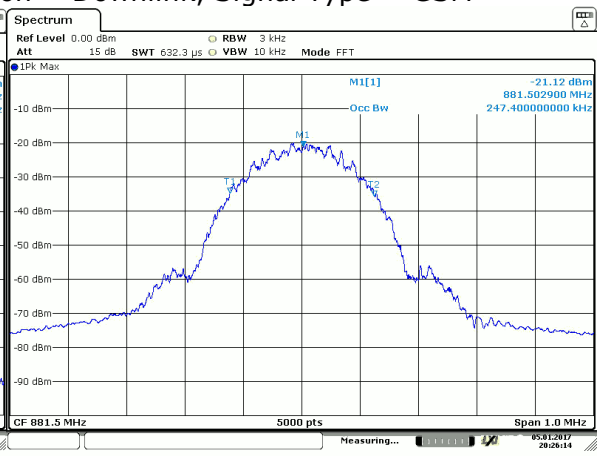
Frequency Band = Band 4, Direction = Uplink, Signal Type = LTE



Frequency Band = Band 5, Direction = Downlink, Signal Type = GSM

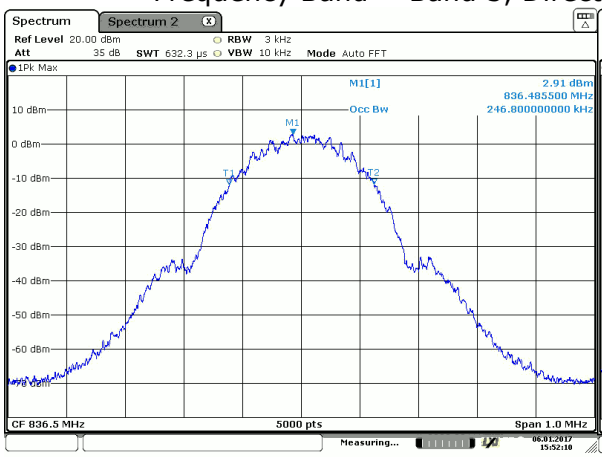


Date: 5.JAN.2017 20:24:45

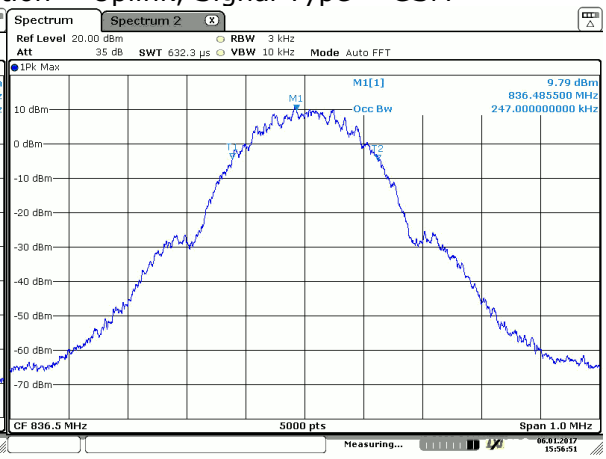


Date: 5.JAN.2017 20:26:15

Frequency Band = Band 5, Direction = Uplink, Signal Type = GSM

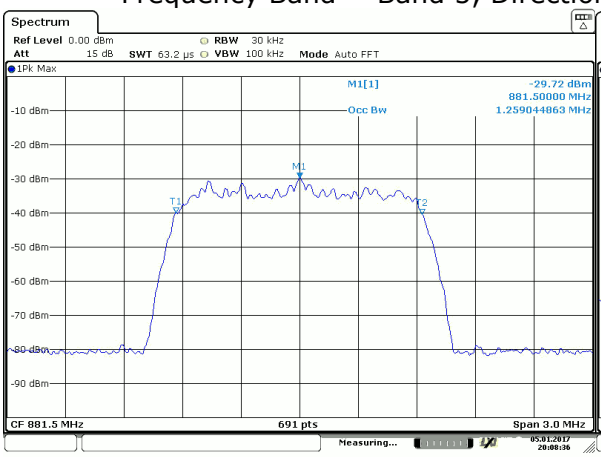


Date: 6.JAN.2017 15:52:11

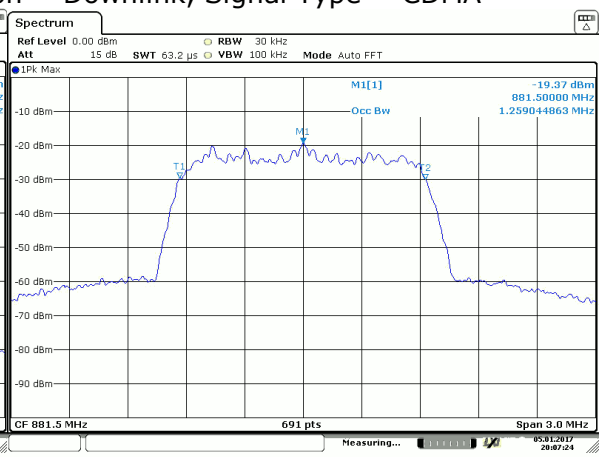


Date: 6.JAN.2017 15:56:52

Frequency Band = Band 5, Direction = Downlink, Signal Type = CDMA

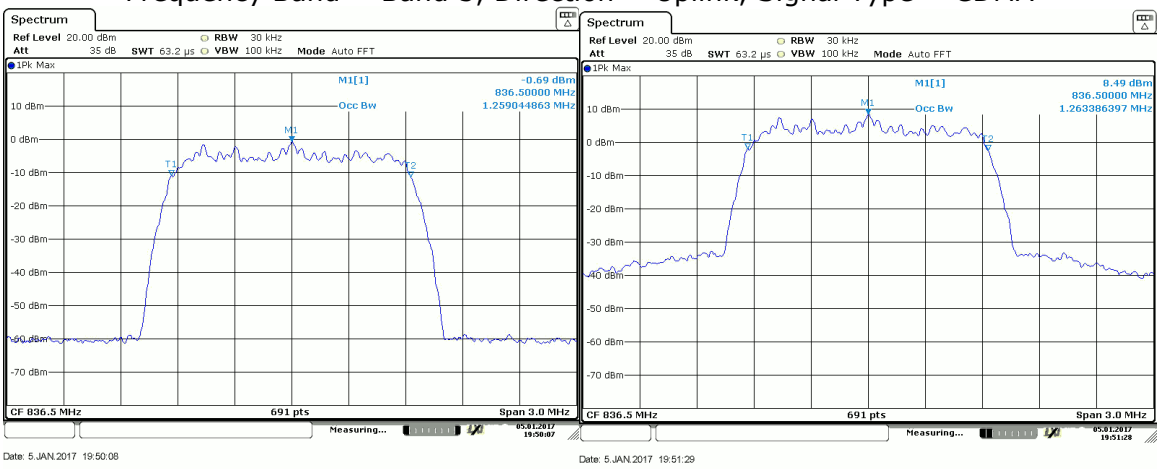


Date: 5.JAN.2017 20:08:35

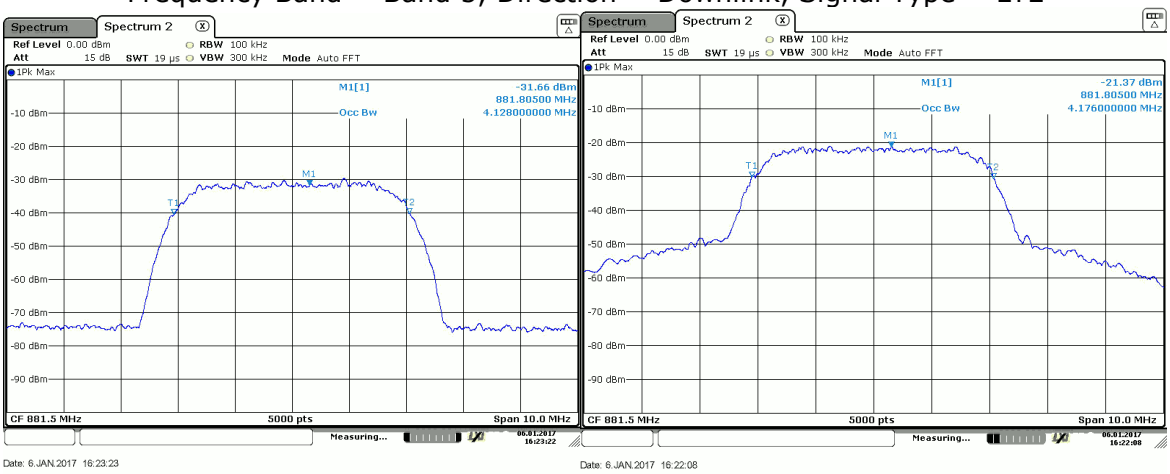


Date: 5.JAN.2017 20:07:24

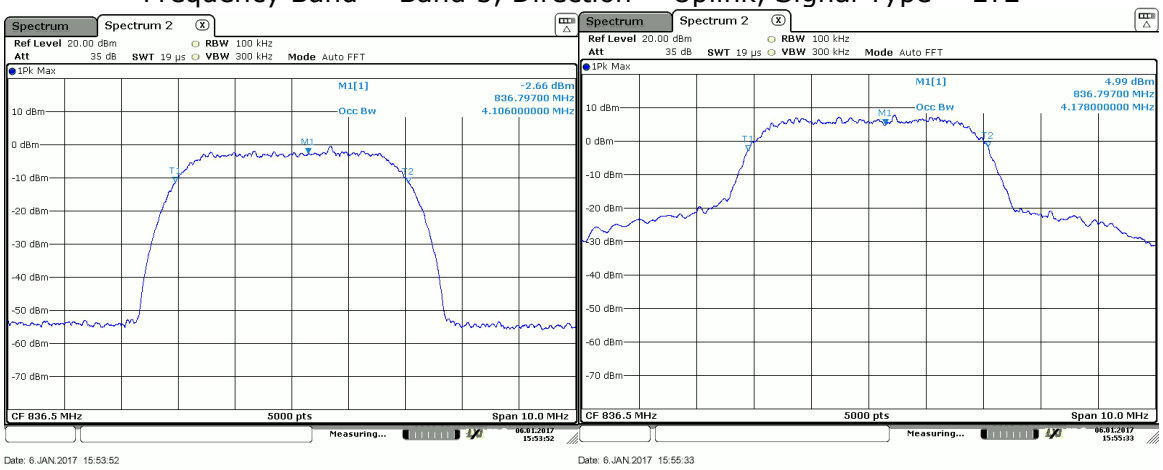
Frequency Band = Band 5, Direction = Uplink, Signal Type = CDMA



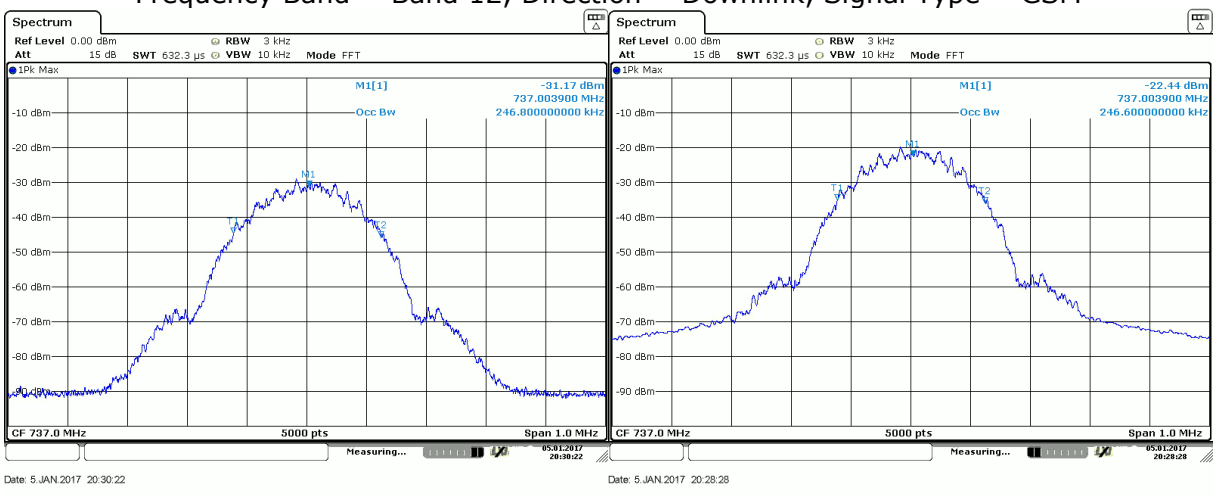
Frequency Band = Band 5, Direction = Downlink, Signal Type = LTE



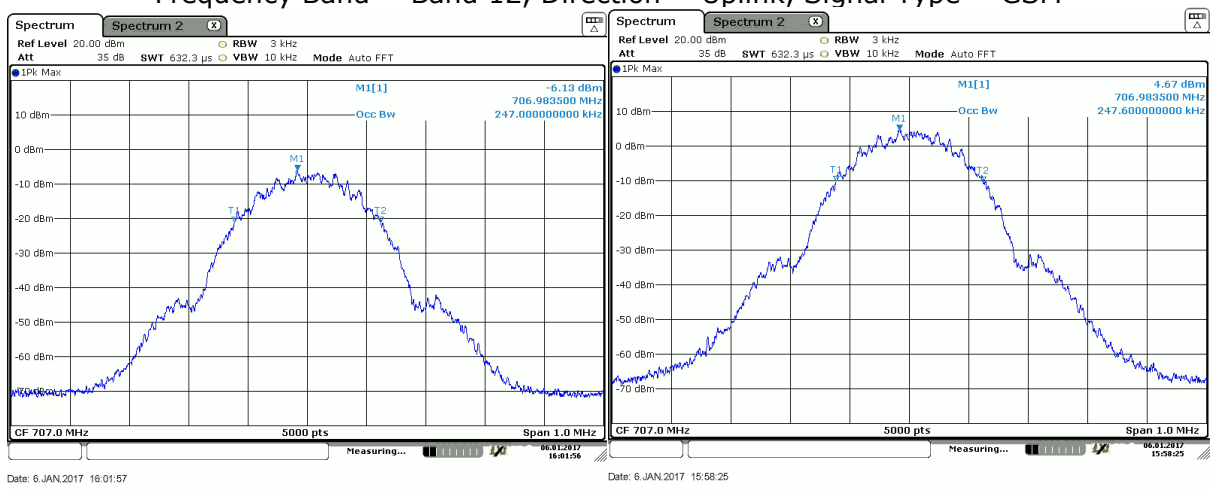
Frequency Band = Band 5, Direction = Uplink, Signal Type = LTE



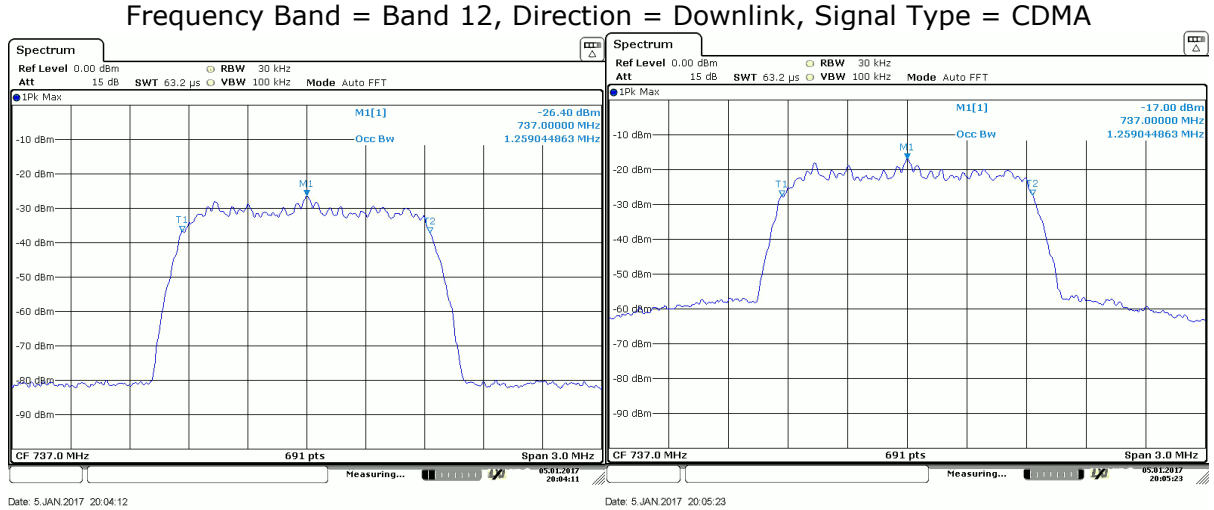
Frequency Band = Band 12, Direction = Downlink, Signal Type = GSM



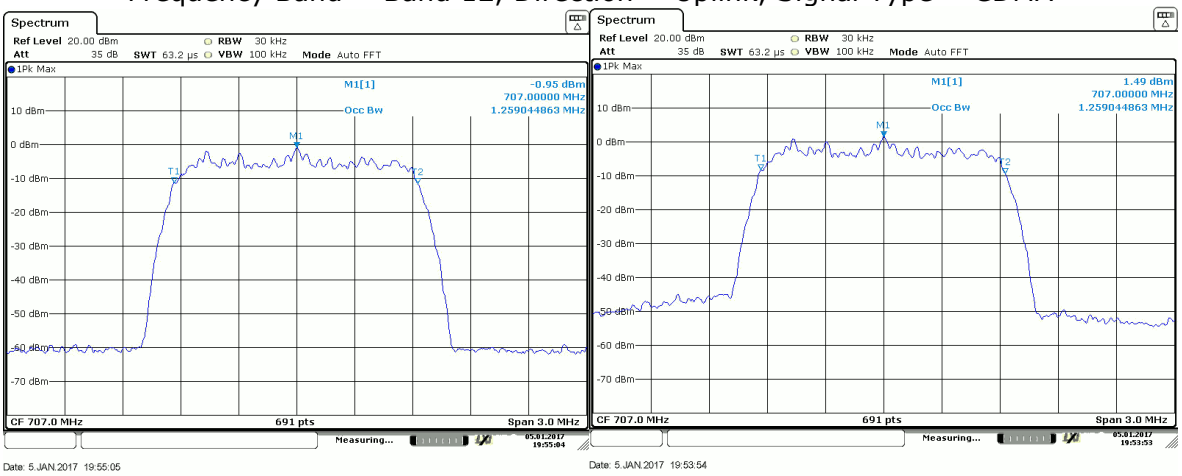
Frequency Band = Band 12, Direction = Uplink, Signal Type = GSM



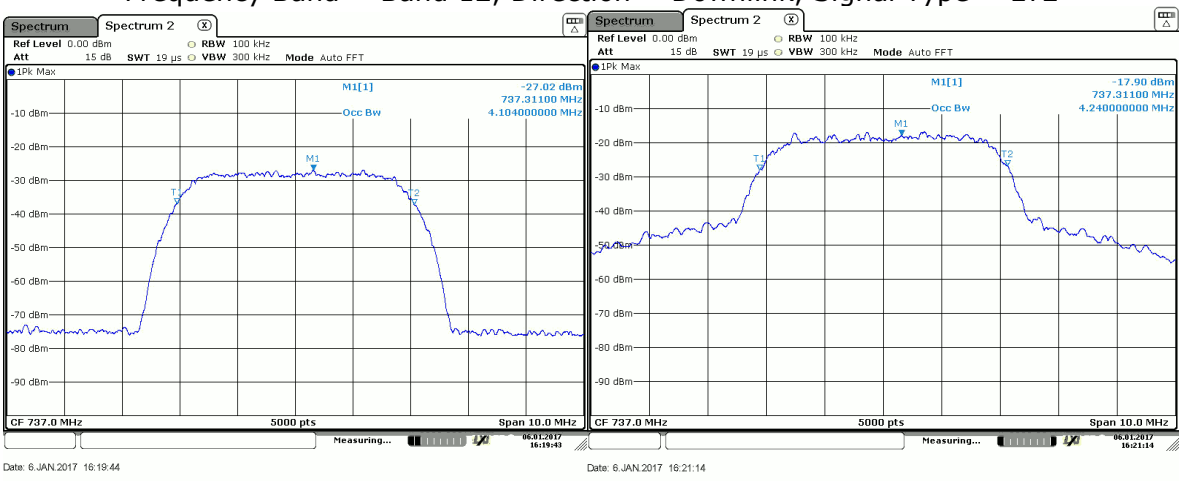
Frequency Band = Band 12, Direction = Downlink, Signal Type = CDMA



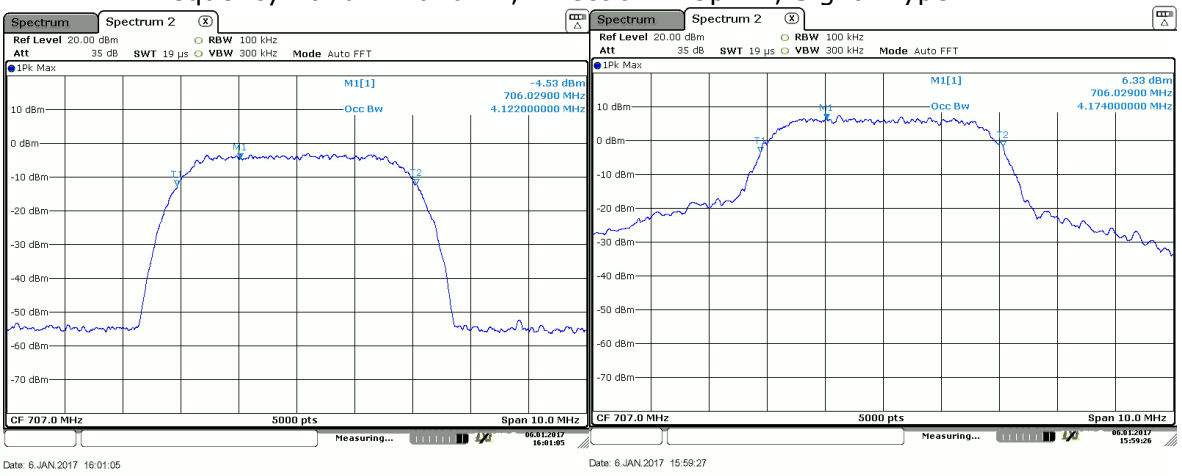
Frequency Band = Band 12, Direction = Uplink, Signal Type = CDMA



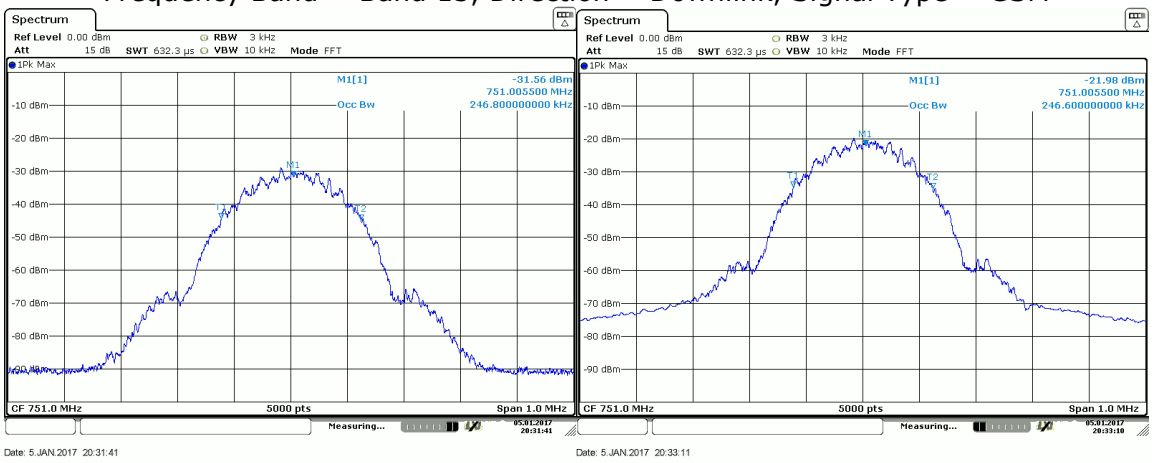
Frequency Band = Band 12, Direction = Downlink, Signal Type = LTE



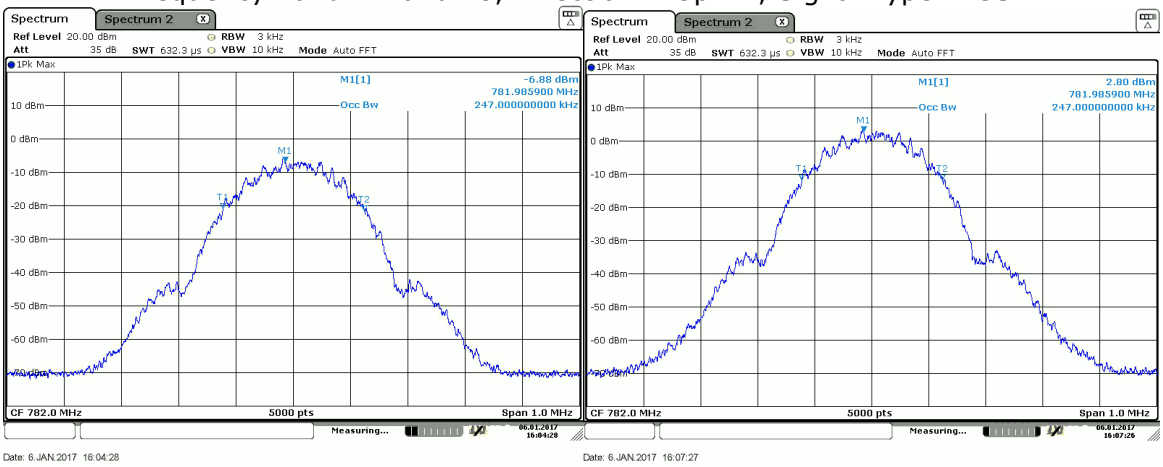
Frequency Band = Band 12, Direction = Uplink, Signal Type = LTE



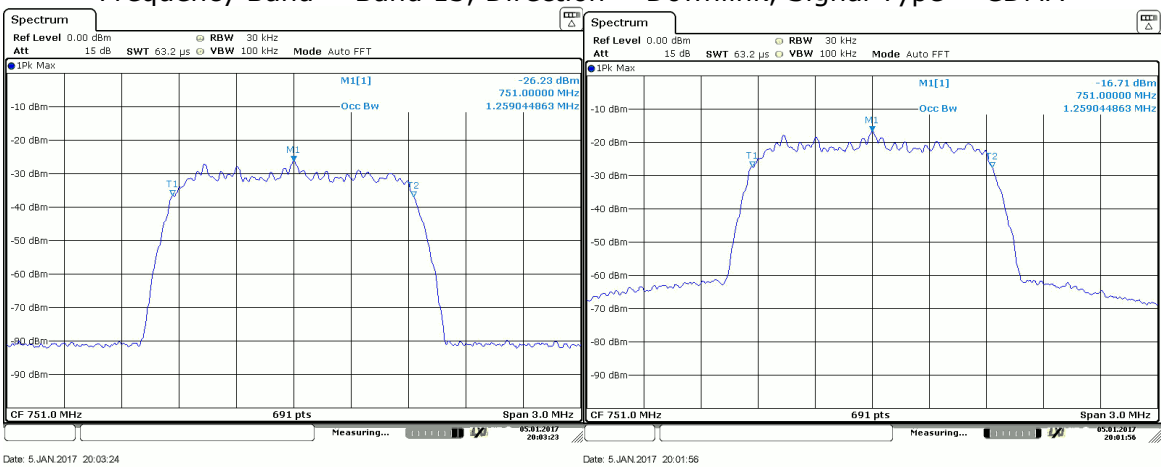
Frequency Band = Band 13, Direction = Downlink, Signal Type = GSM



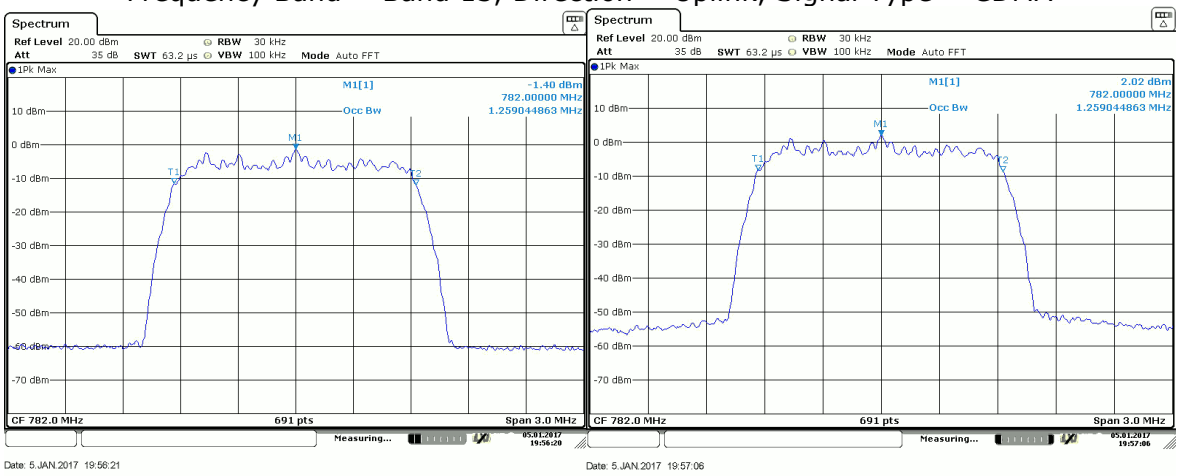
Frequency Band = Band 13, Direction = Uplink, Signal Type = GSM



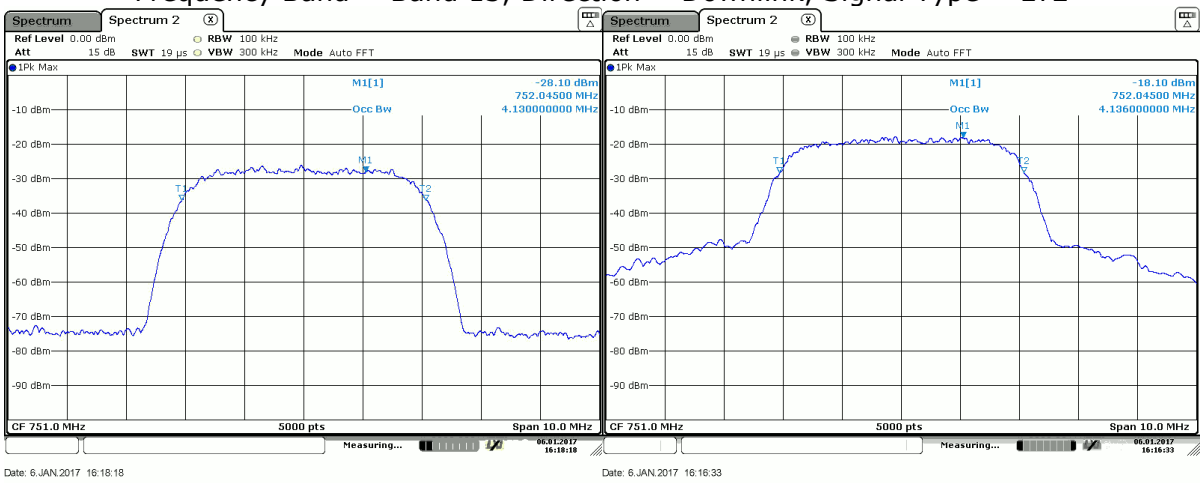
Frequency Band = Band 13, Direction = Downlink, Signal Type = CDMA



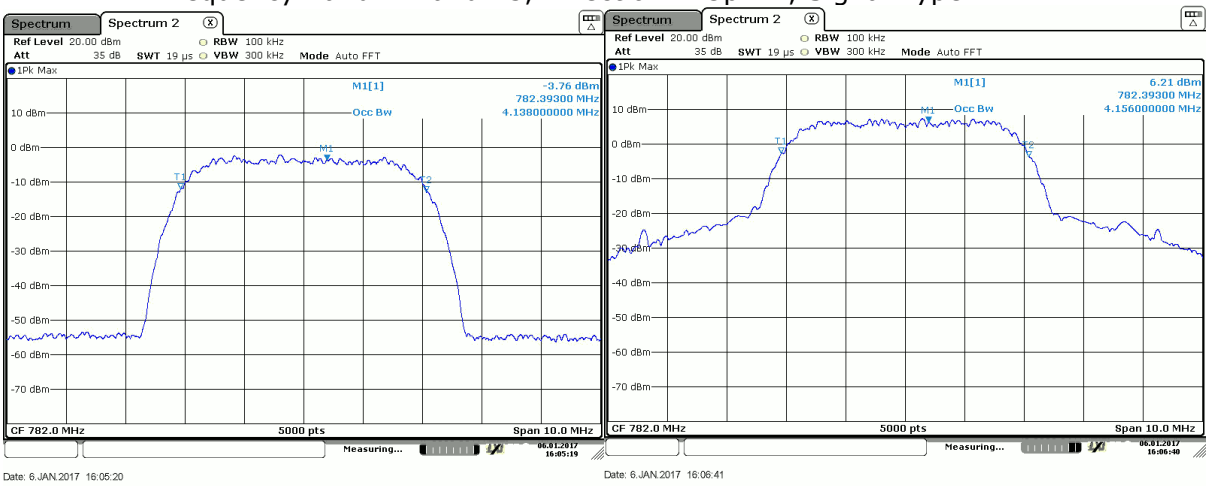
Frequency Band = Band 13, Direction = Uplink, Signal Type = CDMA



Frequency Band = Band 13, Direction = Downlink, Signal Type = LTE



Frequency Band = Band 13, Direction = Uplink, Signal Type = LTE



4.12.5TEST EQUIPMENT USED

R&S TS8997

4.13 OSCILLATION RESTART

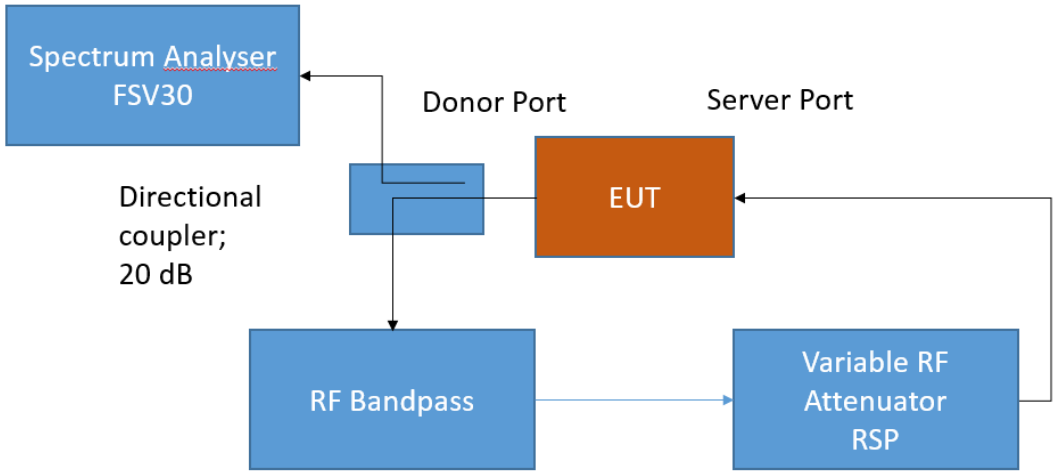
Standard

The test was performed according to:
KDB 935210 D03

4.13.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster Anti-Oscillation limits and requirements as specified in §§ 20.21(e)(8)(ii)(A for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.11.2; Oscillation Restart

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.13.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21 (e)(8)(ii)(A)

Anti-Oscillation. Consumer boosters must be able to detect and mitigate (*i.e.,* by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

4.13.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, downlink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
1960.0	206.6	62.4	4	300.0	60.0	5	93.4	2.4	1

Band 4, downlink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
2132.5	212.6	62.4	4	1000.0	60.0	5	787.4	2.4	1

Band 5, downlink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
881.5	207.5	62.4	4	1000.0	60.0	5	792.5	2.4	1

Band 12, downlink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
737.0	211.0	62.4	4	1000.0	60.0	5	789.0	2.4	1

Band 13, downlink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
751.0	206.9	62.4	4	1000.0	60.0	5	793.1	2.4	1

Band 2, uplink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
1880.0	36.1	62.3	4	300.0	60.0	5	263.9	2.3	1

Band 4, uplink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
1732.5	149.5	62.3	4	300.0	60.0	5	150.5	2.3	1

Band 5, uplink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
836.5	149.4	62.3	4	300.0	60.0	5	150.6	2.3	1

Band 12, uplink

Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
707.0	149.8	62.3	4	300.0	60.0	5	150.2	2.3	1

Band 13, uplink

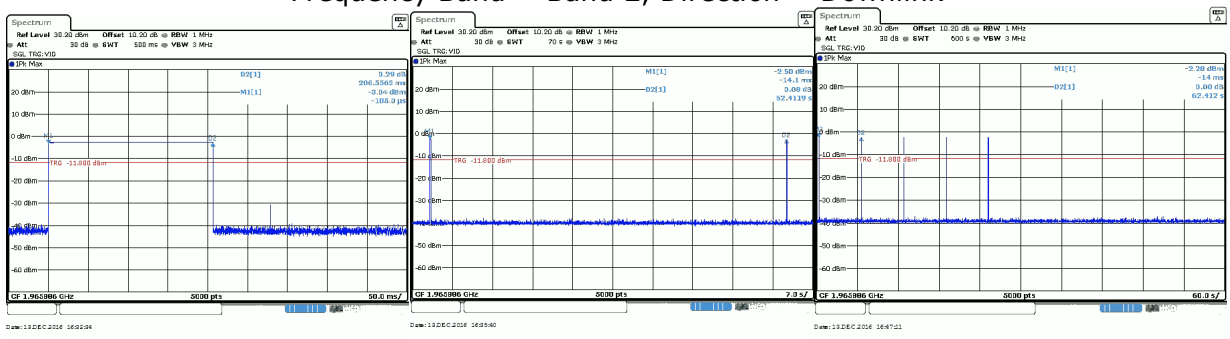
Frequency [MHz]	Oscillation Detection Time [ms]	Oscillation Restart Time [s]	Oscillation Restarts	Oscillation Detection Time Limit [ms]	Oscillation Restart Time Limit [s]	Oscillation Restarts Limit	Margin Oscillation Detection Time [ms]	Margin Oscillation Restart Time [s]	Margin Oscillation Restarts
782.0	149.2	62.7	4	300.0	60.0	5	150.8	2.7	1

Remark: Please see next sub-clause for the measurement plot.

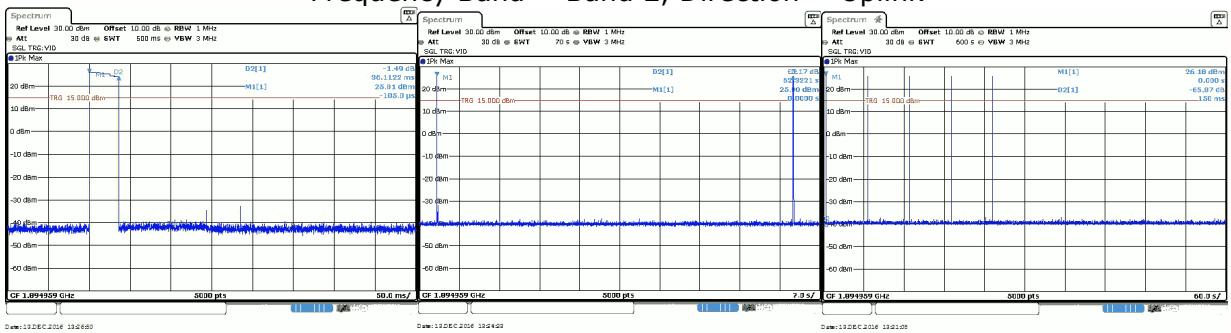
4.13.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

First plot shows oscillation detection time
Second plot shows restart time
Third plot shows restart attempts

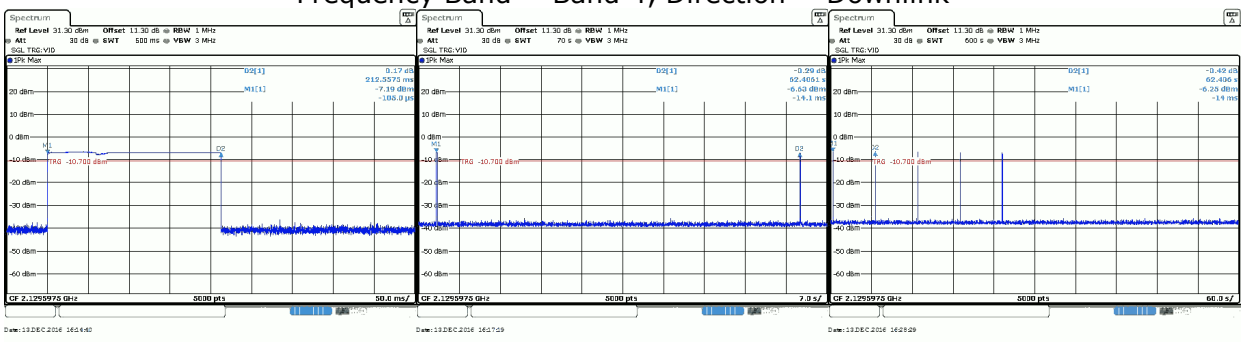
Frequency Band = Band 2, Direction = Downlink



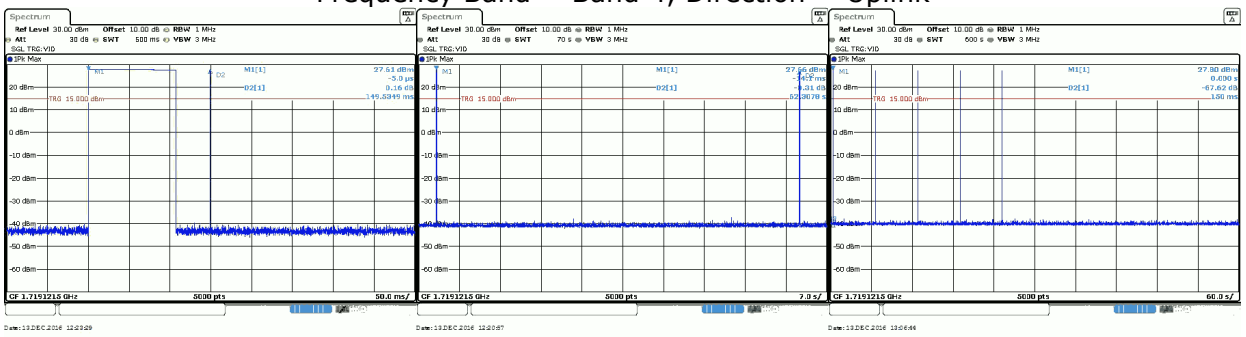
Frequency Band = Band 2, Direction = Uplink



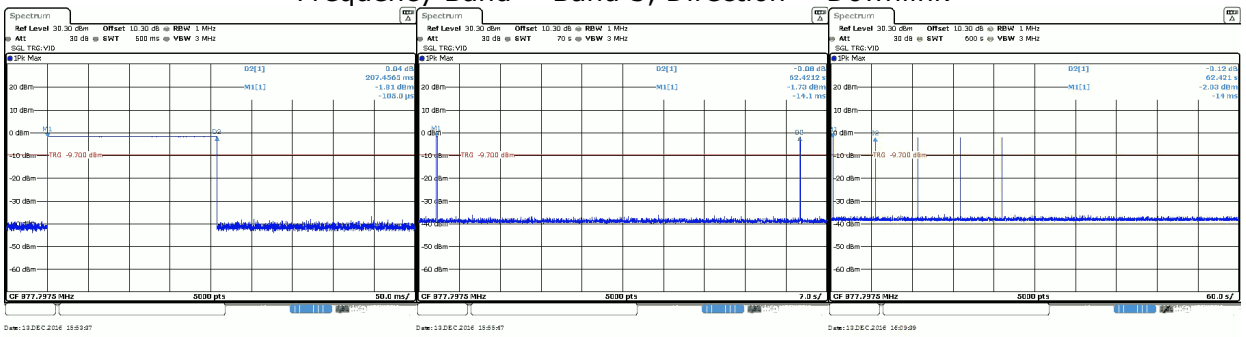
Frequency Band = Band 4, Direction = Downlink



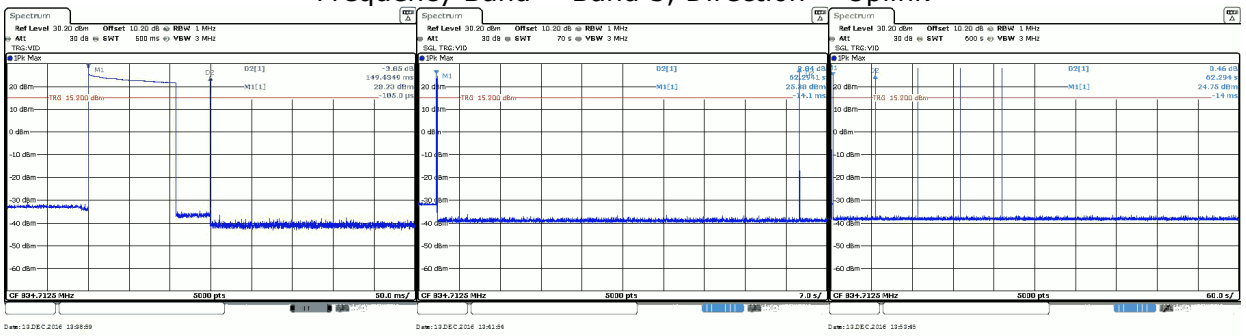
Frequency Band = Band 4, Direction = Uplink



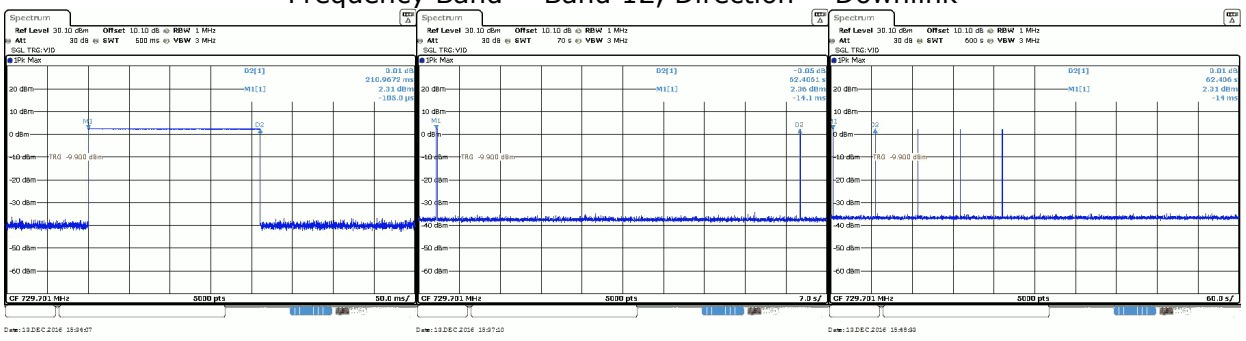
Frequency Band = Band 5, Direction = Downlink



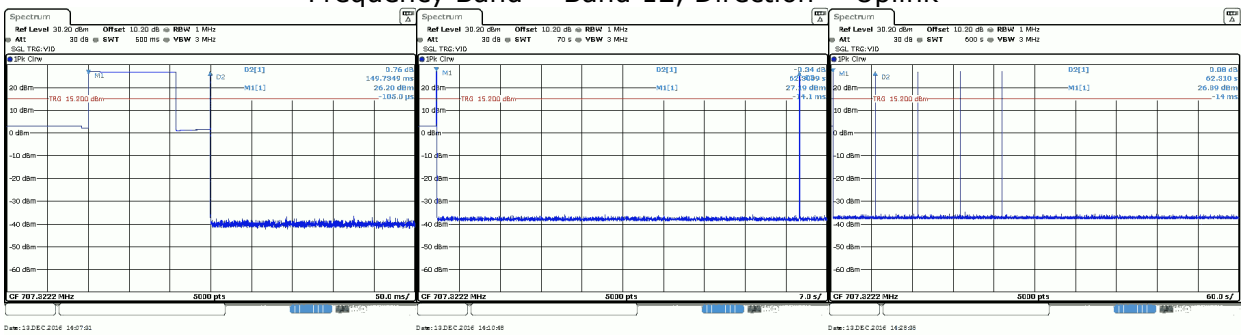
Frequency Band = Band 5, Direction = Uplink



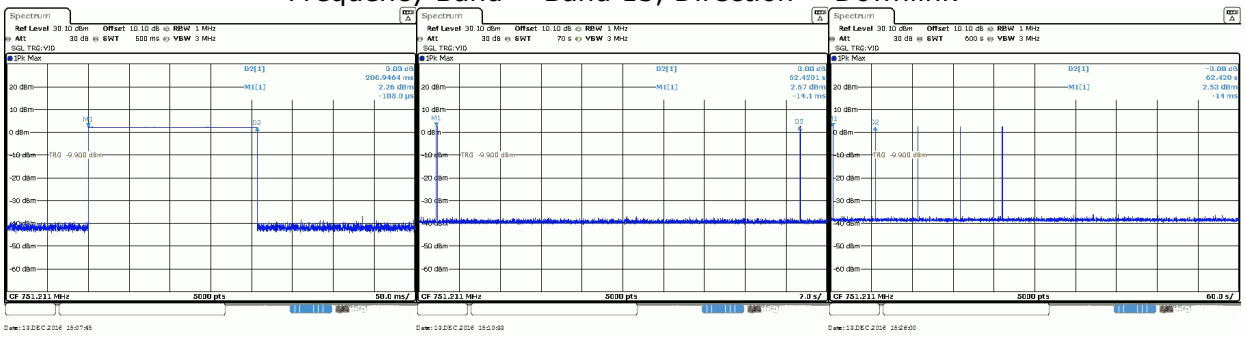
Frequency Band = Band 12, Direction = Downlink



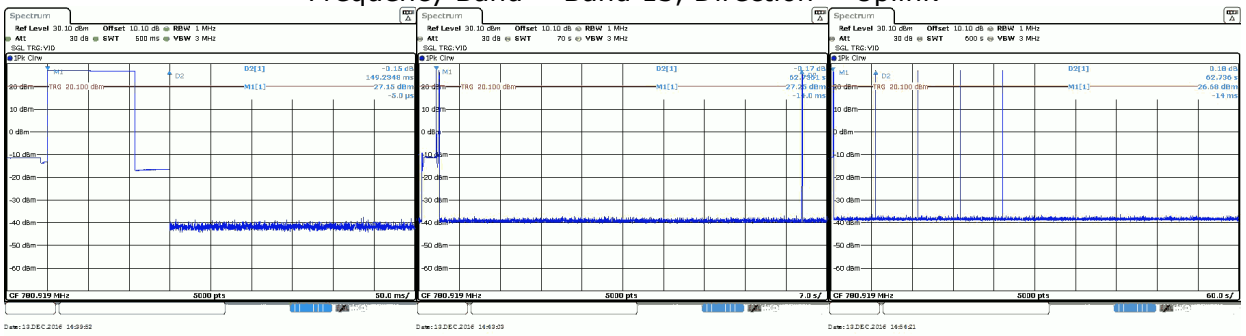
Frequency Band = Band 12, Direction = Uplink



Frequency Band = Band 13, Direction = Downlink



Frequency Band = Band 13, Direction = Uplink



4.13.5TEST EQUIPMENT USED

R&S TS8997

4.14 OSCILLATION SHUTDOWN OR MITIGATION

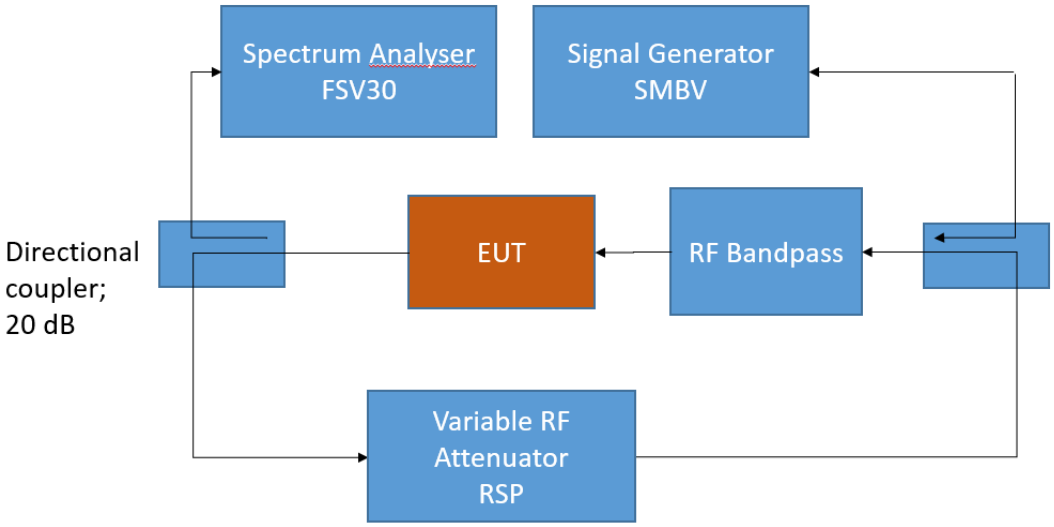
Standard

The test was performed according to:
KDB 935210 D03

4.14.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster Anti-Oscillation limits and requirements as specified in §§ 20.21(e)(8)(ii)(A for wideband consumer signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.11.3; Oscillation Mitigation/Shutdown

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.14.2TEST REQUIREMENTS / LIMITS

FCC Part 20, § 20.21 (e)(8)(ii)(A)

Anti-Oscillation. Consumer boosters must be able to detect and mitigate (*i.e.,* by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

KDB 935210 D03 7.11.3 f6)

The procedure of 7.11.3 f1) to 7.11.3 f5) allows the spectrum analyzer trace to stabilize, and verification of shutdown or oscillation level measurement must occur within 300 seconds.[1]

[1]The time response requirements are provisional and are as determined by the ANSI ASC C63® task group in collaboration and consultation with FCC OET Laboratory Division staff.

4.14.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 30 %

Band 2, downlink

Frequency [MHz]	Oscillator Frequency Max. Power [MHz]	Oscillator Max. Power [dBm]	Oscillator Frequency Min. Power [MHz]	Oscillator Min. Power [dBm]	Delta Max.-Min. Power [dBm]	Limit Delta Max.-Min. Power [dBm]	Margin Delta Max.-Min. Power [dBm]
1932.5	1886.2	-80.4	1891.9	-87.4	7.0	12.0	5.0

Band 4, downlink

Frequency [MHz]	Oscillator Frequency Max. Power [MHz]	Oscillator Max. Power [dBm]	Oscillator Frequency Min. Power [MHz]	Oscillator Min. Power [dBm]	Delta Max.-Min. Power [dBm]	Limit Delta Max.-Min. Power [dBm]	Margin Delta Max.-Min. Power [dBm]
2112.5	2127.7	-79.9	2133.1	-86.1	6.2	12.0	5.8

Band 5, downlink

Frequency [MHz]	Oscillator Frequency Max. Power [MHz]	Oscillator Max. Power [dBm]	Oscillator Frequency Min. Power [MHz]	Oscillator Min. Power [dBm]	Delta Max.-Min. Power [dBm]	Limit Delta Max.-Min. Power [dBm]	Margin Delta Max.-Min. Power [dBm]
871.5	880.3	-75.3	882.1	-85.9	10.6	12.0	1.4

Band 12, downlink

Frequency [MHz]	Oscillator Frequency Max. Power [MHz]	Oscillator Max. Power [dBm]	Oscillator Frequency Min. Power [MHz]	Oscillator Min. Power [dBm]	Delta Max.-Min. Power [dBm]	Limit Delta Max.-Min. Power [dBm]	Margin Delta Max.-Min. Power [dBm]
730.5	738.5	-83.1	736.1	-86.3	3.2	12.0	8.8

Band 13, downlink

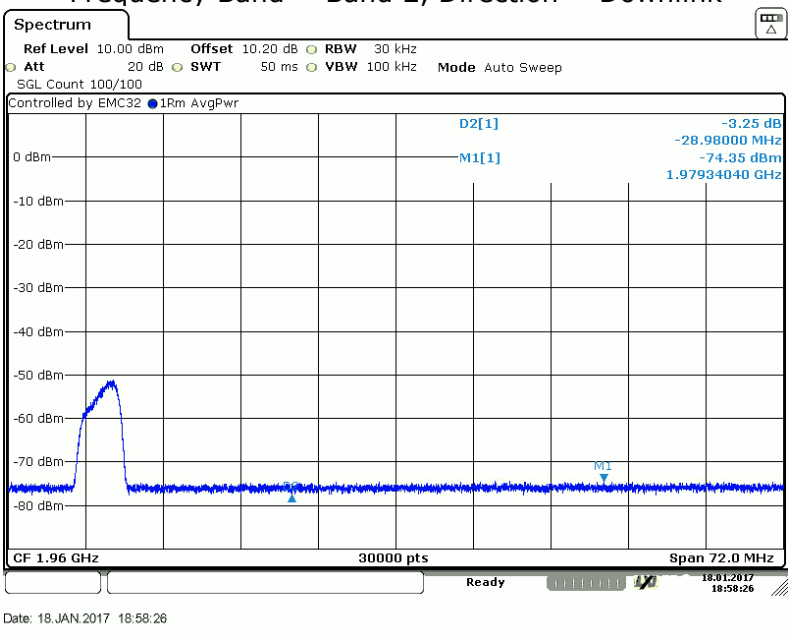
Frequency [MHz]	Oscillator Frequency Max. Power [MHz]	Oscillator Max. Power [dBm]	Oscillator Frequency Max. Power [MHz]	Oscillator Min. Power [dBm]	Delta Max.-Min. Power [dBm]	Limit Delta Max.-Min. Power [dBm]	Margin Delta Max.-Min. Power [dBm]
748.5	751.6	-75.4	754.8	-86.2	10.8	12.0	1.2

For all bands in uplink the booster switched not on with the in the KDB specified input power settings.

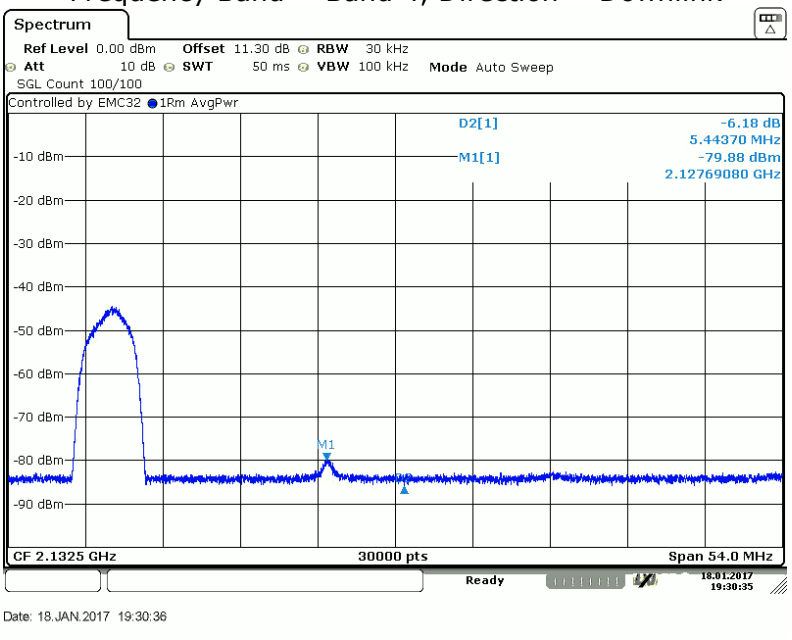
Remark: Please see next sub-clause for the measurement plot.

4.14.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, “WORST CASE”)

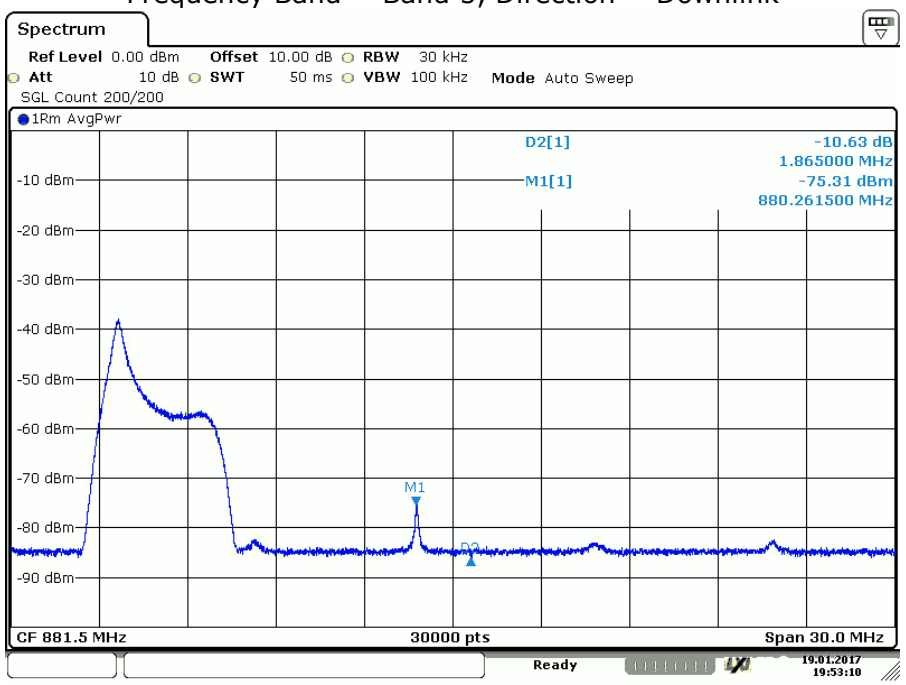
Frequency Band = Band 2, Direction = Downlink



Frequency Band = Band 4, Direction = Downlink

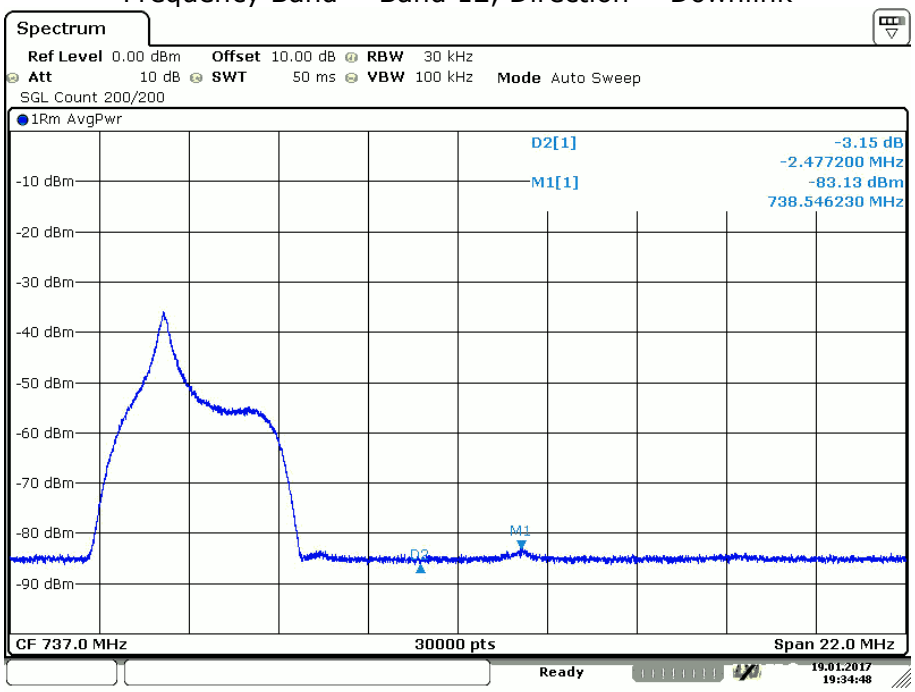


Frequency Band = Band 5, Direction = Downlink



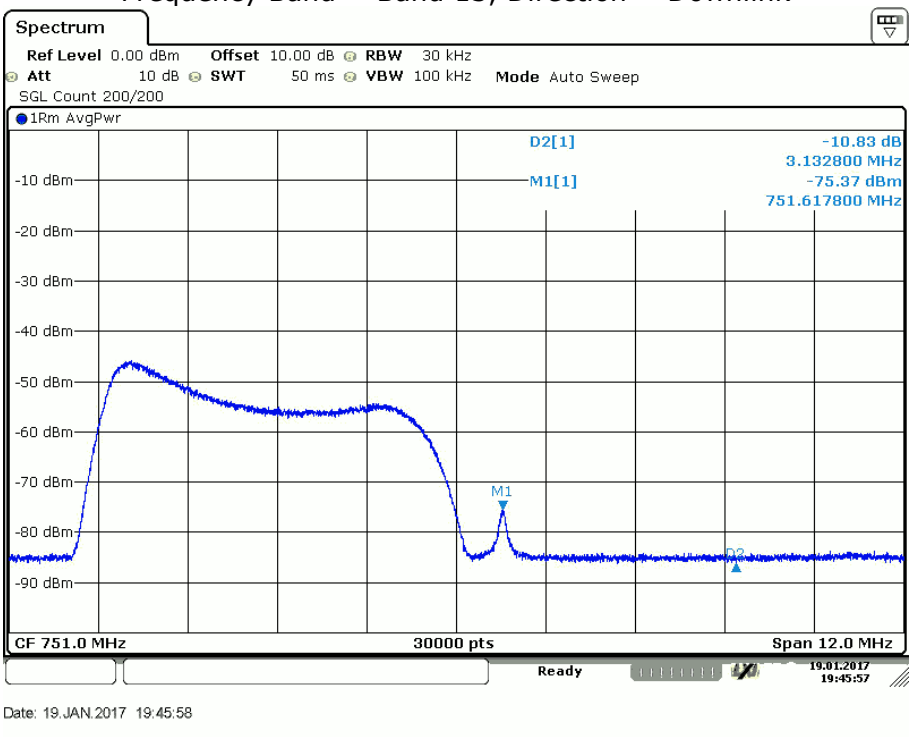
Date: 19.JAN.2017 19:53:11

Frequency Band = Band 12, Direction = Downlink



Date: 19.JAN.2017 19:34:48

Frequency Band = Band 13, Direction = Downlink



4.14.5TEST EQUIPMENT USED

R&S TS8997

4.15 RADIATED SPURIOUS EMISSIONS

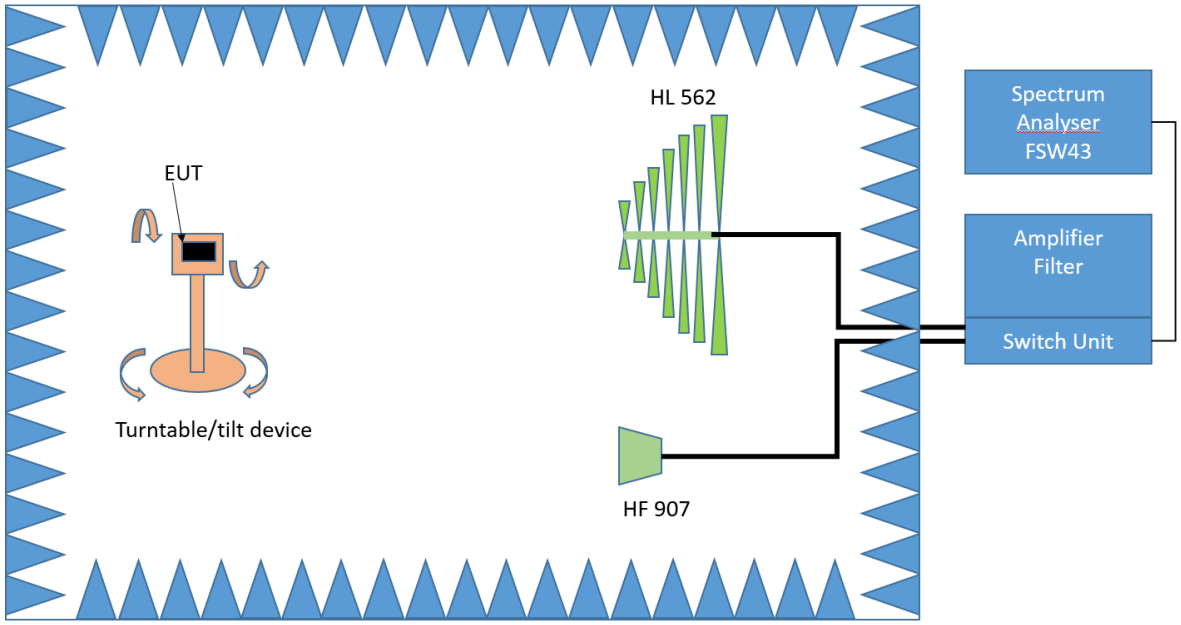
Standard

The test was performed according to:
KDB 935210 D03

4.15.1TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable radiated spurious emission measurements per § 2.1053

The EUT was connected to the test setup according to the following diagram:



FCC Part 20.21; Consumer Signal Booster – Test Setup 7.12; Radiated Spurious Emissions

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.
The measurement procedure is implemented into the EMI test software EMC32 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered from a DC power source.

1. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan
This is a preliminary test to identify the highest amplitudes relative to the limit.
Settings for step 1:
- Antenna distance: 3 m
- Detector: Peak-Maxhold / Quasipeak (FFT-based)
- Frequency range: 30 – 1000 MHz

- Frequency steps: 30 kHz
- IF–Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 ms
- Turntable angle range: –180° to 90°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: Adjustment measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by ± 45° around this value. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by ± 100 cm around the antenna height determined. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: ± 45 ° around the determined value
- Height variation range: ± 100 cm around the determined value
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with QP detector

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

3. Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:

Step 1:

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height (1.5 m) of the receiving antenna only.

The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90 °.

The turn table step size (azimuth angle) for the preliminary measurement is 45 °.

Step 2:

Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna instep 2 is omitted. Instead of this, a maximum search with a step size ± 45° for the elevation axis is performed.

The turn table azimuth will slowly vary by ± 22.5°.
The elevation angle will slowly vary by ± 45°
EMI receiver settings (for all steps):
- Detector: Peak, Average
- IF Bandwidth = 1 MHz

Step 3:

Spectrum analyser settings for step 3:
- Detector: Peak / Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

4.15.2TEST REQUIREMENTS / LIMITS

FCC Part 2.1051; Measurement required: Spurious emissions at antenna terminal:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 20, § 20.21(e)(8)(i)(E)

Out of Band Emission Limits. Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

Part 22, Subpart H – Cellular Radiotelephone Service; Band 5 (Cellular)

§ 22 917 – Emission limitations for cellular equipment

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 24 E – Personal Communication Services

§ 24.238 – Emission limitations for Broadband PCS equipment; Band 2 (Broadband PCS)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Part 27 – Miscellaneous Wireless Communication Services;

Band 4 (AWS-1)
§ 27.53 (h) – Emission limits

(1) *General protection levels.* Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) dB.
(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.
(ii) For operations in the 2000-2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
(iii) For operations in the 1915-1920 MHz band, the power of any emission between 1930-1995 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
(iv) For operations in the 1995-2000 MHz band, the power of any emission between 2005-2020 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 $\log_{10}$(P) dB.
Band 12 (Lower 700 MHz)
§ 27.53 (g) – Emission limits

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed

Band 13 (Upper 700 MHz)
§ 27.53 (c), (f) – Emission limits

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the

frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

4.15.3TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 1020 hPa
Humidity: 36 %

Band 2, downlink; Center frequency: 1960.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	-29.6	RMS	1000	-13.0	>10

Band 4, downlink; Center frequency: 2132.50 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	-29.6	RMS	1000	-13.0	>10

Band 5, downlink; Center frequency: 881.5.0 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	-26.8	RMS	100	-13.0	>10

Band 12, downlink; Center frequency: 737.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	-23.3	RMS	100	-13.0	>10

Band 13, downlink; Center frequency: 751.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	-23.2	RMS	100	-13.0	>10

Ambient temperature:	23 °C
Air Pressure:	1020 hPa
Humidity:	38 %

Band 2, uplink; Center frequency: 1880.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
1949.0	-22.0	1.0	RMS	1000	-13.0	9.0

Band 4, uplink; Center frequency: 1732.50 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
1750.6	-16.0	1.4	RMS	1000	-13.0	3.0

Band 5, uplink; Center frequency: 836.50 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	2.4	RMS	100	-13.0	>10

Band 12, uplink; Center frequency: 707.00 MHz

Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	1.7	RMS	100	-13.0	>10

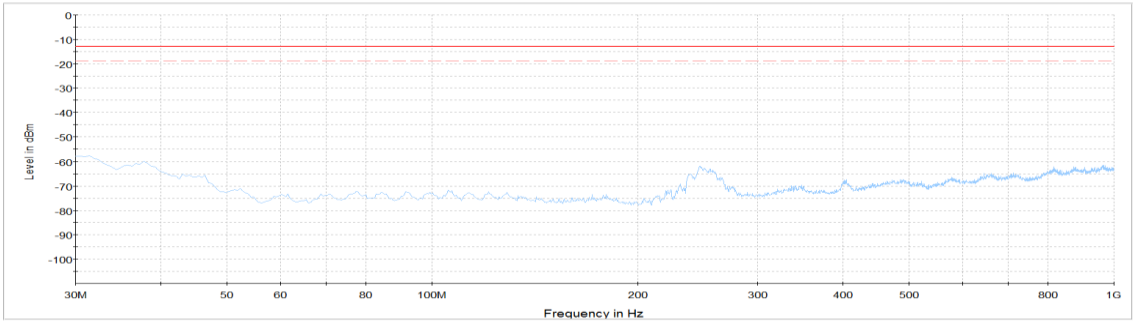
Band 13, uplink; Center frequency: 782.00 MHz

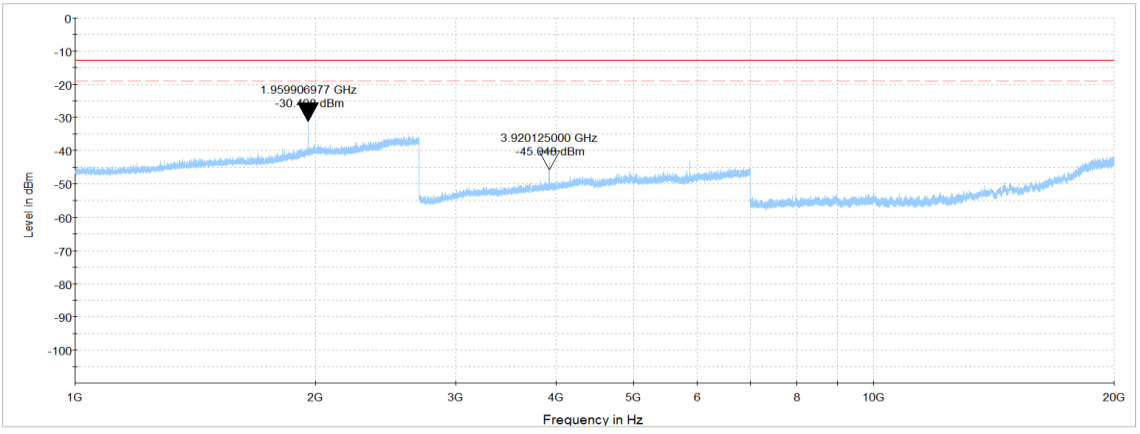
Spurious Freq. [MHz]	Spurious Level [dBm]	Pin [dBm]	Detector	RBW [kHz]	Limit [dBm]	Margin to Limit [dB]
-	-	1.1	RMS	100	-13.0	>10

Remark: Please see next sub-clause for the measurement plot.

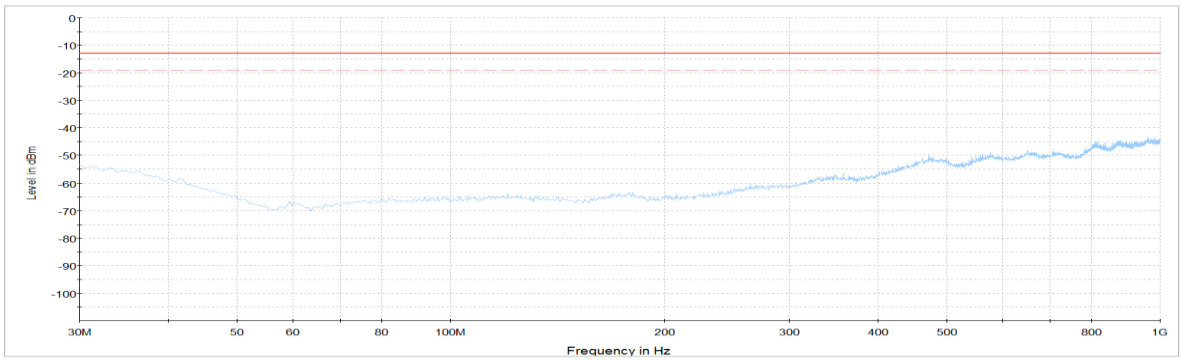
4.15.4MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

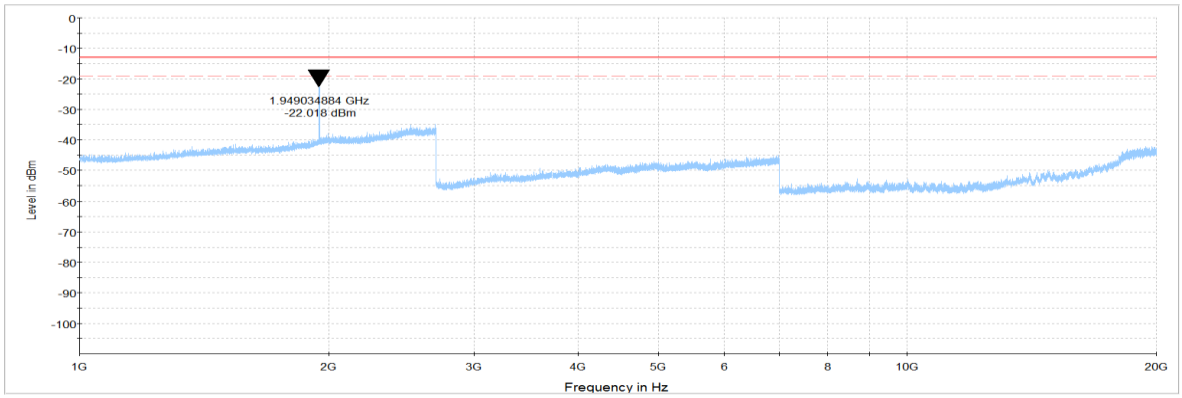
Frequency Band = Band 2, Direction = Downlink



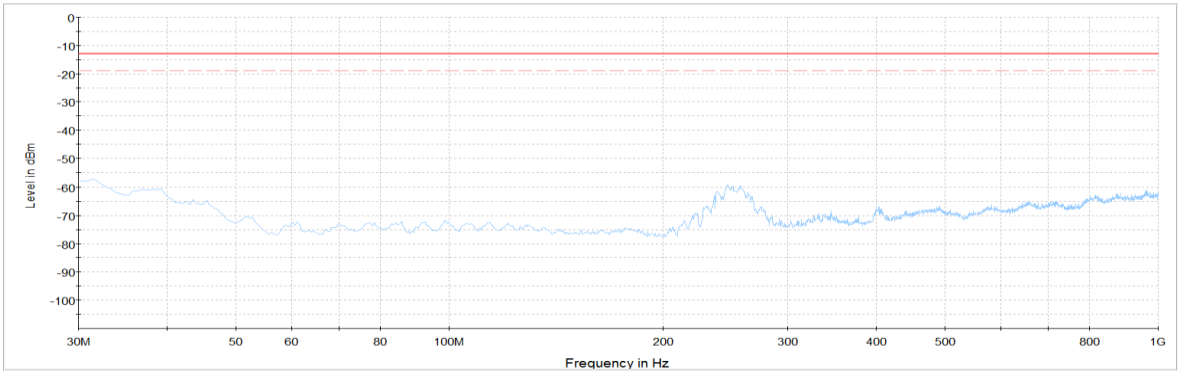


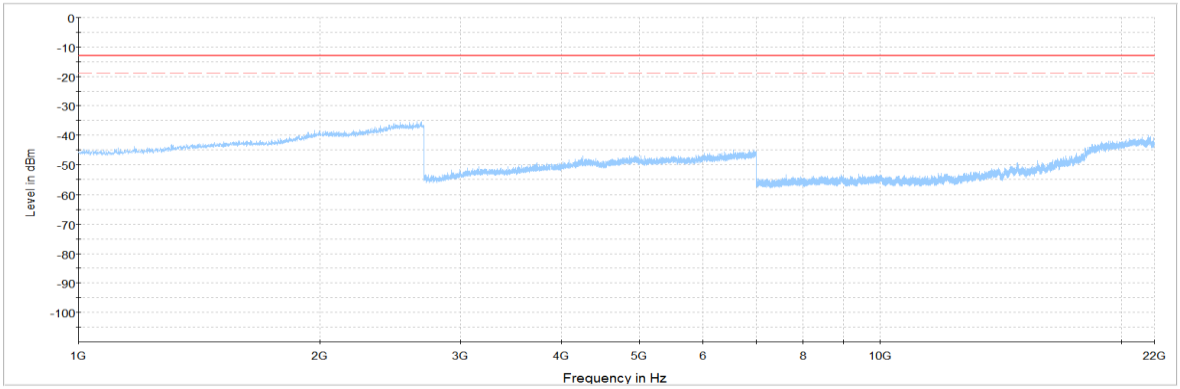
Frequency Band = Band 2, Direction = Uplink



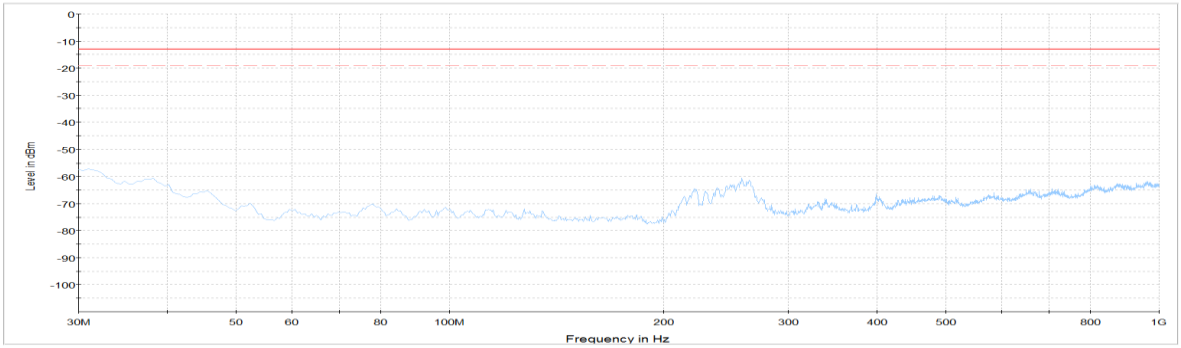


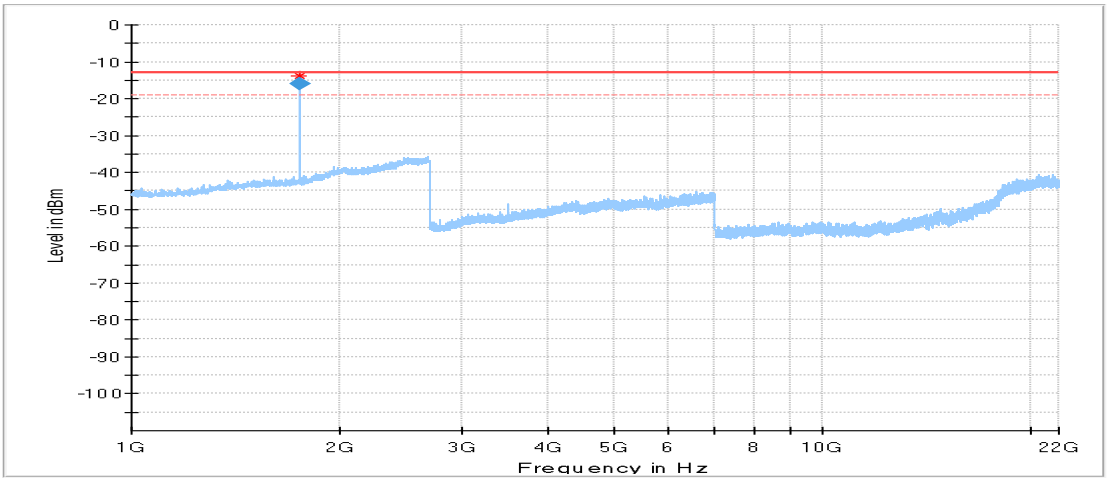
Frequency Band = Band 4, Direction = Downlink





Frequency Band = Band 4, Direction = Uplink





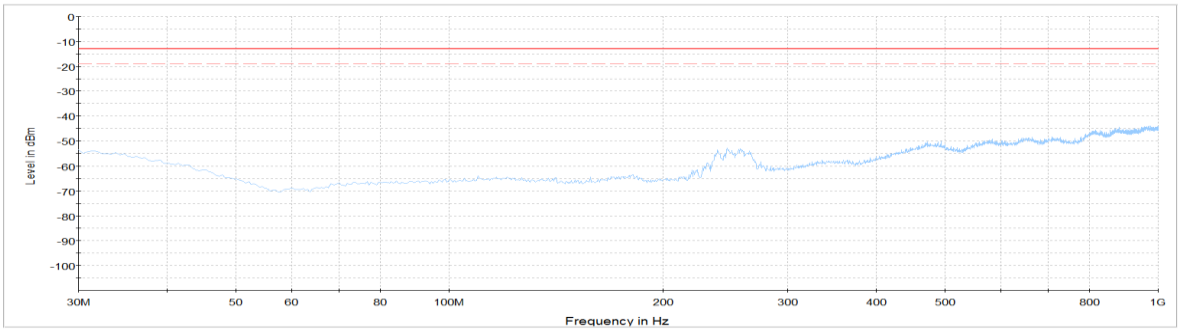
Critical_Freqs

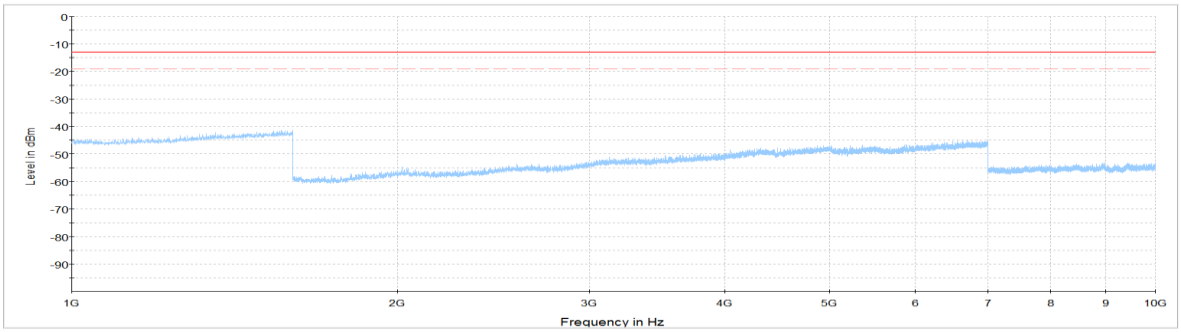
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1750.550000	-13.79	-13.00	0.79	---	---	150.0	H	-146.0	-10.4	-65.1

Final_Result

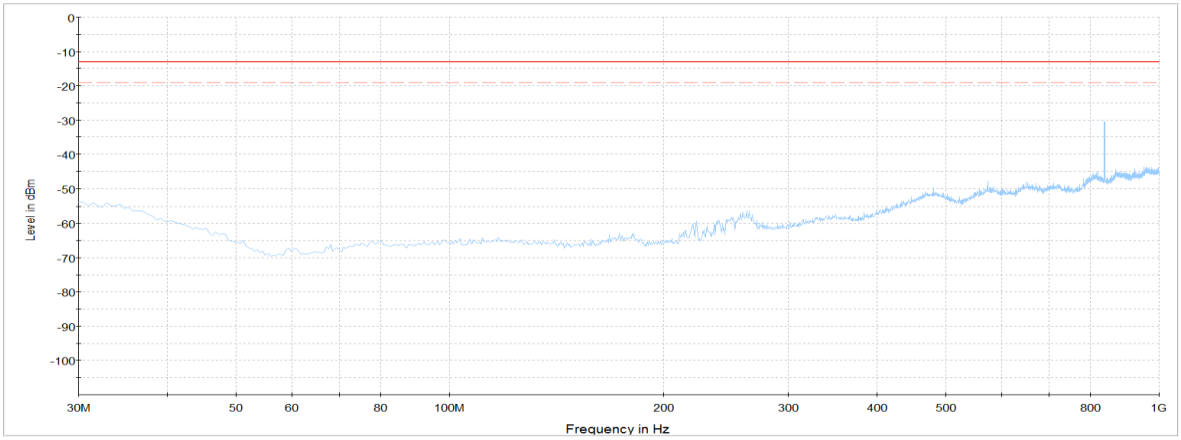
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1750.550000	-15.96	-13.00	2.96	1000.0	1000.000	150.0	H	-146.0	-10.3	-65.1

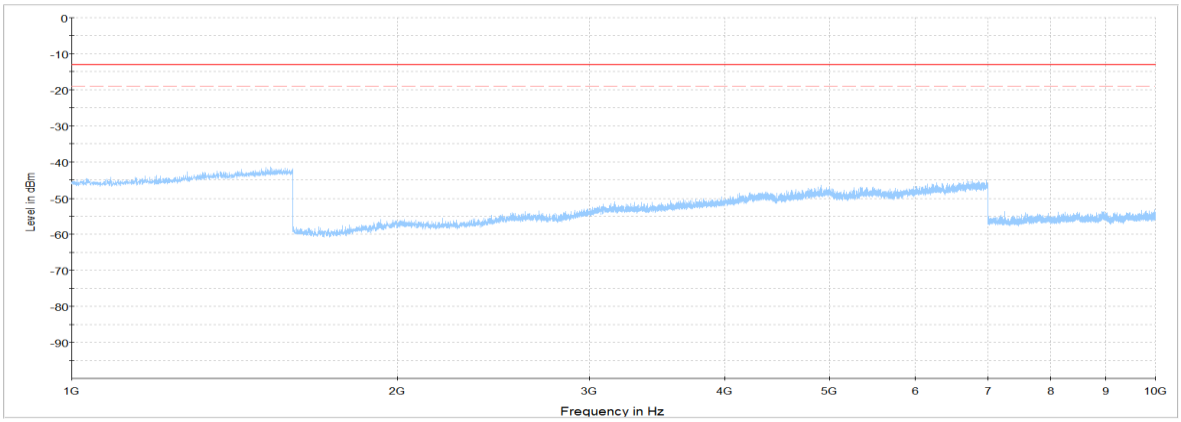
Frequency Band = Band 5, Direction = Downlink



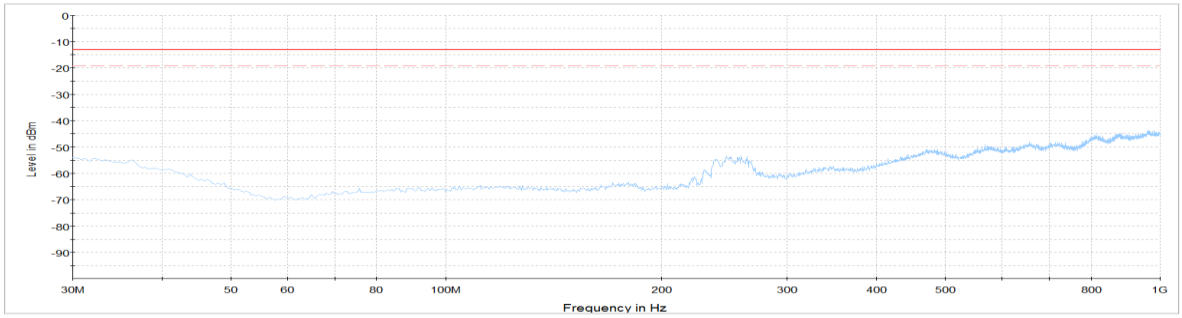


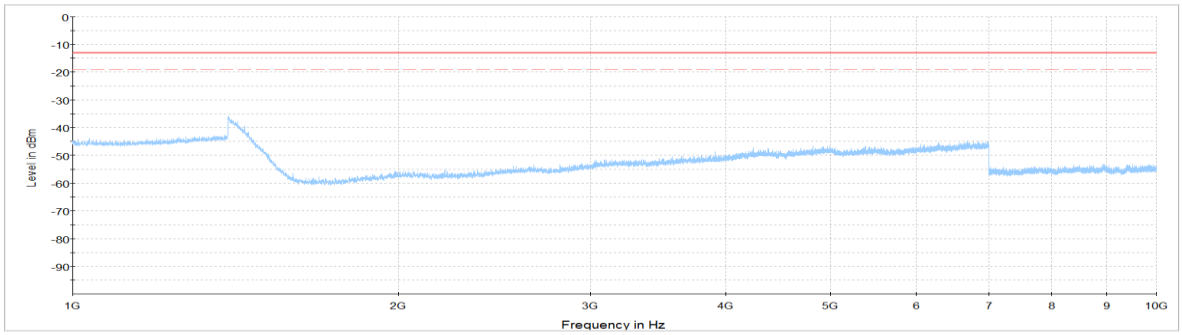
Frequency Band = Band 5, Direction = Uplink



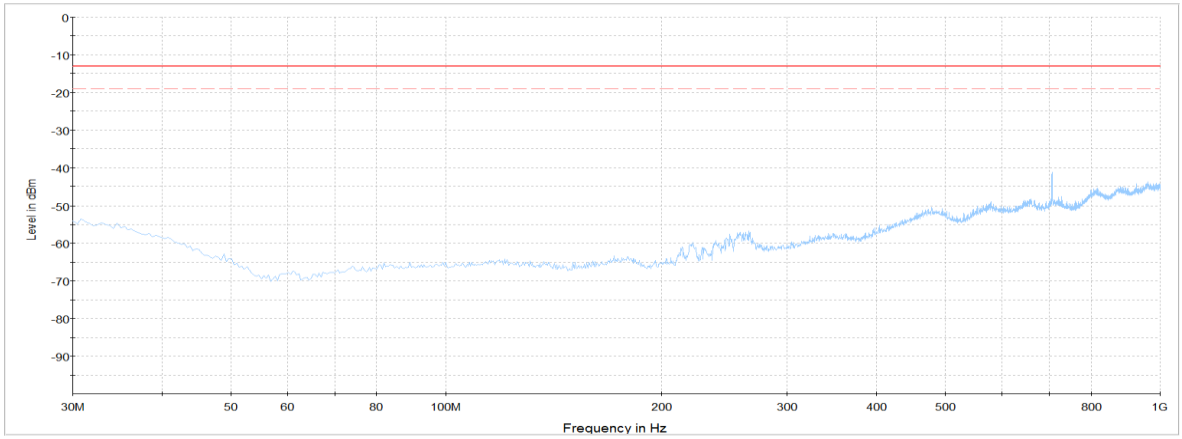


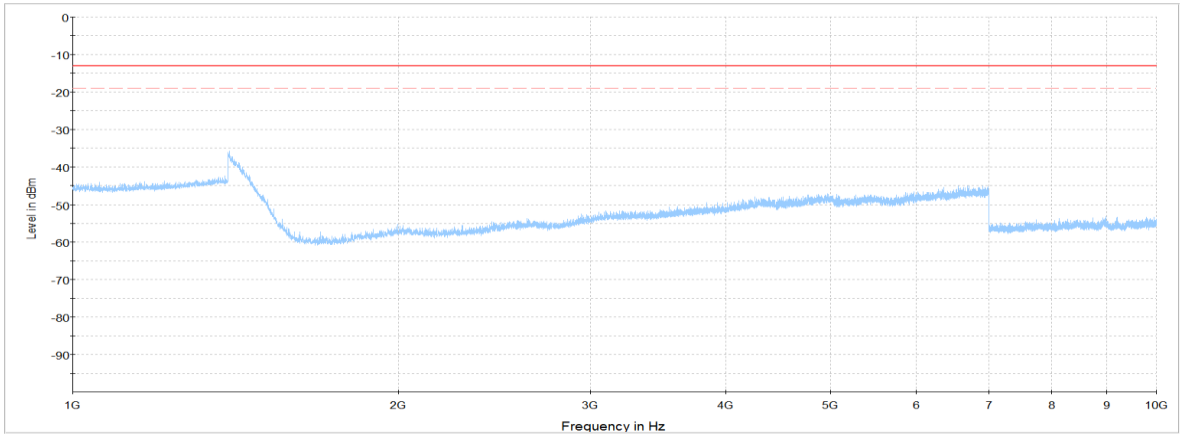
Frequency Band = Band 12, Direction = Downlink



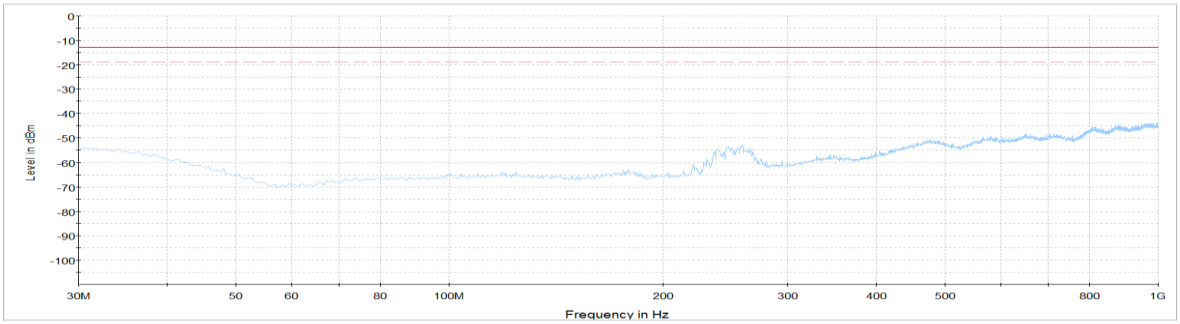


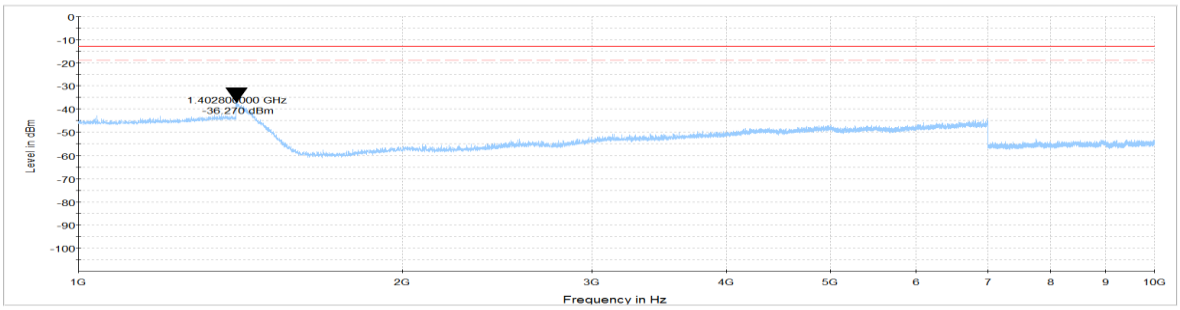
Frequency Band = Band 12, Direction = Uplink



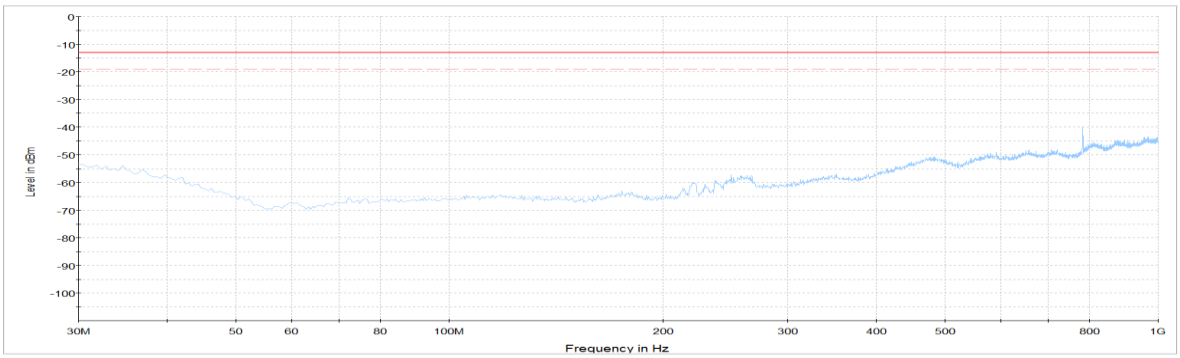


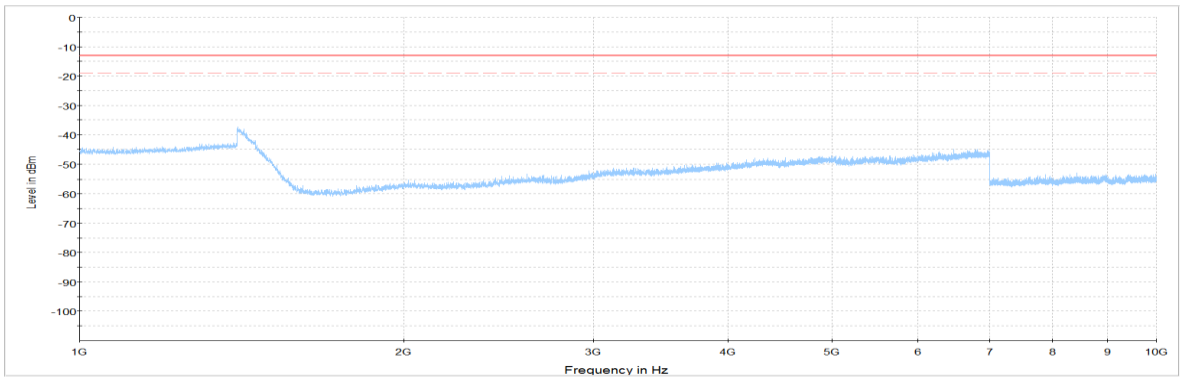
Frequency Band = Band 13, Direction = Downlink





Frequency Band = Band 13, Direction = Uplink





4.15.5 TEST EQUIPMENT USED

Radiated Emissions

5 TEST EQUIPMENT

1 R&S TS8997
EN300328/301893 Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	OSP120	Switching Unit with integrated power meter	Rohde & Schwarz	101158	2016-11	2018-11
1.2	A8455-4	4 Way Power Divider (SMA)		-		
1.3	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2016-02	2018-02
1.4	Opus10 THI (8152.00)	ThermoHygro Datalogger 03 (Environ)	Lufft Mess- und Regeltechnik GmbH	7482	2015-02	2017-02
1.5	SMB100A	Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	107695	2014-06	2017-06
1.6	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2016-02	2018-02
1.7	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	259291	2016-10	2019-10
1.8	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	260001	2016-01	2016-01
1.9	1515 / 93459	Broadband Power Divider SMA (Aux)	Weinschel Associates	LN673		
1.10	Datum, Model: MFS	Rubidium Frequency Standard	Datum-Beverly	5489/001	2016-06	2017-06
1.11	PJ D6PF1G960M3B6-Q P	Band 2 Duplexer	Taiyo Yuden	3100110400477 2000		
1.12	PJ D6PF2G132M3D9-Q P	Band 4 Duplexer	Taiyo Yuden	-		
1.13	PJ D5DA881M5K2E2-Q P	Band 5 Duplexer	Taiyo Yuden	3100110400563 1000		
1.14	PJ D5PF737M5M3N9-Q P	Band 12 Duplexer	Taiyo Yuden	-		
1.15	PJ D5DA782M0K2J6-Q P	Band 13 Duplexer	Taiyo Yuden	3100110400479 6001		

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.16	A2023-10 (2x)	Directional Coupler	AtlanTecRF	-		

2 Radiated Emissions
Lab to perform radiated emission tests

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronic GmbH	00083069		
2.2	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright	09		
2.3	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008		
2.4	Datum MFS	Rubidium Frequency Normal MFS	Datum GmbH	002	2016-09	2017-09
2.5	Fully Anechoic Room	8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB		
2.6	AM 4.0	Antenna mast	Maturo GmbH	AM4.0/180/11920513		
2.7	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz	101424	2016-11	2018-11
2.8	TT 1.5 WI	Turn Table	Maturo GmbH	-		
2.9	Anechoic Chamber	10.58 x 6.38 x 6.00 m³	Frankonia	none	2014-01	2017-01
2.10	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2016-02	2018-02
2.11	ESIB 26	Spectrum Analyzer	Rohde & Schwarz	830482/004	2015-12	2017-12
2.12	Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	Maturo GmbH	TD1.5-10kg/024/3790709		
2.13	5HC2700/12750-1.5-KK	High Pass Filter	Trilithic	9942012		
2.14	AS 620 P	Antenna mast	HD GmbH	620/37		
2.15	NRV-Z1	Sensor Head A	Rohde & Schwarz	827753/005	2016-05	2017-05

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.16	4HC1600/12750-1.5-KK	High Pass Filter	Trilithic	9942011		
2.17	ASP 1.2/1.8-10 kg	Antenna Mast	Maturo GmbH	-		
2.18	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785		
2.19	JS4-00101800-35-5P	Broadband Amplifier 30 MHz - 18 GHz	Miteq	896037		
2.20	HL 562	Ultralog new biconicals	Rohde & Schwarz	830547/003	2015-06	2018-06
2.21	Opus10 THI (8152.00)	ThermoHygro Datalogger 12 (Environ)	Lufft Mess- und Regeltechnik GmbH	12482	2015-03	2017-03
2.22	JS4-00102600-42-5A	Broadband Amplifier 30 MHz - 26 GHz	Miteq	619368		
2.23	HFH2-Z2	Loop Antenna	Rohde & Schwarz	829324/006	2014-11	2017-11
2.24	FSW 43	Spectrum Analyzer	Rohde & Schwarz	103779	2016-12	2018-12
2.25	Opus10 TPR (8253.00)	ThermoAirpressure Datalogger 13 (Environ)	Lufft Mess- und Regeltechnik GmbH	13936	2015-02	2017-02
2.26	Chroma 6404	AC Power Source	Chroma ATE INC.	64040001304		
2.27	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronic GmbH	00086675		
2.28	HL 562 Ultralog	Log.-per. Antenna	Rohde & Schwarz	100609	2016-04	2019-04
2.29	PAS 2.5 - 10 kg	Antenna Mast	Maturo GmbH	-		
2.30	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2015-05	2018-05

The calibration interval is the time interval between “Last Calibration” and “Calibration Due”

6 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

6.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

Frequency		Corr.	LISN insertion loss ESH3-Z5	cable loss (incl. 10 dB atten-uator)
MHz		dB	dB	dB
0,15		10,1	0,1	10,0
5		10,3	0,1	10,2
7		10,5	0,2	10,3
10		10,5	0,2	10,3
12		10,7	0,3	10,4
14		10,7	0,3	10,4
16		10,8	0,4	10,4
18		10,9	0,4	10,5
20		10,9	0,4	10,5
22		11,1	0,5	10,6
24		11,1	0,5	10,6
26		11,2	0,5	10,7
28		11,2	0,5	10,7
30		11,3	0,5	10,8

Sample calculation

U_{LISN} (dB µV) = U (dB µV) + Corr. (dB)
U = Receiver reading
LISN Insertion loss = Voltage Division Factor of LISN
Corr. = sum of single correction factors of used LISN, cables, switch units (if used)
Linear interpolation will be used for frequencies in between the values in the table.

6.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

Frequency	AF HFH-Z2)	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-40 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
0,009	20,50	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,01	20,45	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,015	20,37	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,02	20,36	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,025	20,38	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,03	20,32	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,05	20,35	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,08	20,30	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,1	20,20	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,2	20,17	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,3	20,14	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,49	20,12	-79,6	0,1	0,1	0,1	0,1	-80	300	3
0,490001	20,12	-39,6	0,1	0,1	0,1	0,1	-40	30	3
0,5	20,11	-39,6	0,1	0,1	0,1	0,1	-40	30	3
0,8	20,10	-39,6	0,1	0,1	0,1	0,1	-40	30	3
1	20,09	-39,6	0,1	0,1	0,1	0,1	-40	30	3
2	20,08	-39,6	0,1	0,1	0,1	0,1	-40	30	3
3	20,06	-39,6	0,1	0,1	0,1	0,1	-40	30	3
4	20,05	-39,5	0,2	0,1	0,1	0,1	-40	30	3
5	20,05	-39,5	0,2	0,1	0,1	0,1	-40	30	3
6	20,02	-39,5	0,2	0,1	0,1	0,1	-40	30	3
8	19,95	-39,5	0,2	0,1	0,1	0,1	-40	30	3
10	19,83	-39,4	0,2	0,1	0,2	0,1	-40	30	3
12	19,71	-39,4	0,2	0,1	0,2	0,1	-40	30	3
14	19,54	-39,4	0,2	0,1	0,2	0,1	-40	30	3
16	19,53	-39,3	0,3	0,1	0,2	0,1	-40	30	3
18	19,50	-39,3	0,3	0,1	0,2	0,1	-40	30	3
20	19,57	-39,3	0,3	0,1	0,2	0,1	-40	30	3
22	19,61	-39,3	0,3	0,1	0,2	0,1	-40	30	3
24	19,61	-39,3	0,3	0,1	0,2	0,1	-40	30	3
26	19,54	-39,3	0,3	0,1	0,2	0,1	-40	30	3
28	19,46	-39,2	0,3	0,1	0,3	0,1	-40	30	3
30	19,73	-39,1	0,4	0,1	0,3	0,1	-40	30	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -40 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values

6.3 ANTENNA R&S HL562 (30 MHZ – 1 GHZ)

(d_{Limit} = 3 m)

Frequency	AF R&S HL562	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
30	18,6	0,6	0,29	0,04	0,23	0,02	0,0	3	3
50	6,0	0,9	0,39	0,09	0,32	0,08	0,0	3	3
100	9,7	1,2	0,56	0,14	0,47	0,08	0,0	3	3
150	7,9	1,6	0,73	0,20	0,59	0,12	0,0	3	3
200	7,6	1,9	0,84	0,21	0,70	0,11	0,0	3	3
250	9,5	2,1	0,98	0,24	0,80	0,13	0,0	3	3
300	11,0	2,3	1,04	0,26	0,89	0,15	0,0	3	3
350	12,4	2,6	1,18	0,31	0,96	0,13	0,0	3	3
400	13,6	2,9	1,28	0,35	1,03	0,19	0,0	3	3
450	14,7	3,1	1,39	0,38	1,11	0,22	0,0	3	3
500	15,6	3,2	1,44	0,39	1,20	0,19	0,0	3	3
550	16,3	3,5	1,55	0,46	1,24	0,23	0,0	3	3
600	17,2	3,5	1,59	0,43	1,29	0,23	0,0	3	3
650	18,1	3,6	1,67	0,34	1,35	0,22	0,0	3	3
700	18,5	3,6	1,67	0,42	1,41	0,15	0,0	3	3
750	19,1	4,1	1,87	0,54	1,46	0,25	0,0	3	3
800	19,6	4,1	1,90	0,46	1,51	0,25	0,0	3	3
850	20,1	4,4	1,99	0,60	1,56	0,27	0,0	3	3
900	20,8	4,7	2,14	0,60	1,63	0,29	0,0	3	3
950	21,1	4,8	2,22	0,60	1,66	0,33	0,0	3	3
1000	21,6	4,9	2,23	0,61	1,71	0,30	0,0	3	3

(d_{Limit} = 10 m)

30	18,6	-9,9	0,29	0,04	0,23	0,02	-10,5	10	3
50	6,0	-9,6	0,39	0,09	0,32	0,08	-10,5	10	3
100	9,7	-9,2	0,56	0,14	0,47	0,08	-10,5	10	3
150	7,9	-8,8	0,73	0,20	0,59	0,12	-10,5	10	3
200	7,6	-8,6	0,84	0,21	0,70	0,11	-10,5	10	3
250	9,5	-8,3	0,98	0,24	0,80	0,13	-10,5	10	3
300	11,0	-8,1	1,04	0,26	0,89	0,15	-10,5	10	3
350	12,4	-7,9	1,18	0,31	0,96	0,13	-10,5	10	3
400	13,6	-7,6	1,28	0,35	1,03	0,19	-10,5	10	3
450	14,7	-7,4	1,39	0,38	1,11	0,22	-10,5	10	3
500	15,6	-7,2	1,44	0,39	1,20	0,19	-10,5	10	3
550	16,3	-7,0	1,55	0,46	1,24	0,23	-10,5	10	3
600	17,2	-6,9	1,59	0,43	1,29	0,23	-10,5	10	3
650	18,1	-6,9	1,67	0,34	1,35	0,22	-10,5	10	3
700	18,5	-6,8	1,67	0,42	1,41	0,15	-10,5	10	3
750	19,1	-6,3	1,87	0,54	1,46	0,25	-10,5	10	3
800	19,6	-6,3	1,90	0,46	1,51	0,25	-10,5	10	3
850	20,1	-6,0	1,99	0,60	1,56	0,27	-10,5	10	3
900	20,8	-5,8	2,14	0,60	1,63	0,29	-10,5	10	3
950	21,1	-5,6	2,22	0,60	1,66	0,33	-10,5	10	3
1000	21,6	-5,6	2,23	0,61	1,71	0,30	-10,5	10	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

6.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay + cable inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit, atten-uator & pre-amp)	cable loss 4 (to receiver)		
MHz	dB (1/m)	dB	dB	dB	dB	dB		
1000	24,4	-19,4	0,99	0,31	-21,51	0,79		
2000	28,5	-17,4	1,44	0,44	-20,63	1,38		
3000	31,0	-16,1	1,87	0,53	-19,85	1,33		
4000	33,1	-14,7	2,41	0,67	-19,13	1,31		
5000	34,4	-13,7	2,78	0,86	-18,71	1,40		
6000	34,7	-12,7	2,74	0,90	-17,83	1,47		
7000	35,6	-11,0	2,82	0,86	-16,19	1,46		

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (inside chamber)	cable loss 3 (outside chamber)	cable loss 4 (switch unit, atten-uator & pre-amp)	cable loss 5 (to receiver)	used for FCC 15.247
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	
3000	31,0	-23,4	0,47	1,87	0,53	-27,58	1,33	
4000	33,1	-23,3	0,56	2,41	0,67	-28,23	1,31	
5000	34,4	-21,7	0,61	2,78	0,86	-27,35	1,40	
6000	34,7	-21,2	0,58	2,74	0,90	-26,89	1,47	
7000	35,6	-19,8	0,66	2,82	0,86	-25,58	1,46	

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (High Pass)	cable loss 3 (pre-amp)	cable loss 4 (inside chamber)	cable loss 5 (outside chamber)	cable loss 6 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	dB
7000	35,6	-57,3	0,56	1,28	-62,72	2,66	0,94	1,46
8000	36,3	-56,3	0,69	0,71	-61,49	2,84	1,00	1,53
9000	37,1	-55,3	0,68	0,65	-60,80	3,06	1,09	1,60
10000	37,5	-56,2	0,70	0,54	-61,91	3,28	1,20	1,67
11000	37,5	-55,3	0,80	0,61	-61,40	3,43	1,27	1,70
12000	37,6	-53,7	0,84	0,42	-59,70	3,53	1,26	1,73
13000	38,2	-53,5	0,83	0,44	-59,81	3,75	1,32	1,83
14000	39,9	-56,3	0,91	0,53	-63,03	3,91	1,40	1,77
15000	40,9	-54,1	0,98	0,54	-61,05	4,02	1,44	1,83
16000	41,3	-54,1	1,23	0,49	-61,51	4,17	1,51	1,85
17000	42,8	-54,4	1,36	0,76	-62,36	4,34	1,53	2,00
18000	44,2	-54,7	1,70	0,53	-62,88	4,41	1,55	1,91

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

6.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

Frequency	AF EMCO 3160-09	Corr.	cable loss 1 (inside chamber)	cable loss 2 (pre-amp)	cable loss 3 (inside chamber)	cable loss 4 (switch unit)	cable loss 5 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB
18000	40,2	-23,5	0,72	-35,85	6,20	2,81	2,65
18500	40,2	-23,2	0,69	-35,71	6,46	2,76	2,59
19000	40,2	-22,0	0,76	-35,44	6,69	3,15	2,79
19500	40,3	-21,3	0,74	-35,07	7,04	3,11	2,91
20000	40,3	-20,3	0,72	-34,49	7,30	3,07	3,05
20500	40,3	-19,9	0,78	-34,46	7,48	3,12	3,15
21000	40,3	-19,1	0,87	-34,07	7,61	3,20	3,33
21500	40,3	-19,1	0,90	-33,96	7,47	3,28	3,19
22000	40,3	-18,7	0,89	-33,57	7,34	3,35	3,28
22500	40,4	-19,0	0,87	-33,66	7,06	3,75	2,94
23000	40,4	-19,5	0,88	-33,75	6,92	3,77	2,70
23500	40,4	-19,3	0,90	-33,35	6,99	3,52	2,66
24000	40,4	-19,8	0,88	-33,99	6,88	3,88	2,58
24500	40,4	-19,5	0,91	-33,89	7,01	3,93	2,51
25000	40,4	-19,3	0,88	-33,00	6,72	3,96	2,14
25500	40,5	-20,4	0,89	-34,07	6,90	3,66	2,22
26000	40,5	-21,3	0,86	-35,11	7,02	3,69	2,28
26500	40,5	-21,1	0,90	-35,20	7,15	3,91	2,36

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

6.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

Frequency	AF EMCO 3160-10	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
GHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
26,5	43,4	-11,2	4,4				-15,6	3	0,5
27,0	43,4	-11,2	4,4				-15,6	3	0,5
28,0	43,4	-11,1	4,5				-15,6	3	0,5
29,0	43,5	-11,0	4,6				-15,6	3	0,5
30,0	43,5	-10,9	4,7				-15,6	3	0,5
31,0	43,5	-10,8	4,7				-15,6	3	0,5
32,0	43,5	-10,7	4,8				-15,6	3	0,5
33,0	43,6	-10,7	4,9				-15,6	3	0,5
34,0	43,6	-10,6	5,0				-15,6	3	0,5
35,0	43,6	-10,5	5,1				-15,6	3	0,5
36,0	43,6	-10,4	5,1				-15,6	3	0,5
37,0	43,7	-10,3	5,2				-15,6	3	0,5
38,0	43,7	-10,2	5,3				-15,6	3	0,5
39,0	43,7	-10,2	5,4				-15,6	3	0,5
40,0	43,8	-10,1	5,5				-15,6	3	0,5

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

7 MEASUREMENT UNCERTAINTIES

Test Case(s)	Parameter	Uncertainty
7.12 - Radiated Spurious Emissions	Power	± 5.5 dB
7.1 -Authorized Frequency Band 7.10 - Occupied Bandwidth (99%)	Power Frequency	± 2.9 dB ± 11.2 kHz
7.2 - Maximum Power 7.3 - Maximum Booster Gain 7.4 – Intermodulation 7.7.1 – Maximum TX Power Noise, 7.7.2 - Variable Uplink Noise 7.8 - Uplink Inactivity 7.9.1 - Variable Gain,	Power	± 2.2 dB
7.9.2 - Variable Uplink Gain Timing 7.11.2 - Oscillation Shutdown 7.11.3 - Oscillation Mitigation	Power Time	± 2.2 dB ± 1 x 10^{-4}s ± 120 x 10^{-3}s
7.5 - Out-of-band emissions 7.6 – Conducted Spurious Emissions	Power Frequency	± 2.2 dB ± 11.2 kHz

8 PHOTO REPORT

Please see separate photo report.